S. Fishes

UNITED STATES COMMISSION OF FISH AND FISHERIES.

V

PART IX.

REPORT

OF

THE COMMISSIONER

FOR

1881.

A.—INQUIRY INTO THE DECREASE OF FOOD-FISHES.
B.—THE PROPAGATION OF FOOD-FISHES IN THE WATERS OF THE UNITED STATES.

Cota

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1884.

LETTER

FROM THE

COMMISSIONER OF FISH AND FISHERIES,

TRANSMITTING,

In compliance with law, his report for the year 1881.

JUNE 21, 1882.—Ordered to lie on the table and be printed.

UNITED STATES COMMISSION OF FISH AND FISHERIES,
Washington, D. C., March 17, 1882.

GENTLEMEN: I have the honor to transmit herewith my report for the year 1881, as United States Commissioner of Fish and Fisheries, embracing, first, the result of inquiries into the condition of the fisheries of the sea-coast and lakes of the United States; and, second, the history of the measures taken for the introduction of useful food-fishes into its waters.

Very respectfully, your obedient servant,

SPENCER F. BAIRD,
Commissioner.

Hon. DAVID DAVIS,
President of the United States Senate, and
Hon. J. W. KEIFER,
Speaker of the House of Representatives.

CONTENTS.

I.—REPORT OF THE COMMISSIONER.

A.—GENERAL CONSIDERATIONS.

B.—INQUIRY INTO THE HISTORY AND STATISTICS OF FOOD-FISHES.

C.—THE PROPAGATION OF FOOD-FISHES.

D.—ABSTRACT OF THE ARTICLES IN THE APPENDIX.

E.—SUPPLEMENT TO REPORT PROPER.

II.—APPENDIX TO REPORT OF COMMISSIONER.

APPENDIX A.—GENERAL.

APPENDIX B.—THE FISHERIES.

APPENDIX C.—NATURAL HISTORY AND BIOLOGICAL RESEARCH.

APPENDIX D. PROPAGATION OF FOOD-FISHES.

LIST OF ILLUSTRATIONS.

DREDGING APPARATUS.

HATCHING APPARATUS.

MACKEREL FISHERY.

ANNELIDA CHÆTOPODA.

RETARDING THE DEVELOPMENT OF EGGS OF THE SHAD.

FISH TRANSPORTATION.

HATCHING APPARATUS.

REPORT OF THE COMMISSIONER.

A.—GENERAL CONSIDERATIONS.

1.—INTRODUCTORY REMARKS.

In the report herewith presented will be found an account of the operations of the United States Fish Commission during the year ending December 31, 1881.

In entering upon a second decade a few changes in methods of administration have been made, some of which were rendered necessary by the expansion of the work, while others have been suggested by the experience of the first ten years. Some idea of the extent of the correspondence may be obtained from the accompanying table prepared by Mr. C. W. Smiley, in charge of the archives, showing the number of letters written each month from 1871 to 1881, inclusive. The number received was much greater. Probably one-half of the latter were answered by printed circulars or by furnishing publications of the Commission.

The table may be of interest, also, as showing the increase of correspondence with succeeding years and steady expansion of the work. The decrease of the letters in 1876, the year of the International or Centennial Exhibition in Philadelphia, was due to the cessation of field-work caused by the necessary occupation of the time of the Commissioner, for the greater part of the year, in connection with the Government participation on the occasion in question.

Number of letters written monthly in the office of the United States Fish Commission 1871–1881, inclusive.

Months.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
January	......	34	109	137	105	72	156	244	223	366	365
February	......	65	102	82	115	69	151	132	219	492	398
March	19	41	94	138	204	106	121	252	241	631	412
April	32	27	104	247	182	67	176	401	269	411	471
May	41	44	113	173	217	74	278	334	337	415	440
June	36	48	86	133	103	61	187	310	339	515	511
July	31	97	65	129	275	102	307	173	275	486	555
August	7	46	98	180	187	61	300	218	261	331	676
September	7	45	137	138	232	117	200	334	360	283	447
October	16	26	82	167	220	11	107	228	268	305	367
November	41	86	102	132	221	16	232	221	238	410	44[illegible]
December	42	88	116	166	114	58	276	268	295	422	59[illegible]
Total	272	647	1,208	1,822	2,235	814	2,491	3,115	3,325	5,067	5,673

Up to the present year, or for eleven years, all the office and administrative work of the Commission was carried on in the private residence of the Commissioner, built by him with special reference to the same, and for the use of which compensation was neither asked nor received. The accommodation thus furnished proving too contracted, an appropriation for rent of offices was for the first time made in 1881, and upon the vacant lot adjacent to the Commissioner's residence a suitable building was erected by the owner, Mr. J. O. Wilson, and occupied by the Commission in the latter part of the year. This, however, has not in any way obviated the necessity of the continued employment of the office rooms in the Commissioner's own residence.

The most noteworthy features of the year have been the following:

1. The production and distribution of German carp on a much larger scale than heretofore, in spite of the flood of February 12, which threatened to sweep away all the breeding fish.

2. The construction of an additional carp pond.

3. The construction of a car suitable for distributing fish of all kinds, and an entire change in the methods of fish transportation.

4. An entire change in the policy of distributing fish in public waters, whereby, instead of depositing a few fish in a great many localities, a great many fish have this year been introduced in fewer localities.

5. An unprecedentedly large yield of shad and consequent increase in the distribution of fry.

6. A flood in the McCloud River sweeping away all the works at that station, and which resulted in a decrease of production and distribution of California salmon and of California trout.

7. Extended experiments upon the hatching of cod at Wood's Holl in winter, and of Spanish mackerel at Cherrystone in summer.

8. The exportation of young carp, the eggs of California and land-locked salmon, and of the whitefish, to foreign countries.

9. Important investigations into the embryology and food of fishes, and upon the retardation of the development of the eggs of shad.

10. The inauguration of experiments looking to the artificial propagation of the oyster.

11. The further investigation of the new tile-fish grounds, and the publication of instructions for the use of the cod gill-net, which had been previously introduced in the ocean fisheries upon the recommendation of the Fish Commission.

12. The collection, arrangement, and distribution to educational institutions of a series of marine invertebrates.

13. The preparation of plans and specifications for an ocean steamer, an appropriation of $103,000 for the construction of a vessel for deep-sea research having been made by Congress.

14. The securing, with money raised by private subscription, of a large tract of land on Wood's Holl Harbor upon which to establish a station for the artificial propagation of sea-fishes, such as cod, &c., and also for general biological research.

15. The establishment, by act of Congress, of an annual Bulletin of

500 pages, to be issued in numbers as well as in a bound volume, and to contain important information gathered by the Commission.

16. The leasing of a building for the offices of the Fish Commission.

17. The importation from England of living turbot and sole for the purpose of stocking the waters of the United States.

Full information upon all these topics will be found under the proper headings.

2.—PRINCIPAL STATIONS OF THE UNITED STATES FISH COMMISSION.

A brief statement of the principal localities at which the work of the Commission was conducted during this year is here given as prefatory to a fuller discussion under each head.

A.—INVESTIGATION AND RESEARCH.

1. *Gloucester.*—Since Gloucester was made the summer station of 1878, quarters have, until the present year, been maintained there under lease, at Fort Wharf, for the use of the Commission. This was considered an important point, as being one of the principal fishing ports of the Atlantic Coast, where much information in regard to the fisheries and many valuable specimens could be obtained from fishing vessels. In June of the present year Messrs. Burns & Co., having purchased the premises, took forcible possession of the Fish Commission quarters, although the lease under which the rooms were held did not expire until January, 1882. The Attorney-General, the honorable Wayne MacVeagh, instructed the district attorney for Massachusetts, Judge G. P. Sanger, to take any necessary steps for maintaining the rights of the United States, but to avoid litigation it was thought best to abandon the station, although it had been intended to make it one of the principal points for hatching codfish and mackerel on an extensive scale. Since that time, however, Capt. S. J. Martin has made weekly reports of the arrival of fishing vessels and the general features of the fisheries, together with daily records of ocean and atmospheric temperatures.

2. *Wood's Holl.*—The summer investigations by the Commission have formed an important feature during nearly every year of its history, having been conducted in its successive years at the following places: 1871. Wood's Holl, Mass.; 1872. Eastport, Me.; 1873. Portland, Me.; 1874. Noank, Conn.; 1875. Wood's Holl, Mass.; 1876. Intermitted on account of the engagement of the Commissioner at the Centennial Exhibition in Philadelphia; 1877. Salem, Mass., and Halifax, Nova Scotia; 1878. Gloucester, Mass.; 1879. Provincetown, Mass.; 1880. Newport, R. I.; 1881. Wood's Holl, Mass.

The Commissioner was in attendance at this station from July 8 to October 4. From this point dredging trips were made by the steamer Fish Hawk to the Gulf Stream and other regions of the North Atlantic.

3. *Saint Jerome.*—This station, located near the mouth of the Potomac River, was established during the previous year by Mr. T. B. Fer-

guson, as Commissioner of Fisheries for the State of Maryland, for the purpose of conducting experiments in regard to the artificial propagation of oysters, &c. This year the United States Commissioner joined with the Maryland Commissioner, and the operations were under their general auspices, but under the special direction of Mr. Ferguson.

B.—Propagation of Salmonidæ.

4. *Grand Lake Stream on the Schoodic Lakes.*—The station at this place, situated not very far from Calais, Me., was inaugurated in 1875, and has proved very successful in furnishing a supply of the eggs of the land-locked salmon.

5. *Bucksport, Me.*—This station, located near Bucksport, and adjacent to the mouth of the Penobscot River, has been in operation since 1871 for the taking and hatching of eggs of the Penobscot or Atlantic salmon, under the direction of Mr. Charles G. Atkins.

6. *Northville.*—A fish-hatching station was established at Northville, in 1868, by the late Mr. N. W. Clark. Since 1874 the United States Fish Commission has made use of it, and since 1880 has held it under lease. At this station whitefish, lake trout, brook trout, California trout, &c., are hatched.

7. *McCloud River Salmon Station.*—This station, not far from Mount Shasta, and on a tributary of Pitt River, one of the principal branches of the Sacramento, has been in successful operation since 1872, and has turned out 70,000,000 eggs, largely increasing the local supply of the Sacramento River, as well as furnishing eggs for shipment to the East, and to foreign countries.

8. *McCloud River Trout Station.*—This is located a few miles from the salmon station, and was established in 1879 for the taking of eggs of the California mountain trout.

C.—Propagation of Shad.

9. *Battery Island.*—Work at this station, near Havre de Grace, Md., was carried on from May 15 to June 13, under the direction of Mr. Frank N. Clark, for the taking and hatching of eggs of the shad, and for conducting some important experiments connected with the retardation of the development of the eggs.

10. *North East River, Maryland.*—This station, a few miles from Battery Island, near the mouth of the Susquehanna, was operated from May 5 to June 5, inclusive, by the steamer Fish Hawk, for taking and hatching the eggs of shad, this vessel having been transferred from Avoca upon the completion of the season there.

11. *Central Station.*—The Centennial exhibits, which had been stored in the Armory building in Washington for several years, were this year in part removed to the new Museum building, and by authority of Congress the space thus vacated was fitted up as a central hatching and distributing station. It is abundantly supplied with water, and from

its location, adjacent to the Baltimore and Potomac Railroad tracks, is very convenient as a shipping depot for fish and eggs. During the year permission has been obtained from the District Commissioners to extend a side track from the railroad, along the southern side of the building. It will also be used for investigations upon fish and eggs in relation to many practical and biological questions.

12. *Washington navy-yard.*—This station was occupied temporarily, as in some former years, from May 4 to June 25, inclusive, for the hatching of shad-eggs, which were collected at the fisheries on the Potomac and brought thither by a steam launch.

13. *Potomac River barges.*—Two of the barges, one fitted as quarters and the other containing facilities for hatching, were transferred from Havre de Grace and anchored in Gunston Bay, about 20 miles below Washington. This temporary shad-hatching station was most successful, and was under the immediate direction of Mr. Marshall McDonald from April 20 to May 30, inclusive.

14. *Avoca, N. C.*—This was a temporary station occupied from April 12 to April 30 by the steamer Fish Hawk, Lieut. Z. L. Tanner, U. S. N., commanding, for the taking and hatching of the eggs of shad.

D.—Propagation of Carp.

15. *Carp ponds at Monument Lot.*—These ponds have been maintained during the present year for the propagation of carp under the superintendence of Mr. Rud. Hessel. The number of carp produced was larger than in any previous year. A new pond has also been constructed during the present year.

16. *Carp ponds at the Washington Arsenal.*—These ponds were maintained as heretofore for the propagation of the scale and mirror carp, and were under the charge of Mr. Elliott Jones, of the Ordnance Department, United States Army, until the latter part of May, when, through his transfer to another field of duty, the Commission was deprived of his services. The General of the Army, however, kindly instructed General Ayres, the commandant of the artillery station in the Arsenal Grounds, to protect the ponds and their contents from disturbance and depredation.

3.—ASSISTANCE RENDERED TO THE COMMISSION.

The act of Congress establishing the Commission directs the Executive Departments of the Government to render all necessary and practicable aid in carrying out its mission; and, as in previous years, it is my very agreeable duty to report the cordial manner in which this has been done. The most noteworthy occasions for this service have been as follows:

Treasury Department—*Secretary's Office.*—June 1, Thomas J. Hobbs was designated to disburse the appropriation for "fish hatching establishments, 1881–1882, $10,000," and on the 15th of November he was instructed to disburse the appropriation for the new steamer.

Bureau of Revenue Marine.—In the latter part of October a consignment of turbot and sole arrived from Europe, and in order to facilitate their immediate transportation to a place of deposit, the revenue steamer Grant, under Captain Fengar, was placed at the disposal of the Commission by order of the Secretary of the Treasury.

Light-House Board.—By instruction of the Board in previous years, many light-house keepers have continued to furnish satisfactory records of ocean temperature. November 25 the Board directed that these temperatures should also be taken at three new places in Chesapeake Bay. May 11 the Board granted the use of a building in the buoy shed at Wood's Holl for the summer. June 15 the Board granted a three months' leave of absence to Ephraim Edwards in order that he might act as fog pilot of the steamer Fish Hawk during its stay at Wood's Holl. In March General O. E. Babcock rendered important services to the steamer Fish Hawk in navigating Albemarle Sound. At the request of the Fish Commission, the Light-House Board, in the latter part of August, had the entrance to Saint Jerome's Creek properly marked with buoys.

Coast Survey.—On many occasions during the year Capt. C. P. Patterson, Superintendent of the Coast Survey, responded to requests for charts of Wood's Holl, Chesapeake Bay, Atlantic coast, as well as for copies of the Coast Pilot.

WAR DEPARTMENT.—June 16 the Adjutant-General of the Army announced that instructions had been given by General Hancock to the chief quartermaster of the Washington Arsenal to take charge of the carp ponds at that point.

Engineer Bureau.—In November Col. W. P. Craighill, United States engineer, Baltimore, ordered important improvements at Battery Island, such as providing a landing place for the seine; the preparation of a breakwater; laying the foundation of the hatching house; the filling of the island; and the sheathing of the basin with boards. The Ordnance Department remitted a charge for rifles and ammunition used in 1878 at McCloud River Station, the property having been lost in the flood of this year, and issued an order for duplicating the same.

Signal Office.—On many occasions during the year, the Chief Signal Officer has furnished thermometers for light-house keepers to use in taking ocean temperatures. April 27 General Hazen furnished a complete set of recording and self-registering meteorological instruments for use at Havre de Grace, and on June 27 sent Sergeant Seybooth to Havre de Grace to inaugurate the observations. During operations at Wood's Holl he furnished a series of weather reports, and gave special notice of apprehended hurricanes and storms on the coast, which were of great importance to the steamer Fish Hawk in arranging for trips to the Gulf Stream. He also authorized the stretching of telephone wires along the signal service poles at Wood's Holl.

THE NAVY DEPARTMENT.—From its first organization the United States Fish Commission has been more closely related to the Navy Department than to any other branch of the Government, and the facilities extended by it, in compliance with the law as well as in accordance with the kindly feeling of the Secretaries and of the chiefs of bureaus, have been of the utmost importance. This aid has been shown in the detail of several steamers, fully manned and equipped, for service; the loan of launches; the execution of work and of repairs at the navy-yards, and in many other ways.

The experiences of 1881 have been in the same general direction; the most important occasion being the loan of two steam launches, one a Herreshoff, No. 62, and the other a naval launch, No. 55, both rendering admirable service in their respective avocations; this, of course, in addition to furnishing officers and men to the Fish Hawk, the Lookout, and the launches.

The United States steamer Despatch being under orders for service in the West Indies was likely to be delayed unseasonably by waiting for the completion of repairs on her steam launch. In this emergency it gave me great pleasure to accede to a request from the chief of the Bureau of Construction and Repair to supply the Despatch with the Fish Hawk's launch and take the other in exchange when completed, as both were of the same character. No inconvenience resulted to either vessel by the exchange.

POST-OFFICE DEPARTMENT.—At various times during the year Mr. W. L. Nicholson, the topographer of the Department, furnished post-route maps.

INTERIOR DEPARTMENT.—The Commissioner of Patents has furnished copies of specifications of patents relating to the fisheries and fishery apparatus.

DEPARTMENT OF JUSTICE.—The Attorney-General, Hon. Wayne MacVeagh, instructed the district attorney of Massachusetts to advise with the Commissioner with reference to the interests at Gloucester and also to the acquisition of land at Wood's Holl.

COMMISSIONER OF PUBLIC BUILDINGS AND GROUNDS.—May 20, Col. A. F. Rockwell furnished the Commission with a quantity of iron fencing to be used at the carp ponds.

DISTRICT COMMISSIONERS.—The District Commissioners, May 31, issued a permit for extending a railroad track from the Baltimore and Potomac line to the Armory. Major Brock, Chief of Police, gave directions for removing squatters from the river front near the carp ponds. Dr. Smith Townshend, health officer, has furnished each month reports of the inspection of fresh fish for the District of Columbia.

RAILROADS.—At the close of this report will be found a list of railroads that have granted the privilege of carrying fish in their baggage cars during the year, in continuance of a custom which had been established for several years. The Fish Commission car having been completed in the spring, some special arrangements with reference to its rate of transportation were called for. On May 20 Mr. Isaac Hinckley, president of the Philadelphia, Wilmington and Baltimore road, offered the rate of 20 cents a mile for car and five messengers. This was shortly afterwards acceded to by the Pennsylvania Railroad, the Baltimore and Ohio, the Chicago, Burlington and Quincy, the Boston and Albany, the Cincinnati, Hamilton and Dayton, the Flint and Pere Marquette, the Illinois Central, the Louisville and Nashville, the New York, New Haven and Hartford, the Old Colony, the Pittsburgh, Fort Wayne and Chicago, the Terre Haute and Indianapolis, and the Vandalia line. The Union and Central Pacific railroads offered the rate of $370 for moving the car from Council Bluffs to San Francisco.

STEAMSHIPS.—The North German Lloyd steamer Donau, sailing in January, took out 20,000 land-locked salmon for Germany. December 20 the steamer for Panama took a can of carp for Arthur Morell at San José. In December the steamship Oder took 350,000 whitefish eggs for Germany.

WESTERN UNION TELEGRAPH COMPANY.—January 28 the operators of the Western Union were instructed to receive and transmit at Government rates, without prepayment, the messages on official business from the messengers of the Fish Commission.

FOREIGN COUNTRIES.—Of courtesies extended to the Commission by individuals or establishments in foreign countries, the following may be enumerated:

GERMANY—(*Saibling.*)—On the 23d of January an invoice of 60,000 saibling eggs (*Salmo salvelinus*) arrived from Burgomaster Schuster, of Freiburg, Germany, with a loss of but 5,000 eggs. The particulars of their treatment on arrival will be found on page XLV.

FRANCE—(*Gourami.*)—In August an effort was made by Monsieur L. Carbonnier to send a pair of live gourami to the United States, consigned to Mr. E. G. Blackford. Unfortunately, one died on the passage and the other a short time after reaching this country. Further reference to this experiment will be found on page LII.

ENGLAND—(*Turbot and sole.*)—In October Mr. C. L. Jackson, of Bolton, England, started 70 live soles and 35 turbot for the United States, in charge of A. Wilson Armistead. Of these, 67 soles and 29 turbot died on the passage, and there arrived, October 26, 3 soles and 6 turbot. These were taken charge of by Mr. Blackford, Mr. Mather, and Mr. Phillips, who deposited them off Long Island, nearly opposite the Hotel Brighton, on the day of their arrival. Further particulars of this will be found on page LIII.

4.—COURTESIES EXTENDED BY THE COMMISSION TO FOREIGN COUNTRIES.

During the present year, as in previous ones, considerable numbers of salmon, whitefish, and trout eggs have been sent abroad in exchange for such species as it is considered desirable to import into the United States. These shipments have been generally successful, though sometimes attended with loss. This year, in addition, carp have been sent to a considerable number of countries.

GERMANY.—The whitefish eggs which were forwarded December 25, 1880, per steamer Donau, to the *Deutsche Fischerei-Verein*, of which Herr von Behr is the president, arrived in good condition on January 10 of the present year. On the 19th of March, 20,000 land-locked salmon eggs were forwarded to the *Verein* by the same steamer, and again, on the 8th of October, 350,000 eggs of California salmon, also by the Donau. The California salmon eggs reached Germany in good condition, and were hatched partly at Freiburg and partly in Hungary, the latter finding their final destination in the Danube.

On the 17th of December 20,000 eggs of lake trout were forwarded by the steamer Maine to Herr von Behr.

On the 26th of December there were shipped per steamer Oder, from New York, 300,000 whitefish eggs for the *Deutsche Fischerei-Verein*, and 12,000 whitefish eggs for G. L. Ebrecht, Geestemunde, near Bremen.

There were also forwarded on the same date and by the same steamer 20,000 lake-trout eggs for F. Busse, at Geestemunde, and 12,000 brook-trout eggs for G. L. Ebrecht. Mr. Busse has furnished us on previous occasions with collections of fishes from Germany from which to make plaster casts. Mr. Ebrecht has signified his intention of forwarding blue and golden carp in return for these eggs.

FRANCE.—On the 19th of March there were forwarded per steamer Donau, via Bremen, 20,000 salmon eggs, consigned to the *Société d'Acclimatation*. On the 25th of April the *Société* acknowledged their receipt in excellent condition, and stated that those sent in the previous year were doing well.

At the request of the secretary, M. Raveret-Wattel, there was forwarded, February 21, through the Bureau of International Exchanges a sample of Frank N. Clark's self-picking apparatus for the *Société d'Acclimatation*.

ENGLAND.—Correspondence was entered into early in the year with Hon. W. Oldham Chambers, honorary secretary, in reference to his obtaining from the Commission a consignment of eggs of the California salmon, the California trout, and the land-locked salmon. The floods in the McCloud River and the reduced number of land-locked salmon eggs, however, prevented any sending during the present year.

SCOTLAND.—On the 9th of November 25 leather carp were delivered in New York to A. Wilson Armistead, of Douglas Hall, near Dalbeattie, Scotland. After a very stormy voyage, he was able on the 22d of December to announce their safe arrival. He also took home with him 30 or 40 large black bass.

BELGIUM.—Correspondence has been maintained during the year with Thomas Wilson, United States consul at Ghent, looking to the introduction of the American catfish into Belgium.

ECUADOR.—In May of the present year thirty carp were forwarded to E. G. Blackford, New York, who delivered them to Frederick Wesson, of 75 William street, for shipment to Ecuador. On the 21st of May they were forwarded per steamer Colon. On the 23d of August Mr. Wesson was able to announce that six of the carp had safely arrived and had been deposited in a lake on the estate of Señor Jijon, near Quito, although not until numerous difficulties had been overcome.

COSTA RICA.—In November Hon. William Hunter, of the State Department, made application in behalf of Arthur Morrell, United States consul in Costa Rica, for a can of living carp. These were forwarded to New York December 15, and left on the steamer of December 20 for Aspinwall, consigned to Mr. Morrell, at San José, Costa Rica. Dr. Bransford, of the Navy, was a passenger on the steamer, and kindly undertook to give them the necessary supervision on the voyage.

MEXICO.—Early in the year Maj. Gen. O. E. C. Ord took with him a supply of carp to the city of Mexico. News was received from him, March 10, of their safe arrival.

CANADA.—As on one or two previous occasions, carp were this year sent to Samuel Wilmot, superintendent of fisheries, Newcastle, Ontario. On December 31 he reported that they reached him in good condition.

5.—FISHERY EXHIBITIONS.

Last year a full account was given of the participation of the United States in the International Fishery Exhibition at Berlin, and of the safe return of the collections. These were in due time installed in the National Museum so far as practicable. On February 18, Congress passed a bill, which had been introduced by the Hon. J. G. Carlisle, to admit free of duty the vase which was awarded to the United States Fish Commissioner. On the 28th of February this bill was signed by the President and became a law. On the 30th of March the Hon. James G. Blaine, Secretary of State, transmitted the various medals and diplomas which had been awarded to the American Exhibitors. These were forwarded to the proper persons. During the year there was held a fishery exhibition at Norfolk, England, and another was announced for Edinburgh, Scotland, in 1882, in both of which the United States Commission was asked to participate, but it was necessary to decline the invitations.

6.—FISH COMMISSION BULLETIN.

On the 14th of February Congress, by joint resolution (House resolution No. 372), authorized the publication annually of a Bulletin of 500 pages, to contain the announcements of new observations, discoveries, and applications of fish-culture and fisheries. The following is a copy of the resolution:

JOINT RESOLUTION authorizing the Public Printer to print reports of the United States Fish Commissioner upon new discoveries in regard to fish-culture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Printer be, and he hereby is, instructed to print and stereotype, from time to time, any matter furnished him by the United States Commissioner of Fish and Fisheries relative to new observations, discoveries, and applications connected with fish culture and the fisheries, to be capable of being distributed in parts, and the whole to form an annual volume or bulletin not exceeding five hundred pages. The extra edition of said work shall consist of five thousand copies, of which two thousand five hundred shall be for the use of the House of Representatives, one thousand for the use of the Senate, and one thousand five hundred for the use of the Commissioner of Fish and Fisheries.

This Bulletin was introduced by an article of 16 pages, accompanied by 12 plates, upon the use of gill-nets in the cod-fishery, by Capt. J. W. Collins. Of this paper 1,500 extra copies were also published and distributed in pamphlet form. There were 109 different articles published in this Bulletin, among the more important of which were the following: Observations on the food of young whitefish, by Prof. S. A. Forbes; Notes on the development of stickleback, Spanish mackerel, shad, hippocampus, and silver gar, oysters, &c., by John A. Ryder; Notes on the cod, mackerel, and other fishes of Gloucester, by S. J. Martin; Notes on the life-history of the eel, by G. Brown Goode; Carangoid fisheries of the United States, by G. Brown Goode; The winter haddock fishery, by Goode and Collins; Changes in the fisheries of the Great Lakes, from 1870-'80, by C. W. Smiley; Notes on white-fish-hatching apparatus, by Frank N. Clark; Description of new species of fish, by Jordan and Gilbert; and A discussion on the disease among salmon in English waters, by Professor Huxley and S. Walpole.

7.—THE PROPOSED STEAMER ALBATROSS.

The steamer Fish Hawk, of the construction and performances of which a full account has been given in the present and preceding Reports, was built to serve as a floating station for hatching the eggs of shad and other fish, experience having shown that many important stations need to be occupied only for a short time, without the necessity of a permanent establishment. Thus, by means of a vessel like the Fish Hawk, work can be begun at the South in the winter or early spring, and the vessel moved, as the season advances, to more northerly points, carrying with it, of course, all its outfit and equipment, and able to commence operations immediately on arriving at a suitable anchorage.

Provision having thus been made to utilize all possible opportunities for the propagation of food-fishes, by the establishing of movable as well as of permanent stations, the United States Fish Commission has endeavored to extend its sphere of operations in other directions, so as to render its work more and more useful to the country.

It is well known that the interests of the nation are closely identified with the prosperity of its fisheries, their extension and development furnishing a stimulus to all the industries connected with the waters. While supplying occupation to a large number of persons, the amount of the fish product is increased and the cost diminished.

In this connection may also be considered the increase in the number of persons accustomed to the use of boats and vessels, and furnishing in time of need the material for supplying the vessels of the United States Navy.

Referring to the next section of the present Report for the details of desirable research and for a presentation of the importance of constructing a suitable vessel for carrying on the work, I have to announce the approbation of Congress, as shown in an appropriation of $103,000 for the construction of a suitable steamer to be built for the use of the Fish Commission.

No Department having been designated to overlook its construction, the Secretary of the Treasury was asked to place the work under the direction of the Light-House Board, which had so ably supervised the building of the Fish Hawk. This having been granted, Mr. Charles W. Copeland was selected by the Board to prepare the necessary plans and specifications, so as to carry out the needs of the Commission. In this he had the assistance of Lieut. Z. L. Tanner, commander of the Fish Hawk, who was able to indicate important points to be provided for in connection with scientific work, as also of Engineer G. W. Baird.

The estimates of the cost of the vessel upon which the appropriation was based were made in the year 1880, but it was not until October, 1881, that it become possible to issue advertisements for proposals. By that time the price of iron and of labor had advanced very materially, and the appropriation was found to be inadequate, the bids for an iron steamer being severally as follows:

H. A. Ramsey & Co., of Baltimore	$129,500
Pusey & Jones, of Wilmington, Del	130,800
Harlan & Hollingsworth, of Wilmington, Del	137,000

These figures being all far beyond the amount of the appropriation, it became necessary either to prepare plans for a smaller vessel or to defer further action until an additional appropriation could be made by Congress. The latter alternative was considered preferable.

B.—INQUIRY INTO THE HISTORY AND STATISTICS OF FOOD-FISHES.

8.—PROPOSED INVESTIGATIONS INTO THE OFFSHORE FISHERY GROUNDS OF THE UNITED STATES.

Among the most important objects of a Government fishery commission is that of investigating the known fishing-grounds of a country, to determine accurately their extension and character, so as to define the circumstances and conditions under which the pursuit of the various species of fish can be prosecuted at the various seasons of the year, and also to ascertain what natural bait most attractive to the fish can be secured on the ground, and what can be most advantageously brought from a distance. This involves, also, the question of the methods of fishing most appropriate to the different localities.

A second object of such a commission should be the discovery and definition of new fishing-grounds, or such as had been previously unknown to the fishermen. Such undoubtedly exist, and from time to time are accidentally brought to light, some becoming of national importance. Incidental to this is the inquiry into the hitherto unknown winter abode of many of our valuable summer fishes, which are absent from our shores for several months of the year, as is the case with the mackerel, menhaden, bluefish, and many other species. An important corollary is to relieve the United States fishermen from their dependence upon the Canadian waters, either for fish or for bait; so that, even with the utmost probable development of the fishery marine of this country, it may find ample occupation in the waters directly off from our own coast, from Maine to Florida.

One general result of such stimulation and development will, of course, be found in a great increase in the number of sea-going fishing-vessels and the training of their crews to maritime adventure. Norway is the only country in Europe in which the Government has come to the aid of the fishermen in any notable degree, and the result of a moderate amount of attention by the State is shown by the immense development of the fishing industry. It is well known that Norway is supported by her fisheries to a greater extent than any other country, and that her exports constitute a great source of the fish supply of the world, her cod and herring being exported in immense quantities, not only over the whole of Europe, but even to the West Indies, and to Central and South America. The Loffoden Islands are the great winter spawning-grounds of the cod in the North Atlantic of Europe; and here, for four or five months of each year, the fishing industry is prosecuted to its utmost extent, the product being greater than that of America, including both the British provinces and the United States.

The Norwegian Government has for many years sustained a scientific commission for the purpose of studying carefully all possible methods of protecting and developing her fisheries, and with distinguished success. It has, however, not been satisfied with its labors in the known grounds, but has for several years had a large steamer engaged in a thorough search for additional fishing-grounds, and although the Norwegian seas have been traversed by her fishing-vessels for hundreds of years, each year some new locality is discovered, made known and occupied, including the previously unknown summer abode of her winter fish.

This problem, so far as the offshores of the United States is concerned, is one that is eminently worthy of the attention of the United States Fish Commission and the support of Congress in its attempt to solve it. At present the principal grounds visited by the fishermen of the United States, excepting for mackerel, are found between latitudes 41° N. and 46° N., a breadth of only about five degrees, but extending eastward beyond the eastern edge of the Grand Banks. The special objects of search over these grounds are the cod and halibut; but the incessant prosecution of the business in one locality tends to diminish the supply and to lead to the inquiry for other banks not yet ascertained. A systematic investigation of the fishing-grounds will result in determining the exact depths at which the fish can be taken at different seasons of the year and the regions where this industry can be most profitably pursued.

Another, even more important, branch of the subject, is that of finding entirely new localities not previously explored. A notable instance of what may be done in this respect is seen in the case of the tile-fish, a species already mentioned. A few of these were accidentally taken by a Gloucester fishing-vessel in 1879, and like all strange fishes brought into that port, were delivered to an agent of the Fish Commission, who transmitted them to Washington. Here they were carefully investigated and found to constitute a very desirable as well as new genus and species of food-fish, and one entirely worthy of future attention. In September, 1880, the Fish Hawk proceeded to the locality where these fish were taken, about 75 miles south of Newport, and discovered that this was in the western edge of the Gulf Stream. On putting down the trawl-net the sea-bottom was found to be rich in animal life, beyond any previous experience of the Commission, the mass and variety being perfectly startling, and a large number of new species being readily secured in a short time. The quantity of crabs, shell-fish, &c., serving as food for fishes, was incalculable. The fishing-lines were then brought into requisition and the tile-fish found in abundance proportional to that of its food. The fish were then traced, in three successive trips of the vessel, along an extent of 60 miles, where they appeared to be as abundant as codfish on their banks, and were taken with even greater facility with the hook. The flesh was found to be most palatable, and to be capable of preservation by salting or drying, in the same way as the cod. A fish, therefore, which two years ago was entirely unknown, even to the fishermen, now bids fair, when its distribution is better ascertained, to constitute a most important object of pursuit by the fishermen, and to have the especial advantage of occurring farther to the south than the localities in which the cod and halibut are abundant, and yet to be equally accessible from any part of the coast. It is extremely desirable therefore that this inquiry be prosecuted so as to ascertain exactly over what degrees of latitude the tile-fish occurs. A similar research in the waters to the south and southeast of New England will, in all probability, show much more accessible localities for the halibut and cod, especially in the winter season.

There is also a large field for investigation into new fishing-grounds off the coast of the Southern States; several fishes, such as the sea bass, the red snappers, &c., occurring there in great abundance, while a few localities only are known.

In time these investigations should be continued into the Gulf of Mexico (where there are vast possibilities of fisheries not yet developed), as well as on the Pacific coast of the United States. Here scarcely anything has been done, or is known, beyond the general fact that valuable stores of food-fishes exist in the sea, though the best fishing-grounds are not yet indicated.

An incidental result of winter explorations off the middle and southern coast of the United States, will be, in all probability, the discovery of the present winter grounds of certain fishes that are abundant near the shores only in the summer, but which are absent for from four to six months in entirely unknown winter quarters. These are especially the mackerel, the bluefish, the menhaden, the swordfish, the horse-mackerel, the shad, the salmon, the Spanish mackerel, &c. In all probability they are found in the same region with the tile-fish, as the researches of last summer showed that the food of all the fishes mentioned occurs in an inexhaustible quantity in the locality just indicated.

Norway has a very small area of ocean in which to prosecute her fisheries, compared with the United States, and a systematic investigation on the American side will undoubtedly produce results of greater comparative importance.

In the earlier years of the American fisheries and in the greater abundance of inshore fishes, with a comparatively slight demand in consequence of the small population of the country, and the difficulties of transporting the fish, it was quite possible to obtain within easy reach of our coast fish enough to meet all the requirements. Now, with a population of fifty millions of people, the great decline of the inshore fisheries, and the ability not only to transport fresh fish to any distance inland, without deterioration, but with also the growing demand for salted, dried, and canned fish, it is of the utmost importance that every facility be furnished to the fishermen in the prosecution of their business. The diminution of inshore fishing is particularly noticeable in the case of the halibut. This fish was formerly taken with great ease in small boats all along the New England coast, and at first was considered of very little value, fish weighing a hundred pounds and over being caught and thrown back into the water as refuse, and classed in the same category with sharks, skates, and rays. Within a comparatively few years, however, the halibut has appreciated in value, and is now one of the principal objects of pursuit by the New England fishermen. The yield of this fish to Gloucester alone in 1879 amounted to over eleven millions of pounds.

In later years it has been necessary to follow the halibut into deeper and deeper waters, so that while twenty years ago it might be taken in water of 10 to 50 fathoms, it is now seldom caught in less than 100 fathoms, and deeper waters are gradually traversed up to 300 fathoms. The increasing depth renders it constantly more difficult for the fishermen to prosecute their labors, and makes it more important that new localities be discovered.

An important result of the research herein proposed will be the release in a greater or less degree from that dependence upon Canadian waters for fish and bait, for which the United States is now paying at the rate of $800,000 a year for twelve years, extending from 1873 to 1885. It is to be hoped that before the expiration of this period, and the meeting of a new commission, we will be in a position to decline any negotiations whatever for privileges much inferior in value to those possessed on our coast without any question of interference on the part of others. It is confidently believed that, in the discovery of new fishing banks and grounds, at a comparatively moderate distance from the coast, from Cape Cod to Florida, a large increase of the fishing fleet may be looked for, and that vessels from the ports of Jacksonville, Fernandina, Savannah, Charleston, Wilmington, Norfolk, &c., will find ample occupation throughout the year. That this will result in a great increase of the fishery marine is unquestionable; and in the continued diminution of the number and crews of merchant vessels of the United States, the question of securing and maintaining an ample sea-faring population, is one of no small moment to the political economist. The magnitude of the present industry is shown by the fact that the fishing fleet of Gloucester alone, consists of 385 vessels of above 5 tons, manned by 4,375 individuals, in large part consisting of men from Nova Scotia and New Brunswick. More southern crews will probably be more or less entirely American in their composition. The catch of these 385 vessels in 1880 is estimated at 129,620 barrels, or 25,924,000 pounds, of mackerel; 9,000,000 pounds of halibut, and 57,758,000 of salt cod, or other salt fish—an aggregate of 92,682,000 pounds, and this exclusive of a large quantity of other fish sold fresh. The total number of trips to secure the above-mentioned quantity of fish consisted of 1,430 to the George's Banks, 249 to the Grand and Western Banks for cod, and 261 to the same for halibut, a total of 1,940 trips. The necessity of new grounds for halibut is shown by the fact that the number of this fish taken in 1879 was 11,336,716 pounds, a decrease of 2,336,716 pounds, or 20 per cent. in a single year.

An important consideration in connection with this problem of the expected fishing-grounds is the great increase in the demand for fish, consequent upon the success of the American display at the International Fishery Exposition at Berlin in 1880, as will be seen in another portion of this report. The American success was everything that could be desired, the display of this country being placed unhesitatingly at the very head of all others, although but a short time was allowed for its preparation. The quality and character of the American prepared fish attracted also deserved attention, and already engagements and contracts have been entered into between parties in Europe and the United States involving interests likely before long to amount to millions of dollars.

It may not be amiss, in this connection, to refer to the fact that the introduction by the United States Fish Commission to the American fishermen of the Norwegian system of taking codfish by means of gill-nets, with glass floats, has already become of the utmost value. Heretofore in the capture of codfish the question of bait has been the most important, ample opportunities frequently occurring for taking cod which cannot be utilized for the want of suitable bait. This rendered it necessary to resort to the British provinces for the purpose of obtaining it, and has caused almost entirely the recent difficulties between the fishermen of the two countries, which have been the subject of repeated diplomatic correspondence between the United States and Great Britain. When gill-nets can be used bait is unnecessary, and it is probable that within a few years three-fourths of the fish taken will be by gill-nets, and bait used only in localities where the net is not applicable.

The preliminary research by which the locality and relationships of the tile-fish were ascertained was prosecuted by the Fish Hawk, the fish-hatching steamer connected with the service of the United States Fish Commission. This vessel, in an interval of enforced inaction in her special work, made three trips to the edge of the Gulf Stream during the months of September and October, each time being but twelve hours on the ground. Not intended as a sea-going steamer, of course, it was not proper to run any risks, and it was simply on the occasion of a spell of settled weather that the vessel could run out one night to the grounds, spend a single day there, and return the next night, on each occasion being absent only thirty-six hours. To do the work properly requires a steamer that can remain off the coast in any weather, winter or summer. Such a vessel has been planned by Mr. C. W. Copeland, the naval constructor of the Light-House Board, in which are embodied all the requirements for a staunch sea-going vessel, as small as the service will permit, and able to do any work of this kind, and at the same time perfectly fitted for the hydrographic service of either the Coast

Survey or the Navy Department, to either of which branches of the service it can be transferred when no longer needed for the Fish Commission. The length of keel proposed is about 200 feet. Under the law of Congress she would be furnished by the Navy Department with officers and crew, otherwise not employed, so that the expense to the country will be little beyond that of construction, the vessel, of course, being available either in an emergency or permanently for the service of the Government in any Department other than that for which especially constructed. Provided with sails, such a vessel will be able to dispense with a large expenditure of coal. There is at present nothing of the kind belonging to the United States service, either in the Navy or Coast Survey, and her construction would furnish an important addition to the naval resources of the United States.

The method of research, in the interest of the fisheries, upon the proposed steamer, will consist in the use of the most approved apparatus for determinations of temperature, depths, and currents, and for collecting objects from the sea-bottom, from the surface, and for the depths midway; also in securing samples of the water at the different depths, for chemical and microscopical investigation. The temperature investigations will be of very great importance, as the distribution and migrations of fish are influenced by the variation of temperature in the waters inhabited by them.

An important problem for solution on such a vessel is the determination of the reasons why the menhaden, within the last few years, have almost entirely abandoned the coast of Maine, and indeed the whole region to the north of Cape Cod. Upon this fishery in the Gulf of Maine depends the livelihood of some two thousand men, and the success of an investment of between one and two million dollars. If this change in the habit of the fish is likely to be permanent, the sooner the fact is ascertained the better, that the industry may be transferred to some other quarter, since now its prosecution is attended with no other result than that of serious loss to those who are concerned in it. There is no question that the cause is a physical one and capable of determination.

A similar problem is that relating to the disappearance of mackerel in the Gulf of Saint Lawrence. It was for the privilege of participating in this fishery that the United States recently paid the onerous Halifax award. If we can determine the probability of a continued absence of fish from the Gulf before the next convention to consider the value of the Canadian fisheries to the United States, it will greatly simplify the impending negotiations.

Many other similar questions may be solved by the results of a thorough scientific inquiry, and it is not impossible that we may hope to establish general principles by which the fishermen each year may know at what points to meet the incoming schools of mackerel and menhaden, and save weeks of fruitless search for them.

As incidental to the economical inquiry, but of very great interest to the naturalist, will be the collecting of objects of natural history in large quantity otherwise unattainable. The investigations already made by the inshore explorations of the United States Fish Commission have added greatly to our knowledge of the biology of the sea, and enabled the Smithsonian Institution to distribute to the principal museums and universities of the country duplicate series of objects of great educational value to them.

With the larger field of investigation which will be accessible to a sea-going steamer, this material will be vastly increased, both in quantity and variety. This is shown by the fact that during the three days, or thirty-six hours in all, spent by the Fish Hawk on the tile-fish grounds, no less than 175 different species of shells were collected, of which more than one-fourth were entirely new to science.

The scientific aspect of deep-sea research is one that has occupied the attention of the principal nations of Europe, the British Government having a few years ago sent out one of her finest frigates on a three years' voyage in the seas of all parts of the globe, the results of which proved to be of very great interest and importance.

9.—THE FISHERY CENSUS OF 1880.

In pursuance of the arrangements made in 1879 with General F. A. Walker, Superintendent of the Tenth Census, particulars of which have been given in the two preceding reports, work upon the fishery division of the census was continued during the year 1881, under the general supervision of Mr. G. Brown Goode.

The plan of operations pursued has been published as an appendix to the Fish Commission Report of 1880, by the close of which year nearly all of the investigations were completed. The gathering of material from the eastern side of Buzzard's Bay, from the north shore of Long Island Sound, from the Pacific coast, from the shad and alewife rivers, and from the lobster, crab, and whale fisheries, extended into 1881, but was mostly finished in the early part of the year. The preparation of material for the press, which had advanced very satisfactorily in 1880, was pushed forward with vigor in 1881.

The following publications have been made:

1. On the 24th of May a bulletin (Census No. 176) was issued under the direction of Mr. Goode. This contained four tables giving statistics of the fisheries of California, Oregon, Washington, and Alaska. It included the cod, salmon, whale, seal, fur-seal, and shore fisheries, and also the marine salt industry. The tables show the number of men, boats, vessels, and other apparatus employed, and the quantity and value of the products, for the sections considered. These figures were compiled from the returns of David S. Jordan, James G. Swan, and T. H. Bean.

2. The second instalment of results appeared in Census Bulletin 261,

dated September 1, giving the statistics of the fisheries of the Great Lakes, from the material collected by Mr. Ludwig Kumlien. This series of sixteen tables relates to the various kinds of food-fishes which are taken from those lakes, such as whitefish, trout, herring, sturgeon, pike, &c., as well as the caviar, isinglass, and oil prepared in that region.

3. A larger bulletin (Census No. 278) covering 47 pages quarto was issued under date of November 22, 1881. It was prepared by Mr. R. Edward Earll, and contained the statistics of the fisheries of Maine. He incorporated with his own researches those of Mr. C. G. Atkins, Mr. W. A. Wilcox, and Capt. J. W. Collins. These figures relate to the cod, hake, haddock, pollock, cusk, mackerel, herring, lobster, and clam fisheries, and show the quantity and value of the fresh, dried, pickled, smoked, and canned products. The production of oil and dried sounds is also considered.

4. Under date of December 1, the statistics of the fisheries of Virginia were published in Census Bulletin No. 281. These were prepared by Col. Marshall McDonald, and include the fisheries for shad, herring, sturgeon, Spanish mackerel, bluefish, gray and salmon trout, sheepshead, crabs, clams, terrapin, and oysters, and the manufacture of oil and fertilizers from menhaden.

5. A monograph entitled "The Oyster Industry," by Mr. Ernest Ingersoll, was issued in the latter part of this year. It covers 250 quarto pages, and contains 13 plates.

Under the direction of Mr. C. W. Smiley, a series of 1,419 tables were completed and turned over to the Census Office for publication. These related to the imports and exports of fish in the United States from 1731 to the present time. This material was drawn from the State papers and other early records of the colonies and of the nation, and, since its organization, from the publications of the Bureau of Statistics of the Treasury Department.

A large amount of material ready for press, which could not be printed and issued during this year by the Census Office, was held over till another year.

10.—OCEAN TEMPERATURES.

The arrangement made with the Light-House Board in 1878, whereby the keepers of the light-houses at selected points upon the Atlantic coast have observed and recorded temperatures of the sea, has been continued during the present year, with instruments furnished for the most part by the United States Signal Office.

The points selected, as will be seen by the accompanying list, are those most favorably situated for obtaining the mean ocean temperatures along the coast. The work is done by the keepers without extra compensation, and too much credit cannot be given to them for performing this duty, in addition to that connected more directly with the Light-House Service. Their records have been of the utmost possible importance in throwing a flood of light upon many important problems in reference to the movements and migrations of our food-fishes.

The following is a list of the light-houses (with their keepers) at which temperatures have been observed during a portion or all of the present year:

List of light-houses on the Atlantic coast at which ocean temperatures have been taken during the year 1881, together with the number of monthly reports made at each one.

Petit Manan light-house, Petit Manan Island:	
George L. Upton, Millbridge, Me	11
Mount Desert light-house, Mount Desert Rock:	
Amos B. Newman, Tremont, Me	12
Matinicus Rock light-house, Penobscot Bay:	
William G. Grant, Matinicus, Me	12
Seguin light-house, Seguin Island, Kennebec River:	
Thomas Day, Hunnewell's Point, Me	12
Boone Island light-house:	
Alfred J. Leavitt, box 808, Portsmouth, N. H	12
Minot's Ledge light-house, Cohasset Rocks, Boston Bay:	
Frank F. Martin, Cohasset, Mass	12
Race Point light-house, Cape Cod Bay:	
Heman F. Smith, Provincetown, Mass	12
Pollock Rip light-station, entrance to Vineyard Sound:	
Joseph Allen, jr., South Yarmouth, Mass	8
Nantucket New South Shoal light-station, Davis New South Shoal:	
Andrew J. Sandsbury, Nantucket, Mass	12
Cross Rip light-station, Vineyard Sound:	
James F. Chase, jr., Nantucket, Mass	6
Buoy Depot, Government wharf, office inspector second division:	
Benjamin J. Edwards, Wood's Holl, Mass	12
Vineyard Sound light-station, Sow and Pigs Rocks:	
William H. Doane, 13 Milk street, New Bedford, Mass	11
Brenton's Reef light-station, off Brenton's Reef and Newport Harbor:	
Charles D. Marsh, Newport, R. I	12
Block Island light-house, southeast end of Block Island:	
H. W. Clark, Block Island, R. I	12
Bartlett's Reef light-station, Long Island Sound:	
Daniel G. Tinker, New London, Conn	12
Stratford Shoals light-house, Middle Ground, Long Island Sound:	
James G. Scott, Port Jefferson, N. Y	12
Fire Island light-house, south side of Long Island:	
Seth R. Hubbard, Fire Island, N. Y	12
Sandy Hook light-house, entrance to New York Bay:	
James Cosgrove, 128 Rutledge street, Brooklyn, N. Y	12
Absecom light-house, Absecom Inlet:	
A. G. Wolfe, Atlantic City, N. J	12
Five Fathom Bank light-station, off Delaware Bay:	
Capt. John Reeves, Cape May City, N. J	12
Fourteen-Foot Bank light-station, Delaware Bay:	
John Lund, Wilmington, Del	10
Winter-Quarter Shoal light-station, Chincoteague Island:	
C. Lindermann, Chincoteague Island, Accomack County, Virginia	12

Bodie's Island light-house, north of Cape Hatteras:
Peter G. Gallop, Manteo, Dare County, North Carolina 11
Cape Lookout light-house, Cape Lookout:
Dewald Rumley, Beaufort, N. C 12
Frying-Pan Shoal light-station, Cape Fear:
David W. Manson, Smithville, N. C 12
Rattlesnake Shoal light-station, off Charleston:
John McCormick, Charleston, S. C 12
Martin's Industry light-station, Port Royal Entrance:
John Masson, Port Royal, S. C 12
Fowey Rocks light-house, Fowey Rocks:
John J. Larner, Miami, Fla 12
Carysfort Reef light-house, Florida Reefs:
Edward Bell, Key West, Fla. (succeeded by F. A. Brost in September) 9
Dry Tortugas light-house, Loggerhead Key:
Robert H. Thompson, Key West, Fla 11

11.—BIOLOGICAL RESEARCH.

The necessity of studying carefully the circumstances under which the development of the egg of the shad, salmon, &c., takes place, and the practical bearing of definite facts on this subject, induced the Commission to add, during the year, to its working force, Mr. John A. Ryder, a prominent member of the Academy of National Sciences of Philadelphia. This gentleman having given much attention to the microscopic work connected with the development of eggs of fishes and other animals, was able to render very important assistance. His labors during the year had relation more particularly to the eggs of the whitefish, the shad, the flounder, the white perch, the California salmon, the Penobscot salmon, and other species. On many of these subjects he prepared elaborate memoirs, some of which have already been published by the Commission in its Bulletin for 1881, and others will be published in the Appendix of the present Report.

Mr. Ryder's inquiry extended into the phenomena of the development of shad eggs on trays covered with wet flannel, as suggested by Colonel McDonald. The results of this research have promised to largely revolutionize the entire method of transporting eggs from the river stations to the hatching-houses.

12.—THE INTRODUCTION OF COD GILL-NETS.

The introduction of gill-nets in the shore cod-fisheries during the winter of 1880–'81 created a general and widespread interest among those concerned in fishing. The use of these nets was first suggested by the Commission in the winter of 1878–'79, but those first tried were not sufficiently strong for the capture of the large cod that frequent our coast in winter. This experiment has been described in an article by Mr. R. E. Earll, on the cod-fisheries of Cape Ann, published in the Report of the United States Fish Commission for 1878. He says: "The method of catching cod with gill-nets, though so successfully used by the fishermen of Norway, has never been adopted by the fishermen of our coast. Knowing the profits derived from the use of these nets by those foreign fishermen, Professor Baird, who is ever anxious to introduce among the Americans any methods that will result to their advantage in the prosecution of the fisheries, decided to make experiments with them at Cape Ann, with a view to their introduction among our shore cod-fishermen. Accordingly he secured from parties in Norway a set of these nets and forwarded them to Gloucester to be thoroughly tested by the employés of the Commission at that place. They reached the hatchery when the pasture school was on the shore, and were set on the favorite fishing grounds a number of times. But the strength of the twine had probably been affected in transit, and the nets proved far too frail. The strong tide and rough water caused them to catch among the rocks, where they were badly damaged; while numerous holes indicated clearly that large fish had torn their way through the nets, only such being retained as had become completely rolled up in the twine. The nets were always taken from the water in bad order, but the capture of 800 pounds on one occasion, even under the circumstances, seemed to indicate that nets of sufficient strength might be used to good advantage, at least on the smooth fishing grounds along the coast."

Having made the preliminary trials with the nets, and demonstrated that with reasonably fair chances a good catch might be obtained with them, the offer to lend the nets to any responsible fisherman who would give them a fair and thorough trial was made. The manner of setting them was also explained to any persons who applied for information.

But fishermen are somewhat conservative, and do not hurriedly adopt new ideas about catching fish. They know that they can ill afford to waste time or money on questionable ventures. Whatever was the cause it appears that none of the fishermen showed a desire either that winter or the next to try the gill-nets.

When Captain Collins left for the Berlin International Fishery Exhibition in 1880 he received special instructions to study, from a practical standpoint, the Norwegian methods of using these nets, so that our fishermen might be provided with all the information that could be obtained. On his return he embodied the facts in a report on the methods of catching cod in Norway; giving, also, an account of the methods that have been tried by our fishermen, as these differ in some respects from those of the Norwegians. This has been published in the Fish Commission Bulletin for 1881.

Although the fruits of the work done by the Commission in 1878 did not immediately appear, the seed that was thus sown was destined in time to bear its legitimate fruit.

The difficulty of procuring a supply of bait is a source of great trouble to the shore fishermen, and its cost, even when it is obtainable, is so great that oftentimes the fishermen hesitate to invest, fearing that it may result in loss rather than gain. Such was the feeling of Capt. George H. Martin, master of the Northern Eagle, of Gloucester, during the fall of 1880. For several years he had been engaged in the shore cod-fishery during the winter, but the prospect of getting sperling (small herring that are used for bait) appeared so uncertain that he hesitated about fitting out. His father, an employé of the Commission, and also an old fisherman, suggested gill-nets as a means of solving the problem. Together with several of his crew he visited the station of the Commission at Gloucester and examined the nets.

Before starting out on his first trip, he conferred with Capt. J. W. Collins, who had studied the Norwegian methods at Berlin. This resulted in his devising a plan whereby one man is enabled here to accomplish nearly the same amount of work as six in Norway. This new method is called "under-running," and is found to be an improvement. Nets of 10-inch mesh are set the same as herring nets, being suspended by hollow glass balls or floats at any required depth. They are usually left out several days at a time, the fishermen under-running them each morning, and taking out the fish that have been caught in the meshes during the night. None are caught except at night. The first trials proved successful, the Northern Eagle taking 4,000, 6,000, and 7,000 pounds, respectively, on her first three trips with nets, in spite of the weather being unfavorable. The nets first used, part of which had been lent by the Commission, were found too weak to resist the struggles of the larger cod, some of which weigh as much as 75 or 80 pounds each. The average weight of those taken in the nets is 23 pounds. Stronger nets were soon obtained, and their number was increased. At present the Northern Eagle carries 8 dories, each with a single man, who is provided with a gang of three nets, making a total of twenty-four nets for the crew. The nets are each 50 fathoms long and three fathoms deep, knit of salmon twine. Unexampled success has resulted from the use of these new nets. On a trip ending January 11th, 35,000 pounds of cod were taken by the crew of the Northern Eagle, 8,000 pounds of which were obtained in a single morning. Two other vessels, which were absent the same length of time, fishing at the same place, but in the old way, got only 4,000 and 5,000 pounds, respectively. Later, another trip was made by the same vessel, which was even more successful, when 35,000 pounds of cod were caught in four days' fishing, 18,000 pounds being taken in one day. The catch was three times as large as that of the trawlers fishing on the same ground.

At first the nets met with the same opposition from the trawlers that trawls had from the hand-line fishermen, when they were introduced, some thirty years ago. Although at first inclined to inveigh against "building a fence" to prevent the fish from reaching the trawls, &c., the fishermen soon began to realize its advantages. Whenever in port, the deck of the Northern Eagle would be crowded with fishermen anxious to learn about this new method of fishing. Letters from all along the coast were received by the Boston net factories inquiring about the cod gill-nets. Allusion has been made to the difficulty of obtaining bait for the shore fisheries, its cost, &c. As an instance of this, the average bait bill of a vessel in the Gloucester shore fleet for the month of December, 1880, may be stated at $150, and the bait bill of the schooner Phantom for fifteen days was $380. This, added to the loss of time in seeking bait (often one-third), was a serious drawback. But the bait question is a still more important one to the bank fishermen, who have generally been obliged to seek it in the ports of the British Provinces. Great stress has been laid by the inhabitants of the provinces on the importance of this privilege to our fishermen.

Gill-nets have been used in the Norwegian cod fisheries for nearly two hundred years, and with good success. M. Friele, in an account of the fisheries of Norway, in 1877, says they are "quite indispensable when the cod does not bite," while, according to Mr. Hermann Baars, *Die Fischerei Industrie Norwegens*, Bergen, 1873, "the fatter the fish the less it is attracted by the bait, and during spawning season it scarcely ever takes the hook at all. For this reason the well-to-do fisherman is usually provided with nets as well as trawls. These nets are held upright in the water by means of floats of hollow glass, the invention of Merchant Christopher Faye, of Bergen. Sometimes, however, wood or cork is used. The glass floats are almost exclusively in use in all the Loffoden Islands." The importance of the use of gill-nets in the Norwegian cod-fisheries is shown in the following extracts from the official report of the superintendent, Niels Juel (first lieutenant in the navy), for 1878, giving the statistics, &c., of the Loffoden Island fisheries:

"The percentage of fishermen using different apparatus was as follows: 58 per cent. used nets; 32 per cent. used lines; 10 per cent. used deep-bait. There was an increase from last year of 2,542 in the number of net fishermen. There was an average of 3,725 boats employed, of which 2,154 boats, carrying 13,168 men, were engaged in fishing with gill-nets. The total catch for 1878 was 24,660,000 cod in number, of which upwards of 14,000,000 of the largest were caught with nets."

The net-fishing has since increased, according to Mr. Hermann Baars, who says: "In 1879 the following enumeration was made: 2,532 boats, with crews numbering 14,322 men, fitted out for the net-fishery." He further says that "usually the boats fishing with nets obtain the greatest net receipts, since these often sell 10,000 to 12,000 fish, 10 to 12 barrels of oil, and 10 barrels of roe, valued at 2,500 marks ($595.24), and at least 400 marks ($95.24) to each man. A net yield of 350 marks a head is considered by the trawl-line fishermen very satisfactory." These remarkable results are obtained by fishing in open boats in the dead of winter north of the arctic circle. What may we not hope for under more favorable circumstances? Of this Mr. Baars says: "But it must be remembered that the stormy weather, which often lasts for weeks at a time in the winter months at this region, often renders it impossible for the fishermen to go out to sea. As a rule, fishing cannot be carried on more than two days in a week."

13.—THE VALUE OF FISH AS FOOD.

In a previous Report reference was made to the results of a series of elaborate chemical investigations by Prof. W. O. Atwater, of Middletown, Conn., into the absolute and comparative value of fish as food. This work has been continued during the year on an increased scale, and it is expected that his next report will contain some additional data of much interest.

14.—WORK DONE AT WOOD'S HOLL, MASS., IN 1881.

Advantages as a permanent sea-coast station of the United States Fish Commission.—From the inception of the work of the Commission in 1871 it has been the custom to select some station on the sea-coast from which to prosecute the researches required by Congress into the scientific and economical problems connected with the sea and its inhabitants; the stations, as already indicated, covering the coast from the Bay of Fundy to Long Island Sound. In this way the peculiarities of the inshores have been well determined and the geographical distribution of the fishes, mollusks, crustacea, radiates, &c., properly marked out. In addition to the discovery of a great many new species, much light has been thrown upon the whole subject of marine zoology generally.

It is not to be supposed that everything in this connection has been learned; but the broad features have been determined, and the minor details can be safely left to local and special researches.

The acquisition of a sea-going steamer in the Fish Hawk, and the hope of obtaining a still more serviceable vessel, rendered it expedient to fix upon some point for permanent occupation where the necessary facilities for the maritime work of the Commission could be obtained. The southern side of New England was considered better than the eastern, as permitting investigation for a longer period and presenting a much richer fauna. The best conditions for the propagation of marine fishes were also found on the southern coast of New England, as fish are in greater variety, and, so far as the winter hatching is concerned, the cold is less severe, and other circumstances generally were more favorable.

By the use of a suitable fishing smack, the fish can be brought in alive and penned up until they are ready to yield their eggs, and in this way will be exposed to much less danger from destruction by cold than proved to be the case at Gloucester.

After a careful consideration of the subject, the choice was found to lie between Newport and Wood's Holl. Newport has a great many advantages in its accessibility, and in the very great desire manifested by its citizens to secure the presence of the United States Fish Commission. A number of gentlemen, of whom Mr. J. M. K. Southwick was spokesman, offered to furnish the requisite buildings, and also the use of a suitable wharf, and otherwise to encourage the selection of the station. The Navy Department also gave the Commission a provisional invitation to establish itself on the northern end of Coasters' Harbor Island, which was not required for the purposes of the training school.

The great difficulty in the way of Newport, however, was found to be in the comparative impurity of the water, Narragansett Bay receiving the drainage of a number of large cities, such as Newport, Fall River, Bristol, Providence, &c., and also having extensive mud bottoms and flats. The experience of the year 1880 showed that the abounding impurities would settle as a sediment upon the eggs of the fishes to be hatched and materially impair their development, as was found to be the case at Gloucester.

A totally different condition of things was found at Wood's Holl, where the water is exceptionally pure and free from sediment, and where the sudden tide rushing through the Wood's Holl passage keeps the water in a state of healthy oxygenation especially favorable for biological research. The entire lack of sewage, owing to the remoteness of large cities, and the absence of large rivers tending to reduce the salinity of the water, constitute a strong argument in its favor, and this station was finally fixed upon for the purpose in question.

The quarters occupied by the Commission at Wood's Holl, furnished by the courtesy of the Light-House Board, are too scanty for the expected work of the Commission in the future, and measures were immediately instituted to obtain foothold on the Great Harbor. Here a point of land constituting the neck of the upper harbor was fixed upon as a suitable location, affording the advantage of pure and very deep water, accessible to vessels of quite unusual draught, and immediately adjacent to the rapid tide of the passage.

Negotiations were opened with the owners of the ground, Messrs. Isaiah Spindel & Co., and a provisional agreement made as to the price and conditions of the purchase, the details of which will be given in the next Report.

Work of the year 1881 *at Wood's Holl.*—Pending the permanent establishment of the Commission at Wood's Holl, as explained in the preceding section, that station was selected for the work of 1881, and, by the renewed courtesy of the Light-House Board, the old quarters on the Light-House wharf were secured and fitted for occupation.

As the Government wharf was unable to furnish a berth for the steamer Fish Hawk, the private wharf of Isaiah Spindel & Co. was leased for the purpose. The requisite accommodations for board and lodging for the party were obtained with considerable difficulty, but finally the necessary arrangements were completed.

I reached the station on the 8th of July, being joined soon after by the remainder of the party.

As in previous years, Professor Verrill, of Yale College, had charge of the work connected with the marine invertebrates, and Dr. Tarleton H. Bean of the fishes, in this being assisted by Mr. Peter Parker. Other assistants were Prof. L. A. Lee, of Bowdoin College, Mr. Sanderson Smith, Mr. James H. Emerton, and others. Capt. H. C. Chester had general charge of the buildings, assisted by Vinal N. Edwards, of Wood's Holl.

During the summer the usual branches of research were prosecuted under the direction of the several chiefs, and a great deal of valuable information collected, some of which will be furnished in the form of monographic papers, and the rest presented in the pages of the Reports of the Commission or in the Fishery Division of the United States Census of 1880.

One of the most practical results of the work of the season was the investigation into the area of distribution and the economical qualities of the *tile fish.* This species was first brought to light by the casual capture of some specimens in 1879 by Captain Kirby, of Gloucester, Mass., who carried them into that city, where they were secured by the Fish Commission, which had a station there at the time. As explained in the previous Report, the ground was investigated by the Fish Hawk in 1880, and a number of specimens captured.

During 1881 special efforts were made to define the limitation and area of this fish. It was found to occur on the edge of the continental plateau, and in abundance equal to that of codfish on the fishing banks. It is confidently believed that a large part of the fish supply of New York and Boston could readily be furnished from this species. Careful tests were made of its qualities as a food-fish, not only on board the vessel and at Wood's Holl, but by distributing them among the New York experts, through Mr. E. G. Blackford. The reports were uniformly favorable; one gentleman characterizing the fish as having hard meat and sweet and juicy as any game fish he ever met with; another ranking it above sheeps-head, as being more juicy and better flavored.

The work accomplished by the Fish Hawk, to which a great deal of the success of the summer was due, will be referred to under a subsequent heading.

The season was closed by my departure on the 4th of October, the Fish Hawk proceeding to Washington with her collections and apparatus, stopping, however, at New Haven to discharge the packages containing specimens for Professor Verrill.

15.—EXPLORATIONS OF THE FISH HAWK.

With the exception of the years 1872 and 1876, when the Commissioner was necessarily otherwise occupied, the Navy Department, in compliance with law, has, since 1871, furnished the Commission with a steamer for its summer work. The first detail of this kind was that of a small steam-launch in 1871. In 1873, 1874, and 1875, the steamer

Blue Light, under command of Captain Beardsley, was made use of; in 1877 the Speedwell, under command of Commander Kellogg; the same vessel again in 1878, under command of Captain Beardsley, and again in 1879, under command of Lieut. Z. L. Tanner.

The appropriation by Congress for a special steamer—the Fish Hawk—completed in the spring of 1880, enabled the Commission to dispense with the naval steamer, but it gladly embraced the privilege of calling upon the Department for a detail of officers and crew.

The first service of this vessel, under command of Lieut. Z. L. Tanner, was rendered at Newport in 1880, the Report of which year contains an account of her work on this occasion. The off-shore exploration, however, was limited to two or three trips, the results of which were so interesting as to induce great expectations from the renewal of these labors in 1881.

It will be remembered, as stated in the last Report, that the water deepens very slowly for a considerable distance off the coast, from Cape Cod southward; so that a depth of 100 fathoms is, for the most part, only attainable at a distance, out, of from 75 to 100 miles. This brings us to the edge of the continental plateau; and beyond that there is usually an abrupt declivity, showing rapidly deepening water.

On her expeditions in 1880 the Fish Hawk found that the edge of this slope or declivity was occupied by an extremely rich fauna, both as to species and individuals; indeed, far exceeding in this respect any of the regions nearer the land; and the necessary arrangements were made to renew work in that vicinity during 1881.

On her return to Washington in 1880 she was sent to Point Lookout to obtain a supply of oysters for the oyster-hatching station at Saint Jerome; and the ice forming before she could return, obliged her to winter in the Norfolk navy-yard. Returning, however, from that point in February, she was fitted out with shad-hatching apparatus, and on the 23d of March was ordered to Avoca, a shad-fishing station at the mouth of the Roanoke River in Albemarle Sound. Here she remained until the 30th of April, carrying on her work, and obtaining many courtesies from Dr. W. R. Capehart, the owner of the station. The vessel reached Havre de Grace on the 3d of May, and was occupied until the 5th of June in hatching shad at the head of Chesapeake Bay.

On the 13th of June she again proceeded to Saint Jerome to make experiments in connection with the hatching of Spanish mackerel, but started for Washington on the 20th of June, having left her work at that place in charge of Col. M. McDonald.

The details of her labors in connection with shad and Spanish mackerel will be found in the second division of this Report.

After a short stay at the navy-yard in Washington undergoing repairs, she took on board the apparatus for the deep-sea research, and left for Wood's Holl on the 7th of July, arriving there on the 10th.

From that time until the 4th of October numerous trips were made to the localities near the Gulf Stream, referred to as having been visited in 1880, and many very interesting results were secured. In the supplementary portion of this Report will be found a popular statement of this work, consisting of the substance of an address by Prof. L. A. Lee, one of the scientific party. A special list of the fishes collected during the season, prepared by Dr. Bean, is also appended.

The steamer arrived at Washington on the 12th of October, and the offer of her services was at once embraced by the Navy Department, in connection with the naval and military celebration at Yorktown, from October 7 to October 20. She was placed by the Secretary of the Navy at the service of the Secretary of War. Having been absent several days, upon returning to Washington, she went into winter quarters at the navy-yard, where she was thoroughly repaired and put in readiness for the work of 1882.

A full description of the vessel and her outfit, together with the details of her work during 1880 and 1881, furnished by her commander, Lieut. Z. L. Tanner, will be found in the Appendix of the present Report.

C.—THE PROPAGATION OF FOOD-FISHES.

It has already been shown that, while the original object of establishing the United States Fish Commission was the investigation of the alleged decrease of the food-fishes of the United States, during the second year of its existence it was charged by Congress with the added duty of increasing the supply, and of stocking the waters with suitable additional species of economical value. At the present time much the larger part of the expenditure of time and money on the part of the Commission is in the last-mentioned direction.

16.—THE METHOD OF DISTRIBUTION OF FISH AND EGGS.

In the beginning of the work of the Commission, in connection with the introduction of food-fishes into new waters, it was entirely possible to cover all the service by placing the fish in cans and employing suitably trained messengers to accompany them to such points of deposit as might have been selected.

All the railroads of the country, with scarcely an exception, when applied to, gave instructions to allow the transportation, in baggage-cars, free of extra charge, of the cans containing the young fish, and granted access to the same on the part of the messengers; instructions being given, in many cases, to stop the car at stations near rivers or streams to allow the introduction of the fish therein. This was specially the case with the shad, and where the annual production amounted to but a few millions it became quite possible to accomplish all that was necessary by this means. As, however, the supply of young fish increased, partly in consequence of the increase in the scale of operations and partly from the increase in the supply, caused by the work of the Commission, this was found to be inadequate, especially as one messenger was unable to carry satisfactorily more than ten or twelve cans, containing from 100,000 to 150,000 fish. The possibility of obtaining a larger number of fish than at first, made it practicable also to test the theory which the Commission has been gradually reaching, that the number of fish likely to survive the attacks of their enemies when planted in a river is increasingly proportionate to the total number introduced, or rather that the expectancy of destruction, in a given locality, is essentially an absolute quantity dependent upon the existing number of minnows and other predaceous fish. Thus, if the expectancy of destruction be estimated at 100,000 young fish, we will have none left to grow up from a deposit of 100,000 fish. If, however, we introduce 200,000 fish, then we may claim a surplus of 100,000. It is highly probable that the larger the number introduced the greater will be the percentage of survivals.

Where we can introduce a car-load of fish instead of a tenth or twentieth of that quantity, our chances of success in stocking waters are probably increased far beyond the difference in the ratio.

When the available supply of young shad increased to an extent of perhaps a million a day, for a number of days in succession, the method of transportation mentioned above proved to be entirely inadequate, and the experiment was made of filling an entire baggage-car with fish cans and forwarding it to destination, accompanied by a suitable number of messengers. This was done was done with the kind assistance of President Hinckley, of the Philadelphia, Wilmington and Baltimore Railroad, and subsequently of the officers of the Baltimore and Ohio Railroad.

It was in time found that even this plan was insufficient, as it was not always possible to obtain the cars, and these were not provided with the necessary facilities for keeping the fish in good condition. It was at length determined either to build a new car, or to adapt an old one of proper character to this express purpose, and an arrangement was finally made with President Hinckley to refit one of the best baggage-cars belonging to his company, and sell it to the Commission, when completed, at cost.

This car was fitted up by Mr. J. H. Ridgway, of Philadelphia, as a refrigerator car, and was provided with living and sleeping rooms at either end for the accommodation of the messengers. It was also supplied with air-brakes, Miller platform, six-wheeled trucks, &c., by means of which it could be moved on passenger trains.

As thus arranged, the car is capable of carrying from one to two millions of fish at a load and five messengers. The details of its construction will be given hereafter.

The car reached Washington from the shops on the 7th of May, and made a trial trip on the 2d of June to Atlanta, Ga., with shad. Owing, however, to the difficulty experienced in changing the trucks at Lynchburg, it returned to Washington after depositing the fish in the James River.

On the 15th of June a load of 1,150,000 fish was transported to Maine from the hatchery at Havre de Grace, and introduced successfully into the Kennebec and Mattawamkeag Rivers.

The experience of these trips suggested some additional changes, which were made in the course of the summer; and in the middle of October the car was again used, this time for distributing carp.

In December, it was determined to use the car for transporting a supply of carp to Texas, Arkansas, Louisiana, and Missouri. There were 950 applicants to be supplied in Texas alone. There were placed on board the car forty large cans, each containing one hundred carp, and seven containing one hundred and fifty carp each. There were also placed on board eighteen crates, each containing sixteen small tin pails. As each pail contained twenty carp, each crate would thus contain three hundred and twenty carp. In addition, there were three crates containing four hundred carp each. This made a total of twelve thousand carp. The car was not ready to leave, however, until January 3, 1882, when it was moved by the Pennsylvania Railroad from Washington to Saint Louis, in charge of Colonel Marshal McDonald. The first distributions were made from Saint Louis; after which the car proceeded to Texarkana, from which point applicants in Arkansas were supplied. Similar stops were made at Shreveport, La., Sherman, Tex., Dallas, Tex., Austin, Tex., &c. A full account of this trip, as also of a previous one to Kentucky in November, will be found in the report of Mr. McDonald in the Appendix.

17.—SPECIES OF FISH CULTIVATED AND DISTRIBUTED IN 1881.

a. **Whitefish** (*Coregonus albus*).

Northville Station.—The work at this station, under the charge of Mr. Frank N. Clark, as heretofore, has been prosecuted with increased vigor. A number of improvements have been made in the arrangements for supplying water, and an increased hatching capacity has been obtained. Four new ponds (20 by 83 feet) were constructed during the summer. The total number of whitefish eggs handled during the season of 1881–'82 was 22,500,000, against 14,780,000 for the previous season. The spawn-taking operations were carried on from November 10 to December 5, the points selected being North Bass Island, Middle Bass Island, and Kelley's Island, in Lake Erie. Although the last eggs which reached the hatchery were allowed to remain in the shipping cases for ten days after their arrival, pending the fitting up of additional hatching-jars, there was no increased loss noticeable.

The Chase automatic jar was used in place of the hatching-box in the incubation of the eggs, and experiments were made with a view to obtaining a still more reliable apparatus. The "Improved Shad Hatcher" was found to give a better movement to the eggs, and useful modifications of this and of the Chase jar were devised by Mr. Clark's assistants. One of these gentlemen, Mr. Seymour Bower, invented a new form of hatching-box which possesses advantages.

The number of whitefish eggs shipped was 2,032,000. Shipments were made to Germany and France, and to the States of California, Connecticut, Iowa, and New Jersey. Over 17,700,000 young fish were released in the waters of the Great Lake system, the deposits being made in Lake Michigan, Lake Huron, the Detroit River, Lake Erie, and Lake Ontario.

b. **Brook Trout** (*Salvelinus fontinalis*).

Northville Station.—The ponds for brook trout at Northville, Mich., have been greatly enlarged and improved, and four new ones have been added to the three already existing, so that their total area is now 10,674 square feet. About 140,000 eggs were obtained from the trout in the ponds during the spawning season, which lasts from the beginning of November to the middle of January. Shipments of eggs were made to France and to the Druid Hill hatchery in Baltimore; 20,000 young fish were planted in neighboring streams, and 30,000 were shipped East by the Fish Commission car. It is expected that half a million brook-trout eggs will be taken next season.

c. **Saibling** (*Salmo salvelinus*).

On January 10, Mr. Schuster, Burgomaster of Freiburg, Germany, announced that he had sent 60,000 saibling eggs by the North German Lloyds steamer Mosel, of January 8, consigned to the United States Fish Commission. These reached New York January 22. Mr. Fred. Mather took charge of them and forwarded them the next day to Mr. A. H. Powers, Plymouth, N. H., which point they reached on the 24th. The entire loss while crossing the ocean and being transported to the hatchery was but 5,000 eggs. Mr. Powers was directed to hatch them and place them in Newfound Lake, located 7 miles from Plymouth. The eggs were all hatched by February 28, with a loss in hatching of 6,515 eggs. Mr. Powers deposited 30,000 fry in Newfound Lake May 18.

Another installment of saibling eggs was announced by Herr Max von dem Borne February 3. These were lost in transit.

d. **Lake Trout** (*Cristivomer namaycush*).

Northville Station.—While waiting for the whitefish to begin spawning, 57,000 lake-trout eggs were obtained for this station, of which 52,000 were shipped and 1,400 hatched and retained at the hatchery. Of those shipped, 20,000 were forwarded to Germany.

e. **The Quinnat or California Salmon** (*Salmo quinnat*).

The McCloud River Station.—The work at this place has been under the direction of Mr. Livingston Stone, whose detailed report will be found in the Appendix. The establishment met with a serious disaster on the 3d of February. January had been attended by a rainfall wholly unprecedented in that region, the total amount for the season being placed at 109.7 inches. During the first days of February the rain continued to fall in torrents, and the McCloud River to rise at the rate of a foot an hour. During the night of February 2 the water rose above the danger-mark, and at half-past two in the morning of February 3 the buildings of the station were swept away. All the improvements which had accumulated since 1872 were thus demolished in a night. The water reached a maximum height of 26 feet 8 inches above its summer level.

At the instance of Senator Booth, of California, an appropriation of $10,000 for rebuilding the station was made by Congress, March 5, and the work of restoration, beginning in May, was completed in September. At the time of the disaster the work was in charge of Mr. Myron Green. Mr. Stone reached the fishery May 19 and superintended the reconstruction, as well as the taking of eggs in the fall, which amounted to 7,500,000. Several millions of these eggs were sent to the commissioners of various States to hatch for local waters, as well as to Canada and New South Wales. Particulars of the distribution are found in the tables appended to this report.

f. **Rainbow or California Mountain Trout** (*Salmo irideus*).

The McCloud River Station.—This fishery was first operated in July, 1879, and like the salmon station has been continuously under the direction of Mr. L. Stone. It is located near the mouth of Crook's Creek, a tributary of the McCloud River, and about 4 miles distant from Baird Post-office. The station suffered at the time of the flood from a deluge of mud which was precipitated into the ponds, and by which many of the trout were killed.

The region is subject to land slides. The steep hillsides becoming thoroughly saturated with water, whole acres are washed into the valley below. Sometimes the creek is completely dammed up thereby and the water is rendered intensely muddy. To shut off this water from the trout ponds would be as fatal as to admit it, so that the catastrophe to the trout was unavoidable. Many which were not actually killed were seriously injured by mud getting into the gills and producing inflammation. The occurrence of the flood just as the trout were beginning to spawn made the matter still more unfortunate. Only about a thousand trout survived. From these, however, 261,000 eggs were obtained, 179,900 of which were sent to the commissioners of various States to be hatched. During October and November the losses of trout were made up as far as possible by fishing in the river. A new pond was also constructed for the purpose of catching the mud which was brought down by water in the rainy season. The year closed with brighter prospects for the future.

g. **Atlantic or Penobscot Salmon** (*Salmo salar.*)

Penobscot River Station.—This station, as heretofore, was carried on by the United States conjointly with the States of Maine, Massachusetts, and Connecticut, and under the continued superintendence of Mr. Charles G. Atkins. Between June 1 and July 2 he purchased from the fishermen 514 salmon, averaging 16½ pounds each. These were placed in the inclosure prepared for them, to await the spawning season in October. An unusual number, 146, died during this interval, most of the deaths occurring, however, in June and July. The first eggs were taken October 26, and, between this date and the 17th of November, 358 fish were manipulated, of which 232 were females and 126 were males. They produced 515 pounds of spawn. The number of eggs was estimated at 2,693,009, or an average of 11,608 eggs from each female. In August and September of this year Mr. Atkins made an important improvement by conducting cold water from a brook through an aqueduct 1,600 feet long. The water previously received from springs near the hatchery attained so high a temperature that in former years the eggs were matured early in December. Under the new arrangement, their development was retarded until the middle of January. The first shipments of eggs were made January 16, 1882, and continued at the convenience of the consignees until March 13, 1882. The total number of eggs shipped was 2,611,500, of which 1,006,500 belonged to the United States. The loss in shipping and hatching out the eggs was very slight, and 2,397,132 were actually planted, as shown by the tables. From the United States quota eggs were sent to New York, Pennsylvania, New Jersey, Minnesota, and Virginia. The full report of Mr. Atkins will be found in the Appendix.

h. **Schoodic or Land-locked Salmon** (*Salmo salar*, subs. *sebago*).

Grand Lake Stream Station.—Conjointly with the States of Maine, New Hampshire, Massachusetts, and Connecticut, this station was this year again occupied by the United States Fish Commission, under direction of Mr. Atkins, who commenced his work at Grand Lake, September 10, 1881.

Grand Lake is situated upon the western branch of the Saint Croix River, known as Schoodic River. Its water is exceedingly pure, and attains a depth of 100 feet. Its outlet, the Grand Lake Stream, is frequented by this species of salmon in October and November, for the purpose of spawning. As a net can be stretched across this outlet at that time, it is not necessary to hold the fish in confinement for several months, as is the case with the Penobscot salmon.

Hatchery No. 3, which was constructed last year, became the principal scene of operations this year. When originally built it was but 30 feet long. Mr. Atkins has this year added wings, which very largely increase its capacity. The nets were placed across the stream, as usual, about the middle of September. The capture of salmon began October 31. The manipulating of spawning fish continued until its completion of the season, November 19. Six hundred and fifty-three females and three hundred and seventy males, a total of 1,023, were utilized. A total of

947,000 eggs were taken, being an average of 1,525 for each female. Between January 12, 1882, and March 10, 1882, eggs were shipped to the States which were in partnership, and, in behalf of the United States, to New York, New Jersey, Pennsylvania, Vermont, Maryland, Michigan, Iowa, Missouri, Wisconsin, and California; in addition to these 20,000 were sent to Fred. Mather for shipment to Germany. The United States' share of eggs was 311,750. About 215,000 eggs were retained at the hatchery, from which 213,097 young fish were hatched and planted in Grand Lake. The diary of the station, as well as full particulars of the work, have been reported by Mr. Atkins, and will be found in the Appendix. The hatching and distribution of eggs necessarily extends into the following year. This renders it desirable to anticipate dates, to some extent, in this report, in order to show the completion of the work inaugurated in 1881.

i. **The Shad** (*Alosa sapidissima*).

As has already been stated on page XVI, six stations were operated for shad work this season, three of these conjointly with the Maryland Commission, the entire yield of which was 70,035,000 young shad. Of this amount 46,518,500 were deposited in the waters near the various hatcheries and 23,516,500 transferred to 18 different States of the Union. This yield of seventy millions was unprecedentedly large, that of 1880 falling a little short of thirty millions, and that of 1879 being less than twenty millions. This increase in production was due, first, to the increased efficiency of the methods and apparatus of the Commission; and, second, to the favorable fishing season both on the Potomac and Susquehanna Rivers.

On the afternoon and evening of May 27, President Garfield made a trip down the Potomac on board the Lookout to witness the shad operations.

The completion of a special car for the operations of the Commission gave facilities, heretofore not enjoyed, for moving a large quantity of shad to distant waters. On the 1st of June a car was loaded at Havre de Grace with one million of shad for the waters of Georgia, but, owing to the break of gauge and the impossibility of obtaining suitable trucks, the fish were deposited in the James River, at Lynchburg. On the 3d of June 1,500,000 fry were placed in the car and consigned to General J. R. Hawley and Dr. W. M. Hudson, for deposit in Connecticut waters. It reached Hartford on June 4, accompanied by General Hawley and Mr. Davidson, the local superintendent, and was moved by special train to Warehouse Point, 13½ miles above Hartford, where the fish were successfully deposited in the Connecticut River. On the 14th of June the car was again loaded, partly from the navy-yard and partly from Havre de Grace, with 1,150,000 shad, consigned to the Maine commissioners, who had secured free freight over the Boston and Maine Railroad. The shad were met at Bangor by Mr. E. M. Stillwell, and a part were deposited in the Kennebec and part in the Mattawamkeag Rivers. On the 24th of June there were placed on board the car at the Washington navy-yard 1,140,000 shad, which were taken to Dubuque, Iowa, and deposited in the Mississippi River. The distribution to other States was by the old method of placing the fish in cans to be transferred in the baggage cars of passenger trains under the care of messengers.

Avoca Station.—Dr. Capehart having offered to furnish eggs from the spawning shad at his fishery, the Fish Hawk, was ordered, in April, to proceed, with suitable hatching apparatus on board, to Capehart Wharf, on Salmon Creek, North Carolina. The first eggs (66,000 in number) were obtained April 12, but were lost in handling. Eggs were taken nearly every day from that time to April 30, or 5,727,000 in all. From these 1,328,000 fry were hatched and released in local waters on April 29 and 30. Some eggs were also transferred to the North Carolina commissioner, Mr. S. G. Worth, for hatching and deposit in other parts of the State. The season having advanced sufficiently for work farther north, the Fish Hawk was ordered on May 2 to proceed to Havre de Grace.

Potomac River Barges.—Simultaneously with that in North Carolina, work was begun the middle of April at Gunston's, on the Potomac River, Col. M. McDonald in charge. The first eggs (125,000 in number) were taken on the 20th of April, and continued to be taken in increasing quantities, the maximum being reached on May 18, at which date 4,870,000 were secured. Over three millions were gathered May 7 and also May 24. The last were taken May 29. These eggs were hatched out with some loss, but supplied a deposit of 26,515,000 fish in the Potomac River, and about six millions sent to other waters. The work closed May 30, at which time Colonel McDonald was transferred to the charge of the navy-yard station at Washington.

Washington Navy-Yard Station.—This station was opened May 4 with Frank L. Donnelly in charge, eggs being brought to it from various fishing shores on the river. The first fish were hatched May 10, and 85,000 were transferred to Cumberland, Md., for deposit in the upper waters of the Potomac. From this station instalments of from 100,000 to 200,000 each were sent to Delaware, South Carolina, Maryland, Ohio, and Kentucky. By June 2d, 3,280,000 fry had been produced, at which date the station was turned over to Colonel McDonald. Between June 2d and June 25th, 3,840,000 eggs were received from the gill-netters of the Potomac, which yielded 3,800,000 fry. Colonel McDonald improved the opportunity to experiment in the transportation of eggs upon trays covered with moistened flannel, and reached some very satisfactory results. He succeeded in carrying the eggs forward almost to the point of hatching, while stratified in layers.

The Potomac shad work was completed July 1, and Launch No. 55, which had been kindly lent by the Navy Department, was returned to the commandant of the yard.

Battery Island Station.—Mr. Frank N. Clark was directed to leave the Northville Station in charge of Mr. Seymour Bower and to proceed to Havre de Grace. He arrived at the station about April 15 and immediately commenced preparations for the season's work. No eggs were taken, however, until about the 10th of May. Between that time and June 13 over 15,000,000 eggs were obtained and 13,560,000 hatched, of which number 8,385,000 were released in local waters and 5,175,000 transported to other points. Included in the latter were 3,500,000 which the Pennsylvania commission took charge of and deposited in the headwaters and tributaries of the Susquehanna River. Mr. Clark conducted some extended experiments in retarding the development of the eggs of shad during the season, a report of which will be found in the Appendix. This retardation is considered very desirable as a possible solution of oceanic transportation. Mr. John A. Ryder was also present at the station during several weeks and conducted some important embryological experiments. Several papers from his pen will be found in the Appendix of this volume. On the 17th of June the season closed at Havre de Grace, and Mr. Clark returned to Northville.

North East River Station.—The steamer Fish Hawk, upon leaving Avoca, proceeded to the North East River, where it arrived May 3. Lieut. Tanner commenced taking eggs on the 5th of May and continued until the 4th of June with gratifying success. On the 16th of June he directed the removal of the Fish Hawk from the station then occupied to a point near the Battery in order to haul the thousand-fathom seine which had been obtained. On the 29th of May the station was visited by the Commissioners, accompanied by Major Ferguson. Lieut. Tanner obtained in all 15,444,000 eggs. Of the young fish, over 10,000,000 were released in the Susquehanna and about 2,500,000 transported to other waters.

j. **The Carp** (*Cyprinus carpio*).

The production and distribution of carp has been carried on more extensively this year than in any previous one, the number of applications having also very greatly increased. Over 7,000 applications were filed during the year, 5,758 of which were supplied with from 15 to 20 fish each; the total number of carp thus used was 143,696. There were 1,244 additional applications filed which it was impossible to supply in the year 1881.

The Monument Station.—On the 12th of February the ponds in the Monument Lot were visited by a flood considerably exceeding anything that was ever before experienced. The water stood 9 feet above the level of the banks of the ponds, and was 4 feet deep in the guard-house. On this occasion the city was flooded even to Pennsylvania avenue, and the street in front of the Smithsonian grounds was filled with water to so great a depth as to stop all movement of vehicles. Fortunately the water was cold enough to drive the carp to the bottom of the ponds close to the mud, so that not very many of the breeding-fish escaped.

March 30 an edition of 1,000 copies of Mr. Rudolph Hessel's paper on the cultivation of carp was ordered from the Public Printer for distribution to persons applying for information. This treatise was reprinted in the London Fishing Gazette.

In April, at the request of the Commissioner, Maj. W. J. Twining, the Engineer Commissioner of the District advertised for bids for constructing an additional carp pond. B. J. Coyle & Co. proved to be the lowest bidders, and the contract was awarded to them April 13. This action was in pursuance of an appropriation by the Forty-sixth Congress, second session, of "$12,000 for the construction of an additional carp pond." Including the one in question there are now 20 acres of water devoted to the cultivation of carp. The grading of the pond was completed December 28.

During the summer, many fish born in 1879 spawned abundantly; indeed, in some cases, fish of 1880 produced an abundance of fry. Superintendent Hessel succeeded in the artificial impregnation of carp, having during June many thousands in his hatching-trays. Some of his young fish, only twelve and fifteen days old, acquired a length of from 3 to 4 inches.

On the 31st of May Mr. George Eckardt arrived from Germany with two cases of carp-eggs. These had been sent by his father, Mr. R. Eckardt, of Lübbinchen, with a view of testing the feasibility of transportation across the ocean. Unfortunately, the eggs were found to be dead and covered with fungus. They were packed in ice, which probably destroyed them, as they are extremely sensitive to cold. On the other hand, without ice the eggs would probably have been hatched prematurely.

In September we were confronted with the problem of distributing an enormous number of carp in small quotas to numerous applicants. An ordinary 10-gallon milk-can had hitherto been found most suitable for their transportation in lots of twenty-five or thirty. This method, however, being expensive and not entirely satisfactory, Colonel McDonald tried the experiment in November of shipping carp in small tin pails. As the result, he found that 20 carp could be inclosed in a tin pail of 6 quarts capacity, when half full of water, and be kept alive two or three days. This led to a radical change in the methods of shipping, and a great saving of expense. Sixteen pails containing 20 carp each were put into a crate and sent by express almost as readily as the single 10 gallon can had been sent. In December the new car was brought into requisition, and being loaded with carp was sent to Missouri and Texas, as has been explained under that heading.

The Arsenal Ponds.—On the 4th of June Mr. Elliot Jones reported the stock of carp in the ponds at the Arsenal the previous autumn to have been as follows:

In the large pond:

15 breeding scale carp, weighing from 2 to 3 pounds each.
1,422 scale carp, of 1879, weighing from 5 to 20 ounces each.

In the small pond:

6 breeding leather carp, weighing from 1 pound 10 ounces to 2 pounds 1 ounce.
242 scale carp, of 1879, weighing 5 ounces each, and
62 mirror carp, of 1879, weighing 5 ounces each.

At this date Mr. Jones was ordered from Washington, and Lieutenant Smith, of the Quartermaster's Department, will hereafter, have charge of these ponds. Richard Lynch, the Arsenal gardener, has the personal oversight of them.

k. **Gourami** (*Osphromenus olfax*).

In my last Report I presented several reasons why the gourami would be a desirable species to introduce into the United States, and spoke of the efforts of the *Société d'Acclimatation*, with the aid of a French resident of Saigon, Cochin China, to supply the United States Fish Commission with this fish, as also of the arrangement made with Mr. B. B. Redding to place what might thus be obtained in a lake near San Gabriel, Cal. No result has so far been obtained from this effort.

Monsieur L. Carbonnier, of Paris, having received some specimens from Mauritius, forwarded a pair to the United States through Captain Briand, of the French steamship line, who arrived at New York August 19. Unfortunately one of the fish had died during the passage. The other was delivered to Mr. E. G. Blackford to care for until suitable arrangements could be made. It died, however, early in September, some ten or fifteen days after its arrival.

l. **Cod** (*Gadus morrhua*).

Wood's Holl Station.—In November, 1880, Capt. H. C. Chester went to Wood's Holl, Mass., with a view of continuing experiments in cod-hatching. Later in the season, Colonel McDonald was directed to take charge of the station and to test some apparatus which he had arranged. He was accompanied by Mr. John A. Ryder, who made some valuable experiments upon the embryology of the cod. Mr. Ryder's report, with numerous illustrations, will be published as an Appendix of the Report for 1882. The experiments were somewhat limited, as only a single lot of spawning-fish was obtained in that locality. In one experiment with 40,000 eggs, Colonel McDonald hatched 25,000 fry. These fish were sent to Annapolis, Md., and deposited in Chesapeake Bay. An account of his operations and of the apparatus which he used will be found in the Appendix. On the 8th of March the station was closed and the apparatus returned to Washington.

m. **The Spanish Mackerel** (*Cybium maculatum*).

Chesapeake Bay.—The account of the discovery of spawning-mackerel and the work of hatching them, conducted by Mr. R. E. Earll, was given in full in the last Annual Report. In order to continue the experiments, the Fish Hawk, on the 15th of June, took on board a special outfit for hatching Spanish mackerel. On the 14th it proceeded down the river and arrived at Cherrystone Inlet on the 15th, accompanied by Launch No. 62, which had been ordered from Havre de Grace. The pound-nets of the fishermen were visited, and on the 17th live eggs were taken and placed in hatching-cones. Eggs were also taken on subsequent days, but the hatching was not successful, most of the fish and eggs dying. The particulars of the work of the Fish Hawk will be found in Captain Tanner's report for the year.

On the 29th of June the Fish Hawk left for Washington, turning over the launch, however, to Col. Marshall McDonald, who had arrived to prosecute the experiments still further, with instructions to work out as fully as possible the proper methods without endeavoring to turn out any considerable number of fish during the present season. He was accompanied by Mr. John A. Ryder, who studied the embryology of the fish, and has made a somewhat full report, with four plates, upon "The development of the Spanish mackerel," in the Bulletin of 1881, pages 155-172. On the 26th of July it became necessary to return the borrowed launch to the Navy Department. The work was soon after closed, and Colonel McDonald returned to Washington. A short paper upon his work will appear in the Appendix.

n. **Turbot and Sole** (*Rhombus maximus* and *Solea vulgaris*).

The turbot and sole are generally considered to be the best fish in Europe, commanding a higher price than any other, exclusive of the salmon; and the question is frequently asked as to the intentions of the Commission in regard to introducing and propagating them on the shores of the United States.

By those best qualified to judge, these fish are not considered to possess any marked superiority over corresponding forms of the flat fish found in the United States, which, when properly cooked, are of very great excellence. Many persons, thoroughly familiar with the turbot and sole, who have been present at one of the famous fish dinners given by Mr. Taft, of Point Shirley, Mass., and who have tasted the Northern flat-fish (*Pleuronectes americanus*) and the Southern flounder (*Paralichthys dentatus*), as served by him, stoutly deny any and every claim of superiority in the first-mentioned fish.

Appreciating, however, the interest of the problem, which if solved would simply add to the species of desirable food-fishes in the United States without interfering with the abundance of those belonging to it, the Commission has several times made efforts to introduce both the turbot and the sole into the United States.

The first experiment of importation was made by the United States

Fish Commission in 1878, when Mr. Fred. Mather was instructed to bring over from England thirty specimens collected by Mr. C. L. Jackson, of Bolton, England. During the voyage to Boston most of the fish perished, as it was believed, in consequence of the well-meant but inauspicious action of the boatswain of the Cunard steamer in introducing very cold water, the shock destroying the fish. Only two turbot survived, which were deposited in Massachusetts Bay.

The second experiment, also under Mr. Mather, was made in 1879. This was entirely a failure; the fish all dying, having been injured, it was thought, by the land transportation from Southport to Southampton.

In April, 1880, Captain Mortimer, of the ship Hamilton Fish, brought five sole out of nine sent by Mr. Moore, of the Derby Museum; and these were deposited by Mr. Blackford outside of Sandy Hook.

On the present occasion the Commission again had the important aid of Mr. C. L. Jackson, of Bolton, England, who undertook to collect a number of turbot and sole, and acclimate them in the tanks of the Southport Aquarium. A large number died, but those that survived appeared to be in very good condition, and were shipped from Liverpool on the Cunard steamer Parthia on October 15, in charge of Mr. Armistead. The fish were carried in two oval wooden tanks 5 feet 6 inches long, 4 feet wide, and 2½ feet deep, each tank sub-divided into four spaces, so as to prevent undue agitation during the passage. A cask was set on the top of each, and filled every day with sea-water, and a circulation of the water maintained thereby.

The temperature of the water at Southport on starting was 53½°. During the voyage the range of temperature of the water in the tanks was from 51° to 58°.

Starting with seventy soles and thirty-five turbot, sixty-seven soles and twenty-nine turbot died on the way; three of the former and six of the latter alone surviving.

In response to an application from the Commission, the Secretary of the Treasury directed the collector of customs at New York to have the revenue-steamer Grant in readiness for the immediate transfer. A party of gentlemen interested in the experiment, consisting among others of Mr. E. G. Blackford, Mr. Barnet Phillips, Mr. John Foord, and others, were on board the Grant; and the nine fish were placed in cans and transferred to the ocean in Sheepshead Bay, just opposite the Oriental Hotel, in water about 2 fathoms deep.

It is, of course, impossible to tell what may be the fate of these fish, but the chances are very few that they will ever be heard of again.

After a careful consideration of the whole problem, it is believed that the only chance of successful experiment is to place such fish on arrival in an inclosed basin of tidal water of suitable character, where they can be fed, and guarded against any possible enemies; and where, when ripe, the eggs can be taken and, after artificial impregnation, be hatched out in accordance with the methods adopted for the floating eggs of the sea fish. This is one of the several problems to be solved in connection with the proposed sea-fish hatching station at Wood's Holl. The facilities there will be excellent for the purpose, and it is hoped that the experiment may be made at the earliest possible moment.

The following report of results, made by Mr. A. Wilson Armistead to Mr. C. L. Jackson, of Bolton, England, will probably be of interest:

It is with sorrow that I have now to inform you of the sad ending of nearly all the fish. However, I do not think it is by any means a lost journey for the Americans. From what I have seen, I feel satisfied the thing can be done. Inclosed you will find an account I have kept, showing changes of temperature, losses, &c., which speaks for itself. You will notice the fish began to die very soon after leaving Liverpool, and when I examined them the first thing noticeable was their sickly appearance, and when examined more closely I could trace scars or bruises which were not observed at the Southport Aquarium.

I am now confident that the fishes must have been injured in their journey down to the landing stage from Liverpool Station, as the jolting about, owing to the bad road, was very severe, and in any future attempt that may be made, I am quite sure that this short part of the journey must be made in some other way. When the largest tank was filled with sea-water, after the carpenter had fixed the cross-pieces, all seemed right until the following day, when the sun's rays falling upon the surface of the water revealed what appeared to be small splinters, very minute, floating about, which had to be got rid of, as they might be bad for the fish by getting lodged in their gills; but I could not discover that any fish had been choked, with but one doubtful exception. This was a large turbot, and appeared as though it had been choked, but I could not find anything in the gills or about the throat to satisfy me.

As to the voyage itself, we had both rough and fine weather. The hole in the largest tank is rather too wide. The water overflowed several times while we had rough weather, and we could only keep it filled up to the cross-pieces. I do not think the fish suffered much by the rolling about of the steamer, unless it be the fish have pressure put upon them when the steamer is heaving upward. I have thought about this a great deal, and have come to the conclusion that the fish do experience a slight pressure, not so great as to injure them, but which, if long continued, might make them sickly. The water was changed every morning, except when the temperature of the sea rose considerably when passing the Gulf Stream currents. You will see that on Monday morning, October 24, when the water in the tanks stood at 51°, in the sea it was 61°, and at 2 p. m. same day it had risen as high as 68°, so I considered it wisest to keep the water I had.

Wood, I fear, is not good for fish to lie upon. I would recommend that the tank be either charred all over inside, or a coating of Portland cement, with about two or three parts sand, which, when well set, to be thoroughly seasoned by placing it in the sea for, say, two or three months; a very thin coating would do. As to procuring the fish, in the first instance, I believe a good deal hinges upon this for making the thing a success. If caught in a trawl-net, I believe that the net should be hauled up at short intervals; this, I expect, would necessitate a trawl-boat to fish expressly for live soles or turbot, and would be more costly, but decidedly more satisfactory. Indeed, I should not like myself to make another venture across the Atlantic unless I could be sure that the fishermen intrusted with the catching of the fish could be relied upon. The best way would be to see them caught one's self.

I do wish I had been in a position to give you a more satisfactory result. Under the circumstances, all that could be has been done. Captain McKay, John Atkins, chief officer, and Mr. Field, the purser, all connected with the steamer, have been very good to me. I am sure they are sorry for the poor result and would like to have seen the experiment successful. I liked Captain McKay very much, and so did all the passengers; and if ever another attempt is made with living fishes, whoever goes out with them I trust may have the same captain.

STEAMER PARTHIA, *October* 26, 1881.

o. **The Oyster** (*Ostrea virginica*).

Within a few years past special attention has been paid by the Commission to various features connected with the artificial cultivation of the oyster, Major Ferguson having visited France in 1878 to study the details of the business as practiced in that country.

Reference has already been made, in the list of stations of the United States Fish Commission, to Saint Jerome as a station for the artificial cultivation of the oyster. This is located not far from Point Lookout, near the mouth of the Potomac River, and was first established by Major Ferguson while Commissioner of Fisheries of Maryland, and subsequently carried on at the joint expense of the Maryland Commission and the United States Fish Commission. Here it is proposed to establish a system of parks and other arrangements similar to those adopted in France; and, in addition, to test practically the possibilities of the artificial impregnation of the eggs of the oyster and the production of spat at will, a measure not satisfactorily accomplished in Europe.

Lieut. Francis Winslow, of the Navy Department, having been occupied in collecting statistics of the oyster industry for the Census of 1880, continued his labors in the service of the United States Fish Commission by authority of the Secretary of the Navy. His researches will be duly published when they are completed.

By the courtesy of Mr. E. G. Blackford, of New York, a great variety of living oysters of the different breeds was imported from Europe, and placed in the hands of Mr. John A. Ryder for investigation. The special problem was to ascertain how far the European oysters, including the German, French, Portuguese, and English natives, and the green oysters, differed in character from the American; and thus to determine whether processes applicable to the former were suitable for the latter. Some very interesting facts ascertained by Mr. Ryder will be duly made the subject of a report.

p. **The Oregon Clam** (*Glycimeris generosa*).

On the Pacific coast there are several species of bivalve mollusks, coming under the general head of clams, which are of very great value in their localities, and which it has been thought might be profitably introduced to the Atlantic coast.

One of the most important of these is the *Glycimeris generosa*, known by the Indians as the Geoduck, a clam found in California, Oregon, and Washington Territory, and which reaches an enormous size, retaining, however, a great tenderness and delicacy of flesh, much more resembling that of the oyster than of the clam. Correspondence has been entered into with Mr. Henry Hemphill in regard to obtaining and shipping a quantity of these clams for experiment, but it was finally concluded that it would be better to wait the occasion of a return trip of the fish-transportation car of the Commission before attempting a sending.

Several other species of western clams are also under consideration for a similar purpose.

D.—ABSTRACT OF CONTENTS OF APPENDIX.

18.—ANALYSIS.

In the general Appendix to this report will be found a number of separate papers treating upon matters related to the work of the Fish Commission. These are classified under four headings, as follows:

A.—GENERAL.

The first paper is by Lieut. Z. L. Tanner, and gives a thorough description of the Fish Hawk, illustrated by eighteen plates. This is followed by an account of the Fish Hawk's work during the second year; and, finally, by a list of patents issued in the United States during the year relating to fish and fisheries. The latter is by Dr. R. G. Dyrenforth, chief examiner of the Patent Office.

B.—FISHERIES.

First under this head is a paper upon the mackerel fishery, by Messrs. Goode, Collins, Earll, and Clark. It embodies all that the Fish Commission has heretofore collected upon the subject, covering some 440 pages, and provided with a special index. An extra edition has been issued, in pamphlet form, for distribution to persons interested in this fishery. Two translations by Dr. Bean furnish the statistics of the Norwegian fisheries for the year 1880. There is a review of the early shad fisheries on the Susquehanna, by Harrison Wright; a reprint from the London Quarterly Review upon the fish-supply of London; and a report, by Charles W. Smiley, upon the extent to which fish-guano is used as a fertilizer in the United States.

C.—NATURAL HISTORY AND BIOLOGICAL RESEARCH.

Prof. H. E. Webster and Mr. James E. Benedict, of Union College, furnish a report on the worms collected by them at the Fish Commission station at Provincetown in 1879, which is accompanied by eight plates and a special index. Messrs. John A. Ryder, and S. A. Forbes report upon the food of fishes; and Messrs. F. N. Clark, H. J. Rice, and John A. Ryder upon experiments designed to retard the development of shad eggs, with a view to facilitate their transportation.

D.—PROPAGATION OF FOOD-FISHES.

Under this head will be found detailed and statistical reports upon the work of the United States Fish Commission in propagating and distributing food-fishes, such as shad, whitefish, trout, and several kinds of salmon, by F. N. Clark, Livingston Stone, Charles G. Atkins, and Charles W. Smiley.

E.—SUPPLEMENT TO REPORT PROPER.

19.—ON THE WORK OF THE FISH HAWK AND OF THE UNITED STATES FISH COMMISSION DURING THE YEAR 1881, BY PROF. LESLIE A. LEE, OF BOWDOIN COLLEGE.*

The Fish Hawk is fully equipped with all necessary apparatus for conducting the investigations. The experience of the Commission has been so great that the apparatus for dredging, trawling, &c., is probably more perfectly adapted for its purposes than any which has been used elsewhere. Many important improvements have been suggested from time to time by members of the Commission, and changes are continually being made. Perhaps the most important addition to the apparatus this season was in the "trawl-wings." A large net-trawl is used more than anything else for obtaining bottom animals, and it has long been supposed that many of the more active ones escaped capture by swimming to one side after being aroused by the on-coming trawl. To capture these the trawl-wings were contrived. These are light nets which are attached to rods which run out on each side from the top of the trawl. The nets are fitted within with a transverse partition, perforated in the center, which prevents the escape of the animals after they are once confined. This arrangement was a complete success, many new species being taken by it.

But not all the energies of the Commission are devoted to the collection of specimens. Careful soundings are made by which the existing charts are often corrected. The temperature of the water is taken at all depths, particularly at the surface and bottom; and the specific gravity of the bottom water is determined. In fact a complete record is made of everything which can be supposed to have a bearing upon the subjects before the Commission.

Upon the prospect of pleasant weather the party would go aboard of the Fish Hawk and proceed directly to the southward, remaining off shore for from two to four days. Nine such trips were made during the past season. The Gulf Stream off the coast of Southern New England is situated about 100 miles from land. Its distinctness as a stream is well indicated by the soundings. The depth of the water from Gay Head outward is very uniform for nearly 90 miles, not more than 50 fathoms often occurring. Then comes the beginning of the slope. Within 10 or 15 miles 1,000 fathoms and probably greater depths can be reached. The work of the Commission was done in depths of less than 800 fathoms.

Upon reaching suitable ground, as indicated by the soundings, the trawl or dredge would be put over and allowed to drag on the bottom for perhaps twenty minutes. Or, if fish were desired particularly, the line-trawl, similar to that used by cod-fishermen, would be set. Upon

* From a paper read before the Portland Society of Natural History January 16, 1882.

making a haul with the net-trawl, the first thing to impress one is the wonderful abundance of life present, in both species and individuals. Nowhere in the previous history of the Commission have such results been obtained, surprising alike to the novice and the experienced. The bottom in this region is usually soft, and is composed of sand and mud, with many foraminifera, both calcareous and arenaceous. Much of the mud is brought up in the trawl, which at times must sink deeply into it. Within the trawl when it comes to the surface, the conspicuous features are the echinoderms, fishes, crustaceans, and annelids.

Of the many sorts of fishes taken, perhaps the several species of hake were the most abundant. The trawl often contained bushels of these, which, however, were usually of small size. Cod, haddock, and whiting were not so common, but good sized specimens sometimes occurred. Many of the species, particularly of the genera *Careproctus* and *Liparis*, were very soft and gelatinous, and could be preserved only by being dropped at once into strong alcohol. These occurred mostly at the greater depths, where they would naturally not be exposed to conditions requiring a more perfect protection. The most important species taken was the tile-fish. This was first discovered here in 1878 by a passing fisherman. A few were caught in 1880 by the Commission, and during the past season particularly attention was paid to this species, to determine whether its quality and abundance are such as to lead it to become an important food-fish. Trawl-lines were therefore set at different depths and localities, and special efforts were made to determine its limits. It was found to exist everywhere, from Cape Cod to Delaware (which is probably not its southern limit), in a depth of about 100 fathoms, and is nearly as abundant as all other kinds together. It is of large size, averaging in weight from 12 to 20 pounds, the largest taken weighing about 50 pounds. The color above is violaceous, and below light gray. On the back and sides are scattered bright yellow spots, each about an inch in diameter. What chiefly distinguishes it from other genera is the fact that it has a dorsal fleshy lobe just back of the head. It has been named *Lopholatilus chamæleonticeps* Goode and Bean. The flesh is white and firm and free from bones. The quality is very fine, so that it cannot fail of becoming a good market fish. It remains now for the fishermen to develop here a new industry.

Crustacea occur in large numbers and furnish an abundant supply of food for all kinds of fishes. They are mostly northern forms. Many have previously been known from the Norwegian coast, and others have close affinities to northern species. Several species which Stimpson long ago described from single or few small or imperfect specimens were re-discovered in abundance and of large size. Decapods largely predominate, particularly shrimps and anomurans. Hundreds and thousands of specimens were brought up in nearly every haul. The largest yet taken is a crab, *Geryon quinquedens* Smith, first described from specimens in the collection of this society, which were taken from the stomachs of the fishes caught on our coast. This species, in life, is of a brilliant vermilion color. The carapax is often 6 inches in diameter. To some individuals were attached two species of stalked barnacles, one being the type of a new genus. An anomuran, *Latreillia elegans* Roux, is certainly an elegant species. The carapax is triangular in shape and rarely more than an inch in length, while the legs extend 4 or 5 inches on each side. The eyes are at the ends of stalks half as long as the carapax. The legs are banded alternately with bright red and light pink. One of the most interesting of the crustaceans was a hermit crab, *Parapagurus pilosimanus* Smith. This was first described in 1879 from a single specimen brought in by a fisherman from the Banks. We found it in great abundance, 500 specimens being taken at a single haul. This forms the type of a new family as well as of a new genus. It possesses characters hitherto unknown in its group, having gills in the form of papillæ instead of lamellæ as in most hermit crabs. The carcinœcium was originally a shell, as is commonly the case, but a compound polyp with a tough leathery integument soon becomes attached to the shell and extends beyond it, growing as the crab grows, often in time completely absorbing the shell. This polyp is also new to science, forming the type of a new genus. It is interesting to note that this crustacean and the polyp have never been found separated. While there are many other species of the hermit crabs in the same region, this polyp is never found upon any of them, and this crab is never protected by any other of the numerous species of polyps which abound.

Hitherto few species of Cephalopods have been found on our coast, but many new and interesting forms were taken during the past summer. The largest was *Alloposus mollis* Verrill, of which we took two specimens, each about three feet long and weighing 25 or 30 pounds. It belongs to the eight-armed group, and the arms are united throughout nearly their entire length by a muscular web. Its suckers are over half an inch in diameter. The body is very soft and gelatinous. It shrinks exceedingly when put into alcohol and is reduced to not more than one-third of its original weight. Such an animal would hardly seem to be a formidable enemy. This is also the type of a new genus. A species described by Sars from the Norwegian coast was taken sparingly. This closely resembles the common squid of our shores, but the tentacular arms, besides possessing the usual suckers, are supplied with horny hooks, giving it a fearful advantage in the struggles with its prey. A species described by Le Seur in 1821, *Taonius pavo*, also occurred, not having been seen on our coast since that time. This is well deserving of the name "goggle-eyed squid," its eyes being altogether out of proportion to the body. Fragments of the shells of the paper nautilus were frequently dredged, but the animal itself was not taken. Two or three living specimens have lately occurred on the New Jersey coast.

Each haul brought up an abundance of Echinoderms, mainly star-fishes. The number of new species taken was considerable. Certain forms were so plenty that they were cast overboard again by the bushel. Many curious modifications of structure occur among them. An interesting form, *Diplopteraster multipes* Verrill, is large and thick, with short arms, a rich purple above, beneath orange streaked with brown, the feet large and purple and arranged in four rows. Twenty species of star-fish were taken at one haul. Sea-urchins were not abundant, only a few species being taken. Some of these, however, were new and remarkable. Among them is a large species hitherto known only from off Florida. Several others were northern forms.

Annelids and other worms occurred in great variety. One new species was perhaps more plenty than any other form of life in those depths. It has been named *Hyalinœcia artifex* Verrill. In general appearance this is something like the common clam-worm, *Nereis*. But it secretes a tube 10 or 12 inches in length, of a horny substance, quill-like, amber-colored, sometimes one-third of an inch in diameter. The tubes containing the animal probably lie loosely on the bottom, but it is likely that the animal is sometimes able to swim about, dragging its tube behind. Often the trawl came up filled with their tubes. The large sea-mouse, *Aphrodita*, which is often found on our own coast, was also plentiful.

The forms of life thus far described are mostly those which have hitherto occurred only in the colder regions of the North Atlantic or those which show strong affinities to northern forms. We now come to the shell-bearing mollusca, and another wonderful variety of forms is discovered. The alliances of some of these are with tropical species, many being represented by similar species in the West Indies. The new form of rake-dredge did good service in the collecting of shells, nearly every haul bringing up something new. Conspicuous among the new species is a Trochus-like form, *Calliostoma Bairdii* V. and S., by far the handsomest shell found on the New England coast. This presents a decidedly tropical aspect. Two species of *Solarium* also occurred, both of small size. Another shell taken sparingly was *Dolium Bairdii* V. and S., a representative of a genus one would hardly expect here. These are all Gasteropods. The Lamellibranchs present, among many others, three genera new to the coast and remarkable for their close affinities to fossil forms. These are *Diplodonta*, *Mytilimeria*, and *Pholadomya*. Of the latter there is only one other living species, which occurs on the coast of Africa. Mingled with these were a large number of northern species of shells. In all, more than 200 species of mollusks were taken, of which more than 100 were additions to the American fauna, and nearly 75 new to science.

A surprising feature of life at the bottom is the large number of sea-anemones, some being of great size. They are attached to everything.

Even the tubes of *Hyalinœcia* give support to a peculiar species. The larger ones hold firmly enough to the mud bottom since they are subject to no wave action.

One species of sea-pen, *Pennatula aculeata* Dan., was taken in great abundance on several occasions. A very delicate branching coral, *Acanella Normani* Verrill, often covered the net with its orange-red branches. A simple, horn-shaped coral, *Parasmilia Lymani*, was secured in specimens of great perfection, while another coral of exceeding delicacy was brought up more often broken than perfect. The latter was a species of *Flabellum* very similar to one taken by the Challenger expedition.

Thus far I have spoken only of the bottom species. The surface and intermediate depths all abound in life. The floating weed at the surface conceals among its branches many fishes and crustaceans which remain there for protection. Jelly-fishes are seen in great variety, together with a gigantic *Salpa* which sometimes covered the nets so as to obscure the other specimens. But little surface collecting was done, although, without doubt, that would prove exceedingly profitable.

While we consider the life of this region as a whole, some curious questions arise. That of coloration is one. The crustaceans are nearly all brilliantly colored, but there is no great variety in their tints. Scarlet and vermilion predominate, with some orange-red. The star-fishes, too, are gorgeous in their purple and orange. The sea-anemones are pink and orange-red. The sea-pens are deep red. Many fishes also possess the same tints. What is the reason of such gorgeous array? Professor Verrill explains it by saying that these colors render the animals invisible in the great depths. The sunlight in passing through the water loses most of its red and yellow rays by absorption before reaching the bottom, and consequently, as none of the remaining rays could be reflected from these red and yellow pigments, the animal could not be seen by others in search of prey. He suggests that these colors have been produced by a process of natural selection.

Phosphorescence, too, is an interesting phenomenon exhibited by many forms of life. The sea-anemones and sea-pens show this most conspicuously, although many others are also highly phosphorescent. The light given off by these is usually bluish or greenish, rarely yellowish. There would seem to be a connection between this fact and the brilliant coloration of the forms previously mentioned.

The mingling of two apparently distinct faunæ on the Gulf Stream slope seems to be due to two causes: the low, uniform temperature and the currents. We find here the contact of a cold polar current with the warm Gulf Stream at a depth which prevents seasonal variations. The bottom temperatures are low enough for arctic forms, and the Gulf Stream has slowly brought up from the West Indies species which have become gradually fitted to their environment. The abundance of life can be accounted for by the rapidity of circulation which keeps the bottom water purer and better fitted for supporting life than is usually the case at such depths. With such an abundance of life for food and with the uniform temperature there seems to be a combination of conditions which may make this the region to which the migratory fishes resort in winter.

20.—TABLES OF THE DISTRIBUTION OF FISH AND EGGS.

In the following tables, numbered I to X, which have been prepared by Mr. Charles W. Smiley, and in Table XI, prepared by Col. M. McDonald, will be found the condensed record of the distribution for the year of whitefish, lake trout, brook trout, California salmon, California trout, Penobscot salmon, Schoodic salmon, shad, and carp. Fuller details will be found in various papers of the Appendix: In XX, Mr. Clark's account of whitefish and trout operations; in XXI, Mr. Stone's account of California salmon operations; in XXII, Mr. Stone's account of California trout operations; in XXIII, Mr. Atkins' account of Penobscot salmon operations; in XXIV, Mr. Atkins' account of Schoodic salmon operations; in XXV, the account of shad operations.

TABLE I.—*Distribution of whitefish eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
	DOMESTIC.	
California	B. B. Redding, San Francisco	750, 000
Connecticut	H. J. Fenton	10, 000
District of Columbia.	Central Station, Washington	110, 000
Iowa	B. F. Shaw, Anamosa	500, 000
New Jersey	Mrs. J. H. Slack, Bloomsburg	100, 000
	FOREIGN.	
France	F. Mather, for M. Raveret-Wattel, Paris	250, 000
Germany	F. Mather, for Herr von Behr, Berlin	300, 000
	F. Mather, for G. Ebrecht	12, 000
	Total	2, 032, 000

TABLE II.—*Distribution of young whitefish by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of fish.
Michigan	Detroit River, near Detroit	1, 250, 000
	Lake Michigan, near Ludington	1, 000, 000
	Lake Michigan, near Muskegon	1, 500, 000
	Lake Huron, near Port Huron	2, 000, 000
	Lake Michigan, near Saint Joseph	1, 500, 000
New York	Near islands in Lake Erie	3, 500, 000
	Lake Ontario, near Oswego	3, 500, 000
Wisconsin	Lake Michigan, near Racine	1, 750, 000
	Lake Michigan, near Sheboygan	1, 750, 000
	Total	17, 750, 000

TABLE III.—*Distribution of eggs of lake trout by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
	DOMESTIC.	
Iowa	B. F. Shaw, Anamosa	30,000
New Jersey	F. Mather, Newark	2,000
	FOREIGN.	
Germany	F. Mather, for Herr von Behr, Berlin	20,000
	Total	52,000

TABLE IV.—*Distribution of brook trout eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
	DOMESTIC.	
Maryland	Druid Hill hatchery, Baltimore	30,000
	FOREIGN.	
France	F. Mather, for reshipment	20,000
	Total	50,000

TABLE V.—*Distribution of young brook trout by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of fish.
Maryland	Pond at Oakland, Md	30,000
Michigan	Tributaries of Rouge River	20,000
	Total	50,000

TABLE VI.—*Distribution of California salmon eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
	DOMESTIC.	
California	Lenni Fish Propagating Company, Sonoma	500,000
	B. B. Redding, San Francisco	200,000
Maryland	T. B. Ferguson, Baltimore	500,000
Minnesota	R. O. Sweeny, Saint Paul	200,000
Nebraska	R. R. Livingston, Omaha	500,000
Nevada	H. G. Parker, Carson City	50,000
New Hampshire	A. H. Powers, Plymouth	50,000
New Jersey	Fred. Mather, Newark	500,000
	Percy C. Ohl, Plainfield	50,000
Pennsylvania	Seth Weeks, Corry	100,000
	Curtis Johnson, Saint Petersburg	50,000
South Carolina	C. J. Huske, Walhalla	300,000
West Virginia	C. S. White, Romney	100,000
	FOREIGN.	
Canada	S. Wilmot, Newcastle, Ontario	500,000
New South Wales	Zoological Society, Sydney	50,000
	Total	3,650,000

TABLE VII.—*Distribution of California trout eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
California	B. B. Redding, San Francisco	40,000
Illinois	N. K. Fairbanks, Chicago	35,000
Iowa	B. F. Shaw, Anamosa	35,000
Kentucky	William Griffith, Louisville	5,000
Maryland	T. B. Ferguson, Baltimore	36,400
Michigan	J. G. Portman, Pokagon	6,000
Minnesota	R. O. Sweeny, Saint Paul	8,000
New Hampshire	S. Webber, Plymouth	4,000
New York	Eugene G. Blackford, New York City	500
Pennsylvania	J. P. Creveling, Marietta	5,000
Wisconsin	Philo Dunning, Madison	5,000
	Total	179,900

TABLE VIII.—*Distribution of Penobscot salmon eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
Connecticut	H. J. Fenton, Windsor	95,000
Maine	Charles G. Atkins, Grand Lake Stream	50,000
Minnesota	R. O. Sweeny, Saint Paul	200,000
New Hampshire	A. H. Powers, Plymouth	95,000
New Jersey	E. J. Anderson, Bloomsbury	95,000
New York	E. G. Blackford, New York City	344,500
Pennsylvania	Seth Weeks, Corry	100,000
Virginia	S. F. Baird, Washington, D. C	27,000
	Total	1,006,500

TABLE IX.—*Distribution of schoodic salmon eggs by the United States Fish Commission during season of* 1881.

States.	Destination.	Number of eggs.
	DOMESTIC.	
California	B. B. Redding, San Francisco	10,000
Connecticut	H. J. Fenton, Windsor	5,250
Iowa	B. F. Shaw, Anamosa	25,000
Maine	A. J. Darling, Enfield	5,000
Maryland	T. B. Ferguson, Baltimore	11,000
Massachusetts	E. A. Brackett, Winchester	5,000
Michigan	F. N. Clark, Northville	56,750
	J. G. Portman, Paris	25,000
Minnesota	R. O. Sweeny, Saint Paul	25,000
Missouri	C. H. Brownell, Saint Joseph	25,000
New Hampshire	A. H. Powers, Plymouth	4,750
New Jersey	Mrs. J. H. Slack, Bloomsbury	22,000
New York	E. G. Blackford, New York City	10,000
	Seth Green, Mumford	11,000
Pennsylvania	Seth Weeks, Corry	11,000
Tennessee	E. M. Russell, Paris	5,000
Vermont	J. M. Haven, Rutland	10,000
Wisconsin	M. T. Bailey, Madison	25,000
	FOREIGN.	
Germany	F. Mather, for reshipment	20,000
	Total	311,750

TABLE X.—*Distribution of shad from April* 27, 1881, *to June* 22, 1881, *by the United States Fish Commission.*

States.	No. of lots.	Streams stocked.	Number of fish.
Connecticut	1	Connecticut	1,000,000
Delaware	1	Nanticoke	940,000
District of Columbia	2	Potomac	205,000
Georgia	6	Oconee, Ocmulgee, Flint, Little	1,800,000
Iowa	1	Mississippi	1,106,000
Kansas	1	Missouri	200,000
Kentucky	4	Barren, Green, Kentucky, Salt	767,000
Maine	2	Kennebec, Mattawamkeag	1,150,000
Maryland	42	Choptank, North East, Patapsco, Patuxent, Potomac, Susquehanna	24,705,500
North Carolina	3	Haw, Salmon Creek	4,357,500
Ohio	2	Maumee, Ohio	1,020,000
Pennsylvania	3	Juniata, Susquehanna	3,500,000
Rhode Island	1	Palmers	500,000
South Carolina	3	Catawba, Congaree, Pedee	620,000
Tennessee	4	Holston, Nolachucky, Tennessee, Wautaga	400,000
Texas	5	Brazos, Colorado, Sabine, San Antonio, San Marcus	277,000
Virginia	15	James, Potomac	24,280,000
West Virginia	1	Ohio	175,000
Total	97	Total	67,003,000

TABLE XI.—*Distribution of carp during the year* 1881, *by the United States Fish Commission.**

State.	Number of counties represented.	Number of applicants supplied by express.	Number of applicants supplied by messenger.	Total number of applicants supplied.	Total number of fish furnished.	Number of applicants remaining unsupplied.	Total number of applicants.
Alabama	38	28	60	88	1,856	70	158
Arizona	2	......	......	......	......	7	7
Arkansas	17	5	28	33	818	5	38
California	24	......	......	......	......	38	38
Colorado	9	1	......	1	20	18	19
Connecticut	8	21	71	92	2,220	14	106
Dakota	5	......	......	......	......	8	18
Delaware	3	16	42	58	2,100	1	59
District of Columbia	......	1	3	4	86	7	11
Florida	11	2	23	25	432	5	30
Georgia	94	30	380	410	7,681	133	543
Idaho	2	......	......	......	......	2	2
Illinois	62	23	139	162	2,844	24	186
Indiana	52	135	10	145	3,896	27	172
Indian Territory	1	......	16	16	317	......	16
Iowa	29	1	15	16	292	28	44
Kansas	45	5	105	110	2,366	17	127
Kentucky	70	7	489	496	9,732	84	580
Louisiana	24	1	51	52	1,276	6	58
Maine	6	6	......	6	116	5	11
Maryland	28	15	240	255	22,424	9	264
Massachusetts	10	24	3	27	745	21	48
Michigan	20	3	37	40	1,848	9	49
Minnesota	18	4	1	5	100	17	22
Mississippi	55	139	389	528	9,445	97	625
Missouri	50	2	208	210	4,126	54	264
Montana	2	......	......	......	......	2	2
Nebraska	11	6	1	7	120	8	15
Nevada	2	......	......	......	......	2	2
New Hampshire	6	6	......	6	140	5	11
New Jersey	19	49	21	70	1,352	11	81

*The number of carp actually sent out in 1881 was from six to eight thousand greater than appears from the subjoined table, many having been distributed through agents whose reports were not available when this table was made. There should also be added the number of carp distributed in the spring of 1882, those being of the 1881 crop and amounting to five or six thousand. The crop of 1881 aggregated about 160,000.

TABLE XI.—*Distribution of carp during* 1881 *by United States Fish Commission*—Cont'd.

State.	Number of counties represented.	Number of applicants supplied by express.	Number of applicants supplied by messenger.	Total number of applicants supplied.	Total number of fish furnished.	Number of applicants remaining unsupplied.	Total number of applicants.
New Mexico	3	....	....	....	....	6	6
New York	40	140	50	190	4,616	68	258
North Carolina	56	47	115	162	3,104	91	253
Ohio	62	172	35	207	4,258	89	296
Oregon	13	....	....	....	....	35	35
Pennsylvania	54	209	141	350	7,256	73	423
Rhode Island	4	5	20	25	1,140	2	27
South Carolina	26	9	236	245	11,884	11	256
Tennessee	46	34	165	199	4,200	55	254
Texas	112	15	926	941	16,580	9	950
Utah	5	5	....	5	130	5	10
Vermont	3	4	....	4	76	2	6
Virginia	68	172	304	476	11,669	30	506
Washington	....	....	....	....	....	11	11
West Virginia	21	35	41	76	1,935	6	82
Wisconsin	19	10	4	14	296	15	29
Wyoming	1	....	2	2	200	2	4
Total	1,256	1,387	4,371	5,758	143,696	1,244	7,002

21.—LIST OF RAILROADS GRANTING FACILITIES IN 1881.

During the present year a large number of railroads have accorded the facilities for carrying fish in baggage cars and for stopping trains at bridges so as to deposit young fish. The list is given herewith, and the most hearty acknowledgment made of their interest and co-operation.

Alabama Great Southern Railroad Company. Charles P. Ball, general superintendent, Chattanooga, Tenn.

Alabama Central Railroad Company. W. L. Lanier, president, Selma, Ala.

Associated Railways of Virginia and the Carolinas. A. Pope, general passenger agent, Richmond, Va.

Atchison, Topeka and Santa Fé Railroad. George O. Manchester, assistant general manager, Topeka, Kans.

Atlantic, Mississippi and Ohio Railroad Company. N. M. Osborne, secretary, Petersburg, Va.

Atlanta and Charlotte Air-Line Railway. C. J. Foreacre, general manager, Atlanta, Ga.

Atlanta and West Point Railroad. A. J. Orme, general passenger agent, Atlanta, Ga.

Baltimore and Ohio Railroad Company. G. M. Serpell, master of transportation, Pittsburgh division; C. H. Hudson, superintendent Trans-Ohio division; W. M. Clements, master of transportation.

Boston and New York Air-Line Railroad Company. J. H. Franklin, superintendent, New Haven, Conn.

Boston and Albany Railroad. C. O. Russell, superintendent, Springfield, Mass.

Boston and Providence Railroad Company. A. A. Folsom, superintendent, Boston, Mass.

Burlington and Missouri River Railroad in Nebraska. A. E. Touzalin, general manager, Omaha.

Carolina Central Railroad. W. Q. Johnson, general superintendent, Willmington N. C.

Central Railroad of New Jersey. James Moore, general superintendent and engineer, Elizabeth, N. J.; F. S. Lathrop, receiver.

Central Railroad and Banking Company of Georgia. William Rogers, general superintendent, Savannah, Ga.

Central Pacific Railroad Company. F. H. Goodman, general passenger and ticket agent, San Francisco, Cal.; A. N. Towne, general superintendent.

Central Vermont Railroad Company. J. W. Hobart, general superintendent, Saint Albans, Vt.

Charlotte, Columbia and Augusta Railroad Company. T. M. R. Talcott, general manager; A. Pope, general passenger agent, Richmond, Va.

Cheraw and Darlington, and Cheraw and Salisbury Railroads. J. F. Divine, general superintendent; A. Pope, general passenger agent, Richmond, Va.

Chesapeake and Ohio Railway Company. William S. Dunn, engineer and superintendent, Richmond, Va.

Chicago, Rock Island and Pacific Railroad Company. A. Kimball, general superintendent, Davenport, Iowa.

Chicago and Alton Railroad. J. C. McMullin, general manager, Chicago, Ill.

Chicago, Saint Louis and New Orleans Railroad Company. W. H. Osborn, president; J. C. Clarke, vice-president and general manager, New York.

Chicago and Northwestern Railway. M. Hughitt, general manager; Chicago, Ill.

Chicago, Burlington and Quincy Railroad Company. T. J. Potter, general manager, Chicago, Ill.

Chicago, Milwaukee and Saint Paul Railway Company. W. C. Van Horne, general supernt endent, Milwaukee, Wis.

Chicago, Saint Paul, Minneapolis and Omaha Railroad, North Wisconsin Railroad. E. W. Winter, general superintendent, Saint Paul, Minn.

Cincinnati, Hamilton and Dayton; Dayton and Michigan; Cincinnati, Hamilton and Indianapolis; and Cincinnati, Richmond and Chicago Railroads. L. Williams, general manager, Cincinnati, Ohio.

Cincinnati Southern Railway. S. Woodward, superintendent, Cincinnati, Ohio.

Cincinnati, Sandusky and Cleveland Railroad. D. W. C. Brown, general manager and superintendent, Springfield, Ohio.

Cleveland, Columbus, Cincinnati and Indianapolis Railway Company. E. B. Thomas, general manager, Cleveland, Ohio.

Cleveland, Mount Vernon and Columbus Railroad Company. G. A. Jones, receiver, Mount Vernon, Ohio.

Columbia and Greenville Railroad. T. M. R. Talcott, general manager; A. Pope, general passenger agent, Richmond, Va.

Connecticut River Railroad. J. Mulligan, superintendent, Springfield, Mass.

Delaware and Chesapeake Railway. O. S. Sanford, superintendent, Easton, Md.

Delaware, Lackawanna and Western Railroad. Samuel Sloan, president, New York.

East Tennessee, Virginia and Georgia Railroad. John F. O'Brien, chief engineer and superintendent, Knoxville, Tenn.

European and North American Railroad. F. W. Cram, superintendent, Bangor, Me.

Fitchburg Railroad Company. John Adams, general superintendent, Boston, Mass.

Flint and Pere Marquette Railway. Sanford Keeler, superintendent, East Saginaw, Mich.

Florida Central Railroad Company. W. M. Davidson, superintendent, Jacksonville, Fla.

Fort Wayne and Jackson Railroad Company. M. D. Woodford, general superintendent, Jackson, Mich.

Galveston, Harrisburg and San Antonio Railroad Company. James Converse, general superintendent.

Galveston, Houston and Henderson Railroad. W. H. Harding, general manager, Galveston, Tex.

Georgia Railroad Company. E. R. Dorsey, general freight and passenger agent, Augusta, Ga.

Gulf, Western Texas and Pacific Railroad. M. D. Monserrate, general superintendent, Cuero, Tex.

Hannibal and Saint Joseph Railroad Company. W. R. Woodward, superintendent, Hannibal, Mo.

Hartford and Connecticut Valley Railroad Company. Samuel Babcock, president, Hartford, Conn.

Houston and Texas Central Railroad. G. Jordan, vice-president, Houston, Tex.

Indianapolis and Saint Louis Railroad Company. E. B. McClure, general superintendent, Indianapolis, Ind.

Illinois Central Railroad Company. Joseph F. Tucker, traffic manager, Chicago, Ill.

International and Great Northern Railroad. H. M. Hoxie, vice-president and manager, Palestine, Tex.

Jacksonville, Pensacola and Mobile Railroad. Edgar Vliet, master of transportation, Tallahassee, Fla.

Kansas City, Fort Scott and Gulf Railroad; Short Creek and Joplin Railroad; Fort Scott, Southeastern and Memphis Railroad; Rich Hill Railroad; Memphis, Kansas and Colorado Railroad; Springfield and Western Missouri Railroad; Kansas City, Lawrence and Southern Railroad, Southern Kansas and Western Railroad. L. W. Towne, general superintendent, Kansas City, Mo.

Kansas City, Saint Joseph and Council Bluffs Railroad Company. I. F. Barnard, general superintendent, Saint Joseph, Mo.

Keokuk and Saint Louis Line. H. B. Blood, general freight and passenger agent, A. L. Griffin, general superintendent, Keokuk, Iowa.

Lake Shore and Michigan Southern Railroad. Charles Paine, general superintendent, Cleveland, Ohio.

Little Rock and Fort Smith Railway. Theodore Hartman, general superintendent, Little Rock, Ark.

Louisville, Cincinnati and Lexington Railway Company. William Mahl, general superintendent, Louisville, Ky.

Louisville and Nashville Railroad. D. W. C. Rowland, general superintendent, Louisville, Ky.

Montgomery and Eufaula Railroad. William Rogers, general superintendent, Montgomery, Ala.

Macon and Brunswick Railroad. J. M. Edwards, superintendent and general manager, Macon, Ga.

Marietta and Cincinnati Railroad. J. H. Stewart, superintendent, Cincinnati, Ohio.

Memphis and Little Rock Railroad. W. E. Smith, general manager, Little Rock, Ark.

Memphis and Charleston Railroad Company. John A. Grant, general superintendent, Memphis, Tenn.

Missouri Pacific Railway. A. A. Talmage, general superintendent, Saint Louis, Mo.

Mississippi and Tennessee Railroad. M. Burke, general superintendent, Memphis, Tenn.

Mobile and Ohio Railroad. A. L. Rives, general manager, Mobile, Ala.

Morgan's Louisiana and Texas Railroad. Charles A. Whitney and Co., managers, New Orleans, La.

Nashville, Chattanooga and Saint Louis Railway. J. W. Thomas, general superintendent, Nashville, Tenn.

New York, Lake Erie and Western Railroad. E. S. Bowen, general superintendent, New York.

New York and New England Railroad Company. A. C. Kendall, general passenger agent; O. M. Shepard, superintendent of transportation, Boston; J. H. Wilson, vice president.

New York, New Haven and Hartford Railroad Company. E. M. Reed, vice-president, New York.

New York, Pennsylvania and Ohio Railroad. P. D. Cooper, general superintendent, Cleveland, Ohio.

Northern Central Railway Company; Baltimore and Potomac Railroad; and Alexandria and Fredericksburgh Railway. L. P. Farmer, general passenger agent, Philadelphia, Pa.

Northeastern Railroad of Georgia. Lyman Wells, superintendent, Athens, Ga.

Ohio and Mississippi Railway Company. W. W. Peabody, general superintendent, Cincinnati, Ohio.

Old Colony Railroad Company. J. R. Kendrick, superintendent, Boston, Mass.

Pennsylvania Company. J. D. Layng, general manager, Pittsburgh, Pa.

Pennsylvania Railroad Company. L. P. Farmer, general passenger agent, Philadelphia, Pa.

Petersburg Railroad Company; R. G. Pegram, receiver, Petersburg, Va.

Pittsburgh, Cincinnati and Saint Louis Railway Company. D. W. Caldwell, general manager, Columbus, Ohio.

Philadelphia, Wilmington and Baltimore Railroad. H. F. Kenny, superintendent, Philadelphia, Pa.

Richmond and Danville Railroad. T. M. R. Talcott, general manager; A. Pope, general passenger agent, Richmond, Va.

Richmond and Petersburg Railroad Company. Theo. D. Kline, general superintendent, Richmond, Va.

Richmond, Fredericksburg and Potomac Railroad Company. E. T. D. Myers, general superintendent, Richmond, Va.

Savannah, Griffin and North Alabama Railroad. William Rogers, general superintendent, Savannah, Ga.

Savannah and Memphis Railroad Company. W. C. Fowler, cashier, Opelika, Ala.

Savannah and Charleston Railroad Company. C. S. Gadsden, engineer and superintendent, Charleston, S. C.

Savannah, Florida and Western Railway Company. H. S. Haines, general manager, Savannah, Ga.

Seaboard and Roanoke Railroad Company; Raleigh and Gaston Railroad Company; Raleigh and Augusta Air Line Railroad Company; Baltimore Steam Packet Company; Albemarle Steam Navigation Company. John M. Robinson, president, Baltimore, Md.

Selma, Rome and Dalton Railroad. John F. O'Brien, superintendent, Selma, Ala.

Southwestern Railroad of Georgia. William Rogers, superintendent, Macon, Ga.

South Carolina Railroad. John B. Peck, general superintendent, Charleston, S. C.

Saint Louis and San Francisco Railway. C. W. Rogers, general manager, Saint Louis, Mo.

Saint Louis, Iron Mountain and Southern Railway. A. W. Soper, general superintendent, Saint Louis, Mo.

Saint Paul, Minneapolis and Manitoba Railway. James J. Hill, general manager, Saint Paul, Minn.

Texas and Pacific Railway Company. George Noble, general superintendent, Marshall, Tex.

Texas and New Orleans Railroad. J. F. Crosby, vice-president and general manager, Houston, Tex.

Union Pacific Railway. Thomas L. Kimball, assistant general manager, Omaha.

Vandalia Line; Terre Haute and Indianapolis Railroad Company. D. W. Caldwell, general manager, Saint Louis, Mo.

Vicksburg and Meridian Railroad Company. E. F. Raworth, general superintendent, Vicksburg, Miss.

Wabash, Saint Louis and Pacific Railway. John C. Gault, general manager, Saint Louis, Mo.

Washington City, Virginia Midland and Great Southern Railroad. Peyton Randolph, general superintendent, Alexandria, Va.; John S. Barbour, receiver.

Western and Atlantic Railroad Company. William MacRae, general manager, Atlanta, Ga.

Western North Carolina Railroad. James W. Wilson, president, Morganton, N. C.

Western Railroad of Alabama. Cecil Gabbett, general manager, Montgomery, Ala.

West Jersey Railroad Company, passenger department. L. P. Farmer, general passenger agent, Philadelphia, Pa.

Western Maryland Railroad Company. J. M. Hood, general manager, Baltimore, Md.

Wilmington and Weldon, and Wilmington, Columbia and Augusta Railroads. A. Pope, general passenger agent, Wilmington, N. C.; John F. Divine, general superintendent.

Wisconsin Central Railroad Company. F. N. Finney, general manager, Milwaukee, Wis.

APPENDIX A.

GENERAL.

I.—REPORT ON THE CONSTRUCTION AND WORK IN 1880 OF THE FISH COMMISSION STEAMER FISH-HAWK.

By LIEUTENANT Z. L. TANNER, U. S. N., Commanding.

The U. S. S. Speedwell was put out of commission at meridian October 24, 1879, and I received orders on the same day to report to Prof. S. F. Baird, United States Commissioner of Fish and Fisheries, for duty connected with the construction of the steamer Fish Hawk building at the establishment of the Pusey and Jones Company, Wilmington, Del. The vessel was designed by Charles W. Copeland, consulting engineer of the Light House Board, and constructed under the supervision of the board.

I arrived at Wilmington on the 29th, and found the iron hull practically completed and a portion of the wooden sheathing on. The wood-work was well advanced above the main deck, and lumber for the joiner's work dressed and prepared for putting up.

The engines were approaching completion, the boiler well advanced, and at high water, December 13, the vessel was successfully launched. The trial trip took place February 19, 1880, with the following results:

Course—Down the Delaware River from mouth of Christiana Creek and return.

Duration of trial	6 hours.
Total distance	54.9 knots.
Average speed per hour	9.15 knots.
Pitch of screw	12 feet 3 inches.
Average revolutions per minute	89.77.
Average revolutions per mile	574.2.
Average slip, per cent	15.6.
Average steam	28 pounds.
Average vacuum	21 inches.
Ship's draft forward	5 feet 9 inches.
Ship's draft aft	7 feet 2 inches.
Mean draft	6 feet 5½ inches.

The engines were not stopped nor the throttle-valve moved during the trial, everything working satisfactorily, and though the contract called for a sea trial of twelve hours, it was not considered necessary to extend it to that time.

Cadet Engineer William B. Boggs was ordered to special duty in connection with the construction of machinery about the middle of December, 1879, and has been on duty since that time.

The builders completed their contract February 23, 1880, and the ship was turned over to the commission, but remained at the works awaiting her outfit. This depended upon a deficiency appropriation not yet passed, and which did not, in fact, become available until June 2.

I received orders from the Navy Department to assume command of the vessel on the 12th of March, 1880, and reported to Professor Baird for that duty on the above date.

The months of June and July were occupied in procuring the vessel's outfit and in the construction of her fish-hatching machinery.

Mate James A. Smith was ordered to report as executive officer, and Assistant Engineer William B. Boggs in charge of engines, on the 4th of June. Passed Assistant Paymaster George H. Read was ordered to the ship June 12, and Dr. F. C. Van Vliet joined the vessel on June 14, as medical officer.

The general description of the vessel is as follows (see Plate):

	Feet.	In.
Length from rabbet to rabbet on 7 feet water-line	146	6
Length over all	156	6
Breadth of beam moulded	27	00
Depth of hold amidships	10	9
Shear forward	4	4
Shear aft	1	9

The vessel's rig is a fore-and-aft schooner with pole topmasts.

The hull below the main deck is of iron, built on Lloyd's rules for vessels of her class, and sheathed with yellow pine, from $2\frac{1}{2}$ to 3 inches in thickness, calked and coppered. Above the main deck the structure is of wood. She has a promenade deck extending from stem to stern, and from side to side, covered with canvas, on which are located the pilot house, captain's quarters, and laboratory.

There are five iron bulk-heads: the collision bulk-head about 20 feet from the stem, No. 2 forward of the boiler, No. 3 between the boiler and engines, No. 4 abaft the engines, and No. 5 about 9 feet from the stern rabbet, all water-tight except No. 3.

In the hold forward of the collision bulk-head, on a platform raised about 5 feet above the keelson, is the boatswain's store-room. Abaft the bulk-head, extending aft about 10 feet, are the ice-houses, one on each side of a central passage 3 feet in width. The bulk-heads are double, with an air space of 4 inches, which is filled with sawdust, the whole interior lined with sheet tin soldered and well secured, and a lead drain-pipe in the after outboard corner of each. They have two entrances, one through a door in the central passage and another through a scuttle in the main deck.

The chain-lockers are under the ice-houses and extend across the hold, a bulk-head amidships separating the starboard from the port chain. They are entered through a scuttle in the central passage above mentioned.

Abaft the houses are six store-rooms, three on each side, on an extension of the floor platform, with a central passage 4 feet 3 inches in width. The laboratory store-rooms are forward, one on each side, 4 feet wide fore and aft, with shelves for the reception of specimens. Abaft this, on the port side, is the navigation and equipment store-room, 9 feet 4 inches fore and aft, and abaft this the sail-room, 4 feet wide. On the starboard side, abaft the laboratory store-room, is the paymaster's store-room, 9 feet 4 inches wide, and abaft this the bread-room, 4 feet in width, lined with sheet tin.

Next aft is the steerage, extending 15 feet fore and aft. There is a state-room in the after end, on each side, two bunks in the starboard and one in the port room; forward of the rooms are two open bunks on each side, a pantry on the starboard side forward, and a wash-stand on the port side.

The rooms are carpeted, and are furnished with bureaus, wash-stands, lamps, &c.; the steerage country has an oil cloth on the floor, a hanging lamp, extension table, chairs, steam heater, &c. The entrance is at the forward end, amidships, by a ladder from the main deck.

Fore hold.—Under the steerage and store-rooms, extending 32 feet 6 inches abaft the chain-lockers, is the fore hold. The water-tanks, having a capacity of 800 gallons, are located at the after end, immediately forward of bulk-head No. 2.

Engine department.—Abaft the bulk-head, extending about 45 feet to bulk-head No. 4, is the space occupied by the boiler, coal-bunkers, fire-room, and engines.

Lower cabin.—Abaft the bulk-head, extending 26 feet, is the lower cabin, having seven open bunks on a side. The dispensary, wash-stand, and a wardrobe are in the forward end, amidships. The floor is covered with an oil cloth, and the apartment is furnished with lamps, extension table, chairs, &c.

Linen-room and pantry.—Abaft the cabin, on the starboard side, is the linen-room; and on the port side a pantry and store-room, 6 feet 6 inches in width fore and aft, extending to bulk-head No. 5.

The entrance to the lower cabin is aft, amidships.

Store-room.—Abaft the bulk-head, in the stern of the vessel, is a cabin store-room about 9 feet fore and aft, entered through a scuttle on the main deck.

Forecastle.—On the main-deck forward, extending 31 feet from the stern, is the forecastle, having fourteen bunks arranged in two tiers on the sides and after end.

The paint-locker is in the forward end; and the forward force-pump, windlass, compressors, and riding-bitts are located there. In the deck are the scuttles leading to the boatswain's store-room, the ice-houses and chain-lockers. The apartment contains two sliding tables, camp-stools, a swinging lamp, steam heater, &c.

There are two entrances, one through a door on the after end to the main deck, another by a ladder and booby-hatch to the promenade deck.

Water-closets.—The water-closets are abaft the forecastle on each side of the fore hatch.

Main or hatching deck.—The main or hatching deck extends 47 feet aft from the forecastle. The fore hatch is on the forward part of this deck; the foremast 5 feet abaft the hatch; the steerage companion way about 2 feet abaft the mast, and the lamp-locker abaft the companion way. The boiler hatch extends about 17 feet forward from the after bulk-head, is about 9 inches above the deck, and on it are placed the donkey-pump, distributing-tanks, and, attached to the beams overhead, are the cam-shaft and attachments for working the hatching-beams.

There are three coal-scuttles through the main deck on each side of the boiler hatch. A gangway port on each side abreast of the foremast, 6 feet wide, extending from deck to deck, and four swinging ports on each side 4 feet by 3 feet 4 inches, which can be opened or closed at pleasure.

The hatching machinery is located on the main deck each side and forward of the boiler hatch.

Donkey-boiler room.—There is a sliding door in the starboard side of the after main deck bulk-head, communicating with the donkey-boiler room, which extends 13 feet aft from the main deck.

The donkey boiler stands on the starboard side forward; the steam chimney amidships, and the galley, 8 feet 6 inches by 7 feet 6 inches, on the port side. The galley door is in the after bulk-head; there is a window on the side, and another forward, in the main-deck bulk-head. The floor is of brick laid in cement.

There is a cooking-range, coal-bunker, fresh-water pump connecting with the tanks, a sink and ample lockers, shelves, &c.

The distiller stands on the starboard side of the boiler hatch between the steam chimney and main-deck bulk-head. There is a ventilator, through which ashes are hoisted, in each after corner of the boiler hatch, and the deck between them and the engine-room bulk-head is composed of an iron grating, giving light and air to the fire-room. There is a vertical iron step-ladder attached to the engine-room bulk-head leading from the donkey-boiler room to the fire-room.

Engine-room.—The engine-room extends aft 11 feet from the donkey-boiler room, is 12 feet in width, and occupies the central part of the deck. There are two doors in the forward end opening into the donkey-boiler room; a door on the starboard after end into the cabin, and a stairway on the port after end communicating with the lower engine-room. The engines are worked from the upper engine-room.

Machinist's room.—The machinist's room is on the starboard side abreast of the engine-room; has a door opening to the donkey-boiler room, a large window in the side, and two bunks. Abaft this is a room (opening into the cabin) used for members of the scientific corps; it has two bunks, also, and a window in the side.

Passage.—There is a passage 2 feet 6 inches in width on the port side of the engine-room leading from the donkey-boiler room to the cabin.

Cabin pantry.—The cabin pantry is on the port side of the above passage, 11 feet fore and aft, and about 5 feet wide; there are two large windows on the side; a door opening into the passage; shelves; lockers; racks, and other necessary appliances for a pantry on ship board.

Cabin.—The cabin is abaft the engine-room, 30 feet in length, has four rooms on a side with one bunk in each. Aft on the starboard side is the Commissioner's office. The lower cabin companion way is amidships, and a bath room and closet on the port side. Between the latter and lower cabin companion way is a passage 2 feet 4 inches in width, leading from the cabin to the bath-room and after deck.

After deck.—The after deck above mentioned is 14 feet in length and extends to the stern. The sides are open above the main rail. The spare tiller and relieving tackles are on this deck. The cabin storeroom scuttle is forward of the rudder; the entrance to the Commissioner's office on the starboard side; the lower cabin companion way amidships; the entrance to the cabin passage on the port side, and just abaft the rudder the after force-pump.

Promenade deck.—On the promenade deck, forward of the foremast, are the anchors, forward force-pump, windlass brakes, capstan, forecastle booby-hatch, fore hatch, hoisting and reeling engine, and the dredging boom, its heel attached to the foremast.

Abaft the mast is a booby-hatch covering the entrance to the main deck, and abaft that the pilot-house and captain's quarters.

Pilot-house—The pilot-house is 8 feet in length fore and aft, 10 feet in width, and has an elliptical front. The glass windows and venetian blinds are hung with weights, and all metal work about it, or used in its construction, is brass.

There is a liquid steering compass on the port side forward of the wheel; a sofa, signal-locker, and convenient receptacles for fire-works and flags on the after end. The floor is covered with lignum and ash gratings. The necessary bells, speaking and sounding tubes, and whistle-rope are in their appropriate places.

The pilot-house is raised 26 inches above the captain's quarters; has a door on each side, the upper portion set with glass. There are also windows in the after end, giving an unobstructed view fore and aft, and a door on the starboard side communicating with the captain's room.

Captain's room.—The captain's room is in the deck-house, abaft the pilot-house, 9 feet 10 inches in length, fore and aft, 12 feet in width, 7 feet high, and has a sky-light 2 feet 6 inches by 3 feet 3 inches. There is a door and window on each side; a door opening into the pilot-house in the forward end and one into the bath-room aft. There is a folding bed, a sofa, writing-desk, marble-topped bureau, and book-case of black walnut. There are also drawers for charts, clothing, &c.

Bath-room.—The captain's bath-room, 6 feet 10 inches long and 4 feet 10 inches wide, is on the starboard side of the deck-house, abaft the captain's room, and communicates with it. A door on the starboard side opens on the promenade deck. The room has two windows, one on the starboard side and one in the after end; a bath-tub, wash-stand, mirror, &c.

There is a state-room on the port side of the deck-house, abaft the captain's room, 6 feet 10 inches in length, 7 feet wide; the sky-light extending over it. A door communicates with the bath-room, and another, on the port side, with the promenade deck. There is a window on the port side and one aft; a folding bed, a secretary-bureau, wash-stand, lamp, mirror, steam heater, &c., in the room. The funnel is about 2 feet abaft the deck-house, the engine-room sky-light abaft the funnel.

The laboratory.—The laboratory, 10 feet 7 inches in length, 9 feet 11 inches wide, and 7 feet 3 inches high, is abaft the engine-room sky-light, and covers the entrance to the cabin. It has a book-case, work-table, specimen case, box for microscope, and the necessary shelves and drawers. There are two windows on each side, two in the forward end, and one aft. The door is in the after end.

Abaft the laboratory is the mainmast, cabin skylight, standard compass, rudder head, tiller, &c.

Steering gear.—The steering gear consists of an iron tiller, secured to the rudder head on the promenade deck, with chains extending through sheaves on each quarter. Iron wire wheel ropes are led over small rollers on each side of the promenade deck, the after ends secured to chains and the forward ends to the after block of the sliding purchase, which consists of two single blocks, the fall leading over the barrel of the wheel in the pilot-house.

Spars.—The vessel is schooner rigged, the foremast 49 feet in length above deck and 17 inches in diameter; mainmast 46 feet, and 14 inches in diameter; the poles 15 feet in length, the masts and poles in one stick. The fore-gaff 23 feet, and main-gaff 18½ feet in length, diameter 5 inches, main-boom 38 feet long and 8 inches in diameter.

Sails.—There are three sails, fore stay-sail, foresail, and mainsail, all of cotton canvas; the stay-sail of No. 2, the foresail and mainsail of No. 3.

Anchors and chains.—There are three anchors, the largest weighing 1,525 pounds, including the stock; one 846 pounds, and one 307 pounds, stocks included. Two chain cables, one ninety fathoms $1\frac{1}{8}$ inches, the other 75 fathoms $\frac{15}{16}$ inch in diameter.

Boats.—The vessel has four boats; 1st, a steam cutter built by the Herreshoff Manufacturing Company, Bristol, R. I., 24 feet in length, 6 feet 9 inches beam and 3 feet 6 inches depth; weight, 2,900 pounds; capacity of coal bunkers, 560 pounds, sufficient for 28 hours' steaming at 6 knots per hour; a fresh-water tank holding 40 gallons of water, enough for six days' steaming; she has a keel condenser which receives the discharge from the cylinder and escape valve.

Both hull and machinery are constructed of the best material. Steam is raised in a few minutes, and when under banked fires requires no attention. She is an excellent sea-boat and has been of great service to this ship.

2d. A ten-oared cutter 24 feet 6 inches in length.

3d. A gig 26 feet 5 inches in length.

4th. A dingy 17 feet 6 inches in length.

She has also several flat-bottomed boats 18 feet in length, used for spawn taking.

Awnings and stanchions.—The promenade deck is covered with awnings fore and aft, supported by turned wooden stanchions.

ENGINES AND MACHINERY.

General description.—There are two propelling-screws, right and left handed, one under each counter; each screw driven by one inverted cylinder surface-condensing engine, 22-inch diameter of cylinder, and 27-inch stroke of piston. The two engines are fitted on one bed-plate; the surface condenser, common to both, is located between the engines and forms a part of the framing for them.

The center of the cylinder is about 49½ feet forward of the stern-post; the distance between the shafts being about 8 feet 8 inches. The engines are inclined towards the center line of the vessel, the cylinders at the upper end being about 36 inches from center to center athwartships. There is one overhead return-flue boiler 8½ feet diameter of waist and 21½ feet in length, with steam chimney 6 feet 2 inches diameter outside and 10½ feet high.

The water of condensation is supplied by an independent steam pump.

The valve-chests are on the forward side of the cylinders, main valves working by a link motion, the cut-off valve working on a separate face within the main steam chest and operating by a link, one end of which is connected to an eccentric and the other to a concentric disk on the main shaft.

The air-pumps are trunk-plunger pumps, driven by cranks on forward end of main shafts; the feed-pumps are driven from the same motion. The bilge-pump is independent.

Cylinders are 22 inches diameter and 27 inches stroke of piston; steam openings 2 inches wide by 14 inches in length; exhaust openings 3½ inches wide by 14 inches in length. All necessary lugs, flanges, nozzles, and lower cylinder head are cast with the cylinder, and all flanges faced. The lower ends are fitted with a small bonnet, with stuffing box and gland, both bushed with composition; also a composition "water valve" seven-eighth inch diameter, which works either automatically or by hand. Cylinders and steam chests are fitted with the necessary pipes and valves for applying the indicator, and are cased with black walnut staves, secured by brass bands and screws.

Framing.—The main frame for carrying the cylinders is the surface condenser, which is strongly ribbed and bracketed for that purpose, the outboard sides of the cylinders being supported, each by two wrought-iron columns, $2\frac{1}{4}$ inches diameter, turned and finished. The ends of these columns are fitted to flanges of lower end of cylinders and to bed-plate, each end being fastened by two bolts $1\frac{1}{8}$ inches diameter.

Steam chests are cast separate, fitted with faced joints and bolted to cylinders, covers planed, finished and fastened with finished bolts and case-hardened nuts. Set screws are fitted to break the joints. The cut-off valve operates in a separate chest, which is bolted to that of the main valve.

Pass-over valve.—To each cut-off chest is fitted a screw-valve for a pass-over valve, $2\frac{1}{2}$ inches diameter. The valve, seat, and stem are of composition, and valve is worked by a hand-wheel in front of chest.

Relief valve.—A composition relief valve of seven-eighths inch diameter is attached to steam chests and to exhaust connection to condenser.

Slide valves.—The valves are of cast iron, of a different texture from that of the seats and scraped to a bearing surface. The main slide valves are of the ordinary D form; for steam openings 2 by 14 inches and for exhaust openings $3\frac{1}{2}$ by 14 inches, and are worked by a "Stephenson" link motion. The link is case-hardened and link block composition. The link is worked by hand, by means of a pinion, quadrant and "tumbling" shaft.

Cut-off valves.—Cut-off valves are of cast iron, of the gridiron pattern, with two openings $1\frac{1}{4}$ by 13 inches. The valve is operated by a link, one end of which is worked by an eccentric and the other end held in position by a concentric disk on crank-shaft. Steam can be cut off at points from three-fourths to one-fourth the stroke of piston. Proper hand gear is fitted to alter the point of cut off and to hold the link in position.

Cylinder-heads.—Upper cylinder-heads are ribbed, turned, and finished. Inside of heads are recessed for nuts of piston-rods and for heads of follower-bolts. Wrought-iron eyebolts are fitted for lifting the heads and set-screws for breaking the joints; also a "traveler" for removing them.

Bed-plate.—The bed-plate or frame is of cast iron, in one piece, and extended forward to receive the pumps; is hollow, of the box form of section, $14\frac{1}{2}$ inches in depth, and has all the necessary passage-ways for water, bosses and nozzles or flanges for pumps, pillow blocks, &c., and flanges or lugs for bolting in place. All surfaces for flanges, pumps, hand-hold plates, and pipes are planed.

Surface condenser.—The shell is of cast iron 1 inch thick, well ribbed, strongly bracketed, and serves as a frame for the engines. The necessary seating for cylinders and for cross-head slides are cast on. All joint surfaces are planed, and suitable bonnets are fitted for access to interior, to tubes, and to all valves. The condenser is fitted with horizontal yellow metal tubes $\frac{5}{8}$ inch diameter, turned both inside and outside; cast-iron tube sheets $1\frac{3}{4}$ inches thick, planed, and tubes packed with "Allen's" wood packing. Condensing surface is 900 square feet. The tubes are arranged in three nests, and the condensing water passes three times through the tubes. A $3\frac{1}{2}$-inch copper pipe is also fitted to convert this into a jet condenser, if necessary. There is a screw-valve $1\frac{1}{2}$ inches diameter connecting the salt with the fresh water, as an additional feed; also a brass cock for introducing soda. A perforated cast-iron scattering plate is fitted above the tubes, upon which the injection water impinges.

Exhaust connections.—Exhaust connections from the cylinders to the condenser are so arranged as to be independent; one engine exhausting without interfering with the other.

Steam-pipe connections.—The main steam-pipe is a single copper pipe from the boiler, with slip joint and double poppet throttle-valve operated by a hand-lever. The pipe branches near the engines, and there is a throttle-valve for each engine, operated independently.

Air-pumps are horizontal trunk-plunger pumps, one for each engine, and driven by a crank upon the forward end of main shaft. Pumps are 11 inches diameter and 12 inches stroke; lined with composition; trunk, piston, valve-seats, stems, and guards of composition; valves of pure rubber; chests for receiving and delivery valves cast with the pumps and with convenient openings for access to valves. There is also a guide cast on for slipper side of trunk.

Hot well.—There is a suitable cast-iron hot well, common to both air-pumps, with vapor-pipe from top and overflow-pipe to outside of ship, with proper outboard valve. This pipe is of copper, 7 inches diameter, No. 10 wire gauge; composition valve $7\frac{1}{2}$ inches diameter, with composition seat and stem.

Circulating pump is an independent steam-pump, direct acting, of the "Davidson" pattern, $13\frac{1}{4}$ inches diameter and 13 inches stroke; lined with composition; piston, valve-seats, stems, and guards of same metal; steam cylinder same diameter as pump; pump-valves of rubber. Outboard delivery pipe is of copper, No. 12 wire gauge, and fitted with outboard valve of composition. To suction-pipe there is a branch leading to engine-room bilge, with a separate screw-valve and "check" valve to prevent flooding. Screw-valve has an attachment for locking.

Pistons are of cast iron, double shell, ribbed, with cast-iron follower fastened by wrought-iron bolts screwed into brass bushings; follower turned and scraped to rings and piston, and fitted with eye-bolts for lifting. Packing-rings of cast iron in two thicknesses, accurately turned and fitted and set out with steel springs.

Piston rods are of mild steel, $2\frac{3}{8}$ inches in diameter, and fastened to piston with a nut.

Feed-pumps.—To each engine there is fitted a feed-pump, worked from the air-pump motion, 4 inches in diameter and 12 inches stroke; composition plunger, valves, and seats; also a by-pass valve and air-vessel.

Bilge-pump is an independent steam-pump of the Davidson pattern, valves of rubber, composition seats, guards, and stems, and copper air-chamber. This pump has connections through a "manifold" to the various water-tight compartments; also, in the event of breakage of the auxiliary pump, can be used in lieu of that pump, having the same connections.

Cross-heads are of wrought iron, finished and fastened to piston-rod by a nut secured by a "dowel." Journals are $2\frac{3}{8}$ inches diameter and $3\frac{1}{4}$ inches long. Cross-heads move upon composition slipper slides working in a cast-iron guide. The bottom slipper has a bearing surface of 80 square inches. Both top and bottom gibs can be readily removed.

Slide-valve stems are of mild steel; those for main valves are $1\frac{5}{8}$ inches diameter, and cut-off valves $1\frac{3}{8}$ inches diameter; stuffing boxes and glands are bushed with composition.

Eccentrics and rods.—There are two eccentrics for each main valve, with a "Stephenson" link of wrought iron connected by the proper rods. For each cut-off valve, there is one eccentric to one end of a link, and the opposite end of the link is held in position by a proper rod in connection with a concentric disk on the crank-shaft. This link is adjusted by a hand-lever working against an arc, which is marked for the different points of cut-off. The straps are of composition, ribbed and "babbitted." Eccentric rods are of wrought iron, and connected to links so as to be adjusted for wear. Links and pins are case-hardened and link-blocks are of composition.

Connecting-rods are of wrought iron, forked at the cross-head end and finished, 5 feet 11 inches long between centers; crank-end neck $2\frac{5}{8}$ inches diameter and fork-end $2\frac{3}{8}$ inches diameter. Boxes for cross-head and crank-pin journals are of composition and secured by wrought-iron straps with gibs and keys; keys secured by steel set-screws.

Main pillow-blocks are cast with the bed-plate, and the lower part of the box is of phosphor-bronze. After journal $6\frac{1}{2}$ inches by 9 inches in length, forward, 5 inches by 8 inches; pillow-block caps for after journals are $2\frac{1}{4}$ inches thick and $7\frac{1}{2}$ inches in width, and for forward journals $2\frac{1}{4}$ inches thick and $6\frac{1}{2}$ inches in width; each cap held by two bolts $2\frac{1}{8}$ inches diameter; caps made so as to lip over ends of blocks.

Crank-shafts are of wrought iron, forged in one piece; after journals $6\frac{1}{2}$ by 9 inches, forward 5 by 18 inches, crank-pin journals $4\frac{3}{4}$ inches diameter and $6\frac{1}{2}$ inches in length.

Line-shafts are of wrought iron in three lengths, smallest diameter $6\frac{1}{4}$ inches; covered with composition-sleeve the length of the stern-bearing. Line-shaft couplings are of cast iron, turned and fitted and fastened by six bolts $1\frac{1}{4}$ inches diameter and with a steel feather. Couplings of crank-shaft to line-shaft are a pair of cast-iron wheels, with wrought-iron driving pins fastened by a cross-key in forward wheel and working free on composition bearing-plates in after wheel. The wheels are 3 feet 4 inches diameter, with mortises on periphery for turning the engine with a pinch-bar. Thrust-bearing is on forward length of line shafting, and is a collar thrust.

Thrust pillow blocks are of cast iron, with phosphor-bronze boxes and collar plates; with set-screws to adjust wear. There is also a fore-and-aft fastening to receive forward thrust.

Line-shaft-pillow blocks are of cast-iron, with cast-iron caps, and fitted with phosphor-bronze for lower half of journal.

Screw-propellers are of cast iron, four bladed, 6 feet 8 inches diameter, 12¼ feet mean pitch, and 20 inches in length fore and aft. They are keyed upon shafts by a feather key and cross-key; ends of shafts fitted with a water-tight composition cap and fastened with composition tap-bolts to after end of hub; also, composition caps over ends of cross-keys.

Shaft brackets supporting the after end of shafts are placed close to forward side of propellers and are of composition. Section of brackets 1¼ by 6½ inches; forward and after edges rounded off; feet of brackets 1¼ inches thick, each foot fastened by four composition bolts 1⅜ inches diameter, with countersunk heads and screwed up on plates on inside of ship. The eyes of the brackets are boxed to receive a phosphor-bronze bushing 7¼ inches diameter by 10½ inches in length, and bushing lined with lignum-vitæ, fastened to brackets with composition tap-bolts.

Stern bearing is of composition, 2 feet 8 inches in length. The outer end has a large warped flange, 1⅛ inches thick, to fit the counter of the vessel, and the inner end a loose flange riveted to hull of ship. The inner ends of the stem-bearings project inboard about 10 inches and are fitted with lignum-vitæ staves. The inboard stuffing-boxes are of composition, riveted to hull of vessel, with a packing space of 8½ inches, and a loose ring fitting in bottom of packing space; packing held in place by a gland also of composition.

Sea-valves are screw valves, with composition chambers, valves, stems, and glands. One valve for injection, 4½ inches diameter, one for circulating pumps, 6 inches diameter, and one for steam pump, 4 inches diameter. Chambers bolted to cast-iron forms, which are riveted to hull of vessel. All sea-valves are fitted with strainers.

Hoisting-engine. (Plates V and VI.)—There is a hoisting-engine with double cylinders and cranks at right angles to each other; cylinders, 9 inches diameter and 9 inches stroke of piston, placed forward on hurricane deck for "trawling" purposes. The central drum holds the steel wire rope and is independent of the engine proper, connection being made by means of a friction clutch. The load on the drum is held by a friction brake. With the central drum disconnected, the two smaller drums can be used for ordinary hoisting purposes. There is also fitted an automatic guide by means of which the wire rope is neatly coiled upon the drum. Steam from either the main or auxiliary boiler may be used, and the engine exhausts into the atmosphere through the escape pipe of the main safety-valve. There is a pan of sheet-lead fitted under the engine to receive all dripping oil or water.

Boiler is an overhead, return-flue boiler, $8\frac{1}{2}$ feet front, $8\frac{1}{2}$ feet diameter of waist, and $21\frac{1}{2}$ feet in length, with water-leg furnaces; two furnaces, 6 feet 8 inches long, by $3\frac{1}{2}$ feet wide; grate surface, 46.6 square feet; main flues, three of 11 inches diameter, one of 12 inches, and one of 15 inches for each furnace; return flues in two tiers, seven flues of $10\frac{1}{2}$ inches diameter in each tier. The flues are welded and drawn. All outside seams, seams of steam chimney, and water-legs double riveted. Flat surfaces are braced with seven-eighth inch socket-bolts $7\frac{1}{2}$ inches from center to center. Thickness of circular part of shell is five-sixteenths inch; water-legs three-eighths inch; steam chimney of mild steel five-sixteenths inch. Fire-box and crown-sheets are also of mild steel, three-eighths inch thick; heads of shell and flat surfaces three-eighths inch. There are the necessary man-holes and hand-holes and double furnace doors. The boiler has been tested by a hydrostatic pressure of 65 pounds per square inch. The legs of the furnace part of the boiler rest upon cast-iron chairs set outside of ash pans, and under the waist is a cast-iron saddle. The boiler is held in place by turnbuckle bolts. Under the furnaces are cast-iron pans, made in one width, for each furnace; bottom of pans five-eighths inch and one-half inch thick for all flanges. Ash pans have a long, beveled front flange, projecting 15 inches from front of boiler to catch dropping fire and cinders. Grate-bars are of cast iron in two lengths, three-fourths inch thick on face and five-sixteenths inch at lower edge, with five-eighths inch air spaces. Boiler shell and steam chimney are covered with hair felt, and wool backing $1\frac{1}{2}$ inches thick. Main and all other steam pipes are covered with hair felt 1 inch thick, with canvas backing, and painted.

Boiler attachments.—There are attached to the boiler, one steam stop-valve 7 inches diameter, one safety-valve 6 inches diameter, with connections to engine-room, and copper escape-pipe, 16 feet long; one bottom blow-valve $2\frac{1}{2}$ inches, one surface blow-valve 2 inches, two check-valves $2\frac{1}{2}$ inches, and one screw stop-valve, each for auxiliary and circulating pumps. All these valves are of composition, with composition glands and stems; also four brass gauge-cocks, glass water-gauge 15 inches long and salinometer.

Smoke-pipe and casing.—The smoke-pipe is 42 inches diameter and 24 feet high, in three lengths of 8 feet each; flush jointed, $2\frac{1}{2}$-inch angle-iron at top, and band $2\frac{1}{2}$ by $\frac{3}{8}$ inches at bottom. Pipe is made of iron No. 14 wire gauge, and is fitted with a proper damper. There is a casing around lower part of pipe and top of steam-drum, extending above the hurricane deck $2\frac{1}{2}$ feet, made of iron No. 12 wire gauge, and fastened to deck with angle-iron; casing covered by an umbrella. There are six stays to smoke pipe of wire rope nine-sixteenths inch in diameter, and secured to deck by eye bolts.

Auxiliary boiler is of the vertical fire tubular type, 48 inches diameter, and 7 feet 8 inches in height, with 106 brass tubes, $2\frac{1}{4}$ inches outside diameter, and 5 feet 2 inches long. Boiler rests on a cast-iron frame 14 inches in height. Upper end of boiler surrounded by a casing of iron No. 12 wire gauge, and secured to deck by $1\frac{1}{4}$-inch angle-iron, fastened with wood-screws. Smoke-pipe is 18 inches diameter and 18 feet in height.

The boiler was tested to 120 pounds hydrostatic pressure, and is fitted with all the necessary grate-bars, bearers, safety-valve, steam-gauge, gauge-cocks, blow-cocks, and "check-valves." This boiler can be supplied with water either by a Hancock "inspirator" or by the auxiliary pump, and has the same steam connections as the main boiler. It is situated on the main deck, immediately over the fire-room.

Steam-pump.—There is one fly-wheel steam-pump with water-cylinder, 5 inches diameter and 12 inches stroke, having all the necessary connections to be used as a fire-pump, as a feed to main or auxiliary boiler from either hot-well or the sea, as a bilge-pump, as a circulating pump for Baird's distiller, and to supply hatching tanks. There is a double exhaust connection to either condenser or atmosphere. In case of fire the flow of water can be increased by combining this pump with the independent bilge-pump. By means of the proper gearing, this pump works the hatching cylinders on outside of ship. The suction-pipe is connected with the overflow-pipe from hatching apparatus, so that the same water can be used repeatedly for hatching. There is a connection on the "manifold" for suction-hose of sufficient size to supply both auxiliary and bilge-pumps. All water-pipes are of copper; steam and exhaust pipes of iron.

Miscellaneous.—There is one ash-chute for discharging ashes over side of ship; eight cast-iron deck scuttles on main deck with close covers and gratings; two iron ventilators, 16 inches diameter, to fire-room, with revolving caps, and also used to hoist ashes. The fire-room is covered with rough cast-iron floor-plates one-half inch thick, and above fire-room is an open cast-iron grating for ventilation. There are steam-heaters in pilot-house, and all habitable portions of the ship are fitted with the proper steam and drain pipes and valves. All heaters drain into a "trap" in fire-room, and a vapor-pipe from top of "trap" leads to escape-pipe from main safety-valve. There are the proper tanks for oil, waste, and tallow. There is a steam-whistle 6 inches diameter of bell with valve where attached to boiler. In the engine-room there are three gongs, one of 12 inches diameter, and two of 8 inches diameter, with "jingle" bell; all arranged with proper wires and pulls to pilot-house; also shield and tube to return sound to pilot-house, and a speaking tube from engine-room to pilot-house.

In the engine-room there are two $6\frac{1}{2}$-inch nickel-plated gauges, one for steam and the other for vacuum; two counters, one for each engine, and a marine clock. There are the proper oil-cups to all journals; also proper connections for applying water to journals when necessary. A "Baird's" distiller is in use, capable of distilling 1,500 gallons of tepid and 800 gallons of potable water per diem.

OUTFIT.

The contract for building the vessel covered only hull and machinery, the outfit being provided from a special appropriation.

Anchors, chains, hawsers, &c., were loaned by the Bureau of Equipment and Recruiting, Navy Department.

Boats—gig, cutter, and dingy—by the Bureau of Construction and Repair.

Compasses, flags, nautical instruments, books, and chronometer by the Bureau of Navigation.

Small-arms and ammunition by Bureau of Ordnance.

Charts and Atlantic Coast Pilot were furnished by the United States Coast and Geodetic Survey.

The various articles of outfit were procured by open purchase at reasonable prices and have given general satisfaction.

FISH-HATCHING MACHINERY.

The fish-hatching machinery was constructed by the Pusey & Jones Company under special contract, and consists of a Woodward steam-pump with water cylinder, 5 inches diameter and 12 inch stroke, capable of supplying 10,000 gallons of water per hour.

Two iron distributing tanks with a capacity of 500 gallons each are placed forward of the pump on the boiler hatch and raised 3 feet 4 inches above the deck. (Plate II.)

There is a water connection and proper valves between the pump and tanks, with overflow and drain pipes connecting with the general delivery for hatching machinery. There is also an arrangement of valves by which the water can be pumped back into the tanks and used as often as desired instead of discharging it overboard.

HATCHING CONES.

The number of hatching cones on board at present is thirty-six, capable of hatching 7,200,000 shad at a time, or 200,000 each when charged to their full capacity.

The number of cones can be increased about one-third in case of necessity. The material of which they are made is copper, tinned inside, and the mountings are of brass. Their arrangement on the port side of deck will be seen by reference to the Plate. They are in sets of 4 and 6 to each frame and are hung on gimbals which permit a free motion in every direction, maintaining a vertical position even when the vessel is in violent motion.

In artificial fish hatching it is necessary to maintain a constant and carefully graduated flow of fresh water through the vessels in which the eggs are placed for development. In the early days of this industry shad eggs were hatched in floating boxes with gauze bottoms anchored in a tide way or current which effected the necessary change of water, but they were subject to various accidents beyond the control of those having the operations in charge. A sudden squall might capsize them, a gale of wind break them from their moorings, or drift-wood carry them away, the entire charge of eggs being liable to loss or serious damage in either case.

Various other methods have been used with good results, but for service on shipboard, under all conditions of wind and weather, the cone is thus far the most perfect appliance for hatching non-adhesive eggs, with greater specific gravity than the water in which they are developed.

To prepare for shad hatching with cones, water is pumped into the distributing tanks, which have independent connections for each set of cone frames through which the water flows by gravity into the upper or feed-pipes, where, at proper intervals, small feed-valves are tapped in and connected to the base of the cones by a flexible hose. The feed-valves being opened, a stream of water is admitted at the bottom, rapidly filling them till near the top, where a fine wire gauze rim is encountered. Through this the water finds an outlet to the discharge connections, thence to the waste pipes at the bottom of the frames, and into the general delivery; thus establishing a steady and constant upward current.

From 100,000 to 200,000 impregnated eggs are placed in each cone and the current regulated by the feed-valves so as to give them a gentle movement, just sufficient to prevent "matting," or settling to the bottom in a mass, where they would soon become asphyxiated. The dead eggs being lighter soon accumulate at the surface, and are removed with a skimmer, sediment and other impurities being cleared from the gauze rims to allow an unobstructed flow of waste water to the discharge-pipes.

Development takes place rapidly, and the embryo is hatched in from two and a half to five days, according to the temperature of the water.

HATCHING CYLINDERS.

There are in addition to the cones eighteen hatching cylinders, which are suspended, nine on each side, from beams outside of the vessel and operated by a cam motion imparting a vertical movement of about 8 inches. (See Plate III.) They have wire-gauze bottoms, and both solid and wire-gauze covers, the former used when the cylinders are converted into transporting cans, the latter in stormy weather. The cylinders are made of heavy tin and the mountings are brass.

To prepare for shad hatching they are suspended from the beam, as shown in Plate III, in such a manner that the bottoms will be constantly submerged; from 250,000 to 300,000 impregnated eggs are placed in each cylinder and the cam motion put in operation, which gives them a very gentle ascent, occupying about three-quarters of the revolution; the descent, being accomplished during the remaining fourth of the revolution, is made more rapid, causing the eggs to rise from the bottom and circulate freely through the water at every downward movement.

The cylinders require but little attention during the hatching process, and, in moderately smooth weather, are undoubtedly equal, if not superior, to all other appliances for shad hatching. They can also be made available for the development of all non-adhesive eggs, no matter what their specific gravity, as the requisite motion can be attained by simply modifying the form of cam.

Plate IV shows some of the apparatus used by the United States Commission in fish hatching: the spawn pans of marbleized iron in which the eggs are placed for impregnation; the spawn pail in which the impregnated eggs are placed for transportation to the hatching establishment; the dipper in which all eggs are measured when received on board, and the hatching cone, with goose-neck unscrewed; the three kinds of cylinders used, the large one with the solid tin body, a smaller one with a combination body of copper and wire gauze, and a third with gauze body.

Between the cylinders stands a funnel, with fine wire-gauze bottom, used for siphoning water from hatching cones without removing eggs or young fish.

DREDGING MACHINERY.

The hoisting and reeling engine, the main features of which are given in the general description of machinery, stands on the promenade deck immediately forward of the foremast, as shown in the plates V and VI.

The drum, or reel, holding a thousand fathoms of steel-wire dredge rope, three-eighths inch in diameter, is carried on the main shaft of the engine and driven by friction gear. An automatic guide lays the rope fairly on the reel when heaving in. One man attends the engine, hoisting and lowering the trawl and dredge without the necessity of touching the rope by hand.

The dredging beam is 36 feet in length and 10 inches in diameter, the heel secured to the foremast by a strong goose-neck 5 feet above the deck. The forward end, when not in use, rests in a cradle on an iron frame in which the ship's bell is suspended.

There is an iron band at the boom end for fore-and-aft guys; the topping lift band is about 3 feet from the end, and has a strong link on the under side, to which is hooked the dredging block. The topping lift is composed of two 14-inch double blocks and a 4-inch manila rope. The upper block is shackled to an iron collar on the foremast 3 feet below the eyes of the rigging. There is a strong sheave in the boom inside of the lower topping-lift block, over which is rove the pendant of a tackle used for hoisting the bag of the trawl on board when the weight is too great to be managed by hand.

A composition sheave (Plate VI) is inserted in the heel of the boom, two revolutions of which are equal to one fathom of dredge rope, and attached to its shaft is a register which accurately records the amount of rope out at all times.

SAFETY-HOOKS.

The safety-hooks (Plate VII) are designed for the purpose of detaching the trawl when from any cause, such as fouling a rock, or wreck, the tension on the dredge rope reaches the limit of safety. It can be adjusted to detach at any point between 3,000 and 6,000 pounds by the nut on the end of the central rod. In practice we have set it to 4,000 pounds, the breaking strain of the dredge rope being 8,700 pounds. The spring and hooks being placed in the cylinder and the cap screwed on, it is ready for use.

The end of the dredge rope is spliced into the eye and the trawl shackled to the hooks, which are held in position by their shoulders pressing against the inner surface of the cylinder (Plate VIII.)

The spring is compressed as the tension increases till, the limit of safety being reached, the shoulders are released and the hooks open freely, allowing the shackle pin to slip through, detaching the trawl and relieving the rope from undue strain.

The accumulator (Plate VIII) is designed to prevent jerking strains on the dredge rope due to motion of the vessel in a sea-way, or working over a rough bottom. It is copied from that used on board the Coast-Survey steamer Blake, with slight modifications. It answers its purpose admirably and is an almost indispensable adjunct when steel-wire rope is used.

The side rods and central shaft are of steel, the ends of wrought iron. Twenty-six rubber buffers, with a brass washer between each, are placed on the central shaft under considerable pressure and secured by a nut on the upper end. A swivel link at the lower extremity carries a leading block.

The hubs of the brass washers are extended on each side, forming a collar over which the rubber buffers ride free from contact with the central shaft. This feature, introduced by Lieutenant-Commander Sigsbee, U. S. N., placed the present form of accumulator far ahead of all others for our purposes.

DREDGING BLOCKS.

The dredging block at the boom end and that seen hooked to the accumulator (Plate VIII) are all that are used. They, also, are copied from those of the Blake, except that the diameter of sheave is reduced from 18 inches to 12 inches, making the blocks much lighter.

STEEL-WIRE DREDGE ROPE.

This excellent rope was made by the John A. Roebling's Sons' Company, Trenton, N. J. It is one and one eighth inch in circumference, composed of six strands laid around a hemp heart, each strand composed of seven galvanized steel wires (No. 19 American gauge) having no hemp heart.

Sigsbee—"Deep-sea dredging and trawling"— gives the ultimate strength of the rope as 8,750 pounds, and the breaking strain, in kinks, 4,500 pounds; weight, 1.14 pounds per fathom in air, or about one pound in sea-water.

PREPARATION FOR DREDGING.

The rope being on the reel the end is passed between the rollers of the automatic guide (Plate V), carried aloft and rove through the block on the lower end of the accumulator (Plate IX), brought down again and rove under the registering sheave in the heal of the boom, thence through the dredging block at the boom end, and spliced into the eye of the safety-hooks.

The boom is then topped up and secured over the side port by strong fore-and-aft guys, the trawl shackled to the safety-hooks and swayed up clear of the rail, a man at each end to steady it, an engineer at the hoisting engine, and the officer in charge, as shown in Plate IX, ready at the order to lower away.

TRAWLS.

The beam trawl, shown in Plate IX, is used by the Commission, and, for moderate depths, has not been equaled by any other form. Three sizes are used, the smallest with 9 feet length of beam, the second with 11 feet, and the third 17 feet, the length of net from 15 feet to 40 feet. The trawl nets are invariably provided with pockets.

The Otter trawl has been used to advantage in shoal water, over smooth bottom, when the capture of fish was the special object.

It is necessary for the successful operation of the beam trawl that it should land right side up. A capsize in moderate depths is rare, but in deep water it may be considered as among the probabilities.

To avoid the vexatious delays attending accidents of this nature, Professor Agassiz and the officers of the Blake devised a double trawl which works equally well either side up and was subsequently used on board that vessel with excellent results. It has also been used experimentally by the vessels of the Commission, but they have not heretofore operated in sufficient depths to make it a necessity.

DREDGES.

The common form of deep-sea dredge is used by the Commission, with excellent results on sandy bottoms. The form designed by the officers of the Blake, and used successfully on board that vessel, is adapted for very soft bottoms usually encountered at great depths.

THE CHESTER RAKE DREDGE.

This arrangement of a double rake to be used in connection with a dredge of any form is shown in Plate X and is very useful in bringing to the surface mollusks and various other forms living a few inches under the mud or sand of the bottom.

The Blake dredge is usually preferred for use with the rake as it skims over the bottom lightly, picking up what has been turned up by the rake without overloading itself with mud.

THE TANGLE BAR.

The form of tangle bar used by the Commission was devised by Prof. A. E. Verrill in 1873, and consists of an iron bar supported at each end by a fixed wheel, or iron hoop. Six chains are attached to the bar at intervals of one foot, and they are about 12 feet in length. To these chains are secured deck-swabs or bundles of rope yarn at intervals of about 18 inches. The apparatus is shown in Plate X, partially suspended under the main boom. It is very useful on rocky bottoms where it will capture specimens when no other device could be made available.

THE TABLE SIEVE.

Plate XI shows the table sieve, as used by the Commission. The hopper, with its coarse wire-gauze bottom, is seen in the foreground, then the fine wire-gauze tray which rests beneath it, and finally the table itself with its canvas bottom and hose from which the waste-water is conducted to the scupper. This device is peculiar to the United States Fish Commission, and has probably contributed as much towards its success in deep-sea exploration as any single implement used. To prepare the table sieve for service, the tray is placed in position, then the hopper when it will assume the form shown in Plate XII. The contents of the trawl (a mixture of mud and various forms of marine life) being emptied into the latter, a stream of water is turned upon the mass and the work of collection and assortment commences. The larger forms are taken from the hopper, the smaller ones from the tray, while the more minute and delicate specimens are found on the canvas bottom.

THE CRADLE SIEVE.

The cradle sieve is designed to receive the contents of the dredge, as the table sieve does that of the trawl. It is semicircular in form, as shown in Plate XI; the bottom and sides being composed of a coarse wire-gauze, lined with the same material, but very fine; the tray or hopper has also a coarse gauze bottom.

To prepare the cradle sieve for use, the hopper is placed in position and the sieve hung over the side, abreast of the dredging port. The contents of the dredge being emptied into it, a stream of water, strong or light as desired, is turned on as with the table sieve, the collection and assortment being carried on in a similar manner.

DREDGING ARRANGEMENTS, MAIN DECK.

Plate XII shows a portion of the starboard side of the main deck as arranged for dredging. The table sieve is seen standing abaft the dredging port. On the swinging table which has been lowered from the beams overhead is a nest of hand sieves and various sizes of jars, bottles, and vials, used for preserving specimens. Deck tubs, buckets, &c., are at hand, and a tank of alcohol is secured on the boiler hatch. The side ports are closed in the view, but if more light or air is required they can be opened and secured by iron hooks suspended from the deck beams.

SOUNDINGS AND SERIAL TEMPERATURES.

The vessels of the Commission have heretofore used the ordinary deep-sea lead and line for soundings and serial temperatures, and in shoal water it answered their purpose, but in depths exceeding 100 fathoms it consumed much time and required nearly every man of the small crew to haul the lead back.

During the season of 1879 a wooden reel was improvised, on which the lead line was coiled and, by a simple attachment to the fly-wheel of the hoisting engine was hove up rapidly, requiring the services of but two men, one at the engine and one to attend the reel. This was a marked improvement over the old method, but as the work of the Fish Hawk was expected to take her into 300 fathoms or more, it was deemed advisable to substitute piano wire in place of hemp in order still further to facilitate the work of taking soundings and serial temperatures.

SOUNDING MACHINE.

The machine adopted is shown on a small scale in Plate X, where it is mounted at the stern in readiness for casting the lead. The reel is of cast brass 11.43 inches in diameter, and holds 600 fathoms of wire. A friction line, led through a groove common to all sounding reels, controls the motion. The cranks are thrown out of gear and hang vertically one on each side. The register is on the left of the reel. A small ratchet wheel and pawl hold the reel in place when desired.

On the extremity of the frame is a small grooved pulley of brass, working in guides and suspended by a coiled spring which allows several inches vertical play. A brass guard is fitted over the upper portion of the pulley to prevent the wire from flying off if suddenly slacked. The reel is moved by friction motion; a half turn of the right crank ahead brings them both into action, the reverse motion throwing them out, leaving the reel to revolve freely.

To prepare the machine for sounding, wind the wire on the reel, splice on two or three fathoms of stray line, reeve it over the pulley and bend on the lead and thermometer, the reel being held in position by the ratchet and pawl. Pass the friction line over the groove, reverse the pawl, attend the friction line, lowering the lead carefully to the water's edge, then set the register at zero and all will be ready for a cast. The total weight of the apparatus is 96 pounds. The ordinary leads from 12 to 20 pounds weight are used, and, if specimens of the bottom are required, they are armed in the usual manner. This, however, is a matter of little consequence, as the dredge or trawl invariably follows the lead, from which specimens can be taken.

The machine described was purely experimental as we had no practical knowledge of sounding machines or the use of piano wire. The results were eminently satisfactory, and the little machine continued to do its work well until finally we got into depths exceeding its capacity. We then decided to have a larger one made embodying such improvements as our experience suggested; the original being relegated to the stern, where, with Bassnett's patent atmospheric lead, it is still doing good service as a navigational sounding machine by which we can ascertain the depths to 25 or 30 fathoms while running at full speed.

The improved machine is shown on Plates XIII, XIV, and XV, and its location on Plates I and IX. It is constructed on the same general plan as the original machine. The standard which ships in the rail is of wrought iron screwed firmly into the base of the brass frame that carries the reel. The frame above mentioned is cast in one piece, is bored to receive the shaft, and has appropriate lugs for the pawl and register. The reel is of cast brass, and will hold 2,000 fathoms of sounding-wire, one fathom to a turn on the first layer, increasing as the score is filled. It has also the usual friction groove, Plate XIV. The cranks by which the reel is turned have friction surfaces, which are brought into action by moving the right one-half a revolution ahead, the left remaining clamped, as shown in Plate XIII; or it may be held firmly in the hand. The reverse motion releases the reel, and it revolves freely without moving the cranks.

On the left of the frame, between it and the crank, is a worm-wheel which operates the register, as shown in Plate XIII. The ratchet and pawl are on the right, between the frame and crank.

The arm supporting the guiding pulley is of flat bar-iron, its lower end riveted between lugs on the frame. The small metal block projecting from the arm is part of a tackle for suspending the reel when mounting and dismounting. The guiding pulley is the same as that used in the original machine, except that it carries a small arm near the upper end of its shaft or spindle, which works through a slot in the casting, as shown in Plate XIV. A small cord is attached to the arm and made fast to the free end of the friction rope, the standing part being hooked to a small metal eye in the frame over the reel.

By this arrangement the friction is intended to act automatically in the following manner: The machine being ready for a cast the small friction line is hauled taut before the lead is bent, and while the guiding pulley is up in its place. In this condition it requires a strong man to move the reel, but, the lead being bent and suspended, it compresses the spring and drags the pulley down sufficiently to slack the friction rope and allow the reel to move with comparative freedom; the instant the lead strikes the bottom, however, or the weight is removed from any cause, the pulley flies up, putting a strain on the friction rope which stops the reel at once. It acts also as a check in paying out, the friction being governed by the weight suspended on the guide pulley. The reel is kept in a tank of oil when not in use, to preserve the wire. By a most ingenious arrangement, for which we are indebted to Mr. Tippet, draughtsman at the ordnance department, Washington navy-yard, the reel is unshipped by simply unscrewing one nut, shown in Plate XIII, on the left crank, with a chain attached to prevent its loss by falling overboard. The nut being unscrewed releases the shaft, which is drawn out leaving the ratchet, worm-wheel, and left crank in position.

With the use of the tackle one man can easily ship and unship the reel.

The comparative sizes of the ordinary deep-sea lead-line, hand-line and sounding-wire are shown in Plate XIII.

Plate XIV shows the machine in position for heaving in.

Plate XV shows the machine in poition for sounding with the Bassnet atmospheric lead, used for navigational purposes, when the vessel is steaming ahead at her usual speed.

When the machine is in place it turns freely, the guide-pulley taking the direction of the wire if, from any cause, it trends out of the perpendicular. A set-screw is provided in the rail bearing for clamping the apparatus to steady it while heaving in. Total weight of the machine, 128 pounds.

PIANO-FORTE WIRE USED FOR SOUNDING.

The steel wire used for sounding and serial temperatures was purchased of the Washburn & Moen Manufacturing Company, Worcester, Mass. It is called No. 11, music, by the makers; is 0.028 of an inch in diameter, tensile strength about 200 pounds, weight .0145 of a pound to the fathom, or 14.5 pounds to the nautical mile.

The method of splicing is simple and effective. The ends of the wire, for about 2 feet, are thoroughly cleaned, and laid together with about eight turns; the ends and two or three intermediate points are wound with a few turns of very fine wire, and covered with solder, which is smoothed with a knife or piece of sand-paper. As this form of splice is smooth, flexible, and reliable, we have tried no other.

Slack-laid cod-line is used for stray-line, and is applied to the wire in the following manner: The end of the wire is stuck twice against the lay, about six inches from the end of the line, then passed with the lay for six inches, the end stuck twice against the lay and served over with seaming twine. The wire is then passed with the lay to the end of the line, the strands trimmed down and served over with twine; a seizing is also put on over the wire first stuck against the lay. This makes a smooth and secure splice, which passes readily over the guide-pulley without danger of catching under the guard.

DEEP-SEA THERMOMETERS.

The Miller-Casella and Negretti & Zambra deep-sea thermometers have been used by the vessels of the Commission. They are both excellent instruments, but the latter possessed some notable advantages for the peculiar service required of them in the prosecution of our work.

THE NEGRETTI & ZAMBRA DEEP-SEA THERMOMETER.

This thermometer is shown in Plate XVI; the tube removed from its case; the rubber guards taken off and laid beside it; the messenger between them. The metal case used by the Commission and the wooden frame furnished by the manufacturers are shown. The spring and slip hooks are removed from the former, and lie beside it.

The bulb containing the mercury is cylindrical; the neck much contracted, and the tube near it bent in a peculiar manner, with a catch reservoir at the bend. To take the temperature the bulb is held downward, when the column of mercury in the tube will be in contact with it. To register the temperature the instrument is capsized; the column breaking at the bend, falls to the bottom, and the scale is then read in the usual manner, it being marked from the opposite end toward the bulb.

The tube is completely inclosed in a glass shield, which protects it from pressure, eliminating any errors that might arise from that cause; and in order to avoid sluggishness, the portion surrounding the bulb is filled with mercury.

This thermometer, as mentioned above, registers by being capsized, or turned with the bulb up, at the point where the temperature is to be taken; and, to accomplish this, some device is necessary by which the requisite movement will take place with certainty at the proper time.

For this purpose the manufacturers use a wooden frame containing a charge of shot, which moves freely from end to end, and is of sufficient weight to leave the entire apparatus a slight buoyancy in sea water.

In using this instrument the end of the frame carrying the bulb is made fast to the sounding-line and is pulled down in the descent; the shot are at the lower end, and the buoyancy of the frame, added to the friction of the water, keeps it in position.

The ascent is commenced with a quick pull of the line, which, by changing its center of gravity, causes the thermometer to capsize, the weight of shot transferred to the lower end and friction of the water keeping it in position. The ascent should be continuous after it commences, for if the line is stopped or slacked from any cause the thermometer is liable to reverse, giving, of course, erroneous readings.

We experienced no trouble from this cause in smooth water, but in a sea-way, with the vessels moving rapidly, the results were unsatisfactory; in fact, totally unreliable. The frames soon became water-logged in depths of four or five hundred fathoms, which was another fruitful source of error.

The accuracy of the thermometer itself and its extreme sensitiveness made it particularly valuable to us where we required several temperatures in rapid succession at moderate depths, provided we could control its motions.

Several devices were tried, and finally a simple gas-pipe, seven-eighths of an inch inside diameter, was adopted. Several holes were drilled in the end inclosing the bulb, a slit cut in the side to expose the scale, and a pair of slip-hooks held in position by a small spring placed in the opposite end. The thermometer was then inserted; the rubber guards used to protect the shield in the wooden frame serving not only to hold it securely in place but to protect it from sudden jars, and a lanyard of cod-line, spliced into the end carrying the bulb, completed the arrangement.

THE MESSENGER.

The messenger used for capsizing the thermometer is of cast brass, cylindrical in form, with rounded ends. It is about two inches in length, one in diameter, and has a three-eighth-inch hole through its center, well rounded at the ends to prevent catching on splices. Its weight is from three to four ounces.

TO TAKE A DEEP-SEA TEMPERATURE.

Plate XIII shows both forms of the Negretti & Zambra thermometer arranged for descent. In the modified form it is held firmly in position by the slip-hooks through which the stray-line passes.

Having attained the proper depth, and sufficient time elapsed for the thermometer to indicate the temperature, the messenger, which has been resting in its cradle under the guide-pulley, is sent down the wire and capsizes the thermometer by striking the slip-hooks and forcing them open, when, having lost its support, the instrument promptly reverses, as shown in Plate XIV, where both forms are represented as on the ascent.

All buoyancy being destroyed by substituting a metal case, the thermometer is independent of the motions of the vessel either from rolling, pitching, or drifting. The line may be stopped on the ascent or lowered again without affecting the instrument in any way. We have taken hundreds of temperatures with the apparatus described, under varying conditions of wind and weather, with the most satisfactory results.

THE MILLER-CASELLA DEEP-SEA THERMOMETER.

Plate XVII shows this thermometer in its copper case used for deep-sea work; also partially dismounted, to show the form of construction. The magnet seen between the two instruments is used to adjust the indices.

The following description is from Sigsbee's "Deep-sea Sounding and Dredging:"

"A glass tube bent in the form of U is fastened to a vulcanite frame, and to the latter are screwed white glass slabs containing the graduated scales. Each limb of the tube terminates in a bulb. A column of mercury occupies the bend and a part of the capillary tube of each limb.

"The large bulb and its corresponding limb, above the mercury, are wholly filled with a mixture of creosote and water; the opposite limb, above the mercury, is partially filled with the same mixture, the remaining space therein being occupied by compressed air. In the mixture, on each side, is a steel index having a horse-hair tied around it near the upper extremity. The ends of the elastic horse-hair, being held in a pendent position by the inner walls of the tube, exert enough pressure to oppose a frictional resistance to a movement of the index in elevation or depression. As thus described, the instrument is a self-registering maximum and minimum thermometer for ordinary use. The indications are given by the expansion and contraction of the creosote and water mixture in the large, full bulb. The instrument is set by bringing the lower ends of the indices in contact with the mercury by means of a magnet provided for the purpose. Then, when the instrument is submitted to a higher temperature, the expansion of the mixture in the large bulb depresses the column of mercury on that side, and correspondingly elevates it on the other side. A decrease of temperature contracts the mixture in the large bulb, and by the elastic force of the compressed air in the smaller bulb a transference of the column of mercury takes place in precisely the reverse manner to that which occurs on a rising temperature. Thus the mercury rises in the left limb for a lower, and in the right limb for a higher, temperature.

"The greater the change of temperature, the higher the point reached in the respective limbs; hence, the scale on the left is graduated from the top downwards, and that on the right from the bottom upwards. The rising of the mercury in either limb carries with it the index of that limb, and on the retreat of the mercury the index remains at the highest point attained. The bottom of the index, being the part which has been in contact with the mercury, gives the point at which to take the reading."

The large bulb of these instruments is now protected from pressure by a glass shield, with which it is covered; the space between shield and bulb is nearly filled with alcohol, which acts as a transmitting medium for temperature, performing the same function as the mercury in the shield of the Negretti & Zambra thermometer. The shield above mentioned has added much to the value of the instrument, as it has practically eliminated errors arising from varying pressures.

This thermometer has been considered the standard for deep-sea work, and where several are to be sent down on the same line, particularly to great depths, it is unrivaled. It is not as sensitive as the Negretti

& Zambra, but, under the above conditions, a delay of a few minutes is not of great importance. The movable indices are a fruitful source of annoyance and vexatious delay. An index may, without any apparent cause, absolutely refuse to move in the tube; coaxing with the magnet is followed by lightly tapping the frame in the hand or swinging it rapidly about the head, and, if this fails, more vigorous tapping is apt to follow, with various active measures, none of which tend to improve the general condition of the instrument.

The indices are also liable to move if the instrument is subjected to rough treatment; this, however, is not of frequent occurrence with careful handling.

Most of the minor casualties to which the instrument is liable are apparent to the eye and are readily set right.

WATER DENSITIES.

Hilgard's ocean salinometer (Plate XVIII) is used by the Commission for observing the density of sea-water. We found it difficult at times to use this delicate instrument at sea, until we adopted the plan of setting it on a nicely adjusted swinging stand, which rendered it to a great extent independent of the movements of the vessel.

An excellent description of the apparatus is given by Professor J. E. Hilgard in the Coast Survey Report for 1874, and reproduced in Sigsbee's Deep-sea Sounding and Dredging, as follows:

The density of sea-water in different latitudes and at different depths is an element of so great importance in the study of ocean physics as to have caused a great deal of attention to be paid lately to its determination.

The instruments employed for the purpose have been, almost without exception, areometers of various forms. The differences of density as arising from saltness are so small that it is necessary to have a very sensitive instrument. As the density of ocean water at the temperature of 60° Fahr. only varies between the limits of 1.024 and 1.029, it is necessary, in order to determine differences to the hundredth part, that we should be able to observe accurately the half of a unit in the fourth decimal place. This gives a great extension to the scale and involves the use of a series of floats, if the scale starts from fresh-water, or else the instrument assumes dimensions which make it unfit for use on board ship.

With a view to the convenient adaptation to practical use, this apparatus has been devised for the Coast Survey by Assistant Hilgard.

The instrument consists of a single float about 9 inches in length. The scale extends from 1.020 to 1.031, in order to give sufficient range for the effect of temperature. Each unit in the third place, or thousandths of the density of fresh water, is represented by a length of 0.3 of an inch, which is subdivided into five parts, admitting of an accurate reading of a unit in the fourth place of decimals by estimation. The float is accompanied by a copper can, with a thermometer inserted within the cavity, which is glazed in front. In use the can is nearly filled with water, so as to overflow when the float is inserted, the reading being then taken with ease at the top of the liquid. For convenience and security two such floats and the can are packed together in a suitable case, and a supply of floats and thermometers, securely packed in sawdust, is kept on hand to replace the broken ones.

The following table has been derived from the observations of the expansibility of sea-water, made by Prof. J. S. Hubbard, U. S. N. Column II contains a table of reductions for temperature of salinometer readings to the standard of 60° Fahr. To facilitate the use of this table the following directions are given:

Record the actual observation of hydrometer and thermometer. From Column II (which is applicable to any degree of saltness within the given limits) take the number corresponding to the observed temperature, and multiply this number by the number of degrees and fractions of a degree that the observed temperature differs from 60°. Apply this product as a correction, with proper sign, to the reading of the salinometer, and the result will be the reading of the salinometer at the standard temperature of 60° Fahr.

EXAMPLE.—Actual reading of thermometer=80°.5; actual reading of salinometer=1.02425.

Opposite 80°.5 in column II is +0.0001585, which, multiplied by 20.5, gives as a product +0.003249. Add this to the observed reading of salinometer, and 1.02750 will result as the reading of the salinometer at the standard temperature.

Temperature.	Coefficients for reduction to 60°.	Temperature.	Coefficients for reduction to 60°.	Temperature.	Coefficients for reduction to 60°.	Temperature.	Coefficients for reduction to 60°.
°		°		°		°	
50	−0. 000108	60	+0. 000000	70	+0. 000145	80	+0. 000158
51	−0. 000110	61	+0. 000130	71	+0. 000146	81	+0. 000159
52	−0. 000112	62	+0. 000135	72	+0. 000147	82	+0. 000160
53	−0. 000113	63	+0. 000137	73	+0. 000148	83	+0. 000162
54	−0. 000115	64	+0. 000137	74	+0. 000149	84	+0. 000163
55	−0. 000118	65	+0. 000138	75	+0. 000151	85	+0. 000164
56	−0. 000120	66	+0. 000140	76	+0. 000152	86	+0. 000166
57	−0. 000120	67	+0. 000141	77	+0. 008154	87	+0. 000167
58	−0. 000120	68	+0. 000142	78	+0. 000156	88	+0. 000168
59	−0. 000120	69	+0. 000143	79	+0. 000157	89	+0. 000170

A method quite different in practice for determining the density of sea-water has been suggested by Prof. Wolcott Gibbs, of Harvard University. It depends upon the determination of the index of refraction by means of an angular instrument similar to the sextant. As all navigators are familiar with the use of the sextant, and as the observation can be made without hinderance from the motion of the ship, this form of the instrument may be found to possess certain advantages.

NOTE IN 1876.—When the table of reductions for temperature above given was constructed, the investigations relative to the same subject made by Thorpe and Rücker (Royal Society's Proceedings, January, 1876) were not known. The following comparison of the results of the experiments on the thermal dilation of sea-water, as taken from Professor Hubbard's tables, and as derived from the results of Thorpe and Rücker, shows the differences within the range of temperature covered by our table of corrections:

Temperature	Volume.	
	Hubbard.	Thorpe and Rücker.
°		
50	0.99895	0.99902
55	0.99943	0.99946
60	1.00000	1.00000
65	1.00067	1.00059
70	1.00142	1.00127
75	1.00221	1.00205
80	1.00309	1.00280
85	1.00402	1.00364

DEPARTURE OF THE VESSEL FROM WILMINGTON.

At 4 p. m. July 29, 1880, the Fish Hawk left the builder's yard for Newport, R. I., the headquarters of the Commission for the season.

The hatching machinery was not entirely complete, but the dredging apparatus was in place, and it was considered advisable to leave at once, returning for the remainder of her hatching outfit after completing her work of deep-sea exploration for the season.

The weather was clear and pleasant, with a gentle breeze from NW. The vessel attained a speed of 7 to 8 knots during the night, the engines working smoothly. Passed Cape Henlopen at 11.20 p. m., Absecon at 4.30, and Barnegat at 8.35 a. m. July 30. The position at noon was latitude 40° 06′ N., longitude 73° 09′ W., 177 miles from Wilmington, giving an average speed of 8.55 miles per hour.

At 5 p. m. passed Fire Island light-house, and between 5 and 6 observed azimuths of the sun on such courses as we would require during the trip for the purpose of ascertaining the deviation of our compasses. July 31, at 12.25 a. m., passed Montauk Point, at 3.30 Point Judith, at 4.15 Beaver Tail, and at 4.40 a. m. anchored in Dutch Island Harbor for the purpose of cleaning and painting ship.

Monday, August 2, got under way and steamed to Newport, the headquarters of Commission, and reported for duty in connection with deep-sea exploration.

The weather was unsettled and rainy during the 3d, 4th, and 5th, clearing during the night of the latter date, and on Friday, the 6th, we left the wharf at 8.35 a. m., with the naturalists on board, for our first dredging expedition of the season. It was an experimental trip for the purpose of testing the mechanical appliances, which were mostly new. Three hauls of the dredge and three of the trawl were taken in the channel to the westward of Canonicut Island, in from 8 to 12 fathoms of water, returning to port at 3.58 p. m.

Slight modifications were found necessary in the arrangement of leading blocks, accumulator, &c. The sounding apparatus was easily operated by one man, doing its work satisfactorily. In fact, the experience of the day satisfied us that with the modifications mentioned above, the apparatus would answer the purpose for which it was designed.

Six hauls of the dredge and trawl were taken on the 7th, in the channel between Fort Adams and the Dumplings, in from 17 to 27 fathoms of water. Great numbers of specimens were taken, sufficient to keep the scientific corps fully employed in the laboratory for several days.

On Friday, the 10th, the weather being favorable, the ship was swung under steam, and azimuths taken on every point to determine the deviation of compasses.

Thursday, August 12, took six hauls of the dredge and trawl in the sound, about three miles to the southward of Brenton's Reef light-ship, in from 16 to 19 fathoms. The trawl fouled a wreck during the day, detaining us several hours in vain efforts to clear it. Failing in this, we hove in all slack line and backed the engines till the dredge rope parted, losing the trawl and about 15 fathoms of rope.

Five hauls of the trawl and dredge were taken on the 13th, about 5 miles to the southward and eastward of the light-ship, in from 18 to 20 fathoms; and seven hauls on the 14th, in the vicinity of Point Judith, in from 18 to 19 fathoms. Four hauls were taken in various localities in Narragansett Bay on Monday, the 16th, and on the 17th, eight hauls on Brown's Ledge, from 8 to 12 miles SW. by W. of the Vineyard Sound light-ship, in from 11 to 22 fathoms.

Wednesday, August 18, took four hauls of dredge and trawl, about 20 miles S.SE. of Block Island, in from 27 to 29 fathoms of water. Thursday and Friday, the 19th and 20th, the naturalists were occupied in the examination and preservation of specimens. Saturday, the 21st, was foggy and rainy, the weather clearing during Sunday, and on Monday, the 23d, three hauls were taken between Narragansett Pier and Point Judith. A heavy swell prevailing in that locality, we ran into Narragansett Bay, where four hauls were taken in from 11 to 15 fathoms.

Thursday, the 24th, five hauls were taken from 1 to 3 miles to the eastward of Block Island, in from 13 to 22 fathoms, and on the following day one haul in the same vicinity, when, being overtaken by a heavy squall of wind and rain, we were forced to stop work and start for port. We had heavy rain and a dense fog all the way in, the weather clearing after we reached the harbor. We were detained in port the following day by a heavy swell in the sound, and, on the 27th, finding an uncomfortable sea outside, we ran into the Sakonnet River and took ten hauls of the dredge and trawl between its mouth and Gould Island.

The naturalists were employed in the laboratory on Saturday, and we were detained by unfavorable weather on Monday, but Tuesday, the 31st, was more favorable, and ten hauls of the trawl and dredge were taken in the channel between the Dumplings and Beaver Tail, and various localities in Narragansett Bay, in from 8 to 27 fathoms. On the following day, September 1, ten hauls were made between the Dumplings and Beaver Tail, in from 3 to 20 fathoms. The naturalists were occupied the following day in the laboratory, and on the 3d six hauls of the trawl and dredge were taken at the entrance to Vineyard Sound, from 3 to 4 miles to the southward of Cuttyhunk, in 17 fathoms.

At 3.30 p. m. we started for Wood's Holl, arriving at 4.30, when preliminary examinations of the harbor, &c., were made, with a view of stationing the ship at this place for codfish hatching during the coming winter.

At 5.15 p. m. left Wood's Holl, and started for latitude 40° 04′ N., longitude 70° 23′ W., the locality where the first tile fish (*Lopholatilus chamæleonticeps*) were reported to have been taken. We passed Gay Head at 7.05 p. m., and slowed down to about 3 knots between that point and No Man's Land, to allow surface towing by the naturalists, which resulted in the capture of some interesting specimens. The vessel was then put at a speed of 8 knots per hour for the night, in order to reach the desired position at daylight. The wind was light to moderate from SW., but there was quite a heavy cross swell from SE. to SW., increasing as we left the land, and, during the latter part of the night the vessel was rolling and pitching in a most lively manner.

At 4.50 a. m., September 4, stopped, latitude 40° 04′ N., longitude 70° 23′ W., cast the lead in 65 fathoms' sand, and lowered the trawl with most satisfactory results. Four miles south we found 192 fathoms; eight hauls were taken during the day between the depths above mentioned.

The results were remarkable, and the temptation to seek greater depths almost irresistible, but we had 300 fathoms of dredge rope only on the reel, and were obliged to confine ourselves within moderate depths.

The bottom and intermediate temperatures were unreliable owing to the use of the Negretti-Zambra deep-sea thermometer in a sea-way, the motion of the vessel being liable to capsize it at any time. It was the results of this day's work that led us to devise some plan by which this admirable thermometer could be used under all conditions of wind and weather.

The sounding and dredging apparatus which had heretofore been used in depths of but 30 fathoms or less, worked so well that we concluded to double their present capacity by adding to the length of rope and sounding wire.

At 1.40 p. m. we started for port, about 100 miles distant. The weather was clear at this time, but about 5 p. m. a heavy bank rose rapidly ahead, the wind veering to NW. At 7 p. m. the sky was entirely overcast with a light mist and drizzling rain, and at 10 p. m. a dense fog closed in. The speed was reduced and the fog-whistle sounded at short intervals.

At 3.30 a. m., September 5, stopped near Brenton's Reef light-ship to wait for daylight or the fog to lift; and, although frequently within a ship's length of the vessel, we could not see the lights. In fact, we saw the vessel herself for an instant only, after daylight, when we were less than a hundred feet from her. I mention this as an illustration of the density of coast fogs and the difficulties attending navigation during their prevalence.

After daylight we ran in by compass, catching an occasional glimpse of points as we passed up channel, and finally arrived at the wharf at 7.15 a. m.

We were employed Monday and Tuesday, the 6th and 7th, coaling ship; were detained by unsettled weather till the 12th, when, at 6.40 p. m., we left port for another off-shore trip.

While in port we doubled the length of our dredge rope by splicing 300 fathoms to that already on the reel, increased the length of wire on the sounding machine to something over 600 fathoms, and adopted a simple spring catch or detaching arrangement by which the Negretti & Zambra thermometer could be held firmly in position until the proper time to register the temperature by reversing it; this being accomplished (as explained in the description of the Negrette & Zambra thermometer as used by us at present) by sending a small weight or messenger down on the wire, detaching the spring catch by impact, and freeing the upper end, when, being inclosed in a metal case without bouyancy, it promptly reverses, thus registering the temperature.

At 5.35 a. m. on the 13th we cast the lead in 100 fathoms—latitude 40° 02′ N., longitude 70° 57′ W.—and sent the trawl down. Nine hauls were taken during the day in from 85 to 325 fathoms, within a radius of 7 or 8 miles, everything working satisfactorily in depths less than 200 fathoms; but our first attempt in deeper water resulted in numerous kinks in the rope and several turns around the trawl, which, of course, came up empty. A little caution in paying out the rope was all that was necessary, and we had no further trouble from those causes.

We had provided ourselves with a quantity of menhaden for bait, and, during the morning, set a trawl line in 126 fathoms—latitude 39° 57′ 07″ N., longitude 70° 56′ W.—for the purpose of catching tile-fish (*Lopholatilus chamæleonticeps*). The line was down 45 minutes, and on hauling it up three tile-fish were taken. Three more got off the hooks after coming to the surface and were lost. There were numerous skate and hake on the line, and the bait was gone from most of the hooks.

The line was set again in the afternoon in 250 fathoms—latitute 39°

48′ 30″ N., longitude 70° 54′ W.—without success, so far as tile-fish were concerned. There were, however, several hake and skate taken, showing that the line reached the bottom.

One of the tile-fish taken in the morning was boiled for dinner and served with egg sauce. The flesh was white and firm, bearing a strong resemblance to codfish in texture and flavor, though somewhat coarser.

Work was continued till 6 p. m., when the vessel was headed for port. It was evident, from a rapidly falling barometer and other indications, that a change of weather was impending. At nine o'clock the sky was overcast, threatening rain.

At 1 a. m. on the 14th the wind veered to northwest with thick rainy weather. We made Block Island light at 1.45, and at 2.40 were struck by a furious squall of wind and rain, with incessant thunder and lightning, followed by a dense fog. Between three and four o'clock, while passing several miles to the eastward of the island, a large pyramid of light was observed on shore, penetrating the dense fog and illuminating our surroundings, increasing the range of vision from a few yards to at least half a mile in every direction, and toward the island to a much greater extent. We could not detect a distinct flame or discover the source of light, but learned subsequently that it was caused by the burning of a hotel. The possibility of penetrating and illuminating a dense fog by the use of powerful lights was practically demonstrated by the occurrence above mentioned.

The wind veered to the northward and eastward, increasing rapidly, till at 7.15, upon our arrival in port, it was blowing a gale, which continued with greater or less violence till the 16th, detaining the vessel in port.

Friday, September 17, was clear and pleasant, with light winds.

At 10.17 a. m. we left the wharf with a number of gentlemen on board, and steamed up the bay, where hauls were made with the beam trawl, otter trawl, dredge, and rake dredge. Our system of sounding and taking serial temperatures, the preservation of specimens, &c., were explained to the guests, and at 4.15 p. m. we returned to port.

The 18th and 19th were occupied by the naturalists in preserving specimens, and we were detained on the 20th by fog.

At 9.15 a. m. on the 21st we left the wharf and steamed to the southward of Block Island, where we took five hauls of the trawl and dredge in from 11 to 19 fathoms water. A heavy southwest swell made it excessively uncomfortable on board, and, at times, almost impossible to carry on the work. We returned to our wharf at 7 p. m., the results of the day's work having been very satisfactory.

At 11 a. m. on the 22d we left for Wood's Holl with the Commissioner on board, arriving at 4.15 p. m. An inspection was made with the view of establishing an experimental station for codfish hatching during the coming winter.

We left Wood's Holl at 1.15 p. m. on the 23d, arriving in Newport at

5.30 p. m., when fires were hauled to clean the boiler, and this opportunity was taken to make some needed repairs to machinery, which were completed on the 25th.

Preparations were made for an off-shore trip on the 26th, but we were detained by unsettled weather, fogs, or strong winds till October 1, when at 4.30 p. m. we left the wharf and proceeded to sea.

The local deviation of our compasses was accurately obtained and tabulated upon our arrival at the station, but later in the season it became evident that it was changing, at least, on the north and south courses, and, to ascertain the actual error, azimuths were observed on the points between S. and SW. and N. by E. to NNW., the result showing a decrease of 2° to 3° on those points.

When the above observations were completed we steamed to the southward, and at 5.40 a. m. on the 2d cast the lead and put the trawl over, in latitude 39° 46′ N., longitude 71° 10′ W., in between 300 and 400 fathoms, bringing up a heavy load of soft mud with but few specimens. The depth was uncertain, as the sounding-wire parted at 310 fathoms before reaching bottom.

At 8.40 a. m. the trawl was cast again in latitude 39° 46′ N., longitude 71° 05′ W., in 487 fathoms, mud and small stones. A large number and great variety of specimens were brought up.

At 11.23 a. m. the trawl was cast again in 39° 52′ 20″ N., 70° 58′ W., 372 fathoms, bringing up mud, sand, and a few small stones.

Another haul was taken at 1.10 p. m.—latitude 39° 53′ N., longitude 70° 58′ 30″ W.—in 365 fathoms, sand and mud; and another at 3.17 p. m.—latitude 39° 56′ 30″ N., longitude 70° 59′ 45″ W.—in 238 fathoms, sand and mud. The hauls were all successful, but the last was the largest of the season, both in numbers and species. The weight in the net was so great that it required considerable time and great care to land it safely on deck. This being accomplished, we started at 5.25 p. m. for port, arriving at 5 a. m. on the morning of the 3d.

The 4th and 5th were occupied in coaling ship; the 6th in taking on board specimens of natural history, the result of the season's work, destined for New Haven and Washington, and making preparations for sea.

At 6.05 a. m., October 7th, we left Newport for New Haven, arriving at 3.50 p. m., and remained over night.

The articles consigned to Prof. A. E. Verrill were delivered, and, at 7.30 a. m., October 8th, we left for New York, arriving at the navy-yard at 2.30 p. m., where we took on board a supply of paymaster's stores, water, &c.

We left at 4.20 p. m. on the 12th for Wilmington, Del., to complete the hatching machinery left unfinished on our departure in July.

The weather was clear with a moderate gale blowing from NW. It was a fair wind, however, and by hugging the coast we had comparatively smooth water till we opened out Delaware Bay, where we encountered a heavy sea, which tested the strength and weatherly qualities of the vessel.

At 8 a. m. on the 13th we passed inside the capes, and at 4.30 p. m. arrived at the Pusey & Jones Company's works, Wilmington, Del.

Work was resumed at once on the hatching machinery. Some slight repairs were made about the engines, and such modifications as the season's experience suggested were adopted.

The work was completed on the 13th of November, and at 8.50 a. m. on the 14th we left for Washington, D. C.

The weather was unsettled, and finding cautionary signals flying at the cape we deemed it advisable to wait for a change. We anchored inside the breakwater at 4.30 p. m., remaining till 7.50 p. m. the following day, when, the weather having partially cleared, and the cautionary signals lowered, we got under way and proceeded to sea.

After clearing Cape Henlopen a course was laid which would carry the vessel off shore, intending to make a depth of from 100 to 200 fathoms water by daylight, when we proposed to try the dredge and trawl.

We encountered a heavy southerly swell during the night, but it moderated towards morning, and at 9.20 a. m.—latitude 37° 26′ north, longitude 74° 19′ west—cast the trawl in 56 fathoms, sand and shells. Six hauls were taken during the day, in from 300 fathoms down to 18, with most satisfactory results; several new species were added to the marine fauna of the coast, and some were found new to science.

The last haul in 18 fathoms was taken after dark for the purpose of ascertaining whether a greater number of fish would be taken than during daylight. We saw no perceptible difference, but a single haul would hardly be significant either way.

The trawl was up at 7.30 p. m., and the vessel headed for land, passing inside the capes of the Chesapeake at 12.55 a. m., the 17th. At 10.45 a. m. we anchored off Saint Jerome Creek, and sent a party in with the steam cutter to bring out a barge belonging to the Commission, which we were directed to tow to Washington. They found her lying in a bad position, pretty well filled with water, and the tide ebbing and flowing through the open seams in her sides and bottom.

The water was finally bailed out, the worst leaks temporarily stopped, and at high tide, about 2 a. m. on the 18th, an attempt was made to tow her out; but the channel had become filled with sand, making it narrow for her to pass.

She was taken back to her old station and anchored again, and, at low tide, all our available force was put to work with shovels to widen the channel. It was high tide again between two and three o'clock in the afternoon, when we succeeded in getting her out, reaching the ship at 5 p. m., having kedged off against a fresh northeast wind, and quite a heavy swell. As soon as the barge was fast astern the boats were hoisted and we got under way for the Potomac.

It was blowing a moderate gale from northeast by this time, with a drizzling rain, and the night was intensely dark; the sea was quite rough, causing the vessel to roll heavily, and soon filling the barge with water. We had two hawsers fast to her, but one parted when we were off Point

Lookout; the other held, however, and at 7.25 p. m. we anchored in Cornfield Harbor for the night. The wind had backed to northwest by this time, and was blowing a fresh gale, causing quite a swell, but we rode it out very comfortably. Working parties were kept bailing the water out of the barge during the night.

We got under way at 6.35 a. m. on the 19th, and, with the barge in tow, started for Washington.

At 8 a. m. the United States Fish Commission steamer Lookout steamed out of Saint Mary's River, and coming within hail informed us that she had a mail for the ship. It was still blowing fresh, with a heavy swell in our exposed position, so she was directed to follow us under the lee of Piney Point, where the mail was transferred, and she was directed to make the best of her way to Washington. We were obliged to run at about half speed, owing to the bad condition of the barge, and working parties were pumping and bailing during the day. At 5.20 p. m. we anchored off Indian Head for the night.

At 7.20 a. m. on the 20th we were under way again and arrived at the navy-yard, Washington, D. C., at 1.40 p. m.

The specimens of natural history and other articles consigned to the Smithsonian Institution were landed on the 22d. We coaled ship on the 26th and 27th.

Arrangements were made with the authorities at the navy-yard to caulk the main deck, and the crew were actively employed refitting ship until 9 a. m., December 4, when we left for the Lower Potomac on duty connected with the artificial propagation of oysters at Saint Jerome Creek.

At 7.15 p. m. anchored in Saint Mary's River for the night. At 8 p. m. the Lookout arrived and anchored near this vessel. The weather was thick and rainy, with a fresh breeze from the eastward.

On Sunday morning, December 5, the Lookout went into Smith's Creek, where she could find a more secure harbor, and this vessel followed her on the morning of the 6th, the weather still rainy and unsettled, with a heavy swell in the bay.

The object of the expedition was to dredge a quantity of oysters and plant them at the station in Saint Jerome Creek, for the purpose of investigation and artificial propagation during the following spring and summer; but unfavorable weather forced us to seek a harbor, and on the 7th the wind veered to northwest, blowing a fresh gale, with very cold weather, ice forming rapidly. On the 9th, when the gale moderated, the oyster-pond was frozen over, obliging us to abandon the attempt to carry out the object of the expedition at that time.

It was desirable to test the practical working of our dredging apparatus, and for that purpose we put it in operation on the banks between Smith's Creek and Point Lookout for about three hours, the result being 75 bushels of oysters, dead shells, &c., and 25 bushels of marketable oysters.

Having satisfied ourselves as to the working of our apparatus we started at 1 p. m. for Washington, anchoring at 9.20 p. m. off Nanjemoy Point for the night. The weather was clear and cold, ice making rapidly along the shores.

At daylight on the morning of the 10th we got under way and steamed up the river. At 9.30 spoke the Lookout off Quantico. They reported the river frozen above that place, and that they were unable to go any farther. We then steamed up to Stump Neck, but were obliged to return, the sharp young ice cutting the unprotected planking of the vessel's sides like a knife.

Having anchored off Quantico, the Lookout, which was short of coal, was taken alongside and a sufficient quantity transferred to her bunkers. I took the train for Washington to confer with the Commissioner as to the future movements of the vessels, and, returning at 12.30 p. m. the following day, both vessels were got under way for Norfolk, Va.

There was considerable floating ice about us at this time, and the river was frozen over both above and below. The ice was not more than 2 inches in thickness, and our engines would have forced us through it without the least difficulty, but, owing to the fact that our metal sheathing was below the water line, there was every probability that the vessel would sustain serious damage if we made the attempt.

Fortunately the Lady of the Lake, an iron steamer, was seen approaching, and following in her wake we finally reached clear water and arrived at our destination, the Norfolk navy-yard, at 7.50 a. m. on the 12th, with the Lookout in company. Both vessels were carefully examined on the 13th to ascertain the damage by ice. This vessel was repaired by the naval constructor at an expense of $285. The Lookout was repaired by our own mechanics without expense to the government.

The weather during the remainder of the month was unusually severe; navigation became very difficult in the Potomac, and considerable ice formed even in Norfolk.

We were actively employed, when the weather permitted, in painting and refitting both vessels, the work being in progress at the close of this report, December 31, 1880.

REMARKS BY MR. RICHARD RATHBUN ON THE SCIENTIFIC RESULTS OF THE SEASON'S EXPLORATIONS.

The explorations carried on in Narragansett Bay, and to the eastward and southward of Block Island, demonstrated the existence of a fauna similar to that previously discovered by the Fish Commission, in and about Vineyard Sound (1871 and 1875) and in Block Island Sound and the neighboring regions (1874), the species differing more or less, however, according to the depth and character of the bottom on which they lived. No new species of fish were found in these inshore dredgings, and most of the invertebrates obtained were identical with already known species. Sufficiently large collections of fish and invertebrates were made to properly illustrate the fauna of the region.

The three trips of the Fish Hawk to the inner edge of the Gulf Stream slope, on September 4 and 13 and October 2, resulted in the discovery of a new and exceedingly rich marine fauna, quite excelling anything hitherto encountered by the Fish Commission off the New England coast. In fact, the region opened up by these off-shore dredgings may be fairly regarded as the most interesting and prolific of any yet explored upon our northern coasts, both as regards the number of species found and the abundance of specimens. Several hundred species of both fish and invertebrates were taken by means of the dredge and beam trawl, the larger share being new additions to the fauna of Southern New England, and a considerable proportion entirely new to science. The bottom appeared to be nearly continuously covered with life, as the dredge and trawl seldom came to the surface without a load of interesting forms, demonstrating that the region was eminently well fitted as a feeding ground for fish, of which several edible species were taken by the Fish Hawk.

Attention was first called to this region in the winter of 1878–'79, by the discovery there of a new species of food-fish—the so-called tile fish (*Lopholatilus chamæleonticeps* Goode and Bean)—by a Gloucester fishing schooner, commanded by Captain Kirby. This fish, which is quite unlike any other species occurring on the New England coast, ranges in size very much like the cod, specimens having been taken weighing all the way from 3 to 60 pounds. Its flesh is white and firm in texture, and by many who have tried it is considered good eating. It can be salted and dried like the cod.

The main object of the Fish Hawk, in visiting this section of the Gulf Stream slope, was to ascertain the distribution and abundance of the tile fish, and the character of its feeding grounds, which, as stated above, were found to be very rich. A comparison of the various animals obtained from there with those brought in by the Gloucester fishermen from the great fishing banks off Nova Scotia and Newfoundland indicates that a close resemblance exists between these two regions, and very many of the species of animals are identical in both. As the tile fish cannot be taken in the dredges and beam trawls commonly used in exploring the sea bottom, an ordinary cod trawl-line, with several hundred hooks, baited with menhaden, was set for about an hour in 100 fathoms of water, on one of the trips, and three fine specimens secured, together with other species of bottom-feeding fish. Otherwise, the natural history investigations were conducted entirely by means of the dredge and beam trawl.

The bottom in the region explored, which, beyond the 75 to 100 fathom line, forms quite a rapid slope, differs considerably in character in different localities. In some places it has a smooth surface, formed of fine compact sand, with more or less mud and fragments of shells, and sometimes with small stones. In others it consists of softer mud and sand, or is covered with broken shells and great quantities of sponges, hydroids, and worm tubes. Both the sand and mud generally contain a large percentage of calcareous foraminifera, some of which are of unusually large size. The mud in some places also yields innumerable quantities of large sand-covered rhizopods, which vary greatly in form, some being irregularly branched or rudely stellate, and others simply rod-like, and measuring at times nearly an inch long.

An especial feature of several of the muddy localities was a large round worm tube, resembling a goose-quill both in texture and consistency. These tubes, which belong to a new species of the genus *Hyalinœcia*, often came up by the thousands, sometimes composing fully half the contents of the trawl. They frequently measure over a foot in length and are nearly straight, but somewhat larger at one end than at the other. They live free upon the bottom, probably, as a rule, lying flat upon the mud, the worms being able to drag them about. These tubes afford attachment to many species of invertebrates, belonging to the groups of hydroids, actinians, and sponges. Another common inhabitant of the muddy bottoms, giving shelter to numerous species of worms, actinians, and mollusks, was the beautiful gorgonian, or bush coral, *Acanella Normani*, previously known from the northern fishing banks. A large cup coral of rather fragile texture, the *Flabellum Goodei*, occurred abundantly on some of the muddy bottoms, and was taken in large quantities, though generally in a fragmentary condition.

The mollusca were the most prolific of all the groups, as regards the number of forms taken, 175 species having been secured on the three trips. Of these, 115 species were new to the fauna of Southern New England, and 48 species entirely undescribed. Among the mollusca were 8 species of cephalopods, including 3 genera new to the New England coast. One of the species was a large and curious form of *Octopus* (*Alloposus mollis*), with the arms joined together by a web. Many fragments and several nearly perfect specimens of the paper nautilus (*Argonauta argo*) were obtained from the deeper hauls. Some of the species of *Octopus* and squids were quite abundant.

The crustacean fauna of this region was very rich in the number of species and individuals. The majority of the forms obtained belonged to the decapoda or higher crustacea, the species of schizopoda, cumacea, and amphipoda being comparatively few in number. The echinoderms were represented by a large number of species, many of which were new to the region and to science. Several of the species of starfishes and ophiurans, and a species of crinoid (*Antedon Sarsii*) frequently occurred in such extreme abundance as to form a very conspicuous feature of the hauls. One new species of starfish, the *Archaster Americanus*, sometimes appeared by the thousands, and other new species, as well as several species previously known only from occasional specimens brought in from the fishing banks off Nova Scotia, were very common.

About 50 species of fish were taken in the beam trawl beyond the 100-

fathom line, the larger proportion being new additions to the fauna of Southern New England, and including at least 5 new genera and 18 new species. One interesting form was the pole flounder, common in the deeper parts of Massachusetts Bay and the Gulf of Maine, and of which both young and adult individuals were secured.

At each dredging station, collections were made with the towing net, which is designed to scoop in the free-swimming forms, living at the surface and at intermediate depths. It was used at the surface, at depths of 5 and 10 fathoms, and near the bottom, for the latter purpose having been attached to the dredge line a short distance above the dredge or trawl. The animals obtained by this means were mostly jelly fishes, pteropods, heteropods, salpæ worms, larval crustaceans of the higher orders, and copepods, the latter frequently occurring in countless numbers. They serve as food for the surface-swimming fish, such as the menhaden and mackerel.

Many of the species found in this new faunal region are arctic, or belong to the colder waters of the Atlantic coast of Europe, or to the Mediterranean. Others again are more tropical, being related to southern or West Indian forms. Some of the commoner forms of crustacea and echinoderms are identical with species described from off the Florida coast. The surface species belong mainly to the Gulf Stream fauna.

The mass of material taken on these three trips was very great, filling several hundred jars, and a greater number of small bottles and homœopathic vials, as well as many large tanks. The proper working up of this material requires the expenditure of much time and labor, and while several hundred species have already been recognized and described, large quantities of the smaller and more obscure forms still await elaboration.

The few dredgings made November 16, off the mouth of Chesapeake Bay, in depths of 18 to 300 fathoms, gave very interesting results, especially in the greater depths, where nearly all the species secured were identical with those from the more northern localities, the character of the bottom being also the same. A large amount of material was obtained for a single day's work. All the species have not yet been worked out, but the identifications, so far as they have been made, indicate that the several groups of invertebrates are represented by about the following number of species: The mollusca by 48 species, including three species of squids and two of *Octopus*; the echinoderms by 19 species; the polyps by 6 species; and the hydroids by two species. The singular tube-dwelling worm of the north, *Hyalinœcia artifex*, was also very abundant in this region, as were other associated species of worms.

Synopsis of the steam log of the United States Fish Commission steamer Fish Hawk, for the year ending December 31, 1880.

Stroke of piston in feet	$2\frac{1}{4}$
Number of condensing cylinders	2
Diameter of condensing cylinders in inches	22

Mean point of steam cut-off from commencement of stroke of piston in inches	10.89
Mean number of holes of "throttle" valve open	2.47
Mean vacuum in condenser, in inches of mercury	23.51
Mean steam pressure in boilers, while engines were in operation	26.25
Mean temperature of engine-room	88.8
Mean temperature on deck	58.4
Mean temperature of injection water	60.38
Mean temperature of discharge water	85.52
Mean temperature of feed water	86.7
Total time fires were lighted, in hours and minutes	2,333.45
Total time engines were in operation, in hours and minutes	437.04
Total time engines were in operation, in hours and minutes while dredging	100.15
Total number of revolutions, port engine	1,772,970
Total number of revolutions starboard engine	1,394,190
Mean number of revolutions per minute en route	84.15
Mean piston speed, in feed, per minute	378.68
Total number of knots run	2,825
Mean number of knots run per hour	6.56
Mean number of knots per hour en route	9.02
Tons of coal consumed for engineer department	$239\frac{175}{2240}$
Tons of coal consumed while engines were in operation	$125\frac{1000}{2240}$
Tons of coal consumed for galley	$8\frac{1730}{2240}$
Tons of refuse	$51\frac{1320}{2240}$
Mean number of pounds of coal consumed per hour while engines were in operation	657.95
Mean number of pounds consumed per square foot of grate	14.1
Total number of gallons of oil consumed	149.75
Total number of pounds of tallow consumed	121
Total number of pounds of wiping stuff consumed	117.75
Mean draught forward, in feet and inches	7′ 1¼″
Mean draught aft, in feet and inches	7′ 4″
Number of screws	2
Kind of	True.
Mean pitch, in feet and inches	12′ 3″
Diameter of screws, in feet and inches	6′ 8″
Length of screws, in feet and inches, parallel to axis	20″
Number of blades	4
Mean indicated horse-power	186.7
Maximum indicated horse-power	222.92
Mean number of pounds of coal per horse-power	3.32
Maximum number of pounds of coal per horse-power	3.9

Maximum number of pounds of coal consumed per square foot of grate	18
Maximum speed attained under steam alone, in knots per hour	10.52
Number of hours maintained	$9\frac{1}{2}$
State of sea	Smooth.
Maximum slip of screws in per cent	17.08
Maximum number of revolutions per minute	105
Mean slip of screws in per cent	12.1

Table of distances made under steam by the United States Fish Commission steamer Fish Hawk, for the year 1880.

Date.		Where bound.	Distance.
1880.			
July	29	From Wilmington, Del., to Newport, R. I.	
	30	do	315
	31	do	
Aug.	2	Dutch Island Harbor to Newport, R. I	$8\frac{1}{2}$
	6	Dredging trip	20
	7	do	12
	10	Adjusting compasses	14
	12	Dredging trip	23
	13	do	30
	14	do	27
	16	do	33
	17	do	48
	18	do	80
	23	do	29
	24	do	45
	25	do	36
	27	do	48
	31	do	18
Sept.	1	do	14
	3	do	97
	4	do	130
	5	do	17
	6	Going to coal wharf	$\frac{1}{2}$
	8	Picking up moorings of this vessel	2
	12	Dredging trip	57
	13	do	105
	14	do	55
	17	do	25
	21	do	66
	22	Newport, R. I., to Wood's Holl	43
	23	Wood's Holl to Newport, R. I	43
Oct.	1	Dredging trip	69
	2	do	122
	3	do	47
	4	Going to coal wharf	$\frac{1}{2}$
	5	Trying port engine	$2\frac{1}{2}$
	7	Newport to New Haven	82
	8	New Haven to New York	53
	12	New York to Wilmington, Del	69.5
	13	do	143.5
Nov.	14	Wilmington, Del., to Washington, D. C	67
	15	Dredging trip	38
	16	do	131
	17	On the way to Washington, D. C	80
	18	do	8
	19	do	84
	20	do	22
	26	Navy-yard to Seventh street wharf	2
	27	Seventh street wharf to Navy-yard	2
Dec.	4	Washington, D. C., to Saint Jerome Creek	100
	6	Saint Mary's River to Smith's Creek	5
	9	Smith's Creek to Washington	61
	10	do	35
	11	Quantico to Norfolk, Va	97
	12	do	72
		Total distance run	2,825

Dredging and trawling record of the United States Fish Commis

SEASON

Date.	Thermometer used.	No. of observation.	Locality.	Hour.	Tide.	Air.
1880. Aug. 6	N. Z. 40007 surf.; 42666 bottom.	770	Beaver Tail Light, SE. by S., $\frac{7}{8}$ mile mag.	10 a. m.	Ebb	68
6	do	771	Beaver Tail Light, SE. $\frac{1}{4}$ S., $\frac{3}{4}$ mile mag.	10.30 a. m.	do	68
6	do	772	Beaver Tail Light, S. by E., $1\frac{1}{4}$ mile mag.	11.35 a. m.	do	72
6	do	773	Beaver Tail Light, S. by E., $1\frac{1}{8}$ mile mag.	11.45 a. m.	do	72
6	do	774	N. end Dutch Island, S., $\frac{1}{2}$ mile mag.	1 p. m.	do	72
6	do	775	N. end Dutch Island, S., 1 mile mag.	1.35 p. m.	do	79
7	do	776	Fort Dumpling, NW. by W. $\frac{1}{2}$ W., $\frac{5}{8}$ mile mag.	9.45 a. m.	do	72
7	do	777	do	10.20 a. m.	do	72
7	do	778	Fort Dumpling, N. $\frac{3}{4}$ E., 800 yards	10.40 a. m.	do	76
7	do	779	Fort Dumpling, NE., $1\frac{1}{4}$ miles	11.05 a. m.	do	78
7	do	780	Beaver Tail Light, W., 1 mile mag.	11.30 a. m.	do	79
7	do	781	Beaver Tail Light, N. NW., 1 mile mag.	12 m.	do	75
12	do	782	Beaver Tail Light, W. $\frac{3}{4}$ N., $1\frac{1}{4}$ mile mag.	9.30 a. m.	Flood	68
12	do	783	Brenton's Reef Light-Ship, N. by E., 1 mile mag.	10.15 a. m.	do	70
12	do	784	Point Judith, W. $\frac{1}{2}$ S., $4\frac{3}{4}$ miles mag.	10.50 a. m.	do	71.5
12	do	785	Brenton's Reef Light-Ship, N. $\frac{1}{2}$ W., $2\frac{1}{2}$ miles mag.	11.30 a. m.	do	72
12	do	786	Brenton's Reef Light-Ship, N.W. $\frac{1}{2}$ W., $4\frac{1}{2}$ miles mag.	2.35 p. m.	H. W	74
12	do	787	Brenton's Reef Light-Ship, N.NW. $\frac{1}{2}$ W., 4 miles mag.	3 p. m.	Ebb	74
13	do	788	Brenton's Reef Light-Ship, N.NW. $\frac{3}{4}$ W., 6 miles mag.	10.40 a. m.	Flood	70
13	do	789	Brenton's Reef Light-Ship, N.NW. $\frac{3}{4}$ W., $5\frac{1}{4}$ miles mag.	11.05 a. m.	do	70
13	do	790	Point Judith, W. NW. $\frac{3}{4}$ W., $8\frac{1}{2}$ miles mag.	11.55 a. m.	do	70
13	do	791	Point Judith, W. NW., $12\frac{1}{2}$ miles mag.	1.10 p. m.	H. W	72
13	do	792	Point Judith, W. NW., 12 miles mag.	1.50 p. m.	Ebb	72
14	do	793	Point Judith, W. NW. $\frac{1}{2}$ W., 6 miles mag.	9 a. m.		71
14	do	794	Point Judith, W. NW. $\frac{1}{2}$ W., 5 miles mag.	9.45 a. m.		70
14	do	795	Point Judith, W. NW. $\frac{1}{2}$ W., 4 miles mag.	10.25 a. m.		71
14	do	796	Point Judith, W. NW., $3\frac{1}{4}$ miles mag.	11 a. m.		70
14	do	797	Point Judith, NW. by W. $\frac{3}{4}$ W., $2\frac{1}{4}$ miles mag.	11.40 a. m.		70
14	do	798	Point Judith, NW. by W. $\frac{3}{4}$ W., $1\frac{1}{4}$ miles mag.	12.10 p. m.		71
14	do	799	Point Judith, W. $\frac{1}{2}$ N., $1\frac{3}{4}$ miles mag.	12.30 p. m.		70
16	do	800	Poplar Point Light, N. NW. $\frac{3}{4}$ W., $2\frac{1}{4}$ miles mag.	11.35 a. m.		63
16	do	801	Poplar Point Light, W. by N., $2\frac{1}{4}$ miles mag.	12.20 p. m.		65
16	do	802	Half Way Rock, W., $\frac{3}{4}$ mile mag.	2.15 p. m.		68
16	do	803	Half Way Rock, N. by E. $\frac{1}{4}$ E., $2\frac{5}{8}$ miles mag.	3.25 p. m.		67
17	do	804	Cuttyhunk Light, NE. by E., $8\frac{3}{4}$ miles mag.	11.15 a. m.		68
17	do	805	do	11.20 a. m.		68
17	do	806	Cuttyhunk Light, E.NE., $7\frac{3}{4}$ miles mag.	12 m.		69
17	do	807	Cuttyhunk Light, NE. by E. $\frac{3}{4}$ E., $7\frac{3}{4}$ miles mag.	12.50 p. m.		70
17	do	808	Cuttyhunk Light, NE. by E. $\frac{1}{2}$ E., 8 miles mag.	1.20 p. m.		70
17	do	809	Cuttyhunk Light, NE. by E., 12 miles mag.	1.55 p. m.		70
17	do	810	Cuttyhunk Light, NE. by E., $12\frac{1}{2}$ miles mag.	2.15 p. m.		70
17	do	811	Cuttyhunk, NE. by E., $12\frac{1}{2}$ miles mag.	2.20 p. m.		69
18	do	812	Block Island Light, N. NW. $\frac{1}{4}$ W., 20 miles mag.	11.30 a. m.		70
18	do	813	Block Island Light, N.NW. $\frac{1}{4}$ W., 20 miles mag.	11.55 a. m.		70
18	do	814	Block Island Light, N.NW. $\frac{5}{8}$ W., 18 miles mag.	1 p. m.		72
18	do	815	Block Island, NW. by N., 17 miles mag.	2.15 p. m.		72
23	do	816	Brenton's Reef Light-Ship, E. $\frac{3}{4}$ S., $2\frac{3}{4}$ miles mag.	10.25 a. m.		71
23	do	817	Brenton's Reef Light-Ship, E. $\frac{1}{2}$ N., 3 miles mag.	11 a. m.		72

sion steamer Fish Hawk, Lieut. Z. L. Tanner, commanding.

OF 1880.

Temperature of water, intermediate.									
Surface.	5 fathoms.	10 fathoms.	20 fathoms.	Bottom.	Fathoms, depth.	Character of bottom.	Wind.	Drift.	What used.
66.5				62.5	8¼	Sand and shells	NE. 4		Dredge.
66.5				62.5	8¼	do	NE. 3		Trawl.
69.5				67	8	do	NE. 2		Dredge.
69.5				67	8	do	NE. 3		Trawl.
72				69	10½	Sand and mud	N. 2		Dredge.
72				68	12	Gravel, sand, and mud.	Calm		Trawl.
67½				58½	27½	Sand and shells	N. 1		Dredge.
67½				58½	27½	do	N. 1		Trawl.
70				58½	26	do	N. 1		Do.
68				57½	22½	do	SW. 1		Dredge.
69				57½	18	do	SW. 1		Trawl.
69				57	16	Sand	SW. 1		Do.
70				60	16	Sand and shells	N. 1		Dredge.
70				55	17½	Sand	N. 2		Trawl.
71				53½	20	do	NW. 2		Dredge.
71				54½	19½	do	NW. 2		Trawl; trawl caught in wreck; parted rope.
71				53½	19	Mud	NW. 1		Dredge.
71				53½	19	Sand and mud	NW. 1		Trawl.
71				54	18	Sand	NW. 1		Dredge.
71				54	17½	do	NW. 1		Otter trawl.
71				54½	16	do	S. 1		Trawl.
71				60	20	do	S. SW. 2		Dredge.
71				54	18	do	SW. 2		Trawl.
69				63	19	do	SW. 3		Dredge.
69				53	19	do	SW. 4		Trawl.
69				53	19	do	SW. 4		Dredge.
69				53	19	Mud	SW. 4		Trawl.
68½				55	16½	Sand	SW. 3		Dredge.
66				59	12½	Sand and shells	SW. 3		Do.
67				61	13	Black sand	SW. 3		Do.
70				69½	4	Sand	N. 3		Trawl.
71				68	4½	Mud	NE. 1		Do.
70½				62	12½	do	NE. 1		Do.
69				60	20	Sand	S. SE. 2		Dredge.
66				59	11¼	do	SW. 2		Do.
66				59	11¼	do	SW. 2		Do.
67				56	14	do	SW. 2		Trawl.
67				60	12¼	do	SW. 2		Dredge.
67				60	13	do	SW. 2		Do.
67				52	21¼	do	SW. 2		Do.
67				52	21	do	SW. 2	W. NW. ¼ mile	Trawl; came up torn.
67				53	19½	do	SW. 2	SW. ¼ mile	Dredge.
66				46	28½	do	SE. 2	NW. ¼ mile	Do.
67				46	28½	do	SE. 2	SE. ¼ mile	Trawl.
72	71	57	49	46	27½	do	SE. 2	SW. ¼ mile	Do.
72	71	56	49	48	29	do	S. 2	SW. ¼ mile	Chester rake dredge.
69				66	8½	do	S. 2	SE. ¼ mile	Dredge.
68				63	10	do	S. 2	SE. ¼ mile	Do.

Dredging and trawling record of the United States Fish Commission

SEASON

Date.	Thermometer used.	No. of observation.	Locality.	Hour.	Tide.	Air.
1880. Aug. 23	N. Z. 40007 surf.; 42666 bottom.	818	Brenton's Reef Light-Ship, E. ½ N., 3¼ miles mag.	11.20 p. m.	....	72
23	....do	819	South End Hope Isle, SE. by E. ½ E., ½ mile mag.	1 p. m.	....	74
23	N. Z. 42666 surf.; N. Z. 40007 deep.	820	South End Hope Isle, N.NE., ¼ mile mag.	1.40 p. m.	....	76
23	....do	821	South End Hope Isle, N. by E., ½ mile mag.	2.15 p. m.	....	78
23	....do	822	South End Hope Isle, NE. ⅛ mile mag ...	3 p. m.	....	78
24	N. Z. 46400 surf.; N. Z. 40007 deep.	823	N. Light Block Island, W. ½ S., 1½ miles mag.	12.35 p. m.	....	74
24	....do	824	N. Light Block Island, SW. ¼ W., 1 mile mag.	12.50 p. m.	....	74
24	....do	825	N. Light Block Island W.SW. ¾ W., 1¼ miles mag.	1.30 p. m.	....	73
24	....do	826	North Light, Block Island, W. NW. ½ W., 2½ miles mag.	2.40 p. m.	....	73
24	....do	827	North Light, Block Island, W. NW. ½ W., 2½ miles mag.	3.05 p. m.	....	71
25	....do	828	North Light, Block Island, SW. by W. ¾ W., 2½ miles mag.	12.40 p. m	....	70
27	N. Z. 42666 surf.; 40007 deep.	829	Cormorant Rock, NW. by N., ¼ mile mag.	10.45 a. m.	....	63
27	....do	830	West Island, SE. by E. ½ E., ¾ mile mag..	11.15 a. m.	....	64
27	....do	831	North end Gould Island, SW. ¼ W., 350 yards mag.	12.30 p. m.	....	68
27	....do	832	North end Gould Island, W., 150 yards mag.	12.45 p. m.	....	70
27	....do	833	South end Gould Island, W., 100 yards mag.	1 p. m.	....	70
27	....do	834	McCurry's Point, W. SW., ¾ mile mag ..	1.30 p. m.	....	63
27	....do	835	McCurry's Point, N. ¼ E., 1¼ miles mag..	1.50 p. m.	....	68
27	....do	836	Black Point, W. ¼ N., ½ mile mag........	2.25 p. m.	....	66
27	....do	837	Black Point, NW. by W. ½ W., ½ mile mag.	2.45 p. m.	....	69
27	....do	838	Woods' Castle, W. by N., 1 mile mag	3.15 p. m.	....	66
31	....do	839	Dumplings, NW. ½ N., 300 yards mag....	9.50 a. m.	....	67
31	....do	840	Dumplings, N. by W. ½ W., 100 yards mag	10.03 a. m.	....	67
31	....do	841	Goat Isle Light, NE. by E. ¾ E., ⅞ mile mag.	10.45 a. m.	....	68
31	....do	842	Goat Isle Light, E. NE. ½ E., ½ mile mag.	11 a. m.	....	69
31	....do	843	North end Dyer's Island, NE. ½ E., ¾ miles mag.	12 m.	....	69
31	....do	844	North end Dyer's Island, SE. ½ E., ¼ mile mag.	12.30 p. m.	....	70
31	....do	845	Prudence Light, N. ½ W., ¾ mile mag....	1 p. m.	....	70
31	... do	846	Prudence Light, N. by E. ¾ E., 1½ miles mag.	1.35 p. m.	....	70
31	....do	847	Halfway Rock, N. ¼ W., 1 mile mag......	2.15 p. m.	....	70
31	....do	848	Bishop's Rock, E., ½ mile mag	3 p. m.	....	69
Sept. 1	....do	849	Fort Dumpling, W. NW. ½ W., ¼ mile mag.	9.20 a. m.	Ebb	67
1	....do	850	Fort Dumpling, E. NE. ½ E., ½ mile mag..	9.40 a. m.	..do.	67
1	....do	851	Beaver Tail Light, SW. ¼ W., 1¾ miles mag.	10 a. m.	..do	66
1	....do	852	Beaver Tail Light, S. SW. ¾ W., 2⅜ miles mag.	10.35 a. m.	..do	67
1	....do	853	Beaver Tail Light, SW. by S., 2 miles mag.	10.50 a. m.	..do	68
1	....do	854	Beaver Tail Light SW. ¼ S., 1¾ miles mag.	11.10 a. m.	Ebb	69
1	....do	855	Beaver Tail Light SW. by S., 2 miles mag.	11.40 a. m.	Ebb	70
1	....do	856	Beaver Tail Light SW. ½ W., 1⅜ miles mag.	12.05 p. m.	..do	69
1	....do	857	Beaver Tail Light, W.SW. ¾ W., $1\frac{6}{10}$ miles mag.	12 35 p. m.	..do	69
1	....do	858	Beaver Tail Light, W. NW. ¼ W., ⅓ mile mag.	1.05 p. m.	Flood...	69
3	N. Z., 46400 surf.; 40007 deep.	859	Cuttyhunk Light, N. ½ W., 3 miles mag..	11.20 a. m.	....	68
3	....do	860	Cuttyhunk Light, N. ½ W., 3 miles mag..	11.55 a. m.	....	70
3	....do	861	Cuttyhunk Light, N. ¾ W., 3¼ miles mag.	12.20 p. m.	....	69

steamer Fish Hawk, Lieut. Z. L. Tanner, commanding—Continued.

OF 1880.

Temperature of water, intermediate.									
Surface.	5 fathoms.	10 fathoms.	20 fathoms.	Bottom.	Fathoms, depth.	Character of bottom.	Wind.	Drift.	What used.
68	....	......	....	65	9½	Sand	S. 2	SE. ¼ mile	Dredge.
73	....	......	....	70	6	Mud	S. SW. 3.	W. SW. ¼ mile	Trawl; cracked thermometer No. 42666.
72	....	......	....	70	5½	....do	S. SW. 4.	W. by S. ¼ mile	Trawl.
72	....	......	....	70	5	....do	S. SW. 4.	SW. ¼ mile	Do.
71	....	......	....	70	4½	Sand	S. SW. 4.	W. ¼ mile	Do.
65	63	63	....	60	15½	....do	W. 3	NW. ¼ mile	Dredge.
65	63	63	....	67	13	....do	W. 3	NW. ¼ mile	Trawl.
67	61	......	....	60	13	....do	W. SW. 4	NW. ¼ mile	Otter trawl.
67	66	......	....	57	22	Sand	S. 3	S. SW. ¼	Dredge.
67	66	......	....	57	20½	....do	S. 3	....	Blake trawl.
66	....	......	....	60	15	....do	N. NE. 6	E. NE. ½	Dredge.
66	....	......	....	65	9	Gravel	E. 2	S. by E. ¼	Do.
66	....	......	....	65	10½	Sand	E. 2	NE. ½ E. ¼	Do.
71	....	......	....	71	6	Black mud	SE. 1	S. ¼	Do.
71	....	......	....	71	9	....do	SE. 1	S. ¼	Do.
71	....	......	....	71	6½	Sand	SE. 1	S. ¼	Chester rake dredge.
73	....	......	....	71	11	....do	E. 2	N. by E. ¼	Do.
73	....	......	....	71	3½	Shells	SE. 2	N. ¼	Do.
71	....	......	....	71	5	Sand	S. SE. 2	S. SW. ¼	Do.
71	....	......	....	71	5	....do	S. SE. 2	S. by E. ¼	Trawl.
70	....	......	....	68	5½	....do	S. SE. 2	S. by E. ¼	Do.
67	62	65	....	61	27½	Gravel	N. NE. 2	SW. ¼	Dredge.
67	65	65	....	61	20½	....do	N. NE. 2	SW. ½	Do.
67	67	65	....	60	21	....do	E. NE. 2	S. ½	Do.
67	....	......	....	67	8	Sand	E. 2	....	Do.
69	67	......	....	63	14½	....do	E. 2	N. ¼	Trawl.
69	67	......	....	63	11½	....do	E. 2	W. SW. ¼	Do.
69	67	......	....	64	14½	Gravel	NE. 3	....	Do.
68	67	......	....	63	14½	....do	NE. 3	E. NE. ¼	Chester rake dredge.
68	68	......	....	62	12½	Mud	E. 3	N. NE. ¼	Trawl.
68	68	67	....	62	15½	....do	SE. 3	N. ¼	Do.
67	67	66	....	63	20	Sand	Var. 1	SW. ¼	Chester rake dredge.
67	67	66	....	63	14½	Shells	E. 2	S. SW. ¼	Do.
67	66	......	....	66	12½	Sand	SE. 2	S. ¼ m.	Do.
66	....	......	....	66	2½	....do	E. 1	S. ¼ m.	Trawl.
76	....	......	....	67	4½	....do	E. 1	S. ¼ m.	Do.
67	....	......	....	67	6	Sand	SE. 1	S. ¼ mile	Trawl.
68	....	......	....	68	3½	....do	E. 1	S. ¼ mile	Do.
68	....	......	....	67	11	Gravel	E. 2	S. SE. ¼ mile	Chester rake dredge.
63	....	66.5	....	66	19	Sand	SE. 2	SE. ¼ mile	Do.
63	....	66.5	....	66	14	Shells	SE. 2	E. ¼ mile	Do.
66	65	......	....	63	17½	Sand	SW. 2	W. ¼ mile	Do.
66	65	......	....	64	17½	Mud	SW. 2	W. ¼ mile	Do.
66	65	65	....	61	17	Sand	SW. 2	S. ¼ mile	Trawl.

Dredging and trawling record of the United States Fish Commission

SEASON

Date.	Thermometer used.	No. of observation.	Locality.	Hour.	Tide.	Air.
1880. Sept. 3	N. Z., 46400 surf.; 40007 deep.	862	Cuttyhunk Light, N., 4 miles mag	12.55 p. m.	....	68
3	....do	863	Cuttyhunk Light, N. ⅛ E., 3¾ miles mag..	1.40 p. m.	Flood...	70
3	....do	864	Gay Head Light, S. SW. ⅞ W., 5 6/10 miles mag.	3.00 p. m.	Flood...	70
4	N. Z., 46400 surf.; 46401 deep.	865	Lat. 40° 05′ N., long. 70° 23′ W	5.40 a. m.	....	71
4	....do	866	Lat. 40° 05′ 18″ N., long. 70° 22′ 18″ W....	6.30 a. m.	....	73
4	....do	867	Lat. 40° 05′ 42″ N., long. 70° 22′ 6″ W	7.04 a. m.	....	75
4	....do	868	Lat. 40° 01′ 42″ N., long. 70° 22′ 30″ W...	8.23 a. m.	....	75
4	....do	869	Lat. 40° 02′ 18″ N., long. 70° 23′ 06″ W...	9.27 a. m.	....	80
4	....do	870	Lat. 40° 02′ 36″ N., long. 70° 22′ 58″ W ..	10.50 a. m.	....	80
4	....do	871	Lat. 40° 02′ 54″ N., long. 70° 23′ 40″ W ...	11.40 a. m.	....	84
4	....do	872	Lat. 40° 05′ 39″ N., long. 70° 23′ 52″ W ...	12.45 p. m.	....	81
13	N. Z., 46404 surf.; 46400 deep.	873	Lat. 40° 02′ N., long. 70° 57′ W...........	5.36 a.m.	....	68
13	....do	874	Lat. 40° N., long. 70° 57′ W	6.26 a.m.	....	70
18	....do	875	Lat. 39° 57′ N., long. 70° 57′ 30″ W.......	7.51 a. m.	....	70
13	....do	876	Lat. 39° 57′ N., long. 70° 56′ W...........	8.45 a. m.	....	68
13	....do	877	Lat. 39° 56′ N., long. 70° 54′ 18″ W.......	9.40 a. m.	....	71
13	....do	878	Lat. 39° 55′ N., long. 70° 54′ 15″ W.......	11.00 a. m.	....	72
13	....do	879	Lat. 39° 49′ 30″ N., long. 70° 54′ W	1.20 p. m.	....	73
13	....do	880	Lat. 39° 48′ 30″ N., long. 70° 54′ W	3.12 p. m.	....	74
13	....do	881	Lat. 39° 46′ 30″ N., long. 70° 54′ W.......	5.00 p. m.	....	70
17	....do	882	Halfway Rock, N. NE. ½ E., 2⅜ miles mag	10.56 a. m.	....	68
17	....do	883	Halfway Rock, NE. by N., 2¼ miles mag	11.35 a. m.	....	70
17	....do	884	Hope Island, NE. ½ E., 20 yards mag	2.10 p. m.	....	72
17	....do	885	Gould Island, N. by E. ¾ E., ⅜ mile mag ..	3.15 p. m.	....	71
21	....do	886	South Light, Block Island, N. ¾ E., 5¾ miles mag.	12.46 p. m.	....	67
21	....do	887	South Light, Block Island, N. ½ W., 5¾ miles mag.	1.30 p. m.	....	67
21	....do	888	South Light, Block Island, N. by E., 6 miles.	2.00 p. m.	....	68
21	....do	889	South Light, Block Island, W. ¼ S., 5 miles mag.	3.50 p. m.	....	68
21	....do	890	South Light, Block Island, W. ¼ S., 4¾ miles mag.	4.15 p. m.	....	68
Oct. 2	N. Z. 46403 surf.; 46404 deep.	891	Lat. 39° 46′ N., long. 71° 10′ W...........	6.00 a. m.	....	60
2	....do	892	Lat. 39° 46′ N., long. 71° 05′ W	8.46 a. m.	....	64
2	N. Z. 46403 surf.; Mil.-Casel. deep	893	Lat. 39° 52′ 20″ N., long. 70° 58′ W	11.23 a. m.	....	63
2	....do	894	Lat. 39° 53′ N., long. 70° 58′ 30″ W	1.10 p. m.	....	63
2	....do	895	Lat. 39° 56′ 30″ N., long. 70° 59′ 45″ W....	3.17 p. m.	....	62
Nov. 16	46405 surf.; 46403 deep.	896	Lat. 37° 26′ N., long. 74° 19′ W...........	9.20 a. m.	....	52
16	....do	897	Lat. 37° 25″ N., long. 74° 18′ W...........	10.10 a. m.	....	62
16	....do	898	Lat. 37° 24′ N., long. 74° 17′ W...........	11.25 a. m.	....	60
16	....do	899	Lat. 37° 22′ N., long. 74° 29′ W	1.55 p. m.	....	58
16	....do	900	Lat. 37° 19′ N., long. 74° 41′ W	4.00 p. m.	....	55
16	....do	901	Lat. 37° 10′ N., long. 75° 08′ W	7.15 p. m.	....	53
Dec. 9	N. Z. 46405 surf.; 46402 deep.	902	Point Lookout, SE. by E., 3¼ miles	9.55 a. m.	....	30
9	....do	903	....do..............................	10.05 a. m.	....	30
9	....do	904	....do..............................	10.08 a. m.	....	30
9	....do	905	....do..............................	10.15 a. m.	....	30
9	....do	906	....do..............................	10.33 a. m.	....	32
9	....do	907	....do..............................	10.40 a. m.	....	23
9	....do	908	....do..............................	10.55 a. m.	....	36
9	....do	909	....do..............................	11.07 a. m.	....	34
Dec. 9	....do	910	....do..............................	11.20 a. m.	....	34
9	....do	911	....do..............................	11.44 a. m.	....	34
9	....do	912	....do..............................	11.54 a. m.	....	34
9	....do	913	....do..............................	11.08 p. m.	....	36
9	....do	914	....do..............................	12.23 p. m.	....	38
9	....do	915	....do..............................	12.38 p. m.	....	38
9	....do	916	....do..............................	12.47 p. m.	....	38

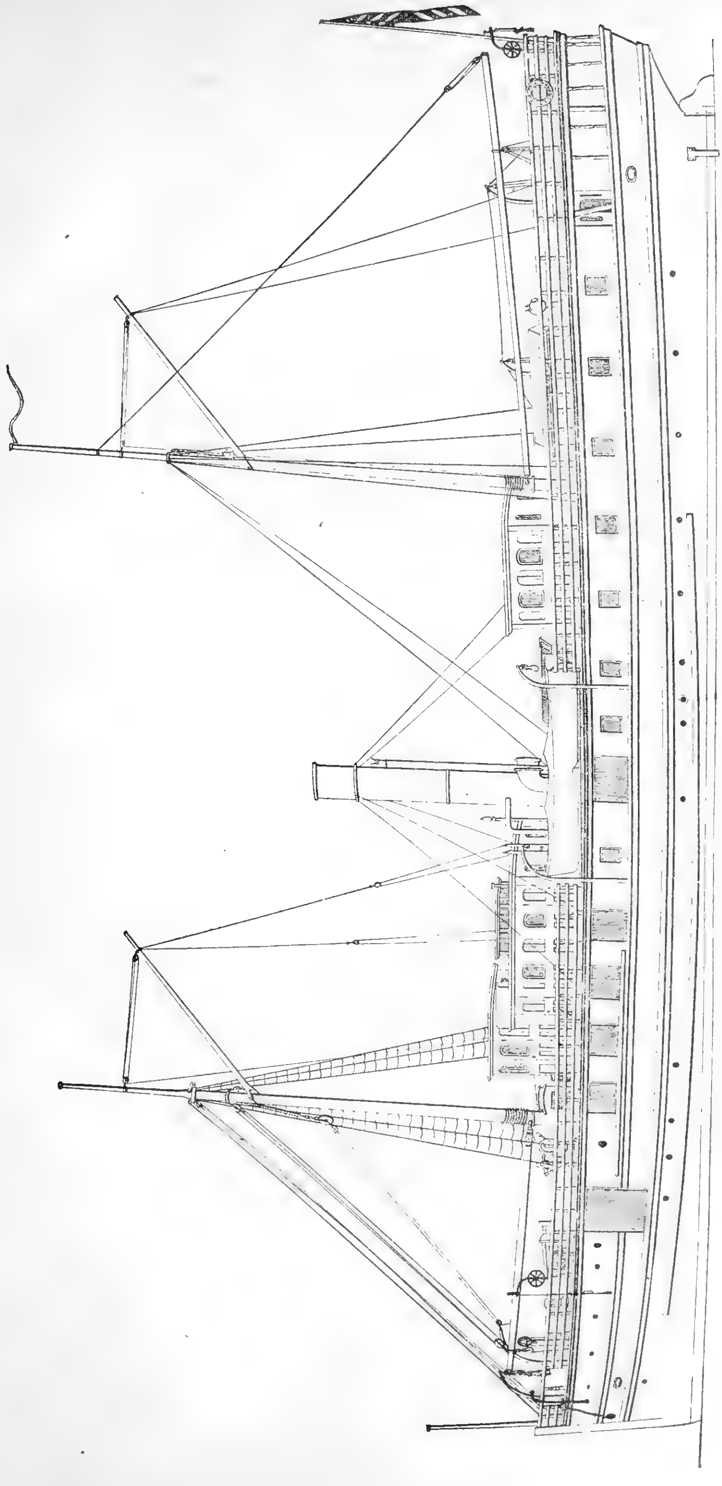
steamer Fish Hawk, Lieut. Z. L. Tanner, commanding—Continued.

OF 1880.

Temperature of water, intermediate. Surface.	5 fathoms.	10 fathoms.	20 fathoms.	Bottom.	Fathoms, depth.	Character of bottom.	Wind.	Drift.	What used.
66	65	......	....	64	17	Sand	SW. 2...	S. ¼ mile	Trawl.
67	65	65	....	65	18	Mud	SW. 2...	S. ¼ mile	Chester rake dredge.
67	66	......	....	65	13	Sand	SW. 2...	S. ¼ mile	Dredge.
73	75	......	....	68	65	Sand	Var. 2...	E. NE. ¾ mile..	Trawl.
73	74. 5	......	....	68. 5	65	....do	Var. 1...	NE. by E. ½ mile.	Do.
73	75	......	....	53	64	....do	Calm ...	E. SE. ¾ mile ..	Chester rake dredge.
75	75	......	....	47	162	....do	Calm ...	NW. ¾ mile ...	Trawl.
76	75	......	....	50	192	....do	Calm ...	N. NE. ¾ mile .	Do.
77	75	......	....	......	155	....do	Calm ...	W. by N. 1 mile	Do.
76. 5	75	75	....	49	115	....do	Calm ...	N. NW. ¾ mile.	Do.
77	75	......	....	50. 5	86	....do	S. 1	NW. by N. ½ mile.	Do.
69. 5	70	70	....	51	100	Mud	SW. 3...	NW. by N. ½ mile.	Do.
70	70	70	64	51	85	....do	SW. 2...	NW. ½ mile ...	Do.
70	71	70	69	53	126	....do	SW. 2...	NE. ½ mile	Do.
70	71	70	69	53	120	....do	SW. 2...	N. ¾ mile	Do.
71	70	70	66	57	126	....do	SW. 2...	N. NW. ¾ mile.	Do.
71	70	70	55	52	142½	....do	SW. 2 ..	NW. ¾ mile ...	Do.
71. 5	71	71	70	42	225	....do	SW. 3...	N. by W. ¾ mile	Do.
71. 5	74	72	....	43	252½	....do	SW. 3...	W. by N. ¾ mile	Do.
71	71	71. 5	....	42	325	....do	SW. 3...	W. NW. ⅓ mile	Do.
65	....	......	....	67	12½	Mud	SW. 2...	SW. ¼ mile	Trawl.
65	....	......	....	63. 5	13	....do	SW. 2...	SW. ½ mile	Do.
65	....	......	....	63. 5	5	....do	SW. 3...	SW. ¼ mile	Chester rake dredge
69	64	......	....	65	16	....do	SW. 2: .	S. ¼ mile	Otter trawl.
64	62	......	....	62	19	Shells	W. 2	N. ¼ mile	Dredge.
64	62	......	....	62	19	....do	W. 2	W. ¾ mile	Trawl.
64	62	......	....	62	19	....do	W. 3	W. 1½ miles ...	Do.
64	62	......	....	61. 5	11	Rocky	W. 3	W. SW. ½ mile	Dredge.
64	62	......	....	61. 5	11	....do	W. 3	W. SW. ½ mile	Do.
67	....	......	....	......	310	Mud	NE. 3 ...	N. ½ mile	Trawl; sounding wire broke at 310 fathoms.
65	....	......	....	......	487	Mud; small stones.	NE. 3 ...	N. NE. 2 miles	Trawl; lost lead and thermometer at surface of water.
64	....	......	....	40	372	....do	NE. 3 ...	N. 1 mile	Trawl.
64	....	......	....	40	365	Sand	NE. 3 ...	N. 2 miles	Do.
65	....	......	....	42	238	Mud	NE. 3 ...	N. 1½ miles	Do.
62	....	......	....	55	56	Sand and shells.	NW. 2 ..	W. NW. ½ mile	Do.
62	....	......	....	48	157½	Mud	SW. 2...	W. 1 mile	Do.
62	....	......	....	44	300	....do	SW. 2...	W. 1 mile	Do.
61	....	......	....	54	57½	Sand	SW. 2...	SW. ¼ mile	Do.
59	....	......	....	56	31	....do	SW. 2...	W. ½ mile	Do.
60	....	......	....	......	18	....do	SW. 2...	W. ½ mile	Do.
50	....	......	....	40	3	Oyster bank	NW. 2 ..	NW. ¼ mile ...	Oyster dredge.
50	....	......	....	40	4	....do	NW. 3 ..	NW. ¼ mile ...	Do.
45	....	......	....	40	4	....do	NW. 3 ..	N. ¼ mile	Do.
45	....	......	....	40	3½	....do	NW. 3 ..	N. NW. ½ mile	Do.
45	....	......	....	39	3¼	....do	NW. 3 ..	N. NW. ⅓ mile.	Do.
45	....	......	....	39	3	....do	NW. 3 ..	N. NW. ½ mile.	Do.
45	....	......	....	39½	3	Oyster rock	NW. 2 ..	NW. ¼ mile ...	Do.
45	....	......	....	40	3	....do	NW. 2 ..	W. ½ mile	Do.
....	45	......	....	39	3	....do	NW. 2 ..	NW. ⅓ mile	Do.
....	45	......	....	40	3	....do	NW. 1	N. NW. ⅓ mile.	Do.
....	45	......	....	40	3	....do	NW. 2	N. ⅓ mile	Do.
....	45	......	....	40	3	....do	NW. 2	N. NW. ⅜ mile.	Do.
....	45	......	....	40	3	....do	NW. 2	N. NW. ⅓ mile.	Do.
....	45	......	....	40	3	....do	NW. 2	N. NW. ¼ mile.	Do.
....	45	......	....	40	3	....do	NW. 2	N. NW. ⅓ mile.	Do.

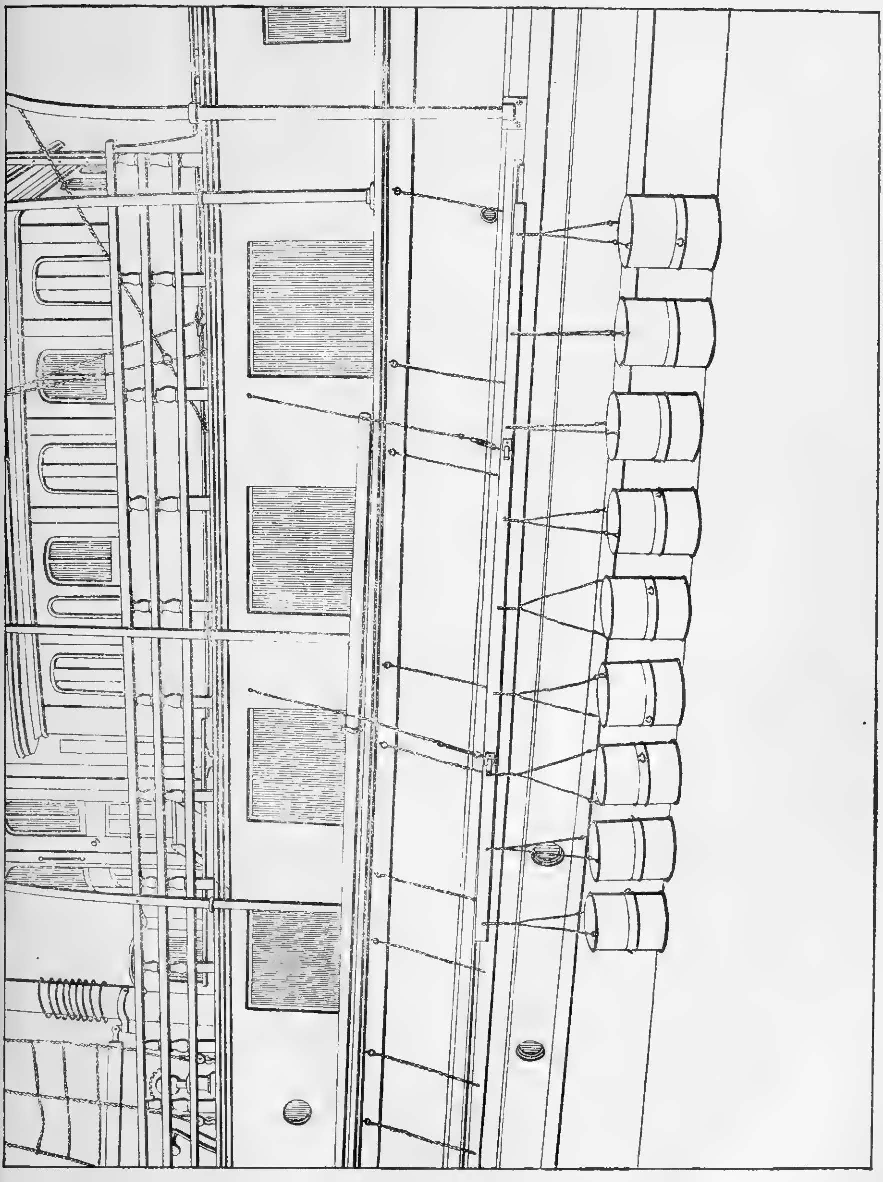
LIST OF PLATES.

INDEX.

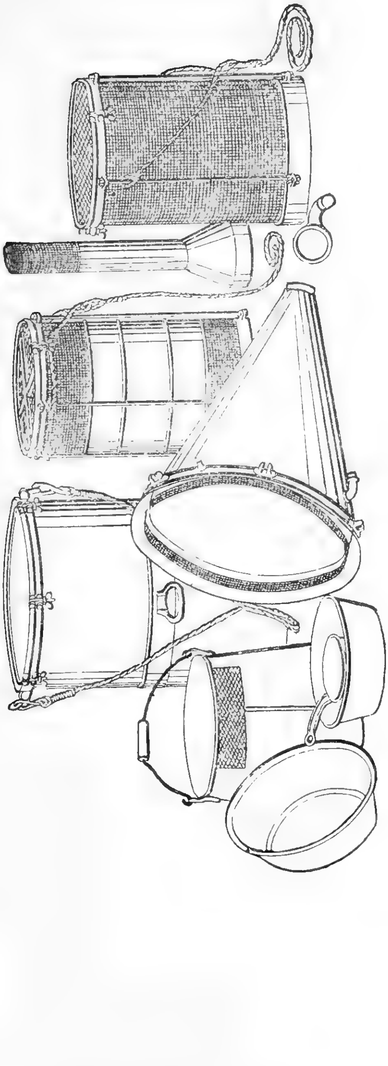


United States Fish Commission steamer Fish Hawk.

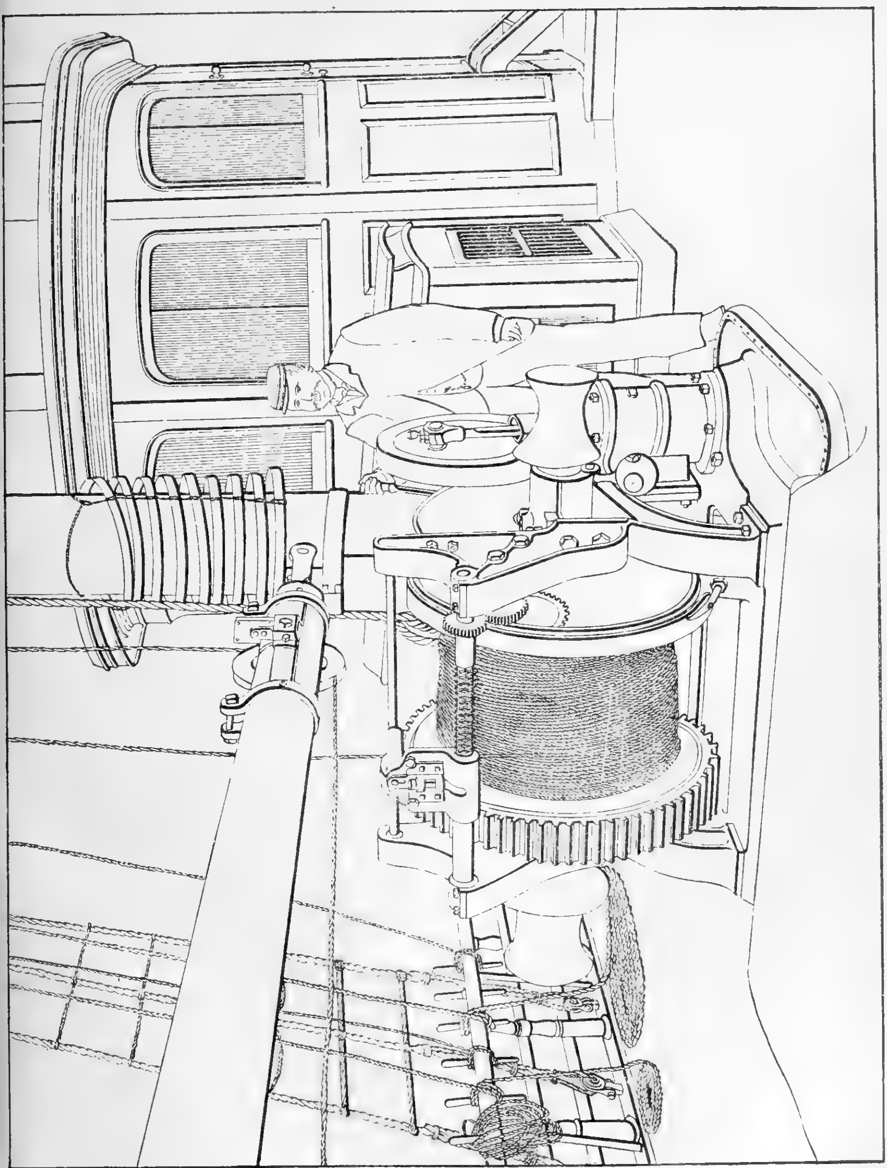
Port side of main deck, showing portion of hatching machinery.



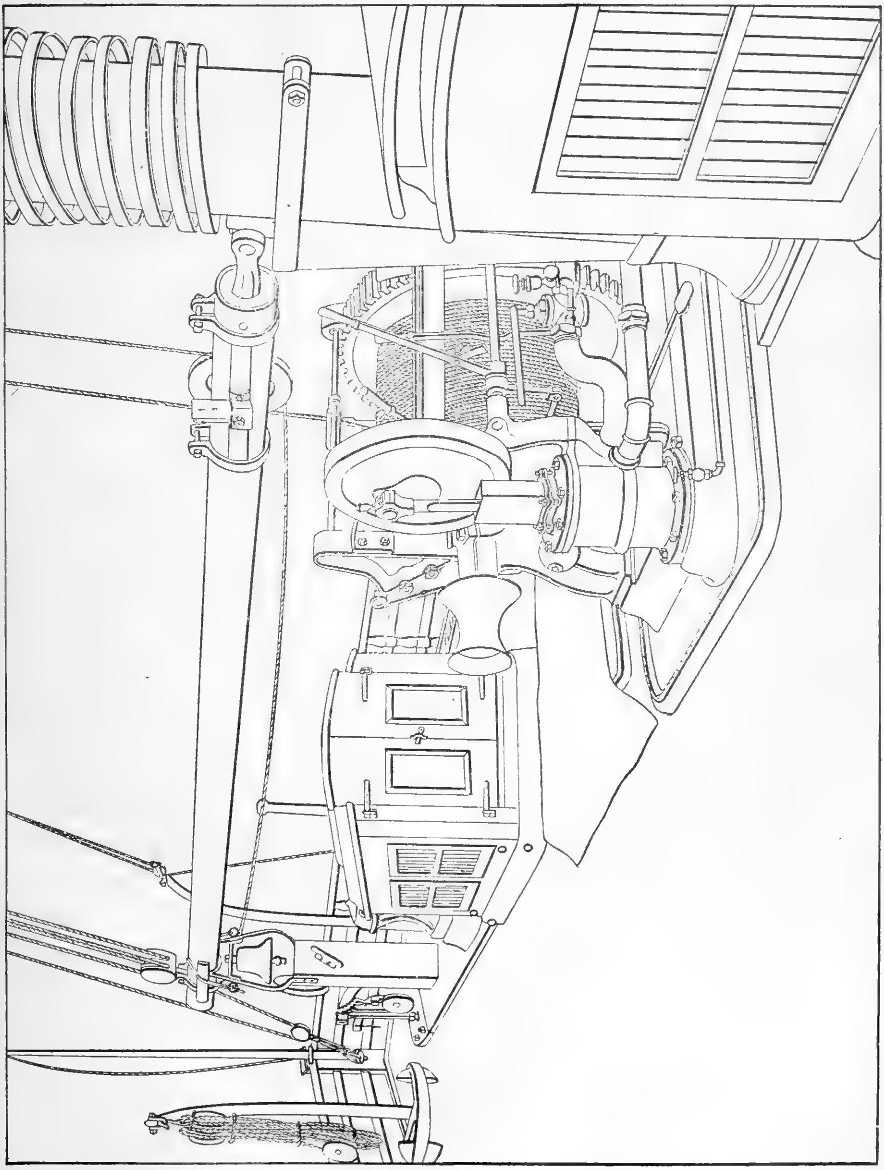
Hatching cylinders, port side.



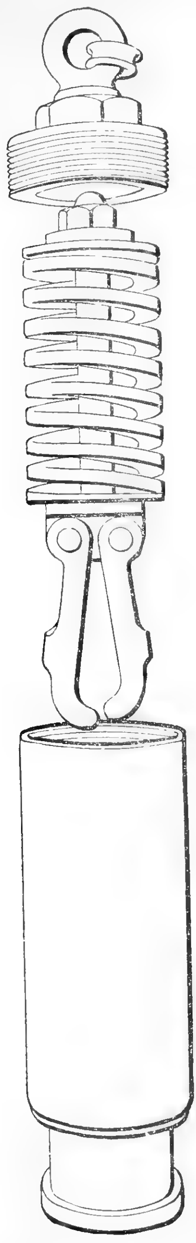
One hatching cone, 3 hatching cylinders, 1 syphon funnel, 2 spawn pans, 1 spawn pail, 1 spawn dipper.



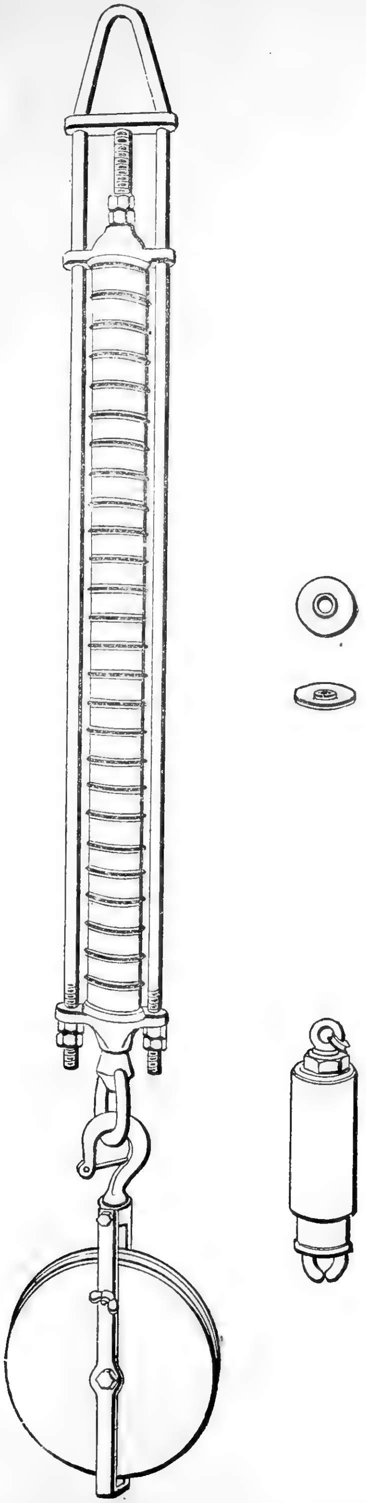
Hoisting and reeling engine from forward looking aft.



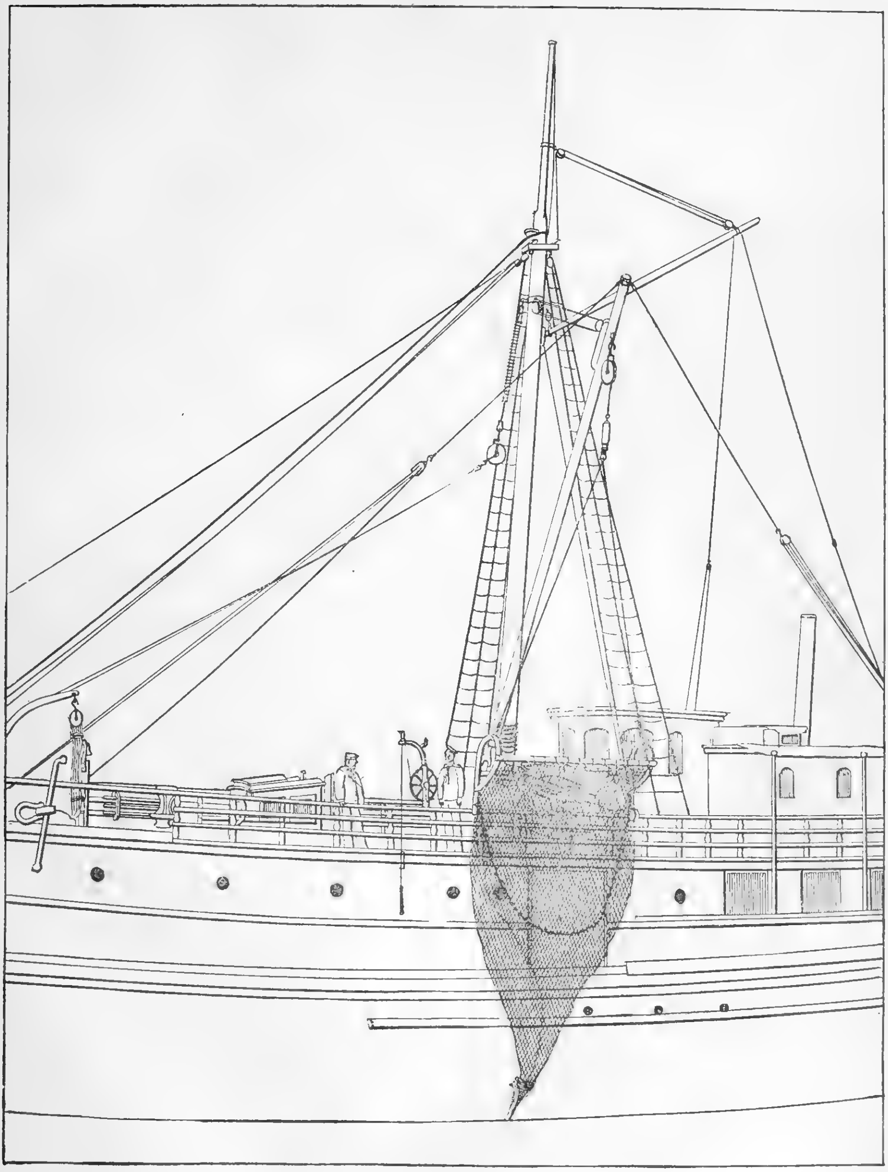
Hoisting and reeling engine from aft looking forward.



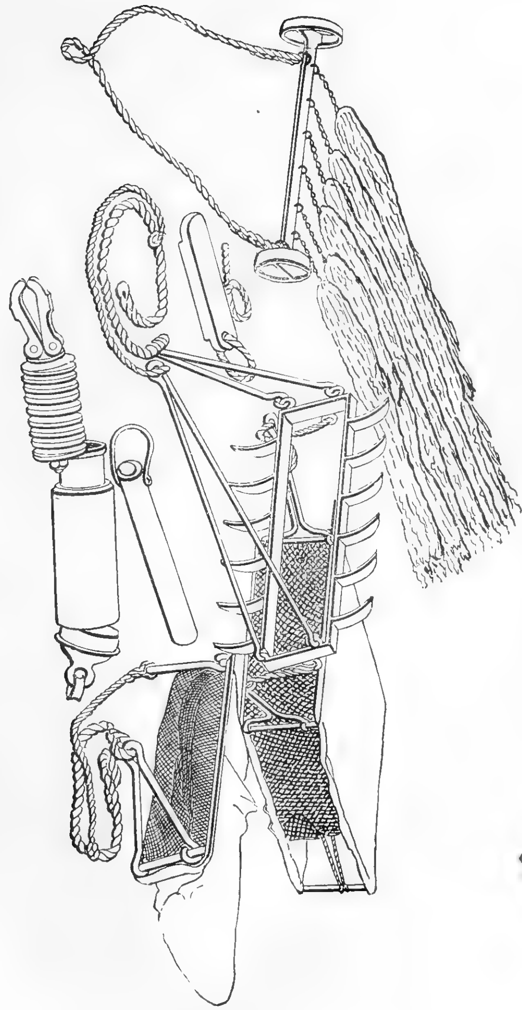
Safety hooks, showing spring.



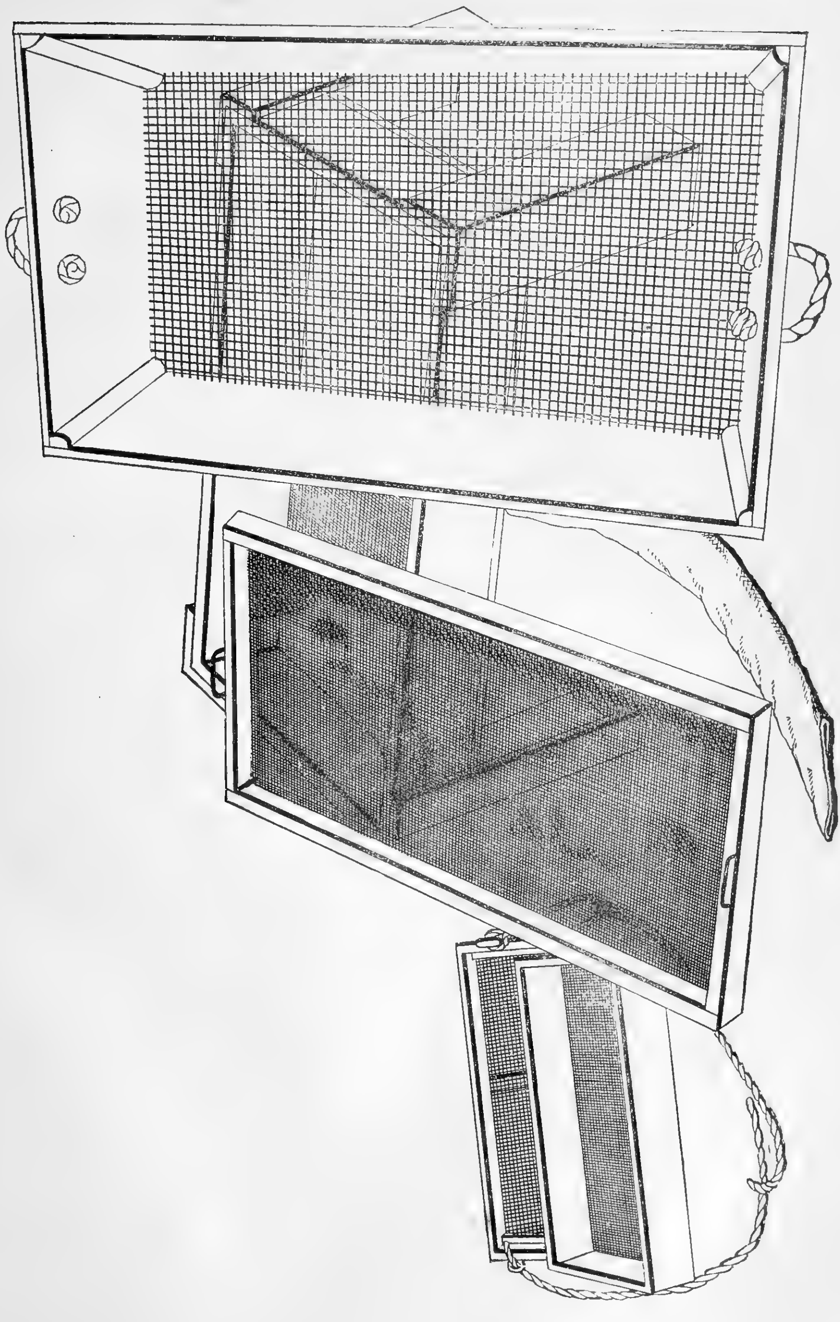
Accumulator, with dredging block hooked; safety hook; brass washer.



The beam trawl ready for lowering.

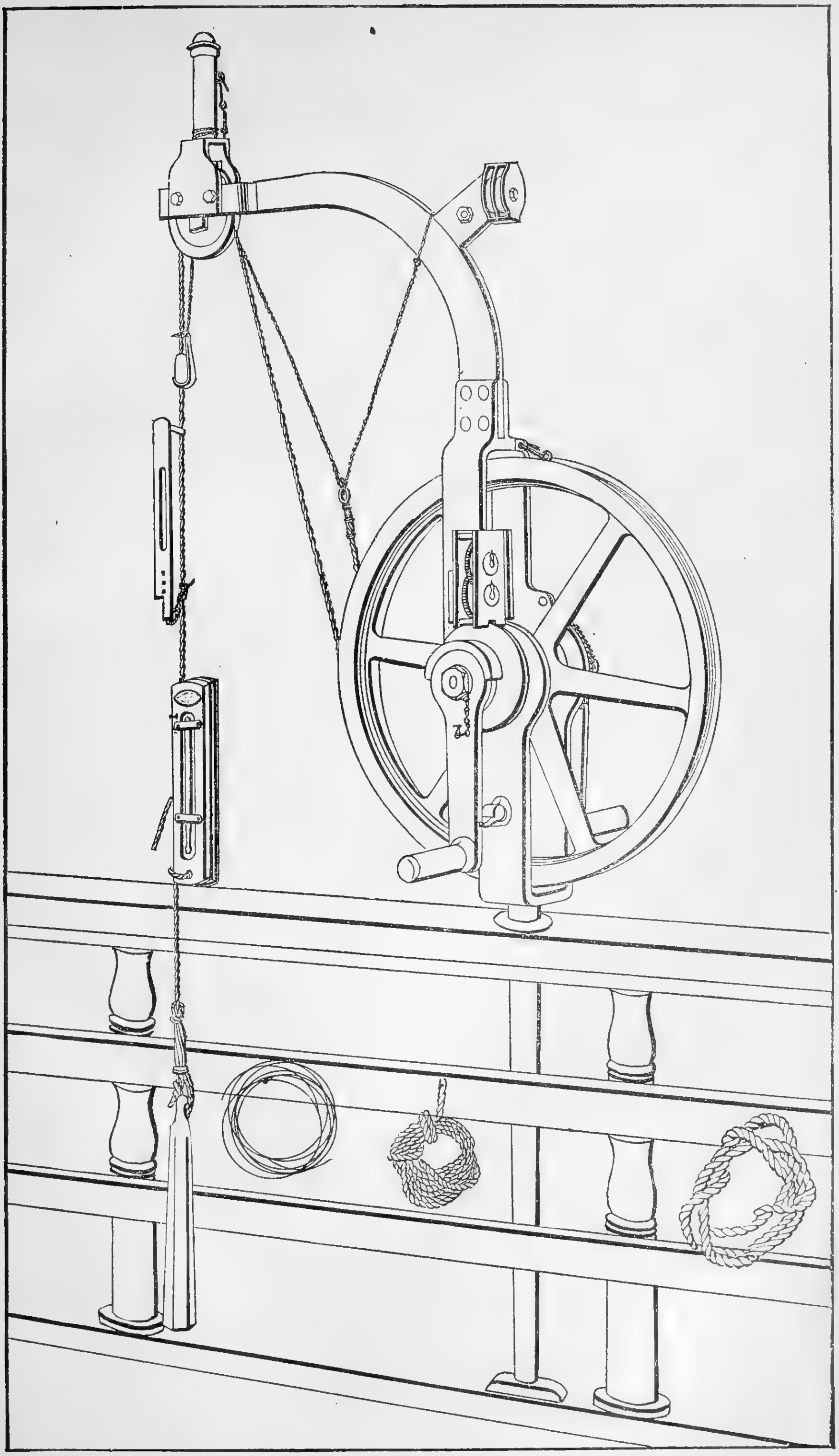


Dredge safety hook, water bottle, dredge weight, and tangles, Chester rake dredge.

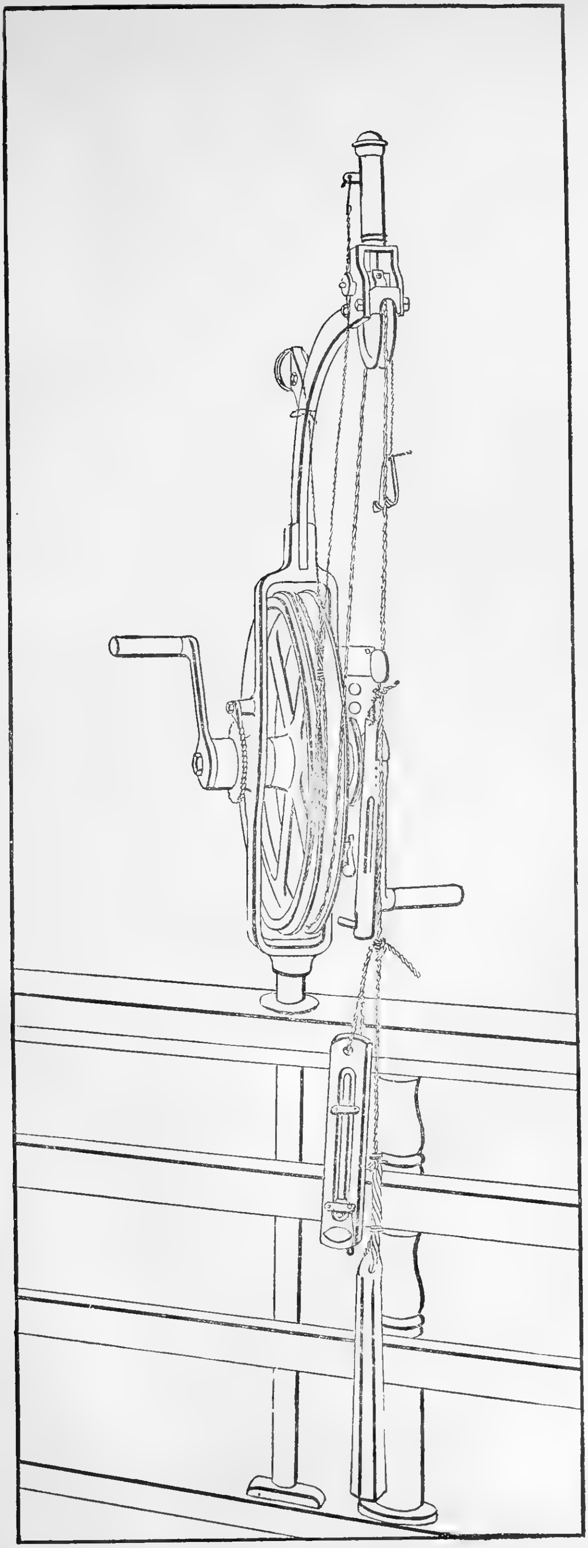


The table sieve and cradle sieve, hopper and tray exposed.

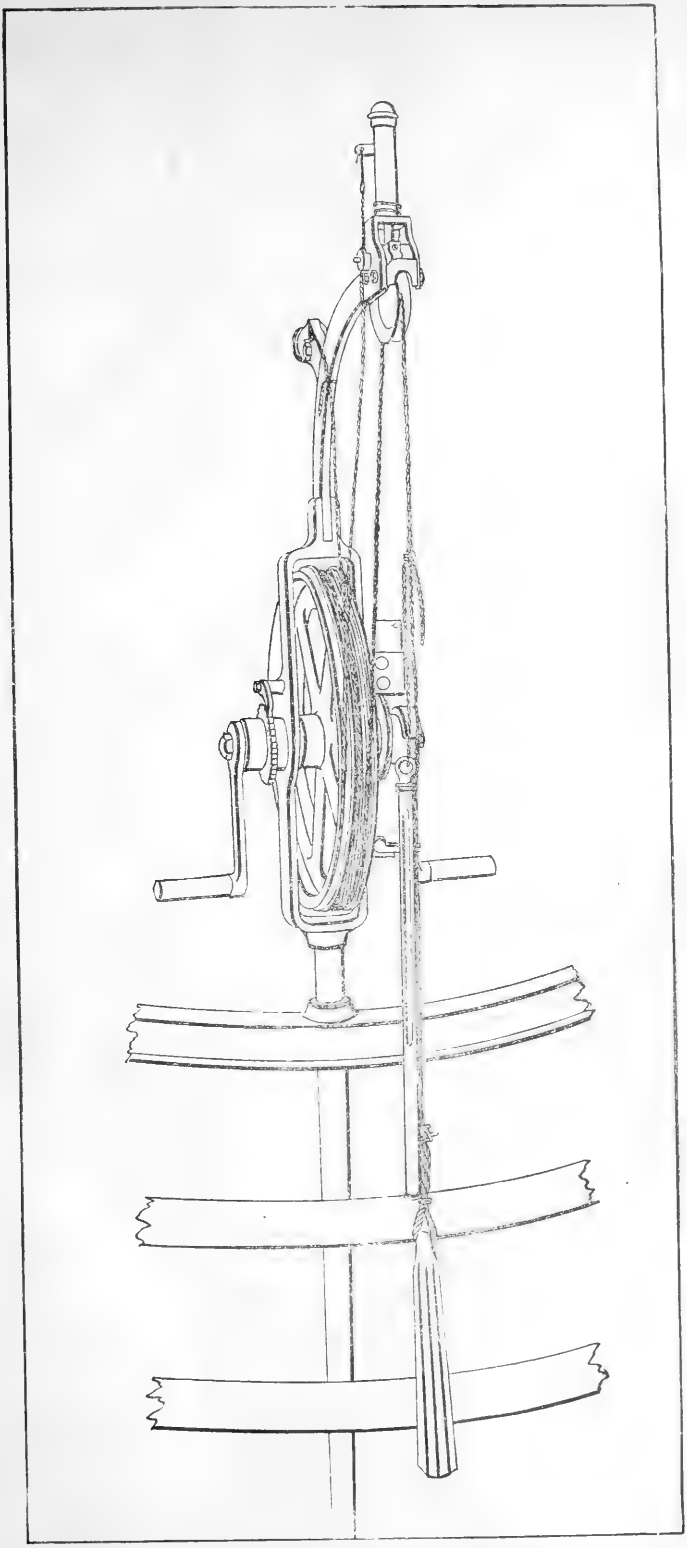
Main deck, starboard side, table sieve, swinging table, and collecting apparatus.



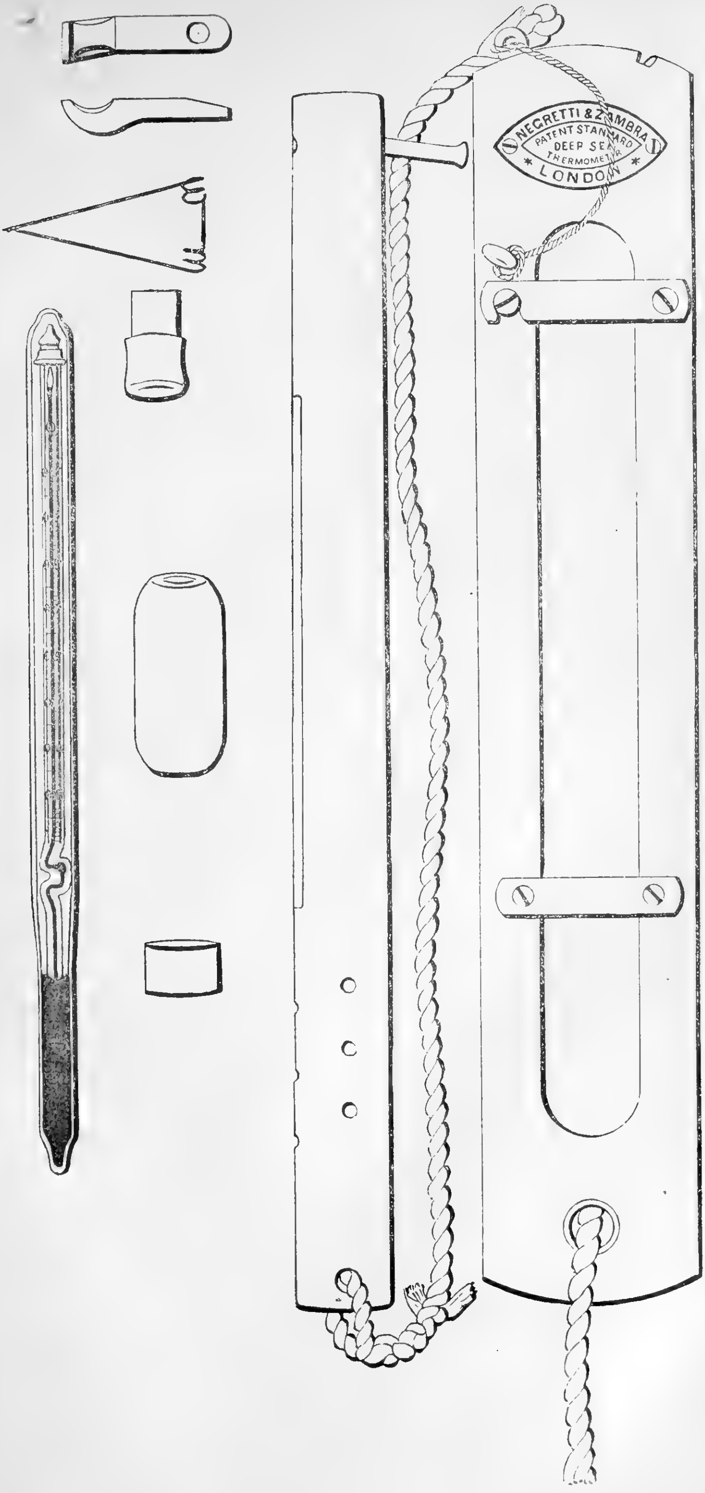
Sounding machine, with Negretti and Zambra deep-sea thermometer descending.



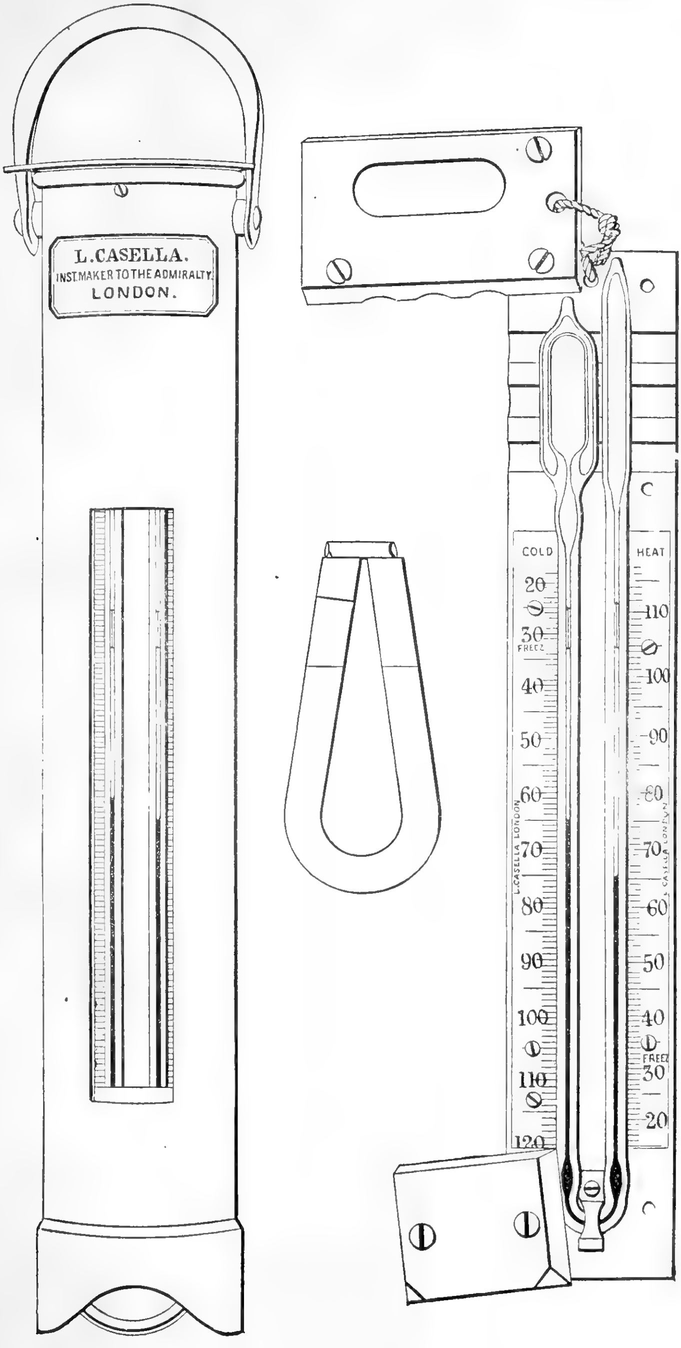
Sounding machine, with Negretti and Zambra deep-sea thermometer ascending.



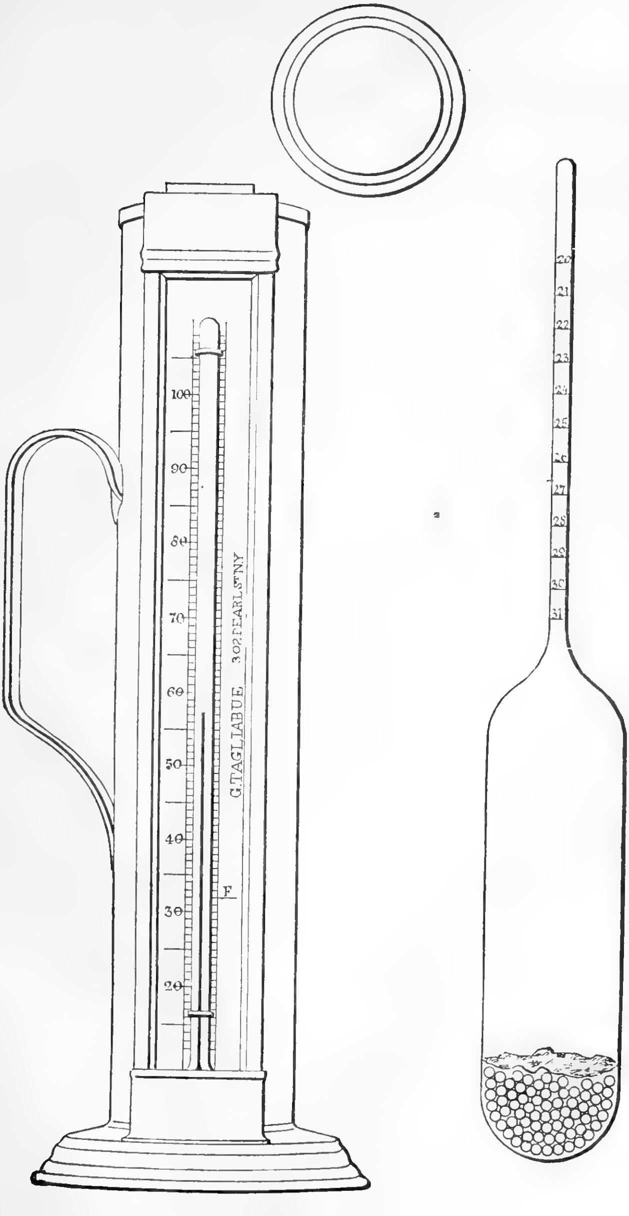
Sounding machine, with Bassnett's patent atmospheric lead.



The Negretti and Zambra deep-sea thermometer, with wooden frame and metal case.



The Miller-Casella deep-sea thermometer in and out of case.



Hilgard's ocean salinometer.

II.—A REPORT OF THE WORK OF THE UNITED STATES FISH COMMISSION STEAMER FISH HAWK, FOR THE YEAR ENDING DECEMBER 31, 1881.

BY LIEUTENANT Z. L. TANNER, U. S. N., *Commanding.*

At the close of my last report, December 31, 1880, the vessel was at the United States navy-yard, Norfolk, Va., where she remained until February 26. The work of painting and refitting was completed about the middle of January, and a series of experiments with the hatching machinery carried on during the months of January and February.

It was considered desirable to introduce air with the feed-water on its entrance to the hatching cones for the purpose of economizing water, and, in order to mix the two sufficiently to prevent violent ebullition by the rapid ascent and explosion of large air bubbles at the surface, we experimented with numerous forms of simple aerators, succeeding finally, as far as practicable, without first reducing the feed-water to a spray.

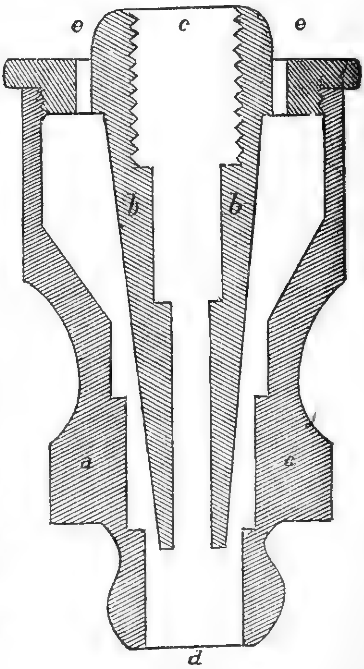


FIG. 1.

Fig. 1 is a vertical sectional view of the aerator (full size). *a a* is the outer case into which *b b* is screwed; *c*, the feed-pipe connection; *d*, the nozzle over which the upper end of the flexible feed-pipe is attached; *e e*, air-holes.

Fig. 2 is an end view, *b b* is the nozzle to which the feed-pipe is attached; *c*, feed-pipe connection; *e e e e e e e e*, air-holes.

The feed-water entering at *c* and the air at *e e* meet and find their way into the bases of the hatching cones partially mixed, that is, the feed-water is impregnated with numerous small air-bubbles.

Experiments were instituted also with a view of adapting the cones to cod-fish hatching.

Shad eggs, for which the hatching apparatus on board this vessel was designed, sink rapidly and require a constant upward current to prevent matting or settling at the bottom in a solid mass. Cod-fish eggs, on the contrary, float upon the surface of sea-water, continued submersion resulting in the destruction of the embryos from asphyxia.

It was necessary, therefore, to devise some means by which the requisite change of water could be effected without establishing a constant current in either direction. Since the specific gravity of cod eggs is very near that of sea water, they take the direction of its slightest movement. Admitting water at the bases of the cones as in shad hatching would soon result in packing them around the perforated plates. Were the order reversed, by introducing water at the top and discharging at the base the downward current would soon send them all to the bottom. To surmount these difficulties, if possible, the following series of experiments was inaugurated:

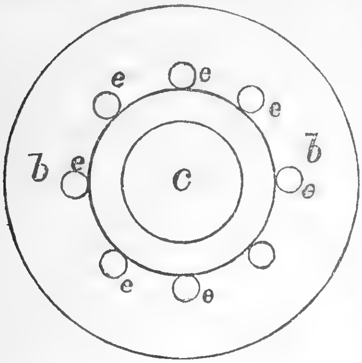


FIG. 2.

A cylindrical tank was hung on gimbals, occupying the place of one cone in a set of four. The long leg of a siphon was secured to the bottom of the tank, the upper end reaching the maximum water level required in the cones. The lower end of the short leg, which was five inches long, reached the minimum water level. The goose necks at the bases of the cones were so modified as to have two feed-pipe connections; the lower end of the main feed remained attached to the goose neck, as usual; the upper end, instead of connecting with the distributing pipe, was attached to the bottom of the siphon tank. The second or auxiliary feed-pipe was substituted for the main feed, being attached to the cone by the second connection above mentioned.

Water being pumped into the distributing tanks filled the pipes and, by opening the auxiliary feed valves, a current was admitted to the base of the cones which in due time filled them to the maximum level desired, when the siphon became submerged and commenced to act. The area of its discharge being about three times that of the combined auxiliary feeds, the water level in the cones steadily fell until it reached the height of the short leg of the siphon, when, its action ceasing, it rose again to its maximum level, producing a constant rise and fall of five inches every fifteen minutes.

The short leg of the siphon was at first cut square, but we found its action uncertain, as it was liable to suck air and water for an indefinite time, instead of breaking promptly when the water level reached its minimum. This defect was remedied by cutting the end of the short leg at an angle of about 60°.

We succeeded in establishing a steady and reliable ebb and flow in the cones by the use of this very simple and inexpensive device which, working automatically, required no extra attention. For the purpose of observation, we kept a set of cones in operation several days, closely watching the circulation and found that the surface water remained practically unchanged, the circulation taking place in the lower portion of the cones.

To obviate this defect the auxiliary feed-pipes were removed from the base of the cones and laid in the space outside of the perforated plates in such a manner as to give the surface water a slightly circular motion, and a feed-pipe was attached to the siphon tank, thus giving a feed at both top and bottom.

We labored under the disadvantage of having no eggs with which to experiment, but we knew their specific gravity and utilized such substitutes as small pieces of beeswax about the size of cod eggs, bread dust, &c., which served at least to demonstrate what effect the various movements would exert on minute floating bodies.

The experiment of admitting feed water at both ends of the cones resulted in a complete change of water, but was not otherwise satisfactory, as the circular motion imparted by the surface feed caused a movement of the particles representing eggs towards the center, and, the bottom feed being converted into a discharge while the siphon was in operation, a miniature whirlpool developed sufficient strength to draw the eggs to the bottom and thence through the discharge pipe to the tank where they were taken up by the siphon and carried to the general discharge.

Numerous experiments were tried with varying success until, finally, the following arrangement was adopted as most nearly producing the required movement:

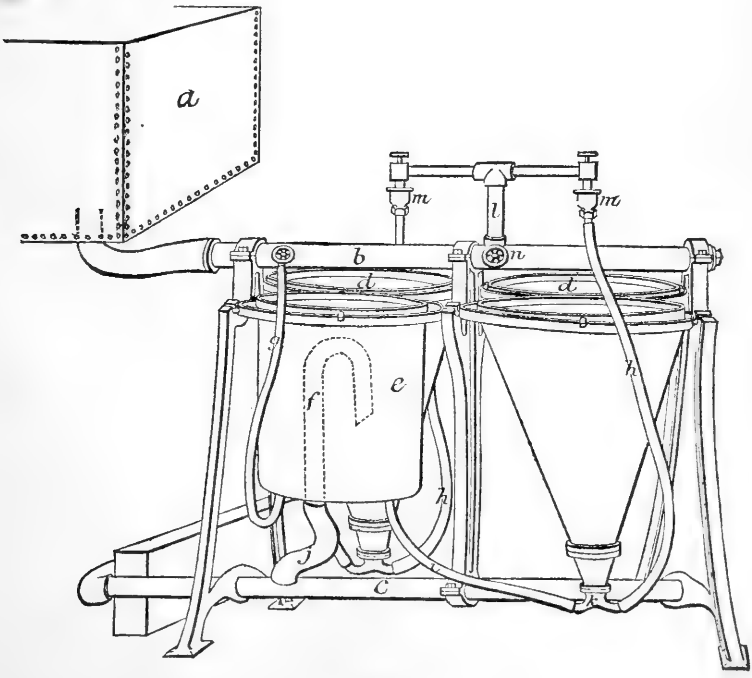


FIG. 3.

Fig. 3 represents the nest of three hatching cones and siphon tank; *a* is the distributing tank; *b*, the general feed pipe; *c*, the general discharge pipe; *d d d*, cones; *e*, siphon tank; *f*, siphon; *g*, feed pipe; *h h*, auxiliary feed-pipes; *i*, discharge pipe; *j*, siphon discharge; *k*, goose neck; *l*, auxiliary feed connection; *m m*, aerators; *n*, feed valve.

The feed-pipe *g* remained attached to the siphon tank *e*, to be used in case it was required. The auxiliary feed-pipes *h h* were again attached to the bases of the cones, and aerators, *m m*, attached to their upper ends. The water being at low level and the feed turned on, a series of air bubbles followed each other in rapid succession to the surface, causing a general movement of the water, and periodical change at the surface as well as in the lower part of the cones. There being no surface feed during the action of the siphon *f*, and the auxiliary feed *h h* taking the direction of the discharge *i*, the water then became placid, the particles representing eggs spread over the surface, where they remained until the siphon ceasing to operate; air-impregnated feed-water again entered the cones, renewing the upward current, causing a general movement in which the surface of the eggs would be cleansed, to a certain extent, of fungus growth and other minute foreign substances liable to adhere during the process of hatching.

While the above experiments were in progress preparations were made for the reception of a quantity of impregnated eggs to be sent from Wood's Holl with which to test our apparatus practically, but, owing to the unusual severity of the weather, they failed to procure them at that station.

Arrangements were then made with a fishing schooner to deliver the entire proceeds of a trip at Hampton Roads, and, to provide for the live fish, we made two large cars, capable of receiving several hundred, intending to anchor them in some convenient locality where pure salt-water could be found.

The water at Norfolk, being impregnated with that from the Dismal Swamp region, was not suitable for our purposes. We examined numerous localities, finally selecting a sheltered spot inside the bar of Hampton Creek, near the boat-houses belonging to Fortress Monroe.

The commanding officer of that post placed one of the above-mentioned boat-houses at our disposal, and expressed a desire to render us any assistance in his power.

Captain Gillis, quartermaster, to whom the Commission is indebted for many favors, assisted us materially in our search, giving us the benefit of his local knowledge, also tendering his services whenever we could make them available.

Our arrangements being complete, we awaited the arrival of the fisherman, but inclement weather prevented the fulfillment of his contract until the season was too far advanced for our purposes.

The Fish Hawk left Norfolk on February 26 for Washington, arriving on the 28th, when preparations were made for the hatching season.

As many of the crew as could be spared were set to work on the barges overhauling machinery, painting, &c.

Everything being in readiness, we left Washington on the 23d of March and arrived at Norfolk the following day, bound for Avoca, Albemarle Sound, where we were to commence the season's work of shad-hatching. A few tons of coal and other stores were taken in during the day. On the afternoon of the 25th we left the navy-yard, and steaming to the lock gates made fast for the night. The following morning the wind was strong from the northeast, giving more than an average depth of water in the canal. We passed the locks soon after daylight, and worked our way along about three miles, and finally grounded on a shoal spot and remained till high-tide, then made another mile. Starting again at high-tide in the morning, we reached North Landing and moored to the wharf for the night.

At daylight on the morning of the 28th we left the wharf and reached North West River, when the vessel grounded again. The light-house steamer Tulip came to our assistance, taking a tow-line ahead, and in this manner we finally reached the vicinity of Bell Island, where the vessel stuck fast and remained during the night. Her draught was 7 feet, and there being but 6 feet 6 inches in the channel, we found it necessary to lighten her. Work was commenced at daylight on the 29th, and everything movable placed in lighters, sent for the purpose by General O. E. Babcock, of the Light-House Department, and at 2.30 p. m., with the assistance of the Tulip, we passed the shoals and anchored in North River, where the stores, &c., were taken on board from the lighters, which were towed to that place by the light-house tender Bramble. We took on board a ton and a half of coal also, which was kindly furnished by General Babcock.

At 5.30 a. m., March 30, got under way and steamed to Salmon Creek, Avoca, Bertie County, North Carolina, and anchored near the steamboat landing.

I called at once upon Dr. Capehart, who informed me that no ripe shad had been taken yet, owing to cold weather and low temperature of the water.

Preparations for hatching were soon completed, and spawn-takers attended every haul of the seine at the two fisheries owned by Dr. Capehart, Sutton Beach, and Scotch Hall. The schooner E. G. Pickup arrived on the morning of April 8 with 40 tons of coal which we had contracted for in Norfolk.

Westerly winds prevailed from the 1st to the 8th, causing very low water in the sound, which prevented our getting up the creek to Capehart's wharf, where the vessel was to be stationed. Fresh easterly winds sprung up on the morning of the latter date, however, and we crossed the bar without much trouble, mooring in a snug berth about 40 yards below the wharf.

As soon as the vessel was moored, the schooner was taken alongside and the coal transferred during the 9th.

The first shad eggs were taken on the 12th, 66,000 being procured from both fisheries. They were not in good condition, many being unripe and the milt hard; but they were put into the cones, more to test the apparatus than from any expectation of satisfactory results.

Eggs were taken on the 13th, 14th, and 15th; total number, including those of the 12th, 283,000. No ripe fish were found during the 16th, 17th, and 18th. A fair proportion of the eggs taken were impregnated, and the development, although slow, was apparently normal, except the eyes, which were very small, barely visible to the naked eye.

The embryos from eggs taken on the 12th died on the 19th, either before or immediately after leaving the shell. The temperature of the water ranged between 50° and 58°, much too low for successful hatching. Eggs were taken again on the 19th and every day after that until the 30th. Those taken from the 13th to the 15th died on the 22d and 23d under similar conditions to those of the 12th. The range of temperature was from 50° to 64°.

From the 23d to the 30th, the water varied from 57° to 71° in the hatching cones; and although the frequent changes operated against us, a fair proportion of eggs were hatched. Five hundred thousand herring eggs were taken on the 25th, of which about 200,000 hatched on the 30th and were deposited in the sound. Great quantities of the latter fish were taken at the fisheries, but no ripe females were found except those mentioned above.

Our work ceased at Avoca on the 30th of April, and preparations were made for immediate departure. The eggs on board were transferred to the North Carolina Commission, the young fish deposited in the sound, boats taken on board, and ship unmoored ready for an early start.

The results of the season's work at Avoca are briefly as follows:

Shad eggs taken	5,727,000
Herring eggs taken	500,000
Total eggs taken	6,227,000
Shad hatched	1,328,000
Herring hatched	200,000
Total	1,528,000

Shad eggs transferred to North Carolina Commission, 3,029,500.

The shad eggs were procured from 196 females, 189 males being used for impregnation. The average number of eggs from each female was 30,300.

The arrangement of pipes and valves is such that water can be pumped back into the distributing tanks from the waste-pipe using it over and over as often as desired. In order to ascertain the practicability of transporting eggs and young fish under the above conditions, we retained half a million eggs and commenced the experiment at 6 p. m., April 30. The temperature rose to 68° during the night and to 71° at 10 a. m., May 1, the water smelling badly and a large portion of the eggs dying. The cones were thoroughly cleaned, dead eggs removed, and the experiment continued.

At 5 p. m. but few survived, and 330,000 dead ones were thrown overboard. The remainder were found dead and thrown overboard at daylight the following morning.

At 5 a. m. on May 1 we got under way and steamed down Albemarle Sound, through Croatan Sound, Roanoke Marshes, and down Pamlico Sound, to Hatteras Inlet, where, at 7.20 p. m., we anchored for the night. At 4.45 a. m. on May 2 got under way, with a pilot on board, and proceeded to sea by way of Hatteras Inlet. The swell on the bar was so heavy that the pilot refused to take the vessel out, whereupon he was discharged and the ship proceeded to sea without one. At 8 a. m. passed Hatteras Light, Bodie's Island Light at meridian, and at 3.50 p. m. Currituck. At 8.10 p. m. passed Cape Henry, and at 11.35 Wolf Trap. At midnight a thick fog and mist prevailed. At 10.10 p. m. on May 3 we anchored in Annapolis Roads. At 4.45 a. m. on May 4 got under way, and at 10.10 a. m. arrived at Havre de Grace. At 11.40 made fast to the coal wharf, and the crew were employed during the remainder of the day in coaling ship. At 10 a. m. on the 5th instant, having finished coaling, we proceeded to our station off Bull Mountain, mouth of North East River, where we anchored in 15 feet of water.

The fisheries along the shore were visited, and preparations made for hatching work. During the evening 182,000 shad eggs were taken. On May 6 the wind was light and variable, and the weather rainy during the night, clearing after daylight. Four hundred and sixty-two thousand shad eggs were taken during the day. On May 7 every haul of the seines at the various fishing shores was attended and gill boats visited during the evening, but no eggs were taken. No ripe fish were found in the seines, and those taken by gillers were penetrated and stripped by eels. On the 8th 506,000 eggs were taken, and on the 9th 1,660,000.

No payment had been made thus far for the privilege of taking eggs. On the 9th instant a fisherman called on behalf of the gillers, and stated that, at an informal meeting, they had decided to furnish the Commission with eggs, whether paid for it or not, but, as they were put to some inconvenience and extra labor thereby, they requested him to see if I could not procure them the usual compensation of twenty-five cents for each spawning fish.

Tickets having been received from the Commission, they were issued from the 10th instant.

On the 10th the breeze was moderate to brisk from the southward and westward, making quite a heavy swell in the channel; 341,000 eggs were procured during the day. On the 11th 913,000 were taken, and on the 12th 979,000; 664,000 young fish were deposited in the river near the ship on the latter date. On the 13th 265,000 eggs were taken and 1,660,000 young fish deposited in the North East River and at the mouth of the Susquehanna.

On the 14th 348,000 eggs were taken and 830,000 young fish deposited in the river near the ship. During the evening of the 15th there was a fresh breeze from the southward and westward. A large number of eggs were procured, but owing to the heavy swell many were spilled out of the pans and pails in the boats, leaving 357,000 as the result of the evening's work; 598,000 young fish were deposited near the ship. On the 16th 357,000 eggs were received and 979,000 young fish deposited near the vessel. On the 17th 424,000 eggs were taken, and on the 18th, 257,000. On the latter date 498,000 young fish were deposited. The weather was overcast and cloudy, raining during the afternoon and evening, the wind blowing fresh from northeast, changing to west during the evening. The water was rough, making it difficult to attend the gill-boats. At 3.30 p. m. the Herreshoff steam launch, No. 62, borrowed from the Navy, arrived from Brooklyn in charge of Mr. Robert West.

On the 19th the weather was overcast and rainy; moderate breeze from southeast; 423,000 eggs were received, and 1,660,000 young shad deposited near the ship. On the 20th the weather was overcast and rainy, partially clearing during the day; moderate breeze from east-southeast to northeast. Large numbers of fish were taken at the beaches, but most of them were unripe and were recognized as "the May run"; 781,000 eggs were taken during the day. On the 21st the weather was cloudy, latter part rainy, with thunder and lightning, light variable breezes; 1,792,000 eggs were taken during the day. The seines in this vicinity have all cut out except two.

The following seine fisheries are located in North East River, and have been visited by our spawn-takers during the season, viz:

Carpenter's Point, west side, P. K. Barnes.

Carrot Cove, east side, Russell & Sempers.

Bull Mountain, east side, J. C. Caruthers.

Gridiron Beach, east side, W. J. Wilson.

Gilder's Hole, east side, J. Fletcher Wilson.

Beaver Dam, James Roney.

The two last were not regularly visited.

On the 22d of May 291,000 eggs were taken. Large numbers of people visited the ship, many of whom had traveled long distances for the purpose. On the 23d 650,000 eggs were taken and 325,000 young fish deposited in the river near the ship. A considerable number of young fry, hatched on the 11th from eggs taken on the 7th, were retained in a cone for the purpose of ascertaining how long they could be kept alive after absorption of the yolk bag, which disappeared from the naked eye on the 15th instant. On the 16th the fish which had hitherto remained on the surface went down from four to six inches or more, where they appeared to be feeding upon the minute particles collected on the surface of the cone. On the 23d they were still thriving, but few dead ones having been seen. It was an undoubted fact that they were feeding and developing normally. On the 24th 463,000 eggs were received and 313,000 young fish deposited in the river near the ship.

On the 25th 781,000 eggs were taken and 275,000 young fish deposited. The young shad before mentioned, fourteen days old, were doing well, no dead fish being noticed. The last seine in this region cut out on this date. On the 26th 1,062,000 eggs were taken and 406,000 young fish deposited. One of the young shad, fifteen days old, was examined under a microscope to-day. Minute crustacea were found in its stomach.

On the 27th 625,000 eggs were taken and 1,250,000 young fish deposited near the ship. A ripe rock, the first of the season, was taken to-day, but no milt could be procured to impregnate the eggs. On the 28th 675,000 shad eggs were taken and 500,000 young shad deposited. Mr. Capehart and his son, Dr. R. W. Capehart, owners of two great fisheries in Albemarle Sound, visited the ship and inspected the hatching operations.

On the 29th 369,000 shad eggs were received. The small number of eggs taken may be attributed to the lateness of the tide. Shad are taken in gill-nets at or near slack-water in this locality, and when this occurs at sundown or an hour or two later many fish are taken in the act of spawning. It should not be inferred from this that all spawning takes place at that time, but it is an undoubted fact that we take a large proportion of our eggs between the hours mentioned.

On the 30th 50,000 eggs were taken and 375,000 young fish deposited near the ship, and at 3 p. m., May 31, we got under way and delivered a shipment of 1,250,000 young fry at Havre de Grace. We then steamed down the channel and anchored near Locust Point, Spesutie Island. A furious squall of wind and rain with thunder and lightning swept down the river from 7 to 11 p. m., two inches of rain falling in the mean time.

The gill-boats along the west shore were visited and 106,000 eggs procured; 625,000 young fry were deposited in North East River. There was a slight freshet in the river on June 1st, which made the water very muddy; 187,000 eggs were taken and 500,000 young fish transferred to Battery Station for shipment; 38,000 eggs were taken on the 2d, 312,500 young fish transferred to Battery Station, and 625,500 deposited near the ship.

The young fish of May 11, twenty-two days old, remaining in the cone, were sent to Washington. They were well developed and in fine condition.

On the 3d of June 50,000 eggs were taken and 125,000 fry transferred to Battery Station.

The estimate of eggs taken during the season has been on the basis of 25,000 to the dipper of $7\frac{1}{4}$ gills. By actual count, four fluid ounces (one gill) of impregnated shad eggs were found to contain 3,600, that is, 900 per fluid ounce or 26,100 per dipper. A deduction of 1,100 was made for water, &c. The above measurements were made with an ordinary apothecary's graduate, used in the medical department.

All necessary preparations having been made for leaving the Susquehanna, we transferred 300,000 shad eggs to Battery Station, and directed the Herreshoff launch, No. 62, to report to the officer in command for temporary duty.

At 9.25 a. m., June 5, we left the river for Baltimore, arriving at 2.55 p. m. On the following morning the vessel was hauled out on W. Skinner & Son's marine railway, her bottom examined, copper cleaned and repaired, propellers painted, and outboard connections examined. The work was completed during the day, and on the following morning the vessel was put into the water, and at 10.35 a. m. left for Washington, where we arrived at 1.40 p. m. on the 8th.

On the 10th coaled ship, and on the 13th received a special outfit designed for hatching Spanish mackerel. As this work was to be carried on in salt water, all metallic surfaces were nickel plated in order to reduce galvanic action to the minimum. At 4.15 a. m., June 14, we left the navy-yard and steamed down the Potomac, arriving off Saint Jerome's Creek at 3.30 p. m., where we were directed to examine the channel improvements and report what progress had been made. Having made the required examination, we steamed off-shore two or three miles and swung ship, with port helm, under steam, observing azimuths on each point for compass error. When the circle was completed with the port helm, we ran into Cornfield Harbor and anchored for the night.

Launch No. 62 arrived from Havre de Grace at 6 a. m. on the 15th and reported for duty. At 6.15 a. m. we got under way, swung ship with starboard helm and, as soon as the observations for compass error were finished, started for Cherrystone Inlet, the launch in company, arriving at 2.30 p. m.

The pound nets were visited the following morning, but no ripe fish were found, and the fishermen reported that they had seen none during the season.

We met with better success, however, on the 17th, when 700,000 Spanish mackerel eggs were taken and placed in hatching cones with siphon attachment. A small number were placed in a marbleized pan, the water being changed every three hours. About 30 per cent. of the eggs hatched in from thirty to forty hours after impregnation, the temperature of the water ranging from 76° to 80° F. The fry were not in good condition and were all dead within a few hours.

No eggs were procured on the 18th and 19th. On the 20th, however, we succeeded in getting 240,000, a portion of which were placed in an ordinary hatching cone and treated as shad eggs, the remainder being distributed among the various forms of cylinders. They commenced hatching twenty-four hours after impregnation, but the fry were not strong and many of them died.

We deposited 120,000 fry in Cherrystone Inlet on the 22d and on the 23d procured 300,000 eggs, which were placed in the various hatching apparatus on board. The temperature fell suddenly nearly ten degrees, which retarded the development, the first young fry appearing thirty-nine hours after impregnation. About 60 per cent. of the eggs hatched and the fry were in much better condition than any of the previous lots.

Three hundred thousand eggs were procured on the 25th and placed in cones and cylinders. About 75 per cent. hatched, but those in the cones soon died.

We were unable to account for the loss of fry hatched in cones and the survival of those in the cylinders, unless we attributed it to galvanic action. The cones above mentioned were copper, nickel plated, and after a few hours' service in salt water the entire submerged surface was covered with a dark deposit which we thought was sulphate of nickel, to which was attributed the great mortality among the fry hatched in the cones.

Among the cylinders used was one of block-tin, in which the largest proportion of eggs were hatched, and the fry seemed to be in better condition. In this vessel we had a light whitish deposit which we called sulphate of antimony, but it did not seem to have an injurious effect on the eggs or fry.

One hundred thousand young fish were deposited on the 26th, 50,000 on the 27th, and 100,000 transferred to the Lookout on the 28th for experimental purposes.

Mr. Marshall McDonald, of the United States Fish Commission, arrived on the latter date to continue the experimental work, the Fish Hawk being required for other service. Such articles as he required were landed, launch No. 62 turned over to him, and at meridian on the 29th we left for Washington. We had at this time about 5,000 young fish which I had placed in a glass aquarium soon after they were hatched, where they had remained ninety-six hours without change of water. Very few died in the meanwhile, and those that were alive were strong and vigorous. There were about ten thousand in a hatching cylinder, and they were placed in a glass jar for transportation. They were in good condition until about 3 p. m., when we encountered a furious squall in Chesapeake Bay, with very heavy thunder and incessant lightning. From that time they showed signs of distress, and before morning were nearly all dead.

We anchored for the night at Lower Cedar Point, and arrived at the Washington navy-yard at 9.50 a. m., June 30. Active preparations were made for the summer's cruise; hatching apparatus was landed and the dredging outfit taken on board.

The last of the young fish in the aquarium died on the 1st of July, having been one hundred and forty-four hours without change of water.

At 2.10 p. m., July 7, we left the navy-yard for Wood's Holl, Mass., passing Cape Henry at 8.40 a. m. on the following day. A fresh northerly wind was encountered, and on the 9th a moderate northeast gale with mist, rain, and thick fog at times, the weather clearing during the latter part. We passed Montauk at 1.15 a. m. and arrived at Wood's Holl at 8.10 p. m. on the 10th. On the morning of the 11th we went to Bristol, where we left the steam cutter for repairs, returning on the following day.

At 7.28 p. m., July 15, we left Wood's Holl, with the naturalists on board, for an off-shore trip. Speed was reduced between Gay Head and No Man's Land to allow surface towing.

At 4.10 a. m. on the 16th we cast the trawl in 44 fathoms, latitude 40° 22′ north, longitude 70° 42′ west. Ten casts were made during the day between the above position and latitude 39° 55′ north, longitude 70° 47′ west, in from 44 to 229 fathoms. There was some delay in preparing for the first cast, but with that exception everything worked smoothly and the results of the day's work were very satisfactory. We started for port at 6.30 p. m., arriving at 6.15 the following morning.

The naturalists were employed in the laboratory during the 18th and and 19th preserving specimens, and on the 20th we made eight hauls of the dredge and trawl in the sound between Gay Head and Vineyard Haven.

The naturalists were engaged in the laboratory until the 23d and unfavorable weather detained us in port till the 29th, when we went to New Bedford for coal, returning the following day. We were again detained by unfavorable weather till 5.40 p. m. on the 3d of August, when we left for another off-shore trip. There was a thick fog during the night, but it cleared towards morning, and at 8.14 we cast the trawl in 782 fathoms, latitude 39° 45′ north, longitude 69° 44′ 45″ west. The trawl came up foul and several fathoms of the dredge-rope were badly kinked. Seven hauls were made during the day in from 782 to 95 fathoms, between the above position and latitude 40° 01′ north, longitude 69° 56′ west. We started for port at 8.30 p. m., and arrived at 8.30 a. m. the following morning.

The naturalists were employed in the laboratory on the 6th and 7th. At 5 p. m. on the 8th we left for an off-shore trip. A dense fog prevailed during the night, with moderate breezes from northwest to southwest, the weather clearing towards morning.

At 6.15 a. m. we set the trawl-line for tile-fish in 138 fathoms, latitude 40° 01′ north, longitude 71° 12′ 30″ west.

A ship's boat was reported adrift about 9.30 a. m., which proved to be the wreck of a mackerel seine boat having on one quarter the name G. M. Hopkins, and on the other, Hingham, Mass.

At 11.30 a. m. picked up our boat and found that they had taken 157 pounds of tile-fish, the largest specimen weighing 29 pounds; several whiting, and large numbers of hake, skate, &c., were taken. Six hauls of the trawl and dredge were made during the day in from 138 to 319 fathoms between the position given above and latitude 39° 53′ 30″ north, and longitude 71° 13′ 30″ west. We started for port at 5.30 p. m., arriving at 6.10 a. m. the following morning. There was a fresh breeze during the night, with a moderate beam sea, which caused the vessel to roll heavily at times.

The naturalists were employed in the laboratory during the 11th and 12th. One cast of the trawl was taken in Buzzard's Bay on the 13th. We were detained in port by unfavorable weather until 4 p. m. on the 22d, when we left for an off-shore trip. At 4.15 a. m. the following morning, we set a trawl-line with 900 hooks in 100 fathoms, latitude 40° 03′ north, longitude 70° 31′ west, and took 540 pounds of tile-fish, the largest weighing 32 pounds. Large numbers of skate, hake, and whiting were taken also. Many interesting specimens were taken during the day by fine towing nets, so attached to each end of the trawl-beam as to act from the time it was lowered from the ship's side till it left the water. So far as I know, this ingenious contrivance was never used before and the results were most satisfactory

Six casts of the trawl and dredge were made in from 71 to 724 fathoms between the position given above and latitude 39° 52′ 30″ north, longitude 70° 17′ 30″ west. It is doubtful whether the trawl reached the bottom in the latter depth, but several interesting specimens were found in the net, probably caught on the way down or up. We started for port at 6.50 p. m. and arrived at 7.25 the following morning.

The naturalists were engaged in the laboratory on the 25th, and on the 26th we made a re-examination of various localities in Buzzard's Bay.

We were detained in port by unfavorable weather until the 29th, when, the weather clearing, we left for the fishing banks off Chatham. Finding a thick fog hanging over the shoals, we anchored at Hyannis for the night. The weather clearing, we got under way at 4.25 a. m., and at 7.50 cast the trawl in 10 fathoms, Chatham Lights bearing northwest ½ west, distant 5 miles. Twenty-one casts of the trawl and dredge were made during the day, and at 4.30 p. m. we started for port, arriving at 10.55 p. m.

On the following day, August 31, we went to New Bedford for coal, returning September 2. We were detained by gales and fog until the 7th. A peculiar atmospheric condition worthy of note was observed on the 6th instant. The weather was overcast, with a brisk breeze from southwest, moderating during the morning, when a thick fog set in, lasting until afternoon when it rose, and, combined with smoke, darkened the atmosphere to almost a twilight. The light was peculiarly yellow, and gave to the foliage an intensified color; ordinary oil lamps had the color and general appearance of electric lights. The sky remained overcast after dark, but became clearer and objects resumed their natural colors.

At 8.45 a. m., September 7, we left port, and at 12.50 p. m. cast the trawl in 26 fathoms, latitude 41° north, longitude 70° 49′ west. Nine casts of the trawl and rake dredge were taken in from 26 to 39 fathoms between the above position and latitude 40° 28′ north, longitude 70° 44′ west. The last haul was made at 8.20 p. m., completing a line from No Man's Land to our off-shore working ground.

At 4.50 a. m. the following morning we cast the trawl in 368 fathoms, latitude 39° 40′ north, longitude 71° 30′ west. Eight hauls of the rake dredge and trawl were made between the above position and latitude 39° 50′ 30″ north, longitude 71° 23′ west, in from 368 to 182 fathoms. We started for port at 3.30 p. m. and arrived at 3.30 a. m. on the 9th, where we were detained till the 13th by the report of a storm moving along the coast from the southward.

At 4.30 p. m., on the latter date, we left for an off-shore trip. At 7.32 the following morning the trawl was cast in 93 fathoms, latitude 40° 00′ north, longitude 69° 19′ west. Ten hauls were made between the above position and latitude 39° 58′ north, longitude 69° 30′ west, in from 93 to 458 fathoms.

We started for the port at 8.30 p. m., and at 7.20 a. m. the following day cast the trawl in 16 fathoms between No Man's Land and Gay Head. It fouled on a rock, the sudden strain unshipping the heel of the dredging boom; it was soon replaced, however, and the trawl recovered without further damage. At 10 a. m. we anchored in Wood's Holl harbor.

We were detained in port by unfavorable weather till 4 p. m. on the 20th, when we left for an off-shore trip. Passed No Man's Land at 6.45. Between 8 and 9 o'clock passed through large schools of fish, probably menhaden.

At 6 a. m., the following day, we set a trawl line in 113 fathoms, latitude 39° 58′ north, longitude 70° 06′ west. No tile-fish were taken, and but few of the baits were disturbed. This was the first time we had failed to take more or less of this fish when we made the attempt. Three casts of the dredge and trawl were taken, when the increasing wind and sea made it impracticable to carry on work, and at 11.30 a. m. we started for port, arriving at 11.50 p. m.

Two casts of the trawl were made in Vineyard Sound on the 22d.

The colors were set at half mast on the 26th, and the day observed in memory of the late President James A. Garfield. We were detained in port by unfavorable weather till 4.10 p. m. on the 30th, when we went to New Bedford for coal, returning at 5.50 p. m. on the 2d of October.

The specimens taken during the season, and material belonging to the United States Fish Commission, were taken on board during the 3d and preparations completed for leaving the station, the work of deep-sea exploration at this station being finished for the season.

At 2.05 p. m., October 4, we left Wood's Holl and steamed to New Bedford to take on board a whale-boat and equipments, which had been presented to the National Museum by J. H. Bartlett & Sons. The boat was received on the evening of the 5th, and at 5.50 the following morning we left for Bristol, R. I., arriving at 11.20, when the steam cutter was sent on shore for slight repairs. At 5.30 a. m. the following day we left for New Haven, arriving at 5.10 p. m. The specimens consigned to Prof. A. E. Verrill were landed at daylight the following morning, and at 9.15 a. m. we left for Washington. At 3.45 p. m. made fast to Bayles' wharf, at Throgg's Neck, for the night, as the weather was somewhat threatening.

At 2 p. m., October 9, we cast off and proceeded to sea. At 7.17 the following morning we cast the trawl in 130 fathoms, latitude 38° 39′ north, longitude 73° 11′ West. Seven hauls were made during the day between the above position and latitude 38° 28′ north, longitude 73° 22′ west, in from 130 to 435 fathoms. At 5.30 p. m. started for the capes of the Chesapeake. The weather was pleasant during the day, with moderate winds, but at 8 p. m. a northerly gale rose suddenly, making it necessary to heave the vessel to until 5 o'clock the following morning, when wind and sea moderating we resumed our course, passing Cape Henry at 6 p. m., and arriving at the navy-yard, Washington, at 11.20 a. m., October 12. The specimens were landed and sent to the National Museum the following day.

The vessel having been placed at the disposal of the Hon. Robert T. Lincoln, Secretary of War, during the celebration at Yorktown, preparations were made for departure, and at 12.25 p. m. on the 17th we left for the latter place with the Secretary and party on board, arriving at 10.15 a. m. on the 18th.

The ceremonies attending the laying of the corner-stone of the monument ended on the afternoon of the 20th, and at 5.30 p. m. we left for Washington, arriving at 1 p. m. the following day, having visited Mount Vernon on the way.

We coaled ship during the 24th and 25th, returning to the navy-yard on the latter date, where we remained until the close of the year. The crew were employed during this time in giving the vessel a thorough overhauling preparatory to next season's work.

On the 29th of November we transferred our Herreshoff steam cutter and First-class Fireman William H. Lynch to the United States steamship Despatch for surveying duty in the West Indies, receiving from that vessel a cutter of the same description which was at the time unserviceable. The transfer was made at the request of the Navy Department.

Reports received from officers of the Despatch show that it performed excellent service, being at times the only steam cutter in working order. The boat received from that vessel was refitted by our crew, and at the close of this report was in good condition.

List of officers attached to the vessel during the year.—Lieut. Z. L. Tanner, U. S. N., commanding; mate, J. A. Smith, U. S. N.; mate, Samuel Gee, U. S. N., June 1 to December 30, inclusive; mate, C. H. Cleaveland, U. S. N., from December 31; passed-assistant paymaster, G. H. Read, U. S. N.; assistant engineer, W. B. Boggs, U. S. N.; apothecary, first-class, J. A. Kite, from March 21; paymaster's yeoman, first-class, H. E. Minkler; machinist, F. J. Barry; machinist, John Maxwell.

Record of shad-hatching on board United States Fish Commission steamer Fish Hawk, Lieut. Z. L. Tanner commanding, at Capehart's Wharf, in Salmon Creek, Aroca, N. C., from March 30 to May 2, 1881.

Date.	Barometer. Max.	Barometer. Min.	Temp. air. Max.	Temp. air. Min.	Water surface. Max.	Water surface. Min.	Bottom. Max.	Bottom. Min.	In cones. Max.	In cones. Min.	State of water.	Winds. Direction.	Winds. Force.	Weather.	Ripe shad. Males.	Ripe shad. Females.	Eggs obtained.	Fish deposited.	Where deposited.	Remarks.
1881.	°	°	°	°	°	°	°	°	°	°										
Mar. 30	29.45	29.32	59	39	54	49	..	....	..	....	Muddy	Sd. and Wd.	1-8	Cloudy			....	....	....	Anchored in mouth of Salmon Creek; muddy water sets in from the sound; generally clearer water higher up the creek.
31	29.70	29.40	52	26	50	48	..	....	..	....	do	W. SW.	3-6	do			....	....	....	
April 1	29.60	29.83	52	39	49	47			..	....	do	W. SW.-W. NW.	1-3	Showers			....	....	....	
2	30.10	29.90	57	34	50	46	49	46	....	....	do	Var.	1-3	Clear			....	....	....	
3	30.10	29.90	60	35	51	47	50	47	....	..	do	Var.	1-4	do			....	....	....	
4	29.86	29.65	59	35	53	48	51	48	..	....	do	SW.-NW.	1-3	Rain			....	....	....	
5	29.91	29.85	47	31	59	46	49	46	..	....	do	NW.	0-4	Fair			....	....	....	8th.—Moved to the bank 1 mile above the mouth, near Capehart's wharf; 10 to 13 feet of water; generally clear, colored with juniper.
6	30.00	29.85	57	32	47	46	47	45		....	do	W. SW.-N. NW.	1-4	Clear			....	....	....	
7	30.20	30.00	64	35	51½	46	49	45½	....	....	do	NW.-SE.	1-4	Fair			....	....	....	
8	30.04	29.65	55	43	51	48	50	48	....	....	do	SE.-N. NW.	1-4	Rain			....	....	....	
9	29.95	29.89	52	44	53	48	50	48	....	....	Clear	NW.	1-2	do			....	....	....	
10	30.66	29.83	62	41	53	49	53	49	....	..	do	N. NW.-S. SW.	1-4	do			....	....	....	
11	30.24	30.05	74	42	59	51	52	51	....	....	do	Var.	1-2	Clear			....	....	....	April 30.—Transferred the eggs on board to the North Carolina Commission.
12	30.10	29.95	79	50	57	51½	56½	51	....	..	do	Sd.	1-5	Cloudy	3	3	66,000	....	....	
13	29.93	29.74	73	64	56½	53	55½	51	..	....	do	Sd. and Wd.	1-5	Rain	2	2	66,000	....	....	
14	29.74	29.48	59	44	52	50½	55	53	....	..	Muddy	Wd.	3-7	do	4	4	117,000	....	....	
15	29.87	29.75	64	45	53	50½	53	50½	....	....	Clear	W. SW.	1-4	Clear	1	1	34,000	....	....	The herring eggs were taken on the 25th and hatched on the 30th and 31st. The only ripe herring found.
16	30.03	29.80	58	47	54	52½	54	52½	....	....	do	W. SW.	1-4	Fair			....	....	....	
17	30.20	30.03	70	41	56	52	56	52	....	....	do	W. SW.	1-4	Clear			....	....	....	
18	30.06	29.95	78	50	57	53	56	53	....	..	do	Var.	0-3	Cloudy			....	....	....	
19	30.20	30.00	66	52	58	54½	57	54½	....	....	do	N. NE.	1-3	Fair	9	8	132,000	....	....	
20	30.11	30.03	74	50	60	55	55½	55	....	....	do	N. NE.	1-4	Cloudy	3	3	107,000	....	....	Eggs lost on May 1 and 2 were kept on board for experiment, using water over, and over 66,000 eggs died.
21	30.24	30.06	68	49	61	54½	56	54½	....	....	do	Nd. and Ed.	1-3	Fair	11	11	332,000	....	....	
22	30.20	30.06	63	50	59	54½	55½	54½	58	56½	do	Var.	1-2	Rain	21	21	649,000	....	....	149,000 eggs died.
23	30.40	30.15	86	48	65	57	57	55	61	57	do	NE.	0-1	Clear	18	18	489,000	....	....	83,000 eggs died.
24	30.40	30.15	83	50	63	61	57	55	62	57	do	SE.	0-3	do			....	....	....	
25	30.20	30.03	85	60	65½	61	58	56	66	59	do	SW.	1-3	Fair	28	28	929,000	....	....	{ 41,500 eggs died. 18,000 fish died.
26	30.05	29.96	89	66	69	61	60	56	66	59	do	SW.	1-2	Cloudy	34	32	979,000	....	....	34,000 eggs died.
27	30.02	29.95	76	63	66	61	60	56	65	61	do	Var.	0-4	Rain	32	30	931,000	....	....	16,000 eggs died.
28	30.20	30.00	94	60	73	62	57	56	63	58	do	Var.	1-2	Fair	11	10	298,000	....	....	41,000 eggs died.
29	30.15	30.05	93	60	71	67	58	56	63	60	do	Var.	0-3	do	13	13	432,000	498,000	Albemarle Sound	34,000 eggs died.

	30	30.35	30.15	80	61	70	62	59	57	71	60	...do ...	NE.	1–4	Clear	5	5	166,000	830,000	...do	8,000 eggs died.
																			3,029,500	(*)	
May	1	30.45	30.30	65	59	66	62	59	....	71	64	Clear ..	NE.-SE.	3–4	Clear						500,000 eggs died.
	2	30.36	30.10	79	64	61	49	....	....	72	....	....	Var.	2–4	Fair						379,000 eggs died.
																195	189	5,727,000	4,357,500	....	1,369,500

* Eggs transferred to North Carolina Commission.

NOTE.—Herring eggs taken, 500,000; 200,000 deposited in Albemarle Sound; 300,000 eggs died. The average number of eggs per female shad at this station was 30,301.

Record of Spanish mackerel-hatching on board the United States Fish Commission steamer Fish Hawk, Lieut. Z. L. Tanner commanding, at Cherrystone, Northampton County, Virginia, from June 16 to June 29, 1881.

Date.	Barometer.		Temp. air.		Water surface.		Bottom.		In cones.		State of water.	Winds.		Weather.	Ripe shad.		Eggs obtained.	Fish hatched.	Fish deposited.	Remarks.
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Direction.	Force.		Males.	Females.				
1881.	°	°	°	°	°	°	°	°	°	°										
June 16	30.25	30.05	74	68	79	75	79	75	...	....	Clear ..	E.NE.-E.SE.	2–4	Clear	....	..	.....	....	......	
17	30.05	29.90	83	70	78	74	78	74	79	78	.do	SW.	6–7	Threatening	...	...	700,000	....	....	
18	30.05	29.92	84	75	78	74	79	75	80	76	..do	NW.-SW.	6–3	.do	....	...	0	....	....	
19	30.00	29.98	83	72	78	75	78	75	78	75	..do	SW.	4	Fair	....	...	....	200,000	....	500,000 dead eggs thrown over board.
20	30.03	29.84	85	75	80	75	80	76		....	..do	NW.-SE.	2–4	do	....	...	240,000	....	......	200,000 fish died on 19th.
21	29.94	29.80	78	70	80	78	79	77	81	78	..do ...	NW.	4	Fair q. r....	....	...	....	93,000	....	147,000 eggs died.
22	30.00	29.94	70	61	79	72	79	72	79	72	..do	NE.	5	Rain	....	...	....	....	120,000	74,000 fish died and escaped.
23	30.12	29.98	71	61	73	69	73	69	73	70	..do	Eastward.	4	Fair	....	...	300,000	....	....	
24	30.25	30.10	75	64	74	71	74	71	74	71	..do	SW.-SE.	4–4	Clear; rain	..	...	....	....	....	
25	30.23	30.13	77	65	75	72	75	72	76	72	..do	Var.	2–4	Fair	....	...	300,000	168,000	....	132,000 eggs spoiled.
26	30.17	30.11	77	67	78	73	77	73	77	73	..do	SE.-SW.	2–4	..do	....	...	....	....	100,000	
27	30.20	30.02	77	70	79	76	78	75	80	76	..do	SW.-SE.	2–5	..do	....	...	....	210,000	50,000	90,000 eggs spoiled.
28	30.01	29.92	81	75	84	77	83	77	83	78	..do	SW.-SE.	2–5	..do	....	...	....	....	100,000	Transferred to str. Lookout.
29	29.95	29.50	86	77	81	76	81	81	82	81	..do	SW.	2–4	..do	....	...	....	....	....	
															....	....	1,540,000	671,000	370,000	

NOTE.—896,000 eggs failed to hatch. 274,000 fish died after hatching.

Record of shad-hatching on board the United States Fish Commission Steamer Fish Hawk, Lieut. Z. L. Tanner commanding, on the Susquehanna River, Maryland, from May 5 to June 5, 1881. Station at the junction of the Susquehanna and North East Rivers.

Date.	Barometer.		Temp. air.		Water surface.		Bottom.		In cones.		State of water.	Winds.		Weather.	Ripe shad.		Eggs obtained.	Fish deposited.	Where deposited.	Remarks.
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Direction.	Force.		Males.	Females.				
1881	°	°	°	°	°	°	°	°	°	°										
May 5	30.40	30.18	62	49	60	58	60	58	....	....	Clear ..	Sd. and Ed.	1–4	Cloudy ..	6	6	182,000	....	....	Vessel was anchored on the west side of the channel off Bulls Mountain, from the 5th to 31st, and off Spesutie Island from the 31st till the 5th of June. The former station was at the junction of the Susquehanna and North-east Rivers. The water was frequently quite muddy farther up the Susquehanna when it was clear at the ship. From the 17th to the 20th, inclusive, it was stormy rainy weather. May 31 and June 1, 2, and 3 there was heavy rain and strong winds, practically breaking up the season. The average number of eggs from each female shad at this station was 29,463.
6	30.15	30.05	73	50	59	59	59½	59½	61½	59½	...do ...	Var.	1–3	Rain....	17	17	462,000	....	....	
7	30.21	30.07	78	55	62	59	60	58½	61	59	...do ...	NE.–SE.	1–3	Fair			....	....	....	
8	30.24	30.10	77	54	63	60	63	60	65	61	.. do ...	Sd. and Wd.	2–4	Clear ...	21	21	506,000	....	....	
9	30.26	30.15	79	59	66	63	66	62	67	63	.. do ..	Sd. and Wd.	1–4	...do ..	49	47	1,660,000	....	....	
10	30.25	30.16	80	66	70	65	69	65	71	66	...do ..	Sd. and Wd.	1–4	...do ...	11	11	341,000	....	....	
11	30.25	30.10	87	69	72	68	72	68	73	70	.. do ...	Sd. and Wd.	2–4	...do ...	28	28	913,000	.....	....	
12	30.20	30.06	91	73	76	71½	74	71	77	73	...do ...	Sd. and Wd.	1–3	.. do ..	30	30	979,000	664,000	Susquehanna and North East Rivers.	
13	30.16	30.06	90	72	78	74	77	73	80	75½	...do ...	Var.	0–4	...do	8	8	265,000	1,660,000	... do	
14	30.10	29.90	75	66	77	74½	76	74	77	75½	.. do ...	Var.	2–4	...do	9	9	348,000	830,000	... do	
15	29.90	29.71	82	69	76½	75	76½	75	77	76	...do ...	Var.	2–4	Cloudy ..	14	12	357,000	598,000	.. do	
16	29.84	29.68	70	64	75½	74	75½	74	76	74	.. do ...	Nd. and Wd.	2–4	...do	10	11	357,000	979,000	....	
17	30.00	29.80	61	54	74	71	74	71	74	71	...do ..	E.NE.	2–4	Rain....	10	13	424,000	....	Susquehanna and North East Rivers.	
18	30.02	29.84	58	52	70	67	70	68	71	68	...do ...	NE.–NW.	2–4	...do	9	8	257,000	498,000	...do	
19	29.94	29.84	60	57	68	65	68	65	67½	65	.. do ...	SE.	1–4	...do	12	14	423,000	166,000	....	
20	30.05	29.92	81	57	66	63	65	63	66	64½	...do ...	Nd. and Ed.	1–4	.. do	20	25	781,000	....	....	
21	30.16	30.02	82	58	69	64	65	64	67	65	.. do ...	Var.	0–2	Fair	53	54	1,792,000	....	....	
22	30.20	30.10	80	62	69	65	68	65	70	66	.. do ...	Var.	0–3	Rain.....	18	19	291,000	....	Susquehanna and North East Rivers.	
23	30.30	30.15	77	59	69½	67	69	68	71	68	.. do ..	NE.	1–3	Fair	17	23	650,000	325,000	....do	
24	30.34	30.21	70	61	70½	68	69	68	71	69	.. do ...	Var.	0–3	.. do ..	14	15	463,000	313,000	....do	
25	30.25	30.18	80	61	73½	69	72½	69	75	70	...do ...	Var.	1–3	Clear	28	31	781,000	275,000	....do	
26	30.31	30.16	80	59	73½	70	72½	70	75	70	...do ...	Var.	1–3	Fair . ..	40	43	1,062,000	406,000	....do	
27	30.17	30.02	84	63	75	71	74	71	76	72	...do ...	SW.	0–3	Clear	22	22	6[illegible]5,000	1,250,000	....do	
28	30.04	29.98	87	66	77	74	76	74	78	75	...do ...	SW.	2–4	.. do	22	25	675,000	500,000	... do	
29	30.06	29.95	88	59	77	74½	76	75	78	75	.. do ...	SW.	1–4	...do	10	10	369,000	....	....	
30	30.03	29.95	89	71	78½	75	78	74½	80	76	...do ...	SW.	2–3	...do	2	2	50,000	{ 375,000 { 625,000	Susquehanna and North East Rivers.	
31	30.02	29.90	90	68	80	77	80	77	81	78	Muddy.	Var.	2–5	Rain.....	6	6	106,000	1,250,000	Shipment	

June	1	29.94	29.75	103	68	80	78	80	78	80	77	...do ...	Var.	0–5	...do	8	8	187,000	{ 500,000 } { 312,000 }	Battery.........
	2	29.90	29.76	68	60	80	73½	80	73	79	78	...do ...	NE.	4–5	...do	2	2	38,000	625,500	Susquehanna and North East Rivers.
	3	29.78	29.72	61	59	73	69½	73	69½	74	71	...do ...	NE.	2–7	...do	2	2	50,000	125,000	Battery ....
	4	29.95	29.74	73	57	70	68	70	68	70	69	...do ...	NE.-NW.	0–3	...do	2	2	50,000	....	....
																500	524	15,444,000	12,576,500	

NOTE.—Shad eggs on hand morning of 5th, transferred to Battery, 300 000.

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide.	Temperature of air: Air.	Surface.	5 fathoms.	10 fathoms.	15 fathoms.	20 fathoms.
1881.						°	°	°	°	°	°
July 16	N. Z. 46402, surface; N. Z. 46403, deep.	917	Lat. 40° 22′ N., long. 70° 42′ W.	4.10 a. m.	....	66	63	....	49	....	45
16	....do	918	Lat. 40° 22′ 24″ N., long. 70° 12′ W.	5.33 a. m.	....	67	63	....	49	....	45
16	....do	919	Lat. 40° 16′ 18″ N., long. 70° 41′ W.	7.00 a. m.	....	70	66	....	....	48	....
16	....do	920	Lat. 40° 13′ N., long. 70° 41′ 54″ W.	8.20 a. m.	....	72	66	....	45	....	....
16	N. Z. 46402, surface; N. Z. 42663, deep.	921	Lat. 40° 07′ 48″ N., long. 70° 43′ 54″ W.	9.40 a. m	....	75	70	...	66	...	....
16	....do	922	Lat. 40° 03′ 48″ N., long. 70° 45′ 54″ W.	10.57 a. m.	....	76	72	..	59	....	58½
16	....do	923	Lat. 40° 01′ 24″ N., long. 70° 46′ W.	12.27 p. m.	....	74½	72	....	55	....	54
16	....do	924	Lat. 39° 57′ 30″ N., long. 70° 46′ W.	1.52 p. m.	....	74½	71	70	61	..	60
16	....do	925	Lat. 39° 55′ N., long. 70° 47′ W.	3.35 p. m.	....	74	71	70	58	....	48
16	....do	926	Lat. 39° 56′ N., long. 70° 46′ W.	5.24 p. m.	....	74	71	...	68	....	59
20	....do	927	Gay Head light, W. by S. ⅜ S., 2½ miles.	10.47 a. m.	Ebb ..	68	62	61	....	....	....
20	....do	928	Gay Head light, W. ¾ S., 2⅜ miles.	11.30 a. m.	Low water.	69	62½	59	....	....	....
20	....do	929	Gay Head light, S. by W., 4¼ miles.	12.35 p. m.	Low water.	66	63	....	....	....	....
20	....do	930	Gay Head light, S. by W., 4¾ miles mag.	1.10 p. m.	Low water.	65	63	63	....	....	....
20	....do	931	Gay Head light., SW. by S. ½ S., 5½ miles mag.	1.42 p. m.	Flood.	65	63	....	....	..	....
20	....do	932	Nobska light, NE. by E. ¾ E., 2½ miles mag.	2.43 p. m.	Flood.	67	66	63	65	....	....
20	....do	933	West Chop light, S. ¾ E., ¾ miles mag.	3.30 p. m.	Flood.	68	65	64	....	....	....
20	....do	934	Nobska light, W. ¾ S., 1¾ miles mag.	4.10 p. m.	Flood.	68	67	67	....	....	....
Aug. 4	....do	935	Lat. 39° 45′ N., long. 69° 44′ 45″ W. by chr.	8.14 a. m.	Flood.	72	70	69	66	....	48
4	....do	936	Lat. 39° 46′ 30″ N., long. 69° 47′ W.	10.43 a. m.	Flood.	78	71	69	66	...	48
4	....do	937	Lat. 39° 49′ 25″ N., long. 69° 49′ W.	12.45 p. m	Flood.	75	72	67	62	....	42
4	....do	938	Lat. 39° 51′ N., long. 69° 49′ 15″ W.	2.44 p. m.	Flood.	80	72½	69	57	....	50
4	....do	939	Lat. 39° 53″ N., long. 69° 50′ 30″ W.	4.25 p. m.	Flood.	78	73	70	67	....	57
4	....do	940	Lat. 39° 54′ N., long. 69° 51′ 30″ W.	5.30 p. m	Flood.	76	72	70	62	....	49
4	....do	941	Lat. 40° 01′ N., long. 69° 56′ W.	7.45 p. m.	....	74	71	70	53	....	..
9	....do	942	Lat. 400° 1′ N., long. 71° 12′ 30″ W.	6.15 a. m.	....	72	69	69	65	52	53
9	....do	943	Lat 40° N., long. 71° 14′ 30″ W.	7.10 a. m.	....	76	70	69	65	52	53
9	....do	944	Lat. 40° 01′ N., long. 71° 14′ 30″ W.	8.27 a. m.	....	78	70	68	66	50	53
9	....do	945	Lat. 39° 58′ N., long. 71° 13′ W.	12.05 p. m.	....	75	71	70	67	58	53
9	....do	946	Lat. 39° 55′ 30″ N., long. 71° 14′ W.	2.00 p. m	....	75½	71	61	55	51	52
9	....do	947	Lat. 39° 53′ 30″ N., long. 71° 13′ 30″ W.	4.00 p. m	....	75	70	60	55	50	50
13	....do	948	Penikese Island E., 2 miles.	5.20 p. m.	....	76	67	....		....	....
23	....do	949	Lat. 40° 03′ N., long. 70° 31′ W.	4.20 a. m.	....	78	66	66	66	48	50
23	....do	950	Lat. 40° 07′ N., long. 70° 32′ W.	5.50 a. m.	....	69	65	64	63	47	....
23	....do	951	Lat. 39° 57′ N., long. 70° 31′ 30″ W.	9.40 a. m.	....	78	67½	65	64	49	52

Commission steamer Fish Hawk, season of 1881.

and water. 40 fathoms.	50 fathoms.	— fathoms.	Bottom.	Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity. Depth.	Tempera-ture.	Specific gravity.	Corrected to standard of 60°.
°	°					*Miles.*	*Miles.*					
...	...	...	42	44	Gn. mud	SE. 1	NE. ¾	Trawl	......		......	......
...	...	...	42	46	Gn. mud	SE. 1	N. NE. 1	do	......		......	......
...	...	...	42½	53	Gn. mud	S. 1	NE. 1	do	......		......	......
...	...	...	49	63	Gn. mud	S. 1	W. by S. 1	do	......		......	......
...	...	...	52	67	Gn. mud	S. SW. 1	W. 1	do	......		......	......
...	...	...	52	71	Sand and gn. mud.	SW. 2	N. by W. 1	do	......		......	......
...	...	...	52	78	Sand	SW. 2	W. NW. ½	do	......		......	......
...	...	...	44½	164	Sand	SW. 2	NW. 2	do	......	...	......	......
...	53	...	42	229	Sand and mud	S. SW. 3	NW. by W. 1½	do	......		......	......
53	...	...	44	199	Sand and mud	S. SW. 3	NW. ½ N. 2½	do	......		......	......
...	...	...	59	11	Sand	S. SW. 2	W. NW. ½	do	......		......	......
...	...	...	60	10	Sand	S. SW. 3	W. by N. ½	do	......		......	......
...	...	...	62	10	Sand	S. SW. 3	SE. by S. ¾	Dredge	......		......	......
...	...	...	62	12	Sand and shells	SW. 3	S. ½ E. ½	do	......		......	......
...	...	...	62	16	Sand and shells	SW. 2	S. ½ W. ½	do	......		......	......
...	...	...	66	14	Rock	SW. 2	NW. by W. ¾	do	......	...	......	......
...	...	...	64	14	Stones	SW. 3	E. NE. 2½	do	......	...	......	......
...	...	...	67	9	Sand and shells	SW. 2	N. NW. 1	Trawl	......	...	......	......
...	44	...	39½	782	Yel. mud and sand.	N. NE. 4	NW. ½ N. 2½	do	......	...	......	......
...	44	...	39½	716	Gn. mud	N. NE. 3	NW. ⅜ W. 2	do	Surface 5 fms	70½ 70	1.02420 1.02420	1.02573 1.02565
...	55	...	40½	516	Gn. mud and sand.	N. NE. 2	N. 2½	do	Surface 5 fms	75 72	1.02370 1.02380	1.02596 1.02556
...	53	...	42	315	Gn. mud and sand.	Calm, 0	N. NW. 2	do	Surface 5 fms	73 71½	1.02380 1.02400	1.02572 1.02568
...	56	...	47	264	Gn. mud and sand.	SW. by W. 1	N. NW. 1½	do	Surface 5 fms	72½ 71	1.02380 1.02400	1.02564 1.02560
...	49½	...	52	134	Sand	SW. by W. 1	N. NW. ½ W. 2	do	Surface 5 fms	71½ 70	1.02400 1.02420	1.02568 1.02580
...	...	...	52	79	Sand and mud.	NW. 3	W. NW. 1½	Trawl	Surface 5 fms	71 70½	1.02400 1.02425	1.02560 1.02577
...	...	...	50	138	Sand and mud	SW. 2	SW. by W. 2	Dredge	Surface 5 fms	69 68	1.02400 1.02420	1.02528 1.02533
...	...	...	49	157	Mud, sand, and shells.	SW. 1	NW. by N. 2½	do	Surface 5 fms	70 69	1.02380 1.02385	1.02525 1.02513
...	...	...	51	128	Mud, sand, and shells.	SW. 1	NW. by N. 1½	Trawl	Surface 5 fms	70 70	1.02380 1.02385	1.02525 1.02530
...	...	...	44	207	Gn. mud and sand.	SW. 4	NW. by N. 2	do	Surface 5 fms	70 70½	1.02385 1.02390	1.02545 1.02542
...	...	...	47	247	Gn. mud and sand.	SW. 4	NW. by W. 1½	do	Surface 5 fms	71½ 68	1.02385 1.02420	1.02553 1.02533
...	...	...	44	319	Gn. mud and sand.	SW. 4	W. NW. 3	do	Surface 5 fms	70 65	1.02385 1.02460	1.02530 1.02529
...	...	...	66	7	Bl. mud and shells.	SW. 4	W. SW. 1	do	......	...	......	......
...	...	...	52	100	Yel. mud	W. 3	N. NW. 2	Rake dr'ge	Surface 5 fms	65 65	1.02520 1.02520	1.02589 1.02589
...	...	...	52	71	Sand, shells, and mud.	W. 4	N. NW. 1½	Trawl	Surface 5 fms	60½ 65	1.02500 1.02485	1.02500 1.02554
...	...	...	41	225	Mud	W. NW. 3	N. 1½	do	Surface 5 fms	67½ 67	1.02485 1.0250	1.02591 1.02598

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide	Temperature of air					
						Air.	Surface.	5 fathoms.	10 fathoms.	20 fathoms.	50 fathoms.
						°	°	°	°	°	°
1881. Aug. 23	N. Z. 46402, surface; N. Z. 42663, deep.	952	Lat. 39° 55′ N., long. 70° 28′ W.	11.28 a. m.	....	82	68	66	63	49	53
23	....do	953	Lat. 39° 52′ 30″ N., long. 70° 17′ 30″.	2.30 p. m.	....	77	68	64	62	53	54
23	....do	954	Lat. 39° 53′ N., long. 70° 18′ 30″ W.	4.50 p. m	....	74½	68	65	63	50	53
26	N. Z. 46402, surface; N. Z. 46405, deep.	955	Buzzard's Bay, Nye's Neck, E. by S., ¼ mile.	10.50 a. m.	Ebb ..	67	67½	....	....	....	....
26	....do	956	Buzzard's Bay, Nye's Neck, S. SE. ¾ E., ⅛ mile.	11.26 a. m.	Ebb ..	71	69	....	....	....	....
26	....do	957	Buzzard's Bay, Nye's Neck, S. SE. ¾ E., ⅛ mile.	11.45 a. m.	Ebb ..	73	69½	....	....	....	....
26	....do	958	Buzzard's Bay, Nye's Neck, S. by E. ¼ E., ¼ mile.	12.20 p. m.	Ebb ..	75	70	....	....	....	....
26	....do	959	Buzzard's Bay, Nye's Neck, S., ½ mile.	12.40 p. m.	Ebb ..	72	69	....	....	....	....
26	....do	960	Buzzard's Bay, Nye's Neck, S. ¾ E., ½ mile.	1.10 p. m.	Ebb ..	72½	69½	....	....	....	....
26	....do	961	Buzzard's Bay, Nye's Neck, NE. ¾ E., 2¾ miles.	1.52 p. m.	Low ..	71½	69	....	....	....	....
26	....do	962	Buzzard's Bay, Woefuke and island, NE. ¾ E., 1¼ miles.	3.10 p. m.	Flood.	71	68	....	....	....	....
26	....do	963	Buzzard's Bay, Woefuke and island, SE. ½ S., 1 mile.	3.40 p m.	Flood.	70	68	....	....	....	....
30	....do	964	Chatham light, NW. ½ W., 5 miles.	7.50 a. m.	Ebb ..	65	61	59	....	....	....
30	....do	965	Chatham light, NW. ½ W., 6 miles.	8.15 a. m.	Ebb ..	65	61	59	....	....	....
30	....do	966	Chatham light, NW. by W. ¼ W., 6¼ miles.	8.40 a. m.	Ebb ..	65	61	....	54	....	....
30	....do	967	Chatham light, NW. by W. ¼ W., 6¾ miles.	8.50 a. m.	Ebb ..	66	61	61	....	....	....
30	....do	968	Chatham light, NW. by W. ¾ W., 7¼ miles.	9.00 a. m.	Ebb ..	66	61½	61	....	....	....
30	....do	969	Chatham light, NW. by W. ¾ W., 7 miles.	9.10 a. m.	Ebb ..	66	61½	....	....	....	....
30	....do	970	W.NW. ¾ W., 6 miles.	9.43 a. m.	Ebb ..	67	61	....	....	....	....
30	....do	971	Chatham light, W. ¾ N., 4¼ miles.	10.05 a. m.	Ebb ..	67	61½	....	....	....	....
30	....do	972	Chatham light, NW. by W. ⅞ W., 7½ miles.	10.48 a. m.	Ebb ..	67	62	....	....	....	....
30	....do	973	Chatham light, W.NW. 6¾ miles.	11.10 a. m.	Ebb ..	67	62	....	....	....	....
30	....do	974	Chatham light, W.NW. ½ W., 6½ miles.	11.30 a. m.	Low ..	67	62	....	....	....	....
30	....do	975	Chatham light, W.NW. ¼ W., 6¼ miles.	11.45 a. m.	Low ..	68	63	....	....	....	....
30	....do	976	Chatham light, W.NW. ⅞ W., 6 miles.	12.00 m	Low ..	69	63	....	....	....	....
30	....do	977	Chatham light, W.NW. 6¼ miles.	12.20 p. m.	Low ..	70	64	....	....	....	....
30	....do	978	Chatham light, W.NW. 6 miles.	12.30 p. m.	Low ..	70	64	....	....	....	....
30	....do	979	Chatham light, W.NW. ¼ W., 6 miles.	12.40 p. m.	Low ..	70	64	....	....	....	....
30	....do	980	Chatham light, NW. by W. ¼ W., 5¾ miles.	1.00 p. m	Low ..	70	62	....	....	....	....
30	....do	981	Chatham light, W.NW. 16 miles.	2.10 p. m.	Flood.	65	63½	63	56	....	....
30	....do	982	Lat. 41° 36′ N., long. 69° 35′ W.	2.45 p. m.	Flood.	65	63½	60	67	43½	....
30	....do	983	Lat. 41° 33′ N., long. 69° 32′ W.	3.23 p. m.	....	64½	64	62	54	....	....
30	....do	984	Lat. 41° 31′ N., long. 69° 28′ W.	4.07 p. m.	Flood.	64	63½	63	52	....	....

Commission steamer Fish Hawk, season of 1881—Continued.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
— fathoms.	— fathoms.	— fathoms.	Bottom.						Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
			°			*Miles.*	*Miles.*					
...	...	...	40	396	Yel. mud and sand.	W. NW. 2...	NE. by N. 1½	Trawl	Surface	67½	1.02525	1.02631
									5 fms..	67	1.02505	1.02603
...	...	...	39½	724	Mud	W. NW. 2...	N. NW. 1½ ..	...do	Surface	69	1.0250	1.02628
									5 fms..	67½	1.(2505	1.02611
...	...	...	39½	651	Sand and mud.	W. NW. 2...	N. NW. 2	...do	Surface	68	1.02485	1.02598
									5 fms..	67½	1.02485	1.02591
...	...	...	68	7	Sand..........	SW. 3.......	W. by S. ½ S. ½	...do	Surface	68½	1.02320	1.02441
									5 fms..	69½	1.02385	1.02521
...	...	...	68	5¼	Sand..........	SW. 3.......	W. by S. ¼...	Trawl, with wings.	Surface	69	1.02280	1.02408
									5 fms..	71	1.02270	1.02430
...	...	...	68	6	Sand and stone	SW. 4.......	W. ¾ N. ¼ ...	.. do	Surface	69½	1.02270	1.02406
									5 fms..	70	1.02280	1.02425
...	...	...	68	5	Sand, stone, and shells.	SW. 5.......	W. SW. ½	...do	Surface	70	1.02270	1.02415
									5 fms..	69½	1.02285	1.02421
...	...	...	68	5	Sand, stone, and shells.	SW. 5.......	W. ½	...do	Surface	....	......	......
									5 fms..	....	......	......
...	...	...	68	4½	Sand, stone, and shells.	SW. 5.......	SW. by W. ½	...do	Surface	....	......	......
									......	....	......	......
...	...	...	68	8	Bn. mud	SW. 5.......	W. by S. ¾...	...do	Surface	68½	1.02240	1.02411
									5 fms..	....	......	......
...	...	...	66	8	Bn. mud and sand.	SW. 6.......	W. NW. ½...	...do	Surface	68	1.02320	1.02433
									5 fms..	68½	1.02360	1.02421
...	...	...	66	8½	Bn. mud	SW. 6.......	W. SW. ¾ ...	Dredge ...	Surface	68½	1.02320	1.02441
									5 fms..	68	1.02321	1.02433
...	...	...	55	10	Sand and gravel.	S. 4	S. SE. ⅛	...do	Surface	61	1.0240	1.02413
									5 fms..	58	1.02465	1.02462
...	...	...	53	15	Sand and gravel.	S. 4	SE. by E. ½..	...do	Surface	61	1.0240	1.02413
									5 fms..	59	1.02460	1.02448
...	...	...	52	16	S. and sm. st..	SW. 4.......	SE. ⅛........	Dredge ...	Surface	61	1.02420	1.02413
									5 fms ..	60	1.02440	1.02440
...	...	...	52	16	S. and g	SW. 4.......	SE. ⅙........	...do	Surface	61	1.02440	1.02453
									5 fms ..	61½	1.02400	1.02419
...	...	...	50½	18	G	SW. 4.......	NW. by W ⅛	...do	Surface	61½	1.02420	1.02439
									5 fms ..	62	1.02370	1.02397
...	...	...	51	18	S. p. st	SW. 4.......	SE. ¼	...do	Surface	61½	1.02420	1.02439
									5 fms ..	60	1.02440	1.02440
...	...	...	54	13	S. p. st	SW. 4.......	W. NW. ⅛....	...do	Surface	61½	1.02400	1.02419
									5 fms ..	59½	1.02420	1.02414
...	...	...	54	11	S. p. st	SW. 4.......	S. SE. ¼	...do	Surface	62	1.02395	1.02422
									5 fms ..	61	1.02400	1.02413
...	...	...	52	16	Gr., s., and st .	SW. 5.......	NE. ⅛	...do	Surface	62½	1.02400	1.02434
									5 fms ..	62	1.02420	1.02447
...	...	...	51	17	Gr., s., and st .	SW. 5.......	W. SW. ⅛	...do	....	....	....	....
...	...	...	51	16	Gr., s., and st .	SW. 5.......	W. SW. ⅛	...do	....	....	....	....
...	...	...	52	16	Gr., s., and st .	SW. 5.......	S. ⅛	...do	....	....	....	....
...	...	...	52	16	Gr., s., and st .	SW. 5.......	S. SW. ⅛	...do	....	....	....	....
...	...	...	52	17	S. p. st	SW. 5.......	W. by N. ¼ ..	...do	Surface	63	1.02420	1.02458
									5 fms ..	62	1.02440	1.02467
...	...	...	52	17	S. p. st	SW. 5.......	W. by N. ⅛ ..	.. do	....	....	....	....
...	...	...	52	16	S	SW. 5.......	W. by N. ⅛ ..	...do	....	....	....	....
...	...	...	53	14	S. p. st	SW. 5.......	SW. ⅛........	...do	Surface	62	1.02420	1.02447
									5 fms ..	61½	1.02450	1.02461
...	...	...	49	43	S. and grv	SW. 5.......	S. ¼ W. 1¼ ...	Trawl	Surface	63½	1.0243	1.02477
									5 fms ..	65	1.02420	1.02489
...	...	...	41½	42	S. and grv	SW. 7.......	S. SW. 1½ ...	...do	Surface	63	1.02420	1.02458
									5 fms ..	63½	1.02420	1.02467
...	...	...	42	36	S	SW. 7.......	S. by E. ½....	...do	Surface	63½	1.02400	1.02447
									5 fms ..	63½	1.02410	1.02457
...	...	...	41½	33	M. and s	SW. 6.......	S. ½ W. ½	...do	Surface	63	1.02390	1.02431
									5 fms ..	63	1.02500	1.02541

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide.	Temperature of air					
						Air.	Surface.	5 fathoms.	10 fathoms.	20 fathoms.	30 fathoms.
1881.						°	°	°	°	°	°
Sept. 7	N. Z. 46402, surface; N. Z. 46405, deep.	985	Lat. 41° 00′ N., long. 70° 49′ W.	12. 55 p. m.	....	73	66	64	57½	60½	....
7	....do	986	Lat. 40° 55′ N., long. 70° 48′ W.	2. 00 p. m	....	73	67	65	....	50	....
7	.. do	987	Lat. 40° 54′ N., long. 70° 48′ 30″ W.	2. 28 p. m	....	73	67	65	59½	50	....
7	....do	988	Lat. 40° 49′ 30″ N., long. 70° 47′ W.	3. 30 p. m	....	73	67	64	58½	50	....
7	... do	989	Lat. 40° 49′ N., long. 70° 47′ W.	4. 00 p. m.	....	73	67	64	58½	50	....
7	....do	990	Lat. 40° 44′ N., long. 70° 47′ W.	5. 08 p. m.	....	71½	66	64	59½	50½	....
7	....do	991	Lat. 40° 39′ N., long. 70° 46′ W.	6. 05 p. m.	....	70	66	64	56½	49½	....
7	...do	992	Lat. 40° 33′ N., long. 70° 45′ W.	7. 30 p. m.	....	69	65	63	52	50	....
7	.. do	993	Lat. 40° 28′ N., long. 70° 44′ W.	8. 20 p. m.	....	69	65	63	54	51	....
8	...do	994	Lat. 39° 40′ N., long. 71° 30′ W.	4. 50 a. m.	....	72	68	69	65½	49	46½
8	...do	995	Lat. 39° 40′ 30″ N., long. 71° 31′ W.	6. 00 a. m.	....	72	68	69	65½	47	46½
8	... do	996	Lat. 39° 41′ 00″ N., long. 71° 31′ 37″ W.	7. 35 a. m.	....	75	67½	65	56½	45	44
8	...do	997	Lat. 39° 42′ N., long. 71° 32′ W.	8. 40 a. m.	....	75	67½	65	56½	45	44
8	...do	998	Lat. 39° 43′ N., long. 71° 32′ W.	10. 05 a. m.	....	74	68	63	51	44	43½
8	...do	999	Lat. 39° 45′ 13″ N., long. 71° 30′ W.	11. 45 a. m.	....	73	68	63	51	45	43
8	...do	1025	Lat. 39° 49′ N., long. 71° 25′ W.	1. 05 p. m.	....	71	69	68	69½	54½	48
8	...do.	1026	Lat. 39° 50′ 30″ N., long. 71° 23′ W.	2. 40 p. m.	....	69	69	68	68	56	48
8	... do	1027	Lat. 40° 00′ 00″ N., long. 69° 19′ W.	7. 32 a. m	....	61	65	66	56	47	44
14	...do	1028	Lat. 39° 57′ N., long. 69° 17′ W.	8. 38 a. m.	....	66½	66	66	61	48	45
14	....do	1029	Lat. 39° 57′ 06″ N., 69° 16′ W.	12. 00 m.	....	72	68	66	63	48	45
14	....do	1030	Lat. 39° 58′ 30″ N., 69° 15′ W.	1. 30 p. m.	....	65	66	66	65	48	45
14	.. do	1031	Lat. 39° 57′ 00″ N., long. 69° 19′ W.	2. 45 p. m.	....	64	65	63½	58	47	45
14	....do	1032	Lat. 39° 56′ 00″ N., long. 69° 22′ W.	3. 42 p. m.	....	65	65	63½	58	47	45
14	N. Z. 46405, surface; N. Z. 46402, deep.	1033	Lat. 39° 56′ 00″ N., long. 69° 24′ W.	4. 55 p. m.	....	66	63	63	57	47	47
14	... do	1034	Lat. 39° 56′ 00″ N., long. 69° 26′ W.	5. 55 p. m.	....	66	62	60	57	47	47
14	....do	1035	Lat. 39° 57′ 00″ N., long. 69° 28′ W.	6. 43 a. m.	....	65	62	60	57	47	47
14	... do	1036	Lat. 39° 58′ 00″ N., long. 69° 30′ W.	7. 45 p. m.	....	62	61½	....	....	....	....
15	....do	1037	Gay Head, NE. ¾ N. 4 miles.	7. 20 a. m.	....	....	....	....	..	...	....

Commission steamer Fish Hawk, season of 1881—Continued.

and water.									Specific gravity.			
50 fathoms.	100 fathoms.	200 fathoms.	Bottom.	Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
°	°	°	°			*Miles.*	*Miles.*					
......	......	...	50	26	S	SW. 3	SW. 1¼	Trawl	Surface	69	1. 02340	1. 02468
									5 fms ..	66	1. 02360	1. 02441
									10 fms .	65	1. 02380	1. 02449
...	...	...	49	28	S	SW. 3	S. ½ W. 1	do	Surface	67	1. 02340	1. 02438
									5 fms ..	66	1. 02350	1. 02434
									10 fms .	64	1. 02370	1. 02424
...	...	...	49	28	S	SW. 3	S. ½	R. D	Surface	67	1. 02340	1. 02438
									5 fms ..	66	1. 02350	1. 02434
									10 fms .	64	1. 02370	1. 02424
..	...	...	49½	30	S	SW. 3	S. ½	do	Surface	67½	1. 02370	1. 02476
									5 fms ..	67½	1. 02380	1. 02486
									10 fms	64½	1. 02420	1. 02481
......	......	...	49½	30	S	SW. 3	S. ¾	Trawl	Surface	67½	1 02370	1. 02476
									5 fms ..	67½	1. 02380	1. 02486
									10 fms .	64½	1. 02420	1. 02481
...	...	...	47	34	G. m. and s....	W. SW. 3 ...	S. ½ W. ¾	do	Surface	66	1. 02400	1. 02484
									5 fms ..	65	1. 02420	1. 02489
									10 fms .	65	1. 02420	1. 02489
..	...	...	47½	34	Gn. m. s	W. SW. 3 ...	S. ¼ W. ¼	Trawl	Surface	66	1. 02400	1. 02484
									5 fms .	65	1. 02420	1. 02485
									10 fms .	63	1. 02420	1. 02461
.	...	...	48	36	M	....	S. ⅛	Trawl ...	....	....	....	......
..	...	...	46½	39	M	W. SW. 4 ...	S. ⅜	do	....	....	.....	......
48½	...	...	40½	368	Bro. m	N. NW. 3 ...	W. NW. 2	do	Surface	68	1. 02450	1. 02543
									5 fms ..	67½	1. 02440	1. 02546
									10 fms	67½	1. 02440	1. 02546
48½	48½	..	40½	358	Yl. m. s	N. NW. 3 ...	W. NW. ½	do	....	...	....	......
48	...	...	40	346	Yl. m. s	N. NW. 3 ...	NW. ⅛	Rake dr'ge	....	....	......	......
48	...	41½	40	335	Yl. m. s	N. NE. 3	N. by W. ⅓ ..	Trawl ..	....	....	......	......
46	49	...	40	302	Yl. m. s	E. NE. 4	N. 1¼	do	Surface	68	1. 02450	1. 02563
									5 fms ..	68	1. 02430	1. 02543
									10 fms	59	1. 02500	1. 02488
46	...	42	40	266	Gn. m. s.......	E. NE. 4	N. NW. ¾ ...	Rake dr'ge	Surface	68	1. 02440	1. 02553
									5 fms ..	67	1. 02450	1. 02548
									10 fms .	59	1. 02460	1. 02448
51	...	..	45	216	Gn. m	NE. by E. 4 .	N. ¼ E. 1	Trawl	Surface	68½	1. 02480	1. 02601
									5 fms ..	68	1. 02440	1. 02553
51	...	...	47½	182	Gn. m. s.......	E. NE. 5	N. by E. 1½	do	Surface	68	1. 02460	1. 02513
									5 fms ..	67½	1. 02460	1. 02566
46	...	...	48½	93	S	E. NE. 3	N. ¾	do	Surface	65	1. 02480	1. 02549
									5 fms ..	65½	1. 02500	1. 02576
									10 fm s	64	1. 02520	1. 02574
49½	46	...	41	410	M	NE. 3	N. NE. ½	do	Surface	66	1. 02490	1. 02574
									5 fms .	66½	1. 02490	1. 02581
									10 fms	65½	1. 024·0	1. 02556
49½	46	...	40	458	Yl. m. s	E. NE. 4	NE. by N. 1	do	Surface	66	1. 0249	1. 02574
									5 fms ..	66½	1. 02490	1. 02581
									10 fm s	65½	1. 02480	1. 02556
49	46	...	41	337	Yl. m. s	E. NE. 4	N. by W. 1½ .	Rake dr'ge	Surface	66	1. 02490	1. 02574
									5 fms ..	66½	1. 02490	1. 025·1
									10 fms .	65½	1. 0248	1. 02556
46	...	...	46	255	Yl. m. s	N. NE. 4	NW. by N. 1¼	Trawl	Surface	65	1. 02470	1. 02539
									5 fms ..	63½	1. 02480	1. 02522
									10 fms	63	1. 02480	1. 02521
46	...	...	46	208	Yl. m. s	NE. 4	NW. ¾	do	Surface	65	1. 02470	1. 02539
									5 fms ..	63½	1. 02480	1. 02522
									10 fms .	63	1. 02480	1. 02521
...	...	...	...	183	G. s	NE. 3	N. NW. 2	do	....	....	....	......
49	...	...	46½	146	S	NE. 3	N. NW. ½	do	......		.....	....
49	...	...	47	120	S	NE. 3	N. ¾	do	....	....	....	......
...	...	...	51	94	S	NE. 4	N. NW. 1½ ..	Rake dr'ge	....	....	....	......
...	...	...	47	16	S	....	....	....	....	....	....	......

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide.	Temperature of air: Air.	Surface.	5 fathoms.	10 fathoms.	20 fathoms.	30 fathoms.
1881.						°	°	°	°	°	°
Sept. 21	N. Z. 46405, surface; N. Z. 46402, deep.	1038	Lat. 39° 58′ 00″ N., long. 70° 06′ W.	6. 55 a. m.	....	67	67	68	68	49	....
21	....do	1039	Lat. 39° 59′ 00″ N., long. 70° 06′ W.	9. 35 a. m.	....	66½	67	68	....	....	....
21	....do	1040	Lat. 40° 00′ 00″ N., long. 70° 06′ 00″ W.	10. 43 a. m.	....	64	68	....	....	....	....
22	....do	1041	West Chop light, E. ½ N., 1¾ miles.	12. 35 p. m.	....	63½	65	65	....	....	....
22	....do	1042	West Chop light, E. ½ N., 1½ miles.	1. 17 p. m.	....	63½	65	....	....	....	....
Oct. 10	....do	1043	Lat. 38° 39′ 00″ N., long. 73° 11′ 00″ W.	7. 17 a. m.	....	63½	65½	65½	65	62	....
10	....do	1044	Lat. 38° 37′ 00″ N., long. 73° 12′ 00″ W.	8. 15 a. m.	....	65	66	66	65	62	53
10	....do	1045	Lat. 38° 35′ 00″ N., long. 73° 13′ 00″ W.	9. 32 a. m.	....	67	66	66	65	63½	53
10	N. Z. 47996, surface; N. Z. 46402, deep.	1046	Lat. 38° 33′ 00″ N., long. 73° 18′ 00″ W.	11. 14 a. m.	....	66	66	65	65	61	53
10	....do	1047	Lat. 38° 31′ 00″ N., long. 73° 21′ 00″ W.	12. 15 p. m.	....	69	66	65	65	61	50
10	....do	1048	Lat. 38° 29′ 00″ N., long. 73° 21′ 00″ W.	1. 55 p. m.	....	71	66	66	65	55	49
10	....do	1049	Lat. 38° 28′ 00″ N., long. 73° 22′ 00″ W.	3. 30 p. m.	....	68	66	66	65	55	49

Record of speed of soundings of United States Fish Commission

[Lead, 18

Current number.	Going down: Surface to 100 fathoms.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 400 fathoms.	400 to 500 fathoms.	500 to 600 fathoms.	600 to 700 fathoms.	700 to 800 fathoms.	800 to 900 fathoms.	Total of time.	Depth in fathoms.
	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.			m. s.	
949......	3 00	3 00	....	....	....	....	....	....	....	6 00	100
950......	3 00	....	....	....	....	....	....	....	....	3 00	71
951......	2 00	3 00	....	....	....	....	....	....	....	5 00	225
952......	2 00	2 15	2 40	1 05	....	....	....	....	....	8 00	396
953......	1 10	0 50	1 20	1 10	1 10	1 10	1 10	....	....	8 00	724
954......	0 50	0 50	0 50	0 32	1 43	1 13	1 26	....	....	7 04	651
995......	1 05	1 03	1 02	0 35	....	....	....	....	....	3 45	345
996......	1 20	1 15	1 15	0 20	....	....	....	....	....	4 10	322
997......	1 20	1 15	1 15	0 20	....	....	....	....	....	4 10	322
998......	1 15	1 15	0 55	....	....	....	....	....	....	3 30	289
999......	1 15	1 20	1 30	....	....	....	....	....	....	4 05	256
1026......	2 05	0 55	....	....	....	....	....	....	....	3 00	175
1028......	1 05	1 30	1 15	1 35	....	....	....	....	....	5 25	395
1031......	1 00	1 05	0 35	....	....	....	....	....	....	2 40	240
1034......	1 20	0 45	....	....	....	....	....	....	....	2 05	140

Commission steamer Fish Hawk, season of 1881—Continued.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
50 fathoms.	100 fathoms.	200 fathoms.	Bottom.						Depth.	Tempera-ture.	Specific gravity.	Corrected to standard of 60°.
°	°	°	°			*Miles.*	*Miles.*					
...	...	...	47	146	S. sh	N. NE. 4	N. by E. 1	Trawl	....	....	....	......
...	...	...	50	136	S. sh	NE. 6	N. by E. 2	...do	....	....	....	......
...	...	..	66	93	S. sh	N. NE. 6	N. by E. 2	Ex. dredge	....	....	....	......
...	...	...	65	9	S. g	S. SW. 4	W. SW. ¾	Trawl	....	....	....	......
...	...	...	65	6	S. g	S. SW. 5	W. by N. ½	...do	....	....	....	......
...	..	...	49	130	Sand	N. NE. 4	NW. by N. 1¾	...do	Surface 5 fms 10 fms	65 64½ 64	1. 0256 1. 0254 1. 0252	1. 02629 1. 02601 1. 02574
52	...	...	42	224	Gray mud	NW. 3	W. NW. ½	...do	Surface 5 fms	65 65	1. 0252 1. 0252	1. 02589 1. 02589
...	51	...	40	312	Gray mud	N. NW. 3	W. ¾ N. ¾	...do	....	....	....	......
52	...	...	51	104	Sand	N. 4	W. NW. ¾	...do	Surface 5 fms 10 fms	65 65 64	1. 0252 0254 0255	1. 02589 1. 02609 1. 02604
51	...	...	49	156	Sand	N. 4	N. W. 1½	...do	....	....	....	......
51	51	45	40	435	Mud	N. 4	W. 2	...do	Surface 5 fms 10 fms	65 65½ 65	1. 0250 1. 0248 1. 0248	1. 02569 1. 02556 1. 02549
51	51	45	40	435	Mud	N. 4	N. NW. 2	...do	....	....	....	......

steamer Fish Hawk, Lieut. Z. L. Tanner, U. S. N., commanding.

pounds.]

Coming up.										Remarks.
900 to 800 fathoms.	800 to 700 fathoms.	700 to 600 fathoms.	600 to 500 fathoms.	500 to 400 fathoms.	400 to 300 fathoms.	300 to 200 fathoms.	200 to 100 fathoms.	100 fathoms to surface.	Total in time.	
		m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*
....	....	....	....	....	....	....	4 00	4 00	8 00	....
....	....	....	....	....	....	....	....	5 00	5 00	....
....	....	....	....	....	....	....	3 10	1 50	5 00	....
....	....	....	....	....	1 30	2 40	3 20	2 00	9 30	....
....	....	1 30	2 00	1 30	1 30	1 40	1 40	1 20	10 05	....
....	....	1 30	0 45	1 32	1 36	1 27	1 28	1 25	9 53	7 46
....	....	....	....	....	....	1 50	1 25	1 20	4 35	8 55
....	....	....	....	....	0 20	2 00	1 40	1 05	5 05	2 50
....	....	....	....	....	0 20	2 00	1 40	1 05	5 05	2 50
....	....	....	....	....	....	1 25	1 55	2 05	5 25	8 40
....	....	....	....	....	....	1 30	1 40	1 45	4 55	5 00
....	....	....	....	....	....	....	0 45	1 15	2 00	5 00
....	....	....	....	....	1 50	1 40	1 20	1 45	6 35	4 25
....	....	....	....	....	....	0 25	1 50	1 55	4 10	1 45
....	....	....	....	....	....	....	0 28	1 32	2 00	2 25

Record of speed of trawling United States Fish Commission

Current number.	Going down.											Fathoms of line out.
	Surface to 100 fathoms.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 400 fathoms.	400 to 500 fathoms.	500 to 600 fathoms.	600 to 700 fathoms.	700 to 800 fathoms.	800 to 900 fathoms.	Total time.	Depth in fathoms.	
	m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*		
949	3 00	3 00	......	......	......	......	......	......	......	6 00	100	200
950	2 30	3 10	......	......	......	......	......	......	......	5 40	71	200
951	3 00	3 00	5 00	4 30	2 33	......	......	......	......	17 00	225	420
952	2 15	2 25	2 05	2 30	11 05	4 50	......	......	......	24 10	396	600
953	3 50	3 40	3 10	2 45	2 35	2 38	3 57	5 35	5 20	33 30	724	885
954	2 32	2 52	2 11	1 55	1 50	1 24	4 20	5 43	......	23 00	651	800
994	......	......	......	......	......	......	......	......	......	......	368	615
995	3 05	2 35	2 10	2 15	2 05	2 15	0 03	......	......	14 28	358	615
996	4 00	4 00	4 00	3 35	3 25	4 05	0 25	......	......	23 30	346	625
997	3 15	3 05	2 45	2 40	3 30	3 05	3 05	......	......	21 25	335	700
998	2 45	3 00	2 30	3 45	4 00	5 25	0 30	......	......	21 55	302	610
999	8 05	3 25	4 45	2 45	4 40	1 20	......	......	......	25 00	266	550
1025	2 50	3 00	3 00	3 15	9 25	......	......	......	......	21 30	216	500
1026	3 30	2 45	3 15	2 30	......	......	......	......	......	12 00	182	400
1028	3 40	3 50	3 15	4 05	2 45	2 10	2 25	......	......	22 10	410	694
1029	3 50	3 55	2 35	2 10	3 10	2 55	2 30	1 10	......	22 15	458	750
1030	3 25	3 25	3 40	6 45	5 50	1 20	......	......	......	24 25	337	530
1031	3 45	1 45	2 10	3 25	2 40	0 25	......	......	......	14 20	255	520
1032	6 30	4 15	3 25	4 05	......	......	......	......	......	18 15	208	400
1033	......	......	......	......	......	......	......	......	......	21 45	183	404
1034	6 15	3 25	2 35	......	......	......	......	......	......	12 15	146	300
1035	......	......	......	......	......	......	......	......	......	13 45	120	340
1036	......	......	......	......	......	......	......	......	......	16 45	94	300
1038	......	......	......	......	......	......	......	......	......	15 00	146	325
1039	......	......	......	......	......	......	......	......	......	17 00	136	295
1040	......	......	......	......	......	......	......	......	......	21 00	93	340
1043	4 00	3 50	4 50	......	......	......	......	......	......	12 40	130	360
1044	4 05	4 10	4 00	4 30	......	......	......	......	......	16 45	224	409
1045	3 55	4 10	4 15	3 25	4 00	9 25	4 20	......	......	33 30	312	650
1046	3 10	6 00	12 05	......	......	......	......	......	......	21 15	104	230
1047	3 10	5 40	5 15	4 05	......	......	......	......	......	18 10	156	355
1048	3 20	4 45	4 25	4 00	3 15	3 10	2 45	......	......	25 40	435	700
1049	6 10	3 15	4 25	3 20	3 20	2 30	2 10	2 00	10 30	37 40	435	877

steamer Fish Hawk, Lieut. Z. L. Tanner, U. S. N., commanding.

Coming up.											
Trawl down.	900 to 800 fathoms.	800 to 700 fathoms.	700 to 600 fathoms.	600 to 500 fathoms.	500 to 400 fathoms.	400 to 300 fathoms.	300 to 200 fathoms.	200 to 100 fathoms.	100 fathoms to surface.	Total time.	Remarks.
m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*h. m. s.*	*m. s.*	*m. s.*	*m. s.*	*h. m. s.*	
30 00	......	......	......	......	......	......	......	4 00	4 00	8 00	Rake dredge.
24 00	......	......	......	......	......	......	......	3 30	3 45	7 15	Trawl.
16 00	......	......	......	......	2 00	2 00	3 15	3 20	3 55	8 00	Do.
18 50	......	......	......	5 40	6 35	3 55	3 02	2 58	3 10	25 20	Do.
23 00	4 10	3 54	3 56	3 54	3 31	3 20	3 17	3 04	3 29	32 35	Do.
21 00	......	3 22	3 47	3 27	2 24	3 12	3 01	2 57	3 22	26 34	Do.
......	......	......	......	4 30	4 00	4 15	4 00	3 40	3 15	......	Trawl and wings.
22 07	......	......	......	5 00	3 52	3 48	2 50	3 35	3 25	23 30	Trawl.
9 30	......	......	......	4 45	3 15	3 15	3 00	2 45	6 10	23 10	Rake dredge.
15 20	......	......	4 16	3 45	3 55	3 50	6 15	3 40	3 50	29 30	Trawl.
12 45	......	......	......	5 00	3 50	5 15	4 25	3 55	3 10	25 35	Do.
7 00	......	......	......	1 35	4 30	3 25	3 15	2 50	2 55	18 30	Rake dredge.
7 15	......	......	......	......	4 25	3 45	3 45	4 05	4 10	20 10	Trawl.
7 00	......	......	......	......	......	4 30	4 05	4 25	4 00	17 00	Do.
15 20	......	......	6 30	7 30	7 30	1 02 35	7 10	6 30	6 05	1 43 50	D. trawl—Heavy load.
15 15	......	2 45	4 05	3 20	3 20	3 30	3 20	3 20	3 25	27 15	Trawl.
3 30	......	......	......	1 25	3 40	3 20	3 10	3 10	3 15	18 00	Rake dredge.
13 30	......	......	......	......	5 15	3 30	4 10	3 55	5 15	22 00	Trawl.
......	......	......	......	......	......	......	......	......	......	......	Do.
9 00	......	......	......	......	......	......	......	......	......	......	Do.
......	......	......	......	......	......	......	5 05	3 55	3 45	12 45	Do.
......	......	......	......	......	......	......	......	......	......	12 15	Do.
......	......	......	......	......	......	......	......	......	......	9 55	Rake dredge.
......	......	......	......	......	......	......	......	......	......	17 00	Trawl.
......	......	......	......	......	......	......	......	......	......	11 00	Do.
......	......	......	......	......	......	......	......	......	......	11 00	Excelsior dredge.
......	......	......	......	......	......	......	2 15	3 00	3 10	8 25	Trawl.
......	......	......	......	......	......	3 25	2 15	3 50	2 40	12 10	Do.
7 20	......	......	2 35	3 50	3 35	3 55	3 45	3 50	3 05	24 35	Do.
7 35	......	......	......	......	......	......	1 20	3 30	3 00	7 50	Do.
20 20	......	......	......	......	......	2 40	3 20	3 30	2 42	12 15	Do.
25 50	......	......	7 15	4 10	4 30	3 45	3 25	3 10	3 10	29 25	Do.
8 45	6 15	13 30	5 30	4 00	3 45	3 30	4 45	4 30	4 00	49 45	Do.

Synopsis of the steam log for the year ending December 31, 1881.

Stroke of piston, in feet	$2\frac{1}{2}$
Number of condensing cylinders	2
Diameter of condensing cylinders, in inches	22
Mean point of steam cut-off from commencement of stroke of piston, in inches	6.75
Mean number of holes of the throttle valve, open	3.39
Mean vacuum in condenser, in inches of mercury	24.02
Mean steam pressure in boilers while engines were in operation	26
Mean temperature of engine room	92.4
Mean temperature on deck	60.1
Mean temperature of injection water	64.9
Mean temperature of discharge water	95.8
Mean temperature of feed water	83.9
Total time fires were lighted, in hours and minutes	4,685 25
Total time fires were lighted for hatchings, in hours and minutes	1,433 00
Total time engines were in operation in hours and minutes	778 50
Total time engines were in operation for dredging, in hours and minutes	121 09
Total number of revolutions of starboard engine	3,126,099
Total number of revolutions of port engine	3,272,441
Mean number of revolutions per minute *en route*	81.7
Mean piston speed, in feet per minute	387.65
Total number of knots run	5,029.5
Mean number of knots per hour	6.46
Mean number of knots per hour *en route*	8.4
Total weight of coal consumed for engineer department	$473\frac{1430}{2240}$
Total weight of coal consumed while engines were in operation	$237\frac{130}{2240}$
Total amount of coal consumed for galley	$24\frac{990}{2240}$
Total weight of refuse	$83\frac{1270}{2240}$
Mean number of pounds of coal consumed per hour while engines were in operation	692
Total number of gallons of oil consumed	364.75
Total number pounds of tallow consumed	138
Total number of pounds of wiping stuff consumed	199
Mean draught forward, in feet and inches	7 feet $3\frac{3}{4}$ inches.
Mean draught aft, in feet and inches	7 feet 7 inches.
Number of screws	2
Kind of screws	true.
Mean pitch of screws, in feet and inches	12 feet 3 inches.
Diameter of screws, in feet and inches	6 feet 8 inches.
Length of screws, in inches, parallel to axis	20 inches.
Number of blades	4
Maximum indicated horse power	222.92
Mean indicated horse power	172.85
Mean number of pounds of coal per horse power	3.9
Maximum number of pounds of coal per square foot of grate	15
Mean number of pounds of coal per square foot of grate	12.7
Maximum speed attained, under steam alone, in knots per hour	10.33
Number of hours maintained	5
Slip of screws at maximum speed, in per cent	9.4
State of tide and sea	favorable and smooth.
Mean slip of screws, in per cent	14.9

Table of distances made under steam by the United States Fish Commission Steamer Fish Hawk, for the year 1881.

Date.	Where bound.		Distance.
1881.			*Miles.*
Feb. 26	From Norfolk to Washington	109	
27	......Do	60	
28	......Do	31	
			200
Mar. 23	From Washington to Norfolk	120	
24	......Do	80	
			200
25	From Norfolk to Avoca, N. C	8	
26	......Do	4	
27	......Do	3	
28	......Do	19	
29	......Do	9	
30	......Do	47	
			90

Table of distances made under steam, &c.—Continued.

Date.	Where bound.		Distance.
Apr. 30	From Avoca to Havre de Grace	1	
May 1	......Do	92	
2	......Do	166	
3	......Do	93	
4	......Do	43	
			395
5	From Havre de Grace to Northeast River		9
31	From Northeast River to Havre de Grace		13
June 5	From Havre de Grace to Baltimore		42
7	From Baltimore to Washington	108	
8	......Do	68	
			176
14	From Washington to Cherrystone	107	
15	......Do	60	
			167
29	From Cherrystone to Washington	93	
30	......Do	53	
			146
July 7	From Washington to Wood's Holl	90	
8	......Do	177	
9	......Do	192	
10	......Do	68	
11	......Do	60	
12	......Do	50	
			637
15	Dredging trip		36
16	......Do		133
17	......Do		56
20	......Do		32
29	From Wood's Holl to New Bedford		14
30	From New Bedford to Wood's Holl		14
Aug. 3	Dredging trip		52
4	......Do		124
5	......Do		75
8	......Do		62
9	......Do		116
10	......Do		50
13	......Do		27
22	......Do		66
23	......Do		103
24	......Do		62
25	......Do		28
29	......Do		22
30	......Do		112
31	From Wood's Holl to New Bedford		14
Sept. 1	From New Bedford to Wood's Holl		14
2	From wharf at Wood's Holl to anchorage		½
3	From anchorage to wharf at Wood's Holl		½
7	Dredging trip		93
8	......Do		119
9	......Do		37
13	......Do		67
14	......Do		111
15	......Do		78
17	From anchorage to wharf		½
20	Dredging trip		67
21	......Do		141
22	......Do		14
30	From Wood's Holl to New Bedford		14
Oct. 1	From New Bedford to Wood's Holl		14
4	From Wood's Holl to New Bedford		14
6	From New Bedford to Bristol, R. I.		52
7	From Bristol, R. I., to New Haven		93
8	From New Haven to New York		42
9	From New York to Washington, D. C		96
10	From New York to Washington (dredging trip)		100
11	From New York to Washington		168
12	......Do		109
17	From Washington to Yorktown	88	
18	......Do	74	
			162
20	From Yorktown to Washington	57	
21	......Do	89	
			146
24	From Navy-yard, Washington, to Sixth street coal wharf		2
25	From Sixth street coal wharf to Navy-yard, Washington		2
	Total distance run		5,029½

III.—LIST OF PATENTS ISSUED BY THE UNITED STATES, DURING THE YEAR 1881, RELATING TO FISH AND THE METHODS, PRODUCTS, AND APPLICATIONS OF THE FISHERIES.

By Robert G. Dyrenforth,

Assistant Commissioner of Patents, United States Patent Office.

FISHWAYS.

243,893. A. B. Hendryx .... July 5, 1881.

FLOATS.

239,063. B. W. Ross .... March 22, 1881.
240,611. P. S. Redfield .... April 26, 1881.
241,150. G. Norwood .... May 10, 1881.
250,848. C. M. Smith .... Dec. 13, 1881.

HOOKS AND ATTACHMENTS.

236,161. C. Hymers .... Jan. 4, 1881.
237,566. E. Marion .... Feb. 8, 1881.
242,866. M. D. Beach .... June 14, 1881.
243,987. J. Shields .... July 5, 1881.

OYSTER CULTURE.

237,351. D. G. Weems .... Feb. 1, 1881.
239,592. D. G. Weems .... March 29, 1881.
249,942. V. N. Hughes .... Nov. 22, 1881.

OYSTER DREDGES AND TONGS.

237,160. G. C. Brown .... Feb. 1, 1881.
246,726. W. B. Collier .... Sept. 6, 1881.

PISCICULTURE.

245,704. O. M. Chase .... Aug. 16, 1881.

REELS.

243,371. G. Hancock .... June 28, 1881.
244,828. F. R. Smith .... July 26, 1881.
246,147. L. A. Kiefer .... Aug. 23, 1881.
250,165. J. Palmer .... Nov. 29, 1881.
9,787. F. A. Loomis (reissue) .... July 5, 1881.

RODS AND SINKERS.

250,204.	T. H. Chubb	Nov. 29, 1881.
250,842.	W. H. Rippard	Dec. 13, 1881.
250,968.	H. Prichard	Dec. 13, 1881.
236,750.	W. H. Andrew	Jan. 18, 1881.

FISH-TRAPS, NETS, AND LANCES.

237,231.	W. B. Atkinson	Feb. 1, 1881.
240,630.	H. E. Willard	April 26, 1881.
241,060.	E. Pierce	May 3, 1881.
243,622.	G. Rentz and F. H. Herzog	June 28, 1881.
244,150.	J. S. Simpson	July 12, 1881.
245,251.	T. F. Williams	Aug. 2, 1881.
247,179.	A. Duvall	Sept. 20, 1881.

ISINGLASS, GELATINE, ETC.

9,715.	I. Stanwood (reissue)	May 17, 1881.
243,685.	R. Brooks	July 5, 1881.
243,713.	W. N. Le Page	July 5, 1881.
244,502.	P. C. Vogellus	July 19, 1881.

FERTILIZERS.

251,628.	G. B. Oakes	Dec. 27, 1881.

PRESERVING FISH FOR FOOD.

238,378.	E. H. Frazier	March 1, 1881.
240,143.	O. P. Johnson	April 12, 1881.
240,281.	A. and E. B. Squires	April 19, 1881.
241,187.	P. Brick	May 10, 1881.
245,679.	N. Webster	Aug. 16, 1881.
247,579.	W. Plumer	Sept. 27, 1881.
248,586.	S. L. Goodale	Oct. 25, 1881.
250,382.	F. B. Nichols and C. Thomson	Dec. 6, 1881.
250,776.	C. A. Bergtold	Dec. 13, 1881.
9,957.	G. W., G. H., and F. B. Dunbar (reissue)	Dec. 6, 1881.

FISH DRESSING AND SCALING MACHINES.

242,056.	J. H. Schaal and S. V. Harbaugh	May 24, 1881.
249,663.	M. J. Palson	Nov. 15, 1881.

MISCELLANEOUS APPLIANCES.

243,780.	R. S. Jennings, submarine illumination	July 5, 1881.
247,445.	A. Ward, oyster opener	Sept. 20, 1881.
247,689–90.	J. C. Rodman, minnow bucket	Sept. 27, 1881.

APPENDIX B.

THE FISHERIES.

IV.—MATERIALS FOR A HISTORY OF THE MACKEREL FISHERY.

By G. Brown Goode, Joseph W. Collins, R. E. Earll, and A. Howard Clark.

ANALYSIS.

/

I.—NATURAL HISTORY OF THE MACKEREL.

A.—LIFE HISTORY OF THE MACKEREL.

1.—GEOGRAPHICAL DISTRIBUTION.

The common mackerel, *Scomber scombrus*, is an inhabitant of the North Atlantic Ocean. On our coast its southern limit is in the neighborhood of Cape Hatteras in early spring. The fishing schooners of New England find schools of them in this region at some distance from the shore, but there is no record of their having been taken in any numbers in shoal water south of Long Island. A. W. Simpson states that the species has been observed in the sounds about Cape Hatteras in August, September, and October. R. E. Earll finds evidence that stragglers occasionally enter the Chesapeake. Along the coasts of the Middle States and of New England mackerel abound throughout the summer months, and are also found in great numbers in the Gulf of Saint Lawrence, where, in past years, fishermen of the United States congregated in great numbers to participate in their capture. They are also found on the coast of Labrador, though there is no evidence that they ordinarily frequent the waters north of the Straits of Belle Isle.

Captain Atwood* has expressed the opinion that they visit Northern Labrador only in seasons remarkable for the prevalence of westerly winds, and that in colder seasons they do not go so far north.

Professor Hind was told by the residents of Aillik and Kypokok, Labrador, 150 miles northwest of Hamilton Inlet, that mackerel were abundant there in 1871, and that a few were caught in cod-seines. While at Double Island harbor, some fifteen miles north of Hopedale, a French Canadian resident informed him that there is "a scattering of mackerel" on that part of the coast.

They appear also at times to have been abundant on the northeastern coast of Newfoundland, though their appearance there is quite irregular. Mackerel do not occur in Hudson's Bay nor on the coast of Greenland. It seems probable that the natural northern limit of the species in the Western Atlantic is not far from the Straits of Belle Isle. Professor Packard, who visited this region in 1866, recorded that a few mackerel are taken in August in Salmon Bay and Red Bay, but that the Straits of Belle Isle were evidently the northern limits of the genus, while Fortin, one of the best Canadian authorities on fisheries, in his annual report for 1864, stated that in summer they appear in some places, such

*Proceedings Boston Society of Natural History, vol. 10, p. 66.

as Little Mecattina on the adjoining coast, latitude $50\frac{1}{2}^\circ$ north, and even sometimes enter the Straits of Belle Isle.*

Perley says that they are rarely known to visit the coast of Labrador. H. R. Storer, after carefully studying the fauna of Southern Labrador, in 1849, came to the conclusion that they were sometimes found at Little Mecattina.

In the various reports of the Canadian inspectors of fisheries on the Labrador coast from 1864 to 1870 may be found evidence that mackerel are rarely taken even on the Labrador coast of the Gulf of Saint Lawrence.

Professor Verrill, who visited Anticosti and Mingan in 1861, was unable to find any mackerel in the waters of that region, although the best methods of catching them were often used.

Some years ago mackerel were abundant in the Bay of Fundy, as many as twelve vessels from Eastport, besides others, being engaged in their capture, chiefly about Digby and Saint Mary's Bay. They have now so completely disappeared as not to form an item in the commercial record of the catch.

The species is found throughout the entire length of the Norwegian coast from the Christiana Fjord to the North Cape and Varenger Fjord, latitude 71°.

It occurs on the south coast of Sweden, and, entering the Baltic, is found along the shores of Eastern Denmark and Eastern Prussia, and also abundantly in the German Ocean and the English Channel, as well as everywhere in all parts of the British Isles, and southward to the Mediterranean, where it abounds, especially in the Adriatic. There is no record of its capture in Africa, South America, in the West Indies, Gulf of Mexico, or even about the Bermudas.

The mackerel, then, would appear to be a shore-loving fish, not addicted to wide wanderings in the ocean, and with range limited in the Western Atlantic between latitudes 35° and 56°; in the Eastern Atlantic between 36° and 71°.

---

* In 1860 Capt. Peter Avery, of the schooner Alabama, of Provincetown, took 100 barrels of fat mackerel at Port au Port, Newfoundland. Captain Atwood, however, has seen them at the Bay of Islands. He has also seen large schools at Mecattina.

Capt. J. W. Collins writes:

"As early as 1836, Capt. Stephen Rich, in the schooner "Good Hope", of Gloucester, spent almost the entire mackerel-fishing season on the coast of Labrador in pursuit of mackerel. He was induced by the reports brought him by the Labrador cod-fishermen to make this attempt. They had reported seeing mackerel abundant in the vicinity of the Straits of Belle Isle, and Captain Rich being of an adventurous turn decided to devote one summer to the investigation of the subject, feeling in hopes of obtaining a large catch. My father was one of the crew, and I have often heard him tell that the trip was entirely unsuccessful, notwithstanding the fact that they cruised all the way from Mecattina Islands through the Straits of Belle Isle, and on the northwest coast of Newfoundland as far down as the Bay of Islands. Few or no mackerel were taken until the vessel returned in the fall to the southern part of the Gulf of Saint Lawrence, where a small fare was obtained in a few weeks' fishing."

2.—MIGRATIONS.

The migrations of the mackerel, the causes of their appearance and disappearance at certain seasons at different points along the coast, the causes of their relative abundance and scarcity in different years, have already been discussed by numerous writers. The subject has received special attention on account of the disputes between our own and the Canadian Government concerning the value to our fishermen of the right to participate in the mackerel fisheries in the Provincial waters.

Notwithstanding the great amount of paper which has been covered with theories to explain the various mooted questions, it cannot be said that the habits of the mackerel are understood at all better than those of other fishes which have not attracted so much attention. The most voluminous writer upon this subject has been Prof. Henry Youle Hind, who devotes many pages of his book, "The Effect of the Fishery Clauses of the Treaty of Washington on the Fisheries and Fishermen of British North America," to the attempt to prove that the mackerel which have been at certain seasons in the past so abundant in the Gulf of Saint Lawrence and on the Atlantic coast of Nova Scotia, remain there throughout the year, hibernating in deep waters not very remote from the shore.* I have attempted to show the weakness of his argument in an

---

* Mr. Barnet Phillips, in the New York Times, December 31, 1880, thus criticises the theory of Mr. Hind, while referring to Mr. William H. Rideing's essay entitled "First Families of the Atlantic":

"In an article entitled 'First Families of the Atlantic,' to be found in the January number of Harper's Magazine, certain assertions are advanced in regard to the habits of the mackerel which are entirely of an ex parte character and might unintentionally act injuriously to our interests in case future disputes arose between the Provinces and the United States on the fishery question. The writer states that, 'seeking a soft muddy or sandy bed at the approach of winter, it [the mackerel] buries itself therein, first drawing a scale or film over each eye.' In a prior paragraph of this same article the possibility of the hibernation of the mackerel is advanced. Now, exactly these two arguments were presented by Professor Hind, who wished to prove that the mackerel was a local fish, in favor of the Provinces, which assertions were entirely refuted by Prof. Spencer F. Baird, Secretary of the Smithsonian Institution, and by Prof. G. Brown Goode. The great argument used by the Provincial fish experts was to show that the mackerel belonged to their waters, and the ideas of hibernation were therefore represented. If this had been granted, our case would have had, as far as mackerel go, little to rest upon. As to hibernation of the mackerel there are innumerable reasons to suppose that nothing of the kind exists. In fact, hibernation is one of those ichthyological questions which require very long research to know anything about. It does seem that sturgeon in Russian waters, and carp in cold temperatures, take to the mud, and may, perhaps, do something like hibernation, but this habit has no precedent in sea-fish. It may happen that a few individuals of the *scomber* family have been inclosed in the winter season in the waters of the Newfoundland coast. Such cases have undoubtedly happened, for on page 62 of the late report of the United States Commission, the statement is made that in a river of Nova Scotia where a school of mackerel had been detained, the fish were speared out of the mud. Returning to the numbing effects of cold weather on sea-fish, in order to show how unusual it must be, the American turbot is taken with hooks in essay published in the Fifth Annual Report of the United States Commissioner of Fisheries for the year 1877, pp. 50–70. It is by no means demonstrated that certain schools of mackerel do not remain throughout the year in waters adjacent to the coast of Canada, but the weight of evidence at present seems to rest with those who believe that the mackerel are given to extensive migrations north and south along our coasts. These migrations are believed to be carried on in connection with another kind of migration which I have called "bathic migration," and which consists in a movement, at the approach of cold weather, into the deeper waters of the ocean. The menhaden and many other fishes have these two kinds of migrations, littoral and bathic. The sea-herring, on the other hand, has extensive littoral migrations and probably very slight movements of a bathic nature. In some the latter is most extended, in others the former. Anadromous fishes, like the shad and the alewife, very probably strike directly out to sea without ranging to any great degree northward or southward, while others, of which the mackerel is a fair type, undoubtedly make great coastwise migrations, though their bathic migrations may, without any great inconsistency, be as great as those which range less.

Upon this point I cannot do better than to quote from a manuscript letter from Professor Baird to the Hon. Hamilton Fish, Secretary of State, dated July 21, 1873. Having expressed certain views concerning the well known phenomenon of the migration of the herring and shad, he continues:

"The fish of the mackerel family form a marked exception to this rule. While the alewife and shad generally swim low in the water, their presence not being indicated at the surface, the mackerel swim near the surface, sometimes far out to sea, and their movements can be readily followed. The North American species consist of fish which as certainly, for the most part at least, have a migration along our coast north-

---

the dead of winter under the floe ice of North Greenland at a depth of 300 fathoms. If sea-fish were mummified in the ocean depths by the cold, because at the deeper strata of the ocean temperatures are fairly uniform, once a fish had hibernated, his sleep might continue on forever. There can be no better proof of the migratory character of the mackerel than to cite a paragraph from the Cape Ann Advertiser, published this week, where the fact is announced that the mackerel fleet have gone off Hatteras in hopes of securing mackerel, and that some time ago 'vessels reported having sailed through immense schools for forty miles.' The film over the eye of mackerel Professor Hind placed great stress on, as he supposed it was a preparatory step to the hibernating process. Now, this film over the eye, as Mr. Goode shows, is not peculiar to the *Scombers*, for many fish, such as the shad, the alewife, the menhaden, the blue-fish, the mullet, the lake white-fish, and various cyprinoid fishes, have this membrane, though it never does cover the whole eye. The fact remains also to be proved that a skin forms over the eye in winter only. The writer of this article has apparently culled his facts in regard to mackerel from one side, and has read most superficially the whole of the testimony. 'Public documents' are rarely of an amusing character, but when they happen to be of interest, as were those published as 'The Award of the Fisheries Commission,' it is most unfortunate when false deductions are derived from them."

ward in spring and southward in autumn, as that of the ordinary pleasure seekers, and their habit of schooling on the surface of the water enables us to determine this fact with great precision. Whatever may be the theories of others on the subject, the American mackerel fisher knows perfectly well that in the spring he may find the schools of mackerel off Cape Henry, and that he can follow them northward day by day as they move in countless myriads on to the coasts of Maine and Nova Scotia."

The movements of the mackerel schools, like those of the menhaden, appear to be regulated solely by the temperature of the ocean.

In my essay upon menhaden, which has just been referred to, I have attempted to show, in a preliminary way, the relations of the movements of the menhaden schools to the temperature of the water at different stations along the coast in accordance with certain crude observations, which at present constitute the only material available as a basis for such generalizations. I have there claimed that menhaden make their appearance near the shore in the spring as soon as the temperature of the water in the harbors has reached a weekly average of 50°, and that they disappear in the fall soon after the waters have again cooled down to the same average temperature.

The mackerel is partial to much colder waters. They range ten to fifteen degrees farther to the north, and their southern limit is proportionally high. They appear earlier in the spring and disappear later in the fall, and their presence is nearly synchronous with the time when the water temperatures of the harbor have reached a weekly average of 45°. It has been remarked that the presence of the menhaden depends upon a weekly average of the harbor temperature of 50° or more. These harbor temperatures are several degrees—it is not known exactly how many—higher than those of the open ocean at the same latitude, and there can be no question that the menhaden thrives in water as cold as 45°. Mackerel will remain active and contented in a temperature of 40°, or even less. The normal time of the departure of mackerel from the coast is, therefore, a month or two later than that of the menhaden.

There are well recorded instances of the capture of menhaden in Massachusetts Bay as late as December, and there are also many instances where mackerel have been taken not only on the New England coast, but also in the Gulf of Saint Lawrence, in mid-winter.*

* Twenty mackerel were caught in a gill-net at Provincetown January 17, 1878. Others were taken late in December. Captain Harding tells me that they sometimes come ashore frozen in cold weather, and are found in the ice on the beach.

Early in February, 1881, small mackerel 5 or 6 inches in length were found in considerable numbers in the stomachs of hake and cod, taken on the eastern part of George's Bank in 50 fathoms, and on the southeastern part of Le Have in 60 and 80 fathoms of water; sometimes ten, twelve, or fifteen in the stomach of a single fish. On the 8th and 9th of February, Captain Olsen observed them schooling at the surface on George's. Gloucester fishermen had before seen them in winter on George's, but never so abundant.

Mr. John Fletcher Wonson tells me that at one time he left Gloucester on a halibut trip January 1, and January 3 or 4 on George's Bank caught a hogshead of herring and 7 or 8 mackerel in a gill-net.

The Schooner Shooting Star took a number of mackerel on George's Bank in March, 1856.*

The fishermen on George's took tinkers from the stomachs of cod-fish in February, 1878, using them for bait. Sometimes five or six were taken from one fish.

In January, 1868 or 1869, Capt. Warren Brown, of the schooner Charles Frederick, of Gloucester, caught 30 mackerel on a trawl-line set on the middle bank.

The Yarmouth Herald (Yarmouth, Nova Scotia), January 2, 1879, states that "two fine fat fresh mackerel were found among the kelp at Green Cove on Friday, December 28, 1878."

Basing their arguments upon such occurrences as these, Canadian writers have attempted to prove that large bodies of mackerel hibernate along their shores throughout the winter. It is still believed by many fishermen that the mackerel, at the approach of cold weather, go down into the mud, and there remain in a state of torpidity until the approach of warm weather in the spring. All that can be said regarding this claim is that, although we do not know enough about the subject to pronounce this impossible, American ichthyologists think they know enough to be of the opinion that it is very decidedly improbable.†

---

* Cape Ann Advertiser, April, 1856.

† It seems only fair to quote in this connection a letter printed in Forest and Stream, a leading New York journal devoted to field sports and the fisheries, in criticism of views published at the time in that paper and also in the report of the Fish Commission, part v. I feel the utmost confidence in Dr. Gilpin's statements as to facts observed, though my interpretation might perhaps be different.

"HALIFAX, *June* 19, 1878.

"*Mr. Editor:* In some papers published some time since in the Forest and Stream upon the habits of the mackerel, it is asserted by Prof. Brown Goode that there is no reliable evidence of mackerel being seen upon the coast of Nova Scotia after the 25th of October, quoting me as his authority. Had he quoted me as giving the 1st of November, 1868, when the fish market at Halifax was full, I should have felt more complimented, as I should have known he had read my paper with more attention. In summing up my remarks I stated that mackerel remain usually all November on the surface in Nova Scotia, and during mild winters linger to December. This, Professor Goode says, is not reliable as scientific evidence, because no specific dates are given. To admit this would be to destroy almost the whole mass of information compiled in the report of both the Royal and American Commissioners of English and American Fisheries. But as I am certain that Professor Goode's desire is to have the truth simply, will you allow me a place in your columns to add to my previous assertions such specific dates as I may be able now to obtain, though not admitting his principle.

"On May 23, 1875, going into the Halifax fish market, I asked generally how long are mackerel in market? I was answered, generally all through November. On asking how long in December they had known them in market, Mr. Greywire said: 'I recollect them as late as the 10th of December. We keep our nets out to the 30th of November. Men hire to that time. Mackerel are seen after that date, but the seas

The appearance of the mackerel schools at the approach of summer in ordinary years has been noticed somewhere in the neighborhood of the following dates: At sea, off Cape Hatteras, March 20 to April 25; off Norfolk, Va., March 20 to April 30; off the Capes of Delaware, April 15 to May 1; off Barnegat and Sandy Hook, May 5 to May 25, and at the same date along the whole southern coast of New England, and as far east as Southern Nova Scotia, while in the Gulf of Saint Lawrence they appear late in May, and in abundance early in June.*

There appears to be a marked difference between the movements of mackerel and the menhaden, for while the menhaden are much more gradual in their approach to the shore, and much more dependent upon a small rise of temperature, the mackerel make their appearance almost simultaneously in all the waters from New Jersey to Nova Scotia at about the same time. Stragglers, of course, appear much earlier than the dates just mentioned; a few mackerel were observed at Waquoit, Mass., as early as April 19, 1871.

In the fall the mackerel disappear as suddenly as they came in the spring, but they have only in one instance been observed off the Carolina coast, except during the spring run. This is very probably because no fishing vessels ever visit this region later than June.

The instance referred to is the experience of Mr. Peter Sinclair, a well-known fisherman of Gloucester, who states that he has frequently taken them in great abundance off Cape Hatteras in December, where they are not known at all in the summer season. He has found them in the

---

are so boisterous that our nets are destroyed. Some few parties will keep them out in December in spite of cold and storms.' Mr. White corroborated this. Mr. Thomas Brackett said he had taken them often in December, and often in weather so cold that the fish were frozen in removing them from the meshes of the nets, but could remember no dates. Mr. William Duffy stated he saw one once on the 24th of December. He recollected it because it was Christmas eve, and on account of its rarity; but he had frequently taken them during December, though having no dates. The nets used are about two fathoms deep, set near the shore in about five to ten fathoms of water. My own recollections, but without dates, are seeing stops made in very cold weather and frozen ground, which must have been late in November. I think I have now made good my assertion that they linger to December, and that in any future history of

---

*The following letter from the skipper of the schooner Edward E. Webster is important, in that it gives the exact positions as well as the dates of some of the earliest captures in 1878, '79, '80, and '81:

"NEW YORK, *April* 22, 1881.

"Captain COLLINS:

"DEAR SIR: I have just received your letter of March 14, in which you wanted to know whereabouts I caught my first mackerel. (The first catch) in 1878, April 16, lat. 36° 10′ N., long. 74° 45′ W.; in 1879, April 12, lat. 36° 35′ N., long. 74° 50′ W.; in 1880, April 1, lat. 35° 30′ N., long. 74° 15′ W.; in 1881, March 20, lat. 37° 10′ N., long. 74° 05′ W.; and this trip we got them April 18 in lat. 38° 38′ N., and long. 74° 00′ W This is our second trip this season. I have seen mackerel in lat. 35° 15′ N., and long. 73° 46′ W., which is the fartherest south I have ever seen any. I have been off Cape Lookout many times, but have never seen mackerel there. * * *

"Yours, truly,

"SOLOMON JACOBS."

spring as far south as Charleston, and followed them from Cape Henry to the Bay of Fundy and the Gulf of Saint Lawrence.

The very vagueness of the statements just made is evidence to show how little is actually known about the movements of these fish. The subject must be studied long and carefully before it can be understood, and the interests of the American fishermen demand that it should be thus studied.

"There is," writes Professor Baird, "no very satisfactory evidence of the occurrence of mackerel in the winter or any other season south of Cape Hatteras, and it is not given by Poey and other writers as occurring in the West Indies. A few mackerel are said to be occasionally brought into the Charleston market, and Mr. Moses Tarr, of Gloucester, thinks that some years ago he saw in the early part of March, a short distance to the southeast of Key West, a large school of mackerel. He, however, did not capture any, and it is more likely that the fish observed belonged to some other small species of the mackerel family which occasionally school like the mackerel itself, and might easily be mistaken for it. The skip-jack or leather-back may possibly have been the species referred to.

"I have been quite surprised to find the extent of belief among Massa-

---

their habits it must be assumed as truth that they remain in numbers during November, but are found sparingly later on our coasts. Where they are during those dates in any intermediate point from Maine to Virginia, must be left to American observers. When these blanks are filled and a generalization made their history will be more complete, a task we may well leave in the hands of the American Commissioners of Fisheries.

"In my paper (1865) I speak of their asserted torpidity and the story of their blindness as needing more proof before they are asserted as facts. I have had nothing to alter my opinion since. In examining the eyes of many mackerel on May 23 and 27 and October 27, in different years, I have found that, as in most fish, the bony orbit is much larger than the base of the eye, and that the space is filled by gelatinous substance, which may be called cellular membrane and adipose deposit to this transparent membrane arising from the outer angle of this orbit spreads half way over the pupil of the eye. It may easily be raised and defined by passing a pen-knife between it and the eye. At the inner angle there is also a similar, but much smaller, membrane, not reaching to the eye. As the mackerel appear on our coasts about the 15th of May, and these observations were made the 23d, I do not think it can be asserted the eye is closed entirely in spring; and as the same appearance is found in September, we must admit it to be a permanent structure. An analogous membrane is found in the clupide, and doubtless other fish. On asking Thomas Loyd, our roughest and oldest fisherman: 'I don't know anything about the scales of the eyes, but I do know that, curse them, they see too sharp for us, steering clear of our spring nets,' and doubtless old Tom was right.

"On dissecting a mackerel, May 23, I found the heart first presenting the tricornered ventrical with its white aorta and deep red auricle resting upon the fringe of cœca that covered the intestines, sweeping down to the vent. The liver and stomach were both covered by the cœca. The latter was about three inches long, its upper lobe thick and round, but ending in a narrow tail or point. The cardiac end of the stomach was prolonged two and a half inches, ending in a point. The cœcæ were attached to the gut about an inch below the pylorus. There was but little difference in appearchusetts fishermen that the mackerel goes into the mud in the winter time. I have, indeed, been assured by trustworthy parties that they have known mackerel caught on eel spears when fishing for eels in the mud of Provincetown harbor.

"A similar belief is referred to by Dr. Gilpin in his paper on the mackerel in the transactions of the Nova Scotia Scientific Association, and it is difficult to refuse assent to the testimony of otherwise credible observers. There is nothing apparently in the economy of the mackerel to prevent its following the example of the sand lance, the eel, and other fish. We know that the melanora, the tench, and many other fresh-water fish have the burrowing habit, some of them being imbedded very deep in the mud at the bottom of a dried-up pond, to emerge again when the water is restored.

"The entire disappearance of mackerel during the winter season is a noteworthy fact, as we can hardly suppose that if it schooled on the surface in the Gulf Stream during that season it would not be noticed by the experienced eyes of sea captains, and we can hardly imagine that the fish would remain in the depths without an occasional rise.

---

ance and size between stomach and gut. This we may roughly sum up: Stomach and gut very simple; cœca usually large and complicated; liver small, all noteworthy facts in the study of comparative life. The fish being a male one, lobe on either side of ivory-white; milt reached from gills to vent, slightly adhering to the sides by thin membrane, and covered by a similar one. They were divided in lobes by shallow lines, the upper lobes slightly fimbriated. On removing both entrails and milt a dark-purple space about an inch wide extended from gills to vent beneath the back bone. This, when opened, seemed filled with coagulated blood. It had in some respects the appearance of the air bladder in the salmonidæ, though wanting in the direct communication they have with the œsophagus. But this communication is also wanting in the gadidæ, where, especially in the hake, the air bladder assumes its highest form of organization. I have often found coagulation and reticulated plexi in air bladders of other fish.

"It has been asserted the European mackerel have no air bladders, and a new genus proposed, but with more probability they have the same organization as our own, and the difference lies in the opinion whether or not it is an air bladder.

"The mackerel appear on the Atlantic coast of Nova Scotia, and almost simultaneously on the Bay of Fundy, about the 15th of May. Nearly all spawners, male and female, perform a somewhat easterly and northerly route, disappear from the surface in a few weeks and reappear again in September without spawn, and fat, remain in numbers during November, and very sparingly during December, coming from the eastward and then disappear. It may be asserted generalizing from observation extending over a series of 8 or 10 years, that they are irregular in their movements as regards localities, though probably not as regards ocean surfaces.

"The very great difficulty of accounting how these enormous masses of surface feeders find food after disappearing from the surface has caused many ingenious theories, as to the question in what state and where they pass that time. These are all pleasant reading, but valuable more or less as regards the ingenuity and scientific standing of the writers. In this paper and the one I inclose (1865) I have stated what I think are facts, and which must be accepted in the future history of American mackerel, which I hope soon to see written by that commission which has already done so much in Atlantic waters.

"BERNARD GILPIN."

"It appears to be a well-established fact that mackerel are not unfrequently found in the stomachs of cod, and possibly of halibut, taken on the George's Banks in the winter season. Perhaps the number noted would be still larger if fishermen had the time and inclination to examine more frequently than they do the stomachs of the fish captured by them.

"Another curious fact in relation to the mackerel is in respect to the membrane, the vertical edge of which is observed during the summer season on the corner of the eye. This, it is claimed, during the winter extends over the whole eye, and imparts the appearance of blindness. This the mackerel is said to possess on making its first appearance near the coast in the spring, when it extends over the greater part of the eye, thus preventing the fish from seeing the bait, and it is a matter of common remark that mackerel in the spring cannot be taken with the hook, but must be captured with the net. The membrane appears to recede with the advancing season, and during a considerable portion of the time of its abode in the north it is scarcely appreciable."

Mr. Perley, of Saint John, N. B., in his work upon the fishes of the Provinces, remarks that mackerel have been taken on cod-hooks in deep water, near Grand Manan, in the winter season, and there is evidence to show that a few remain on the coast. It is, however, believed that these cases are exceptional and confined to stragglers, as such instances frequently occur with all the migratory fish.

The mackerel belongs to what may technically be termed pelagic or wandering fish, as their movements, something like those of the herring, are apparently more or less capricious, though probably governed by some definite law, which has not yet been worked out. It moves in large schools or bands, more or less isolated from each other, which sometimes swim near the surface and give distinct evidence of their presence, and at others sink down into the depths of the ocean and are entirely withdrawn from observation. The army of fish, however, in its northern migration, moves along with a very broad front, a portion coming so close to the shore as to be taken in the weirs and traps along the coast of Southern New England, especially in Vineyard Sound and on Cape Cod; while at the same time other schools are met with from 20 to 50 miles, or even more, out to sea. It is, however, still a question whether the fish that skirt the coast of the United States enter the Bay of Saint Lawrence, or whether the latter belong to another series, coming directly from the deep seas off the Newfoundland and Nova Scotia coast. Until lately the former has been the generally accepted theory, in view of the alleged fact that the fishermen of the Nova Scotia coast always take the fish coming from the west in the spring and from the east in the fall.

Captain Hanson B. Joyce, of Swan's Island, Maine, one of the most expert and observing mackerel fishermen of New England, thinks that the movements of the spring schools of mackerel are very much influenced by the direction and force of the prevailing winds while the fish are performing their northerly migration. He has generally found, he says, that when there has been a continuance of strong northerly winds about the last of May and early in June, the season at which the mackerel are passing the shoals of Nantucket and George's Bank, that the schools have taken a southerly track, passing to the southward of George's Shoals and continuing on in an easterly direction to the coast of Nova Scotia, and thence to the Gulf of Saint Lawrence.

When southerly winds or calms prevail at that season the mackerel are carried into the waters of the Gulf of Maine, and in consequence are much plentier off the New England coast than in the Saint Lawrence Gulf.

On this theory Captain Joyce bases his actions in cruising for mackerel, always fishing off the New England shores when southerly winds have predominated in the spring, and going to the Saint Lawrence if northerly winds have been exceptionally strong and continuous about the last of May.

The movements of the fish, as already stated, season by season, are quite uncertain, sometimes being very abundant in one direction and sometimes in another, and occasionally, indeed, they may disappear almost entirely for several years, and then reappearing after a considerable absence. In some years mackerel are very abundant on the coast of the United States and at others rare; the same condition applying to the fish of the Bay of Saint Lawrence. It is not certain, of course, that this indicates an entire absence of the fish from the localities referred to, but they may, possibly for some reason, remain in the depth of the sea, or some change in the character of the animal life in it, which constitutes the food of the fish, may produce the changes referred to. A notable instance of a somewhat permanent change in the migration of the mackerel is found in the entire failure since 1876 of the mackerel fishery in the Bay of Fundy, which, a few years ago, enabled a merchant of Eastport to employ successfully as many as a dozen vessels, especially in Digby and Saint Mary's Bay, but which is now given up. There are indeed faint suggestions, in the early history of the country, of their total absence from the whole coast for several years, as was also the case with the bluefish.

3.—Abundance.

The wonderful abundance of mackerel in our waters has always been a subject of remark. Francis Higginson, in his "Journal of his voyage to New England, 1629," speaks of seeing "many schools of mackerel, infinite multitudes on every side of our ship," off Cape Ann on the 26th of June; and Richard Mather, in his "journal" 1635, states that the seamen took abundance of mackerel off Menhiggin (Monhegan). In Governor Winthrop's journal, speaking of the year 1639, he remarks: "There was such store of exceeding large and fat mackerel upon our coast this season as was a great benefit to all our Plantations, since one Boat with three men would take in a week ten hogsheads, which were sold at Connecticut for £3 12*s.* 0*d.* per hogshead."

Their abundance has varied greatly from year to year, and at times their numbers have been so few that grave apprehensions have been felt lest they should soon depart altogether.

As early as 1670, laws were passed by the colony of Massachusetts forbidding the use of certain instruments of capture, and similar ordinances have been passed from time to time ever since. The first resource of our State governments has always been, in seasons of scarcity, to attempt to restore fish to their former abundance by protective legislation. It seems to us at the present day absurd that the Massachusetts people should have supposed that the use of shore-seines was exterminating the mackerel on the coast of Massachusetts, but it is a fair question whether their apprehensions were not as well grounded as those of legislators of the present century who have endeavored to apply a similar remedy for a similar evil. In connection with the chapter on the mackerel fishery will be shown a diagram, which, by means of curves, exhibits the catch of mackerel in New England for a period of seventy-five years.

From a study of this it seems quite evident that the periods of their abundance and scarcity have alternated with each other without reference to overfishing or any other causes which we are prepared to understand. In the year 1831, 383,548½ barrels of mackerel were inspected in Massachusetts. In 1881 the number of barrels inspected was 269,495; to this, however, should be added 125,000 barrels caught and marketed fresh by the Massachusetts fleet, making an aggregate of 394,495 barrels. The fluctuations in the catch year by year from 1804 to 1881 are shown most instructively in a plate accompanying this report.

The total catch of mackerel by the New England fishermen in 1880 amounted to 131,939,255 pounds; while the Canadian catch (according to official returns, barrels being estimated to contain 300 pounds, cans, one and one-half pounds of fresh round fish) was 70,271,260 pounds, making an aggregate of 202,210,515 pounds. The yield of New England in 1881 is estimated to have exceeded that of 1880 by 10,000,000 pounds. We have no means at present for estimating the decrease of the Canadian catch, but it is perhaps safe to put it at 11,000,000. This brings the catch of 1881 to about 201,000,000 pounds. In addition to this, at least 100,000 barrels or 20,000,000 pounds, according to estimates from competent authority, were thrown away by the New England fleet. This brings the total weight of mackerel caught up to 221,000,000, representing 294,667,000 fish, if the weight be estimated at three-quarters of a pound each. The catch of mackerel in the waters of Europe does not probably exceed ten per cent. of this quantity.

The stories which are told by experienced fishermen of the immense numbers of mackerel sometimes seen are almost incredible. Capt. King

Harding, of Swampscott, Mass., described to me a school which he saw in the South Channel in 1848: "It was a wind-row of fish," said he; "it was about half a mile wide, and at least twenty miles long, for vessels not in sight of each other saw it at about the same time. All the vessels out saw this school the same day." He saw a school off Block Island, 1877, which he estimated to contain one million barrels. He could see only one edge of it at a time.

Upon the abundance of mackerel depends the welfare of many thousands of the citizens of Massachusetts and Maine. The success of the mackerel fishery is much more uncertain than that of the cod fishery, for instance, for the supply of cod is quite uniform from year to year. The prospects of each season are eagerly discussed from week to week in thousands of little circles along the coast, and are chronicled by the local press. The story of each successful trip is passed from mouth to mouth, and is a matter of general congratulation in each fishing community. A review of the results of the American mackerel fishery, and of the movements of the fish in each part of the season year by year, would be an important contribution to the literature of the American fisheries. Materials for such a review are before me, but space will not allow that it should be presented here.

4.—Food.

The food of the mackerel consists, for the most part, of small species of crustaceans, which abound everywhere in the sea, and which they appear to follow in their migrations. They also feed upon the spawn of other fishes and upon the spawn of lobsters, and prey greedily upon young fish of all kinds.* In the stomach of a "tinker" mackerel, taken in Fisher's Island Sound, November 7, 1877, Dr. Bean found the remains of six kinds of fishes—of the anchovy, the sand-lance, the smelt, the hake, the barracuda, and the silver-sides, besides numerous shrimps and other crustaceans. Captain Atwood states that when large enough they devour greedily large numbers of young herring several months old. Specimens taken July 18, 1871, 20 miles south of Noman's Land, contained numerous specimens of the big-eyed shrimps, Thysanopoda, larval crabs in the zoea and megalops stages, the young of hermit crabs, the young lady crabs, *Platyonichus ocellatus*, the young of two undetermined Macrura, numerous Copepoda, and numerous specimens of *Spirialis Gouldii*, a species of Pteropod. They also feed upon the centers of floating jelly-fishes (*Discophores*). In Gaspé the fishermen call jelly-fishes "mackerel bait."

The greed with which mackerel feed upon the chum, or ground men-

*Near the New London light-house is a small brook which empties into the harbor and abounds with a small species of fish of which the mackerel appear to be fond.

A few days since the keeper of the light-house, while the mackerel were indulging in a meal, caught five hundred at one haul with a scoop-net.—(Gloucester Telegraph, December 3, 1870.)

haden bait, which is thrown out to them by the fishing-vessels, shows that they are not at all dainty in their diet, and will swallow without hesitation any kind of floating organic matter.

Large mackerel often eat smaller ones. Captain Collins has frequently found young mackerel three or four inches long in the stomachs of those full grown. This is generally noticeable only in the fall, and the young fish are probably those which have been hatched in the spring.

In the fall of 1874 the writer made a trip upon a gill-net schooner to the grounds off Portland, Me., some distance to sea, for the purpose of studying the food of the mackerel, and found their stomachs full of a species of *Thysanopoda* and of a large copepod crustacean. The greater part of the food of mackerel consists, however, of minute crustaceans. Owing to the infinite abundance of these in the sea, mackerel probably have very little difficulty in finding food at almost any portion of the ocean visited by them, whether on the edge of the Gulf Stream or near the shore.

In an interview with Capt. King Harding, of Swampscott, one of the most experienced mackerel catchers on our coasts, I obtained the following amusing observations: He described one kind which looked like spiders, which were red, and crawled over his hand when he took them up. They look like little spiders; the mackerel are especially fond of them. At Boone Island, Maine, in July, 1850, the water all around the island was red for 100 yards from the shore; they crawled up the rock-weed on the shore until it was red. He took the sprays of rock-weed in his hand and pulled them slowly to him, and the mackerel, one and a half pound fish, would follow in quite to the rocks. He killed three with his oar, and tried to catch some in a basket by tolling them over it, but they were too quick for him. He asked his old skipper, Capt. Gorham Babson, what they were, and was told that they were "Boone Island Bed Bugs." And, said he, "Young man, when you see this kind of bait, no matter if you don't see any fish, never leave; the fish will be there in a few days."

Then there is another kind, called "Snappers." These are white, and dart rapidly about in the water; they are doubtless small crustaceans. He says that sometimes they swim at the surface, where the mackerel follow them. A few days before he had been standing on the stern of his vessel, and though he could see nothing under the water he knew the snappers were there about two feet below the surface, for he could see a school of mackerel swimming along, opening their mouths and taking in their food, and then letting the water out through their gills.

When the mackerel are tolled up from 12 or 15 fathoms below the surface their stomachs are often full of bait; so it is certain that these little animals swim at all depths.

Another kind of food is red, and is hot to the hands. This is called "Cayenne"; it spoils the fish.

Years ago, according to Captain Harding, mackerel did not school as they do now.

When you see pollock jumping near the shore, it is a pretty good sign that there is plenty of mackerel food.

The presence of abundance of mackerel food is indicated by the great schools of sea-birds, particularly by the flocks of phalaropes, or sea-geese (*Phalaropus borealis*), as the fishermen call them, which congregate together, floating upon the water, and when seen in summer gives a sure sign of the presence of mackerel also.

The various invertebrate animals preyed upon by mackerel are known to the fishermen by such names as "Shrimp," "Red-seed," and "Cayenne."

"The wide-spread distribution from shore seaward of the Thysanopoda and other minute crustacea, which constitute to so great an extent the food of the mackerel and herring on our shores, was proved," writes Professor Baird, "during a trip of the 'Speedwell' from Salem to Halifax in 1877." At numerous points and at regular intervals on the way across, including the middle of the route, immense numbers of these shrimp were met with and collected by the towing net. They were found in especial abundance at Le Have Bank. These prove to be specifically identical with those found in immense quantities in Eastport Harbor at the surface.

"That these same animals occur at least as far east as the Gulf Stream is shown by the list of the collections made by Professor S. I. Smith off the Georges near the edge of the Gulf Stream, and published in the Transactions of the Connecticut Academy of Arts and Sciences, vol. iii, July, 1874."

Capt. Chester Marr, of Gloucester, confirms the statements of Captain Harding regarding the effects of "red-seed" upon mackerel; he states that when mackerel are feeding on "red-seed" the fishermen have great trouble in keeping them sufficiently long to dress them properly. Their bellies soften at once. When the weather is good and dogfish are not troublesome, the common practice is to allow the fish to lie in the net until they have disposed of the food in their stomachs. Capt. Henry Willard, of the schooner "Henry Willard," of Portland, Me., carries a large net of coarse twine, which is suspended over the side of the vessel from two long booms. Into this he turns the fish and leaves them until the seed works out.*

Captain Marr states that the "red-seed" is very troublesome to the men engaged in dressing the fish; it makes their hands very sore, often causing the blood to run. A man can clean twice as many fish in a given time if he is not annoyed by the "red-seed" in their stomachs.

Captain Marr describes another kind of mackerel food, which he calls "small brit," which, he says, resembles young herring, which also rots

*This "large net of coarse twine" is the mackerel pocket described in the chapter on the purse-seine mackerel fishery.

the fish. This is probably, as he supposes it to be, "white-bait" or the young of the sea herring, *Clupea harengus*. It is known as "eye-bait" to the Canadian fishermen.

Captain Merchant tells me that when mackerel are found with "red-seed" in their stomachs fishermen are sure that they are on the right fishing grounds.

I am told by Captain Collins that it is common for many of the American fishermen to consider it a good sign of mackerel when they see floating seaweed, more especially eel grass, "chopped up," *i. e.*, cut into short pieces, which they think is done by these fish. Perhaps there may be a good reason for this supposition, since the mackerel, while feeding on the diminutive shells with which the weeds are covered, may also bite the latter in two. The presence of gannets is also considered a good sign of mackerel.

In England the food of the mackerel is called the "mackerel mint," and this is said to consist at certain seasons of the year of the sand-lants and five other fish, especially the herring and the sprat, while they have also been observed to devour, in the summer months, minute crustaceans, the swimming larvæ of tape-worms, and the embryos of the small spiral shell of the genus *Rissoa*, which, in its adult state, is found in great abundance upon seaweed. It was probably some animal of this kind which was referred to by Captain Harding in the statement above quoted, concerning the abundance of red-seed about Boone Island. Mr. J. F. Whiteaves has recorded a similar habit for the mackerel of the Gulf of Saint Lawrence.*

Professor Hind has pointed out certain relations which exist in the Gulf of Saint Lawrence between the mackerel and the lant, or sand-eel, which appears to be one of its most important articles of diet in these waters. I quote here in full his observations upon this subject, and also his views upon the relations of currents and tides to the presence of mackerel food, and the constant movements of the schools of fish:

"The movements of the mackerel, like those of the cod, and indeed of most species of fish, are determined at different seasons of the year by the geographical position of its food; and the first important kind of food which appears to lure the mackerel inshore, after spawning in the Gulf of Saint Lawrence, is the launce or sand-eel.

"The relation of the launce or sand-eel (*Ammodytes americanus*) to the mackerel is very much greater than appears at the first blush, and resembles the relation of the herring to the cod in general, and in particular the relation of the so-called Norwegian 'Sull còd,' or launce cod, to this widespread and important bait-fish. The approach of the launce to the coast in spring is most probably the cause why the so-called spring cod fishing suddenly ceases on many banks and shoals, commencing again at different localities two and three weeks later.

---

* Report on the second deep-sea dredging expedition of the Gulf of Saint Lawrence, 1872.

"The cod leaves the banks and shoals to meet and to follow the launce as they approach the coast. In the same manner they meet and follow the caplin, guided no doubt by the peculiar odor developed by each species at the approach of the spawning season.

"But it is the habit of the sand eel of burying itself in the sand between the tides, or in submerged sand beaches, that leads the mackerel so close inshore.

"There can be little doubt that a similar indraught and outdraught of mackerel and other fish occur in our waters when the launce leave the deep sea to approach the land, or when they return to the deep sea again. Unlike many of the shrimps and larval forms on which the mackerel feed, which are drifted to and fro by winds and currents, the launce is independent of the wind; but it is only in certain favorable localities frequented by this fish that the burying process between tide-marks, from which it derives its name, can be easily effected; hence, these resorts are not only valuable as bait grounds, but generally noted mackerel grounds, such as Seven Islands, and some parts of Bay Chaleurs, and part of the gulf coast of New Brunswick.

"This bait-fish approaches the sandy beaches fringing the shores of the gulf in the early summer months to spawn; and here the mackerel are found pursuing them while engaged in depositing their comparatively large reddish-colored ova on the sands between high and low water. Hence, during flood tide, and in the launce season, mackerel are commonly taken close inshore on these coasts, in pursuit of the launce; and the best catches are said to be made during the period of high tide, for the following reason: In dull, cloudy weather the launce buries itself in the sand left bare by the ebbing tides; but in bright, hot weather it rarely seeks the shelter of the sands except near low-water mark, probably because the heat of the sun would be oppressive. The breadth of sandy ground in which the launce buries itself for the brief period between high and low water marks is thus dependent upon the clearness of the sky.

"A continuance of cloudy weather is conducive to this kind of close inshore fishery; whereas a bright sky, and a day with a drying wind, leads the launce to select the narrow bands of sandy beach near the margin of ebb-tide, which always remain moist. In cloudy weather with a moist wind, the area in which the launce bury themselves and emerge during the incoming tide is thus very much greater than in bright, hot weather; and it is not unfrequently found by experience that the mackerel catch in such localities is much greater in cloudy weather than in bright weather, because the bait ground is then far more extensive close inshore.

"As the summer advances and the launce retire to deep water the mackerel feed upon the free-swimming and floating embryonic forms of crustaceans; among the latter the zoea of different forms of crabs are the most common. Adult shrimps of many species form also a large portion of their food, and the infinite numbers of these forms of life which exist in the sea, from the coast line to a thousand miles from land, may be inferred from the fact that, together with fish, they form the great staple of food of seals in northern seas.

"Dr. Robert Brown states that during the sealing season in Spitzbergen seas he has taken out of the stomachs of seals various species of *Gammarus* (*G. Sabini; G. loricatus; G. pinguis: G. dentatus; G. mutatus*, &c.), collectively known to whalers under the name 'mountebank shrimps,' deriving the designation from their peculiar agility in water.*

"These small crustaceans are found in countless numbers on the great outlying banks off the North American coast, and in the Labrador seas they are also in great profusion.

"It is of special importance to notice that very many if not all of these free-swimming creatures in the sea, from invisible microscopic forms to the largest shrimp, sink to different zones of water or rise to the surface with the variations in temperature and changes in the direction and force of the wind. In fine weather *when* the food is *at the surface*, the mackerel, the herring, and other surface feeders swim open-mouthed against the wind. Dr. Brown states that the right-whale and most of the whale species feed in a similar manner. The right-whale feeding, swims leisurely at the rate of about four miles an hour. Mackerel when feeding come often by millions, like a swiftly-moving ripple on the water, with eager staring eyes and mouths distended to entrap the floating prey. Many of the free-swimming Pteropeda are active only during the night time, sinking during the day to a certain zone of depth.

"The effect of currents and tides, assisted by winds, is to drive these free-swimming forms towards the different shores and into land-locked or sheltered bays. On the shores of the open sea a continued land breeze drives them far out to sea, and the fish following them will be lost to view. Off the coast of the United States the mackerel ground is not unfrequently found near the summer limit of the Gulf Stream where wide-spreading eddies prevail, caused by the meeting of the great Labrador current flowing in an opposite direction, or the surging up of the Arctic underflow. In these vast eddies the temperature is greatly reduced by the mixing of almost ice-cold water from beneath with a warm overlying stratum.

"It is here too that the free-swimming mackerel food will congregate, sometimes at the surface, at other times at different depths, dependent upon the temperature of the mixed waters. In the vicinity of the south edge of the Grand Bank of Newfoundland the line of contact between the Arctic and the Gulf streams is sometimes very marked by the local currents which 'boil and form strong eddies.' The line of contact of the two great cold and warm currents is continually changing for hundreds of miles with the varying seasons and under the influence of winds;

* "On the seals of Greenland."—*Dr. R. Brown.*

hence also the changes in geographical position and in the depth or zone of the open-sea mackerel grounds.*

"Inshore the floating and free-swimming food is drifted to and fro by winds and tides, and great accumulations are sometimes thrown up upon the beaches in windrows after storms. This floating and swimming food gathers in eddies, either near the coast line or at the junction of opposing tidal waves or currents. Hence, along sheltered and embayed coasts, confronting the open sea in the vicinity of banks where great tidal currents and eddies are formed, or in the gulf and estuary of the Saint Lawrence, where two opposite and wholly different tides dragging along the coast-line approach to meet, there will be the mackerel ground of the fishermen, but not necessarily *at the surface*."

The winged Pteropods very properly form an important part of mackerel food, as they sink and rise with changes of the temperature of the zone or sheet of water in which they are feeding.

5.—REPRODUCTION.

Although little is actually known concerning the spawning habits of the mackerel compared with those of fish which, like the shad and the salmon, have been artificially propagated, it is perhaps safe to say that the subject is understood in a general way. The testimony of reliable observers among the fishermen of our coast and the coast of the British Provinces indicates that the spawning takes place in rather deep water all along the shore from the eastern end of Long Island to Eastport, Me., along the coast of Nova Scotia, and in the Gulf of Saint Lawrence. The spawning season occurs in May in southern New England, in May and June in Massachusetts Bay, and in June in the Gulf of Saint Lawrence, and on the Bradley Banks and about the Magdalenes early in the month, and, according to Hind, on the northeast coast of Newfoundland toward the end of the month.†

*There are no mackerel-fishing grounds within 250 miles or more of the Grand Bank, and certainly none nearer than 400 miles of its southern edge. It is possible that mackerel have occasionally been seen, or stray specimens captured, nearer the Grand Bank than this, but no mackerel fishermen would think of trying for these fish east of the west coast of Newfoundland. There are but three instances on record where mackerel fishermen have gone so far east as that. Whatever influence may be exerted upon other forms of ocean life by the meeting of the Gulf Stream and the Arctic current, it can be quite safely asserted that the mackerel is never found in summer near the junction of these currents, excepting, perhaps, on the southern edge of George's Bank and off the south shoal of Nantucket. These localities are the nearest mackerel-fishing grounds to the Gulf Stream of any on the United States coast. And even here mackerel are rarely or never taken nearer than 40 or 50 miles from the northern edge of the stream.—J. W. COLLINS.

†During the entire month of June mackerel are taken in the Bay of Saint Lawrence with roes well developed. Having been engaged in the mackerel fishery in the Gulf for twenty-two consecutive seasons, ten of which I went to the Bay early in June, I have therefore had abundant opportunity to learn the spawning season of the mackerel in that region. It is my opinion that mackerel spawn in the Gulf of Saint

Capt. Benjamin Ashby, of Noank, Conn., states that in the spring of 1877 mackerel spawned in great numbers in Vineyard Sound and Buzzard's Bay. Many mackerel were taken in the pounds, and the eggs were so ripe that when the fish were thrown from the net to the boat the eggs escaped to such an extent that in cleaning out the boat afterwards he found at least half a bushel at the bottom. This was as early as the second of May, and continued through the month.

Capt. R. H. Hurlbert, of Gloucester, found the spawn running out of mackerel taken off Kettle Island, south of Cape Ann, in May and June.

Capt. Henry Webb, who owns a weir on Milk Island, under the shadow of the Thatcher's Island lights, obtains many mackerel every year in his nets. He informs me that when they first make their appearance, about the first of June, the spawn is running out of them and many of them are half through the process of spawning. The eggs will spurt from a female fish in a stream six feet long, and there is a large percentage of females in the catch, probably two-thirds of the whole.

Lawrence some time between the 1st and the 15th of July. Have caught them in abundance and full of roe as late as the 4th and 5th of July, and it is exceedingly rare to find spent mackerel previous to the 20th of June. In the period when hook-and-line fishing was most prosperous, the fishermen usually planned to leave the Gulf about the first week in July if they had succeeded in getting nearly a fare of mackerel previous to that time, since while the fish were spawning, or between the 1st and 15th of the month, but little could be done, as the mackerel sunk at that time, and would not readily take the hook. The fishermen, therefore, knowing that they could catch few fish during this period, between "hay and grass," as they termed it, usually improved the opportunity thus afforded of making their passage home and refitting for another trip with comparatively little loss of time. Apparently one of the most favorite breeding grounds for mackerel in the Gulf of Saint Lawrence is the area along the shores of New Brunswick and Prince Edward Island (on the north side of the latter) lying inside of a line drawn from North Cape to Point Miscou. Bank Bradley is also a breeding-ground for mackerel of considerable importance. The fish seem to assemble on the grounds mentioned above during June, in a depth varying from 3 to 40 fathoms. The greater part, however, are found in a depth varying from 10 to 20 fathoms. The spawning season being over, they usually stay on the same grounds, though later in the summer and during autumn the mackerel were formerly abundant around the Magdalenes and the bend of Prince Edward Island; when the fall migration takes place they move farther south. It is probable that large numbers of mackerel may deposit their spawn around the Magdalene Islands, though it is worthy of note that but few or no fish have been taken in that locality on hook and line during the month of June. Considerable quantities are, however, caught by the gill-net fishermen early in June, though the catch has always been small compared with that formerly obtained by hook-and-line fishing in the western part of the Bay.—J. W. COLLINS.

As corroborative of the views of Captain Collins, I give the statements of Capts. Andrew Leighton and Joseph Rowe, two of the most keenly observant, and in consequence the most successful, of the old school Cape Ann "mackerel killers." The former writes to Captain Collins: "My observations are in harmony with yours." The latter remarks: "I have always thought that the mackerel in the Bay of Saint Lawrence sunk about the last of June to spawn. From the first to the middle of July was always a very dull time to catch mackerel on hooks. When the mackerel sunk they were full of spawn. When we got them again, about the middle of July, they would have the most of the spawn out of them and be some fat."

The spawn begins to dry up after the first of August, and young fish begin to appear about the 4th of August. He thinks that it takes mackerel four or five weeks to spawn; after that they begin to grow fat, and when they are fat there is no sign of spawn to be seen, the male and female not being distinguishable.

The growth is rapid, and in about seven weeks the young fish are about four or five inches long.

Mackerel spawn abundantly in Grover's Beach at a depth of one and a half to two fathoms. The eggs are very minute and the old mackerel feed upon them greedily.

Captain Fisher, of Portland, Me., told me, in 1874, that when the mackerel come in they are almost empty and have a muddy taste. They first engage in spawning, but toward the last of June they have finished and begin to grow fat.

Captain Hurlbert caught a dozen fish off Camden July 1, 1870, which were half spawned and had spawn running out of them.

According to Mr. Wilkins, of Two Isles, Grand Manan, the mackerel spawns there on the rocks and sand in water from 1 foot to 10 feet or more in depth. This is in the first half of June. The spawn is in bunches and does not float on the water.

During the spawning season mackerel are taken in seines, as they will not bite and are then very poor. They come again in September and October, and are then taken with the hook.

Mr. Hall, of Charlottetown, Prince Edward Island, says that mackerel spawn only once in seven years in large numbers, this period representing the interval between the successive large catches. The mackerel strike in there about the 10th of June. They spawn about the 2d or 3d of July on the Bradley Bank to the north of Prince Edward Island. At that time they have been taken with spawn running out of them. They cease to bite for several weeks while spawning. One of the principal spawning-grounds on our coast appears to be on the Nantucket Shoals, where for a period of three or four weeks after their first appearance the mackerel hug the bottom and rarely take the hook. At this time there is a lull in the prosecution of the mackerel fishery, although before its beginning great quantities are taken in the purse-seines far south along the coast. After the close of the spawning season the old fish are said to be very poor, but take the hook greedily along the entire coast, as also before the beginning of the spawning season; although the fish first brought to market are sold at a high price on account of their previous scarcity, it is not until after the close of the spawning season and the subsequent fattening up of the fish that they attain their highest excellence as an article of food. Fall mackerel are well understood to be by far the best fish. Storer, in his history of the fishes of Massachusetts, remarks: "From the 10th of May to the 15th of June they appear at the entrance to Massachusetts Bay, having been a few days previous at Nantucket and the Vineyard Sound.

Nine-tenths of those first seen are males, and they are all large but poor, weighing from one pound to one pound and a half. At their first appearance they will not take the hook, and are therefore captured in seines."

The contrast between the statements of Storer and Captain Webb should be carefully noted. The former states that the early fish taken near the end of Cape Cod are mostly males. This would naturally be the case, as the females at this time are either engaged in spawning or are perhaps so weak that they would not be likely to come to the surface. At Milk Island, however, which seems to be in the middle of the spawning region, the majority of the fish are females.

We are indebted to Capt. N. E. Atwood for the most complete series of observations upon the spawning of the mackerel which has ever been made, and what he has seen he shall be allowed to tell in his own words:

"I have many seasons been engaged in fishing for mackerel in our bay with gill-nets. I watched the mackerel more particularly in regard to their time for spawning. In 1856, owing to the fact that a measure had passed the Massachusetts legislature authorizing the appointment of three commissioners to make investigations with regard to the artificial propagation of the fish, and that I expected to be named one of the commissioners, I went to the upper part of Massachusetts Bay, where it is about twenty miles broad, and I found these spawning mackerel there near the bottom. This year the mackerel came in about the middle of May; few at first. On the 20th I went out for the first time with my drifting-nets all night in the bay; I caught 2,250 mackerel; on the following night I caught 3,520. When I first began to catch them I observed that the spawn had come to its full size, though it was not free to run from them, not being yet fully matured. On or about the 1st of June we found that some of them were depositing spawn, and as I took them from the nets the spawn ran freely. On the 5th of June I took the mature eggs as they came from the fish and put them in alcohol, marking the date, as I considered this time the middle of the spawning season. (By the 10th of June the fish had all deposited their spawn, and they then proceeded to the grounds where they expected to meet with better food in order to fatten and recruit. The spawning takes place at a depth of from five to fifteen fathoms.) Thirty days after I went out in the bay and found any quantity of schools of little mackerel which were, I should think, about two inches long, though their length might have been a little less. I took a number of specimens and put them in alcohol, marking the date. Twenty-five days later I procured another lot of them which had grown to double that size. I don't mean to imply that they were twice as long, but twice as heavy. I put them also in alcohol, marking the date. The first time I subsequently went to Boston I called on Professor Agassiz and gave him the specimens. He said that he had never before been able to ascertain these facts so clearly and so well, and that he was very much pleased with them. I watched the growth of these young mackerel all along, and I saw them grow considerably from month to month, so much so that the same fall, in the latter part of October, I caught some of them with a very small mesh net and found they had grown to a length of 6½ or 7 inches. I kept a small quantity of them, split, salted, and packed them, in accordance with the Massachusetts inspection law, as No. 4's, and, since mackerel were then scarce and very high in price, I sold them for as much as $6 a barrel."

"Much yet remains to be learned in regard to the spawning season of the American mackerel" (writes Professor Baird), "and little more is known of this except in regard to the European variety. It is, however, well established by the researches of Sars that this fish, like the cod, and many of the flat fish, &c., spawns in the open sea, sometimes at a great distance from the land, at others closer in shore. Sars found them on the outer banks of the coast of Norway; and Mr. Matthew Dunn, of Mevagissey, England, communicates to *Land and Water* of his observations of mackerel found, with ripe spawn, 6 miles from the coast.*

"The fish taken in the wiers and pounds on Vineyard Sound and about Cape Cod, in the early spring, are filled with ripe spawn; and that the operation of spawning on the American coast is shown by the immense schools of small fish that are taken throughout the summer, of various sizes, from a few inches up, and from Buzzard's Bay to Portland and Penobscot Bay. No species of young fish is, at times, more abundant throughout the summer season than the mackerel.

"The egg of the mackerel is exceedingly minute, not larger than that of the alewife or gaspereau. It appears to be free from an adhesive envelope, such as pertains to the egg of the herring, and in consequence of which it agglutinates together, and adheres to gravel, the rocks, or the sea-weed at the bottom. As with the egg of the cod, that of the

*SPAWNING OF MACKEREL.

SIR: I have been again fortunate in taking a mackerel alive in the act of spawning, on the night of May 10, about 6 miles from land. A better specimen could not possibly be had, and the roe ran freely without assistance. I got a bucket of sea-water, and allowed the fish to spawn in it; for some time I had a difficulty in finding what became of it, as the globules would not reflect the light of the candle like the pilchard spawn; but by running the water into a clean bottle, and holding it to the light, I found them floating on the surface, but not so buoyant as the pilchard roe. In this state they continued for about half an hour, and then gradually sank to the bottom; but, unlike the pilchard spawn, they retained their vitality there for more than twelve hours. With the daylight the globules could scarcely be discerned by looking directly down into the water; but on holding it towards the light in a bottle they could be seen, with that healthy, bright, silvery hue so peculiar to living ones, each marked with a dark spot in the center. Believing the pilchard spawn would have reached you, I did not send you any of these. As I sent that spawn by post, I suppose the bottle must have been broken in the post-bag.—Matthias Dunn (Mevagissey, Cornwall, May 15, 1871.) (*Land and Water, May* 20, 353.)

mackerel is provided with an oil globule, which makes it float nearly at the level of the surface."

I am indebted to Mr. Frederick W. True for a count of the eggs in two mackerel taken at Woods Holl, Mass., in May, 1873. One of these (No. 10512, U. S. Nat. Mus.), contained 363,107, the other (No. 15205), 393,887.

The only enumeration of mackerel eggs previously recorded is that made by Thomas Harmer, in 1764, and published in the Philosophical Transactions of London, vol. 57, p. 285. He found in one large mackerel, weighing $1\frac{1}{4}$ pounds, 454,961 eggs; in a second, of much the same weight, 430,846; and in a third, weighing about 1 pound 2 ounces, 546,681. His estimate is probably too large.

6.—Rate of growth and size.

The rate of growth of the mackerel during the first summer has been quite carefully studied by Captain Atwood; and the same authority has, perhaps, more satisfactorily than any other interpreted the facts from which may be deduced the conclusions as to their growth year by year.

Referring to the small fish, $6\frac{1}{2}$ or 7 inches in length, which he believed to be the young of the year, caught by him in October, 1856, he says: "Fish of this size are sometimes called 'spikes,' but I do not know their proper name. The next year I think they are the 'blinks,' being one year old; the following year they are the 'tinkers,' two years old, and the year after they return to us as the second-size, three years old. It is probable that the fish reaches its full maturity in four years." He continues: "The first mackerel that come in are very large and spawners, but these do not bite at the hook; and you don't catch them with the seine, because they don't show themselves. You would not know of their presence if you did not set nets for them. When they are taken in nets set anywhere along the coast, at Provincetown, &c., a good many people imagine that they are the remnant of the mackerel which were there the year before, and which have been imbedded in the mud; and when they taste these fish they fancy that they taste mud. When the next school arrives there appear mackerel of different sizes, which take the hook. They are carried to Boston market and are sold fresh in their season. They are not sold by weight, but are culled, and are denominated as follows: Large ones, second-size, tinkers, and blinks. When the large ones are worth 12 cents, the others may sell: second size, 8 cents; tinkers, 4 cents, and blinks, $1\frac{1}{2}$ cents. These prices may fluctuate before a large proportion of one or more of the above-named kinds at the same time. Any man who is well acquainted with them will make the same culling, as there seems to be a line of demarkation between the different kinds which stands out prominently.

"Admitting this to be the fact, those that come as blinks are from the spawn of the year before, while those which are called tinkers are from the blinks of the year previous, being the two-year-old fish; and those that are called second-size are from the tinkers of the year before, when they grow up and mix with the bigger ones, I don't know how they live, or much about them. This is my opinion about these matters. You will find fishermen tell you they think that mackerel are six or seven years in getting their growth."

Mackerel, when full-grown, are from 17 to 18 inches in length; sometimes they attain a larger size. Captain Collins has caught individuals measuring twenty-two inches. In August, 1880, a school of mackerel was taken in the vicinity of Plymouth; they weighed from three to three and a half pounds each, and were from 19 to 19½ inches long. They were regarded as extraordinarily large, and a barrel of them were sent to the Fishery Exhibition at Berlin as an illustration of the perfection to which the mackerel attains in this country. Although the size just mentioned is unusual at present, in past years many thousands of barrels have been taken nearly, if not quite, as large. The size varies from year to year, sometimes very few barrels which can be rated as No. 1's being found in our waters. A No. 1 mackerel, according to the Massachusetts inspection laws, measures 13 inches from the tip of the snout to the crotch or fork of the caudal fin. The average length from year to year for the whole coast is probably not far from 12 inches in length, and a weight of twelve to sixteen ounces. The following quotations from writers of two centuries ago are interesting, since they show that large mackerel were known to the early colonists of New England:

"The mackerel, of which there is choicefull plenty all summer long; in the spring they are ordinarily 18 inches long; afterwards there is none taken but what are smaller."—Joselyn, 1675.

"The Makarels are the baite for the Basse, & these have been chased into the shallow waters, where so many thousands have shott themselves a shore with the surfe of the Sea that whole hogges-heads have been taken up on the Sands; & for length they excell any of other parts: they have bin measured 18. & 19. inches in length & seaven breadth: & are taken with a drayee, (as boats use to pass to & froe at Sea on business,) in very greate quantities all along the Coaste.

"The Fish is good, salted; for store against the winter, as well as fresh, & to be accounted a good commodity."*

7.—Enemies.

Captain Collins writes: "The gannet is one of the most destructive enemies of the mackerel. I have often seen these birds so heavily weighted with these fish that they were unable to rise on the approach of the vessel until they had disgorged from two to four good sized mack-

* New England's Fish, John Smith, 1622. U. S. F. C. Rep., 153.

erel. This is so common an occurrence that there are but few fishermen who have not witnessed it."

"Porpoises and whales may also be included in the list of enemies of the mackerel. It is by no means an unusual sight on the fishing grounds to see hundreds of the former rushing and leaping among schools of mackerel scattering them in every direction."

"The shark, known to fishermen as the 'mackerel shark,' is one of the principal enemies of the mackerel. I have often seen them chasing mackerel, and, when jigging was practiced, it was a common occurrence for sharks to drive off a school from alongside of a vessel."

Dogfish often hover around the outside of large schools of mackerel, and doubtless feed on them. Great difficulty is sometimes experienced in saving fish that have been inclosed in a purse-seine, owing to the immense numbers of dogfish that gather around, and in their efforts to eat the mackerel, which they see through the meshes, they bite off the twine, making large holes in the seine through which the inclosed fish escape."

The dogfish is doubtless a dangerous foe to the mackerel weakened by the act of spawning, and remaining near the bottom. An old fisherman has described to me with great animation how greedily the dogfish devour the mackerel which have become gilled in the nets, how they follow them to the surface and linger about the vessel while the process of cleaning is going on, drinking the blood of the fish as it flows from the scuppers.

Among the other principal enemies of the mackerel are the bluefish, tunny, and cod. The appearance of a school of bluefish in waters crowded with mackerel is an almost sure signal for their disappearance.

The young mackerel are eaten also by squids. Professor Verrill has recorded the following description of the maneuvers of the squid known to zoologists by the name *Ommastrephes illecebrosa*:

"Messrs. S. I. Smith and Oscar Harger observed it at Provincetown, Mass., among the wharves, in large numbers, July 28, engaged in capturing and devouring the young mackerel, which were swimming about in 'schools,' and at that time were about four or five inches long. In attacking the mackerel they would suddenly dart backward among the fish with the velocity of an arrow, and as suddenly turn obliquely to the right or left and seize a fish, which was almost instantly killed by a bite in the back of the neck with the sharp beaks. The bite was always made in the same place, cutting out a triangular piece of flesh, and was deep enough to penetrate to the spinal cord. The attacks were not always successful, and were sometimes repeated a dozen times before one of these active and wary fishes could be caught. Sometimes after making several unsuccessful attempts one of the squids would suddenly drop to the bottom, and, resting upon the sand, would change its color to that of the sand so perfectly as to be almost invisible. In this way it would wait until the fishes came back, and when they were swimming close to or over the ambuscade, the squid, by a sudden dart, would be pretty sure to secure a fish. Ordinarily when swimming they were thickly spotted with red and brown, but when darting among the mackerel they appeared translucent and pale. The mackerel, however, seemed to have learned that the shallow water is the safest for them and would hug the shore as closely as possible, so that in pursuing them many of the squids became stranded and perished by hundreds, for when they once touch the shore they begin to pump water from their siphons with great energy, and this usually forces them farther and farther up the beach. At such times they often discharge their ink in large quantities. The attacks on the young mackerel were observed mostly at or near high-water, for at other times the mackerel were seldom seen, though the squids were seen swimming about at all hours; and these attacks were observed both in the day and evening."

B.—STUDIES OF THE MOVEMENTS OF THE MACKEREL SCHOOLS.

8.—Hind on the causes of irregular movements.

In closing this chapter upon the natural history of the mackerel, it seems appropriate to quote from the writings of Professor Hind some very important paragraphs in which he has attempted to interpret the irregular movements of the mackerel schools in our waters, and to explain the causes of the alleged annual variation of their numbers:

"What is the proper interpretation of the movements of the mackerel from its first appearance in the spring to its disappearance in the fall? These movements vary with the geographical position of local schools of this fish. On the coasts of the United States and Nova Scotia, its annual movements resemble in all particulars those of the same species in European seas where the schools have a free and unobstructed ocean in which to seek their prey.

"In the spring, at the end of April and May, the Atlantic schools of this fish which have wintered off the coasts approach the land in separate bodies, full of spawn and poor, coming direct from winter homes where they have remained in a torpid condition, partially buried in sand or mud. After spawning, the different schools feed for a short time on the fry of fish, and as the temperature rises they go out to sea in search of free-swimming crustaceans and larval forms of food according as they are distributed by wind and tide.

"They pursue this food against the current or tide. They often feed during the night, because at that period great numbers of free-swimming larval forms approach the surface. This is one reason why mackerel schools are frequently missed by fishermen, and areas supposed to be deserted may really abound with this fish, which would be discovered by sink-net fishing. The currents are constantly changing with the seasons under the influence of temperature and prevailing winds, hence the course of direction and depth of the food is constantly changing also.

"Sometimes it is carried far off from the land, at other times towards it, and the mackerel schools following the food move first in one direction, then in another, and range from close inshore to fifty miles and more seawards, and often, doubtless, at a considerable depth below the surface.

"The general direction of these movements, when plotted on paper, would be a series of irregular circles or elongated ellipses, the range of each school or group of schools being opposite, and often adjacent to that part of the coast where they spawn.

"As the fall approaches, owing to the diminution in the supply of their floating food out at sea, they come more inland.

"All the free-swimming larval forms of most species of shrimps, crabs, lobsters, sea-urchins, starfish, sea-worms, &c., have disappeared in the open sea, after passing through their final transformation. But near the shore there are great numbers of other forms of life, which are developed later in the year. Coming inshore to feed on these on the Atlantic coast, the mackerel are found by American fishermen later and later on their return voyage to the southwest, which gives rise to the impression that they are following the schools, when they are only meeting with fresh schools approaching the shore from their feeding grounds. Similar movements occur on the Atlantic coast of Nova Scotia and Cape Breton. As winter approaches, beginning at Cape Breton in November, the different schools retire to their winter homes off the coast in deep water later and later from north to south.

"In the Gulf of Saint Lawrence, where land is, as it were, on all sides, the local schools come from their winter haunts to the banks and beaches of the Magdalens, of Prince Edward Island, in the Bay Chaleur, &c., to spawn about the first week in June. They retire after spawning to deep water, and meet the incoming sand-launce. They follow the sand-launce inshore or on to banks, and for some weeks feed on these fish. When the sand-launce again retires to deep water, the season of the small crustaceans has arrived, and these by tidal action, already described, and winds, are concentrated near the coast lines of Prince Edward Island, New Brunswick, the north and south shore of the Estuary and Gulf of Saint Lawrence, and the shores of Cape Breton. On all these coasts the effect of the single and confluent tides, dragging along the coast line and retarded by it, is to produce eddies, where the free-swimming food concentrates. The course of direction of the different schools during the summer is thus dependent upon winds and tides, and their movements would, if correctly plotted, resemble long narrow ellipses adjacent to the coast, which are doubtless many times repeated.

"At the approach of winter the different schools seek their winter quarters opposite and near to the places where they spawned in the preceding spring, as is the case of the schools on the Atlantic coasts. In these particulars their movements resemble those of different species of fish which feed and move in great schools in directions outlined by circles or ellipses throughout the period during which they are at the surface.*

*It is a fact well known to all experienced mackerel fishermen that during the month of May and the early part of June large bodies of mackerel pass along the shores of Nova Scotia and Cape Breton from west to east, and while many of these fish move through the waters of Chedabucto Bay and the Straits of Canso to the Gulf of Saint Lawrence, other schools pass in around the east end of Cape Breton Island, their destination being the same as those fish taking the shorter route. No better evidence of this migratory habit can be given than the fact that at this season of the year the fishermen along the Nova Scotian coast and about the Strait of Canso are busily employed in catching mackerel both in gill-nets and in drag-seines. On some occasions when the season has been exceptionally favorable the amount of mackerel so taken has often been very great. This movement of the mackerel is so regular and so well-defined that the fishermen rarely fail to tell within a few days, or, perhaps, even a few hours of the time when they will appear on certain portions of the coast. The fall migrations are quite as regular. As the season advances and the temperature of the water decreases, the mackerel, instead of simply changing their position into deeper water near their summer habitat, as has been stated by Professor Hind, move in vast bodies towards the southern part of the Gulf of Saint Lawrence, frequently striking in a succession of waves. as it were, on the northern shores of Cape Breton Island, where, deflected from their southern course, they divide into two streams or branches, one passing through the Strait of Canso, and the other out round the north cape of the island, by its eastern and southern sides, and so on up along the south coast of Nova Scotia. The mackerel which are found about the Magdalene Islands during the summer and early autumn apparently move in a nearly direct line towards the northeast end of Cape Breton Island when they begin their fall migration. I have often had occasion to notice, in a practical way, these movements, the knowledge of which is of vital importance to the fishermen and of considerable interest to the naturalist. On one occasion in the fall of 1867 an immense body of mackerel was found along the north shore of Cape Breton, and on the last day that the fish were seen the schools came near the surface of the water, and I feel safe in saying, from actual observation, that they moved at a rate of no less than three or four miles per hour in the direction of the north cape of the island. On another occasion, a body of mackerel that was found near Amherst Island (one of the Magdalenes) one day, were met with the following morning about 30 miles distant from the first locality, in the direction of the north cape of Cape Breton Island, towards which they were moving at the rate of one or two miles an hour. I have myself seen schools of mackerel off the Nova Scotian coast, in the fall, moving rapidly in a westerly direction, but all efforts to catch them with a hook failed, since they seemed to pay no regard whatever to toll bait. All of my own observations and those of the Nova Scotian fishermen with whom I have been brought in contact, lead me to believe that mackerel will not bite the hook to any extent during their fall migrations along the southern coasts of Nova Scotia. This is all the more remarkable since they seem to take the hook very eagerly up to the last moment of their stay on their feeding-grounds in the gulf. The spring and fall migrations of the mackerel on our own coast are carried on with equal regularity and precision. On more than one occasion, in autumn, I have followed these fish day after day in their progress to the south and west along the shores of Maine and Massachusetts. An instance of this kind occurred in the fall of 1862, when I caught mackerel nearly down to the Fishing Rip on the Nantucket shoals. These fish were moving rapidly southward, and the schools could be kept alongside of the vessel only a short time, and each trial had to be made two or three miles farther south than the drevious one. At another time, in the fall of 1870, the mackerel moved in large schools

"Sars has shown that this form of movement is taken by the herring on the Norwegian coast.*

"The mackerel are pursued by cod and hake, and these fish gather where offal is thrown over from vessels on which the mackerel are cleaned. As a natural consequence the mackerel avoid the sea areas where their enemies are congregated, and fishermen attribute the desertion of the mackerel-ground directly to the throwing of offal overboard. Cod, and probably hake, follow up the scent of offal or food of any description carried by currents with remarkable facility, as may be witnessed during the process of jigging for cod in calm and clear waters. On looking over the side of the boat, with a man engaged in jigging at the bow or stern, as soon as a fish is wounded merely by the jigger and blood flows from the wound, the creature may be seen to dart here and there in pain. The neighboring fish of the cod tribe are attracted by the scent and follow the blood 'tracks' against the current, hunting their wounded comrade to the death. A fish coming across the stream of scent, immediately follows it up, and it is thus that fish offal or bait thrown overboard in the open sea, or some distance from shore, gathers the fish on the course of the current. In harbors and confined or landlocked bays, where there is no constant strong current to carry off the results of decomposition, and where the sea-scavengers are not sufficiently numerous to consume it, the effect cannot fail to be extremely prejudicial to young fry and to fish-spawn.†

---

very rapidly from Ipswich Bay across in the direction of Cape Cod. The schools were at the surface of the water, and it is not an exaggeration to say that their speed was not less than three or four miles an hour. The schools of mackerel spread over many square miles, each body of fish was separated from the others, perhaps many hundred fathoms, but all seemed to be impelled by the same motive and were moving steadily in the same direction. These fish would bite eagerly at the hook for a few minutes at a time, but so strong was their instinct of migration that it was impossible to detain them longer than a few minutes at a time in their onward movement.

J. W. COLLINS.

* See chart by Dr. G. O. Sars, in his report for 1874.

† Fisheries of British North America, pp. 20, 21. It is difficult to see how the offal of mackerel could injure the spawn of the young fry of this fish since the eggs are known to swim at the surface of the sea, and it is presumable that the mackerel, when first hatched out, also keeps near the surface. Therefore in a depth of ten or twenty fathoms it seems extremely problematical that the welfare of either the eggs or young fish could be interfered with by the viscera thrown over from the fishing-vessels. Another thing: It is well known that the waters of the Bay of Saint Lawrence swarm with small and extremely voracious crustacea—"sea-fleas"—which rapidly devour anything of this kind which is thrown into the sea. Indeed, so active are these small scavengers that codfish caught on a trawl are often completely devoured by them in three or four hours. Again, there can be no doubt but what throwing over the offal from the vessels is really beneficial to the mackerel, which feed upon it. The recent diminution in the abundance of mackerel in the Bay of Saint Lawrence, and the remarkable increase of this fish on our own shores, since the New England fleet has ceased to visit the waters of the Gulf in such numbers as formerly, seems to prove conclusively that the decrease or increase in the abundance of the mackerel is due to other causes than that of throwing over the offal which is taken from those which are caught.—J. W. Collins.

"The effect of temperature on the local movements of the mackerel may be recognized in the process employed by fishermen to 'raise' mackerel by toll-bait, and luring them seawards. The mackerel follow the bait for some distance from shore, where suddenly they cease to bite and disappear. They probably find long exposure to the warm temperature of the surface waters unsuited to their habits, and sink to a cooler zone.

"Hence the reason why a 'mackerel breeze,' mixing the heated surface water with the cooler understratum, is favorable to prolonged mackerel fishing with bait. The mixing produced by agitation cools the surface and permits the fish to feed for a lengthened period."*

"The mackerel, like the herring and the cod, seeks cold water for its spawning grounds wherever the Labrador current exercises its influence. Between Block Island and Noman's Land, where the spawning grounds on the United States coast south of Cape Cod are alleged to exist, a thin wedge of the Labrador current stretches far into Long Island Sound."†

"In Massachusetts Bay, where a mackerel spawning ground also exists, as also in the vicinity of Stellwagen Banks, the temperature when observed by Dr. Packard in September ranged from 41½ to 45 degrees, and the fauna resembled the cold-water species on each side of Jeffrey's Ledge. On George's Shoals the marine life is said by Verrill to be the same as that found in the deeper muddy parts of the Gulf of Saint Lawrence, and indicates a temperature not above 40 degrees, and probably considerably lower. Bradelle Bank, according to Mr. Whiteaves, presents the phenomenon of a small stony patch, tenanted by an assemblage of marine animals which usually inhabit very cold water, and are almost entirely surrounded by another series, which are for the most part prevalent where the bottom is warmer and more affected by surface conditions of temperature.‡

"Wherever the areas are situated where young mackerel are found in the summer, we find near at hand a cold-water zone, either existing as a part of the Labrador current at the surface, or brought up from greater depths by banks and shoals. On the coast of Prince Edward Island, and in the gulf generally, the cold water lies frequently near the shore, because the diurnal tides mix the strata warmed during the daytime with the cold underlying strata. In the estuary of the Saint Lawrence Dr. Kelly found the surface temperature 57 degrees Fah. on the

---

*It is often the case that a school of mackerel may be kept alongside of the vessel for many hours at a time, even during the hottest days of summer, though generally at such times they will not bite very much. For this reason, therefore, the fishermen do not usually endeavor to keep the fish alongside of their vessels, but prefer instead to change their position and try to secure a new school of mackerel. This action on the part of the fishermen, just referred to, may have led to the belief that their movements were caused by the disappearance of the fish from the vessels' side instead of on account of the disinclination of the mackerel to take the hook.—J. W. Collins.

†Hind, Fisheries of British North America.

‡Professor Verrill, page 485, Report of the United States Commissioner of Fish and Fisheries, 1871–'72.

9th July, but three feet below the surface it was 44 degrees, having in that short vertical space sunk 13 degrees; at 24 feet it was 40 degrees, or 17 degrees below the surface temperature.

"The coastal waters of Massachusetts rapidly acquire an elevated temperature in June, when the waters of the Gulf of Saint Lawrence are often still ice-cold. In April, May, and June the cod and haddock resort in large numbers to the banks and reefs off Stonington, Watch Hill, No Man's Land, and other similar places, but are quite unknown there later in the summer.

"Local winds and tidal currents bring the waters of the Gulf Stream on to this coast and displace the cold waters, even at the distance of twenty or thirty miles from the shore in summer.*

"In the Gulf of Saint Lawrence the temperature of the surface in summer rarely reaches, as far as observed, the temperature of the bottom of the sea off No Man's Land, or $59\frac{1}{2}$ to $61\frac{1}{2}$ degrees in 11 and 18 fathoms respectively.†

"Dr. Kelley records the following surface temperature in various parts of the gulf, and generally within view of the land:

Date.	Position.	Temperature of surface.
		°
June 19, 1832	Off Point de Monts	43
July 9, 1831	......do	57
Aug. 10, 1831	Off Anticosti	54
Sept. 2, 1832	Mingan Harbor	53
June 28, 1832	Estuary of Saint Lawrence	48
Aug. 14, 1832	Off Kegashka	53
Aug. 15, 1832	In Kegashka Harbor	48
Aug. 18, 1832	......do	38
Aug. 28, 1832	......do	55
Aug. 30, 1832	......do	52
Aug. 31, 1832	Off Mingan	51
Sept. 1, 1832	Mingan Harbor	39
Oct. 10, 1832	Near Cape Gaspé	41
Oct. 10, 1832	Off Cape Gaspé	43
Oct. 11, 1831	Near Mount Louis	41
Oct. 11, 1831	7 miles off	47
Oct. 12, 1831	Bay of Seven Islands	46
Oct. 13, 1831	......do	42
Oct. 14, 1831	......do	39

"In the harbors of the gulf coast, and even at a considerable distance off the land, the temperature of the surface is greatly affected by winds. A warm dry wind off the land diminishes the temperature of the surface by evaporation.

"Tidal currents have a powerful effect on the temperature of the surface over shoals near the shore, by bringing the cold water to the surface. On the 27th June, 1832, Dr. Kelley observed the temperature of the surface water over a shoal ledge which runs out a considerable distance from Mingan Harbor to be only 33 degrees; on the previous day the water in the estuary of the Saint Lawrence being 47 or 48 degrees.

*Professor Verrill, page 485, Report of the United States Commissioner of Fish and Fisheries, 1871–'72.

†Verrill, *op. cit.*, page 484.

"In these differences of surface temperatures, and the causes which give rise to them, we discover the reason why the mackerel retire, as the summer advances, from the warm coastal waters of the United States out to sea, where they find a stratum of water of the requisite temperature for their free-swimming food.* In the Gulf of Saint Lawrence this requisite temperature is best attained where cold substratum waters are mixed with warmer coastal waters by the tidal waves, the food being at the same time brought inshore by these currents as already described. Here it lingers, partly on account of a suitable temperature being attained, and partly because the efflux and reflux of the tides occasion a constant circular or elliptical movement of the water. Hence, while the off-shore waters on the coast of the United States alone possess the requisite degree of coolness in summer for the mackerel food, the inshore waters of the gulf acquire the degree of warmth best suited to the habits of these free-swimming creatures, which continues until late in the fall. The question of inshore and off-shore mackerel fishing grounds thus becomes, in a great measure, reduced to the different conditions of marine climate which prevail where the Labrador current is the controlling agent, or where the Gulf Stream asserts its power and influence during the summer season."†

9.—Hind on the causes of the alleged annual variations in the number of mackerel observed.

"It is well known that the spawn of the herring is deposited at the bottom; and owing to the glutinous secretion binding the eggs, one to the other, it adheres firmly to everything which may happen to touch it; and masses of eggs are found to be tightly glued together. But it has been conclusively established by Professor Sars that the mackerel spawn, like that of the cod, floats; and the spawn is developed at the surface of the sea, being drifted to and fro by currents and winds, and, wholly unlike the spawn of the herring, sculpin, smelt, caplin, &c., is at the mercy of the ever-varying currents of the ocean.

"The taking of mackerel on banks and shoals, dropping their spawn, must be accepted that the fish are ready to spawn at the place where they are then caught. The transparent floating spawn being very difficult to recognize and indeed rarely to be seen, except looked for and caught in tow-nets at the surface of the water.

* Mackerel are frequently abundant close in to the shores of New England in midsummer. As a matter of fact large catches of mackerel have been occasionally made in Penobscot Bay, fifteen miles or more inside of the outer headlands and islands. Bluehill Bay, also in Maine, is a famous resort for small and medium-sized mackerel in summer. It is also well known that the immediate vicinity of Monhegan Island is one of the best mackerel grounds on the New England coast during the months of July and August.—J. W. Collins.

† Fisheries of British North America, pp. 42, 43.

"But mackerel *fry* are found near the land, in detached sea areas, all the way from the shores of Massachusetts to the shores of northeast Newfoundland.

"While the cod spawn on the North American coast during every month of the year wherever the temperature of the water is sufficiently low and ice does not interfere, and the herring spawn in like manner during spring and fall, when the *bottom* waters have acquired a certain temperature, the mackerel spawns, as a general rule, in the spring of the year, and large schools appear to be established where the Arctic current exercises its influence either as a distinct surface current, or where it is brought to the surface by banks or shoals, and thus secures the requisite coldness in the waters for the floating spawn.

"The floating spawn may be drifted by winds or tides many miles from the place where it is shed; and the birthplace of the fish will be that portion of the sea area where the young fry first issue from the egg, but not the spawning ground of the mother fish. In ordinary seasons the swing of the tides, apart from local currents, brings back twice every day the drifting surface matter, whatever it may be, near to the place from which it set out; but winds may greatly alter the course and distance to which floating ova would be drifted. Hence, except in the case of secluded bays like the Bay of Chaleurs, Pleasant Bay or Massachusetts Bay, the geographical position of mackerel fry is in a great measure dependent upon the winds which may have prevailed. A storm near the end of May or early in June on the coasts of the United States may drive floating spawn far out to sea, even into the heated waters of the Gulf Stream; and it has yet to be shown that mackerel spawn could survive the sudden and extreme change of temperature this would involve; or a continuance of southerly winds may drive the spawn on to the shore and destroy it. This occurs frequently with the spawn of those fish which are deposited near the shore, as in the case of the capelin and herring. The small size of the mackerel spawn would cause it to be unobserved, and it would be more distributed than the spawn of the herring and the capelin. The United States Signal Service charts show the course of storms and winds during the spawning season, which would produce these results.

"The relation of cod spawn to rain has been referred to elsewhere (Part I, page xii). Reasoning from analogy, which in so many instances must be for the present our only guide, the effect of rain or of a rainy month on mackerel spawn would be equally prejudicial, by causing it to sink below the surface and be removed from those conditions of light and oxygen which are essential to the development of the embryo.

"On the other hand, the spawn might be driven in an easterly direction, or in a westerly direction, and be hatched some miles off the coast in great abundance. These new schools might attain great magnitude in three or four years, being unobserved, and might so remain for several years, pursuing their circular feeding movements until noticed by the fishermen. The same contingencies occur in the Gulf of Saint Lawrence, and similar distribution arising from winds or tides drifting the spawn far from the spot where it was shed, often lead to the establishment of new schools of fish in different localities.

"This feature in the natural history of the mackerel has already been noticed with regard to the Bay of Fundy schools.

"The occurrence of mackerel in great abundance on the northeast coast of Newfoundland, and their subsequent disappearance, may be explained in a similar manner, and may be attributed to unfavorable meteorological conditions, which would drive the floating spawn on shore, or far out to sea. There are, however, other probable reasons for the observed annual variations in the schools, which will now be noticed.

"In the foregoing paragraphs it is assumed that the fluctuations in the numbers of mackerel observed by fishermen correctly interpret a phenomenon which appears to be generally recognized.

"But while it is right to receive the statement that very large fluctuations in the numbers seen usually occur, it is wrong to infer that, because the schools are not visible, proof is afforded that they do not exist. There are strong reasons for believing that during many seasons the schools escape the notice of fishermen on account of their finding their food in a lower and colder stratum of water, and more rarely coming to the surface than during other seasons. It will now be shown how a cold stratum is produced, and that, as a necessary result of the mode of its formation, it varies each year and during every month of the year in vertical position and thickness, and that it is constantly brought to or near the surface on banks and shoals within certain geographical limits. These variations in depth of suitable feeding zones throw light upon the alleged inconsistency of the appearance of the mackerel, and its selection of coastal waters in some sea-areas and off-shore waters in other areas, and variations in both during different seasons."*

10.—Observations of American fishermen on the movements of the mackerel schools.

Since it is not practicable in this place to present a full account of the movements of the mackerel schools along the coast, it may be interesting to present the observations of a few reliable observers at different localities.

Captain King Harding, of Swampscott, gave me a very full account of the movements of the mackerel in Massachusetts Bay.

About the 20th of May the schools begin to draw around Cape Cod into the bay; the earliest date, in the memory of Captain Harding, is

*Hind, Fisheries of British North America, pp. 22, 23.

the 11th of May. The schools continue swimming at the surface until about the middle of June, when they sink down into deep water. Now none can be taken in the seines. When they disappear they are full of spawn; when they again appear, in twelve or fifteen days, they are spawned. When any are accidentally hooked up or tolled up during the slack season they are sometimes seen to have partially spawned. When they come to the surface they form in schools and move to the eastward. These remarks apply to the large fish. Small fish may be schooling at the surface all the time. A pound mackerel in the spring is apt to have spawn in it.

"When jigging was the ordinary method of catching mackerel," writes Captain Collins, "many thousands of barrels were taken each year during or just previous to the spawning season, when the ova was well developed. It was not an uncommon occurrence for vessels to secure fares in the Bay of Saint Lawrence before the spawning season was over."

Capt. N. E. Atwood, of Provincetown, Mass., gives the following account of the migrations and movements of mackerel:

"The mackerel comes to us from the south. As they are with spawn nearly mature when they arrive in our bay they probably come into the South Channel, passing east of Nantucket, then along the eastern shore of Cape Cod, then around the cape and on until they reach their spawning ground in from 15 to 5 fathoms of water, in the southern part of Massachusetts Bay, where they deposit, as I have answered in another reply."

"Mackerel leave the coast in the same manner as they came in in the spring. The mackerel is a migratory species, coming on our coast in the spring, and when the water becomes cold leaving the inshore ground and going to their winter quarters. We have no way of knowing where they are when away, but can only say they are at their winter home. The first that arrive are the largest; others come in later, but are smaller or rather a mixture of large and small fish. There are no equal intervals between the arrival of the different schools. When the fish leave our shores they go gradually, and they are several weeks passing away from our coast. The mackerel never fails to come, but often varies in abundance in different years. This may be due to the fact that the bait has taken a different course. The first run of mackerel is made up almost entirely of male fish, but the spawn of the *few* females that accompany them is always very nearly matured when they reach our coast. "I have to-day (July 1, 1877) examined a quantity of mackerel brought in by a vessel, caught in another locality, and find they are about three-quarters males. Neither sex will take the hook when they first come in; they seem to have no inclination to bite until they have deposited their spawn; they then commence to feed, and in time become fat. The large spawning mackerel, after they have deposited, pass on to the north. We do not see much of them until they return late in the autumn. When they pass by here going off the coast they do not take the hook, so we catch them in gill-nets. The second run of mackerel that comes in the early part of the season, which Dr. Mitchell, in his 'Fishes of New York,' calls *Scomber grex*, is the kind that takes the hook; they are, no doubt, the younger class of fish. This fish (mackerel) on its arrival swims low in the day-time; in the night it comes near the top of the water and is caught in gill-nets. We would not know they had arrived if no nets were set. The ebb and flow of the tide does not affect them. I have never seen spawn run from this fish when taken with the hook; when spawning they do not bite in this locality. In fishing with gill-nets we see no spawn floating in the water. There are no pounds here. The mackerel does not run up from the sea into fresh water. We find no small young fish with the larger mackerel when they are spawning. Mackerel are liable to go anywhere when they are following the bait."

In his testimony before the Halifax Commission the same eminent authority stated:

"The mackerel, like some other species of fish I could name, come in poor and destitute of fat. being only number threes according to the Massachusetts inspection law; and when they reach Provincetown, those that have come in from the south have, I think, spawned at places at which they have found about the right depth of water for the purpose. I have never fished south of Cape Cod, and hence could not vouch for that; but the fish that come in east of Nantucket and South Channel do not fall in with land or a shoal channel until they strike back of Cape Cod, and, winding round, come into the southern part of Massachusetts Bay. In that locality I have fished with gill-nets for a great many seasons, at the time of their arrival, and they only last till the bluefish make their appearance. We have six or seven weeks of mackerel fishing, and generally do something considerable at it; but after the bluefish come in the mackerel leave, as that drives them all off and ruins our fishery.

"Question. When are mackerel in the finest condition off the coast of the United States, say from Cape Cod down?—Answer. I should say, taking one year with another—years differ a little—say from the middle of September to the middle of October, I could get as nice mackerel as could be procured at any time during the year, and then good mackerel, some years, can be obtained as early as the middle of August.

"Q. Is it your opinion that some of the schools of mackerel found on the coast of the United States remain there during the entire season, or do they all go north of the coast of Maine?—A. I think that the mackerel which come south of us, and then strike into Cape Cod and Massachusetts Bay, and north of that, and some of them farther eastward, come in from the deep water, where they have wintered, and strike on and back of George's Bank. This is my opinion. I consider that they come from their winter quarters all along the coast, from away down as far as Chincoteague Shoals to Newfoundland. I have no idea that the mackerel which are on our coast in the region of Cape Cod and south of that, or anywhere near that, ever come down the coast here and pass Halifax. I have never thought that they did so; but then I cannot bring evidence to prove that they did. I never saw mackerel between Cape Sable and Cape Canso, though I have seen some at Louisburg, on the south shore of Cape Breton Island, when I was there once. I never saw these mackerel, but I fully believe that mackerel do come in the spring northward by Halifax, and again pass this way in the fall. But then I think that after the mackerel which pass Halifax get to Cape Sable they pass off the coast.

"Q. I wish you to state how late in the season you have successfully fished at the Magdalen Islands?—A. I could not remember the date exactly; but I should think that we never staid at these islands later than about the first of October, though it may have been the 10th of that month; but that is about the latest period.

"Q. Have you found mackerel good in quantity at the Magdalens as late as the first of October?—A. I think that is the case. I believe that it was October before we left these islands the first year I was there; and we caught mackerel just before we left them."

Mr. A. B. Rich, of Provincetown, Mass., makes the following remarks concerning the migrations and movements of mackerel:

"Mackerel come along the coast from the south. When the water becomes cold they strike off into the depths. It is quite likely that they spend the winter at the south, at points where the water is about as cold as along the Massachusetts coast in the summer time. They are first seen in June, and steadily increase until September, when the main body makes its appearance. The first run is the smallest. Their appearance is regular and certain. In November these fish begin to leave, and withdraw by degrees. Both sexes come together and the spawn of the female seems to be mature when they first appear. Very few mackerel will take the hook at first, but do so after the spawning season is over. Their arrival is known by their capture only, for they swim low. Very little spawn runs out of the mackerel caught with a hook, but large quantities out of those captured in nets. Mackerel are not anadromous. No small fish are seen on the breeding grounds. Mackerel seem to like deep water where the temperature is about 48° or 50°. About 20 fathoms is their usual depth."

Mr. Noah Mayo, of Boston, Mass., makes the following statements concerning the movements of mackerel:

"Mackerel come on this coast from the south, making their first appearance off Cape Hatteras and along the coast to Long Island. So along the Massachusetts and Maine coasts as it grows later, going into the Bay of Fundy and into the Bay of Chaleur and Gulf of Saint Lawrence. All mackerel found in the Bay of Chaleur come from the American waters. Most of them pass between George's Bank and Cape Cod on their journey from the south to their summer resort. They leave by the same route they came. Mackerel spend their winters either in the Gulf Stream or south of it, none being seen or caught after they leave the coast of Massachusetts. Mackerel are first seen off Cape Hatteras and along by Cape May usually about the last of April. As a rule the head of the shoals are large and the smaller come right after. From April to July they continue to come at different times. They commence leaving about the 1st of November, and continue going in the same manner they had come, some earlier, some later, until into December, then they disappear. When they return in the spring they are very poor. Mackerel appear on the coast regular and certain; they never fail. In some years they are more abundant than in others. If the bait upon which they feed comes on the coast then they follow, and in proportion as the live bait is found so is the abundance of the mackerel. The sexes come together, and they spawn in about two to four weeks after they arrive. Mackerel take the hook at first as well as at any time, and both sexes are alike in this respect. Mackerel sometimes swim at the top of the water, but sometimes they cannot be seen. Birds are often attracted by them. The spawn often runs from these fish when taken by hooks, and it is frequently seen floating in the seines. Mackerel are not anadromous. Fish of all ages are found together on the breeding grounds. Mackerel are found in all sorts of water, deep and shallow, but they seem to prefer shallow water around the shore and on the off-shore shoals. They like warm water better than cold."

Mr. Josiah Snow, of Boston, Mass., makes the following report on the movements and migrations of mackerel:

"Mackerel come on this coast from the south, first appearing off Cape Hatteras and then off Long Island Sound, so continuing along the coast. After passing Cape Cod they become fatter as the season advances. They pass along the coast of Maine into the Bay of Fundy, to the Bay of Chaleur and the Gulf of Saint Lawrence. I do not think all the mackerel found in the Bay of Chaleur follow the American coast; part of them appear to come direct from the south, striking into Chaleur through the Gut of Canso. Mackerel leave the coast in about the same manner as they come, some passing off southeasterly, some following the coast closely and going around Cape Cod. At this time, the season being so far advanced, with bad weather, vessels do not follow them. Though there are many conjectures on this point, it is my opinion that they (mackerel) spend their winter in the Gulf Stream, or at the south of it. It is certain that when they leave this coast in the fall they are fat, and are very poor when they return in the spring. They generally spawn on our coast. Mackerel are first seen in quantity about May 1, and during May and June appear to be constantly coming. Perhaps a few arrived in April. As a rule the first to come are the larger ones, and the smaller soon after. They commence leaving the shore about November 1, and continue going through part of December. They always appear on this coast in summer. I think more come some years than others, because more live bait upon which they feed is found on the coast some seasons. Runs differ, some being nearly all large, and some nearly all small. I know of no difference in the coming of sexes; they usually spawn in about two to four weeks after they arrive. I know of no difference in the sex in taking hook; as a general thing they take the hook freely when they first come. Mackerel swim both high and low. They are seen in large 'shoals,' or 'schools,' as sometimes called, and at other times they remain under water so they cannot be seen without throwing bait to attract them. The fishermen on this coast now need to see the fish on the surface because they use seines altogether. Spawn does not run out of mackerel caught by hook, nor is it seen in quantity floating in the nets. These fish never go into fresh water. Young and old come on the coast together. Mackerel prefer shallow water and shoals. The water must be quite warm to suit them."

Capt. David N. Mehlman, of Gloucester, Mass., gives the following account of the movements of mackerel:

"Mackerel come from the southern coast and pass through the Southern Channel between George's Bank and Cape Cod. They travel eastward, and return by the same route toward the south. It is probable that mackerel spend the winter on the coast of Florida and in the Gulf of Mexico. They are seen about Gloucester first in spring in May, and their numbers continue to increase until the 1st of July. Those fish that come first are the largest of all in size. There is no *regular* interval between the appearance of different schools. About November they begin to leave this coast, and their departure is very gradual. The appearance of mackerel is rather uncertain. Some years they are very abundant, while in others they are quite scarce. This may be in part due to the course they take in coming in, making their scarcity a matter of appearance and not a reality, and partly also to the change of the feeding-ground. Some runs are composed of all large fish, and some of all small ones. Both sexes come together, and it is quite certain that the spawn of the female is already matured when they first arrive on these shores. When the mackerel first come they are quite uncertain about taking the hook. However, after a short time both sexes take it readily. The mackerel schools swim high, and make their arrival known by their appearance at the surface. They always make a ripple, and not unfrequently attract birds. The spawn never runs out of these fish, whether caught by hook or in nets. Fish of all ages are found on the breeding-ground. Mackerel remain in places where the water may be very shallow or as much as 100 fathoms deep. They seem to prefer rather warm water."

Mr. Moses Pettingell, of Newburyport, Mass., presents the following report on the movements of the mackerel:

"In coming in to the shore the mackerel take a northwesterly course from the Gulf Stream off Cape Hatteras. The first are taken on the edge of the Gulf Stream in April. They usually depart by the same route. The fish of the first school are seen in April, and are larger than those of the main body which arrives in June. The schools, which are many, are separated by intervals of nearly a hundred miles. The appearance of mackerel is uncertain in point of time, but they never entirely fail. Mackerel will not take the hook at all times. They will scarcely take it at all for ten days or more after they first arrive. They usually swim near the surface, and attract birds, and make a ripple. In the spring months the spawn runs out of the fish caught with the hook, but the eggs are never seen floating in the nets. The mackerel is not an anadromous fish; they seem to prefer shallow water and a sandy bottom"

Mr. E. J. Nealley, of Bath, Me., states that "mackerel appear to follow the coast northerly in the spring, and to return by the same route. Mackerel are found on the coast of Maine, for the first time in the season at any date from the 15th to the 20th of May, and seem to increase gradually in number until midsummer. The first school is of large size. Different schools leave at different times, but the main body appears to depart early in October. Their appearance is regular and certain. They all take the hook most readily after the spawning season is over. They swim low at their first arrival, but afterward very frequently swim at the surface. The spawn is often seen floating in the nets in considerable quantity. Mackerel are not anadromous. These fish seem to prefer a sandy or gravelly bottom in from 6 to 12 fathoms of water."

Mr. Benjamin F. Hinckley, of Georgetown, Me., states that "mackerel come along the coast from the south and go toward the east; they return by the same route. They spend the winter at the edge of the Gulf Stream. The first fish are seen about the middle of May, and the main body arrives about the middle of July. The first schools are largest in size. The fish continue to come in at intervals, and also leave at different times. Their appearance is certain. The female fish come first and appear to be ready to spawn. Neither sex will take the hook on first arriving, and this state of things continues for about a month after their arrival. The first schools swim low, but the later ones swim high and attract much attention. The tide has nothing to do with their movements. The spawn is often seen floating in the nets in large quantity. Mackerel are not anadromous. Young fish are not found among the spawning ones. After the spawning season is over the fish seem to have no preference in regard to depth of water."

Mr. George B. Kenniston, of Boothbay, Me., makes the following statements in regard to the movements of the mackerel:

"They come along the coast from the west, part remaining while others continue toward the east. They depart toward the west. About June 10 the first are seen, and after this some are always to be found until their departure altogether. There are no regular intervals of scarcity and abundance. They leave the shores about October 1st to the 10th, quite gradually. Their appearance is regular and certain. The small ones appear first, but they continue to improve during their stay. Their arrival is known by their capture and the ripple on the water. Mackerel are not anadromous. Their favorite resorts are about rocks in shallow water."

Mr. U. S. Treat, of Eastport, Me., makes the following report in regard to the movements of mackerel:

"Mackerel come in from the west. Their presence is known by the ripple they make at or near the surface. They pass out toward the west, touching at the bays and harbors. They are last seen in the Gulf of Mexico late in the season. They first appear in April or May, and the main body arrives in August and September. The largest and fattest are taken in September and October. Several schools or 'runs' come in at short intervals. They leave in October and November in a body. Their appearance is regular, although they sometimes fail to go as far north as at other times. Want of food is supposed to be the cause of this thing. The first runs are of the average size, and are poor; the later runs are of good size, and are fat. Both sexes come at the same time, and the spawn in the female is well matured. Neither will take the hook readily on first arriving. They swim high, but rarely attract birds. They leave the shores at ebb tide and return at flood tide. The spawn often runs out of the female when taken with the hook or caught in a net. The spawn is often seen floating in seines and weirs. The mackerel is not anadromous. Fish of all ages are found on the breeding grounds. These fish are found in both deep and shoal water, and on very different bottoms. The general average temperature of bays and the ocean seems to suit this fish quite well."

Prof. H. Y. Hind thus discusses their movements in the Gulf of Saint Lawrence:

"The mackerel regularly appear at the Magdalen Islands in the Gulf of Saint Lawrence about one month after the first arrival of the herring. The time as far as observed during 1861 to 1866 inclusive, 1871 and 1873 to 1876 inclusive, varied from the 30th May to the 12th June.

"The following table shows the dates of the first appearance of the herring and the mackerel at Pleasant Bay during the years named. The authorities are to be found in the official reports of officers engaged in the protection of the fisheries, in Captain Fortin's reports, and in other published documents relating to the Canadian fisheries in the annual sessional papers.

"In Captain Fortin's report for 1853, herring are stated to have arrived about the 1st of May of that year, and the mackerel fishing to have been nearly finished on the 7th of June.

Table showing the period and the yearly differences in number of days between the first appearance of the herring and the mackerel at the Magdalen Islands, from 1857 to 1876.

Year.	First appearance of the herring.	First appearance of the mackerel.	Difference in days.	
1857	May 7	June 1	23	
1859	April 29			
1860	April 28	June 1	32	
1861	May 1			
1862	May 2	June 4	32	
1863	May 17	June 12	25	
1864	May 1	June 6	35	
1865	April 27	May 30	32	
1866	April 25	May 29	33	
1867	May 7	June 2	26	
1868				
1869				
1870	April 15			
1871	May 8	May 31	23	
1872	May 3	June 20		Mackerel three weeks later than usual—much ice.
1873	April 27	June 5	38	
1874	May 2	June 7	35	
1875	May 6	June 8	32	
1876	May 5	June 6	31	

"On the 31st May I went inside Amherst Harbor and boarded twelve vessels engaged in mackerel fishing."—(Report of Capt. L. H. LaChance, commanding the marine police schooner Stella Maria. December, 1871. Sessional papers 1872, page 158.)

The mackerel must have been in the vicinity of the Magdalens during the last week in May, in 1871, and fishermen were then taking mackerel simultaneously far south and far north, or in Martha's Vineyard, south of Cape Cod, in latitude 41° 20′, and Amherst Harbor, Magdalen Islands, in latitude 47° 20′, or six degrees of latitude apart.

"It will be seen from the table that generally when the herring were early the mackerel were also early, and when the herring appeared late the mackerel also were late.

"In 1872 the herring came in on the 3d of May, but owing to the prevalence of ice the mackerel were three weeks later than usual inshore. With this exception the greatest difference between the recorded times of the appearance of these fish inshore was thirty-one days, or about one month.

"In all instances the large mackerel are generally full of spawn when they are first seen in the spring, and the young fry are observed a few weeks later in many parts of the gulf.

"It will be observed that in the year 1871 the mackerel were first taken at the Magdalen Islands on the 31st of May, and in 1872 they were three weeks behind their usual time. A similar difference in point of time in the first appearance of this fish on the coast of Massachusetts occurred during those years. On that coast the following differences are recorded:

WAQUOIT, MASSACHUSETTS.*

1871	April 25
1872	May 10

Difference in time—15 days.

MAGDALEN ISLANDS.

1871	May 31
1872	June 20

Difference in time—21 days.

"At the Waquoit weir the earliest mackerel would probably be taken in 1871. At Amherst Harbor the mackerel vessels were actually engaged in fishing (see L. H. LaChance—Report of the marine police schooner Stella Maria, 1871), so that the fish must have been present in small numbers perhaps some days before the fishing began, and we may conclude that the difference in time between the arrival of the schools at the two places in 1871 and 1872 was very nearly the same, and due solely to local variation in marine climate.

"According to resident Newfoundland fishermen, young mackerel have been seen in great numbers in the Bay of Notre Dame during the months of September and October, about three inches in length.

"They appear on the coasts there generally about the 20th July, and during the period when mackerel were common on the northeast coast, Green Bay, at the extremity of the Bay of Notre Dame, was a noted place for swarms of mackerel fry."

To this may be added the following statement from the report for 1871 of the captain of the Canadian police schooner Water Lily:

"These fish, as a general rule, are to be found close inshore during the month of June and part of July; they then go off into deep water, their favorite resorts being on the Orphan and Bradley Banks, and from Point Miscou to North Cape, Prince Edward Island. There are some always to be found inshore, but the best fish are in deep water. From the middle of August till the end of September they are to be found more off the Prince Edward Island; that is to say, from North Cape to East Point, and in the bay formed by Cape George and Cape Jack, on the Nova Scotia shore. In October, at which time the mackerel are at their prime, they again strike inshore and are to be found in great numbers on the Cape Breton coast from Chetican to the Judique Shoals, but their position depends a great deal on the weather in the fall of the year, as heavy gales of wind drive them off into deep waters."

In this connection I cannot refrain from quoting also an extract from a statement made to the United States House of Representatives by Hon. Caleb Cushing, in 1836, which teaches us that the habits of the mackerel were very well understood nearly half a century ago, and were much the same as at the present day:

* Report of U. S. Commissioner of Fish and Fisheries, 1871–'72.

"The season for the first appearance of mackerel on those parts of our coasts where they are usually taken is from the 20th April to the 1st of May, according as the season is more or less forward; at which time they strike on the shore soundings off the capes of the Chesapeake and Delaware. Between the latter place and Egg Harbors they are usually plentiful for 15 or 20 days within a few leagues of the land, and mackerel vessels, which are on the ground seasonably, meet in general with good success, if the weather prove to be favorable; after which the mackerel move to the northeast, scattering over a large space of ground, from near the shore to the soundings inside the Gulf Stream, and extending down the coast off Long Island and Block Island to Nantucket, which they reach early in June. Sometimes they collect more in bodies off Long or Block Islands, and are plentiful for a few days, after which they proceed north through the South Channel and between the Vineyard Islands into Massachusetts Bay. They reach that bay from the 20th of June to the 1st of July and continue there until late in November.

* * * * * * *

"It occasionally happens that late in the year fishermen will reap a rich harvest, when the whole previous season had been comparatively unproductive. Thus it was in the autumn of 1831, in October of that year, the mackerel struck in very near to Cape Ann. Large fleets of vessels collected in such close order as to be continually coming in contact. The sea being smooth, and great quantities of the bait thrown out, the fish gathered in vast numbers, and some vessels took nearly one hundred barrels in a single day. At the same time they were very abundant off Cape Cod and on Jeffrie's Ledge; and it was computed more than 70,000 barrels were taken in a single week."

TABLE SHOWING COASTWISE MOVEMENTS OF THE MACKEREL.

The following table, compiled in 1877, chiefly from the records of the United States Fish Commission, may be of interest, since it shows in a general way the dates of appearance, greatest abundance, disappearance, and spawning at several points along the coast.

MACKEREL.

Dates of appearance, greatest abundance, departure, and spawning, principally from records of the United States Fish Commission.

Locality.	Appearance.	Greatest abundance.	Departure.	Spawning.
Cape Hatteras	April 15–20			
Capes of Delaware	May 1	May 8–12		
Barnegat and Sandy Hook.		May 15–30		
Easthampton, N. Y.	April	July, November.	Autumn	In bays in spring.
Providence, R. I	May to September.	June	September 15, November.	June, on soundings.
Naushon	May 2			Spawn runs abundantly, May 2.
Wood's Holl, Mass.	May 9		October	Spawn runs abundantly, May 10.
Waquoit, 1871	April 19	May 19		

MACKEREL.—*Dates of appearance, greatest abundance, departure, &c.*—Continued.

Locality.	Appearance.	Greatest abundance.	Departure.	Spawning.
Nantucket	May 1-25		October 20, November 20.	May and June, on shores.
Chatham	May 1-30	May 20		May.
Harwich	June	September and October.	November	June, spawn seen in nets.
Dennis	June		November	Do.
Provincetown	May 15-20	October, November.	November and December.	Do.
Wellfleet	June	September and October.	November	
Boston	May*	July, September.	November and December.	May and June, spawn seen in nets.
Newburyport	April	June, September 20 to October 10.	October and November.	Do.
Georgetown, Me	May	July 15, September.	September	Do.
Boothbay, Me	June 10	July 1, September.	October 1-10	
Seguin Island, Me	May	July, September.	October and November.	Before July 1.
Eastport, Me	April and May	August and September.	October, November.	Spawn seen in weirs.
Southern Nova Scotia	May†			

*At Gloucester, May 13, 1881. †Barrington, N. S., May 14, 1881.

II.—THE MACKEREL FISHERY OF THE UNITED STATES.

C.—THE PURSE-SEINE FISHERY.

The purse-seine has come into general use since 1850, and with its introduction the methods of the mackerel fishery have been totally revolutionized. The most extensive changes, however, have taken place since 1870, for it is only during the last ten years that the use of the purse-seine has been at all universal. As late as 1873 and 1874 a few vessels have fished with the old apparatus in the Gulf of Saint Lawrence, and also a few on the coast of New England. Such changes in the manner of fishing for mackerel have brought about also a change in the fishing grounds. Vessels fishing in the old style were most successful in the Gulf of Saint Lawrence, but the purse-seine can be used to very much better advantage along our own shores between Cape Hatteras and the Bay of Fundy.

The mackerel fleet in 1879 and 1880 is owned almost entirely by Massachusetts and Maine, a very few vessels from New Hampshire and Connecticut also participating. The distribution of the vessels in the mackerel fleet, their tonnage, and the number of men employed, is shown in the tables, prepared by Mr. R. Edward Earll and printed below in sections 40–43.

11.—THE FISHING GROUNDS.

In the spring, from March to the 1st of June, the mackerel seiners cruise between the capes of the Chesapeake and the South Shoal of Nantucket. The mackerel are first encountered off Chesapeake and Delaware Bays, from 20 to 50 miles from the land, and gradually move northward, followed by the fleet. When off the coasts of New Jersey, Long Island, and Block Island, the fish usually draw closer in to the land, frequently approaching within one or two miles of the shore. During the summer and fall months the principal seining ground for mackerel is in the Gulf of Maine, from the Bay of Fundy to Cape Cod; the immediate vicinity of Mount Desert Rock, Matinicus Rock, Monhegan Island, Cape Elizabeth, Boon Island, and Massachusetts Bay being favorite localities. Good catches of mackerel are frequently made in summer on George's Bank and, within the past few years, near Block Island. Though mackerel have, at times, been taken in seines in the Gulf of Saint Lawrence, so little, comparatively, has been done in this locality that it can scarcely be classed among the grounds generally resorted to by the mackerel seiners. In a large majority of cases the mackerel schooners which have gone to the gulf within the last four or five years have met with decided failures, and in 1880 several returned home from there without a single barrel of fish.

12.—THE FISHERMEN.

The mackerel fleet contains a larger percentage of American-born fishermen than any other. The 113 mackerel vessels from Gloucester are manned by 1,438 men, of whom 821 are Americans; 322 Provincials; 24 British, most of whom are Irish; 39 Scandinavians; 6 French; and 13 Portuguese. The mackerelmen belonging to other ports in Massachusetts and on the coast of Maine have a still larger percentage of Americans in their crews, most of the vessels being manned entirely by natives of New England. Many of the Gloucester fishermen, engaged in the mackerel fishery, are, in winter, employed in the haddock fishery, in the Georges cod fishery, or in the fresh halibut fishery. Many others, like those from Provincetown and Maine, do not go to sea in winter. The winter herring trade is carried on almost entirely by the mackerel schooners and their crews from Gloucester and Maine, and the winter oyster business is, in the same manner, monopolized by the Cape Cod and Portland mackerel vessels, while some of them enter into the business of bringing fruit from the West Indies to the United States.

13.—THE VESSELS.

The mackerel fleet is made up of 468 vessels, which pursue this fishery to a greater or less extent. Of these, 235 vessels are employed exclusively in catching mackerel between March and November, though some of the fleet do not start before June or July. A large number of these, the best fishing vessels of New England, in winter are engaged in the haddock fishery, in the Georges fishery, in the herring trade, in the oyster trade, and in the West India fruit trade, as well as in the shore cod fishery.

There is a small fleet of vessels which, though, like their companions, designed for rapid sailing, are seldom employed in the winter, except in the herring trade to New Brunswick, on account of the shallowness and sharpness of their hulls, which renders them unfit to encounter the heavy winter gales in the open ocean.

The mackerel vessels are, as a class, swift sailers; they carry, while engaged in this fishery, all the canvas which their rig will allow. The manner in which their sails are managed, and the amount of canvas which they carry, are fully described in the chapter on the fishing vessels. The mackerel schooners, as a rule, spread more sail, in comparison with their size, than any other vessels in the world, except, perhaps, the extreme type of schooner-rigged yacht, which is essentially a development of the fishing schooner.

Vessels designed especially for the work of seining mackerel usually have a wide deck, much deck-room being necessary for the proper handling of the fish. Many of the schooners of 60 to 80 tons have a beam of 21½ feet to 22½ feet. But, although plenty of deck-room is considered of great importance to a mackerel vessel, even deck-room is held to be less necessary than speed. In consequence every effort has been made by the builders to construct swift sailing schooners, and the result is that many of the vessels composing the mackerel fleet are quite able to cope successfully with first-class yachts of the same size. The mackerel vessel is fitted for seining; (1) by placing upon her a summer outfit of repairs and sails;* (2) by removing the heavy cables used in winter fishing, and substituting chain cables. This change is not necessary in the case of many of the Cape Cod and Portland vessels which are employed in the oyster trade, or in the case of most of the Gloucester vessels engaged in the herring trade, since these use only chain cables at any season; (3) by the removal of gurry-pens, and all other incumbrances from the deck; (4) by the rigging of a seine-roller upon the port-quarter rail. This is a wooden roller of oak or other hard wood, 6 to 7 inches in diameter, and 6 to 8 feet long, which revolves on pivots in its ends, received into iron sockets in cleats, which are fastened to the rail. The forward end of the roller is about 3 feet aft of the main rigging.

* Whatever repairs are needed are first attended to, while, in the meantime, the jibboom is rigged out, the foretopmast (if the vessel carries one) is sent up, the spars cleaned and painted, and the rigging tarred. This having been done, the vessel is taken on the railway and thoroughly cleaned and painted. The work of cleaning and painting spars, tarring rigging, &c., was formerly done by the vessel's crew, but at the present time it is done by gangs of shoresmen organized for the purpose, the expense for the labor performed being paid for by the fishermen. The custom of hiring others to do this work began about 1863 or 1864. The fisheries were at that time very prosperous, and many of the fishermen preferred to pay some one for tarring and such work rather than to do it themselves. At first two or three men of the crew usually did the work, being paid for it by their shipmates, but in a short time it passed into the hands of the longshoresmen to the general satisfaction of both owners and crews. The work of cleaning the vessel's bottom, preparatory to painting it, is now often done by shoresmen, who are paid by the crew.

The use of this roller is to lessen the friction between the rail of the vessel and the seine, as the latter is being hauled on deck or overhauled into the boat;* (5) by the head-box being fastened to the forward end of the house. The head-box is a bin 10 or 12 feet long, and wide enough to receive the head of a fish barrel. In this box are stowed the heads of the barrels that happen to be on deck; (6) by placing the bait-mill on deck, and fastening the bait-box (when one is used) to the main rigging on the starboard side; (7) by nailing boards to the top timbers underneath the main rail, between the fore and main rigging. These are about 6 inches in width, and are provided with single ropes, or stoppers, 2 or 3 feet apart; the object of these stoppers is to hold the cork rope of the seine when brought over the rail, preparatory to bailing the fish from the seine upon the deck; (8) by taking on board an ice-grinder, these being used only on vessels which carry their fish fresh to market; (9) by clearing the hold of all bulkheads, ice-houses, or other appliances which may have been used in the course of the winter's fishery; (10) by properly adjusting the quantity of ballast; if the vessel has been in the haddock or Georges fishery, ballast must be removed; if in the herring trade, ballast must be added; a mackerel schooner of 60 tons will carry from 15 to 20 tons of ballast, and in exceptional cases somewhat more; (11) by an arrangement of ice-house on those vessels which intend to take their fish fresh to market, somewhat similar to that on board the halibut fishermen;† (12) and by taking on board the necessary supply

* Capt. George Merchant, jr., of Gloucester, Mass., states that purse-seines were used by the fishermen of that port for six or seven years before "seine-rollers" were put on the vessel's rails. This useful implement was first invented and used by Capt. Simeon Tarr, of Gloucester, about the year 1857, while he was in command of the pinkie "Andes."

†The mackerel schooner's ice-house, as a rule, occupies the middle portion of the hold, extending from side to side of the vessel one way, and from the grub beam to the forward side of the main hatch the other way. It is separated from the other sections of the hold by bulkheads, and is divided into a number of pens similar to those in the ice-house of a halibut schooner. Each of these pens is subdivided into three parts by shelves, which are constructed, when occasion requires, by laying some boards crosswise, the ends resting on cleats which are nailed to the sides of the pens. The first shelf is put in about fifteen inches above the floor of the ice-house, and a second shelf fifteen inches above the first. The front of the pens are closed by boards which slide in grooves on the stanchions, or bulkheads. The mackerel are iced fifteen inches deep on the floor of the pen, after which the first shelf is laid and another tier of the same depth is put on that. After the second shelf is put in the fish are iced on it nearly to the deck, a covering of ice being put over all. In this way the fish can be kept in a better condition than if they were packed in a large bulk. If stowed in bulk the fish are jammed and soon become worthless. An average sized ice-house has a capacity of about 200 barrels of fresh mackerel; some ice-houses will hold 300 barrels.

Capt. Joseph Smith, of Gloucester, tells us that at present few of the mackerel vessels carry ice-grinders, since the fishermen prefer to use the ice-pick instead. Each vessel employed in market fishing is provided with from 2 to 4 ice-picks, and three men can pick up ice fast enough to supply a whole crew, even if they should ice 100 barrels or more an hour, which is about the average speed with which mackerel are taken care of. Captain Smith thinks his crew, on one occasion, iced 300 barrels in an hour and a half. About 4 tons of ice are put on 100 barrels of fresh mackerel.

of barrels.* Vessels which take their fish fresh to market carry from 175 to 250 barrels; those intending to salt their fish carry from 175 to 500 barrels, about one-third of this number being filled with salt, which is used in curing the fish, and serves in the meantime as ballast.

Wellfleet has a three-masted schooner, the "Carrie D. Allen," employed in the mackerel fishery; her burthen is 175 tons, and she carries 25 men.†

14.—APPARATUS AND METHOD OF FISHING.

(*a*) *The seine-boat and its fittings.*—The boats used by the Gloucester fleet in the purse-seine fishery are built after a peculiar model and solely for this purpose. The present form of the seine-boat was devised about the year 1857 by Messrs. Higgins & Gifford, boat-builders, Gloucester, Mass.‡ The seines had previously been set from square-sterned, lap-streak boats, about 28 feet in length, and resembling in shape an ordinary ship's yawl.

The seine-boat, as now in use, resembles the well-known whale-boat, differing from it, however, in some important particulars.

The seine-boat, according to Mr. Gifford, must have three qualities: (1) It should tow well; consequently it is made sharpest forward. A whale-boat, on the other hand, is sharpest aft, to facilitate backing after the whale has been struck. (2) It should row well, and this qual-

* Vessels which carry a mackerel pocket or "spiller" are provided with outriggers on the starboard side and other necessary arrangements for its proper management. All of the seiners also have an outrigger on the port side, by the fore rigging, to fasten the seine-boat to.

† The three-masted schooner "Carrie D. Allen," of Wellfleet, Capt. Darius Newcomb, arrived at Gloucester, June 18, 1874, with 900 barrels of mackerel. Only vessel of her class in the coast fisheries; 175 tons, carries 25 men.—(Cape Ann Advertiser, June 26, 1874.)

‡ Capt. George Merchant, jr., of Gloucester, Mass., claims to have been the first to design and introduce the form of seine-boat now universally employed in the mackerel fishery, and which has been used to some extent in the menhaden fishery since 1857.

In 1856, while engaged in fishing for menhaden, he carried two boats, one of which was a whale-boat of the ordinary type. The latter, which he used for a "second boat," proved very serviceable—rowing and towing easily, and turning quickly—and was much better adapted for seining than the old-fashioned square-sterned seine-boats which were in general use at that time. Captain Merchant therefore conceived the idea that a decided improvement could be made in seine-boats by building them on the same general plan as the whale-boat, through making them somewhat wider than the latter, especially towards the stern, so that they would be better able to bear up the seine. Having decided on the dimensions required, Captain Merchant wrote to Mr. Higgins (now the senior partner of the celebrated boat-building firm of Higgins & Gifford, Gloucester, Mass.), who was then at Provincetown, desiring the latter to build a boat 21 feet long and according to the plan submitted, and which should be ready for the season of 1857.

Many of the old fishermen laughed at the idea of attempting to use a sharp-sterned boat for purse-seining, declaring that it would upset while the seine was being "pursed up," that it would tow under, and making other unfavorable predictions. Notwithstanding their croakings, they soon became convinced of the good qualities of the new boat, and in the following years hastened to adopt the same kind themselves.

ity also is obtained by the sharp bow; the whale-boat also should row well, but in this case it has been found desirable to sacrifice speed in part to the additional safety attained by having the stern sharper than the bow. (3) It should be stiff or steady in the water, since the operation of shooting the seine necessitates much moving about in the boat.

The Gloucester seine-boat of the present day is a modification of the old-fashioned whale-boat, combining the qualities mentioned above. The average length of such a boat is about 34 feet, its width 7 feet 5 inches, its depth amidship 33 inches. At the stern is a platform, measuring about 4 feet, fore and aft, on which the captain stands to steer; this is 6 to 8 inches below the gunwale. Another platform extends the whole length of the boat's bottom, from the afterpart of which the seine is set. In the bow is still another platform, on which stands the man who hauls the cork-line. There are four thwarts or seats, a large space being left clear behind the middle of the boat for the storage of the seines. Upon the starboard side of the boat, near the middle, is arranged an upright iron support, about 18 inches in height, to which are attached two iron snatch-blocks used in working the purse-ropes.* Upon the opposite side of the boat, generally near the bow and stern, but with position varied according to the fancies of the fishermen, are fixed in the gunwale two staples, to which are attached other snatch-blocks used to secure additional purchase upon the purse-ropes. In the center of the platform at the stern of the boat is placed a large wooden pump, used to draw out the water which accumulates in large quantities during the hauling of the seine. The steering rowlocks, with the peculiar attachment for the tow-rope and the metallic fixtures described above, are manufactured especially for seine-boats by Messrs. Wilcox & Crittenden, Middletown, Conn.

Until 1872 the seine-boats were always built in the lap-streak style; since that time an improved form of smooth-bottomed boats, built with battened seam, set-work, sheathed inside with pine, and with oak frame and pine platform, has been growing in popularity. The advantages claimed for this boat by the builders are: (1) increased speed; (2) greater durability, on account of the more solid character of the wood-work and tighter seams; and, (3) less liability to catch the twine of the nets by reason of the smooth sides. It is not so stiff as a lap-streaked boat of same width, but in other respects superior.

Since the general adoption of the purse-seine, in the menhaden and mackerel fisheries, an account of which is given elsewhere, there has

* The first iron purse-davit (with wooden snatch-blocks), according to Captain Merchant, was invented and used by Capt. Henry Blatchford, in 1858. With the exception of the blocks, it was essentially the same as the purse-davit in use at the present time. Previous to this a wooden davit (usually an old one), such as were in use on the fishing-vessels, was employed for the purpose of pursing up the seine. These davits were rigged out over the side of the boat, a place being cut in them three or four inches deep, so that they might fit over the gunwale of the boat in such a manner as to steady the outer end while the inner end was secured to the midship thwart by a grommet strap.

been a gradual increase from year to year in the size of the seine-boats, keeping pace with a corresponding increase in the size of the seines.

In 1857 all boats were 28 feet in length. In 1872 the length had increased to 30 feet, and in the summer and fall of the same year an additional foot was added to the length. In 1873 almost all boats which were built had a length of 31 feet, a few of 32 and 33. In 1874 almost all were 33 feet, as they were during 1875 and 1876, although some were made 35 and 36 feet. In 1877 34 feet is the most popular length, though one or two 38-foot boats have been built. Seven, eight, or nine oars, usually 13 or 14 feet in length, are used in these boats, besides a steering-oar of 16 or 17.

These boats last, with ordinary usage, six or seven years. At the close of the fishing season they are always taken ashore and laid up for the winter in a shed or under trees, and are completely refitted at the beginning of another season.

The seine boats carried by the "menhaden catchers" south of Cape Cod and by all the steamers are shaped like ships' yawls, square-sterned, smooth-bottomed, and batten-seamed, 22 to 26 feet long and 6½ feet beam. They are built at New Bedford, New London, Greenport, and at Mystic River, and cost about $125 each, the finest $185. The New Bedford boats are preferred by many fishermen.

The Cape Ann fishermen stow their seines in one boat, and in shooting the seine one end of it is carried in a dory.*

The arrangement of the thwarts are especially adapted for the mackerel fishery. There is some variation, however, as to the number of these in the different sizes of boats. In the size most commonly in use at the present time (1881) there are six thwarts, five of these being forward of midships, and one 7¾ feet farther aft. The following are the general dimensions of the boat: 36 feet long over all; 7 feet 7 inches wide; 2 feet 8 inches deep. The bow thwart is placed 4 feet from the stem, and there is a space of 2½ feet between each of the five forward thwarts. The boat is ceiled to the gunwales and platformed inside. In the bow she has a raised platform which comes up to the level, or nearly so, of the forward thwart, to which it extends, and is bulkheaded on the after end. The stern is covered over on the top of the gunwales, forming the stern sheets, this being 3 feet long forward of the stern-post, with a bulkhead on the forward side. Forward of this again, and a little below the level of the thwarts, is another platform, 3 feet in length, also bulkheaded on the forward side; on this the seine-master stands while steering the boat, and in it is placed the pump by which the boat is freed from water. The after portion of the boat between the two after thwarts is used for stowing the seine, this being a section 7¾ feet long by 7¼ feet wide. There are five rowlocks on either side, corresponding to each of the five thwarts. The purse-davit is placed on the starboard side and usually stepped in the midship thwart

* Goode, History of the American Menhaden, p. 122.

near the gunwale. At present, however, an improvement has been made in placing the purse-davit by stepping it in the thwart nearer to the center of the boat, it being placed at a distance of 18 inches to 2 feet from the gunwale. It is said that by this improvement the seine can be more easily pursed up and the pursings taken over the gunwale of the boat without the use of a pry or lever, and also that there is less probability of the boat being capsized. The boats of the most recent construction have their purse-blocks on the port side, nearer the bow and stern than formerly, the forward being 2 feet aft of the stem, and the after one close to the upper stern sheet, about 3½ feet from the stern-post. Galvanized iron plates, each provided with a projecting eye, are neatly fastened to the gunwale, and the snatch-blocks are hooked into these eyes.

Until recently it has been customary to build these boats with a raised garboard, in imitation of the whale-boat (whale-boats are constructed in this way by some builders), but within the present year, during 1881, Messrs. Higgins & Gifford, before mentioned, and the principal if not the only constructors of this style of boat in the United States, have built them with smooth garboards, which have given better satisfaction than the old style. They are remarkably well adapted for swift rowing and for towing. Both of these qualities are very desirable, especially the latter, since they are frequently towed at a rate of 10 or 12 knots. The thwarts are double-kneed but not dunnaged. The boat is steered with an oar similar to the whale-boat. On the port side are two oar rests in which the oars are placed after the seine has been shot. The after one of these is just forward of amidships, and the two are separated 8 feet.

The seine-boat is usually towed astern by a warp, a 2½ or 3-inch rope, 20 to 50 fathoms in length. When the vessel is making a long passage the seine-boat is hoisted upon the deck. Some of the larger vessels carry two seine-boats and two seines. In the largest schooners these boats are both of a large size; in other vessels, one of them is usually a small one. In addition to the seine-boats, each vessel carries two dories. One of these is usually towed astern when the vessel is on the fishing grounds; sometimes both. They are taken on deck in rough weather, when making a passage, or when not required for use in fishing.* When

* The following is the price-list of Messrs. Higgins & Gifford, of Gloucester, Mass., for 1880:

Seine-boats, including pump, iron breast hook, outside tow iron, and iron stem cap.

Smooth bottom, battened seam, 31 feet	$186 00
Smooth bottom, battened seam, 32 feet	192 00
Smooth bottom, battened seam, 33 feet	200 00
Smooth bottom, battened seam, 34 feet	210 00
Smooth bottom, battened seam, 36 feet	225 00
Galvanized rowlocks, with brass sockets, per set (8)	6 50
Pursing gear	8 50
Patent steering rowlock with socket	1 25
Pursing blocks, per pair	6 00
Towing iron and pin	2 00

a large catch is obtained at the last set of a seine for the trip, and more mackerel are secured than the barrels on board will hold, the dories are taken on deck and filled with fish. During the mackerel season it is a common occurrence to see, in any of the large fishing ports, vessels arrive with both dories piled full of mackerel.

(*b*) *The seine.*—Two kinds of seines are used. The large seine, only used in connection with the largest kind of seine-boat, is 190 to 225 fathoms in length, and 20 to 25 fathoms in depth when it is hung, being deeper in the center of the bunt than at the extreme wings, one of which, the "boat end," is from one to ten fathoms deep, and the other, the "dory end," varies from about seven to fifteen fathoms in depth.* It is made of three kinds of twine. The "bailing-piece," which is a section of the net occupying about 10 to 12 fathoms along the center of the cork-line, and having about the same depth as length, is made of the stoutest twine. Beneath this, and composing the remainder of the bunt and extending to the bottom of the seine, is a section knit of twine a size smaller. There is also a band of large twine, 15 meshes in depth, extending along the cork-line of the seine on either side of the bailing-piece to the extremity of each wing. The remainder of the net is made of smaller twine.

A seine 200 fathoms in length is usually about 1,000 meshes deep, both in the bunt and in the wings. The strongest twine is placed at those places where the seine is subjected to the greatest strain. On the cork-line are two or three sizes of corks, the largest being placed over the bailing-piece, the smallest generally at the ends of the wings. The cork in the middle of the seine is much larger than the rest, and is painted or covered with canvas in order that it may be easy to find the center of the net either night or day. To one end of the cork-line at the upper corner of the wing, which is first thrown out when the seine is set, is a buoy. The seine is hung to lines which are called the hanging-lines. The lead-line is placed as in an ordinary seine, and is weighted with sinkers about two ounces in weight, which are attached to it at intervals varying from a few inches to several feet. The arrangement of the pursing rings and bridle is described elsewhere. In a mackerel seine of 175 fathoms the bridles are about 15 to 18 feet in length, and the rings, which weigh $1\frac{3}{4}$ pounds and are 3 inches in diameter, are fastened to the middle of each bridle. The middle ring is on the bottom of the seine, opposite the middle cork already referred to.† The purse-line extends through the rings;

* Capt. Joseph Smith tells us that the depth of the seine-ends varies a great deal according to the fancy of the fishermen. Some of the skippers prefer to have the ends of their seines "taken up" enough to make them very shallow, while others think a net with deep ends will fish the best.

† The middle ring is usually made of different metal from the others, or is larger, so that the center of the bottom of the seine can be easily found.

its center is marked by a line tied around it or tucked through its strands, but more frequently now by a brass swivel, into which the purse-rope is spliced, and which serves the double purpose of marking the center of the line and preventing it from kinking.*

When the vessel is not searching for fish the seine is stowed on a grating forward of the house, between that and the after hatch. This grating is a frame-work, about 8 to 10 feet square, made of boards from 4 to 6 inches in width, crossing each other at right angles. The boarding is supported on a frame-work of joists. The top of the grating is 4 to 6 inches above the surface of the deck. When two seines are carried, the grating must be wider. When the seine is stowed in the boat or upon the deck, it is always "salted down" to prevent it from rotting or burning. From a bushel of salt to a barrel or more is used, according to the necessity of the case. When the seine is thus stowed, it is often protected by a canvas cover.

---

* The following dimensions of an average-sized deep-water mackerel purse-seine have been supplied by Capt. George Merchant, jr., of Gloucester, Mass.:

Total length of seine when hung, 203 fathoms.

Depth, 1,000 meshes, or about 21 fathoms.

Size of mesh in all its parts, 2 inches.

Length of "bailing-piece" or "bunt," 500 meshes; size of twine, 12-9.

Depth of "bunt" or "bailing-piece," 500 meshes.

Length of "sides," each, 300 meshes; size of twine, 20-9.

Depth of "sides," each 500 meshes.

Length of "under," 1,100 meshes; size of twine, 20-9.

Depth of "under," 500 meshes.

The central section of the mackerel purse-seine, that portion composed of the bailing-piece, sides, and under, is generally spoken of as the "bunt," though the bunt proper constitutes only a small portion of it. Capt. Joseph Smith, of Gloucester, says that at present the whole center of the seine (including the bunt, sides, and under) is made of one size of twine, 20-12, this portion being 1,000 meshes square.

There is sometimes considerable difference in the length of the wing and arm of one end of the seine from that of the other, though some are constructed with both ends of equal length. Many of the seiners prefer to have the bunt of their seines a little to one side of the middle of the net. In such cases the ends are, of course, of unequal lengths. It may also be mentioned that a border of stout twine (size 20-9), 15 meshes deep, extends along both the top and bottom of the wings and arms of each end of the net.

Size of first wing, 125 yards long in the web, 1,000 meshes deep; size of twine, with the exception of that for the border, 16-6, hawser-laid; size of first arm on the same end of the net as the wing just described, 125 yards long in the web, 1,000 meshes deep; size of twine, exclusive of that in the border, 20-6, hawser-laid. Size of wing No. 2, on the other end of the net, 150 yards long in the web; depth, 1,000 meshes; twine, 16-6, hawser-iaid. Size of arm No. 2, 150 yards long in the web; depth, 1,000 meshes; size of twine, 20-6, hawser-laid, exclusive of the border.

Captain Merchant writes: "We always use for hangings 6-thread manila right and left rope. In Boston factories they sometimes use 9-thread manila for bridle-rope, or 'loops,' as they are occasionally called." These loops, to which the purse-rings are attached at the bottom of the seine, are one part of the hanging-rope, and are made three fathoms long, the spaces between them being the same distance. Thus it will be seen that the purse-rings are about 6 fathoms distant from each other. Captain

When looking out for mackerel the seines are generally stowed in the seine-boats upon the platform arranged for that purpose between the two after thwarts. The cork-lines are stowed aft and the lead-lines forward, the seine always being set from the starboard side of the boat.

As has been stated, the small seine differs from the large seine only in its size, being from 150 to 175 fathoms in length and 10 to 12 fathoms in depth. These seines are used in shallow water, and those vessels which have gone to the Gulf of Saint Lawrence for the purpose of catching mackerel by this method have generally carried them.

Many of the large schooners carry two seines whether they have two seine-boats or not, since the deep seine cannot be used on rocky bottom in shallow water.

The seine is always passed from the boat to the vessel and *vice versa* over the roller upon the port side, which has already been described. To transfer the seine from the vessel to the boat requires five or more men. The operation can be performed in from fifteen to thirty minutes. To haul the wet seine from the boat to the vessel is a somewhat laborious task, but as less care is required than in stowing it in the boat, less time is usually needed to perform this operation.

(c) *Bait.*—Mackerel seiners usually carry a small supply of bait for the purpose of tolling the fish to the surface and, incidentally, of catching fish with the jigs when they are not schooling. Sometimes they toll the school along side and spread the seine around the vessel, and as she drifts over the cork-rope and away to leeward the net is pursed up

---

Merchant adds: "We use the left-laid rope for loops and the right for the sinkers. The loops are formed by separating the ropes at what are called the 'bridle hitches.' Only one ring is attached to a loop." The net has attached to it, when completed, 800 No. 1 corks, 1,200 No. 2 corks. The No. 1 corks, which are the largest, are placed in pairs in the center of the bunt of the seine, at a distance of 10 inches between the pairs. The "middle cork," however, is made of three, joined together and covered with canvas. This is for the purpose of determining the center of the seine when it is being overhauled. The No. 2 corks are secured to the upper part of the seine upon the wings and arms, being placed 15 inches apart. From 65 to 75 pounds of lead sinkers, which weigh from 2½ to 4 ounces each, are placed at the bottom of the seine. None of these are put in the bunt, but are scattered along the foot of the wings and arms, being nearest together close to the ends of the net. The rings used at present are made of galvanized 1-inch iron, and weigh about 2½ pounds each; with the sinker-leads they make about 160 pounds weight attached to the bottom of the seine. One and three-fourth inch hemp rope is used for the purse-line, the length of this being generally about 25 fathoms more than that of the seine. In hanging the seine it is "taken up" at the ends, so that one end is 7 fathoms deep while the other is only 1 fathom deep, though the middle of the net will go down 125 feet. The first or deepest end is called the "dory end" or "outer end," and the other is known as the "boat end" or "inner end." As will readily be understood by reference to the preceding dimensions of the purse-seine, the difference in the depth of the several sections of the net, when hung, is due solely to the "taking up" in the process of hanging it, since the webbing is of the same depth throughout. The purse-seines, like many other things, are being improved. Those we are making now [for the mackerel fishery] are much lighter than we have been making them in former years, and can be handled with greater ease and rapidity.

and the fish captured. It is often the case, too, when mackerel are moving rapidly for the men in the dory to throw bait ahead of the school, and while the fish are thus induced to stop, the seine-boat circles around them, the net is thrown out, and while yet engaged in feeding the fish are inclosed in the big purse. Many good catches are obtained in this way. The favorite bait is slivered and salted menhaden, of which each vessel usually carries five to ten barrels. Many if not all of the vessels, however, at the present time, depend entirely upon small mackerel, which they catch and salt. The bait-mill, bait-boxes, and bait-throwers are similar to those used in the mackerel hook fishery, and are used in the same manner.

(*d*) *Methods of seining by day.*—The following description of the method of seining mackerel is mainly from the pen of Mr. J. P. Gordy: When a vessel is on the fishing grounds and there are no signs of fish, if the weather is favorable, a man is stationed at the mast-head on the lookout, while the rest of the crew, excepting, of course, the man at the wheel, lounge lazily around, amusing themselves as they feel inclined. If a whale is seen blowing or a vessel is "putting out her boat," the man at the wheel steers toward them. The skipper is usually on deck directing the evolutions of the vessel, and is consulted before any change is made in the course of the vessel. When signs of fish begin to be numerous and sea geese and gannets are plenty, and whales and porpoises show themselves frequently, the "fishy men" of the crew stop lounging and begin to survey the surface of the water intently. At such times one can count half a dozen here and there in the rigging, carefully observing the movements of other vessels, if any of the fleet are in sight. "There's crooked actions, men," the skipper exclaims, meaning that some vessel in sight suddenly alters her course, and that she is either on fish herself or sees another vessel that is. When one school appears, another is likely to be seen, and when a vessel has "crooked actions," those who observe them bend their course in the direction in which she is sailing. When a man sees fish, he shouts, "I see a school." "Where?" asks the captain. The direction is indicated. "How does it look; is it a good one?" He wants to know whether they are tinkers or whether the fish seem large. If they are abundant, he will wait until he gets a "sight" at a good school. Much attention is paid by the lookouts to the manner in which the school of fish is moving. The seiners prefer those schools which are "cart wheeling,"* or going round and round in circles in a compact body, in the act of feeding. Fish which are "cart-wheeling" can be surrounded with a seine much more readily than those going straight ahead in one direction.

If the man who has found the school is not experienced, the captain examines it for himself, and if satisfied that it is a good one he shouts, "Get in the seine boat; look alive, boys." As a pack of school-boys

* This habit of circling, which the mackerel performs, is also called "milling" by the fishermen.

jump from an apple tree when the indignant owner appears, so eleven men leap into the seine-boat one over another, as if they had meant to jump overboard but by accident had reached the seine-boat instead. The captain takes his place at the steering-oar. Two men sit on the forward part of the seine and one at the cork-line, ready to "throw out the twine" when the captain gives the word of command. The remaining seven row swiftly and silently until the fish disappear or the captain orders them to "stop rowing." All the while the captain is eagerly watching the fish, noticing which way they move and how fast. He wants, before beginning to put out his twine, to get near enough to enable him to make the wings of the seine meet around the school. He must, therefore, keep far enough away to prevent the head of the school from striking the seine until it is nearly pursed up. He calculates the speed of the fish, and sets the seine in such a manner that by the time the school gets thoroughly within the circle of the net he will be able to come round to the starting point and completely encircle them. If he fails in this, the wings of the seine must be towed together before it can be pursed up, and in the time thus occupied there is a chance of losing the fish. A skillful skipper rarely fails in making the ends of the seine meet. In seining on George's, or any other place where there is a strong tide, it requires much skill and judgment to set the seine in such a manner that it shall not be tripped and thrown out upon the surface of the water. Under these circumstances, to prevent "tripping," the seine should be so set that the bunt of it will be in the direction from which the tide runs; the force of the tide then aiding the act of pursing the net.

When the skipper is near enough to satisfy the conditions of the above problems he orders the men at the seine to "Put out the twine." They begin their work, the oarsmen in the mean time rowing as fast as possible. The skipper steers the boat around the school in such a manner that when the seine is fully out the cork-line approximates more or less closely to the form of a circle. Two of the men who did not get in the seine-boat now appear on the scene of action in the dory in which they have closely followed in the wake of the seine-boat until the act of setting begins. As soon as the first end of the seine has been thrown overboard they row up to it and seize the buoy at the end of the cork-line, which they hold until the seine-boat has made a circle, merely rowing fast enough to keep the end of the seine in its place and to prevent it from swagging. When the seine-boat has completed its circle, it approaches the dory, which is holding fast to the buoy. When the two ends of the seine meet, the men in the dory get into the seine-boat to assist in pursing; sometimes, however, the ends do not meet, and in this case they are brought together by means of a line, about 20 fathoms in length, which is always taken in the dory and is fastened by the men in the dory to the buoy and carried to the seine-boat.*

* Capt. Nelson A. Kenney, of Gloucester, states that two men usually go in a dory, one of whom pulls a little while the other holds to the end of the seine. If the one

The work of "pursing up" is now to be performed with all possible speed. Until this is begun the seine is in the form of a hollow cylinder, and the fish, in order to escape, have only to dive down and swim away under the lead-line. In pursing, the bottom of the seine is to be closed up, and in this operation the saying of the men, "A man who won't pull every pound he can and *an ounce more*, is not fit to be a fisherman," is fully exemplified.

The men stand six in one end of the seine-boat and seven in the other end, holding the two ends of the purse-line, which, having passed through the rings in the bridles on the lead-line of the seine, pass round the two blocks of the purse-davit and through the snatch-blocks on the opposite side of the seine-boat, one of which is forward and the other aft. One of the uses of the bridles now appears. As soon as the men in the seine-boat commence pursing up the seine the rings, which before this have been hanging downward below the lead-line, now extend the same distance laterally from this line. We have only to remember that they all extend toward each other to see that they considerably diminish the open area at the bottom of the seine. To be sure, the spaces between the bridles are open, but the fish are not likely to escape through these, for in such an attempt many of them would strike the bridles and finding such obstacles would turn, hoping to find an outlet in some other direction.

The men stand, as has been said, when pursing up the seine, six in one end of the boat and seven in the other. They are divided into three rows of three and one of four men. On the side of the boat next to the seine are two rows of men facing each other and pulling; one row on the end of the first line that passes over the blocks in the purse-davit nearest them, the other on the other end of the purse-line passing over the other block of the davit. Each end of the purse-line passes around another block, which changes the direction of the line, and two rows of men on the side of the boat away from the seine stand back to back, pulling on the purse-line, its direction having been changed by the pulleys.

As previously remarked, the seine before being pursed up is in the shape of a hollow cylinder. A strong tide may make it take the form of a hollow frustrum with a slit in the side. Its longer area is at the bottom. In such a case the slit is wider at the bottom and grows narrower toward the top, until it vanishes at a point where the two ends of the purse-line bring the seine together at the pursé-davit. Then the purse-weight comes into play. This is "reeved out" to the two end lines, and its weight brings the two ends of the seine together, closing up the slit and

having the oars is an expert (and as a rule only old hands do the rowing), he will quickly and dexterously turn the dory as the seine-boat approaches "close to," so that the latter may shoot alongside of the former in such a manner that the purse-line held by the man in the stern of the dory may be easily transferred to the larger boat. As soon as this is done both of the dorymen jump aboard the seine-boat and assist in "pursing up" the seine.

destroying the frustrum shape of the seine. If this were not done the fish might escape at the side as well as at the bottom.*

When the seine is pursed up it is in the form of a bag, the bottom of which does not hang freely, for it is bent upward, having been drawn up by the purse-line near the side of the boat and during the operation of pursing up the boat is pulled nearly into the center of the circle made by the corks on the upper edge of the seine. Occasionally, when there is a current, the boat is brought up against the corks in the bunt of the seine. The object is now to get the fish, if they have any, into such close quarters that they may be taken on deck. To this end the larger part of the seine must be pulled into the seine-boat, and this operation, called "drying up," now begins. The seine is taken up entirely if there be no fish, partly if the school has not escaped, and the net is so drawn up that the "bailing-piece" will inclose the fish at last. The position of this part of the seine being marked by the central cork, already spoken of in the description of the seine, it is of course not difficult to bring it around the fish. The experienced fishermen can also quickly tell, either *night or day*, when the bunt of the seine is reached in the process of drying up, since the difference in the size of the twine of which the bailing-piece is made and that of the other parts of the net is readily detected.

If any fish have been caught, especially if the school is large, the dory, with the skipper and three or four men, go to the vessel to help the cook, who is the only man on board, to bring her alongside of the seine-boat. If the school is very large the dory is rowed to the vessel

*It should be stated that the large purse-weight is at present seldom used. The tide is rarely so strong as to make it useful, and even then the process of "reeving" is likely to be so tedious as to make the loss of time more than balance the gain through its use. According to Capt. Joseph Smith the majority of the mackerel seiners now use two purse-weights, each of 75 or 100 pounds weight, instead of the old-fashioned "Long Tom," which usually exceeded 300 pounds. The two weights above mentioned, being so much lighter than those formerly employed, can be handled by one man, and rove on the purse-line very much quicker than if the heavier, or "double weight," as it is called, was used. These small purse-weights are provided with one block, and each weight has a line attached of sufficient length to reach the bottom of the seine. The time occupied in reeving them on the purse-line rarely exceeds fifteen or twenty seconds. One of the purse-weights is most commonly used on the "boat end," or the end of the seine last thrown out, for the reason that this part of the net has not usually time to sink down to its full extent before the pursing begins. A weight is more rarely used on the end of the seine which is first thrown out, and, consequently, has had time to sink to its extreme depth; though sometimes, on account of the current, or for some other reason, it may be found necessary to put the purse-weight upon this end, as well as upon the other. In using one large weight, as formerly, it would be necessary, of course, to always put it on both ends of the purse-line of the seine, but in having two weights one can be attached and run down on either end of the purse-line as required. That sinks it and keeps the net deep, and if both ends "purse high" a weight should be put on each end. The ends of the purse-line, when the weights have been run down, in the manner above stated, will stand out from each other, something in the form of the letter A, both parts coming nearly together at the purse-davit and being separated several fathoms at the lower part of the net, as the first purse-rings are attached about 15 fathoms from the ends of the seine.

as rapidly as possible, and the second dory is rowed back to the seine for the purpose of holding up the bunt, since a school of 500 barrels may sink both seine and seine-boat if left without assistance. This, however, rarely occurs, and it generally happens that the school either is small enough to be dipped into the dory and to be taken to the vessel, or that the seine-boat without any assistance is capable of managing them until the vessel is brought alongside.

While the fish are being caught the cook has charge of the vessel; if it happens to be about meal time he attends to the cooking as best he can, but whether the cakes burn or not the vessel must be cared for, and he generally divides his time between the forecastle and the wheel. If he is preparing dinner, and is able to, he continues his cooking, taking charge of the vessel at the same time.

The vessel usually lays to, with the jib to windward, not far from the seine-boat; and, perhaps, as the cook sits at the wheel he has a basin of potatoes before him, which he peels while he is eagerly watching every movement of the seine-boat, trying to ascertain whether his mates are successful, and, if so, to what degree.

When the dory has been rowed aboard, the men at once take measures to bring the vessel alongside of the seine-boat. The evolution of shooting alongside of a seine-boat calls into play all the skill of the steersman. The vessel must approach so near that a rope may be thrown to the men in the seine-boat, and in such a manner that she will move slowly enough not to tear the seine as it is pulled along, before the schooner is "bowsed to the windward" and her motion ceases.

The cork-line is then taken over the side of the vessel and made fast by "stoppers" along the rail. This having been done the process of drying up is resumed and the fish are gathered together in a compact body so that they can be dipped out upon the deck. When the fish are to be taken on deck the men are distributed as follows: three or four are employed in hoisting the fish by means of a large dip-net attached to the main and fore staysail halliards, the captain directs the movements of the net, holding its long handle, and, shouting "hoist" when it is about half full of fish, two men standing by the rail empty the dip-net on the deck.

When all the fish have been bailed out the seine is overhauled and salted. In the mean time most of the crew are making preparations to dress the fish. If the school is large, the crew, cook and all, unless it is just at meal time, begin the work as soon as the fish are ready; if the catch of fish is small, and there is a prospect of getting another set that day, a part of the crew take the seine out of the seine-boat to mend it, if necessary, and lay it back in an orderly form so that it may be thrown out without difficulty.

The operation of setting a seine around the school and pursing it up usually occupies from ten to twelve minutes, though it is claimed by some expert fishermen that they have done it in seven minutes. Under unfavorable circumstances it may be nearly an hour from the time the first end is thrown out until the "pursings" are on the boat. This delay is usually caused by a strong tide, such as is generally found on Georges. The catch of a purse-seine may vary from one barrel to five or six hundred barrels. The seine may be set eight or ten times in the course of a day without getting any considerable quantity, or, perhaps, no fish, the mackerel escaping by diving under the "lead-line"; and then a more fortunate set will secure more fish than can by any possibility be taken care of by the crew of the vessel. Under such circumstances it is customary to set a flag from the main-topmast head or main peak. This is to indicate to vessels which may be in sight that more fish have been caught than can be taken care of, and that the skipper is willing to dispose of some of them. This is called "giving the seine away." Sometimes the fish are given away to be dressed on shares, and at other times they are given away without expectation of return.* An ordinary crew can dress and salt at one time about 100 barrels of small mackerel or 200 barrels of large ones.†

Almost incredible quantities of fish can be taken care of in a short time. Vessels have been known to leave New York on one day and return the next day with 200 to 300 barrels of fresh mackerel, while some Gloucester vessels in the course of a week have caught and salted 500 or 600 barrels, landing two or three cargoes during that time.

It sometimes happens that when a large school of mackerel have been taken in a seine, that the fish press down so hard on the bottom of the net that the fishermen find it difficult, if not impossible, to gather in on the twine sufficiently to "dry the fish up" enough to bring them to the surface. It has been found, however, that by throwing coal ashes into the water along s'de of the seine the fish are caused to rise to the surface, being frightened by the whitish appearance which the ashes give to the sea. When the mackerel rise the twine can be readily drawn in. The same result is secured in another way by the menhaden

* The schooner Oliver Cromwell, while on a mackerel cruise recently, had a curious incident befall her. Her seine being out, a school of mackerel suddenly turned, and, making for the seine, took it down. A vessel in the neighborhood immediately answered a call for assistance, and swept her seine under that of the Oliver Cromwell. Twenty-three hundred dollars' worth of mackerel were secured, the two vessels dividing the catch, the fish selling on an average at nine cents each. The bunt of the seine belonging to the Oliver Cromwell was badly rent by the sudden rush of the fish, or more would have been secured. This is the second time the seine of the Oliver Cromwell has experienced similar treatment, losing all the fish at the first, on account of the seine giving way and there being no help near.—(New Bedford Mercury, 1875 (?).)

† A much larger quantity could be taken care of were it not for the fact that mackerel, after being kept a certain length of time, grow "soft," and rapidly become unfit for food. This change takes place much sooner when the weather is warm than at other times. The fishermen, however, are generally able to tell pretty accurately how many fish can be dressed and salted before they spoil. When good catches are made for several days in succession the fishermen get no sleep, being constantly employed night and day in taking and curing the fish.

fishermen when they have a large school of menhaden in their seine alongside of the steamer. If the fish hang heavy on the twine one or two quick turns is given with the propeller and the frightened menhaden rise quickly to the surface. This method is called "whirling 'em up."

(*e.*) *Methods of seining by night.*—The practice of fishing for mackerel, purse-seining in the nighttime, which has recently come into quite general use, was first attempted, so far as we can learn, in 1874. The honor of introducing this method of fishing is assigned to a number of the more enterprising captains of the mackerel schooners, and, in consequence, it is difficult to say here who should receive the credit for the innovation. As is well known to all who are familiar with the sea, the water, on dark nights, frequently exhibits a remarkably brilliant phosphorescent display. At such times objects moving in the sea can be distinctly traced by the illumination which they leave behind, and schools of fish rising near the surface can be readily seen. Indeed on some occasions so remarkable is the phosphorescence thrown out from a large school of fish that it frequently seems to light up the surrounding darkness. From this reason, and the fact that the fisherman, by long experience and close observation, can accurately determine the kind of fish which he may see sporting at night, he is thus often enabled to learn the whereabouts of certain species, such for instance, as the mackerel, and their abundance, even when they do not come to the surface during the day. The mackerel is a remarkably capricious fish, and perhaps for many days in succession its presence can not be detected in its favorite haunts while daylight lasts, and the fisherman therefore seeks for it in vain, but as soon as the sun sets and darkness appears over the sea the schools rise to the surface and the fish continue to disport themselves in this manner until near daylight when they again sink out of sight.

For many years after the introduction of purse-seines it was considered impracticable by the fishermen to catch mackerel in the night, but at last some of the more adventurous skippers, having a favorable opportunity for night fishing, and deeming it possible to catch the mackerel, made an attempt and met with even better success than they dared to anticipate. Thereafter they followed up this method of fishing whenever a good chance occurred, but as it usually resulted greatly to their personal success, as well as increased their reputation among their fellow fishermen, on account of the additional amount of fish caught, they were by no means anxious to tell that part of their catch was made in the night, since if they did so, all the other mackerel fishermen would at once come directly into competition with them. As a matter of course, however, the fact of mackerel being seined at night could not long be kept a secret, and the result was that one after another began to adopt this practice until in the fall of 1881 it reached its climax, nearly every vessel in the fleet engaging to a greater or less extent in night fishing.*

Previous to this time the public at large were not, it seems, aware that such large quantities of mackerel were taken in the night, though it was on record that night fishing had been previously attempted, and with good results.†

The method of seining mackerel in the night is as follows: The vessel being on the fishing-ground, if the night is favorable, she is allowed to sail slowly ahead while a man goes aloft to the foremast-head and keeps a lookout for the fish. If the signs are peculiarly favorable, perhaps two or more men may be aloft for this purpose. These lookouts are the men who have the watch on deck, and, not infrequently, the skipper may be one of them, his ambition to succeed often impelling him to remain up during the entire night, constantly keeping on the alert for fish and watching the movements of surrounding vessels. The remainder of the crew—those having a watch below—are thoroughly prepared and dressed in their oil-clothes ready to jump into the seine-boat at a moment's warning. If the fish are not seen in the first of the night, the men off duty lie down on the cabin or forecastle floors or stretch themselves on the lockers, and endeavor in this way to get what sleep they can, unless, indeed, they may be busy on deck in caring for the fish taken the night or day previous. When a school of fish is seen by the lookout, he at once shouts "I see a school!" If it is the skipper who first descries them, he gives directions to the man at the wheel how to steer in order to approach them. If not, the man who first reports the school

* Mr. A. Howard Clark, writing under date of October 28, 1881, says: "During the past few weeks the mackerel fleet have taken some good hauls during the night, as the fish have been difficult to catch by daylight but have rarely failed to show themselves on dark nights. When the moon shines it is impossible to see them, but when the night is dark or starlight they can be plainly seen from the mast-head, and sometimes from the vessel's deck. Heretofore, in night fishing, the methods have been the same as by day, but recently, owing to the difficulty of seeing the fish from the deck or the boat, the lookout at the foremast-head has given directions to the men while setting the seine. In this method the seine-boat is towed astern of the vessel, and when ready to 'give 'em twine,' the dory is allowed to drift astern with one end of the seine while it is being thrown out from the seine-boat. When ready to go around the school, the order is given from the mast-head, to 'go ahead'; the seine-boat is cast loose from the vessel and the seine brought together in the usual manner. Still another improvement in the methods is likely soon to be adopted in this night seining, and that is in the use of large lanterns to show their position to the men while setting for them. The schooner 'Northern Eagle' tried this new method last Tuesday night and found it to work splendidly. It was probably the first attempt to use lanterns for such a purpose. Two schools of mackerel were secured, one at ten o'clock and the other at midnight, both together yielding 160 barrels. The lantern was the ordinary large signal light used by fishing vessels."

† We hear of one vessel with a catch of 100 barrels in one week, and of several with catches ranging from 30 to 60 barrels. Another vessel made a good haul in a seine, one moonlight night recently, a new feature in this fishery.—(Cape Ann Advertiser, October 19, 1877.)

is asked in which direction it bears from the vessel. He also directs how the course shall be laid in order to approach close to the body of fish. In the mean time the men below, having been hurriedly awakened, rush on deck and quickly take their places in the seine-boat and dory which are towed alongside or astern. If the mackerel "show up" well and can be plainly seen by the men in the boat, the latter is cast off as soon as the vessel approaches close to the school, and the seine is set and pursed up in the same manner as has before been described; though it frequently happens that owing to the darkness of the night, it is sometimes difficult to bring the ends of the net together with such a degree of certainty and success as it is generally done in the daytime. Of late, however, the custom of carrying a light in the dory has been adopted in order that the skipper, who steers the boat, can determine the position of the end of the seine first put out and therefore be enabled to make a circle with a great deal more accuracy than he otherwise could. It often happens that fish can only be seen by the man at the mast-head, and in such cases, the vessel is usually hove to near the mackerel, and the lookout directs the men in the boat how to row in order to surround the school. Another method, we are told, has been occasionally adopted when the chance for its success is promising. If the wind is sufficiently moderate the lookout at the foremast-head may direct the course of the vessel in such a manner that nearly a complete circle may be made round the school of fish. In this case the seine-boat remains fastened to the stern and is towed along by the vessel while the men in her throw out the seine in obedience to the order given by the man at the mast-head. At the proper time she is cast off and proceeds to close up the circle by bringing together the ends of the seine. The dory is cast off and allowed to remain at the end of the seine as usual until the other end is brought around to her. An evolution of this kind, of course, requires the most skillful seamanship for its success, and also remarkable qualities of adaptability in the vessel.*

*Night fishing, says Capt. Joseph Smith, can only be carried on in reasonably moderate weather. The boat is usually towed alongside of the vessel, the painter being fastened to the out-rigger. When a school is seen, the men jump into the boat, each taking his station, and at the proper time the boat is cast off and proceeds to set the seine if the fish "show up" in a promising manner. Sometimes, however, the school of mackerel may sink suddenly after the boat leaves the vessel's side, and, in consequence, the fishermen are not able to set their seine. As a rule the man on the lookout aloft reports the school of fish and indicates the direction in which it is and tells about how far it is distant. After the boat leaves the vessel's side, however, the captain, or seine-master, who steers, takes charge of her, and when the boat approaches near the fish, which may be seen by the phosphoresence in the water, he gives the order to put out the seine as his judgment may direct. On special occasions this method may be somewhat varied, but the usual practice of setting a seine in the night is the one described above. Sometimes a portion of the net is set from the boat while towing astern of the vessel; or, again, even while the boat is towing alongside. In the latter case the towing rope is fastened to the boat some distance aft from the stem, so that she will keep from the schooner's side some ten or fifteen feet. The oarsmen have out their oars

When a school of mackerel has been taken in the seine and the net is *pursed up*, a signal is made by the crew of the seine-boat, who have a lantern, so as to attract the attention of the men on board of the vessel who immediately bring the latter near the seine-boat. The skipper and three or four of the crew then go on board the vessel in the dory and bring the schooner along side the seine-boat, performing this evolution in the same manner as it is done in the daytime. The lantern, which is always carried in the seine-boat, enables the skipper to find her without any trouble. Much vexatious delay and difficulty, however, sometimes occurs in consequence of the light carried by the seine-boat's crew being extinguished. In such case it is not only hard, but sometimes impossible for the men on the vessel to find the seine-boat, since on a dark, windy night she cannot be seen more than a few rods distant.

The practice of using a large lantern to attract the fish nearer to the surface of the water than they usually come, so that they can be more plainly seen, has met with decided success, and there seems strong reason for anticipating considerable improvements in this respect hereafter. In alluding to this matter a writer in the Cape Ann Advertiser, November 4, 1881, says:

"It would not greatly surprise us if the mackerel fleet, next year, were supplied with powerful calcium lights, to be carried at the masthead, and that the fishery will be extensively prosecuted in the night-time. Surely the signs of progression are manifested in almost every branch of the fisheries, and brains are rapidly coming to the front and making themselves manifest. A year ago who would have dreamed of catching mackerel in the night time? Now it is fast becoming a reality."

As may be readily inferred this practice of night fishing is one which calls for the greatest possible amount of endurance and hardihood on the part of the fishermen who engage in it. It frequently happens, when good catches are made for days and nights in succession, that the men get no rest whatever until they are thoroughly worn out by their constant labors and vigils and are scarcely able to refrain from falling asleep even when engaged at their work. Nor is the work on the fishing-ground all they have to do. When a fare is obtained, all sail is made upon the vessel and she is driven as swiftly as possible for the

ready to pull whenever the men aloft gives the order for them to cast off. These methods of setting the seine, however, are only adopted when the fish do not *show* plainly, so that they can be seen by the men on the vessel's deck, or in the boat; it therefore becomes necessary for the man on the masthead to give the requisite orders for throwing out the seine as well as to direct the wheelsman how to steer the vessel until the boat leaves the side.

Captain Smith has never known a vessel to make a complete circle around a school of mackerel while towing the seine-boat from which the net was being thrown out, but thinks it probable that it may have been done.

A lantern is carried both in the seine boat and dory, the one in the former always being kept darkened or out of sight until the seine is set, since a light would so blind the men in the boat that it would be difficult for them to perform successfully the work of setting the net.

home port, where the fish are landed, new supplies taken on board, and again the men go to sea without, in the mean time, having an opportunity of visiting their homes or of securing the rest they so much stand in need of. So sharp is the competition in this fishery, and so eager are the fishermen to "make hay while the sun shines," that is, to improve every opportunity during the short season while the mackerel can be taken, that the only limit to their labors is when nature is no longer able to sustain the extraordinary drafts that are made upon it. The following notes written by Capt. S. J. Martin will serve to give an idea of the continued labor and consequent fatigue which the fishermen endure:

"Our mackerel fishermen have drove business this year. I know a number of cases where vessels came in in the morning with 300 barrels of mackerel [which were landed] and went out [again] the same night. The schooner "Fleetwing" caught 210 barrels of mackerel; came into Gloucester with them all on deck; hired 20 men who had them [the fish] all dressed and salted at two o'clock the following morning. The vessel's crew went home to sleep; went out again the same morning at eight o'clock.

"Schooner "William M. Gaffney" came in here with 450 barrels of mackerel, of which 150 barrels were fresh on deck. The men had not been to sleep for two days and nights, and were nodding while putting the mackerel in the barrels. They got the mackerel all salted at four o'clock in the afternoon. Captain Smith then told the men to go home and rest till morning, but to be down the first thing after breakfast, as he wanted to get the mackerel out and go to sea in the evening. This they did."

The success of the night fishing was quite marked in the fall of 1881, as has been indicated above, and as the following paragraphs will show:

"Several of the [mackerel] fleet have made night hauls recently, some of them securing as high as 200 to 300 barrels at one setting of the seine. The operations are conducted by a lookout stationed at the foremast-head of the vessel, who gives the orders to the boat's crew in charge of the seine, as in the night-time the motions of a school of mackerel cannot be seen from the boat in pursuit of the fish, nor from the deck of the schooner."—(Cape Ann Advertiser, October 21, 1881.)

"Schooner "Henry Friend" took 140 wash barrels [of mackerel] at one haul Sunday night [October 16]."

Schooner "Phantom" went out Sunday morning, and about 11 o'clock p. m. discovered a school of mackerel on Middle Bank, and getting her seine out secured ninety wash barrels. The night was very dark, and lanterns were found necessary to conduct the seining operations and find the way back to the vessel.—(Cape Ann Advertiser, October 28, 1881.)

In regard to the night fishing for mackerel in the fall of 1881, Captain Martin writes as follows:

"Seven-eighths of the mackerel since the 10th of September have been caught in the night. Catching mackerel in the night is done with great difficulty. Sometimes the vessel goes away from the boat. There were two such cases this fall. Schooner "Everett Pierce's" boat went out and set around a school of mackerel, and the seine was full of fish. At this time a squall of wind came and blew the lantern out, and the two men on board of the vessel lost sight of the boat. The men were in the boat from 11 o'clock at night until 5 o'clock the next morning. They were obliged to cut holes in the seine in order to let the mackerel go out so as to save the net, for if the mackerel died the seine would have been lost. The crew of the "Minnehaha," of Swampscott, had a similar experience the same night. The darker the night the better it is for seining, since the water will 'fire' more. When watching for mackerel one man is on the mast-head. He can see a school from the mast-head when he could not see it from the deck of the vessel. Sometimes the fish may be seen from the deck, but when the men get in the seine-boat they are not able to see them. A man on the mast-head can see them all the time. He gives orders to the men in the boat which way it is best for them to go. Captain Martin, of the schooner "Northern Eagle," saw a school of mackerel one night. They could not see them plainly, so the lantern was held up, when the mackerel could be seen from the boat. They then set their seine and got 150 barrels of mackerel. When the fish saw the light they came nearer the surface. Sometimes when the mackerel are close to the surface it is not necessary to have a man on the mast-head since they may be seen from the deck and seine-boat. It is not very often that the mackerel come to the surface during the fall of the year. Sometimes on a calm night in summer you can hear them rushing, but not often. Catching mackerel in the night is hard work. Say, for instance, you get 200 barrels a night, and perhaps it is the latter part of the night, it will take all day to dress and salt them, head them up, and get them below. Thus if another dark night follows, all of the men are on the lookout for another school. After looking for, perhaps, two hours, some one (most likely the man on the mast-head) gives the alarm, telling those on deck where the fish are. The vessel is then kept in the direction of the school, and as soon as they can be seen from the deck the men jump into the boat, shoving off from the vessel, while the captain stands up with the steering-oar in his hand, looking for the school. Soon he espies the fish, or the man on the mast-head sees them, and tells the men in the boat which way to go. When the captain sees them he sings out: 'I see them, boys! Pull away! Pull hard, the mackerel are going fast.' When the boat is in the right position the captain shouts, 'Give 'em twine,' and away goes the seine, three men heaving it out as fast as they can. When they are nearly around the school they sing out: 'Give them twine.' Sometimes they make a good circle so that the seine-boat and dory will meet, but it is difficult to do this in the night. When the seine comes together they haul in on the purse-line, and when the net is pursed up and they see the mackerel, signs are made for the vessel, which comes alongside. The lines are hove from the boat and the mackerel are *bailed in* on deck and dressed."

(*f.*) *The mackerel pocket, or spiller.*—In 1877 the schooner "Alice," of Swan's Island, had a bag-net made of haddock ganging-line, into which the fish were transferred when there were too many to be cared for at once. This vessel began the season in the Gulf of Saint Lawrence, but caught only 200 barrels of mackerel there, and later fished on the coast of Maine, where, up to October, she had caught 1,400 barrels.

A development of this idea is the mackerel pocket or spiller, patented in April, 1880, by H. E. Willard, of Portland, Me., an article long needed in the mackerel seine fishery, and which has received from the fishermen the name of "mackerel pocket," or "spiller." It was first used by the patentee in 1878, and Capt. Geo. Merchant, jr., of Gloucester, Mass., invented and put into practical operation an improved "spiller" last year (1880), though it was not until the present summer that the advantage of its use was known to the majority of the mackerel fishermen, who have hastened to adopt it, and now more than thirty of the vessels sailing from this port are each provided with one of the pockets.

The apparatus is a large net-bag, 36 feet long, 15 feet wide, and 30 feet deep; it is made of stout, coarse twine and is attached to the side of the vessel, where it is kept in position, when in use, by wooden poles or "outriggers," which extend out a distance of 15 feet from the schooner's rail.

When distended in this manner a "spiller" will hold over 200 barrels of mackerel, which can thus be kept alive, as in the well of a smack, until the crew, who have captured them in the great purse-seines, have time to cure their catch. As is well known, it frequently happens that several hundred barrels of mackerel are taken at a single haul. Heretofore, when such a large quantity of fish were caught, but a comparatively small portion of them could be cured by the crew of the vessel to which the seine belonged. The result was that when a large catch was made, a considerable percentage of the fish were generally "given away" to some other vessel, since if only a part of them were removed from the seine to the vessel's deck, the remainder being left in the net until the first lot were cured, the chances were nine to one that the fine twine of which the purse-seines are made would be bitten in many places by the swarming dogfish (*Squalus Americanus*), that *bete noir* of the mackerel fisher. In addition to the injury to the net, the inclosed body of fish were thus allowed to escape and went streaming out through the numerous holes made by the keen teeth of these voracious blood-hounds of the sea, which, in their fierce and ravenous pursuit of the imprisoned mackerel, usually succeeded in robbing the fisherman of a large portion of the fruits of his labors.*

* Captain S. J. Martin writes that in the summer of 1881 the crew of one of the mackerel schooners endeavored to save their seine from the depredations of the dog-

The "spiller" is only made of coarse twine, and though not entirely exempt from the ravages of the dogfish and sharks, is rarely injured by them; and now when a large school of mackerel are caught in a seine the fish are turned into the bag, from which they are "bailed out" on to the schooner's deck only as fast as they can be dressed, and in this way it frequently happens that a full fare may be secured from a single set of the net. * * *

The introduction of this simple net-bag will undoubtedly save to our fishing fleet many thousands of dollars, even in this the first season of its adoption.

The "spiller" invented by Mr. Willard was simply a sheet of netting 540 meshes square, bound around with rope; it is made of five sheets of twine, each 180 meshes deep and 540 meshes long. These sheets are laced together. This net, when in use, is suspended from its four corners to the side of the vessel and the outriggers, mentioned above, and hangs something like a hammock. From its shallowness, however, it was not so well adapted for the purpose for which it was designed as was the deeper bag-shaped net subsequently devised by Captain Merchant, and which has been described above.*

The mackerel pocket is hung to $1\frac{1}{4}$-inch rope, and on the portion of this which comes next to the vessel are strung egg-shaped wooden floats. These are only for the purpose of securing the edge of the net-bag firmly to the rail of the vessel. The border of the pocket being drawn over the rail, a board is laid on top of it and held in position by wooden pins passing through both board and rail, the net being thus fastened between the two.

To the outer edge of the mackerel pocket, either Williard's or Merchant's, is attached a rope bridle, the ends of which are fastened at a distance of about 9 feet from each outrigger; a thimble is seized into the upper part of this bridle, and when the mackerel have been turned into the pocket the fore and after staysail halliards are bent into this thimble, and the outer edge of the pocket is supported thereby so as to take as much strain as possible off the outriggers, which are only 4 inches in diameter. The outer and upper corners of the "spiller" are supported by ropes which run through single blocks attached to the farther ends of the outriggers. By means of these ropes the outside edge of the pocket may be raised or lowered. When a school of mackerel has been caught in the seine, the pocket is slacked down to the surface of the water, and its outer edge having been fastened to the

---

fish by hauling the staysail underneath it, thinking that if they could thus prevent the dogfish from seeing the mackerel inclosed in the net the latter would not be harmed. But this did not succeed fully, since the sail was badly bitten and much injured by the dogfish, making this experiment a rather costly one.

*The "mackerel pockets" constructed by Capt. George Merchant, of Gloucester, are 36 feet long, 30 feet deep, from 15 to 18 feet wide across the mouth; two-inch mesh, and knit of 12-21 half-patent twine.

cork-rope of the seine, the fishermen gather in on the twine of the latter, and, by dexterous management, turn the whole body of fish into the bag provided for their reception, and where they can be kept alive, as previously mentioned, until such time as they can be properly cared for. The mackerel having been transferred to the pocket, its outer edge is usually raised slightly above the water. When the vessel is rolling and there are many fish in the pocket there is often considerable strain brought to bear on the outriggers, which, however, being supported by guys or tackles to the standing rigging, rarely break. It may be assumed, perhaps, that the enormous catches of some of the mackerel schooners in the summer of 1881 are due very largely to the use of this implement. Never within the history of the fishing business of New England have so many fish been caught or so much money made by a single vessel in the mackerel season as has been the case in the year of 1881. The schooner "Alice," of Swan's Island, Maine, is reported by the secretary of the Boston Fish Bureau to have taken 4,900 barrels of mackerel, the value of which exceeded $28,000. The schooner "Edward E. Webster," of Gloucester, caught 4,500 barrels of mackerel, stocking more than $26,000. A long list of other large catches might be added in proof of the efficacy of the mackerel pocket, but for obvious reasons they are omitted here.

16.—Taking care of the fish.

The manner of caring for the fish is very similar to that upon the mackerel schooners fishing in the old way with jigs, excepting that a larger quantity is likely to be taken at once, necessitating much more haste in salting or dressing them. When haste is necessary, the process of "plowing" is usually deferred until after the fish have been salted.

Mr. Gordy thus describes the method of dressing on a seining schooner: "The men engaged in dressing are divided into gangs generally of three men each. Each gang has two wooden trays about 3 feet square and 6 or 8 inches deep; these are placed on the tops of barrels; one is called a 'gib-tub' the other a 'splitting-tub.'"*

Except on the seiners, the mackerel when caught are put into barrels, and the splitting is done upon a board laid across the top of the barrel, rather than in a "splitting-tub." One man of each gang splits, the other two gib, or eviscerate, the fish. The tub of the man who splits, of course, contains the fish to be split. With a scoop-net the splitter, or one of the "gibbers," from time to time, fills the splitting-tub from the pile of mackerel lying upon the deck. On the side of the splitting-tray next to the "gibbers" is a board about 6 to 10 inches wide, called a "splitting-board," on which the splitter places the fish as he cuts them open. He takes them in his left hand (on which he has a mitten) round the center of the body, head from him, and with the splitting-knife splits them down the center of the back. As fast as he

*Also called, especially in Gloucester, "gib-keelers" and "splitting-keelers."

splits the fish he tosses them into the tray of the "gibbers." The "gibbers" protect their hands with gloves or mittens. As fast as the "gibbers" remove the viscera, with a peculiar double motion of the thumb and fingers of the right hand, they throw the fish into barrels, which are partially filled with water; these are called "wash-barrels." If the men have time they "plow" the fish before salting them, making a gash in the abdominal cavity nearly to the skin with the peculiar knife, "the plow," provided for the purpose.

Before the fish are salted the dirty water is poured out and clean water is added. About one barrel of salt is used for every four barrels of mackerel. This is the first salting. When the fish have been salted they are placed in unheaded barrels until the weather is unfit for fishing, or the deck is filled with them, when they are carefully headed up and stowed away below.

The speed with which a large deck-load of mackerel can be disposed of by the crew is something marvelous. A good splitter will handle from forty-five to sixty mackerel a minute. In one well-authenticated case a man split sixty-seven mackerel a minute for three consecutive minutes.* A good "gibber" can handle a barrel of large mackerel in from five to seven minutes. A smart crew of fourteen men can dispose of a deck-load of large mackerel in from fifteen to eighteen hours, salting them away properly in the barrels. The smaller the mackerel the longer it takes to dress a barrel of them, the time required to handle a small or a large mackerel being precisely the same.

When the fish are to be iced and carried fresh to market they can be disposed of much more rapidly, it being simply necessary to stow them away in the hold without splitting. They are usually washed before being placed in ice, and occasionally gibbed without splitting, the viscera being drawn through the gill openings.† The most rapid way of caring for the fish is to place them in barrels of ice-water. This is done for the most part in the spring or fall.

---

*An expert can split mackerel nearly as fast in the darkest night as at any other time. The sense of touch becomes so acute from long practice that the fisherman can tell (without seeing it) when he grasps a mackerel whether its head is in the right direction or not, and also which side should be laid to the board in order to bring the fish's back in proper position for the knife. The splitter holds the knife with his fingers, letting the thumb slide down along the upper side of the fish, thus guiding unerringly the keen and swiftly moving blade. Whether the fish be large or small it is almost invariably split with the utmost precision, the edge of the knife glancing along on the left side of the vertebra, and scarcely a hair's breadth from it, while the point goes *just* deep enough and no farther. But one must witness the operation of splitting mackerel in order to fully appreciate the skillfulness of the performance.

†Fresh mackerel are never gibbed for the New York market in spring, but a law of Massachusetts compels the fishermen to eviscerate all mackerel taken to Boston. In the first named port the cargoes of fresh fish are sold by commission merchants, while in Boston the captain sells directly to the dealers.

17.—Running for the market.

Those mackerel schooners engaged in market fishing find it desirable to make their passages with the utmost speed, but rapid passages in summer are, of course, much less dangerous than those made in winter by the haddock and halibut vessels. Great expedition is used by all mackerel vessels, since the season is short, and they feel obliged to take advantage of every opportunity. In the case of salted fish, however, there is no such anxiety to sell, and the chief desire of the skipper is to land his fish and to return to the fishing ground with no unnecessary loss of time.

It often happens that mackerel-catchers who are not engaged in the fresh-fish trade take a big haul, 200 barrels or so, when they have but few barrels to put them in and scarcely any salt. In such cases it is of the highest importance to reach home if possible, or at least some large fishing port where barrels and salt can be obtained, and all the sail that can be spread or that the vessel will carry is set.

18.—Landing the cargoes.

The mackerel are hoisted out on the wharf by a horse, the duty of the crew being to hook on the barrels and to roll them to the proper places on the wharf, after they are landed, where the barrels are generally stowed on their heads ready to be opened. In seasons of abundance, and when the men have become exceedingly fatigued from their labors in catching and dressing a fare of mackerel, it is often the case that the skipper will hire a number of longshoremen to take the fish out of the vessel. At such times, too, the shoremen are employed to plow the fish, and also to assist in packing them, since the fishermen find it more profitable to hire men to do this than to remain ashore and do it themselves. For, in the mean time, they may be fortunate enough to catch a fare of two or three hundred barrels of mackerel.

In the days of hook and line fishing, the landing and packing of mackerel was carried on much more leisurely than at the present time. At first it was customary for the men composing a crew to hoist the mackerel out on the wharf by tackles; but within the last fifteen or twenty years it has been found more profitable to employ a horse for this purpose, since the work of discharging can be carried on much more rapidly than before, and with less tax upon the energies of the men. The several processes of unheading the barrels, culling, weighing, and packing the mackerel have been fully described in another chapter and need not be repeated here.

19.—Financial profits of seining.

The following tables, copied from the annual reports of the Boston Fish Bureau, show the large catches and "stocks" by the mackerel fleet in New England waters for the seasons of 1880 and 1881.

1881.	Barrels cured.	Amount of stock.
Schooner Alice, Capt. H. B. Joyce, Swan's Island, Me	3,700	$19,548 75
Schooner Edward E. Webster, Capt. S. Jacobs, Gloucester, Mass	3,969	19,465 00
Schooner Alice C. Fox, Captain Rowe, Portland, Me		13,432 00
Schooner Louis and Rosa	2,769	12,492 00
Schooner Frank Butler	2,036	11,600 00
Schooner Mary Greenwood	1,700	11,035 00
Schooner Kate Florence	2,500	11,000 00
Schooner Addie F. Cole	1,900	10,500 00
Schooner Cora Lee	1,875	10,250 00
Schooner Cora Smith	2,150	10,000 00
Schooner M. O. Curtis	2,000	10,000 00
Schooner Mary Snow	1,352	9,281 00
Schooner F. F. Nickerson	2,350	9,730 00
Schooner Dictator	1,652	9,213 00
Schooner Morning Star	1,527	9,087 00
1881.		
*Schooner Alice, Swan's Island, Me	4,905	28,055 23
†Schooner Edward E. Webster, Gloucester, Mass	4,500	26,570 00
Schooner Isaac Rich, Swan's Island, Me	3,276	15,500 00
Schooner Frank Butler, Boston, Mass	2,600	15,000 00
Schooner Mertie and Delmar, S. Chatham, Mass	3,005	14,138 00
‡Schooner A. E. Herrick, Swan's Island, Me	2,280	13,674 00
Schooner Robert Pettis, Wellfleet, Mass	2,580	12,419 18
Schooner Roger Williams, North Haven, Me	2,450	12,000 00
Schooner R. J. Evans, Harwichport, Mass	3,000	12,000 00
Schooner Louis and Rosa, Boothbay, Me	3,028	11,557 46

When it is taken into consideration that these vessels are employed in fishing barely eight months at the longest, and some of them only four to six months, it will be seen that the business is an exceedingly profitable one for many of the fleet, while the greater portion make fair returns.§

*3,665 barrels pickled, and 1,240 fresh; total, 4,905 barrels.

†1,600 barrels pickled, and 2,900 barrels fresh; total, 4,500 barrels.

‡The Herrick did not sail until July 22.

§Among the "fishing items" in the Cape Ann Advertiser of October 21, 1881, we find the following mention of catches of mackerel made by some of the seiners, which may serve to show the energy and activity with which this fishery is prosecuted: "Schooner 'Moro Castle' sailed from this port on Thursday morning of last week, and returned in the evening of the same day with 140 wash barrels of handsome mackerel. Schooner 'Dreadnaught' sailed from Portland after mackerel the other night, was gone twenty-one hours, and returned with 205 barrels. Schooner 'David A. Osier' sailed from Hull Friday evening, and was at this port next morning with 105 wash barrels of mackerel. Schooner 'Wildfire,' Captain McLain, has landed and sold $3,200 worth of mackerel in the past fortnight, and has enough fish on board to add another thousand dollars to her stock. Schooner 'Fleetwing' took 210 barrels sea-packed mackerel at one haul of the seine off Plymouth on Saturday. Schooner 'Wm. M. Gaffney' took 140 wash barrels at one haul Sunday, and schooner 'Henry Friend' 140 wash barrels at one haul Sunday night. Schooner 'Madawaska Maid' left Gloucester Sunday, turning Eastern Point at 11 o'clock a. m., and arrived at Boston at five o'clock Monday morning, with 225 barrels sea-packed mackerel; in five weeks the 'Madawaska Maid' has landed 1,000 barrels of mackerel. The schooner 'Wm. M. Gaffney' landed 900 barrels of mackerel in twenty-one days."

20.—History of the use of purse-seines.

The earliest record of the use of the purse-seine is the following, obtained from Capt. E. T. Deblois, of Portsmouth, R. I.:

"The first purse-seine that was made, so far as I know, was made by John Tallman the first, and Jonathan Brownell and Christopher Barker, in the year 1826. It was 284 meshes deep and 65 fathoms long. The purse-weight was a 56-pound weight, and the blocks were the common single blocks, and they had to reeve the end of the purse-line through the blocks before they put the purse-weight overboard. The first time the seine was set there were fourteen men to help; they set around what they called a 500 barrel school of menhaden, and while they were pursing the fish rushed against the twine so hard that they twisted and snarled the net around the purse-line and weight to that extent that the men could not gather the seine up or get her into the boat again as they were, and after they had worked six hours, and quarreled over the matter, they decided to tow or warp the seine ashore at high water, and when the tide left the seine they would be able to *unsnarl* it, which they did the next day. It was a number of days before they could muster courage to set her again, and when they did they set around a small school with better success."

There is a general impression among the fishermen of Northern New England that the purse-seine was a development of the "spring-seine," elsewhere referred to, but this would seem to be a mistake, since the spring-seine, which really appears to have been nothing but a large sheet-net with special appliances adapting it for use on board of a vessel, was not used in New England until 1853 or 1854. There is also another tradition to the effect that the purse-seine was invented about the year 1837 by a native of Maine who had for some years been employed as a hand on a Gloucester schooner, and who conceived the idea of capturing mackerel in large numbers, and invented a seine substantially like the one now in use, which, finding the Gloucester fishermen unwilling to enter into experiments, he carried to Rhode Island, where it was used in the vicinity of Seaconnet for seining menhaden. This would appear to be a conglomeration of errors, partly imaginary, partly based upon the circumstances already narrated by Captain Deblois.

Reference has already been made to the claim that the purse-seine was invented in Rhode Island as early as 1814. Another early allusion to this new instrument of capture was given in the following paragraph, taken from the Gloucester Telegraph of Wednesday, July 21, 1839:

"*New Fishing Tackle.*—We noticed, a week or two since, the fact that Capt. Isaiah Baker, of Harwich, had recently commenced fishing with a seine of entirely new construction and with remarkable success. It was stated in the Yarmouth Register that he had cleared about $3,000 in one week, by taking shad. A correspondent writes us from West Harwich that the fortunate captain still continues to make equally 'glorious hauls.' He is now in Provincetown with his seine catching mackerel, and recently took 60 barrels at one 'shoot.' This new mode of fishing bids fair to create an entire revolution in the mackerel and shad fisheries. Our correspondent says that the Vineyard Sound will soon become a great fishing ground. It is well known that all the shad, bass, mackerel, etc., which are found in Block Island Channel early in the spring pass through the sound, and it is now ascertained that with proper seines they may be caught in great abundance. With a purse-seine, when mackerel are schooling or shoaling, the fishermen may run around them and inclose *one hundred barrels.* They will not bite at bobs as in years past, but Cape Cod ingenuity has devised something to out-general them."

The purse-seine was undoubtedly a development and extension of the idea of the drag-seine supplemented by that of the gill-net used at sea in sweeping around schools of fish.

The first seine used north of Cape Cod was that carried by Capt. Nathaniel Adams, of Gloucester, in the schooner "Splendid," in the year 1850. Capt. Nathaniel Watson, of the "Raphael," began using one the same year. According to Mr. Luther Maddox, the earliest experiments were at Chelsea Beach. It is claimed by some that Gorham Babson, of Gloucester, had one in use as early as 1847.

The early seines were about 200 yards in length, 22 fathoms in depth, and of 2½-inch mesh, the bunts being about 250 meshes square. The twine was much heavier than that used in the present seine; the whole net weighed 600 or 700 pounds. The seine in its present form did not come into general use until about 1860.

The rapidity with which this expensive form of apparatus has come to be generally employed in our fisheries seems almost marvelous. At the present time the total number of these nets used in the mackerel fishery is not far from 400, valued at 160,000 dollars; in the menhaden fishery 366, valued at 138,400 dollars. The total value of the purse-seines with the value added of the seine-boats, which really are parts of the same apparatus, cannot be less than 440,000 dollars.

Capt. W. H. Oakes states that in early days a certain kind of net was used in catching menhaden which reached to the bottom in shallow water and which was pursed by means of ropes. Capt. George Blatchford used to go for menhaden in an old pinkie, and used one of these nets.

Captain Oakes is of the opinion that Capt. William Ratcliff, of Rocky Neck, Gloucester, was the first man who caught mackerel in deep water off-shore. He used some kind of a purse-seine, and with it in two hauls caught about 90 barrels of mackerel off Monhegan in 90 fathoms of water. Capt. George Merchant, jr., of Gloucester, writes as follows regarding the early attempts to seine mackerel in deep water. He says: "Previous to 1862 the only mackerel caught in deep water, in seines, were taken with the schools of pogies. From one to ten or twelve hundred in number were often caught in this way, the seiners supposing that their being with the pogies prevented them from trying to escape, since pogies seldom leave the seine after it is around them, but we never set the seine for them (mackerel) when in deeper water than ten fathoms, our seines not being deeper than that at that time. One day in July, 1862, I lay at anchor near Boon Island, it being calm at the time. While lying there a school of mackerel came up and began to play around at the surface, not far from us. Knowing that the water was twenty-five fathoms deep where the fish were, I did not go after them right away, but after they had been schooling some time I concluded to go out and look at them. I found the water to be as I had expected—twenty-five fathoms deep. I thought, however, that I would try just to see what would come of it, although the men said it would be no use, as the fish would soon disappear, but we threw out our seine and went around them, with as little noise as possible, and commenced to purse up, the men saying that the mackerel would soon go, but they did not go, but continued to school in the seine until the latter was pursed up, and the rings on the boat. Then we thought we had done something never before heard of. We took fifty barrels of large mackerel that time.

"After securing the fish I weighed anchor and ran to Richmond's Island. When I arrived there I found fifteen fishing vessels at anchor. I told them (the skippers and crews) that I had taken fifty barrels of mackerel in deep water, but they would not believe it, saying that if I had it would never be done again. But it set them to thinking, and they soon found that mackerel could be caught in deep water. The fleet of seiners began to increase from that time, and has kept growing until the present, when it amounts to about two hundred sail.* I date the catching of mackerel in deep water from the time and occurrence I have mentioned above. I was in one of the first seven vessels that sailed on seining voyages from Gloucester, Capt. Samuel Blatchford and Capt. Nathaniel Watson being the two first to try the business, and they both gave up seining, as it did not pay them."

Wellfleet, Mass., had 52 mackerel seiners in 1877. Seines were first carried by the Wellfleet vessels about 1857, but their use was soon abandoned. In 1863 to 1865 the "Mary B. Dyer" had a seine, and since that time more or less seines have been in use. In 1873 all the vessels went into this business.

The first purse-seine brought into Central Maine, writes Mr. Earll, was bought by Mr. Amherst Spofford, and taken to Damariscove in 1859, and used with rather indifferent success until 1861; it was 130 fathoms long and 12 fathoms deep; the parties kept it on the island and took it out in small boats whenever fish were seen schooling in the vicinity. It seems that Mr. Spofford did not thoroughly understand setting it and caught but few fish.

* Sailing from Gloucester.

In 1861 he sold it to Messrs. William Gray and Miles Pierce, and it was taken to Cape Newagen, where it was successfully used by carrying it out in a small boat and landing the fish on a dressing stage on shore in the same way. The next year it was put aboard a small schooner, the "Leon," and the fish landed as before in small boats to be dressed, the vessel being only large enough to carry the seine.

In 1863 the seine was put aboard the schooner "Dawning Day," 73 tons O. M., and the fish were dressed aboard. This was really the commencement of deep-water seining in this section, and the vessel did so well as to induce others to go into the business the following year.

The schooner "Niagara" was the first to provide herself with a seine in 1864, and another was bought and owned by two small vessels, the "Wild Rose" and the "Neptune," one carrying the seine and the other salt and barrels for curing the fish. This plan did not work well and was soon abandoned. The schooner "Niagara" did well from the start and has always been high line of the seiners for this section.

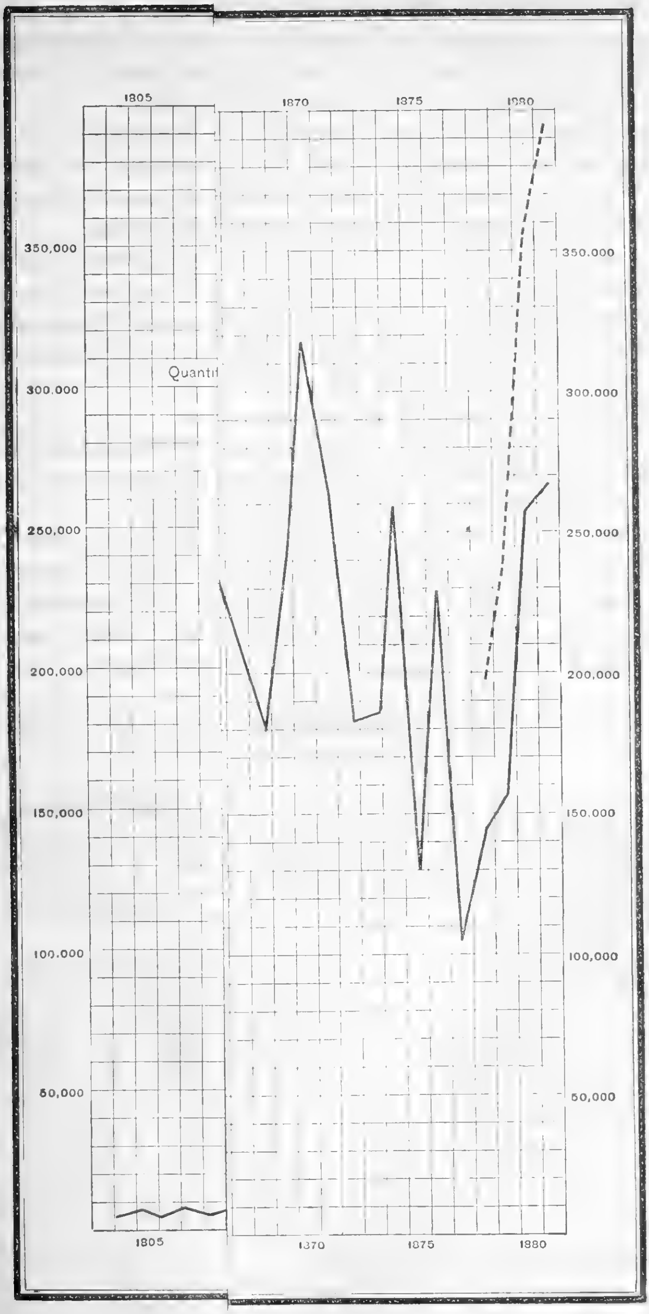
Georgetown sent one seiner, the "Coquimbo," in 1865, and a little later the schooner "Sunbeam," Captain McMann, but they met with poor success, and no seiners have been sent since from that port.

Westport has made two attempts at introducing seining; the first in 1872 by schooner "Jennie Armstrong," Capt. B. F. Jewett, and the second a three-masted schooner of 350 tons, the "Geo. W. Jewett," Capt. A. M. Jewett, carrying two seines and crews in 1875. Both vessels did very poorly and gave up the business after the first season.

21.—The attempted use of the purse-seine in Norwegian waters.

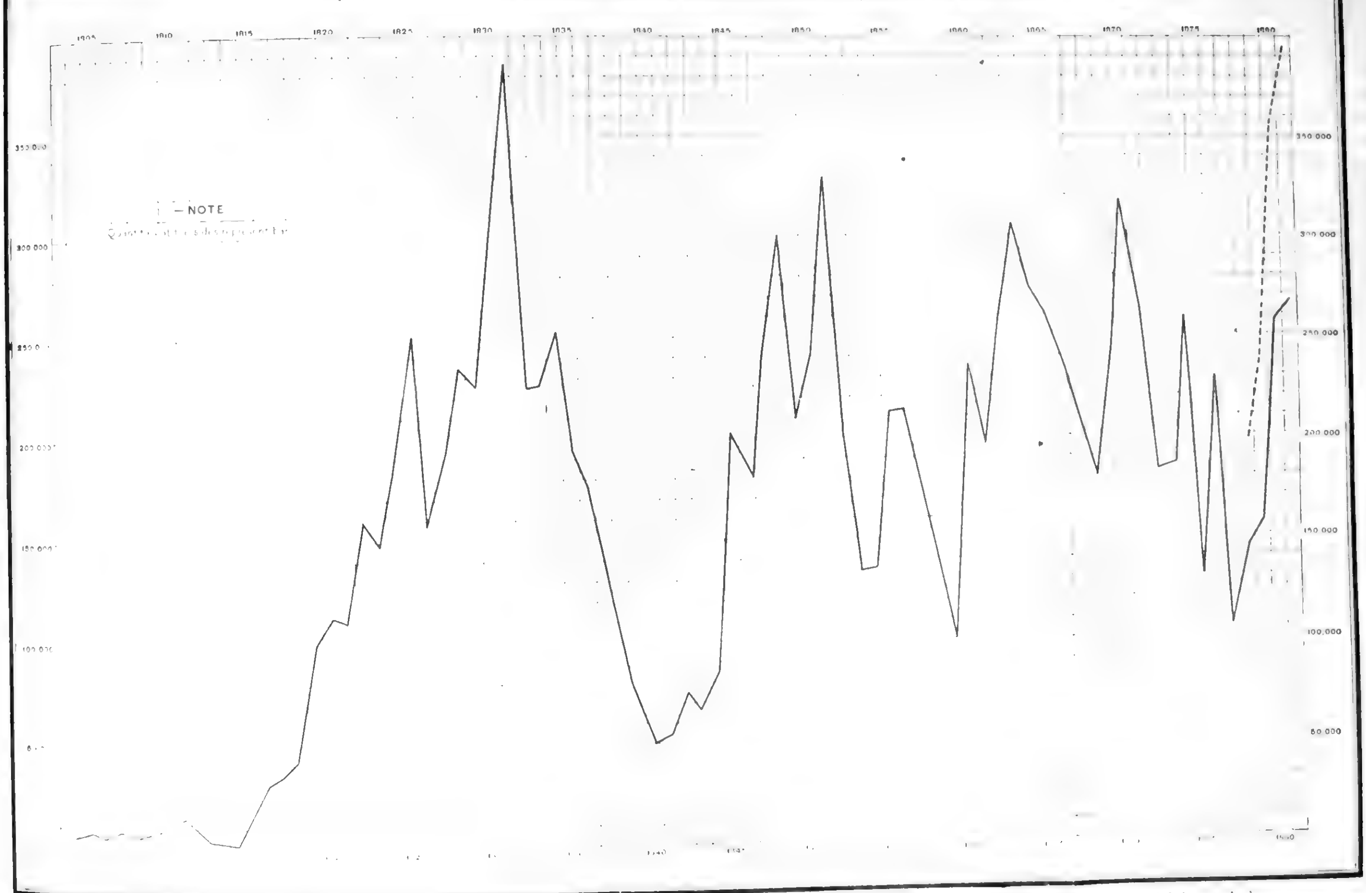
In 1878 a Gloucester vessel essayed fishing for mackerel with a purse-seine on the coast of Norway. In April the schooner "Notice," Capt. Knud Markurson, departed on this mission, taking a crew of twelve men and the most approved seining apparatus. It was remarked by a writer in the Deutsche Fischerei Zeitung, of July:

"The mackerel fishermen, who have till now been in the habit of plying their trade in open but suitable boats, are, however, greatly agitated at the present moment in consequence of the arrival at Risor, some three weeks ago, of an American fishing smack, direct from Gloucester, in North America, understood to be followed by a whole fishing fleet from New England, to take part in the mackerel fishery outside the Norwegian fishing territorium. As all these American smacks are reported as provided with bag or purse nets, by means of which they are enabled to catch more fish upon one single haul than ten Norwegian boats during a whole day, it is obvious that the Norwegian fishermen will have to discard their old mode of fishing, and to have recourse to the American fishing method, if they do not want to lose all the advantages enjoyed till now. The mackerel fishery has always been of great importance to Norway, some 7,000,000 of these fish being on the aver-



The unbrts in a fresh condition or salted.

Diagram showing the Catch of Mackerel by Citizens of Massachusetts between the years 1804 and 1881 inclusive.



… quantities of pickled mackerel in barrels. The broken line indicates the total quantities of mackerel taken, whether sold in the markets in a fresh condition or salted.

age caught annually, of which number about 70,000 centners, at a value of from 600,000 to 700,000 crowns, are exported. The government is well aware of the danger threatening the public weal, and has consequently taken every possible measure in order to prevent such disastrous results as the loss by the Norwegian fishermen of the mackerel fishery. A most accurate description of the nets used by the Americans has been printed, and, with a great number of nets of this kind, made to order by the net manufactory at Bergen, distributed among the fishing population. Models of the different sorts of the fast-sailing American boats have also been obtained through the Norwegian consul at Gloucester, Massachusetts, direct from the manufacturers of such boats. The well-known industry and activity of the Norwegian fishermen, combined with the efforts of the government, will, no doubt, enable them not only successfully to hold, but to improve, their own prospects as regards the mackerel fishery by the timely adoption of the American methods and arrangements for fishing."*

The venture was, however, not a successful one. On his return home Captain Markurson stated that he had been unable to use the seine advantageously owing to the fact that the mackerel did not in those waters school together in large bodies as they do along the New England shores.

D.—THE MACKEREL HOOK FISHERY.

The mackerel fishery at the time of its highest development, from 1820 to 1870, was carried on almost exclusively by the use of little hooks with heavily weighted shanks, known as "mackerel jigs." For many years there were from 600 to 900 vessels, chiefly from Cape Cod and northward, engaged in this fishery; and in the year 1831 the total amount of mackerel salted in Maine, New Hampshire, and Massachusetts was 450,000 barrels.

As will be seen by an examination of the diagram, showing the yield in the mackerel fishery from 1804 to 1881, elsewhere published in this report, the quantity of fish taken from year to year has been extremely variable, but has at no other time approached the enormous quantity on record for the years 1835 and 1881.

The jig has now been almost entirely superseded by the purse-seine, and this radical change in the method of catching mackerel has caused the desertion, by the mackerel fleet, of the Gulf of Saint Lawrence, and the practical futility—to benefit our fishermen—of the fishery clauses of the Treaty of Washington. All attempts, with a very few exceptions, to use the purse-seine in the Gulf of Saint Lawrence have been failures.

In 1880 the schooner "Alice," of Swan's Island, caught 700 barrels by use of the purse-seine in the gulf, but not 10 per cent. of the other vessels which visited this region, then or within the four or five previous years, paid their expenses.

---

*Cape Ann Advertiser, August 9, 1878.

The mackerel hook fishery is of the past; and this chapter must be regarded, in large part, as historical. It is by no means impossible, however, in years to come that the old method of fishing, which had many undoubted advantages over that at present employed, will be revived.

22.—Fishing-grounds.

The grounds frequented by the mackerel-hookers, as the fishermen call them, were as follows:

(*a.*) *The Gulf of Saint Lawrence.**—In the early part of the season the favorite fishing-grounds were in the southwestern part of the Gulf of Saint Lawrence, from Cape Gaspé to the North Cape of Prince Edward Island; especially off Point Escuminac, Pigeon-hill ground, or the west shore lying along the coast from Miramichi to Point Miscou, Bank Bradley, Bank Orphan, and Bay of Chaleur. Later in the season, in July, August, and September, the principal fisheries were carried on upon the grounds just mentioned, also around the Magdalen Islands and along the north side of Prince Edward Island. Occasionally, too, in August and September, vessels fished on the south side of Prince Edward Island from Georgetown to East Point. In September and October fishing was carried on at the Magdalens, Prince Edward Island, in the Bay of Saint George, between Cape Saint George and Port Hood, and on the northwest shore of Cape Breton from Port Hood to Cape North. Favorite localities were about Margaree Islands and Cheticamp; also, on the east side of Cape Breton, in Aspee Bay, and about Sydney. About 1858 and 1859 several successful fares were made in the estuary of the Saint Lawrence from Cape Gaspé to Cape Chatte; and about the Seven Islands and Mingan Islands on the coast of Labrador. In the year 1877 a Gloucester schooner obtained 200 barrels of mackerel at Port-au-Port, on the west coast of Newfoundland.† Bird

---

*Note upon the origin of mackerel fishing in the Gulf of Saint Lawrence.

Mr. Daniel Cameron, of Southport, Me., thinks the first American vessels went to the Bay in 1832. This year 4 went, among others the schooner "Galen," Captain Pate, of Freeport. These schooners averaged 60 to 70 tons, carried about 250 barrels, and filled up in four or five days. The first vessel going to the bay from this section of which we learn was the schooner "Olinda," Capt. Jos. Maddocks, of Southport, in 1837. Captain Atwood states that, in 1834, the New England fleet in the Gulf of Saint Lawrence consisted of six vessels, three of them from Provincetwn. The Cape Ann Advertiser of May 13, 1859, refers to "the custom which has grown up within a few years of going to the Gulf of Saint Lawrence for mackerel, where already the supply is lessening."

†A LUCKY STREAK.—The schooner "William T. Smith," Capt. Henry O. Smith, the last of the baymen, arrived home on Monday, bringing a good fare of mackerel, of which about 200 barrels were caught off Newfoundland, as already mentioned in our columns. These fish are of good size and prime quality, and will command a ready sale. Captain Smith struck a streak of luck when he ventured into untried waters in pursuit of mackerel, and his voyage will prove a profitable one, which is an anomaly in this branch of the fishing industry the present season.—(Cape Ann Advertiser, November 23, 1877.)

Rock, situated east of the Magdalen Islands, has occasionally been a favorite ground, since the mackerel taken there were almost always very large.

(*b.*) *Gulf of Maine.*—From June to November excellent fishing was to be had in various parts of the Gulf of Maine. Early in the season mackerel were taken all the way from Cash's Ledge to the Bay of Fundy; from the middle of June to September the favorite localities were in the vicinity of Monhegan Island, Matinicus Rock, and Mount Desert Rock. From about 1830 to about 1845 some fishing was done in the Bay of Fundy, north of the island of Grand Manan. When the autumnal migration of the mackerel begins the vessels follow them as they proceed southward. Favorite fishing grounds are then off Portland; later, about Boone Island, off Cape Ann, and the waters of Massachusetts Bay, and along the outside of Cape Cod, the latest catches being generally obtained off Chatham and the eastern part of Nantucket Shoals. Fishing here continues sometimes until the latter part of November.*

(*c.*) *George's Bank.*—Mackerel were in some years very abundant on George's Bank, especially on the southern portion from June to September. Later in the season the weather was generally unfavorable for fishing in this region. The mackerel caught here were recognized, as now, to be of very fine quality.

(*d.*) *South coast of New England.*—Of late years a small quantity of extraordinarily fine mackerel have been caught with jigs in the vicinity of Block Island in summer and fall. In previous years the mackerel fishery in this vicinity was chiefly carried on in the spring.

(*e.*) *The coast of the Middle States from Montauk Point to Delaware.*—This fishery was chiefly carried on in May, and in many respects corresponded to the spring mackerel fishery described in another section of this chapter; this is now prosecuted with seines on the same grounds, and the fish are mostly taken to New York for sale, principally in a fresh condition, though formerly they were generally salted.

(*f.*) *The eastern coast of Nova Scotia.*—In this region, although great quantities of mackerel are sometimes taken in pounds, nets, and seines, in the early summer and fall, they are very rarely taken on the hook. About 1854 and 1855 several fares of extremely large mackerel were caught at Sable Island by Cape Cod vessels.

23.—The fishermen.

The men engaged in the mackerel hook fishery, especially in the period of its culmination, were almost exclusively natives of New England. From 1850 to 1870 the provincial element in the fleet gradually increased. When this fishery was most prosperous not less than 10,000

* In the fall of 1849 one of the writers had the opportunity of seeing a fleet of mackerel schooners fishing off Chatham. The number of vessels in the fleet was variously estimated from 500 to 700 sail—a beautiful and interesting sight.

were employed on board the vessels belonging to the American fleet. The vessels engaged in this fishery carried very large crews; in fact, larger than have ever been carried by other vessels. Not unfrequently a schooner of 80 to 100 tons would carry twenty men, and, in some instances, twenty-four. Among the crew were generally three or four boys, sometimes five, from ten to seventeen years of age. These boys fished from the extreme ends of the vessel; they were frequently very successful, and by the training in this fishery fitted themselves to take responsibilities in the fishing fleet at a much earlier age than otherwise would have been possible. At sixteen or seventeen years of age many of the boys ranked among the first of the crew to which they belonged, and it sometimes happened that the command of a schooner was given to the most enterprising before they were out of their teens.

24.—The vessels.

Prior to 1848 the mackerel fleet was made up exclusively of the old-fashioned square-stern schooners registering from 25 tons to 80 or 90 tons, old measurement, and of pinkies registering from 20 to 60 tons. Newburyport had a large fleet of pinkies, registering, old measurement, from 40 to 60 tons. Most of them carried a flying jib.

From 1848 to 1850 the necessity for swifter vessels was felt, and various experiments, which are described in the chapter on the schooner, were made. From this time on all the vessels added to the fleet were of improved model, approximating, more or less closely, to the modern type of the fishing schooner. These vessels were in those days known as "sharp-shooters." As early as 1855 the character of the fleet had become very much modified, there being a large percentage of modern-built vessels, and the pinkies and square-stern schooners were retained only by conservatives and by the smaller ports, especially those on the coast of Maine. Many of these old vessels had by this time been withdrawn from the mackerel fishery and employed in other branches of the fisheries. As early as 1870 the old square-stern vessels and pinkies had entirely disappeared from the fleet, most of them long before that date.

The mackerel-hookers, when fitted out for fishing, had the decks clear. Upon the starboard side of the vessel were arranged line-cleats. These were in early times small narrow cleats of pine nailed to the inside of the waist, but after the introduction of finer vessels the fishermen became more careful, and substituted a complicated, ladder-like arrangement, consisting of two long horizontal strips, which were crossed by from eight to twelve shorter vertical strips or cleats, with projecting ends, an arrangement of this kind being secured between each pair of the top timbers. On the top of the rail was nailed the bait-board, in which were cut grooves arranged for the reception of a supply of jig bait, which was cut into bits ready for use; these grooves cannot be easily described. Upon the bait-board, or upon the edge of the rail, were fastened so-called "snapper cleats," ingenious contrivances, of elastic wood or of metal, by which the lines were kept in their places while the men were fishing.

The bait-boxes were fastened on the starboard side; these were wooden troughs holding from one to seven or eight buckets of bait apiece. There were three of these bait-boxes, the largest placed outside of the rail at the foot of the main rigging, one on the quarter near the davit; the third was placed at the fore rigging. The forward and after bait-boxes were usually less than half as large as the one amidship. The bait-mill was placed on deck, on the port side of the vessel, near the main rigging. During the later years of this fishery many of the vessels carried on the deck at the foot of the main rigging on the starboard side a bait-chest divided into two compartments, the smaller one for the clam bait and the larger one for the ground menhaden bait. On such schooners as were not provided with a bait-chest, the ground bait, or chum, was kept in barrels. Two of these barrels were generally kept near the starboard main rigging, so that those who threw out the toll-bait could refill the boxes with as little loss of time as possible.

The hold was left unobstructed by bulkheads; the ballast was usually gravel or pebbles and was not covered by a platform. Some vessels carried part of their ballast in barrels, throwing it overboard when the barrels were needed for fish. The number of barrels carried by a vessel would vary, according to her size, from one hundred to six or seven hundred, part of these being filled with salt and bait. The mackerel-hookers usually carried a single boat (of the yawl pattern) at the stern. Occasionally vessels going to fish on the coast of Labrador, or at the mouth of the Saint Lawrence, or even on the coast of New England, carried a number of dories or other boats, which were used by the men when they fished in the harbors.*

25.—Apparatus and methods of fishing.

(*a.*) *The mackerel jig.*—The mackerel jig is said to have been invented about the year 1815, by Abraham Lurvey, of Pigeon Cove; according to other authority by one Thurlow, of Newburyport.† It is simply a

* In certain localities the mackerel could only be taken to good advantage among the rocks close to the shore; and the men fished from small boats rather than from the side of the vessel.

† According to Captain Merchant, the "mackerel jig" was introduced at Cape Ann about 1815. Mr. Abraham Lurvey, of Pigeon Cove, was one of the first to use them, and was supposed to have invented them. The advantages of this new invention immediately brought it into general use. Before "jigs" were devised, the "gangings" of the mackerel lines would frequently break when the fish was jerked or "slatted" off the hook; when the "jig" is used this rarely occurs. Before the time of the "jig" it was customary to bait the hooks, when mackerel were plenty, with pieces of pork "as big as a four-pence-ha'penny."

According to Captains Daniel Cameron and John Grey, of Southport, Me., Edward Caiss, a fisherman of Hingham, Mass., invented the mackerel jig between the years 1810 and 1814, and by 1829 it had come into general use on the coast of Maine. It was introduced into Maine some time before 1829, but by whom no one knows.—[Earll.]

hook, round the shank of which has been cast a plummet of lead, pewter, or tin, somewhat globular at its upper end and tapering down toward the bend of the hook. At the upper end is a hole through which a fishing line is bent. The weight of a mackerel jig has varied from a quarter of an ounce to three or four ounces at different times during the history of the fishery. At first they were made much heavier than they have been in later years. At present many fishermen, when using jigs, prefer them very small. It has been stated that each fisherman has from seven to twelve fishing cleats in his berth at the rail. On these cleats are fastened an assortment of lines with jigs of various sizes, the heaviest being used when the mackerel are biting fast, or when the wind is blowing fresh; the lightest, when the water is very smooth, or when the mackerel are "picking," or nibbling daintily.

The fishermen always made their jigs in molds of metal or soapstone, this operation being similar to the old-fashioned method of making bullets. In former days these molds were made of iron, but many of the fishermen being dissatisfied with the shape constructed them for their own use of lead. At present the soapstone jig-molds and the lead and pewter constitute a part of the outfit of a vessel.

When jigs were first introduced, however, it was customary for fishermen to cast them for themselves in molds improvised in buckets of sand or ashes, afterwards beating into shape the rough castings, and boring the hole for the line. This custom was prevalent on some vessels as late as 1850. In the later years of this fishery the fishermen became very critical in the matter of jigs, and were not satisfied unless they were elegantly shaped and brilliantly polished. The lines were six or eight fathoms in length, of cotton, being either hawser or shroud laid. Of later years these have always been of cotton. In early days, when the heavier jigs were in vogue, much larger lines were used than at a later period; since 1860 it has been customary to use a kind of snood, called "snapper-line," made of strong linen thread and usually colored blue. The "snapper-lines" are from 15 to 18 inches long, one end being bent to the jig, and the other fastened to the fishing-line with what is called a "water-knot." During the voyage the lines are generally coiled up and hung upon the fishing-cleats on the waist when not in use. As has been stated, each man has from eight to twelve lines, with jigs of different sizes, fastened to the cleats at his berth. A quantity of extra lines and hooks are carried by the vessel.

(*b.*) *The mackerel fly-hook.*—The mackerel fly-hook, formerly very popular and introduced before 1850, has been discontinued since 1860. This is an extra hook on a ganging from 12 to 15 inches long, fastened to the jig-line 8 or 10 inches above the jig. Not being weighted, this hook floats at an angle when the jig is sinking, and by using it two mackerel are sometimes caught at once, one biting at the jig and one on the fly-hook. The fly-hook went out of favor because it was liable to become entangled with the other fishing-gear.

(c.) *The mackerel gaff.*—The mackerel gaff is an iron rod a quarter of an inch in diameter, 3½ feet long, having at one end two recurved sharp points about 2 inches long and separated at the extremities by an interval of one-half to three-quarters of an inch, returning in a line parallel with the direction of the rod. The mackerel gaff is fastened to a wooden handle about 10 or 12 feet long, and was used when the mackerel were schooling thickly alongside of the vessel and were not inclined to take the hook. The gaff was thrust among the fish and rapidly drawn back, often impaling one and sometimes two mackerel at a time. This implement has not been used since the introduction of seines, and but rarely during the last twenty years.

(d.) *The mackerel "bob" or "bobber."*—This is an instrument resembling the mackerel gaff in the manner of its use. In its rude form the bob was a stick of wood, around the end of which three or four cod-hooks, with their barbs filed off, were fastened. The same idea has since been developed in various ways, the most elaborate form being that illustrated in our plate. The bob is fastened to a string and drawn through a school of fish, impaling them in the same manner as the gaff. This instrument was discontinued long before the gaff, and, in fact, has never been so popular. These bobs were used only when the mackerel were schooling in great numbers alongside of the vessel and refusing to bite.

(e.) *Bait and apparatus for its preparation.*—Bait used in the mackerel fishery is of two kinds, (1) that put upon the hooks, and (2) that thrown into the water to attract the fish.

The method of baiting the jigs which has been adopted by mackerel fishermen is somewhat peculiar, and a description of the process may be of interest in this place.

As a rule, when a mackerel schooner first arrives on the fishing ground and is about to begin fishing with hook and line, the jigs which are to be immediately used are baited with small circular pieces of pork rind, two or three of these being put on each hook. Sometimes, however, no one but the skipper uses pork-rind bait, the other members of the crew preferring to wait until some mackerel are caught from which they can procure a supply of bait for their hooks. The favorite way of baiting mackerel hooks is as follows, namely: Several thin strips about a half inch wide and three to five inches long, are cut either from the belly of the mackerel or from the lower portion of the body on either side of the anal fin.* When a sufficient number of these slices have been obtained they are cut into sections, each of which is, approximately, a half inch square. A large number of these pieces are put on the hook, completely filling the bend, after which the baits are scraped with the back of a knife in such a manner as to remove everything but the tough white skin, which, when distended in the water, forms a soft pulpy mass

* Strips for bait cut from near the anal fin are usually preferred, since they cannot so easily be torn from the hook as can the fatter and tenderer strips taken from the abdomen.

about the size of the end of one's forefinger; but this can be contracted into a very small space, and thus afford the eager fish ample opportunity to secure a good hold of the hook while seeking the tempting but yielding morsel upon it. A bait of this kind will last more than an hour without being renewed, even when mackerel are biting sharply. When the fish are "picking" or less inclined to take the hook, a fisherman is often not obliged to bait his jigs more than once in a whole day. Sometimes the fishermen cut out a small circular piece from the throat of the mackerel, which they place on their hook above the scraped bait. This throat piece is quite firm and for awhile prevents the soft skins composing the bait below it from being entangled on the point of the hook and thus preventing the latter from easily catching the biting fish.

In the early days of the mackerel hook fishery the toll bait chiefly used was made of small mackerel, and sometimes of large ones too when small fish could not be obtained. The viscera of the mackerel were also frequently used in the absence of better. From 1835 to 1840 menhaden came into general use, and were subsequently always in high favor. They had, however, been in common use by Gloucester fishermen at the very commencement of the century. They were caught in gill-nets. It was the custom of the Gloucester people to leave home a little after tea, set their nets off Kettle Island, and lie there till about midnight. They would then haul their nets, pick out the fish, and start off to the mackerel grounds.*

There can be no question that the custom of chopping up small mackerel for bait was detrimental to the mackerel fishery in succeeding years, and that the introduction of menhaden was a benefit to the fishery in more ways than one. As a "toll" bait for the mackerel, menhaden is believed to be better than any other fish; the mackerel seem to prefer it; and the presence in its flesh of a quantity of oil renders it especially convenient for the use of fishermen, since in the process of "chumming-up," presently to be described, a small quantity of ground menhaden bait will spread over a large area of water. In the Report of the Commissioner of Fisheries, Part V, pp. 143 to 147, may be found a discussion of the comparative merits of herring and menhaden as a bait for mackerel.

The quantity of menhaden bait carried by a mackerel schooner on a trip of two and a half to three months to the Gulf of Saint Lawrence varies, according to the size of the vessel, from 25 to 40 barrels. In addition to this they were accustomed to carry 5 to 10 barrels of clams. Capt. Sylvanus Smith, of Gloucester, stated to the Halifax Commission that a vessel fitting out for a four months' trip to the Gulf of Saint Lawrence would need to be supplied with 40 barrels of pogie bait, worth

* Mr. Earll writes: "Daniel Cameron, of Southport, states that pogies were first used in Maine about 1844, and by 1846 had come into general use. People of this section claim to have introduced the pogy, *Brevoortia tyrannus*, as mackerel bait, but with whom the practice originated I was unable to learn."

$6 a barrel, making $240, and 10 barrels of clam bait, worth $8 a barrel, making $80.*

Major Low's statement, copied from the trip-book of the schooner Oliver Eldredge, which sailed to the Gulf of Saint Lawrence August 5, 1875, arrived at Gloucester November 2, 1875, having been absent two months and twenty-eight days, obtaining 224 barrels of mess mackerel, worth $1,771.83, shows that she fitted out with 55 barrels of slivered pogies, at $6.50 per barrel, making $337.50, and 7 barrels of clams, at $6, making $42.

In 1867, when almost the entire mackerel fleet fished with hooks, the amount of menhaden bait consumed by Gloucester alone amounted, by the estimate of Mr. Joseph O. Proctor, to 6,500 barrels, and the total consumption by the United States of mackerel bait must have exceeded 25,000 barrels. In addition to this more than 1,000 barrels of clams were used. In 1877 another estimate was made of the quantity consumed by Gloucester. The purse-seiners were then in a large majority. The whole amount consumed by a seining vessel does not exceed 5 or 6 barrels in a season. Gloucester had, in 1877, about 50 "mackerel-hookers," using about 2,400 barrels of slivers, while the seining fleet used about 600 barrels more. The entire amount of menhaden bait consumed by the mackerel fleet of the United States in 1877 did not probably exceed 8,000 to 9,000 barrels of slivers, or 24,000 to 27,000 barrels of round fish.

The menhaden used for bait in the mackerel fisheries was formerly, when a larger quantity was in demand than at present, obtained to a considerable extent from Gloucester vessels fishing expressly for menhaden in the vicinity of Cape Ann and in the Gulf of Maine.

Capt. F. J. Babson, of Gloucester, whose account of the bait fishery of Cape Ann is quoted elsewhere, states that in 1873 there were over 60,000 barrels of round menhaden taken in his district, while in the same year vessels belonging to the Maine Oil and Guano Association sold of bait 2,977 barrels; in 1874, 10,400; in 1877, 10,795. From the bait fisheries about Marblehead and in the vicinity of Provincetown, according to Mr. Lowry, from 1,000 to 2,000 barrels of bait were taken in 1873. At Chatham, from 1872 to 1877, the average catch was about 5,000 barrels. A large portion of all of these fish, however, was sold to the vessels engaged in the George's Bank cod-fishery. Considerable quantities also were obtained about Salem and in the Merrimac River, a portion of which went to the mackerel fishery.

It was the custom of many of the vessels belonging to the spring mackerel fleet to devote a considerable time to obtaining a supply of bait for their own use during the summer fishery. In addition to this quite a number of vessels were fitted out each spring to go to Seaconnet and other places in that vicinity for the purpose of securing cargoes of menhaden slivers to sell to the early fleet going to the Bay of Saint

*Proceedings of the Halifax Commission, 1877, Appendix L, p. 334.

Lawrence. Cape Cod vessels were accustomed to dress their bait in a peculiar manner. They did not sliver them in the ordinary way, but salted them down "round," simply eviscerating them, cutting off the heads and the thin parts of the belly, and making slits in the sides.

These vessels obtained their bait from the pound fishermen at various points on the coast of southern New England, especially in the vicinity of Seaconnet and Rhode Island, and also from the various fishing gangs connected with the oil and guano factories.

In addition to the vessels which thus obtained supplies of bait for their own use, there was a fleet of bait vessels which annually proceeded to the same localities in the spring to obtain bait for sale to the vessels of the mackerel fleet not otherwise supplied. The number of baiters was five or six.

The price of menhaden for bait varied with their abundance. In Gloucester, in 1873, according to Captain Babson, 60,000 barrels of round fish made 20,000 barrels of slivers, worth $4 a barrel to the producer. At Marblehead the price in 1876 averaged $1 for fresh and $6 for salt bait; at Chatham, $1.50 fresh; at Nantucket, 50 to 75 cents; and at Martha's Vineyard, 50 cents. In Narragansett Bay bait sold in 1871 for $1 to $1.50 per barrel, fresh. The regular price from 1867 to 1877 at the mouth of the Merrimac River was $1 per barrel; probably 1,000 barrels of slivered fish were prepared in 1876, which sold for $5 a barrel. Boston and Gloucester vessels were accustomed to anchor at the mouth of the river and wait there for supplies of bait. At one time in 1877 there were probably 25 schooners waiting.

The process of slivering and salting menhaden was described in the report on the menhaden fisheries in Part V.

The manner of preparing the slivered menhaden or other fish for toll bait is very simple, and is essentially the same as that employed in early days, when it was the custom to grind up small mackerel for bait. Captain Atwood remarked in his testimony before the fishery commission at Halifax: "We now use menhaden for bait, but when I first went fishing we did not do so; our practice then was to grind up small mackerel for the purpose. Any quantity of these mackerel were at that time to be had for the cost, and plenty are to be met there now. These fish were of no account then, and so we ground them up for bait. And when we could not obtain them we ground up what you call gurry, the inwards of fish with the gills attached. American fishermen, when they fish with hooks, use menhaden bait almost exclusively. The superiority of this over any other is proved by the fact that when they can't get menhaden they won't take any other. At first mackerel fishermen were afraid of this bait; it was a very bony fish, and they even thought that if it was cut up for bait the mackerel would get sick of it owing to the number of bones. There is a species of fish belonging to this family found on our coast which is exceedingly fat; we call them blue-backed herrings;* and some prefer this fish for bait, as it is not so bony as menhaden, but when the mackerel got to be worth having, about everybody adopted menhaden for bait; it is the cheapest bait."†

To prepare menhaden for use in the mackerel fishery, the slivers are ground up into a mush which is called "ground bait." The slivers are passed through a bait-mill, which is a machine somewhat resembling a farmer's feed-cutter. The fish are thrown into the hopper, and, by the agency of a roller operated by a crank at the side of the mill, are passed through a complicated array of sharp knives arranged upon the sides of the mill, and in spiral rows upon the roller. The bait is usually ground at night by the watch on deck. As a rule the bait is run through the mill twice in order to make it fine enough. When the vessel has no bait-mill, which at present is rarely the case, the fish are cut up with a hatchet or scalded with boiling water in a tub. Bait-mills were first introduced about the year 1822. Prior to the introduction of the bait-mill all the bait was cut up at night with the hatchet, by the watch, upon a chopping-block, which was a large flat-topped piece of wood resembling a butcher's meat-block. The veterans of this fishery relate with great glee how they used to be kept awake all night by the pounding of the bait-cutter over their heads, and contrast the present usages with those of former days. When there was leisure in the day-time, three or four men would work at the block together, each chopping with his own hatchet. In this way a constant supply was kept. Bait which had been ground was packed in barrels full of pickle, and covered up.

The earlier bait-mills were very rude affairs, the teeth being common nails driven into the barrel and into the sides of the mill and broken off, leaving jagged ends which tore the bait into pieces. Later these were filed down to a point, while at the present time the teeth are arrow-shaped, made of steel, and are attached to the wood by means of shanks made especially for the purpose. Bait-mills are now manufactured by various mechanics at the different ports, those made by Adolph Voss, of Gloucester, being considered among the best. The cost of a good bait-mill is from $8 to $15.

According to Maj. D. W. Low, the first bait-mill was made in 1820, of nails driven in lines across two wooden cylinders and then sharpened. The first one made for grinding or cutting with knives was made in 1822 by Gorham Burnham, and they were driven into cylinders in the same manner. In 1823 he commenced putting in the knives in spiral form, which form has continued in use ever since. He has made and sold in one year $1,600 worth at $10 each, besides making anchors and other work.

The first bait-mill taken to southern Maine was bought in Gloucester

* The *Clupea æstivalis*.

†N. E. Atwood, Proceedings of the Halifax Commission, Appendix L, p. 42, September 19, 1877.

in 1827 by Mr. John Cameron, of Southport, for use on the schooner Echo.*

The manner in which the labor of grinding bait was distributed among the different members of the crew after bait-mills came into general use varied upon different vessels. Sometimes each man had his "bait day," upon which, in addition to his regular labor of fishing, he was expected to grind bait for the use of the vessel.

When fish were abundant the quantity used might be as great as five or six barrels a day. The bait-cutter was expected to have a supply of bait ready, and when there was promise of good fishing the next day would grind what he thought would be needed for the next day's fishing during his watch at night. When he was not forehanded and the fish were abundant he suffered considerable loss, since he was obliged to work at grinding the bait while the others were fishing, and thus failed to obtain his share of the fish.

On some vessels, in order to obviate this difficulty, it was customary for each man to grind a barrel in his turn, the boys doing their share of the work by cutting the clam bait. The order of their succession was determined by their position at the vessel's rail, the man farthest forward taking the first turn. On other vessels, if a man was not on deck in the morning to help hoist the sails, the penalty for his absence was the grinding of a barrel of bait, a task which required about an hour and a half for its performance.

When the bait has been ground it is placed in barrels or in the bait chests. The ground bait is an oily mass of yellowish color, resembling in consistency sausage meat. Before it is used water is added to it, and it is then reduced to the consistency of porridge. It now becomes a yellowish slushy liquid with an oily smell, and in this condition occupies about twice to three times the space that it did before water was added. In this condition it is sometimes called "chum" or "stosh."

(*f.*) *Mode of fishing.*—The present method employed by mackerel schooners of fishing with hook and line while the schooner lies adrift was first practiced in Massachusetts at the very beginning of the present century, and the use of toll bait began about the same time. According to Capt. Epes W. Merchant, the first man to introduce this method of fishing in Massachusetts Bay was John Story, of Rockport, about the year 1804.

The method of "tolling" or "chumming up" the fish by the use of this ground bait resembles the process of calling up a flock of fowls by scattering corn over a large piece of ground. The oily bait is thrown over the side of the vessel, and as the latter drifts along and the bait spreads the fish are attracted by the floating particles most remote from the vessel, and swim up toward the source of supply.

The use of toll bait originated with the shore fishermen, who crushed

* Statement of Daniel Cameron and Capt. John Gray, of Southport, Me., obtained by R. E. Earll.

the oily menhaden under foot with their heavy fishing boots, washing the pulpy mass of flesh and the oil with buckets of water out through the scuppers of the vessel. Another statement, and perhaps the most correct one, is that at first the fishermen made toll bait by boiling a cod-fish or haddock until it was nearly cooked, when it was taken by the tail and beaten over the sides of the boat or vessel, causing the fibers of the fish to separate in small pieces, which, considering their white-ness, made a very attractive bait. This practice was still in vogue among the boat fishermen of Maine as late as 1849 and 1850.

The process of throwing toll bait, of late in practice, may now be described. Several buckets of the ground bait are put into the boxes, the positions of which have already been described, and to it several buckets of water are added, the mass being thus reduced to a proper consistency by stirring it up with the bait-heavers, which are scoop-shaped contrivances made of tin on the ends of wooden handles 2 or 3 feet in length. The vessel is "hove to" under mainsail and foresail, or sometimes under mainsail, making a square drift to leeward. One man—generally the skipper—stands forward of the main rigging with the bait-heaver and throws out the bait, something in the manner of a man sowing seed broadcast, by a sweeping motion of his right arm, scattering it over a space of 15 or 20 feet along the side of the vessel. The oily particles slowly sink and spread out under the influence of the whirling eddies caused by the receding vessel. As the vessel drifts away and one scattering of bait is on the point of disappearing from sight, another lot is thrown, and so a succession of waves of bait is left in the wake of the vessel. In the mean time the man who is throwing the bait puts out two lines and thus ascertains whether the mackerel have been attracted to the sides. As soon as the fish begin to bite, the man sings out, "Here they are!" or "Here they gnaw!" and the crew rush to their places and begin fishing.

When the fish appear, they are sometimes in small numbers and bite daintily, but often they come in immense schools and bite as fast as the hooks touch the water.*

---

* "*Jigging mackerel.*"—"Jigging mackerel" is a method peculiar to mackerel-catchers that superseded the old way called "trailing," or taking them while the vessel was under headway. The manner of jigging is peculiarly interesting to new beholders. The vessel is kept comparatively motionless; a large quantity of poor mackerel chopped into mince-meat is thrown upon the water, which brings them to the surface. So much of this has been done that it has, in a great measure, destroyed their appetites, and sharp-pointed hooks of a sufficient length to reach the fish have been resorted to.

A line of the color of the water, called the jig line, attached to a lead of a finger's length, say one-half inch in diameter, diminished at the end towards the hook which is solid in the lead called a "jig lead." Bait of such as is thrown overboard is put on the hook and thrown also among the "floating bait," or more properly the floating fish. Thus prepared, the fisherman has little else to do but to draw in the line and snap off the fish in a tub prepared for that purpose a little faster than can be easily imagined by the land fisherman. From 50 to 80 barrels have often been taken on a good "fishing day" in this way by a crew of 6 or 8 hands; oftentimes several boys comprise a portion of the company.—(Barnstable Patriot, Nov. 15, 1836.)

On these occasions the deck of the vessel presents a scene of great activity and excitement.

Let us try to depict a scene in the Gulf of Saint Lawrence. We are on the deck of a clipper schooner from Gloucester, standing along with the four lower sails and the main gaff-topsail set, a fresh breeze blowing from the southwest; the sky is overcast, and the sea comparatively smooth; within the plane of vision are the white sails of some 250 schooners, most of which are hove to, a few tearing along under press of sail seeking new positions; here and there among the fleet is a vessel with a flag set at her main peak or at her main topmast head; this is to indicate that she has completed her fare and is homeward bound. Some of these are lying to, and are still fishing, while others have all sail set, and are heading for the Strait of Canso on their homeward way. A few miles to the northeast looms up the rugged shore of the Magdalen Islands, its high outline here and there broken by long stretches of sandy beach; a train of great white gannets crosses our bow, five or six of them rapidly flying close to the water; suddenly the leader disappears beneath the water, and his companions rise up for a moment and then "plug down" head foremost after the fish which they see. The movement is perceived by other gannets, and they flock in from all directions and share the feast. As we speed along two or three of these birds, which have filled themselves to repletion, are swimming in our course, unable to rise, and, in order to escape, they disgorge their stomach-loads of fish and flap away just before the vessel reaches them. We now approach the fleet, and pass by the leeward vessels which are hove to, the starboard rails of which are lined with men excitedly plying their lines. Our skipper stands on the quarter with his glass to his eye, trying to determine which portion of the fleet is meeting with the best success. He selects a berth near the middle of the fleet, and thither he directs the course of the vessel by word to the steersman. We thread our way in a zigzag course among the drifting vessels, sometimes escaping by a few inches only the thrust of a jib-boom, and again almost snapping off the main-boom of some other vessel. At length we approach the selected position and heave to, coming up sharply to the wind with the mainsail hard aback. The skipper takes his position at the main rigging and begins throwing bait, at the same time putting out his lines for trial. After the vessel is hove to, the men are lounging about the deck, yet in expectant attitudes. At a little distance from the rail stands a row of barrels, one opposite the berth of each man. These are called "strike" barrels. The lines, with the jigs attached, are coiled upon the cleats or lie upon the rails, each man having examined his own and prepared it for immediate use. At last the skipper is seen to rapidly haul in his line, pulling a glittering mackerel over the rail, and, by the peculiar motion known to the fishermen as "slatting off," the fish is jerked over his right shoulder into the barrel, while the drumming of the mackerel against the bottom of the barrel announces to the men that the fish have struck. The men rush to their positions, and a scene of great activity and excitement begins. The fish are now within four or five fathoms of the side of the vessel, but they soon come much nearer; looking over the rail we see their mottled backs as they swim to and fro alongside the vessel. The lines are shortened up as the mackerel rise, and now the time required for throwing over the jig and jerking it back with a mackerel fast to it is only a few seconds. The men throw out their lines, pull them in, and, without glancing at the fish, dexterously "slat" them into the barrels, the jigs being torn out of their mouths by the same motion which casts the line back into the water; two twists of the wrist are sufficient to accomplish this feat. The mackerel are large—"No. 1's"—and in fifteen or twenty minutes the best fishermen have their barrels full. When a man's barrel is filled he springs from the rail, rolls it back towards the center of the deck, and puts an empty barrel in its place. The fish may continue actively biting for ten minutes or for several hours, but usually the sharp biting is over very soon, and the mackerel begin to "pick." Now the work is less exciting, though much more exacting upon the skill of the fishermen. When the fish are "picking," a high-line fisherman will catch quantities, and the greenhorn will catch none, and even among the most skillful fishermen there is a great difference in their success at this time.

It should be stated that all the time mackerel have been biting, four men have been actively employed in throwing bait over the side, at the same time attending to their lines like the remainder of the crew. The cook heaves bait in the position farthest forward, and one of the boys in the position farthest aft, while amidships the skipper and one of the most experienced of the crew are similarly engaged.*

When the fish begin to "pick," the skipper reconnoiters for a better position, and finding that other vessels are having good fishing, orders the crew to coil in their lines and to make sail; away we go in search of another "spurt of mackerel."

The excitement among the crew, when the mackerel are biting fast, can hardly be described. When the fishing begins, the drumming of the mackerel in the empty barrels is inexpressibly cheering to the fishermen, especially if they have been unsuccessfully hunting for fish on previous days, and adds to their excitement. This sound ceases as the barrels begin to fill up, the resonance of the wood being deadened by the accumulation of fish; it is, however, from time to time repeated, as empty barrels are substituted for those which have been filled. Every man is striving to the top of his bent to catch as many mackerel as possible while the "spurt" continues, and, if possible, to catch a larger

* On the mackerel "hookers" the cook stood to fish just aft of the forerigging. The large schooners sometimes had a boy forward of the forerigging, but this was not the rule by any means. Each man or boy had a certain number of inches measured on the rail and assigned him as his berth. The length of a berth at the rail varied from 2½ to 3 feet.

share than any of his comrades. The emulation to be "high-line" for the day and for the season is extreme. The number of barrels caught by each man is carefully noted, for upon his relative success depends his proportion of the proceeds of the voyage and his reputation as a fisherman. In a single day a high-line fisherman has caught from 10 to 15 barrels, and since each barrel contains from 150 to 200 mackerel, the rapidity of the men's movements throughout the day may be estimated. In seven or eight hours' fishing he has probably lifted over the side 2,000 to 3,000 fish, to say nothing of throwing over his jig and bringing it back empty almost as many times more. Such cases as this are exceptional, since mackerel rarely continue biting long enough to allow such a number to be taken. At the same time, when a much smaller number is caught, the activity of the fishermen is something to be wondered at.*

The confusion and excitement is increased by the frequent snarling of the lines and the attempts to straighten them out again. As has been stated, each expert fisherman has ten or twelve lines in his berth, and changes from one to the other according to the rapidity with which the fish are biting, or the strength of the wind. Much experience and skill are necessary to enable the fishermen to make these changes understandingly. Little is said while the fishing is going on; the men lean far over the rail in strange attitudes of expectancy with one or two lines in each hand, the hands moving up and down and constantly hauling in and throwing out one of the lines at a time. When it is necessary to haul in one of the lines, the others are allowed to drop upon the rail.

We have described one phase of the life of a mackerel fisherman, but experiences like this may occur only a few times during a season. Mackerel vessels are constantly under sail, cruising hither and thither over great areas of water on the lookout for fish, heaving to and trying more frequently without than with success, except in extraordinary seasons. At night they are hove to, or, when mackerel are scarce, are making long passages from one ground to another. Information as to the location of the schools of mackerel is passed from vessel to vessel. As they meet, the vessels almost invariably speak each other and compare notes upon the position and abundance of fish.

When a vessel is seeking fish and heaves to for the purpose of tolling them up, she will continue in this position, as a rule, for about an hour, sometimes longer, when there is any prospect of success. Sometimes the mackerel, however abundant, will not rise to bait; they are very capricious; at other times in the same day they will be exceedingly voracious. One of the common tactics of the mackerel fishermen was that of running round a school; when the fish could be seen, the vessel would make a complete circle, surrounding them at the same

* LARGE CATCH OF MACKEREL.—Schooner "Bloomer," of Hingham, with a crew of 10 men, caught on Thursday last, between 10 a. m. and 2 p. m., 5,700 mackerel with the hook and line.—(Barnstable Patriot, May 28, 1861.)

time with the line of toll bait. The effect of this maneuver was to keep the fish from moving away by placing the bait in such a manner that whichever course they took the fish must invariably meet with and be attracted by it to the vessel's side. It frequently happened, however, that the schooling fish took no notice whatever of the toll-bait, either because they were not hungry, or were engaged in feeding upon some form of crustacea, of which they are exceedingly fond.

The practice of "lee-bowing," the method of which, so far as the management of the vessel is concerned, has been described in another place, was simply to "heave to" to the leeward of another vessel which was lying to and had a school of fish alongside, and, while so doing, to throw a quantity of bait overboard; this bait passing under the bottom of the first vessel would attract the fish, which would then follow the course of the new bait, passing to leeward under the first vessel and appearing alongside and close to the vessel which was executing the maneuver of lee-bowing. The success of this maneuver is sometimes thwarted by the crew of the first vessel throwing over such a quantity of bait that the bait thrown by the second vessel is not noticed by the fish. In this act it is frequently the custom to use a considerable quantity of chopped clams, these being considered better to "hold" the fish alongside than the menhaden bait. The clam bait is also used on other occasions to "hold" the fish, or induce them to bite more rapidly when they are supposed to be tired of the ordinary bait.

A maneuver sometimes executed by the mackerel schooner is called "springing up." This is done when the mackerel are so close to the shore that the vessel cannot lie to and drift for them. It is accomplished by bringing the vessel to anchor and then putting a "spring" on the cable, the latter, which is a stout rope, being taken to the port-quarter, and the cable veered out so that the vessel lies with her port side to the wind. The fishing is then carried on on the starboard side, in the same manner as with vessels lying to.

In former years, when an extensive mackerel fishery was prosecuted in the vicinity of the Seven Islands and at the mouth of the Saint Lawrence River, much jig fishing was carried on by small boats sent out from the vessels. Each of the boats carried a small quantity of ground bait, which was used in the same manner as on the vessels. This method of fishing has also been practiced to some extent on the coast of Maine even as late as 1879.

Vessels occasionally returned home from the Gulf of Saint Lawrence to land their catch, leaving a portion of their crew to fish from small boats until their return.*

The above description of jigging mackerel has been written with

* Schooner "B. D. Haskins" lately arrived from Bay Saint Lawrence with mackerel; left five of her crew to continue the fishery in dories until her return on her second trip.—(Cape Ann Advertiser, August 17, 1860.) Instances of this kind were rare.—Authors.

special reference to the fishery in the Gulf of Saint Lawrence, since it was here that the jig fishing was most extensively prosecuted; the methods are the same, however, as those practiced on the New England coast.

26.—Care of the fish.

(*a.*) *Cleaning and salting.*—The manner of caring for the fish is essentially the same as that described in the preceding chapter, except that (the quantity of fish taken being much smaller, there was, of course, much more time for handling them) greater care was taken, and the fish were uniformly of better quality. Many of the Gloucester mackerel-hookers were accustomed to divide their crew into dressing gangs of two each instead of three, as at the present time on the seining vessels, one of these men splitting and the other gibbing. It was the duty of the splitter to get the barrels, fill them with water, and, when he had split more fish than the gibber could take care of, to aid the latter in his work.*

On the seining vessel, as we have seen, the mackerel are, in most cases, heaped on the deck; on the mackerel-hookers, the fish were already in barrels, and the order of proceeding was slightly different. The splitting-board was placed on the head of one of the "strike" barrels; the fish were taken out of the barrels, split, and thrown into the gib-tub, where they were handled in the ordinary manner. The process of gibbing having been completed, the fish were "plowed" and put into the second barrel, which was filled with clean water. From this barrel they were changed into the barrel in which they were salted. The process of salting is as follows: A barrel of mackerel is emptied out on deck; a "gib-keeler" is filled with salt; one of the men now throws the mackerel into the "gib-keeler," while the other man "rubs" them in the salt by taking one in each hand; the back of one is then placed to the flesh of the other, and they are thrown into the barrel with the flesh side down. They are thus salted and packed away into barrels in successive layers, each (with the exception of the bottom tier) with the flesh side down.† A barrel of large mackerel can be salted in from five to ten minutes.

In order to cure mackerel successfully very fine salt must be used, and every part of the fish must be touched or it will spoil.‡ Careless

* The most general custom, perhaps, on the Gloucester vessels was to have two men in a gang, though this was varied a good deal on different schooners. Some crews preferred dress gangs of three men each, while others sometimes had four men working together, one of them "passing up" the mackerel to the splitter.

† The early method of packing them flesh up has been abandoned.

‡ This is the case when the mackerel are "rubbed," Liverpool salt being almost wholly used, since Cadiz salt, owing to its coarseness, has a tendency to tear or "ruck up" the flesh of the fish and give them a ragged appearance. Many of the Cape Cod fishermen, however, preferred to use Cadiz salt, believing it to be better for curing the fish than Liverpool. Their manner of applying it was quite different from that which has been described. Each man salted his own catch. Placing a wash-

salters sometimes leave "thumb-marks" where their thumbs touch the fish during the process of salting, preventing the access of the salt. These do not keep well.

It was customary on the "hookers" to let the mackerel remain on deck for several days after being salted, the length of time varying to a considerable extent, as it depended very much on the amount of fish taken. When the mackerel were well struck, or after they had been salted from two to five or six days, the barrels were "topped up" with fish, to make up for the shrinkage from the first salting, after which they were carefully headed up and stowed in the hold. If the men kept their catch separate, each one cut a private mark on the head of the barrel containing his fish. As a rule, the mackerel were "stowed down" whenever 40 or 50 barrels had accumulated on deck, but when fish were abundant and took the hook freely for several days in succession it often happened that more than a hundred barrels of fish would be caught before any were put below.

Capt. Epes W. Merchant, of Gloucester, informs us that the practice of salting mackerel was inaugurated at Gloucester in 1818. Scituate fishermen had begun this practice somewhat earlier. The methods of salting have not materially changed since that time. Previous to 1850 the vessels engaged in mackerel fishing were generally accustomed to carry butts, in which the fish were salted.

Capt. Chester Marr tells us that in the early days the mackerel fishermen made a practice of salting the mackerel in hogsheads, which were placed in the hold, standing on end, with stone ballast stowed in the "spaces" between them. When a vessel was loaded she would hold about 10 butts, or about 50 "wash-barrels." These butts were used until about 1850.

---

barrel of mackerel at his left hand, an empty barrel in front of him, and with a bucket or basket of salt at his right, the fisherman rapidly transferred the fresh fish into the proper barrel, placing each flesh up, and scattering over it with the right hand a sufficient quantity of salt. An expert can thus take care of many more fish than any one unacquainted with the method would believe possible, though, it is safe to say, mackerel can be handled more expeditiously by the process of rubbing, and for this reason the Cape Cod style of salting has never come into favor at Cape Ann and on the coast of Maine.

*The largest of the mackerel schooners had sufficient capacity for stowing 20 or 25 butts, besides a number of barrels alongside of them in the wings on each side of the hold.

When salting mackerel in these casks, the salters worked in the hold. A gib tub was filled with salt and set on top of the butts near the hatchway, and one man threw down the mackerel from the deck into the salt box (or gib tub) while two others standing alongside of the butts did the salting—one "rubbing" the fish and the other packing them away in the proper place. When the cask was full a large stone was placed on top of the fish to keep them beneath the brine so that they would not get rusty. Each man usually had a hogshead of his own for the reception of his fish; that is, if each of the crew kept his catch separate. At that time, however, it was quite generally the custom to "go on shares." This term, as then understood, differed radically from what is now meant by the same expression, and may be described as fol-

(*b*.) *Mackerel plows.*—The mackerel plows, to which frequent allusion has been made, are also known to the fishermen by several other names, such as rimmers, reamers, fatters, and fatting-knives, in the same and in different localities. The original object of using these instruments may be said to have been "a trick in the trade," although the fact of their being employed at the present time is so well known that no one considers it any longer a secret, neither has it been for many years. The quality of mackerel is determined not only by their size, but also by the richness or fatness which they acquire as the season advances, and the opportunities for obtaining food are better than during the spring. In the spring when they approach the coasts of the Middle States and Southern New England they are in a poor and lean condition and remain in such a state until after they have deposited their spawn. After the spawning-season is over the schools then seek their favorite feeding-grounds and the fish soon begin to exhibit much improvement in their condition. During the month of June this improvement is first noticeable, and by the last of August, and sometimes even at an earlier date, the mackerel have arrived at their finest condition and remain so until they leave the coast in the fall. As the fish fatten, the belly, or that portion which covers the abdominal cavity, increases in thickness, and the quality of the mackerel can be more easily and certainly determined by noticing this particular portion of it than in any other manner. The mackerel are invariably split along the back from the snout to the tail in such a manner that they will lay open and flat after the viscera has been removed. It is a fact well known to persons familiar with this fish that when they are in a fat condition the sides of the abdominal cavity will crack open along the entire length when the fish are opened for the purpose of removing the viscera. The depth of these cracks or "breaks" show the relative fatness of the fish. As these cracks occur about half way from the backbone to the center of the abdominal cavity, it will be readily seen that by using an implement for making the crack a little above or nearer to the backbone than where it would naturally be and where the belly is considerably thicker,

---

ows: The crew were shipped as much upon their merits of good seamanship and steady habits as for their skill as fishermen. Each man was provided with a "strike tub"—a half hogshead—and for the first few days' fishing the skipper would note the catch of each of the men, and from this comparison would decide what share every one should receive. Thus some half dozen, perhaps, in a crew of 12 or 14 men would be assigned a full share. Though there might be some difference in the relative catch of these men it was thought fair to consider a capable and reliable man a full sharesman, though he caught somewhat less fish than another who might not be so well experienced in other matters. The remainder of the men were allowed three-fourths or one-half of a share, as the case might be, their expertness in catching fish and other qualifications always being taken into account in settling their relative standing. Thus, if a vessel had a crew of twelve men, six of whom were full sharesmen, four three-quarter sharesmen, and two half sharesmen, there would be ten full shares, and a sharesman would receive one-tenth of the crew's half of the proceeds of the voyage, while those having a smaller "lay" would be paid accordingly.

it will give the fish the appearance of being much fatter than it really is. As previously stated, the depth of the "break" is the test of the fatness of the fish, and is the guide by which the inspectors cull them into the different grades for market, provided always that they are of suitable size. Stringent laws have in past years been enacted in most of the New England States to regulate the method of inspecting mackerel, and the use of any artificial means to fatten them was for many years strictly prohibited. The introduction of the mackerel plow, like that of many other inventions, was the direct result of a need long felt by fishermen. Previous to its adoption it was the custom for the fishermen to attempt to improve the looks of their fish by increasing the natural break with their thumb-nails drawn along its entire length. This method was called "rubbing the mackerel." Later a few began to use the back of the point of their bait-knives or splitting-knives for this purpose, by degrees venturing to place the cut a little higher than where it naturally belonged. The use of knives led to the introduction of plows, which soon came into general use, though the fishermen at first felt some hesitation about revealing the fact that their fish had been plowed.*

A comparatively poor mackerel would not open sufficiently in a natural way to pass for a No. 2, but the fishermen give them an inviting appearance to the buyer by the use of the plow, which they handle with remarkable dexterity, running the blade longitudinally along each side of the abdominal cavity with great rapidity, laying the sides of the fish open in such a manner that it may pass for a No. 2, and, perhaps, if it is of large size, a fairly fat fish may be culled as a No. 1 mackerel. It is but fair to say here that, since the general adoption of the mackerel plow as a means of "fattening" the fish, the subject is so well understood by the dealers that they demand a finer looking fish than formerly, and the consumer, therefore, actually gets as good an article as before, and one that is much more attractive. This is especially the case when the size of the mackerel is not sufficient to pass for the best quality, or No. 1. A fish whose length is 13 inches and "of

* From a circular addressed to the masters and crews of mackerel vessels by Hon. James Barry, inspector-general of pickled fish for Massachusetts, dated May 2, 1832, we quote the following in relation to the use of the mackerel plow: "It is a mischievous error that fishermen have fallen into by salting their fish too slack, as has been often the case; and another by using the plow, which has given to the fish a false appearance, and has been a source of mortification to the fishermen, and they have in a great many instances found fault with the inspectors when the fault belonged to themselves in not taking care of the fish which it was their duty to do, and which in many cases has been a ruinous business to purchasers. By a law of the commonwealth the inspector is required to throw into an inferior quality all mackerel which have been plowed, cut, or mutilated for the purpose of deception. It can be of no advantage to the fishermen, and I trust will never again be done."

Capt. N. E. Atwood says that some of the fishermen made mackerel plows with "the ends tipped with pewter and fine teeth on the edges so as to make the crease look rough, as though it was broken naturally; others had a knife in the end which cut them [the mackerel] smoothly."

suitable fatness" is required for a No. 1, but it is easy to see that a fish of fine quality, though not exceeding 12 or 12½ inches, is just as good for food, notwithstanding the fact that it must pass for a lower grade and be sold for a much less price. For the past few years a very large portion of the mackerel caught on our coast have been "undersized," that is, not long enough to pass for the best quality, according to the inspection laws of New England; nevertheless they are in all respects quite as good as the larger and rarer grades.

As previously stated, the fishermen no longer make a secret of using the plow, and during the summer season, when the wharves on the eastern coast are filled with mackerel, the operators may be seen in the open air busily rimming the fish almost as fast as they can pick them up and throw them into another barrel. There are many styles of this type of knife, their patterns and designs being as varied as the fancies of those who make them. They are, with but few exceptions, made by the fishermen; some of them are exceedingly plain and rough, while others are artistically and elaborately decorated, often with imaginary uncouth figures or with fancifully carved leaves, wreaths, &c.

There are several knives of this character deposited in the fisheries collection of the United States National Museum, and among them is one *factory-made* rimmer, with a polished walnut handle and a curved iron shank about one-quarter inch in diameter; into the forward end of the shank is fitted a small cutting blade about 1½ inches in length, tapering to a point at the heel, and with a square-cut forward end. There are also other styles made by the fishermen, some having steel and others having copper blades, and one specimen made of wood, in the form of a human leg, the extreme end terminating in a thick-set flat foot, in the bottom of which is inserted or driven a silver three-cent piece, ground to a sharp edge, to be used as the knife or plow.

27.—HOMEWARD PASSAGE AND DISPOSITION OF THE FISH.

When one of the vessels in the fleet has obtained a fare of fish, or the skipper decides to go home, sometimes with a partial fare, the flag is usually set at the maintop-mast or on the main peak. This custom was not so common on our coast as in the Gulf of Saint Lawrence. The fish being salted, the homeward passage was usually performed in a leisurely manner, unless indeed the return was made during the fishing season, and the skipper expected to make another trip, in which case the utmost expedition was used, and rapid passages were made. For several years it has been a common practice for vessels fishing in the Gulf of Saint Lawrence to land their fish at the Strait of Canso, or sometimes at Prince Edward Island, sending the fish home by steamer or freight vessels. This was only done when the vessel had obtained a large fare, and there was a prospect of another successful trip for fish that season. By this means vessels sometimes filled up three or four times in the course of the summer, obtaining, in some instances, as many as 1,100 to 1,200 barrels.*

28.—Financial profits of the mackerel hook fishery.

Old-fashioned vessels were employed as seiners for a number of years from Gloucester, it then being thought by many of the fishermen that swift sailers were not so necessary for this branch of the fisheries as for some others. In this respect, as in many other things, there has been a radical change.

The expense of fitting out with seine, boat, &c., deterred many of the owners from sending their vessels seining, and the more conservative clung to the old method of jigging until the failure of mackerel in the Gulf of Saint Lawrence compelled them to adopt the seine or abandon the business.

As a matter of course such large stocks and enormous profits were not obtained by the seiners years ago as they have made for the past two years, 1880 and '81. Nevertheless many of them did well. But a vessel's "fit out" for jigging cost comparatively little, and with a much smaller stock more clear money would be left than if she went seining. This, together with the fact that more or less risk is attached to seining, such, for instance, as losing the apparatus altogether, having the net torn, the

* The influence exerted upon the settlements in the Strait of Canso in the period between 1850 and 1870, by the trade thus derived from the mackerel fleet, was very remarkable. In many of the coves, on either side of the strait, small villages sprang up, and large store-houses and wharves were built where the American vessels could secure storage for their fish until they could be shipped, and also at the same time obtain supplies of salt, bait, provisions, &c., which they required for the prosecution of their voyages. This, of course, brought a great deal of money to the people of Canso, and many of the merchants who were not slow to take advantage of the circumstances became quite wealthy. Those were lively times in the strait, and it was not an unusual thing to see ten or twenty sail of mackerel schooners lying at Port Hawkesbury or at McNair's or some of the other coves discharging their cargoes and taking on board outfits for another trip. This afforded much employment to local residents and remunerative returns. Most of the people who owned wood lands devoted their time in winter to cutting and preparing for use a lot of fuel which they could readily dispose of the following summer to the American fishermen at good prices; and whoever was fortunate enough to have a small stream or brook running through his land near the coves, usually derived quite a revenue from the American fishermen by charging five or ten cents per barrel for the water which they were obliged to fill there.

Of late years, however, since the general introduction of the purse-seine in the mackerel fisheries, and the consequent failure of our fishing fleets to resort to the Gulf of Saint Lawrence during the mackerel season, a great change has taken place in the prosperity of the settlements at Canso. So much so, indeed, that many of the wharves and store-houses have been allowed to fall into decay and become nearly worthless from disuse. Most of the coves which were formerly the scene of busy life and activity during the mackerel season, now have a comparatively deserted and forlorn appearance. Many of the merchants have moved away to Halifax and other business centers of the provinces, while those who remain find their business much less remunerative than it was at the time when the Strait of Canso was frequented by a large fleet of American mackerel schooners, which were engaged in fishing in the Gulf of Saint Lawrence.

boat stove, &c., served to deter the timid ones from engaging in it until compelled to.

Rapid advances in the knowledge of using the purse-seine have been made within the past few years, which no doubt has had a strong influence in changing the hook fishery into seining. For a number of years it was believed that mackerel could not be taken except in shoal water where the seine would reach bottom, and as a result of this but comparatively little could be done. More recently the practice of seining in the night; tolling the fish alongside of the vessel and then surrounding them, &c., have added much to the profits of the fishermen.

The large net profits which were sometimes made by the mackerel hook fishermen previous to 1870 bore no mean comparison to the money cleared by the seiners of the present day, though, of course, the latter frequently get higher stocks. This, as mentioned above, is due to the difference of the cost of fitting out of a vessel for hooking and for seining, the expense for the latter often being twice or three times as much as it would be for line fishing. The following account of some of the large mackerel stocks made by vessels engaged in fishing with hook and line we copy from the "Fishermen's Memorial":

"The largest stock made in the Bay of Saint Lawrence mackerel fishery was that of schooner "Colonel Ellsworth," Capt. George Robinson, in 1865. She was absent about five months, her net stock amounting to $13,728.* The high-liner's share was $558; cook's, $582.

"Schooner "Gen. Grant," Captain Coas, in 1864, stocked, in two trips to the Bay of Saint Lawrence, $11,254.94, clear of all expenses.† The high line made $502.24; cook's share, $638.17.

"Schooner "Nor' Wester" the same year stocked $9,721.74, net, in one Bay trip; the high liner making $308.60, and the cook $486.61.

"Schooner "Gen. Sherman," in a three months' trip to the bay in 1864 packed 612 barrels of mackerel, her net stock amounting to $9,696. High-liner's share, $575.06.

"Schooner "Kit Carson," in 1865, brought in 591 barrels of mackerel, having been absent about ten weeks. Her net stock amounted to $6,542. High-liner's share, $260.

"Schooner "James G. Tarr," in 1866, stocked $5,824 in a nine weeks' trip to the bay. Cook's share, $331.76.

"Schooner "Seddie C. Pyle," in 1871, packed 1,070 barrels of mackerel caught off this shore,‡ in addition to 18,000 southern mackerel sold fresh in New York, in the spring. Her net stock for the year was $10,561.66. High-liner's share, $491.38; cook's share, $708.52.

"Schooner "Eureka," in six months' mackereling off this shore in 1868, packed 935 barrels, her stock amounting to $10,748.33. High-liner's share, $440.82; cook's share, $473.70."§

---

* Her gross stock—the amount her fish sold for—was doubtless about $16,000.

† Her gross stock would be between $13,000 and $14,000.

‡ New England coast.

§ Fishermen's Memorial and Record Book, pp. 86 and 87.

29.—ITINERARY OF A MACKEREL VOYAGE TO THE GULF OF SAINT LAWRENCE.

(By Maj. D. W. Low.)

We go to Essex, a neighboring town on Cape Ann, six miles from Gloucester, or to the ship-yards of Gloucester, where we see on the stocks, ready for launching, a schooner of 60 or 70 tons, built in that thorough and staunch manner which makes the American fishing schooner celebrated for her sailing and seaworthy qualities required in the hazardous business she was built for.

We next find the schooner alongside of the wharf in Gloucester, where she is got ready, or "fitted," for a voyage to the Gulf of Saint Lawrence, called a "bay trip." Fifty-five barrels of porgies and seven barrels of clams, with fifty hogsheads of salt in 115 barrels, and sixteen barrels of water are stowed by her crew in her hold, on top of which are stowed 335 barrels more with their heads taken out and put inside, both head and barrel being numbered. After the provisions, lines, hooks, &c., are on board the flag is hoisted and she is ready for sea, having cost to that time $7,700 for the vessel and $2,075 for her outfits. Had she been fitted for seining her outfits would have cost $750 more, making her total cost with outfits $10,525.

Leaving Gloucester August 5, 1875, we proceed to the Gulf of Saint Lawrence with seventeen hands, shipped "by the berth," according to their experience as fishermen, the best fishermen getting the best berths, which are nearest to and on each side of the master. The master's berth is forward of the main rigging on the starboard side, nearly in the center of the vessel. Formerly the berths to fish, with exception of the master's and cook's, were sold at auction on board the vessel after she had started, as high as $50 or even more being paid for first choice; the amount of the bids, called "berth money," was equally divided among the sharesmen, they paying the amount of the excess of their bid over the average share. The cook fishes forward so as to be handy to his cooking. After each man's berth is decided upon, each one prepares the cleats for his lines on the bulwarks under the rail at his berth. "Jigs" are run in the "jig molds," and the lines, eight to twelve to each man, are neatly put upon the cleats ready for service. After passing through the Gut of Canso (stopping there for a little wood), the vessel is ready for fishing. Lashed on the "port" side of the schooner, opposite the skipper, stands the "bait-mill," at which each of the crew, excepting the master and cook, take turns, commencing with the youngest, in grinding bait. The slivers of porgies are ground up fine, and clams are chopped with a long handled chopper, which are mixed with the porgie bait and some of it put into a box called the "bait-box" which is hung outside of the bulwarks, to the right of the master's berth, and water is added to it. After the vessel is "hove to" and she commences to drift to leeward, the master, with a "bait-heaver," throws the bait from the bait-box into the water fore and aft the vessel to attract and draw the mackerel alongside. Some of the crew are below and others looking on, or perhaps put out a line with the skipper's to try for them. Soon the peculiar tapping of a mackerel's tail is heard on the bottom of a barrel, which, with the cry of "here they are," from the skipper, brings every man to his berth, and for a time the "strike barrels" standing a little in the rear and at the right of the fisherman, in which the mackerel are slat from the hooks, resound with the lively occupants. The best fishermen fishing with four and sometimes six lines each. The "spurt," however, is soon over, and after "picking" one once in a while the master orders "take in your lines," after which we haul in our mainsail, hoist the jib, and go on. The mackerel are then dressed, generally by gangs of three, comprising a "splitter," one to pass up the mackerel to him, and the "gibber"; the mackerel, after being split, are thrown into a "keeler," which is a shoal square box, about two by three feet square, which are put on board in nests of three; the "gibber," with mittens on to prevent getting his hands sore from the bones, opens the mackerel, takes out the gills and entrails (which are thrown overboard after dressing the catch), and throws the mackerel into a barrel partly filled with water to soak the blood from them, which is called a "wash barrel"; after soaking, they are thrown into a keeler of salt, a few at a time, rubbed all over in the salt, and packed in a "sea barrel," one barrel of salt ($3\frac{1}{2}$ bushels) being used in packing four sea barrels; after the barrel is filled and the fish allowed to shrink it is filled up (sometimes there is not time enough to allow it to shrink before heading up). The head of the barrel is put in reversed, on which the private mark of the catcher is cut in to identify it when landed, after which the barrels of mackerel are stowed in the hold. Frequently, when mackerel are scarce and time hangs heavy, industrious ones will "mess" their mackerel by scraping the blood from the backbone and cutting off the heads and tails, losing by the operation thirteen pounds on a hundred, but making the mackerel bring more in the market for the labor.

During our voyage we sometimes tried for mackerel with others of the fleet one or two miles from shore, and being "hove to" together, and occasionally picking a mackerel which, as it glistened in the sun coming over the rail, no doubt led those on shore to suppose we were getting a good catch of fish, when fifteen wash barrels would cover the whole catch for the fleet in several hours' fishing. The latter part of October finds us on the way home, at Georgetown, Prince Edward Island, where we put in for a harbor, paying one dollar for harbor dues, and on 2d of November arrived at Gloucester, having been absent two months and twenty-eight days, and caught 250 sea barrels of mackerel.

The mackerel are hoisted out with a horse, the crew paying for it in preference to hoisting them out by hand, as formerly. After being landed each man's lot is stood upon the head together, with the marked head up. One of the crew unheads them, another pitches the mackerel as wanted into a "culling-crib," which is made about three feet wide and four feet long, with slat bottom, at each end of which stands an experienced and careful "culler," who tosses the mackerel according to their grade into "culling tubs," which hold a half barrel each; two of the crew then place the tubs when full on the platform of a beam scale where the "weigher" weighs them off, crying out "barrel of one's," or whatever the weight or grade requires; two of the crew empty them into the "packing cribs," while the master places the account of it under the name of the catcher, and the packer with a piece of red chalk marks the head of the barrel or whatever package is used with the grade of the mackerel. Half a bushel of salt to the barrel is used in packing, after which the cooper takes them, and after putting in the head it is rolled out on the wharf by a laborer and there bored and pickled off by the "pickler." After being pickled off and bunged, they are stood upon their head and branded with the deputy inspector's name and grade of the fish; the trip is sold by the owner with the master, he acting for himself and crew; the voyage is then made up in the ordinary manner. When the mackerel are delivered to the packer the vessel and crew are done with them as producers.

E.—THE MACKEREL GILL-NET FISHERY.

30.—Implements, methods, and results of mackerel dragging.

Considerable quantities of mackerel are sometimes caught in gill-nets at various points along the New England coast from Vineyard Sound to Eastport. For the most part, however, they are taken west of Mount Desert. This fishery is carried on in two ways: The gill-nets may be anchored and left out over night, as is the custom about Provincetown, or they may be set from a boat or vessel. The latter method is called "dragging"; the vessels are called "draggers," or "drag-boats," and the fishermen "mackerel draggers."

The mackerel gill-nets are 20 to 30 fathoms long, 2½ fathoms deep, with a mesh varying from 2½ to 3 inches. In Provincetown harbor they are set in the following manner:

About the middle of November the fishermen of Provincetown Bay begin to put out nets for the large mackerel on its return. On one occasion Captain Atwood had twelve nets out, five miles from land. On the last night of November he had taken nothing, but on visiting the nets the next day, he found they had sunk to the bottom filled with mackerel. He, however, succeeded in getting up eight, and the nets as they came to the surface looked like a sheet of silver. Three thousand three hundred and sixty mackerel were taken from these eight nets by nightfall. The next day the remaining nets were dragged in and 1,700 more taken, making 5,000 fish netted at a single catch. On another occasion a catch lasted three nights, when he alone caught mackerel enough of the best quality to make sixteen barrels when packed.*

In Gloucester harbor and at other points on the coast of Massachusetts and Maine they are set in shallow water, one or both ends being anchored and their position marked by buoys on each end of the gang. When set thus in protected harbors they are ordinarily placed across the direction of the tide, usually in a cove or bight of the harbor where the mackerel are known to occur, and where they are out of the track of vessels.

The most extensive "drag-net fishery" is carried on by the vessels of Portland and Friendship, Me. The method employed by these fishermen six years ago was somewhat as follows: The vessels are small schooners of 15 to 25 tons. They usually run out from the harbor near the close of the day, timing their departure so that they will be upon the fishing grounds about sunset, except when it is necessary to go a long distance out to sea, in which case, of course, the time of starting is earlier. Reaching a locality where mackerel are supposed to be abundant the vessel is hove to, and a gang of 10 to 20 nets is paid out. The nets are fastened together at top and bottom, and the outer end is marked by a buoy, other buoys being distributed along the gang at intervals, the junction between each pair of nets being generally marked by a keg or spar. To the last net is fastened a rope called a "net swing," corresponding to the "fleeth-rope" used by the herring fishermen of Europe. This is a rope of three inches in circumference and 60 to 70 fathoms long. It is paid out to its full length and made fast at the bow of the vessel. The foresail is then lowered down and furled, and the vessel lies head to the wind, drifting to leeward and dragging the nets as she goes. If the wind is moderate the whole mainsail is kept up, but if the breeze is fresh, or what is called a mackerel breeze, it is reefed. Under favorable circumstances the nets are allowed to remain out all night, but the fishermen in the two dories row constantly along the nets back and forth noticing the movements of the fish, and especially looking out for the approach of dogfish. When a school of dogfish approaches the nets after any number of mackerel have been gilled it is at once necessary to take them in less the dogfish should devour the mackerel, chew innumerable holes in the twine, and roll themselves up in it until it is so twisted and tangled that it takes the labor of days to get it in proper condition for setting again. If the fishermen are not annoyed by dogfish the nets are allowed to remain down, as has been stated, all night long, and the men in the dories constantly pick out the fish, frequently carrying their catch back to the vessel. When the dogfish attack the nets they haul them in with the utmost expedition and bundle them as hurriedly as possible into the bottom of the dory, and after they have lifted them to the deck of the vessel take out the fish from among the meshes.

* Captain Atwood, Proc. Bos. Soc. Nat., x, 1865-'66.

It is part of the duty of the men in the dories to keep a vigilant lookout for approaching vessels. The gang of nets may be more than half a mile in length, and the keel of a large vessel passing over it would be almost certain to cut it in two. When it is still weather they row toward any vessel which they may see coming and ask the men on watch to steer clear of the nets; otherwise they are obliged to stand by the nets and repair the damages as best they may. Sometimes the approaching vessels are induced to stear clear of the nets by the dorymen, who hold up a lantern for that purpose. The mackerel caught in this manner are always carried fresh to the shore, and are intended chiefly for the supply of the markets of the large cities. They are packed in barrels, and may or may not be gibbed through the gills before reaching shore. A vessel setting a long string of nets may catch as much as fifty barrels of mackerel in a night, but ordinarily not more than five or ten barrels, frequently less. The barrels are carried on deck, and the fish are put in them as soon as they are removed from the nets. When the weather is warm the barrels are filled with ice-water. Besides the mackerel caught, considerable quantities of shad and alewives are taken in these nets. On an excursion made by one of the writers from Portland in 1873, besides six barrels of mackerel, there were caught with a small string of nets about forty fine shad, averaging two pounds each, and three or four hundred of that species of alewives known to the Portland fishermen by the names of "kyack," "cat-thresher," "saw-belly," or "blue-back," probably identical with the glut-herring, *Clupea aestivalis*, of the Chesapeake basin, the summer alewive occasionally taken in New England rivers. On this occasion the mackerel were feeding extensively on various entomostraca, with which the water was filled, and which imparted to it a vivid phosphorescence all night long. The presence of these animals, and of others more minute, causes the water and the nets to "fire" in such a manner as often to render them so visible to the fish that they successfully avoid contact with the twine.

The mackerel caught at Provincetown in gill-nets are brought in by the boats, and shipped by the fishermen to Boston in vessels devoted specially to this business, the owners of which receive a percentage upon the amount of their sales.

The crew of a Maine mackerel-dragger consists generally of two to four men, the vessels being usually owned by the fishermen.

The custom of dragging for mackerel, though practiced for centuries in Europe,* appears to have been first used in this country at Province-

*For convenience of comparison the following description of drift-net fishing for mackerel on the coast of England is quoted from Yarrell's British Fishes:

"The most common mode of fishing for mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is 20 feet deep by 120 feet long; well corked at the top, but without lead at the bottom. They are made of small fine twine, which is tanned of a reddish-brown color to preserve it from the action of the salt water, and it is thereby rendered much more durable.

"The size of the mesh is about 2½ inches, or rather larger. Twelve, fifteen, and town about the year 1841, where it is still prosecuted to a considerable extent in addition to the stationary gill-net fishery which has been mentioned.* At first small open boats were used, such as the one described and figured in the fishery census report under the name of "Provincetown drag-boat." About 1845 Provincetown fishermen with their boats and nets essayed dragging for mackerel in the vicinity of Monhegan, Me., and by their example this practice was introduced into Maine, and since that time it has been carried on at various points on the coast.

---

sometimes eighteen of these nets are attached lengthways by tying along a thick rope, called the drift-rope, and the ends of each net to each other. When arranged for depositing in the sea, a large buoy attached to the end of the drift-rope is thrown overboard, the vessel is put before the wind, and, as she sails along, the rope with the nets thus attached is passed over the stern into the water till the whole of the nets are thus thrown out. The nets thus deposited hang suspended in the water perpendicularly, 20 feet deep from the drift-rope and extending from three-quarters of a mile to a mile, or even a mile and a half, depending on the number of nets belonging to the party or company engaged in fishing together. When the whole of the nets are thus handed out, the drift-rope is shifted from the stern to the bow of the vessel, and she rides by it as at anchor. The benefit gained by the boats hanging at the end of the drift-rope is that the net is kept strained in a straight line, which, without this pull upon it, would not be the case. The nets are 'shot' in the evening, and sometimes hauled once during the night; at others, allowed to remain in the water all night. The fish roving in the dark through the water hang in the meshes of the nets, which are large enough to admit them beyond the gill-covers and pectoral-fins, but not large enough to allow the thickest part of the body to pass through. In the morning early preparations are made for hauling the nets. A capstan on the deck is manned, about which two turns of drift-rope are taken; one man stands forward to untie the upper edge of each net from the drift-rope, which is called casting off the lashings; others haul the net in with the fish caught, to which one side of the vessel is devoted; the other side is occupied with the drift-rope, which is wound in by the men at the capstan."—(The History of British Fishes, first edition, 1836, vol. 1, pp. 126, 127.)

*Capt. N. E. Atwood, at Provincetown, writes as follows in regard to the introduction of the method of dragging for mackerel at Cape Cod: "As early as I can recollect most of the mackerel taken along our coast were caught with hook and line. A few gill-nets were set at moorings in our harbor and along the Truro shore during the first part of the mackerel season or as soon as the fish came in. The mackerel which were then taken in nets were sent to Boston market and sold fresh, sometimes bringing good prices. As the mackerel would not bite at the hook when they first struck in we would often get two weeks fishing before a sufficient quantity of mackerel were caught on the hook to glut the market. Boston market being at that time small and no ice used in packing, only a few fresh fish could be sold there at any one time.

"In 1841 I went to Monomoy Bay (Chatham) to fish for shad; we went out in the bay and put out our gill-nets and drifted with them all night, if the weather would permit that mode of fishing, which we then and have always since called 'dragging.' On my return home to engage in the mackerel net fishery, very few had been caught in nets in our harbor, but large schools of mackerel had been passing in by Race Point and Wood End, and were going up the bay. I took my mackerel nets in the boat and and went out in the bay towards Plymouth, some two or three miles, and put them out and drifted all night; next morning I found I had got a good catch. This occurrence took plack about the 15th of June, 1841.

"It did not take the other fishermen long to get into this new way of fishing, and since that time this method of drag-fishing has been adopted along the coast of Maine and elsewhere."

In 1873, 12 or 15 vessels from 15 to 25 tons were employed at Portland; at present the number at this port is 18, and quite a fleet of the mackerel-draggers also belongs to the vicinity of Friendship, Me.*

Along the southern coast of Nova Scotia, and about the vicinity of the Straits of Canso, there is an extensive gill-net fishery for mackerel carried on with stationary nets, and, in a smaller degree, a similar fishery is prosecuted in some parts of the Gulf of Saint Lawrence.† This fishery on the Nova Scotia coast is prosecuted when the mackerel are traversing the coast line in the spring and fall.

"During the mackerel fishing season," remarks Mr. J. Matthew Jones, "the people along shore appear to live in a state of much excitement, expecting every hour the 'runs' to come into their bays. The traveler who may desire a horse and wagon to get on from place to place will find hard work to prevail upon the people to hire one out to him with a driver. Lookouts are kept on some elevated spot so that the schools may be seen some distance off in order to give time for the fishermen to get off in their boats with the net." As at Provincetown, these nets are anchored only at one end, the other end being left free to swing with the current. They are sometimes set as far as ten or twelve miles from the shore, in water 20 to 50 fathoms in depth, care being taken to put them as nearly as possible in those localities which are known to lie in the "track" of the mackerel.

The mackerel gill-nets are usually set with their upper lines close to the surface; sometimes, however, as much as 2 or 3 fathoms below. The position of the net in the water is regulated by the length of the buoy-ropes and the weight of the sinkers. As a rule, especially on the coast of Nova Scotia, they are, however, set close to the surface.

In this region also there has been for many years an extensive seine fishery for mackerel corresponding to that which is elsewhere referred to as having been formerly carried on, two hundred and fifty years ago, on the shores of Cape Cod Bay. The principal points for the seine fishery are at Margaret's Bay, west of Halifax, and at Chedabucto Bay, at the eastern part of Nova Scotia.

Perley, writing in 1852, remarked: "In those harbors of Nova Scotia which are within the Straits of Canso mackerel have of late years been taken in seines capable of inclosing and securing 800 barrels, and in these seines 400 and even 600 barrels have been taken in a single sweep."‡

In the same locality Perley refers to the use of the drift-nets, undoubtedly meaning the set gill-net just described, remarking, however,

*Friendship has 12 vessels, Cushing 5, Waldoboro' 2, and Booth Bay and Bremen 1 each; the total from Maine, including those from Portland, being 39; the tonnage is 559.47; number of men, 133.

†Schooner "Yankee Lass," of Boston, arrived home last week from a season's mackereling trip around the Seven Islands of Saint Lawrence River, with 300 barrels, all large No. 1 mackerel, taken in [gill] nets.—(Cape Ann Advertiser, September 30, 1881.)

‡Fisheries of New Brunswick, 1852, pp. 13-16.

that this mode of fishing is probably not so well understood on the coast of Nova Scotia as in England. He however quotes from Yarrell an account of drift-net fishing in England, which is altogether different from that used in Nova Scotia and corresponds precisely with the drag-net fishing also described in the beginning of this chapter.

It is worthy of mention that mackerel as well as herring, on the coast of Europe at the present time, are almost exclusively caught by the use of the drag-net, the only other method in use being the equally old-fashioned one of "drailing," which was abandoned by our fishermen sixty-five years ago.* The antiquated method of drailing was, however, kept up by the fishermen of the Gulf of Saint Lawrence until 1860, or perhaps even to the present time, for the purpose of obtaining mackerel for bait to be used in the cod fisheries.

F.—THE SPRING SOUTHERN MACKEREL FISHERY.

The spring mackerel fishery is in reality a branch of the mackerel seine fishery, and the methods employed in it are identical with those described in the previous section of this chapter. In this place it is necessary only to add a history of this fishery, a description of the grounds frequented by the southern fleet, and a few statistical notes.

31.—Fishing-grounds.

The fishing grounds frequented by the southern mackerel fleet lie between Cape Hatteras and the South Shoals of Nantucket. The fishing season is in the months of April and May. The first vessels go south about the middle of March or soon after; but until 1878 no mackerel were ever taken before the 1st of April.†

32.—Early catches of mackerel, 1878 to 1881.

The earliest catches of the three past years are shown in the following notes:

EARLY CATCHES OF MACKEREL IN 1878.

March 30.—Schooner "Lilian," of Noank, Conn., Captain Latham, off Chincoteague.

April 16.—Schooner "Sarah M. Jacobs," of Gloucester, Capt. Solomon Jacobs, caught her first mackerel in latitude 36° 10′ N., longitude 74° 45′ W.

April 18.—Schooner "Alice," of Swan's Island, Me., Capt. Hanson B. Joyce, master, caught her first mackerel 25 miles southeast from Cape May.

April 25.—Schooner "John Somes," of Swan's Island, Me., Capt. J. S. Staples, master, caught her first mackerel 50 miles southeast from Cape May.

* Though drailing was abandoned so long ago by the professional mackerel fishermen of New England, we are, nevertheless, told by Capt. Joseph Smith, of Gloucester, that this method of fishing is still practiced by the Block Island boat fishermen.

† Schooners "Edward E. Webster," "Nellie N. Rowe," and "Ivanhoe" sailed for the south on Saturday (March 11) in pursuit of mackerel, the "Webster" getting the start by sailing at 4 o'clock a. m., and the others following at 4 o'clock p. m. This is the earliest start ever made in the mackerel fishery. Last year the "Edward E. Webster" sailed March 15, which was unusually early, and obtained a fare within a week thereafter.—(Cape Ann Advertiser, March 17, 1882.)

EARLY CATCHES OF MACKEREL IN 1879.

April 12.—Schooner "Sarah M. Jacobs," of Gloucester, caught first mackerel in latitude 36° 35′ N., longitude 74° 50 W.

April 13.—Schooner "Augusta E. Herrick," of Swan's Island, Me., Capt. William Herrick, caught first mackerel (130 barrels) in latitude 37° 37′ N., longitude 74° 23′ W.

April 13.—A few fish taken by schooner "S. G. Wonson," of Gloucester, 75 miles south-southeast from Cape Henlopen.

April 14.—Schooner "Charles Haskell," of Gloucester, caught first mackerel in latitude 38° 08′ N., longitude 73° 57′ W.

April 19.—Schooner "Alice," of Swan's Island, Me., caught first mackerel (140 barrels) in latitude 37° 50′ N., longitude 74° 03′ W.

EARLY CATCHES OF MACKEREL IN 1880.

April 1.—Schooner "Edward E. Webster," of Gloucester, Capt. Solomon Jacobs, caught the first mackerel of the season in latitude 35° 30′ N., longitude 74° 15′ W.

EARLY CATCHES OF MACKEREL IN 1881.

March 20.—Schooner "Edward E. Webster," of Gloucester, caught the first fish of the season, and the earliest on record, in latitude 37° 10′ N., longitude 74° 05′ W. A second trip was caught by the same vessel on April 18 in latitude 38° 38′ N., longitude 74° 00′ W.

May 16.—The schooner "Alice," of Swan's Island, caught 30,000 mackerel off Block Island.

33.—THE VESSELS.

The southern mackerel fishery is participated in by 30 or 40 of the Gloucester mackerel schooners and a number of vessels from Cape Cod and Maine. The total number of vessels engaged in this fishery in 1879–'80 was 64, of which 23 were from Maine ports and the remainder from Massachusetts. These are among the swiftest and best of the fleet, and are provided with the fullest amount of canvas for making a quick passage to and from the fishing-grounds. Nearly all of them have ice-houses arranged in the manner already described.

34.—APPARATUS AND METHODS OF FISHING.

The apparatus is in every respect identical with that used in the summer fishery; the vessels, however, carry, as has been stated, a much smaller number of barrels than when engaged exclusively in salting the fish. The manner of fishing is the same as that already described, except that the fish being much scarcer and their movements less regular than in summer on the more northern fishing grounds, a greater amount of vigilance and perseverance is required on the part of the fishermen. This is the season of the migration of the mackerel, and it is necessary that the fishermen should understand how to follow the schools of fish as they make their way northward, even if they are out of sight for days at a time. They cruise sometimes for weeks off the capes of the Delaware and Chesapeake, sometimes venturing farther south to the latitude of Cape Lookout, though they rarely find mackerel south of the mouth of the Chesapeake. Sometimes weeks elapse before they find the fish. After the schools have made their appearance they follow them, and when they are not visible, usually allow five to fifteen miles a day for their northern progress, trying to keep among them as they make their way northward. When among the fish it is a common practice of the vessels to heave to and "jog" all night long in a northerly direction, to keep pace with the movements of the fish.

As soon as the first fare of fish is obtained, even if only a small one, the vessels make their way to New York with all possible speed; the earliest fish command much higher prices than those brought in later in the season. After mackerel become more plenty the vessels seldom go to market with less than 75 or 100 barrels, and it is not unusual for 250 to 300 barrels, the results of one day's catch, to be taken in. The successful vessels often run into New York two or three times a week, especially when the fish are most abundant off Sandy Hook.* This method of fishing and marketing the fish is kept up until the schools have reached the shoals of Nantucket, and the spawning season in that locality begins. At the close of the spawning season, when the fish again rise to the surface, or when the other schools are found on George's Banks and in the Gulf of Maine, the vessels resort to the ordinary method of salting their fish, only a few continuing the practice through the summer of carrying their fish fresh into the markets of New York and Boston. Occasionally cargoes of fresh mackerel are taken in the spring and summer into Philadelphia, and also, later in the season, to Portland.

The spring mackerel fishery, as just described, is of comparatively recent origin, not dating back much before 1870. Twenty to thirty years ago New York was supplied with fresh mackerel chiefly by Connecticut smacks, which caught the fish with hook and line and carried them to New York alive in wells. A peculiarity of this smack fishery was that the men fished with lines fastened to poles, as anglers fish for trout. The object of having poles was to enable the fishermen to drop the captured fish alive, and without injury, into the smack's well.

Vessels belonging north of Cape Cod at that time rarely if ever sold their fish fresh, although they often went as far south as the capes of Delaware. Their fares were salted and carried to Boston or other ports in the ordinary manner.

The southern mackerel fishery was undoubtedly first prosecuted by vessels from Cape Ann; at least we have been unable to obtain relia-

---

* Dispatches received here yesterday announce the arrival of schooner "J. J. Clark" at New York on Monday, with 150 barrels fresh mackerel, which sold at from 6 to 18 cents apiece according to size, and later of the arrival at the same port of the schooners "Seth Stockbridge," "A. M. Terry," "Smuggler," and "T. M. Cromwell," each with 200 barrels; "Moses Adams," 300; "Maud and Effie," 250; "Golden Hind," 75; "Fleetwing," 65; "H. A. Duncan," 20; and "James A. Stetson," 50 barrels, which were sold at from 8 to 12 cents apiece.—(Cape Ann Bulletin, April 17, 1878.)

ble accounts of any fishermen from other ports engaging in this fishery at an earlier date.

"Capt. John Parsons, of Rockport," writes Mr. A. Howard Clark, says "that he was one of the first to go south after mackerel from that port. He went in 1817 in the schooner 'Defiance' of 35 tons. They went as far south as Cape May, and caught 60 barrels of mackerel, all of which were taken by drailing. They had outriggers for towing their lines, and the lead sinkers weighed from 4 to 6 pounds."

An item in the Cape Ann Advertiser of May 20, 1859, remarks:

"The practice of going south for mackerel has almost died out of late years, and this year there are but three or four vessels in the business. Some of the vessels which go in quest of bait take mackereling apparatus with them."

"The practice of going south for mackerel in spring," writes Mr. Earll, "was first begun in Maine by a Georgetown vessel, the 'Queen of the West,' Capt. Francis Lowe, in May, 1851. She was gone but a short time (four to six weeks), and returned with a full fare, after which she proceeded to the bay. The next year the schooner 'Arcola,' Capt. Warren Low, of Georgetown, joined the 'Queen of the West' on her southern spring trip, and in 1853 three went. Booth Bay sent none south until 1867, when the 'Cynosure' went, and Southport sent her first vessel south in 1868. In 1879 five or six went from this section. Vessels from Massachusetts, as stated above, had engaged in this fishery at even an earlier date."

G.—THE EARLY METHODS OF THE MACKEREL FISHERY (1620 to 1820).

35.—CATCHING MACKEREL WITH DRAG-SEINES.

The method chiefly practiced by the colonists of New England for the capture of mackerel was that of drag-seining, and we find as early as 1626 a record of the establishment, by Isaac Allerton, of a fishing station at Hull, where mackerel were seined by moonlight. There can be little doubt that the practice of fishing with baited hooks was also early introduced, and that in the seventeenth and eighteenth centuries groups of boats might have been seen, as at the present day, clustered together in the harbors, or near the outer shores, their crews busily engaged in hauling in the tinkers, and, occasionally, larger mackerel, which during the summer season found their way into these protected waters. It is not known when the custom of drailing for mackerel was first introduced, but it was, beyond question, the common method at the close of the last and the beginning of the present century.

In July, 1677, the records of the Plymouth colony show that the Cape Cod fishery was let seven years, at £30 per annum, to seine mackerel and bass, to certain individuals who are named. They were restricted to take in the Plymouth colonists with them; and if none offer, to admit strangers.

The profits of the hire which accrued to the colony were sometimes distributed to the schools. (Mass. Hist. Collections, iii, 220.)

A writer in the Historical Society's collections gives the following description of these fisheries (vol. iv, 2d series, p. 232): "The aborginal name of this fish (the mackerel) is Wawunnebeseag, a plural term signifying fatness—a very descriptive and appropriate name. The mode of taking these fish is while the vessel is under quick way and the helm secured, when all are engaged at the long veered lines, of which it is said that one man will attend three, and it may be more. The first manner of taking mackerel was by seining by moonlight. This perhaps was first practiced by Mr. Isaac Allerton and his fishing company at Hull as early as 1626. After half a century the mode of fishing was changed to that of drailing with long lines while the vessel was under easy way; and this mode has been changed within these last twenty years (1811–1831). The mode of fishing generally practiced now is to invite the fish around the vessel while lying to by throwing out great quantities of fish cut in small pieces, and to take them with short lines held in the hand and drawn in with a single motion of the arm. By this method it is thought that thrice as many fish may be taken in a given time as by any other method. They are a capricious and sportive fish. In cloudy and even wet weather they take the hook with most avidity. They are very partial to the color of red; hence a rag of that hue is sometimes a bait. A small strip of their own flesh taken from near the tail is used with most success."

Seining mackerel with drag seines is still practiced extensively in the British provinces. That the practice was in vogue in Massachusetts less than fifty years ago is shown by the following item:

"Last week twenty barrels of mackerel were seined at one haul at Sandy Point by Captain Baker. His seine is 500 yards long. A few weeks ago he inclosed a multitude of fishes, principally menhaden shad. It is estimated that their number was 200,000."—(Gloucester Telegraph, June 30, 1838.)

In his history of Scituate, pp. 25–27, Samuel Deane writes: "In early times the shores of our bays were skirted with forest trees quite near to the water's edge. In the month of June, when all nature is in bloom, the volatile farina of the forest trees then floats in the air, and occasionally settles on the smooth surface of the seas. Then it is that this playful fish, attracted by this phenomenon, leaps and bounds above the surface of the water. So again, at a later season, in July and August, winged insects, carried away by the southwest winds, settle and rest on the bosom of the ocean, a welcome herald, it is said, to the mackerel-catcher. Such are the habits of many fishes; and hence the use of the fly as a bait by the angler of the trout streams."

Douglas, in 1747, says: "Mackerel, split, salted, and barreled for the negroes in the Sugar Islands, are caught either by hook, seines, or meshes. Those by hook are the best, those by seines are worst, because in bulk they are bruised. Mackerel will not take the hook unless it have a motion of two or three knots; if quicker they will take the hook, but their jaw being tender gives way, and the mackerel is lost. There are two seasons of mackerel, spring and autumn; the autumn mackerel are the best; those of the spring appear about the middle of May, very lean, and vanish in two or three weeks."

36.—Drailing for mackerel.

Captain Atwood writes: "In my boyhood, when I caught my first mackerel, nobody thought of jigging them. We then took them in the same way as bluefish are caught. My first experience in mackerel fishing took place when I was a little boy, about 1815. I went out with two old men. One of them fished in the stern of the boat, and when it did not sail fast enough the other and myself—I was eight years old at the time—had to row, in order, by the more rapid motion of the boat, to induce the fish to bite. They would not bite unless the line was towed. Two great long poles were run out, one just forward, in such a manner that our vessel had the appearance of a long-armed spider. The poles were straight, and one line was fastened at one part, and another line on the end of the pole, in order to have them separated. This style of fishing continued until about the time when I began to go to sea, about 1820. Jigging for mackerel then commenced, bait being thrown overboard, and the fish being thus attracted alongside of the vessel, and this soon came into general use."

Capt. James Turner, of Isle au Haut, Me., who assures us that as late as 1815 the fishermen drailed for mackerel, gives the following account of this method of fishing:

"While drailing, the sails were trimmed in such a manner that, when the helm was partly down, the vessel would 'jog' along slowly, making a little leeward drift, so that the lines would trend off at a slight angle from the weather side. Each man had one line, the end of which was attached to the end of a pole that was fastened to the vessel's rail, projecting out about 8 feet at right angles with the side of the vessel. The fisherman held in his hand a hauling-line which was attached to the middle of the one fastened to the pole, so that he might know when a fish took the hook and be able to haul it in."

"About a pound of sheet lead was wound around the line a foot above the hook. When the vessel was engaged in fishing, the man standing forward threw over a small amount of fine bait (which had previously been chopped with hatchets) occasionally, scattering it along in order to attract the fish, and keep them near the vessel."

The following paragraphs are quoted from an essay in the Fishermen's Memorial and Record Book:

"Trailing was one of the means used to catch mackerel in the olden time, and one of our old fishermen informs us that when a lad he distinctly remembers of being out in Boston Bay, one day, in a boat with his father, when he saw a vessel which looked very strangely to his young eyes, and, boy-like, he asked his father what sort of craft it was.

"'That's a trailer, my boy, and we'll speak with him,'" was the reply.

"They sailed quite near, and they observed that the vessel had outriggers of long poles on each side, commencing forward at about seventeen feet, and tapering off to five feet aft. At the ends lines were fastened, about twenty fathoms long, with a sinker of four pounds, and hook below. To each of these lines was attached a bridle, reaching to the side of the vessel, where the fishermen stood to feel the bites. This particular vessel was from Hingham, and had been out four weeks without receiving even a bite, and the skipper said he was going to give it up and go home."

"The present mode of catching mackerel by drifting and tolling with bait did not come into general use until after 1812. The gear for catching, previous to that, was a white hempen bob-line, as it was called, and the style of fishing was termed 'bobbing' mackerel. These lines were some seven fathoms in length, with a leaden sinker two inches long, and shaped like a thin pea-pod. At one end was a ganging about a foot long, for the hook. Every few minutes off would go the hook, and extra hooks were always in readiness to replace those lost. This mode continued until the year 1816, when Abraham Lurvey, of Pigeon Cove, discovered a method of running lead around the hooks, and which were afterward called jigs. This he kept secret for many months. The hooks then in use were nearly as large as the haddock hooks of to-day. The small lines and fly-lines did not come into use until about 1823. About this time the gaff was introduced, and was abandoned after being used some ten years."*

It seems scarcely necessary to discuss more in detail the methods used during the first two centuries of the mackerel fishery of North America. In a following chapter an effort will be made to present a chronological history of the fishery from its inception to the present time.

* The mackerel gaff was used to some extent, by the hook and line fishermen, as late as 1865, and possibly even since that time.

III.—LEGISLATION FOR THE PROTECTION OF MACKEREL.

H.—LAWS, PETITIONS, AND PROTESTS.

37.—LEGISLATION IN THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

At an early day in the history of the United States a failure of the mackerel fishery was apprehended. The following notices of legislation, copies of laws, and newspaper extracts will serve to give an idea of the state of public opinion at different periods from 1660 to the present time:

1660.—*Early regulation of the mackerel fishery.*—The commissioners of the United Colonies recommended to the several general courts to regulate the mackerel fishery; conceiving *that* fish to be the most staple commodity of the country. Few, who have not investigated the subject, have at the present day an adequate conception of the importance of this branch of productive industry.—(Freeman's Hist. of Cape Cod, Boston, 1862, vol. i, p. 239.)

1670.—*Prohibition of early mackerel fishing by laws of Plymouth Colony.*—Wheras wee haue formerly seen Great Inconvenience of taking mackerell att vnseasonable times wherby there encrease is greatly deminished and that it hath bine proposed to the Court of the Massachusetts that some course might be taken for preventing the same and that they have lately drawne vp an order about the same this Court doth enacte and order that henceforth noe makerell shalbe caught except for spending while fresh before the first of July Annually on penaltie of the losse of the same the one halfe to the Informer and the other halfe to the vse of the Collonie; and this order to take place from the 20th of this Instant June.—(Plymouth Colony Records, vol. xi, 1623–1682. Laws, p. 228.)

1684.—*Prohibition of mackerel seining.*—In 1680, Cornet Robert Stetson, of Scituate, and Nathaniel Thomas, of Marshfield, hired the Cape fishery for bass and mackerel. In 1684, the court enacted a law "prohibiting the seining of mackerel in any part of the colony"; and the same year leased the Cape fishery for bass and mackerel to Mr. William Clark for seven years, at £30 per annum.

Subsequently to 1700, it is certain that the mackerel were very abundant in Massachusetts Bay. It was not uncommon for a vessel to take a thousand barrels in a season. The packing, as it is called, was chiefly done at Boston and Plymouth.—(Deane's History of Scituate, Mass.)

1692.—*Repeal of prohibitory laws in Massachusetts.*—And be it further enacted and declared, That the clause in the act, entituled "An Act for the Regulating and Encouragement of Fishery", that henceforth no mackeril shall be caught (except for spending whilst fresh), before the first of July annually, be and hereby is fully repealed and made void, anything therein to the contrary notwithstanding. [Passed February 8, 1692–'3.]—(Acts and Resolves of the Province of Massachusetts Bay, vol. 1, 1692–1714, p. 102.)

1692.

AN ACT for the regulating and encouragement of fishery.

Upon consideration of great damage and scandal, that hath happened upon the account of pickled fish, although afterwards dried and hardly discoverable, to the great loss of many, and also an ill reputation on this province, and the fishery of it,—

Be it therefore enacted by the Governor, Council and Representatives, convened in General Court or Assembly, and it is enacted by the authority of the same,

[SECT. 1.] That no person or persons whatsoever, after the publication hereof, shall save or salt any sort of fish (that is intended to be dried) in cask or fattes, or any other way than what hath formerly and honestly been practised for the making of dry fish, on penalty of forfeiting all such fish so salted and pickled, whether it be green or drye; the one moiety thereof to the use of the poor of the town where the offence is committed, and the other moiety to the person that shall sue for the same.

And it is further enacted by the authority aforesaid,

[SECT. 2.] That henceforth no mackrel shall be caught (except for spending whilst fresh) before the first of July annually; and no person or persons whatsoever, after the publication hereof, shall at any time or place within this province take, kill, or hale ashore any mackrel, with any sort[s] of nets or sa'ens whatsoever, on penalty of forfeiting all such mackrel so taken or haled ashore, and also all such nets or sa'ens which were so imployed; the one half thereof to their majesties towards the support of this their government, and the other half to him or them that shall inform and sue for the same. And all justices are hereby impowered, and required to grant their warrants for the seizing of the same and the aforesaid forfeitures, or the receiving of the like value in currant money of this province. [Passed November 26, 1692.]

[Acts and Resolves of the Province of Massachusetts Bay. Vol. I, 1692–1714, p. 71. Province Laws, 1692–3. Chap. XXXII.]

1702.—*Re-enactment of prohibitory laws.*

AN ACT for the reviving and re-enacting a clause in the act intituled "An act for the regulating and encouragement of fishery" that hath been for some time repealed by the General Assembly.

Whereas, in the second paragraph of the said act it is enacted "that henceforth no mackerel shall be caught (except for spending whilst fresh) before the first of July annually"; and whereas the said clause, by an act afterwards made and passed by the general assembly [1692–3 Feb. 8.], was repealed and made void, which said repeal and the unseasonable catching of mack[a]rel thereupon hath been experienced to be very prejudicial to this province,—Be it therefore enacted by His Excellency the Governour, Council and Representatives [convened] in General Court or Assembly, and it is enacted by the authority of the same, That the said clause above-recited shall be and is hereby revived and re-enacted, and that henceforth no person or persons whatsoever shall presume to catch or cause to be caught any mack[a]rel, (except for spending whilst fresh,) before the first of July annually, on penalty of forfeiting all the mack[a]rel so caught contrary to the true intent and meaning of this act, and twenty shillings per barrel over and above for each barrel of the same; the one-half of the said forfeiture to be to her majesty for and towards the support of this her government, and the other half to him or them that shall inform and sue for the same in any of her majesty's courts of record within this province. [Passed November 11, 1702; signed by the Governor and published November 21, 1702.]—(Acts and Resolves of the Province of Massachusetts Bay, vol. i, 1692–1714, p. 507.)

38.—PROTESTS AGAINST GIGGING AND SEINING IN THE PRESENT CENTURY.

1838–9.—*Protests against gigging.*—The Boston Journal protests strongly against the barbarous method of taking mackerel called "gigging,"* and urges that it is not only liable to censure on the score of humanity, but it is also *impolitic*, and that if this destructive method of fishing is generally continued a few years longer it will break up the fishery. We have for a year or two past entertained a similar opinion, and probably the complaints now so frequently made by the fishermen that, though mackerel are plenty, they "will not bite," is owing to the custom of "gigging." There is hardly anything which possesses life that has so little instinct as not to become very shy under such barbarous inflictions. It is obvious that all which are hooked in this manner are not taken on board; the gig frequently tears out, and thousands, millions of these fish are lacerated by these large hooks and afterwards die in the water.—(Newburyport Herald, Gloucester Telegraph, Sept. 23, 1838.)

The following protest appeared in the Gloucester Telegraph, Wednesday, August 7, 1839, it being a quotation from the Salem Register:

"All the mackerel men who arrive report the scarcity of this fish, and at the same time I notice an improvement in taking them with nets at Cape Cod and other places. If this speculation is allowed to go on without being checked or regulated by the government, will not these fish be as scarce on the coast as penguins are, which were so plenty before

* The method of capture called "gigging" here is undoubtedly gaffing, since a fish-gaff is even yet called a "gig" by some of our fishermen.

the Revolutionary war that our fishermen could take them with their gaffs? But during the war some mercenary and cruel individuals used to visit the islands on the eastern shore where were the haunts of these birds for breeding, and take them for the sake of the fat, which they procured, and then let the birds go. This proceeding finally destroyed the whole race. It is many years since I have seen or heard one except on the coast of Cape Horn. In 1692 the General Court passed an act prohibiting the taking of mackerel before the first day of July annually, under penalty of forfeiting the fish so taken. In 1702 this act was revived with additional penalties—besides forfeiting the fish and apparatus for taking, 20 shillings per barrel, and none to be taken with seines or nets.

"A FISHERMAN.

"MARBLEHEAD, *August* 3, 1839."

1859.—*Protests against the use of seines.*—A petition is now before the Committee on Fisheries, in the House, to abolish the catching of mackerel in seines on our coast. As mackerel can now be caught only in this way, and many of our people are interested in this business, it becomes highly important that any such stupid petition should be prostrated at once. Mr. Gifford has asked for a delay in the petition, and Mr. Atwood has written to show the nature of the business upon our coast. One thing is certain, if we do not take the mackerel in seines or nets we shall get none at all.—(Provincetown Banner, February, 1859.)

1870–1882.—*Protest against the purse-seine.*—Since the general adoption of the purse-seine no year has passed without a considerable amount of friction between fishermen using this engine of wholesale destruction in the capture of mackerel and menhaden and those engaged in fishing with other forms of apparatus. Petitions to Congress and State legislatures have been made from both sides, and in some instances laws have been passed by State legislatures prohibiting the use of menhaden seines within certain specified tracts of water, such as the Chesapeake Bay. These laws, while especially antagonistic to menhaden fishing, were aimed chiefly at the purse-seine as a means of capture, and would doubtless have been equally prohibitory of mackerel fishing with purse-seines had this been attempted within the limits. In 1878 a delegation of fishermen from Portland, Me., and Gloucester, Mass., visited Washington for the purpose of securing the passage of a law prohibiting the use of purse-seines in the mackerel fishery. In 1882 the clamors of shore fishermen, especially on the coast of New Jersey, led to the appointment of a committee of the United States Senate, which at the time of printing this report is engaged in taking testimony regarding the effect of the purse-seine upon the menhaden fishery, and incidentally upon other fisheries of the coast. The labors of this committee will probably result in the recommendation of some form of legislation which will apply, in part at least, to the mackerel fishery.

In the summer of 1882 a serious commotion was caused among the mackerel fishermen by the announcement of the intention of a number of menhaden fishermen to employ their steamers and nets in the mackerel fishery. It was the impression among these men that the mackerel were to be used for the manufacture of oil and guano, but this has been denied by Capt. David T. Church and other representative men, who, reasonably enough, state that they could not afford to use so valuable a fish for this purpose, and who claim that they have an undoubted right to use their steamers in the capture of mackerel for sale fresh in the markets and for pickling.

As a matter of record we reproduce the following paragraphs from an editorial in the Cape Ann Advertiser, July 14, 1882:

"It is not a difficult matter to anticipate the result if this class of steamers engage in this branch of the fisheries. There is no reason to doubt their ability to catch almost or quite as many mackerel as they have formerly caught menhaden. Several of them are large, capable of carrying 2,800 barrels of fish in bulk. These carry a double gang of men, and apparatus to correspond. During moderate weather, when mackerel generally school the best, and sailing vessels find it difficult to move, these steamers can play around the fleet of schooners, catch almost every fish that shows itself, and carry them away to be used, not for food fish as they were intended, but for oil and guano, to enrich a few men at the expense of many."

"If the steamers were to engage in the mackerel fishery, selling their catch for food, and were obliged to spend the requisite time for dressing them, which would debar them from an overcatch and carrying them to market, thus placing them on somewhat equal footing with the other fishermen, there could be no reasonable objection to their employment; but it certainly seems, in view of this startling innovation, that some decided action should be taken by 'the powers that be' to prevent the catch of mackerel for the purpose of manufacturing oil and guano. They are altogether too valuable for such a purpose, and the risk of breaking up the schools and driving them almost entirely from our waters, as has been the case with menhaden, is altogether too great.

"Unless some action is taken, and taken at once, and stringent laws enacted, we may confidently look forward to the destruction in a few years of one of the important industries of New England and the permanent and serious injury of large communities which now derive a considerable part of their support from the mackerel fishery."

IV.—STATISTICS OF THE MACKEREL FISHERY IN 1880.

[BY R. EDWARD EARLL.]

I.—TABLES SHOWING NUMBER OF MEN, NUMBER AND VALUE OF VESSELS, AND VALUE OF PRODUCT.

39.—TABLE SHOWING THE NUMBER OF VESSELS AND MEN EMPLOYED IN THE MACKEREL FISHERY.

Ports.	Total.					Vessels engaged in the mackerel fishery only.					Vessels engaged in the mackerel and other fisheries.				
	Vessels.	Tonnage.	Value.	Value of gear and outfit.	Men.	Vessels.	Tonnage.	Value.	Value of gear and outfit.	Men.	Vessels.	Tonnage.	Value.	Value of gear and outfit.	Men.
Grand total	468	23, 551. 64	$1, 027, 910	$1, 094, 450	5, 043	235	15, 489. 49	$675, 195	$699, 900	3, 134	233	8, 062. 15	$352, 715	$394, 550	1, 909
MAINE.															
Eastport	*1	52. 49	2, 000	2, 900	13	1	52. 49	2, 000	2, 900	13					
Hancock	1	18. 11	150	1, 100	4						1	18. 11	150	1, 100	4
Tremont	2	41. 79	130	2, 200	14						2	41. 79	130	2, 200	14
Cranberry Island	4	178. 43	8, 200	8, 000	45						4	178. 43	8, 200	8, 000	45
Bluehill	1	10. 50	250	650	3	1	10. 50	250	650	3					
Brooklin	3	115. 82	4, 100	4, 250	25	1	67. 66	3, 000	2, 900	14	2	48. 16	1, 100	1, 350	11
Deer Isle	18	454. 01	12, 485	19, 150	105	5	262. 61	8, 900	12, 000	54	13	191. 40	3, 585	7, 150	51
Sedgwick	1	57. 95	3, 000	2, 500	13	1	57. 95	3, 000	2, 500	13					
Bucksport	1	11. 43	600	800	4						1	11. 43	600	800	4
Swan's Island	14	664. 40	23, 500	30, 500	137	10	598. 49	22, 350	27, 700	126	4	65. 91	1, 150	2, 800	11
Isle au Haut	3	52. 84	1, 300	2, 100	15						3	52. 84	1, 300	2, 100	15
Belfast	3	66. 73	1, 000	2, 300	17						3	66. 73	1, 000	2, 300	17
Lincolnville	1	20. 48	375	700	4						1	20. 48	375	700	4
Camden	3	161. 54	4, 000	8, 500	41	3	161. 54	4, 000	8, 500	41					
North Haven	14	451. 99	17, 600	22, 800	107	6	338. 18	13, 500	18, 000	72	8	113. 81	4, 100	4, 800	35
Vinal Haven	5	52. 22	1, 250	3, 000	16						5	52. 22	1, 250	3, 000	16
Rockland	1	30. 84	6, 000	2, 000	11	1	30. 84	6, 000	2, 000	11					
Saint George	3	95. 45	4, 150	4, 600	26	1	41. 58	2, 000	2, 200	11	2	53. 87	2, 150	2, 400	15
Cushing	5	64. 55	1, 400	5, 000	15	1	9. 06	450	1, 100	2	4	55. 49	950	3, 900	13
Friendship	13	217. 62	7, 625	17, 000	41	1	14. 16	1, 500	2, 500	2	12	203. 46	6, 125	14, 500	39
Matinicus Island	4	90. 64	3, 850	5, 150	26	1	43. 96	1, 600	2, 000	10	3	46. 68	2, 250	3, 150	16
Waldoboro'	2	29. 59	350	2, 100	5	1	12. 84	200	1, 050	2	1	16. 75	150	1, 050	3
Bremen	1	16. 73	300	1, 100	4						1	16. 73	300	1, 100	4
Bristol	6	86. 25	2, 950	5, 850	25						6	86. 25	2, 950	5, 850	25
Boothbay	13	773. 89	29, 600	37, 000	171	8	515. 38	21, 600	26, 000	113	5	258. 51	8, 000	11, 000	58
Southport	5	305. 13	13, 500	13, 400	68	1	60. 91	1, 500	2, 900	13	4	244. 22	12, 000	10, 500	55

Wiscasset	1	53. 59	$800	$2, 800	12						1	53. 59	$800	$2, 800	12
Portland	46	1, 940. 56	83, 000	98, 100	434	18	1, 105. 98	$45, 000	$55, 500	229	28	834. 58	38, 000	42, 600	205
Kennebunkport	1	6. 88	250	600	2						1	6. 88	250	600	2
Total	176	6, 122. 45	233, 715	306, 150	1, 403	61	3, 384. 13	136, 850	170, 400	729	115	2, 738. 32	96, 865	135, 750	674
NEW HAMPSHIRE.															
Portsmouth	11	567. 53	29, 300	25, 700	113	3	292. 09	15, 500	10, 500	47	8	275. 44	13, 800	15, 200	66
MASSACHUSETTS.															
Newburyport	11	554. 53	24, 170	30, 500	123	6	351. 96	11, 650	18, 000	70	5	202. 57	12, 500	12, 500	53
Essex	2	156. 91	9, 500	6, 000	30	2	156. 91	9, 500	6, 000	30					
Rockport	10	487. 17	27, 000	26, 900	116	3	191. 26	10, 000	8, 700	40	7	295. 91	17, 000	18, 200	76
Gloucester	113	6, 707. 79	318, 745	310, 900	1, 394	60	4, 000. 32	183, 345	190, 300	810	53	2, 707. 47	135, 400	120, 600	584
Salem	2	141. 29	5, 200	6, 000	26	2	141. 29	5, 200	6, 000	26					
Marblehead	3	107. 13	8, 300	7, 800	31						3	107. 13	8, 300	7, 800	31
Swampscott	12	559. 85	30, 400	31, 200	142						12	559. 85	30, 400	31, 200	142
Boston	25	1, 612. 28	50, 700	73, 400	336	17	1, 267. 77	41, 350	54, 400	245	8	344. 51	9, 350	19, 000	91
Hingham	2	140. 53	5, 400	6, 400	28	2	140. 53	5, 400	6, 400	28					
Cohasset	6	443. 56	22, 000	19, 200	86	6	443. 56	22, 000	19, 200	86					
Duxbury	4	157. 27	5, 700	10, 000	36						4	157. 27	5, 700	10, 000	36
Wellfleet	34	2, 569. 55	109, 450	102, 900	470	34	2, 569. 55	109, 450	102, 900	470					
Truro	1	65. 40	2, 200	3, 100	14	1	65. 40	2, 200	3, 100	14					
Provincetown	5	343. 19	13, 600	15, 000	74	5	343. 19	13, 600	15, 000	74					
Orleans	2	150. 80	7, 000	6, 200	29	2	150. 80	7, 000	6, 200	29					
Chatham	6	421. 77	22, 900	18, 400	89	5	376. 83	19, 800	16, 000	79	1	44. 94	3, 100	2, 400	10
Harwick	19	1, 101. 53	50, 250	43, 300	244	12	878. 80	43, 500	37, 200	191	7	222. 73	6, 750	6, 100	53
Dennis	18	755. 24	30, 500	31, 200	185	12	547. 42	24, 850	22, 800	132	6	207. 82	5, 650	8, 400	53
Barnstable	3	142. 56	5, 400	6, 400	28						3	142. 56	5, 400	6, 400	28
Fair Haven	1	55. 63	2, 500	1, 000	12						1	55. 63	2, 500	1, 000	12
Total	279	16, 673. 98	750, 895	755, 800	3, 493	169	11, 625. 59	508, 845	512, 200	2, 334	110	5, 048. 39	242, 050	243, 600	1, 169
CONNECTICUT.															
New London	2	187. 68	14, 000	6, 800	34	2	187. 68	14, 000	6, 800	34					

*This vessel, though owned at Eastport, is chartered and run by Portland capitalists, and therefore more properly belongs to the Portland fleet.

40.—TABLE SHOWING THE MACKEREL FISHING FLEET OF THE UNITED STATES, CLASSIFIED BY STATES, ACCORDING TO FISHING GROUNDS.*

State.	Total.			Cape Hatteras to Gulf of Maine, inclusive.			Cape Hatteras to Gulf of Saint Lawrence, inclusive.			Block Island.			Gulf of Maine.			Gulf of Maine and Gulf of Saint Lawrence.			Gulf of Saint Lawrence.		
	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.
Maine	176	6,122.45	1,403	20	1,288.70	264	3	215.67	41				146	4,197.09	1,005	5	282.96	66	2	138.03	27
New Hampshire	11	567.53	113										11	567.53	113						
Massachusetts	279	16,673.98	3,493	38	2,513.02	528	3	178.43	41	12	201.82	59	186	11,195.60	2,356	24	1,580.59	308	16	1,004.52	201
Connecticut	2	187.68	34													2	187.68	34			
Total	468	23,551.64	5,043	58	3,801.72	792	6	394.10	82	12	201.82	59	343	15,960.22	3,474	31	2,051.23	408	18	1,142.55	228

* The figures for Massachusetts represent the condition of the fleet for 1879; the fleets for the other States are shown for 1880. During the last-named year not over 25 American vessels visited the Gulf of Saint Lawrence, some of these remaining only a few weeks.

41.—TABLE SHOWING THE MACKEREL FISHING FLEET OF THE UNITED STATES, CLASSIFIED BY STATES, ACCORDING TO KIND OF APPARATUS USED.

State.	Total.			Vessels using line.			Vessels using net.			Vessels using line and purse-seine.			Vessels using purse-seine.		
	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.	Vessels.	Tonnage.	Men.
Maine	176	6,122.45	1,403	51	773.63	205	40	562.41	137				85	4,786.41	1,061
New Hampshire	11	567.53	113										11	567.53	113
Massachusetts	279	16,673.98	3,493	30	900.06	211	4	78.61	28	5	257.64	52	240	15,437.67	3,202
Connecticut	2	187.68	34										2	187.68	34
Total	468	23,551.64	5,043	81	1,673.69	416	44	641.02	165	5	257.64	52	338	20,979.29	4,410

42.—THE PRODUCTS OF THE NORTH AMERICAN MACKEREL FISHERY FOR 1880. (With tables.)

From the earliest settlement of the country the mackerel fisheries have been extensively prosecuted by a large number of people living along the New England coast as well as by many of the inhabitants of the British Provinces. The catch has varied greatly from time to time, and seasons of extreme plenty have often been followed by those of remarkable scarcity. Various theories have been advanced to account for this fluctuation. Many have been inclined to attribute it to overfishing or to the apparatus employed in the fishery, while others claim that the movements of the fish are affected by natural causes, such as temperature, currents, the presence or absence of food, and the like, over which man has little or no control. Whatever the causes that influence the movements of the fish, the fact of great variation in the abundance of the species from time to time remains.

In 1804, according to the returns of the various fish inspectors, 8,079 barrels of mackerel were packed in Massachusetts, while in 1814, only 1,349 barrels were put up. In 1831 the quantity was increased to 383,658, this being the largest amount ever inspected in the State. A period of scarcity followed, and between 1839 and 1845 the inspection returns show an average of only 67,674 barrels annually. About 1860 the fish were again abundant, and for eight years the quantity packed averaged 246,877 barrels. This period of plenty was in turn followed by one of scarcity, which culminated in 1877, at which time only 105,017 barrels were inspected, and the fishery was practically a failure, resulting in great loss both to fishermen and capitalists. Fortunately this condition of affairs is at an end, and the fishery is again in a prosperous condition; the catch of the New England fishermen at present, if we include the fish sold fresh, being larger than at any time since the origin of the fishery.

In 1880 the New England mackerel fishermen met with marked success, though those of the British Provinces were not so fortunate. By the middle of March a number of the Maine and Massachusetts vessels sailed for the South to engage in the spring fishery, and by the 20th of the following month the last of the fleet, which consisted of 64 sail, averaging 65.66 tons each, were under way. The season opened with a haul of 25,000 mackerel taken off the Virginia capes on the 2d of April. These were carried to New York where they met with a ready sale at good figures. From that time mackerel were taken frequently, the fleet working northward with the fish as the season advanced, reaching Long Island about the last of April, and Cape Cod a few weeks later. The season was not a very satisfactory one for the Southern fleet, as the catch was small, and the fish were of poor quality, a majority of the vessels engaged making comparatively light stocks, while many of them scarcely paid expenses. As the summer approached, the fishing improved greatly, the fish increasing both in number and quality, and the Southern fleet was joined by a large number of vessels from the various fishing ports. Later, as the vessels arrived from their trips to the codfish banks, many were fitted out to engage in the mackerel fishery, and by the 1st of August the fishing was at its height, the fleet numbering 468 sail, averaging a trifle over 50 tons apiece. Of this number 343 were provided with purse-seines for engaging in the off-shore fisheries, while 125 fished with hook or net chiefly on the in-shore grounds. The value of this fleet, including the fishing gear and the outfits, reached $2,122,360, and 5,043 men were employed. A little later in the season about 25 of the vessels proceeded to the Gulf of Saint Lawrence in the hope of meeting with better success; but few fish were seen, and the venture resulted disastrously to a large majority of them, many failing to pay expenses, while a few returned without having caught a fish. These vessels on their return at once joined the home fleet, and meeting with good success, most of them were enabled to make good the loss which they had previously sustained.

About the 1st of July an unprecedentedly large body of mackerel entered the Gulf of Maine, many of them visiting the shore-waters, entering the various harbors and coves, where they remained for some weeks. During their stay in these in-shore waters thousands of men and boys engaged in their capture from small boats, and in many localities a majority of the male population participated in the fishery to a greater or less extent. The pound-nets along the southern coast of New England were peculiarly successful, while large quantities were taken in the traps and weirs between Cape Cod and Penobscot Bay. Probably not less than 10,000 people along various portions of the coast of Maine were engaged in mackerel hooking during some portion of the season, though many of them fished chiefly for pleasure, while others caught only limited quantities for home supply. About 3,500 followed the business regularly for some time, many of them realizing considerable profit from the work. In Massachusetts a similar condition of affairs existed, and thousands of persons engaged in the fishery from small boats to a greater or less extent, fully 2,000 fishing extensively for profit.

Most of the fish taken by both the vessel and boat fishermen were of uniform size and of excellent quality. Few extremely large ones were secured, while there was also a notable absence of "tinkers." Over two-thirds of the catch were branded as "twos," many of them going as "extras." During the season, which lasted till the 1st of December, nearly 132,000,000 pounds of mackerel were taken. Of this quantity the Massachusetts fishermen caught 95,000,000 pounds, and those of Maine secured 31,000,000 pounds, the bulk of the remainder being taken by the citizens of New Hampshire and Connecticut. Over 75 per cent. of the entire catch was salted, about 22,000,000 pounds were sold fresh for food, nearly 5,000,000 pounds were used for canning, and the rest were sold for bait or for fertilizing purposes. The value of the catch, as placed upon the market, was $2,606,534. The following table shows in detail the extent and value of the fishery for the United States during the year:

Table showing, by States, the quantity of mackerel taken by the New England fishermen in 1880, and the value of the same in the condition in which they were placed upon the market.

State.	Total.		Disposition of catch.				
	Pounds of round mackerel taken.	Value of mackerel as sold.	Pounds used for pickling.	Pounds used for canning.	Pounds used fresh for food.	Pounds used fresh for bait.	Pounds used fresh for fertilizer.
Total	131, 939, 255	$2, 606, 534	103, 142, 400	4, 957, 455	22, 239, 400	1, 100, 000	500, 000
Maine	31, 694, 455	659, 304	27, 342, 000	1, 252, 455	3, 000, 000	100, 000	
New Hampshire	2, 573, 000	48, 181	2, 379, 600		193, 400		
Massachusetts	95, 528, 900	3, 858, 342*	72, 153, 900	3, 705, 000*	18, 170, 000	1, 000, 000	500, 000
Rhode Island	89, 000	1, 669			89, 000		
Connecticut	1, 303, 900	24, 976	1, 266, 900		37, 000		
New York	750, 000	14, 062		(?)	750, 000		

*Including both the fresh and salt mackerel used for canning.

As already intimated, there was a great falling off in the Provincial mackerel fisheries during the year, the bulk of the catch, which amounted to over 70,000,000 pounds, according to the Canadian Fishery Report,† being taken by the shore fishermen of Nova Scotia and Prince Edward Island. Of the entire quantity 233,669 barrels were pickled. In the Canadian report the average price of the salt mackerel is given as $9.25 per barrel, but as the fish were much inferior in quality to the American catch, these figures are evidently incorrect. Statistics show that 105,730 barrels of the above, equal to nearly one-half of the catch, were marketed in the United States (and it is fair to presume that these were of average quality), where they were ordinarily sold at lower figures than the fish taken by the New England fleet. If we suppose the Canadian fish to be equal to those taken on our own shores (a supposition which is hardly warranted), the value of the catch, as given by the Canadian authorities, must still be reduced by $818,662, as the average price of the New England fish during the season was only $5.75 per barrel.

The following table shows in detail the extent of the catch for the several Provinces:

†Supplement No. 2 | to the Eleventh Annual Report of the | Minister of Marine and Fisheries | for the year 1880. ═══ Fisheries Statements | for the year | 1880.——— Ottawa: | Printed by MacLean, Roger & Co., Wellington street. | 1881.

Table showing the quantity and value of the mackerel taken in the Dominion of Canada in 1880, *as shown by the Canadian Fishery Report.*

Provinces.	Grand total.			Pickled mackerel.			Canned mackerel.			Page of Canadian Report from which the figures are taken.
	Pounds fresh mackerel required.	Value of prepared products, according to Canadian Fishery Report.	Value of prepared products at New England prices.	Number of barrels put up.	Average price per barrel.	Value.	Number of cans put up.	Average price per can.	Value.	
Total	70, 271, 260	$2, 178, 966	$1, 355, 441	233, 669	$9. 253	$2, 162, 258	*13, 707	$0. 147 –	$16, 708	....
Ontario	....	....	....	....	....	....	....	....	....	292
Quebec	1, 505, 100	40, 878	28, 848	5, 017	8. 15	40, 878	....		....	pp.53, 76, 100, 118.
Nova Scotia	37, 990, 080	1, 270, 368	731, 184	126, 432	10. 00	1, 264, 320	40, 320	. 15	6, 048	165
New Brunswick	5, 994, 640	206, 464	119, 906	19, 650	10. 00	196, 500	66, 427	. 15	9, 964	215
Prince Edward Island	24, 781, 440	661, 256	475, 503	82, 570	8. 00	660, 560	6, 960	. 10	696	249
British Columbia	....	....	....	....	....	....	....	....	....	269

* In estimating the pounds of fresh mackerel required and the value of prepared products at New England prices, the cans shown here are regarded as 1-pound cans.

In the tables from which the above summary has been compiled, no allowance seems to have been made for local consumption. A rough estimate of the amount used in this way would be 18,000,000 pounds, making a total catch for the Provinces of about 88,000,000 pounds, worth, at prices current in the United States, not far from $1,620,000.

Mackerel are not abundant in the waters of the Newfoundland coast, and few are taken by the fishermen. The returns for the year ending July 31, 1881, show that only 181 barrels were exported. This quantity, which equals 54,300 pounds of fresh fish, doubtless represents the bulk of the mackerel taken, as few are consumed locally. Allowing an equal quantity for local consumption, we have only about 110,000 pounds, valued at $1,650, taken by the islanders.

By combining the catch of the New England, Canadian, and Newfoundland fishermen, we have the total product of the mackerel fishery for the western Atlantic in 1880. This is found to be about 220,000,000 pounds of round mackerel, valued at $4,228,000. This value represents the fish as they are first placed upon the market. If the value to the consumer is desired, the figures must be nearly doubled, to include the transportation charges and the profits of the various middlemen who handle them.

V.—THE MACKEREL-CANNING INDUSTRY.

By R. Edward Earll.

J.—THE ORIGIN AND DEVELOPMENT OF THE MACKEREL-CANNING INDUSTRY.

43.—The methods and statistics of canning.

The first experiments in the canning of fish on the American continent were conducted at Halifax, Nova Scotia, by Mr. Charles Mitchell, a native of Aberdeen, Scotland, who came to America in 1840 to engage in this work. During his stay in Halifax he was engaged in the canning of salmon and meats of various kinds. Later he removed to the United States and continued the work, putting up lobsters, salmon, and such other fish as were thought desirable. It was in this way that the value of the mackerel as a canned fish came to be known to our people. Prior to 1850 a few were canned in Boston and small quantities were put up at the lobster canneries in the State of Maine. From that date the business has been continued on the Maine coast, though for many years it was very limited, as the qualities of the mackerel when prepared in this way were not at first fully appreciated. The trade, however, has increased slowly from year to year, until canned mackerel are now handled by the principal dealers of all of the larger cities throughout the entire country.

Prior to 1872 the only canned mackerel seen in our markets were fresh fish prepared in hermetically sealed cans by means of the ordinary process. At this time it was found that there was a growing prejudice against salt mackerel, owing to the size and quality of the packages in which they were placed upon the market. The smallest packages known to the trade were kits holding from 15 to 25 pounds each. These contained more fish than the average family cared to purchase at a time; and after a package was once opened, unless it was properly cared for, the brine was apt to leak out, leaving the fish exposed to the air, thus causing them to rust and otherwise deteriorate.

In the fall of 1872 Mr. Edward Pharo, of Philadelphia, obtained a patent covering the packing of salt mackerel in small hermetically sealed packages.* For some time the business was very limited, but later

---

*We are indebted to Mr. A. Howard Clark for the following letter of specifications regarding Mr. Pharo's patent:

IMPROVEMENT IN PUTTING UP SALT MACKEREL AND SIMILAR FISH.—(Letters Patent No. 132,316, October 15, 1872.)

* * * Heretofore salt mackerel have been put up in wooden barrels, kegs, and kits. The form or kind of vessel was made necessary by the fact that it was difficult or practically out of the question to make a square water-tight box. Hence, also, the size of the package was limited; that is, no package smaller than the kit—which holds, say, about 25 pounds of fish—could be conveniently employed. The result was that many families were deprived of purchasing from first hands, as even the smallest-sized package—a kit—is much too large for many persons to buy. Another objection was on the part of dealers who, not selling in bulk, were obliged to open the packages and handle the mackerel, a necessity particularly disagreeable to country dealers, who keep stocks of silk and dry goods which are soiled by a contact with brine. The odor, too, arising from an open barrel of salt mackerel is held in extreme repugnance by many people. To obviate these several objections I have devised a method whereby salt mackerel can be put up in any sized packages, so as to come within the reach of persons of limited incomes, which will enable the dealer to keep on hand a stock whence no offensive odor arises, and which can be disposed of without breaking packages. My invention, then, consists in putting up salt mackerel in hermetically sealed packages, preferably in metallic boxes. The boxes are made of any size and shape, though I prefer to make them cubical in form, and of dimensions to hold, say, five, ten, or fifteen pounds of mackerel. When metal is employed in the construction of the boxes, I design using a wash or varnish to protect the same from the action of the pickle. When metal is not used, but instead some material which may not be acted upon by the brine, this wash may be dispensed with. Although metal is deemed the most suitable material for the boxes, India rubber or some other substance may be advantageously employed.

Besides those already enumerated, another advantage of this method of putting up salt mackerel is that the purchaser pays only for what he gets. Thus a quarter barrel of mackerel is supposed to run fifty pounds, and a purchaser, in buying a package of that size, imagines that he gets that quantity. Frequently, however, the packages run short; a quarter barrel, for instance, of "repacked" containing generally only about thirty-five pounds. When, however, he buys by the pound, as he must do in this case, he pays, as already remarked, only for what he gets. Still another advantage of this method is that, as I design using only the best quality of fish, the interest of the purchaser is consulted, which is not always the case now, as the packer, not having a due regard for reputation, puts up an inferior quality of goods, and does not give full weight.

What I claim as my invention, and desire to secure by letters patent, is the herein-described method of putting up salt mackerel, namely, in a hermetically sealed box

EDW. A. PHARO.

the fish dealers of the principal cities began to realize the importance of this method for increasing the demand for salt mackerel, though, as far as we can learn, the fact that a patent had been issued has from the first been entirely ignored. In the spring of 1879 Henry Mayo & Co., of Boston, engaged extensively in mackerel canning, utilizing the ordinary salt fish, which were put up in tin cans holding from five to ten pounds each. A little later a number of the principal fish dealers of Boston and Gloucester turned their attention to the business, which soon came to be very extensive. The quantity put up in 1880 was double that for 1879, and the products for 1881 were considerably in excess of those of 1880. The present season, according to Mr. W. A. Wilcox, there is a notable falling off in the business, and the quantity canned will be quite small; the decrease being largely due to the loss occasioned by the rusting of the cans. If this difficulty can be overcome the trade seems destined to develop enormously, as the size of the package, and the convenience of handling and keeping the fish have brought them into favor among the consumers.

In the spring of 1880 parties interested in the preparation of sardines at Eastport secured a limited quantity of small mackerel, which they canned and placed upon the market as "broiled mackerel." The cans used were like those employed for the large herring which are known by the trade names of "brook-trout" and "sea-trout," and the methods of preparation were very similar. The mackerel were found in every way superior to the herring, and the demand for them has been constantly increasing to the present time.

The advantages of mackerel canning are many. Perhaps the greatest point in favor of the industry is the fact that it gives an outlet for the small mackerel, which, for canning purposes, are found superior to the larger ones. The small fish known as "tinkers" are very abundant along the New England shores, great quantities of them being taken by the fishermen, who, on account of their small size, which renders them undesirable for salting, have heretofore experienced great difficulty in finding a market for them, and have frequently been obliged to throw them away. Limited quantities are sold fresh in the larger markets, but boat fishermen living at a distance are unable to avail themselves of the opportunities offered, owing to a lack of suitable means of transportation; while the vessel fishermen find it difficult to dispose of small fish when larger ones chance to be abundant, and the price paid for tinkers is always exceedingly low. The canning of mackerel, then, is peculiarly important, in that it renders valuable for purposes of food immense quantities of otherwise worthless products. The boat fishermen are greatly benefited by the development of the industry, as with a demand for the small fish they find remunerative employment in fishing at a time when there is little else to occupy their attention.

COOKED MACKEREL.—Prior to 1879, when salt mackerel were first put up in tin packages, nearly all of the canned mackerel were packed by parties engaged in lobster-canning, the same apparatus being used for the work. The factories are open for the canning of lobsters about the 1st of April, from which date to the 1st of July a large force is kept constantly busy. About this time the lobsters begin "shedding" in such numbers as to seriously interfere with the business, and the factories are often obliged to discontinue the work till late in the fall. Fortunately, however, the mackerel usually make their appearance on the coast at this season, and many of the factory-men turn their attention to packing them, thus furnishing employment to their hands during the summer months. The canneries for this work are located on the coast of Maine, and, with the exception of the recently developed canning interest in Boston, Maine has practically a monopoly of the business for the United States, though limited quantities are put up by the lobster canners of the British Provinces. As has been said, the fish usually arrive early in July, gradually nearing the shore, until, in a few weeks, they are abundant in many of the coves and harbors of the New England coast. For several weeks during the height of the season the majority of the male population of the smaller fishing ports are engaged in hooking mackerel, a considerable revenue being derived from this work. This is especially the case in the vicinity of the canneries, where a good market is usually found for the catch. The fishing continues till early in October, when the mackerel leave for warmer waters.

In the canning of lobsters it is necessary that each factory should be provided with smacks or small vessels for gathering its supply. These usually visit the different fishing stations within a radius of 20 to 30 miles of their respective factories, gathering the lobsters from the fishermen, who would find it difficult to run them to market in their small boats. These vessels are often used in the same way for securing a supply of mackerel for the canneries. As a rule, they are ordinary sloops or schooners, but the factory at Castine is provided with a small steamer, by means of which it is enabled to cover a much larger territory, bringing the fish to the factories in excellent condition.

The catch varies greatly with the season; some years large quantities of mackerel are taken, while again the fish are scarce, and but few are secured. The price paid along the different portions of the coast is quite uniform, the fishermen usually receiving 1 to 1½ cents per pound for the fish as they come from the water, though in some localities the fish are dressed by the fishermen, and in this condition bring about two cents per pound.

To obtain the best results it is necessary that the mackerel should be canned as soon as possible after they are caught. On reaching the factory the heads, tails, and entrails are removed, after which the fish are thoroughly washed and placed in strong brine, in which they are allowed to remain long enough to give them a salty flavor. They are then packed in cans which are at once carefully sealed. These are immersed in boiling water, where they remain till their contents are thoroughly cooked. They are next "vented," and after cooling are sent to the paint-room, where they are dipped in thin paint or varnish, which serves to protect them from rust. When dry they are covered with attractive paper labels and packed in cases for shipment. The cans used are similar to those employed for packing fruit, being made of tin and having a cylindrical form. Two sizes are used by most of the canners. The smaller, for which there is a large demand, is 4½ inches in height by 3 inches in diameter, and holds about 1 pound of fish; the other is 4½ inches high by 3½ inches in diameter, and contains about 1½ pounds, though it is ordinarily known as a 2-pound can. A larger size, holding 3 pounds, is sometimes employed. The loss in dressing varies from 25 to 35 per cent., according to the size and condition of the fish, while the labor of cleaning and canning costs from 18 to 22 cents per dozen cans. Fifteen to twenty-five persons constitute an average working force for a cannery. One-half of these are women and children, who receive from 50 to 75 cents per day for their services; the remainder are tinsmiths and laborers, whose compensation ranges from $1 to $3 per day, according to agreement.

The price of canned mackerel is largely dependent upon the quantity packed during a given season. In 1880 the price at the factory was $1.25 per dozen for the 1-pound cans, while the 2-pounds sold for $1.85. In 1881 it is said to have been reduced to $1 for 1-pounds, and $1.50 for twos.

Until 1880, as already stated, the canning of fresh mackerel was confined almost exclusively to the lobster canneries on the coast of Maine. At this time, however, a number of Boston dealers engaged extensively in the work, and, according to Mr. Wilcox, 750,000 pounds of fresh mackerel were used for canning, the product of the canneries amounting to 480,000 1-pound and 24,000 2-pound cans, valued at $53,700. During the same season the Maine canners purchased 1,252,455 pounds of mackerel, from which 814,668 cans of the various brands were put up, their value at wholesale prices being $96,749. In other portions of the country a limited quantity of mackerel, estimated at 60,000 cans, valued at $6,500, were packed. In 1881 the Boston business had, as we are informed by Mr. Wilcox, increased enormously, and during the summer 1,764,000 cans were put up. The quantity for Maine was increased to about 1,000,000 cans, and that for other places doubtless reached 100,000, making a total of 2,864,000 cans. In 1879 the quantity for the entire country did not exceed 900,000 1-pound cans.

SALT MACKEREL.—The canned salt mackerel, as has been remarked, are put up from the ordinary pickled fish. Different brands are used for this purpose. Some packers select large fish of the best quality, though a majority use standard No. 2's. In preparing them for the cans, they are carefully washed and scraped so as to give them a neat and attractive appearance. Frequently the heads and tails are removed, and, if of large size, the mackerel are cut in halves to facilitate packing. When the can contains the proper weight of fish it is filled with strong brine and carefully sealed; after which it is labeled and packed for shipment.

No uniform standard of shape or size has been adopted in the manufacture of cans for this trade, those used being either square, oblong, or cylindrical, as the packer may think most desirable. Those oftenest seen in the markets are cylinders, 4 to 5 inches high, and 6 to 8 inches in diameter, holding from 5 to 6 pounds. Other and larger sizes, holding from 10 to 15 pounds, are frequently seen.

During the season of 1880 the wholesale price averaged $5.50 per dozen for 5-pound cans. The cans usually bear the brand of the deputy inspector under whose supervision they are packed, this being in accordance with the Massachusetts inspection law.

The business has from the first been confined largely to Boston and Gloucester. Mr. A. Howard Clark informs us that 100,000 5-pound cans were put up in the latter city in 1879, and Mr. Wilcox gives 72,000 cans as the quantity packed by the dealers of the former place. In 1880, according to the same authorities, Boston parties packed 144,000 cans, and the Gloucester firms put up about 135,000. The quantity for the entire county, including those packed in New York and other places, is estimated at 360,000 cans, valued at over $150,000.

BROILED MACKEREL.—At the sardine canneries two methods have been adopted for the preparation of mackerel. The first originated with Mr. Julius Wolff, of the Eagle Preserved Fish Company. By it the fish are treated in a manner exactly similar to that employed for certain brands of sardines. They are carefully cleaned and dried, after which they are fried in oil and packed in cans with vinegar and spices. The second method, which is now extensively adopted, originated with Mr. Henry Sellmann of the Americann Sardine Company. In June of 1880 Mr. Sellmann, fearing that the increased number of canneries at Eastport, Me., would result in a scarcity of herring, decided to erect one at Camden near the mouth of the Penobscot River, where small herring were reported to be abundant. Failing to secure a sufficient quantity of herring, he turned his attention to the canning of mackerel, buying all that were offered by the local fishermen and sending daily to Boston for an additional supply.

In preparing the fish, the heads, tails, and viscera are removed, after which the bodies are thoroughly cleansed and immersed in strong brine for a few minutes. When they have absorbed a sufficient quantity of salt they are again washed, spread upon wire trays, and placed in a tight box, where they are steamed for several minutes. The trays containing the fish are next placed in a large oven, to be thoroughly baked or broiled. On removal they are packed in oval tin boxes, holding about three pounds each, and covered with mustard, or with a dressing consisting of tomato-sauce seasoned with spices. The cans are then sealed and placed in a hot-water bath. When sufficiently cooked they are taken out and "vented." They are then allowed to cool, after which they are neatly labeled as "fresh-broiled mackerel," and packed in wooden cases for shipment. Mackerel prepared in this way are, on account of their delicate flavor, far superior to any of the brands of herring, and from the first the demand has been greater than the supply. Owing to the favor with which the goods were received Mr. Sellmann soon found it desirable to locate a factory at some point where a large and constant supply of fish could be depended upon. Accordingly, in the spring of 1881 he associated with himself other capitalists, and built a cannery at Gloucester, Mass., where considerable quantities of mackerel have been packed. Up to the close of the season no other factories were built for the preparation of broiled mackerel, but it is thought that in 1882 a good many persons will devote their attention to this industry. In 1880 Mr. Sellmann packed 50,784 cans, valued at $16,400, and in 1881 the combined product of the Camden and Gloucester establishments was about 200,000 cans.

VI.—METHODS OF PACKING, AND INSPECTION LAWS.

By A. Howard Clark.

K.—METHODS OF PACKING AND INSPECTION LAWS.

44. Methods of packing mackerel.

The bulk of the catch of mackerel by the American fleet is cured in pickle, being split, and salted in barrels. Some of the salt mackerel are afterwards smoked, but this method of curing is practiced only in two or three places, and here only to a very limited extent, though in parts of Europe a large business is done in the smoked product. The European way of preparing mackerel for salting is much inferior to the American method. The fish are cut open with a knife along the belly, instead of being split down the back. The gills and entrails are taken out, and the fish are then packed, belly up, in barrels. This is a very poor way of handling mackerel, for they are not soaked, and the blood remaining in them makes them dark-colored and liable to spoil in a short time.

In previous sections of this report the manner of handling mackerel on board of the fishing-vessels has been fully described. Until about the beginning of the present century the labor of splitting and salting could be done on shore, since the fish were sufficiently abundant near the land so that boats or vessels made but short trips, disposing of their fares each day in a fresh condition. With the growth of the industry it has been found necessary to follow the fish further from land, and with the larger class of vessels employed it has for some years been more convenient and profitable to make longer trips than formerly. It has, therefore, become customary to perform much of the work of preserving the fish on board the vessels instead of on shore. After being captured, the mackerel are immediately split, salted in barrels, with sufficient pickle to insure their preservation at least until the vessel shall arrive home, and the barrels are stowed in the hold. When a fare is secured the vessel returns to port to "pack out." The barrels of fish are at once landed on the wharf, when they are culled into grades as defined by law, and, after being properly weighed, are put up in various sized packages and distributed over the country. In most of the New England States there are laws that require each package to be branded by an authorized inspector, who must thus certify that it contains the designated kind, grade, and weight of fish, and that they are properly preserved. The same fish are sometimes repacked in the Western and Southern States and resold under brands different from those required by the laws of New England.

The manner of handling mackerel, though differing in some of the minor details, is essentially the same for all of the New England ports. The method described in this chapter is that pursued at Gloucester where great quantities of mackerel are annually packed.

The barrels of fish are hoisted by horse-power from the vessel's hold to the wharf, and are set on end until all are ready for packing. They are next unheaded and the mackerel emptied, one or more barrels at a time, into the culling-crib,* around which stand three or more "cullers," who separate the fish into several grades, throwing them into weighing-tubs holding about 100 pounds each. After being weighed the fish are thrown into the packing-crib, and are ready to be put into barrels or smaller packages. The first two tiers in the bottom of a barrel are placed flesh up, and the successive layers back up. Over each layer is sprinkled a few handfuls of salt, using about a half bushel, or 35 pounds, to each barrel. The law requires that a barrel shall contain 200 pounds of mackerel exclusive of the weight of the pickle, and that half, quarter, and eighth barrels shall contain proportionate quantities. Smaller packages of any size may be put up, provided the weight is properly branded thereon. The cooper now heads up the barrel and rolls it along the wharf in the proper row for each grade. It is next taken by the pickler, who bores a hole in the side and pours in some brine. For this purpose he places in the hole the pickle-tub, which is an ordinary water-bucket, with a copper nozzle in the bottom, thus making a very good funnel. The pickle is usually the same as taken from the barrel of mackerel as it comes from the vessel, being poured from the barrel into a pickle tub or butt and then dipped by the pickler. It may be strengthened by the addition of fresh salt, and is considered of the proper strength when it will float a mackerel of ordinary fatness. The barrel having been filled with pickle, the hole is plugged up, and it is then turned on end ready for branding. It is often allowed to remain for several days on its side or on end, in order to allow the fish to settle, and is then refilled with pickle. A lack of sufficient pickle is determined

*A culling-crib may be of any size, but is usually a wooden box 5 feet long, 3 feet wide, and 8 inches deep, with slat bottom, and is set on legs 2½ or 3 feet high.

by the sound produced by striking the barrel with a stick or cooper's hammer.

The labor of packing or putting the fish in barrels is generally done by boys from ten to eighteen years of age, who receive about 5 cents per barrel for this work, and often make good days wages as they become very expert. Captain Collins mentions one instance of a Gloucester boy, twelve years old, who packed 49½ barrels in one day, and on another occasion 143 barrels in less than four days.

The entire work of culling, weighing, packing, and pickling must be under the personal supervision of an inspector, who puts his official brand on the head of each package. This brand must state the kind and grade of fish in the package, the name of the inspector, the name of the town and State where packed, and the date of packing. In Massachusetts the year when they are put up is considered sufficient, but in Maine and New Hampshire the month must also be given. After being kept all winter, or even for a less time, the mackerel may become rusty or the pickle may leak out, so that they may require repacking and reinspection. Illegal branding by an inspector is punished by fine and removal from office.

There is very little difference in the inspection laws of the several States defining the grades of mackerel. In Massachusetts there are five qualities, called numbers one, two, three large, three, and four. New Hampshire has the same grades. Maine laws define a grade called number three small; that is, the same as number four of the other States. The first grade, or *number one*, must be mackerel of the best quality, not mutilated, free from rust, taint, or damage, and measuring not less than 13 inches from the extremity of the head to the crotch or fork of the tail. *Number two* are those of the next best quality, free from rust, taint, or damage, and measuring not less than 11 inches in length. Those that remain after the above selections, if free from taint or damage, and measuring not less than 13 inches in length, are *number three large*. The next inferior quality, free from taint or damage, and not less than 10 inches in length, are *number three*. All other mackerel free from taint or damage are called *number four*. Rhode Island laws declare that "every cask of pickled codfish and mackerel offered for sale, or for exportation from the State, shall also be branded No. 1, No. 2, or No. 3, to denote the quality of such fish."

Besides the regular grades required by law, dealers are accustomed to make other qualities, designated *extra ones*, *extra twos*, and *mess mackerel*. The first named are superior both in size and fatness, and are sold at a great advance over ordinary number one fish. Extra two mackerel are better than ordinary two, and are in all respects equal to ordinary number one fish, except in the length; these also bring an advanced price. Mess mackerel are made from any grade, but principally from numbers two and one fish, free from the heads and tails, and with the blood scraped off.

The size and material of packages for pickled mackerel are regulated by law. The Massachusetts statutes require that pickled fish be put up in tierces containing each 300 pounds; in barrels, 200 pounds; half-barrels, 100 pounds, or in packages containing a less quantity, upon which the weight of the fish therein is legibly branded. Large quantities of mackerel are put up in a sort of firkin, called a kid or kit, which holds about 25 pounds, or an eighth of a barrel. Quarter-barrels are also used to a considerable extent, and for the last two or three years packers have used tin cans containing about 5 pounds of fish each.

All packages, except those containing less than 25 pounds weight, must be made of sound, well-seasoned wood, and be well hooped. The staves may be of either white or red oak, spruce, pine, or chestnut, and must be 28 inches long. The heads may be of either above kinds of wood, planed, and when of pine must be free from sap or knots. They must measure seventeen inches between the chimes. Each tierce, barrel, and half-barrel must be well hooped with at least twelve hoops, three on each chime and the same number on each bilge. The barrels must contain not less than 28 nor more than 29 gallons; the half-barrels not less than 15 gallons, and the tierces not less than 45 nor more than 46 gallons each. Each cask must be made in a workmanlike manner, and be branded on its side, near the bung, with the name of the maker. All casks not properly made may be rejected by the inspector. New Hampshire laws require rift timber for staves. In Maine poplar staves are also allowed.

Barrels for packing fish are manufactured in various parts of New England, but most of them are made in Maine, Bangor being the headquarters for this industry. They are sent to the fishing ports either put together ready for use or in shooks that are made into barrels at the cooper-shops in Gloucester and other places. The demand for barrels at the fishing ports sometimes exceeds the supply, so that their value is greatly enhanced. In 1881, during the height of the season, they frequently sold at over a dollar apiece, but the usual price for some years past has been from forty to sixty cents. Old barrels that have served one or more trips on the vessels for holding salt or fish are often repaired and sold at cheaper rates.

While Trapani, Cadiz, and Liverpool salt are used in salting mackerel, Liverpool salt is more generally preferred, as it keeps the fish in better condition. The salt is taken from home by the mackerel vessels. It is carried in barrels that are stowed in the hold until occasion comes to use it, when it is emptied and the barrels are used for mackerel.

The quantity of salt required to prepare a barrel of mackerel ready for branding is about 108 pounds. On the vessel it is customary to use one and one-sixth bushels of salt for stowing down each barrel of fish, or 3½ bushels for three barrels. On shore one-half bushel is used for each packed barrel, and as there is a shrinkage of one-tenth in packing, we find the total quantity of salt required to produce a barrel of packed mackerel is 108 pounds, or three pounds over a bushel and a half of salt. The entire shrinkage on mackerel from the fresh to the packed state is 33 per cent.

The cost of packing mackerel varies with the price of barrels, salt, and labor. During the war it was very high, and it continued so until about 1876, when it was reduced to about $1.75 per barrel. In 1880 it varied from $1.30 to $1.50, and in 1881, owing to a large demand for barrels for the increased catch of fish, packing advanced to $2 during the height of the season, and averaged about $1.75. This cost of packing includes all the expense incurred in preparing the fish for market after they have been received from the vessel in sea-packed barrels.

The packer is generally a deputy inspector, who is also part owner of the fish to be packed and inspected. He therefore realizes a profit both in the packing and in the sale of the mackerel. In some cases, however, the packer is not at all interested as an owner, but is hired as a deputy inspector to prepare the fish for market. With a gang of men he goes to the wharf where the mackerel have been landed from the vessel, and being provided by the owners of the fish with barrels, salt, pickle, and culling and weighing apparatus, he performs the work, and charges from 50 cents to $1 for assorting, weighing, packing, coopering, and branding. He may also make a profit on the labor in addition to his lawful inspection fee.

The inspection fee, exclusive of the labor and cooperage, is 9 cents per barrel in Massachusetts and New Hampshire, of which amount the personal inspecting officer is entitled to 8 cents and the general inspector to 1 cent. In Maine, where there is no general inspector, the fee is 7 cents per barrel. This fee is to be paid by the owner of the fish or the person hiring the inspector, and may be recovered of a purchaser.

In settling with the crew of a mackerel vessel under the old methods of capture, the share of each man depended on his individual catch of fish. At the present day, when seining is the almost universal mode of capture, it is impossible to follow the old way of determining the shares, what the men receive depending on the total catch. One man may receive a half or quarter share because of his inexperience, while another may receive a share and a half for his unusual activity or some other reason. The extra half share, however, would be paid by the owners of the vessel as a premium for the best work.

Barrels and salt for use on the vessel are provided by the vessel-owners, who also furnish the apparatus of capture and the provisions for a trip. Stock charges or the expense of bait, if it be used, harbor dues, and some other items are paid one-half by the owner and one-half by the crew. Several other items, called the crew's expenses, as the wages of a cook, the milk and water used on the trip, the cost of hoisting the mackerel from the vessel to the wharf, towing, and extra labor for scraping and tarring are paid entirely by the crew.

When the mackerel are packed and sold, the fishermen are entitled to one-half of the net proceeds of sale, and the vessel-owners to the other half. The difference between the gross and net proceeds is the cost of packing, including the barrel and the stock charges. Thus, a trip of mackerel may be sold for $5,000. The stock charges may be $300 and the cost of packing $600. The net proceeds would be $5,000, minus $900, or $4,100. One half the net proceeds, or $2,050, is the owner's share, and the other half the crew's share. From the crew's half must be deducted the crew's expenses, which may be $150, thus leaving $1,900 to be divided among the men.

Prior to 1872 a settlement with the vessel's crew for a trip was not made until the mackerel were inspected and sold, which might be several months after the trip was completed. As a general rule, the vessel-owner packed and purchased the catch very soon after it was landed, and then, having settled with the crew, he waited for a favorable time to put the fish on the market. The crew have, perhaps, a legal right to take their half of the fish, after deducting stock and packing charges, and may sell that half whenever they please, but in practice the owner of the vessel usually sells the fish for the crew or buys them outright. The captain of the vessel may act as agent for the owner in selling mackerel away from home.

Since 1872, and especially during the past two or three years, many trips have been sold "out of pickle" immediately after being landed. The crew at once receive their share of money, and may proceed on another trip, and the fish may not be packed and put upon the market for several weeks, or even months. In selling out of pickle a barrel of mackerel is reckoned at 200 pounds of fish as they come from the sea-packed barrel, without being drained of pickle or the salt washed off, though the fishermen sometimes complain that there is a pretty thorough draining and washing before the fish are weighed. The price paid the fisherman is so much per 200 pounds of fish, exclusive of the barrel, which is furnished by the purchaser.

Mackerel bought from the vessel out of pickle are sometimes re-sold before being properly culled and inspected according to the letter of the law. The practice of selling out of pickle is often an accommodation to the fishermen, as it does not require them to wait for weeks or months for their money. It is also often a source of considerable profit to the purchaser, who, by careful culling, may realize a far greater proportion of good grades of fish than was estimated in buying them without being assorted.

A considerable source of profit to the dealers is the practice of buying inspected barrels of mackerel and then re-packing them, perhaps making a few more barrels of the better grades, or packing them as mess mackerel by cutting off the heads and tails and scraping off the blood. There is a loss of about 25 per cent. in weight from ordinary to mess mackerel, but usually a more than proportionate increase in the value of the fish.

There has been considerable discussion as to the relative merits of mackerel taken with the purse-seine and those caught with the hook, and interesting experiments were made a few years ago to test the keeping power of the two kinds. An experienced fish-dealer of Boston states to Capt. J. W. Collins that he very carefully salted and pickled a half-barrel of each kind, using the same quantity of salt on each. He headed the half-barrels up and set them away about the 1st of October, and when he opened them about the 1st of the following March he found a marked difference between them. The flesh of the hooked mackerel was firm and in fine condition, while the flesh of the seined fish was short and mealy, retaining little or no firmness. He thinks the same difference will hold good in most cases. The same gentleman also made very careful experiments as to the comparative merits of fresh and salt water for pickling mackerel. He salted and pickled two half-barrels, using fresh water for one and salt for the other. He put them up in the fall and opened them the following July, when he found a marked difference in them. Those filled with salt-water pickle were in excellent condition, while the others had a dirty scum on the pickle, and the flesh was dark and somewhat slimy; the skin had a whitish, discolored appearance, and the fish were thought unfit to eat. He says that in 1879 fresh water was extensively used in making pickle for fish, and thinks that when the fish are kept for any length of time they are unfit for food; hence the sale or market for pickled fish is injured.

Concerning the relative quality of hooked and seined mackerel, it appears certain, from the statements of many men of large experience, that the former are superior, and the reason is a simple one, namely, only a small quantity out of the entire school of fish is captured, and these are carefully handled, while in seining the entire school of perhaps several hundred barrels is caught and the fish are necessarily allowed to remain for a considerable time without care, so that many of them may become soft and greatly inferior in quality to fresh mackerel. With proper care the seined mackerel may no doubt be as good as the others.

There is a great difference in mackerel taken at different seasons of the year. Those caught in the early spring are very lean and shrink when pickled. As the season advances they grow fatter, and in the fall are at their best; so that the large fish taken in September and October grow heavier rather than lighter in pickle.

The care taken of mackerel in the early years of the fishery may be judged from the following instructions to the masters and crews of Massachusetts mackerel vessels, which appeared in the Gloucester Telegraph May 26, 1832. It is dated Boston, May 2, 1832, and signed James Barry, inspector-general of pickled fish:

"The mackerel fishery has already become a very important item in the catalogue of the staples of our State; and, if we may judge from its rapid progress in past years, is destined to become one of its greatest sources of wealth. Your attention is requested to the following facts and remarks: Mackerel should be split as soon as possible, and, after the blood has been soaked out of them, immediately salted with such salt as is suitable for the pupose; my own opinion is in favor of Liverpool or Cape Cod salt. It is necessary that it should dissolve as soon as possible. Eastport salt, so called, must not be used; it will not save the fish; it has proved destructive to fish and to meat. I have instructed my deputies not to pack mackerel struck with that kind of salt. Mackerel should be well salted in the first instance; it is a mischievous error that fishermen have fallen into by salting their fish too slack, as has often been the case; and another by using the plough, which has given to the fish a false appearance, and has been a source of mortification to the fishermen; and they have in a great many instances found fault with the inspectors when the fault belonged to themselves in not taking that care of the fish which it was their duty to do, and which in many cases has been a ruinous business to purchasers. By a law of this commonwealth the inspector is required to throw into an inferior quality all mackerel which have been plowed, cut, or mutilated for the purpose of deception. It can be of no advantage to the fishermen, and I trust will never again be done. I have strictly forbidden any deputy inspector from packing any mackerel with the gills or entrails in them. They must be cleansed by the fishermen before they are offered for packing; otherwise they will be rejected. You must be aware how much better a fare of mackerel are, and how much more salable, when they are brought into market clean and well struck.

"My hope is that you will take this subject into your serious consideration and remedy the evils which have existed, and which I think you will do if you wish to insure the sale of your fish and have a due regard for your own interest. Those of you who are acquainted with me will do me the credit of seeking the welfare of the fishermen, which is so nearly connected with that of the inspector.

"Wishing you success in your business and prosperity in your homes, I remain, your friend and humble servant,

"JAMES BARRY."

The following item appeared in the Boston Atlas July 15, 1845:

"For the last twenty years scarcely a year has passed but there has something new taken place in the mackerel fishery which had a bearing on the inspection laws. The mackerel are fatter or poorer, larger or smaller, plenty or scarce, some one of which are different from the previous year, and thus it is impossible to make a law to meet all these changes in every particular. Whenever a change takes place its first operation is generally in favor of one or the other, until an alteration in the law takes place or interest dictates a remedy. Such has been the case the present season in relation to the South No. 3.

"Heretofore all mackerel taken south of Nantucket have been denominated Block Island, and considered to be of inferior quality; so much so that it became necessary to designate them from the North No. 3's by the word 'South.' Now it is the reverse.

"This year the fishermen found more of the middling-size mackerel at the south and in the latitude of Block Island than formerly, and, as the law did not oblige the inspector to cull these mackerel and make two numbers, the fishermen insisted upon their being packed and branded according to the letter of the law under the brand South No. 3.

"As soon as those mackerel came into market and the true condition of the fish became known the prices began to recede. Upon learning this fact, it was immediately recommended to the fishermen and inspectors to cull their mackerel and make two qualities of South No. 3, which was, I believe, generally adopted. Thus we shall have four qualities of No. 3's, when, in fact, we ought to have but two, viz, large and small. I have thought proper to make this statement to inform the consumers and dealers in fish against any error they might be led into, supposing that all the mackerel packed in 1845 branded South are all large fish.

"E. H. LITTLE,

"*Inspector-General of Fish.*

"JULY 14, 1845."

Capt. N. E. Atwood, of Provincetown, Mass., gives the following account of the past and present methods employed for curing mackerel by salting and pickling:

"Some sixty years ago the method of catching mackerel with jig came into general use, so that in 1826 a large fleet of vessels were engaged in this branch of the fishery, fishing off the coast of Massachusetts and of Maine through the summer and autumn. Before the jig was introduced the quantity of mackerel taken was comparatively small; they were mostly caught by trailing while the vessel or boat was sailing through the waters, only a few being captured in nets. When the jig came into use the way of fishing on board of mackerel vessels was by hauling down the jib and laying the other sails in such a way that the vessel would drift squarely to leeward. Bait chopped fine was thrown overboard in very small quantities, so as to keep a small string of bait going from the vessel all the time, and the school of mackerel, meeting this bait, would follow it up to the vessel and bite at the jigs, so that the fishermen would not have to wait for a bite while the fish was inclined to take the hook. In this way a number of barrels of fish could be taken in a short time, and a crew of ten men could catch in an hour or two from ten to twenty barrels, sometimes more and many times much less, or very few. As soon as the fish ceased biting, the crew engaged in dressing them, making three gangs of two or three men each, one man to split the fish and two to gib. The splitter as he splits them throws them into a gib-tub; the gibbers take each an empty barrel and put in it two buckets of water; they then commence to gib, taking up a single fish and opening it suddenly with a jerk, which causes them to break lengthwise along the lower end of their ribs if they are fat, thus making a crease on each side, but if they are poor they will not break. He then takes out the entrails and gills and throws the fish into a barrel flesh down, and open; if one or more should be put in shut up the blood would not soak out. When the barrel is about level full he fills it with water, and it is then left for the blood to soak out of the fish. The gibber then fills another barrel in the same way, and so on until all the fish are dressed. After washing the decks, the next thing is to shift the fish into clean water, as that in which they have been soaking has become very bloody. Taking an empty barrel and putting in it two buckets of clean water, the fish are taken out one by one, and if any of the entrails or gills have been left in by the gibber, it is removed, so that the fish is thoroughly cleaned. At the same time that the fish are examined and cleaned the rimmer is used, plowing deeper the creases in them, which makes them look fatter, so that when the inspector culls them and puts them up ready for market they may have a larger proportions of No. 1's and and No. 2's. The rimmers are of various kinds and shapes; some are made wholly of wood; others have the end tipped with pewter and fine teeth on the edge, so as to make the crease look rough, as though it was broken naturally; others have a knife in the end, which cuts them smoothly. There are other kinds of rimmers and other ways of rimming too numerous to mention, but the object is to make them look fatter than they really are, and thereby gain in number of fat fish or in better quality, as this crease is an indication of their fatness. After the mackerel have been in the second water a short time they are ready for salting. They are salted in tight barrels, so as to hold the pickle, which keeps them from rusting, using salt enough to preserve them well until the end of the voyage.

"When the vessel arrives at port the fish are taken out of the barrels and assorted or culled by an authorized inspector, agreeably to the Massachusetts inspection law. The inspector puts them up with his name on the barrels, and then he becomes responsible for their condition and quality. The above is the whole process of curing mackerel, and if so cured, and the barrels kept tight and full of pickle, they will keep in good condition a long time.

"While jigging was the principal way of catching mackerel they were taken in such a way and in such quantities that they could be dressed before they became soft; but since seining has come into general use the quality of mackerel is much inferior to what they were before.

"The seining vessel may be on the fishing-ground and cruise for weeks and not get a single fish, for they may keep down and not show themselves on the top of the water. Then a day may come when mackerel will come up and large schools of them may be seen in every direction. The seiner then throws his seine around a school, and if he is fortunate enough to inclose them, he hauls in the purse-lines, gathers in the net so as to bring the fish into a compact body, and then commences to bail them out on deck with his scoop-nets. In this way large quantities of fish are caught in a single haul, sometimes hundreds of barrels. Having such a large quantity, and handling them so much, the men cannot dress them before they get soft. When they are dressed and salted they are headed up in barrels and brought into port, and when opened for culling and inspection they are found to be ragged and soft, and do not compare in quality with the jig mackerel of former years.

"One more fishery I will mention; that is, when the mackerel are passing off the coast late in autumn. A large number of gill nets are then set in our bay and kept there night and day. The fishermen visit them daily, as often as the weather will permit, and take out the fish that may have been caught during the night. The weather is often windy and rugged, so that they cannot go to their nets for several days. The fish are injured by remaining in the nets any considerable length of time after they are caught. Mackerel taken at this season of the year are not of the best quality, for, even if they are taken out of the nets as soon as may be, on the following morning after they have run in, and dressed at once and put in water to soak, the water is cold, and as the blood is already chilled, it will not soak out of the flesh of the fish, so that they will be dark colored. When the water becomes cold the mackerel lose their fat fast, so that those that are caught here as they are passing off late in November and early in December, many of them have little or no fat in them, however large the creases may be that have been made by the fisherman's rimmer to indicate their fatness. They are inferior fish, and often fail to give satisfaction to the parties who buy them."

45.—Inspection laws.

Statutes regulating the method of packing pickled fish are in force in many of the States, but the only ones governing the manner of preparing salt mackerel are those of Maine, New Hampshire, Massachusetts, and Rhode Island. Nearly the entire catch of the mackerel fleet of the United States, with the exception of fish sold fresh, is packed in Massachusetts and Maine, and thence shipped throughout the country. As there is no national law governing the proper preservation and requiring uniform grades of mackerel, it often happens that fish packed according to law in New England are repacked in other States and sold under false or misleading brands, much to the injury of the original packer.

In some of the States outside of New England, as in Pennsylvania, there have been laws requiring fish that have been legally inspected in other States, but repacked in that State, to be reinspected. The Pennsylvania law was repealed in 1874. The laws of Ohio require the inspection of all pickled fish except shad, mackerel, and herring. In New York there is a law on the statute-book which declares that pickled fish intended for foreign exportation must be inspected, but this law is entirely inoperative. The laws of Michigan permit the inspection of fish when desired by packers. Fish-inspection laws are in force in New Jersey, Virginia, North Carolina, and Michigan, and also in the city of Chicago and some other large cities, but they do not concern the mackerel trade, except that the sale of damaged fish is generally forbidden.

We give in the appendix to this report, first, the existing laws of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut; second, some of the repealed laws of Maine, Massachusetts, Connecticut, and Pennsylvania; and, third, the laws now in force in the Dominion of Canada, as also the old law of the Province of Nova Scotia.

In early colonial days it became necessary to enact laws for the proper regulation of the trade in fish, and to prevent deceit in packing them. Accordingly, as early as 1651 we find that the general court of elections held at Boston ordered that in every town within its jurisdiction officers should be appointed whose duty it was to see that the barrels of fish be properly packed, containing only one kind of fish, and those well cured. Each town was to make choice of a proper person as inspector, and within one week after the choice he was to be presented before a magistrate by the constable and take the requisite oath for the performance of his duty. Refusal to take the oath incurred a penalty of forty shillings, and another choice was made. The oath was a strong one, and required the officer to swear by the living God that he would well and truly pack all beef, pork, and other things when required; that he would pack none but good and sound goods; that he would set his mark upon every cask thus packed; and that he would discharge his duties according to his best judgment and conscience. The size of casks and barrels in which fish, beef, pork, &c., were packed were regulated by law, and according to an act passed by the general court of the Province of Massachusetts in 1692 these casks must be of London assize; puncheons, 84 gallons; hogsheads, 63 gallons; tierces, 42 gallons; barrels, 31½ gallons; and must be made of sound, well-seasoned timber, and free from sap.

If any person should illegally shift any fish that had been properly packed and branded, he must pay double damages to persons wronged thereby, and must be set in the pillory not exceeding one hour. Equally severe penalties were imposed upon violators of other sections of the inspection laws. If the master of a vessel receive provisions aboard of his vessel not properly branded, he must forfeit double the value of all such provisions, and the owner of the provisions must forfeit the same.

From time to time during the history of the States various inspection laws have been passed, but since there is so much sameness to them it seems unnecessary to reproduce them all.

In some of the States the appointment of inspectors has been left to the towns, while in other States they have been appointed directly by the governor. Some States have passed no general laws covering the inspection of fish, but all such regulations have been left to the cities and towns. But throughout New England, the center of the fishing industry, the question has been regulated by State enactments, and the appointments of the chief officers have been made by the governor, who has, however, left the appointment of deputies to the chief inspector.

Massachusetts has found it prudent to have an inspector-general, who supervises and is responsible for the numerous deputy inspectors in the seaport towns. Maine had such an inspector-general down to 1875, but the office was then abolished, and inspectors appointed in the fishing ports are now responsible to the State alone.

As early as 1816 there was an inspector-general of fish appointed in New Hampshire, whose duties were the same as of similar officers in other States.

The existing laws of Maine were passed January 25, 1871, and amended by acts passed February 24, 1871, and February 10, 1875, and provide that the governor "shall appoint, in places where pickled fish are cured or packed for exportation, one or more persons skilled in the quality of the same, to be inspectors of fish, who shall hold their office for a term of five years, unless sooner removed by the governor and council." Each inspector must be sworn and give bonds to the treasury of the city, town, or plantation where he is appointed for the faithful performance of his official duties. Inspectors must make yearly returns to the secretary of state, showing the quantities and kinds of fish inspected. Their fees are paid by the original owners of the fish.

The law regulates the grades of mackerel under three numbers, and requires that other pickled fish as well as mackerel shall be packed in proper barrels, and no more salt put with the fish than is necessary for their preservation. No pickled fish in casks can be exported from the State, or sold within the State, except such as have been inspected according to law in this State or under the inspection laws of other States. Although, according to the requirements of the law, each inspector is expected to make annual returns to the secretary of state showing the quantities of fish inspected during the year, no such returns can be found for the years 1821 to 1864, and for 1879, and only imperfect ones for some other years.

The present laws of New Hampshire were passed in 1878, and are very similar to those of Maine and Massachusetts. An inspector is appointed by the governor, and he may appoint deputy inspectors, for whom he shall be responsible. The inspector is under bond to the State treasurer for the faithful discharge of his duties, and the deputies under bond to the inspector.

The law requires that all fish pickled in barrels for exportation, and all smoked herring or alewives, shall be inspected and the barrels and boxes properly branded. It regulates the size of casks and the material from which they may be manufactured.

The inspector is required to make returns to the governor annually of all fish inspected by him or his deputies during the year. The inspection fees are paid by the owner or person employing the inspecting officer, and these fees are divided between the general inspector and his deputies.

Pickled fish and smoked fish intended for consumption within the State, and fish packed in kegs of less than 10 gallons, require no inspection, but they must be properly cured and packed, under the same penalty as inspected fish.

The existing inspection laws of Massachusetts provide for the appointment by the governor of an inspector-general of fish, who shall hold office for five years, and who shall be sworn and give bonds to the treasurer of the commonwealth in the penal sum of $10,000, and who shall have no interest, directly or indirectly, in the cure or packing of pickled fish. The inspector-general appoints deputies in the various seaport towns, and takes bonds from them with sufficient sureties. He is responsible for their official conduct, and may remove them from office at his pleasure. The deputies are, in most cases, members of firms that are engaged in packing fish, and receive fees for inspection that are divided with the inspector-general.

The fees of the office of the inspector-general will be seen in the following extract from the Cape Ann Advertiser of April 16, 1875:

"General William Cogswell, inspector-general of fish, has submitted a statement to the joint standing committee on fisheries of all the fees he has received from the office for the past eight years. The total receipts of that period have been $23,365.06; total expenses, $4,400; net receipts, $18,965.06. During the eight years he has made some twenty-eight different seizures of packages of mackerel, valued at $5,781.75, from which he received, after paying expenses, $1,446.44, instead of $5,781.75, which he might have insisted on had he carried out the strict letter of the law, or an average of about $160 a year. Average net salary per year, about $2,550."

As these fees are paid entirely by dealers in fish, the office of inspector-general is of no expense to the State.

It is provided further that "under the supervision of the inspector-general and his deputies, respectively, all kinds of split pickled fish and fish for barreling, except herring, and all codfish tongues and sounds, halibut fins and napes, and sword-fish, whenever said articles are intended for exportation, shall be struck with salt or pickle in the first instance, and preserved sweet and free from rust, taint, or damage; and when the same are found in good order and of good quality, they shall be packed either in tierces containing each 300 pounds," &c.

Smoked herring and alewives are also to be inspected, and the size of the boxes for smoked fish, as well as size and material for barrels used for packing pickled fish, are clearly defined.

Fish are divided in various grades, and only one kind allowed to be packed in the same package. Of mackerel there are five grades, determined by their length and quality. Other fish are divided generally into two qualities, and so branded.

There has been considerable opposition to the office of inspector-general, and strong efforts have been made by fish-dealers to abolish the office. In Maine there has been no inspector-general since 1875, and it is claimed by many that there is greater satisfaction among purchasers than formerly. The question has been discussed in the Massachusetts legislature at various times, and has always resulted in the retention of the office as one that is important to the security of purchasers.

Since there is no national law covering the inspection of fish or the protection of the packers, it is claimed by the dealers in Massachusetts that mackerel are adulterated oustide the State, so that those inspected in the State reach the consumer in a poorer grade. A remedy suggested is to pack mackerel as they do other merchandise, by any weight or style of packages, and brand honestly on each head, the grade, the weight, and the owner's name, and do it in such manner as to prevent repacking without destroying the trade-mark. "Buyers will demand original packages if all such names as cover fish that correspond to the mark on each head, and packages that have been tampered with will be rejected. There seems to be but one objection to this plan, namely, a large buyer inland might find it necessary to repack for better preservation, necessitating the breaking of the original seal. But this, we apprehend, is not serious." There have been other plans suggested as substitutes for the existing laws, but the legislature has decided that the present regulations are just and proper.

The laws of Rhode Island provide for the election in each town of one or more packers of fish, who "shall see that the same have been properly pickled and properly repacked in casks, in good shipping order, with good salt sufficient in each cask to preserve such fish from damage to any foreign port." The packers give bond to the town treasurer for the faithful performance of their duties.

Every kind of pickled fish must be sorted, and one kind only be put into one cask. The casks must be "well seasoned, and bound with twelve hoops; those for menhaden and herring of the capacity to hold 28 gallons, and those for other fish of the capacity, if a barrel, to hold 200 pounds, and if a half-barrel, to hold 100 pounds weight of fish; each cask to be full, and the fish sound and well cured."

The law provides for three grades of pickled codfish and mackerel, and imposes fines upon packers who neglect to obey the law, as well as upon any person who shifts fish from a cask after the same has been branded by the packers.

Laws for the inspection of pickled fish in Connecticut relate to pickled shad, and provide that they shall be "well cleansed, and pickled in strong brine, and shall remain in such brine at least fifteen days before they shall be put up for market, and shall be put in barrels or half-barrels, the barrels containing 200 pounds each and the half-barrels 100 pounds each of fish." Three denominations of shad are defined, the size being determined by the number required to fill a barrel.

Inspectors are appointed by the superior court in the several counties, and receive a fee of 20 cents per barrel for packing, heading, flagging, pickling, and branding. "Any inspector of fish who shall inspect or brand any package of shad *imported into this State* shall forfeit $5 to the State."

In the several provinces now comprising the Dominion of Canada laws have from time to time been enacted requiring all pickled and smoked fish to be properly salted, packed, and inspected before they were offered for sale. In the year 1867 the Dominion of Canada was created by the union of Upper and Lower Canada, Nova Scotia, and New Brunswick. In 1873 Prince Edward Island became a part of the confederation; so that the Dominion of Canada now includes all the provinces where fisheries are carried on, with the exception of Newfoundland, which still retains its individuality as a separate province of Great Britain. General fish-inspection laws, extending throughout the Dominion, were enacted by the Dominion Parliament in 1873, but were repealed in 1874, when more complete statutes were enacted, which, with slight amendments passed in 1876, 1880, and 1881, now regulate the manner of preparing pickled and smoked fish for exportation or for sale within the Dominion.

We give in the appendix the fish-inspection law as enacted in 1874, together with subsequent amendments; also the old law of Nova Scotia, as found in the revised statutes of that province, published in 1851.

The principal object of fish-inspection laws is to prevent fraudulent pickling. There has been a great deal of discussion concerning the benefit of these laws; some packers contend that they are hardships, while others claim that without some legislative regulations much more fraud would result and the trade in salt mackerel be reduced to a very low state. The law is a protection to both buyer and seller. It guarantees to the former a definite quality of fish, and protects the trade of the latter in that it prevents a great amount of dishonest underselling and assures to the seller a definite knowledge of the merchandise sold by his neighbor. The principal kinds of fraud in packing mackerel are short weight and wrong grades. The first kind of fraud is practiced by the addition of more salt than is necessary for the proper preservation of the fish, and a corresponding subtraction in the quantity of mackerel, thus keeping the same total weight in the barrel. According to law a barrel of fish, means 200 pounds of fish, and not that weight of fish and salt. The second kind of fraud, or that of packing wrong grades, is more generally practiced, and the least liable to detection by ordinary customers. A No. 1 mackerel is plainly defined as the best quality of fish, at least 13 inches in length. A packer's notion of best quality may be as varied as the number of his customers, for, while the requisite length of 13 inches is given, there may be great difference in the degree of fatness, so that the No. 1 mackerel packed by one firm may be far inferior to those packed under the same number by other firms. In other grades of mackerel the same fraud is practiced, No. 3 appearing as No. 2, and No. 4 packed as No. 3. But a small part of the fraud in packing is done within the precincts of States that have inspection laws. Most of the fraud is in repacking in Western or Southern States barrels of fish that have been inspected in New England. A large quantity of fish are bought of New England packers and are by dealers West and South repacked, and the same frauds again practiced that governed the original packing of the fish. Thus mackerel that are in reality No. 3 are first fraudulently packed as No. 2 and later as No. 1. A small short weight of fish and extra quantity of salt is increased until ten barrels of fish become twelve or thirteen. Especially is this short weight liable to be practiced where whole barrels of fish are repacked in small packages containing 25 or 50 pounds, and as in most of the States outside of New England there is no law regulating the grade of mackerel and quantity required in a barrel, the dishonesty is not illegal, and can be carried on with an impunity only limited by the patience of the customer.

A chief cause or occasion for fraud is, perhaps, the fact that the inspectors in States where inspection laws are in force are themselves the owners and packers of the fish. In Massachusetts only the inspector-general is forbidden to be interested, directly, or indirectly in the packing of the inspected fish. Nearly all the deputies, or the men who really do the culling, weighing, and branding, are the owners and sellers of the very fish they inspect. There is little protection against fraud, therefore, save in the honesty of the man, and as the moral standard varies with different men, so does the degree or extent of fraud. A strictly honorable inspector would scorn to take advantage of his authority and under the cloak of his commission cheat his customers. Some inspectors, however, have an elastic conscience that will stretch to the point beyond which there is liability of detection either by a superior officer or by a customer. Such men can make old fish appear new by scraping off some of the rust, or can from one legal grade of fish make two superior grades.

In Maine there is no inspector-general of fish, so that each inspector is responsible alone to the county or city authorities to whom he is under bonds for the faithful discharge of his official duties. For several years prior to 1875 Maine had an inspector-general, but in the year named the office was abolished as unnecessary, and inspectors became personally responsible for their acts. A loud cry was made in Massachusetts in 1874 and 1875 concerning the abolishment of the office of inspector-general of fish, and numerous articles appeared in the papers of the day discussing both sides of this question, and including the general subject of fraudulent packing. We quote several of these newspaper discussions to show the general spirit of the discussion. The following article appeared in the Portland (Me.) Advertiser April 4, 1874:

"*To the Editor of the Advertiser:*

"In your issue of March 31 I noticed an article headed 'Fish Inspectors,' from which readers not familiar with the business would receive a decidedly wrong impression, as they would infer that the inspectors of fish are in favor of abolishing the present law by which they are governed. But such is not the case. The whole difficulty seems to rest with one or two fish buyers; they are anxious to have the law repealed, and those acquainted with the fish business can easily understand the motives by which they are prompted. The fishing interest of Portland is of vital importance, and should be protected, and every honorable influence brought to bear to encourage fishermen living east of Portland to bring their fish here to market; but if the views of some of the fish buyers should be carried out, it is evident that not only vessels from the east would pass this port, but vessels that are owned and pack their fish here would be obliged to seek another market.

"All the regular deputy inspectors of fish in this city have presented a petition to the governor praying that the present manner of conducting the business under a general inspector may be continued, and the present incumbent, who has served so faithfully and impartially, may be reappointed for the usual term of five years, believing that it is the best and most judicious course to pursue both for the buyer and inspector.

"The old system, as it is termed, has been tried, and it failed to give satisfaction. Under the present law a general inspector is appointed to take the entire charge, and he appoints his deputies, who are required to give bonds for the faithful performance of their duties. Massachusetts has the same law, and we hear no complaint.

"You state that 'by the old system deputy inspectors were appointed who were, generally speaking, connected with the fish business, and on them the responsibility rested, and at that time Portland fish stood very high.' Under the present law *all* the deputies are directly interested in the fish business, and they know that if these fish are not put up according to law the responsibility rests upon them. Upon whom else can they throw the responsibility? They inspect the fish and brand them, and have given bonds as the law requires. You 'would not imply there is deterioration in Portland fish, but yet the deputies have been inclined to be careless.' So it seems that, although the deputies have been careless, yet the fish is up to the standard! Then what reason is there for complaint? I am inclined to believe that the writer of the article was either misinformed, or else he wished to abuse the public mind with the impression that the general inspector had an exorbitant salary, and that this office entails an expense upon the merchants. The compensation of the general inspector last year was about three hundred dollars, and it is all paid by his deputies, who are assessed one cent per barrel for all the fish they inspect. So far as regards the quality of the fish, there is a law which definitely states what is required to constitute the different grades of fish, so that the inspector has his instructions from the law, and there is no motive for the deputy to pack in any other way than the law directs, for he has nothing to gain, but everything to lose, providing the fish are returned to him.

"We hope the law will remain as it is, and that the governor will be pleased to reappoint for a general inspector Mr. D. L. Fernald, of Camden, who is soon to become a resident of this city.

"INSPECTOR."

An editorial in the Cape Ann Advertiser of November 28, 1874, says:

"The Boston Herald of Monday has a lengthy article on mackerel packing, in which it argues that the recent depression of the mackerel market is owing to the fraud practiced in selling short-weight packages and the making of No. 1 mackerel out of 3's, and it is charged that large spring herring have been split along the back and sold out West for mackerel, giving a large profit to those engaged in the nefarious business.

"The appointment of an inspector-general of fish purely on political grounds, without his having knowledge of the practical duties of the office, is denounced, as the office is one which requires the services of a practical man, who should devote his whole time to the work. A well-deserved compliment is given those engaged in the fish-packing business in Massachusetts, saying that nearly all the old and reliable fish houses are as exact and careful in putting up fish now as ever; but the principal part of the fraud in weight and quality of fish is perpetrated outside of Massachusotts, and the packages marked with counterfeit Massachusetts inspectors' brands. Instances of fraud are quoted, and the Herald concludes by asserting that 'good inspection laws rigidly enforced, and a practical inspector-general, who will attend to his duties, devoting his whole time thereto, are the only means by which our mackeral trade can be sustained and extended to the gigantic proportions to which good management and honest dealing will surely bring it in the end.'

"We venture the assertion that the dealers in mackerel who wish a really good article and send orders directly to this city have but little, if any, cause for complaint in the matter of fraud in packing. Gloucester fish-packers, as a whole, have an enviable reputation in this particular; but they cannot hinder dishonorable dealers in other cities from repacking and selling short-weight packages or lean fish for fat ones, short fish for long, or herring for mackerel. Neither can they prohibit the counterfeiting of their brands or any other trickery which unprincipled dealers in States where there is no inspection law may perpetrate after receiving their stock from headquarters. All they can do is to continue packing and selling the best qualities of fish, and it will not be long ere the entire catch of this port will find its way into the hands of those who can and will appreciate fair and honest dealing. There is little fear but this fraud in mackerel-packing, will soon regulate itself, and honest dealers will reap the reward of well-doing."

The following communication, signed W. S., appears in the same paper as the preceding, under date of February 12, 1875:

"There seems to be a hitch in mackerel—an honest, clever fish—but by the haste of somebody to overreach somebody else they fail to reach the cook South and West under an accurate denomination, and this curtails their consumption. If adulteration was chargeable to Massachusetts inspectors, a capable, efficient, and honest general inspector could remedy the evil, but we apprehend that the bulk—we will not say all, lest our communication be worthless—of the adulteration is beyond the precincts of our State.

"It appears to the writer that there are two ways to improve the mackerel trade, both within easy reach of the merchants engaged in fish commerce. First, install a general inspector familiar with fish by a practical education; and next, to go for his duty as unerringly as a bullet would, and call for the cooper and a pair of scales, and confine his business to the said cooper and the said scales. If criticism is demanded, let it be with a note that makes one deputy less. But it is remarked, 'This is all very well for Massachusetts; we have no control beyond the limits of the State, where the chief mischief lies.' This we admit, and it is a feature that can't be remedied except by national legislation.

"A remedy we offer, that avoids necessity for State or national laws, general and deputy inspectors, as follows: Pack mackerel as they do other merchandise, by any weight or style packages, and brand honestly on each head as follows—the grade, the weight, and the owner's name, and do it in such manner as to prevent repacking without destroying the trade-mark. Buyers will demand original packages of all such names as cover fish that correspond to the mark on each head, and packages that have been tampered with will be rejected. There seems to be but one objection to this plan, namely, a large buyer inland might find it necessary to repack for better preservation, necessitating the breaking of the original seal. But this we apprehend is not serious. As at present conducted, we learn from our most intelligent and reliable fish merchants that the office of a general inspector is of no sort of benefit to the fish interest, and ought to be done away with, or place in the office some one who will execute the laws of the Commonwealth without fear or favor."

On the same date as the preceding article we find the following editorial:

"A petition is in circulation in this city, and has received a large number of signatures, for the repeal of the law providing for an inspector-general of fish. The petition sets forth that 'said officer is no benefit or advantage to the fishing interests of Massachusetts, and that the fees as at present paid to said inspector-general is a tax upon the business from which the fish-producers and dealers receive no benefit.'

"Once was the time when a deputy fish-inspector's brand on mackerel had some significance, and the buyer could rely upon it in the purchase and selling of fish, without even opening the package. That time has gone by now, as the brands are counterfeited by dealers South and West, the fish oftentimes repacked, and poorer qualities substituted in brands branded the best. This has become a serious detriment to the business, and now there is really no further need of an inspector-general of fish. Of late years the office has become a sinecure, from the fact that it has become mixed up in politics, and given to men who know nothing of the business, and whose principal duty is to receive their fee on the number of barrels of mackerel inspected by their several deputies.

"There is need of some protection to the many well-disposed, honest men engaged in the mackerel and pickled-fish business along the sea-coast. As a class they are strictly honest, and take great pains to put up their fish in the best possible manner, making a conscientious cull, which will bear strict investigation, giving a full equivalent for the price received, and securing the confidence of the consumer in all cases where they are fortunate enough to get the original package. Very many of the first-class dealers, West and South, who have a business reputation which they value far above the few dollars which they might make in selling inferior articles, send direct to Gloucester for their goods, and in this way they get what they pay for and secure their own trade from imposition as far as may be. But it is very difficult to counterbalance the other class who make it a business to defraud. Something must be done to remedy this evil, and when the fishing inspectorship is abolished, then we hope the fishing dealers will counsel together and take immediate and active measures for self-protection. Have a law which will make it comparatively easy to convict a guilty party of fraud in brands or quality. Our correspondent, 'W. S.,' in another column, offers some practical ideas on this subject which are worthy of attention."

A correspondent writes to the Cape Ann Advertiser as follows, under date of Portland, Me., February 15, 1875:

"I was highly gratified to read in your last issue of a movement on foot to abolish the office of general inspector of pickled fish. The strongest argument used in its favor last winter in our legislature was that our old mother, Massachusetts, had such a law and it worked well, and no one complained. Statutes, hundreds of years old, were produced to establish this fact, but all of no avail. We accomplished our purpose in defeating it, and the bill to abolish the office was passed almost unanimously. It now only awaits the governor's signature, and then there will be abolished a nuisance we have been obliged to suffer for thirteen years. The office expired by limitation in this State last May, and through the efforts of parties opposed to the office the governor and council were persuaded not to make an appointment, thereby giving an opportunity to appeal to the legislature. We have suffered no detriment in not having a general inspector, but have got along much better by allowing the deputies to act on their own responsibility. As a proof of this assertion, I will state that I purchased 23,000 barrels of mackerel, and having shipped them, the only deduction called for was $12. I assure you we feel relieved of this burden, and our friends in New York and Philadelphia are not the least afraid to trade here now, notwithstanding we have no general inspector."

An editorial in the same paper on March 5, 1875, says:

"The hearing on the petition for the abolishment of the office of general inspector of fish came before the senate committee on Friday last. Messrs. J. O. Proctor, of this city, Charles Ropes, of Salem, Franklin Snow, and others, of Boston, were present, and opposed the petition, arguing that without a general inspector there would not be any redress for buyers of pickled fish in case of fraud.

"Mr. George Steele, of this city, was present to defend the petition, and give any information to the committee why it should be abolished. He argued that there was not the least necessity of such an office. Each packer of fish should be made directly responsible for his own brand, and should not be held accountable for pickled fish after they have been sold and left his premises. This would afford great protection to those in the packing business. As the law now operates, it holds out inducements for unprincipled dealers to tamper with the brands, or take out mackerel and report them short weight, more especially if the price decreased after purchasing. If a packer was disposed to cheat, he could not follow it up any great length of time, as no one would purchase of him at full market rates; consequently his brand would always be at a discount, and no man having even the pretense of honor about him, could afford to be thus classed among business men, and trickery would very soon find its level. He advocated a trade-mark which should protect its owner everywhere in the United States, the same as patent-medicine and other trade-marks protect their owners, and make it a crime for any one to counterfeit or interfere with for improper purposes. He cited instances where such trade-marks were in themselves very valuable, as the articles they covered could always be relied upon. The paying out of $3,000 to a general inspector of fish, who did not know enough of the business to cull a trip of mackerel, he considered entirely wrong. The office was not needed. Let inspectors be appointed by the selectmen of towns or mayors of cities, to be held responsible to the State authorities if need be, and all fees arising therefrom be paid into the treasuries of said towns and cities. This would be just and satisfactory. Mr. Steele met all the objections of his opponents in an able manner, and another hearing was ordered for Thursday next, when it is hoped that the entire number, or at least a majority of those who signed the petition, will attend, and by their presence and voice add testimony toward the abolishment of an office which is nothing more or less than a sinecure.

"The State of Maine has passed a law providing for the appointment by the governor of inspectors of fish in those places where pickled fish are cured or packed for exportation, to hold office five years. These inspectors are to make annual returns to the secretary of state."

In the Advertiser of March 12, 1875, is the following letter written to Mr. George Steele, of Gloucester, by Mr. E. G. Willard, and dated Portland, Me., March 1, 1875:

"DEAR SIR: I noticed the hearing you had Friday before the committee, in the Boston Advertiser, and was astonished to see the parties' names who were present in opposition. We had no opposition from a purchaser of fish in Maine; the opposition came from the late general inspector and a part of his deputies, who were not disposed to cull the fish according to the law of the State. With these parties we had much trouble and expensive law suits, in which we beat them; thus showing that the decision of the general inspector amounted to nothing.

"I have been in the business of purchasing pickled fish, as well as dry, the last twenty years. The past ten years I have purchased one-half of the pickled fish packed in the State.

"We had no general inspector till I had been in the business seven years. During this time we had no trouble about the cull, nor did we have any until after we got a general inspector, when trouble commenced, and grew worse and worse, till it culminated two years ago, when our business stopped altogether; no one would buy here, the cull was so poor.

"The office terminated in this State last May, and we were determined not to have another appointed if we could prevent it. The governor and council gave us a hearing, and they concluded not to make an appointment; and we went on last season without a general inspector, and had no trouble. There was a much greater catch last year than the year before—45,000 barrels against 32,000—and parties that withdrew from the market two years ago, returned last year, and have been buying in our market since, and some 28,000 barrels were sold last week. A general inspector is a general nuisance, and no honest inspector wants a guardian.

"My ownership in fishing-vessels is large. I have an interest in twenty-three vessels. The best argument to use is, let the parties opposed show any good the office is to any one; what benefit any one receives from it. Our law was a copy from yours, and a decision of the general inspector amounts to nothing; either party aggrieved can appeal to the courts, and the opinion of the general inspector amounts to no more than that of any other man, as we proved in the cases we had here. Our mackerel here are nearly all packed in barrels. Several parties here repack in halves, quarters, and kits; Dana & Co., largely for the West. Our deputies gave no bonds last year, but will now get their commissions from the governor, and give bonds to the mayor and aldermen, or selectmen of towns, rated according to their business. In fact, we get right back where we were thirteen years ago. Our committee was unanimous at the first meeting, and the change was put right through and is now a law; and I will guarantee that there will never be a general inspector in this State again."

The question of abolishing the office of inspector-general of fish came before the legislature of Massachusetts in April, 1875, and that office was continued. A communication in the Advertiser of June 4, 1875, in discussing the wants of Gloucester in the regulation of the trade in pickled fish, says:

"What Gloucester really wants is a closer relation between producer and customer, or, in other words, we want to sell our products directly to the man who supplies the customer. We are entitled to the profit on our goods that our advantage as producer gives us, without having to divide that profit with any middle-men. We want to bring the customer here. Now, if we are going to do a regular distributing business as well as producing, we must do it on business principles. We must have a regular standard quality of our goods to quote to the trade; a standard that is known and established by law, so that when your customer at a distance buys your goods without seeing them, he must know what he is buying; and further, there must be some one in position when any question shall arise on the quality of the goods, as between buyer and seller, who must settle the dispute and whose decision must be binding on both parties. This position must be filled by a person of large practical experience and sound judgment; and though you call him inspector-general or not, you can confine and limit his powers and duties to this one special duty, making him simply referee, with no power to harass or to confiscate. The interest of yourself, as well as your customers, demands such protection, which must neccessarily be mutual. We want an inspector-general just that much and no more.

"Outside of this State there is practically no inspection law touching our goods. So, to more rigidly enforce the law as it stands is to enforce it against ourselves and in favor of outsiders. Any law that says to the man who packs mackerel in Gloucester, you shall put those fish only in such sized packages as are mentioned and no others, no matter if you do brand the exact weight and quality on each package, or whether your customer desires that size or another, is unnecessarily stringent and despotic; especially so when anywhere outside the State the customer can be accommodated with the same goods in just such packages as he wants. That portion of the law should be abolished. We should have the unquestioned right to put our fish in just such packages as our customers want, provided the quality and the quantity is branded on the package, as on all other kinds of provisions.

"To resume: We must not abolish the law; it is the protection our customers have a right to ask. We must not abolish the office of inspector-general, for we need him to enforce the law in good faith as well as our customers.

"Let the law be plain and simple. Let the inspector-general be only referee for the buyer and seller, and let any man put up his fish in just such packages as he chooses, with the quality and quantity branded on each package. Won't this come nearer what we want than 'no law' or too much law?"

A seizure of Gloucester pickled mackerel occurred in Boston in the fall of 1875. The Advertiser of September 17, 1875, in discussing this seizure, says:

"Washing off the salt which may adhere to recent packed small mackerel, and the draining of the pickle therefrom, would, as we are informed by practical inspectors, cause the confiscation of nearly if not every barrel examined, that is, if the very letter of the law requiring 200 pounds of fish was executed. Some might not fall short but a few ounces, others as many pounds; still, whatever the shrinkage, however small, the mackerel, under the present law, could be confiscated, and thereby come into the hands of the official. * * *

"It is full time that this law was removed from the statute books. So long as it is there and administered, it will prove, in the hands of unprincipled men, a drawback upon any place engaged in the fisheries. It affords a weapon which can be used against fish packers at any time by parties who may wish to do them an injury. Not only does the inspector-general and his allies have a chance to seize mackerel, but purchasers anywhere and everywhere, in case of a sudden decline in prices, have only to write to those of whom they purchased:

"'Your mackerel are short weight; make me so much allowance on a barrel, or back they will come to you.' What protection has the fish dealer at headquarters, under such a law? None at all. Fish with his brand upon the barrels may come back at any time unless he will consent to settle any trumped-up claims. There would not be the least objection, if mackerel were examined on the wharves at the time of packing or shipping. That is the time to make such examination, if any. But this getting them away first is perfectly ridiculous, and altogether too one-sided to be long borne.

"Let each packer have his own brand or trade-mark. Allow them to put up such sized packages as their customers require, branding the weight in a conspicuous place, so that it cannot easily be erased. Then each man would stand or fall on his own merits. If there are any washing off the salt and draining the pickle—not because the purchaser had made complaint or had any suspicion that he was to be defrauded; but the law gives the officials liberty to seize, open, confiscate! And the latter put money in their pockets. We are not sorry that this case has occurred, for it needed something of the kind to wake up our people. They begin to see this blue law now in a light which never before dawned upon them. They begin to realize that at the instance of any jealous fish dealers out of the city—and there are such—their frauds in the business, they would soon be discovered and honest dealers benefitted, as the trade would soon learn of them and give their brands the preference. Then again, let all sales be made from the wharf or store-house, the packages to be weighed by a sworn weigher before they are shipped, and after that to be at the risk of the buyer. Some such system as the above will have to be agreed upon ere the business can be considered a really safe one, and the sooner those engaged confer together and resolve to have the matter presented before the legislature, with a view for the abolishment of the law, the better it will be for all interested. Mackerel can be seized and tampered with until their reputation is affected, and Gloucester lose the prestige which she is gaining so rapidly. Will our business men stand that? Can they suffer it? We opine not, and they will say so most emphatically ere long."

In the spring of 1879 some amendments were made to the Massachusetts inspection laws. One of these amendments permits the packing of pickled fish in small packages of any size which are properly branded. Another amendment repealed the section that required the word "foreign" to be stamped on barrels of dutiable imported pickled fish.

The Boston Commercial Bulletin in February, 1879, discussed the reasons for abolishing the office of inspector-general, and said, "that the whole system of inspection of mackerel at the present time is a perfect farce, and rather than have it carried on as it is, it would be better for the trade and the public to have the office of inspector-general abolished, and the system done away with. In that case the packers would do their own branding; and buyers, in making their purchases, would place faith in the truthfulness of the brand only according to the reputation of the packers."

VII. STATISTICS OF THE INSPECTION OF MACKEREL FROM 1804 TO 1880.

[By A. Howard Clark.]

L.—STATISTICS OF MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE, AND TOTAL STATISTICS.

46.—Statistics of Massachusetts.

The inspection of pickled mackerel in Massachusetts is exhibited in three statements. The first statement shows in detail the number of barrels packed in each inspection port of the State during each year from 1804 to 1881; and for the years from 1804 to 1878, was compiled by Mr. Alexander Starbuck from the official returns deposited by the inspector-generals in the office of the secretary of state of Massachusetts. The statistics for the years 1879, 1880, and 1881 are from official documents, signed by the inspector-general. From a review of this statement we find that in the earlier years of the mackerel fishery nearly forty fishing ports were engaged in packing mackerel, but during recent years the business has been concentrated to a dozen or fifteen places, the ports of Gloucester and Boston packing by far the greater part of all the pickled mackerel put up in the State.

The second statement shows the total number of barrels of each grade of mackerel packed in Massachusetts during each year from 1804 to 1881, and also the total value of each year's inspection since the year 1830. The quantities of mackerel in this table are from the preceding table. It shows substantially the total quantity of pickled mackerel sold for exportation from the State as well as for consumption within the State; though perhaps 5 per cent. of the total number of barrels packed escapes inspection.

From a review of this statement we see that there has been a very great fluctuation in the extent of the mackerel business. The smallest number of barrels was packed in 1814, and the largest number in 1831. The year 1851 was a prosperous one, and also the year 1870. During the past four or five years an extensive business in fresh mackerel has been developed, so that in 1881 about 125,000 barrels were sold in a fresh condition. If this quantity be added to the amount inspected, it shows a total catch by Massachusetts vessels nearly equal to that of the year 1831.

The third statement shows the number of barrels of mackerel reinspected in Massachusetts during the years 1850 to 1853, 1859 to 1876, 1878 to 1881. It represents barrels of mackerel that are repacked in smaller packages, and may include fish already accounted for under the head of "inspected," while a very small fraction may consist of imported fish repacked. These statistics are compiled from the official documents, signed by the inspector-generals.

MACKEREL INSPECTION IN MASSACHUSETTS.

STATEMENT I.—*Showing by ports the number of barrels of each quality of pickled mackerel inspected in Massachusetts from* 1804 *to* 1881.

[Half and quarter barrels and smaller packages reduced to barrels.]

Port of inspection.	1804.				1805.				1806.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	1,631½	6,226		7,857½	1,787	2,518½	4,228	8,533½	2,563½	2,756	2,907	8,226½
Newburyport	3	17		20	300	700	600	1,600	120			120
Ipswich												
Rockport a												
Gloucester												
Manchester												
Beverly												
Salem	92			92	66	61		127	67½	100	2	169½
Marblehead	31			31								
Medford												
Charlestown												
Boston	374½	2,570		2,944½	553½	691	885	2,129½	1,218½	1,305½	1,224	3,748
Dorchester and Roxbury												
Quincy												
Weymouth												
Hingham	216½	2,064		2,280½	556	767	1,424	2,747	670½	562	658	1,890½
Cohasset	377½	696		1,073½	307½	266½	628	1,202	357	529½	313	1,199½
Scituate	537	879		1,416	2½	21	614	637½	128	244	591	963
Duxbury												
Plymouth												
Sandwich												
Barnstable												
Yarmouth												
Brewster												
Wellfleet												
Truro												
Provincetown					1½	12	77	90½		15	119	134
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset									2			2
Swansea												
Other towns												

a Rockport was a part of Gloucester until 1840.

STATEMENT I.—*Mackerel inspection in Massachusetts.*—Continued.

Port of inspection.	1807.				1808.				1809.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	2,353½	2,462	4,489½	9,305	1,305½	2,413½	3,910½	7,629½	2,274½	3,078	3,472½	8,825
Newburyport		76		76	10	13		23	150	510		660
Ipswich												
Rockport												
Gloucester					177	61		238	26	17	3	46
Manchester												
Beverly												
Salem	7	40		47	17	21	73	111			1	1
Marblehead												
Medford												
Charlestown												
Boston	903	881	1,809	3,593	278½	841	1,442½	2,562	931½	1,465	1,261½	3,658
Dorchester and Roxbury												
Quincy												
Weymouth												
Hingham	731½	726½	1,168	2,626	491	509	1,338	2,338	388	534½	1,486	2,408½
Cohasset	400	401½	769½	1,571	139½	381½	756	1,277	699	321	492	1,512
Scituate	238½	201	614	1,053½	162	282½	89	533½	66	192	149	407
Duxbury												
Plymouth												
Sandwich												
Barnstable												
Yarmouth												
Brewster												
Wellfleet												
Truro												
Provincetown	73½	132	127	332½	30½	246½	212	489	14	38½	80	132½
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown		4		4								
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset												
Swansea			2	2		58		58				
Other towns												

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1810.				1811.				1812.			
	1.	1.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	2,540½	4,770	5,242	12,552½	1,368½	6,023	10,009½	17,401	1,000½	2,154½	2,726	5,881
Newburyport	57			57	28	12		40	94	73		167
Ipswich												
Rockport												
Gloucester							6	6				
Manchester												
Beverly												
Salem	45	28	1	74	15	28	15	58				
Marblehead	147	144½	39	330½	1	42	10	53	36½	40½	24	101
Medford												
Charleston												
Boston	1,099½	2,936½	2,827	6,863	557½	4,016½	6,159½	10,733½	213½	877½	1,098	2,189
Dorchester and Roxbury												
Quincy												
Weymouth									22½	17	112	151½
Hingham	687	771	1,375	2,833	221½	960	2,138½	3,320	182½	279	768	1,229½
Cohasset	291½	595	712	1,598½	183½	743½	1,512	2,439	126½	548	573	1,247½
Scituate	48½	126	82	256½					81	204½	39	324½
Duxbury												
Plymouth												
Sandwich												
Barnstable												
Yarmouth												
Brewster												
Wellfleet												
Truro												
Provincetown	165	169	206	540	237	221	168½	626½	244	115	112	471
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset					19			19				
Swansea					106			106				
Other towns												

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1813.				1814.				1815.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	900½	1,231	1,625	3,756½	89	546½	703½	1,339	3,225½	5,456½	7,377½	16,059½
Newburyport	179	35		214	50	248	63	361	251	222	255	728
Ipswich												
Rockport												
Gloucester	4	23	64	91					72			72
Manchester												
Beverly												
Salem												
Marblehead		1	22	23	2½	20	21	43½		4	5	9
Medford												
Charlestown												
Boston	422	624	867	1,913	32	199½	323½	555	1,602½	3,847	5,408	10,858
Dorchester and Roxbury									31	172		203
Quincy												
Weymouth									129	180	208½	517½
Hingham	131	182	153	466					1,034½	739½	1,370	3,144
Cohasset	72	176½	202	450½					105½	273	80	458½
Scituate	38½	66½	17	122		1	2	3				
Duxbury												
Plymouth												
Sandwich												
Barnstable												
Yarmouth												
Brewster						9	15½	24½				
Wellfleet												
Truro						19	212½	231½			7	7
Provincetown	8	123	300	431	4½	50	66	120½		19	43½	62½
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset												
Swansea	46			46								
Other towns												

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection1	1816.				1817.				1818.			
	1.	2.	3.	Total.	1.	1.	3.	Total.	1.	2.	3.	Total.
Total	8,694½	9,264½	13,010	30,979	10,406½	5,267½	21,688	37,362	14,410	11,162½	20,775½	46,348
Newburyport*a*	983	952½	335	2,270½	1,234½	742	739½	2,716	2,386	1,555½	2,540	6,481½
Ipswich									15	2	1	18
Rockport												
Gloucester	11	9	103	123	62	34	19	115	33	54	67	154
Manchester												
Beverly												
Salem					65	15	206	286				
Marblehead	46	50	47	143	84	65	2	151	233½	186	103	522½
Medford												
Charlestown												
Boston	4,741	6,309	8,285	19,335	6,421½	3,469	14,347	24,237½	7,777½	6,850	11,587½	26,215
Dorchester and Roxbury												
Quincy												
Weymouth	189½	287½	502	979	312½	104½	1,017	1,434	379	214½	617	1,210½
Hingham	2,264	1,204½	3,084½	6,553	1,525	455	3,193	5,173	1,945½	1,214	2,817	5,976½
Cohasset	459½	357	566	1,382½	488½	289	1,031	1,808½	736½	524½	1,267½	2,528½
Scituate									282	242	895	1,419
Duxbury												
Plymouth					30	31	110	171	96	92	229	417
Sandwich												
Barnstable												
Yarmouth												
Brewster												
Wellfleet												
Truro												
Provincetown	½	95	107½	203	14½	18	52	84½	53	46½	49	148½
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven							16	16			20	20
New Bedford					136	37	840½	1,013½	7		105½	112½
Dartmouth					33	8	115	156	112	44½	477	633½
Westport												
Somerset									125			125
Swansea									229	137		366
Other towns												

a Newburyport in 1818 and 1821 included Newbury.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1819.				1820.				1821.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	19,614	36,521½	43,975½	100,111	12,455	34,811½	68,374½	115,641	7,400½	32,103½	71,505½	111,009½
Newburyport *a*	1,995	4,966½	8,176½	15,138	999	3,302½	6,940	11,241½	550½	2,911	8,655½	12,117
Ipswich	312	104	108	524	40	60	695	795	1	1	3	5
Rockport												
Gloucester	32	69	109	210	5	97	115	217	365½	714	1,097	2,176½
Manchester												
Beverly												
Salem	118	67	183	368	258½	616½	855	1,730	428	1,800	2,279½	4,507½
Marblehead	598	870	854	2,322	96½	238½	639½	974½	153	334	554	1,021
Medford												
Charlestown												
Boston	12,121½	21,974½	23,515	57,611	8,372½	23,801½	40,755	72,929	4,112½	18,208	43,957½	66,278
Dorchester and Roxbury												
Quincy					37	128	137½	302½	5	28	1	34
Weymouth	335½	512	977	1,824½	278½	512	1,127	1,917½	16	103	94½	213½
Hingham	2,098	4,102	4,477	10,677	1,218½	3,036	8,598	12,852½	1,019½	3,297½	5,833	10,150
Cohasset	435	675½	855½	1,966	257½	363	1,532	2,152½	178	1,701½	2,129	4,008½
Scituate	612½	1,762	2,369½	4,744	445½	1,440½	2,697½	4,583½	295½	1,929	4,342½	6,567
Duxbury	39½	20½	49	109	35½	146	93	274½				
Plymouth	275	326	569	1,170	272½	473½	1,916	2,662	98	499	1,035	1,632
Sandwich												
Barnstable												
Yarmouth												
Brewster												
Wellfleet												
Truro												
Provincetown	106	202	201	509	1	11	165	177		1	20	21
Chatham	14	4	27	45	23	63	76	162	39	313	764	1,116
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven		2	5	7								
New Bedford	58½	141	456	655½	25	53	199	277	13	95	224	332
Dartmouth	463½	723½	1,044	2,231	89½	469½	1,834	2,393	26	168½	536	730½
Westport												
Somerset									100			100
Swansea												
Other towns												

a Newburyport in 1818 and 1821 included Newbury.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1822.				1823.				1824.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	20, 035	66, 681½	73, 578	160, 294½	19, 804	62, 047½	63, 154½	145, 006	45, 246½	75, 221	71, 183	191, 650½
Newburyport	1, 606	6, 683	7, 877	16, 166	1, 829	5. 154½	6, 814	13, 797½	4, 201	6, 842	6, 436½	17, 479½
Ipswich	30	75	45	150	122½	202	61	385½	223	208	94½	525½
Rockport												
Gloucester	571	1, 361	872	2, 804	869	1, 296½	1, 425	3, 590½	1, 654½	3, 013	1, 635½	6, 303
Manchester												
Beverly												
Salem	411½	1, 846	1, 515	3, 772½	255½	1, 276½	1, 164½	2, 696½	1, 085½	3, 116½	1, 252½	5. 454½
Marblehead	593½	1, 522	1, 445¼	3, 561	256½	806	687	1, 749½	310	1, 075½	477½	1, 863
Medford												
Charlestown												
Boston	12, 690	39, 784	43, 206½	95, 680½	12, 943	36, 845½	34, 615	84, 403½	27, 033½	39, 136	34, 887	101, 056½
Dorchester and Roxbury												
Quincy												
Weymouth	37	298	306	641	11½	122	244	377½	12	49	39	100
Hingham	2, 019½	6, 545½	8, 271	16, 836	1, 860½	6, 832½	6, 417	15, 110	5, 113½	8, 403	10, 138½	23, 655
Cohasset	661	2, 631½	4, 099	7, 391½	464	4, 111½	4, 788	9, 363½	2, 288	6, 417½	8, 053½	16, 759
Scituate	796	2, 802	3, 484½	7, 082½	665½	3, 333½	4, 231½	8, 230½	1, 889½	4, 083½	4, 627½	10, 600½
Duxbury	41½	313½	389	744	27	119	24	170				
Plymouth	311	1, 161	708	2, 180	342	1, 331	1, 414	3, 087	999½	1, 650	1, 256	3, 905½
Sandwich												
Barnstable												
Yarmouth	60	373½	124	557½	34	83	187	304	17	98½	167½	283
Brewster												
Wellfleet												
Truro												
Provincetown	½	7	143½	151	13	65	314	392	355½	596	1, 726½	2, 678
Chatham			269	269	1½	55	232½	289				
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford	94	478	64	636	44½	156	304	504½	19	143½	235	397½
Dartmouth	112½	750½	709	1, 572	23	222	232	477	45	385	156	586
Westport												
Somerset												
Swansea		50	50	100	42	36		78		4		4
Other towns												

STATEMENT I—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1825.				1826.				1827.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	29,640	109,840	114,904½	254,384½	43,499	80,584	34,657½	158,740½	81,357½	69,335	39,612	190,304½
Newburyport	4,179	11,403	8,256½	23,838½	5,170½	10,082½	3,857	19,110	9,687½	9,242½	3,901	22,831
Ipswich	224	378	287	889	18½	46	47	111½	48½	105½	87	241
Rockport												
Gloucester	1,287	4,913½	3,159	9,359½	4,446	5,614½	1,608	11,668½	9,187½	5,842	1,258½	16,288
Manchester												
Beverly												
Salem	665	4,825	5,970½	11,460½	1,512½	3,533½	2,004½	7,050½	2,104	3,041	1,642½	6,787½
Marblehead	223½	1,284	1,203½	2,711	238½	871½	612	1,722	723½	772½	257½	1,753½
Medford												
Charlestown												
Boston	15,381½	62,542½	61,595	139,519	19,551	38,215½	17,935½	75,702	32,698½	32,122	19,476	87,296½
Dorchester and Roxbury												
Quincy												
Weymouth	6	88½	194	288½	20	158	48	226	79	139	37	255
Hingham	5,045	10,205	14,808½	20,058½	7,469½	8,633½	2,553½	18,656½	12,283½	7,337	6,007½	25,628
Cohasset	1,510	6,283	9,727	17,520	1,996½	4,913½	2,075½	8,985½	3,804	3,584½	2,647	10,035½
Scituate	743	4,868	5,485	11,096	1,407	4,689½	1,602	7,698½	4,509	3,898½	2,339½	10,747
Duxbury	36½	539½	628	1,204					6	27	6	39
Plymouth	166	1,058	1,826	3,050	135½	432	381	948½	589½	711½	632	1,933
Sandwich												
Barnstable												
Yarmouth					12	24	12	48				
Brewster	4	15½	18	37½								
Wellfleet					1,201½	2,194	523	3,918½	1,764	1,628	469½	3,861½
Truro												
Provincetown	160	1,231	1,080½	2,471½	319	999½	1,034½	2,353	821	747½	696	2,264½
Chatham												
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford	3	179½	534	716½	1	176½	364	541½	35	87½	154	276½
Dartmouth	6½	26	132	164½					17	49	1	67
Westport												
Somerset												
Swansea												
Other towns												

STATEMENT I—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1828.				1829.				1830.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	63,235½	110,666½	63,422½	237,324½	54,184	77,098	94,695	225,977	47,868½	104,569½	156,025½	308,463½
Newburyport	6,679½	13,518½	6,193½	26,391½	4,842½	8,202	8,378½	21,423	3,437	11,707	11,052½	26,196½
Ipswich	203½	234½	131	569	18	31	16	65	34	83	47	164
Rockport												
Gloucester	9,720½	17,165½	7,317½	34,203½	10,873½	13,257	13,453	37,583½	7,761½	16,856½	26,995½	51,613½
Manchester												
Beverly												
Salem	696½	1,840½	1,436½	3,973½	487	1,066½	1,057	2,610½	1,169	2,430½	3,536½	7,136
Marblehead	647	860½	406½	1,914	306½	339½	568	1,214	199½	359	520½	1,079
Medford					251	454	1,117	1,822	436	1,085½	1,977½	3,499
Charlestown									381½	767½	915	2,064
Boston	25,593	43,203½	25,789½	94,586	22,531½	30,922	32,801½	86,255	19,823½	39,975	53,376½	113,175
Dorchester and Roxbury												
Quincy												
Weymouth	52½	203½	64	320	7	51	90	148	14	30	40	84
Hingham	9,786½	13,581½	10,282½	33,650½	6,897	8,809½	18,311½	34,018	5,383	10,570½	27,565½	43,519
Cohasset	2,954½	6,480½	5,157	14,592	2,348	4,148½	8,465	14,961½	2,438	5,431½	11,352	19,221½
Scituate	3,556½	7,200	4,355	15,111½	2,857	4,794	4,819	12,470	3,003	4,589½	6,626½	14,219
Duxbury									83½	572	1,414	2,069½
Plymouth	422½	1,076½	795	2,294	504½	954	1,735	3,193½	359	1,406½	3,754	5,519½
Sandwich												
Barnstable	445½	811	381½	1,638	618	1,237	2,473½	4,328½	481½	968½	2,242½	3,692½
Yarmouth												
Brewster												
Wellfleet	2,026	3,852	588	6,466	1,237½	2,236	516	3,989½	2,052½	4,795½	1,971½	8,819½
Truro												
Provincetown	449½	571	474	1,494½	366½	331½	757	1,455	670	2,228½	2,084½	4,983
Chatham									32	121	295	448
Harwich												
Dennis												
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford	2	67½	51	120½	15	181½	137	333½	73½	274	143	490½
Dartmouth					23½	83		106½	36½	318	116	470½
Westport												
Somerset												
Swansea												
Other towns												

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1831. 1.	1831. 2.	1831. 3.	1831. Total.	1831. Kegs.	1832. 1.	1832. 2.	1832. 3.	1832. Total.	1832. Kegs.	1833. 1.	1833. 2.	1833. 3.	1833. Total.	1833. Kegs, 1 & 2.
Total	70, 198	171, 186	142, 164½	383, 548½	14, 382	28, 679	97, 219½	96, 553½	222, 452	12, 540	54, 559½	98, 927½	69, 445½	222, 932½	13, 449
Newburyport	6, 102½	17, 938½	12, 382½	36, 423½	5, 654	3, 815½	9, 709	7, 640	21, 164½	1, 934	5, 981½	9, 975	4, 479½	20, 436	1, 159
Ipswich	114½	291½	447	853		76½	406½	492	975		121½	273	373	767½	10
Rockport															
Gloucester	11, 297	29, 030	29, 428½	69, 755½	5, 971	6, 039	16, 855½	16, 826	39, 720½	3, 811	11, 239	19, 002½	15, 283½	45, 525	3, 338
Manchester															
Beverly	22½	91	53	166½		66½	278	175½	520						
Salem	1, 128½	2, 951½	3, 081½	7, 161½		518½	1, 799	1, 468	3, 785½		683½	1, 075	556	2, 314½	
Marblehead	512	1, 068½	720½	2, 301		98½	177½	202	478		142	204	65	411	
Medford															
Charlestown	2, 563	6, 847½	2, 818	12, 228½	1, 297	857	5, 370	3, 848½	10, 075½	1, 729	2, 271½	4, 246	1, 734	8, 251½	1, 927
Boston	27, 098½	60, 745	41, 121	128, 964½	1, 460	9, 987	33, 228	27, 523½	70, 738½	4, 954	16, 402	27, 684½	13, 869½	57, 956	5, 701
Dorchester and Roxbury											690	1, 764½	1, 631	4, 085½	738
Quincy											433	751½	402½	1, 587	
Weymouth															
Hingham	9, 083½	18, 803½	24, 652	52, 539		2, 363½	8, 328	15, 436½	26, 128	112	4, 569	10, 009	13, 392	27, 970	448
Cohasset	2, 582	7, 138½	9, 622	19, 342½		705	3, 642½	6, 323½	10, 671		1, 817½	4, 364½	5, 088½	11, 270½	
Scituate	3, 087½	7, 064½	5, 492	15, 644		1, 230	3, 879½	4, 398	9, 507½		2, 118½	4, 379	3, 432	9, 929½	
Duxbury	436½	1, 972½	2, 056	4, 465		135	608	915½	1, 658½		170	432½	250	852½	
Plymouth	583½	1, 361½	1, 273	3, 218		257½	1, 187	1, 205½	2, 650		422	1, 216½	921	2, 559½	
Sandwich															
Barnstable	567½	2, 313	2, 442	5, 322½		131½	1, 210	1, 150½	2, 492		836½	2, 190½	976½	4, 003½	
Yarmouth	227	1, 346	1, 059	2, 632		140½	839½	1, 546	2, 526		685½	1, 272½	802	2, 760	30
Brewster															
Wellfleet	2, 637	6, 661	2, 690	11, 988		1, 098½	5, 665	4, 704	11, 467½		3, 429	6, 569	2, 812½	12, 810½	98
Truro													15	15	
Provincetown	1, 715½	4, 065	1, 807	7, 587½		932	2, 868	1, 820½	5, 620½		2, 321	2, 919	3, 268	8, 508	
Chatham	102½	213½	90	406		75	476½	331	a 822½						
Harwich	120	554½	214½	889											
Dennis															
Falmouth															
Nantucket						74½	222	205	501½		149½	102	9	260½	
Edgartown															
Fairhaven															
New Bedford	88	481	237	806		57	371	154	582		77	497	85	659	
Dartmouth	129	248	478	855											
Westport															
Somerset															
Swansea															
Other towns						20½	99	188	307½						

a Includes Dennis.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1834.					1835.					1836.				
	1.	2.	3.	Total.	¼ and ⅓ barrels.	1.	2.	3.	Total.	¼ and ⅛ barrels.	1.	2.	3.	Total.	¼ and ⅛ barrels.
Total	80,433½	93,553½	78,892½	252,879½	15,705	45,605	57,271½	91,924	194,800½	10,443	53,665½	60,558	60,187	174,410½	10,541
Newburyport	11,289½	9,639	6,849	27,777½	692	4,635½	6,453	11,244½	22,333	345	8,694	7,680½	6,134½	22,509	602
Ipswich	200	304	210	714											
Rockport															
Gloucester	23,551	23,933½	13,834½	61,319	3,861	14,697	15,570½	18,271½	48,539	2,554	17,346	14,904½	11,548	43,798½	2,398
Manchester															
Beverly															
Salem	1,440	1,064½	787	3,291½	90	498½	962	651½	2,112		1,407	717	366½	2,490½	3
Marblehead											59	118	66	243	
Medford															
Charlestown	2,311	3,139½	2,117½	7,568	949	852½	1,161½	1,878	3,892	8	341	202	289	832	
Boston	18,395	25,280	22,456	66,131	7,867	10,214½	15,149½	24,037½	49,401½	6,409	10,431½	14,911	14,610½	39,953	6,251
Dorchester and Roxbury	1,522	2,416	1,325½	5,263½	960										
Quincy	147	200	350	697	99	100	138	509	747						
Weymouth															
Hingham	5,198½	6,075	10,503½	21,777	595	3,150½	2,950	9,510	15,610½	265	2,857½	4,257½	6,771½	13,886½	316
Cohasset	2,165	3,725	5,799½	11,689½	400	1,217	2,280½	5,978	9,475½	107	1,333½	3,728½	6,622½	11,684½	16
Scituate	2,123½	2,408	1,655	6,186½	185	1,392	2,091	2,510	5,993	533	929	1,418½	1,447½	3,795	955
Duxbury	400½	746	614	1,760½		493	412	748	1,653		376	592	172	1,140	
Plymouth	691½	1,166	810	2,667½	6	276	689	1,725½	2,690½	218	207½	452	817	1,476½	
Sandwich															
Barnstable	942	1,857½	1,939	4,738½		1,159	1,432½	1,997½	4,589	4	475	1,481	2,157½	4,113½	
Yarmouth	791½	867	1,091½	2,750		411½	670	1,053	2,134½		283½	774½	1,388	2,446	
Brewster															
Wellfleet	4,211	4,585½	3,263½	12,060		2,932½	3,536½	2,830½	9,299½		3,670½	5,374	2,588	11,632½	
Truro												1	65½	66½	
Provincetown	3,956	4,822½	4,560½	13,339	1	3,176½	3,251	7,919½	14,347		5,224½	3,834	5,071	14,129½	
Chatham						208	301½	737	1,246½		2	7	32	41	
Harwich											7	19	4	30	
Dennis											21	86	36	143	
Falmouth															
Nantucket						100	78	53	231						
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerest															
Swansea															
Other towns	1,098½	1,324½	726½	3,149½		91	145	270	506						

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1837.					1838.				1839.			
	1	2.	3.	Total.	¼ and ⅛ barrels.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	24,573	61,027	52,557½	138,157½	13,467	37,968¼	28,588	44,184	110,740¼	22,217½	22,037¼	30,013½	74,268¼
Newburyport	5,088	5,726	4,471	15,285	211	5,709¾	2,993¼	4,367¼	13,070¼	4,333¾	1,660¾	2,592¼	8,586¼
Ipswich	20	33	12	65		2¾	13	9¼	25				
Rockport													
Gloucester	9,162½	16,198	7,163½	32,524	3,152	11,582¾	7,154¼	5,606¼	24,343	5,273¾	3,467¼	2,684	11,424¾
Manchester													
Beverly	26	68	13	107		35	63	32	130			½	½
Salem	459½	473	225	1,157½	120	747¾	309	273	1,329¾	96¾	104¾	44	245
Marblehead	86½	188	177	451½		76¾	40¼	52	169		2		2
Medford													
Charlestown	61½	242½	46	350									
Boston	2,758½	10,852½	9,273	22,864	8,390	5,176¾	4,309¼	6,127¾	15,613¾	2,790¾	2,719¾	3,119½	8,629¾
Dorchester and Roxbury													
Quincy													
Weymouth													
Hingham	2,034½	5,571	9,077½	16,683	239	3,069¾	2,218¾	6,187¾	11,476	2,476¾	2,608¼	4,633¾	9,718¾
Cohasset	607	3,989½	8,301	12,897½	412	2,061¾	1,732¾	6,665	10,459½	1,180¾	1,616	4,823¾	7,620½
Scituate	622½	1,595	1,786	4,003½	792	781¼	502	1,090	2,373¾	289	424¼	1,058¼	1,771¾
Duxbury	46	252½	320½	619	1	109¾	159	80¾	349	38¼	53¾	175¾	267¾
Plymouth	188½	589½	708½	1,486		341¾	303¾	472¾	1,117¼	63¼	191¾	357¾	613
Sandwich											3¾	33	36¾
Barnstable	627	2,714	2,138½	5,479½	22	1,000	1,365	1,534	3,899	1,035	1,419¾	2,235¾	4,690
Yarmouth	270	1,403½	1,917	3,590½		471	538	659	1,668	394	509	517¾	1,420¾
Brewster													
Wellfleet	1,695	5,573½	1,776	9,044½	118	3,315	3,608¾	3,618	10,541¾	2,045¾	2,968¾	2,741	7,755¾
Truro	70	522½	549½	1,142	10	677¾	799¾	1,646¼	3,123¾	706	1,315¾	1,320¼	3,342
Provincetown	622½	4,729	4,287½	9,639		2,194¾	1,798	4,747	8,739¾	630¾	1,736¾	2,599	4,966
Chatham	28	69	54	151		223¾	126¾	103	453	184¾	260	158	602¾
Harwich										10	8	2	20
Dennis	40½	166	85	291½		392¾	553¾	913¾	1,859¾	669	968¼	918¾	2,556
Falmouth													
Nantucket													
Edgartown													
Fairhaven													
New Bedford													
Dartmouth	59	71	196	326									
Westport													
Somerset													
Swansea													
Other towns													

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1840.				1841.				1842.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	19,351½	11,049	20,091	50,491½	23,747	10,649	21,141	55,537	29,363	22,496	23,684	75,548
Newburyport	2,903	1,109½	1,797	5,809½	2,975	1,535	2,717	7,227	3,330	1,508	2,254	7,092
Ipswich												
Rockport *a*									630	249	194	1,078
Gloucester	5,487	1,757½	954	8,198½	5,071	1,868	1,931	8,870	7,701	4,868	2,766	15,335
Manchester												
Beverly	2	2½		4½	10	6	5	21	1	2	1	4
Salem	46	2		48	80	29	75	184				
Marblehead												
Medford												
Charlestown												
Boston	2,986½	1,649½	3,087	7,723	2,917	1,406	1,386	5,709	2,192	2,023	1,449	5,664
Dorchester and Roxbury												
Quincy												
Weymouth												
Hingham	2,222	1,163½	3,743½	7,129	2,592	756	2,901	6,248	3,507	2,630	3,351	9,488
Cohasset	824	1,092½	3,103	5,019½	1,312	723	2,326	4,361	1,469	1,717	2,868	6,054
Scituate	237	112	561½	910½	371	237	452	1,060	258	561	491	1,310
Duxbury												
Plymouth	172	96½	61½	330	296	127	166	589	96	75	493	664
Sandwich			10	10								
Barnstable	367	409½	1,137	1,913½	738	276	829	1,843	780	740	1,306	2,826
Yarmouth	493	441½	444	1,378½	427	169	60	656	845	677	815	2,337
Brewster												
Wellfleet	983½	1,069	1,860	3,912½	2,368	1,242	2,862	6,472	2,441	2,786	2,782	8,009
Truro	1,018	696	1,074½	2,788½	2,440	951	3,461	6,852	2,563	1,266	2,250	6,079
Provincetown	584½	792½	709½	2,086½	916	830	940	2,686	2,011	1,489	992	4,492
Chatham	115½	27½	7	150	16	5	63	84	214	323	122	659
Harwich	3	22	45	70								
Dennis	907½	605½	1,496½	3,009½	1,218	489	967	2,674	1,325	1,582	1,550	4,457
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset												
Swansea												
Other towns												

a Rockport prior to 1840 was a part of Gloucester.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1843.				1844.				1845.			
	1.	2.	3.	Total.	1.	2.	3.	b Total.	1.	2.	3.	c Total.
Total	32,759	13,088	18,604	64,451	28,843½	22,515	35,023	86,381½	28,083⅛	88,623⅛	85,596½	202,302¾
Newburyport	2,771	1,187	1,403	5,361	28,842½	1,327	2,837	7,006½	2,814	2,754⅜	5,493	11,061¾
Ipswich												
Rockport	675	227	365	1,267	831½	492	610	1,933½	1,211	3,704¼	3,919½	8,834¾
Gloucester	10,489	2,987	2,852	16 328	6,147	4,757	6,057½	16,961½	6,824¼	22,795⅝	19,091¾	48,711⅝
Manchester												
Beverly	9	2		11	2	12	7	21	14	21	19	54
Salem										52	45	97
Marblehead									28¼	253½	326⅓	608¼
Medford												
Charlestown												
Boston	5,078	2,149	2,119	9,346	7,008	5,142	3,606	15,756	6,779¾	15,587¼	12,762½	35,129½
Dorchester and Roxbury												
Quincy												
Weymouth												
Hingham	2,314	1,017	2,597	5,928	2,629	1,798	4,943½	9,370½	2,055½	8,684	6,548½	17,288
Cohasset	2,306	1,116	3,039	6,461	1,775½	1,817⅓	4,266½	7,858⅓	1,684¾	6,290¼	9,609¾	17,584¾
Scituate	322	127	100	549	140⅓	228⅓	283	652	77¾	599¾	811	1,488½
Duxbury	13	9	25	47					14	42	32	85
Plymouth	153	87	176	416								
Sandwich												
Barnstable	665	246	510	1,421	658⅓	526	1,090	2,274⅓	398	1,978½	1,415¾	3,792¼
Yarmouth	1,040	399	957	2,396	533	545	1,333	2,411	290¼	2,009½	2,701½	5,001¼
Brewster												
Wellfleet	3,043	1,343	1,220	5,606	2,459	3,089	4,123	9,671	2,430⅝	9,394⅞	8,074	19,899½
Truro	1,542	721	1,112	3,375	1,785	828½	2,070	4,683½	1,600⅓	6,847⅛	7,300½	15,748⅓
Provincetown	1,131	901	1,085	3,117	1,077½	955½	1,841	3,874	980⅝	4,397⅜	4,765¼	10,143¼
Chatham	268	99	82	449	138	109	151⅓	398½	40	520	412	972
Harwich												
Dennis	940	471	962	2,373	816½	888	1,804	3,508½	843¼	2,691¼	2,269	5,804
Falmouth												
Nantucket												
Edgartown												
Fairhaven												
New Bedford												
Dartmouth												
Westport												
Somerset												
Swansea												
Other towns												

b The original return is figured 28,843, No. 1; 22,515, No. 2; 34,823, No. 3.

c The original return gives 28,086, No. 1; 88,696, No. 2; 85,520, No. 3.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1846.				1847.				1848.			
	1.	2.	3.	*a*Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	44,430⅞	70,005	65,076	179,511⅞	104,150⅝	76,006½	71,760⅜	251,917½	113,093¼	79,979⅛	107,058¼	300,130⅝
Newburyport	2,787	7,657	8,370¼	18,814¼	5,161⅝	8,937½	9,254	23,353⅛	2,289⅜	7,049¼	16,955½	26,294⅝
Ispwich												
Rockport	1,960	2,907	1,519	6,386	2,726	2,397½	1,657½	6,781	3,445⅛	2,936⅜	1,369¼	7,750¾
Gloucester	9,937⅜	18,400⅞	14,563	42,901¼	14,597½	15,316⅛	11,493⅝	41,407¼	15,565½	17,301⅞	20,632¾	53,500⅛
Manchester	174¼	275¾	127	577	583¾	449	65	1,097¾				
Beverly					332	330	84	746	389	313½	81½	784
Salem	91	336	117	544	350¼	150	7	507¼	80	102	19	201
Marblehead	105	162	108½	375½	166¾	162½	95¼	424½	267½	218¼	73	559¼
Medford												
Charlestown												
Boston	6,404⅞	7,111⅝	6,146¼	19,662¾	17,646⅞	14,107⅞	7,557½	*b*39,312	14,414½	10,829⅛	11,870	37,113⅝
Dorchester and Roxbury												
Quincy												
Weymouth												
Hingham	4,097	6,371¾	7,246	17,714¾	7,698	5,675	6,538¼	19,911¼	8,258⅞	4,026¼	7,565¼	19,850⅜
Cohasset	2,036⅜	4,424⅝	5,833¾	12,294¾	5,747⅜	4,567⅝	7,053½	17,368½	9,211⅝	4,710⅛	9,045¾	22,967⅛
Scituate	333¾	880¾	458½	1,673	179	376½	212	767½	435¾	592	523¾	1,551½
Duxbury												
Plymouth	75	92	97	264	307	245	110	662	352	463	83	903
Sandwich												
Barnstable	1,086½	861⅛	1,680	3,627⅝	4,620⅝	1,557¾	1,861¼	8,039⅝	2,553¾	1,058¼	1,022	4,634
Yarmouth	992½	871½	1,117	2,981	1,973¾	1,023½	1,551½	4,548¾	3,842¼	2,512¼	3,975	10,329½
Brewster												
Wellfleet	4,307⅜	8,559½	6,901	19,768⅜	11,645½	6,203⅞	9,404¼	27,253⅝	12,611	5,728¾	9,879½	28,219¼
Truro	3,255¾	3,522⅞	4,550½	11,328¾	6,962	3,217⅝	5,440	15,619⅝	9,360¾	3,697½	6,221⅛	19,279¾
Provincetown	4,145⅜	4,888⅛	3,716½	12,750	12,345⅛	6,329½	5,187	23,861⅝	14,919⅝	7,734⅝	8,395	31,049¼
Chatham	631½	711	443	1,785½	1,644	1,024	511½	3,179½	2,844¼	2,206¼	1,218	6,268½
Harwich	475	493½	431½	1,400	2,110½	949¾	118½	3,178¾	4,862¼	3,208½	1,651¼	9,722
Dennis	1,535⅛	1,478	1,650¼	4,663⅜	7,353	2,985⅞	3,559	13,897⅞	6,403⅛	4,124¼	6,066¼	16,593⅝
Falmouth									157⅛	164½	83½	405½
Nantucket									270	280	60	610
Edgartown									430½	604	231½	1,266
Fairhaven												
New Bedford									129	112½	36	77½
Dartmouth												
Westport												
Somerset												
Swansea												
Other towns												

a The original return is footed 42,808½, No. 1; 69,380⅜, No. 2; 64,877, No. 3. *b* Includes some reinspected fish.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1849.				1850.					1851.				
	1.	2.	3.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	61, 404	81, 962	65, 584	208, 950	88, 401	44, 909	87, 604	21, 658	242, 572	90, 765⅛	102, 467¼	135, 597¼	414½	329, 244⅛
Newburyport	4, 148	5, 818	6, 914	16, 880	8, 580	5, 014	8, 840	495	22 929	6, 467¼	5, 879¾	8, 855⅜		21, 202¼
Ipswich														
Rockport	1, 459	2, 105	822	4, 386	2, 058	738	357	763	3, 916	1, 349¾	2, 737¾	5, 121	32	9, 240½
Gloucester	14, 636	19, 822	11, 121	45, 579	22, 488	8, 839	14, 141	4, 525	49, 993	37, 130¾	18, 524⅛	25, 689¾	282½	81, 627⅛
Manchester	27	178	82	287										
Beverly	60	97	30	187	561	295	520	166	1, 542	629	632	619		1, 880
Salem	33	82		115	55	79	34	6	174	42	80	1		123
Marblehead	50	45	9	104	51	16		41	108					
Medford														
Charlestown														
Boston	4, 100	6, 327	4, 014	14, 441	9, 007	5, 442	6, 895	2, 512	23, 856	10, 904	14, 164	15, 666½	3	40, 737½
Dorchester and Roxbury														
Quincy														
Weymouth														
Hingham	4, 177	4, 681	4, 566	13, 424	4, 997	1, 699	6, 914	926	14, 536	3, 937½	7, 702	12, 205	19	23, 863½
Cohasset	3, 227	5, 207	6, 859	15, 293	3, 806	2, 290	7, 495	1, 755	15, 346	3, 193⅞	5, 822⅞	13, 695½		22, 712¼
Scituate	392	577	442	1, 411	534	291	1, 306		2, 131	97½	914¾	707	1½	1, 720¾
Duxbury														
Plymouth	76	213	277	566	35	26	2	7	70	79½	222	302		603½
Sandwich														
Barnstable	2, 035	2, 066	2, 111	6, 212	2, 309	1, 441	1, 648	667	6, 065	1, 499½	2, 539⅞	2, 110⅝	12	6, 162
Yarmouth	1, 487	1, 821	2, 524	5, 832	1, 935	1, 320	2, 341	225	5, 821	1, 076½	3, 300½	3, 160		7, 537
Brewster														
Wellfleet	5, 504	7, 726	5, 319	18, 549	5, 969	2, 684	7, 343	1, 619	17, 615	4, 058¼	14, 234¾	15, 184½		33, 477½
Truro	3, 335	4, 666	3, 861	11, 862	2, 314	1, 127	4, 300	829	8, 570	2, 538¼	3, 046½	4, 694¼	8½	10, 287½
Provincetown	7, 080	9, 256	7, 010	23, 346	9, 938	4, 774	9, 222	3, 931	27, 865	7, 481½	7, 774	5, 223½	9½	20, 488½
Chatham	1, 627	1, 351	867	3, 845	2, 740	1, 169	1, 228	627	5, 764	1, 483⅝	3, 683	4, 015¾	40½	9, 222⅞
Harwich	5, 039	5, 401	4, 165	14, 605	5, 007	3, 369	5, 426	1, 037	14, 839	5, 448½	6, 641¼	9, 735½		21, 825¼
Dennis	2, 629	4, 181	4, 275	11, 085	5, 716	3, 960	9, 365	1, 354	20, 395	3, 271⅞	4, 453⅛	8, 491	4	16, 220
Falmouth														
Nantucket	106	106	218	430	6	14	73		93					
Edgartown	153	188	25	366	261	305	150	140	856	76	115	120	2	313
Fairhaven														
New Bedford														
Dartmouth														
Westport	24	48	73	145	34	17	4	33	88					
Somerset														
Swansea														
Other towns														

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1852.					1853.					1854.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	84, 030⅜	67, 071½	44, 808⅛	2, 210	198, 120	49, 015⅜	24, 584	39, 897	19, 843⅞	133, 340¼	30, 595⅜	46, 242¼	55, 133⅜	3, 378¾	135, 349¾
Newburyport	6, 333	1, 985	3, 295½	192½	11, 806	3, 513⅛	1, 625⅝	4, 558	695⅝	10, 392⅜	1, 449¼	2, 458⅝	4, 078¼	84½	8, 070⅝
Ipswich															
Rockport	2, 021⅛	2, 717⅛	528¾	78½	5, 345½	1, 855⅞	1, 197⅜	661½	808½	4, 523¼	950⅛	1, 235⅞	1, 053	39	3, 278
Gloucester	23, 017¾	16, 639⅛	7, 529⅞	826	48, 012¾	20, 428⅜	6, 134¼	7, 461⅜	3, 867	37, 891	11, 299¼	18, 317¾	11, 037¼	678	41, 332¼
Manchester															
Beverly	149	169⅝	48		366⅝	388¾	288¾	136¾	366⅝	1, 120⅞	26	61	51		138
Salem	2	9	3		14										
Marblehead															
Medford															
Charlestown															
Boston	18, 074¼	13, 026½	8, 499½	291½	39, 891¾	11, 391¼	6, 975¼	8, 940¼	6, 021¼	33, 328	7, 910	9, 401⅛	10, 312¾	975½	28, 599⅜
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	3, 434⅝	5, 244½	4, 386	68½	13, 133⅝	1, 629	1, 102½	3, 070¾	1, 071½	6, 873¾	1, 271¼	1, 330½	2, 625¾	99½	5, 327
Cohassett	3, 479⅝	3, 335¼	4, 701¾	100	11, 616⅝	1, 195¾	953¼	3, 959¼	1, 495	7, 603¼	807⅝	1, 761¾	4, 848⅜	174½	7, 591½
Scituate	264	270¼	148½	34½	717¼										
Duxbury															
Plymouth	25	26	16		67										
Sandwich															
Barnstable	1, 440⅜	1, 082	677		3, 199⅜	777	450⅜	728½	528	2, 483⅞	106	172½	202½	1	482
Yarmouth	1, 155¼	1, 499	580¾		3, 235	402½	236½	265¼	145¾	1, 050	99	300½	556¼	12¾	968½
Brewster															
Wellfleet	4, 993	4, 244	1, 869½	262	11, 367½	2, 669	2, 198⅞	2, 468¾	1, 386½	8, 723⅛	2, 483⅝	4, 193⅝	5, 186¼	524	13, 017½
Truro	1, 424⅛	821⅓	295		2, 540⅝	85	50	142	21	298	202	15	33		250
Provincetown	9, 243⅛	5, 618⅞	3, 276¾	125½	18, 264¼	630⅞	537⅛	566¼	551¾	2, 286	1, 300⅜	2, 706½	4, 095¼	255½	8, 357⅜
Chatham	1, 477½	1, 713¼	2, 559½	30	5, 780¼	552¾	335	537½	613⅜	2, 038⅝	402¼	475	1, 417¾	70½	2, 365½
Harwich	4, 413⅞	4, 648	3, 312¾	96½	12, 471⅛	1, 803	1, 266⅛	3, 321⅞	1, 077	7, 468	1, 247⅜	2, 440¼	5, 002¼	216¼	8, 906¾
Dennis	3, 083¾	4, 022½	3, 080	104½	10, 290¾	1, 693⅛	1, 293	3, 079	1, 195	7, 260⅛	1, 041¼	1, 371⅝	4, 003¾	247¾	6, 664⅜
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1855.					1856.					1857.a				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	29,302¼	91,122⅝	90,193⅛	1,338⅝	211,956⅝	89,333⅜	76,819⅜	47,981⅞	178	214,312⅝	84,519⅜	45,218⅛	38,257⅛	711	168,705⅜
Newburyport	1,517⅛	5,915⅛	5,803⅛	4	13,239⅜	5,802⅝	3,927½	2,399½	1	12,130⅝					
Ipswich															
Rockport	896	2,530⅛	2,314½		5,740⅝	1,985⅝	3,224¼	1,303½		6,513⅜					
Gloucester	14,718⅜	41,542½	16,532⅜	341½	73,134¾	44,930⅞	16,296⅓	6,849⅜	17½	68,093¾					
Manchester															
Beverly	84	274	106	2	466	42½	110	102		254½					
Salem															
Marblehead															
Medford															
Charlestown															
Boston	6,147	14,822⅞	22,648¾	368⅝	43,987¼	17,335	21,886⅝	14,845⅝	73	54,140¼					
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	420⅛	3,026½	4,939¾	64	8,450⅜	1,882⅛	3,591⅓	3,541⅛		9,014⅜					
Cohasset	438	2,723¾	5,798½	58	9,018¼	2,053¾	1,863⅝	4,036⅝		7,954					
Scituate															
Duxbury															
Plymouth						35	54	15		104					
Sandwich															
Barnstable	138	217	224½		579½	159½	194½	78	15	447					
Yarmouth	95¾	418	586½	2	1,102¼	194½	174¼	30¼		399					
Brewster															
Wellfleet	1,919	7,602⅞	11,008	308	20,837⅞	5,429½	9,733⅞	5,391	41	20,595⅜					
Truro	354	1,564	3,576	17	5,511	536	1,196	607		2,339					
Provincetown	537	2,427⅛	3,264¾	37	6,265⅞	2,948¾	3,767½	2,781½	30½	9,528¼					
Chatham	236½	735⅛	2,184¼		3,155⅞	860¾	2,167¼	1,384⅞		4,412⅞					
Harwich	1,077¾	4,080⅛	6,546⅛	32½	11,736½	3,071⅛	4,693⅛	2,256¼		10,020½					
Dennis	723⅝	3,243½	4,660	104	8,731⅛	2,066¼	3,939¼	2,360¼		8,365¾					
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

a The returns for 1857 do not give ports of inspection.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1858.					1859.					1860.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	75,347$\frac{10}{16}$	21,929$\frac{6}{16}$	32,332$\frac{13}{16}$	1,992$\frac{8}{16}$	131,602$\frac{5}{16}$	61,330	12,060$\frac{1}{8}$	22,207$\frac{1}{4}$	4,118$\frac{3}{8}$	99,715$\frac{3}{4}$	58,828$\frac{2}{8}$	122,837	50,578$\frac{5}{8}$	3,441$\frac{3}{8}$	235,685$\frac{1}{4}$
Newburyport	5,169$\frac{4}{16}$	1,453$\frac{6}{16}$	2,431	35$\frac{12}{16}$	9,089$\frac{6}{16}$	4,219$\frac{3}{8}$	1,033$\frac{1}{4}$	1,536$\frac{1}{2}$	62$\frac{1}{4}$	6,851$\frac{3}{8}$	3,582$\frac{7}{8}$	1,753$\frac{6}{8}$	1,382$\frac{6}{8}$	85$\frac{6}{8}$	6,805$\frac{1}{8}$
Ipswich															
Rockport	2,645$\frac{9}{16}$	754$\frac{14}{16}$	730$\frac{4}{16}$	21$\frac{2}{16}$	4,152$\frac{2}{16}$	1,683$\frac{3}{4}$	376$\frac{1}{8}$	643$\frac{1}{2}$	301	3,004$\frac{3}{8}$	1,608	3,096$\frac{7}{8}$	820	37	5,561$\frac{7}{8}$
Gloucester	39,948$\frac{14}{16}$	6,777$\frac{10}{16}$	9,502$\frac{2}{16}$	260$\frac{12}{16}$	56,489$\frac{6}{16}$	41,254$\frac{5}{8}$	5,947$\frac{1}{4}$	9,764$\frac{3}{4}$	2,698	59,664$\frac{5}{8}$	37,407$\frac{4}{8}$	42,659$\frac{7}{8}$	17,108	816$\frac{5}{8}$	97,992
Manchester															
Beverly						35	6$\frac{1}{2}$	6$\frac{1}{2}$	$\frac{1}{2}$	48$\frac{1}{2}$	177	55$\frac{4}{8}$	4$\frac{4}{8}$		237
Salem															
Marblehead															
Medford															
Charlestown															
Boston	17,175$\frac{8}{16}$	7,512$\frac{4}{16}$	9,392$\frac{8}{16}$	1,467$\frac{5}{16}$	35,547$\frac{5}{16}$	1,100$\frac{1}{2}$	483$\frac{1}{4}$	1,109$\frac{1}{4}$	230$\frac{1}{4}$	2,923$\frac{1}{4}$	5,055$\frac{4}{8}$	20,219$\frac{7}{8}$	5,749$\frac{6}{8}$	1,102$\frac{7}{8}$	32,127$\frac{3}{4}$
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	939$\frac{10}{16}$	616$\frac{14}{16}$	1,441$\frac{4}{16}$	9$\frac{12}{16}$	3,007$\frac{8}{16}$	1,524$\frac{1}{8}$	571$\frac{3}{4}$	1,477	17$\frac{3}{4}$	3,590$\frac{5}{8}$	712	7,478	3,367$\frac{4}{8}$	216$\frac{4}{8}$	11,773$\frac{3}{4}$
Cohasset	1,271$\frac{6}{16}$	479	1,375$\frac{12}{16}$	2$\frac{4}{16}$	3,128$\frac{6}{16}$	1,127$\frac{7}{8}$	185$\frac{3}{4}$	921$\frac{3}{4}$	9	2,244$\frac{3}{8}$	1,271$\frac{4}{8}$	6,030$\frac{6}{8}$	4,534	144$\frac{2}{8}$	11,980$\frac{1}{2}$
Scituate															
Duxbury															
Plymouth						31$\frac{1}{2}$	$\frac{1}{2}$	1$\frac{1}{2}$		33$\frac{1}{2}$	12	93	14		119
Sandwich															
Barnstable															
Yarmouth	204$\frac{4}{16}$	105$\frac{12}{16}$	78		388	171	82	38		291	154	352$\frac{4}{8}$	126$\frac{4}{8}$		633
Brewster															
Wellfleet	2,430$\frac{8}{16}$	1,443$\frac{4}{16}$	1,461	1	5,335$\frac{10}{16}$	3,844$\frac{7}{8}$	1,391$\frac{7}{8}$	2,272$\frac{1}{4}$	243$\frac{1}{2}$	7,752$\frac{1}{2}$	2,297	17,509$\frac{6}{8}$	6,916	627$\frac{4}{8}$	27,350$\frac{1}{4}$
Truro	544$\frac{4}{16}$	313$\frac{4}{16}$	650	137	1,644$\frac{8}{16}$	622	95$\frac{3}{8}$	400	2	1,119$\frac{3}{8}$	113	131	42$\frac{4}{8}$		286$\frac{1}{2}$
Provincetown	3,361$\frac{14}{16}$	853$\frac{12}{16}$	1,722$\frac{4}{16}$	47$\frac{8}{16}$	5,985$\frac{6}{16}$	2,739	863$\frac{7}{8}$	2,058$\frac{1}{2}$	216	5,877$\frac{3}{8}$	2,612$\frac{5}{8}$	12,017$\frac{3}{8}$	4,465$\frac{4}{8}$	235	19,330$\frac{1}{2}$
Chatham	310$\frac{2}{16}$	238$\frac{2}{16}$	454$\frac{8}{16}$	2	1,004$\frac{12}{16}$	214$\frac{7}{8}$	69	199$\frac{3}{4}$	25$\frac{1}{4}$	508$\frac{3}{4}$	725$\frac{3}{8}$	2,413$\frac{7}{8}$	1,364$\frac{4}{8}$	10	4,513$\frac{3}{4}$
Harwich	906$\frac{12}{16}$	842$\frac{4}{16}$	1,966$\frac{4}{16}$	2$\frac{8}{16}$	3,717$\frac{12}{16}$	1,907$\frac{5}{8}$	528$\frac{3}{4}$	669$\frac{1}{2}$	92$\frac{1}{2}$	a3,198$\frac{3}{8}$	1,911$\frac{4}{8}$	5,337$\frac{4}{8}$	2,599	32$\frac{4}{8}$	a9,880$\frac{1}{2}$
Dennis	440	539	1,128$\frac{4}{16}$	5	2,112$\frac{4}{16}$	853$\frac{7}{8}$	424$\frac{7}{8}$	1,108$\frac{1}{2}$	220$\frac{1}{2}$	2,607$\frac{3}{4}$	1,188$\frac{3}{8}$	3,687$\frac{3}{8}$	2,084$\frac{6}{8}$	133$\frac{6}{8}$	7,094$\frac{1}{4}$
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

a Harwich and Harwichport.

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1861. 1.	1861. 2.	1861. 3.	1861. 4.	1861. Total.	1862. 1.	1862. 2.	1862. 3.	1862. 4.	1862. Total.	1863. 1.	1863. 2.	1863. 3.	1863. 4.	1863. Total.
Total	70,877½	100,286⅜	22,486	633¾	194,283⅝	81,962¾	78,388⅜	100,011	562¾	260,864⅞	67,985½	136,075 5/16	102,601¾	280	306,942 9/16
Newburyport	1,733	4,159½	1,251⅜	2½	7,186⅜	1,222⅝	2,892⅝	3,197½	65	7,377¾	1,505⅓	2,826⅞	2,643¾	6	6,982⅜
Ipswich															
Rockport	2,008¾	2,746⅝	219½	15	4,989⅞	2,171¼	1,947¾	1,969	12	6,100	920⅛	3,470⅞	1,280		5,671
Gloucester	37,995⅜	45,533½	6,707¼	279¾	90,515⅞	53,569⅞	33,115⅜	29,364⅜	188¼	116,237⅞	51,855⅜	71,983⅝	26,921¼	132	153,892½
Manchester															
Beverly	211½	50½	2½		264½	52	159	69		280					
Salem															
Marblehead															
Medford															
Charlestown															
Boston	5,602¼	11,314½	2,405½	149	19,471¼	5,648⅝	9,776⅛	14,028¾	70½	29,524	3,248¾	13,793 15/16	13,471¾	16	30,530 7/16
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	1,754½	5,566⅜	1,866	39	9,225⅜	1,841⅛	4,161⅞	5,383½	7	11,396½	680¾	5,872⅝	7,780¼	10½	14,344⅛
Cohasset	2,148	3,975½	3,135⅜	13½	9,272⅜	1,865⅛	2,508⅞	7,071¼	9	11,454¼	518¾	4,335⅞	10,971½	26	15,852⅛
Scituate															
Duxbury															
Plymouth	7½	12½	16		26										
Sandwich															
Barnstable															
Yarmouth	114½	187	106		407½	44	138¾	252½		435¼					
Brewster															
Wellfleet	4,062¾	8,915	1,116⅓	34	14,118¼	4,630⅜	7,111⅞	14,599¼	90	26,431½	1,675	10,885¼	14,522¾		27,083
Truro	87⅞	117⅛	15		220										
Provincetown	5,670⅝	8,459⅞	2,365	100⅓	16,596	4,383⅓	7,214¼	11,104¼	51½	22,753⅓	2,437⅜	10,477¾	12,351⅓	67	25,336⅞
Chatham	1,502⅜	1,672¾	275¾	6½	3,457⅜	1,616	1,993⅜	2,841¼	4½	6,455⅛	626⅛	3,364⅝	2,955¼		6,946
Harwich	4,862½	4,216½	1,834¼	4	10,917¼	2,638⅜	4,041⅞	4,606¾	55	11,342	759⅜	4,513	4,394⅛		9,666½
Dennis	3,076	3,359⅜	1,170		7,605⅜	2,220¼	3,323⅝	5,523⅝	10	11,077½	757⅝	4,550⅞	5,306⅝	22½	10,637⅝
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1864.					1865.					1866.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	63,383¼	137,746¾	33,212¾	14½	274,357¼	153,723¼	63,562¼	39,266⅜	244¼	256,796⅛	150,322⅜	36,319 15/16	44,784⅝	269½	231,696 7/16
Newburyport	2,620⅜	4,319¾	867½		7,807⅝	4,755¼	2,467⅞	1,121⅝		8,344¾	4,914 5/16	955 9/16	1,596⅛	2	7,468
Ipswich															
Rockport	1,891¼	2,483½	592½		4,970¼	3,912⅞	1,587⅛	246½		5,746½	5,065	1,738⅜	759½		7,562⅞
Gloucester	68,061⅛	73,001 15/16	13,866¾	8½	154,938 5/16	99,174⅜	28,378⅛	13,995¼	28	141,575¾	86,245	13,630⅞	12,978	2½	112,856⅜
Manchester															
Beverly	72¾	124½	20		217¼	94½	21	1		116½					
Salem															
Marblehead															
Medford															
Charlestown															
Boston	7,268⅜	11,927⅞	4,158¾	1½	23,356½	17,080⅞	12,635⅜	6,670¼	12½	36,399	28,197 7/16	9,901⅝	7,986⅞	47	46,132 15/16
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	1,765⅞	4,500⅝	1,863		8,129½	2,169⅝	1,671	1,860⅛	½	5,701¼	1,744¼	1,433¼	2,233⅛		5,411
Cohasset	2,270¼	3,632 13/16	2,818¼	1	8,722 5/16	3,434¾	1,863⅛	3,726½	4	9,028⅜	2,854⅝	1,068¾	3,505⅝	5½	7,434½
Scituate															
Duxbury															
Plymouth															
Sandwich															
Barnstable															
Yarmouth															
Brewster															
Wellfleet	7,207½	16,720⅜	2,847		26,774⅞	7,928⅝	5,522	4,085½		17,536⅛	7,120⅛	3,267⅝	5,426	20½	15,834¼
Truro						7⅛	6½	2¼		15⅞					
Provincetown	4,847⅞	10,215⅝	2,759⅛		17,822⅝	6,509⅜	5,756⅛	4,949⅝	188½	17,403⅝	6,366¾	2,845⅝	5,533½	148½	14,894⅜
Chatham	2,496⅛	3,485¼	1,063⅞	3½	7,048¾	2,697	914¾	514¾	4¾	4,131½	1,812⅜	166¼	954⅛	13¼	2,946⅜
Harwich	2,903½	3,674⅝	1,133		7,711⅛	3,470¼	1,341⅞	1,081		5,893⅛	3,108⅝	696¼	1,885	12½	5,702⅛
Dennis	1,975¼	3,659⅞	1,223		6,858⅛	1,929⅞	1,157⅜	916	6	4,009¼	1,718¼	324¼	1,336⅜	12¼	3,391
Falmouth															
Nantucket						558¾	240	96		894¾	868¼	202½	419	4	1,493¾
Edgartown															
Fairhaven															
New Bedford															
Dartmouth											307⅜	89	171	1½	568⅞
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1867.					1868.					1869.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	122,808 9/16	46,038 9/20	41,048 11/20	418 1/2	210,314 1/16	93,091 11/80	42,263 7/20	44,077 21/40	625 1/8	180,056 11/80	72,924 1/2	92,019 1/2	65,717 1/8	3,549 3/4	234,210 7/8
Newburyport	3,283 3/5	1,626 3/5	2,548 3/10	11	7,469 1/2	2,580 1/8	533 1/2	2,082 17/20		5,196 19/40	1,218 1/4	1,953 1/8	3,008 1/4	39	6,218 5/8
Ipswich															
Rockport	4,313 3/8	1,702 1/4	464		6,479 5/8	3,147 1/4	1,462 1/8	651		5,260 3/8	1,942 7/8	2,168	1,839 1/2	12	5,962 3/8
Gloucester	78,062 1/8	17,328 1/8	8,507 1/8	20 1/2	103,917 7/8	50,652 9/16	14,209 3/8	10,495 1/2	160	75,517 7/16	37,153 1/4	36,595 1/2	18,495 3/8	882 1/8	93,126 1/4
Manchester															
Beverly	9	3/4			9 3/4										
Salem						2,285 1/2	382 1/4	193 1/4		2,861	1,050 1/2	1,083 1/2	229 5/8	6 1/4	2,369 7/8
Marblehead															
Medford															
Charlestown															
Boston	8,437 7/16	5,212	4,777 1/4	14.	18,440 11/16	14,117 1/2	7,284 5/8	8,700 1/2	186 1/4	30,288 7/8	10,457 1/2	13,156 1/4	9,742 3/8	779 1/8	34,135 1/4
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	2,245 1/2	1,350 1/4	2,200 3/4	1/2	5,797	1,323 7/8	2,230 3/4	2,342 5/8	17 1/2	5,914 3/4	1,340 7/8	3,011 1/8	2,116 5/8	56 3/4	6,525 3/8
Cohasset	3,093 1/4	2,360 3/4	4,265 1/8	38 1/2	9,757 5/8	1,553 3/4	1,274 1/8	2,162 1/2		4,990 3/8	2,115 1/8	4,003 7/8	3,371 7/8	141	9,631 7/8
Scituate															
Duxbury															
Plymouth															
Sandwich															
Barnstable															
Yarmouth			22		22										
Brewster															
Wellfleet	8,087 19/20	8,617 11/40	6,840 3/4		23,545 39/40	4,124 3/4	3,602 5/8	3,608	20 1/2	11,355 5/8	5,543 1/4	11,266 1/2	10,380 7/8	685	27,875 5/8
Truro															
Provincetown	7,582 23/40	4,952 3/20	4,579 5/8	278	17,392 7/20	6,352 5/8	7,074 1/10	7,295 3/4	134 1/4	20,856 1/2	5,377 1/4	9,536 3/4	8,574 7/8	509 1/2	23,998 3/8
Chatham	1,425	150 7/8	724 7/8	13	2,313 3/4	1,115 3/4	485 5/8	850	5 1/8	2,456 1/2	884	1,294 1/2	1,305	168 3/4	3,652 1/4
Harwich	2,808	1,097 3/4	2,594 7/8	29 1/2	6,530 1/8	2,940 7/8	1,553 1/8	2,630	24 3/4	7,148 3/4	2,952 1/8	3,463 1/4	3,333	105 1/2	9,853 7/8
Dennis	1,836 1/2	1,234 1/4	2,357 7/8	1	5,429 5/8	1,821 7/8	1,393 7/8	1,973 1/4	29 3/4	5,218 3/4	2,116 1/8	2,912 3/4	2,633	111 1/4	7,773 1/8
Falmouth															
Nantucket	1,445 1/4	391 17/40	1,043 3/4	12 1/2	2,892 37/40	992 3/10	733 1/4	979 11/20	47	2,752 1/10	746 1/4	1,499	636 3/4	53 1/2	2,935 1/2
Edgartown															
Fairhaven															
New Bedford															
Dartmouth	179	14	122 1/4		315 1/4	82 5/8	43 1/2	112 3/4		238 7/8	26 5/8	75 1/2	50		152 1/8
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1870.					1871.					1872.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	66,046$\frac{1}{10}$	189,422$\frac{5}{8}$	63,019$\frac{3}{8}$	33$\frac{1}{2}$	318,521$\frac{3}{5}$	105,187$\frac{33}{40}$	85,867$\frac{23}{40}$	68,322$\frac{17}{20}$	38$\frac{1}{2}$	259,416$\frac{3}{4}$	71,866$\frac{27}{40}$	54,370$\frac{57}{80}$	55,603$\frac{1}{8}$	115$\frac{1}{2}$	181,956$\frac{1}{80}$
Newburyport	2,084$\frac{3}{20}$	3,057$\frac{1}{5}$	2,254$\frac{3}{20}$		7,395$\frac{1}{2}$	1,158$\frac{4}{5}$	3,241$\frac{13}{20}$	1,746$\frac{1}{8}$		6,146$\frac{23}{40}$	1,775$\frac{9}{10}$	1,370$\frac{7}{10}$	674$\frac{3}{4}$		3,821$\frac{7}{20}$
Ipswich															
Rockport	2,187$\frac{3}{8}$	6,437$\frac{7}{8}$	1,175		9,800$\frac{1}{4}$	4,426$\frac{3}{8}$	2,066$\frac{3}{8}$	448		6,940$\frac{3}{4}$	1,617$\frac{1}{4}$	1,310$\frac{7}{8}$	751		3,679$\frac{1}{8}$
Gloucester	32,089$\frac{7}{10}$	82,935$\frac{3}{4}$	14,564$\frac{7}{10}$	5	129,595$\frac{3}{20}$	49,144$\frac{23}{40}$	36,880$\frac{9}{10}$	20,952$\frac{4}{5}$	30$\frac{1}{2}$	107,008$\frac{31}{40}$	34,013$\frac{31}{40}$	20,403$\frac{3}{40}$	12,950	29	67,395$\frac{17}{20}$
Manchester															
Beverly	7	26			33										
Salem	1,418$\frac{1}{2}$	2,202$\frac{5}{8}$	822$\frac{3}{4}$		4,443$\frac{7}{8}$	2,132$\frac{7}{8}$	1,507$\frac{1}{8}$	1,273$\frac{7}{8}$		4,913$\frac{7}{8}$	1,589$\frac{5}{8}$	733$\frac{3}{8}$	946$\frac{1}{8}$		3,269$\frac{1}{8}$
Marblehead															
Medford															
Charlestown															
Boston	9,034	22,442$\frac{5}{8}$	11,297$\frac{3}{4}$	12	42,786$\frac{3}{8}$	14,439$\frac{1}{8}$	15,223$\frac{3}{8}$	13,353$\frac{1}{2}$		43,016	13,101$\frac{5}{8}$	11,136$\frac{11}{16}$	11,157$\frac{3}{8}$	59	35,454$\frac{11}{16}$
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	749$\frac{1}{5}$	4,393$\frac{13}{40}$	2,058		7,200$\frac{21}{40}$	769$\frac{7}{8}$	805$\frac{3}{8}$	713		2,288$\frac{1}{4}$	414	506$\frac{1}{2}$	730$\frac{1}{2}$		1,651
Cohasset	1,421$\frac{3}{8}$	5,774$\frac{3}{4}$	3,569$\frac{5}{8}$		10,765$\frac{3}{4}$	2,183$\frac{9}{20}$	1,366$\frac{13}{40}$	1,968$\frac{3}{5}$		5,518$\frac{3}{8}$	1,218$\frac{1}{2}$	1,404$\frac{3}{4}$	2,292$\frac{1}{2}$		5,015$\frac{3}{4}$
Scituate															
Duxbury															
Plymouth															
Sandwich															
Barnstable						123$\frac{1}{2}$	174	178		475$\frac{1}{2}$	116	131	215		462
Yarmouth															
Brewster															
Wellfleet	5,932$\frac{3}{20}$	26,059$\frac{11}{20}$	9,361		41,351$\frac{7}{10}$	11,448$\frac{1}{2}$	11,525$\frac{11}{20}$	9,897		32,871$\frac{1}{20}$	6,377$\frac{2}{5}$	6,903$\frac{9}{10}$	10,459$\frac{1}{2}$		23,740$\frac{4}{5}$
Truro															
Provincetown	3,678$\frac{39}{40}$	15,813$\frac{3}{8}$	6,330$\frac{3}{40}$	7	25,829$\frac{11}{40}$	10,305$\frac{39}{40}$	7,525$\frac{29}{40}$	7,538$\frac{9}{40}$	5	25,374$\frac{37}{40}$	5,353$\frac{9}{20}$	4,401$\frac{3}{8}$	6,962$\frac{11}{40}$	2	16,719$\frac{1}{10}$
Chatham	2,064$\frac{1}{4}$	3,758$\frac{5}{8}$	2,325		8,147$\frac{7}{8}$	2,514$\frac{7}{10}$	1,169$\frac{3}{5}$	2,523$\frac{5}{8}$		6,207$\frac{37}{40}$	1,368	803$\frac{3}{8}$	1,241$\frac{5}{8}$		3,413
Harwich	3,337$\frac{13}{40}$	9,477$\frac{9}{20}$	4,828		17,642$\frac{31}{40}$	4,129$\frac{11}{20}$	2,332$\frac{2}{5}$	5,531$\frac{3}{5}$	3	11,996$\frac{11}{20}$	3,095$\frac{2}{5}$	2,794$\frac{7}{20}$	4,601$\frac{7}{20}$	25$\frac{1}{2}$	10,516$\frac{3}{5}$
Dennis	1,156	4,559$\frac{3}{4}$	2,744$\frac{39}{40}$	1	8,461$\frac{29}{40}$	2,128$\frac{1}{40}$	1,931$\frac{1}{10}$	1,868		5,927$\frac{1}{8}$	1,666$\frac{7}{8}$	2,233	1,916$\frac{1}{8}$		5,816
Falmouth															
Nantucket	752$\frac{17}{20}$	2,078$\frac{3}{5}$	1,480$\frac{17}{20}$		4,312$\frac{3}{10}$										
Edgartown															
Fairhaven															
New Bedford															
Dartmouth	133$\frac{1}{4}$	405$\frac{1}{8}$	207$\frac{1}{2}$	8$\frac{1}{2}$	754$\frac{3}{8}$	282$\frac{1}{2}$	118	330$\frac{1}{2}$		731	158$\frac{7}{8}$	237$\frac{3}{4}$	605		1,001$\frac{5}{8}$
Westport															
Somerset															
Swansey															
Other Towns															

STATEMENT I.—*Mackerel inspection in Massachusetts.*—Continued.

Port of inspection.	1873.					1874.					1875.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	83,681 7/8	63,888 71/80	37,795 29/80	376 3/8	185,748 1/2	112,971 31/40	71,342 11/80	73,966 1/20	......	258,379 15/16	33,106 7/8	19,270 13/40	73,424 27/80	4,261 17/20	130,062 71/80
Newburyport	1,549 3/20	1,186 1/4	538 1/4	......	3,273 13/20	2,234 1/10	2,278 3/10	545 17/20	......	5,058 1/10	777 13/20	899 2/5	525 9/20	......	2,202 1/2
Ipswich															
Rockport	1,442 1/4	1,255	387	......	3,084 1/4	2,016 1/4	1,320 3/4	789 1/2	......	4,126 1/2	506 1/8	430	756 1/2	49 1/2	1,742 1/8
Gloucester	49,247 17/20	24,283	9,554 19/40	373 7/8	83,459 1/8	60,852 27/40	31,757 39/40	25,702 3/8	......	118,313 1/2	18,172 73/80	7,065 13/40	21,763	4,039 7/20	51,040 17/40
Manchester															
Beverly															
Salem	2,003	979	816	......	3,798	1,645	809 3/4	252 3/4	......	2,707 1/2	461	231 3/4	318 1/2	36	1,047 1/4
Marblehead															
Medford															
Charleston															
Boston	9,482	9,729 3/16	7,199 13/16	......	26,411	13,909 3/4	10,674 11/16	11,921 3/8	......	36,505 13/16	5,073 15/16	4,732 11/16	15,655 11/16	110	25,572 5/16
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham	543	376 3/4	280 3/4	......	1,200 1/2	508 1/2	500 1/2	448 1/4	......	1,457 1/4					
Cohasset	1,000 1/4	1,333 3/4	1,810 5/8	......	4,144 5/8	2,267 1/2	1,539 3/8	2,651	......	6,457 7/8	361 1/4	256	3,648 3/4	2	4,268
Scituate															
Duxbury											1 7/8	4 5/8	32	......	38 1/2
Plymouth															
Sandwich															
Barnstable	113	250 1/3	119 1/2	......	483	235	177 3/8	438 1/2	......	850 7/8	237 1/2	46	1,576	......	1,859 1/2
Yarmouth															
Brewster															
Wellfleet	7,262 1/4	10,587 1/8	6,128 1/8	......	23,977 1/2	12,074 1/3	10,953 29/40	11,804 3/4	......	34,823 5/8	3,550	2,637 1/2	12,218 7/8	......	18,406 1/8
Truro															
Provincetown	5,669 33/40	5,975 13/40	4,280 17/40	......	15,925 23/40	8,400 7/40	6,147 21/40	7,472 1/3	......	22,019 33/40	2,150 7/40	1,911 1/2	6,104 1/3		10,168 1/3
Chatham	986 3/8	1,236 1/8	1,223 1/8	......	3,445 3/4	1,891	806 7/8	1,846 1/8	......	4,544	262 3/4	121	1,115 1/4	4	1,502
Harwich	3,363 11/40	4,749 1/40	4,052 9/20	2 1/2	12,167 1/4	6,034 7/40	3,207 2/10	7,560 3/5	......	16,802 7/10	1,285 1/4	843	8,216 13/40	20 1/2	10,340 1/8
Dennis	968 1/2	1,947 17/20	1,270 7/10	......	4,187 1/20	902 1/4	1,268 1/4	2,525 1/4	......	4,696 1/4	246 1/3	106	1,173 1/4	......	1,526 1/3
Falmouth															
Nantucket	5 1/2				5 1/2										
Edgartown															
Fairhaven															
New Bedford															
Dartmouth	51 1/3	......	134	......	185 1/3			7 1/2	......	7 1/2	19				19
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1876. 1.	1876. 2.	1876. 3.	1876. 4.	1876. Total.	1877. 1.	1877. 2.	1877. 3.	1877. 4.	1877. Total.	1878. 1.	1878. 2.	1878. 3.	1878. 4.	1878. Total.
Total	30, 8[illegible]	96, 772$\frac{19}{20}$	93, 481$\frac{13}{20}$	4, 818$\frac{1}{4}$	225, 942$\frac{17}{80}$	18, 015$\frac{4}{5}$	37, 286$\frac{23}{40}$	37, 700$\frac{37}{40}$	12, 094$\frac{2}{5}$	105, 097$\frac{7}{10}$	14, 094$\frac{7}{8}$	48, 170$\frac{5}{8}$	70, 175$\frac{1}{8}$	11, 785$\frac{1}{2}$	144, 226$\frac{1}{8}$
Newburyport	1, 0[illegible]	1, 407$\frac{3}{4}$	1, 515$\frac{3}{8}$	26	3, 981$\frac{5}{8}$	516$\frac{7}{8}$	768$\frac{3}{8}$	157$\frac{3}{8}$	23	1, 465$\frac{5}{8}$	471$\frac{7}{8}$	744$\frac{3}{4}$	228$\frac{1}{8}$	24$\frac{1}{2}$	1, 469$\frac{1}{4}$
Ipswich															
Rockport	70[illegible]	2, 665$\frac{1}{4}$	2, 083	156	5, 610	124	599$\frac{1}{4}$	459	265$\frac{1}{2}$	1, 447$\frac{3}{4}$	116$\frac{5}{8}$	259$\frac{1}{2}$	421$\frac{1}{2}$	178	975$\frac{5}{8}$
Gloucester	14, 08[illegible]	45, 312$\frac{3}{10}$	33, 109$\frac{11}{40}$	2, 916$\frac{1}{8}$	95, 421$\frac{33}{40}$	9, 842$\frac{19}{20}$	19, 518$\frac{13}{40}$	14, 963$\frac{1}{20}$	4, 719$\frac{31}{40}$	49, 644$\frac{1}{10}$	7, 152$\frac{3}{4}$	22, 088$\frac{1}{4}$	23, 381$\frac{1}{8}$	3, 119$\frac{1}{2}$	55, 741$\frac{5}{8}$
Manchester															
Beverly															
Salem															
Marblehead															
Medford															
Charlestown															
Boston	4, 862$\frac{21}{80}$	12, 890$\frac{17}{40}$	18, 175$\frac{3}{4}$	455	36, 383$\frac{13}{16}$	3, 379$\frac{39}{40}$	6, 441$\frac{9}{40}$	9, 617$\frac{4}{5}$	3, 742$\frac{1}{2}$	23, 182	3, 105	10, 369	18, 637$\frac{1}{8}$	4, 550	36, 661$\frac{1}{8}$
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham															
Cohasset	520$\frac{33}{40}$	2, 142$\frac{1}{5}$	4, 147$\frac{7}{10}$	177$\frac{1}{2}$	6, 988$\frac{9}{40}$	230$\frac{1}{5}$	783$\frac{9}{20}$	1, 832$\frac{1}{2}$	49	2, 895$\frac{3}{20}$	266$\frac{1}{4}$	948$\frac{1}{2}$	2, 461	153	3, 828$\frac{3}{4}$
Scituate															
Duxbury															
Plymouth		8$\frac{1}{2}$	20		28$\frac{1}{2}$										
Sandwich															
Barnstable	389$\frac{3}{4}$	399$\frac{1}{4}$	900$\frac{3}{8}$	34$\frac{1}{2}$	1, 723$\frac{7}{8}$	359$\frac{3}{4}$	109	75	25	568$\frac{3}{4}$	22$\frac{1}{4}$	47	132$\frac{1}{4}$	13$\frac{1}{2}$	215
Yarmouth															
Brewster															
Wellfleet	3, 461$\frac{3}{4}$	16, 625$\frac{1}{2}$	17, 703$\frac{1}{2}$	490	38, 280$\frac{3}{4}$	1, 033$\frac{1}{4}$	3, 138	4, 331$\frac{1}{2}$	827	9, 329$\frac{3}{4}$	1, 282$\frac{1}{2}$	6, 493$\frac{1}{2}$	11, 221$\frac{1}{2}$	1, 206	20, 203$\frac{1}{2}$
Truro															
Provincetown	2, 426$\frac{17}{20}$	7, 797$\frac{3}{10}$	6, 293	414$\frac{1}{8}$	16, 931$\frac{11}{40}$	1, 128$\frac{3}{8}$	2, 715$\frac{1}{8}$	1, 826$\frac{1}{2}$	1, 777$\frac{1}{2}$	7, 447$\frac{1}{2}$	438$\frac{1}{4}$	2, 183	3, 555	786$\frac{1}{2}$	6, 962$\frac{3}{4}$
Chatham	700$\frac{3}{8}$	1, 855	1, 928$\frac{1}{2}$		4, 483$\frac{7}{8}$	206$\frac{1}{4}$	640	831	226	1, 903$\frac{1}{4}$	492$\frac{1}{2}$	1, 524$\frac{1}{2}$	1, 785$\frac{1}{2}$	149	3, 951$\frac{1}{2}$
Harwich	2, 230$\frac{4}{5}$	4, 913$\frac{3}{40}$	6, 744$\frac{1}{8}$	45	13, 933$\frac{3}{20}$	677$\frac{3}{8}$	1, 768$\frac{1}{40}$	3, 122	370$\frac{5}{8}$	5, 938$\frac{1}{40}$	507$\frac{1}{2}$	2, 410	5, 841	739	9, 497$\frac{1}{2}$
Dennis	454	756$\frac{1}{4}$	861$\frac{1}{20}$	104	2, 175$\frac{3}{10}$	516$\frac{1}{5}$	805$\frac{3}{10}$	485$\frac{1}{5}$	68$\frac{1}{2}$	1, 875$\frac{4}{5}$	239$\frac{3}{8}$	1, 102$\frac{5}{8}$	2, 511	866$\frac{1}{2}$	4, 719$\frac{1}{2}$
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

STATEMENT I.—*Mackerel inspection in Massachusetts*—Continued.

Port of inspection.	1879.					1880.					1881.				
	1.	2.	3.	4.	Total.	1.	2	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	9, 025⅝	91, 113½	54, 806¼	352¼	155, 297⅝	20, 453⅛	104, 434½	99, 554⅜	19, 516¾	243, 958¾	15, 598½	139, 586	98, 861¼	2, 127⅜	256, 173⅛
Newburyport	58	1, 004½	528½		1, 591	153½	445	136⅜		734⅞					
Ipswich															
Rockport	3⅜	141½	27		172⅛	62	438⅞	219	239	958⅞	9¼	237¾	44		291
Gloucester	2, 737⅞	33, 983⅞	11, 574	347¼	48, 643	11, 247⅞	58, 348	38, 833⅜	8, 418⅝	116, 847⅞	8, 456⅛	70, 300⅛	32, 496¾	1, 950⅜	113, 203⅜
Manchester															
Beverly															
Salem															
Marblehead															
Medford															
Charlestown															
Boston	3, 342¼	29, 742	20, 779⅜		53, 863⅞	4, 496⅝	21, 464⅞	23, 438¾	4, 567½	53, 967¾	5, 537⅞	43, 105½	28, 427	129	77, 199⅜
Dorchester and Roxbury															
Quincy															
Weymouth															
Hingham															
Cohasset	124	3, 289½	1, 567½		4, 981	431⅞	3, 201⅛	2, 877¼	127	6, 637¼	163⅛	3, 682⅞	4, 161¼	3	8, 010¾
Scituate															
Duxbury															
Plymouth															
Sandwich															
Barnstable	242½	80⅛	28⅞		351½	44⅛	350½	459½		853⅞					
Yarmouth															
Brewster															
Wellfleet	426½	10, 070	6, 445½	5	16, 947	1, 460½	9, 420½	13, 795½	4, 703	29, 379½	740½	13, 810	16, 647½	28	31, 226
Truro															
Provincetown	350⅝	2, 468	1, 741¼		4, 559⅞	552⅞	2, 060⅞	2, 556⅞	192⅛	5, 362¾	122⅛	2, 637⅜	3, 476¼	17	6, 252¾
Chatham	312½	2, 548	2, 863		5, 723½	435½	2, 561¼	3, 835	421	7, 252¾	234	3, 251	5, 615		9, 100
Harwich	1, 183¾	5, 235	5, 921		12, 339¾	1, 131¼	4, 169¾	10, 513	431	16, 245	335½	2, 561⅜	7, 993		10, 889⅞
Dennis	244	2, 551	3, 330		6, 125	437	1, 973¾	2, 890	417½	5, 718¼					
Falmouth															
Nantucket															
Edgartown															
Fairhaven															
New Bedford															
Dartmouth															
Westport															
Somerset															
Swansea															
Other towns															

MACKEREL INSPECTION IN MASSACHUSETTS.

STATEMENT II.—*Showing the total number of barrels of each quality of pickled mackerel inspected in Massachusetts from* 1804 *to* 1880, *and the total value of each year's inspection from* 1830 *to* 1880.

Year.	Barrels of mackerel inspected.					Total value.
	1.	2.	3.	4.	Total.	
1804	1, 631$\frac{1}{2}$	6, 226	....	....	7, 857$\frac{1}{2}$	....
1805	1, 787	2, 518$\frac{1}{2}$	4, 228	....	8, 573$\frac{1}{2}$	....
1806	2, 563$\frac{1}{2}$	2, 756	2, 907	....	8, 226$\frac{1}{2}$	....
1807	2, 353$\frac{1}{2}$	2, 462	4, 489$\frac{1}{2}$	....	9, 305	....
1808	1, 305$\frac{1}{2}$	2, 413$\frac{1}{2}$	3, 910$\frac{1}{2}$	....	7, 629$\frac{1}{2}$	....
1809	2, 274$\frac{1}{2}$	3, 078	3, 472$\frac{1}{2}$	....	8, 825	....
1810	2, 540$\frac{1}{2}$	4, 770	5, 242	....	12, 552$\frac{1}{2}$	....
1811	1, 368$\frac{1}{2}$	6, 023	10, 009$\frac{1}{2}$	....	17, 401	....
1812	1, 000$\frac{1}{2}$	2, 154$\frac{1}{2}$	2, 726	....	5, 881	....
1813	900$\frac{1}{2}$	1, 231	1, 625	....	3, 756$\frac{1}{2}$	....
1814	89	546$\frac{1}{2}$	703$\frac{1}{2}$	....	1, 339	....
1815	3, 225$\frac{1}{2}$	5, 456$\frac{1}{2}$	7, 377$\frac{1}{2}$	....	16, 059$\frac{1}{2}$	....
1816	8, 694$\frac{1}{2}$	9, 264$\frac{1}{2}$	13, 010	....	30, 969	....
1817	10, 406$\frac{1}{2}$	5, 267$\frac{1}{2}$	21, 688	....	37, 362	....
1818	14, 410	11, 162$\frac{1}{2}$	20, 775$\frac{1}{2}$	....	46, 348	....
1819	19, 614	36, 521$\frac{1}{2}$	43, 975$\frac{1}{2}$	....	100, 111	....
1820	12, 455	34, 811$\frac{1}{2}$	68, 374$\frac{1}{2}$	....	115, 641	....
1821	7, 400$\frac{1}{4}$	32, 103$\frac{1}{2}$	71, 505$\frac{1}{2}$	....	111, 009$\frac{1}{2}$	....
1822	20, 035	66, 681$\frac{1}{2}$	73, 578	....	160, 294$\frac{1}{2}$	....
1823	19, 804	62, 047$\frac{1}{2}$	63, 154$\frac{1}{2}$	....	145, 006	....
1824	45, 246$\frac{1}{2}$	75, 221	71, 183	....	191, 650$\frac{1}{2}$	....
1825	29, 640	109, 840	114, 904$\frac{1}{2}$	....	254, 384$\frac{1}{2}$	....
1826	43, 499	80, 584	34, 657$\frac{1}{2}$	....	158, 740$\frac{1}{2}$	....
1827	81, 357$\frac{1}{2}$	69, 335	39, 612	....	190, 304$\frac{1}{2}$	....
1828	63 235$\frac{1}{2}$	110, 666$\frac{1}{2}$	63, 422$\frac{1}{2}$	....	237, 324$\frac{1}{2}$	....
1829	54 184	77, 098	94, 695	....	225, 977	....
1830	47, 868$\frac{1}{2}$	104, 569$\frac{1}{2}$	156, 025$\frac{1}{2}$	....	308, 463$\frac{1}{2}$	$1, 119, 470
1831	70, 198	171, 186	142, 164$\frac{1}{2}$	....	383, 548$\frac{1}{2}$	1, 589, 936
1832	28, 679	97, 219$\frac{1}{2}$	96, 553$\frac{1}{2}$	....	222, 452	797, 795
1833	54, 559$\frac{1}{2}$	98, 927$\frac{1}{2}$	69, 445$\frac{1}{2}$	....	222, 932$\frac{1}{2}$	976, 935
1834	80, 433$\frac{1}{2}$	93, 553$\frac{1}{2}$	78, 892$\frac{1}{2}$	....	252, 879$\frac{1}{2}$	1, 165, 842
1835	45, 605	57, 271$\frac{1}{2}$	91, 924	....	194, 800$\frac{1}{2}$	1, 030, 560
1836	53, 665$\frac{1}{2}$	60, 558	60, 187	....	174, 410$\frac{1}{2}$	1, 268, 388
1837	24, 573	61, 027	52, 557$\frac{1}{2}$	....	138, 157$\frac{1}{2}$	803, 653
1838	37, 968$\frac{1}{4}$	28, 588	44, 184	....	110, 740$\frac{1}{4}$	925, 002
1839	22, 217$\frac{1}{2}$	22, 037$\frac{1}{4}$	30, 013$\frac{1}{2}$	....	74, 268$\frac{1}{4}$	719, 204
1840	19, 351$\frac{1}{2}$	11, 049	20, 091	....	50, 491$\frac{1}{2}$	473, 345
1841	23, 747	10, 649	21, 141	....	55, 537	518, 300
1842	29, 363	22, 496	23, 684	....	75, 543	493, 979
1843	32, 759	13, 088	18, 604	....	64. 451	549, 419
1844	28, 843$\frac{1}{2}$	22, 515	35, 023	....	86, 381$\frac{1}{2}$	634, 502
1845	28, 083$\frac{1}{8}$	88, 623$\frac{1}{8}$	85. 596$\frac{1}{2}$	....	202, 302$\frac{3}{4}$	1, 883, 669
1846	44, 430$\frac{7}{8}$	70. 005	65, 076	....	179, 511$\frac{7}{8}$	1, 094, 585
1847	104, 150$\frac{5}{8}$	76, 006$\frac{1}{2}$	71, 760$\frac{3}{8}$	....	251, 917$\frac{1}{2}$	2, 259, 958
1848	113, 093$\frac{1}{4}$	79, 979$\frac{1}{8}$	107, 058$\frac{1}{4}$	....	300, 130$\frac{5}{8}$	1, 858, 500
1849	61, 404	81, 962	65, 584	....	208, 950	1, 560, 126
1850	88, 401	44, 909	87, 604	21, 658	242, 572	1, 777, 517
1851	90, 765$\frac{1}{8}$	102, 467$\frac{1}{4}$	135, 597$\frac{1}{4}$	414$\frac{1}{2}$	329, 244$\frac{1}{8}$	2, 249, 511
1852	84, 030$\frac{3}{8}$	67, 071$\frac{1}{2}$	44, 808$\frac{1}{8}$	2, 210	198, 120	1, 491, 923
1853	49, 015$\frac{3}{8}$	24, 584	39, 897	19, 843$\frac{7}{8}$	133, 340$\frac{1}{4}$	1, 207, 975
1854	30, 595$\frac{3}{8}$	46, 242$\frac{1}{4}$	55, 133$\frac{3}{8}$	3, 378$\frac{3}{4}$	135, 349$\frac{3}{4}$	1, 313, 535
1855	29, 302$\frac{1}{4}$	91, 122$\frac{5}{8}$	90, 193$\frac{1}{8}$	1, 338$\frac{5}{8}$	211, 956$\frac{5}{8}$	2, 129, 084
1856	89, 333$\frac{3}{8}$	76, 819$\frac{3}{8}$	47, 981$\frac{7}{8}$	178	214, 312$\frac{5}{8}$	2, 064, 581
1857	84, 519$\frac{3}{8}$	45, 218$\frac{1}{8}$	38, 257$\frac{1}{8}$	711	168, 705$\frac{5}{8}$	2, 162, 738
1858	75, 347$\frac{5}{8}$	21, 929$\frac{3}{8}$	32, 332$\frac{13}{16}$	1, 992$\frac{1}{2}$	131, 602$\frac{5}{16}$	1, 729, 546
1859	61, 330	12, 060$\frac{1}{8}$	22, 207$\frac{1}{4}$	4, 118$\frac{3}{8}$	99, 715$\frac{3}{4}$	1, 255, 073
1860	58, 828$\frac{1}{4}$	122, 837	50, 578$\frac{3}{4}$	3, 441$\frac{3}{4}$	235, 685$\frac{3}{4}$	2, 251, 067
1861	70, 877$\frac{1}{2}$	100, 286$\frac{3}{8}$	22, 486	633$\frac{3}{4}$	194, 283$\frac{5}{8}$	1, 116, 851
1862	81, 902$\frac{3}{4}$	78, 388$\frac{3}{8}$	100, 011	562$\frac{3}{4}$	260, 864$\frac{7}{8}$	1, 597, 416
1863	67, 985$\frac{1}{2}$	136, 075$\frac{5}{16}$	102, 601$\frac{3}{4}$	280	306, 942$\frac{9}{16}$	2, 878, 777
1864	103, 383$\frac{1}{4}$	137, 746$\frac{3}{4}$	33, 212$\frac{3}{4}$	14$\frac{1}{2}$	274, 357$\frac{1}{4}$	5, 935, 525
1865	153, 723$\frac{1}{4}$	63, 562$\frac{1}{4}$	39, 266$\frac{3}{8}$	244$\frac{1}{4}$	256, 796$\frac{1}{8}$	4, 729, 840
1866	150, 322$\frac{3}{8}$	36, 319$\frac{15}{16}$	44, 784$\frac{3}{8}$	269$\frac{1}{2}$	231, 696$\frac{7}{16}$	4, 324, 790
1867	122, 808$\frac{9}{16}$	46, 038$\frac{9}{20}$	41, 048$\frac{11}{20}$	418$\frac{1}{2}$	210, 314$\frac{1}{16}$	2, 961, 933
1868	93, 091$\frac{11}{80}$	42, 262$\frac{7}{20}$	44, 077$\frac{21}{40}$	625$\frac{1}{8}$	180, 056$\frac{11}{80}$	2, 522, 151
1869	72, 924$\frac{1}{2}$	92, 019$\frac{1}{2}$	65, 717$\frac{1}{8}$	3, 549$\frac{3}{4}$	234, 210$\frac{7}{8}$	3, 248, 315
1870	66, 046$\frac{1}{10}$	189, 422$\frac{5}{8}$	63, 019$\frac{3}{8}$	33$\frac{1}{2}$	318, 521$\frac{3}{5}$	3, 744, 197
1871	105, 187$\frac{33}{40}$	85, 867$\frac{23}{40}$	68, 322$\frac{17}{20}$	38$\frac{1}{2}$	259, 416$\frac{3}{4}$	2, 233, 055
1872	71, 866$\frac{27}{40}$	54, 370$\frac{57}{80}$	55, 603$\frac{1}{8}$	115$\frac{1}{2}$	181, 956$\frac{1}{80}$	1, 948, 416
1873	83, 687$\frac{7}{8}$	63, 888$\frac{71}{80}$	37, 795$\frac{29}{80}$	376$\frac{3}{8}$	185, 748$\frac{1}{2}$	2, 799, 083
1874	112, 971$\frac{31}{40}$	71, 442$\frac{11}{80}$	73, 966$\frac{1}{40}$	....	258, 379$\frac{15}{16}$	2, 657, 616
1875	33, 106$\frac{7}{8}$	19, 270$\frac{13}{40}$	73, 424$\frac{27}{80}$	4, 261$\frac{7}{20}$	130, 062$\frac{71}{80}$	1, 310, 140
1876	30, 869$\frac{29}{80}$	96, 772$\frac{19}{20}$	93, 481$\frac{13}{20}$	4, 818$\frac{1}{4}$	225, 942$\frac{17}{80}$	1, 650, 306

MACKEREL INSPECTION IN MASSACHUSETTS.—Continued.

STATEMENT II.—*Showing the total number of barrels inspected, &c*—Continued.

Year.	Barrels of mackerel inspected.					Total value.
	1.	2.	3.	4.	Total.	
1877	18,015 4/5	37,286 23/40	37,700 27/40	12,094 5/8	105,097 7/10	$1,137,516
1878	14,094 7/8	48,170 5/8	70,175 1/8	11,785 1/4	a144,226 1/8	1,034,144
1879	9,025 5/8	91,113 1/2	54,806 1/4	352 1/4	*155,297 5/8	892,957
1880	20,453 1/8	104,434 1/3	99,554 3/8	19,516 3/4	243,958 3/4	1,474,152
1881	15,598 1/2	139,586	98,861 1/4	2,127 3/8	256,173 1/8	1,601,081

a The reports of the Boston fish bureau give the number of barrels packed in Massachusetts in 1878, 144,205 barrels; in 1879, 156,125 barrels; in 1880, 255,986 barrels; in 1881, 269,495 barrels. These figures for 1880 and 1881 are probably nearer than the inspection returns to the actual product of the fishery, since some 5 per cent. of the catch escapes inspection.

MACKEREL REINSPECTION IN MASSACHUSETTS.

STATEMENT III.—*Showing the number of barrels of each quality of pickled mackerel reinspected in each port of Massachusetts from* 1850 *to* 1881.

Year.	Boston. 1.	Boston. 2.	Boston. 3.	Boston. 4.	Boston. Total.
1850	...	...	...	...	...
1851	...	...	...	...	...
1852	...	...	...	...	...
1853	...	...	...	...	...
1854	...	...	...	...	...
1855	...	...	...	...	...
1856	...	...	...	...	...
1857	...	...	...	...	...
1858	...	...	...	...	...
1859	14,681 7/16	7,242 3/16	10,083 1/16	2,705 1/2	34,712 3/16
1860	6,652 3/16	3,332 1/4	5,985 1/8	1,053 5/8	17,023 3/16
1861	5,996	5,937 3/4	3,143 1/4	205 1/2	15,282 1/2
1862	7,119 1/8	5,839 5/8	3,392 3/4	38 1/2	16,390
1863	9,507 9/16	7,333 1/3	5,580 5/16	11	22,432
1864	12,451 1/2	11,726 11/16	7,537 1/4	5	31,720 7/16
1865	22,660 5/8	18,857 3/4	7,523 1/8	14 1/2	49,056
1866	13,623 3/4	4,867	4,305 3/4	...	22,796 1/2
1867	48,436 7/8	11,043 7/8	6,711 5/8	18	66,210 3/8
1868	14,019 13/16	3,621 3/4	2,121 5/16	4	19,767 1/8
1869	9,512 3/16	9,050 1/8	6,713 1/2	20	25,295 13/16
1870	8,915 15/16	17,303 7/8	7,130 3/16	...	33,350
1871	10,501 3/4	12,442 19/80	6,461 5/16	...	29,405 3/10
1872	14,384 17/40	16,244 7/16	15,443 39/80	...	46,062 7/20
1873	12,183 1/8	14,349 51/80	9,291 11/40	...	35,824 3/80
1874	18,276 5/16	14,879 67/80	10,447 75/80	...	43,604 7/80
1875	13,930 41/80	16,007 31/40	12,848 5/16	74	42,860 3/5
1876	9,816 61/80	12,833 11/400	10,972 39/200	349 1/8	33,971 143/400
1877	...	...	...	...	...
1878	3,744 1/2	6,881 1/8	7,834 1/4	1,999 1/2	20,459 3/8
1879	3,810 5/8	9,185	7,400 3/4	...	20,396 3/8
1880	5,657 1/2	11,711 1/8	9,322 3/8	...	26,691
1881	5,060 1/8	7,875 5/8	8,158	100	21,193 3/4

Year.	Gloucester. 1.	Gloucester. 2.	Gloucester. 3.	Gloucester. 4.	Gloucester. Total.	Newburyport. 1.	Newburyport. 2.	Newburyport. 3.	Newburyport. 4.	Newburyport. Total.
1850	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	...
1858	...	...	...	...	...	...	...	...	...	...
1859	...	...	...	...	...	...	...	...	...	...
1860	...	...	...	...	...	...	...	...	...	...
1861	...	444 1/2	...	...	444 1/2	41 1/2	...	...	...	41 1/2
1862	287 7/8	119	...	...	406 7/8	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...
1864	483 3/4	...	...	...	483 3/4	110 5/8	1 7/8	...	...	112 1/2
1865	1,235 1/2	401 7/8	204 1/8	...	1,841 1/4	376 3/8	44 3/8	...	...	420 3/4
1866	444	103 1/8	185	...	732 1/8	579	15 3/8	...	...	594 3/8
1867	169 1/4	2 1/4	...	...	170 1/2	401 1/8	18 3/8	...	...	419 1/2
1868	...	...	...	...	...	307 1/2	5 1/5	...	...	312 7/10
1869	250	...	...	...	250	234 3/5	3 9/20	...	...	238 1/20
1870	132 1/4	204 5/8	19 3/4	...	356 5/8	157 1/2	17 3/10	...	...	174 4/5
1871	423 5/8	581 9/40	221 3/10	...	1,226 3/20	125 1/2	23 39/100	10 26/100	...	159 3/20
1872	618 1/4	618 1/8	295 1/2	...	1,531 7/8	119 3/20	8 2/5	1	...	128 11/20
1873	665 19/40	456 27/40	300 9/20	...	1,422 3/5	84 1/2	7 1/10	...	...	91 3/5
1874	1,559	319 3/8	125 3/20	...	2,003 21/40	51 3/4	11 7/8	...	...	63 5/8
1875	484 15/16	206 7/8	264 7/16	...	956 1/4	28 3/8	...	...	...	28 3/8
1876	1,394 4/5	1,100 51/40	863 11/40	...	3,358 3/5	...	...	...	...	...
1877	...	...	...	...	...	...	...	...	...	...
1878	533 1/2	945 3/8	928 1/8	15	2,422	...	...	...	...	...
1879	371	1,333 1/2	474 1/2	...	2,179	...	...	...	...	...
1880	332 1/2	873 1/2	202 5/8	44	1,452 5/8	...	...	...	...	...
1881	353	1,694 1/4	779 7/8	...	2,827 1/8	...	...	...	...	...

Year.	Grand total. 1.	Grand total. 2.	Grand total. 3.	Grand total. 4.	Grand total. Total.
1850	11,143	8,356	2,069	40	21,608
1851	5,722	6,192	1,553	...	13,467
1852	9,420	7,048	3,304	...	19,772
1853	5,173	3,562	2,927	...	11,662
1854	...	...	...	...	...
1855	...	...	...	...	...
1856	...	...	...	...	...
1857	...	...	...	...	...
1858	...	...	...	...	...
1859	14,681 7/16	7,242 3/16	10,083 1/16	2,705 1/2	34,712 3/16
1860	6,652 3/16	3,332 1/4	5,985 1/8	1,053 5/8	17,023 3/16
1861	6,062 1/2	6,419 3/4	3,143 1/4	205 1/2	a15,831
1862	7,414	5,958 5/8	3,392 3/4	38 1/2	b16,803 7/8
1863	9,507 9/16	7,333 1/3	5,580 5/16	11	22,432
1864	13,045 7/8	11,728 9/16	7,537 1/4	5	32,316 11/16
1865	24,272 1/2	19,304	7,727 1/4	14 1/2	51,318 1/4
1866	14,653 7/8	4,986 1/2	4,490 3/4	...	c24,131 1/8
1867	49,007 1/4	11,063 1/2	6,711 5/8	18	66,800 3/8
1868	14,327 5/16	3,626 19/20	2,121 9/16	4	20,079 33/40
1869	9,996 63/80	9,053 23/40	6,713 1/2	20	25,783 69/80
1870	9,205 11/16	17,525 4/5	7,149 15/16	...	33,881 37/40
1871	11,050 7/8	13,046 341/400	6,692 349/400	...	30,790 3/5
1872	15,756 33/40	17,189 27/80	15,733 79/80	...	d48,680 3/20
1873	12,933 1/10	14,813 33/80	9,591 29/40	...	37,338 19/80
1874	19,887 1/16	15,211 7/80	10,573 47/80	...	e45,671 59/80
1875	14,443 33/40	16,214 13/20	13,112 3/4	74	43,845 9/40
1876	11,211 9/16	13,933 4/5	11,835 47/100	349 1/8	37,329 383/400
1877	...	...	...	...	...
1878	4,278	7,826 5/8	8.762 1/4	2,014 1/2	22,881 3/8
1879	4,181 5/8	10,518 1/2	7,875 1/4	...	22,575 3/8
1880	5,990	12,584 5/8	9,525	44	28,143 5/8
1881	5,413 1/8	9,569 7/8	8,937 1/4	100	24,020 7/8

a Includes 25 barrels No. 1, and 37½ barrels. No. 2, reinspected at Wellfleet.
b Includes 7 barrels No. 1, reinspected at Cohasset.
c Includes 7⅛ barrels No. 1, and 1 barrel No. 2, reinspected at Beverly.
d Includes 635 barrels No. 1, 318⅝ barrels No. 2, and 4 barrels No. 3, reinspected at Provincetown.
e Includes ½ barrel No. 3 reinspected at Salem.

47.—STATISTICS OF MAINE.

The mackerel inspection of the State of Maine is exhibited in two statements, showing the total number of barrels of pickeled mackerel packed within the State for a series of years.

The first statement shows in detail the number of barrels of each grade of mackerel inspected in the several inspection ports of the State during the years 1804 to 1820, and from 1864 to 1878, and was compiled by Mr. Starbuck from the original returns of the inspectors, deposited in the office of the secretary of state. Until the year 1820 Maine was a district of Massachusetts, but since that year has been a separate State. For the years from 1820 to 1864 the original returns could not be found, and it is probable that the returns of many years between 1864 and 1878 exhibit not more than 50 per cent. of the actual number of barrels of mackerel packed in the State.

The second statement shows the total number of barrels of each grade of mackerel packed in the State during a series of years, and is compiled from the following sources: 1804 to 1820, from the official inspection returns; 1825, 1834, 1836 to 1838, and 1851, from Sabine's report on the American fisheries; 1864 to 1878, from the official inspection returns; 1879 to 1881, from the annual reports of the Boston fish bureau.

A review of the statement indicates that the mackerel industry of the State was more extensively prosecuted in 1881 than during any previous year.

MACKEREL INSPECTION IN MAINE.

STATEMENT I.—*Showing by ports the number of barrels of each quality of pickeled mackerel inspected in Maine from* 1804 *to* 1820, *and from* 1864 *to* 1878.

[Half barrels and smaller packages reduced to barrels.]

Port of inspection.	1804.				1805.				1806.				1807.				1808.				1809.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	19	203	......	222	212	158	33	403	130	116½	......	246½	406½	424	769	1,599½	43	66	......	109	14	22½	4	40½
Eastport	16	167	......	183	203	158	33	394	97	12	......	109	7	22	......	29	......	......	......	......	......	7	......	7
Lubec																								
Frankfort																								
Cranberry Isle																								
Mount Desert																								
Swan's Island																								
Deer Isle																								
Castine																								
Orland																								
Bucksport																								
Brewer																								
Bangor																								
Hampden																								
Belfast																								
Camden																								
North Haven																								
Vinalhaven																								
South Thomaston																								
Thomaston																								
Matinicus																								
Booth Bay																								
Southport																								
Westport																								
Georgetown																								
Bath																								
Phippsburg																								
Harpswell																								
Portland	3	36	......	39	9	......	......	9	33	104½	......	137½	399½	402	769	1,570½	43	66	......	109	14	15½	4	33½

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1810.				1811.				1812.				1813.				1814.				1815.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	72	380	44	496	100	186	203	489	134	497	248½	879½	46½	14½	15	76			10	10	75	72	24	171
Eastport	25	224		249	2	33	37	72	56	214	73	343												
Lubec																								
Frankfort																								
Cranberry Isle																								
Mount Desert																								
Swan's Island																								
Deer Isle																								
Castine																								
Orland																								
Bucksport									3	4		7									42½			42½
Brewer																								
Bangor													2			2								
Hampden																								
Belfast																								
Camden																								
North Haven																								
Vinalhaven																					3½	18	17	38½
South Thomaston																								
Thomaston																								
Matinicus																								
Booth Bay																								
Southport																								
Westport																								
Georgetown																								
Bath																					5			5
Phippsburg																								
Harpswell																								
Portland	47	156	44	247	98	153	166	417	75	279	175½	529½	44½	14½	15	74			10	10	24	54	7	85

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1816.				1817.				1818.				1819.				1820.			
	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.	1.	2.	3.	Total.
Total	274	53	2	329	300	230	90	620	381	170	311	862	999	2,557	1,766	5,322	165½	788½	4,037	4,991
Eastport									1½		57	58½	57	38	45	140				
Lubec					3	14	6	23	28	10½	105	143½	17	61	177	255	43½	42		85½
Frankfort					59	10		69	2	10	1	13	29	10	33	72				
Cranberry Isle																				
Mount Desert													66	29	10	105				
Swan's Island																				
Deer Isle													111	20	5	136				
Castine	46	6		52					175	13		188					73½	102½	273	449
Orland																				
Bucksport	72	4		76	36	6		42	108½	46	62	216½	199	183	116½	498½	3	40	167	210
Brewer					17	1		18												
Bangor	8			8	19	2		21												
Hampden					14			14												
Belfast																				
Camden													101	104	70	275	21	38	162	221
North Haven																				
Vinalhaven																				
South Thomaston																				
Thomaston									2	3		5					5	10		15
Matinicus																				
Booth Bay																				
Southport																				
Westport																				
Georgetown																				
Bath						1½		1½					21	20	13	54	13	26	219	258
Phippsburg																				
Harpswell																				
Portland	148	43	2	193	152	195½	84	431½	64	87½	86	237½	398	2,092	1,296½	3,786½	6½	530	3,216	3,752½

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1864.					1865.					1866.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	14,677¼	30,171¼	4,881½	67½	49,797⅜	34,705¼	13,868	5,635⅞	6	54,215¾	31,711	6,141⅜	6,756⅜	18¾	44,627½
Eastport	92½	351½	21	....	465	120½	20	5	....	145½	148	43	1	....	192
Lubec	6	23	2	....	31	....	....	....	....	....	....	....	....	....	....
Frankfort	....	....	....	....	....	400	....	....	....	400	....	....	....	....	....
Cranberry Isle	41	154	4	....	199	....	....	....	....	....	6⅛	....	....	....	6⅛
Mount Desert	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Swan's Island	100	115	....	....	215	343	13	3	....	359	332	4½	....	....	336½
Deer Isle	2,758½	4,784	2,761	....	10,303½	4,467⅛	1,649⅞	2,915	....	9,032	5,621	1,221¾	2,547¼	....	a9,390
Castine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Orland	110	237	....	....	347	99½	....	....	....	99½	377½	61	105	....	543½
Bucksport	....	....	....	....	....	661	89	9	....	759	24	10	....	....	34
Brewer	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bangor	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hampden	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belfast	659	677½	277	11	1,624½	253	50	70	....	373	....	....	....	....	....
Camden	213¼	307¾	24½	....	545½	1,233	999	218	....	2,450	1,993½	660	662	....	3,315½
North Haven	539¾	699¾	16½	....	1,256	385	181	126	....	692	949½	257	156½	....	1,363
Vinalhaven	12	32	....	....	44	218	29	....	....	247	100	5	6	....	111
South Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Matinicus	37	183½	19	....	239½	4½	....	....	....	4½	....	....	....	....	....
Booth Bay	248½	876	23	7	1,154½	2,793⅜	1,006	196¼	6	4,001⅝	3,202½	460½	486½	....	4,149½
Southport	1,740⅛	3,782¼	84	....	5,606⅜	2,129⅛	1,262⅛	271	....	3,662¼	824½	127	162½	....	1,114
Westport	....	....	....	....	....	260⅝	112⅝	4	....	377¼	88	6	4	....	98
Georgetown	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bath	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phippsburg	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Harpswell	....	....	....	....	....	662	413	100	....	1,175	306¾	143	202	....	651¾
Portland	8,119⅜	17,948	1,659¼	49½	27,766⅞	20,676⅛	8,043⅜	1,718⅝	....	30,430⅛	17,737⅝	3,142⅝	2,423⅜	18¾	23,322⅜

a Includes 171 barrels inspected at Sedgwick.

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1867.					1868.					1869.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	21,060 7/8	8,043	4,320 5/8	250 5/8	33,675 1/8	17,946 7/8	6,363	4,464 1/4		28,774 1/8	13,614 3/20	12,410 3/10	10,201 13/20	939 3/4	37,166 1/4
Eastport	24	28			52										
Lubec															
Frankfort						260	128	83		471					
Cranberry Isle															
Mount Desert															
Swan's Island	74 1/2				74 1/2										
Deer Isle	2,816	1,508	1,059	41	5,424	1,318 3/8	695 1/2	206 1/2		2,220 3/8	1,844 1/4	1,119 1/2	391	108 1/2	3,463 1/4
Castine	352	198	142		692	145	35	20		200					
Orland															
Bucksport															
Brewner															
Bangor															
Hampden															
Belfast	206 1/2	125	64	13	408 1/2	230 1/2	96 1/4	52		378 3/4	104	92	46		242
Camden	1,062 1/2	548 1/2	100		1,711	916	632	39		1,587	163 1/2	297 1/2	81 1/4	24 1/4	566 1/2
North Haven	528	222	201		951	610 1/2	214 1/2	266 1/2		1,091 1/2					
Vinalhaven	35	47	4		86	105	112	4		221					
South Thomaston											2	9 1/2	3 1/2		15
Thomaston															
Matinicus															
Booth Bay	1,981 1/2	649 1/2	281 1/2	35	2,947 1/2	2,468 5/8	786 1/4	384		3,638 7/8	1,877 8/10	1,690 6/10	1,355	56	4,979 2/5
Southport	1,178 1/2	178 1/2	226 1/2	46 1/2	1,630	821 1/4	129 1/4	366 1/4		1,316 3/4	495 8/10	439 1/2	151	10	1,096 3/10
Westport	60				60	55				55					
Georgetown															
Bath															
Phippsburg															
Harpswell	346	157 1/2	61	26	590 1/2										
Portland	12,396 3/8	4,381	2,181 5/8	89 1/8	19,048 1/8	11,016 5/8	3,534 1/4	3,023		17,573 7/8	9,126 8/10	8,762 1/10	8,173 8/10	741	26,803 4/5

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1870.					1871.					1872.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	13, 135 3/10	32, 613 3/10	6, 555½		52, 304 1/10	23, 391 17/20	18, 417 17/20	6, 793¾		48, 603 9/20	10, 013⅕	6, 162⅘	5, 626	371	22, 178
Eastport	60½	223	30		313½										
Lubec															
Frankfort						250	200	50		500					
Cranberry Island															
Mount Desert															
Swan's Island															
Deer Isle	1, 079 19/20	2, 414½	1, 093 2/10		4, 587 13/20	1, 48[illegible]½	1, 264	118		2, 864½					
Castine															
Orland															
Bucksport															
Brewer															
Bangor															
Hampden															
Belfast	172½	154	11		337½										
Camden	275¼	1, 701¾	513		2, 490	1, 101	1, 055½	650½		2, 807	463½	454	174½		1, 092
North Haven	80½	470	18½		569	110 9/10	125	17		252 9/10	275 2/10	74	2		351⅛
Vinalhaven	1⅓	27½	4½		33⅓										
South Thomaston	4 7/10	14	3		21 7/10	39¼	17½			56¾					
Thomaston															
Matinicus	57 9/20	155 13/20	3		216 1/10	678½	151			829½	119½	27½	17½		164½
Booth Bay	1, 337 7/10	3, 299⅓	471½		5, 108⅕	2, 719½	1, 864	668		5, 251½	1, 070	570	528		2, 168
Southport	230	496½	29		755⅓	864½	966½	215		2, 046	899	576	929	113	2, 617
Westport	8	59			67	49	102½	12		163½					
Georgetown											35	7½	2	1	45½
Bath															
Phippsburg															
Harpswell											2	3			5
Portland	9, 827¾	23, 597 9/10	4, 378 8/10		37, 804 9/20	16, 096 7/10	12, 671 17/20	5, 063¼		33, 831⅘	7, 149	4, 450 8/10	3, 973	257	15, 829⅘

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1873.					1874.					1875.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	12,769 3/5	6,845 1/20	2,579	....	22,193 13/20	25,193¾	14,326	4,222	....	43,741¼	2,221	1,433½	5,848	....	9,502½
Eastport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Lubec	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Frankfort	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Cranberry Isle	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mount Desert	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Swan's Island	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Deer Island	1,456	219	135	....	1,810	1,738	25	12	....	1,775	....	....	....	....	....
Castine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Orland	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bucksport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Brewer	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bangor	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hampden	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belfast	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Camden	469¼	240	100½	....	809¾	1,006	524½	188	....	1,718½	....	....	....	....	....
North Haven	226 7/10	175	....	....	401 7/10	150	....	....	....	150	70	10	....	....	80
Vinalhaven	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
South Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Matinicus	137½	10½	....	....	148	....	....	....	....	....	84	6½	....	....	90½
Booth Bay	170	....	....	....	170	2,840½	1,361½	199½	....	4,401½	....	....	....	....	....
Southport	567	336	213½	....	1,116½	1,162¼	730	970	....	2,862½	....	....	....	....	....
Westport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Georgetown	151 8/10	40 8/10	1	....	193 3/5	800	293	152	....	1,245	....	....	....	....	....
Bath	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phippsburg	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Harpswell	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Portland	9,591 7/20	5,823¾	2,129	....	17,544 1/10	17,496¾	11,392	2,700½	....	31,589¼	2,067	1,417	a5,848	....	9,332

a 3,201 barrels of these are No. 3 small, same as No. 4 in Massachusetts.

STATEMENT I.—*Mackerel inspection in Maine*—Continued.

Port of inspection.	1876.					1877.					1878.				
	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.	1.	2.	3.	4.	Total.
Total	1,905½	9,293½	11,230½	....	22,429½	2,792¾	9,941½	9,423½	....	22,157¾	1,478⅓	5,874	16,082$\frac{1}{12}$	....	23,434¾
Eastport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Lubec	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Frankfort	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Cranberry Isle	*a*48½	117½	*b*89½	....	255½	4	20	*c*26	....	50	....	....	....	....	....
Mount Desert	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Swan's Island	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Deer Isle	144	644	260	....	1,048	....	....	....	....	....	....	....	....	....	....
Castine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Orland	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bucksport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Brewer	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bangor	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hampden	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belfast	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Camden	195	1,076	1,180	....	2,451	....	....	....	....	....	....	....	....	....	....
North Haven	....	....	....	....	....	10	150	*d*1,015	....	1,175	....	....	....	....	....
Vinalhaven	....	....	....	....	....	....	....	....	....	....	26	55	167	....	248
South Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Thomaston	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Matinicus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Booth Bay	....	....	....	....	....	533½	1,068	*e*1,536½	....	3,138	150	1,125	3,729	....	5,004
Southport	....	....	....	....	....	83¼	320⅓	*f*159	....	562¾	24½	129	574	....	727½
Westport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Georgetown	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bath	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phippsburg	....	....	....	....	....	....	....	....	....	....	....	21	7	....	28
Harpswell	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Portland	1,518	7,456	*g*9,701	....	18,675	2,162	8,383	*h*6,687	....	17,232	1,278⅓	4,544	*i*11,605$\frac{1}{12}$	....	17,427½

a 264 barrels No. 3, large; 8,775½ barrels No. 3, 2,566 barrels No. 3, small.
b 6 barrels "extra."
c 1 barrel No. 3, small.
d 762 barrels N. 3, large; 2,946½ barrels No. 3, middle; 343 barrels No. 3, small.
e 24 barrels No. 3, small.
f 1,000 barrels No. 3, small.
g 3,055 barrels No. 3, small.
h 108 barrels No. 3, small.
i 21 barrels No. 3, large; 3,570½ barrels No. 3, small.

MACKEREL INSPECTION IN MAINE.

STATEMENT II.—*Showing the total number of barrels of each quality of pickled mackerel inspected in Maine from* 1804 *to* 1820, *and from* 1864 *to* 1881.

Year.	Barrels of mackerel inspected.				
	1.	2.	3.	4.	Total.
1804	19	203	....	....	222
1805	212	158	33	....	403
1806	130	116$\frac{1}{2}$	....	....	246$\frac{1}{2}$
1807	406$\frac{1}{2}$	424	769	....	1,599$\frac{1}{2}$
1808	43	66	....	....	109
1809	14	22$\frac{1}{2}$	4	....	40$\frac{1}{2}$
1810	72	380	44	....	496
1811	100	186	203	....	489
1812	134	497	248$\frac{1}{2}$	....	879$\frac{1}{2}$
1813	46$\frac{1}{2}$	14$\frac{1}{2}$	15	....	76
1814	....	....	10	....	10
1815	75	72	24	....	171
1816	274	53	2	....	329
1817	300	230	90	....	620
1818	381	170	311	....	862
1819	999	2,557	1,766	....	5,322
1820	165$\frac{1}{2}$	788$\frac{1}{2}$	4,037	....	4,991
1825	....	....	....	....	33,065
1834	....	....	....	....	40,661
1836	....	....	....	....	25,228
1837	....	....	....	....	22,462
1838	....	....	....	....	24,312
1851	....	....	....	....	31,472
1864	14,677$\frac{1}{4}$	30,171$\frac{1}{4}$	4,881$\frac{1}{2}$	67$\frac{1}{2}$	49,797$\frac{1}{2}$
1865	34,705$\frac{7}{8}$	13,868	5,635$\frac{7}{8}$	6	54,215$\frac{3}{4}$
1866	31,711	6,141$\frac{3}{8}$	6,756$\frac{3}{8}$	18$\frac{3}{4}$	44,627$\frac{1}{2}$
1867	21,060$\frac{7}{8}$	8,043	4,320$\frac{5}{8}$	250$\frac{5}{8}$	33,675$\frac{1}{8}$
1868	17,946$\frac{7}{8}$	6,363	4,464$\frac{1}{4}$	....	28,774$\frac{1}{8}$
1869	13,614$\frac{3}{20}$	12,410$\frac{7}{10}$	10,201$\frac{13}{20}$	939$\frac{3}{4}$	37,166$\frac{1}{4}$
1870	13,135$\frac{3}{10}$	32,613$\frac{3}{10}$	6,555$\frac{1}{2}$	....	52,304$\frac{1}{10}$
1871	23,391$\frac{17}{20}$	18,417$\frac{17}{20}$	6,793$\frac{3}{4}$	....	48,603$\frac{9}{20}$
1872	10,013$\frac{1}{5}$	6,162$\frac{4}{5}$	5,626	371	22,173
1873	12,769$\frac{3}{5}$	6,845$\frac{1}{20}$	2,579	....	22,193$\frac{13}{20}$
1874	25,193$\frac{3}{4}$	14,326	4,222	....	43,741$\frac{3}{4}$
1875	2,221	1,433$\frac{1}{2}$	5,848	....	9,502$\frac{1}{2}$
1876	1,905$\frac{1}{2}$	9,293$\frac{1}{2}$	11,230$\frac{1}{2}$	....	22,429$\frac{1}{2}$
1877	5,792$\frac{3}{4}$	9,941$\frac{1}{2}$	9,423$\frac{1}{2}$	....	22,157$\frac{3}{4}$
1878	1,478$\frac{2}{3}$	5,874	16,082$\frac{1}{12}$	....	*a* 23,434$\frac{3}{4}$
1879	....	....	....	....	*b* 58,249
1880	....	....	....	....	*b* 86,338
1881	....	....	....	....	*b* 116,762

a The returns of the Boston Fish Bureau give the inspection this year 48,263 barrels.
b From returns of the Boston Fish Bureau. The State inspection returns for 1879 could not be found. For 1880 the returns by the inspectors to the secretary of state give the number of barrels at 72,714$\frac{7}{25}$, which is believed to be inaccurate.

48.—STATISTICS OF NEW HAMPSHIRE.

The statistics of mackerel inspection in New Hampshire are in a single statement which shows the total number of barrels of mackerel packed in Portsmouth, the only inspection port of the State, during the years 1830 to 1852, 1861 to 1881. These facts are compiled from the following sources: 1830 to 1852, from Sabine's Report on the American Fisheries; 1861 to 1877, from original returns of inspectors copied by Mr. Starbuck; 18 9 to 1881, from official documents signed by the secretary of state of New Hampshire. In a foot-note is given the number of barrels packed in the State during the years ending December 31, 1878 to 1881, as reported to the Boston Fish Bureau.

Statement showing the total number of barrels of pickled mackerel inspected in New Hampshire from 1830 *to* 1852, *and from* 1861 to 1881.[a]

Year.	Barrels.	Year.	Barrels.	Year.	Barrels.
1830	20,300	1845	1,075	1867	572
1831	21,450	1846	1,369	1868	....
1832	21,700	1847	2,008	1869	157
1833	19,375	1848	2,400	1870	3,700
1834	18,200	1849	2,867	1871	2,071
1835	15,300	1850	3,125	1872	1,878
1836	9,450	1851	3,073	1873	2,398
1837	5,225	1852	2,140	1874	5,519
1838	3,420			1875	3,415
1839	700	1861	97	1876	5,351
1840	630	1862	15	1877	643
1841	1,100	1863	65	1878	[b] 2,252
1842	1,050	1864	300	1879	[b] 3,435½
1843	1,175	1865	45	1880	[b] 5,967
1844	1,240	1866	200	1881	[b] 5,385

[a] The inspection year ends on May 1, from 1869 to 1877, and on June 1 in subsequent years.
[b] The annual report of the Boston Fish Bureau gives the number of barrels packed in New Hampshire in years ending December 31, 1878, 4,000 barrels; 1879, 6,225 barrels; 1880, 7,350 barrels; 1881, 5,400 barrels.

49.—STATISTICS OF THE UNITED STATES.—TOTALS.

The mackerel industry of the United States, as far as pickled mackerel is concerned, is exhibited in a series of statements which show the total number of barrels packed in the United States, and the imports of mackerel from the Dominion of Canada. Several statements gathered from Canadian sources are also included to show the mackerel industry of the United States as compared with that of Canada.

Statements I to III show the number of vessels employed by the New England States in the Bay of Saint Lawrence and American coast fisheries, and the total catch of salt mackerel by these fleets during the years 1879, 1880, and 1881.

Statement IV shows the quantity and value of pickled mackerel produced by the fisheries of the United States for the years 1831, 1834 to 1838, 1851, 1864 to 1881. From this statement it appears that more mackerel were packed in the year 1881 than in any year, with the exception of 1831, in the history of this fishery. If to the quantity of mackerel salted there be added the quantity sold in a fresh condition, which was from 150,000 to 175,000 barrels, the total catch of mackerel by the American fleet in 1881 represents not less than 150,000,000 pounds of round fish, a larger amount by 30,000,000 pounds than was ever before taken in a single year.

Statement V shows the total quantity and value of pickled mackerel produced by the fisheries of the United States as compared with the production of Canadian fisheries during the years 1873 to 1880, from which it appears that during this period the United States have produced 1,809,333 barrels, valued at $16,083,453, and the Canadian fisheries have produced 1,320,217 barrels, valued at $12,717,576, making the total for both countries 3,129,550 barrels, valued at $28,801,029. Of the American production not over 260,000 barrels, valued at about

$2,500,000 were taken by American vessels in the Bay of Saint Lawrence.

Statement VI shows the number of barrels of pickled mackerel received at Boston from United States and foreign ports during each month of the years 1878 to 1881, also the total receipts during the year 1877. From this statement it appears that the mackerel industry of Boston is increasing in importance, especially in the receipts of American mackerel.

Statement VII shows the price per barrel of the several grades of mackerel during the first week of September in each year from 1830 to 1881. These values may perhaps be generally taken as the average value for the year, though in some years, as in 1881, the price rapidly increased later in the year, when a large part of the product was placed upon the market.

Statement VIII shows the number of barrels of pickled mackerel imported from the British North American provinces during the years 1821 to 1841, and from 1850 to 1881, also the value of each year's importation from 1850 to 1881.

Besides the quantity of mackerel imported in 1872 from these provinces there were 1,504 barrels, valued at $11,214, received from England, Scotland, British West Indies, France, and Portuguese possessions, making the total importation 79,235 barrels, valued at $449,625. In the year 1873, 1,191 barrels mackerel, valued at $4,679, were received from the Danish West Indies and England, making the total importation for that year 90,889 barrels, valued at $610,457. The entire importation of pickled mackerel for the years subsequent to 1873 has been from the British North American provinces.

The quantities of dutiable mackerel imported since June 30, 1873, and included in the tabulated statement, are as follows: 1874, 190 barrels, $1,550; 1875, 59 barrels, $553; 1876, 7 barrels, $48; 1877, 14 barrels, $148; 1878, 6 barrels, $67; 1879, 2 barrels, $14; 1880, none specified; 1881, 9 barrels, $97; total, 287 barrels, $2,477. The quantities of pickled mackerel imported from the provinces free of duty under the treaty of Washington since June 30, 1873, are as follows: 1874, 89,503 barrels, $800,920; 1875, 77,479 barrels, $584,283; 1876, 76,531 barrels, $695,412; 1877, 43,066 barrels, $372,260; 1878, 102,148 barrels, $907,246; 1879, 101,420 barrels, $649,721; 1880, 112,468 barrels, $493,059; 1881, 120,288 barrels, $614,729; total, 722,903 barrels, $5,117,630.

Statement IX shows the quantity and value of pickled mackerel imported into the United States from the British provinces during the years 1856 to 1872, being the time of the operation of the reciprocity treaty, and from the close of that treaty to the beginning of the treaty of Washington. The statement also shows what would have been the duty on these imports during the period of reciprocity. These statistics are compiled from sheets published by W. R. Clark, and believed to be copied from United States custom-house returns.

Statement X shows the quantity and value of foreign pickled mackerel entered for consumption in the United States during the years ended June 30, 1872 to 1881. Comparing this Statement with statement VIII, it appears that the total imports from the Dominion of Canada, from 1872 to 1881, amount to 890,619 barrels, valued at $6,164,295, and the total consumption of Canadian mackerel during the same period amounts to 836,218 barrels, valued at $5,900,649. This shows that nearly the entire importation of foreign mackerel is consumed in this country; and such would naturally be the case since the imports are the best qualities of Canadian mackerel that are too fat for export to the West Indies or other foreign countries.

Statements XI to XV, inclusive, show the production of mackerel by the fisheries of the Dominion of Canada, and the exports of mackerel from that country during a series of years. They are compiled from the annual reports of the department of marine and fisheries of the Dominion of Canada, the documents and proceedings of the Halifax Commission, and a report by United States Consul-General Jackson, of Halifax, on the fisheries of Canada, and their value to the United States, printed in commercial reports of the Department of State for January, 1881.

The first three of these statements show the total value of pickled and fresh mackerel, the value of mackerel exported to all countries, and the value of mackerel exported to the United States during the period from 1873 to 1879. From these statements we see that the production is valued at $10,654,528, and the exports amount to $5,481,493, of which the United States receives nearly three-fourths, or $4,090,139 worth. Of the entire production only $115,918 worth of fresh or canned mackerel is included, of which $26,018 worth was exported to the United States, as follows: 1873, none specified; 1874, from Nova Scotia, 26,390 pounds fresh, $2,689; 1875, from Nova Scotia, 1,008 pounds fresh, $126; 1876, from Nova Scotia, 22,760 pounds fresh, $4,632; 1877, from Nova Scotia, 8,976 pounds preserved, $1,051; from New Brunswick, 703 pounds fresh, $62; 1878, from Nova Scotia, 54,200 pounds fresh, $1,266, 4,365 pounds preserved, $4,287; from New Brunswick, 87,883 pounds fresh, $5,099, 9,448 pounds preserved, $693; from Quebec, 10,738 pounds fresh, $654; 1879, from Nova Scotia, 39,700 pounds fresh, $2,632, 266 pounds preserved, $818; from New Brunswick, 52,786 pounds fresh, $2,009; total value, $26,018.

The total yield of fish and fish products, by the fisheries of Canada, from 1873 to 1879, as given in official documents, was valued at $82,094,962, of this amount $40,802,322 worth was exported to all countries, including $11,695,530 worth exported to the United States.

Statement XIV shows the quantity and value of mackerel produced by the Canadian fisheries from 1869 to 1880, including those of Prince Edward Island since its entry into the Dominion in 1873.

Statement XV shows the quantity and value of pickled mackerel exported from the Dominion of Canada to the United States from 1873 to 1879, also from Prince Edward Island from 1857 to 1873, and from

Newfoundland from 1853 to 1876. From this statement it appears that the total exports of pickled mackerel to the United States amounts to 528,272 barrels, valued at $4,068,925. Comparing this quantity and value with the imports into the United States during the same period as given in Statement VIII, by the United States Bureau of Statistics, we find the imports amount to 580,123 barrels, valued at $4,618,000. Part of the discrepancy between those two statements may be accounted for from the fact that the United States returns are for the fiscal years ended June 30, while the Canadian returns may be for the calendar years.

NEW ENGLAND MACKEREL FLEET, 1879.

STATEMENT I.—*Showing the number of vessels and their catch of salt mackerel in the Bay of Saint Lawrence and American shore mackerel fisheries for the season of* 1879, *as reported to the Boston Fish Bureau.*

[Compiled from annual report for 1879.]

	Vessels.			Barrels of mackerel.		
	Bay.	Shore.	Total.	Bay.	Shore.	Total.
MASSACHUSETTS.						
Newburyport	6	2	8	721	870	1,591
Rockport *	......	8	8	....	....	....
Gloucester	26	85	111	7,125	47,085	54,210
Boston †	4	35	39	1,310	48,103	49,413
Cohasset	......	6	6	....	4,900	4,900
Wellfleet	......	22	22	....	17,200	17,200
Provincetown	......	5	5	....	4,354	4,354
Chatham	......	7	7	....	5,688	5,688
Harwich	......	11	11	....	10,938	10,938
Dennis	1	10	11	240	7,290	7,530
Hyannis	......	2	2	....	301	301
Total	37	193	230	9,396	146,729	156,125
NEW HAMPSHIRE.						
Portsmouth	......	9	9	....	6,225	6,225
MAINE.						
Deer Isle *	......	3	3	....	....	....
Camden	......	3	3	....	1,020	1,020
North Haven ‡	......	6	6	....	1,278	1,278
Booth Bay	......	9	9	....	3,951	3,951
Portland	5	60	65	1,400	50,600	52,000
Total	5	81	86	1,400	56,849	58,249
Total for New England	42	283	325	10,796	209,803	220,599

* Vessels packed out away from home.
† Numerous vessels packed out in addition to home fleet.
‡ Vessels mostly packed out away from home.

NEW ENGLAND MACKEREL FLEET, 1880.

STATEMENT II.—*Showing the number of vessels and their catch of salt mackerel in the Bay of Saint Lawrence, the New England shore, and the Southern mackerel fisheries for the season of 1880, as reported to the Boston Fish Bureau.*

[Compiled from annual report for 1880.]

	Vessels.				Total number of crews.	Barrels of mackerel.				Remarks.
	Bay.	New England shore.	South.	Total.		Bay.	New England shore.	South.	Total.	
MASSACHUSETTS.										
Newburyport	4	5	3	12	110	......	738	....	738	3,885 barrels packed at other ports.
Rockport	1	5	1	7	96	50	706	......	756	6,269 barrels packed at other ports.
Gloucester	15	61	34	110	1,650	2,189	124,477	2,954	129,620	Includes other than home fleet.
Boston	5	31	....	36	530	2,158	51,844	.....	54,002	Several vessels packed in addition to home fleet.
Cohasset	1	....	6	7	100	390	5,856	600	6,846	
Wellfleet	6	5	20	31	450	30	28,707	500	29,237	
Provincetown	......	4	3	7	105	....	4,863	205	5,068	
Chatham	.....	1	5	6	87	....	6,230	1,000	7,230	
Harwich	......	5	6	11	180	....	12,838	1,000	13,838	
Dennis	......	7	3	10	160	....	7,691	460	8,151	
Hyannis	......	2	....	2	30	....	500	....	500	
Total	32	126	81	239	3,498	4,817	244,450	6,719	255,986	
MAINE.										
Swan's Isle	2	2	6	10	145	....	....	....	....	All packed from home.
Deer Isle	......	2	2	4	56	....	....	....	....	All packed from home.
Camden	......	3	....	3	39	....	1,421	....	1,421	
North Haven	......	1	5	6	90	....	....	1,400	1,400	Vessels partly packed away from home.
Booth Bay	......	12	4	16	235	....	3,300	700	4,000	Many of them packed away from home.
Southport	......	5	....	5	70	....	3,100	....	3,100	Part packed from home.
Sedgwick	......	....	1	1	15	....	....	....	....	1,240 barrels packed away from home.
Portland	......	50	....	50	730	2,484	73,933	....	76,417	Many vessels in addition to home fleet included.
Total	2	75	18	95	1,380	2,484	81,754	2,100	86,338	
NEW HAMPSHIRE.										
Portsmouth	......	4	4	8	110	....	6,750	600	7,350	
Total for New England*	34	205	103	342	4,988	7,301	332,954	9,419	349,647	Inspected barrels.

*The New England shore fleet mentioned above are only the vessels that fish nowhere else; to which may be added the Southern and North Bay fleets after they returned from their unsuccessful cruise in those waters, making the total shore fleet 342 sail.

[In the annual report for 1881 some corrections are made in the returns of 1880; shore fleet, 201, Southern fleet, 92; total fleet, 327; total crews, 4,778.]

NEW ENGLAND MACKEREL FLEETS, 1881.

STATEMENT III.—*Showing the number of vessels and their catch of salt mackerel in the Bay of Saint Lawrence, the New England shore, and the Southern mackerel fisheries for the season of* 1881, *as reported to the Boston Fish Bureau.*

[Compiled from annual report for 1881.]

	Vessels.				Total number of crews.	Barrels of mackerel.				Remarks.
	Bay.	New England shore.	South.	Total.		Bay.	New England shore.	South.	Total.	
MASSACHUSETTS.										
Newburyport	1	......	3	4	59	......	......	......	......	*
Rockport	......	6	......	6	65	......	290	......	290	‡ Total catch 3,590 barrels.
Gloucester	1	59	46	106	1,548	40	120,597	9,000	129,637	‡
Boston	1	15	5	21	296	290	63,768	5,611	69,669	†
Cohasset	......	7	......	7	100	......	8,013	......	8,013	
Wellfleet	......	33	3	36	508	......	30,977	500	31,477	5 sail packed at Boston.
Provincetown	......	8	......	8	120	......	6,175	......	6,175	3 sail packed at Boston.
Chatham	......	......	......	......	......	......	170	......	170	Weir caught.
South Chatham	......	1	4	5	75	......	8,940	1,470	10,410	
Harwich	......	......	9	9	146	......	4,388	5,500	9,888	6,100 barrels landed at Booth Bay additional.
Dennisport	......	......	3	3	45	......	2,646	900	3,546	
Fairhaven	......	1	......	1	13	......	220	......	220	1,536 barrels were caught.
Total	3	130	73	206	2,975	330	246,184	22,981	269,495	
MAINE.										
Swan's Isle	......	10	2	12	180	......	......	1,700	1,700	
Deer Isle	......	1	1	2	28	......	2,280	223	2,503	‡Southern catch landed at New York and Philadelphia.
Camden	......	3	......	3	39	......	......	......	......	
Northhaven	......	5	5	10	120	......	500	......	500	‡
Booth Bay	......	4	9	13	185	......	14,259	800	15,059	‡
Southport	......	8	......	8	120	......	5,000	......	5,000	‡ 6,100 barrels of those landed by Harwich sail.
Sedgwick	......	1	......	1	15	......	......	......	......	‡
Portland	......	35	......	35	490	140	91,860	......	92,000	‡
Total	......	67	17	84	1,177	140	113,899	2,723	116,762	
NEW HAMPSHIRE.										
Portsmouth	......	5	3	8	106	......	3,700	1,700	5,400	‡
Total for New England	3	202	93	298	4,258	470	363,783	27,404	391,657	Inspected barrels.

* None packed at home port. † Numerous vessels from other ports included. ‡ Part of the catch landed at Boston and Portland. Amount given packed at home ports.

NOTE.—The New England shore fleet mentioned above are only the vessels that fished nowhere else, to which may be added the Southern and North Bay fleets, after they returned from their unsuccessful cruise in those waters, making the total shore fleet two hundred and ninety-eight sail.

MACKEREL FISHERY OF THE UNITED STATES.

STATEMENT IV.—*Showing the number of barrels and value of pickled mackerel produced by fisheries of the United States for the years* 1831, 1834 *to* 1838, 1851, 1864 *to* 1881.*

Years.	Massachusetts.	Maine.	New Hampshire.	Total quantity and value.	
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Value.*
1831	283, 548$\frac{1}{2}$	44, 951$\frac{1}{2}$	21, 450	449, 950	$1, 862, 793
1834	252, 879$\frac{1}{2}$	40, 661	18, 200	311, 740$\frac{1}{2}$	1, 437, 123
1836	174, 410	25, 228	9, 450	209, 088	1, 520, 069
1837	138, 157$\frac{1}{2}$	22, 462	5, 225	165, 844$\frac{1}{2}$	965, 214
1838	110, 740$\frac{1}{4}$	24, 312	3, 420	138, 472$\frac{1}{4}$	1, 156, 243
1851	329, 244$\frac{1}{8}$	31, 472	3, 073	363, 789$\frac{1}{8}$	2, 484, 679
1864	274, 357$\frac{1}{4}$	49, 797$\frac{1}{2}$	300	324, 454$\frac{3}{4}$	7, 001, 098
1865	256, 796$\frac{1}{8}$	54, 215$\frac{3}{4}$	45	311, 056$\frac{7}{8}$	5, 729, 851
1866	231, 696$\frac{7}{16}$	44, 627$\frac{1}{2}$	200	276, 523$\frac{15}{16}$	5, 161, 261
1867	210, 314$\frac{1}{16}$	33, 675$\frac{1}{8}$	572	244, 501$\frac{3}{16}$	3, 174, 130
1868	180, 056$\frac{11}{80}$	28, 774$\frac{1}{8}$	....	208, 830$\frac{21}{80}$	2, 924, 987
1869	234, 210$\frac{7}{8}$	37, 166$\frac{1}{4}$	157	271, 534$\frac{1}{8}$	3, 762, 985
1870	318, 521$\frac{3}{5}$	52, 304$\frac{1}{10}$	3, 700	374, 525$\frac{7}{10}$	4, 400, 563
1871	259, 416$\frac{3}{4}$	48, 603$\frac{9}{20}$	2, 071	310, 091$\frac{1}{5}$	2, 668, 851
1872	181, 956$\frac{1}{80}$	22, 173	1, 878	206, 007$\frac{1}{80}$	2, 205, 761
1873	185, 748$\frac{1}{2}$	22, 193$\frac{13}{20}$	2, 398	210, 350$\frac{3}{20}$	3, 167, 948
1874	258, 379$\frac{15}{16}$	43, 741$\frac{3}{4}$	5, 519	307, 640$\frac{11}{16}$	3, 163, 701
1875	130, 062$\frac{71}{80}$	9, 502$\frac{1}{2}$	3, 415	142, 980$\frac{31}{80}$	1, 439, 315
1876	225, 942$\frac{17}{80}$	22, 429$\frac{1}{2}$	5, 351	253, 722$\frac{57}{80}$	1, 853, 103
1877	105, 097$\frac{7}{10}$	22, 157$\frac{3}{4}$	643	127, 898$\frac{9}{20}$	1, 384, 223
1878	144, 205	48, 263	4, 000	196, 468	1, 408, 675
1879	156, 125	58, 249	6, 225	220, 599	1, 268, 444
1880	255, 986	86, 338	7, 350	349, 674	2, 398, 004
1881	269, 495	116, 762	5, 400	391, 657	2, 447, 556

*The figures for the years 1834 to 1838 and 1851 are from Sabine's Report on the American Fisheries; for the years 1864 to 1877 from the State inspection returns; for the years 1878 to 1881 from the annual reports of the Boston Fish Bureau.

MACKEREL FISHERY OF THE UNITED STATES AND OF THE DOMINION OF CANADA.

STATEMENT V.—*Showing the number of barrels and value of pickled mackerel produced by the fisheries of the United States from* 1873 *to* 1881, *and by the fisheries of the Dominion of Canada from* 1873 *to* 1880.

Year.	United States.		Dominion of Canada.		Total.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
1873	210, 350$\frac{3}{20}$	$3, 167, 948	159, 530	$1, 615, 552	369, 880$\frac{3}{20}$	$4, 783, 500
1874	307, 640$\frac{11}{16}$	3, 163, 701	161, 096	1, 559, 551	468, 736$\frac{11}{16}$	4, 723, 252
1875	142, 980$\frac{31}{80}$	1, 439, 315	123, 654$\frac{1}{2}$	1, 236, 545	266, 634$\frac{71}{80}$	2, 675, 860
1876	253, 722$\frac{57}{80}$	1, 853, 103	104, 356	992, 794	358, 078$\frac{57}{80}$	2, 845, 897
1877	127, 898$\frac{9}{20}$	1, 384, 223	163, 916	1, 639, 160	291, 814$\frac{9}{20}$	3, 023, 383
1878	196, 468	1, 408, 675	183, 919	1, 766, 226	380, 387	3, 174, 901
1879	220, 599	1, 268, 444	190, 076$\frac{1}{2}$	1, 745, 490	410, 675$\frac{1}{2}$	3, 013, 934
1880	349, 674	2, 398, 044	233, 669	2, 162, 258	583, 343	4, 560, 302
1881	391, 657	2, 447, 556	....	....	....	....
Total 1873 to 1881.	2, 200, 990$\frac{33}{80}$	18, 531, 009	....	....	....	....
Total 1873 to 1880.	1, 809, 333$\frac{33}{80}$	16, 083, 453	1, 320, 217	12, 717, 575	3, 129, 550$\frac{33}{80}$	28, 801, 029

MACKEREL INDUSTRY OF BOSTON, MASS.

STATEMENT VI.—*Showing the number of barrels of pickled mackerel received in Boston from home and foreign ports, from 1877 to 1881, as reported to the Boston Fish Bureau.*

[Compiled from annual reports of Boston Fish Bureau.]

	1877.		1878.		1879.		1880.		1881.	
	Home ports.	Foreign ports.	Home ports.	Foreign ports.	Home ports.	Foreign ports.	Home ports.	Foreign ports.	Home ports.	Foreign ports.
January	....	....	272	480	611	1,484	117	3,576	211	1,179
February	....	....	371	1,132	1,417	1,490	709	3,947	1,202	2,065
March	....	....	842	1,555	3,868	4,577	331	2,012	3,252	7,269
April	....	....	740	50	1,606	1,878	184	138	464	4,482
May	....	....	3,077*	2,160*	1,183	95	945*	178	2,161	1,725
June	....	....	2,299	5,037	2,843	779	1,679	6,283	3,269	2,366
July	....	....	774	5,341	1,505	6,450	4,166	8,222	10,943	5,766
August	....	....	5,472	21,495	5,158	12,290	10,158	14,891	12,678	3,931
September	....	....	4,533	12,109	5,035	13,878	9,412	19,713	20,868	12,902
October	....	....	7,025	15,092	4,934	25,600	4,934	30,033	10,391	11,550
November	....	....	5,039	9,383	2,425	12,180	2,425	11,532	6,574	5,356
December	....	....	1,437	4,405	3,233	3,512	1,701	5,205	1,640	3,259
Catch of Boston fleet	(20,139)	....	32,458	....	49,413	....	54,002	....	69,669	....
Total	55,668	86,356	64,339	78,689	83,231	84,213	90,763	105,730	143,319	61,850
Grand total.	142,024		143,028		167,444		196,493		205,172	

* New.

PRICE OF MACKEREL IN MASSACHUSETTS.

STATEMENT VII.—*Showing the price per barrel of each grade of pickled mackerel in th first week of September, from 1830 to 1881.*

[Compiled from the files of the Gloucester Telegraph and the Cape Ann Advertiser.]

Year.	No. 1.	No. 2.	No. 3.	Year.	No. 1.	No. 2.	No. 3.
1830	$5 00	$4 50	$2 62	1859	$14 50	$12 59	$8 50
1831	5 75	4 75	2 62	1860	16 00	8 50	5 00
1832	5 00	4 00	2 75	1861	8 50	4 50	2 75
1833	5 72	4 72	2 85	1862	8 25	6 00	4 50
1834	5 72	4 72	3 35	1863	14 00	9 25	6 50
1835	7 00	6 00	4 00	1864	30 00	20 00	....
1836	9 00	8 00	5 00	1865	22 00	15 00	9 75
1837	7 75	6 50	4 12	1866	22 75	13 25	....
1838	11 00	9 25	5 50	1867	17 00	12 25	7 50
1839	12 50	10 50	7 00	1868	17 00	13 00	....
1840	12 75	10 50	5 50	1869	23 00	11 50	....
1841	12 00	10 00	6 00	1870—bay	21 50	11 00	....
1842	9 00	6 00	4 00	shore	23 00	9 75	....
1843	10 12	8 12	6 00	1871—bay	10 50	7 50	5 50
1844	9 50	7 50	5 50	shore	11 25	7 25	6 25
1845	13 00	10 50	6 87	1872—bay	11 50	9 25	7 00
1846	9 12	6 25	3 87	shore	14 50	9 50	....
1847	12 75	8 25	4 25	1873—bay	14 75	12 25	9 00
1848	9 00	6 00	3 37	shore	20 00	12 25	....
1849	12 00	7 00	3 50	1874—bay	15 00	8 00	7 00
1850	10 12	8 12	5 00	shore	13 25	9 00	7 00
1851	10 00	6 50	5 12	1875—bay	14 00	11 00	....
1852	9 00	7 00	5 75	shore	16 25	10 25	7 50
1853	11 50	9 50	7 50	1876	15 00	6 75	5 50
1854	15 00	12 25	5 00	1877	16 50	12 50	8 00
1855	19 00	11 00	6 25	1878	18 00	8 00	5 00
1856	13 00	8 00	6 00	1879	[16 00]	5 00	3 00
1857	15 00	12 50	8 50	1880	14 00	7 00	4 00
1858	15 50	12 50	8 50	1881	14 00	6 00	4 00

UNITED STATES IMPORTS OF PICKLED MACKEREL.

STATEMENT VIII.—*Showing the number of barrels of pickled mackerel imported into the United States from the British North American Provinces from* 1821 *to* 1841, *and from* 1850 *to* 1881, *and also the value of same from* 1850 *to* 1881.*

Year.	Barrels.	Year.	Barrels.	Year.	Barrels.	Value.	Year.	Barrels.	Value.
....	....	1834	223	1850	75, 326	$335, 309	1866	56, 613	$528, 270
....	....	1835	8, 153	1851	102, 394	548, 553	1867	77, 503	675, 986
....	....	1836	6, 037	1852	78, 334	327, 613	1868	41, 655	364, 429
1821	7	1837	1, 256	1853	54, 407	329, 216	1869	29, 701	327, 079
1822	387	1838	182	1854	61, 815	470, 916	1870	30, 712	346, 956
1823	67	1839	7, 046	1855	80, 012	427, 283	1871	29, 333	254, 986
1824	790	1840	11, 823	1856	62, 606	492, 802	1872	77, 731	438, 410
1825	242	1841	10, 877	1857	49, 477	457, 074	1873	89, 698	605, 778
1826	87	....	....	1858	67, 345	664, 852	1874	89, 693	802, 470
1827	39	....	....	1859	49, 086	565, 029	1875	77, 538	385, 836
1828	38	....	....	1860	63, 549	588, 969	1876	76, 538	695, 460
1829	95	....	....	1861	38, 023	269, 399	1877	43, 080	372, 408
1830	391	....	....	1862	37, 710	247, 678	1878	102, 154	907, 313
1831	4, 552	....	....	1863	62, 767	402, 178	1879	101, 422	649, 735
1832	32	....	....	1864	80, 665	599, 109	1880	112, 468	493, 059
1833	20	....	....	1865	120, 067	957, 411	1881	129, 297	614, 820

*The statistics in this statement are obtained from the following sources: For the years 1821 to 1841 from Sabine's "Report on the American Fisheries"; for the fiscal years ending June 30, 1850 to 1855, 1867, 1868, and 1872 to 1881, from the annual reports of the United States Bureau of Statistics; for the years 1856 to 1866, 1869, 1870, and 1871, from sheets published in 1879 by W. R. Clark, and believed to be compiled from United States custom-house records. Mr. Clark's statistics are the most reliable we have obtained for the years for which we quote them, as the returns of the United States Bureau of Statistics do not give the desired details for those years.

UNITED STATES IMPORTS OF PICKLED MACKEREL.

STATEMENT IX.—*Showing the quantity and value of pickled mackerel imported into the United States from the British provinces, 1856 to 1872.*

[Compiled from "Statistics of Importation of Fish from the Provinces, 1856 to 1872, inclusive, entered according to act of Congress, in the year 1879, by W. R. Clark," 8 sheets (A to H) 18 by 12 inches.]

Year.	Maine.			Massachusetts.			New York.			Pennsylvania.		
	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.
1855	....	....	....	....	....	....	....	....	....	....	....	....
1856	321	$2, 140	$642	47, 350	$384, 990	$94, 700	....	....	....	5, 299	$43, 469	$10, 598
1857	1, 361	9, 396	2, 722	36, 551	317, 610	73, 102	5, 440	$60, 351	$10, 880	2, 813	42, 592	5, 626
1858	1, 830	13, 321	3, 660	49, 592	488, 968	99, 184	7, 129	76, 455	14, 258	3, 944	48, 473	7, 888
1859	816	5, 307	1, 632	36, 386	420, 900	72, 772	6, 798	79, 016	13, 596	3, 239	38, 467	6, 478
1860	461	3, 499	922	49, 362	439, 730	98, 724	5, 869	70, 706	11, 738	5, 552	58, 296	11, 104
1861	380	2, 645	760	18, 957	123, 866	37, 914	8, 732	74, 389	17, 464	7, 281	53, 893	14, 562
1862	1, 673	17, 730	3, 346	23, 334	142, 361	46, 668	5, 537	39, 980	11, 074	4, 953	34, 769	9, 906
1863	1, 777	26, 877	3, 554	42, 825	266, 611	85, 650	12, 352	71, 380	24, 704	3, 651	25, 539	7, 302
1864	2, 325	28, 672	4, 650	48, 440	340, 710	96, 880	22, 462	176, 989	44, 924	6, 472	47, 126	12, 944
1865	2, 214	26, 098	4, 428	82, 306	651, 850	164, 612	23, 778	183, 625	47, 556	7, 303	62, 291	14, 606
1866	2, 545	30, 667	5, 090	46, 425	487, 884	92, 850	3, 617	23, 261	7, 234	3, 492	36, 171	6, 984
1867	1, 218	8, 831	2, 436	42, 254	362, 890	84, 508	9, 482	88, 732	18, 964	4, 778	44, 193	9, 556
1868	3, 698	39, 080	7, 396	26, 765	248, 650	53, 530	6, 775	52, 724	13, 550	613	6, 582	1, 226
1869	1, 458	18, 704	2, 916	24, 723	259, 782	49, 446	3, 030	42, 595	6, 060	302	4, 195	604
1870	3, 315	37, 211	6, 630	24, 673	273, 923	49, 346	1, 982	24, 224	3, 964	6	90	12
1871	1, 491	13, 946	2, 982	23, 280	187, 680	46, 560	2, 940	33, 378	5, 880	481	7, 074	962
1872	6, 026	32, 891	12, 052	46, 155	299, 000	92, 310	8, 123	50, 895	16, 246	1, 742	14, 753	3, 484
	32, 909	317, 015	65, 818	669, 378	5, 697, 405	1, 338, 756	134, 046	1, 148, 700	268, 092	61, 921	567, 973	123, 842

STATEMENT IX.—*Showing the quantity and value of pickled mackerel imported into the United States, &c.*—Continued.

Year.	Maryland.			Boston.*			Portland.*			Total.		
	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.	Barrels.	Value.	Duty.
1855	....	....	....	61, 513	$391, 625	$123, 026	889	$5, 463	$1, 778	....	....	....
1856	9, 636	$62, 204	$19, 272	44, 956	349, 663	89, 912	214	1, 406	428	62, 606	$492, 803	$125, 212
1857	3, 312	27, 125	6, 624	30, 794	273, 830	61, 588	109	972	218	49, 477	457, 074	98, 954
1858	4, 850	37, 635	9, 700	32, 522	377, 650	65, 044	340	2, 197	680	67, 345	664, 852	134, 690
1859	1, 847	21, 339	3, 694	41, 572	390, 915	83, 144	441	1, 649	882	49, 086	565, 029	98, 172
1860	2, 305	16, 738	4, 610	40, 816	374, 050	81, 632	232	1, 993	464	63, 549	588, 969	127, 098
1861	2, 673	14, 606	5, 346	17, 179	90, 046	34, 358	148	523	296	38, 023	269, 399	76, 046
1862	2, 213	12, 838	4, 426	14, 704	87, 768	29, 408	224	928	448	37, 710	247, 678	75, 420
1863	2, 162	11, 771	4, 324	35, 048	211, 253	70, 096	425	2, 603	850	62, 767	402, 178	125, 534
1864	966	5, 612	1, 932	45, 714	308, 878	91, 428	2, 980	24, 747	5, 960	80, 665	599, 109	161, 330
1865	4, 466	33, 547	8, 932	67, 300	524, 998	134, 600	95	991	190	120, 067	957, 411	240, 134
1866	534	4, 287	1, 068	38, 522	363, 910	77, 044	442	3, 773	884	56, 613	582, 270	113, 226
1867	1, 487	12, 887	2, 974	29, 176	259, 186	58, 352	155	1, 308	310	59, 219	517, 533	118, 438
1868	163	2, 145	326	16, 102	156, 847	32, 204	3, 318	33, 275	6, 636	38, 014	349, 181	76, 028
1869	188	1, 803	376	18, 343	186, 821	36, 686	1, 365	17, 563	2, 730	29, 701	327, 079	59, 402
1870	736	11, 508	1, 472	14, 716	164, 508	29, 432	2, 610	30, 017	5, 220	30, 712	346, 956	61, 424
1871	1, 141	12, 908	2, 282	15, 900	109, 578	31, 800	1, 223	11, 725	2, 446	29, 333	254, 986	58, 666
1872	778	4, 238	1, 556	35, 437	221, 935	70, 874	2, 763	14, 886	5, 526	62, 824	401, 777	125, 648
	39, 457	293, 191	78, 914	600, 314	4, 843, 461	1, 200, 628	17, 973	156, 019	35, 946	937, 711	8, 024, 284	1, 875, 422

*rncluded under Massachusetts and Maine.

CONSUMPTION OF FOREIGN MACKEREL IN THE UNITED STATES.

STATEMENT X.—*Showing the number of barrels and value of foreign mackerel entered for consumption in the United States,* 1872 *to* 1881.

[Compiled from reports of United States Bureau of Statistics.]

Year ended June 30—	Free of duty.		Dutiable.		Total.	
	Barrels.	*Value.*	*Barrels.*	*Value.*	*Barrels.*	*Value.*
1872	....	....	39, 572	$247, 796$\frac{75}{100}$	39, 572	$247, 796$\frac{75}{100}$
1873	....	....	70, 651$\frac{7}{20}$	523, 357$\frac{25}{100}$	70, 651$\frac{7}{20}$	523, 357$\frac{25}{120}$
1874	89, 376$\frac{3}{4}$	$793, 764	1, 496$\frac{3}{4}$	13, 325	90, 873$\frac{1}{2}$	807, 089
1875	78, 091$\frac{1}{4}$	586, 825	41	524	78, 132$\frac{1}{4}$	587, 349
1876	76, 582$\frac{85}{100}$	695, 847	16	70	76, 598$\frac{85}{100}$	695, 917
1877	44, 169$\frac{1}{2}$	373, 792$\frac{38}{100}$	8$\frac{1}{2}$	105	44, 178	373, 897$\frac{38}{100}$
1878	101, 995	907, 013	6	67	102, 001	907, 080
1879	101, 450	650, 048$\frac{13}{100}$	2$\frac{63}{100}$	19$\frac{5}{100}$	101, 452$\frac{63}{100}$	650, 067$\frac{18}{100}$
1880	112, 385$\frac{1}{2}$	492, 807$\frac{40}{100}$	12	127	112, 397$\frac{1}{2}$	492, 934$\frac{40}{100}$
1881	120, 352$\frac{1}{2}$	615, 063$\frac{10}{100}$	8$\frac{1}{2}$	98$\frac{50}{100}$	120, 361	615, 161$\frac{60}{100}$
Total	724, 403$\frac{35}{100}$	5, 115, 160$\frac{1}{100}$	111, 814$\frac{73}{100}$	785, 489$\frac{55}{100}$	836, 218$\frac{8}{100}$	5, 900, 649$\frac{56}{100}$
Duty paid	....	....	$223, 629$\frac{70}{100}$			

NOTE.—All the consumption of foreign mackerel as given in the above table for the year 1877, and subsequent to that time, and nearly all, if not the entire consumption for the year prior to 1877, is the product of the British North American provinces.

MACKEREL FISHERY OF THE DOMINION OF CANADA.

STATEMENT XI.—*Showing the total value of the production of the mackerel fishery of the Dominion of Canada,* 1873 *to* 1879.

Year.	Quebec.	Nova Scotia.	New Brunswick.	Prince Edward Island.	Total.
1873	$61, 700	$1, 411, 676	$35, 447	$111, 512	$1, 620, 335
1874	72, 780	1, 234, 649	51, 280	221, 761	1, 580, 470
1875	....	....	....	....	1, 245, 752
1876	49, 750	714, 263	30, 610	203, 064	997, 687
1877	53, 579	1, 155, 140	54, 476	404, 620	1, 667, 815
1878	87, 360	1, 307, 611	97, 372	291, 976	1, 784, 319
1879	60, 420	1, 019, 640	114, 676	563, 411	1, 758, 150
Total 1873 to 1879	....	....	....	....	10, 654, 528

MACKEREL EXPORTS OF THE DOMINION OF CANADA.

STATEMENT XII.—*Showing the total value of mackerel exported from the Dominion of Canada to all countries,* 1873 *to* 1879.

Year.	Quebec.	Nova Scotia.	New Brunswick.	Prince Edward Island.	Total.
1873	$2, 076	$673, 894	$10, 232	$29, 830	$716, 032
1874	984	615, 992	25, 123	73, 329	715, 428
1875	953	509, 117	30, 338	252, 839	793, 247
1876	206	582, 155	56, 979	108, 332	747, 672
1877	65	442, 306	46, 179	98, 383	586, 933
1878	1, 078	677, 550	85, 239	279, 568	1, 043, 435
1879	1, 665	651, 037	83, 946	145, 098	881, 746
Total 1873 to 1879	7, 027	4, 152, 051	338, 036	987, 379	5, 481, 493

MACKEREL EXPORTS OF THE DOMINION OF CANADA.

STATEMENT XIII.—*Showing the total value of mackerel exported from the Dominion of Canada to the United States,* 1873 *to* 1879.

Year.	Quebec.	Nova Scotia.	New Brunswick.	Prince Edward Island.	Total.
1873	$940	$502, 226	$10, 232	$20, 440	$533, 838
1874	984	518, 809	25, 123	73, 279	618, 195
1875	860	242, 704	28, 978	251, 232	523, 774
1876	206	415, 143	56, 274	108, 332	579, 955
1877	21	216, 170	46, 023	97, 359	359, 573
1878	1, 088	473, 571	84, 682	279, 402	838, 743
1879	1, 394	406, 024	83, 605	145, 038	636, 061
Total 1873 to 1879	5, 493	2, 774, 647	334, 917	975, 082	4, 090, 139

MACKEREL FISHERY OF THE DOMINION OF CANADA.

STATEMENT XIV.—*Showing the quantity and value of mackerel produced by the fisheries of the Dominion of Canada,* 1869 *to* 1880, *including Prince Edward Island since its entry into the Dominion in* 1873.

Year.	Quebec.			Nova Scotia.			New Brunswick.			Prince Edward Island.			Grand total.			
	Pickled mackerel.		Value of fresh or canned mackerel.	Pickled mackerel.		Value of fresh or canned mackerel.	Pickled mackerel.		Value of fresh or pickled mackerel.	Pickled mackerel.		Value of fresh or canned mackerel.	Pickeled mackerel.		Value of fresh or canned mackerel.	Total value.
	Barrels.	Value.		Barrels.	Value.		Barrels.	Value.		Barrels.	Value.		Barrels.	Value.		
1869	....	....	....	....	....	....	....	....	....	....	....	....	51,011	$530,110	....	$530,110
1870	3,677	$36,770	....	85,254	$1,023,048	....	3,282	$39,384	....	....	....	....	92,213	1,099,202	....	1,099,202
1871 *	7,638	76,380	....	128,028	1,220,333	....	4,639	56,603	....	....	....	....	140,305	1,349,682	$3,634	1,353,316
1872	1,759	17,590	....	115,833	1,624,894	....	2,217	32,728	....	....	....	....	119,439	1,665,110	10,102	1,675,212
1873	6,170	61,700	....	141,005	1,410,050	$1,626	3,229	32,290	$3,157	9,126	$111,512	....	159,530	1,615,552	4,783	1,620,335
1874	7,278	72,780	....	122,258	1,222,580	12,069	4,243	42,430	8,850	27,317	221,761	....	161,096	1,559,551	20,919	1,580,470
1875	....	....	....	91,235	....	....	....	....	....	....	....	....	123,654½	1,236,545	9,207	1,245,752
1876	4,975	49,750	....	70,964	709,640	4,623	3,034	30,340	270	25,383	203,064	....	104,356	992,794	4,893	997,687
1877	5,343½	53,435	$144	113,638½	1,136,385	18,745	4,472	44,720	9,756	40,462	404,620	....	163,916	1,639,160	28,655	1,667,815
1878	8,659	86,590	770	126,698	1,296,980	10,631	9,080	90,800	6,572	36,482	291,856	$120	183,919	1,766,226	18,093	1,784,319
1879	7,552½	60,420	....	101,559	1,015,590	4,050	10,880	108,800	5,876	70,085	560,680	2,734	190,076½	1,745,490	12,660	1,758,150
1880	5,017	40,878	....	126,432	1,264,320	6,048	19,650	196,500	9,964	82,570	660,560	696	233,669	2,162,258	16,708	2,178,966

* The annual report of the Department of Marine and Fisheries for the year 1871 gives the product of the mackerel fishery, 239.429 barrels, valued at $2.870.807, but the statistics presented at the Halifax Commission, as also a review in the annual report of the Commissioner of Fisheries for 1877 gives the value of the product of this fishery for the year 1871, $1,353,316, which is probably the more accurate value.

MACKEREL EXPORTS OF BRITISH PROVINCES.

STATEMENT XV.—*Showing the quantity and value of pickled mackerel exported to the United States from the Dominion of Canada,* 1873 *to* 1879, *also from Prince Edward Island,* 1857 *to* 1873, *and from Newfoundland,* 1853 *to* 1876.

Year.	Quebec.		Nova Scotia.		New Brunswick.		Prince Edward Island.		Newfoundland.		Total.	
	Bbls.	Value.	Bbls.	Value.	Bbls.	Value.	Bbls.	Value.	Bbls.	Value.	Bbls.	Value.
1853									10	$48		
1854									19	144		
1855												
1856												
1857							3, 048	$25, 000				
1858							4, 078	38, 440				
1859							3, 243	33, 890				
1860							3, 471	36, 760				
1861							1, 143	11, 525				
1862							2, 321	19, 320	170	1, 016		
1863							3, 402	27, 045				
1864							6, 583	42, 775	158	950		
1865							16, 530	181, 675	4	24		
1866							13, 413	79, 990				
1867							12, 302	119, 195	17	102		
1868							11, 686	161, 836	9	54		
1869							10, 242	109, 625				
1870							13, 960	176, 280	864	6, 912		
1871							17, 216	146, 925	916	7, 328		
1872							9, 126	111, 512	244	1, 952		
1873	106	$940	77, 420	$502, 226	1, 276	$10, 232	2, 528	20, 440	28	196	81, 330	$538, 838
1874	164	984	58, 385	516, 120	2, 561	25, 123	6, 583	73, 279			67, 693	615, 506
1875	146	860	35, 568	242, 578	3, 375	28, 978	31, 466	251, 232			70, 555	523, 648
1876	36	206	49, 407	410, 511	7, 122	56, 274	13, 276	108, 332			69, 841	575, 323
1877	3	21	27, 285	215, 119	5, 049	45, 961	10, 867	97, 359			43, 204	358, 460
1878	71	434	61, 812	473, 018	7, 437	78, 890	31, 702	279, 402			101, 022	831, 744
1879	223	1, 394	65, 949	402, 574	9, 952	81, 596	18, 526	145, 038			94, 655	630, 602

VIII.—MATERIALS FOR A CHRONOLOGICAL HISTORY OF THE MACKEREL FISHERY OF NORTH AMERICA.

M.—EXTRACTS FROM RECORDS AND REMINISCENSES OF FISHERMEN.

50.—SEVENTEENTH CENTURY.

The mackerel fishery has been of great importance to the United States both from a commercial standpoint and as a motive for the formation of treaties with the Government of Great Britain and the establishment of rates of tariff intended to regulate the importation of mackerel from the British provinces. Its history from year to year has been so varied, the conditions under which it was prosecuted in successive years so changeable, that it seems worth while to present here a series of notes chronologically arranged which have been gathered from various sources and which illustrate the changes in method and in result which have been recorded by observers from 1620 to the present time.

1629 TO 1635.—ABUNDANCE OF MACKEREL ON THE COAST OF NEW ENGLAND IN THE FIRST HALF OF THE SEVENTEENTH CENTURY.

Francis Higginson, in his "Journal of His Voyage to New England," 1629, speaks of seeing "many schools of mackerel, infinite multitudes, on every side of our ship" off Cape Ann, June 26. [Young's Chronicles, 232.] Richard Mather, in his "Journal," 1635, speaks of the seamen taking abundance of mackerel off Menhiggin (p. 470).

1671.—Early fishing on Cape Cod.

In 1671 the code of laws for the government of the colony was revised and ordered to be printed under the title of "The Book of the General Laws of the Inhabitants of the Jurisdiction of New Plymouth." Under these laws, or "General Fundamentals," as they were called, provisions were made, as, has been suggested, "for the better improving of fishing for mackerel, &c., at the Cape." Penalties were imposed for taking them at other than specified times, licenses were to be granted, &c., &c. It was now "ordered that the charges of the free schools, £33 per annum, shall be defrayed by the treasurer out of the profits arising from the fishing at the Cape until such time as the minds of the freemen be known concerning it."

At this time, also, "certain persons belonging in Hull petitioned the government for permission to fish at Cape Cod for mackerel, they having discovered a new method of fishing with nets by moonlight."—(Freeman's Hist. of Cape Cod, Boston, 1862, vol. i, p. 266.)

1677.—Rental of the Cape Cod fishery.

In July, 1677, the records of the Plymouth colony show that the Cape Cod fishery was let for 7 years, at thirty pounds per annum, to seine mackerel and bass, to certain individuals who are named. They were restricted to take in the Plymouth colonists with them, and if none offer, to admit strangers.

The profits of the hire which accrued to the colony were sometimes distributed to the schools.—(Massachusetts Historical Collections, iii, p. 220.)

51.—Nineteenth century.

1802.—Mackerel fishing in Cape Cod Bay.

The following paragraph is taken from the Gloucester Historical Collections, vol. viii, 1802, p. 199:

"Provincetown, 1802.

"The first mackerel which are taken to Boston market in the spring are taken in the harbor and yield a handsome profit, though the Boston marketmen purchase them at about $\frac{1}{4}$ of what they are sold for. 300 barrels are every year pickled and sent to Boston. The mackerel, bass, and herring are caught with seines, of which there are about 50 in the town, and which cost $100 each. Another seine, worth six dollars, is made use of for catching mackerel in the spring, and herring for bait."

1804–1832.—Price of mackerel in Boston market.

The average price of fresh mackerel in Boston market from 1804 to 1822 was six to eight cents apiece, sometimes ten; they were always sold by counts.—(Captain Merchant.)

1804.—SHORE MACKEREL FLEET OF CAPE ANN.

"From 1804 to 1822," remarks Capt. E. W. Merchant, of Gloucester, "Cape Ann had a considerable fleet of vessels engaged in the shore mackerel fishery for the sole purpose of supplying the Boston market; seven or eight from Gloucester Harbor, seven or eight from the north side of the Cape." They preserved their fish in a peculiar way, which will be described under the proper heading.

It is stated that the first shore mackerel fishing was prosecuted by the small boats, about the year 1800. The mackerel were caught mostly on the Inner Bank, and carried fresh to Boston market through the summer. Only the largest were saved, and these were sold for 5 or 6 cents apiece, and sometimes as high as 10 cents. Each boat was ballasted with pebbles; on this were placed hogshead tubs, each having a hole with a plug in it. These tubs were filled with salt water, and as soon as the mackerel were dressed they were put into the tubs, and the water changed every hour by drawing the plugs and allowing it to run off, until sufficient were caught to start for market, the changing of the water continuing until the boat arrived above the Castle, where it is said the water loses its coolness. The great object after catching the mackerel was to get them to market before daylight, in order to have the cool of the morning to sell them in. If a boat with three men and two boys stocked fifty dollars a week, it was considered satisfactory.

1804.—THE INTRODUCTION OF HAND-LINING FOR MACKEREL FROM THE DECKS OF VESSELS.

According to Capt. E. W. Merchant, the first man to introduce this mode of fishing was John Story, of Rockport, about the year 1804.

1818–1821.—The first voyages made for the purpose of salting mackerel was in the summer of 1818, by Capt. Simeon Burnham, in the schooner "President," on a trip to Cashe's; consequently to Captain Burnham belongs the honor of being the pioneer in this branch of the fisheries. It was considered quite an important event at the time, so much so that Capt. Benjamin Tarr was hired to go as navigator. Seventy barrels were caught on this trip, and they were packed in Boston. Two years after, this branch began to increase, and in 1821 several other jiggers* were added to the fleet. They carried six hands, and were absent about a week. The jiggers were stowed with butts and wash-barrels, and no mackerel were headed up on board until about 1820. In 1821, Samuel Wonson, Elisha M. Oakes, Robert Marston, Simeon Burnham, Samuel Brown, Nathaniel Blatchford, John Wonson, George

*The name "jigger" was first applied to the vessels engaged in jigging meakerel. As these vessels were all, or nearly all, pinkeys previous to 1830, the name in later years came to have a more special reference to the style of craftthan to the particular branch of fishery in which she was engaged. Thus the term "jigger" came to be synonymous with "pinkey," and was often used in that sense by the fishermen.

Wonson, James Merchant, Epes Merchant, were the skippers of the jiggers which comprised the chief part of the mackerel fleet. These jiggers ranged in tonnage from twenty-seven to forty-five tons. Prior to 1818 there were but few mackerel packed in Gloucester, that part of the business being mostly done in Boston. Moses Gilbert was the only inspector in town until 1828, and his accommodations were quite limited. At this date several other inspectors were appointed, and the mackerel fishery began to assume quite a business importance.—(Fisherman's Memorial and Record Book.)

1815.—The Hingham mackerel fishery.

In 1815 there were packed in Hingham 5,615 barrels mackerel, and in 1828, 32,313 barrels. There were 54 vessels employed, some for the season and some for a shorter time. There were 15 employed for the whole season, averaging 1,027 barrels each. The average number of hands were 8 to each vessel, making 432 in the whole. The quantity of salt used in striking and packing, allowing 18 hogsheads to 100 barrels, would be about 6,000 hogsheads.

There is a company formed in this town who carry on this fishing to some extent, besides several vessels fitted out by individuals. We understand there is a mackerel company in Wellfleet, in this county, extensively engaged in this fishery. We would like to hear with what success.—(Barnstable Journal, July 16, 1829.)

1815.—Invention of the mackerel jig.

The mackerel jig is said to have been invented about the year 1815 by Abraham Lurvey, of Pigeon Cove, Cape Ann; according to other authority, by one Thurlow, of Newburyport.

1817.—Beginning of the southern mackerel fishery.

Capt. John Parsons, of Rockport, Mass., went South after mackerel in the schooner Defiance; went as far south as Cape May, and took 60 barrels of fish, all of which were caught by drailing.

1821.—The large vessels of the Gloucester fleet.

About 1821 the fleet began to enlarge. The "Volante," of 37 tons, a pinkie built by Mr. Epes W. Merchant, was considered a very large vessel; then came the Independence, and afterwards the Columbus, a square-sterned vessel of 43 or 44 tons, built by George Friend, which was considered a very large vessel. These vessels went after mackerel to salt. Previous to that the entire Gloucester fleet had 'tended the fresh-fish market. Plymouth, Scituate, and Cohasset began salting mackerel in advance of Gloucester.—(Statement of Capt. E. W. Merchant.)

1818-1836.—Mackerel fishery of Hingham.

Mackerel Fishery.—We believe the extent to which this fishery is carried on from the towns of Massachusetts is not generally known. For ourselves we were not aware of it and of the importance of encouraging this branch of industry, which not only furnishes the means of employment to a large number of persons, but is of great consequence to the commercial interests of the country in affording a good nursery for seamen. We have seen a pamphlet recently printed containing "A statement of the quantity of mackerel packed from Hingham vessels from 1818 to 1828 inclusive." It appears from this statement that there has been in that town a gradual increase during the above period of ten per cent. a year. In 1815 the number of barrels packed in that town was 3,615; in 1828, 33,313. During the last year 54 different vessels were employed from that place in the business, some for the season and some for a shorter period. There were 15 employed the whole season, averaging 1,027 barrels each, the highest vessel having packed 1,728½. The average number of persons was 8 to each vessel, making 432 in the whole, to which if the number employed in coopering, packing, &c., be added, would exceed 500. The quantity of salt used in salting and packing, allowing 18 hogsheads to 100 barrels, would be nearly 6,000 hogsheads.

The number of barrels packed in that town during the above period of years, 225,331½. The salt consumed for the same, 45,559 hogsheads.

We have been informed that this fishing is carried on at Scituate, in this county, about as largely as in Hingham, and several vessels from other towns in this vicinity on the bay.

A bill is now before the legislature of this State which provides for the repeal of the law requiring a reinspection of mackerel packed in other States when brought into this market.—(Gloucester Telegraph, July 18, 1829.)

1821.—Mackerel-fishing with the hook commenced in the province of Nova Scotia, and was prosecuted with great success in some of the harbors of the Bay of Fundy.—(Journal and Proceedings of the House of Assembly of the Province of Nova Scotia, 1857, Appendix 75.)

1822.—First mackerel voyages from Cape Ann to George's banks.

In the year 1822, Capt. William Marshall caught a few mackerel on George's, which were the first, so far as we can ascertain, ever caught there by a Cape Ann skipper. Mackerel have been caught there every year since, more or less, and rank in quality among the best.—(Fisherman's Memorial and Record Book.)

1823.—Introduction of the mackerel gaff.

The mackerel gaff was introduced about 1823.—(Fisherman's Memorial and Record Book.)

1823.—Introduction of bait-mills.

Bait-mills were first generally used by the Massachusetts mackerel fishermen about 1823. Previous to that time toll-bait had been cut with hatchets.

1825.—Mackereling in the gulf of Maine.

In 1825, Captain Merchant went mackereling in the "Hornet," a schooner of 52 tons. The season began May 15, the vessel having been previously engaged in cod-fishing. During the season the crew of 7 men and a boy landed and packed 1,304 barrels. They caught 700 barrels in Massachusetts Bay in seven weeks' time, and packed them in Boston. The season continued until the 24th of November, and by that time the crew were entirely worn out by their continued labor. A considerable number of vessels in this same year packed from 1,000 to 1,300 barrels each. The proceeds of the season's work exceeded $2,700, the crew making about $350 or $400 each. The vessel cost about $1,300, when fitted for the work at the beginning of the season.

According to Captain Merchant the crews of mackerel vessels of Gloucester have made from $100 to $400 to the man during his experience of sixty years. In war times their average returns were about $400 each.—(Reminiscences of Captain Merchant.)

1825 and 1831.—Mackerel fishing from Cape Ann.

The seasons of 1825 and 1831 were the greatest known for mackerel up to this date. Vessels not over 50 tons landed upwards of 1,300 barrels, averaging through the fleet about 800. Mackerel continued in Boston Bay, near the land, in the year 1825, until the 4th day of December, the crew of schooner "Frances Elizabeth" having caught 12 wash-barrels on that day. The catch was not so large as in '31, to each vessel, but the aggregate was much larger, and the mackerel of a better quality. These fish were so plenty that the fishermen devoted the day to catching and the greater portion of the night to landing and dressing, and were completely worn out with their arduous labors. One morning during the first week in December, while the fleet were some ten miles off Eastern Point, the mackerel failed to come to the surface, after the usual throwing of bait. This was a pretty sure sign that they had gone, and the fishermen, whose sore hands and tired bodies bore evidence of the work they had accomplished in mackerel catching, were heartily glad that at last the fish had taken themselves off, and many of the fleet hoisted their flags as a token of their rejoicing over the event of the mackerel's departure. The price of mackerel this year was $5.50 for 1's; $3.50 for 2's; $2.50 for 3's, and out of this, $1.25 was paid for packing.—(Fisherman's Memorial and Record Book.)

1815 TO 1820.—A MACKERELING TRIP IN THE EARLY DAYS OF THAT FISHERY.

"I was ten years old when I made my first fishing trip. We went to Cashe's in a deck-boat of 20 tons. Capt. Daniel Robinson was skipper and I was cook. There were six of us, all told. We went at the halves, and all shared alike, the privilege of cooking and the glory of being skipper being considered in those days ample compensation for any extra labor or responsibility. We took about 40 barrels of mackerel, saving only the large bloaters, which we slat into the barrels; the small fish we slat into the lee scuppers and stamped them up with our boots for bait with which to toll the fish. Afterwards we chopped bait with a hatchet, until Gunnison, of Newburyport, invented the bait-mill, a godsend to the fishermen, who could now smoke and spin yarns while on watch, instead of chopping bait. A story is told on the best of authority, of one skipper, Andrew Burnham, who had been a great 'killer' in his time, that after the bait-mill came into use he was unable to sleep without the sound of the hatchet chopping bait, to which he had been so long accustomed. It is said that they tried pounding on the anchor stock, and tramping with their big boots on deck above his head, but all to no avail. There was an element lacking in the noise they made, and he wooed the somnolent god to no effect, and was obliged to retire to private life on a farm, in the 'second parish', I believe.

"We cooked in the old-fashioned way, in a brick fireplace with a brick chimney, and a wooden smoke-stack or funnel, which was intended to carry off the smoke, but did not always do so. The crane, pot-hook, Dutch oven, and trencher were all there, and all brought into use, as I well remember. We baked short-cakes on the trencher, bread in the Dutch oven, and hung our kettle on the crane, with the pot-hook, to make coffee or tea.

"We had fine weather, and everything passed off finely except the smoke, which refused to pass off at all, and under a less resolute commander than Skipper Robinson would doubtless have assumed command altogether. No casualties occurred except the burning of a few short-cakes, while 'Bijah (it being his first voyage) paid tribute to father Neptune, and was himself again. We were gone three days. Arriving on the fishing grounds we made but one 'berth,' catching and dressing until everything was full, when we hoisted the foresail, for jib we had none, and bore away for 'Squam, arrived in the channel, dropped anchor, furled the sails, and went home to see the folks."—(The Old-time Fishery at 'Squam, by Gideon L. Davis, in the Fisherman's Own Book, pp. 41, 42.)

1819 TO 1859.—REMINISCENCES OF "UNCLE" GEORGE DAVIS CONCERNING THE EARLY MACKEREL FISHERIES OF ANNISQUAM.—FIRST BAIT-MILL ON CAPE ANN.—SOUTHERN MACKEREL FISHERY, ETC.

"Uncle" George Davis, of Annisquam, Gloucester, says that in 1821 he helped make the first bait-mill that was ever made in Gloucester.

They had been made in Newburyport in 1820. At that date, or about 1824, there were six vessels of from 40 to 50 tons went as far south as New York for mackerel.

"I commenced mackerel fishing in 1819; built a pinky and went south; chopped our bait; worked sometimes all night; called 125 to 150 barrels a good trip for three or four weeks; sold no mackerel fresh in those days; all salted. The first trip was usually sold in New York; the next one brought home to Gloucester. In 1859 'Squam had twenty-five to thirty sail of mackerel catchers. Shore fishing was then first rate."—(Notes of A. Howard Clark.)

1828.—Close of the mackerel season.—Poor success of the fishery.

The mackerel fishery is about terminated for the season, and we are sorry to say that anticipation in this article has not been realized. We believe other towns make a like complaint in regard to the failure of the fall fares. This will necessarily enhance the prices, and in part balance the failure in the number caught. The loss, however, falls upon those who are immediately engaged in taking them, and consequently deprives them of that on which they depend for a livelihood, as they seldom hold on in order to speculate.—(Gloucester Telegraph, November 22, 1828.)

1828.—The mackerel fleet.

The Gloucester Telegraph, June 21, 1828, states that from three hundred to four hundred mackerel vessels were often seen at anchor in Gloucester Harbor at one time.

1830.—First voyage from Cape Ann to the Gulf of Saint Lawrence.

The first trip to the Bay of Saint Lawrence for mackerel, from this port, was made in 1830, by Capt. Charles P. Wood, in the "Mariner." She was absent but four weeks, and came in full of large fat mackerel. This created quite an excitement among the fishermen, and the next season the Bay fishing commenced in good earnest. The vessels at first made but one trip, and finished up their season's work on this shore. Two hundred and fifty barrels was considered a good trip for a vessel of forty or fifty tons. As soon as the business was found to be profitable, vessels of a larger class were added to the fleet, and it has gradually increased from year to year until the present time.—(Fisherman's Memorial and Record Book.)

1830.—Comparative scarcity of small mackerel in Massachusetts Bay previous to 1830.

Captain Merchant, of Gloucester, states that small mackerel were very scarce in Massachusetts Bay until 1830. He also says that small mackerel always lead the large ones in their approach to the coast. When he was in the habit of fishing on George's he went there about the first of June, and always caught "finger mackerel" before the large ones.—(Notes on the Mackerel Fisheries, by G. Brown Goode.)

1832.—Markets for mackerel.

In 1832 the demand for mackerel was much greater than the supply, according to Captain Merchant. Philadelphia bought two-thirds of the entire catch of Gloucester, which amounted to 320,000 barrels.

1826.—The following account of a mackerel voyage on the coast of New England in 1826 is from the pen of N. E. Atwood:

"The first year that I fished for mackerel on this coast was in 1826, and having changed from the laborious and exposed business of cod-fishing on the Labrador coast, I took a good deal of notice of what passed, and, consequently, I still remember a good deal about the voyage. We sailed from Provincetown on the 28th of June, and went down to a point some twenty leagues northeast of Cape Cod.

"On the day following we saw one school of mackerel, and, getting into it, we threw out bait, and caught, well, some 3 or 4 barrels. That was the first school which we met with; and this happened on the 29th of June. It was the last school we saw until the 13th of September, my birthday; this was a very large school. In five weeks we caught 238 barrels of mackerel, and, although it was early in the season, still they packed very well. After they were packed we went out again and secured 250 barrels where we saw the school of mackerel on the 13th of September."

1827.—Price of mackerel.

In 1827–'28, according to Capt. William H. Oakes, the price of No. 1 mackerel ranged from $4.50 to $5.50 per barrel, while No. 2's sold for $2.50.

1828.—Mackerel, sales, prices, etc.

A large quantity of mackerel are afloat amounting, perhaps, to 1,500 barrils. The sales have been extensive, though at rather lower prices. The current rates have been 4¾ to ⅞ for 1's and 2's, and in some cases $5.—(Gloucester Telegraph, April 19, 1828.)

1828.—Scarcity of mackerel.

Our fishing vessels the past week have returned with very few mackerel. Some have brought in only 25 or 30 barrels after being absent a week or ten days. What have been caught were packed out as No. 3's, and very likely the fish have struck off in order to fat for No. 1's and 2's. We advise dealers to hold on to what they have, as there is likely to be a scarcity this season.—(Gloucester Telegraph, July 12, 1828.)

1832.—FAILURE OF MACKEREL ON THE WESTERN COAST OF NOVA SCOTIA.—IMPORTANCE OF THE AMERICAN MACKEREL FISHERY.

So far this fall the mackerel fishery on our western shore has been an entire failure. Some idea may be formed of the extent to which this fishery is carried on from the United States by the circumstance of 360 vessels having left the port of Gloucester for that purpose on the night of the 28th ultimo.—Halifax, November 20.—(Gloucester Telegraph, December 1, 1832.)

1833.—DISINCLINATION OF MACKEREL TO TAKE THE HOOK.

These fish [mackerel] are taken in much less quantities this season thus far than usual. The complaint of the fishermen is not so much that they can't find mackerel, but that they "won't bite" when they find them. This again makes the salt manufacturer complain that his commodity is less wanted, and consequently the price is reduced; and when our fishermen and salt makers are disappointed and have hard luck makes sorry times on Cape Cod. Some of our shoresmen, however, the onion growers, have good crops and they obtain a fair price for them at market. And the sea-serpent, or something else, has driven on shore upon the cape, at several places, a considerable number of black fish, the blubber of which makes very good oil, and some of these fish have a considerable quantity of it.—(Barnstable Patriot, August 28, 1833.)

1833.—GREAT ABUNDANCE OF MACKEREL IN MASSACHUSETTS BAY.

Mr. S. B. Brown, writing of the early fisheries of Gloucester, says: "The next year [1833] I went to Gloucester, hunted up my old skipper, who was still master of the same boat, and went with him that season.

"I recollect well the great school of mackerel that struck Middle Bank that year. September 22, at 10 o'clock at night, there were some two hundred sail at anchor, 25 miles southeast of Eastern Point light, in a dead calm, when our skipper sang out, 'Here they are, boys,' at the same moment every vessel in the fleet commenced the catch. We fished for three days, and filled everything, even our boat, and struck on deck until we were in fish knee deep. Then, a breeze up, we ran in and packed out 280 barrels, and returned to the bank just as the wind left us. We fished three days more when they struck off as suddenly as they had come."—(Fisherman's Own Book, page 197.)

1834.—MACKEREL FLEET IN THE GULF OF SAINT LAWRENCE.

According to Captain Atwood the fleet of American mackerel catchers in the Gulf of Saint Lawrence, in 1834, consisted of six vessels, three of which belonged at Provincetown. They secured full fares, and returned in a very short time.

1834.—Scarcity of mackerel on the New England coast.

The Gloucester Telegraph of September 3, 1834, copies the following extract from the Hingham Gazette:

"A Halifax paper states that herring and mackerel are very plenty this season. Our fishermen have never found mackerel more scarce than during this season. We hope the fall fishing will be more productive."

1835.—Inspection of No. 4 mackerel begun.

Tinkers.—The legislature has concluded that the little fry caught by our mackerel fishermen, commonly called "Tinkers," shall be separated from those of a larger growth and packed by themselves, and branded No. 4. The distinction between No. 3 and No. 4 will be, we suppose, only in the size of the fish, without regard to the fatness. Something was said about making all those No. 4 which should be less than six inches long from tip to tail, but it was finally left rather indefinite, so that each inspector will have to exercise his own discretion and judgment as to what constitutes a "tinker."—(Barnstable Patriot, October 21, 1835.

1835.—Capt. N. E. Atwood's experience in the mackerel fisheries of the Gulf of Saint Lawrence.

"In 1842 I was first master, and in 1835 I first came to the gulf for mackerel. When we arrived there we could hear of no mackerel anywhere. We went toward the Magdalen Islands, and about 8 miles off from them to the southwest we got a large number of mackerel the first day we were there. This induced us to fish in that vicinity, and we fished between that and the west head of the islands, as we call it, or Deadman's Island, as it is sometimes called.

"Q. Is that part of the Magdalen Islands?—A. Yes; it is the west end of them. We fished there all that trip, and the result was that we got about 180 barrels, speaking in round numbers. The crew received a large share, and did much better than those fished to the westward that season. * * *

"During my first year in the Gulf of Saint Lawrence, when we got 180 barrels, we fished at the west end of the Magdalen Islands, and when we set out to go home, the wind freshened from the southward, and we struck in somewhere near St. Peter's Sandhills, as we called the place, and while reefing the foresail, we hove the vessel to, and I threw out a few shovels full of bait. Mackerel came up, and seemed to be very abundant, but we only caught about half a barrel. Night came on just as soon as the foresail was reefed, and hoisting it up, we hauled in the hand-lines instead of anchoring there, and went about along shore, hove to, and let the vessel drift off. Next day we got back to Pleasant Bay, Magdalen Islands. That was all we got there that voyage, and we never fished anywhere, or caught any mackerel on the Prince Edward Island side, or anywhere within the restricted limits, until 1842. During that year I was passing Port Hood late in the afternoon—it was just nightfall—when I hove to and tried the school, and I do not think that I was at the time three miles offshore I did not fish there over a day, and we obtained a few mackerel, perhaps six or seven barrels. When I came to talk with the crew, some said we were 6 miles offshore, and some 4 miles, and so on; but I will tell you what I thought about it: this was, that if a cutter came along he would take me, so I considered that I did not need to stay there. Soon after dark I discovered a vessel running down apparently towards the Strait of Canso, and hauling up for us. I was afraid she was a cutter, and I was then very sorry that I had obtained any mackerel there. She happened, however, not to be a cutter, and I got away the next day. This was all the mackerel I ever caught within the three-mile line."—(Testimony of Captain Atwood before Halifax Commission.)

1836.—PRICES OF MACKEREL.

Sales of mackerel at $9 for No. 1, $8 for No. 2, $4.25 to $4.50 for No. 3, per barrel, purchaser paying inspection.—(Gloucester Telegraph, June 8, 1836.)

1836.—UNUSUAL SCARCITY OF MACKEREL.

The Barnstable Patriot says: We learn from Wellfleet that the mackerel fishermen which have arrived at that place within two weeks have got unusually small fares, averaging less than 50 barrels each.—(Gloucester Telegraph, July 6, 1836.)

1836.—A PROTEST AGAINST BOBBING OR "GIGGING" MACKEREL.

The Boston Journal protests strongly against the barbarous method of taking mackerel, called "gigging," and urges that it is not only liable to censure on the score of humanity, but is also *impolitic*, and that if this destructive method of fishing is generally continued a few years longer, it will break up the fishery. We have for a year or two past entertained a similar opinion, and probably the complaints now so frequently made by the fishermen that, though mackerel are plenty, they will not bite, is owing to the custom of "gigging." There is hardly anything which possesses life that has so little instinct as not to become very shy under such barbarous inflictions. It is obvious that all which are hooked in this manner are not taken on board; the gig frequently tears out, and thousands, millions of these fish are lacerated by these large hooks, and afterwards die in the water.—*Newburyport Herald.*—(Gloucester Telegraph, September 3, 1836.)

1836.—ONE OF THE GREAT MACKEREL-FISHING STATIONS.

The principal business of the place [Sandy Bay, now Rockport, Mass.] is the bank, bay, shore, and mackerel fisheries, which, with the freighting, employ probably not less than six or seven hundred hands. More mackerel is usually taken by them than by any other people on the coast.—*From the Salem Landmark.*—(Gloucester Telegraph, September 14, 1836.)

1836.—Small catch of mackerel.

From present appearances the number of mackerel taken this year will fall short some hundred barrels of the last year's catch. There are mackerel enough, we are told, but they do not bite freely. Some fishermen have abandoned the mackerel fishery entirely and taken out cod-fishing papers.—*Democrat.*—(Gloucester Telegraph, October 1, 1836.)

1836.—Active demand for mackerel.

The demand for mackerel has been very active, and in consequence of a limited supply, prices have advanced. Sales of No. 1, $9.75@$10; No. 2, $8.75@$9; No. 3, $6.—(Gloucester Telegraph, October 12, 1836.)

The supplies [of mackerel] are very light and prices have again advanced. No. 1 at $10@$10.50, No. 2 at $9, No. 3 at $6.50. One thousand barrels, principally Nos. 1 and 2, were taken out of our market on Monday.—(Gloucester Telegraph, October 19, 1836.)

1836.—Captain Atwood's experience in the mackerel fishery of the Gulf of Saint Lawrence.

Q. Where did you fish during the remainder of the six years?—A. The next year, 1836, was my second year there at the Magdalen Islands, I having done so well there the years previous. I want it to be understood that I was in a small vessel with a small crew.

Q. Perhaps you will give the tonnage and the number of the crew?—A. Her tonnage was 59, with the then reckoning, but now it would be called less than 40. We went direct that year to the Magdalen Islands, and we found that there had been some mackerel caught there, but none within a few days of that period; and as we had heard that mackerel were sometimes taken at Newfoundland, we bore up and went over there. The next day after our arrival we tried near Cape St. George, but though we tried all day, we never saw one, and so we returned to the Magdalen Islands, and remained there during the fishing term until we obtained a full cargo—225 barrels. We afterward proceeded westward, and found that vessels which had been fishing about Prince Edward Island, and further up, on Bradley Bank and elsewhere, had done better than that; but we were satisfied; our voyage suited us, and we had got all we wanted.—(Proceedings Halifax Commission.)

Extent of Massachusetts fisheries for 1837.

In 1837 there were employed in Massachusetts in the cod and mackerel fisheries 1,290 vessels, manned by 11,146 men, and the fish taken were valued at $3,208,559; about one-half of these were in the cod fishery.—*Gloucester Telegraph, February* 20, 1839.—(From the report of the Washington Commission on Salt Bounty.)

1837.—Poor doings of the mackerelmen.

The vessels from Cape Sable and the Western Banks have generally brought in good fares. The mackerel fishermen have not done so well. —*Yarmouth Register.*—(Gloucester Telegraph, July 4, 1837.)

1837.—Success of the Cape Cod and Cape Ann mackerelmen.

The Barnstable Patriot says: "Since 'hard times' have become the universal topic of conversation throughout the Union, if not the world, it affords us no little pleasure to find that the fishermen of Cape Cod have been blessed with large discounts from their favorite banks. We learn that five mackerelmen who have packed their fares in this town, have already caught 1,600 barrels for the quarter ending in July. During the same time last season there were less than 700 barrels."

"We have heard of several excellent fares having been brought in by our mackerel fishermen, within two or three weeks past; and, although the fish are reported rather scarce, yet the season promises well so far." —(Gloucester Telegraph, August 5, 1837.)

1837.—A big school of mackerel in Portsmouth and Gloucester harbors.

Nearly 400 barrels of mackerel were taken in Portsmouth Harbor, daily, for two or three days last week. It is not usual for them to be found there. Mackerel have been plenty for several days past just off Eastern Point, in this harbor, but we do not learn that any considerable quantity has been taken.—(Gloucester Telegraph, August 26, 1837.)

1837.—Boat fishing in Maine.

We learn that not less than 90 barrels of mackerel were brought into our harbor on Thursday, in open boats.—*Kennebunk Gazette.*—(Gloucester Telegraph, September 13, 1837.)

1837 to 1841.—Scarcity of mackerel; introduction of night fishing.

Captain Merchant, of Gloucester, informs me that there was a great scarcity of all kinds of mackerel from 1837 to 1841. He had at that time eight vessels engaged in this business, the smartest of which only packed 70 barrels, in the season of 1837. Mackerel continued scarce until 1841. At last the skippers became discouraged, and this year they went to Georges' in search of fish. They found there large schools of mackerel, which would bite only at night. Vessels would catch 30 or 40 barrels in a night when it was so dark that they must needs have lanterns to see their lines. These night schools were a godsend to Gloucester. Such habits had never been observed before that time nor since.

In 1837, according to Captain Merchant, the vessels did not get enough mackerel to cover the bottoms of their tubs. In 1841, mackerel struck in great abundance; there were oceans of "tinkers."—(Notes on the Mackerel Fisheries, by G. Brown Goode.)

1837.—Fall mackerel fishery at Portsmouth.

Nearly 400 barrels of mackerel were taken daily (with hand lines) for two or three days last week in Portsmouth Harbor; also plenty off Eastern Point.—(Gloucester Telegraph, August 26, 1837.)

1837-1838.—Mackerel fishery of Hingham.

The Hingham Gazette says, during the past year (1836) 49 vessels have been engaged in the mackerel fisheries; number of barrels taken, 14,436. In 1835, 57 vessels were engaged in the business; number of barrels taken, 15,398. During the past year several vessels formerly in the mackerel fisheries have been fishing for cod.—(Gloucester Telegraph, January 5, 1837.)

In Hingham during the past year 57 vessels have been engaged in the mackerel fishery; the catch was 17,134 barrels. In 1836, 49 vessels; catch, 14,436 barrels. In 1835, 57 vessels; catch, 15,398 barrels.—(Gloucester Telegraph, January 3, 1838.)

1838.—Fall mackerel in Cape Cod Bay.

Mackerel were abundant in Cape Cod Bay. On September 8 it is estimated that 3,000 barrels of mackerel were taken in Barnstable Bay; one vessel took 70 barrels.—(Gloucester Telegraph, September 12, 1838.)

1838.—Catch of mackerel for Massachusetts.

Returns of mackerel packed in this State up to January, 1839, all the packages reckoned in barrels; also, the number of vessels, tonnage, men and boys employed.

	Barrels No. 1.	Barrels No. 2.	Barrels No. 3.	Vessels.	Tons.	Men and boys.
Gloucester	11,582	6,854	5,796	245	11,699	1,831
Boston	5,301	4,307	6,128	162	9,761	1,315
Newburyport	5,709	3,000	4,316	99	4,876	772
Hingham	3,040	3,218	6,188	51	3,051	522
Wellfleet	3,314	3,609	3,617	72	2,777	449
Cohasset	2,052	1,729	6,665	47	2,637	439
Provincetown	2,203	1,797	4,748	70	3,492	546
Barnstable	1,000	1,365	1,533	11	739	129
Truro	677	800	1,645	19	638	119
Scituate	781	502	1,091	25	1,632	225
Yarmouth	470	539	659	10	697	106
Salem	748	309	273	11	690	104
Plymouth	340	305	472	7	240	58
Dennis	391	605	913	6	335	62
Chatham	223	127	103	7	320	46
Duxbury	110	159	80	8	284	40
Marblehead	76	40	52	5	425	55
Beverly	35	63	32	1	40	9
Ipswich	2	13	9	1	46	6
	38,054	29,341	44,320	857	44,381	6,833
1837	26,830	61,940	52,541			
1836	54,016	60,569	58,883			

	Barrels.
Total for 1838	111,815
Total for 1837	141,311
Total for 1836	173,468

(Barnstable Patriot, January 16, 1839.)

1838.—The spring fishery.

The Philadelphia Daily Advertiser states that large quantities of mackerel have been taken during the last month, within 10 or 15 miles of Cape Henlopen. One boat from Portland took in one day 45 barrels.—(Gloucester Telegraph, July 21, 1838.)

1838.—Scarcity of mackerel in Gulf of Saint Lawrence.

Arrived, schooner Metamora, from Bay Chaleur, with 13,000 [cod] fish. Reports fish plenty, but mackerel very scarce; could not obtain them in sufficient quantities for bait.—(Gloucester Telegraph, July 25, 1838.)

1838.—Excellent quality and abundance of mackerel in Massachusetts Bay.

Our oldest fishermen have never known the season when *fat* mackerel were so plenty about our shores as they have been for a week or two past. On Sunday last (in these times people will fish on Sunday) at least 150 barrels were taken just off the shore opposite Eastern Point, by wherries and a few larger craft; and for size and fatness, the samples which came under our observation were altogether superior to any we had ever before seen. One of these beauties was exhibited by a gentleman, which weighed upwards of three pounds, and the fat upon him measured an inch in thickness.—(Gloucester Telegraph, September 12, 1838.)

The [mackerel] fishermen have brought in larger fares the last week. The vessels that have cruised around the shores of the Cape, have taken from 100 to 150 barrels during the last four weeks. The vessels in the Bay of Fundy are reported doing well; those off Mount Desert and the eastern shore have taken very few fish.—(Yarmouth Register.)

1838.—Prosperity of the mackerel fishery.

"The Fishing Business.—Joyfully do we announce prosperity in this line of the business. Our bay seldom exhibits its late appearance, during the week past, from our office window. Oftentimes we could numerate 100 sail of fishermen, and on Saturday, Monday, and Tuesday last, 200 to 250 sail were counted, making a splendid sight. Mackerel have bitten for the past week remarkably well. Considering the industry and enterprise which lie at the root, no more imposing appearance can be witnessed than that of 200 or 250 sail of vessels spreading their bleached canvas to the wind, and gliding gently along on the coast. On Saturday we understand that the schooner 'Roxana,' of Wellfleet, was run afoul of by the 'Columbia,' of Dennis, by which accident she was dismasted. We do not learn that any other serious injury was sustained."—(Barnstable Patriot, September 12, 1838.)

OVERFISHING DESTROYING THE MACKEREL FISHERY.

After commenting on the great demand for mackerel in the West, it (the Newburyport Herald) says: "It appears now almost reduced to a certainty that the time is not distant when, if we are not compelled in a great measure to abandon the business, it will be prosecuted as an uncertain one, and by a greatly decreased number of vessels and men. There is of late not more than one successful season out of four."—(Gloucester Telegraph, August 18, 1838.)

1838.—CAPTAIN ATWOOD'S EXPERIENCE IN THE MACKEREL FISHERIES OF THE GULF OF SAINT LAWRENCE.

My brother and I bought a little vessel and fished around home, and we finally concluded to go to the Bay of Saint Lawrence. We did so, and stopped there some six weeks.

Q. When was that?—A. In 1838. We stopped only six weeks, and we got only about twenty barrels.

Q. Where?—A. We were at the Magdalen Islands all the time. We had poor sails and a poor vessel, and we found it much safer about the Magdalen Islands. We always considered it safer than in the bight of Prince Edward Island.

Q. And twenty barrels were all that you got that year?—A. Yes. We came home about the 20th of September. We went to the bay in August, and we remained there, I think, about six weeks.—(Proceedings Halifax Commission.)

1838.—APPEARANCE OF MACKEREL IN BARNSTABLE BAY.

Mackerel have made their appearance in the bay (Barnstable Bay) in considerable quantities. On Thursday we saw from the Highland a fleet of about 100 sail lying from Gurnet to Manomet, making a beautiful appearance. They were apparently taking fish. We noticed also a great number of small boats among them. We learned at Plymouth that boat fishing had been a very good business for the last week or two, some individuals clearing $30 per day each. The mackerel taken are of the best quality. * * *—(Hingham Patriot.)

PROVINCETOWN, *September* 9.—The mackerel fishermen are doing well. It is estimated that 3,000 barrels were taken in Barnstable Bay on Friday last. One vessel took 70 barrels on that day.—(Gloucester Telegraph, September 12, 1838.)

1838.—A BIG FLEET IN BARNSTABLE BAY.

The mackerel fishermen have continued to do a little better of late, though we suspect not near as well as is generally supposed. We have been informed, on what we esteem good authority, that the average number of barrels taken on Friday last would not exceed ten per vessel, Some, it is stated, procured large fares (such, for instance, as the Ino, which took 150 wash-barrels), while others did not catch a fish. For a week or two past the bay has been thronged with fishermen. On Tuesday last 280 sail could be distinctly seen.—*Yarmouth Register.*—(Gloucester Telegraph, September 19, 1838).

1838.—Scarcity of mackerel in Bay Saint Lawrence.

Captain Morgan, of schooner "Cossack," of Beverly, cod-fishing from the Bay Chaleur, arrived here yesterday, reports that he was in the harbor of Castle Rock (?) the 25th August, with 120 sail of mackerel catchers. Mackerel were scarce, and none of the vessels in the harbor exceeded 30 barrels, except two. Captain M. left the Gut the 3d of September; saw a large number of vessels every day, but could hear of no vessels doing well.—(Gloucester Telegraph, September 22, 1838.)

1839.—Abundance of mackerel in the Bay of Fundy.

The Saint Andrews Standard says: "Our bay and coves have been literally swarming with mackerel during the past week. Large quantities have been caught in the weirs at Bocabec and along the shores." The fishermen along our coast complain that the mackerel have all gone away. It appears from the above that they are on a visit to the British provinces.

1839.—Mackerel fishing from Cape Ann.

Cape Ann, says the Telegraph, as everybody knows, has always taken the lead in the mackerel fishery, having a much larger number of vessels engaged in it than any other place; and the crews have in times past made their calculations to land by this time and have landed their 200, 250, or 300 barrels each, whereas the largest fare that has been brought in this season is 73 barrels, and the whole catch packed out probably does not exceed 500.—(Barnstable Patriot, September 4, 1839.)

1839 and 1840.—Captain Atwood's experience in the mackerel fishery.

In 1839 I went in my own vessel, the "Lucy Mary," which was the one in which I first went to the bay, to the Grand Bank. Mackerel were scarce, and the prospect was discouraging, so I went cod-fishing, curing the fish myself. I then hauled the vessel up and did not go for mackerel until 1840. I did not then go to the Grand Bank, and having no fish to cure I had to go mackereling somewhere. There was at the time no encouragement to fish for mackerel, either on our coast or in the Gulf of Saint Lawrence, and as people had told me stories about mackerel being found at the Azores, I was induced to fit out and go there.

Q. Did you get any mackerel at the Azores?—A. No.—(Proceedings Halifax Commission.)

1841.—Doings of the Cape Cod and Cape Ann fleets.—Night fishing a new feature in the mackerel fishery.

The quantity of mackerel taken the present season is, thus far, not materially different from the quantity caught last year. A few vessels from Barnstable, Yarmouth, and Dennis, have been more successful, but this is by no means the case with vessels generally.—(Yarmouth Register.)

Mackerel are reported to be more plenty the present than they have been the last two or three years past; but *our* fishermen do not seem to meet with much success in taking them. It is somewhat remarkable that thus far the present season nearly all the mackerel that have been caught have been taken *in the night*, while heretofore this fish has scarcely ever been known to bite after sundown.—(Gloucester Telegraph, July 21, 1841.)

There have been but few arrivals of mackerel this week, for which a ready demand has been experienced, and prices are consequently a shade higher, No. 1, $11.50; No. 2, $10.25; No. 3, $5.75 and $6 per barrel.—(*Ibid.*)

1841.—A curious reason given for the scarcity of mackerel

A correspondent suggests as a cause for the scarcity of mackerel the general practice of using "hardhead" [menhaden] for bait, the sharp-bones of which fish kill the mackerel that feed upon it. The suggestion is worthy of consideration, at least.—*Yarmouth Register.*—(Gloucester Telegraph, January 30, 1841.)

1841.—First fare of the season.

A fare of 66 barrels of mackerel, the first arrival this season, came up from an outport.—(Gloucester Telegraph, June 16, 1841.)

1841.—Discouraging prospects for the mackerelmen.

Two vessels arrived this week from mackereling, absent over three weeks, without obtaining one barrel of mackerel. The prospects for the mackerel fishermen this year are unusually discouraging.—(Gloucester Telegraph, August 7, 1841.)

1841.—The mackerel fishery.—What were considered good fares in 1841.

Several of the mackerel fishermen from our vicinity, who were unusually successful during the first part of the season, have recently returned with very small fares. Many of our most experienced fishermen are included in the number, who give as their opinion that the number of mackerel rapidly diminishes every year.—(Yarmouth Register.)

Two of the Gloucester vessels have recently come in with tolerable fares—*good*, indeed, they may be called in the present state of the fisheries. We have heard of one vessel with 90 and another with 120 barrels.—(Gloucester Telegraph, August 11, 1841.)

1841.—Favorable reports from Gulf of Saint Lawrence.

Favorable accounts have been received from Bay Chaleur, and full fares are expected from the fishery in that quarter.—(Gloucester Telegraph, August 11, 1841.)

1841.—Almost total failure of the mackerel fishery.—Bad results therefrom.

The Gloucester Telegraph says that nearly the whole fleet from that port were returning, and mostly without mackerel.—(Philadelphia Gazette.)

So unfavorable has been the mackerel fishery the present season (and it was nearly as bad the last and preceding years) that most of those who have been actively engaged in it have not earned enough to carry themselves and families through the winter. Indeed, we heard one individual remark the other day that he himself had seen a hundred fishermen who, after all the toil, privations, and dangers they had endured during the whole fishing season, had *not a dollar* coming to them, or either of them, now that they have returned to their homes and families. We have heard of a firm who, upon settling up the voyages of their vessels, paid to the crew of one $1.43 each man—to that of another a little more, and to others nothing. And such has been the general result of the fisheries for the season just closed. * * * It would have been better for their owners, in a pecuniary point of view, had most of our fishing vessels been suffered for the last two or three years to remain at the wharves, instead of being sent either to the banks or down to the bay * * *.—(Gloucester Telegraph, November 17, 1841.)

The whole of the bay fleet are now in [the last two arrivals brought home 90 and 80 barrels of mackerel, respectively, besides from 100 to 200 quintals of codfish. Four Gloucester vessels reported as seized and condemned at Halifax for alleged violations of the treaty].—(*Ib.*)

1842.—Arrivals from George's.

Six schooners, reported in Gloucester Telegraph of August 10, 1842, arrived from George's Bank with fares of mackerel ranging from 20 to 140 barrels each. August 18, five schooners from George's with fares varying from 25 to 120 pounds.

1842.—SUCCESS OF THE SOUTH SHOREMEN.

We learn from a friend at Plymouth that the cod and mackerel fishermen at that place have been unusually successful thus far this season.—*Bay State Democrat.*—(Gloucester Telegraph, August 27, 1842.)

1842.—ARRIVAL OF MACKEREL CATCHERS

For the week ending September 7, 1842, eight mackerel schooners are reported in the Gloucester Telegraph, with fares ranging from 5 to 126 barrels, the total being 416 barrels, or an average of 52 barrels each.

The following vessels [23 in number] have arrived since our last Wednesday's paper, with fares varying from 10 to 100 barrels and upwards. The above are the fleet that sailed from the 1st to the 10th of August.—(Gloucester Telegraph, September 14, 1842.)

1842.—POOR SUCCESS OF THE BAY MEN.

Arrived 24th, schooner "George Parker," from Bay Chaleur, 8 barrels mackerel. The G. P. brings accounts of Gloucester vessels, three months out, with less than 30 barrels.—(Gloucester Telegraph, October 26, 1842.)

1842.—SCARCITY OF FALL MACKEREL ON NEW ENGLAND SHORE.

No mackerel of consequence have been caught the last three weeks.—(Gloucester Telegraph, October 8, 1842.)

Arrived 20th, about 150 sail of mackerel fishing vessels; report mackerel very scarce, none having been taken for the past fortnight.—(Gloucester Telegraph, October 22, 1842.)

1843.—UNFAVORABLE OUTLOOK FOR THE MACKEREL FISHERY.

A writer in the Gloucester Telegraph of August 30, 1843, says: "At the present date the catch of mackerel falls far short of last year's, but it is very uncertain how it will terminate. The prospect is considered by our most experienced fishermen as not encouraging."

1843.—SUCCESS OF THE HINGHAM FLEET.

We are happy to hear that this business, so important to our town, bids fair to be more successful this season than it has been for many years. Our mackerel vessels are returning with fuller fares than usual at this season of the year, some of them lately arrived having brought in from 80 to 100 barrels.—*Hingham Patriot.*—(Gloucester Telegraph, July 15, 1843.)

1843.—ABUNDANCE OF MACKEREL ON NOVA SCOTIA COAST.

The Halifax papers state that the coast of Nova Scotia is now visited by mackerel and herring in larger quantities than ever were known at this season. In the Straits of Canso the people are taking them with seines, a circumstance without a parallel for the last thirty years.—(Gloucester Telegraph, August 16, 1843.)

1843.—Scarcity of mackerel in Nova Scotia.

Captain Stephens, the commander of one of the provincial revenue cruisers, published a letter in the last Acadian Recorder, which states that * * * the mackerel fishery in the spring proved remarkably unsuccessful, not more than 500 barrels having been taken, where upwards of 23,000 barrels were obtained last year. The subsequent catch has, however, been more abundant.—(Newburyport Herald, September, 1843.)

1843.—Small catch of mackerel by the New England fleet.

Mackerel sell on arrival at last week's quotations. (No. 1, $10; No. 2, $8; No. 3, $5.75 per barrel.) There has been no great accumulation this week, and we quote the article as before. The catch will probably fall one-fourth to one-third short of what it was last year.—(Gloucester Telegraph, October 30, 1843.)

1843.—Failure of the mackerel fishery.

The mackerel fishery, says the Hingham Gazette, has thus far proved a poor business. Some vessels arrive in port with hardly fish enough to pay the expenses of the trip.—(Barnstable Patriot, October 4, 1843.)

1844.—Doings of the mackerelmen; poor catch.

The mackerel fishermen have done but little lately. Most of the vessels heard from are clean, or nearly so. So says the Yarmouth Register.—(Gloucester Telegraph, July 24, 1844.)

The mackerel fishermen have been very unsuccessful for the last two months, the catch, which commenced well in the early part of the season, having suddenly declined. A schooner arrived at this place on Tuesday from a six weeks' cruise, with only *six barrels* of mackerel on board.—*Yarmouth Register.*—(Gloucester Telegraph, August 21, 1844.)

1844.—The mackerel fishery of Hingham.

The Hingham Patriot publishes a list of 23 vessels from that port which have been employed in the mackerel fishery during a part or the whole of the last summer, with the number of barrels of mackerel packed by each, amounting in all to 8,097 barrels, or an average of 356 barrels to each vessel. There are five other vessels owned in Hingham, whose names are not given, which packed 1,170 barrels, making in all 9,267 barrels.—(Gloucester Telegraph, November 27, 1844.)

1845.—A good haul.

We learn that Holmes & Co., at Manomet Ponds, who were seining for menhaden, on Thursday afternoon last, in drawing their seine, found they had inclosed about a hundred barrels of mackerel. Barrels and salt were sent from town yesterday morning for the purpose of packing them.—(Plymouth Memorial, July, 1845.)

1845.—Mackerel abundant in Gloucester harbor.

For a few days past our harbor has been filled with mackerel, and on Monday about 400 barrels, it is estimated, were taken in seines, vessels, boats, and on the wharves. Upwards of a hundred barrels were taken in a seine at one haul. Considerable many were taken yesterday, but not in such quantities as on Monday. The visit of this fish to our harbor has afforded rare sport to such of our inhabitants who have never been a mackereling, but it will not last long, as the fish will take a start off in a day or two.—(Gloucester Telegraph, July 9, 1845.)

1845.—Canning of mackerel.

In an extract from the Eastport Sentinel, published in the Gloucester Telegraph of August 30, 1845, mention is made of the packing at Eastport, by Messrs. Treat, Noble & Co., of 3,000 cans of fresh mackerel.

1845.—Mackerel in the bays of Maine; a big haul at Provincetown.

Our piscatory visitors have nearly all left us and gone "down east." The Belfast Signal, of Thursday last, states that mackerel are quite plenty in that bay.

The Yarmouth Register is informed that at Provincetown, week before last, they seined about 1,000 barrels of mackerel at one haul. Those who took them gave half for dressing, but they were enabled to save only 500 barrels.—(Gloucester Telegraph, July 23, 1845.)

1845.—Abundance of mackerel on the New England coast.

So many mackerel have not made their appearance in our bay [Ipswich Bay] for many years before; while the fishermen who have gone down to the Bay Chaleur, the principal place of the fishery, have had less success.

It will be seen by an item in the ship news, that the Gloucester fishermen, who came in full at the close of the week, report about 500 vessels busily engaged in fishing in the bay. The mackerel brought in now are mostly branded small No. 2.—*Newburyport Herald.*—(Gloucester Telegraph, September 20, 1845.)

1845.—No mackerel on George's.

Arrived at Hyannis 9th, schooner "Resolve," and two other mackerel catchers from George's Bank; absent ten days; caught nothing.—(Gloucester Telegraph, September 16, 1845.)

1839 to 1846.—Nova Scotia fisheries.

The exports of mackerel from the port of Halifax during the years 1839 to 1846 inclusive, show that considerable attention was given to this fishery on the coasts of Nova Scotia thirty years ago.*

	No. of barrels.
1839	19,127
1840	25,010
1841	35,917
1842	54,118
1843	71,854
1844	50,698
1845	38,320
1846	82,645

1847.—Scarcity of mackerel.

The catch of mackerel thus far this season, says the Gloucester Telegraph, has been small in comparison with that of the two past years. The number of barrels taken on the coast has greatly diminished, and the prospects being so unfavorable, many of our vessels have gone to the Bay Chaleur. The fares that have arrived at this port are readily sold at good prices as soon as landed, and are immediately shipped to the great markets of New York and Philadelphia.—(Barnstable Patriot, October 6, 1847.)

1847.—Unprofitableness of the mackerel fishery.

Mackerel fishing has not prospered to such a degree as the cod-fishery, none of the small number of crafts engaged in the business from this port, having obtained a full cargo.—(Barnstable Patriot, October 13, 1847.)

1847.—Abundance of mackerel about Sable Island.

Mackerel were very abundant in the vicinity of Sable Island, and the fisheries committee of the house of assembly of Nova Scotia urged the granting of a bounty to all vessels engaged in the deep-sea mackerel fishery. This was not adopted.—(Journal and Proceedings of the House of Assembly of the Province of Nova Scotia, 1857, Appendix 75.)

1845 to 1848.—Importance of the mackerel fishery.

From the Barnstable Patriot we quote the following review of the mackerel fishery of Massachusetts from 1845 to 1848:

"The yearly inspection of returns of mackerel, show plainly that there is no more important branch of the fishing business carried on in this

* Inspected.

State than the mackerel fishery. From 1831 to 1840, the depreciation in the catch was 333,225 barrels; and from 1840 to 1845, the increase was only 36,270 barrels, during which, a period of thirteen years, the business had become nearly prostrated, and with it nearly all those who were engaged in it. In 1845, unexpectedly large shoals of mackerel appeared on our coast between Cape Ann and Cape Cod, of a small, uniform size, about 12 inches in length, but very fat. Owing to these fish being so near home, but little or no time was lost by the fishermen in going out and returning with full fares, except the delay in procuring barrels to put their fish in. At the close of the season the inspection returns showed an increase of 116,122 barrels from the previous year. This gave an impulse to the business.

"In 1846 this great shoal of mackerel did not return again on our coast, which disappointed the hopes of the fishermen, especially those who depend upon their small boats for a living. At the close of the season the catch had fallen off 28,439 barrels. Not being so easily discouraged by this depreciation in one year, they entered into business with renewed energy and enterprise, and were crowned with great success during the next year. In this year, 1847, the fishermen did not find any mackerel on our coast of much account, until late in the season, when a large school appeared off Cape Cod, called the 'Chatham school,' from which great quantities have been taken of the best mackerel that have been in the market for many years. All other mackerel, elsewhere, bore no comparison with these, either for size, fatness, or goodness. Unfortunately, however, for the Newburyport and Gloucester fishermen, they were nearly all in the Bay of Chaleur; for the mackerel which they brought home were of an inferior quality. This great difference between the two kinds caused much complaint, and created for a time some little excitement and feeling among the dealers both at home and abroad, which resulted in establishing a greater confidence in the different brands, and a more uniform cull, and a higher standard of inspection in 1848.

"The inspection returns in 1848 show that the increase is 67,548 barrels. More than one-half of this number are No. 3, and only one-quarter are No. 1. This great increase of No. 3 is owing chiefly to the mackerel which came from the Bay of Saint Lawrence, denominated 'Bay Chaleur,' being a poorer quality than those taken on our coast. For the last two or three years the mackerel in that quarter have been depreciated gradually both in size and quality. Formerly the best mackerel we had in the market came from that place, and they demanded the highest price, and were very much sought after, on account of their superior size and fatness.

"At one time the George's mackerel were all the rage, on account of their size; but within the past two years the Chatham mackerel have taken the lead, with the exception of that extraordinary fat school which appeared off Gloucester early in September. The mackerel taken from this school are said to be superior in size and fatness to any ever before or since taken by our fishermen. It is estimated that there were upwards of 50,000 barrels taken from this school by our fishermen in the course of ten or fifteen days, which inspected nine-tenths No. 1, and this accounts for the increase in their number; otherwise there would have been a great deficiency in this branch.

"The increased consumption of No. 1 mackerel up to this time had been fully equal to the supply, according to the best information obtained on the subject; but the Nos. 2 and 3 mackerel coming more directly in competition with the English fish, on account of the low rate of duty, it is fair to calculate that the prices will rule much lower than the usual difference between the No. 1 and 2, especially in those years of a large catch.

"The English mackerel which have come into this market under the brand of No. 2 are of a fair quality, but none are fat enough to make No. 1, compared with the present standard of our inspection; therefore there will be less inducement for the trade to speculate in English mackerel with a view of reinspection, as formerly."—(Barnstable Patriot, January 31, 1849.)

1848.—Large school of mackerel in the south channel.

The largest school of mackerel Captain Harding ever saw was in the south channel about the year 1848. It was a winrow of fish. It was about half a mile wide and at least 20 miles long, for vessels not in sight of each other saw it at about the same time. All the vessels out saw this school the same day.

1848.—Abundance of mackerel in the Gulf of Saint Lawrence.

A gentleman who came up from Point Escuminac a few days ago says that the Prince Edward Island Gazette informs us that during the last fortnight there have been from 40 to 50 American schooners about two miles from the Point, the crews of which had been busily engaged in catching mackerel, and so abundant are the fish that they have hired persons from the shore to assist them. Some of them had 300 barrels on board.—*Halifax paper*.—(Barnstable Patriot, September 20, 1848.)

1848.—Immense schools of mackerel off Cape Ann.—Supposed early departure.

The mackerel which were reported in such immense schools off Cape Ann week before last have been completely broken up or quitted the shores. The vessels took but a few last week. It is about time for mackerel to make their annual visit to the shores of Cape Cod. We have no fear that our fishermen will fail to bait them well and see that they don't suffer for want of salt.—(Barnstable Patriot, October 4, 1848.)

1848.—A LATE SCHOOL OF MACKEREL OFF CAPE COD, AND GREAT ABUNDANCE.

In 1848 large mackerel kept in close to Cape Ann. Two hundred and fifty vessels. Pilot found them abundant 26th November off Three-light Nauset. One hundred and fifty vessels.

Captain Wixon, schooner "Hamilton," of Dennis, in debt $250 September 15, and towards the end of the season made three trips (November) without taking off his oil clothes; made $900.

1849.—SCARCITY OF MACKEREL IN THE EARLY SUMMER.

The vessels that have arrived in this vicinity from mackerel voyages have brought in very small fares. The Yarmouth and Dennis fleets, which have just arrived from a two months' cruise, have packed, at an average, about 50 barrels to each vessel.—(Barnstable Patriot, June 27, 1849.)

1849.—ABUNDANCE OF MACKEREL OFF THE COAST OF MAINE.

MACKEREL CATCHING.—A fleet of nearly 200 vessels, says the Portland Advertiser of the 13th instant, was in the offing on Wednesday after mackerel. The mackerel were very abundant, and took the bait well in round the shores and reefs.—(Barnstable Patriot, July 25, 1849.)

1849.—THE MACKEREL FISHERY.

About 150 fishing vessels came into our harbor on Saturday p. m., 21st July, there being an appearance of a storm coming on. This was quite an unusual circumstance for this period of the year, as the mackerel are not in any quantity off our cape until the latter part of August and during the months of September and October. These vessels, we learn, had on board from 10 to 40 wash-barrels each, which they had taken during the previous week or ten days, which was rather slim doings.

There had been two arrivals this season from Bay Chaleur, and although they had an average fare, the men employed made poor wages in consequence of the low price of the article. We understand that but few vessels have gone to the bay this year, in consequence of the poor luck they have experienced at that place for a few years past.—(Gloucester Telegraph, August, 1849.)

1849.—A BIG FARE FROM THE BAY.

September 26, 1849, the schooner "Canton," Capt. Edward Watson, was reported arrived at Gloucester Monday week from Bay Chaleur, with 600 barrels mackerel, the largest number of barrels ever caught and brought into that port by one vessel up to that time. The "Canton" was

100 tons burden, manned by 18 hands, and had been absent three months. She reported very few vessels at the bay, and the prospect good. The whole Gloucester fleet at that time were on this coast, and were doing very poorly, and the prospects were not favorable for a heavy catch. At Gloucester there were 200 sail of Cape Cod vessels at anchor in the harbor, and many vessels had arrived at that port, absent four or five weeks, with only 40 barrels of mackerel. The trips averaged about one-third No. 1.

1849.—Fall mackerel fishery of Cape Cod Bay.

The mackerel fishermen in several of the towns of the Cape during the months of October and November brought in good fares, which has helped to make up for an otherwise poor season's business. We learn that the mackerel caught off Chatham by fishermen in the south part of Dennis and Harwich during these months amount to more than $100,000. The vessels packing at the new establishment of Messrs. Fred. Scudder & Co., in the south part of this town, caught during the same time mackerel to the amount of more than $10,000, and several vessels packing at Messrs. Baxter & Bragg's returned with some thousands in value. All this was earned after many of the vessels of the Cape had hauled up.—(Barnstable Patriot, December 12, 1849.)

1849.—Reminiscences of Capt. J. W. Collins.

The mackerel off the New England shore in 1849 were all large fish and fairly abundant. That summer I made my first trip mackerel fishing, going out as one of the crew of the pinkey Walker. We fished off Mount Desert Rock, and caught 40 barrels of fine, large mackerel in three or four weeks. At that time each one of the crew was provided with a hogshead tub to strike their fish in; the mackerel were salted in butts, which were stowed on their heads in the hold, the catch of each one of the crew being counted by the splitter and placed to his credit. The pinkies of those days had no cabin aft, all hands sleeping in a dingy little cuddy forward, where the meals were also prepared and eaten.

1850.—Scarcity of mackerel.—Influence of bluefish on the movements of mackerel.

The following extract, copied from the Newburyport Herald by the Gloucester Telegraph of September 4, 1850, gives an idea of the mackerel fishery at that date:

"We have never known fresh mackerel so scarce in this market in the season for them as they have been this year. Up to the present time no good mackerel, suitable for the table, have found the way here; and considering how very desirable they are in dog days as an article of food, it is quite a calamity to the lovers of good fish. Some attribute the scarcity of mackerel in our bay to the presence of the bluefish, which within a few years have visited our shore and rivers in great abundance. From the movements of the bluefish in our rivers, and their savage treatment of the smaller fish which come in their way, we are not surprised that the mackerel should give them a wide berth.

"Fresh mackerel are not very scarce here, but the amount of fares of salted ones this season have been very small. Yesterday made thirteen days since we had an arrival of a fishing craft with mackerel of any description, either from our bay or from the Bay Chaleur. We think they cannot be plenty upon any of the usual fishing-grounds.

"If they are not taken more plentifully in course of the next six or eight weeks, the catch must be very limited and the season an unpropitious one for those engaged in the mackerel fishery."

1850.—Reminiscences of Capt. J. W. Collins.

In 1850 I went as one of the schooner "Mercy and Hope" to the Gulf of Saint Lawrence, starting on our trip about the 1st of June. The mackerel were large that year in the Gulf, but not very abundant. The fishing-grounds over which we cruised the most were round Gaspe, Bonaventure, Bay of Chaleur, off Point Miscou, the West Shore, and around the north cape of Prince Edward Island, and on Banks Bradley and Orphan. We were absent from home sixteen weeks, and succeeded in taking only 175 barrels of mackerel with a crew of eleven men, all told.

In the fall of the same year I shipped in the schooner "Three Sisters," and we fished from Portland to Chatham. An enormous school of mackerel was found by the fleet off Cape Cod, near Chatham, that fall, some time from the 1st to the 15th of November. The fish, which were exceedingly fine and large, took the hook very readily, and large catches were made by most of the vessels, some of them succeeding in obtaining a full fare in three or four days' fishing.

The fleet was a very large one, and was estimated to be about 700 sail. Sharp vessels were then just coming into use, and the "Mary S. Wonson," "Jennie Lind," and a few others of that class were looked upon as very remarkable for their beauty and speed. We did not reach the fleet until the "spurt" was nearly over, and, in consequence, did rather poorly. Our skipper, feeling rather chagrined at his ill luck, determined to stay on the fishing-ground in hopes that he could catch some fish from a later school. In this, however, he was disappointed, since we caught no mackerel of any importance, though we did not leave the fishing-ground off Chatham, except for a harbor in stormy weather, until the 5th day of December.

1850.—Slim doings of the Cape Cod fishermen.

Our mackerel fishermen, we regret to say, are doing a very slim business this year. A gentleman who has lately made a tour of the Cape informs us that there are not at present 2,000 barrels of mackerel in the country. Two years ago, at the same season of the year, he counted over 20,000 barrels on the wharves of the Cape. A much larger fleet is now engaged in the business than at that time, and its failure this year would greatly depress our enterprising capitalists. We hope, however, that that last resort of our fishermen, the school "off Chatham," will not disappoint their reasonable expectations.—*Yarmouth Register*.—(Gloucester Telegraph, October 12, 1850.)

1850.—SCARCITY OF MACKEREL OFF CAPE ANN IN LATE AUTUMN, ARRIVALS FROM BAY, PRICES, ETC.

The arrivals of mackerel the previous week have been very small. Our vessels are doing nothing. Many of them for the last ten days have not salted one barrel. There are now in this port some 200 sail of mackerel vessels waiting for the fish to come on this coast.

There have arrived from Bay Chaleur since our last report about 1,800 barrels, and sales have been made at $8.75 for No. 1, $7 for 2's, and $5.12½ for 3's. There now remain about 1,200 barrels in first hands, which are held at higher prices.

There are now but 16 vessels to arrive from the bay, and five which have just sailed for that place.—(Gloucester Telegraph, October 26, 1850.)

The arrivals at this port since our last have been very light. The catch in Massachusetts Bay and on the coast of Maine has entirely failed for the last month past. There have been received from the Bay Chaleur this week about 400 barrels. Within a few days more desire is manifested to purchase, and sales have been made at $9 for 1, $7 for 2, $5.12½ for 3, and $4 for 4, leaving but few in first hands, which are held at higher prices.—(Gloucester Telegraph, November 6, 1850.)

1850.—QUICKEST BAY-TRIP EVER MADE.

The clipper schooner "E. W. Merchant" arrived from the Bay Chaleur on Friday last with about 200 barrels of mackerel, having been absent from this port only 27 days, which is the quickest trip ever made from this place. Beat that who can.—(Gloucester Telegraph, November 20, 1850.)

1850.—CLOSE OF THE MACKEREL SEASON.—LAST ARRIVAL FROM THE BAY.

The mackerel season has about ceased. The vessels are now hauling up as fast as they arrive. For the last two months not enough has been caught by the Massachusetts Bay fishermen to pay the outfits for the time. The last vessel from the Bay Chaleur arrived on Friday last.—(Gloucester Telegraph, November 20, 1850.)

Our mackerel season has closed with the Massachusetts Bay fishermen with a smaller catch than any season since 1841. The few vessels that were so fortunate as to go to Bay Chaleur have made fair voyages.—(Gloucester Telegraph, November 27, 1850.)

1841 TO 1851.—CAPTAIN ATWOOD'S EXPERIENCE IN THE MACKEREL FISHERIES.

"I went again to the Gulf of Saint Lawrence in 1841, when we fished off the Magdalen Islands. We got about 100 barrels of very excellent mackerel. They were about all No. 1's, I think; there were very few No. 2's. The next year I also went in the same "Lucy Mary" to the Gulf of Saint Lawrence, fishing off the Magdalen Islands. I was in the bay in 1841 and 1842. We staid there until the end of the season, but secured only 60 barrels. I was then master—that is, my brother was not with me, and I was master of the vessel. I went home with 60 barrels. This was my experience in the Gulf of Saint Lawrence up to 1842. I was there since, in 1851, when I was in a schooner called the "William Gray," 58 tons. She was a small and dull-sailing vessel. I thought we would be much safer off the Magdalen Islands, and so I went there, as I had done during previous years. I staid there until the middle of September, but was not very successful, getting only 90 barrels; so I concluded to go over to Prince Edward Island and try there. I did so, and the next day after my arrival I found that I was in more danger at this place than at the Magdalen Islands, for I was that day cast away, and I lost my vessel.

"Q. When was this?—A. In 1851. I was cast away on Fish Island, at the entrance to Malpeque Harbor.

"Q. Was this in the great gale, or previously?—A. It was two weeks before the great gale. I cleared up my wreck, saved what I could, took the mackerel out, and shipped for home, going on board another vessel. I was off the mouth of Saint Peter's Harbor when the great gale came on, and we were then cast away again. So I was cast away twice in a fortnight. This seemed to prove to my mind that Prince Edward Island was more dangerous than the Magdalen Islands.

"Q. You speak of fishing at the Magdalen Islands being safer than at Prince Edward Island; explain why it is that you think so?—A. Suppose we were at the Magdalen Islands and it looks stormy. If the wind is blowing on shore where we are, we just run round to the other side of the islands and anchor under the lee. If the wind blows up and it becomes stormy, we are there very comfortable, and night or day we hold ourselves in readiness to get under way and get to the other side again in case the wind should happen to change. Thus I have been round and round the islands time and time again.

"Q. Are the Magdalen Islands regarded by the American mackerel fishermen as a safe place?—A. Yes, I think so.

"Q. And as safe as any in the Gulf?—A. I think so; to a person well acquainted with them, they are considered as safe as any part of the Gulf, and I consider them, for my part, safer. I do not know that everybody is of the same opinion, but I think this would be the case if they are thoroughly acquainted with the matter."—(Statement of Captain Atwood before the Halifax Commission.)

1851.—Cape Cod towns built up by their fisheries.

Wellfleet, like Provincetown, says the Yarmouth Register, is almost entirely built up by the fisheries. Last year some 17,000 barrels of mackerel were packed in the town, and a large quantity of cod and other fish were brought in by Wellfleet vessels. * * *—(Gloucester Telegraph, June 4, 1851.

1851.—Good catch at Yarmouth, Nova Scotia.

The Yarmouth (N. S.) Herald states that large quantities of mackerel have been taken in that vicinity.—(Gloucester Telegraph, June 18, 1851.)

1851.—Small receipts of mackerel and unusual scarcity.

Mackerel continue to come in slowly, and have been sold at $4.75 per barrel for new No. 3.—(Gloucester Telegraph, July 9, 1851.)

The quantity of mackerel taken by our fishermen so far this season has been unusually small. During the last fifteen days less than 200 barrels have been packed, which includes only 2½ barrels fat mackerel. About 75 sail of Cape Cod fishermen made a harbor here on Wednesday, who report mackerel uncommonly scarce for the season.—(Gloucester Telegraph, July 12, 1851.)

1851.—Big mackerel catch at Nova Scotia.—Yankee clippers at Gaspe.

From Halifax papers we learn that the catch of mackerel off the eastern coast of Nova Scotia has been very great this season.

The Gaspé Gazette of July 10 says: "Great numbers of American schooners are busily engaged catching mackerel in our waters. Nineteen handsome looking Yankee clippers, some of them with their colors flying, as if in mockery of the Canadian Government, might have been seen the other day from our office windows, fishing within a short distance from land."—(Gloucester Telegraph, July 26, 1851.)

1851.—Arrival of bay mackerel.

Mackerel have been arriving more freely within a day or two from Bay Chaleur, and prices are a shade lower.—(Gloucester Telegraph, September 20, 1851.)

1851.—Extraordinary large and fat mackerel from Sable Island.

A gentleman yesterday assured us that he had seen in the stores of H. Lyle, esq., mackerel taken at Sable Island a short time since that had at least an inch thickness of fat on them. Some of these delicious fish weighed as much as 7 *pounds !—Halifax Chronicle.*—(Gloucester Telegraph, October 8, 1851.)

1851.—TERRIBLE DISASTER TO THE BAY FLEET.

In the Gloucester Telegraph of October 11, 1851, is reported a dispatch from B. H. Norton, esq., United States consul at Pictou, Nova Scotia, which states that 100 sail of American vessels (all mackerel catchers) and probably more than 300 lives were lost in the Gulf of Saint Lawrence, principally on the north side of Prince Edward Island, in a terrific northeast gale, which had swept with almost unparalleled violence the waters and coasts of that region on the 3d and 4th of October. The Telegraph of October 25 gives the loss of lives, as then ascertained, as 100.

1851.—REMINISCENCES OF CAPT. J. W. COLLINS.

In 1851 the mackerel, though abundant off the New England shore, were of small and medium size, and were so low in price that the majority of the fleet went to the Bay of Saint Lawrence, where large fish could be obtained. About the 1st of July I shipped in the schooner "Brutus," about 40 tons, old measurement, and made a trip mackerel-fishing in the Bay of Fundy. Having obtained a fare in four or five weeks, we packed out in Portland, and thinking we might do better elsewhere, we went to the Bay of Saint Lawrence. There we caught a trip of 160 barrels in about three or four weeks' time, taking these almost wholly in and about the bend of Prince Edward Island, a large part of them near Malpec. We left the fishing-ground on our return home about the last of September, just in time to escape the terrible gale which wrought such devastation among the large fleet of American mackerel schooners which at that time were in the bend of Prince Edward Island. It is now a matter of history that the northern shore of this island was strewn with the wrecks of vessels and bodies of drowned fishermen which were lost in this October gale. Never before had such a terrible disaster occurred to our fishing fleets. So great, indeed, was the loss of American vessels that this particular gale has been known to the residents of that province as the *Yankee gale.*

1851.—VESSELS IN THE MACKEREL FLEET.

The following table, compiled by Mr. Alexander Starbuck from official records, gives the number of vessels, tonnage, and number of men in the crews of the mackerel vessels composing the fleet in 1851:

Ports.	Number of vessels.	Tonnage.	Number of crew.
MASSACHUSETTS.			
Boston	7	596	85
Beverly	12	761	97
Barnstable	28	1,918	339
Brewster	4	259	47
Charlestown	2	74	14
Chatham	19	1,346	230
Cohasset	44	2,885	561

Ports.	Number of vessels.	Tonnage.	Number of crew.
MASSACHUSETTS—Continued.			
Dartmouth	1	117	16
Dennis	47	3,096	585
Eastham	3	170	23
Essex	1	71	10
Gloucester	241	13,639	2,326
Harwich	48	3,231	577
Hingham	37	2,492	491
Lynn	4	167	33
Manchester	1	45	8
Marblehead	1	30	5
Martha's Vineyard	6	421	65
Nantucket	3	168	30
Newburyport	67	4,343	707
Orleans	5	336	54
Plymouth	6	561	65
Provincetown	61	4,322	688
Rockport	42	1,537	283
Salem	1	80	9
Scituate	13	715	119
Salisbury	4	305	48
Truro	52	3,626	581
Wellfleet	79	5,411	852
Yarmouth	14	990	169
Total Massachusetts	853	53,712	9,117
OTHER STATES.			
Maine*	47	3,019	446
New Hampshire	8	515	84
Rhode Island	7	479	71
Connecticut	23	1,551	255
Maryland	2	141	25
Total other States	87	5,705	881
Grand total	940	59,417	9,998

*One of the writers, who was familiar with the mackerel fishery at this time, takes the responsibility of saying that there were probably 200 vessels on the coast of Maine in 1851 engaged in the mackerel fishery, and that Mr. Starbuck's table in this respect is incomplete.

1852.—First mackerel of the season.—Prices.

Several lots of new No. 3 have been received, the first of the season, and sales have been made at $5.50, and some a shade under.—(Gloucester Telegraph, June 9, 1852.)

1852.—Mackerel reported plenty at western Nova Scotia.

The Yarmouth (N. S.) Herald of the 5th instant says: "We rejoice to learn that the mackerel fishermen [gill-netters] at Tusket Islands and other parts of the coast between Yarmouth and Cape Sable have taken good hauls within the last few days."—(Gloucester Telegraph, June 19, 1852.)

1852.—Successful seining at Isle of Shoals.

Great quantities of these fish [mackerel] have visited our shores the past few weeks, and the fishermen at the Shoals have been doing a smart business. These fish are rather shy of the hook, but are taken in seines in great numbers. One or more fishing-smacks may at all times be seen at Star Island or Smutty Nose, waiting for a freight of mackerel for Boston market. The masters of these vessels, as soon as a good haul is made, purchase the mackerel of the fishermen as soon as they are taken from the net, and immediately set sail for Boston, where they arrive by the time the splitters have prepared the fish for market. Five or six thousand are frequently taken at one haul of the seine, and sell at from 1¼ to 2½ cents apiece. Several seine-owners have already made $1,000 each since the coming of these fish, and those engaged in setting and hauling not infrequently bag $10 or $15 for a day's work. * * *—*Portsmouth Messenger.*—(Gloucester Telegraph, July 31, 1852.)

1852.—First seizure of an American vessel for fishing off Prince Edward Island.

Schooner "W. R. Burnham" has arrived at Boston from Prince Edward Island, having on board two of the crew of schooner Lion, of Brooklyn, which vessel was taken into Charlottetown by the Nova Scotian armed cutter Telegraph for violation of the treaty. This is the first instance of seizure for fishing off Prince Edward Island.—(Gloucester Telegraph, August 11, 1852.)

1852.—British cutters in Bay of Saint Lawrence disguised to insure the capture of American schooners.

An exchange paper says: "Captain Whitmore, of Deer Isle, Maine, states that the commanders of the British cruisers in the Bay of Saint Lawrence are in the habit of disguising their vessels as fishermen, so as to decoy the American vessels within their reach, when they become fishers of men and of prize-money. This is true; and some of the tricks resorted to in years past by some of the provincial officers would disgrace any sailor. The present year the colonial vessels are said to look more like common merchant vessels than armed cruisers, and are distinguished from others only when they have the pennant up, which is not always the case."—(Gloucester Telegraph, October 18, 1852.)

1852.—American mackerel schooners not permitted to fish in Bay Chaleur, and otherwise annoyed by British cruisers.

Schooner "Mary Niles," Captain Pool, arrived yesterday from the Bay of Saint Lawrence. Captain Pool informs us that the steamship "Devastation" will not allow the fishermen to fish in the Bay of Chaleur. He and others were driven out. There were plenty of fat mackerel there, six and seven miles from the shore, and had he been allowed to fish he could have filled his vessel with three or four hundred barrels, whereas he only brought home one hundred. The captain of the "Devastation" told Captain Pool that *he should not allow them to fish in the Bay of Chaleur, or within three miles of any of the bays.*

The officers of the steamer were making every effort to catch the vessels, and resorted to many tricks in order to entrap them. Captain Pool states that the steamer had several times come suddenly round Point Miscou (in order to catch the American fishermen unawares). Among other things, the officers of a cutter, when they boarded a vessel, even if she were six or seven miles from the shore, *would feel of the fishing-lines to see if they were wet.*—(Gloucester Telegraph, August 21, 1852.)

1852.—Scarcity of mackerel.

The Gloucester Telegraph says returns of mackerel at that port for the past year fall short full one-half of what the receipts were last year; cause, trouble with the English. Prospects for remainder of season not favorable, and if vessels now out return with more than half a fare it is more than is anticipated.—(Barnstable Patriot, August 28, 1852.)

1852.—Arrivals from the bay.—Reported interference of British cruisers.

There have been several arrivals from the Gulf of Saint Lawrence since our last, and they confirm our previous statements in regard to not being allowed to fish in the Bay of Chaleur. * * * These vessels were obliged to return home without obtaining a full fare; could they have fished in the Bay of Chaleur they would have filled their vessels with fat mackerel. * * *—(Gloucester Telegraph, August 25, 1852.)

1852.—A school of mackerel off Cape Ann.

Quite a "school" of mackerel have been around our shore during the week past, and our Rockport friends have reaped a rich harvest. Some of the boats from our harbor have taken large quantities, but we understand they had struck off yesterday.—(Gloucester Telegraph, August 28, 1852.)

1852.—Reported scarcity of mackerel in the bay.

Two or three vessels have arrived since our last, but they bring no news of importance, except a scarcity of mackerel.—(Gloucester Telegraph, September 18, 1852.)

1852—The mackerel season drawing to a close.—Small catch of the fleet due to trouble in Bay of Saint Lawrence.

The fishing season for mackerel is fast drawing to a close, and there are but few weeks left before the vessels will be hauled up. The returns of mackerel this year at this port fall short full one-half of what the receipts were at this time last year. This, owing mainly to the trouble at the Bay of Saint Lawrence, the vessels being obliged to keep farther from the shore than they heretofore have done, for fear the officers of the cutters would say they were within the limits, and seize them. Not being allowed to fish in the Bay of Chaleur is another cause, as our vessels in years past have sometimes obtained full fares there, and would have done so this year could they have fished in that bay, as it was full of mackerel. Last year at this time many of the vessels had returned from their second trips, but now there are many who have not returned from their first, and there will be but few who will make more than two.

The prospect for the remainder of the season is not very favorable, and if those vessels now at the bay return with more than half a fare, they will do better than is now anticipated. The fish at this season tend mostly in-shore, and at the best fishing-grounds there are two or three cutters who will keep the Americans off, and they will therefore not be able to do much.

The quality of mackerel this season has been different than for a few years past. Those brought from the bay have been very large and handsome, and commanded high prices; while those taken off our coast have been smaller and not of so good quality. Sales have been made this week of several trips of bay mackerel at the following rates: No. 1's, \$12; 2's, \$10; 3's, \$6.75. Shore mackerel have brought \$9$\frac{5}{8}$, \$7$\frac{5}{8}$, and \$5$\frac{1}{2}$ for the three Nos.—(Gloucester Telegraph, September 25, 1852.)

1852.—Loss of many mackerel schooners in the bay.

The Gloucester Telegraph of October 30, 1852, reports the loss of 21 vessels at Souris, Prince Edward Island, in a heavy gale which took place on the 15th of that month. The vessels went into that harbor with the wind NE., but it shifted suddenly round to the SSW., and they could not get out.

1852.—Reminiscences of Capt. J. W. Collins.

In the spring of 1852 I went south on a mackerel trip in the schooner "Science," of about 50 tons, old measurement. We started about the 1st of May, and were gone four or five weeks, bringing to Boston a fare of 45 sea-packed barrels. Our fishing ground was from Barnegat to Block Island, though we caught but few mackerel south or west of Fire Island. At this time all of the vessels belonging to Northern New England ports salted their spring catch of mackerel, and generally packed them north of Cape Cod. A considerable number of sloop smacks, belonging at Noank and New London, Conn., engaged in the spring mackerel fishery to supply the New York market, taking the fish in alive in their wells. Their crews fished with poles, as anglers do for trout, being thus enabled to drop the mackerel into the well without touching them, even from the extremities of this vessel. In June we went to the Bay of Saint Lawrence, where we caught about 150 barrels, being absent from home nearly seven weeks. The mackerel were of large size that year in the Gulf of Saint Lawrence, but not very abundant. Off the New England coast they were very plentiful and in fine condition, though of medium size, scarcely any, or none, being large enough to pack for No. 1's. After returning from the Gulf we fished off the New England coast from Mount Desert Rock to Cape Cod, though we did the best off and around Monhegan Island during the month of August and early in September. At that time a large fleet was fishing off the Maine coast.

1852.—Mackerel fishery of New Brunswick in 1852.

Perley, in his Report on the Fisheries of New Brunswick for 1852, says: "It must be considered settled that the mackerel fishery as a branch of business cannot be said to exist in New Brunswick, although the eastern shores of the province and the whole Bay of Chaleur offer the greatest facilities and most abundant supply of fish.

"It is highly desirable that something should be done to encourage and promote this fishery, which evidently offers such ample reward to the energy, enterprise, and industry of the people."—(Page 16.)

1853.—The armament in provincial waters for breaking up the American mackerel fishery.

The St. John New Brunswicker, of the 31st ultimo, announces the arrival at St. John of H. M. ketch "Netley," which is to be stationed in the Bay of Fundy for the protection of the fisheries this season. H. M. screw steamship "Plumper," fitting out in England, is also expected to be stationed in the bay. H. M. steamers "Basilisk," "Vixen," and "Devastation" are to be stationed at Newfoundland and in the Gulf; and four brigantines or schooners are to be immediately fitted out at Halifax for the Gulf, each under the command of a lieutenant in the navy, with twenty-five picked men in each from the flag-ship "Cumberland." These vessels, says the Brunswicker, with other arrangements for an efficient boat service at several of the most favorable resorts in the Gulf for American mackerel fishers, will doubtless prove the means of preventing encroachments this season, and tend greatly to break up the American mackerel fishery in the Saint Lawrence.—(Gloucester Telegraph, June 4, 1853.)

1853.—Mackerel in western Nova Scotia.

The Yarmouth Herald says: "We are glad to hear that mackerel have been abundant at the Tusket Islands during the past week. In two days two seines secured over 600 barrels. Within the last few days a considerable quantity of small mackerel and fat herring have been caught in this harbor."—(Gloucester Telegraph, July 16, 1853.)

1853.—First arrival from the bay—reported scarcity of mackerel.

The "Leonard McKenzie" arrived at this port on Sunday from the Bay of Saint Lawrence; reports mackerel as not being very plenty, and the vessels were not doing much.—(Gloucester Telegraph, July 20, 1853.)

1853.—Mackerel in Gloucester harbor.

A large school of mackerel has been in our harbor this week, which has given our shore fishermen a good benefit, and many of them have improved it. The fish are larger than those here a week or ten days previous.—(Gloucester Telegraph, July 30, 1853.)

1853.—Successful purse-seining on New England shore.

The Newburyport Union states that the schooner "Ada" [arrived] at that port on Wednesday with 320 barrels of mackerel. This is her second trip in our bay, in both of which she has taken 560 barrels; most of them have been caught with a seine. What other mackerel vessel has done as well as that this year?—(Gloucester Telegraph, August 3, 1853.)

The Newburyport Union states that the schooner "Ada" has completed her third trip in eleven days, with 300 barrels, making a total of 850 barrels in less than two months. We do not recollect that any vessel from this place has ever done so well before; and at the present prices of mackerel she will pay a handsome profits to her owners.—(Gloucester Telegraph, August 13, 1853.)

1853.—Arrivals and reports from the bay.

There were several arrivals yesterday from the Bay of Saint Lawrence. * * * In some parts of the bay mackerel were plenty, in others they were scarce.—(Gloucester Telegraph, August 17, 1853.)

1853.—Success of the Swampscott mackerel seiners.

The schooner "Romp" and the schooner "Vanguard" of Swampscott arrived home last week, having been engaged in mackerel fishing off Boone Island a few days past with remarkable success. One of the boats took at one haul of the seine ninety-four wash-barrels of mackerel. In one day she took 155 barrels.—*Lynn Bay State.*—(Gloucester Telegraph, August 31, 1853.)

1853.—Receipts and prices.

Mackerel remain without change. The arrivals continue moderate for the seasen. Sales of large for $13.00, $11.50, and $8.12½, and shore at $11.75, $9.72, and $7.50 per barrel.—(*Ib.*)

1853.—Extreme high prices consequent upon the scarcity of mackerel.

The scarcity of this article (mackerel), and the poor prospect, both in the bay and off our coast, has caused the prices to reach a higher point this season than ever before known. A trip which arrived on Saturday morning, was taken up at $15⅛ per barrel for No. 1's, and other numbers in proportion.—(Gloucester Telegraph, September 11, 1853.)

1853.—ARRIVALS FROM THE BAY.

Quite a number of vessels have arrived since our last from the Bay of Saint Lawrence. * * * Fish are reported scarce, and but few of the vessels are doing anything.—(*Ib.*)

1853.—THE SHORE FLEET.

Our harbor was filled up on Thursday with about 200 sail of fishing vessels. It was the largest fleet which has been in this season. * * * —(Gloucester Telegraph, October 8, 1853.)

1853.—DESTRUCTIVE GALE AND LOSS OF VESSELS AT THE BAY.

The Gloucester Telegraph of October 8, 1853, contains a report of several mackerel schooners in the Bay of Saint Lawrence during a heavy gale which occurred on the 29th of September.

1853.—ARRIVALS FROM THE BAY.

About 25 vessels have arrived home from the Bay of Saint Lawrence since Saturday morning. They bring no news of importance, but all report stormy weather and a scarcity of mackerel.—(Gloucester Telegraph, October 26, 1853.)

1853.—REVIEW OF THE MACKEREL FISHERY FOR 1853.

The season for mackerel is fast drawing to a close, but about six weeks remaining before the vessels will be hauled up. Present appearances indicate that the catch will be very small compared with last year. At this port not more than one-third as many mackerel have been packed as there were up to this time last year. The vessels which return from the bay do not average half a fare, and those which are fishing off this coast are doing no better comparatively. There are no mackerel around our Capes, which is unusual at this time of the year. This scarcity of the article has carried the price up higher than ever before known, and the tendency is still upward. Sales have been made in town, this week, of bay mackerel at $15\frac{3}{4}$ for No. 1's, $13\frac{3}{4}$ for 2's, and $8\frac{1}{8}$ for 3's; shore do. at $14 for 1's, $10\frac{3}{4}$ for 2's, $7\frac{1}{2}$ for 3's, and $5\frac{1}{8}$ for 4's.—(Gloucester Telegraph, October 5, 1853.)

1853.—REMINISCENCES OF CAPT. J. W. COLLINS.

In June, 1853, I went to the Gulf of Saint Lawrence, in the schooner "Valiant," leaving home about the middle of June. The mackerel were large that year in the Gulf, but rather scarce. Some of the vessels succeeded, however, in getting fine fares, but we were not so fortunate, since we brought back only 60 barrels of mackerel, though absent from home six weeks. Medium-sized mackerel were quite plentiful off the coast of Maine in August and September, and some of the vessels did quite well. A curious thing, however, in connection with the shore-fishery that year was, that while mackerel could be caught to a considerable extent close into the shores of the out-lying islands and around the ledges, but comparatively few could be taken farther out to sea. The consequence was that many of the vessels were provided with boats in which the fish were caught. This was especially the case with those fishing round Monhegan Island, where a small fleet of vessels lay in the harbor, and the crews went out in boats round the island, catching the mackerel close into the rocks. The vessel I was in was one of this fleet. On several occasions we found excellent good fishing in our boats, frequently not more than a stone's throw from the surf on the shore.

1853.—Success of the spring mackerel fishery on the coast of the United States.

Several mackerel catchers have returned to Provincetown to pack, with liberal success. A large quantity of mackerel have been caught in and about the harbor in nets—prospect for fishing remarkably good.—(Barnstable Patriot, May 31, 1853.)

1853.—Newburyport vessels in the Gulf of Saint Lawrence.

The Newburyport Herald, of Friday a. m., has a letter dated Cascumpeque, Prince Edward Island, September 15, which says:

"It is blowing a gale from the northeast, and this harbor is full of vessels, say 120 sail. Hereby I send you a memorandum of Newburyport vessels and their catch of fish. These vessels are all here in the harbor: 'Gentile,' 230 barrels; 'Paragon,' 100; 'Arctic,' 190; 'Equator,' 130; 'Lydia,' 370; 'Palm,' 60; 'M. C. Ames,' 20; 'Angelia,' 70; 'Ada,' 12; there is quite a fleet near Gaspe and some at East Point. As a general thing the fleet has been unfortunate."—(Barnstable Patriot, October 4, 1853.)

1854.—Abundance of mackerel on the New England coast.

Mackerel were unusually plenty on the coast this year. Old fishermen declared them to be more so than at any other time within twenty-five years. Considerable quantities were taken from the wharves in Lynn.—(History of Lynn, Lewis & Newhall, p. 439.)

Mackerel.—We learn from the Salem Register that mackerel continue abundant in the waters near the city. On Tuesday week, a leviathan of the mackerel species, three pounds in weight, was caught near Black Rock, and on the same day two others weighing five pounds each, were captured off Tompkins Island.

A correspondent of the Herald says that mackerel had made their appearance in great numbers during the past week at Danversport, and they have been caught by the bushel from the wharves and boats.—(Barnstable Patriot, August 8, 1854.)

1854.—Reminiscences of Capt. J. W. Collins.

In July, 1854, I again went on a mackerel trip to the Gulf of Saint Lawrence in the pinkey "Julia Ann." The Gulf mackerel that summer were large, though rather scarce on the greater part of the fishing grounds. A fleet of about fifty sail, of which our vessel was one, did remarkably well in August on a small spot of shoal ground lying off to the southwest of Cape Gaspé, and known to the local fishermen as *Yankee Bank.* Instead of fishing here as in the usual manner, by *lying to* and *drifting*, the vessels were all brought to anchor at a short distance from each other, and, while fishing, lay *sprung up.* As a rule the mackerel would take the hook only at night and early in the morning, at which times they would bite, perhaps, for an hour or two, while during the middle of the day scarcely one could be caught at all. The weather at this season was exceptionally fine, and the fleet lay for some weeks contentedly at anchor. Each morning more or less mackerel would be taken, and when they ceased biting, these were dressed and salted. In the same manner the fishermen were almost always sure of a "sundown spurt." Many of the vessels did excellently well, catching more than 200 barrels of fine large mackerel, for which they obtained a high price, and we, ourselves, succeeded in taking over a hundred barrels, with a small crew of nine or ten men. This amount, together with the fish we had previously caught, made us up a fine fare of 150 barrels, for which we obtained a high price. This year the schooner "Game Cock," of Hingham, was provided with a peculiar form of spring seine, by which it was expected that a school of mackerel which had been tolled alongside of the vessel might all be caught at one time in the net. The schooner was provided with long outriggers, from the bow and stern, by means of which the net could be drawn outward from her side, underneath the fish, in such a manner that they might be inclosed in a bag of netting—the edges of which would be at the water's surface—before they would be aware of it. This contrivance did not, however, succeed very well, and no attempts were made to use it, that I am aware of, after this summer in the bay.

1854.—Poor quality of the mackerel taken in the Gulf of Saint Lawrence.

The Gloucester Telegraph says that "in previous years the quality of mackerel taken at the Bay of Saint Lawrence has been mostly large and fat, but this year it has been different. In 1853 Gloucester returned over 20,000 barrels of No. 1 mackerel. This year there will be returned scarcely 5,000 of that No. 1"—(Barnstable Patriot, December 26, 1854.)

1855.—Mackerel fishery of Cape Cod.

Several mackerel fishermen arrived at different harbors on the Cape last week, having from 150 to 180 barrels each. The prospect of the fishermen is generally very good.—(Barnstable Patriot, August 28, 1855.)

1855.—Spring fishing in Barnstable Bay.

For a week past our bay has been enlivened with the presence of quite a fleet of vessels and boats, engaged in taking mackerel. They are quite abundant, and the most encouraging fares are realized. Yesterday a fleet of nearly two hundred sail was in sight from our office, and we learn that most of the crews have averaged some thirty barrels per day for some days past. Persons in boats have, in many instances, taken several barrels, and last week Capt. Ainsley Howes, of Dennis, took seven barrels in a single day. These are lucky times for our fishermen.—(Barnstable Patriot, May 20, 1855.)

1855.—Reported abundance of mackerel south.

The Newburyport Herald learns from one of the crew of the schooner "Flying Cloud," who arrived home by land on Friday, that all the vessels were rapidly filling up, and that the catch of mackerel out south, this year, will be greater than for many years past. He reports the mackerel to be of large size and of good quality, the coves and harbors being literally swarming with them.—(Gloucester Telegraph, June 6, 1853.)

1855.—First arrival from the south.

The schooner "Leader" arrived at Newburyport on Saturday. The Herald says that this is the first of the fishing vessels arrived from the southern coast. The fleet are reported as doing a fair business. The "Leader" packed out 104 barrels. Only $6 per barrel offered for the catch.—(Gloucester Telegraph, June 13, 1855.)

1855.—Only moderate fares obtained by the southern fleet.

The Newburyport fleet of southern fishermen are fast arriving home with moderate fares, and, at the present prices of mackerel, making but small profits. Several of them by falling in with fish off Cape Cod, on their way home, were able to add something to voyages that otherwise would not have paid.—(Gloucester Telegraph, June 27, 1855.)

1855.—Arrivals from the bay—unprofitable trips.

Several vessels have arrived within a few days from the Bay of Saint Lawrence with tolerable trips of mackerel, so far as quantity is concerned, but the quality is poor, and the price is so low that hardly one of them will pay their expenses. This, however, is better than last season, when many of the vessels came home with only from 15 to 40 barrels each.—(Gloucester Telegraph, August 1, 1855.)

The Newburyport Herald states that the fishermen of that port are fast arriving from the Bay of Saint Lawrence with about average fares, and report the fleet not to be doing more than that. If prices keep up they will barely make a living business, and if they decline the fishermen will come out at the close of the season where they have often been of late years, without enough, take the fleet together, to square their bills.—(Gloucester Telegraph, October 3, 1855.)

1855.—Large hauls in Halifax harbor.

The Halifax Colonist of the 3d instant says: "Large hauls of mackerel have been taken, within the last few days, along the shores from the head of the Basin to Portuguese Cove, wherever there was a seine set. Some of these fish will make superior No. 1's, and the quantity taken is valued at a very large sum of money."—(Gloucester Telegraph, November 14, 1855.)

1855.—The baymen.

All of the bay vessels have now arrived home but three, and those, we understand, are on their way. A larger quantity of mackerel has been taken this year than last, and some of the vessels have made a good year's work, but the average of the vessels is not much better than it was in 1854, the expenses of the business being so high and the quality of the mackerel being so low. The season closes later this year than usual, some of the packers having several trips still on hand to pack out.—(Gloucester Telegraph, November 28, 1855.)

1855.—Reminiscences of Capt. J. W. Collins.

The spring mackerel on the southern coast, in 1855, were small, averaging 12 inches or less in length. They were fairly abundant, but being so small, and also very poor, were low in price and scarcely worth catching.

In the summer mixed mackerel were very abundant in the Gulf of Saint Lawrence. It should, however, be mentioned that but few of these were of large size, that is, of suitable size to cull as No. 1 fish. The great majority of the mackerel were of small size, ranging in length from 10½ to 12 inches. These were exceedingly plentiful, and, especially during the early part of the season, took the hook very readily, so that some of the vessels succeeded in obtaining full fares in a very short time, in fact, in some cases the only limit being the time required by the crews to catch and dress the fish.

I went south early in May in the schooner "Matilda," about 45 tons, old measurement. We fished principally at Sandy Hook and along the back side of Long Island. The best day's fishing (about 30 wash-barrels) was obtained a little to the westward of Montauk Point. We were absent about four weeks, bringing to Boston a fare of about 50 barrels of salt mackerel.

About the middle of June I went to the Gulf of Saint Lawrence in the same vessel. Our skipper had been one of the "lucky ones" who had succeeded in getting a fare of large mackerel on Yankee Bank the previous summer, and being fully impressed with the idea that he could again do the same, and thinking the small mackerel hardly worth saving, he made it a rule to throw away all but the largest fish during the first part of the trip; it often happened that, from a catch of twenty to twenty-five barrels, we would not save more than two or three barrels. The result of this was that a large part of the best fishing season passed away almost unimproved by us. In the end, after four months absence, we had to return home with only 160 barrels of mackerel, considerably less than a full fare.

1856.—RELATIVE IMPORTANCE OF THE SHORE AND GULF OF SAINT LAWRENCE MACKEREL FISHERIES.

According to the Cape Ann Advertiser, the shore mackerel fishery in 1856 was very unsatisfactory, the mackerel refusing to take the hook. The bay fishery was fairly successful.

1856.—THE MACKEREL FISHERY OF NEW ENGLAND.

The Gloucester Advertiser of January, 1857, reviews the season of 1856 in the following manner:

"The first trips to the bay were very successful, and the prospect to the 1st of September very encouraging. The catch of mackerel exceedingly large. Mackerel, however, have rated low, and the poor success of the last trips to the bay proved very disastrous, and rendered the closing up of the season's work very poor. Many of the vessels have not paid their current expenses, and empty barrels and salt are left on the owners' hands."

1856.—REMINISCENCES OF CAPT. J. W. COLLINS.

In the summer of 1856 the small mackerel which were found the year before in the Gulf of Saint Lawrence had increased in size so that they ranged in length from about twelve to twelve and a half inches; though at this time, scarcely any large fish were found in the schools. In July I went on a mackerel trip to the Gulf in the schooner "Good Intent." After trying a week round the northern part of Prince Edward Island and on Bank Bradley, we went to the Magdalen Islands, where, about the eastern end of the group, we found mackerel abundant, and succeeded in obtaining a full fare in two or three weeks. After returning home and packing out our trip, we fished off the New England shore but found mackerel rather scarce, and, like those in the Gulf, of medium size. Many of the vessels did excellently well mackerel fishing in the Gulf of Saint Lawrence this year, bringing home two full fares.

1857.—SLIM DOINGS OF THE SOUTHERN FLEET.

Accounts from the southern fisheries have been received. The Boston Traveller says the catch has been very slim. A few vessels from Newburyport were reported. The "Atlas" had the largest number, 80 barrels; "Roanoke," 24; "Tyro," 10. The two first weeks of this month being considered the best of the fishing season in those waters, there is a slight chance of their being able to increase their catch sufficient to meet their expenses. As a general thing the southern fishery does not pay to follow. The fleet to these waters every year diminishes, and will eventually be abandoned.—(Gloucester Telegraph, June 10, 1857.)

1857.—The price of mackerel enhanced by the demand for shipments to California and Australia.

The active demand for mackerel for shipment to California and Australia, says the Boston Traveller, and the comparatively small catch thus far has caused an upward tendency in prices, and speculators are now paying for No. 2 $12.50, large 3's $9, and small 3's $8 per barrel, which are higher prices than we have ever before known. Heretofore Philadelphia has controlled the market for these fish, but the New Yorkers are now attempting to get this trade in their hands, and it is resulting very favorable to the fishermen. As new markets are being opened for shipment, an impetus will be given to this branch of business heretofore unknown. Additions are making to the fleet in all our fishing ports, and upon the arrival of the baymen there is considerable competition by the New York and Philadelphia agents to secure fares. * * * —(Gloucester Telegraph, August 5, 1857.)

1857.—Unfavorable reports from the bay.

A vessel arrived from the Bay of Saint Lawrence yesterday reported that the vessels have done but little during the last four or five weeks. Mackerel were scarce and the weather very rough. During one fortnight but two days were obtained in which the vessel could go out to fish. Some of the vessels were coming home with half fares.—(Gloucester Telegraph, October 3, 1857.)

1857.—Mackerel schooners stranded in the bay.

A dispatch received in town this morning reports that eleven [Gloucester] vessels went ashore at Cheticamp last Thursday * * *—(Gloucester Telegraph, November 3, 1857.)

1857.—High line of the mackerel fleet.

Capt. George Janovin, of the schooner "Eleanor," which arrived yesterday, has made three trips to Bay Chaleur, and packed out 660 barrels of mackerel. This being the largest fare caught, Captain Janovin will be entitled to wear the laurels for this season.—(*Newburyport Herald.* —(Gloucester Telegraph, November 14, 1857.)

1857.—Reminiscences of Capt. J. W. Collins.

This was another year when mackerel were plentiful in the Gulf of Saint Lawrence, and at this time a considerable percentage of them were of suitable size to be packed for large fish. As in previous years a large fleet of vessels went to the Gulf. In July I went to the bay in the pinkey "Rinaldo," 33 tons, old measurement. We fished principally along the north shore of Prince Edward Island from Eastern Point to Cascumpec. We succeeded in getting a full fare of mackerel—about 150 barrels—in five or six weeks, with a crew of seven men all told. I left the "Rinaldo" in the Strait of Canso on her return home, and shipped on the schooner "Mary Ellen," of Truro, Massachusetts, and returned again to the Gulf. During September and the first part of October, we fished on the north side, or in the waters termed the Bend of Prince Edward Island, mostly in the vicinity of Malpec, where was gathered a fleet of 200 or 300 sail of American mackerel schooners. Mackerel were fairly abundant in that locality, and many of the fleet did well. Having secured enough fish to complete our fare early in October we left the Bay and came home. After packing out our fish we engaged for a few weeks in fishing on the New England coast, though with indifferent success. The mackerel off our own shores that fall were mostly of small size and not very plentiful. The vessels that arrived home with their fares early in the fall were much more fortunate than those coming in at a later date, since the price of mackerel was very much affected by the financial panic, which occurred during that autumn. I left the "Mary Ellen" a couple of weeks before the close of the season and went home. But little was done, however, at mackerel-fishing late in the fall.

1858.—Early start for the bay.—Increase in the bay fleet.

Several vessels have already started on their first trip to the bay; and active preparations are now being made for the fitting out of others, which will be ready to sail in the course of a fortnight. The bay fleet will be larger this season than last by some thirty sail.—(Cape Ann Advertiser, May 22, 1858.)

1858.—Arrival of baymen.—Scarcity of mackerel.

Since our last issue there have been several arrivals from the Bay with average fares. They report mackerel scarce when they left.—(Cape Ann Advertiser, July 31, 1858.)

1858.—Early start for the bay.—Poor success of the southern fleet.

The George's fishing has been very dull for the last month or six weeks, and a large portion of the fleet are now in port, painting up and getting ready for the bay. It is calculated that by the last of the month two-thirds of the fleet will be there or on the way. This is earlier than usual, and we trust they will return with full fares.

Several vessels have arrived within a few days from the South, where they have met with poor success, getting few mackerel. Our vessels have never been very successful in the spring mackereling at the south.—(Gloucester Telegraph, June 2, 1858.)

The Yarmouth Register reports that the fishermen who have this spring made their usual trips to the southern waters have met with poor success, the best returning not over 25 barrels. Those who have arrived report the whole mackerel fleet as doing a poor business.—(Gloucester Telegraph, June 16, 1858.)

1858.—The shore fleet off Cape Ann.

Quite a large fleet of mackerel catchers have been visible a few miles off the Cape during the past week. Several of them have done well; one vessel we learn having caught sixty wash-barrels in one day, others have taken twenty-five. They report mackerel plenty, but unusually shy of the hook.—(Cape Ann Advertiser, October 9, 1858.)

1858.—A good bay trip.

One of our vessels recently returned from the bay with a fare, the proceeds of which amounted to $4,234.—(Cape Ann Advertiser, November 25, 1858.)

1858.—Last arrival from the bay.

The last of the bay fleet that is expected to arrive has made her appearance, and the mackerel season has closed.—(Cape Ann Advertiser, December 3, 1858.)

1858.—A big day's work.

The Portland Argus states that one day last week two men engaged in fishing off that harbor caught mackerel which they sold for the sum of $90. The weight of the mackerel caught was about 1,500 pounds.—(Gloucester Telegraph, June 26, 1858.)

1858.—Mackerel plenty off Newburyport.

Mackerel are now schooling in abundance in Newburyport Bay. The schooner Coral seined one day last week, in the vicinity of the Isle of Shoals, 30 barrels.—(*Ib.*)

1858.—Small spring catch.

The Hyannis Messenger says that the catch of mackerel up to the present time has not been a quarter of what it was last year.—(Gloucester Telegraph, July 3, 1858.)

1858.—The spring fishery at the Magdalen Islands.

We subjoin an extract from a letter dated Port Amherst, Magdalen Islands, 7th June. * * *

We are now taking large quantities of mackerel; in fact the greatest quantity ever taken here will be this spring. About 50 sail of strangers are now fishing here. * * *—(Gloucester Telegraph, July 7, 1858.)

1858.—The bay mackerel fleet from Gloucester harbor.

Two hundred and twelve of the fleet have gone to the Bay of Saint Lawrence, and are manned by 2,550 men and boys.—(Gloucester Telegraph, July 24, 1858.)

1858.—Slim doings of the early bay fleet.

Schooner "John Gerard," from Bay Chaleur, mackereling, arrived at Newburyport 21st instant, and reports sailing with a fleet of 25 vessels, the largest catch of which was 80 barrels. As none of the fleet have arrived here, it is supposed they are Cape Cod or eastern vessels. Our skippers prefer staying the whole season in the bay to coming home with fares of 80 barrels and less.—(Gloucester Telegraph, August 25, 1858.)

Several vessels direct from the bay have arrived at Hingham and Cohasset the past week, with very slim fares, the highest catch being about 150 barrels. They report mackerel plenty but will not bite.—Gloucester Telegraph, September 8, 1858.)

1858.—The mackerel fishery almost a failure.

The mackerel fishery seems to have been almost a complete failure so far this season, the number caught being small, and the fish small and poor. We trust something better may result from the fall fishing.—*Provincetown Banner*.—(Gloucester Telegraph, September 15, 1858.)

1858.—The bay mackerel fishery.

Though our vessels are not bringing full fares, the mackerel are very fine, all large and fat.—(Gloucester Telegraph, September 25, 1858.)

1858.—Partial failure of the mackerel fishery.

There is little hope now that any turn in the fisheries will render them profitable this year; but the latest accounts from the Bay of Saint Lawrence are more favorable, and those vessels that succeed in taking full fares—since the mackerel are uncommonly good and the prices higher—will do well. On our shore the mackerel fishing is not much, but the vessels here employed in pollock catching have the promise of a good season. The fish that have annually struck into our bay in large schools for some years past, are now plenty.—*Newburyport Herald.*—(Gloucester Telegraph, October 13, 1858.)

1858.—Mackerel market.—Doings of the shore fleet.

Since last reported the market has been inactive. The shore fleet of mackerel catchers do not report any success. Last sales at $12.50, $10.50, and $8.31, for Nos. 1, 2, and 3.—(Gloucester Telegraph, October 27, 1858.)

The Yarmouth Register reports the arrival last week of a fleet of some 50 sail of fishermen at Wellfleet, with from 10 to 25 barrels each. They sailed again on Tuesday for another three weeks' cruise, and if not more fortunate their gross earnings will be very small.—(Gloucester Telegraph, November 3, 1858.)

Over 100 sail of mackerel catchers, says the Provincetown Banner, tarried in our harbor over Sunday. As yet they have not paid their way, but still have a faint hope to do something before winter sets in. * * * —(Gloucester Telegraph, November 10, 1858.)

1858.—Success of the Gloucester baymen.

Before the last of the present month the last of our fishing fleet will have returned and the season will be finished. Some time since, in the midst of discouraging news from the bay fleet of mackerel catchers, we ventured to predict that they would bring at least one full fare of mackerel which would command high prices. All that have returned up to the present writing have proved the truth of our prediction, and those which are yet to come—about 75 sail—if the last news be reliable, will bring average fares. * * * But reports from other places seem to indicate that the business has been almost a failure this season. The Cape Cod fishermen, especially, as we learn, have been peculiarly unfortunate. Their vessels sent into the bay early, but the poor prospect discouraged them, and they returned home to meet the same hard luck, and unless they meet with remarkable success in the few days that remain of the season, vessels and crews will be deeply in debt.—(Gloucester Telegraph, November 13, 1858.)

1858.—The top and bottom of the mackerel fishery.

One of our vessels recently arrived from the bay with a fine fare, the total proceeds of which amounted to $4,234. As a contrast to this we will mention the fact that one which had been absent a number of weeks brought home only 37 barrels.—(Gloucester Telegraph, November 24, 1858.)

1858.—Last arrival from the bay.

The last of the bay fleet that was expected to arrive made her appearance on Saturday.—(Gloucester Telegraph, December 1, 1858.)

1858.—POOR SUCCESS OF THE NEWBURYPORT BAY FLEET.

The whole bay fleet of Newburyport, comprising upwards of fifty vessels, have returned for the season. The Newburyport Herald says this has been a very hard year for the fishermen, and adds: "The result of this season may be briefly summed up. The schooner, Young America, takes the lead, having packed out 500 barrels, stocking $6,150. But seven vessels have more than paid their expenses; six others have barely met their expenses, and the remainder have sunk money."—(Gloucester Telegraph, December 4, 1858.)

1858.—REMINISCENCES OF CAPT. J. W. COLLINS.

Early in June I again started for the Gulf of Saint Lawrence on a mackerel trip on the schooner "Good Intent." During June and the early part of July, we fished along the west shore from Point Miscou to Richibucto; around the north cape of Prince Edward Island, and on Bank Bradley. Mackerel were found most plentiful during June and early July about Point Escuminac and in Miramichi Bay. On one occasion in June the schooner "Governor," of Deer Isle, Maine, with a crew of 12 men, caught more than a hundred wash-barrels in Miramichi Bay, and nearly every vessel in the fleet, which numbered 40 to 50 schooners, did well. About the middle of July we went down to the east point of Prince Edward Island where our skipper had secured a good fare of fine mackerel the year previous. Here we continued to cruise for five or six weeks, going as far up the north side of the island as Saint Peters, and as far as Surrey and Georgetown on the south side. We found mackerel scarce, however, in that locality, and were obliged to return home with a small fare of about 150 barrels; though vessels fishing at the Magdalens secured full fares in a much less time. There was a large fleet fishing off the New England coast that fall, and we also engaged in the shore mackerel fishery after packing out our bay trip. Mackerel were not abundant, however, off our own coast, and we did rather poorly. In October I left the "Good Intent," which was about to haul up, and shipped in the schooner "E. W. Merchant," of Gloucester, in which I continued for about three weeks. During that time we fished all the way from Cape Ann to Chatham, including Middle Bank and Barnstable Bay. Our success, however, was limited, since we caught only about 30 barrels of mackerel. The "Merchant" was the first real clipper-schooner in which I had sailed. Her performances seemed to me, at that time, quite wonderful.

1858.—SUCCESS OF THE GILL-NET MACKEREL FISHERY IN CAPE COD BAY.

The Provincetown Banner of early December, 1858, contained the following paragraph:

"FAT MACKEREL.—The bay was visited last week with one of the finest schools of mackerel that was ever known to enter these waters. Those who set nets on Thursday and Friday nights were exceedingly fortunate. On both of those nights every net meshed more or less fish, while some of them were so loaded with mackerel as to sink; some men took as high as 1,500 in one night from their nets. These mackerel are large and fat, packing about 200 per barrel. All those fish do not take the hook at this season of the year; those who expect a share of them are under the necessity of providing themselves with nets. To knit these affords employment during the winter to those who follow the business or are hired by them. The success of those who have supplied themselves with this apparatus for taking these mackerel is an incentive to others, who have neglected to provide it, to spend their leisure moments in furnishing themselves with the means of obtaining a share with their neighbors in future years. While the profits of the mackerel taken in the bay last week will not in all cases, perhaps, fall into the hands of the most needy, they will be quite generally distributed and many, both in this town and Truro, are to be congratulated most heartily on their good fortune. Last night 2,000 mackerel were taken off here in three nets—a great haul."—(Barnstable Patriot, December 7, 1858.)

1859.—Decline of the southern mackerel fishery.—Small fleet from Gloucester.

The practice of going south for mackerel has almost died out of late years, and this year there are but three or four vessels in the business. Some of the vessels who go in quest of bait, however, take mackereling apparatus with them, to use in case they should be so fortunate as to fall in with a school.—(Cape Ann Advertiser, May 20, 1859.)

1859.—Growing importance of gill-net fishing at Cape Cod.

Net mackereling seems to be a growing and important business. The absence of the bluefish in the bay seems to be hailed with inward satisfaction by the citizens of Provincetown, and they confidently predict the return of the palmy days of profitable boat and net fishing, and the consequent thrift to their town if this piratical enemy of almost every other species of fish has taken his final departure from their waters.—(Cape Ann Advertiser, July 1, 1859.)

1859.—Spring mackerel fishing.

Schools of mackerel reported in Boston Bay June 5–10, 1859. Several vessels returned from the south with good fares. Fleet has been small, but those that have been engaged in this southern fishery did better than the average of seasons. Largest catch, 140 barrels of small mackerel, selling at $9.50.

1859.—ADVANTAGES OF GILL-NETTING.

HABITS OF FISH.—Mackerel fishermen once found fish inclined to take the hook, as bluefish, by trawling. Late years they take the hook as soon as it is thrown into the water, and a vessel needs but a few hours for a full supply if they will "bite." Now it would seem that the water may be full of them and not one of them can be taken by the hook. At the present, in Provincetown Harbor, none are taken by the hook, while the whole harbor is crowded full of them. The introduction of nets has been a great gain in the way of taking them, and it is predicted by some that mackerel will soon be taken upon this coast only by nets. However this may be, it would seem that a change of mackerel would render it desirable that there should be the corresponding change in the mode of taking them.—(Barnstable Patriot, June 28, 1859.)

Our Provincetown neighbors seem to have a special benefit this season. The harbor is crowded full of mackerel, and though they will not take the hook, they are abundantly meshed in the nets which are set for them. Some nights as many as two thousand fish have been taken in the nets of a single man.—(Cape Ann Advertiser, July 1, 1859.)

1859.—FITTING AWAY OF THE BAY FLEET.—A NEW FEATURE IN THE MACKEREL FISHERY OF TAE GULF OF SAINT LAWRENCE.

Most of our vessels are making preparations for the bay. The prospects of a good season's work are very flattering, and the number of vessels this season will exceed that of last by a large number.

Some of the mackerel fleet in the bay fishery will take dories this season. This is a new feature, and will doubtless prove an advantageous one. Quite a large fleet of cod fishermen are now fitting for bay mackereling.—(Cape Ann Advertiser, May 20, 1859.)

1859.—REPORTED ABUNDANCE OF MACKEREL IN MASSACHUSETTS BAY.—SUCCESS OF THE SOUTHERN FLEET.

Large schools of fresh mackerel have been reported in Boston Bay the past week. Several of our mackerel catchers have returned from the south with good fares. The fleet at the south has been very small, but those that have been there do rather better than the average of seasons. The largest catch yet landed has been 140 barrels of small mackerel. It will be seen by our market quotations that they bring a good price.—(Cape Ann Advertiser, June 10, 1859.)

1859.—SUCCESSFUL USE OF THE PURSE-SEINE OFF CAPE ANN.—SCHOOLS OF MACKEREL IN GLOUCESTER HARBOR.

Last week large quantities of mackerel were seined by vessels on the north side of the Cape.

Our harbor has been visited by schools of mackerel the present week, but they do not take to the hook.—(Cape Ann Advertiser, July 1, 1859.)

1859.—A SCHOOL OF MACKEREL IN GLOUCESTER HARBOR.—ARRIVALS FROM THE BAY.—PROSPECTS.

A large school of mackerel in the harbor yesterday, near Day Bar; large and fat; several dories took good loads with hook and line; schooner "Jane," of Swampscott, seined a good number.

Twelve vessels arrived from the bay with moderate fares the past week. They do not speak very encouragingly of the fleet, many of the vessels having done nothing, and others have succeeded in getting from 50 to 100 barrels. Probably the whole fleet in the bay will not average 50 barrels apiece.

Our fishermen, however, are not discouraged, but rely on making better trips in the fall.—(Cape Ann Advertiser, August 19, 1859.)

1859.—MACKEREL FISHING IN THE BAY.—PRICES, ETC.

Within the last three days 12 vessels have arrived from the bay, averaging 140 barrels each. The fleet generally have not been very successful. Sales yesterday at 16, 13½, and 8½ for 1's, 2's, and 3's.—(Cape Ann Advertiser, August 19, 1859.)

The prospect for a successful fishing season in the bay is quite encouraging. * * * If the second trip to the bay should prove successful, the business of the year will wind up profitably, and our owners be prepared to commence winter fishing.—(Cape Ann Advertiser, August 26, 1859.)

1859.—THE BAY AND SHORE FLEETS.

There are about 240 sail of vessels yet to arrive from the bay; a few have arrived; report very rough weather; no chance to fish for a month past, and the prospect for a fall catch rather discouraging; a few vessels reported with good trips; some have had bad luck (50 to 75 barrels), and will probably hold on till late in November.

The shore fleet have done nothing the past week, as the weather has been very cold and blustering. The prospect now is that unless mackerel make their appearance off Chatham, the fall catch will be small indeed. Some of the mackerel-catchers have gone into pollock-catching, meeting with good success.—(Cape Ann Advertiser, October 28, 1859.)

1859.—REMINISCENCES OF CAPT. J. W. COLLINS.

Early in June, 1859, I left the brig "Houston," in which I had made a coasting trip, in Providence, R. I.; went on to Gloucester and shipped in the schooner "Arcturus" for a trip to the Gulf of Saint Lawrence. This schooner was then on the stocks, but was launched in a few days, made ready for sea, and we started for the bay. The mackerel were of large size in the Gulf that year, but exceptionally scarce. On our first trip we cruised over nearly all of the fishing-grounds that are usually frequented at that season, and although our vessel was commanded by one of the most expert skippers then sailing from Gloucester, we obtained only 100 barrels of mackerel—considerably less than half a fare. We left the bay in August on our return home, and having packed out our fish and refitted, returned again for a fall trip. We succeeded in catching 150 sea-packed barrels that autumn, which was more than an average for the fleet. The price of mackerel was good, since, to the best of my recollection, we got $14.50 per barrel for our No. 1 fish. My own share for the season's work, from the 1st of June to November, amounted to $150. The mackerel were also scarce on our own shore so far as I can remember, and nearly all of the New England fleet resorted to the Gulf of Saint Lawrence. Several vessels secured excellent fares of fine large mackerel in the summer of 1859 along the south shore of the Saint Lawrence between Cape Gaspe and Cape Chatte, the best catches being obtained in the vicinity of the Magdalen River and Mount Louis. Captain Peter Sinclair, in the schooner, "C. C. Davis," did excellently well, perhaps better than any others, bringing home a full fare of extra large mackerel, for which a high price was obtained. These fish were taken chiefly in boats which went out from the vessel and caught the mackerel close into the rocks and along the reefs making out from either side of the coves. In some instances when the mackerel *played in* to the coves, where the vessels lay at anchor, the fishing was carried from the decks of the schooners which were *sprung up* for the purpose. We had also cruised along this coast in July, but the mackerel not then having arrived on the shore in any numbers, our skipper fearing to remain longer, decided to return to the more frequented fishing-grounds in the lower part of the Gulf. An incident transpired, however, before leaving this section that may be worthy of mention here. Failing to find the mackerel inshore we one day stood off between Magdalen River and Anticosti Island, where we caught 17 barrels of fine large fish. It is altogether probable that these mackerel were a part of the school that a short time thereafter were found close in to the shores.

1859.—Prices for mackerel caught in 1858.

Mackerel, no sales reported some small lots are held at $16.25 and $14.26, Nos. 1 and 2.—(Cape Ann Advertiser, May 13, 1859.)

1859.—A good trip from the bay.—Big stock.—Other arrivals. Prices, etc.

Schooner "C. C. Davis" from the Bay Saint Lawrence, arrived yesterday with 250 barrels of large mackerel. Advices from the fleet there are a little more favorable.—(Cape Ann Advertiser, November 4, 1859.)

Schooner "C. C. Davis" made good trips—two trips to the bay, packing 535 barrels, sold for $7,487.74, leaving over $6,400 net profit after deducting expenses. Add to this $5,600 made in fishing, and we have the handsome net stock of over $12,000 in a single season. Who can beat this?

About 100 sail of baymen have arrived the past week, and our streets have presented a lively appearance. Clothing dealers doing a good business. There are now some 50 or 60 sail to arrive. Some do poorly. One arrived with 20 barrels, another with only 8 barrels. The catch will fall greatly below last season. The shore fleet have mostly given up. Mackerel season is about over, and the fleet will soon haul up. Prices of mackerel: $14.50 and $14.75 for 1's, $12.50 and $12.75 for 2's.—(Cape Ann Advertiser, November 18, 1859.)

1859.—A LATE SCHOOL IN MASSACHUSETTS BAY AND AT CAPE COD.

Mackerel again made their appearance in our waters last week, and the few vessels who were fortunate enough to be out succeeded in doing a pretty good business, some of them taking as high as 60 barrels. Some vessels which had been hauled up fitted out again, and will be ready to try them as soon as the weather is suitable. It is rather late in the season, however, to expect any great number of mackerel will be taken, but if there be any catch the Gloucester boys will be on hand to get their share of them. Mackerel quiet the past week. Prices $14.50 for 1's, $12.50 for 2's.—(Cape Ann Advertiser, November 25, 1859.)

1859.—MACKEREL MARKET FOR 1859.

BOSTON, *January* 4, 1860.—Mackerel have sustained very full prices throughout the year, and have been quite steady. In January last prices ranged from $15 to $16 for No. 1's, $14 to $14.50 for No. 2's, and $9.75 to $10 for No. 3's, and they were the current rates for the first four months of the year. In May prices advanced for No. 1's and No. 2's, and ruled at $16.75 to $17 for No. 1's, $15 to $15.50 for No. 2's, while No. 3's were sold at $9.50 to $9.75 a barrel. The first arrival of new No. 3's sold at $10.25 to $11, but prices soon declined to $8 and $9. The principal sales for some months past have been $14.50 to $15.50 for No. 1's, $12 to $14 for No. 2's, and $9.50 to $10 for No. 3's, closing firm for all kinds. Mild weather prolonged the fishing season later than usual, but it is believed that the catch this year will fall short of the last.

The highest and lowest prices for some years past have been as follows:

	No. 1.	No. 2.	No. 3.
1859	$14 00 to $17 00	$11 50 to $15 50	$8 00 to $11 00
1858	9 00 to 16 00	8 90 to 14 00	5 00 to 11 00
1857	8 00 to 14 00	7 00 to 13 00	6 50 to 9 00
1856	9 00 to 16 00	7 00 to 8 00	4 75 to 5 25
1855	13 00 to 18 00	7 00 to 10 00	3 50 to 5 00

1860.—AN EARLY START FOR THE BAY.

Two vessels, "Charger" and "Fleetwing," the first of the season, sailed from this port for Bay of Saint Lawrence Wednesday [May 23]. About 20 sail will be ready next week, and in a few weeks the greater portion of the fleet will be ready.—(Cape Ann Advertiser. May 25, 1860.)

1860.—THE NEWBURYPORT MACKEREL FLEET.

The Newburyport Herald, April, 1860, states that the bay fleet has nearly abandoned the practice of going south for mackerel in the early spring. But two schooners are fitting out, the "Lola Montez" and the "Eleanor," and they are stimulated by the high price offered for 3's—$10 a barrel. Labrador fleet has usually been successful. Would not pay for a single year, from great cost of outfits, but those who continue for several years, till nets and other outfits are used up, find it remunerative.

1860.—A PROPOSED INNOVATION IN THE MACKEREL FISHERY.

There is talk of organizing a company for the purpose of fitting out a vessel to engage in the mackerel fishery of the North Sea.—(Cape Ann Advertiser, March 23, 1860.)

1860.—FIRST ARRIVAL FROM THE BAY.—REPORTED SMALL CATCH.—MACKEREL PLENTY ON NEW ENGLAND COAST.

Schooner "Light of Home" arrived from the bay with 70 barrels: been gone ten weeks. This is the first arrival of the season, and a little earlier than usual. Have reports for the following vessels: "St. Cloud," 125 barrels; "Cyrena Ann," 125; "J. J. Burns," 120; "Anglo Saxon," 100; "North Star," 100; "Flora Temple," 80; "Electric Flash," 90; "Oronoco," 25; "Shooting Star," 75; "Chas. McDonald," 75; "Saint Louis," 90. The fleet will probably average about 60 barrels. "Light of Home" will fit for another trip.

Shore mackerel quite plenty to the eastward; one vessel from the Point has caught 90 barrels on the hook.—(Cape Ann Advertiser, August 3, 1860.)

1860.—MACKEREL ABUNDANT OFF CAPE ANN.—A GOOD CATCH.

Large quantity of mackerel taken off Rockport on Saturday last. One seine obtained 225 barrels of pretty fair mackerel, while quite a number of barrels were caught by dory fishermen. Quite a streak of luck.—(Cape Ann Advertiser, July 13, 1860.)

1860.—ABUNDANCE OF MACKEREL OFF THE MAINE COAST.—SCARCITY IN THE BAY.

The shore fleet have met with a streak of luck quite unprecedented, mackerel of good size swarming the eastern shores of Maine, and take the hook very readily; largest haul is 160 bbls. brought in by the "Electric Flash," all caught on the hook in about ten days. Glad of the luck, because for many years they have done poorly. Bay fleet advices report mackerel scarce.—(Cape Ann Advertiser, August 10, 1860).

1860.—ARRIVALS FROM THE BAY AND SHORE FLEETS.

Eighteen vessels arrived from the bay during the past week, bringing in 1,743 barrels to a vessel, averaging 97 barrels to each vessel; 12 of shore fleet arrived with 1,305 barrels—108 barrels to a vessel. From the bay 9,000 barrels less this year than last. Many have not paid their outfit bills. Shore fleet have done a little better, but not first rate.

Quite a number of the Cape Cod mackerel fleet in the harbor yesterday; brisk trade retailing mackerel at 5 cts. lb.—(Cape Ann Advertiser, September 14, 1860).

1860.—ARRIVAL OF SOME OF THE BAY FLEET.

Since our last 12 vessels have arrived from the bay with an aggregate of 1,377 barrels of mackerel.—(Cape Ann Advertiser, August 24, 1860.)

1860.—GOOD CATCH OF A COHASSET HOOKER OFF THE NEW ENGLAND COAST.

Schooner "Harriet Torrey," of Cohasset, caught 1,500 barrels of mackerel in 1860. Wm. Berdick, of Cohasset, caught 137 barrels with his own hook, which will clear, above expenses, $548. Shore fleet have all done well. Bay fleet have done poorly.—(Contemporary record.)

1860.—REMINISCENCES OF CAPT. J. W. COLLINS.

In July, 1860, after returning home from a cod-fishing trip to Cape North I went to the Gulf of Saint Lawrence on a mackerel cruise, in the schooner "Ocean Traveller" of Gloucester. Leaving home about the 1st of July, we passed through the Strait of Canso on the 5th, passed up along the north side of Prince Edward Island; along the west shore, crossed Bank Orphan, fished around Bonaventure, and up by Cape Gaspe and Cape Rozier without finding mackerel enough to induce us to remain in any one place, though we tried frequently on our way. In the cove at Cape Rozier we anchored, with a number of other vessels, and succeeded in catching 21 barrels *at a spring* in three or four days, getting a few mackerel each morning and evening. Influenced by the success which had been met with by several vessels the previous year along the southern shore of the Saint Lawrence we, as well as many others of the mackerel-catchers, went there fitted for inshore fishing, taking along with us four or five dories in addition to our yawl-boat which was carried at the stern. Leaving Cape Rozier, where the mackerel had ceased taking the hook, we ran up around the coast to Magdalen River, where we stopped and tried for mackerel. We continued to cruise along the shore for about five weeks, going as far north as Mount Louis, but met with extremely poor success; so much so, indeed, that after being in the bay nearly six weeks we had taken only 27 barrels of mackerel, including the 21 barrels caught at Cape Rozier, of which mention has been made above. At last, feeling fully convinced that mackerel would not strike in on the south shore of Saint Lawrence, and the advanced season and state of the weather warning us of the risk of remaining any longer on that coast, we proceeded south and began fishing around the Magdalen Islands, where, in about three weeks, we succeeded in catching enough mackerel to make us up a fare of 125 sea-packed barrels, which, for the time and place, was much better than an average. For the No. 1 mackerel on this trip (a large percentage was No. 1's) we obtained $18.50 per barrel. My own share for the trip was $124.25. After returning home and packing out our bay trip, we engaged in the mackerel fishery off the New England coast. The contrast this year between the Gulf of Saint Lawrence and the New England coast was quite remarkable, since in the former the mackerel were almost all of large size and very scarce, as has been shown, while on our own coast mackerel were of medium size, averaging about 12 inches long, and very abundant. After returning from the bay we made two trips, taking altogether 275 sea-packed barrels of mackerel. For the first fare of 175 barrels we got $8.50 per barrel; but for the last trip the price was lower. A large portion of the mackerel catchers were fishing off the New England coast during the summer and autumn, and it is perhaps safe to estimate that at one time a fleet numbering five or six hundred sail were engaged in fishing for mackerel in Barnstable Bay. The mackerel at one time during the fall were exceedingly abundant off Truro and Wellfleet. This was very advantageous to the fishermen, since in this partially sheltered bay fishing could be carried on much longer than in other places, and, consequently, a great amount of mackerel were taken. But little was done, however, outside of Cape Cod along its eastern shore, from the Highland to Chatham, as has been the case in other years. The mackerel which had remained for several weeks in Barnstable Bay, when once outside of Race Point and on their way south, moved so rapidly that but comparatively few were taken.

1860.—Successful use of the purse seine off Cape Ann.

A large quantity of mackerel were seined off Rockport on Saturday last. One seine obtained 225 barrels of pretty fair mackerel, while quite a number of barrels were caught by dory fishermen.—(Cape Ann Advertiser, July 13, 1860.)

Small catch by the Newburyport fleet at the south.

Southern fleet have all returned, and are now fast leaving for the Bay of Chaleur. Catch south small. "Sarah Jane" took 112 barrels of mackerel, and 50 of bait. Largest catch.—(Newburyport Herald, June 28, 1860.)

HOOK AND LINE FISHING OFF THE NEW ENGLAND COAST.

THE SHORE FLEET.—The largest trip brought into this port is by the "Sunnyside," 200 barrels, after an absence of three weeks. Schooner "Ripple" arrived lately with 100 barrels in 10 days.—(Cape Ann Advertiser, August 24, 1860.)

1860.—SPRING AND GULF MACKEREL FISHERY.

The Cape Ann Advertiser of May 4, 1860, remarks:

"A few vessels have started for the south to prosecute the mackerel fishery. The number will be less than any previous season, owing to the ill-success of this branch of the fisheries of late. A large number will leave for Bay Chaleur the latter part of May and early in June, as the George's fishery is not very profitable at present."

1860.—THE SOUTHERN MACKEREL FLEET.

The Cape Ann Advertiser of June 8, 1860, announces that six vessels had arrived since the last issue of the paper, the average being 100 barrels, and the prospect very good.

1860.—SPRING AND GULF MACKEREL FISHERY.

The Cape Ann Advertiser of June 15, 1860, states as follows:

"The southern fleet have nearly all arrived home and are fitting away for the bay. Late arrivals report the mackerel as being very small, the large ones having struck off to other waters; evidently the mackereling season at the south is about over. Vessels did better than last year."

1860.—FISHING ON THE COAST OF MAINE.

Mackerel of good size are swarming the eastern shores of Maine, and take the hook very readily. The largest haul brought into this port is 160 barrels, by schooner "Electric Flash," all caught on hook in about ten days.—(Cape Ann Advertiser, August 10, 1860.)

1860.—THE FALL MACKEREL FISHERY IN CAPE COD BAY.

The Gloucester Telegraph of December 19, 1860, quotes from a recent number of the Yarmouth Register to the effect that mackerel had never been more numerous in Cape Cod Bay than during the four preceding weeks. They would not bite, but were caught in great abundance in nets. One man took from his nets set in Provincetown Harbor 3,000 mackerel, valued at 7 cents apiece.

November 23, mackerel were very abundant off Billingsgate Point. The Yarmouth Register stated that they were being taken in Cape Cod Bay in the latter part of November in large numbers.

On November 24 the Lieutenant's Island weir, at South Wellfleet, captured 118 barrels at one tide.—(Gloucester Telegraph, November 28, 1860.)

Mackerel of medium size were this fall exceedingly abundant about Cape Ann and other points along the coast of Eastern New England.

In October there was a large fleet of perhaps 300 sail in Barnstable Bay. The vessels had followed the mackerel from Portland to Cape Ann and across Massachusetts Bay.—(Captain Collins.)

1860.—Mackerel in the Gulf of Saint Lawrence.

In 1860 mackerel were quite scarce in the Gulf of Saint Lawrence, though of large size. Nearly all of the vessels which went to these waters early in the season fished off the coast of New England in the fall. No. 1 bay mackerel were sold at $18.25 a barrel, and No. 2's, taken off the New England shore, sold for from $7 to $8.50 per barrel.

1860.—Spring mackerel fishery.

Southern mackerel.—Six vessels have arrived from the south since our last issue with very good fares, averaging about 100 barrels to a vessel. They report the prospect good. * * *—(Barnstable Patriot, June 12, 1860.)

1861.—Fall mackerel fishery at Cape Ann.

Five weir-loads were taken in a seine off Rockport, at one haul, August 28.—(Cape Ann Advertiser, August 30.)

1861.—First mackerel taken.

The first mackerel of the season was taken May 20.—(Cape Ann Advertiser, May 24, 1861.)

1861.—Notes on southern fishery.—Scarcity of mackerel.

Reports from Newport last week, says the Newburyport Herald, state that fish are very scarce, and that 60 barrels is the largest fare yet caught. Many of the vessels have caught but 20 barrels. They are determined to persevere, but it is evident unless they meet with an unusual "streak of luck," the business will prove a losing one. A large fleet of Cape vessels were in Newport on Sunday week, with small fares on board.—(Barnstable Patriot, June 11, 1861.)

1861.—Spring mackerel fishery in Cape Cod Bay.

Mackerel.—The mackerel fishery in the vicinity of Barnstable Harbor has been doing a good business for some days past. Several of the boats have taken 3,000 each, and yesterday a new school came inshore, increasing their prospects for a profitable spring business.—(Barnstable Patriot, May 28, 1861.)

1861.—SPRING MACKEREL FISHERY.

THE MACKEREL FLEET.—Sixty barrels, the largest trip caught yet. —(May 31, page 2, column 2, Cape Ann Weekly Advertiser, 1861.)

1861.—UNFAVORABLE NEWS FROM THE SOUTHERN FLEET.—SAILING OF THE FIRST OF THE BAY FLEET.

Schooner "Shooting Star" arrived from the south on Tuesday, with 60 barrels mackerel; reports poor catch for most of the fleet; one or two have above 80 barrels.

About a dozen of the fleet have sailed for the bay, and quite a number are fitting away and will sail in a few days. Last year at this time there were many more vessels on their way to the bay than the present season.

There is yet a large stock of last year's catch on the wharves. Last year the catch of the previous season was exhausted long before June. —(Cape Ann Advertiser, June 7, 1861.)

1861.—A BIG SCHOOL OF MACKEREL IN GLOUCESTER HARBOR.—GOOD CATCH OFF ROCKPORT.

A large school of mackerel made their appearance in the harbor on Wednesday afternoon; some twenty boats were present, and there was quite a successful catch; many of the mackerel were of good size.

Five wherry-loads of mackerel were taken in a seine, off Rockport, at one haul, on Wednesday of last week.—(Cape Ann Advertiser, August 30, 1860.)

1861.—FIRST ARRIVAL FROM THE BAY.

Schooner "Arcturus" arrived from the bay on Tuesday, with 240 barrels mackerel, absent six weeks. This is the first arrival of the season from the bay, and is somewhat earlier than usual, as vessels rarely arrive before August 1.—(Cape Ann Advertiser, July 19, 1861.)

1861.—QUICK BAY TRIPS.

Schooner "Joseph Story" returned from the bay; gone but little over four weeks; returning with a good fare. Schooner "Queen of the West," gone five weeks. These we believe are the shortest bay trips that were ever made from this port, the usual time of making a voyage being from ten to twelve weeks, and sometimes longer. Eight weeks is considered good time for a vessel in the bay fishing.

The mackerel, which have been schooling off this shore the past month, have struck off to other waters, consequently our market has been without its usual share of fresh mackerel of late.—(Cape Ann Advertiser, August 23, 1861.)

1861.—A FALL SCHOOL ON THE NOVA SCOTIA COAST.

We are pleased to hear that large quantities of mackerel have made their appearance along our shore, and hundreds of barrels taken by our fishermen.—*Halifax Express.*—(Cape Ann Advertiser, September 20, 1861.)

1861.—THE SHORE FLEET.—ITS SUCCESS.—REPORTED SCARCITY OF MACKEREL IN THE BAY.

Three hundred sail of fishermen in the harbor last Saturday; the fleet have done well of late, and report mackerel of good quality and quite plenty. Advices from the bay report mackerel scarce.—(Cape Ann Advertiser, October 11, 1861.)

The shore fleet did well last Saturday; some of the vessels got 90 wash-barrels. Quite a number got 30 to 50 wash-barrels of large, fat mackerel. Some 20 sail from the bay have arrived during the week, and report hard luck. The mackerel season, take it all in all, has not proved very profitable this year.—(Cape Ann Advertiser, October 25, 1861.)

1861.—CLOSE OF THE MACKEREL SEASON.—ADVANCE IN PRICES.

The mackerel fishing business is closed for the season; vessels are hauling up. The catch this season has been 25 per cent. below that of last year, and prices have ruled very low. Within a few weeks prices have advanced.

No. 1 mackerel, which were worth only $7 per barrel October 25, at this date sold for $13. No. 2's, now selling for $9, brought only $5 in October.—(Cape Ann Advertiser, November 23, 1861.)

1861.—REMINISCENCES OF CAPT. J. W. COLLINS.

In the summer of 1861 medium-sized mackerel were very abundant off the New England coast, and some of the hookers obtained a catch of about 1,000 barrels or more, though the price was so extremely low, owing to the distracted condition of the country at the beginning of the war, that the fishermen obtained but little remuneration for their labor. Large mackerel were exceedingly rare, however, and as a consequence of much greater value than the smaller ones. In the Gulf of Saint Lawrence, also, mackerel were fairly plentiful, and there being a greater percentage of large fish, some of the vessels did much better, financially, than those which fished off our own shore. This was especially the case with those which remained late in the bay, or made their home passages in a leisurely manner, since, during November, the prices advanced very rapidly, so much so, indeed, that mackerel nearly doubled in value in the short space of two or three weeks. On the 16th day of August I left Rockport, for the Gulf of Saint Lawrence, in the schooner "Sarah B. Harris." At first we fished about the Magdalen Islands and the north side of Prince Edward Island, and around its eastern point. Later in the fall we obtained some very good catches of mackerel off Cape Saint George, where there was a large fleet collected. Other vessels, however, about the same time, took a considerable quantity of mackerel about Margaree Island and Cheticamp. We left Port Hood for home on the 1st day of November and met with very boisterous weather, causing us to lay in harbor on the Nova Scotia shore for some days. Our passage was also further retarded by strong headwinds, while at sea, so that we did not arrive home until the 19th day of November. In the mean time, while we had been making our passage, mackerel had risen from $7.50 to $12 per barrel, and by the time we were ready to sell we were able to get $13.50 for our best fish. My own share amounted to $100, which was a sum rarely obtained from one trip by any fisherman in 1861.

1862.—Uncertainty of the mackerel fishery compared with that for cod.

Some of the Georgians make shares of $30 to $50 per man.

The mackerel fishery is quite uncertain, and if the fishermen make a poor season's work at mackerel, then George's Bank is made to discount, and from this source they draw the cash, in the shape of codfish and halibut.

George's Bank furnishes them with the ready cash, promptly paid, and dollars would be scarce indeed among them, were it not for this source of revenue.—(Cape Ann Advertiser, March 7, 1862.)

1862.—Southern mackerel fishery.—Fitting away of the fleet.

Quite a number of vessels are now being fitted out to prosecute the early mackerel fishery in southern waters. This branch of the fisheries has been prosecuted for several years past with but indifferent success, the vessels not making enough to pay for their outfit The vessels engaged in this business do not follow the George's fishing, but spend a month or six weeks in Southern waters, prior to going to the bay, in order to help make out a good season's work. The mackerel are generally small and poor, and the prices realized are not very lucrative.—(Cape Ann Advertiser, April 25, 1862.)

1862.—Vessels and men engaged in the Gloucester mackerel fisheries.

About 350 sail of vessels engaged in the fishery, from this port, averaging twenty men to a vessel, making an aggregate of more than 4,000 men that are required to man the fleet.—(Cape Ann Advertiser, May 8, 1862.)

1862.—FLEET FITTING FOR THE BAY.—SUCCESS OF THE SOUTHERN MACKEREL FISHERY.—LARGE FLEET IN GLOUCESTER.

Quite a large fleet of vessels will be ready to start for the bay immediately after the 4th.

The southern mackerel fleet have mostly returned from their first trips with average fares, and many have gone on a second trip, as mackerel are plenty.

Shore mackereling will be prosecuted quite extensively this season. Large fleet of mackerelmen were in port on Wednesday, mostly south-shore vessels fishing on the shore. It is unusual to see a fleet of mackerel catchers in our harbor at this time of year.—(Cape Ann Advertiser, June 27, 1862.)

1862.—THE EARLY BAY FLEET.

Quite a number of vessels are fitting for an early trip to the bay; will be ready to start June 1; no arrivals yet from the southern mackerel fleet.—(Cape Ann Advertiser, May 23, 1862.)

1862.—THE MACKEREL FISHERY IN THE GULF OF SAINT LAWRENCE.—FAVORABLE REPORTS.

Advices from the bay report vessels doing well. July 1 "Bridget Ann" had 150 barrels; "Cyrena Ann," 175; "Wide Awake," 130; "Electric Flash," 120; "Ocean Gem," 60. Weather unfavorable the past fortnight, and the mackerel taken thus far were rather poor.—(Cape Ann Advertiser, July 25, 1862.)

1862.—FIRST ARRIVAL FROM THE BAY.

One fare of 200 barrels of mackerel has arrived from the bay. Sold at $4\frac{7}{8}$ and $3\frac{7}{8}$ per barrel for large and medium 3's. The shore fleet have not done much of late.—(Cape Ann Advertiser, July 18, 1862.)

1862.—GOOD FARES FROM THE BAY.—PRICES AND QUALITY OF MACKEREL BETTER THAN IN 1861.

There has been quite a number of arrivals from the bay during the past fortnight, bringing in good fares. The quality of mackerel is said to be vastly superior to those of last season, and the prices are higher than last year.—(Cape Ann Advertiser, September 12, 1862.)

1862.—MACKEREL ABUNDANT IN IPSWICH BAY AND AT CAPE COD.—TEN ARRIVALS FROM THE BAY.

Shore mackereling good the past week. Ipswich Bay has been swarming with mackerel, and the mild, pleasant weather has been very favorable. A large school of mackerel have made their appearance at Cape Cod. Previous to the present month the catch has been small. Bay trips arrive slowly, as most of the fleet will remain late in order to fill up with fat mackerel.—(Cape Ann Advertiser, October 10, 1862.)

Mackerel were quite plenty in the bay on Wednesday, and the shore fleet did a good day's work, some of them catching as high as 70 wash-barrels. The mackerel are quite large, and the best of them sell readily at $11 per barrel.—(Cape Ann Advertiser, October 17.)

The Newburyport Herald says: "The mackerel have been swarming in our bay for the last ten days; 200 vessels and any number of small boats were fishing. Vessels take from 5 to 40 barrels apiece. On Tuesday the fleet numbered 4,000 vessels, and the fish were so plenty that the 'Live Yankee,' with only 4 hands, brought in 10 barrels."—(Barnstable Patriot, October 14, 1862.)

1862.—A BIG CATCH BY A HOOKER.

Schooner "Nor' Wester" arrived from the Bay of Saint Lawarence yesterday. The day before leaving she took 123 wash-barrels of mackerel, the value of which is $1,000.—(Cape Ann Advertiser, July 14, 1862.)

1862.—REMINISCENCES OF CAPT. J. W. COLLINS.

In the season of 1862 mackerel were quite plentiful in the Gulf of Saint Lawrence, where the larger part of the fleet were engaged in this fishery. Off our own coast there was a school of mixed mackerel—much the greater portion being undersized—while among them were some very large fish. After making two trips' cod fishing to George's I took charge of the schooner "Hattie Lewis" and sailed for the Gulf of Saint Lawrence on a mackerel trip early in June. We fished principally on Bank Bradley, about the North Cape of Prince Edward Island, off Point Miscou and in the vicinity of Point Escuminac, taking a part of our fare, however, in the latter locality. On our first trip we caught 208 sea-packed barrels, which were nearly all No. 3's, and started for home early in July. After landing our fish we went back on a second trip to the Gulf; obtained a fare of 200 barrels and left the bay early in October. In the latter part of the fall we fished off Cape Ann and around Cape Cod. On one occasion we found mackerel quite plenty off Chatham and got 50 wash-barrels in one day; though the majority of these were undersized fish there were a few among them remarkably large; some specimens which I weighed, after they had been salted for a number of weeks, turned the scales at 2½ pounds. The following day we could find no fish in the same locality but struck mackerel in the afternoon about 25 miles in a southerly and easterly direction from Chatham, nearly down off the fishing-rip. These fish, which were moving quite rapidly in a southerly direction, were quite different from those caught the day before, since we did not find any large sized ones among them. On the third day the mackerel were gone, and although we ran to the southward 15 or 20 miles farther we did not succeed in finding them. I have never, at any other time, with the experience of twenty-five years in the mackerel fishery, caught mackerel so far south in the fall as we did on this occasion. The exact date of this last catch I do not now remember, and can only say that it was some time about the middle of November.

1863.—First mackerel in Massachusetts Bay.

The first mackerel were taken in the vicinity of Gloucester May 26.

1863.—Southern mackerel fishery.

There will be but few vessels engaged in this branch of the fishery the present season, owing to the low price of poor mackerel and the great expense which attends fitting out vessels for this business. Salt which sold last year for $2 is now worth $4 per hogshead. Barrels have also advanced considerably; in fact, everything in shape of outfits for mackerel trips has nearly doubled in price. There is but one vessel fitting away at the present time, and we are informed that not more than six vessels at most will prosecute the business this season.—(Barnstable Patriot, June 9, 1863.) In May, 1863, the southern mackerel fleet was reported as doing a good business. The first vessels came into Gloucester June 1; average, 100 barrels each, which sold for $9 and $6.

1863.—Newburyport mackerel fishery.

The mackerel fleet have all arrived with good fares, which have all commanded good prices. We have had fewer vessels in the bay this season than for several years before; we think only eleven. The business had been too poor, the wages and outfits were too high, and there was at one time great danger from Confederate pirates, but the business has been very prosperous to those engaged. Other places have also fewer vessels this season; the aggregate catch, therefore, notwithstanding the success that has attended them, will be small, and consequently the market is very active. The number of barrels packed here will not be far from 6,000. As we are constantly having new markets open for our fisheries, the prices will be likely to advance even upon the present high rates. The last sales were $28 for mess, $12.25 for 1's, $10.25 for 2's, $8 for large 3's, and $5.56 for small 3's. Captain Brown, of the "Sea Spray," considering the time engaged, made the best trip, stocking $6,200.—(Barnstable Patriot, November 17, 1863.)

1863.—Dearth of experienced mackerel fishermen.

In 1863 there was a decided dearth of experienced fishermen at Gloucester and other New England ports on account of the numerous enlistments in the Army. The three hundred vessels fitted out that year for the mackerel fishery in the Gulf of Saint Lawrence were obliged to fill up a large portion of their quota of 4,000 men from green hands.

1863.—Reminiscences of Capt. J. W. Collins.

In the summer of 1863 mackerel were abundant in the gulf of Saint Lawrence and comparatively scarce on the New England coast. In July I started from Gloucester in the schooner "Sea-Witch" on a mackerel trip to the Gulf. We fished about Bank Bradley, North Cape of Prince Edward Island, and the Magdalens, securing a full fare of 250 barrels in four weeks. The last catch of the trip was made off to the eastward of Entry Island, Magdalens; we got more than 60 wash-barrels; not only enough to fill all the barrels we had on board, but also our yawl-boat and every other receptacle we could find which would hold the fish. Returning again to the Gulf on our second trip, we found good fishing off the Magdalens for a few days, when, the mackerel slacking off, we ran down to Sydney, on the east side of Cape Breton Island, where the year previous some of the mackerel catchers had obtained good fares. There we also met with good success, as did the fleet of some 60 or 70 vessels which were fishing in that locality. Again we obtained a full fare of 275 barrels in about four weeks' fishing. After returning home and packing out our mackerel we spent the remainder of the fall, some four or five weeks, in fishing off Cape Ann and Cape Cod, but mackerel being scarce we succeeded in taking only about 30 barrels. The fleet off our own coast engaged in the mackerel fishery that fall compared with that in the Gulf of Saint Lawrence was small and unimportant.

1864.—Harwichport mackerel fishery.

Our mackerel catchers are beginning to report themselves. The following schooners have arrived at Harwich Port: The "Diadem," Robbins, with 90 barrels; "D. Ellis," Baker, 110 barrels; "Prince Laboo," Nickerson, 175 barrels; "E. S. Hammond," Cahoon, 150 barrels; "S. Smith," Taylor, 110 barrels; the "Electric Spark," Godfrey, 125 barrels. Others are expected soon, besides several George's fishermen, which are reported to have good fares.—(Barnstable Patriot, June 13, 1864.)

1864.—Mackerel fishery.

Our bay fleet.—About twenty-five of our bay fleet have arrived since our last issue, bringing full fares, and several fares have been sent home by vessels remaining in Bay Saint Lawrence. The prospects seem good for a fair season's catch. The market is active, mackerel being in demand at prices much in advance of those of any year within the memory of the oldest inhabitant. The expense attending the prosecution of this business is larger by one-half than in ordinary times, all kinds of vessel's gear and supplies of every description being held at enormous rates, and unless good prices for fish are sustained there will be but a small margin for profit. But with present prices and good luck in the way of a catch, we may set the season as a good one.—(Barnstable Patriot, September 13, 1864.)

1864.—MACKEREL FISHERY IN THE GULF OF MAINE.

Mackerel appeared on the coast in great abundance during the early part of the autumn. The crew of the little fishing schooner "Minnehaha," of Swampscott, on the 18th of September, off Boone Island, caught 350 barrels, and the crew of the "Flying Dart," of the same place, at another point, took 130 barrels in some four hours.—(History of Lynn, Lewis & Newhall, p. 478.)

1864.—GULF OF SAINT LAWRENCE MACKEREL FISHERY.

FROM THE BAY.—Quite a number of baymen have arrived the present week, and a large portion of the fleet are on their way home. They report mackerel very scarce for the present month and but little doing. In view of these facts the market has been a little more active for the past week, and quite a number of transactions have been effected at $12 and $15. Shore has also advanced in price, and the prospect now is that still better prices will be obtained the coming month. Mackerel are a staple, and there will doubtless be quite an active demand for them during the fall and winter months. Our fishing firms acted very wisely in not sacrificing their mackerel at panic prices, as we believe they will yet obtain a fair equivalent for them and be enabled to make a very good season's work.—(Cape Ann Advertiser, October, 1864.)

1864.—REMINISCENCES OF CAPT. J. W. COLLINS.

Mackerel have rarely or never been more abundant in the Gulf of Saint Lawrence than they were in 1864, while on the New England coast but little was done in this fishery. I sailed for the bay for mackerel in the schooner "Sea-Witch" early in July, passing through Canso about the 10th of the month. We fished over the same ground that we did on the first trip the previous year, obtaining a full fare of about 275 barrels short of four weeks. We were absent from home five weeks and three days. My own share, exclusive of captain's commission, was $175. We returned again to the bay. Having secured another fare about the last of September, and learning that the prospect on our own coast was poor, we went to the Strait of Canso, where we shipped 200 barrels of our fish on board a freighter and sent them home, while we refitted and returned again to the bay. During the last of September and early part of October the weather was stormy and the mackerel did not appear to take the hook so well as they had previously. A few of the vessels, however, in the mean time, had found very good fishing off Cheticamp, but that locality being so dangerous in the fall, when heavy gales are liable to come on very suddenly, and losses had so frequently occurred in previous years, that the fishermen, as a rule, did not care to take the risk of venturing on that inhospitable shore. For about two weeks after refitting in Canso we did poorly, getting only 60 barrels mackerel, but immediately after we, together with 50 or 60 other vessels, struck a heavy body of mackerel at Margaree, on the north shore of Cape Breton Island. Our vessel was small, being 49 tons, new measurement, but with a crew of ten men we caught 100 wash-barrels the first day at Margaree, while several of the larger schooners, carrying crews from sixteen to nineteen men, secured catches ranging all the way from 100 to 150 wash-barrels. Strong winds and stormy weather prevented us from fishing for a couple of days after this, but in the two or three fine days which occurred during the week we succeeded in obtaining more than enough mackerel to fill all the barrels we had on board. Our catch for the season, from July to October 20, amounted to about 775 sea-packed barrels. Some of the largest vessels of the fleet, which remained in the bay the entire season, landing their fish and refitting at Canso, were reported as catching 1,200 or 1,500 barrels. These vessels, however, began their season's work early in June. The great abundance of mackerel brought down the prices very much in the fall, so that No. 1 fish, which brought more than $20 per barrel at midsummer, were sold for about $14 in November.

In the chapter on "Financial profits of the mackerel hook-fishery," printed above, may be found an account of several large stocks made by vessels fishing in the Gulf of Saint Lawrence in 1864.

1865.—First arrivals from the Bay of Saint Lawrence.

There have been five arrivals from the Bay of Saint Lawrence the present week, all bringing good fares. The mackerel are mostly 3's and will meet with a ready sale, as the market is quite bare. The prospect for a successful season's catch is most encouraging.—(Cape Ann Advertiser, July 21, 1865.)

1865.—Abundance of mackerel on the coast of Maine.—Big catches with a purse seine.

The Portland Argus of Wednesday says that mackerel were never more plenty than at present. A vessel went out last Thursday and secured 110 barrels, returned to Portland, discharged, and was off again on Saturday. On the latter day she secured 120 barrels. They were caught by seining, and the top of the water is said to be literally covered with fish.—(Cape Ann Advertiser, July 21, 1865.)

1865.—Arrival of baymen.—Prices.—The shore fleet.

The baymen have arrived pretty freely the past week, with good fares. The mackerel are mostly poor, and do not bring very remunerative prices. Last season the first trips were sold at $13 and $11 for the large and medium 3's; this year they have been sold for $8.50 and $6.50. Most of the vessels will return home to refit instead of landing their mackerel at the bay, as was the case last year—a project which resulted very unfavorably to those engaged in the business, as the expense of freighting the mackerel home and the bad condition in which most of them were in on their arrival here materially lessened the profits of the voyage. Fat mackerel have not yet made their appearance in the bay. The shore fleet are doing moderately well, and the mackerel are of much better quality than those brought from the bay.—(Cape Ann Advertiser, August 4, 1865.) Twenty-four hundred and three barrels of mackerel have arrived here from the bay this week, having been freighted home. They have found a ready market.—(Cape Ann Advertiser, September 29, 1865.)

The bay fleet have come home along quite freely the present week, some hundred sail having arrived in port, and the balance are now on their way home. Although the weather of late has been such that but few mackerel have been caught, yet the fleet, on the whole, will make very good trips, and the season wind up prosperously for those engaged in the business. Mackerel are now selling at very fair prices (No. 1 at $16.50, No. 2, $13.50), and the prospect is that they will advance rather than decline. The shore fleet have not done much of late, but they may have a streak of luck yet if the weather continues favorable.—(Cape Ann Advertiser, November 3, 1865.)

The baymen have all arrived home, the last of the fleet arriving yesterday. Last year at this time there were 35 sail in the bay, the last vessel arriving as late as the 12th of December.—(Cape Ann Advertiser, November 17, 1865.)

1865.—Abundance of mackerel in Ipswich Bay.

A large school of extra fat mackerel have made their appearance in Ipswich Bay, and the fishermen are paying their respects to them in a most complimentary manner. They are real "bloaters," and fetch the highest price. The weather is all that can be desired, and the fishermen will take every advantage which the season offers. The shore fleet are doing better and the mackerel are working up this way.—(Cape Ann Advertiser, October 6, 1865.)

1865.—Reminiscences of Capt. J. W. Collins.

The year of 1865 was another remarkable season in the mackerel fishery of the Gulf of Saint Lawrence, and in this respect it almost rivaled the previous year. About the middle of June I sailed for the bay in the schooner "Mary Ellen," hailing from Halifax, Nova Scotia, but owned in the eastern part of the province. We caught three fares of mackerel during the summer, making a total of above 900 barrels. The fish during the early part of the year were, as usual, found most plentiful about the North Cape of Prince Edward Island, along the west shore and on Bank Bradley. I recall one occasion, while lying becalmed between North Cape and Point Escuminac, of seeing a remarkable display of schooling mackerel. As far as the eye could extend from aloft, in every direction not bounded by the land, large bodies of mackerel could be seen at the surface of the water like darkened spots on a disk of silver. The previous year I had witnessed such a display on the north side of the eastern point of Prince Edward Island, when, for at least a distance of 20 miles up and down the island, and, perhaps, even farther, mackerel could be seen schooling in great bodies at the surface of the water; their frequent rushing sounding like the noise made by heavy showers striking on the water. For a greater part of the month of August and until the middle of September, in 1865, the weather was extremely rough in the bay, and the mackerel catchers were, in consequence, prevented from fishing a considerable portion of the time, the catch during this period being slight compared with other portions of the season. During the fall an immense school of *biting* mackerel were found on the north side of Prince Edward Island along its entire extent, but more especially in the vicinity of Malpec, where had gathered a fleet of perhaps 300 or 400 sail of vessels. Indeed, so abundant were the mackerel off Malpec in October, and so eagerly did they take the hook, that some of the schooners secured almost a full fare in a few days' fishing. The only trouble was to be able to catch and cure the fish fast enough, and at the same time secure an opportunity of stowing them below. Nearly every vessel in the fleet could be seen with their decks filled with barrels of fish, which were stowed in every available place. Great risks, too, were taken by the fishermen in remaining on the fishing-grounds at night, since at that season a heavy gale was liable to spring up at any time, and should they have been caught on a lee shore in their lumbered-up condition there is no doubt but what the result would have been extremely disastrous. As it was, however, no losses were met with in this case. The last important catches of the season were obtained between the eastern point of Prince Edward Island and the Cape Breton shore, at which time the fish were moving very rapidly to the southward. There can be no doubt but that this school of mackerel could have been followed much farther had the weather not obliged the fishermen to seek shelter.

In the paragraph on the financial profits of the hook-fishery is an account of the "Kit Karson" bringing home to Gloucester 591 barrels of mackerel on her first trip, which she made in about ten weeks. Her net stock amounted to $6,542.

1866.—Reported abundance of mackerel on the New England coast.

Mackerel are reported to be quite plenty. A large fleet of vessels are engaged in taking them. Quite a number of them have been taken in nets by the fishermen in some of the lower Cape towns.—(Barnstable Patriot, June 12, 1866.)

1866.—The outlook for the Bay of Saint Lawrence fishery.

The mackerel fishery in the Bay of Saint Lawrence will be quite extensively prosecuted the coming season, notwithstanding the repeal of the reciprocity treaty. From 30 to 40 sail of vessels will be added to the fleet, and although the business will be attended with considerable risk, yet our fishermen are not scared at trifles; they will keep a sharp lookout for English cruisers and get good trips in spite of them. A few overventuresome ones may get seized, but we believe the most of the fleet will come out all right; strict vigilance will be required, and we think our fishermen will not be caught napping. The mackerel, in the first part of the season, are mostly caught outside of the prescribed limits; but it is in the fall of the year, when the fish play in round shore, that most of the difficulty is apprehended.—(Cape Ann Advertiser, April 13, 1866.)

1866.—The spring fishery.

Quite a large fleet of vessels from this port are now engaged in the menhaden and early shore mackerel fishing, and are meeting with fair success. The early bay mackerel fishery will be quite extensively prosecuted, and the fleet will sail earlier than last season. Several vessels are now fitting away and will leave the latter part of this month. No serious trouble is apprehended from the provincials.—(Cape Ann Advertiser, May 18, 1866.)

1866.—First start of the bay fleet.

The first of the bay fleet sailed on Tuesday and others will soon follow. It is about three weeks earlier than they started last season.—(Cape Ann Advertiser, May 25, 1866.)

Considerable activity now prevails at our wharves in fitting out vessels for the bay. Having finished their George's fishing they are now discharging their ballast and having a general overhauling and painting up, which usually occupies about a fortnight. With the new vessels added to the fleet the present season we shall have about 400 sail in the business (from Gloucester)—the largest number that ever sailed from here. A few of the vessels have already left, and by the last of this month we shall have quite a large fleet in the bay. Some of the vessels will probably make three trips if they are fortunate enough to find mackerel plenty and are not molested by English cruisers.—(Cape Ann Advertiser, June 8, 1866.)

1866.—The southern fleet.

A mackerel fleet of a hundred vessels, with a thousand men, rendezvoused in the harbor of Newport, R. I., last Friday.—(Cape Ann Advertiser, June 1, 1866.)

The fleet of southern mackerel catchers have mostly arrived home with moderate fares. The highest trip we have heard of is 175 barrels, but the fleet will not average more than 150 barrels to a vessel. Good prices are obtained and they will make a fair business of it.—(Cape Ann Advertiser, June 15, 1866.)

The southern mackerel fleet have mostly arrived home with light fares; sales of large and medium 3's at $12.50 and $11.50.

1866.—Scarcity of mackerel in the bay early in the season.

Recent advices from the bay state that mackerel are very scarce and the fleet have done nothing as yet. Last year the mackerel made their appearance there quite early, and the first vessels arrived home about the 1st of July with good fares.—(Cape Ann Advertiser, June 29, 1866.)

1866.—American vessels permitted to fish in Canadian waters on purchase of a license.

The honorable Sir Frederick W. A. Bruce, the British minister, accredited to this government, by an official note of the 24th instant, announces that the Governments of Nova Scotia and New Brunswick have agreed that the possession of a license issued by Canada to fish shall entitle the holder, during the season of 1866, to fish in the waters of New Brunswick and Nova Scotia as well as in those of Canada; the holder of a license from the Government of Nova Scotia or New Brunswick, if any such shall be issued, being entitled to fish in Canadian waters as well as New Brunswick.

The notification is supplemental to one issued early in June, by P. Foster, esq., commanding the Canadian Government schooner "La Canadienne," employed in protecting the fisheries, who was authorized to issue fishing licenses on the payment of 50 cents per ton measurement of the vessel to which they were granted, to remain in force during the season, and conferring the same rights, so far as Canadian fisheries were concerned, as were conferred by the reciprocity treaty to the United States fishermen.—(Cape Ann Advertiser, June 29, 1866.)

1866.—Unusual scarcity of mackerel in the bay, prices, etc.

The baymen have about all sailed, and our warves and railways now present a very quiet appearance. It is full time that some of the early fleet were at home, but as mackerel have been unusually scarce the present season there will probably be few arrivals before August, when business about the wharves will be more lively. Last year most of the fleet arrived home in July with good fares, and many of the vessels made three trips, but the prospect now is that the first fares will be light and prices rule much higher than last season. The shore fleet pick up a few mackerel, and they are readily disposed of at very remunerative prices, which are steadily advancing, showing in very light receipts.

We quote Nos. 1, 2, and 3, at $18, $16, and $13.—(Cape Ann Advertiser, July 20, 1866.)

1866.—First arrival from the bay.

Schooner "Wingaersheek" arrived at Annisquam on Friday last (July 20) from the bay with 313 barrels of mackerel. This is the first arrival of the season, and the mackerel were in good demand. The 2's were sold for $16 and 3's for $13. This is quite an advance over the price obtained for the early trips last year, when they were sold for $11.62 and $8,50. Other vessels are daily expected to arrive, and as mackerel are scarce the trips will be in good demand and bring very remunerative prices.—(Cape Ann Advertiser, July 27, 1866.)

1866.—The bay mackerel fishery.

Since our last issue 14 vessels have arrived from the bay, averaging about 200 barrels apiece. They report seeing plenty of mackerel, but they were rather backward about biting. Most of the vessels that have been spoken have from 150 to 200 barrels, and the prospect for the fall catch is considered very good. Out of nearly 400 sail of vessels in the business, but 20 have as yet arrived home, and during the coming three weeks there will undoubtedly quite a large number arrive to fit away for their fall trips. Some of the fleet, in order not to lose any time, will ship their mackerel home by the steamers and refit from there. Prices have slightly declined the present week, but there are so few mackerel in the market that they will have a tendency to advance rather than decrease in price. Shore mackerel continue scarce, and are in good demand.—(Cape Ann Advertiser, August 10, 1866.)

1866.—A big haul in a purse-seine.

Schooner "Oconee," engaged in shore mackereling, arrived at this port on Monday with 240 barrels of mackerel, which she obtained in three seinings. At the third haul it was estimated that there were 500 barrels in the seine, and the pressure was so great that it burst while drawing it up, and a large portion of the mackerel escaped. They succeeded, however, in saving about 140 barrels, all large and fat. The "Oconee" was absent but ten days, and will make a very handsome stock.—(Cape Ann Advertiser, August 17, 1866.)

1866.—Comparative scarcity of mackerel.

Twenty-one vessels have arrived from the bay since our last issue, making a total of 79 that have thus far arrived home, leaving about three-quarters of the fleet that will make but one trip. There is quite a marked difference in the appearance of our wharves at the present time compared with last season. Here and there a vessel may be seen discharging her mackerel, but most of the wharves have decidedly a deserted appearance. Last year at this time about all of the baymen had arrived from their first trips, and the cullers, coopers, and packers were up to their eyes in business. Should the vessels succeed in getting good trips this fall, they will make a fair season's work if mackerel continue at present prices; but the aggregate catch will fall far short of last year's, and the business prove far less lucrative. The shore fleet have met with rather poor success the past fortnight, and but few mackerel have been landed.—(Cape Ann Advertiser, August 31, 1866.)

1866.—Mackerel in Gloucester harbor.

Mackerel have been quite plenty in our harbor the present week, and the small boats have done a very good business in catching them. Some of them were very large and fat.—(Cape Ann Advertiser, September 7, 1866.)

1866.—Decided advance in prices.

The market continues firm and prices are greatly advanced on those of last season. No. 1 are $6 higher; No. 2 show an increase of $5 and No. 3, $3.75.

About 2,000 barrels (bay) in the market. Last sales at $22.50, $17.50, and $13.25 for Nos. 1, 2, and 3. Shore in light receipt; sales of No. 1 at $22.75.—(*Ibid.*)

1866.—The mackerel fishery.

There have been 42 arrivals from the bay since our last issue, the vessels averaging about 200 barrels apiece. About one-third of the fleet have now arrived home from their first trips, and as the season has now become so far advanced there will probably be but few, if any, more arrivals for the present, as it will be too late to return for a second trip. Mackerel have slightly declined the past week, owing to the late arrivals, but the probability is the prices will again advance, as the stock on hand will not begin to supply the demand constantly being made on our market. Some of the shore fleet have done pretty well of late, but the seiners have not met with very good luck.—(Cape Ann Advertiser, September 14, 1866.)

1866.—Rough weather in the bay.—The fleet expected home.

There have been seven arrivals from the bay the past week, one at Annisquam from her second trip, and six at this port from their first trips. They report very rough weather in the bay the past month, and there is scarcely one day out of a week that is suitable for fishing. The vessels that have arrived home during the past fortnight will not return for a second trip, but will make up their season's work on this shore. The shore mackerel fleet have not done much lately, but there is yet opportunity of doing something next month should the mackerel continue on the coast. * * *

It will be busy times on our wharves next month, as there are upwards of 300 sail of baymen that will probably arrive home during October, and the work of culling, packing, coopering, &c., will call for quite a large force of men.—(Cape Ann Advertiser, September 28, 1866.)

1866.—THE SHORE MACKEREL FLEET.

The shore fleet of mackerel catchers, numbering about 400 sail, have been off the Cape the present week, the mackerel having struck this way. On Saturday last there was pretty good fishing in Ipswich Bay, and some of the vessels did well. There does not appear to be a large body of mackerel off shore, but they cruise in single schools, which is not so favorable for a big catch. On Tuesday afternoon about 100 sail came into our harbor and remained over night, leaving at daylight on Wednesday morning. They report mackerel rather shy, but consider the prospect good.—(Cape Ann Advertiser, October 5, 1866.)

1866.—SUCCESS OF THE SHORE FLEET.

The shore mackereling fleet found very good fishing on Saturday, Sunday, and Monday, in Ipswich Bay, some of the vessels catching as high as 40 and 50 wash-barrels of large fat mackerel. Monday night it commenced blowing heavily, and the larger portion of the fleet came into our harbor, where they remained through Tuesday.—(Cape Ann Advertiser, October 12, 1866.)

1866.—SUNDAY KEEPERS.

About 100 sail of the mackerel fleet, designated as "Sabbath-keepers," lay at anchor on Sunday evening on the verge of the outer harbor, stretching across from Norman's Woe to the Point. At early dawn they made sail and joined the remainder of the fleet off Rockport.—(*Ibid.*)

1866.—HIGH LINE OF THE FLEET.

The schooner "Waterfall," of Southport, Me., claims the flag for being "high line" of the fishing fleet this season. Her fare since the 10th of June last is 810 barrels of mackerel, about two-thirds of which are No. 1's. Whether or not any of the Cape Ann vessels will exceed this remains to be proved.—(Cape Ann Advertiser, October 12, 1866.)

A paragraph is going the rounds of the papers stating that schooner "Lucy J. Warren," of Deer Isle, Me., is "high line" of the bay fleet this season, having landed 846 barrels of mackerel since June 17.

We happen to know of two vessels belonging to this port that have done much better than that, viz, schooner "Electric Flash" has landed 923 barrels of mackerel in two trips to the bay, and the "Wildfire" has landed 875 barrels. The "Electric Flash" consequently has the honor of being "high line" of the bay fleet the present season.—(Cape Ann Advertiser, November 2, 1866.)

1866.—ARRIVAL HOME OF THE BAYMEN.

The baymen have come in quite freely the past week, 93 sail having arrived since our last issue. The vessels that have been absent all the season bring in pretty good fares, but the second trips are rather slim, some vessels bringing in as low as twenty-five barrels. We should judge the aggregate catch would prove full one-third less than last season, but the increase in price will probably make up the deficiency in catch, so that the trips will average about as well as last year. There are now about sixty vessels to arrive, which will close up the business for the season. Prices continue firm at $18 and $16, and the market is quite active.

The prospect now is that the supply for fall and winter consumption will prove far less than the demand, and that prices will advance rather than decline.—(Cape Ann Advertiser, November 2, 1866.)

1866.—REMINISCENCES OF CAPT. J. W. COLLINS.

In the spring of 1866 I engaged in the southern mackerel fishery, in the schooner "Lizzie F. Choate," starting on our trip early in May. We fished principally about the south side of Long Island, from Sandy Hook to Montauk, and in the vicinity of Block Island and Noman's Land. Mackerel that spring were not inclined to take the hook very readily, and therefore we obtained only a small fare of about 45 or 50 barrels. We were absent from Gloucester about four weeks, part of which time was occupied in obtaining a supply of menhaden at Seaconnet River, to be used for mackerel bait in the Gulf of Saint Lawrence during the summer.

After returning from the south we went to the bay, where we arrived about the middle of June. On our first trip we fished almost exclusively between Bonaventure and Prince Edward Island—that is to say, on Bank Orphan and Bank Bradley; off North Cape of Prince Edward Island; along the west shore, from Point Escuminac to Point Miscou, and to a limited degree in the Bay of Cahleur. We succeeded in catching 275 barrels of mackerel, arriving home about the beginning of September. We reached the bay on our second trip on the 13th day of September, proceeding immediately to the Magdalen Islands, where in five days we caught 115 barrels of fine fat mackerel. After that the fish discontinued biting in the vicinity of the Magdalens, and we ran across to the north side of Prince Edward Island, about North Cape and in the vicinity of Malpec, where mackerel were found quite abundant, and where a fleet of about 300 sail had collected. Here we did quite well, so that when we had been in the bay eighteen days we had between 250 and 300 barrels of mackerel. At this time we were off Malpec, and a strong blow from the southwest having come on, we went in there with the fleet (which numbered about 250 or 300 sail) for the purpose of filling water, which we stood much in need of, expecting, as a matter of course, that we would be able to return to the fishing-ground in one or two days at the farthest. The wind came out from northeast on the following day, and continued in an easterly direction almost uninterrupted for nearly two weeks. All of the vessels, including our own, were kept in harbor almost as if we had been in prison. During the time, however, the fleet managed to get out for a few hours on one or two occasions, but an easterly wind springing up before the vessels had an opportunity of getting an offing compelled them to run back again in the harbor, since it would have been extremely hazardous, to say the least, at this season of the year, to have remained out during the night on a lee shore so notoriously dangerous as that on the north side of Prince Edward Island. Though the easterly winds were not so extremely heavy, their long continuance made a heavy swell, which broke with great violence across the bar at the entrance to Malpec Harbor, and rendered any attempt to get out exceedingly risky. On one occasion a vessel which started to pass the bar with a light breeze was carried into such shoal water by the current and undertow that she grounded on the sand, and was only saved from destruction by the efforts of her own and the crews of various other vessels.

While this large fleet was thus kept in harbor, a smaller number of vessels, some 30 or 40, which were around the north cape of the island, succeeded in obtaining a very large catch of mackerel, nearly every one of these vessels getting a full fare in two weeks. By the time the larger fleet was able to leave Malpec the schools of mackerel in that vicinity and about North Cape had evidently departed, and the vessels scattered in different directions, according to the judgment of the several skippers, some of them going to the Magdalens and the others in the direction of the east point of Prince Edward Island and the north shore of Cape Breton. However, by this time it was late in the season, and the weather had become so boisterous that fishing could be carried on only on occasional days. A few good catches of mackerel were obtained about the Magdalen Islands after this, which practically finished the season's work. On the whole, we secured a fare of 315 barrels, and left the bay about the 20th of October. The mackerel caught in 1866 were of large size and of good quality, but were far less abundant than during the previous year.

1867.—The spring mackerel fishery.

The southern mackerel fishery is being prosecuted by the usual number of vessels, and late advices represent the prospect as good. Some of the fleet are landing their mackerel fresh, and obtain very good prices. Mackerel are also reported very plenty off Cape Cod, and some pretty big hauls have recently been made by the Provincetown seiners. The prospect for the shore mackereling fleet is certainly most encouraging.

The bay mackerel fishery will be quite extensively prosecuted the present season, but the vessels will not engage in it so early as they did last year. But few, if any, of the fleet will sail before the middle of June.

There will probably be some 400 sail of vessels employed in the business from this port.—(Cape Ann Advertiser, May 24, 1867.)

1867.—A LARGE BAY FLEET.

Considerable activity now prevails at our wharves and railways, as the early mackerel fleet are getting ready to start, and in about a fortnight quite a number of vessels will be on their way to the Bay of Saint Lawrence. * * *

We shall have the largest fleet of vessels engaged in the bay fishery this season that has ever prosecuted it, and most of them will make two trips. · The shore mackerel fishery will also be extensively prosecuted.—(Cape Ann Advertiser, June 7, 1867.)

1867.—UNUSUAL SUCCESS OF THE SOUTHERN FLEET.

The southern mackerel fishery has proved very successful this season. The fleet have arrived home with good fares, averaging about 200 barrels each. Most of the vessels are now absent on their second trip, and the prospect is said to be very encouraging. It is seldom that the fleet make but one trip out south, but this year mackerel are sufficiently plently in those waters to warrant the undertaking. We learn that one vessel has arrived at Newburyport with a second fare, having landed upwards of 500 barrels on both trips.—(Cape Ann Advertiser, June 14, 1867.)

1867.—THE BAY FLEET.—SCARCITY OF MACKEREL.

Some 50 sail of vessels have left for the bay this week and others will speedily follow. In the course of a fortnight there will be from two to three hundred sail of vessels in the business.

Advices from the early bay fleet represent mackerel rather scarce, and the prospect not very encouraging. The highest trip reported was 50 barrels.—(Cape Ann Advertiser, July 12, 1867.)

1867.—A GOOD SCHOOL ON GEORGE'S.

Mackerel have been quite plenty on George's lately, and those of the fleet who were lucky enough to be there did well. About a dozen vessels have arrived, averaging about 200 barrels each, which were quickly disposed of at remunerative prices.—(Cape Ann Advertiser, August 2, 1867.)

1867.—AMERICAN MACKEREL SCHOONERS FISHING IN THE GULF OF SAINT LAWRENCE REQUIRED TO PAY LICENSE TO THE CANADIAN GOVERNMENT.

In 1867, after the expiration of the "reciprocity treaty," the Canadian Government imposed a tax of 50 cents per ton on all American vessels for the privilege of participating in the inshore fisheries of the Dominion. For this sum a license was granted which, for the purpose above specified, continued good for the year. Afterwards this tax was increased to $2 per ton.

Capt. Fitz J. Babson, collector of customs of Gloucester, Mass., writes: "This tax was considered as an onerous burden by American fishermen, but was submitted to, more in order to prevent capture and confiscation than for the fishing privileges accorded; upon the increase of this tax American vessels generally refused to pay it, preferring rather the risk of annoyance and capture."

1867.—First arrival from the bay.—Reported scarcity of mackerel.

Schooner "Addie M. Story" arrived from the Bay of Saint Lawrence on Tuesday, with 250 barrels of mackerel, having been absent about eight weeks. This is the first arrival of the season. Captain Rowe reports mackerel scarce and the fleet not doing much. The prospect now is that most of the vessels will make but one trip.—(Cape Ann Advertiser, August 9, 1867.)

1867.—Arrivals from the bay.

Seventeen vessels have arrived from the bay since our last issue, making twenty in all this season—less than one-half the number that had arrived last year up to this time. About 3,500 barrels have thus far been landed, which is exceedingly slim doings. The fleet come along very slowly, and the prospect now is that a large proportion of them will make but one trip.—(Cape Ann Advertiser, August 23, 1867.)

Fifty-three vessels have arrived from the bay during the past week, leaving about twenty sail to come. About 12,000 barrels of mackerel have been brought in by the above fleet, averaging 236 barrels to a vessel, most of which have been in the bay all the season, making but one trip. The market is rather quiet the present week and buyers are not disposed to purchase very freely. Holders are firm at $15 for No. 1's, although a few lots caught early in the season have been sold at $14.—(Cape Ann Advertiser, November 8, 1867.)

Forty vessels have arrived from the bay since our last issue, bringing about 8,000 barrels of mackerel.—(*Ibid.*)

Thirty-eight vessels, with a total of 7,000 barrels of mackerel, had arrived from the Bay of Saint Lawrence during the month of August.—(Cape Ann Advertiser, August 30, 1867.)

1867.—Good mackerel fares from George's.

Schooner "B. K. Hough" arrived from George's last Friday and the "Kearsarge" on Monday, with full trips of mackerel. These vessels have made two trips to George's the present season, landing in the aggregate 1,180 barrels of mackerel.—(Cape Ann Advertiser, September 6, 1867.)

1867.—Small catch of mackerel by the bay and shore fleets.

Mackerel still continue very scarce, and the receipts of both shore and bay are very light. The eastern fleet are doing but little, and the prospect of a successful fall catch is anything but encouraging. About 2,200 barrels have arrived from the bay the past week, which have been quickly taken at advanced prices. We quote sales of No. 1's at $21.50 to $21; No. 2's, $13.50 to $13.25. Shore very scarce with slight advance. Least sales of No. 1's at $18.50; No. 2, $13.25. The mackerel catch this season will probably be fully one-third less than that of last.—(Cape Ann Advertiser, September 27, 1867.)

BOYS IN THE MACKEREL FISHING.

James S. McDonald, about fourteen years of age, has caught the present season 36 barrels of mackerel, and James Babson, fifteen years of age, 40 barrels.—(*Ibid.*)

1867.—High line of the mackerel fleet.

The Newburyport Herald states that the schooner "Tanny" takes the palm for this season among the mackerel fleet, having landed 910 barrels, which stocked $13,000.—(Cape Ann Advertiser, November 15, 1867.)

1867.—Review of the mackerel fisheries.

The shore mackerel and seining business has been largely engaged in, but has proved far less remunerative than last year. The southern fleet did remarkably well; but the shore fleet has not done as poorly for many years.

The bay mackerel fishing has proved rather unprofitable the present season. Less than one-third of the fleet have made two trips, and the catch will fall far short of last year.—(Cape Ann Advertiser, November 22, 1867.)

1867.—Reminiscences by Capt. J. W. Collins.

Toward the latter part of May, in 1867, I started on a mackerel trip to the Gulf of Saint Lawrence in the "Lizzie F. Choate." We arrived in the bay about the 1st of June; but, notwithstanding we cruised over all the fishing-grounds usually resorted to at this season, we failed to catch any mackerel until about the middle of the month, and none were taken by other vessels, so far as we could learn, any earlier. Mackerel that year were all large size, as during the two previous seasons, but were apparently not so plentiful as the year before. We fished on the ground usually resorted to in the early summer, but obtained the best catches in the deep water between Bank Orphan and Bank Bradley, where, on one occasion, we took, in a single day, 50 or 60 barrels of mackerel. Having obtained a fare of 300 barrels about the middle of August, we returned home, arriving in Gloucester on the 26th. We packed out our fish and again went back to the bay on a second trip. After arriving in the bay the second time we fished principally about the Magdalens and the north shore of Prince Edward Island, especially in the vicinity of Malpec, and the North Cape of the island. On one occasion during the fall, while fishing near Cascumpec with a large fleet, a smart northwest gale came on very suddenly in the afternoon, and most of the fleet went into Malpec. We also made an attempt to enter the harbor, but owing to the crowded condition of the vessels in the channel and the danger of being injured by a collision, decided to run out again and lay by for the night, which we did. During the night the iron plate on the stem to which our jibstay set up, was carried away and obliged us to go into harbor the following day for repairs. We were detained in Malpec several days on account of the strong winds and stormy weather. After leaving the harbor we ran up toward North Cape, trying the ground with the fleet, but failed to find mackerel in satisfactory numbers. We therefore ran across to the Magdalens, where we continued fishing with indifferent success until well into October. Being caught out in a northeast gale, which came on suddenly one afternoon, we had our sails badly torn, and were obliged to run across the following day to Port Hood for shelter, from which place we proceeded to Canso for repairs and to land a sick man. Leaving Canso, we ran across again to the Magdalens; but not finding any mackerel, returned to Port Hood. In the mean time, during the four or five days while we had been absent at the Magdalens, a fleet of vessels had found mackerel exceedingly abundant about Margaree Island and Cheticamp, on the north side of Cape Breton, and had obtained exceedingly large catches, in some instances almost entire fares having been caught in this short time. The day on which we arrived at Port Hood, with other vessels from the Magdalens, the wind was northeast, blowing a strong breeze, and most of the vessels which had been engaged in fishing along the Cape Breton shore ran into Port Hood for a harbor. On the following day, the wind having changed to the southwest, we, together with many of the other vessels, ran down to the northeastward, along the Cape Breton shore, past Margaree, to Cheticamp, where we found a fleet of about 75 sail of schooners busily engaged in catching mackerel, which were biting eagerly just off the mouth of the harbor. Although we did not reach the fleet until about noon, and had consequently but few hours to fish, we succeeded in taking 75 wash-barrels of fine large mackerel. That night most of the fleet lay to off Cheticamp, preferring to do this instead of anchoring in this one-sided and extremely unsafe harbor. On the following morning it was found that the body of mackerel had changed its position considerably, and the fish were first found off the eastern end of Cheticamp Island some six or seven miles from where they had been taken the previous afternoon. By this time a fleet of 250 sail or more had gathered on the fishing-ground; the wind blew a smart breeze from the southwest, and the mackerel, which were near or at the surface, were moving northeastwardly in the direction of Cape North. The fishermen, feeling that it was their last chance of the season to obtain any fish, made every possible effort to improve the opportunity, and the scene soon became wild and exciting in the extreme. The vessels crowded closely in masses wherever the fish were biting best, the eagerness of the fishermen rendering them in many instances reckless to a fault; booms and bowsprits were carried away; sails were torn; boats smashed up; and in some cases the broadsides of vessels were crushed in, leaving them almost in a sinking condition off a rock-bound and dangerous coast many miles from any safe harbor. Though the mackerel bit very eagerly while alongside the vessel it was impossible to detain them in their onward course for any length of time. The consequence of this was that the vessels were in constant motion, shifting continually to leeward in the direction which the fish were going. Most of the vessels obtained good catches, and we succeeded in taking about 50 wash-barrels during the day. That night a considerable portion of the fleet passed around Cape Breton, but, owing to the strong winds which prevailed for several days thereafter, no reasonable opportunity was offered for pursuing the mackerel any farther, and the vessels were obliged to seek shelter in Sydney Harbor, the season by this time becoming so far advanced that there was no reasonable prospect of any more mackerel for the year; therefore, as soon as the state of the weather permitted, most of the vessels started for home. We arrived in Gloucester early in November with a fare of 375 barrels.

1868.—The spring mackerel fishery.

The southern mackerel fishery will be extensively prosecuted the present season. Some of the fleet have already commenced to fit away, and by the latter part of the month there will be quite a large fleet in readiness to start.—(Cape Ann Advertiser, April 4, 1868.)

The southern mackerel fleet have about all sailed. There are from 40 to 50 vessels in the business this season—a much larger number than have ever prosecuted it before.—(Cape Ann Advertiser, May 8, 1868.)

The prospect of a successful catch of mackerel by the southern fleet is quite encouraging. One vessel arrived at New York on Friday, after two days' absence, with 10,000 mackerel in number; another had taken 50 barrels in a week's cruise.—(Cape Ann Advertiser, May 22, 1868.)

The fishermen are having a lively time of it in Barnstable Bay. On Monday 5,500 mackerel were taken, which were shipped to Boston.

Three hundred barrels of mackerel passed over the Cape Cod Railroad, Tuesday and Wednesday of last week, for New York and Boston, caught by the Cape fishermen.—(Cape Ann Advertiser, May 22, 1868.)

1868.—Increase in the price demanded for license to fish in British waters.

Information has been receved at Ottawa from England that the British Government has agreed to fix the tax on American vessels fishing in Canadian waters at $2 per ton, and that the three warnings heretofore required to be given to American fishing vessels will be dispensed with. * * * Our fishermen would not object to a reasonable tax, but $2 per ton is altogether too much.—(Cape Ann Advertiser, May 15, 1868.)

1868.—First arrivals of the southern fleet.

Two eastern vessels have arrived at this port from the south the present week with about 150 barrels of mackerel each. These are the first arrivals of the season, and the mackerel met with very ready sales. None of the Gloucester fleet have as yet arrived.—(Cape Ann Advertiser, June 5, 1868.)

1868.—Mackerel plenty off Boston.

Mackerel have been quite plenty in the bay (Massachusetts Bay) the past week. The school has mostly tended off Boston harbor, and there has been a large catch. They have been retailed for 3 cents each, and the demand has been quite lively.—(*Ibid.*)

1868.—The mackerel fishery; fitting away of the bay fleet; seining to be tried in the bay.

The George's fishery is now slacking up a little and some of the vessels are hauling off, preparatory to fitting away for the bay of Saint Lawrence. A few of the fleet have already sailed, and by the last of the month there will be quite a number of vessels on their way there. The bay fleet will be quite as large as it was last season. * * *. A new feature will be introduced in this branch of the fisheries this season; that of seining. Some seven or eight vessels are to engage in the business, which it is expected will prove very remunerative. It is an experiment that has never tried, but we see no reason why it should not prove as successful as seining on this shore. Should the vessels which are to engage in it find it profitable, it will no doubt be more extensively engaged in another season.

The southern fleet having had very bad weather through the month of May, are rather backward on their trips this season, and but few of them have arrived home. Another week will probably bring along most of the fleet in time to fit for the bay.—(Cape Ann Advertiser, June 12, 1868.)

1868.—The southern fishery.

Some fourteen sail of vessels have arrived from the south the present week with good fares of mackerel, averaging about 200 barrels ecah.

The mackerel sell readily at remunerative prices (from $6.50 to $9.75), and the business bids fair to prove as successful as last season. Some of the vessels have sailed on second trips, but most of the fleet will fit away for the bay on their arrival home.—(Cape Ann Advertiser, June 19, 1868.)

Schooner "Cyrena Ann" arrived from a southern mackereling cruise on Tuesday, with 325 barrels of mackerel. About 100 barrels of the trip were taken on George's, which were of good size, and the first caught there this season. Captain Elwell has been absent about six weeks, and the vessel will probably stock rising $3,000. This is the best mackerel trip of the season.—(Cape Ann Advertiser, July 3, 1868.)

1868.—A GOOD TRIP FROM GEORGE'S.

Schooner "Maud Muller" arrived from George's yesterday with 200 barrels of mackerel, having been absent about three weeks. She spoke several of the Gloucester fleet on the banks, all of which are doing well.—(Cape Ann Advertiser, July 31, 1868.)

1868.—UNFAVORABLE REPORTS FROM THE BAY.

The reports from the bay are not so encouraging as could be desired. Mackerel are scarce, and the fleet doing little. The catch last season showed considerable falling off from the previous year, and appearances would seem to indicate a light catch this season.—(*Ibid.*)

1868.—MACKEREL ABUNDANT ON GEORGE'S.

The mackerel fleet on George's are meeting with excellent luck of late, and some very good fares have been landed the last week. The mackerel are of good quality, and the vessels are doing much better than those that have gone to the bay. One vessel which started for the bay stopped to try for mackerel on the banks, and returned home on Monday, with 230 barrels. The eastern shore fleet are also doing better of late, and the prospect now is that the home-catch will prove far more remunerative than the bay the present season.—(Cape Ann Advertiser, August 7, 1868.)

EXCELLENT SUCCESS OF ONE OF THE SHORE FLEET.

Schooner "Eureka" is high line of the mackerel fleet from this port, having already landed 800 barrels thus far this season. She has made four trips and her net stock is $904.—(*Ibid.*)

1868.—FIRST ARRIVALS FROM THE BAY.—REPORTED SCARCITY OF MACKEREL IN THE GULF.—PRICES.

Schooner "A. H. Wonson" arrived from the Bay Saint Lawrence yesterday with 200 barrels of mackerel, having been absent nine weeks. This is the first arrival of the season, and is about a week later than the first arrival last year. Captain Webber reports mackerel very scarce, and the fleet not doing much. He heard of no vessel having over 100 barrels.—(Cape Ann Advertiser, August 14, 1868.)

Schooner "Sargent S. Day" arrived from bay, on Wednesday, with 125 barrels of mackerel, having been absent since the 1st of June. This is the second arrival of the season, and rather a poor fare; but there are many of the fleet who have not done as well as this. * * * Last year 38 sailing vessels arrived during the month of August, averaging about 180 barrels each. The scarcity of mackerel causes prices to rule high, and bay 1 sell at $25.25, against $18 last season. The shore fleet bring in some pretty good fares lately, which meet with ready sale.—(Cape Ann Advertiser, August 21, 1868.)

1868.—Arrivals from the bay.

Twenty-one vessels have arrived from the bay since our last issue, averaging about 150 barrels each. The total number of arrivals thus far this season is 41, and an aggregate of 6,000 barrels of mackerel, against 65 vessels and 13,000 barrels up to this time last year—quite a large falling off.—(Cape Ann Advertiser, September 11, 1868.)

1868.—American vessels not troubled by English cruisers in the bay.

Thus far, the mackerel fleet fishing at the bay have not been troubled by English cruisers. There seems to be a good feeling prevalent in that quarter, and the American fishermen catch mackerel whenever and wherever they can prevail upon them to take the hook.—(*Ibid.*)

1868.—Mackerel in Gloucester harbor.

Mackerel made their appearance in our harbor on Saturday for the first time this season. They were of small size. The schools have also shown themselves several times this week.—(Cape Ann Advertiser, September 18, 1868.)

1868.—The baymen.—Doings of the shore and George's fleet.

There have been but few arrivals from the bay the past week, as those of the fleet that intend making two trips have about all arrived home. Several of the vessels which had small fares have shipped them by steamer, and refitted there for a second trip. Less than one-fifth of the fleet will make two trips, and there will be a great falling off in the catch from last season, providing all the vessels get full fares this fall. About 1,000 barrels of shore have arrived the past week, but the George's fleet have done nothing, the mackerel having left the banks.—(*Ibid.*)

1868.—Influence of the mackerel fishery on the welfare of the fishing towns.

The success of the mackerel fleet, both at the bay and off-shore, is looked forward to with deep interest. There is much depending upon the fall catch.—(Cape Ann Advertiser, September 15, 1868.)

1868.—Scarcity of mackerel attributed to bluefish.

Bluefish have been unusually plenty on this coast the present season, and the fishermen attribute the scarcity of mackerel to this fact. They are great destroyers of smaller fish, especially of mackerel, and whenever they come, the "small fry" get away as soon as possible.—(Cape Ann Advertiser, September 25, 1868.)

1868.—Successful catches made by the seiners off the New England coast.—Unfavorable news from the bay.

The weather the past week has been very favorable for the shore fleet, and the seiners have had pretty good luck, some of them taking from 100 to 150 barrels in one day. The mackerel, however, do not take the hook very readily. They are of large size, and if the good weather holds on the fleet will yet have an opportunity of making up a fair season's work. The baymen are picking up a few mackerel when the weather is favorable; but the catch there will not be large, and those vessels that succeed in making even one good trip will be fortunate. Late advices from there are not very encouraging.—(Cape Ann Advertiser, October 2, 1868.)

1868.—Arrivals from the bay.—Slim doings.

Fifty-six sail of vessels have arrived from the bay since our last issue, most of them with light fares. There are upwards of 100 sail yet to arrive, most of which will be along by the middle of the month. So far as we can learn the vessels will average about 150 barrels each, which is rather slim doings for those that have been down there all the season. There will be quite a falling off in the catch—fully one-half.—(Cape Ann Advertiser, November 6, 1868.)

A large portion of the bay fleet have arrived the present week, leaving about 10 sail to come. In consequence of the light catch the market is very active, and fares are sold as soon as landed. Prices are improving, sales yesterday being effected at $22, and the probability is that they will go still higher.—(Cape Ann Advertiser, November 13, 1868.

1868.—Sad results of the failure of the mackerel fishery in 1868.

The mackereling season is rapidly drawing to a close, and with some few exceptions the profits are on the wrong side of the ledger. Everything has been done within the power of mortals to render the season a successful one. The vessels have been on the ground early and late, and in some instances days have merged into weeks without having a real lively catch. This has been exceedingly discouraging, no one can deny. * * *

That there are very many families in this town who have no money wherewith to support life the coming winter, on account of the poor returns of the mackerel season, is also a fact that stares us in the face in these dull and cheerless days of November. * * * The fishermen with families dependent upon them for bread are eager and anxious to be earning. It is no fault of theirs that they have not a balance of two or three hundred dollars whereby to meet the wants of their families. They did their best and failed. Such men are deserving of praise and substantial encouragement. * * *

Let us hope that winter fishing will yield good returns; and it hardly seems possible that there can be another unsuccessful mackereling season to follow in the footsteps of the past three years.—(Cape Ann Advertiser, November 13, 1867.)

1868.—Reminiscences of Capt. J. W. Collins.

During the early part of 1868 I was engaged in the cod fisheries on George's and Western Bank; but leaving this fishery, I started for the Gulf of Saint Lawrence on the schooner "Glenwood" in July. We fished about the north side of Prince Edward Island, on Bank Bradley along the west shore, in the Bay of Chaleur, and about the Magdalens. Mackerel were large, but perceptibly scarcer than for a number of years previous. Having obtained a fare of over 200 barrels, we returned home in the latter part of August to pack out our fish and refit for a second trip to the bay. On our second trip we fished chiefly about the Magdalens, though to some extent off east point of Prince Edward Island and along the north shore of Cape Breton. We obtained a fare of good barrels, and arrived home about the middle of November.

1868.—Mackerel fishery on the French coast.

The mackerel fishing on the French coast is at present exceedingly good. Two smacks have just returned to Dieppe, one with 12,060 fish and the other with 18,525. Also a boat belonging to Boulogne has brought in nearly 18,000.—(Barnstable Patriot, May 12, 1868.)

1869.—American vessels in the Gulf of Saint Lawrence.

The following statement of the number of fishing vessels in the Gulf of Saint Lawrence mackerel fishery and the American shore mackerel fishery, was submitted by David W. Low to the Halifax Commission:*

	Barrels.
194 vessels in Gulf, average catch 209 barrels	40,546
151 vessels off shore, average catch 222 barrels	33,552
Mackerel caught by boats and some eastern vessels, packed in Gloucester	19,028

*Documents and Proceedings Halifax Commission, 1877, U. S. edition, p. 2595.

1869.—MACKEREL FISHING IN CAPE COD BAY.

Three thousand mackerel were taken in the last weir at Provincetown in two nights.—(Provincetown Advertiser, June 23, 1869.)

1869.—FALL FISHERY IN CAPE COD BAY.

M. L. Adams caught, on Thursday morning in his weir, eight tons of mackerel, and Thursday evening, 2,200 mackerel.—(Provincetown Advertiser, November 10, 1869.)

1869.—HIGH PRICE FOR MACKEREL.

Bay mackerel have advanced to $28 per barrel, $1.10 more than they sold for last year at this time.—(Cape Ann Advertiser, April 30, 1869.)

1869.—FRESH MACKEREL IN BOSTON.

Fresh mackerel have made their appearance in Boston market the past week, and are selling for 30 and 35 cents apiece.—(Cape Ann Advertiser, May 7, 1869.)

1869.—GOOD CATCHES OF THE PROVINCETOWN GILL-NETTERS.

The several Provincetown mackerel fishermen, which have been rendezvousing in Barnstable Harbor, have been very successful the past week. On some days they have averaged 2,000 [mackerel] to a boat. They are taken by nets.—(Cape Ann Advertiser, May 14, 1869.)

1869.—EARLY APPEARANCE OF MACKEREL OFF CAPE ANN.—GOOD CATCHES BY THE SEINERS.

Mackerel have been quite plenty off this shore the past week, and the seiners have made some pretty good hauls. One vessel belonging to this port took as high as 120 wash-barrels on Monday; and others from 20 to 50 wash-barrels. None of the southern fleet have as yet arrived. One Gloucester vessel has been into New York with a small fare which were sold for $500. Mackerel are earlier than usual offshore this season, and the prospect for the home fleet is very encouraging.—(Cape Ann Advertiser, May 28, 1869.)

1869.—FIRST ARRIVALS FROM THE SOUTH.—PRICES.

Schooner "Hattie Lewis" arrived at this port on Saturday, from the south, with 205 barrels of mackerel, and the "Northern Light" on Wednesday with 50 barrels. Yesterday the schooner "Colorado" arrived with 250 barrels, and others of the fleet are daily expected. These are the first arrivals of the season, the mackerel selling for $8 and $10 per barrel. The reports from the fleet do not indicate a very heavy catch thus far, but there is yet time for the vessels to make fair trips before fitting for the bay.—(Cape Ann Advertiser, June 4, 1869.)

1869.—Big catch in a weir at Cape Cod.

About 100,000 mackerel were taken in the "Philip Smith weir," at Eastham, week before last, netting the owner about $7,000. So says the Barnstable Patriot.—(*Ibid.*)

1869.—Effect of the reciprocity treaty on Nova Scotia.

The Halifax Chronicle, in speaking of the great need of a reciprocity between the Dominion and the United States, has the following significant article:

Our rulers should have common sense enough to cease prating about the Dominion dignity, and to make some strong effort to renew the reciprocity treaty, the abrogation of which has reduced this country and the other maritime provinces to a state of comparative destitution. From the making of the reciprocity treaty until its abrogation, Nova Scotia increased in wealth and population at a most extraordinary rate; from its abrogation until the present we have retrograded with the most frightful rapidity. Want of a good market has depreciated the value of our coal mines, has nearly pauperized our fishermen, farmers, and miners, and should this want not be supplied in the only way it can be, by a new treaty with the United States, Nova Scotia will in five years be one of the least desirable countries to live in on this continent.—(Cape Ann Advertiser, July 2, 1869.)

1869.—The bay fishery.—Good catch on George's.

A dispatch was received in town on Monday by the owners of schooner "Finance," stating that she had landed 260 barrels of mackerel. Some good fares of mackerel have also been taken on George's lately.—(Cape Ann Advertiser, July 30, 1869.)

1869.—First arrival from the bay.

Schooner "Carleton" arrived from the bay on Wednesday, with 300 barrels of mackerel. This is the first vessel that has arrived from there this season. The "Carleton" made her trip in less than six weeks.—(Cape Ann Advertiser, August 20, 1869.)

1869.—Arrival of the baymen.—Inferior quality of bay mackerel.—Prices.—Success of the shore fleet.

The bay fleet have not come along very freely the present week, but nine vessels having arrived since our last, making 22 in all that have arrived thus far this season. The fares average about 250 barrels, and the mackerel are of fair quality, but not so fat as those caught on this shore, and do not bring so good prices. Bay ones have been sold the present week for $18 per barrel, $4 less than the first trips that were brought in. Some of the fleet have shipped the mackerel home by steamer and refitted in the bay for another trip in order to save time, and the prospect for the fall catch is considered very good. A large portion of the fleet went into the bay late in July, and will make but one trip. The shore fleet are doing fairly of late, and the mackereling season bids fair to be a successful one.—(Cape Ann Advertiser, September 10, 1869.)

1869.—High line of the bay fleet.

Schooner "Finance," of this port, has recently landed her second fare of mackerel, 250 barrels, at Charlottetown (Prince Edward Island), making in all 510 barrels landed thus far. On her last trip she took 130 wash-barrels in one day. She is now out on her third trip, and bids fair to make a great season's work.—(Cape Ann Advertiser, September 17, 1869.)

1869.—Success of the Wellfleet schooners.

The mackerel catchers of Wellfleet have done remarably well. Sixteen thousand barrels have been landed on the wharves, and 3,500 barrels are now afloat.—(*Ibid.*)

1869.—The baymen.

Seven of the bay fleet have arrived since our last issue, bringing about 1,700 barrels of mackerel.—(*Ibid.*)

1869.—Great disaster to the shore mackerel fleet.

A terrific hurricane swept the coast of New England on the 8th of September, causing great loss of life and property in the mackerel fleet. The gale came on so suddenly and unexpectedly that the vessels were not able to reach a harbor in time to escape its fury, and being caught on a lee shore many of them were driven ashore. The Cape Ann Advertiser of September 10 and 17 gives detailed accounts of the losses.

1869.—Small fall catch in the bay.—Light fares brought home by baymen.

The prospect in the bay in the early part of the season for a successful catch of mackerel was most excellent, as many of the vessels obtained good fares on their arrival there; but the September catch fell off amazingly, and for the past month the vessels have done nothing at all.—(Cape Ann Advertiser, October 28, 1869.)

The bay fleet have mostly arrived home, there being but about forty sail now absent. The fares brought in are very light, ranging from 20 to 100 barrels, and the market is quite firm at advanced prices. No. 1's are selling the present week at $25 per barrel, and No. 2's at $15.

Shore mackerel are out of the market. The last sales of No. 1's were made at $26.—(Cape Ann Advertiser, November 12, 1869.)

1869.—REMINISCENCES OF CAPT. J. W. COLLINS.

Having spent the greater part of the fishing-season in the pursuit of codfish on George's, Western Bank, Cape North, and the Gulf of Saint Lawrence, I did not engage in the mackerel fishery in 1869 until August, when I went to the bay in the "Glenwood." We fished principally about the Magdalens and along the west shore between Escuminac, Point Miscou, and off the North Cape of Prince Edward Island. The best catch of mackerel which we obtained was in Miramichi Bay, eight or ten miles off shore, about the middle of September. At this time we had taken, in three or four weeks' fishing, 140 barrels of fine large mackerel, notwithstanding the fact that these fish were still less abundant than they had been the previous season. A strange thing occurred in the mackerel fishery of the Saint Lawrence in the fall of 1869, since the mackerel appeared to leave the bay much earlier than usual. After the middle of September but few fish were obtained by any of the fleet, and none secured large catches. Though we remained in the bay until the middle of October or later, and made every effort to catch fish on all of the principal grounds, yet we succeeded in taking only five barrels in addition to what we previously had, and this amount was a fair average for the fleet. Some four or five vessels, as it was reported, caught 30 or 40 barrels each off the North Cape of Prince Edward Island about the last of September or beginning of October; but, so far as I was able to learn, no other catches of importance were made after the middle of September. The vessels that went to the bay early enough to obtain reasonably good fares before the mackerel left the fishing-grounds were partially remunerated for the loss of time by the advance in the price of the fish, which resulted from the small catch.

1870.—SMALL NUMBER OF NEWBURYPORT VESSELS ENGAGED IN THE SOUTHERN MACKEREL FISHERY.

The Newburyport Herald of the 29th ultimo says: "The southern fleet will be remarkably small this season, some of the vessels which usually go south engaging in the herring fisheries at the Magdalen Islands. This business is thought by some to be more profitable than the early mackereling trips."—(Gloucester Telegraph, May 7, 1870.)

1870.—SUCCESS OF THE GILL-NET FISHERY IN BARNSTABLE BAY.

The Cape Cod Gazette says: "Six mackerelmen have been doing a brisk business in meshing mackerel in the bay off Sandwich."—(Gloucester Telegraph, May 18, 1870.)

SUCCESS OF TWO "SOUTH-SHORE" VESSELS.

Schooner "Isaac Somes," of Harwich, with a crew of 19 men, has landed this season 1,800 barrels of mackerel; stocked, $15,875; average stock among the crew, $886.

Schooner "Mary B. Taylor," of the same port, with a crew of 23 men, landed 1,912 barrels of mackerel; stocked, $17,400; average stock among the crew, $756.30.—(Gloucester Telegraph, November 23, 1870.)

1870.—Notes on the southern mackerel fishery.

A Newport correspondent says that "the mackerel fleet as yet, according to the most reliable news, have done but a slim business. Some 30 sail of vessels were at Newport on the 17th instant, ready to proceed to sea, having obtained bait from the Vineyard Sound fish weirs."—(Gloucester Telegraph, May 25, 1870.)

1870.—First arrival from the south.

The schooner "Geo. S. Low" is the first to arrive from the southern mackereling grounds, bringing 190 barrels of mackerel of good quality for the season.—(Gloucester Telegraph, May 28, 1870.)

1870.—Success of the southern mackerel fleet.

The southern mackerel fleet are meeting with a very fair success. There have been four arrivals at this port, bringing good fares. Nantucket reports an arrival with 137 barrels, and the Newburyport fleet have averaged over one hundred barrels each so far this season.—(Gloucester Telegraph, June 4, 1870.)

1870.—Reported small catch of mackerel in the Gulf of Saint Lawrence.—Profitable shore fishing.

News from the Bay of Saint Lawrence indicates that the mackerel catch has been small so far this season, although large schools are reported in the waters about Prince Edward Island. The shore mackereling business continues to prove profitable, and this, with the troubles in the bay, will have a tendency to diminish the number of vessels pursuing the bay fishing this season.—(Gloucester Telegraph, July 16, 1870.)

1870.—Abundance of mackerel in Gloucester Harbor.

A school of mackerel was in our harbor yesterday. They took to the hook well, and good fares were secured by anything in the shape of a boat.—(Gloucester Telegraph, August 10, 1870.)

1870.—Fishing in Massachusetts Bay.

The Yarmouth Herald, of last Friday, says: "Mackerel are taken in considerable quantities in our bay, and cod and bass in our weirs."—(Gloucester Telegraph, May 18, 1870.)

On Monday of last week the Swampscott fishermen made a good haul of mackerel off Egg Rock. One schooner took a fare of 80 barrels, another of 75, and six others made good trips. Some of the drag-boats brought in from six to eight hundred mackerel apiece from their net-fishing.—(Gloucester Telegraph, June 8, 1870.)

1870.—FALL FISHING IN BARNSTABLE BAY.

The Provincetown netters last week caught considerable quantities of mackerel in Barnstable Bay; 25,000 were sent to Boston by the steamer on a recent trip.—(Gloucester Telegraph, November 23, 1870.)

1870.—SPRING MACKEREL FISHERY.

Mackerel are finding their way along the coast in considerable numbers. On Friday one of our fishing schooners arrived with a fare of 35 barrels which had been taken that day in her seine. The mackerel were large and handsome, though not fat.—(Gloucester Telegraph, May 25, 1870.)

1870.—FISHING IN MASSACHUSETTS BAY.

Mr. William Stone, of Swampscott, had unusually good luck in his net-fishing week before last, making, including Monday's and Tuesday's catch, over $200 by the sale of mackerel landed by himself from a dory during eight days. On Tuesday he caught over 500, which netted him 6 cents apiece.—(Gloucester Telegraph, June 15, 1870.)

1870.—SPRING MACKEREL FISHERY IN CAPE ANN BAY.

The fishermen at Scusset one day last week took 15,000 mackerel.—(Barnstable Patriot, May 31, 1870.)

1870.—FIRST MACKEREL IN MASSACHUSETTS BAY.

Capt. Miles Blanchard, of Swampscott, caught some fine mackerel in the bay on Friday, the first of the season.—(Gloucester Telegraph, May 18, 1870.)

1870.—THE MACKEREL FLEET.

On one occasion 625 mackerel schooners were anchored in the harbor at Gloucester.

1870.—THE MACKEREL FISHERY.

The Portland Press of the 10th says that for ten days past the mackerel fleet had not met with a single mackerel until Friday morning, when they encountered great schools of them about 80 miles off the Cape. They had great luck, and for the next week we may expect they will spend the nights with us. The harbor is packed with their vessels; some 400 sail arrived in the harbor yesterday afternoon, presenting a splendid sight as they came past the breakwater under full canvas at race-horse speed.—(Gloucester Telegraph, September 14, 1870.)

1870.—THE MACKEREL FISHERY OF THE GULF OF SAINT LAWRENCE.

A fishing schooner arrived at Booth Bay on Sunday from the Bay Saint Lawrence with a fare of 380 barrels of mackerel.—(Gloucester Telegraph, October 15, 1870.)

1870.—Success of the Swampscott market fishermen.

One of the Swampscott fishing vessels, last week, with a captain and three men, caught more than 4,000 mackerel, some of which were sold on the beach for 20 cents each. Another caught 4,800; another, 4,000; one man alone, 900; a man and his son, 1,600; another man and his son, 1,400; and a single man and his dory, 800.—(Gloucester Telegraph, October 19, 1870.)

1870.—Gill-netting at Dennis.—New York prices for fresh mackerel.

The mackerel-netters of Dennis made one or two good hauls, and but for the unfavorable weather last week would have done well, the prices of fresh mackerel in New York being from 18 to 20 cents apiece.—(Gloucester Tel graph, November 23, 1870.)

1870.—The mackerel fishery from Gloucester.

Fifty-nine vessels pursued the southern mackerel fishery in the spring, seven of them making two trips. Good fares were secured and the fleet was free from accident. The shore mackerel fleet was unusually large during the summer months, and proved successful. One vessel was lost in the business, the schooner "Day Star," 40.46 tons burden. The bay fleet was a very small one, owing to the difficulties apprehended and experienced from the course pursued by the Dominion authorities. This business met with serious embarrassments by the seizure of four of our vessels and the threatened seizure of others, and the business as a whole did not prove profitable.—(Gloucester Telegraph, November 19, 1870.)

1870.—General discussion of the mackerel fishery.

The southern mackerel season was closed up during the early part of the month of July, eight vessels arriving home from the south during the first ten days of the month, six of which were from a second trip. The whole number of vessels reported as making southern trips in pursuit of mackerel this season was 59, of which number seven made two trips each. These vessels met with a very fair success, and found a ready market for their catch on their arrival home.

The eastern mackerel fishing was actively pursued during the month. and a large proportion of the fleet secured excellent fares. The number of fares landed at this port in July was about 80, and the market has been quite active, and the stock has been kept well reduced. Some 20 vessels have also been engaged in seining along the eastern shore, ostensibly for porgie bait, but some of them have made good hauls of mackerel in their seines, and have made good trips.

The Bay of Saint Lawrence fleet has been constantly augmented, and so far as is known has been free from molestation by British cruisers of late. The fleet now in the bay is quite respectable in point of numbers, though probably not as large as the last few years.—(Gloucester Telegraph, August 6, 1870.)

The shore mackerel fishing is now at its height, and employs a large fleet from the Cape Ann and Cape Cod fishing towns. During the month of August 117 Gloucester vessels were reported as arriving from mackereling cruises east, 11 of which arrived twice, making a total of 128 fares of shore mackerel landed at Gloucester in August, against some 80 fares in July. Besides these, 17 vessels engaged in seining arrived during the month, many of which had secured good fares of mackerel. There were 20 arrivals from seining in July. The fleet has met with good success, although as a rule the mackerel have not been of a very good quality. The last week or two, however, has shown an improvement in the quality of the smaller grades, and the disparity of prices between the ones and twos will probably soon be lessened. No. 1 mackerel have commanded good prices, ruling from $22 to $26 per barrel for shore, but most of the 2's have been closed out at $9.75 per barrel, and 3's have ruled at $6 per barrel since the 1st of July. The arrivals from the bay have not been numerous. Only 10 vessels have arrived here this season, and these have met with a moderate success, averaging about 200 barrels each. The bay mackerel received have been of good quality, and sold at $24 to $25 per barrel for No. 1's; $12.50 to $13 for 2's, and $10.50 for 3's.

Last year the number of arrivals from the bay to this date was 13. In 1868 only 8 vessels arrived in August. In 1867 there were 51 arrivals, and in 1866 84 arrivals from the bay previous to this date. The average fares of the bay fleet arriving previous to September, last year, was about 290 barrels. The Portland fleet are doing about the same as the Gloucester vessels, 13 arrivals having been reported, with a total catch of 2,384 barrels.

Letters received at Newburyport state that 9 vessels belonging to that port had fares on the 15th ultimo ranging from 20 to 110 barrels, and averaging 55½ barrels each, and there has been one arrival from the bay, at Newburyport, with only 80 barrels. Three vessels have arrived at Booth Bay from the bay, averaging less than 150 barrels each.—(Gloucester Telegraph, September 3, 1870.)

1870.—Reminiscences of Capt. J. W. Collins.

In the summer of 1870 I started on a mackerel trip to the Gulf of Saint Lawrence, about the middle of June, in the new schooner "Alice G. Wonson." We reached the fishing ground about the 25th of June. The mackerel in the Gulf of Saint Lawrence were large, but very scarce, and they did not seem to fatten so rapidly as in previous years. We returned home in August after an absence of eight or ten weeks, with a fare of 175 barrels of mackerel, which brought a high price, our No.

1 fish selling for $22.50 per barrel. After packing out our bay trip we engaged in the mackerel fishery off the New England coast, fishing all the way from Mount Desert Rock to Cape Cod, though we caught but few mackerel east of Monhegan. The fish off our own shore in 1870 were of medium size, the greater portion packing for No. 2's. Mackerel were abundant, but did not seem inclined to take the hook very readily until they began moving to the westward along the coast toward Cape Ann and Cape Cod. Good catches were obtained off Boone Island, Ipswich Bay, and in Massachusetts and Barnstable Bays. We made two trips off shore, securing a catch of about 300 barrels.

1870.—The mackerel fishery of the Saint Lawrence.—Hostilities of Canadians causes loss to American vessels.

The following extract from the Gloucester Telegraph shows the condition of the Bay of Saint Lawrence mackerel fishery during the year 1870:

"The Bay of Saint Lawrence mackereling season has closed, and the ill success of this branch of our industry is apparent at a glance. The hostile attitude of the Dominion Government had a tendency to deter many vessels from engaging in this fishing, so that the early fleet in the bay was quite small, and the success of the shore fleet later in the season tended to still further decrease the number of vessels engaging in the bay fishery, so that our fleet was smaller than for many years. The whole number of vessels reported as making bay trips this year is but 80, only three of which made two trips each, and none were allowed to ship mackerel home; whereas, last year, there were 194 vessels employed in the bay fishery, 21 making two trips, and 33 shipping their early trip home, and refitting in the provincial ports.

"Four Gloucester vessels were seized this season by the Canadian authorities on the pretense of unlawful fishing; one of these was released under a bond to pay whatever damages were found by the courts; one was condemned and repurchased by her owners at a cost of nearly $3,000, and two remain in the hands of the provincials."—(Gloucester Telegraph, November 16, 1870.)

1871.—Lack of interest in the mackerel fishery exhibited by Canadian fishermen.

Mackerel Fishery.—Gaspe division.

"In a special report on the duties performed by 'La Canadienne' in connection with the marine police, I shall have the honor of speaking of mackerel fishing by foreign schooners. This pursuit is not much followed by our own fishermen, and has steadily decreased since 1869. The fish did not come near the shores, and not more than 100 barrels were caught in Bay des Chaleurs. It was more abundant in Gaspe Bay, the catch being 400 barrels over that of last year. Cod-fishing is the main occupation of the people in this division. This fish was so abundant, and the price of mackerel so low, that this may account for their not attending to the latter."—(Report of the cruise of the government schooner "La Canadienne," in the River and Gulf of Saint Lawrence, for the season of 1871, under command of N. Lavoie, esq., fishery officer. Annual report of the department of marine and fisheries, for the year ending 30th June, 1871, Appendix C, pages 19, 20.)

WATSHEESHOO DISTRICT. *Felix Sylvestre, overseer.*

"Mackerel abundant, but the fishermen of this division do not follow this fishing."—(Synopsis of fishery overseers' and guardians' reports in the Province of Quebec, for the season 1871. Annual report marine and fisheries, 1871, Appendix H, page 72.)

MOISIE DIVISION. *F. Thivierge, overseer.*

Mackerel were abundant. The fishermen in this division do not, however, in general, follow this fishing, but one man took 64 barrels.—(*Ib.*, p. 71.)

PABOS DIVISION. *James M. Remon, overseer.*

In the mackerel fishing nothing is done beyond taking what is required for bait.—(*Ib.*, p. 67.)

ANTICOSTI DIVISION.

"Although mackerel are very abundant around the island they are not much sought after, and only 20 barrels were caught at Salmon River."—(Report of N. Lavoie, commander government schooner "La Canadienne," of a cruise in the River and Gulf of Saint Lawrence, 1872. Annual Report, marine and fisheries of Canada, 1872, Appendix B.)

1871.—INFERIOR QUALITY OF MACKEREL TAKEN IN CANADIAN WATERS.

The following is taken from letters furnished by the county overseers of Nova Scotia to Mr. Rogers, the fish-officer of the province:

"I am happy to be able to report a very large increase in the quantities of almost all kinds of fish taken this year, and although prices have ruled much lower for most descriptions, the aggregate value is more than one million dollars over the previous year. Mackerel, particularly, show a very large increase, but being mostly the early runs, they are inferior in quality."—(Report of W. H. Venning, esq., inspector of fish for Nova Scotia and New Brunswick. Annual report marine and fisheries, 1871, Appendix N.)

1871.—BAD SEASON FOR MACKEREL IN THE GULF OF SAINT LAWRENCE.

These fish struck in on our shores about the middle of June in large quantities, and the first catches were taken in a very short time, some vessels taking 200 barrels in three weeks; but the fish were poor, not making more than *threes* when culled. After that the catch was moderate, and I do not think that more than 30,000 barrels of mackerel were taken by the whole fleet. It has been a bad year for mackerel, the market prices, as a rule, being one-half below the average prices, and great numbers of American vessels were laid up by their owners, for the reason that the outlay required for fitting the vessel out for fishing being more than the proceeds of the summer work.—(G. V. Story, commander marine police schooner "Water Lily," Pictou, November 27, 1871.)

THE MACKEREL FISHERY.—The Gloucester Telegraph says that the latest news from the Bay of Saint Lawrence reports a large number of American vessels on the fishing-grounds between Saint Margaret's and East Point, with mackerel scarce at the time. At Rustico mackerel catching was slack, and had been for a fortnight, though the few caught were larger than the earlier school. Mackerel were reported plenty at Port Daniel and East Point. All the fish were east of Rustico, and the Cascumpec boats reported neither codfish nor mackerel west. Sixty sail of vessels were reported at Magdalen Island on the 3d instant, with mackerel scarce, and reports from Bradley's, three days later, represent fish "few and far between."—(Boston Journal, August 26, 1871.)

1871.—REAPPEARANCE OF MACKEREL ON THE LABRADOR COAST AFTER FORTY YEARS' ABSENCE.

"Mackerel, which for the last 40 years had disappeared from the waters of the coast of Labrador, returned this season and in as great abundance as formerly. I have seen as many as 400 or 500 barrels caught in one haul of the seine at Bonne Esperance and Meccatina. Several schooners loaded at Seven Islands. Mackerel remained two months in the bay during the winter. A much larger quantity than was needed for their own use was caught at several ports along the coast, but prices were very low. There is no doubt that if codfish and mackerel continue to visit the waters of this division in as large numbers as they did this year, the coast of Labrador will assume an importance which may become superior to that of the Gaspe division."—(Report of the cruise of the government schooner "La Canadienne," in the River and Gulf of Saint Lawrence for the season of 1871, under command of N. Lavoie, esq., fishery officer. Annual report of the department of marine and fisheries for the year ending 30th June, 1871, Appendix C, page 26.)

1871.—ABUNDANCE OF MACKEREL AT SMALL POINT, ME.

The Bath (Me.) Times says that on Thursday, Small Point Harbor was thronged with mackerel, the like of which was never known, and countless thousands of them were caught in seines, nets, and with hook and line. One fishing vessel secured a thousand barrels. Other vessels got several hundred barrels, and the citizens in that vicinity made free with that "school" without consulting the teacher.—(Germantown Telegraph, August 16, 1871.)

1871.—NOTES ON THE MACKEREL FISHERIES, ETC., OF THE PROVINCES OF NEW BRUNSWICK AND NOVA SCOTIA.

In his report for 1871 Mr. Venning states that Mr. John Fitzgerald, overseer for the western district, says: "The mackerel was more productive this year than it has been for the last ten years, but the quality was very poor. The fall mackerel have been a total failure; and as this fish, if of first quality, would bring a high price, the loss has been seriously felt by the fishermen. The mackerel that have been caught this year have brought a very low price, but when the large quantity taken is considered, the fishermen have no reason to complain."

Mr. Daniel Dimock, overseer for the eastern district of Lunenburg, says: "The shore fisheries in this district have been productive, more especially the mackerel."

In same report, Mr. Venning also stated that, "Overseer James A. Tory, of Guysborough County, says with reference to his district: 'The fisheries as a whole have been good this season, especially for mackerel, and although prices have ruled low they will compare favorably with the past.'"

In same report Mr. Venning further states that, "Mr. Francis Quinan, the officer in charge of Cape Breton County, reports as follows: 'The total quantity of fish taken is considerably above that of former years. The run of mackerel was abundant, but of small size; the large brands were conspicuous by their absence; No. 3's ruled, and of their kind were good, but the price realized in our markets was less than in years past.'"—(Report of W. H. Venning, esq., inspector of fisheries for Nova Scotia and New Brunswick. An. Rep. Mar. and Fish., 1871, Appendix N.)

1871.—THE MACKEREL FISHERY.

The Cape Ann Advertiser of September 1 gives the following account of the mackerel fishery in 1871:

"THE FISHERIES.—The bay fleet come along slowly. There have been but eleven arrivals thus far, the vessels averaging about 300 barrels each. The quality of the mackerel is not as good as those taken off this shore, and but few number ones have as yet been landed, but the catch of the present month and next will, no doubt, average much better. Prices rule low, considering the small number of barrels landed this year, and it will require pretty large fares to realize a paying season's work. Late advices from the bay report mackerel scarce.

"The shore fleet have done rather a slim business the past month. Some of the seiners have made some good trips, but the hookers, with a few exceptions, have done very poorly, the mackerel not inclining to bite. Had it not been for the seiners the market would have been bare of shore mackerel; as it is, the catch has not been half as large as it was up to this time last year. The mackerel average mostly ones and are very large and fat, the quality being much better than those caught off this shore last year, but the prices rule much lower. No. 1's are selling the present week for $11.25 per barrel, less than one-half the price they brought at this time last year. Unless mackerel come in more freely than they have, the season's catch will be light and prices must necessarily advance.

"The George's fishery has been prosecuted through the season by a much larger fleet than usual, and most of them have realized very good fares. The catch is greatly in excess of that of last year, and although the prices have not been as remunerative, still the increase in catch will more than make up the difference, and the vessels engaged in this branch of the fisheries will make a very good season's work.

"The Grand Bank halibut fleet have brought in rather light fares of late, and prices have ruled low. About thirty sail of vessels are now engaged in this branch of the fisheries, and the business, as a whole, has proved but moderately successful." (Boston Journal, September 22.)

"BAY SAINT LAWRENCE MACKEREL FISHERY.—The mackerel fishery for this season is rapidly drawing to a close. The shore fleet are doing but little, and may soon be expected in our waters for a week or two, preparatory to winding up the business for the year. The news from the bay indicates a scarcity of mackerel, and, as rough weather may soon be expected, a large portion of the fleet will soon be along. The number of arrivals from the bay reported at Gloucester this season has been fifty-two. The fares have been comparatively small, and the quality poor, while prices have ruled much lower than the past few years. The fares of 31 Gloucester vessels have been reported, ranging from 160 to 450 barrels, and averaging 247 barrels, which will probably be about the average of the fleet. Sixteen of the Portland fleet show an average of 211 barrels, and 11 of the Newburyport fleet show an average catch of 192 barrels. The average catch of the fleet from other fishing towns, so far as reported, is equally small; Booth Bay 227 barrels, North Haven 160, Wellfleet 140, Belfast 110, and New London 235. A Salem vessel has landed 307 barrels, and one Frankfort vessel is reported with a catch of 312 barrels and another with 620. Nineteen vessels reported at Port Mulgrave show an average catch of 200 barrels." (Gloucester Telegraph, August 27.)

1871.—FALL MACKEREL FISHERY IN CAPE COD BAY.

Dennis.—On Wednesday a. m. (8th) the fishermen took 300 to 800 mackerel each in nets.

Barnstable.—Smith Bros. caught 1,200 yesterday (14th).—(Provincetown Advertiser, November 15, 1871.)

1871.—In the Cape Ann Advertiser, of July 28, are the following remarks upon the mackerel fishery:

"The mackerel season has now commenced in earnest, and good returns are anticipated, as the season bids fair of being a prosperous one. The prospect at the bay is very encouraging, many of the fleet having already landed good fares. American vessels are subject to the same treatment as last year, if caught fishing within the limits; but they have liberty to ship mackerel home, and purchase supplies this season, which will greatly add to their chances of making a good year's work.

"The skippers will undoubtedly keep a sharp lookout and give the Dominion cruisers a wide berth, and we do not anticipate any difficulty in those waters at present. Later in the season, when the mackerel tend in shore, it may be a little more difficult to obtain a fare, but we do not believe that the Dominion cruisers intend to annoy American fishermen in the manner which characterized last season.

"The treaty has not been signed by the Dominion Government as yet, consequently it will not take effect this season. It is evident that the price of mackerel will not rule as high as last year, which will tend to bring about quick sales, as people can afford to eat these fish when the price is brought within their means, and the prospect for a lively market is quite encouraging.

"Altogether, the mackerel season, both off shore and at the bay, promises well, and we hope that good trips will crown the efforts of all engaged in this branch of the fisheries."—(Boston Journal, July 29.)

1871.—REMINISCENCES OF CAPT. J. W. COLLINS.

I was engaged in the halibut fishery during the season of 1871 until August, when I fitted out for a mackerel cruise off the New England coast, still being the same vessel in which I had sailed the previous season. The mackerel were comparatively scarce in the fall off shore and disinclined to bite. We succeeded, however, in catching 175 barrels with hook and line, which was much better than the average for the time we were engaged. The last two days' fishing which we had were off Chatham. The first of the two days we caught 50 barrels between Nausett and Chatham, and the following day we obtained 30 wash-barrels more about 15 or 20 miles ESE. from Chatham Light. The fish at that time moved very rapidly in a southerly direction.

Many of the seiners obtained large catches during the fall, but as we were fishing with hook and line it frequently happened that we could get few or no mackerel, even where they were most abundant, and the seiners were filling up.

1872.—GOOD LUCK OF SOME OF THE MARKET FISHERMEN.

On Friday of last week the schooner "Yankee Lass," Captain Brown, took 60 barrels of mackerel off the Highlands of Cape Cod, and sold them in Boston the next day for $1,500. A few weeks before the same vessel sold $1,200 worth, which she caught in a single day. Another vessel made $2,520 in a couple of days. In all these cases the market was bare of mackerel, and hence the high prices obtained. The foregoing fares were sold fresh without dressing.—(Gloucester Telegraph, October 12, 1872.)

1872.—Mackerel fishery of Provincetown.

The Provincetown mackerel fleet, in the early part of last week, after a trial of two days without finding mackerel, broke in small squadrons and sought their home ports to haul up, or to engage in other pursuits. It has hovered around Provincetown, and been in the harbor since August, taking but few fish. Inquiry at the packing establishments discloses the fact that the entire catch of that part of the fleet hailing from Provincetown will not much exceed 12,000 barrels. In 1870 the catch packed 37,552 barrels, and in 1871 it was 24,918 barrels. From information received, the opinion prevails that the falling off in the catch of the whole fleet will not be less than that part of it sailing from Provincetown. A very few vessels using seines have been successful, but those depending upon the hook and line, constituting much the largest part, will not, as a whole, realize a sum sufficient to pay expenses.—(Cape Ann Light and Gloucester Telegraph, May 31, 1874.)

1872.—Mackerel on the south coast of Nova Scotia.

H. S. Jost, esq., overseer for the western district of Lunenburg County, Nova Scotia, reports that mackerel are of a better quality than those taken in 1871, and have generally been sent to the United States, where a fair price has been obtained for them. The hitherto uncertain fares in the North Bay mackerel fishing has had the effect of causing most of the Nova Scotia vessels to seek other employments this fall.—(Report of W. H. Venning, inspector of fisheries for Nova Scotia and New Brunswick. An. Rep. Mar. and Fish., 1872, Appendix N.)

1872.—Disinclination of the Canadian fishermen to engage in catching mackerel.

Mackerel fishing is pursued only to a very limited extent in Gaspe Bay since the repeal of the reciprocity treaty, the few accidently caught in herring nets being used as bate for cod; and even under reciprocity this kind of fishing was entirely in the hands of Americans, the Gaspe fishermen not catching the fish even for local consumption. For the space of about one month this summer mackerel was very abundant in Gaspe Bay, some catching as many as 1,700 in one day. Mackerel as well as salmon sold fresh, but prices being low, fishermen considered it more advantageous to engage solely in the more remunerative pursuit of cod-fishing. During September and October prices ruled higher, but mackerel had then left the bay.—(Report of N. Lavoie, commander of government schooner "La Canadienne," in a cruise in the River and Gulf of Saint Lawrence, 1872. An. Rep. Mar. and Fish., 1872, Appendix B.)

1872.—A BIG TRIP FROM GEORGE'S.

Schooner "Volunteer," Captain Smith of this port, arrived from George's on Friday with 340 barrels of mackerel, which were seined on the bank. This is the largest fare brought in this season, and the mackerel were all large and fat.—(Cape Ann Advertiser, August 16, 1872.)

1872.—A BIG SCHOOL OF MACKEREL—SUCCESS OF THE SEINERS.

Schooner "Judith Ann," of this port, recently came across a big school of mackerel off Thatcher's Island, and had such a heavy draught of them that they were obliged to cut the purse-rope of the seine in order to save it. Out of the lot, estimated at 1,000 barrels, they succeeded in saving only 40 barrels.

Several of the mackerel seiners had quite a streak o' luck last week, which will very materially help out their season's work. * * *

Schooner "Isaac Somes," Capt. E. H. Taylor, was absent from Harwich Port thirty hours, and during that time seined 250 barrels of mackerel. This is reported as the largest catch in the shortest time this season.—(Cape Ann Advertiser, September 13, 1872.)

1872.—REMINISCENCES of CAPT. J. W. COLLINS.

In August, 1872, I went to the Gulf of Saint Lawrence on a mackerel trip in the "Alice G. Wonson." Mackerel were large though scarce, and as a result we cruised over nearly the whole of the fishing grounds in the Gulf from Bonaventure to Cape Breton. We did not succeed in obtaining any great catches, neither did we hear of many being taken. However, we secured a fare of 250 barrels of fine mackerel, for which a fair price was obtained, making the voyage, on the whole, a reasonably profitable one.

1873.—THE PASSAGE OF THE FISHERIES BILL—ANTICIPATION OF ITS BEING INJURIOUS TO AMERICAN FISHERMEN.

The bill to carry into effect the fishery provisions of the treaty of Washington, passed the House Monday by an unexpectedly strong vote, 145 yeas and 30 nays. The only amendment, which was offered by Mr. Buffinton, delays the date on which the duties on fish from the provinces are removed until July 1, and was agreed to both by the Committee on Foreign Affairs and by the State Department. General Butler opposed it, and denounced the treaty as very unfair to the United States. President Grant sent a special message to the Senate and House, in which he urged the passage of the bill. It will go into effect July 1. There are grave apprehensions that we have paid dearly for the whistle in the admission of foreign fish duty free; and the provincial fishermen have thus obtained great advantages over the American, both on the lakes and sea-coast. Be that as it may, there is no help for it now, and ere the end of the present year we shall probably know whether or not we can catch and sell fish under the disadvantages of this treaty as cheaply as our neighbors in the provinces can with the great advantages it affords them.—(Cape Ann Advertiser, February 28, 1873.)

1873.—Sailing of the first of the southern fleet.

A portion of the southern mackereling fleet have sailed the present week, and others will soon follow.—(Cape Ann Advertiser, April 18, 1873.)

Two of the Newburyport schooners sailed on the 17th instant, for the south, on a mackereling cruise.—(Cape Ann Advertiser, April 25, 1873.)

1873.—First arrival of fresh mackerel in New York market.

The first fresh mackerel of the season were carried into New York on Thursday (May 1) of last week, by a Chatham schooner. She had 25,000, which were sold at 20 cents apiece.—(Cape Ann Advertiser, May 9, 1873.)

1873.—A big first trip.

Schooner "Fleetwing," of this port, carried into New York on Tuesday 52,000 fresh mackerel, which were sold for $2,657.—(*Ib.*)

1873.—First mackerel caught off Cape Ann.

May 20, schooner "Sea Foam" caught about 200 mackerel, which, being the first catch of the season off Cape Ann, sold for 10 cents apiece. Last season the same vessel also brought in the first fare of mackerel, having been fortunate in securing 120 barrels on the 22d of May, which sold for $2.50 per hundred.—(Cape Ann Advertiser, May 23, 1873.)

1873.—First arrival in Gloucester of the southern fleet.—Good prices.

Schooner "Emma Jane" arrived home from the south on Thursday last (May 19) with 170 barrels of mackerel, which were sold for $9.25 and $7.25 per barrel. First arrival of the season.—(Cape Ann Advertiser, May 30, 1873.)

1873.—First start of the bay fleet.

The first of the bay fleet sailed on Tuesday (June 3), and others will soon follow. Some 30 sail will be on their way by the middle of the month.—(Cape Ann Advertiser, June 6, 1873.)

1873.—Spring mackerel fishery.

The fishing season has fairly commenced in Long Island waters, in the Great South Bay, and the other bays on the south side. Large numbers of bluefish, weakfish, and mackerel are taken daily. On Friday and Saturday the fishermen found it impossible to dispose of their catches, and most of those who had loads of mackerel were obliged to cast anchor and salt them. On Friday the fishing company at Southold caught 100,000 at one haul.—(Cape Ann Light and Gloucester Telegraph, Gloucester, Mass., May 31, 1873.)

1873.—The southern mackerel fleet at Newport.

One hundred and fifty sail of mackerel catchers put into Newport Harbor on the 5th instant, in consequence of thick weather. They report mackerel more plenty of late, the catch the previous days averaging about 25 barrels to a vessel.—(Cape Ann Advertiser, June 13, 1873.)

1873.—The southern mackerel fishery.—Prices.—The bay fleet.

The Newport southern mackereling fleet has been doing only fairly. The "Miantonomoh" has taken three fares of fresh mackerel, caught by seine, into New York, of 45,000 fish; the "Lizzie Thompson" has taken there two fares of 13,000 fish, and the "G. W. Brown" has taken two fares of 25,000, making in all 83,000 fresh mackerel taken into New York by Newburyport vessels. One firm has received $2,000 for fresh mackerel sold, and has about the same amount to come.

By the hook the schooner "Matilda" has caught 12,000, and the "John Gerard" 8,000, and these also have been carried into New York.

The southern mackerel fleet, as a whole, have not done so well this season as last. A large proportion of the fleet have sold their mackerel fresh in New York, and some of the seiners have made good stocks; but the hookers have done very slim. Some fourteen sail have thus far arrived home, averaging about 100 barrels. The market being bearer of old mackerel, the new stock have been in good demand, recent fares selling at $10.25 and $8.25 per barrel, with prospect of advance on these prices. A large fleet will visit the Bay of Saint Lawrence the present season. The early fleet have already sailed, and by the 1st of July there will probably be a hundred vessels in readiness to start. The shore mackereling fleet will be smaller than that of last season, and comprised mostly of seiners.—(Cape Ann Advertiser, June 13, 1873.)

1873.—The first fare from George's.—A good haul.

Schooner "Mary Odell," of this port, arrived from George's on Monday with 240 barrels of mackerel, the first fare from there this season. They lost most of the first haul they made in consequence of a shark going through the seine just as they had commenced bailing out. After repairing the seine, they made another immense haul, filling all their barrels and the dories, and let as many more go, being unable to take care of them. The mackerel were of large size and excellent quality, and the trip proved a profitable one.—(Cape Ann Advertiser, July 18, 1873.)

1873.—A GOOD STOCK IN THE SHORE FISHERY.

Schooner "Isaac Somes," of Harwich Port, engaged in the shore mackerel fishery, has stocked about $7,500 thus far this season, and is high line of the fleet from that port.—(Cape Ann Advertiser, July 25, 1873.)

1873.—ANOTHER BIG GEORGE'S TRIP.

Schooner "Eddie Pierce" arrived at Boston last week, from a three weeks' cruise, with 550 barrels of George's mackerel. She stocked $6,000 for the trip—pretty good returns for a short voyage.—(Cape Ann Advertiser, August 8, 1873.)

1873.—SHORE AND BAY FISHERIES, PRICES, ETC.

The mackerel catch off this shore still continues light for the season. Nineteen seiners have arrived since our last issue, five of which were from George's, and brought in good fares. The total catch for the past week has been about 2,500 barrels, which have been sold at $20 and $19 for No. 1's; $12.75 and $13 for No. 2's. Schooner "Highflyer" arrived from the Bay of Saint Lawrence on Tuesday (August 5)—the first arrival of the season, and a week earlier than the first arrival last year. She brought in 225 barrels. Others of the fleet are on their way home, and daily expected. Two fares have been sent home per steamer. The quality of the mackerel taken at the bay early in the season is not as good as those taken off this shore, but those caught the past three weeks are said to be much fatter.—(*Ib.*)

1873.—THE MACKEREL FLEET OF NEWBURYPORT, PAST AND PRESENT.

The Newburyport Herald says: Our mackerel fleet, which numbered 140 vessels forty years ago, is now reduced to about 20.—(Cape Ann Advertiser, August 15, 1873.)

1873.—LIGHT CATCH IN THE BAY.

On July 29 there were in the harbor of Georgetown, Prince Edward Island, about 50 sail of American mackerel schooners. The highest catch reported among them was 200 barrels, and the average fares of the whole fleet was estimated at 150 barrels. The catch of mackerel in the Gulf of Saint Lawrence has, up to this time, been light. The fish appear to be abundant, but do not bite freely.—(*Ib.*)

1873.—AN OLD VESSEL MAKES A LARGE STOCK IN THE SHORE MACKEREL FISHERY.

Schooner "I. H. Horton," which recently arrived at Wellfleet from George's, has caught and landed 1,402 barrels of mackerel, stocking

$14,023, having been employed two months and ten days. This is the largest stock made in the mackereling business from any port this season. The schooner is twenty-three years old, and owned by Capt. I. H. Horton, of Eastham.—(Cape Ann Advertiser, August 22, 1873.)

Schooner "I. H. Horton" has recently arrived from her fourth trip, with 282 barrels of mackerel. The "Horton" has now landed 1,664 barrels, making her stock in three months $18,425.—(Cape Ann Advertiser, September 12, 1873.)

1873.—Destructive gale in the Gulf of Saint Lawrence.

In the Cape Ann Advertiser of September 5, 1873, 36 Gloucester mackerel schooners were reported driven ashore in the hurricane of August 24 and 25, causing the loss of thirty-six lives. Besides these many vessels and lives were lost from other ports engaged in the mackerel fishery of the Bay of Saint Lawrence.

1873.—Scarcity of mackerel off New England coast.—Arrivals from bay, high prices, etc.

Mackerel still continue very scarce off this shore, and some of the seiners have abandoned the business and fitted away for the bay. With the exception of a haul by one of the Swampscott boats, and one by a Harwich schooner Saturday on Jeffries, there have been no mackerel seined off this shore the past week. One George's fare of 240 barrels arrived on Tuesday, which were quickly taken up at $23.50 per barrel for No. 1, the highest price obtained this season. No. 2 sold for $13.

Six bay fares, about 1,200 barrels, have arrived the past week, which have met with quick sales, No. 1's selling for $14.50 and $15 per barrel. The market was never so bare of mackerel at this season of the year, and the supply for the fall and winter trade bids fair to be a meager one.—(Cape Ann Advertiser, September 12, 1873.)

1873.—A school off Cape Cod.

A school of mackerel struck the waters off Cape Cod last week. A Harwich schooner took 100 barrels, and other vessels shared in the good luck.—(Cape Ann Advertiser, October 31, 1873.)

1873.—Arrival home of the bay fleet.

The bay fleet have come in freely the past week, 63 vessels having arrived since our last issue, averaging good fares. This leaves about 30 sail yet to come, most of which will be along before the close of another week. The vessels arrive on a dull market, and but few of the late fares have been sold, as holders are not desirous to sacrifice their mackerel at the prices at present offered, unless actually forced to do so. The stock in the market is held at $14 and $12 for Nos. 1 and 2, which prices, if not higher, will no doubt be realized ere many weeks elapse.—(Cape Ann Advertiser, November 14, 1873.)

1873.—THE GLOUCESTER MACKEREL FISHERIES.

The southern fleet in the spring was of usual size—embracing 54 vessels—and fairly successful, marketing their early catch in New York at good prices.

The summer fishery off the shores of Maine, New Hampshire, and Massachusetts was of respectable size, and mostly engaged in seining of mackerel, with a very good average success, although a few vessels did not pay expenses. Eighty-six vessels engaged in this business. Schooners "Beloidem" and "Empire State" were lost in this business.

The Bay of Saint Lawrence fleet was unusually large, consisting of 185 vessels, against 60 last year. The catch was good, and the business would have proved quite successful but for the disastrous gale in August, by which so many vessels were wrecked or temporarily disabled in the height of the fishing season, materially reducing the receipts. Of the 185 Gloucester vessels engaged in this fishery 10 were wrecked, and are total losses, and three remain ashore at the Magdalen Islands, but are not abandoned. Twenty-six vessels made two bay trips each during the season, and the whole number of fares received at Gloucester this season will be 198 against 65 last year.—(Gloucester Telegraph, November 19, 1873.)

1873.—REMINISCENCES OF CAPT. J. W. COLLINS.

During the first part of 1873 I was engaged in the haddock and cod fisheries. About the 25th of August I started from home on a mackerel trip to the Gulf of Saint Lawrence, still being in the same vessel in which I had sailed the three previous years. We arrived in the bay soon after the first of September and immediately proceeded to the Magdalens. There we had an opportunity of witnessing the great destruction which had been wrought by the hurricane of the 24th and 25th of August. At the head of Pleasant Bay, and in Harbor Le Barre, some 20 or 25 sail of American mackerel schooners were driven high up on the sand; many of them lying in such positions as to render it extremely doubtful if they could be again got afloat. Many vessels were also stranded on Prince Edward Island, some being lost with all hands, while the crews of others were fortunate enough to escape. Some of these schooners we had an opportunity of seeing later on our trip. I have taken occasion to allude to this gale here, since it was one of the most disastrous which our mackerel fleet has ever encountered, resulting in very great loss of life and property. The mackerel were scarce in the bay during the fall of 1873, and though mostly of a large size were not so fat as might be expected. We fished most of the time about the Magdalen Islands, visiting, however, other points of the bay more or less frequently. We succeeded in obtaining a fare of 208 barrels, and returned home about the middle of November.

1874.—THE SOUTHERN MACKEREL FISHING.—LIGHT FARES BROUGHT IN.

Southern mackerel fleet are arriving home, averaging light fares. The largest of the season, 300 barrels, was brought in by schooner "Falcon" on Wednesday, June 3; the trips will not average over 140 barrels. The business has been overdone this year.—(Cape Ann Advertiser, June 5, 1874.)

1874.—THE SPRING MACKEREL FISHERY.

The Cape Ann Advertiser of June 12, 1874, states that during the past week twenty vessels belonging to the southern mackerel fleet had arrived with light fares, the average quantity being 100 barrels.

1874.—FISHING IN THE GULF OF MAINE.

The Cape Ann Advertiser of September 25, 1874, states that there are from eight to nine hundred mackerel vessels between Portland and Mount Desert; the catch is light.

1874.—SUCCESSFUL GEORGE'S TRIP.

Schooner "Florence E. Tower," Captain Frye, arrived at Boston on Saturday (June 27), from a mackerel cruise to George's Bank. She brought in 450 barrels, the fare which has arrived at that port this season. * * Most of the fish were of good quality. Her trip this time was four weeks.—(Cape Ann Advertiser, July 3, 1874.)

1874.—HIGH LINE OF THE SEINING FLEET.

Capt. Hanson B. Joyce, of Swan's Island (Maine), is high line of the seining fleet this season. Landed to 9th October 2,300 barrels of mackerel, the largest number ever landed. A small craft of 52 tons still follows the trade, and may get another haul.—(Cape Ann Advertiser, October 16, 1874.)

ANOTHER GOOD CATCH.

Schooner "John Atwood," of Provincetown, had landed up to October 9, 1874, 2,000 barrels mackerel. She took in all 2,100 barrels; was high line of the Provincetown fleet.—(*Ib.*)

LATE CATCH OF MACKEREL OFF CAPE COD.

Schooner "Willie B. Wilbur" took with the hook 20 barrels of fine mackerel off Race Point November 18, 1874.

1874.—A QUICK TRIP.

Schooner "Florence Nightingale" left Swampscott Monday morning, August 24, on a market fishing cruise and arrived in Boston the next morning, August 25, with 350 barrels of mackerel, worth at least $2,500 —a good day's work.—(Cape Ann Advertiser, August 28, 1874.)

ONE OF THE LUCKY VESSELS.

Schooner "Daniel Masey," of Portsmouth, N. H., has landed 1,800 barrels of mackerel up to August 25, and claims to be high line of the fleet.—(Cape Ann Advertiser, September 11, 1874.)

1875.—THE FIRST APPEARANCE OF MACKEREL.

One of the first mackerel fares caught by the mackerel fleet was taken April 29, 1875, by the schooner "Cora E. Smith," of Gloucester, and sold at New York for $15 per 100.

On June 6 a Newburyport vessel arrived at New York with 25,000 mackerel.

1875.—AMERICAN VESSELS IN THE GULF OF SAINT LAWRENCE.

The following statement of the number of fishing vessels in the Gulf of Saint Lawrence mackerel fishery and the American shore mackerel fishery was submitted by David W. Low to the Halifax Commission:

Mackerel inspected in Gloucester	93,126
58 vessels in Gulf, average catch 191 barrels	11,078
117 vessels American shore, average catch 409 barrels	47,853
	58,931

The average catch is based on the average catch of 84 vessels from 17 firms in 1869, and 28 vessels in bay and 62 vessels off American shore from 20 firms in 1875. These firms have done better than the rest.—(Docs. and Proc. Halifax Com., 1877, U. S. edition, p. 2595.)

1875.—FIRST MACKEREL OF THE SEASON.

The first catch of mackerel was brought to New York last week. The fish were of good size, but had not yet acquired that primeness and excellence of savor which mackerel only acquire in colder waters. The fish were struck south of Cape Henry, and now some twenty smacks are in search of the coming shoals.—(B. Phillips, in New York Times, May 9, 1875.)

1875.—FISHING IN THE GULF OF MAINE.

One vessel took 250 barrels of mackerel off the point at Provincetown, Saturday afternoon.—(Provincetown Advocate, October 6, 1875.

1875.—SAILING OF THE SOUTHERN FLEET.

A large part of the George's fleet have fitted out to go south, mackereling.

Several of the south mackerel fleet have sailed, and the balance will follow in a few days. They will tend New York market, selling their fish fresh.—(Gloucester Telegraph, April 21, 1875.)

1875.—First fare of mackerel for the season—A big stock.

To a Portland schooner, the "Georgie Willard," belongs the credit of landing the first fare of mackerel this season. The "Willard" arrived at New York on Friday (April 30) and landed her catch of 22,000 mackerel, stocking over $4,000.

1875.—The spring fishery.

The southern mackerel fleet are meeting with fair success. Last week, Monday, the schooners "Bell of the Bay," and "Bloomer" arrived at New York with 200 barrels each, and schooner "Roger Williams" with 700 barrels. The "Bell of the Bay" had been out eight days, "Bloomer" forty-eight hours, and "R. Williams" three days. On Wednesday the "William S. Baker" (six days out) arrived with 220 barrels. The first vessel to arrive home with a southern mackerel fare was the "Pathfinder" (on Friday), with 280 barrels. Schooner "James A. Stetson" arrived from a southern trip on Sunday, with 250 barrels of mackerel.—(Gloucester Telegraph, May 26, 1875.)

1875.—A good catch at Newport.

A fishing gang near Newport, Thursday, with a purse seine, passed it around a school of fish, supposing them to be menhaden. The result of their haul proved to be upwards of 14,000 mackerel, which were sold from 10 to 15 cents apiece.—(Gloucester Telegraph, June 9, 1875.)

1875.—Small catch of mackerel in June.

Only 53 mackerel arrivals were reported for the month of June, with a total catch of some 7,000 barrels, less than one-half of the receipts for the corresponding month last year.

Mackerel, notwithstanding the lessened receipts, have sold at some two dollars less than last June.—(Gloucester Telegraph, July 14, 1875.)

1875.—Small bay fleet.

The Gloucester bay fleet will be smaller this season than for many years.—(Gloucester Telegraph, July 21, 1875.)

1875.—Scarcity of mackerel off shore—Big fleet on George's.

The schooner "Mary B. Tower," from George's Bank, arrived at Boston 28th ultimo, after an absence of thirty weeks, with 140 barrels of mackerel. She reports fish very scarce. Severel vessals had been out a month without taking anything worth reporting. Many of the vessels which had been cruising off the coast of Maine, finding no fish, put off for the Banks. There were about 200 sail on George's on the 27th ultimo.—(Gloucester Telegraph, August 4, 1875.)

1875.—First arrival from the bay.

One arrival has been reported from the Bay of Saint Lawrence the past week, the first of the season, with 241 barrels.—(Gloucester Telegraph, September 1, 1875.)

1875.—Scarcity of mackerel in the bay.—The fleet at the Magdalens.

The Prince Edward Island Times reports no great catches of mackerel this season about the island. The catch will not be above two-thirds of that of last year, but of superior quality. Reports from all quarters speak of a small catch.—(*Ib.*)

But few mackerel are taken. Nothing has been done at Bay Chaleur or Gaspe. The American fleet in the bay almost wholly surround Magdalen Islands.—(Gloucester Telegraph, September 16, 1875.)

1875.—Arrival of the shore fleet.—Small number of arrivals from the bay.

The mackerel fleet have mostly arrived from the eastern coast—56 having been reported last week—and are now engaged upon the Cape Cod shore, meeting with moderate success in the capture of small mackerel. One arrival has been reported from Bay Saint Lawrence, making three bay arrivals this season, against 31 arrivals up to October 1 last year. The mackerel fleet were reported off Plymouth on Saturday, and on Sunday there were 100 sail on Middle Bank, apparently doing well.—(Gloucester Telegraph, October 6, 1875.

1875.—Mackerel passing Cape Cod.—A good haul.

On Tuesday, the 5th instant, immense shoals of mackerel were seen passing down by Highland Light (Cape Cod), and were even so near shore that a stone might have been thrown among them from the beach. The schooner "Nellie T. Campbell" threw her seine around a school and scooped up many more barrels than she could handle, and after filling her decks full signaled to another vessel to come and take what remained in the net.—(Gloucester Telegraph, October 20, 1875.)

1875.—A big haul at Newport.

A school of large mackerel were reported off Newport last week, and 125,000 in number, large ones, were seined on Tuesday.—(Gloucester Telegraph, November 3, 1875.)

1875.—High price of bay mackerel.

At Newburyport last week bay mackerel were sold from $24 to $26 per barrel for choice mess; $17.50 to $18 for No. 1's; $14 to $16 for 2's, and $9, $11, and $14 for No. 3's.—(*Ib.*)

1870 TO 1876, INCLUSIVE.—THE MACKEREL FISHERIES OF PROVINCE-TOWN, MASS.

"Going back to 1870, we had that year 41 vessels engaged in mackerel fishing, not one of which went into the Gulf. They all fished on our coast. The aggregate quantity of mackerel which they all packed was 37,552 barrels. In 1871 we had still 41 vessels, which still continued to fish on our coast, having done pretty well there the year before. None went to the Gulf. The aggregate catch which these vessels packed amounted to 24,918 barrels. In 1872 we had 36 vessels, of which 3 went to the Gulf of Saint Lawrence, leaving 33 fishing on our own coast. These 36 vessels packed out 16,303 barrels, and the 3 vessels which went to the Gulf packed out 785 barrels, making an average per vessel of 261¾ barrels.

"In 1873, when the Washington treaty went into effect, as we intended going to the bay, having now no fear of the cutters, we enlarged our bay fleet, and so 6 went there that year instead of 3. Two of these 6, or one-third of them, were lost in the gale in which so many vessels were lost. The vessels lost were the schooner "Helen M. Woodward," off the Magdalen Islands—the vessel was a total loss—and the "Carrie P. Rich," off North Cape, Prince Edward Island; vessel and crew total loss.

"The latter went to the bay early in the year, and she had shipped some mackerel home before the gale took place. She was lost, with all she had on board. The whole catch of these six vessels that year was 845 barrels. In 1873 we had 38 vessels, and their total catch was 15,772 barrels, including the 845 barrels mentioned. In 1874 we had 35 vessels engaged in the mackerel fishery, and they packed out 23,098 barrels. Three vessels went to the Gulf, bringing home 590 barrels, which are included in the total catch of the 35 vessels, 23,098. In 1875 we had 37 vessels, which packed out 10,613 barrels. Two of them went to the Gulf, and they brought home 270 barrels, which are included in the gross amount stated.

"In 1876 we had 32 vessels, whose total catch was 16,150 barrels. Two of them went to the Gulf of Saint Lawrence, bringing home 202 barrels, which are included in the 16,150. These totals make a grand total of 144,406 barrels, of which 2,692 were caught in the Gulf of Saint Lawrence in 16 voyages during the several years I have named. The average catch of these vessels since 1872, and since the fishery clause of the Washington treaty went into effect, was 146⅓ barrels per vessel, and prior to that the average was 261⅓ barrels per vessel, in the Gulf of Saint Lawrence."—(Statement of Captain Atwood before the Halifax Commission.)

1876.—THE SOUTHERN FLEET.

About 90 Gloucester and Cape Cod schooners, employed in the mackerel fishery, were reported off Lewes, Del., on Thursday of last week.—(Cape Ann Advertiser, May 12, 1876.)

1876.—FIRST AMERICAN VESSELS IN THE BAY.—FAILURE OF SPRING MACKEREL AT THE MAGDALENS.

The first American mackerelmen in the bay arrived at Port Mulgrave [Canso] on the 13th instant. The first Gloucester schooner in the bay, the General Grant, arrived the next day.

Advices from Magdalen Islands on Monday report net mackerel fishing a failure.—(Cape Ann Advertiser, June 23, 1876.)

1876.—A SCHOOL OF MACKEREL IN THE EEL GRASS.

A school of mackerel became entangled in the eel grass in Chauncy's Creek, near Portsmouth, the other day, and about 30 barrels were taken by hand.—(Cape Ann Advertiser, July 4, 1876.)

SUCCESS OF A GLOUCESTER SCHOONER IN THE MACKEREL FISHERY.

Schooner "Argonaut," Capt. E. A. Horton, landed from May 15 to July 21, 1876, 825 barrels of mackerel.—(Cape Ann Advertiser, July 21, 1876.)

1876.—EXTINCTION OF THE HINGHAM MACKEREL FISHERY.

Mackerel fishery at Hingham, Mass., once gave employment to 65 vessels; now extinct.—(Cape Ann Advertiser, January 28, 1876.)

1876.—MACKEREL FISHERY IN MASSACHUSETTS BAY.

The Swampscott shore fleet, up to the 5th of June, was said to have had success. The best day's catch landed was 1,000 barrels; this amount of course refers to the catch of the whole fleet.

1876.—THE MACKEREL FISHERY IN THE GULF OF SAINT LAWRENCE.

The first American mackerel vessels arrived at Port Mulgrave June 13, 1876; one from Boston, and one from Booth Bay. The first Gloucester vessel arrived on the 14th. A fair catch of mackerel was reported at Canso; on the 16th of June mackerel were reported on both sides of the Gulf.

1876.—THE SOUTHERN MACKEREL FLEET.

The Cape Ann Advertiser of June 19, 1876, remarks: "The southern mackerel fleet have met with good success of late, and a large fleet have arrived the present week, bringing fares of 200 to 400 barrels. There has been a reduction in price."

1876.—THE GULF MACKEREL FISHERY.

The Halifax Chronicle states that in 1874 there were 74 vessels engaged in the mackerel fishery from that city.

In the Gulf of Saint Lawrence, in 1876, the schooner "Samuel Davis," of Halifax, was high line, having landed 282 barrels of sea-packed mackerel.

1876.—The spring mackerel fishery.

Thirteen vessels of the Gloucester fleet were at Lewes, Del., April 22. At the same place, May 4, there were 90 vessels from Cape Cod and Gloucester. The Cape Ann Advertiser, of May 19, announced that the earliest sales, amounting to about 400 barrels, brought $4 a barrel in New York; the catch so far having been very light.

1876.—Fall mackerel fishery.

Eleven hundred and eighty-five barrels of mackerel were landed at Boston September 25; 700 barrels September 27; 1,200 barrels September 29. They were chiefly taken off Minot's Ledge, and sold at 12 to 14 cents for large, 3 to 4 cents for clinchers, and 1½ cents for blunts.

An enormous school a mile long and half a mile wide was struck by fishing boats off New London, October 30, and though many of the nets had to be cut, because of the excessive weight of fish, 300,000 fish, worth $10,000, were taken.

A gang from Wilcox's fish-works at Quiambog surrounded off Watch Hill, September 29, what they supposed to be a large school of menhaden. When the net was hauled they proved to be mackerel; 120,000 of them were No. 1's; they weighed from 1½ pounds to 3 pounds each, and, at 5 cents apiece, were worth over $5,000.—(Cape Ann Advertiser, October 6, 1876.)

Smith & Horton, of Eastham, caught about 2,000 barrels of mackerel in their weirs Friday, November 3. They were large fish. One hundred and twenty-five cart-loads were taken out, still leaving many more to be secured.—(Cape Ann Advertiser, November 10, 1876.)

Mackerel plenty November 13–14 at Vineyard Haven. Small boats have been catching them for two or three days.—(Cape Ann Advertiser, November 17, 1876.)

1876.—Big trips of New England vessels.

Schooner "Daniel Marcy," Capt. Abraham Cahoon, jr., of Harwich, arrived at Portsmouth 1st September, 1876, with 410 barrels mackerel, making total catch for the season 1,500 barrels. Captain C. claims to have been high line for 15 years.

Schooner "Alice," of Swan's Island, packed out 2,700 barrels of mackerel this year, and made another haul of 300 barrels, giving her a catch of 3,000 barrels for the season. She claims to have beaten the "Mary Odell," of Gloucester, and to stand high line in the New England fleet.

Schooner "Rebecca M. Atwood," of Portland, has landed over 2,600 barrels at her home port this season.

Schooner "Mary Odell," Capt. Geo. McLean, made a large haul of fat mackerel in Barnstable Bay last week, taking from her seine 300 barrels, which were all that her crew could handle, besides giving away 110 barrels to the crew of a Boston schooner, and losing several hundred barrels through a break in the seine. She had already landed 2,200 barrels, stocking $11,000 net (the crew sharing $436.96 each), up to September 22, and the next week landed two fares, one of 200 or 300 barrels; during the past week she has made two trips into Boston. Her stock for the season is probably double that of the schooner "Alice."—(Cape Ann Advertiser, October 6, 1876.)

1877.—THE SPRING FISHERY.—ARRIVALS OF FRESH MACKEREL IN NEW YORK.

The early arrivals at New York the middle of last week landed good fares, and prices were good considering the almost simultaneous arrivals of nine vessels on Thursday and Friday. The schooner "Mary Odell" was the first to arrive, followed closely by the schooner "Seth Stockbridge" with 35,000 mackerel in number. The schooner "Madawaska Maid" came next with 180 barrels, and the rest of the fleet had from 100 to 150 barrels each. The market opened with sales of large mackerel at 12 to 15 cents, but soon fell to 10 cents for extra large, 8 cents for large, 5 cents for tinkers, and 3½ cents for flinks.—(Cape Ann Advertiser, May 4, 1877.)

1877.—A NOVA SCOTIA SCHOONER BOUND SOUTH FOR MACKEREL.—THE TABLES TURNED.

Now that our Bay of Saint Lawrence fleet has dwindled to comparative insignificance, and no longer throw the bait that keep the waters swarming with mackerel, it looks as if the Nova Scotia fishermen would have to resort to American waters for a catch. One provincial vessel was in port a few weeks since bound south in pursuit of mackerel.—(Cape Ann Advertiser, May 25, 1877.)

1877.—A GOOD CATCH IN NOVA SCOTIA WEIRS.

A good mackerel catch is reported along the western shore of Shelburne County, N. S. Some traps have taken over 1,000 barrels, and all others are doing well.—(Cape Ann Advertiser, June 29, 1877.)

1877.—A LUCKY HAUL AT PROVINCETOWN.

The keeper of Wood End Light, with the assistance of his wife, seined 4,500 mackerel the other day, which sold for $150.—(*Ib.*)

1877.—A LARGE CATCH IN A CAPE COD WEI.

The Yarmouth Herald reports that upwards of 1,400 barrels of mackerel have been taken from the Sandford fish-trap this season; value not far from $7,000.—(Cape Ann Advertiser, July 20, 1877.)

1877.—DOINGS OF THE SHORE FLEET.—SMALL CATCH.

The Boston Fish Bureau reports the catch of the shore fleet to August 1 at 34,657 barrels, against 113,246 barrels at the same time last year. The July catch was 6,614 barrels, against 81,193 in July, 1876. The reports from the fleet continue unfavorable, nothing being done except in the neighborhood of Block Island. The vessels there are reported with fares ranging from 25 to 160 barrels each. The schooner "Alice," of Boston, arrived at that port Wednesday, with 170 barrels large mackerel, caught off Block Island, the result of four weeks' fishing.—(Cape Ann Advertiser, August 3, 1877.)

1877.—A BIG CATCH OF MACKEREL ON THE NOVA SCOTIA SHORE.

The Halifax Herald reports a mackerel strike in the vicinity of that city. At Tom's Bay the boats landed over 300 barrels, which will average No. 2. At Upper Prospect the catch averaged from 30 to 300 barrels to a seine, over 1,000 barrels being taken the first day after the fish struck in. The reports from all the coves in the vicin.ty were encouraging.—(Cape Ann Advertiser, August 17, 1877.)

1877.—SMALL CATCHES OF THE MACKERELMEN.

The prospects of the mackerel fleet do not brighten. Out of 18 arrivals from off shore the past week the only fares worth mentioning are 125 barrels in the "Argonaut," caught off Block Island, and 75 barrels in the "Volunteer," the rest of the fleet realizing less on a two or three weeks' trip than is often the result of a half hour's good fishing. The news from the bay is not of an encouraging character. There have been six arrivals at this port to date this season, with an average of about 200 barrels each, which does not give the prospect for the rest of the fleet a flattering aspect.—(Cape Ann Advertiser, August 31, 1877.)

1877.—FAILURE OF THE BAY MACKEREL FISHERY.—THE FARE OF THE HIGH LINE OF THE BAY FLEET COST MORE THAN IT CAME TO.

Recent arrivals from the Bay of Saint Lawrence report the mackerel fishery a failure there, as well as on our own shores, and some of the vessels had not seen a mackerel for a fortnight before leaving the bay. The vessels already arrived, representing the portion of the fleet meeting with the best success, report an average catch of 183 barrels, which would not be more than half a fare in ordinary seasons, and will not pay the expenses of the voyage, even at the present high prices. Unless the majority of the fleet still remaining in the bay find better fishing this month, which is not deemed probable, most of the vessels will be obliged to return empty, and the mackerel fishery will prove a lamentable failure this season.

The masters of the vessels returning from the Bay of Saint Lawrence agree in the opinion that the mackerel have left the bay, and that the fall fishery will be a failure. The schooner "Cayenne" is high line of the fleet, and of her fare of 320 barrels sea-packed mackerel, only 45 barrels were caught within the three-mile limits. The vessel was chartered, and for two months the charter was $450; the use of seines and boats was $300 more, and the outfit of provisions, &c., $450; the crew were on shares, but, at the rates paid those hired by the month, their wages would amount to $960; to this add the captain's wages, $150; insurance on seines and boats, $30; salt used, $140; bait, $162.50; and expenses of barrels, packing, &c., $525, and we have a total expense of $3,117.50. The fare packed out 300 barrels, which sold for $2,845, leaving a net loss on the trip of $272.50. With such a record for the high line it will be readily seen that the failure of the majority of the fleet to secure fares will entail a serious loss upon this industry.—(Cape Ann Advertiser, September 7, 1877.)

1877.—Slim doings of the mackerel fleet.—The high liners.

The shore mackereling fleet continue in the neighborhood of Cape Cod, meeting with indifferent success, and it becomes more and more apparent that the mackerel stock for 1877 will be the smallest known for years. Scarcely a vessel employed in this business will pay expenses. * * * The schooner "Alice," of Swan's Island, is high line of the mackerel fleet, having caught rising 1,400 barrels this season. The new schooner "William M. Gaffney" has made the best stock, her catch having realized about $10,000 since she came from the stocks, April 16. * * *

The bay fleet report no catch of consequence since the gale a month ago. The prospect is that many of the vessels will be compelled to come home with very light fares.—(Cape Ann Advertiser, October 26, 1877.)

1877.—Unprofitableness of the mackerel fishery in the Gulf of Saint Lawrence from 1873 to 1877.

The Bay of Saint Lawrence mackerel fishery to the Gloucester fleet has been a growing failure for many years, both in the number of vessels prosecuting it and in their catch. Exceptional trips have been made at a profit, yet the average vessel has prosecuted it yearly with considerable loss.

In proof of which, take an average bayman for an average season's fishing. Her expense account will average at least $2,600 (without charging interest on vessel and outfits, or for depreciation on hull, or any partial loss not covered by insurance). She must catch 400 barrels of packed mackerel, worth an average price of $13 per barrel, to pay her expenses. Any less number of barrels than 400 would only lessen the amount of her bills by the salt not used. The packing of a less number of barrels and the master's commission on decreased amount of stock, the wear of the sails, rigging, cables, &c., would be the same; the crew must be fed; the bait would be used in trying for fish; so that any one can estimate the loss to an average vessel whose catch or its value varies from the above estimate.

Of 19 firms, including those that have been most successful in the Bay of Saint Lawrence mackerel fishery, with 81 vessels employed in that fishery in 1873, their average catch was 283 barrels to each vessel. In 1874, with 46 vessels, 358 barrels was the average; in 1875, with 20 vessels, 195 barrels was the average; in 1876, with 17 vessels, 124 barrels was the average; in 1877, induced by the encouraging reports sent from the Straits of Canso and other places, the fleet to the bay from the same firms was increased to 28 vessels, with still more disastrous results, the catch of those that have arrived or been heard from being far below that of last year, proving now to a certainty that the prosecution of the mackerel fishery in the Gulf of Saint Lawrence by American vessels is a complete and utter failure.

The same firms, during the above years, with 55 vessels employed on the American shore, in 1873 averaged a catch of 350 packed barrels of mackerel each; in 1874, 63 vessels averaged 554 barrels; in 1875, 54 vessels averaged 381 barrels; in 1876, 57 vessels averaged 674 barrels.—(Cape Ann Advertiser, November 2, 1877.)

1877.—Large schools of mackerel seen off the New England coast.

The largest school Captain Harding ever surrounded and kept with his seine amounted to 300 barrels. In 1877 he lost a school off York, Me., which filled his net full. He saw a school off Block Island in 1877 which he estimated to contain 1,000,000 barrels. He could see only one edge of it at a time.

1877.—Mackerel fishery in Cape Cod Bay.

Mackerel struck last week in unusual abundance. The like has not been known for years. The day will be remembered as "mackerel day" for a good many years.—(Provincetown Banner, July 18, 1877.)

1878.—Mackerel fishery of New England.

Mackerel fishery.—The Bay of Saint Lawrence mackerel fishery by the American fleet opened last year June 7, when the first vessel arrived, and closed November 30, when the last vessel sailed for home. The whole number of vessels in the bay was 273, of which 125 or $42\frac{2}{5}$ per cent. were from Gloucester. Wellfleet sent 29; Portland 15; Boston 24; Booth Bay 12; Newburyport 10; Swan's Island 8; Provincetown 8; Rockport, Deer Isle, North Haven, Southport, and Bremen, 5 each; Camden and Cohasset, 3 each; Salem, Rockland, and Dennis Port, 2 each; Danversport, Essex, Harwich, Brooklin, Orleans, Truro, Belfast, Sedgwick, Hingham, Swampscott, Portsmouth, Vinalhaven, New London, Bristol, and Perth Amboy, 1 each. Of the Gloucester fleet, 118 vessels are reported to have taken 28,847 barrels. Of these

8,735 barrels, of a value of $36,725, were caught within the three-mile line. Taking this as a basis, and the American catch in the bay last year was 66,749 barrels of mackerel, of which 20,202 barrels, of a value of $84,848, were taken within the three-mile line, for which latter privilege we have paid $450,000 in cash (without including interest), and probably as much more in remission of duties.—(Provincetown Banner, January 30, 1879.)

1878.—Notes on the mackerel fishery.

The southern mackerel fishery.—The fish dealers of Boston are exercised over the early catch of mackerel, which they think diminishes the later supply and affects the market unfavorably. It would be difficult to prove that the catch or market are influenced either by the early fishery, or by the use of seines, as many contend. The demand for the first fresh mackerel of the season gives the business promise of success, and the quantity packed is not likely to interfere with the sale of the small stock of better quality fish remaining on the market from last year's catch. The Southern mackerel fishery will be followed by the usual fleet as the season advances. Quite a number of vessels are fitting away, and the "Moses Adams," Captain Jacobs, the pioneer of the fleet, sailed for the South Saturday. Schooners "Seth Stockbridge," "Crest of the Wave," "Smuggler," "Ada R. Terry," "Lizzie," and "Namari," have sailed the present week. Others are busy fitting out. The fleet will comprise some 60 sail.

The first southern mackerel caught last year was by the schooner "Seth Stockbridge," Capt. James Anderson, who arrived in New York, April 25, with 35,000 in number. The mild winter gives promise that the first catch this year will be somewhat earlier.—(Cape Ann Bulletin, March 20, 1878.)

1878.—Arrival of mackerel on George's Bank.

Mackerel appeared on George's Bank about the 1st of June. The Cape Ann Advertiser of June 7 states that twelve barrels caught there were received at Edgartown the previous week.

1878.—Spring mackerel fishery.

There were about one hundred and fifty sail of mackerel catchers at Newport on Thursday week, and the "high line" was 150 barrels.—(Cape Ann Advertiser, May 10, 1878.)

1878.—The earliest catch of mackerel.

The schooner "Lilian," of Noank, Captain Latham, took 40 barrels small and large mackerel off Chincoteague March 30. This was the first catch of the season and the earliest ever known on our own coast, except in 1831.

1879.—Fall fishery of Cape Cod Bay.

Mackerel were abundant in Provincetown Harbor on November 22, 1879; one boat caught 1,400 in set-nets.—(J. H. Blake, Cambridge, Mass.)

1879.—Shore fishery in Cape Cod Bay.

A large school of mackerel came into our bay last week, and many of the vessels get good hauls with their seines, from 120 to 160 barrels; besides that, some of the hook fishermen got from 10 to 30 barrels. They were caught along the Plymouth shore, and from that northward close in to the land. For some days past the wind has been blowing too strong for fishing. A few mackerel are being taken here in gill-nets by our shore fishermen. Some of the fishermen that set bluefish nets got from 60 to 90 large fat bluefish to a man.—(Letter of N. E. Atwood, October 27, 1879.)

Notes on the shore mackerel fishery of 1878.

The first mackerel of the season.—Three weeks earlier than last year.— The schooner "Lillian" arrived at Lewes on Friday, from a southern mackerel cruise, with ten barrels of fresh mackerel, the first of the season. They found a ready sale at 20 cents each for large, 15 cents for medium, and 10 cents for tinkers. The first arrival last year was the schooner "Seth Stockbridge" of this port, April 25, with 35,000 in number.

The "Lillian" belongs in Noank, Conn., a small port near New London, and sailed March 12th. She reports seeing a good many tinkers, but there was a rough sea and high winds at the time. The mackerel caught by the "Lillian" were mostly small and were sent to New York from Lewes, Del., by steamer, in water. There have been no other receipts at New York or elsewhere so far as reported.—(Cape Ann Bulletin, April 6, 1878.)

The mackerel fishery.—The early appearance of mackerel this season, and the fact that they are already of quite good size and quality, give promise of a successful shore catch, but it is already evident that prices must rule low in order to compete with the present low prices of all sorts of provisions. Last year the first receipts of fresh mackerel were April 25, and the first receipts of salt mackerel May 4. This year there were fresh mackerel on the New York market April 5, a few being taken off the Delaware coast and forwarded by steamer, and the first fare received arrived on the 12th, quickly followed by others, so that within a day or two there were two thousand "wash-barrels" on the market. The first receipt of new salt mackerel this season was April 22d, and during the [last] week 500 barrels were landed at New York, 450 at Harwich, and about 25 at Boston.—(Cape Ann Advertiser, May 3, 1878.)

New fishing enterprise.—The schooner "Notice," of this port, owned in part and commanded by Capt. Knud Markurson, cleared on

Monday for an experimental fishing trip on the coast of Norway. Captain Markurson is familiar with the fishing grounds of the North Sea and with our improved methods of mackerel fishing, which ought to give him success in a field where the operations have heretofore been confined to old-time methods. He takes out a crew of twelve experienced men and will doubtless dispose of his catch in European markets. The "Notice" is a fine vessel of 66.50 tons burden, Gloucester built, nine years old, and thoroughly fitted for mackereling. This voyage is the fulfillment of an old project, which was first broached eighteen years ago, when the mackerel fishery of New England was at a low ebb, but Captain Markurson is the first to overcome the difficulties surrounding such an undertaking and to make the venture. The present time seems a favorable one for the experiment, and we wish the enterprising master and crew abundant success in striking out in this new field of industry.—*Cape Ann Advertiser.*—(St. John's Chronicle, May 17, 1878.)

MIGRATIONS.—THE PROSPECT OF MACKEREL IN THE BAY.—A gentleman from Halifax informs us that a pilot of twenty-five years' experience on the Nova Scotian shore, states that he never saw such a large body of mackerel off that coast as he has seen this season. They were *en route* for the bay, and there ought to be a good catch there this season.—(Cape Ann Advertiser, June 21, 1878.)

THE BAY FLEET.—The first installment of the Bay of Saint Lawrence fleet have about completed their preparations, and quite a number of the fleet have already sailed. The prospect for mackerel in this region is said to be much better than in the last few years, a large body being reported as passing Nova Scotia on their way thither. The fleet will go prepared to fish with either seines or hand-lines, and it is hoped that their efforts to secure large fares will prove successful.—(Cape Ann Bulletin, June 26, 1878.)

1878.—NOTES ON THE MACKEREL FISHERIES IN THE GULF OF SAINT LAWRENCE, AND OFF THE NEW ENGLAND COAST.

Late advices from the bay report schooner "Jacob Bacon" high line of the fleet, 225 barrels mackerel, schooner "Ratler" coming next with 125 barrels, and a few other fares ranging from 40 to 80 barrels. The "Charles Haskell" left the bay after three days' unsuccessful fishing, and picked up a fare of 100 barrels shore tinkers on the way home, where she arrived Monday. The "C. B. Manning" arrived from a shore trip Tuesday with 80 barrels of inferior quality. Schooner "Smuggler" arrived yesterday with 130 barrels small mackerel. The only large mackerel landed here were taken by schooner "Mary Odell" a few days ago, on the Block Island fishing grounds. She brought in a fare of 25 barrels mixed mackerel, of which 15 barrels were extra 1's, and sold at a fancy price. The whole number of mackerel arrivals for the week has been 9, but there have been no other fares of consequence.—(Cape Ann Advertiser, July 19, 1878.)

THE BAY FLEET.—The schooner "Jacob Bacon" of this port, Capt. William Gray, employed in the Bay of Saint Lawrence mackerel fishery, has shipped home by steamer to Boston, from Port Hawkesbury, 222 barrels good mackerel. A few other vessels are reported with fares from 200 to 300 barrels, of good quality, and the prospect is considered more favorable than heretofore this season.—(Cape Ann Advertiser, July 26, 1878.)

Schooner "Golden Hind" arrived from a Bay Saint Lawrence trip on Wednesday, being the second arrival of the season, but there are others on the way, to arrive in a day or two. The later reports from the bay indicate an improvement in quality and catch, and it is not too late to hope for profitable returns before the season closes. The weather has been rough of late, and unfavorable for fishing, but some good fares are reported. The "Golden Hind" brought 280 barrels mackerel, 100 barrels of which were taken at one haul of the seine off North Cape.

The shore mackerel fleet continue to meet with ill success, and there is little hope for improvement until the mackerel turn southward in the fall. The number of arrivals the past week has been 12 and the receipts some 500 barrels. There is a fair stock on the market, but the call for inferior grades is light.

1878.—MOVEMENTS OF THE FISHING FLEET.

Schooner "David F. Low," Captain Chisholm, arrived home from the Bay of Saint Lawrence on Wednesday, with a fare of 200 barrels good mackerel, being the first arrival and first receipts of bay mackerel at this port this season. Two other vessels fitted for the bay arrived home before the "Low," but neither of them stopped to make a trip, although one secured 19 barrels before leaving to make up a fare of shore mackerel on the way home. One fare of bay mackerel was received at Boston, last week, by steamer, sent home by schooner "Jacob Bacon," and sold without culling or packing, averaging about 187 pounds to the sea barrel, at $9 per barrel, which would be equivalent to about $11 packed. The first arrival at this port from the bay, last year, was the schooner "Eastern Queen," August 15.

The shore mackerel fleet have abandoned the Block Island grounds, having made a much smaller catch there than last year. There were some sixty sail engaged in the business, and most of them secured from 3 to 20 barrels of extra large mackerel, which brought about $26 the barrel. The fleet continue to bring in moderate fares of tinker mackerel, and there are about 1,000 barrels on the market, for which there is little demand. Number of shore arrivals the past week, 12; receipts, 1,550 barrels.—(Cape Ann Advertiser, August 2, 1878.)

The arrivals for the past week have given a more hopeful aspect to the fishing outlook, and our wharves have presented the busy appearance which characterized them in more prosperous season. The arrivals have not been numerous, numbering 56 in all, but some very good fares have been landed in the several departments of fishing followed by Gloucester vessels. The receipts of bay mackerel, 1,400 barrels, fill a want that has long been felt, and indicate a much better prospect for successful ventures in this line than was anticipated a few weeks ago. There have been 5 bay arrivals, the schooner "Ellen M. Adams" being high line, with rising 400 barrels of good quality, and the "Ralph E. Eaton" coming next about 300 barrels. The shore fleet continue to report a scarcity of large mackerel, though a few 2's and and large 3's, are culled from most of the trips. The number of arrivals for the week has been 6, and the receipts about 600 barrels. Schooner "Joseph Garland" brought in a fare of 240 barrels, the "Fleetwing" 190, the other fares being in moderate amounts.—(Cape Ann Advertiser, August 16, 1878.)

Fish of all kinds have been in fair receipt the past week, but the market continues firm except in mackerel, which are somewhat unsettled, though no concessions have been made from the inside rates quoted last week. The receipt of 12,000 barrels Provincial-caught mackerel at Boston last week went far to supply present demands, but there is no considerable accumulation of stock on this market. The number of bay arrivals for the week has been 9, bringing 2,800 barrels, and 624 barrels have been received by freighters. Shore arrivals 6, with a catch of 650 barrels.—(Cape Ann Advertiser, August 30, 1878.)

1878.—Small catches of mackerel at Block Island and in the Gulf of Saint Lawrence.

The mackerel fishery.—A large mackerel fleet, including a number of Gloucester vessels, put into Newport harbor on Saturday, and report the catch of mackerel very light, in some instances scarcely sufficient to feed the crew. The fleet sailed again on Monday.

There is no news of especial encouragement from the bay fleet. Mackerel put in an appearance there several weeks earlier than usual, and the boat and net fishermen met with good success for awhile, but the capricious fish seem to have abandoned their old haunts before the arrival of the American fleet.—(Cape Ann Advertiser, June 28, 1878.)

1878.—First arrival of mackerel in Boston.

Schooner "Ellen M. Adams," of the southern mackerel fleet, arrived in Boston yesterday afternoon with 70 barrels of mackerel, which is the first arrival of the season at that port.—(Cape Ann Bulletin, Wednesday, April 24, 1878.)

1878.—First arrival of mackerel at Gloucester.

The schooner "Marion Grimes" arrived home from a southern mackerel-trip, on Wednesday, with about 250 barrels of mackerel, being the first of the fleet to arrive at this port. Her catch was of good quality, running nearly all large 3's, and was sold immediately upon her arrival at $5.50 per barrel, with barrel, out of pickle.—(Cape Ann Advertiser, May 10, 1878.)

1878.—First fare of fresh mackerel at Portland for the season.

The first fare of fresh mackerel at Portland, 60 barrels, received last week, retailed at 5 cents per dozen.—(Cape Ann Advertiser, June 7, 1878.)

1878.—The mackerel fishery in the Gulf of Saint Lawrence.

The bay mackerel fleet.—Our correspondent at Port Mulgrave writes as follows under date of last Saturday:

We have had very stormy weather of late in the North Bay, and the mackerel fleet has done nothing since the 15th. Late arrivals report the prospect good with the hook, but the mackerel do not school lately. The arrivals at the several stopping places hereabouts, since the 15th, have been as follows:

Gloucester—"Bloomer," 70 barrels; "Cora E. Smith," 250; "Chocorua," 235; "Commonwealth," 430; "Jacob Bacon," 278.

Boston—"M. B. Tower," 400.

Wellfleet—"Gertrude Summers," 345; "Merrimac," 307; "Nellie M. Snow," 365; "Sarah E. Smith," 306.

Harwich—"Nettie Moore," second trip.

Cohasset—"Katie Hall," 300.

Swan's Island—"Augusta E. Herrick," 478; "Alice," 715; "Queen of the West," 270.

Boothbay—"Alice C. Fox," 275; "E. K. Dresser," 320.

Portland—"Venelia," 336.—(Cape Ann Advertiser, August 30, 1878.)

1878.—Review of the mackerel fishery of the Gulf of Saint Lawrence.

The Cape Ann Advertiser gives the following review of the Bay of Saint Lawrence mackerel fishery during 1878:

The Bay of Saint Lawrence mackerel fishery by the American fleet, last year, opened June 7, when the first vessel arrived, and closed November 30, when the last of the fleet sailed for home. The whole number of vessels visiting the bay was 273, of which 125 or $45\frac{2}{5}$ per cent. were from Gloucester; Wellfleet sent 29, Portland 15, Boston 14, Booth Bay 12, Newport 10, Swan's Island 8, Provincetown 8, Rockport, Deer Isle, North Haven, Southport, and Bremen 5 each, Camden and Cohasset 3 each, Salem, Rockland, and Dennis Port 2 each, Danversport, Harwich, Essex, Brooklyn, Orleans, Truro, Belfast, Sedgwick, Hingham, Swampscott, Portsmouth, Vinalhaven, New London, Bristol, and Perth Amboy 1 each. Of the Gloucester fleet 118 vessels are reported to have taken 28,847 barrels; of these, 8,735 barrels, of a value of $36,725, were caught within the three-mile line. Taking this as a basis, and the American catch in the bay last year was 66,749 barrels of mackerel, of which 20,202 barrels, of a value of $84,848, were taken within the three-mile line, for which latter privilege we have paid $450,000 in cash (without including interest) and probably as much more in remission of duties.—(Cape Ann Advertiser, January 10, 1879.)

1878.—Review of the New England mackerel fishery.

The annual report of the Boston Fish Bureau for 1878 gives the following review of the mackerel fishery for that year:

The season opened unusually early. Schooner "Lillian," sailing March 12, landed the first fresh mackerel April 6, followed a few days later by 50 sail, with from 100 to 150 barrels each of mixed fish of poor quality, the early catch resulting, as usual, in a loss to nearly all as well as an injury to the trade. We hope to see its discontinuance in the future. The catch early gave promise of being larger than for years, very soon fell off, and was followed with fluctuation and but partial success off our own shores as well as in the Gulf of Saint Lawrence, a large fleet going there doing worse than those that remained near home, the fish proving of inferior quality in either case. The value of the fisheries in English waters to the United States the past season is not far from 6,200 barrels of mackerel of not over $5 a barrel value, the total Bay or Gulf of Saint Lawrence catch of fish being 62,000 barrels, not over 10 per cent. of which was taken within the three-mile limit. The total Massachusetts catch was 144,205 barrels, a gain of 39,187 barrels over 1877, the shrinkage in value making the catch no more profitable. Total receipts in Boston in 1878, 143,028; in 1877, 142,024. Never in the memory of the oldest dealers has the price been as low on inferior grades as this season, while the average price has not been as low in twenty or more years. Choice mackerel having been scarce all the season, have sustained a good price, a wide margin from the highest to the lowest ranging from $25 down to $1.50 per barrel.

1879.—Failure of the Gulf of Saint Lawrence mackerel fisheries.

Gloucester, Mass., *August* 19, 1879.

Advices from Collector Babson, who is cruising in the Bay of Saint Lawrence, represent that mackerel fishing in the bay this season is a complete failure. Many firms are going out of the business.—(New York Herald, August 19, 1879.)

1879.—Abundance of mackerel off the New England coast, and scarcity in the bay.

Bath, Me., *August* 28, 1879.

Dear Sir: It may interest you to know the present condition of the Portland mackerel fisheries, as I learn it from conversation with several of the more prominent dealers of the place.

They say that mackerel have not been so plenty off the Maine coast for a number of years. A large fleet of vessels are fishing between Portland and Mount Desert Island, taking mostly large No. 2's, and all very fat. The vessels "fill up" in from ten days to two weeks, sometimes bringing in a deck load beside. A good many vessels from different parts of the State, and some from Cape Ann, are packing in Portland at $1.25 per barrel. All the packing houses are kept busy, and it is estimated by Mr. E. G. Willard that they have packed over 7,000 barrels in the three weeks ending August 23. Of these he has bought and shipped over 6,000 barrels to parties in New York.

The price for 2's three weeks ago was $5, but under the heavy receipts, prices have gradually fallen, until Saturday they were selling at $4.12½, and Mr. Willard thought that Monday they would reach $4.

Vessels fishing in the bay have done very poorly, and have mostly returned with "broken trips," or filled up on their way home, off this coast. Mr. Charles A. Dyer gives me the following: Schooner "M. E. Torrey" arrived home about August 1 from a mackerel trip in English waters. She was gone five weeks at an expense for outfit of $470. She brought home 200 barrels of fish that sold at $3 per barrel net, of which the crew took one half. This left a loss to the vessel of $170 in money, beside loss of time and general wear. This represents a fair average, he thinks, of vessels in English waters in 1879.

During the same time of schooner "M. E. Torrey's" trip the schooner "Alice" landed from American waters 700 barrels of better fish, and stocked $2,500.

I know of but one Portland vessel in the bay at the present time, and she has not been heard from since June 25, when she had 20 barrels.

Very truly, yours,

R. E. EARLL.

Prof. G. BROWN GOODE,
United States Fish Commission, Provincetown, Mass.

1879.—MACKEREL FISHERIES OF THE GULF OF SAINT LAWRENCE.

The following observations on the mackerel fishery in the Gulf of Saint Lawrence are from the report of Collector F. J. Babson and Alfred D. Foster, esq., who visited the provincial inshore fisheries in the United States steamship "Kearsarge" in the summer of 1879:

"The principal fishery followed by the American fishermen in the waters of the Gulf of Saint Lawrence is the mackerel fishery. * * * Previous to the reciprocity treaty of 1854 the mackerel fishery was almost wholly in the hands of the Americans, the provincial fishermen confining themselves entirely to the cod-fishery. This treaty, by opening the markets of the United States to Canadian fish, stimulated this industry, until now Canadian fishermen engage in this fishery on all the coasts of the maritime provinces. The methods of taking mackerel in use by the Canadian and American fishermen differ widely. The Canadians fish in small boats, going out a short distance only from the shore, returning to their homes each night, and using hand lines alone. In Prince Edward Island there were engaged in these fisheries during the year 1878 1,175 boats and only 17 vessels.

"Professor Hind, in his confidential report to the Canadian Government upon the effect of the Washington treaty on Canadian fisheries, speaking of the difference in the modes of fishing used by the Canadians and Americans, says: 'Mackerel catching is a special industry, and requires sea-going vessels. The boat equipment so common throughout British-American waters is wholly unsuited to the pursuit of the mackerel so largely carried on by United States fishermen. Immense schools of mackerel are frequently left unmolested in the Gulf and on the coast of Newfoundland, in consequence of the fishermen being unprovided with suitable vessels and fishing gear.' * * *

"The size, quality, and number of mackerel in the Gulf vary exceedingly in different years, sometimes being a mixed quality of large and small, and at other seasons being very poor and of little value. During the present season the mackerel taken in the Gulf have been smaller and poorer than ever before, and will hardly pay even the Canadians themselves for taking them. At Prince Edward Island mackerel can be bought for about $1 a barrel unpacked, while packed, salted, and delivered in Boston they cannot be sold for more than $3, and the dealers there have refused to advance more than $2 upon the mackerel consigned to them. Indeed, the managers of some of the largest fishing establishments upon the island have this summer given up the mackerel fishery and turned their attention entirely to catching cod for the West India market, considering that after paying the expense of packing and transporting the mackerel there was no margin left for any profit.

"The number of American vessels in the Gulf varies very much each year. There have been seasons previous to the treaty of Washington when as many as 500 vessels were in the Gulf at one time, but since the treaty has been in operation the number has greatly diminished. By the official record kept by the collector of customs at Port Mulgrave in the Gut of Canso, there appear to have been in the Gulf in 1873, 254 vessels; 1874, 164 vessels. This record for the years 1875 and 1876 was demanded by the counsel of the United States at the Halifax Commission, but was refused by the British counsel, although it was admitted that the records were in their possession. The evidence produced by the United States shows that during those years there were not more than 100 vessels in the Gulf. There were in 1877, 60 vessels; 1878, 273 vessels; 1879, 44 vessels.

"Of the vessels in the Gulf in 1879, 24 are reported as having obtained 7,045 barrels, an average of 293 barrels each, which would make for the whole fleet, 13,905 barrels taken by American vessels in the Gulf in this year. If one-half of the fish were caught within three miles of the shore, which is a very large estimate, the value of the Canadian inshore mackerel fishery to the United States in 1879 was only \$6,860—this is calculating the value of the fish at the price for which it can be purchased unpacked in Prince Edward Island, and making no allowance for the expense of catching the mackerel. In 1878 more American vessels went to the Gulf than any year since the treaty has been in operation. Early in the season the fishing was poor upon the United States coast, and many vessels went to the Gulf in hope that they would find the mackerel there, but most of them returned at once and did much better on the American shore. The whole American catch in the Gulf, in 1878, was only 61,923 barrels, while 134,545 barrels were taken on our own coast. Every vessel engaged in the Gulf mackerel fishery during the last two years has lost money. * * *

"On Friday, August 15, we left Prince Edward Island for the Magdalen Islands, arriving there the evening of the 16th. Under the convention of 1818 the American fishermen have the right to fish on the shores of the Magdalen Islands, without any restriction as to distance. Situated in the center of the Gulf of Saint Lawrence, these islands were formerly the resort of large bodies of mackerel, which remained there all summer, and until the last few years American vessels found around these islands the best fishing places in the Gulf.

"Mr. Fox, the collector and fishery overseer of the Magdalen Islands, testified before the Halifax Commission that in 1861 he counted 500 American schooners engaged in fishing near the islands. When we saw him there, this summer, he informed us he had not seen a single United States vessel. In 1877 about 30 vessels fished near the islands; in 1878, only 20, and none of these did well. This year the mackerel catch at the islands has been a failure; very few have been taken by the inhabitants, and they were all small, not exceeding 13 inches in length. * * * The great dependence of the Canadian fishing industry upon the markets of the United States for the sale of their fish, and the great benefit which they receive from the remission of duties, clearly appear from the returns. Nearly one-half of all the fish exported from Canada goes to the United States, while of mackerel alone nearly four-fifths of the entire exportation is to the United States. In 1877, 102,698 barrels of mackerel were exported to the United States, and only 28,523 barrels to all other countries. Practically, the United States is the only market for the best qualities of mackerel, and if a prohibitory duty should be imposed, the fishery would be almost abandoned by the Canadians. If an average duty of 20 per cent. had been imposed on Canadian fish, more than two millions of dollars would have been received by the United States since the treaty of Washington came into force.*

1879.—High line of the mackerel fleet.

Schooner "Ada R. Terry," of this port, Capt. Russell D. Terry, master, has landed this season 4,150 barrels mackerel, and her net stock is

*House Ex. Doc. No. 84, 2d sess. 46th Congress.

$10,970, sharing $363 to a man, making her high line of the mackerel fleet from New York to New Brunswick.—(Cape Ann Advertiser, December 12, 1879.)

1879.—REVIEW OF THE NEW ENGLAND MACKEREL FISHERY.

In the annual report of the Boston Fish Bureau for 1879 is the following concerning the mackerel fishery:

With few exceptions the spring catch is followed only at a loss, the past season proving no exception. The first to arrive generally realizing a handsome sum, induced the usual number, seventy-five sail, to go south, sailing in March and April. The first to report, schooners "Ellen M. Adams" and "Sarah M. Jacobs," taking 150 and 120 barrels of mixed size and poor quality, on April 13. But a small amount of the spring catch was cured. First fare of salt mackerel landed by schooner "Cora E. Smith," May 3. As the season advanced and the fish reached our New England coast, finding an abundance of their natural food, they rapidly improved in condition and remained plenty all the season, and much later than for years past, having been taken as late as December 19. The catch is particularly noticeable for its superior quality, much better than for years, as well as for its uniform size, being mostly 2's and 3's, with very few 1's; and the absence of the very small, or No. 4's, of the two previous years gives promise of a size larger, or at least a fair amount of large fish the coming season. While the early-caught, poor fish realized but $2.50 a barrel, as they improved in quality the demand and price also increased, the average price being $16, $6, and $3.50, for 1's, 2's, and 3's. Late in the season our shores were visited by the largest mackerel ever seen, of most excellent quality, measuring from 16 to $19\frac{1}{4}$ inches long, weighing from $1\frac{3}{4}$ to 3 pounds each, readily selling from 25 to 30 cents each, and from $35 to $40 per barrel, cured. Our North Bay fleet was, fortunately, very small, only 42 sail from New England, averaging 257 barrels; aggregate catch 10,796 barrels of small and very inferior fish, one vessel securing but 25 barrels all the season; while the shore fleet, much smaller than usual, numbering 283 sail, averaged 740 barrels; the average shore catch 209,803 barrels. Total catch of the Massachusetts fleet, 156,125 barrels, against 144,205 barrels in 1878. As to the relative value of the mackerel fishery off the New England coast as compared to those in provincial waters, it will be noticed our catch began in April, ending the middle of December, three-fourths of a year. It is now in contemplation sending vessels south to prosecute this branch the remaining three months, making our catch perennial, while the provincial catch, with favorable weather, lasts about four months. [The receipts of fresh mackerel in Boston in 1879 were 11,724,943 fish in number. This is in addition to the receipts of salt mackerel.]

1880.—THE SOUTHERN MACKEREL FISHERY.—EARLY CATCHES.—THE FLEET FOR 1880.

The tendency in the mackerel fishery is to earlier trips from year to year, the use of seines enabling the fishermen to secure a catch as soon as mackerel put in an appearance and before they are ready to take the hook, and the ready market for the first fresh mackerel proving a temptation to enterprising fishermen. The first receipts in the New York and Philadelphia markets in 1875 were April 30; in 1876, April 24; in 1877, April 25; in 1878, April 5; and in 1879, April 14. This year the pioneers of the fleet sailed a month earlier than usual, hoping by going farther South to make an early catch, and quite a respectable fleet are now in southern waters, awaiting the first appearance of mackerel. The following vessels comprise the fleet sailing in March:

Boston.—Schooner "G. W. Bentley," 1.

Booth Bay.—Schooners "Alice G. Fox," "Cyrena Ann," "Cynosure," "Lettie S. Reed," "Louis and Rose," 5.

Chatham.—Schooners "Leila Linwood," "Willie Irving," 2.

Dennis.—Schooners "Charlotte Brown," "Cora Louise," "Mary Doane," "Quivet," "Titmouse," "Willie Parkman," 6.

Gloucester.—Schooners "Bounding Billow," "Chocorua," "Crest of the Wave," "Charles Haskell," "Earnest F. Norwood," "Frank A. Smith," "Golden Hind," "Goldsmith Maid," "Fred. L. Webb," "Fred. P. Frye," "Ellen M. Adams," "Edward E. Webster," "Fleetwing," "Helen M. Crosby," "Joe Hooker," "John W. Bray," "Joseph Garland," "Herald of the Morning," "Marion Grimes," "M. L. Wetherell," "Onward," "Ossipee," "Piscataqua," "Reporter," "Wide Awake," "William S. Baker," "Edward Everett," "Falcon," "Georgianna," "Isaac Patch," "Mary O'Dell," "Madawaska Maid," "Oceanns," "Rattler," "Sarah M. Jacobs," 35.

Harwich.—Schooners "Kate Florence," "Nettie Moore," "Phebe and Emma," "Chas. H. Kelly," "Isaac Somes," 5.

Newburyport.—Schooners "George W. Brown," "Lizzie Thompson," "Miantonomah," 3.

Portsmouth.—Schooners "Gov. Goodwin," and "Daniel Marcy," 2.

Portland.—Schooners "Georgie Willard," "Maggie W. Willard," 2.

Swan's Island—Schooner "Alice," 1.

Total, 62.—(Cape Ann Advertiser, April 10, 1880.)

1880.—First arrival of fresh mackerel in New York.

Fresh mackerel—The first fare of fresh mackerel the present season was landed at New York, Saturday, by schooner "Edward E. Webster," Capt. Solomon Jacobs, of this port. She brought in a fare of 20,000, which were sold at 8 cents apiece, making her stock $1,600.—(Cape Ann Advertiser, April 7, 1880.)

1880.—The largest mackerel ever seen.

Some of the mackerel taken at Block Island Monday, July 25, weighed 3 pounds 2 ounces, *the largest ever seen.*—(Cape Ann Advertiser, August 6, 1880.)

1880.—ABUNDANCE OF MACKEREL.—GOOD FARES.

Large schools of large mackerel were reported off Monhegan on Sunday. Five vessels did well.

Schooner "Alice" of Swan's Island is reported high-line of the bay mackerel fleet, having landed and sent home three fares.

The schooners "Gov. Goodwin," "Helen F. Tredick" and "Anna M. Nash" of Portsmouth, arrived on Tuesday with 400 barrels of the largest mackerel ever brought to that port. They average less than 100 to the barrel. For several days past the water off the harbor has been literally black with mackerel, those at the bottom crowding toward the top. Fishermen report nothing like it for years.—(*Ibid.*)

1880.—MILLIONS OF MACKEREL ON THE NEW ENGLAND COAST.

The vast strike-in of mackerel all along our coast is really phenomenal. Nobody remembers anything like it. Thousands were caught yesterday and the day before, even without bait, as if mackerel were as simple as "Hancock Union soldiers" who snap at a bare rebel hook. Every boat, from the craziest old dory to the fashionable yacht, is pressed into service, and there are as many "kits" going to Boston and Lynn, and Salem and Gloucester, as the unwary boy supposes are on their way to St. Ives, when the famous problem of Pike's old arithmetic is propounded. From any look-out the schools can be seen on the surface of the water, hunting around for somebody to catch them, like bummer politicians seeking for bids. The theory that the mackerel had been depopulated in our waters is annihilated. There are still as good fish in the sea as ever were caught, and apparently more of them. It is said that the mackerel are pursued by the bluefish and the bluefish by the sharks. What is after the sharks is not stated. But our thanks are due to the bluefish in the first degree. They are the mackerel schoolmaster, and the success of our fishermen is due to the fact that the schoolmaster is abroad in the waters.—(Lowell (Mass.) Courier, July 16, 1880.)

1880.—MACKEREL FISHERY OF GLOUCESTER.

The records of the United States Fish Commission at Gloucester, Mass., show that the total number of fares of salt mackerel landed at that port in the year 1880 was 722, of which 25 fares were from the bay of Saint Lawrence in American vessels. The total receipts of salt mackerel were 135,774 sea-packed, equal to about 122,200 inspected barrels of 200 pounds each, making the total weight of the fish 24,440,000 pounds in the salt state, which is equivalent to 36,660,000 pounds of round or fresh mackerel. The receipts of 135,774 sea-packed barrels include 125,214 barrels taken by Gloucester vessels, 6,890 barrels taken by vessels from other New England ports, 505 barrels taken off the United States coast by the schooner "Lertie" of Nova Scotia, 3,623 barrels caught by boats and traps at Gloucester Harbor, and 3,437 barrels taken by United States vessels in the bay of Saint Lawrence. The receipts by months were as follows: April, 7 barrels; May, 3,977 barrels; June, 1,730 barrels; July, 19,105 barrels; August, 28,030 barrels; September, 39,534 barrels; October, 30,996 barrels; November, 12,395 barrels.

The Cape Ann Advertiser record for the year 1880, gives the following facts concerning the mackerel fishery of Gloucester in that year:

The mackerel industry employed 175 vessels and about 2,500 men; the number of vessels engaged in no other fishing branch for the year was 90. Fifteen were employed in mackereling and the shore fishery; 27 in mackereling, the herring and shore fisheries; and 38 in the mackerel, Georges and bank fisheries, &c. * * * The Block Island mackereling fleet comprised 15 vessels, the Southern fleet 34, and the Bay of Saint Lawrence fleet 15, all of which were successfully engaged in the offshore mackerel fishery. Most of the southern fleet disposed of their catch, in large proportion fresh, in the Philadelphia, New York, and Boston markets; the bay of Saint Lawrence trips were failures; the Block Island catch was smaller than in 1879; but the shore catch was larger than for many years, and proved profitable. The total catch is estimated at 129,620 barrels.—(Cape Ann Advertiser, January 14, 1881.)

1880.—Review of the New England mackerel fishery.

In its review of the New England fisheries for the year 1880 the Boston Fish Bureau has the following concerning the mackerel fishery:

The season opened by the early, or southern, fleet sailing in March. First catch reported by schooner "Edward E. Webster," 25,000 fish, April 2. The record of the fleet will be found in the report of the various fleets, and shows another financially disastrous early catch, some of the vessels returning without fish, very few with profit. We have in previous reports mentioned the injurious effects of this branch of the catch, even when followed at a profit, a large catch of poor fish injuring the demand later in the season. The past few years fully demonstrates that the sooner the early catch is abandoned the better it will be for all interested. The first catch in the weirs at Cape Cod April 26; first new salt mackerel arrived at Boston May 10. The market for a new stock ranged from $5 to $6, vessels doing only fairly up to July 1, the fish and fleet being scattered from Cape Cod to Jeffrey's Banks. Early in July an unprecedented large body of mackerel appeared in Massachusetts Bay, at our very doors. The oldest dealers and fishermen report never having known them so plentiful. They continued in the bay until the close of the season in December, during which time the entire fleet did well, while many of them made remarkable "stocks," as will be seen in the reports of individual vessels. The catch was noticeable for the absence of large and very small fish, its excellent quality, however, causing an active demand for immediate consumption. The catch in the North Bay and provincial waters by the American fleet was almost an entire failure, numerous vessels returning without a single barrel. Fortunately, but a small number of vessels visited those waters, and, not finding fish, returned in time to secure enough of the home catch to save them from a disastrous season. The total catch of inspected barrels by the Massachusetts fleet is the largest since 1874, amounting to 255,986 barrels. This season's catch has been exceeded but ten times since 1864. The total catch by the New England fleet is 349,674 inspected barrels, a gain over the previous year of 99,861 barrels on the Massachusetts catch, and total gain of 129,075 barrels. In addition to our own large catch there has been imported from the provinces 105,730 barrels, against 84,213 the previous year.

The total amount of mackerel received in Boston during 1880 from domestic and foreign ports, with home catch, 196,493 inspected barrels.

* * * * * * *

Our report and table of receipts, number of vessels, and crew, having been confined to salt or cured fish, we wish briefly to call attention to the importance and steady growth of the fresh-fish business, * * * the abundance of mackerel at our doors most of the season resulting in the receiving and distributing throughout the country of 75,000 barrels of fresh mackerel. Day after day, for weeks, from 1,000 to 2,000 barrels were received. Notwithstanding this unusually large production, all were used fresh. For the first year in the history of the business not a week during the year has passed but fresh mackerel could be bought at reasonable prices.

1881.—WHAT OUR GOVERNMENT PAID FOR.

Inshore catch of mackerel in the Bay of Saint Lawrence by the Gloucester fleet this year, 18 barrels. That's what we helped to pay a twelfth of $5,500,000 for for this year's fishery. Our herring and bait and ice and other supplies we buy at a profit to the provincials, who send thousands of barrels of mackerel and quintals of codfish to the American market free of duty, in competition with the American fishermen.—(Cape Ann Advertiser, October 14, 1881.)

1881.—THE MACKEREL FISHERY OF GLOUCESTER.

The records of the United States Fish Commission at Gloucester, Mass., show that the total number of fares of mackerel received at that port in 1881 was 713. The total number of sea-packed barrels of mackerel landed was 165,497, equal to 148,948 inspected barrels of 200 pounds each, equal to 29,789,600 pounds of salt mackerel, or 44,684,400 pounds in a fresh condition. The entire catch, with the exception of one fare of 48 barrels from the Bay of Saint Lawrence, was taken off the United States coast.

The records of the Cape Ann Advertiser for the year 1881 show that the American mackerel fleet from Gloucester numbered 149 vessels, 81 of which confined their operations for the year to this department, and the total receipts of salt mackerel were 163,851 sea-packed barrels.—(Cape Ann Advertiser, January 6, 1882.)

1881.—Review of the New England mackerel fishery.

The annual report of the Boston Fish Bureau for 1881 has the following review of the mackerel fishery for that year:

The catch opened unusually early, schooner "Edward E. Webster," on March 21, taking the first fare, 32,700 mackerel, 800 of which were large, balance medium and small. The first fare of new salt mackerel arrived in Boston May 9, one day earlier than in 1880, schooner "Roger Williams" landing 240 barrels that were caught off the Jersey coast. May 10, schooner "J. S. McQuinn" arrived with the first fare of fresh mackerel, 200 barrels, caught southeast from Sandy Hook. First cargo arrived fresh same date in 1880. May 4th the first catch was made in the weirs at Cape Cod; previous year on April 26th. March 25 schooner "Lizzie K. Clark" was capsized by a squall and lost, 20 miles from Barnegat; the crew were saved. This was the only mackerel vessel lost during the season. Although the season opened early the catch of cured mackerel reported at this office during the season, up to November, was as follows: May, 1,670 barrels; June, 38,683; July, 81,748; August, 70,424; September, 71,643; October, 57,268.

A light catch in November brought the season to an early close, the total catch of the New England fleet of 298 sail being 391,657 barrels, of which 269,495 were packed and inspected in Massachusetts—a gain in Massachusetts inspection of 19,534 barrels over 1880. This amount has been exceeded but five times in seventy-eight years.

As will be noticed, the catch off the New England coast opened a little later than usual, and continued good all the season, with the exception of 470 barrels, the entire catch being taken off the United States coast. The size and quality were of an average, with more No. 1's, and an absence of the very small, or No. 4. The price opened low, the first sale recorded being at $4.50 a barrel for large, $3.75 for medium, falling off in June to $4 for packed, or early 3's; inspected 3's, 2's, and 1's selling through the season as follows: July, $3.25, $3.50 for 3's; $5.25, $5.50 for 2's. August, $3.25, 3's; $5, 2's. September, $4.25, 3's; $6.50, 2's; $16, 1's. October, $6, $8 to $9, $18. November, $6.50, $9, $19. December, $7.50, 3's; $9 to $10, 2's; $20, 1's.

The catch in provincial waters being a failure, our imports show a falling off of 43,880 barrels. Fortunately very few American vessels visited them, securing only 470 barrels; they returned home in season to make a good record.

Besides the large quantity of mackerel that were salted, many thousand barrels were sold in a fresh condition. In Boston 2,200,000 and in Gloucester about 650,000 one-pound cans of fresh mackerel were put up.

IX.—APPENDIX—INSPECTION LAWS.

Compiled by A. HOWARD CLARK.

52. EXISTING LAWS.

MAINE.

Inspectors of pickled fish to be appointed. Act February 10, 1875, section 1.

The governor, with advice of the council, shall, from time to time, as occasion may require, appoint in each city, town, and plantation in this State, where pickled fish are cured or packed for exportation, one or more persons skilled in the quality of the same, to be inspectors of fish, who shall hold their office for a term of five years, unless sooner removed by the governor and council.

Bond for the performance of their duties. Ibid., section 2.

Every such inspector, before entering upon the duties of his office, shall be duly sworn, and shall give bonds with sufficient sureties to the treasurer of the city, town, or plantation, for which he is appointed, to the satisfaction of the mayor and aldermen of the city, the selectmen of the town, and the treasurer of the plantation, in the penal sum of not less than five hundred nor more than five thousand dollars, for the faithful performance of his official duties; and such municipal officers shall, at least once a year, examine the bonds given by said inspectors, and if that of any inspector is not in their opinion sufficient, they shall forthwith notify him, and if he for thirty days after such notice neglects to give a bond satisfactory to them, they shall give information thereof to the governor, and he shall remove such inspector from office.

Annual report of inspectors. Ibid., section 3.

Every inspector shall, on or before the tenth day of December, annually, make a return into the office of the secretary of state of all fish by him inspected during the year preceding the first day of December, designating the quantities, kinds, and qualities of pickled fish, and the secretary shall publish the same immediately after in the State paper.

Relief of persons injured by neglect of inspectors. Ibid., section 4.

Any person injured by the neglect or misdoings of any inspector, on tendering to such treasurer a reasonable indemnity against the costs, shall be entitled to bring an action on such inspector's bond in the name of the treasurer, for his own use, and to have a copy of the bond therefor; and if judgment shall be rendered thereon for the plaintiff, execution shall issue for the sum found due to the person for whose use such action is brought, and the sum awarded in damages shall be entered by the clerk of the court on the original bond, to remain in the custody of the treasurer.

Qualities of fish. Ibid., section 5.

Every inspector who inspects any kind of fish that are split or pickled for packing, shall see that they are in the first instance free from taint, rust, or damage, and well struck with salt or pickle; and such of said fish as are in good order and of good quality, shall be pickled in tierces, barrels, half-barrels, quarter-barrels, and tenths of barrels, or kids; each tierce containing three hundred pounds, each barrel two hundred pounds, and so on in that proportion; and the same shall be packed in good clean coarse salt sufficient for their preservation; and then each cask shall be headed up and filled with clear, strong pickle, and shall be branded by the inspector with the name and quality of the fish therein. Mackerel of the best quality, not mutilated, measuring, when split, not less than thirteen inches from the extremity of the head to the crotch or fork of the tail, free from taint, rust, or damage, shall be branded *number one;* the next best quality, being not less than eleven inches, measuring as aforesaid, free from taint, rust, or damage, shall be branded *number two;* those that remain after the above selection, free from taint or damage, and not less than thirteen inches, measuring as aforesaid, shall be branded *number three, large;* those of the next inferior quality, free from taint or damage, not less than ten inches, measured as aforesaid, shall be branded *number three;* all other mackerel, free from taint or damage, shall be branded *number three, small.* The inspector shall brand, in plain letters, on the head of every such cask, the weight, the initials of his Christian name, the whole of his surname, the name of his town, and the letters Me., an abridgment of the month and the year, in figures, when packed.

Quality and size of casks or barrels. Ibid., section 6.

All tierces, barrels, and casks, which are used for the purpose of packing pickled fish, shall be made of sound, well-seasoned white oak, white ash, spruce, pine, chestnut, or poplar staves, with heading of either of such kinds of wood, sound, well planed and seasoned, and when of pine to be free of sap, and the barrels to be hooped with at least three strong hoops on each bilge, and three also on each chime; the barrel staves to be twenty-eight inches in length, and the heads to be seventeen inches between the chimes, and made, in a workmanlike manner, to hold pickle.

Packing of alewives or herring. Branding. Ibid., section 7.

Every inspector who inspects pickled alewives or herring, packed whole or round, shall see that they are struck with salt or pickle, and then put in good casks of the size and material aforesaid, packed closely therein, and well salted, and the casks filled with fish and salt, putting no more salt with the fish than is necessary for their preservation; and the inspector shall brand all such casks with the name of the inspected fish as aforesaid, but in no case shall the inspector brand the casks unless the fish contained therein shall have been packed and prepared under his immediate supervision.

Fees for inspecting and branding. Ibid., section 8.

The fees for inspection and branding, exclusive of cooperage, shall be for each barrel seven cents, and all such fees shall, in the first instance, be paid by the original owners of the fish, but such owners shall be entitled to recover the amount thereof from the party purchasing or receiving the same, under the marks and brands aforesaid, and in addition to the price thereof.

Penalty for selling uninspected pickled fish. Revised Statutes, 1871, chap. 40, sec. 13.

If any person sells in this State, or exports therefrom, any fish in casks not inspected, packed, and branded, as aforesaid, or any tainted or damaged fish, known to be such, except good and wholesome fish packed in kegs of less than ten gallons, or pickled or dry fish imported into this State from some other State or country lawfully inspected and branded there, he shall forfeit ten dollars for every hundred-weight thus sold or exported.

Certificate required for shipment of pickled fish. Ibid., section 14.

No pickled fish in casks shall be shipped from this State, unless the master or owner of the vessel produces to the officer authorized to clear the vessel a certificate from the inspector that the same have been inspected, packed, and branded according to law; and the certificate shall express the number of tierces or casks thus shipped, the kind and quality of fish they contain, the name of the master and owner and that of the vessel into which such fish are received for exportation; and shall take and subscribe the following oath before the officer as aforesaid:

"I, A B, do swear, according to the best of my knowledge and belief, that the certificate hereunto annexed contains the whole quantity of pickled fish packed in barrels or casks on board the ———, ———, master; and that no pickled fish are shipped on board said vessel for the ship's company, or on freight or cargo, but what are inspected and branded according to the laws of this State, or exempted by the provisions thereof: So help me God."

Penalty for transporting uninspected pickled fish. Ibid., section 15.

If any person lades or receives on board any vessel or other carriage, for transportation from this State, any pickled fish, or cured or salted whole fish, packed or not packed, not inspected and branded as aforesaid, except such as is described in the exception of section thirteen, he shall forfeit at the rate of not less than five nor more than ten dollars for every hundred pounds thereof; and any justice of the peace may issue his warrant to the proper officer, directing him to seize and secure any such prohibited fish, and convey it to any inspector within a convenient distance for inspection; and every person refusing to give necessary aid in the service of such warrant, when required by the officer, shall forfeit five dollars to the person suing therefor in an action of debt; and such inspector shall open, inspect, pack, and brand such fish according to law and detain the same till all lawful charges of seizure and inspection are paid.

Penalty for illegally branding or mixing. Ibid., section 16.

If any person takes from a cask any pickled, cured, lawfully inspected and branded, and substitutes therefor or fraudulently intermixes other fish; or any inspector marks any cask out of his town, or which he has not inspected, packed, and prepared himself according to law; permits other persons unlawfully to use his brands; or willfully and fraudulently uses the same himself after the expiration of his commission, he shall forfeit twenty dollars for each cask or box so dealt with.

Recovery of penalties. Ibid., section 17.

All the penalties aforesaid, not otherwise herein appropriated, may be recovered in an action of debt, half to the use of the person suing therefor, and half to the town where the offense is committed.

Branding of smoked herring. Laws of 1871, passed February 24.

Be it enacted, &c.

Hereafter no inspection of smoked herring shall be required in this State, but all smoked herring put up in boxes or casks for sale in this State shall be branded on the cask or box inclosing them with the first letter of the Christian and the whole of the surname of the person putting up the same, and with the name of the State and the place where such person lives, and all such fish offered for sale or shipping not thus branded shall be forfeited, one-half to the use of the town where the offense is committed, and the other half to the person libeling the same; and all laws and parts of laws inconsistent herewith are hereby repealed.

NEW HAMPSHIRE.

(General laws of New Hampshire, 1878.)

Appointment and qualification of inspectors and deputy inspectors. Chap. 124, Section 1-4.

Inspectors of flour, beef, and pork, of potash and pearlash, of butter and lard, of hops, and of fish, shall be appointed by the governor, with the advice and consent of the council, and shall hold their offices for the term of five years, unless sooner removed by the governor and council.

Each inspector, before entering upon the duties of his office, shall give bond to the State, with sufficient sureties, to the satisfaction of the treasurer thereof, in the sum of two thousand dollars.

Each inspector shall appoint so many deputy-inspectors as may be necessary, removable at his pleasure, and for whom he shall be answerable, who shall first give bond to him, with sufficient sureties, in a sum not exceeding one thousand dollars, and shall once in six months, or oftener if requested, make such returns to him as he may require.

All oaths required to be taken by any deputy may be administered by the inspector, and all oaths required to be taken in the inspection of provisions or merchandise may be administered by the inspector or any deputy, or, in either case, by a justice.

If a vacancy shall occur in the office of inspector, his deputies shall continue to perform their duties and shall possess the same powers and be subject to the same liabilities as if no vacancy had occurred, until an inspector shall be appointed and duly qualified.

The word "inspector" in this title may include deputy inspector.

Pickled fish to be well preserved. Chap. 129, sections 1, 2.

The inspector of fish or some deputy shall see that all kinds of split pickled fish and fish for barreling, intended for exportation, have been well struck with salt or pickle in the first instance, and preserved free from rust, taint, or damage.

Such fish as are in good order and of good quality shall be packed in tierces, barrels, or half-barrels; the tierces to contain three hundred pounds, the barrels two hundred pounds, and the half-barrels one hundred pounds of fish each, and shall be packed with good clean salt, suitable for the purpose; and the casks, after being packed and headed, with the fish and sufficient salt to preserve the same, shall be filled with a clear strong pickle.

Qualities of pickled fish. Branding. Ibid., sections 3–5.

Each cask shall be filled with fish of one and the same kind, and shall be branded "salmon," "shad," "alewives," "herring," or as the case may be; those of the best quality, caught in the right season, to be most approved and free from damage, shall be branded "cargo number one"; those which remain after the best have been selected, being sweet, free from taint, rust, or damage, shall be branded "cargo number two"; and the thinnest and poorest of those that are sweet and wholesome shall be branded "cargo number three."

There shall be four numbers of mackerel: Those of the best quality, not mutilated, measuring not less than thirteen inches from the extremity of the head to the fork of the tail, free from rust, taint, or damage, shall be branded "number one." The next best quality, being not less than eleven inches, measuring as aforesaid, free from rust, taint, or damage, shall be branded "number two." Those that remain after the above selections, if free from taint or damage, and not less than thirteen inches, measuring as aforesaid, shall be branded "number three, large." Those of the next inferior quality, free from taint or damage, shall be branded "number three." All other mackerel free from taint or damage shall be branded "number four."

The inspector shall also brand, in plain, legible letters, on the head of every such cask, the initials of his Christian name and the whole of his surname, the name of the town for which he is appointed, and the abbreviation N. H. All mackerel shall also be branded on each cask with the month in which the same are packed.

Inspection of smoked alewives or herrings. Ibid., sections 6–8.

All herrings or alewives intended to be smoked and packed shall be sufficiently salted and smoked to cure and preserve the same, and afterward closely packed in the boxes in dry weather.

All smoked alewives or herrings shall be divided and sorted by the inspector or some deputy, and denominated, according to their quality, "first sort" or "second sort." The "first sort" shall consist of all the largest and best-cured fish; the "second sort" of the smaller but well-cured fish; and in all cases all fish which are belly-broken, tainted, or scorched, slack-salted not sufficiently smoked shall be taken out as refuse.

Each box of alewives or herrings so inspected shall be branded on the top by the inspecting officer with the initials of his Christian name and the whole of his surname, the name of the town where it was inspected, with the abbreviation N. H., the quality, whether "first sort" or "second sort," and the month and year in which they were so branded.

Quality and size of package for pickled fish. Ibid., section 9.

All tierces, barrels, and half barrels used for packing or containing pickled fish shall be made of sound, well-seasoned white oak, ash, red oak, spruce, pine, or chestnut staves, of rift timber, with heading of either of said kinds of wood, well planed, sound, and well seasoned, the heading of pine to be free from sap; and shall be well hooped with at least three good and strong hoops on each bilge, and three hoops on each chime; the barrel staves shall be twenty-eight inches in length, and the heads seventeen inches between the chimes; the barrel shall contain not less than twenty-nine nor more than thirty gallons, the half barrels not less than fifteen gallons, and the tierces not less than forty-five nor more than forty-six gallons, and each cask shall be made in a workmanlike manner to hold pickle, and shall be branded on the side thereof, near the bung, with the name of the maker or owner.

Quality and size of boxes for smoked fish. Ibid., section 10.

All boxes used for packing and containing smoked alewives or herrings shall be made of good, sound boards, sawed and well seasoned, the sides, top, and bottom of not less than half-inch boards, and the ends of not less than three-quarter-inch boards, securely nailed with wrought or cut nails, and shall be seventeen inches in length, eleven inches in breadth, and six inches in depth, in the clear.

Branding-irons to be furnished the inspector. Ibid., section 11.

Every person having fish for packing or pickling, either in bulk, casks, or boxes, to the amount of twenty barrels or forty boxes in one season, shall furnish the inspector, or one of his deputies, with a branding-iron containing the initials of the owner's Christian name and the whole of his surname; and the inspecting officer shall cause such name to be fairly branded on the head of every cask and on one end of every box of fish inspected for such person. If he shall refuse or neglect to furnish such brand, he shall forfeit three dollars for such neglect or refusal.

Inspection of fish packed whole. Ibid, section 12.

All small fish which are usually packed whole with dry salt shall be put in good casks, of the size and materials above required for pickled fish, and shall be packed close, edgewise, in the cask, and well salted; the casks shall be filled with the fish and salt, putting in no more salt than is necessary for the preservation of the fish; and the inspecting officer shall brand each cask with the name of the fish and the quality thereof, whether "first sort", or "second sort," as in the case of smoked fish aforesaid.

Annual report of inspectors and their deputies. Ibid., section 13.

The inspector shall make return to the governor annually, on or before the first Wednesday of June, of all the fish of every kind, whether in casks or boxes, which have been inspected by him or his deputies during the year preceding; and each deputy shall seasonably furnish said inspector with a return of all the tierces, barrels, half barrels, and boxes by him inspected and branded since his last return.

Fees for inspection of fish. Ibid., sections 14, 15.

The fees for inspecting and branding each cask or box of fish as provided by this chapter shall be, for each tierce, fourteen cents; for each barrel, nine cents; for each half barrel, five cents; for each smaller cask or box, three cents; for nailing each cask or box, one cent, exclusive of the labor of packing and coopering; and twenty-five cents for each certificate thereof given; and the general inspector shall have and receive from his deputies the sum of four cents for each and every tierce, and one cent for each barrel or box, and one half cent for each half barrel or smaller quantity so inspected and branded by any of his deputies.

These charges shall be paid by the owner or person employing the inspecting officer, and may by such person be recovered of the subsequent purchaser or exporter, in addition to the purchase or cost of the fish.

Certificate required for shipment of pickled or smoked fish. Ibid., sections 16, 17.

No pickled fish or smoked alewives or herring shall be shipped or exported by water from this State in casks or boxes unless the owner or master of the vessel shall produce to the collector, or other officer authorized by the laws of the United States to clear vessels out, a certificate from the inspector or some deputy that such fish has been inspected, packed, and branded according to law, together with the number of tierces, barrels, half barrels, and boxes thus shipped, the kind and quality of fish they contain, the name of the vessel in which such fish are received for exportation, and the owner or master thereof.

The master or owner, on producing such certificate to such officer, shall take and subscribe the following oath: "I, A B, of ———, do swear, according to the best of my knowledge and belief, that the certificate hereunto annexed contains the whole quantity of pickled and branded fish, smoked alewives, and herrings on board the ———, ———, master, and that no fish is shipped on board said vessel for the ship's company, or on freight or cargo, but what is inspected and branded according to law. So help me God."

Penalty for transporting uninspected fish. Ibid., sections 18, 19.

If any person shall put or receive on board any vessel or other carriage of conveyance, to transport the same from this State, any pickled or whole fish, or any smoked alewives or herrings, packed in casks or boxes, which are not inspected and branded according to law, he shall forfeit not less than two dollars nor more than ten dollars for every hundred pounds of pickled or whole fish, and one dollar for each box of smoked alewives or herrings so uninspected.

If any pickled or barreled fish, smoked alewives or herrings as aforesaid, shall be put on board any vessel, boat, or carriage of conveyance, with intent to sell or export the same contrary to law, any justice may issue his warrant to the sheriff, his deputies, or a constable, requiring such officer to seize and secure said fish, and carry them to the inspector or deputy nearest to such vessel, boat, or carriage, who shall open and inspect, pack, and brand the same as is provided in this chapter, and shall detain the same until the expense and charges of seizure, inspection, packing, and all other charges arising from such seizure shall be paid.

Penalty for illegally banding or repacking. Ibid., sections 20, 21.

If the inspector or any deputy shall brand any cask or box the contents of which he has not inspected, packed, salted, coopered, and nailed according to the provisions of this chapter, or shall permit any other person to use his brands in violation or evasion thereof, he shall forfeit twenty dollars for each cask or box so branded, and shall also be removed from office.

If any person shall intermix, take out, or shift any inspected fish, packed and branded as aforesaid, or shall put in other fish for sale or exportation, he shall forfeit five dollars for each cask, package, or box so altered; and if any casualty shall render it necessary to repack a cask or box of inspected fish it shall in all cases be done by an inspector.

Penalty for selling tainted or damaged fish. Ibid., sections 22, 23.

If any person shall sell or export, or cause to be sold or exported, within or from this State, any tainted or damaged pickled fish, or smoked alewives or herrings, he shall forfeit three dollars for every hundred weight of such pickled fish, and one dollar for each box of such smoked alewives or herrings which shall be thus sold or exported.

Packing of shell-fish. Ibid., section 23.

All shelled clams or other shelled fish used for fish bait, hereafter offered for sale, shall be put in barrels or half barrels of the description required for pickled fish; and the casks shall be filled full and salted sufficiently to preserve the same; if any person shall offer for sale any shelled fish, aforesaid, not packed agreeably to this section, he shall forfeit for each offense two dollars.

Packing of fish for consumption within the State. Ibid., section 24.

All kinds of pickled fish which are packed in tierces, barrels, or half barrels, and all smoked alewives or herrings packed in boxes, for consumption in this State, and which are not subject to be inspected and branded as provided in case of exportation, shall, however, be packed with only one kind of fish in each cask or box, and there shall be the same weight in each cask as hereinbefore provided; and for intermixing different kinds of fish in the same cask or box, or for short weight in any cask, the owner or seller shall forfeit the same sum hereinbefore provided for the like offense is such fish were inspected.

Fish packed in small kegs exempt from inspection. Ibid., section 25.

Nothing in this chapter shall extend to fish packed in kegs of less than ten gallons.

MASSACHUSETTS.

(General statutes of Massachusetts, 1859, with subsequent amendments.)

Appointment and qualification of inspector-general and deputies. Chap. xlix, sections 1, 2, 33, 34.

There shall be inspectors-general of butter and lard, fish, hops, leather, and pot and pearl ashes appointed by the governor, with the advice and consent of the council, for the term of five years, from the time of their respective appointments, unless sooner removed by the governor and council, who, before entering upon the duties of their respective offices, shall be sworn. The inspectors-general now in office shall hold their offices according to the term of their respective commissions, unless sooner removed.

Each inspector-general may appoint deputy inspectors, removable at his pleasure, who shall once in every six months make such returns to him as he requires to carry into effect the provisions of this chapter.

The inspector-general of fish shall give bond with sufficient sureties to the treasurer of the commonwealth in the penal sum of ten thousand dollars, and shall have no interest directly or indirectly in the cure or packing of pickled fish.

He may appoint deputy inspectors in every seaport or other town where such fish is packed for exportation, for whose official conduct he shall be answerable. He shall take bonds of each of them with sufficient sureties, and shall receive from each deputy an excise or fee for his commission and bond of one dollar, and no more. The deputies shall be sworn either before the inspector-general or some justice of the peace.

Pickled fish to be well preserved and packed. Ibid., sections 35, 36.

The inspector-general and deputy inspectors shall inspect all fish for the inspection of which provision is made in this chapter.

Under the supervision of the inspector-general and his deputies, respectively, all kinds of split pickled fish and fish for barreling except herrings, and all codfish tongues and sounds, halibut fins and napes, and sword-fish, whenever said articles are intended for exportation, shall be struck with salt or pickle in the first instance, and preserved sweet and free from rust, taint, or damage; and, when the same are found in good order and of good quality, they shall be packed either in tierces containing each three hundred pounds, in barrels containing each two hundred pounds, in half barrels containing each one hundred pounds,* or in packages containing each less than one hundred pounds, on which

* The conclusion of this sentence, from the words "one hundred pounds," is given as amended by act of April 1, 1879. The Revised Statutes of 1859 conclude the sentence as follows: "in quarter barrels containing each fifty pounds, in eighths of a barrel or kids containing each twenty-five pounds, or in kids or packages containing each less than twenty-five pounds, on which the number of pounds therein shall be branded."

the number of pounds therein shall be plainly and legibly branded. Every cask, kid, or package shall be packed with good, clean salt suitable for the purpose, and, after packing with sufficient salt to preserve its contents, shall be headed or well secured, and filled up with a clean, strong pickle.

Qualities of pickled fish. Ibid., section 37.

There shall be five qualities of mackerel, three of salmon and shad, and two of other kinds of pickled fish. Mackerel of the best quality, not mutilated, measuring not less than thirteen inches from the extremity of the head to the crotch or fork of the tail, free from rust, taint, or damage, shall be branded *number one.* The next best quality, being not less than eleven inches, measuring as aforesaid, free from rust, taint, or damage, shall be branded *number two.* Those that remain after the above selections, if free from taint or damage, and not less than thirteen inches, measuring as aforesaid, shall be branded *number three, large.* Those of the next inferior quality, free from taint or damage, not less than ten inches in length as aforesaid, shall be branded *number three.* All other mackerel free from taint or damage shall be branded *number four.* Those salmon and shad which are of the best quality for family use, free from rust or damage, shall be selected for number one and number two, the best of them selected and branded *number one*, the residue, *number two;* all that remain, free from taint, and sound, shall be branded *number three.* Of all other pickled fish, the best which are free from taint and damage shall be branded *number one*, those that remain, free from taint, and sound, *number two.*

Penalty for illegally packing. Ibid., section 38.

Each cask, kid, or package shall be filled with fish of the same kind, or parts of the same kind of fish; and whoever intermixes, takes out, or shifts any inspected fish which are packed or branded as aforesaid, or puts in other fish for sale or exportation, shall forfeit fifteen dollars for each package so altered. If any casualty renders it necessary to repack a cask of inspected fish, it shall in all cases be done by an inspector of such fish.

Branding of packages. Ibid., section 39.

The inspector shall brand in plain, legible letters, on the head of each cask of fish inspected by him, the denomination of the fish packed or repacked therein, the initials of his Christian name and the whole of his surname, and, if a deputy, the name of the place for which he is appointed, the letters Mass., and the year in which the fish are packed; and shall also, when, in his judgment, it may be necessary, nail in a suitable manner any cask in which fish are packed.

Pickled fish inspected elsewhere not subject to reinspection. Ibid., section 42.

Pickled fish, duly inspected in the State or country in which it is packed, shall not be subject to reinspection in this State.

Inspection of fish packed whole. Ibid., section 43.

Small fish, which are usually packed whole with dry salt or pickle, shall be put in good casks of the size and materials required in this chapter for the packing of split pickled fish, and shall be packed close in the cask and well salted; the casks shall be filled full with the fish and salt, and no more salt shall be put with the fish than is necessary for their preservation, and the casks containing such whole fish shall be branded with the denomination of the fish, and a like designation of the qualities as is before prescribed in this chapter in respect to the qualities of other pickled fish.

Quality and size of packages for pickled fish. Ibid., sections 44, 45.

Casks used for packing or repacking pickled fish intended for exportation, except casks containing less than twenty-five pounds weight, shall be made of sound, well-seasoned white oak, ash, red oak, spruce, pine, or chestnut staves, of rift timber,* sound and well seasoned, with heading of either of said kinds of wood, and when of pine such heading shall be free from sap and knots, and be planed; the barrels, half barrels, and tierces shall be well hooped with at least three good hoops of sufficient substance on each bilge, and three hoops of the like quality on each chime; the barrel-staves shall be twenty-eight inches in length, and the heads shall be seventeen inches between the chimes; the barrels shall contain not less than twenty-eight nor more than twenty-nine gallons each; the half barrels not less than fifteen gallons each; and the tierces not less than forty-five nor more than forty-six gallons each. Each cask shall be made in a workman-like manner, and branded on its side, near the bung, with the name of the maker.

The inspector-general or his deputies shall strictly examine and inspect all casks in which they may be required to pack fish; and shall reject such as are not made in a substantial manner and according to the provisions of this chapter.

Fees for inspection of pickled fish. Ibid., sections 46, 47.

The fees for inspecting and branding, exclusive of cooperage, shall be, for each tierce fourteen cents, each barrel nine cents, each half barrel six cents, each cask of a smaller denomination three cents, and, in addition to the fees aforesaid, one cent for each cask nailed as before provided; and all fees shall in the first instance be paid by the original

* The words "of rift timber" struck out by amendment passed January 30, 1867.

owner of the fish, or by the person employing the inspector, and may be recovered by them respectively of the person who afterwards purchases or exports the same.

The inspector-general may receive from each of his deputies for every cask of fish inspected by him the following fees: For each tierce four cents, for each barrel one cent, for each half barrel,* and all packages less than one hundred or more than fifty pounds, one-half cent, and on all packages of fifty pounds and less, one-quarter of a cent each.

Inspection of smoked alewives or herrings. Ibid., sections 48–52.

Alewives or herrings intended to be packed for sale or exportation, shall be sufficiently salted and smoked to cure and preserve the same, and afterwards shall be closely packed in boxes in clear and dry weather.

Smoked alewives or herrings shall be divided and sorted by the inspector or his deputy, and denominated, according to their quality, *number one* and *number two.* Number one shall consist of all the largest and best cured fish; number two of the smaller but well-cured fish; and in all cases those which are belly-broken, tainted, scorched, or burnt, slack-salted, or not sufficiently smoked, shall be taken out as refuse.

Boxes made for the purpose of packing smoked alewives or herrings, and containing the same, shall be made of good sound boards, sawed and well seasoned; the sides, top, and bottom of not less than half-inch, and the ends of not less than three-quarter inch, boards securely nailed, and shall be seventeen inches in length, eleven inches in breadth, and six inches in depth, in the clear, inside.

Each box of alewives or herrings inspected shall be branded on the top by the inspecting officer with the first letter of his Christian name, the whole of his surname, the name of the town where it was inspected, with the addition of Mass., and also with the quality of *number one* or *number two.* Herrings taken on the coasts of Nova Scotia, Newfoundland, Labrador, or Magdalen Islands, and brought into this State, shall also be branded with the name of the place or coast where taken.

The fees for inspecting, packing, and branding, shall be five cents for each box, which shall be paid by the purchaser; and the inspector-general may require from his deputies one cent for each box inspected, packed, and branded by them.

Annual report of fish inspected. Ibid., section 53.

The inspector-general shall, in the month of January, annually, make a return into the office of the secretary of the commonwealth, of all the

* The conclusion of the section from the words "half barrel" is given as amended by act of April 1, 1879. The Revised Statutes of 1859 conclude the section after the words "half barrel," as follows: "half a cent, and for each smaller cask one-quarter of a cent."

fish inspected by him and his deputies during the year preceding the first day of said January, designating the quantities, kinds, and qualities of pickled and smoked fish, respectively, and distinguishing the quantities, kinds, and qualities of pickled fish of a first inspection from those reinspected; and the secretary shall, as soon as may be after receiving such returns, cause the same to be published in any newspaper in Boston authorized to publish the laws of the commonwealth.

Penalties for selling or transporting uninspected fish. Ibid., sections 54–56.

No smoked alewives or herrings shall be exported from this State, unless inspected and branded as aforesaid, under a penalty of two dollars for each box exported; nor said alewives or herrings be taken from a box, inspected and branded as aforesaid, and replaced by others of an inferior quality, with intent to defraud any person in the sale of the same, under a penalty of five dollars for each box so changed; provided, that all smoked herrings and alewives, arriving from any other State in the United States and having been there inspected, may be exported in a vessel from this State without being reinspected.

Pickled or smoked fish, which has not been inspected and branded according to the provisions of this chapter, put on board of a boat or vessel, or into a carriage of conveyance, with the intent that the same shall be sold within, or exported from, this State, shall be forfeited, and the inspector-general or a deputy may seize and libel the same.

If a master of a vessel or other person puts or receives on board of a vessel, or in a carriage of conveyance, for transportation from this State, pickled fish, or smoked fish, not inspected and branded as provided in this chapter, he shall forfeit a sum not exceeding ten dollars for every hundred pounds of such fish, and in the same proportion for any other quantity.

Penalty for selling tainted or damaged fish for food. Ibid., section 57.

Whoever sells within this State or exports therefrom tainted or damaged fish, unless with the intent that the same shall be used for some other purpose than as food, shall forfeit the sum of ten dollars for every hundred pounds of such fish, and in the same proportion for any other quantity; and upon a trial in such case the burden of proof shall be upon the defendant to show for what purpose such fish was so exported or sold.

Penalty for illegally branding. Ibid., section 58.

If the inspector-general, or a deputy inspector, brands a cask or package of fish, the contents of which he has not duly inspected, packed, salted, or coopered, or permits any other person to use his brands, in violation or evasion of the provisions of this chapter, he shall forfeit twenty dollars for each offense, and be liable to removal from office.

Quintal defined. Ibid., section 59.

When fish are sold by the quintal, it shall be understood to mean a quintal of one hundred pounds avoirdupois, and all contracts concerning fish sold in this manner shall be construed accordingly.

Packing of clam bait. Act of 1867, chap. 347, section 1.

When clam bait is sold by the barrel, it shall be construed to mean a fish-barrel of not more than twenty-nine, nor less than twenty-eight gallons of clams and not over three gallons of pickle. If a disagreement arises between the purchaser and seller respecting the quantity in a barrel, either party may call on an inspector of fish and have the barrel measured; and if it does not contain the aforesaid number of gallons of clams, the seller shall receive pay for the number of gallons it contains, and shall pay the expense of measuring and coopering, otherwise the purchaser shall pay such expense.

Right of inspectors to enter premises. Act of April 1, 1879, section 3.

The inspector-general of fish or some one deputy especially thereto authorized by him for that purpose, shall have the right to enter at all reasonable times, upon any wharf, and into any store, warehouse, or other place, where the packing of pickled fish is carried on in this State, for the purpose of inspecting, examining, and supervising the packing and inspecting of such fish, and to examine and weigh any package of such fish, for the purpose of ascertaining if the same are fit for exportation, in accordance with the requirements of the law.

RHODE ISLAND.

(General Statutes of Rhode Island, 1872.)

Election and qualification of packers of fish. Chapter 34, sections 1, 18; chapter 102, section 2.

The electors in each town shall, annually, on their town election days, choose and elect * * * one or more packers of fish, * * *.

Every packer shall give bond to the town treasurer of the town in which he shall be appointed, in the sum of one thousand dollars, with sufficient surety or sureties, to the satisfaction of such town treasurer, for the faithful performance of the duties of his office.

Duties of packers of fish. Chap. 102, section 1.

In every town in which pickled fish are packed up for sale or exportation from the State, the packers of such town shall see that the same have been properly pickled; that they are properly repacked in casks, in good shipping order, with good salt, sufficient in each cask to preserve such fish from damage to any foreign port.

Casks to contain only one kind of fish. Ibid., section 3.

Pickled fish, whether codfish, mackerel, menhaden, herrings, or other fish, shall be sorted, and one kind only be put into one cask.

Dimensions of casks; how filled; branding. Ibid., sections 4, 5.

Every cask shall be well seasoned and bound with twelve hoops; those of menhaden and herrings of the capacity to hold twenty-eight gallons; and those for other fish of the capacity, if a barrel, to hold two hundred pounds, and if a half barrel, one hundred pounds, weight of fish; each cask to be full, and the fish sound and well cured.

Every cask, being first searched, examined, and approved by a packer, shall, when packed or repacked for exportation, be branded legibly on one head with the kind of fish it contains, and the weight thereof; or the capacity of the cask, with the first letter of the Christian and the whole of the surname of the packer, with the name of the town, and with the words "Rhode Island," in letters not less than three-fourths of an inch long, to denote that the same is merchantable and in good order for exportation.

Qualities of fish. Ibid., section 6.

Every cask of pickled codfish and mackerel offered for sale, or for exportation from this State, shall also be branded No. 1, No. 2, or No. 3, to denote the quality of such fish.

Fish brought from other States, by fishermen, &c., excepted. Ibid., section 7.

Nothing in this chapter contained shall hinder any fisherman or owners of fish, coming to this State from their fishing trips, from selling or reshipping their fish to any other of the United States without being packed into barrels or half barrels.

Penalty for illegally selling fish. Ibid., section 8.

Every person who shall offer for sale in or attempt to export from this State any pickled fish which have not been approved by a sworn packer, or in casks which are not branded as aforesaid, shall forfeit fifty dollars for each offense.

Penalty for illegally packing or branding. Ibid., section 9.

Every person who shall shift any fish from any cask after the same has been branded by the packer, and shall offer to sell or export the same from this State, or shall brand any cask into which the same shall be shifted, or shall brand any cask with the branding-iron of a packer, or with any iron made in imitation thereof, shall forfeit not less than thirty dollars nor more than one hundred and sixty dollars for each offense.

Penalty for fraud. Ibid., section 10.

Every packer who shall be guilty of any fraud or neglect in packing any fish contrary to this chapter, or shall brand any cask not thoroughly examined according to the provisions thereof, shall forfeit fifty dollars for each offense.

Fees of packers of fish. Ibid., section 11.

The packers of fish shall be paid for opening, assorting, inspecting, weighing, pickling, packing, or repacking, heading up, nailing, and giving a certificate, if pickled codfish or mackerel, twenty cents for every barrel, and fifteen cents for every half barrel, by the owner thereof: *Provided*, That for all pickled codfish or mackerel which have been inspected in some one of the United States, and which shall not, in the judgment of the packer, require repacking, the said owner shall pay to the packer twenty cents only, for unheading, inspecting, reheading, branding, nailing, and giving a certificate thereof; and for all other except codfish and mackerel, the owner thereof shall pay the packer twenty-five cents for every cask.

CONNECTICUT.

(Revised Statutes of Connecticut, 1875.)

Appointment and qualification of inspectors. Title 16, Chapter XV, section 17.

The superior court in the several counties may appoint in each town therein not exceeding fifteen inspectors and packers of fish, and shall take a bond of every person so appointed, for the faithful discharge of his duty, in the sum of one hundred dollars, payable to the county treasurer; and the clerk of said court shall give a certificate of his appointment to each inspector, who may exercise the duties of his office in any town in such county.

Packing of pickled shad. Ibid., section 18.

All pickled shad intended for market shall be split and well cleansed and pickled in strong brine, and shall remain in such brine at least fifteen days before they shall be put up for market, and shall be put up in barrels or half barrels, the barrels containing two hundred pounds each, and the half barrels one hundred pounds each, of fish well packed, with a sufficient quantity of salt, and filled with strong brine; and shad so put up shall be of three denominations, to wit: Shad number one, to consist wholly of shad well saved, free from rust or any defect, with the head and tail cut off and the backbone taken out, each barrel to contain not more than eighty shad, and each half barrel not more than forty. The second denomination shall be shad number two, to consist wholly of those well saved, trimmed, pickled, and prepared for packing, in the same manner as shad number one, each barrel to contain not more than ninety shad, and each half barrel not more than forty-five. The third denomination shall be shad number three, to consist of such as will not answer for either of the two former numbers, well saved, with the heads taken off; and every inspector, who shall inspect and brand the same, shall designate by each brand the quality, weight, and kind of fish contained in each barrel and half barrel branded by him, the year when it shall have been inspected, in figures, the word "Conn.," and his own name and the name of the town where said fish was put up.

Quality and size of fish barrels. Ibid., section 19.

All barrels and half barrels containing fish shall be well made, of good seasoned red oak, white oak, or chestnut timber, and each tierce made with twelve hoops; and each barrel shall be of the capacity of from twenty-eight to thirty gallons, and each half barrel of the capacity of fifteen gallons and a half.

Imported shad not to be inspected. Title 20, Chapter XII, section 10.

Any inspector of fish who shall inspect or brand any package of shad imported into this State shall forfeit five dollars to the State.

Inspection fees. Title 13, Chapter XXVIII.

Inspectors shall receive for packing, heading, flagging, pickling, and branding each barrel of fish, twenty cents, and for each half barrel, ten cents.

Penalty for fraud by inspectors. Title 20, Chapter XII, section 12.

Every legally-appointed inspector or packer of fish who shall be guilty of any fraud or neglect, for which no other penalty is specifically prescribed, shall forfeit six dollars for every offense; and every such inspector or packer who shall mark or brand any cask containing fish which has not been actually inspected by him, or shall put a false brand upon any cask inspected by him, shall forfeit ten dollars.

Penalties for illegally repacking or exporting. Ibid., sections 13, 14.

Evry person who, after the inspection and branding of any cask containing fish, shall fraudulently take out or change any part of the contents thereof, or put into it any fish not inspected, shall forfeit twenty dollars.

Every person who shall export, or ship for exportation, to any foreign port, any fish not put up, inspected, and branded according to law, and the master of every vessel, knowingly having on board his vessel any such fish not so put up, inspected, and branded, shall forfeit the following sums: The owner, exporter, or shipper, shall forfeit six dollars for every cask containing fish; and every master of a vessel shall forfeit for every such cask on board, three dollars; but fish brought from another State, and inspected and branded in the State in which they were put up for market, conformably to its laws, and accompanied with such evidence thereof as such laws require, may be exported from this State without any reinspection.

53. REPEALED LAWS.

MAINE.

Until the year 1820, Maine was a province of Massachusetts and subject to the same laws, but in that year the province became a separate State and made its own laws. The fish inspection laws enacted by the State of Maine were very similar to those of the mother State. The first law was approved March 22, 1821, and is entitled "An act to provide for the packing of pickled and smoked fish." It reads as follows:

Appointment and qualification of inspectors.

Be it enacted by the Senate and House of Representatives in Legislature assembled, That the governor, with the advice of council, is hereby authorized and directed to appoint and commission, during his pleasure, in each town and plantation in this State where pickled fish or smoked alewives and herrings are cured or packed for the purpose of exportation, one or more suitable person or persons inspector or inspectors of pickled fish and smoked alewives and herrings, who shall be well skilled in the quality of the same, and who, before he enters on the duties of his office, shall be sworn to the faithful discharge thereof, and shall give bond with sufficient sureties to the treasurer of the town or plantation in which he is appointed, in the penal sum of not less than five hundred nor more than one thousand dollars, for the faithful performance of the duties of his office. And the selectmen of towns and assessors of plantations, in which such inspectors shall be appointed, shall annually examine the bonds given as aforesaid, and if the bond of any such inspector shall by them be considered insufficient, they shall forthwith notify such inspector of the same, and if any inspector shall for thirty days after such notice neglect to give bond as aforesaid to the satisfaction of such selectmen or assessors, it shall be their duty to give information thereof to the governor, who shall remove such inspector and appoint some other person to such office. And any person injured by the neglect or misdoings of any such inspector shall be entitled to a copy of such bond, and shall have a right to bring an action thereon in the name of such treasurer for his own use and benefit; and on producing the original in court and obtaining judgment thereon, execution shall issue for such sum only as shall be found due in damages to the person for whose use any such action shall be brought; and the amount thereof being entered by the clerk of the court on the original bond, the same may be delivered back (by leaving a copy) to the treasurer from whom the same was received.

Material and sizes of casks for pickled fish.

2. *Be it further enacted*, That all barrels, half barrels and tierces which shall be made or used for the purpose of packing, or containing pickled fish, shall be made sound of well-seasoned white oak, ash, red oak, spruce, pine, or chestnut staves, of rift timber, with heading of either of the said kinds of wood, sound, well-seasoned and the pine heads free from sap: said heading to be well planed; the barrels, half-barrels and tierces to be well hooped, with at least three hoops on each bilge and three hoops on each chime, all of which shall be good hoops of sufficient substance, the barrel staves to be twenty-eight inches in length, and the heads to be seventeen inches between the chimes; and to contain not less than twenty-nine nor more than thirty gallons; and barrels, half-barrels and tierces shall be branded on the side of the cask near the bung with the name of the maker or owner of said cask, and shall be made, in a workmanlike manner, to hold pickle; the half barrels to contain not less than fifteen gallons, and the tierces to contain not less than forty-five nor more than forty-six gallons: *Provided, however*, That nothing contained in this act, shall extend to fish packed in kegs of less than ten gallons.

Material and size of boxes for smoked fish.

3. *Be it further enacted*, That all boxes which shall be made for the purpose of packing smoked alewives or herrings and containing the same, shall be made of good sound boards, sawed and well seasoned, the sides, top, and bottom of not less than half-inch boards, and the ends not less than three-quarters of inch boards, securely nailed with not less than eight sixpenny nails, and sixteen fourpenny nails to each box, and the top of each box to be planed, and shall be seventeen inches in length, eleven inches in breadth, and six inches in depth in the clear, inside. And all alewives or herrings intended to be smoked and packed shall be sufficiently salted and smoked to cure and preserve the same; and afterwards closely packed in the boxes, in clear and dry weather.

Qualities of pickled fish. Branding.

4. *Be it further enacted*, That it shall be the duty of the inspector to see the salmon, mackerel, shad, and all other kinds of split pickled fish, or fish for barrelling, have been well struck with salt or pickle in the first instance, and preserved sweet, free from rust, taint or damage. And such fish as are in good order, and are of a good quality, shall be packed in tierces, barrels or half barrels; the tierces shall contain three hundred pounds, the barrels shall contain two hundred pounds, and the

halfbarrels one hundred pounds of fish each; and the same shall be packed with thirty-five pounds of good and clean coarse salt, suitable for the purpose, to each barrel; and said casks after being packed and headed up with the fish and sufficient salt to preserve the same, shall be filled up with a clear strong pickle, and shall be branded salmon, mackerel, shad (or as the case may be); those of the best quality, caught in the right season, to be most approved and free from damage, shall be branded Cargo No. 1; those which remain after the best have been selected, being sweet and free from taint, rust or damage, shall be branded Cargo No. 2; and there shall be a third quality, which shall consist of the thinnest and poorest of those that are sweet and wholesome, which shall be branded Cargo No. 3. And the inspector shall also brand in plain legible letters on the head of each and every cask, in which inspected merchantable fish or whole fish are packed or repacked, the weight, and initials of his Christian name, with his surname at large, the name of the town for which he is appointed, and the word "Maine" annexed; and each cask shall be filled with fish of one and the same kind; and if any person shall intermix, take out or shift any inspected fish which are packed and branded as aforesaid, or put in other fish for sale or exportation contrary to the true intent and meaning of this act, he or they shall forfeit and pay fifteen dollars for each and every package so altered: *Provided, however,* if any casualty shall render it necessary to repack a cask of inspected fish, it may in all cases be done by an inspector of such fish. And if any person shall sell or export or cause to be sold or exported, within or from this State, any tainted or damaged fish, he shall forfeit and pay ten dollars for every hundred weight that shall be thus sold or exported.

Packing and branding of codfish, halibut, &c.

5. *Be it further enacted,* That all codfish, haddock, hake, pollock, and halibut, pickled, and hereafter offered for sale, shall be packed in casks of the contents required by the second section of this act, each barrel to contain two hundred and twenty-five pounds, and each half barrel to contain one huadred and twelve and a half pounds, agreeably to the rules of packing in the fourth section of this act, with sufficient salt to preserve the same. And it shall be the duty of the inspectors to brand with plain and legible figures, the weight of the aforesaid five kinds of fish, in addition to the brands required by the fourth section of this act.

Packing and branding of small fish.

6. *Be it further enacted,* That all small fish which are usually packed whole with dry salt, shall be put in good casks of the size and materials mentioned in the second section of this act; said fish shall be packed close in the cask, and well salted; the casks shall be filled full with the fish and salt, putting no more salt with the fish than is neces-

sary for their preservation; and the inspector shall brand all casks containing such inspected whole fish with the name of the fish, and the quality as described in the fourth section of this act.

Inspection of smoked alewives or herring.

7. *Be it further enacted*, That all smoked alewives or herrings shall be divided and sorted by the inspector, and denominated, according to their quality, first sort and second sort; the first sort shall consist of all the largest and best cured fish, of not less than eight inches long; second sort, of the smaller but well cured fish, of not less than seven inches long; and in all cases the following shall be taken out as refuse: all those which are belly-broken, tainted, scorched, or burnt, slack-salted, or not sufficiently smoked. And each box of alewives or herrings so inspected shall be branded on the top, by the inspecting officer, with the first letter of the Christian name and the surname at length of the inspector who inspected the same; and in like manner the name of the owner thereof, with the name of the town where it was inspected, with the addition of "Maine," and also with the quality of first sort or second sort.

Certificate required for shipment of pickled and smoked fish.

8. *Be it further enacted*, That no pickled fish in casks, and no smoked alewives or herrings in boxes, shall be exported from this State by water, unless the master or owner of the vessel shall produce to the collector or other officer authorized by the United States to clear out vessels, a certificate from the inspector that the same has been inspected, packed, and branded according to the directions of this act; and the certificate shall express the number of barrels, half barrels, and tierces, and the number of boxes thus shipped, the kind and quality of the fish they contain, with the name of the master and owner, and the name of the vessel in which such fish are received for exportation. And such master or owner of every vessel shall take and subscribe the following oath or affirmation before the officer authorized as aforesaid:

I, A B, do swear, (or affirm as the case may be), according to the best of my knowledge and belief, that the certificate hereunto annexed, contains the whole quantity of pickled and barreled fish and smoked alewives and herrings on board the ——, —— master; and that no fish, smoked alewives or herrings are shipped on board said vessel, for the ship's company, or on freight or cargo, but what are inspected and branded according to the laws of this State. So help me God: or this I do under the pains and penalties of perjury (as the case may be).

Shipment of uninspected fish.

9. *Be it further enacted*, That if any pickled or barreled fish, or any smoked fish shall be put on board of any boat, vessel, or carriage of con

veyance, within this State, with intent to sell or export the same, unless said fish shall have been inspected and the casks and boxes containing the same shall have been branded agreeably to the provisions of this act, it shall be lawful for any justice of the peace in the same county, upon complaint made to him, to issue his warrant to the sheriff or his deputy, or to any constable of the town where such boat, vessel, or carriage of conveyance may be, requiring them respectively to seize and secure said fish, and carry the same to the inspector nearest the place where said boat, vessel, or carriage may be; and said inspector is hereby authorized and required to open and inspect and to pack and brand the same in the same manner as is prescribed in this act. And it shall be lawful for said inspector to detain the said fish until the expenses and charges of seizure, inspection, packing, and all other charges arising from such seizure, shall be paid. And it shall be the duty of every person, when required, to give necessary aid to the officer having such warrant, on pain of forfeiting five dollars for his refusal, to be recovered by action of debt, or on the case, before any court proper to try the same; and by any person who will prosecute therefor.

Inspection of imported pickled and smoked fish.

10. *Be it further enacted,* That no pickled or smoked fish, which shall be brought into this State from any other State or government, shall be sold or offered for sale before the same shall have been regularly inspected according to the provisions of this act; and each and every person who buy or sell, or offer for sale [any] pickled or smoked fish which shall be brought into this State from any other State or government, before the same is regularly inspected as aforesaid, shall severally forfeit and pay five dollars for each and every hundred pounds' weight so bought or sold; to be recovered by any person who shall prosecute for the same, by action of debt, or on the case, before any court proper to try the same.

Penalty for handling uninspected fish.

11. *Be it further enacted,* That if any master of a vessel, or other person, shall put or receive on board any vessel or other carriage or conveyance to transport the same from this State, any pickled or whole fish packed in casks which are not inspected or branded in manner by this act prescribed, he or they, on conviction, shall forfeit and pay not less than five dollars nor more than ten dollars for each and every hundred pounds of such uninspected fish.

Penalty for exporting uninspected smoked fish.

12. *Be it further enacted,* That no smoked alewives or herrings which shall not have been inspected and branded agreeably to the provisions of this act shall be exported from this State, under a penalty of two

dollars for each box so exported; nor shall any alewives or herrings be taken from any box so inspected and branded and others of an inferior quality be put in their place, with intent to deceive or defraud any person in the sale of the same, under a penalty of five dollars for each box so changed.

Penalty for illegal branding.

13. *Be it further enacted*, That if the inspector shall brand any cask, the contents of which he has not inspected, packed, salted, and coopered, or any boxes of smoked alewives or herrings which he has not inspected, packed, and nailed, according to the true intent and meaning of this act, or if he shall permit other persons to use his brands in violation or evasion thereof, he or they so offending, shall forfeit and pay, for every cask and box so branded, the sum of twenty dollars.

Branding-irons. Fish for home consumption, etc.

14. *Be it further enacted*, That all persons within this State who shall have fish for packing and pickling, either in bulk or in casks, to the amount of twenty barrels in one season, shall furnish the inspector with a branding-iron, containing the first letter of the owner's Christian name and his surname at large, and the inspector shall cause the names of such owners to be fairly branded on the head of every cask of their inspected fish; and if any such owner of fish shall refuse or neglect to furnish such brand he shall forfeit and pay for such neglect and refusal not less than five dollars nor more than twenty dollars; and all kinds of pickled fish which are packed in tierces, barrels, or half barrels for consumption within this State, and which are not subject to be inspected and branded as provided for exportation, shall, however, be packed with only one kind of fish in each cask, and there shall be the same weight in each cask as is provided by the fourth section of this act; and for intermixing different kinds of fish in the same cask, or for short weight in any cask, the owners or venders shall be subjected to the same penalties and forfeitures as are provided by this act for the like offense in the inspected pickled fish.

Disposition of penalties.

15. *Be it further enacted*, That all penalties and forfeitures arising by force and virtue of this act, except the penalties of five dollars mentioned in the ninth and tenth sections of this act, shall be recovered by action of debt in any court proper to try the same; one moiety thereof for the use of the town or plantation wherein the offense shall be committed, and the other moiety to him or them who shall sue for the same.

Payment of fees.

16. *Be it further enacted*, That the charges for certificates, inspecting, and branding shall be paid by the exporter or purchaser, in addition to

the purchase or cost of the fish; and bills for the legal fees of inspection and certificates shall, in the first instance, be paid by the original owner of said fish, or by the person employing the inspector; and all such owners or employers are hereby empowered to demand and recover the amount of said bills from the subsequent purchaser or exporter.

Inspectors now in office.

17. *Be it further enacted,* That the inspector and his deputies, legally appointed and now in office, shall continue to hold and enjoy their respective offices until the tenth day of April next.

Inspectors to give bonds.

18. *Be it further enacted,* That every inspector of fish appointed in this State shall, on being qualified for such office, pay to the treasurer of the town or plantation in which he shall reside five dollars; and it shall be the duty of such treasurers to pay over all moneys so received to the treasurer of this State on or before the twentieth day of January annually.

Inspection fees.

19. *Be it further enacted,* That the inspectors shall be paid for each certificate for exportation seventeen cents, and for inspecting and branding each and every cask of fish, as directed by this act; for each tierce ten cents, for each barrel seven cents, for each half barrel four cents, for each box of smoked herrings or alewives two cents, exclusive of the labor and expense of packing and coopering; and the fees for inspecting and the expense for packing and coopering shall be paid by the seller.

The following act additional to the preceding law was passed January 29, 1822:

Inspection of smoked herrings.

Be it enacted, &c., That, from and after the passing of this act, the several inspectors of fish in this State shall be authorized to inspect smoked herrings, scaled and cured in a superior manner, and packed in boxes eighteen inches long, nine inches wide, and seven inches deep in the clear, which boxes shall be made and branded on the cover, in the same manner as other boxes for herring are now made and branded, excepting that, instead of *first* or *second sort,* the word *scaled* shall be inserted. And the inspection and exportation of said herrings shall be subject to the same laws and regulations as are prescribed by law for other herrings.

On February 8, 1822, the following law was passed:

Inspection in places where no inspector resides.

Be it enacted, &c., That where it shall be necessary to have fish inspected in any town or plantation where no inspector resides, it shall be lawful for any inspector within the county to inspect and brand the same in such town or plantation.

The following law was passed February 25, 1824:

Inspection of imported fish.

SEC. 1. *Be it enacted, &c.*, That all butter, lard; pickled, dry, or smoked fish, beef, and pork, or other salted provisions that may have been inspected in any other of the United States, may be exported from any port in this State to any foreign port without its being subject to reinspection, any law to the contrary notwithstanding.

The following law passed February 2, 1828:

Inspection of shad.

Be it enacted by the senate and house of representatives, in legislature assembled, That, from and after the passing of this act, it shall be the duty of the several inspectors of fish in this state to brand shad barrelled as specified in the fourth section of an act, passed the twenty-second day of March, one thousand eight hundred and twenty-one, as follows, viz: Those of the best quality, caught in the right season, to be most approved and free from damage, having their tails cut off and back bones out, shall be branded "*Cargo Mess*"; those which remain after the best have been selected, being sweet and free from taint, rust, or damage, with their back bones in, and tails on, shall be branded "Cargo No. 1"; and there shall be a third quality, which shall consist of the thinnest and poorest of those that are sweet and wholesome, which shall be branded "Cargo No. 2"; anything contained in any act to which this is additional, to the contrary notwithstanding.

The following additional law regulating the inspection of smoked herring was passed February 12, 1831:

1. *Be it enacted, &c.*, That from and after the passage of this act, the several inspectors of fish in this state shall be authorized to inspect smoked herring scaled and packed in boxes eighteen inches long, nine inches wide, and seven inches deep in the clear, which boxes shall be made (except as to dimensions) in the manner provided by law for pickled and smoked fish, and in addition to the brand now required by law, there shall be branded upon the cover of said boxes, *first sort, or second sort scaled herring* (as the quality may require), *first sort* to be not less than eight inches long, and second sort not less than six inches and a half long, and cured in a superior manner.

2. *Be it further enacted*, That the inspection and exportation of said herrings shall be subject to the same regulations as are prescribed by law for pickled and smoked fish, and that the act passed January twenty-ninth, in the year of our Lord one thousand eight hundred and twenty-two, entitled "An act in addition to an act to provide for the packing

and inspection of pickled and smoked fish," be and the same is hereby repealed.

The Massachusetts inspection laws passed in 1810, provided for the appointment of an inspector-general of pickled and smoked fish. This law applied to the province of Maine until the separation in 1820. The new law then passed by Maine did not require an inspector-general, but provided for the appointment of inspectors in the several fishing towns of the State. This method of inspection continued until March 14, 1862, when the following law was passed:

Appointment and duties of inspector-general and deputies.

1. The governor with advice of the council shall appoint an inspector-general of fish, removable at pleasure, who shall be commissioned for a period not exceeding two years, and he shall be sworn and give bond with sufficient sureties in the sum of six thousand dollars to the treasurer of state for the faithful discharge of his duties before entering thereon.

2. The inspector-general shall appoint one or more deputies in every town in this state where pickled fish or smoked herrings and alewives are cured or packed for exportation, who shall be responsible for their neglect or misconduct while acting under him, and when the office of inspector-general becomes vacant, they may continue to discharge the duties of the office until a successor is appointed, and they shall be accountable to the state.

3. Every deputy shall be sworn by the inspector-general or by a justice of the peace, and give bond to the inspector-general with sureties to his satisfaction for the faithful performance of his duty, and the bond shall be so expressed as to enure to the use of the state for the time the deputy exercises his duties during a vacancy in the office of inspector-general.

4. Each deputy shall pay to the inspector-general one dollar, as an excise fee for his bond and commission, and the inspector-general may receive from each of his deputies for every cask of pickled fish inspected by him the following fees: For each tierce, four cents; for each barrel, one cent; and every smaller package, one-half cent.

5. The inspector-general shall, in the month of January annually, make a return into the office of secretary of state, of all the fish inspected by him and his deputies during the year preceding the first day of said January, designating the quantities, kinds, and qualities of pickled and smoked fish respectively, and the secretary shall publish the same, as soon after as may be, in the state paper, and the inspector-general may require returns of his deputies as often as he sees fit.

6. All acts and parts of acts inconsistent herewith are hereby repealed.

On March 24, 1864, the following amendment to the fish inspection laws was approved:

Inspection of mackerel.

1. Chapter forty, section five, of the Revised Statutes is hereby amended by striking out all in said section after the word "therein" in the thirteenth line, and inserting mackerel of the best quality, not mutilated, measuring not less than thirteen inches from the extremity of the head to the crotch of or fork of the tail, free from rust, taint, or damage, shall be branded number one. The next best quality, being not less than eleven inches, measuring as aforesaid, free from rust, taint, or damage, shall be branded number two. Those that remain after the above selections, free from taint or damage, and not less than thirteen inches, measuring as aforesaid, shall be branded number three large. Those of the next inferior quality, free from taint or damage, not less than ten inches in length, as aforesaid, shall be branded number three. All other mackerel free from taint or damage shall be branded number three small. The inspectors shall also brand in plain letters on the head of every such cask the weight, the initials of his Christian and the whole of his surname, the name of his town, and the letters Me., an abridgement of the month, and the year, in figures when packed. The inspector-general of fish shall have no interest, directly or indirectly, in the cure or packing of pickled fish.

Term of office of inspector-general lengthened.

2. Chapter ninety-nine, section one, of the public laws of eighteen hundred and sixty-two is hereby amended by striking out the word "two" and *and* inserting *five*.

3. This act shall take effect when approved by the governor.

The present fish inspection laws of Maine were passed February 10, 1875, and abolish the office of inspector-general, which was created in 1862. Each fishing port is now provided with its own inspectors.

MASSACHUSETTS.

Various inspection laws regulating the packing of pickled fish have been in force in Massachusetts since early colonial days. The following law was passed in May, 1651:

Att a Gennerall Courte of Eleccons, held at Boston, 7th May, 1651.

For preventing the deceipt of any person in packing of fish, beife and porke to be putt to salie in this and other jurisdictions, itt is therefore ordered by this Courte and the authoritje thereof, that in every towne wthin this jurisdicon where any such goods are packed up for sale, the gager of that toune, or of the toune wherein it is putt to sale, or shipt, shall see that it be well and orderly performed, that is to say, beife and porke, the whole halfe or quarter together, and so proportionably, and the best be not left out; and for fish, that they be packt all of one kind, and that all caske so packt, be full, and sound and well seasoned setting his seale on all caske so packt, for which he shall receive of the owners, for so packing and sealing, fower shillings p tunne; but if the gager do only veiw them, and find them good and sufficjent, he shall set his seale vppon them, and have one shilling p tunne for so doing; and if such goods so packt shall be put to sale packt vp in caske without the gagers marke, he shall forfeite the said goods so put to sale, one-half to the informer, the other to the countje treasury, and whereas notw^ith^standing the former law provided, *tit.* caske and coopers, page the sixth, much damage is still sustained by marchants and men of trade, through insufficiencie and vendue assize of caske, itt is therefore further ordered by the authorytie of this courte, that wheresoever any new caske are found put to sale being defective either in workmanship, timber, or assize, as in that law is provided vppon due proofe made before any one magistrate, the said caske shall be forfeited to the informer, and the workmen for his default shall pay tenn shillings a tunn forthwith, to the use of the countye and so proportionable to any greater or lesser caske; and becawse there may be no neglect in the choice of a gager to prevent the abuses in this or any other lawe exprest, itt is further ordered by the authorytie aforesajd, the every toune within this jurisdiccon wherein any caske are made shall yeerely make choice of one fitt man for that worke and imploiment, who, being presented by the constable within one weeke after the choice made, before any one magistrate, shall take the oath belonging to his place, which if he shall refuse, he shall pay the some of forty shillings, and another to be chosen in his roome; as also the toune or constable shall either of them suffer the like poenaltie for the neglect of this order, any other lawe, custome or order to the contrary notwithstanding.—(Records of Massachusetts, Vol. IV, Part I, p. 39.)

In 1652 another law was passed as follows:

Att the second Sessions of the Generall Court, held at Boston, the 19th of Oct. 1652.

Vppon sundry information of sundry abuses which may arise, and thereby reproach redound to the countrje, by packing of beife, porke in caske that is not full gage, although the packer doe carefully fill the same, as the lawe provides, it is therefore ordered by this Courte: that henceforth every packer shall see that all caske he packs any beife, pork mackerill, fish or any other goods in comitted to his care, be of true and full asize and gage, and that he packes the same in no other caske whatsoever on penaltie of tenn shillings for every caske by him packed that is or shall be defective in that respect, one halfe to the informer, and the other half to the countrie. This order to be the next day published, and posted vp in Boston and Charles Toune, and, by the first opportunitie, in Salem and Ipswich.

The oath for packers of beife &c—

Whereas, you AB, are chosen a packer of beife porke and other things for the toune of B:, you doe here sweare by the living God that you will well and truely packe, all beife, porke, and other things when you shall be thereunto required; you shall packe no kinde of goods but such as are good and sound nor any goods in any caske that is not of a just and full gage; you shall also sett your particular marke vpon all caske packed by you; and in all things propper to the place of a packer you shall faithfully discharge the same, from tjme to tjme, according to your best judgment & conscjence, So helpe you God.—(Records of Massachusetts, Vol. IV, Part I, page 105.)

The following law was passed November 8, 1692:

AN ACT for regulating the assize of cask, and preventing deceit in packing of fish, beef, and pork for sale.

Be it ordained and enacted by the Governour, Council and Representatives in General Court assembled, and by the authority of the same.

SEC. I. That from and after the first day of December next, all sorts and kinds of tight cask used for any liquor, fish, beef, pork, or any other commodities within this, their majesties' province, shall be of London assize; puncheons, eighty-four gallons; hogsheads, sixty-three gallons; tearses, forty-two gallons; barrels, thirty-one gallons and a half; and made of sound, well-seasoned timber, and free from sap. And that fit persons be appointed, from time to time, in all places needful to view and gage all such cask; and such as shall be found of due assize shall be marked with the gager's mark, who shall have for his pains four pence per tunn; and every cooper shall set his distinct brand-mark on his own cask, on penalty of forty shillings. And whosoever shall put to sale any new cask, being defective either in workmanship, timber, or assize, as aforesaid, upon proof thereof, made before one justice of the peace, he shall forfeit such cask and be fined forty shillings.

And be it further enacted [Sect. 2], That the justices of the peace, at their first general quarter sessions, to be holden in each respective county within this province, shall yearly, in every town needful thereof, choose and appoint a fit person or persons to be gagers and packers, and then to swear to the due execution of their office; which, if any person so appointed shall refuse, he shall pay the sum of forty shillings, and another shall be chosen and appointed in his stead. And every gager and packer shall take care that all cask in which he packs beef, pork, mackerel, fish, or other goods committed to his care, be of true and full assize, and that he pack the same in no other cask whatsoever, on penalty of ten shillings for every cask by him packed, that is or shall be defective in that respect. And if any of the before mentioned provisions shall be packed into half barrels or firkins, the same shall be made in proportion to the assize aforesaid, and be marked by the packer.

And for the preventing of fraud and deceit in the packing of pickled fish, beef, and pork to be put for sale, *Be it further enacted* [Sect. 3], That in every town where such goods are packed up for sale, the gager or packer of such town, or of the town wherein they are put to sale or shipped, shall see that it be well and orderly performed; that is to say, beef and pork, the whole half and quarter, and so proportionably that the best be not left out; and so fish and mackerel, that they be packed all of one kind; and that all casks so packed be full, and the fish sound and well seasoned, setting his seal on all casks so packed; and he shall receive of the owners for so packing and sealing, four shillings per ton. And if any such provisions be put to sale or shipped off without the packer's mark, they shall be forfeited.

[Sect. 4.] *And it is further enacted*, That all sorts of green or pickled fish, sturgeon, or flesh that shall be put up for transportation to a foreign market shall be searched, surveyed, and approved by a sworn packer, who shall take strict care that the same be put in tight cask of full gage, salted with suitable salt. And such as shall be so saved, and for its condition found merchantable and full, the packer shall seal with such brand-mark as shall be assigned to the town, and such other cut-mark added as may denote the sort of provision and the time when packed. And all such other provisions as the packer shall find wholesome and useful, though for its quality it be not merchantable, he shall cause to be well packed, salted, filled, and sealed with the letter R, and such other letters as may signifie the town, specie, and time of packing. And if any master of a ship or other vessel, or any officers or mariners belonging thereto, shall receive such provisions not marked and sealed, as aforesaid, aboard any of their ships or vessels, he or they who shall offend therein, shall forfeit double the value of all such provisions; and he that owns the provisions shall forfeit the same. And if any cooper or other person shall shift any fish or flesh, either on board or on shore, after the same has been so sealed and marked by the packer, and ship and export the same, the packer having not allowed thereof, and anew sealed and marked the cask whereinto such provisions are shifted, all persons acting, ordering or assisting therein, shall be set in the pillory, not exceeding one hour, and shall likewise pay double damages to persons wronged thereby.

And it is further enacted [Sec. 5], That when any such provisions have lain above three months under the packer's mark, betwixt the months of May and October, they shall again, upon exportation or sale, be viewed or searched by the packer; that is to say, so many of them as may probably discover the condition of the whole; and if any be decayed or deceitfully dealt with, the packer shall cull and repack the same, so as to distinguish and mark them for merchantable or refuse, according to their condition. And if those who ship or export any such provision shall neglect or refuse such second search or survey, the packer is hereby ordered and impowered to deface his former mark, and for so doing shall be paid as if he had repackt the same. And if the owner refuse to satisfie the packer, such packer shall have redress on complaint to any justice of the peace, who is hereby impowered to compel the payment thereof by distress.

[Sec. 7.*] That all fines, penalties, and forfeitures, arising by force and virtue of this act, shall be the one-half to their majesties toward the support of the government of this province, and the other half to him or them that shall inform and sue for the same in any of their majestie's courts of record within this province.

Be it further enacted [Sec. 8], That there be a measurer of salt and culler of fish in every seaport town within this province, to be appointed as aforesaid, who being likewise sworn for the faithful discharge of that office, shall cull all merchantable fish and measure all salt that shall be imported and sold out of any ship or other vessel, and shall have three half-pence for every hogshead of salt by him so measured, to be paid, the one-half by the buyer, the other half by the seller. And one penny per quintal for every quintal of merchantable fish by him culled, to be paid, one-half by the buyer and the other half by the seller. (Acts and resolves of the Province of Massachusetts Bay, Vol. I, 1692–1714, p. 49.)

Between the years 1692 and 1784 various other laws similar to the preceding were enacted. A comprehensive law was passed on November 9, 1784, by which the selectmen of the town, in the commonwealth of Massachusetts, were authorized to choose and appoint searchers and packers of dry and pickled fish designed for exportation from the State. In this law it is provided that each barrel of pickled fish must contain a sufficient quantity of salt for their preservation; that mackerel and other barrelled fish be packed all of one kind and in casks well seasoned, containing not less than thirty gallons, and the casks be full and properly branded with the name of the fish therein.

The law of March 6, 1810, which repealed all previous enactments on the same subject is a very minute and important one. It provides for the appointment of an inspector-general and deputy inspectors. The former is required to give bonds to the treasurer of the State for the faithful discharge of his duties. The deputies must give bonds to the inspector-general, and he is held responsible for them. In this law we find the qualities of fish more definitely described than in earlier laws. The section on this subject requires that barrels containing pickled fish "shall be branded salmon, mackerel, shad (or as the case may be); those of the best quality, caught in the right season, to be most approved and free from damage, shall be branded *Cargo No.* 1; those which remain after the best have been selected, being sweet and free from taint, rust, or damage, shall be branded, *Cargo No.* 2; and there shall be a third quality, which shall consist of the thinnest and poorest of those that are sweet and wholesome, shall be branded, *Cargo No.* 3; and the inspector shall also brand in plain, legible letters, on the head

* Section 6 refers to the packing of tar.

of each and every cask in which inspected, merchantable fish, or whole fish are packed, or repacked, the initials of his Christian name, with his surname at large, the name of the town for which he is appointed, and *Mass.* annexed for *Massachusetts.* * * *."

The act passed by the Massachusetts legislature March 28, 1834, says:

SEC. 1. *Be it enacted, etc.,* That the inspector-general, or his deputies, shall not be required to brand upon the casks in which mackerel may hereafter be packed, the owner's name, nor the word "cargo."

SEC. 2. That the second and fifth sections of the act passed *March fourteenth, one thousand eight hundred and thirty-one,* entitled "An act in addition to several acts regulating the inspection of pickled fish," are hereby repealed.

SEC. 3. That the inspector-general, or his deputies, shall brand upon every cask of mackerel inspected by him or them the year in which the same is packed; and upon all No. 3 mackerel, that are usually denominated southern or Block Island mackerel, and all others of a similar quality and description the word "South"; and upon all other No. 3 mackerel, the word "North." Provided, however, that the inspectors shall receive no additional compensation therefor.

SEC. 4. That it shall be the duty of the inspector-general, or his deputies, when mackerel are presented to him or them for inspection, to select those of the best quality, and such as are fit for family use, for No. 1; those of the next best quality, being fat, free from damage, of suitable size, and not cut or mutilated in any manner for the purpose of deception, for No. 2; and all others for No. 3, and to brand the casks in which they are packed, accordingly.

SEC. 5. That all acts or parts of acts inconsistent with the provisions of this act, are hereby repealed.

The Revised Statutes of 1835, in defining the qualities of pickled fish, say:

"There shall be four qualities of mackerel, three of salmon and shad, and two of other kinds of pickled fish; those mackerel of best quality for family use, not mutilated, of suitable size, free from rust or damage, shall be number one and number two, the best of those selected and branded *number one*, the residue *number two;* those remaining after this selection, of usual size, free from taint, and sound, shall be branded *number three;* and those of this number that are of the description called Block Island mackerel shall also be branded with the word *south;* all small-size mackerel, free from taint, and sound, remaining after the above selections, shall be branded *number four;* those salmon and shad which are of the best quality for family use, free from rust or damage, shall be selected for number one and number two, the best of them selected and branded *number one*, the residue *number two;* all that remain, free from taint and sound, shall be branded *number three;* of all other pickled fish the best, such as are free of taint and damage, shall be branded *number one;* those that remain free from taint, and sound, *number two.*"

The act of March 31, 1846, defines the grades of mackerel under four numbers, and reads as follows:

"SEC. 1. From and after the passing of this act there shall be four numbers of mackerel: Those of the best quality, not mutilated, measuring not less than thirteen inches from the extremity of the head to the crotch or fork of the tail, free from rust, taint, or damage, shall be branded number one. The next best quality, being not less than eleven inches, measuring as aforesaid, free from rust, taint, or damage, shall be branded number two. Those that remain after the above selections, if free from taint or damage, and not less than thirteen inches, measuring as aforesaid, shall be branded number three large. Those of the next inferior quality, free from taint or damage, not less than ten inches in length, as aforesaid, shall be branded number three. All other mackerel, free from taint or damage, shall be branded number four.

"SEC. 2. The inspector-general shall not have any interest, directly or indirectly, in the cure or packing of any pickled fish, except so far as a faithful performance of his duty requires.

"SEC. 3. The act in addition to an act regulating the inspection of pickled fish, being the one hundred and fifty-fourth chapter of the statutes of the year one thousand eight hundred and thirty-six; the act concerning the manufacture of barrels for pickled fish, being the forty-second chapter of the statutes of the year one thousand eight hundred and fifty-four; and also so much of the third section of the twenty-eighth chapter of the Revised Statutes; as is inconsistent with this act, are hereby repealed."

In 1850 the following law was enacted in Massachusetts, requiring that dutiable imported pickled fish be branded with the word "foreign." This law was repealed by act April 1,1879. It had become quite unimportant, since nearly all fish requiring such branding were those from the British provinces, which, by the treaty of Washington, had been admitted free of duty for several years. The law reads as follows:

"Pickled fish of foreign catch, on which an import duty is laid by the laws of the United States, which is brought into this State and here inspected or reinspected, shall, in addition to the brand mentioned in the preceding sections, be branded with the word 'foreign' on the head of each cask, barrel, or package, in letters not less than one inch in length, and separate and distinct from the other brands.

"If an inspector of fish inspects or reinspects any fish of foreign catch so imported and brought into this State, and refuses or neglects to comply with the requirements of the preceding section, he shall forfeit and pay for such refusal or neglect fifteen dollars for every cask, barrel, or package so neglected."

CONNECTICUT.

The following fish-inspection law was enacted in Connecticut May 31, 1822, and appeaus in the Revised Statutes of 1849:

"*Be it enacted, &c.*, All pickled shad, codfish, or mackerel, intended for market, shall be split and well cleansed, and pickled in strong brine. Shad and codfish shall be in such brine at least fifteen days, and mackerel at least forty-eight hours, before they are put up for market, and shall be put in barrels or half-barrels, the barrels containing two hundred pounds each, and the half-barrels one hundred pounds each, of fish well packed, with a sufficient quantity of salt, and filled with strong brine. And shad so put up shall be of three denominations, viz: Shad No. 1 to consist wholly of shad well saved, free from rust or any defect, and the head and tail cut off, and the backbone taken out; each barrel containing not more than seventy-two shad, and each half-barrel not more than thirty-six shad. The second denomination shall be shad number 2, to consist wholly of well saved, trimmed, pickled, and prepared for packing, in the same manner as shad number 1; each barrel containing not more than eighty-two shad, and each half-barrel not more than forty-one shad. The third denomination shall be shad number 3, to consist of shad that will not answer for either of the two former numbers, well saved, with the head taken off; and said barrels and half-barrels of fish shall be inspected and branded in the manner hereinbefore prescribed for inspecting beef and pork; and the inspector who shall inspect or who shall brand the same shall designate by each brand the quality, weight, and kind of fish contained in each barrel and half-barrel branded by him, and also his own name, and the name of the town where said fish was put up.

"All barrels and half-barrels containing fish for market or exportation shall be well made of good seasoned red oak, white oak, or chestnut timber; and each tierce made with twelve hoops; and each barrel shall be of the capacity of from twenty-eight to thirty gallons, and each half-barrel of the capacity of fifteen gallons and a half."

PENNSYLVANIA.

Laws regulating the inspection of pickled fish were enacted in Pennsylvania in 1835, and, with subsequent amendments, were in force until 1874, when they were repealed by the adoption of a new constitution that abolished the office of State inspector, and left the regulation of the trade to the several cities and towns. Philadelphia has for many years been a large market for pickled mackerel and other fish. Large quantities are received here from the North, and, after being repacked, are distributed over the State, especially in the mining regions.

A leading fish-dealer of Philadelphia writes as follows:

"Fish-inspection laws were in force in Pennsylvania until the adoption of the new constitution in 1874, since which time we have had no law governing the same. Two different bills have been before the legislature, both of which failed; we remonstrated against both, as they discriminated against us. Under one section of the law as it existed until 1874 any man in a bordering State could pack goods any weight he saw fit and sell them in Pennsylvania. No local law will remedy the defect. The only way to correct the abuse is by a general law requiring the weight and grade stamped on each package, and failure thereof to be punished by penalty. This would require no inspector, as a violation could be tried and determined before a justice or United States commissioner, the same as any misdemeanor. Such a law would be hailed with delight by every honest dealer, and leave no argument for the dishonest ones. From the passage of the law, in 1860, until the repeal of the same, in 1868, our house had their smaller packages put up down East, rather than encourage the inspector, which was only in name, no inspecting being done. He would walk into the counting-house, ask how many packages had been made, take what you gave him, and move on. In conversation with a merchant on this subject he told me of an instance where the inspector collected $3.50 fees, and the firm afterward admitted to packing 2,700 packages."

We give below the law as it stood on the statute-books of Pennsylvania at the time of the abolishment of inspection laws, in 1874:

Appointment and qualification of inspector and his deputies. Act of March 27, 1860, sections 1, 2.

1. The governor shall appoint, for the term of one year, an inspector of pickled fish in and for this commonwealth, who shall give a bond, with sufficient sureties, to the treasurer of the State of Pennsylvania, in the penal sum of ten thousand dollars, who shall have all and singular the powers and authorities and be subject to all and singular the duties and liabilities of such office.

2. Said inspector may appoint deputy inspectors for the city and county of Philadelphia, and in such other cities or towns in this commonwealth where pickled fish is packed or repacked, and shall be answerable for their official conduct, and shall take bonds from each of them, with sufficient surety, in such sum as shall be judged sufficient, and the said deputies shall be sworn, either before the said inspector or some alderman or justice of the peace, to the faithful discharge of their duty.

When pickled fish need not be reinspected. Ibid., section 3.

3. Pickled fish which shall have been duly inspected in the State or country in which they were packed shall not be subject to reinspection in this State: *Provided,* That such fish are sold or exported in the original packages, without being repacked.

Duties of inspectors. Penalties for intermixing. Ibid., section 4.

4. From and after this act shall go into effect the inspector or his deputies shall see that all kinds of split pickled fish for barreling or repacking, intended for sale or export, except herring, haddock, pollock, or codfish, have been well struck with salt or pickle in the first instance, and preserved sweet, free from rust, taint, or damage; and such fish as shall be found in good order, and of a good quality, shall be packed or repacked in tierces containing each three hundred pounds of fish, or in barrels containing each two hundred pounds, or in half-barrels containing each one hundred pounds, or in quarter-barrels containing each fifty pounds, or in eighths of a barrel or kids, twenty-five pounds; each cask shall be filled with fish of one and the same kind; and if any person shall intermix, take out, or shift any inspected fish which have been packed or branded agreeably to the provisions of this act, or put in other fish for sale or exportation, contrary to the true intent and meaning of the provisions of the same, such person shall forfeit fifteen dollars for each package so altered: *Provided, however,* That if any casualty shall render it necessary to repack a cask of inspected fish, it shall in all cases be done by an inspector of such fish.

Packing and repacking. Ibid., section 5.

5. All fish that shall be packed or repacked in accordance with the fourth section of this act shall be so packed or repacked with good and clean salt, suitable for the purpose; and after packing said fish with sufficient salt to preserve them, and heading said casks, they shall be filled up with a clear, strong pickle.

Qualities of fish. Ibid., section 6.

6. There shall be four qualities of mackerel, three of salmon and shad, and two of other kinds of pickled fish; those mackerel of best quality, for family use, not mutilated, measuring not less than thirteen inches from the extremity of the head to the crotch or fork of the tail, free from rust, taint, or damage, shall be branded number one; the next best quality, being not less than eleven inches, measuring as aforesaid, free from rust, taint, or damage, shall be branded number two; those that remain after the above selections, that are free from rust, taint, or damage, shall be branded number three large; those of the next inferior quality, free from taint or damage, not less than ten inches in length, as aforesaid, shall be branded number three. All other mackerel, free from taint or damage, shall be branded number four.

Salmon and shad. Ibid., section 7.

7. Those salmon and shad which are of the best quality, for family use, free from rust, taint, or damage, shall be selected from number one and number two; the best of them selected and branded number one,

the residue number two; all that remain, free from taint, and sound, shall be branded number three.

Quality and size of casks. Ibid., section 8.

8. All casks used for packing or repacking pickled fish intended for sale or exportation shall be made of sound, well-seasoned white oak, ash, red oak, spruce pine, or chestnut staves, of rift timber, with heading of either of said kinds of wood, and if of pine, shall also be free from sap and knots, and shall be planed; the barrels, half-barrels, and tierces shall be well hooped, with at least three good hoops of sufficient substance on each bilge, and three hoops of the like quality on each chime; the barrel staves shall be twenty-eight inches in length, and the heads shall be seventeen inches between the chimes; the barrels shall contain not less than twenty-eight gallons nor more than thirty gallons each; the half-barrels not less than fifteen gallons each, and the tierces not less than forty-five nor more than forty-six gallons; and each cask shall be made in a workmanlike manner.

Inspection of casks. Act of March 27, 1860, chapter 289, section 9.

9. The inspector or his deputies shall strictly examine and inspect all casks in which he or they may be required to pack any fish, and they shall reject all such as are not made in a substantial manner and according to the provisions of this act.

Branding of casks. Ibid., section 10.

10. The inspector or his deputies shall brand, in plain, legible letters, on the head of each cask of fish inspected by them, or either of them, respectively, the denomination of the fish packed or repacked therein, the initials of the Christian name, and the whole of the surname of the inspector or his deputy, as the case may be, the name of the city or town for which such deputy is appointed, the letters "Penn." (for Pennsylvania), and the year in which the fish were packed. All fish of foreign catch which shall be brought into this State, and which shall be repacked, shall be inspected or reinspected, and in addition to the brand as required by this act, shall be branded with the word foreign on the head of each cask containing such inspected or reinspected fish, in letters not less than one inch in length, and separate and distinct from the other brands.

Inspection fees. Ibid., section 11.

11. The fees for inspecting and branding, exclusive of cooperage, shall be, for each tierce, twelve cents; each barrel, eight cents; each half-barrel, five cents; each cask of any smaller denomination, three cents; and in addition to the fees aforesaid, one cent for each cask that

shall be nailed, which shall be done in a suitable manner, when in their judgment it may be necessary.

Seizure of uninspected fish. Appropriation of proceeds. Ibid., section 12.

12. If any pickled fish which have been repacked, and not inspected or reinspected and branded according to the provisions of this act, shall be put on board of any boat or vessel, or into any carriage of conveyance, with intent that the same shall be sold within or exported from this State, the inspector, or any deputy, may seize and libel the same; and if upon trial it shall appear that such seizure was lawful, the fish so seized shall be decreed to be forfeited, and shall be sold and disposed of at public sale to the highest bidder; and the net proceeds, after paying the necessary expenses, shall be paid as follows: One-half to the overseers or guardians of the poor in the county where seized, and the other one-half to the inspector, or his deputy, who shall have caused the same to have been seized.

Penalty for illegal selling or branding. Ibid., section 13.

13. If any person or persons shall sell within this State, or shall export therefrom, any pickled fish which have been packed or repacked therein, and not duly inspected according to the provisions of this act, shall forfeit the sum of ten dollars for every hundred pounds of such fish thus sold or exported, to be recovered in any court of this State having competent jurisdiction. Any person using a brand for the purpose of branding casks of fish in imitation of those used by the inspector or his deputies, or in imitation of those used by the inspectors or their deputies in other States or foreign countries, or who shall counterfeit, forge, or fraudulently impress, or make the brand-mark, or any number or other mark of any such inspection, upon any cask of fish subject to inspection, or shall fraudulently alter, deface, conceal or erase any inspection mark duly made, shall, for every such offence, be deemed guilty of a misdemeanor, and be punishable by a fine not exceeding one hundred dollars, at the discretion of the court having jurisdiction of the offence.

Repealing clause. Ibid., section 14.

14. All the acts heretofore in force, regulating the inspection of salted or pickled fish, which are inconsistent herewith, be, and the same are hereby, repealed.—(Approved, March 27, 1860.)

*Name of packer to be branded.** Act of April 15, 1835, section 70.

SEC. 70. Every brand and half-barrel of salted fish, liable to inspec-

* This section and several of the following ones are only partially repealed by the act of March 27, 1860, from which the preceding sections are quoted.

tion as aforesaid, shall be branded with the initial letter of the Christian name, and surname at full length, of the person or persons putting up the same, or the person selling the same, under penalty of seventy-five cents for every such cask.

Mode of inspection. Ibid., section 72.

15. Every cask containing salted fish, liable to inspection as aforesaid, shall be inspected by opening, and, if necessary, by unpacking and re-packing the same, so that the inspector may judge of the soundness and true package of the fish, as well as of the contents of the cask.

Branding of unmerchantable fish. Ibid., section 74.

16. If the inspector shall, upon examination find any barrel or half-barrel, containing salted fish, not to be of the proper description, or if he shall find the fish not to be merchantable as aforesaid, he shall erase and effectually deface therefrom the brand-marks ; and if the same cannot be made merchantable, as aforesaid, by salting, pickling, repacking, and coopering, it shall be the duty of the inspector to impress distinctly, upon each barrel or half-barrel, a mark of condemnation, in the manner following: 1. If such fish shall be inspected at Philadelphia, the inspector shall impress upon one of the heads of such cask the mark of a cross (thus, X), each stroke of which cross shall be at least two inches and a half in length; 2. If such fish shall be inspected at the city of Pittsburg, or the borough of Columbia aforesaid, the inspector shall cause the casks to be marked on the bilge with a broad arrow (thus, †), or, if required, secure them for future examination, which examination the owner or person selling the same shall procure to be made within four days.

Fish may be branded after penalty incurred. Ibid., section 76.

17. *Provided*, That if any fish shall be laden for exportation, or shall be sold and delivered as aforesaid, without being so branded, the inspector may, after the penalty for such neglect shall have been paid, brand the same with his own name, and he may demand and receive therefor, from the person so lading or selling and delivering the same, the sum of six cents for every such cask.

Penalty for fraudulent packing. Ibid., section 78.

18. If any salted fish, liable to inspection as aforesaid, shall be found, upon the examination thereof by the inspector, to be fraudulently packed, either by the use of improper or unfit substance, or by the intermixture or use of fish of different qualities, the owner thereof or his agent shall forfeit and pay for each and every such cask the sum of five dollars.

When fish must be reinspected. Ibid., section 79.

19. Salted fish liable to inspection, as aforesaid, shall, if they have remained on hand unsold or not exported during six months after the inspecting and branding thereof, as aforesaid, be again examined by the inspector, and if found to be unsound shall be subject to the regulations provided for the case of salted fish which have not been inspected.

Casks must be filled. Ibid., section 80.

20. Every cask of salted fish liable to inspection shall be filled up by the owner thereof or by persons employed by him for that purpose, and be packed or repacked by him or them, as the case may be, and in all respects completed in such manner as the inspector shall require or direct, under penalty of one dollar for each and every cask.

Fees for cooperage. Ibid., section 83.

21. The inspectors aforesaid may also demand and receive such other and further allowance and compensation as shall be reasonable and customary to allow for the expense and trouble of cooperage in putting each cask of salted provisions into good and perfect order and condition.

Cooperage may be done by owners. Ibid., section 84.

22. *Provided*, That the owner of any salted provisions, as aforesaid, or his agent, may employ any person, other than the said inspector, to do the cooperage necessary to put the same in good merchantable order and condition, as aforesaid, and in such case the said inspector shall not be entitled to any allowance on account of such cooperage.

Fees for unmerchantable fish. Ibid., section 85.

23. The inspectors aforesaid may demand and receive from the owner, possessor, or person selling any salted provisions, as aforesaid, which shall be adjudged to be unmerchantable, or not in the condition required by law for sale or exportation, the same fees as if the same had been adjudged to be merchantable and fit for sale or exportation.

On April 13, 1868, a law was approved which repealed the inspection laws theretofore in force.

On June 2, 1871, the repealing act of April 13, 1868, was repealed, and the inspection laws of 1860 thereby re-enacted.

In 1874 the new State constitution was adopted, which abolished all inspection laws in Pennsylvania.

54. INSPECTION LAWS OF THE BRITISH PROVINCES.

DOMINION OF CANADA.

[37 Victoria, Chapter XLV; Assented to 26th May, 1874.]

AN ACT to make better provisions, extending to the whole Dominion of Canada, respecting the inspection of certain staple articles of Canadian produce.

GENERAL PROVISIONS.

Governor may appoint inspectors of certain articles, and at what places.

1. The governor in council may, from time to time, designate the several cities, towns, and other places, or inspection divisions in Canada at and for which, respectively, it is expedient to appoint inspectors of the several articles hereinafter mentioned, or any of them; and the governor may, from time to time, determine the limits of such inspection divisions, and appoint, at and for such cities, counties, towns, places, or divisions, an inspector of any of the following articles, that is to say: Flour and meal; wheat and other grain; beef and pork; pot ashes and pearl ashes; pickled fish and fish oil; butter; leather and raw hides. Such inspectors shall hold office during pleasure, and shall act, respectively, within such local limits as the governor in council may assign to them; and they and their deputies shall be appointed only from and among duly qualified persons, certified as such by the examiners hereinafter mentioned.

Boards of examiners of inspectors.

2. The board of trade at each of the cities of Quebec, Montreal, Toronto, Kingston, Hamilton, London, Ottawa, and St. John, N. B., and the chamber of commerce at the city of Halifax, shall annually appoint, in the said cities, respectively, and the governor may from time to time appoint in any county in the Dominion, or for any inspection division, five fit and skilful persons, any three of whom shall be a quorum, for each class of articles to be inspected at such city or county, to examine and test the ability and fitness of applicants for the office of inspector or deputy inspector of such articles; and no person shall be appointed such inspector or deputy inspector who has not been examined by and received a certificate of qualification from the proper board of examiners: *Provided always*, That the governor may, in his discretion, appoint as an inspector under this act, without a new examination, any person who has been an inspector of the same article under any act hereby repealed. And the board may, at any such examination, permit the attendance of any person or persons of experience and skill in the subject of such examination, and allow them to propose questions pertinent thereto to the examinee, in order to test his knowledge and skill.

It shall be the duty of every such board to grant such certificates, and such only, as to the qualification of the candidates who present themselves for examination as the knowledge and proficiency of such candidates may require or justify.

Examiners to take oath.

3. Each such examiner shall, before acting as such, take, before some justice of the peace, an oath in the following form, or to the same effect:

"I, A B, do swear that I will not, directly or indirectly, personally or by means of any person or persons in my behalf, receive any fee, reward, or gratuity whatsoever, by reason of any function of my office of examiner of applicants for the office of inspector or deputy inspector of ———, except such as I may be entitled to receive by law, and that I will therein well and truly, in all things, act without partiality and to the best of my knowledge and understanding. So help me God."

Which oath shall remain in the custody of the justice administering it.

Inspector not to trade in articles which he inspects.

4. No inspector shall deal or trade in, or have any interest, directly or indirectly, in the production of any article subject to inspection by him, or sell or buy any such article (except for the consumption of himself and family), under a penalty of two hundred dollars for any offence against this section and the forfeiture of his office.

Inspector to take oath of office.

5. Each inspector shall, before acting as such, take and subscribe, before some justice of peace, an oath of office in the form or to the effect following:

"I, A B, do solemnly swear that I will faithfully, truly, and impartially, to the best of my judgment, skill, and understanding, execute and perform the office of an inspector; and that I will not, directly or indirectly, by myself or by any other person or persons whomsoever, manufacture or prepare, deal, trade in, or sell, or buy, except only for the consumption of myself and family, and (*insert the description of the articles he is to inspect*) on my account, or upon the account of any other person or persons whomsoever, while I continue such inspector. So help me God."

Deputy inspector to have no interest in articles he inspects.—Oath of office.

No deputy inspector shall have any direct or indirect interest by himself or by any person whomsoever, in any article inspected by him.

Deputy inspector to take oath of office.

Every deputy inspector shall, before acting as such, take and subscribe before some justice of the peace, the following oath:

"I, A B, do solemnly swear that I will faithfully, truly, and impartially, to the best of my judgment and skill and understanding, execute and perform the office of a deputy inspector of ———, and that I will not inspect, brand, or certify to the quality of any article or thing in which I have any direct or indirect interest on my own account, or upon the account of any person whomsoever, while I continue to hold office as a deputy inspector. So help me God."

Such oaths shall remain in the custody of the justice administering them, and any copy thereof certified by the said justice shall be *prima facie* evidence of such oaths.

Security to be given by inspector or deputy.

6. Each inspector or deputy inspector shall, before acting as such, give security for the due performance of the duties of his office, in such sum as the governor may direct, by bond to Her Majesty, with two sureties to the satisfaction of the governor, to be bound jointly and severally with them, in the form and subject to the provisions prescribed by law relative to the security to be given by persons appointed to offices of trust in Canada, and such bond shall avail to the Crown, and to all persons aggrieved by any breach of the conditions thereof, and such bond shall remain in the custody of the secretary of state of Canada; and any copy thereof certified by him shall be *prima facie* evidence of such bond, and of the contents and tenor thereof, and such copy shall be furnished when required, on payment of a fee of one dollar.

Appointment of deputy inspectors when required.

7. Each inspector may, and shall, when thereunto required by the governor, in any inspection division, or by the boards of trade in any of the before-named cities, appoint a deputy, or so many deputies as may be necessary, for the speedy and efficient performance of the duties of his office; such assistants being duly examined and sworn and giving security, as above provided; and they shall be held to be deputies of the inspector for all the duties of his office, and their official acts shall be held to be official acts of the inspector, and he shall be responsible for them as if done by himself; and each deputy inspector shall make such returns and reports of his official acts as shall be required of him by the inspector whose deputy he is.

Duties and tenure of office of deputy inspector.

8. The said deputies shall respectively be paid by, and shall hold their offices at the pleasure of the inspector; and no such inspector shall allow any person whomsoever to act for him about the duties of his office, excepting only his sworn deputy or deputies, appointed as aforesaid.

Deputy to act on death of inspector.

9. In the event of the death of any inspector, his senior deputy inspector shall perform all the duties of the inspector until his successor is appointed.

Returns or reports of official acts, under regulations to be made by governor in council.

10. The governor in council may, from time to time, require any and every inspector to make such returns or reports of his or their official acts to any public department or officer, board of trade or municipal authority, and in such form and containing such particulars and information as he may deem expedient, and may, from time to time, by order in council, make such regulations for the governance of inspectors under this act, or any of them, and of parties employing them as such, as he may think proper, and may, by such regulations, impose penalties not exceeding fifty dollars to any person offending against them; and any copy of such regulations printed in the Canada Gazette shall be *prima facie* evidence of any such regulations, and that they are then in force; and such regulations not being contrary to or inconsistent with this act shall be obeyed by such inspectors and parties employing them as if embodied in this act; and any offence against them shall be deemed an offence against this act and punishable as such.

Disputes touching inspection, how settled, where there is no board of trade or chamber of commerce.

11. If any dispute arises between any inspector or deputy inspector and the owner or possessor of any article by him inspected, with regard to quality and condition thereof, or relating in any respect to the same, then, upon application by either of the parties in difference, to any justice of the peace for the place in which such inspector or deputy inspector acts, such justice of the peace shall issue a summons to three persons of skill and integrity, one to be named by the inspector or deputy inspector, another by the owner or possessor of the article in question, and the third by such justice of the peace (who, failing the attendance of either of the parties in difference, shall name for him), requiring such three persons forthwith to examine such article and report their opinion of the quality and condition thereof under oath (which oath the justice of the peace shall administer), and the determination, or that of the majority of them, made in writing, shall be final and conclusive, whether approving or disapproving the judgment of the inspector or deputy inspector, who shall immediately conform thereto, and brand or mark such article, or the package containing the same (as the case may be) of the qualities or condition directed by the determination aforesaid; and if the opinion of the inspector or deputy inspector be thereby confirmed, the reasonable cost or charges of re-examination (to be ascertained by the said justice of the peace) shall be paid by the said owner or possessor of the article in question, and, if otherwise, by the inspector or deputy inspector: [Proviso, for the re-examination of flour and meal in cities where there is a board of trade or chamber of commerce.]

Whenever any difference arises between inspectors as to the true quality or grade of any article inspected by one of them and re-inspected by another, such difference shall be definately determined by reference to such board of arbitration or other authority as the governor in council may appoint for that purpose.

Fees for re-examination, how to be fixed.

12. The council of the board of trade, or chamber of commerce, if there be one, for each of the said cities or places where inspectors are appointed, and, if not (or in case such council fails to make such tariff, the governor in council) shall, from time to time, make a tariff of the fees and charges to be allowed for such re-examination and all services and matters connected therewith, and may also establish rules and regulations for the government of the persons re-examining any article on appeal from the decision of the inspector or deputy inspector; and all such fees shall be payable before the delivery of the bill of inspection, or the re-delivery by the inspector of the articles inspected, on which he shall have a special lien for such fees.

Penalty in case of neglect or refusal of inspector to act.

13. If any inspector or deputy inspector refuses or neglects on application to him, made personally or by writing, left at his dwelling-house, store, office, or ware-house, on any lawful day, between sunrise and sunset, by any owner or possessor of any article which such inspector or deputy inspector is appointed to inspect (such inspector or deputy inspector not being at the time of such application employed inspecting elsewhere) forthwith, or within two hours thereafter, to proceed to such inspection, he shall, for every such neglect or refusal, forfeit and pay to the person so applying, twenty dollars over and above all the damage occasioned by such refusal or neglect to the party complaining, recoverable in a summary way before any one justice of the peace, on the oath of one credible witness other than such complainant.

As to fraudulent alteration or imitation or use of, &c., of inspector's marks, &c.

14. Any person who, with a fraudulent intention, alters, effaces, or obliterates wholly or partially, or causes to be altered, effaced, or obliterated any inspector's brands or marks on any article having undergone inspection, or on any package containing any such article, or counterfeits any such brand or mark, or brands, impresses, or otherwise marks thereon any mark purporting to be the mark of any inspector or of the manufacturer or packer of such article, either with the proper marking instruments of such inspector, manufacturer or packer, or with counterfeit imitations thereof, or empties, or partially empties, any such package marked, after inspection, in order to put into the same any other article (of the same or any other kind), not contained therein at

the time of such inspection, or uses for the purpose of packing any article, any old package bearing inspection marks, or (not being an inspector or deputy inspector of any article) brands or marks any package containing it, with the inspector's marks, or gives any certificate purporting to be a certificate of inspection of any article; and any person who being in the employ of any inspector or deputy inspector, or of any manufacturer or packer of any article subject to inspection, hires or lends the marks or marking instruments of his employer to any person whatever, or connives at, or is privy to any fraudulent evasion of this act with respect to any such marks as aforesaid, shall, for such offence, incur a penalty of forty dollars; and any inspector or deputy inspector who inspects or brands or marks any article out of the local limits for which he is appointed, or hires out or lends his marking instruments to any person whomsoever, or gives any certificate of inspection without having personally performed the inspection, or any willfully false or untrue certificate, or connives at or is privy to any fraudulent evasion of this act, shall, for each such offence, incur a penalty of one hundred dollars, and shall forfeit his office, and shall be disqualified from ever after holding the same.

Assuming title of inspector or deputy inspector without authority.

15. Any person not thereunto duly authorized under this act, who in in any manner whatever assumes the title of inspector or deputy inspector, or issues any bill, certificate, or declaration purporting to establish the quality of any pot-ashes or pearl-ashes, flour or meal, beef or pork, grain, pickled fish or fish oil, butter, leather, or raw hides, shall, for such offence, incur a penalty not exceeding one hundred dollars.

Penalties, how recovered and applied.

16. Every penalty and forfeiture imposed by this act, or by any regulation made under it, not exceeding forty dollars, shall, except when it is otherwise herein provided, be recoveable by any inspector or deputy inspector, or by any other person suing for the same, in a summary way before any two justices of the peace for the place, in their ordinary or other sessions, and shall, in default of payment, be levied by warrant of distress, to be issued by such justices against the goods and chattels of the offender; and where such penalty or forfeiture exceeds forty dollars it may be sued for and recovered by any such inspector, deputy inspector, or any other person, by bill, plaint, information, or civil action, in any recorder's court, or in any court having jurisdiction in civil cases to the amount, and may be levied by execution as in case of debt. And the moiety of all such penalties (except such as may be herein otherwise applied) when recovered shall belong to the Crown for the public uses of the Dominion, and the other moiety shall belong to and be paid to the inspector, or deputy inspector, or other person suing for the same.

Limitation of time for commencing suits under this act.

17. Any action or suit against any person for anything done in pursuance of this act, or contrary to its provisions, shall be commenced within six months next after the matter or thing done or omitted to be done, and not afterwards; and the defendant therein may plead the general issue, and give this act and the special matter in evidence, and at any trial therein, and that the same was done under this act; and if it appears so to have been done, then the judgment shall be for the defendant; and if the plaintiff is non-suited or discontinues his action after the defendant has appeared, or if judgment is given against the plaintiff the defendant shall recover treble costs and have the like remedy for the same as defendants have in other cases.

Payment of cost of inspection, when article is sold subject to inspection.

18. In all cases where any article is sold subject to inspection, the person applying to the inspector shall be entitled to reimbursement of the cost of inspection from the vendor, if such applicant be not himself the vendor, unless an express stipulation to the contrary is made at the time of the sale, or of the agreement to submit to inspection; and such agreement to submit to inspection shall imply a warranty that the article in question is of the quality for which it is sold, and that all the requirements of this act have been complied with as to such article and the packages in which it is contained, unless it be otherwise expressly stipulated.

Inspection not always compulsory.—Lien for fees.

19. Nothing in this act shall oblige any person to cause any article to be inspected, unless such inspection is expressly declared to be compulsory, but if inspected, it shall be subject to the provisions of this act, and shall not be branded or marked as inspected unless the said provisions have been in all respects complied with, with respect to such article and the packages in which it is contained. Inspectors and their deputies shall be paid their fees upon the articles inspected by them by privilege and preference over all other creditors, and may retain possession of the articles inspected until the fees to which they are entitled under this act shall have been paid.

The governor in council may make regulations whenever he deems it necessary to do so, for the apportionment of the fees paid under this act between the inspectors and their deputies, and for providing for the payment of fees to the examiners appointed under this act by parties who present themselves for examination; and every such regulation may be rescinded or varied from time to time.

Inspection law of 1873 *repealed.*

20. The act passed in the session held in the thirty-sixth year of Her Majesty's reign, intituled "*An act to amend and to consolidate and to ex-*

tend to the whole Dominion of Canada, the laws respecting the inspection of certain staple articles of Canadian produce," is hereby repealed, except that such repeal shall not effect the repeal of any former act or provision of law, any liability incurred, any bond or security given, any action, suit, or proceeding pending, any penalty, forfeiture, or punishment incurred for any offence committed, any appointment made in council, regulation, or order made or given and not inconsistent with this act, or anything lawfully done before this act comes into force; and if, in any contract made before the coming into force of this act, it has been stipulated that any article therein mentioned, shall be subject to inspection, then, unless the contrary be clearly expressed, the intended standard of quality of such article shall be understood to be that established by the laws in force at the date of such contract; and if the inspection is made after this act is in force, it shall be made according to standard established.

* * * * * * *

SPECIAL PROVISIONS RESPECTING THE INSPECTION OF PICKLED FISH AND FISH OILS.

Inspector to provide branding irons.

61. Every inspector shall provide himself with proper branding irons, or stencil plates, for the purpose of branding or marking such casks, barrels and boxes as may by him be inspected pursuant to this act; and it shall be the duty of each inspector to know that all his deputies are duly provided in this respect.

Inspecting must be in presence of inspector.

62. The inspecting, culling, classing, weighing, packing and branding or marking of any fish or oil shall be done in the immediate presence and sight of an inspector or deputy inspector.

Duty of inspector.—Size and material of packages.

63. It shall be the duty of the inspector or deputy inspector to see that all kinds of split, whole, pickled or salted fish, intending for packing or barrelling, and submitted to him for inspection, have been well struck with pickle and salt, in the first instance, and preserved sweet, free from taint, rust, salt-burn, oil or damage of any kind; and all fish or oil intended for market or exportation, and branded or marked as inspected and merchantable, shall be well and properly packed, in good tight and substantial packages or casks—except green codfish packed without pickle, which may be packed in barrels or packages which are not tight; and all other packages shall be made of the materials and in the manner following:

Tierces, barrels, and half-barrels shall be made of sound, well-seasoned split or sawed staves, free from sap, and in no case to be of hemlock, and the heading shall be of hardwood, pine, fir, or spruce, free from sap, and planed on the outside, and shall be at least three-quarters of an inch in thickness. Staves for salmon and mackerel barrels shall be twenty-nine inches in length, and the heads between the chimes seventeen inches. Staves for barrels for herring shall be twenty-seven inches in length, and the heads between the chimes shall be sixteen inches; and the bung staves of all such barrels shall be of hardwood. All casks shall be hooped with not less than twelve sound, good hoops, of not less than one inch in width at the large end for all tierces and barrels, and in no case to be of alder. The makers of all tierces, barrels, and half-barrels, shall brand the initials of their Christian names and their whole surnames, and also the letters S. M. or H., according as the package may be intended for salmon, mackerel or herrings, at or near the bung staves, under a penalty of twenty cents for every package not so branded.

All empty packages shall be subject to the inspection and approval of the inspector or his deputies, who shall brand or mark the word "condemned" immediately after the maker's name on all packages that will not pass inspection.

In what cases and places inspection shall be compulsory.

64. The inspection of all pickled fish cured for market or exportation, and of all fish-oils, codfish tongues, or codfish sounds, cured for such purpose, and contained in any such packages as are hereinafter mentioned, shall be compulsory in every province of the Dominion, except Manitoba and British Columbia, at any place where an inspector is appointed by law; and if any such pickled fish, fish-oils, or other articles aforesaid, in any such package as aforesaid, is sold, or offered for sale, or exported, or shipped, or laden in any vehicle for exportation, or otherwise offered to be exported in or from any place within any province of Canada, except British Columbia or Manitoba, for which an inspector or deputy inspector has been appointed, without being inspected under this act, the person so selling or offering it for sale, or exporting it, or offering it for exportation, shall incur a penalty of not less than one dollar and not more than five dollars for each such offence.

Inspection to be in accordance with this act.

65. All Pickled fish cured for market or exportation, and all fish-oils, codfish tongues and codfish sounds, shall be inspected, weighed, or gauged, and branded or marked, only in accordance with this act; and all green codfish, in boxes or packages, shall be inspected and culled, and a certificate of inspection for the latter, stating the quality and quantity thereof so inspected, and shipped on board any vessel, shall be granted by any inspector or deputy inspector.

Qualities of fish.—Manner of branding.

66. The various kinds of fish to be inspected under this act, shall be branded or marked of the following denominations respectively:

1. *Salmon* to be branded or marked "No. 1," shall consist of the largest or best and choicest kind, being well split, the blood being well washed out before being salted, well cured, in the best condition, and in every respect free from taint, rust, or damage of any kind.

Those to be branded or marked "No. 2," shall comprehend the best salmon that remain after the selection of the first quality, and shall be good, sound, well split and cured fish, in the best condition, and in every respect free from taint, rust, or damage of any kind.

Those to be branded or marked "No. 3," shall consist of those that remain after the selection of the first two qualities, but must be good, sound fish, and in every respect free from taint, rust, or damage of any kind.

2. *Mackerel* to be branded or marked "mess mackerel," shall consist of the best and fattest mackerel, being well split, having the blood well washed out before being salted, well cured, in the best condition, and free from taint, or rust, or damage of any kind, and shall be such as would have measured not less than fourteen inches, from the extremity of the head to the crotch or fork of the tail, and shall have the head and tails taken off.

Those to be branded or marked "Extra No. 1" shall consist of the best and fattest mackerel, being well split, having the blood well washed out before being salted, well cured, in the best condition, and free from taint or rust or damage of any kind, and shall measure not less than fourteen inches from the extremity of the head to the crotch or fork of the tail.

Those to be branded or marked "No. 1" shall consist of the best and fattest mackerel, being well split, having the blood well washed out before being salted, well cured, in the best condition, and free from taint, rust, or damage of any kind, and shall measure not less than thirteen inches from the extremity of the head to the crotch or fork of the tail.

Those to be branded or marked "No. 2" shall comprehend the best mackerel that remain after the selection of the first qualities, and shall be properly split and washed. well cured, and in every respect free from taint, rust, or damage of any kind, and shall be divided into two qualities, those from thirteen inches and upwards, not being sufficiently fat to make No. 1, being branded No. 2 large, and those from eleven inches up to thirteen inches shall be branded No. 2.

Those to be branded or marked "Large No. 3" shall consist of good, sound mackerel, properly washed, well cured, and free from taint, rust, or damage of any kind, and shall measure not less than thirteen inches from the extremity of the head to the crotch or fork of the tail.

Those to be branded or marked "No. 3" shall consist of good, sound mackerel, properly washed, well cured, and free from taint, rust, or damage of any kind, and shall measure eleven inches and upwards from the extremity of the head to the crotch of the tail.

All mackerel under eleven inches in length, of good, sound quality, and free from taint and rust, or damage of any kind, shall be branded or marked with the words "Small Spring" or "Small Fall" in the place of a number.

All short, sunburnt, or ragged mackerel, of whatever class and not otherwise defective, shall be branded and marked "No. 4."

3. *Herrings*, *Gaspereaux*, and *Alewives* to be branded or marked "No. 1" shall consist of the largest and best fish, well struck with salt, thoroughly cured and clean, and bright in colour; and those to be branded or marked "No. 2" shall comprehend the best herrings that remain after the selection of the first quality.

All undersized herrings to be branded or marked "No. 3" with the word "Small" in addition to the other brands or marks.

All ripped herrings shall be branded or marked with the word "Round" in addition to other brands or marks.

All herrings that are not gibbed or ripped shall be branded or marked with the word "Gross" in addition to other brands or marks.

All spring-caught herrings shall be branded or marked with the word "Spring" in addition to other brands or marks.

The above shall be well cleaned and cured, and in every respect free from rust, taint, or damage.

Herrings that are caught at the Magdalen Islands, Baie des Chaleurs, Labrador, or Newfoundland, and brought into port in Canada in bulk and packed in Canada, shall be branded or marked "Magdalen Islands," "Bay des Chaleurs," "Newfoundland," or "Labrador," respectively, in addition to other brands or marks.

Herrings packed and inspected in Newfoundland and imported into Canada shall be marked or branded "Newfoundland" without further inspection:

4. *Smoked herrings* to be branded or marked "No. 1" shall comprehend the best and fattest fish; and those to be branded or marked "No. 2" shall consist of the poorer, smaller, and inferior fish; both of these qualities shall be well smoked, free from taint, and not burnt or scorched; and no red or smoked herrings shall be so branded or marked, unless they be well and sufficiently saved and cured, and carefully packed in good and substantial barrels, or half-barrels; and if in kegs or boxes, the same shall be of well-seasoned boards, the sides, top and bottom of not less than half an inch in thickness, and the ends at least three-quarters of an inch thick; and the inside measurement of each box shall be eighteen inches long, and nine inches broad, and eight inches deep, well nailed, and the tops or covers smoothed; tainted, burnt, scorched and badly smoked herrings, shall be considered "refuse," and may be branded or marked as such without any character.

5. *Sea trout* to be branded or marked "No. 1" shall consist of the largest, best, and fattest kind, being well split, and in every respect free from taint, rust, or damage of any kind.

Those to be branded or marked "No. 2" shall comprehend the best trout that remain after the selection of the first quality, and shall be good sound fish, free from taint, rust, or damage of any kind.

6. *Lake and salmon trout* to be branded or marked "No. 1, Lake" shall consist of the largest and fattest fish, and be free from taint, rust, or damage.

Those to be branded or marked "No. 2, Lake" to be the next best fish, free from taint, rust, or damage.

7. *White fish* to be branded or marked "No. 1" shall consist of the largest and fattest kind, cured in good condition, and be in every respect free from taint, rust, or damage; "No. 2" shall consist of those that remain after the selection of the first quality, and be free from taint, rust, or damage.

8. *Green codfish* in barrels, with or without pickle, to be classed "No. 1" shall consist of the best and fattest, being well split and cleansed, well cured, in first-rate condition; and in every respect free from taint, salt-burn, rust, or damage of any kind, and shall measure at least fifteen inches to the crotch of the tail.

Those remaining after the selection of the first quality, to class "No. 2," shall be sound, well-cured fish, and free from taint, salt-burn, rust, or damage of any kind.

9. *All other kinds of fish* not enumerated herein, and belonging to denominations specified by this act, such as ling, hake, haddock, pollock, catfish, halibut, shad, bass, eels, codfish tongues and codfish sounds, in casks or barrels, shall be branded or marked as such, and must be sound and well cured, free from taint, salt-burn, rust, or damage of any kind.

10. *Small fish*, which are usually packed whole, with dry salt or pickle, shall be put into good casks of the size and materials required by this act for the packing of split, pickled fish, and shall be packed close, edgeways in the casks, and properly salted with good, coarse, wholesome, dry salt, and the casks shall be filled full with the fish and salt, and no more salt shall be put with the fish than is necessary for their preservation; and the casks containing such whole fish shall be branded or marked with the denomination of the fish, and a like designation as is prescribed by this act in respect of the qualities, &c., of other pickled fish.

11. *All rusty or sour fish*, of whatever kind or class, shall be branded or marked with with the word "rusty" or "sour" in addition to other brands or marks.

12. No foul or tainted fish, or fish mutilated for the purpose of concealing marks and appearances of illegal capture, or unsizeable, shall pass inspection; and it shall be the duty of every inspector or deputy

inspector to seize, and any magistrate may confiscate to Her Majesty, all fish found or exposed for sale having been killed or captured during prohibited seasons or by unlawful means, and all fish at any time offered for sale or barter, or attempted to be exported, whilst in an unwholesome condition.

13. Fish known as pickled fish, that may be cured in bulk, if not inspected and certified as aforesaid, and afterwards packed in barrels, shall be branded or marked with the word "bulk" in addition to other brands or marks.

14. Each cask or package of fish shall contain fish of the same kind, or parts of the same kind and quality, properly packed in separate layers, and on every layer of fish so packed in the cask, a sufficient quantity of good, clean, suitable salt, free from lime, shall be properly placed, and in like proportion for other packages, at the discretion of an inspector or deputy inspector; and after the cask shall have been properly packed and headed it shall be filled with clean pickle, strong enough to float a fish of the kind so packed.

15. Should it appear to any inspector, or deputy inspector, that a portion of the fish inspected by him is sound, and another portion unsound, he shall separate the sound from the unsound, repack the sound fish, and mark or brand the same according to its quality; and such portion as the inspector judges incapable of preservation he shall condemn as bad, and mark "refuse," in addition to other marks.

16. If any casualty renders it necessary to repack inspected fish it shall in all cases be done by and in the presence of an inspector or deputy inspector; and any other person attempting to repack or brand or mark the same shall be liable to a penalty of not more than twenty dollars for every such offense.

17. When any fish, branded or marked by a deputy inspector, proves unequal in quantity or quality to that which may be indicated by the brand or mark, or deficient in any way of the requisites prescribed by this act, the inspector may cause the same to be reinspected; and if it appear that the defect arose from the condition of the fish, or the bad quality of the cask, or the bad packing or pickling of the fish at the time of the inspection, he may recover the cost and charges of such reinspection from the deputy who branded or marked the same.

18. Pickled fish, duly inspected, packed and branded or marked, and oils, inspected and branded or marked under this act, at any place in the Provinces of Nova Scotia, New Brunswick, Quebec, Ontario, or British Columbia, shall not be subject to reinspection within the Dominion, except only in cases already provided for in this act.

19. Each tierce shall be three hundred pounds, and each half tierce one hundred and fifty pounds; each barrel shall be two hundred pounds, and each half-barrel one hundred pounds; each quintal shall be one hundred pounds; each draft shall mean two hundred pounds; and each box of herrings shall contain twenty-five pounds. In each of the above

instances the weight shall be clear avoirdupois, exclusive of salt and pickle.

20. There shall be branded or marked on the head or butt of each cask of pickled or dry-salted fish, in plain, legible letters after the same has been inspected, culled, classed, weighed, and packed, in accordance with this act, the description of the fish, the weight and quality contained in the package, the initials of the Christian name or names, and the whole surname of the inspector or deputy inspector by whom the fish was inspected, and the name of the place where he acts as inspector, and the month and the year of inspection.

Standards of fish oils, how fixed and kept.

67. The boards of examiners of inspectors of fish and fish oils shall fix and have in charge the standard of fish oils in Nova Scotia, New Brunswick, Quebec and Ontario, respectively; and the same shall be classified and branded or marked according to such standards, as follows:

1. *Whale oil* shall be free from adulteration of every kind, and shall be branded as such with the class according to quality appointed by standard—if No. 1, "Pale"; if No. 2, "Straw"; if No. 3, "Brown."

2. *Seal oil* shall be free from adulteration of every kind, and shall be branded as such, with the quality per standard—if No. 1, "Strictly Pale"; if No. 2, "Pale"; if No. 3, "Straw"; if No. 4, "Brown"; if No. 5, "Dark Brown."

3. *Porpoise oil* shall be free from adulteration of every kind, and shall be branded as such, with the quality per standard—if No. 1, "Pale"; if No. 2, "Straw"; if No. 3, "Brown."

4. *Cod oil* shall be free from adulteration, and be branded as such—first quality, "A"; second quality, "B."

5. *Herring, hake, pollock, and dog-fish oil*, and all other oils, shall be branded as such—first quality, "A"; second quality, "B."

6. An inspector or deputy inspector shall determine the gauge of each cask, and the outs thereof, and shall mark the same on the cask; and the barrels shall be in good order and condition, sound and staunch, and shall be made of hard wood, and if any cask or casks be found to contain water or other adulteration, such shall be scribed or branded by the inspector or deputy inspector on the cask.

7. Casks containing fish oils shall be scribed or branded with such quality, the month and the last two figures of the year when inspected, the initials of the Christian name or names, and the entire surname of the inspector, and also the place of inspection, and the initial letters of the name of the province in which it was inspected.

8. The designation "Fish oils" in this act shall include whale, seal, porpoise, cod, herring, sturgeon, siskawitz, and all other kinds of oil derived from fish and marine animals.

Fees for inspection.

68. Every inspector or deputy inspector who shall inspect and brand or mark any cask or package of pickled fish, in bulk, or any fish oil, in accordance with the provisions of this act, shall be entitled to fees at the following rates, which shall be paid by the original owner, or the person who employed him in the first instance:

1. For each tierce of salmon, salmon-trout, or sea-trout, fifteen cents;
2. For each half-tierce of salmon, salmon-trout, or sea-trout, ten cents;
5. For each barrel of mackerel, ten cents;
6. For each half-barrel of mackerel, five cents;
7. For each barrel of herring, five cents;
8. For each half-barrel of herring, three cents;
9. For each barrel of shad, ten cents;
10. For each half-barrel of shad, seven cents;
11. For each barrel of whitefish, ten cents;
12. For each half barrel of whitefish, seven cents;
13. For each barrel of pickled codfish, hake, haddock, or catfish, five cents;
14. For each half-barrel of pickled codfish, hake, haddock, or catfish, three cents;
15. For each barrel of dry-salted codfish, hake, haddock, catfish, ling, or pollock, five cents;
16. For each half-barrel of dry-salted codfish, hake, haddock, catfish, ling, or pollock, three cents;
17. For each barrel of bass, ten cents;
18. For each half-barrel of bass, seven cents;
19. For each barrel of cod tongues, cod sounds, halibut, or eels, ten cents;
20. For each half-barrel of cod tongues, cod sounds, halibut, or eels, seven cents;
21. For inspecting, gauging, and branding each puncheon of oil, twenty cents;
22. For inspecting, gauging, and branding each hogshead of oil, fifteen cents;
23. For inspecting, gauging, and branding each tierce of oil, twenty cents;
24. For inspecting, gauging, and branding each barrel of oil, fifteen cents;
25. The foregoing rates shall be reckoned exclusive of salt, pickle, cooperage, storage, and labour, employed in washing, rinsing, cleaning, nailing, screwing, or repacking and pickling any fish;
26. For branding or marking Newfoundland fish which have been inspected in Newfoundland, two cents per barrel;
27. For inspecting empty packages, one cent:

Provided, always, that any person causing his fish or oil to be inspected, may employ at his cost and charge a cooper to attend upon and assist the inspector or deputy inspector in the performance of his duty, in which case the inspector or deputy inspector shall not be allowed any charge for cooperage, and the cooper so employed shall be governed and guided solely by the directions which he receives from the inspector or deputy inspector, with respect to any fish or oil by him inspected, and not by any other person whomsoever.

Where inspections shall be effected.

69. Fish and fish oil may be inspected either at the place where they are packed or manufactured, or at the place of sale within the Dominion.

When not inspected at place of packing and when at place of sale.

70. When fish are not inspected at the place of packing, the packer's name and the quality of the fish must be marked in paint on each barrel, half-barrel or package; and when they are inspected at the place of sale, the inspector shall empty out ten packages in each hundred of the lot submitted to him for inspection, and such inspection of ten out of every hundred shall regulate the grade of fish so submitted for inspection.

Bill of inspection.

71. So soon as any fish is inspected, a bill of inspection shall be furnished by the inspector or deputy inspector, specifiying the quality as ascertained by inspection, and whether each package contains the weight prescribed by this act, with the name of the packer and of the inspector at the place of packing.

As to fish landed from United States vessels for reshipment there.

72. This act shall not apply to fish landed at any port of the Dominion from United States fishing vessels for the purpose reshipment to the United States, unless the owners ot such fish wish them to be inspected: Provided always, that such fish, if so reshipped without being inspected, shall not be branded or marked.

[39 Victoria, 1876, Chapter XXXIII.]

AN ACT to amend the act to make better provision, extending to the whole Dominion of Canada, respecting the inspection of certain staple articles of Canadian produce.

[Assented to 12th April, 1876.]

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. Section sixty-three of the act of thirty-seventh Victoria, chapter forty-five, cited in the title of this act, is hereby amended by striking

out the words "one inch in width at the large end," and inserting in place thereof the words "five-eights of an inch at the small end."

2. Section sixty-four of the act cited in the title of this act is hereby repealed, and the following is substituted in place thereof:

"64. The inspection of all pickled fish cured for market or exportation, and of all fish oils, codfish tongues, or codfish sounds, cured for such purpose and contained in any such packages as are hereinafter mentioned shall, whenever such pickled fish, fish oils, or other articles as aforesaid, are removed beyond the limits of the inspection district in which they are pickled or packed, be compulsory in every province of the Dominion (except British Columbia and Manitoba), where an inspector is appointed by law: and if any such pickled fish, fish oil, or other article as aforesaid be sold or removed for sale beyond the limits of such district, or shipped or laden in any vehicle for removal, or offered to be removed from any district or place within the Dominion, except Manitoba and British Columbia, without being inspected under this act, the person so selling or removing the same, or offering the same for sale or removal, shall incur a penalty of not less than one dollar and not more than five dollars for each and every such package."

3. Subsection four of section sixty-six of the said act shall be amended by adding the following words to the first paragraph:

"And every such box of smoked herrings shall contain at least twenty pounds of fish, and half-boxes shall be twenty-two inches long, four inches deep and eight inches wide, and to contain not less than ten pounds of fish."

4. Subsection eight of the said sixty-sixth section shall be amended by adding the following:

"Every barrel of pickled codfish shall contain two hundred pounds of fish, and every half-barrel one hundred pounds of fish." * * *

43 Victoria, 1880, chapter XX.

AN ACT to amend "The general inspection act, 1874," and the act amending it.

[Assented to 7th May, 1880.]

In amendment of "*The general inspection act*, 1874," and the act amending it, passed in the thirty-ninth year of Her Majesty's reign, and chaptered thirty-three: Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. The sixth section of the act first above cited is hereby amended by striking out the word "governor" in the fourth line, and inserting in lieu thereof the words "minister of inland revenue."

2. The sixty-fifth section of the said act first above cited is hereby amended by inserting after the word "pickled" in the first line thereof, the words "and smoked."

3. The sixty-eighth section of the act first above cited is hereby amended by inserting after sub-section eight the following paragraphs:

"(*a*) For each box of smoked herrings, two cents;

"(*b*) For each half-box of smoked herrings, one cent;

"(*c*) For each quarter-box of smoked herrings, one-half cent."

4. The sixty-third section of the act first above cited is hereby amended by inserting the following paragraph, following the second paragraph of the said section:

"Barrels of the following dimensions may also be used for a special quality of fish, that is to say: The stave shall be twenty-eight inches long, the head seventeen between the chimes; the chimes to be one and a quarter inches; the head three-fourths of an inch in thickness, and the bung stave shall be of hard wood. Every such barrel shall be branded with the words '*special size.*'" * * *

[44 Victoria, 1881, chapter 52.]

AN ACT to amend "The general inspection act, 1874," and the acts amending it.

[Assented to 21st March, 1881.]

Her Majesty, by and with the advice and consent of the Senate and House of Commons, enacts as follows:

1. The act passed in the forty-third year of Her Majesty's reign intituled "An act to amend 'the general inspection act, 1874,' and the act amending it," is hereby amended by repealing the tariff of fees to be collected for the inspection of smoked herring, contained in the third section of the said act, and substituting the following:

(*a*) For each box of smoked herrings, one cent;

(*b*) For each half-box of smoked herrings, one-half cent;

(*c*) For each quarter-box of smoked herrings, one-quarter cent.

NOVA SCOTIA.

(Revised Statutes of Nova Scotia, 1851, chapter 85.)

On the regulation and inspection of provisions, lumber, fuel, and other merchandise.

FISH.

Appointment of inspectors.

1. The governor in council shall appoint in every county a chief inspector of pickled fish therein, who shall be sworn into office and shall give a bond, with two sureties, in five hundred pounds, to Her Majesty, for the faithful discharge of his duty. He shall not engage nor have any interest, direct or indirect, in the curing or packing or the sale of pickled fish, under a penalty of one hundred pounds and forfeiture of his office; and any person who shall act as inspector or deputy inspector

without having been duly appointed and sworn, shall forfeit five pounds for each offence.

Chief inspector to appoint deputies.

2. Every chief inspector shall appoint a sufficient number of deputies to act under him during pleasure, and shall be responsible for their official conduct, and shall take a bond from each of them in fifty pounds, with sureties; and every such deputy shall be sworn to the faithful discharge of his duty in the same manner as the chief inspector.

Qualities of fish.

3. There shall be three qualities of mackerel, three of salmon, two of other kinds of pickled fish, and two of smoked herrings.

Mackerel of the quality number one shall consist of the best and fattest fall mackerel, having had the blood well washed out previous to being salted, and being properly soaked, well cured in every respect, free from taint, rust, or damage, well split, and being of the best kind and in the best condition, and measuring not less than fifteen inches from the extremity of the head to the crotch of the tail; such mackerel shall be branded "mackerel number one," and if scraped shall be branded "mackerel number one, extra."

Mackerel of the quality number two shall consist of the best fall mackerel which shall remain after the selection of the first quality, being properly soaked, the blood washed out, well cured, and in every respect free from taint, rust, or damage, well split, and measuring not less than twelve inches from the extremity of the head to the crotch of the tail; and such mackerel shall be branded "mackerel number two," and if scraped shall be branded "mackerel number two, extra."

The quality to be branded number three shall consist of good, sound mackerel, properly soaked, the blood washed out, well cured, well split, and in every respect free from taint, rust, or damage; and all mackerel less than ten inches in length shall be branded "small," and all rusty fish, without reference to quality, shall be branded "rusty."

Salmon to be branded "No. 1" shall consist of the best and fattest kind, having all the blood well washed out previous to its being salted, and being well cured, well split, and in every respect free from taint, rust, or damage, being fish of the best kind and in the best condition. Those to be branded "No. 2" shall comprehend the best salmon that remain after the selection of the first quality; and those to be branded "No. 3" shall consist of other salmon; but both of the last-mentioned qualities shall be, nevertheless, sound, good fish, blood well washed out, well cured, well split, and in every respect free from rust, taint, or damage.

The quality of herrings, alewives, or other pickled fish to be branded "No. 1" shall consist of the fattest and best fish; and the quality to be branded "No. 2" of the poorer, thinner, and inferior fish, and both of the qualities shall be carefully cured and cleansed, and in every respect free from taint, rust, or damage.

Smoked herrings branded "No. 1" shall comprehend the fattest and best fish; and those branded "No. 2" the poorer, thinner, and smaller fish. They shall be sweet and well-cured and smoked.

Quality, dimensions, and capacities of casks and boxes.

4. Barrels and half-barrels in which pickled fish is intended to be packed shall be made of sound, well-seasoned staves, free from sap, and the heading shall be of hard wood, pine, or spruce, smooth on the outside, and shall, as well as the staves, be at least three-quarters of an inch in thickness, but if hardwood the staves may be five-eighths of an inch in thickness. Staves for mackerel and salmon shall be twenty-eight inches in length, and the heads, between the chimes, sixteen inches; and the bung-stave shall always be of hard wood; the casks shall be well-hooped with at least four hoops on each bilge and four on each chime. Mackerel and salmon barrels shall contain not less than twenty-eight nor more than twenty-nine gallons, and barrels for herring and alewives not less than twenty-six nor more than twenty-seven gallons, and the tierces and half-barrels shall contain a quantity proportionate thereto. The makers shall brand their names on every barrel and half-barrel under a penalty of five shillings for each cask.

Boxes for smoked herring shall measure on the inside eighteen inches in length, twelve in breadth, and six in depth; or eighteen inches in length, nine in breadth, and eight in depth; and shall be strong, well-made, sufficiently seasoned, and the covers well-planed or shaved.

Casks to contain certain quantities of fish and salt.

5. Casks shall contain the quantity of fish hereinafter prescribed for each, respectively, over and above the salt and pickle necessary to preserve the same, that is to say: a tierce, three hundred pounds; a barrel, two hundred pounds; a half-barrel, one hundred pounds. Each barrel shall contain two pecks of salt, clean and suitable for the purpose; and every tierce and half-barrel shall contain a like proportion.

Pickled and smoked fish to be inspected before exportation.

6. All pickled fish intended for exportation in tierces, barrels, and half barrels, and all smoked herrings intended for exportation or sale, shall be first inspected, and the cask or box branded on the head thereof by an inspector in plain legible characters, with the description of the fish, the number of the quality and the weight, the initials of the Christian names and the whole surname of the actual inspector, the name of the town or place where he acts as inspector, the capital letters "N. S.," for Nova Scotia, and the year of the inspection.

Certificates of inspection; fine for exportation without.

7. The person who shall have actually inspected any pickled fish shall grant a certificate of such inspection, which shall be given to the proper officer before any vessel on board which the fish may be laden shall be cleared out. Any person exporting pickled fish in tierces, barrels, or half-barrels, contrary to this section, shall forfeit five shillings for every such cask.

Smoked herrings liable to seizure if not inspected.

8. Smoked herrings shipped or sold without having been duly inspected and branded may be seized under a warrant of a justice of the peace, to be given upon information under oath.

Instructions for curing and packing fish.

9. All inspected pickled fish, whether split or otherwise, shall be well struck or salted in the first instance, and the qualities shall be those prescribed in the third section. Each cask shall be filled up with fish of the same kind and quality, properly packed and headed up, with the requisite number of hoops thereon. The fish shall be very carefully sorted and classed, according to their respective numbers and qualities, and then weighed, and on every layer of fish, as packed in the barrel, the quantity of salt hereinbefore prescribed shall be regularly placed. Herrings and alewives, whether split or round, and all number three mackerel, shall be packed with coarse salt. Smoked herrings shall be carefully packed, each box with fish as nearly as possible of the same size, laid in the same direction, and not across one another, and so stored as to completely fill the package.

Damaged fish not to be inspected.

10. Tainted or damaged pickled fish, or smoked herrings, shall on no account be permitted to pass inspection.

Fish to be sorted, inspected, and branded in inspector's presence.

11. The sorting, weighing, inspecting, and branding of any package of pickled fish or smoked herrings shall be done by or in the sight of an inspector thereof, and if any casualty render it necessary to repack a cask of inspected pickled fish in any place, it shall in all cases be done by an inspector of pickled fish, if one be resident within five miles thereof.

Inspectors, when to attend; manner of inspection.

12. Every chief inspector, by himself or his deputy, shall inspect all pickel fish under the provisions of this chapter when ten casks are ready for his inspection, and he is required so to do under a penalty of twenty pounds for every default, unless his residence be more than five

miles from the place where his attendance may be required; and shall likewise inspect all tierces, barrels, and half-barrels which are intended to contain pickled fish, and condemn all such as shall not be conformable to these provisions, and brand those he shall approve upon the bung-stave with the initials of his name.

Smoked herrings, how inspected.

13. Inspectors of smoked herrings shall inspect, and, when necessary, shall cull and repack every box thereof which is intended for sale or exportation, and shall for that purpose open, and, after inspecting, reclose and brand the same as hereinbefore directed.

Fees of inspectors, and how paid.

14. Every inspector actually performing the duty shall be entitled to receive the following fees for inspecting and branding, viz: For every tierce, nine pence; for every barrel, five pence; and for every half-barrel, two pence half penny; to be paid one-half by the buyer and the other by the seller; and for each empty cask, one penny, to be paid by the seller. For every box of smoked herrings, one penny-half-penny; and for culling and repacking the same, when necessary, two pence-half-penny in addition.

Returns of chief inspectors, how made.

15. Every chief inspector shall make a return to the provincial secretary of all the pickled fish inspected by him or his deputies; the same to be made up to the last days of March, June, September, and December, in each year, and delivered within one month thereafter.

Deputy inspectors to account to chief inspectors.

16. The deputy inspectors shall account to the chief inspector under whom they act once in every three months, or oftener if required, for all fish inspected and the fees received by them therefor; and shall pay over to him one-fifth of the same.

Fine for allowing unauthorized parties to inspect fish, and for lending branding irons.

17. No person other than an inspector shall sort, weigh, inspect, brand, or alter any tierce, barrel, or half barrel of pickled fish intended for exportation, unless in the presence and sight, and by the authority of an inspector; and any inspector who shall suffer any person so to act, or shall lend his branding irons in violation or evasion of this section, shall forfeit ten pounds for every offence.

Fine for acting without authority.

18. If any person not duly appointed and sworn shall act as an inspector of pickled fish, he shall for every offence forfeit twenty pounds.

Counterfeiting brands, or shifting fish improperly, punishable by fine and imprisonment.

19. Any person counterfeiting or using the brand of an inspector of smoked herrings, or being accessory thereto, or shifting any smoked herrings which shall have been packed and branded, or putting in other fish, contrary to or in evasion of these provisions, shall be punished by fine or imprisonment, at the discretion of the court before whom he may be convicted.

Fine for intermixing or improperly exporting pickled fish.

20. If any person shall take out, shift, or intermix any inspected pickled fish which have been duly packed or branded, or shall cause to be exported, in tierces, barrels, and half barrels, pickled fish not duly inspected and branded, or any such cask not duly inspected and branded he shall forfeit five shillings for every such cask.

Forfeiture upon masters of vessels for receiving on board uninspected smoked herrings.

21. If any master or commander shall receive on board his vessel any smoked herrings which have not been duly inspected and branded, for the purpose of conveying the same out of the township wherein they were cured, he shall forfeit the value thereof; but no such forfeiture shall exceed fifty pounds for any one offence.

Actions for misconduct of deputies; liability of inspector in such cases, and his redress.

22. All actions for the recovery of penalties or damages on account of the misconduct or neglect of any deputy inspector may be prosecuted either against such deputy or the chief inspector under whom he acts, who shall have his remedy against the deputy, either upon the bond given by him or by action on the case for damages; and in every such action the judgment recovered against the chief inspector shall be evidence of damages against such deputy or his sureties, if the deputy shall have had due notice of the action brought against the chief inspector.

Inspected casks may be reinspected; deficiencies, how supplied.

23. When any cask of pickled fish branded by a deputy inspector shall prove unequal in quantity or quality to that which may be indicated by the brand on the cask, or deficient in any of the requisites hereby prescribed, the chief inspector may cause the same to be reinspected; and if it appear that the defect arose from the condition of the fish or the bad quality of the cask, or the bad packing or pickling of the fish at the time of the inspection, he may recover the costs and charges of such reinspection from the deputy who branded the same.

FISH OIL.

Casks of fish oil, how branded.

24. On every cask of fish oil gauged shall be branded or cut with a double iron the initial letters of the Christian name of the gauger, and the whole of his surname, and the word "cod," "dog," "whale," "seal," or whatever word will express the description of the contents.

Gauger's duty and fees.

25. No gauger shall be compelled to leave his residence to gauge a less quantity than five barrels; and the fees for gauging shall be at the rate of one shilling a puncheon or ninepence a barrel.

Fine upon gauger for misconduct.

26. Any gauger who shall falsely brand any cask of fish oil shall, for every gallon, forfeit sixpence.

Fine for acting as a gauger without authority.

27. If any person shall act as a public gauger of fish oil without having been duly appointed and sworn, he shall, for every offence, forfeit five pounds.

X. APPENDIX.—THE MACKEREL FLEET.

55. VESSELS ENGAGED IN THE MACKEREL FISHERY IN 1880.

The following alphabetical list shows the vessels engaged in the mackerel fishery in 1880; the rig, tonnage, number of crew, apparatus of capture, fishing grounds frequented, and the home port of each vessel being shown separately. The list includes 468 vessels, valued at $1,027,910, or an average of $2,196 each. To this quantity should be added $1,094,450, or $2,339 per vessel, which represents the value of the provisions, boats, nets, salt, barrels, and other necessary apparatus and outfit. This brings the total capital invested in the mackerel-fishing fleet up to $2,122,360, exclusive of the shore property for packing and storing the catch. The total tonnage of the fleet is 23,551.64, or an average of 50.32 to the vessel. The regular seining vessels carry from 12 to 16 men, while the crews of the smaller craft range from 2 to 6; the total number of persons employed on the vessels is 5,043.

Of the entire fleet, 235 sail are employed exclusively in the mackerel fishery, while 233 fish for cod and other species in the spring and fall, engaging in the mackerel fishery during the height of the season only. Three-fourths of all the vessels, or 343 sail, are provided with purse-seines, 5 of them carrying, in addition, a supply of jigs for occasional use. Of the remainder, 81 fish with hook and line, and 44 are provided with gill-nets.

The principal fishing grounds are the off-shore waters between Cape Hatteras and Sandy Hook, the Block Island region, the Gulf of Maine, and the Gulf of Saint Lawrence. According to the list, 64 vessels fished along various portions of the coast between Cape Hatteras and Mount Desert Island, on the coast of Maine, 6 of them going to the Gulf of Saint Lawrence for a few weeks. Twelve small craft fished regularly in the waters about Block Island, 343 remained constantly in the Gulf of Maine, 31 others divided their time between the Gulf of Maine and the Gulf of Saint Lawrence, and the remaining 18 fished wholly in British waters. As the fleet for a few of the Massachusetts ports is shown for 1879, the above facts do not represent the actual condition of affairs in 1880; for during the last-named year not over 25 American vessels entered provincial waters.

Massachusetts furnishes over half of the entire mackerel fleet, heading the list with 279 sail, valued at $750,895. Maine comes next with 176 vessels, worth $233,715. New Hampshire has 11 sail, valued at 29,300; while the Connecticut fleet consists of 2 large schooners, worth $14,000. The four principal mackerel-fishing ports are Gloucester, Portland, Wellfleet, and Boston, these sending 113, 46, 34, and 25 vessels, respectively.

56. LIST OF AMERICAN VASSELS ENGAGED IN THE MACKEREL FISHERY IN 1880.

[For a number of the Massachusetts ports the fleet is shown for 1879; but the facts differ only slightly from those of the following season. Vessels marked with a * devote considerable time to the capture of cod and other species, fishing for mackerel during the length of the season only.]

Name of vessel.	Descripton of rig.	Tonnage	No. of crew.	Mode of fishing.	Where fishing.	Where owned.
Abbie Frankfort	Schooner	70.50	12	Purse-seine	Gulf of Maine	Wellfleet, Mass.
*Aberdeen	do	70.12	12	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
*Actress	do	39.28	12	do	Gulf of Maine	Boston, Mass.
Ada R. Terry	do	69.29	14	do	Cape Hatteras to Gulf of Maine, inclusive	Glocester, Mass.
Addie	do	12.38	5	Hand-line	Block Island	Dennis, Mass.
Addie F. Cole	do	76.30	15	Purse-seine	Gulf of Maine	Wellfleet, Mass.
*Adelia Hartwell	do	60.29	14	Hand-line	Gulf of Saint Lawrence	Gloucester, Mass.
*Agnes Belle	do	29.76	11	Purse-seine	Gulf of Maine	Cranberry Islands, Me.
A. H. Lennox	do	72.51	15	do	do	Portland, Me.
*Alabama	do	26.16	10	do	do	Marblehead, Mass.
*Alaska	do	52.42	14	do	do	Southport, Me.
Albert H. Harding	do	64.33	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
*Alfarata	do	55.32	12	do	Gulf of Maine	Do.
Alice	do	89.54	16	do	Cape Hatteras to Gulf of Maine, inclusive	Swan's Island, Me.
Alice	do	88.81	16	do	Gulf of Maine	Boston, Mass.
Alice C. Fox	do	62.21	14	do	Cape Hatteras to Gulf of Maine, inclusive	Booth Bay, Me.
Alice M. Gould	do	60.71	12	do	Gulf of Saint Lawrence	Portland, Me.
Alice P. Higgins	do	91.93	15	do	Gulf of Maine	Wellfleet, Mass.
*Alice S. Hawkes	do	63.62	12	do	do	Swampscott, Mass.
Allen H. Jones	do	47.00	10	do	do	Duxbury, Mass.
*Allie Cook	do	5.35	2	Hand-line	Block Island	Harwich, Mass.
*Amelia	do	12.83	4	do	Coast of Maine	Saint George, Me.
*Amos Cutter	do	60.35	12	Purse-seine	Gulf of Maine	Gloucester, Mass.
Amy Wixon	do	47.43	13	do	do	Dennis, Mass.
Anna H. Frye	do	67.40	15	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Anna M. Nash	do	80.61	14	do	Gulf of Maine	Portsmouth, N. H.
Annie Lewis	do	52.01	12	do	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
Annie Sargent	do	66.66	14	do	Gulf of Maine	Do.
*Annie V. Thomas	do	10.21	3	Hand-line	Coast of Maine	North Haven, Me.
*Annis	do	13.64	3	do	Block Island	Dennis, Mass.
*Ann Maria	do	22.94	2	Gill-net	Coast of Maine and Massachusetts	Friendship, Me.
Arrow	do	53.27	14	Purse-seine	Gulf of Maine	Boston, Mass.
Asa H. Pervere	do	98.31	15	do	do	Wellfleet, Mass.
A. S. Wiley	do	81.10	16	do	do	Boston, Mass.
*Atlas	do	13.87	5	Hand-line	Coast of Maine	Isle au Haut, Me.
Augusta E. Herrick	do	99.58	15	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Swan's Island, Me.
Badoura	do	13.88	3	Hand-line	Coast of Maine	Do.
*Banner	do	17.46	3	do	do	Deer Isle, Me.
Bartie Pierce	do	94.89	16	Purse-seine	Gulf of Maine	Boston, Mass.
B. D. Haskins	do	56.69	12	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.

B. D. Prince	do	62.46	14	do	Gulf of Maine	Camden, Me.
Benjamin Oliver	do	78.06	15	do	do	Wellfleet, Mass.
*Bloomer	do	48.31	13	do	do	Dennis, Mass.
*Bloomer	do	50.64	14	do	do	Gloucester, Mass.
*Bonita	do	18.67	7	Gill-net	Coast of Maine and Massachusetts	Do.
Boquet	do	6.88	2	do	do	Kennebunkport, Me.
Bounding Billow	do	57.18	12	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
*Brunette	do	1.94	3	Hand-line	Coast of Maine	Matinicus Island, Me.
*Bunker Hill	do	100.77	14	Purse-seine	Gulf of Maine	Gloucester, Mass.
*Cadet	do	18.68	2	Hand-line	Coast of Maine	Swan's Island, Me.
*Caleb	do	17.42	2	Gill-net	do	Friendship, Me.
*Can't Come It	do	10.28	5	Purse-seine	Gulf of Maine	Portsmouth, N. H.
*Canton	do	11.99	2	Gill-net	Coast of Maine and Massachusetts	Friendship, Me.
*Caroline	do	12.17	2	do	Coast of Maine	Do.
Carrie D. Allen	Three-masted schooner.	151.65	16	Purse-seine	Gulf of Maine	Wellfleet, Mass.
*Carrie F. Roberts	Schooner	42.16	10	do	do	Swampscott, Mass
Carrie G. Crosby	do	58.31	15	do	do	Orleans, Mass.
*Carrie L. Payson	do	11.10	5	Gill-net	Coast of Maine	Portland, Me.
*Carroll	do	9.68	4	Hand-line	do	Vinal Haven, Me.
Cayenne	do	87.94	14	Purse-seine	Gulf of Saint Lawrence	Salem, Mass.
*C. B. Manning	do	72.25	12	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
*C. C. Davis	do	52.75	10	do	Gulf of Saint Lawrence	Boston, Mass.
*C. E. Morris	do	13.62	4	Gill-net	Coast of Maine	Portland, Me.
*Chameleon	do	47.56	13	Purse-seine	Gulf of Maine	Boston, Mass.
*Champion	do	48.40	13	do	do	Swampscott, Mas
*Champion	do	68.41	12	do	do	Gloucester, Mass.
*Chaparel	do	41.04	11	do	do	Saint George, Me.
*Charles	do	18.46	3	Gill-net	Coast of Maine and Massachusetts	Cushing, Me.
*Charles A. Dyer	do	16.23	5	do	Coast of Maine	Portland, Me.
Charles F. Atwood	do	69.82	15	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Wellfleet, Mass.
Charles Haskell	do	65.62	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Charles H. Killey	do	68.71	17	do	Gulf of Maine	Harwich, Mass.
*Charles McDonald	do	67.71	16	do	do	Dennis, Mass.
Charles R. Washington	do	75.04	15	do	Gulf of Saint Lawrence and Gulf of Maine	Wellfleet, Mass.
Charlotte	do	71.66	15	do	Gulf of Maine	Cohasset, Mass.
Charlotte Brown	do	83.51	19	do	do	Dennis, Mass.
*Christena L.	do	44.33	11	do	do	Duxbury, Mass.
Choncoura	do	62.87	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass,
*Cinderella	do	17.03	5	do	Coast of Maine	Bristol, Me.
Clara L. Dyer	do	77.32	15	do	Gulf of Saint Lawrence	Portland, Me.
*Col. Cook	do	64.75	11	do	Gulf of Maine	Gloucester, Me.
Col. J. H. French	do	83.19	15	do	Cape Hatteras to Gulf of Maine, inclusive	Do.
*Commonwealth	do	85.57	14	do	Gulf of Maine	Do.
*Constitution	do	12.32	4	Gill-net	Coast of Maine	Portland, Me.
*Constitution	do	28.21	10	Purse-seine	Gulf of Maine	Gloucester, Mass.
*Cora	do	48.50	14	do	Gulf of Saint Lawrence	Boston, Mass.
*Cora Ella	do	8.07	3	Gill-net	Coast of Maine and Massachusetts	Friendship, Me.
Cora E. Smith	do	49.24	12	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	North Haven, Me.
*Cora Lee	do	47.30	12	do	Gulf of Maine	Rockport, Mass.
Cora Louise	do	78.42	18	do	do	Dennis, Mass.
Cora Morrison	do	88.89	15	do	do	Wellfleet, Mass.

List of American vessels engaged in the mackerel fishery in 1880—Continued.

Name of vessel.	Description of rig.	Tonnage.	No. of crew.	Mode of fishing.	Where fishing.	Where owned.
Corporal Trim	Schooner	58.96	13	Purse-seine	Cape Hatteras to Gulf of Saint Lawrence, inclusive	Swan's Island, Me.
Cosmopolitan	do	41.58	11	do	Cape Hatteras to Gulf of Maine, inclusive	Saint George, Me.
Cosmopolitan	do	51.38	12	do	Gulf of Maine	Portland, Me.
*Cosmos	do	47.19	12	do	do	Swampscott, Mass.
*Cottage Girl	do	16.74	4	Gill-net	Coast of Maine	Portland, Me.
Crest of the Wave	do	71.38	15	Purse-seine	do	Gloucester, Mass.
*Crown	do	6.08	3	Hand-line	Coast of Maine	Vinal Haven, Me.
Crown Point	do	103.20	15	Hand-line and purse-seine.	Gulf of Saint Lawrence	Newburyport, Mass.
Cynosure	do	72.74	15	Purse-seine.	Cape Hatteras to Gulf of Maine, inclusive	Booth Bay, Me.
*Cyrena Ann	do	60.62	12	do	Gulf of Maine	Do.
Dacotah	do	60.44	12	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Daniel Marcy	do	115.28	17	do	Gulf of Maine	Portsmouth, N. H.
*Daniel McPhee	do	55.56	15	do	do	Harwich, Mass.
Daniel Simmons	do	69.76	16	do	do	Do.
*David A. Osier	do	25.84	10	do	do	Gloucester, Mass.
David Brown, jr	do	62.69	12	do	do	North Haven, Me.
David F. Lowe	do	60.72	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
*David J. Adams	do	69.86	14	do	do	Do.
*David Sprague	do	29.23	3	Hand-line	Coast of Maine and Massachusetts	Harwich, Mass.
*Davy Crockett	do	84.97	14	Purse-seine	Gulf of Maine	Gloucester, Mass.
D. B. Webb	do	76.53	15	do	do	Deer Isle, Me.
D. D. Geyer	do	54.92	12	do	do	Portland, Me.
*Difiance	do	18.97	8	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.
*Delaware	do	11.48	3	Gill-net	Coast of Maine	Portland, Me.
Delia Maria	do	55.75	12	Purse-seine	Gulf of Maine	Gloucester, Mass.
Dictator	do	90.92	16	do	do	Harwich, Mass.
*Dreadnaught	do	42.29	13	do	do	Portland, Me.
Dreadnaught	do	12.63	5	Gill-net	Coast of Maine	Do.
*D. W. Hammond	do	59.44	12	Purse-seine	Gulf of Maine	Barnstable, Mass.
*Eagle	do	21.75	3	Hand-line	Coast of Maine	Swan's Island, Me.
*E. A. Horton	do	66.46	13	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
E. A. Lombard	do	65.40	14	do	Gulf of Maine	Truro, Mass.
*Eastern State	do	19.27	7	do	Coast of Maine	Bristol, Me.
*E. A. Williams	do	33.92	11	do	Gulf of Maine	Marblehead, Mass,
Eben Dale	do	57.99	12	do	do	North Haven, Me.
Eclipse	do	49.69	12	do	do	Gloucester, Mass.
*Eddie A. Minot	do	15.39	4	Gill net	Coast of Maine	Portland, Me.
*Edith Bean	do	17.22	5	Hand-line	do	North Haven, Me.
Edith L. Couly	do	58.90	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Rockport, Mass.
Edmund Burke	do	41.41	10	Hand-line and purse-seine	Gulf of Saint Lawrence	Newburyport, Mass.
Edward Everett	do	57.84	14	Purse-seine	Cape Hatteras to Gulf of Saint Lawrence, inclusive.	Gloucester, Mass.
Edward H. Norton	do	56.51	15	do	Gulf of Maine	Wellfleet, Mass.
Edward Rich	do	74.10	15	do	do	Do.
Effie T. Kemp	do	62.94	15	do	do	Do.

E. K. Dresser	do	62.85	14	do	do	Booth Bay, Me.
* E. K. Kane	do	52.29	10	do	do	Gloucester, Mass.
Electric Flash	do	82.19	14	do	Gulf of Saint Lawrence and Gulf of Maine	Do.
* Eliza	do	47.05	10	do	Gulf of Maine	Marblehead, Mass.
Eliza Abby	do	49.29	12	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Eliza May	do	10.71	2	Hand-line	Coast of Maine	Swan's Island, Me.
* Ella Nash	do	14.61	4	Gill-net	do	Portland, Me.
* Ellen Adams	do	10.50	3	Hand-line	do	Bluehill, Me.
Ellen M. Adams	do	90.33	16	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Elnora	do	13.45	5	Gill-net	Coast of Maine	Portland, Me.
* E. L. Rowe	do	68.78	13	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Emily Holden	do	22.48	12	do	Gulf of Maine	Portland, Me.
Emma A. Higgins	do	94.18	15	do	do	Wellfleet, Mass.
Emma Ann	do	12.84	2	Gill-net	Coast of Maine and Massachusetts	Waldoborough, Me.
Emma Jane	do	42.15	12	Purse-seine	Gulf of Maine	Gloucester, Mass.
Emma J. Gott	do	56.29	11	do	do	Provincetown, Mass.
* Emma S. Osier	do	23.41	7	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.
* Eola	do	12.76	3	Gill-net	Coast of Maine	Friendship, Me.
* Ernest F. Norwood	do	74.50	12	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
Esperanza	do	43.96	10	do	Gulf of Maine	Matinicus Island, Me.
* Etta M. Storey	do	55.63	12	Hand-line	Block Island	Fairhaven, Mass.
* Ettie	do	46.73	12	Purse-seine	Gulf of Maine	Swampscott, Mass.
* Eureka	do	51.96	14	do	do	Gloucester, Mass.
* Eva May	do	27.50	9	Gill-net	Coast of Maine and Massachusetts	Do.
E. W. Merchant	do	47.82	12	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Do.
Excelsior	do	38.30	8	do	Gulf of Maine	Do.
* Fairy Queen	do	8.52	3	Hand-line	Coast of Maine	Belfast, Me.
* Fairy Queen	do	46.29	12	Purse-seine	Gulf of Maine	Portland, Me.
Falcon	do	71.67	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Fannie L. Nye	do	70.08	14	do	Gulf of Maine	Cohasset, Mass.
F. A. Smith	do	77.10	14	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
* Favorite	do	7.13	3	Hand-line	Coast of Maine	Deer Isle, Me.
* Fish Hawk	do	50.01	10	do	Coast of Maine and Massachusetts	Harwich, Mass.
Fleetwing	do	59.29	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Fleetwood	do	55.99	12	do	Gulf of Maine	North Haven, Mass.
Flora A. Newcomb	do	69.49	14	do	do	Wellfeet, Mass.
Flora Temple	do	52.59	10	do	Gulf of Saint Lawrence	Gloucester, Mass.
* Florence Nightingale	do	40.96	12	do	Gulf of Maine	Swampscott, Mass.
Florine F. Nickerson	do	55.58	15	do	do	Chatham, Mass.
Flying Cloud	do	59.59	14	do	Gulf of Saint Lawrence	Boston, Mass.
* Flying Dart	do	47.17	12	do	Gulf of Maine	Swampscott, Mass
* Forest Girl	do	11.60	3	Hand-line	Coast of Maine	Swan's Island, Me.
Francis M. Loring	do	77.05	11	Purse-seine	Gulf of Maine	Cohasset, Mass.
Frank Butler	do	74.55	16	do	Coast of New England and Gulf of Saint Lawrence	New London, Conn.
* Frank Skillings	do	49.81	13	do	Gulf of Maine	Portland, Me.
* Fred. L. Webb	do	54.92	12	do	do	Gloucester, Mass.
Fred. P. Frye	do	85.37	11	do	do	Do.
Garabaldi	do	51.99	14	do	Cape Hatteras to Gulf of Maine, inclusive	Do.
* Garland	do	22.10	7	Hand-line	Coast of Maine	Portland, Me.
* Gazel	do	37.62	8	do	Coast of Maine and Massachusetts	Gloucester, Mass.
General Lyon	do	61.65	15	Purse-seine	Gulf of Maine	Harwich, Mass.
* Geneva Mertis	do	44.94	10	do	do	Chatham, Mass.

List of American vessels engaged in the mackerel fishery in 1880—Continued.

Name of vessel.	Description of rig.	Tonnage.	No. of crew.	Mode of fishing.	Where fishing.	Where owned.
*Gen. Grant	Schooner	50.28	13	Purse seine	Gulf of Maine	Booth Bay, Me.
*Gentile	do	15.66	5	Hand-line	Coast of Maine	Deer Isle, Me.
George S. Low	do	61.69	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
George T. Littlefield	do	111.28	15	do	Gulf of Maine	Wellfleet, Mass.
Georgiana	do	52.01	14	do	do	Gloucester, Mass.
*Georgiana Young	do	22.28	5	do	Coast of Maine	Bristol, Me.
*Georgie Willard	do	55.48	12	do	Gulf of Maine	Portland, Me.
*Gertie Lewis	do	72.24	14	do	do	Do.
Gertrude Summers	do	64.41	14	do	do	Wellfleet, Mass.
*Gipsey Girl	do	37.50	12	do	do	Swampscott, Mass.
Glad Tidings	do	50.76	14	do	Cape Hatteras to Gulf of Maine, inclusive	Swan's Island, Me.
G. N. Hopkins	do	73.61	14	do	Gulf of Maine	Hingham, Mass.
*Golden Eagle	do	14.20	4	Hand-line	Coast of Maine	North Haven, Me.
Golden Hind	do	74.60	14	Purse-seine	Gulf of Maine	Gloucester, Mass.
*Golden Rule	do	41.67	10	do	do	Rockport, Mass.
Goldsmith Maid	do	51.24	13	do	do	Gloucester, Mass.
Governor Goodwin	do	96.20	16	do	do	Portsmouth, N. H.
*Grace Choate	do	41.64	10	do	do	Do.
Gray Eagle	do	51.06	12	do	do	Portland, Me.
Greyhound	do	50.22	12	Hand-line and purse-seine	Gulf of Saint Lawrence	Newburyport, Mass.
*Greyhound	do	66.35	10	Hand-line	do	Gloucester, Mass.
*Guess	do	15.48	6	do	Coast of Maine	Matinicus Island, Me.
G. W. Bentley	do	113.13	18	Purse-seine	Coast of New England and Gulf of Saint Lawrence.	New London, Conn.
G. W. Brown	do	65.05	14	do	Gulf of Saint Lawrence and Gulf of Maine	Newburyport, Mass.
G. W. Reed	do	55.24	14	do	Gulf of Maine	Swan's Island, Me.
*Harrison	do	18.80	3	Hand-line	Coast of Maine	Deer Isle, Me.
Harvest Home	do	56.88	12	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
Hattie B. West	do	56.56	12	do	Cape Hatteras to Gulf of Maine, inclusive	Do.
Hattie Chester	do	73.82	16	Hand-line	Gulf of Saint Lawrence	Essex, Mass.
*Hattie L. Gray	do	6.71	2	do	Coast of Maine	Deer Isle, Me.
*Helen F. Tredick	do	38.59	8	Purse-seine	Gulf of Maine	Portsmouth, N. H.
Helen M. Crosby	do	66.62	14	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
*Helen M. Macomber	do	14.75	4	Hand-line	Coast of Maine	Deer Isle, Me.
Helen Tree	do	9.06	2	Gill-net	do	Cushing, Me.
*Henry Cole	do	16.91	4	Hand-line	Black Island	Dennis, Mass.
*Henry Friend	do	67.39	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
Henry Nickerson	do	73.84	17	do	Gulf of Maine	Harwich, Mass.
Herald of the Morning	do	71.63	14	do	do	Gloucester, Mass.
Hereward	do	90.11	16	do	do	Do.
H. E. Willard	do	103.52	15	do	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
*Highflyer	do	55.73	14	do	do	Gloucester, Mass.
Highland Queen	do	57.51	13	do	Gulf of Maine	Swan's Island, Me.
*Hope	do	8.85	3	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.

* H. S. Rowe	do	59.47	14	Purse-seine	Gulf of Maine	Portland, Me.
Humboldt	do	57.53	14	do	do	Booth Bay, Me.
* Hurricane	Steamer	30.84	11	do	do	Rockland, Me.
H. W. Pierce	Schooner	73.71	14	do	do	Wellfleet, Mass.
* Ida Grover	do	20.26	7	do	do	Matinicus Island, Me.
* Ida May	do	45.17	9	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.
Idella Small	do	62.70	13	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Deer Isle, Me.
Isaac A. Chapman	do	85.06	14	do	Gulf of Maine	Gloucester, Mass.
Isaac Rich	do	92.18	14	do	do	Do.
Isaac Somes	do	68.31	15	do	do	Harwich, Mass.
Isabella	do	50.61	12	Hand-line	Gulf of Saint Lawrence	Gloucester, Mass.
* Island Queen	do	11.13	4	do	Coast of Maine	Vinal Haven, Me.
Island Queen	do	64.18	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
* Israel Washburne	do	25.16	8	Hand-line	Coast of Maine	Deer Isle, Me.
James A. Stetson	do	65.18	14	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Jamestown	do	60.00	12	do	Gulf of Saint Lawrence	Do.
* Jennie and Julia	do	14.27	8	do	Coast of Maine and Massachusetts	Do.
* Jenny Armstrong	do	69.55	14	do	Gulf of Maine	Southport, Me.
Jennie B. Thomas	do	50.95	12	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Jennie P. Phillips	do	55.63	9	do	Gulf of Maine	Swampscott, Mass.
* J. G. Craig	do	77.08	13	do	do	Portland, Me.
* J. H. G. Perkins	do	59.23	13	do	Cape Hatteras to Gulf of Saint Lawrence, inclusive	Gloucester, Mass.
* J. J. Clark	do	69.68	14	do	Gulf of Saint Lawrence and Gulf of Maine	Do.
Joe Hooker	do	71.03	15	do	Gulf of Maine	Harwich, Mass.
John James	do	51.03	14	do	do	Camden, Me.
John M. Ball	do	86.54	15	do	Block Island and Gulf of Maine	Boston, Mass.
John M. Fisk	do	80.76	15	do	Gulf of Maine	Provincetown, Mass.
John Nye	do	66.92	14	do	do	Hingham, Mass.
John S. McQuinn	do	81.76	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
John Somes	do	65.65	13	do	do	Swan's Island, Me.
John W. Bray	do	83.41	16	do	do	Gloucester, Mass.
* John W. Smart	do	18.41	8	do	Gulf of Maine	Portsmouth, N. H.
Joseph Garland	do	51.44	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Josephine	do	38.68	10	do	Gulf of Maine	Rockport, Mass.
* Josie Johnson	do	27.60	8	do	Gulf of Saint Lawrence and Gulf of Maine	Newburyport, Mass.
* Julia Ellen	do	45.55	10	do	Gulf of Maine	Friendship, Me.
* Jupiter	Sloop	8.32	2	Hand-line	Coast of Maine	North Haven, Me.
* J. W. Bradley	Schooner	48.36	12	Purse-seine	Gulf of Maine	Rockport, Mass.
J. W. Sawyer	do	115.77	15	do	do	Portland, Me.
Kate Florence	do	102.04	17	do	do	Harwich, Mass.
* Kate McClintock	do	71.68	15	do	do	Boothbay, Me.
Katie Hall	do	74.69	15	do	do	Cohasset, Mass.
* Kingfisher	do	10.00	3	Hand-line	Coast of Maine	Bristol, Me.
* Kingfisher	do	64.59	14	Purse-seine	Gulf of Maine	Booth Bay, Me.
* Laughing Water	do	31.00	12	do	do	Swampscott, Mass.
Lelia Linwood	do	69.90	15	do	do	Chatham, Mass.
Lottie Linwood	do	68.29	15	do	do	Do.
Lettie S. Reed	do	58.22	13	do	Cape Hatteras to Gulf of Maine, inclusive	Booth Bay, Me.
Lewis and Rosa	do	77.61	16	do	Gulf of Maine	Do.
* Light Wing	do	33.84	8	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.
* Lillian Estelle	do	13.15	3	Gill-net	do	Friendship, Me.
Lillian M. Warren	do	89.05	14	Purse-seine	Cape Hatteras to Gulf of Saint Lawrence, inclusive	Deer Isle, Me.

List of American vessels engaged in the mackerel fishery in 1880—Continued.

Name of vessel.	Description of rig.	Tonnage.	No. of crew.	Mode of fishing.	Where fishing.	Where owned.
*Little Annie	Schooner	18.87	4	Hand-line	Coast of Maine	Deer Isle.
*Little Lizzie	do	60.04	14	do	Coast of Maine and Massachusetts	Harwich, Mass.
*Little Nellie	do	14.90	3	Gill-net	Coast of Maine	Portland, Me.
Lizzie	do	13.75	5	Hand-line	Block Island	Dennis, Mass.
*Lizzie Bradley	do	17.00	5	Gill-net	Coast of Maine	Portland, Me.
Lizzie D. Baker	do	75.93	14	Purse-seine	Gulf of Maine	Wellfleet, Mass.
*Lizzie D. Saunders	do	43.54	12	do	do	Rockport, Mass.
*Lizzie May	do	13.71	4	Gill-net	Coast of Maine	Portland, Me.
Lizzie Poor	do	51.50	14	Purse-seine	Gulf of Maine	Do.
Lizzie Smith	do	77.21	15	do	do	Wellfleet, Mass.
Lizzie Thompson	do	70.89	15	do	Cape Hatteras to Gulf of Maine, inclusive	Newburyport, Mass.
Longwood	do	65.79	15	do	Gulf of Maine	Boston, Mass.
Lottie	do	5.74	2	Hand-line	Coast of Maine	Deer Isle, Me.
*Lucy Devlin	do	46.79	14	Purse-seine	Gulf of Maine	Swampscott, Mass.
Lucy J. Keeler	do	94.35	13	do	do	Wellfleet, Mass.
Lucy J. Warren	do	59.00	14	do	do	Swan's Island, Me.
Lucy N. Jenkings	do	73.33	15	do	do	Wellfleet, Mass.
*Lucy R. Day	do	57.90	14	do	do	Boston, Mass.
*Luther	do	19.73	3	Hand-line	Coast of Maine	Vinal Haven, Me.
Lydia	do	12.66	4	do	Block Island	Dennis, Mass.
*Lydia A. Davis	do	14.68	7	Purse-seine	Gulf of Maine	Newburyport, Mass.
Madawaska Maid	do	63.06	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
*Magellan Cloud	do	15.10	6	do	Coast of Maine and Massachusetts	Do.
Maggie Power	do	60.92	12	do	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
Maggie W. Willard	do	46.44	12	do	do	Do.
*Margaret Leonard	do	33.31	12	do	Gulf of Maine	Boston, Mass.
*Margie Smith	do	61.13	15	do	do	Gloucester, Mass.
Maria Webster	do	58.15	13	do	do	Wellfleet, Mass.
*Marion	do	23.24	5	Hand-line	Coast of Maine	Deer Isle, Me.
Marion Grimes	do	61.36	14	Purse-seine	Cape Hatteras to Gulf of Saint Lawrence, inclusive	Gloucester, Mass.
*Martha C	do	79.16	14	do	Gulf of Maine	Do.
*Martha D. McLain	do	46.97	12	do	Gulf of Saint Lawrence and Gulf of Maine	Portland, Me.
*Martha Emma	do	22.08	6	Hand-line	Coast of Maine	Belfast, Me.
*Martha Jane	do	16.89	6	Purse-seine	Coast of Maine and Massachusetts	Gloucester, Mass.
Mary and Emma	do	18.01	6	Hand-line	Block Island	Dennis, Mass.
Mary Doane	do	72.10	16	Purse-seine	Gulf of Maine	Harwich, Mass.
*Mary Elizabeth	do	22.51	8	Gill-net	Coast of Maine and Massachusetts	Gloucester, Mass.
*Mary Ellen	do	54.11	12	Purse-seine	Gulf of Maine	Rockport, Mass.
*Mary E. Smith	do	33.74	9	do	do	Newburyport, Mass.
*Mary Etta	Sloop	6.00	2	Hand-line	Coast of Maine	Bristol, Me.
Mary Eva	Schooner	61.11	15	Purse-seine	Gulf of Maine	Provincetown, Mass.
Mary E. Wharf	do	64.33	13	do	do	Wellfleet, Mass.
Mary Fernald	do	80.27	14	do	Gulf of Saint Lawrence and Gulf of Maine	Rockport, Mass.
*Mary Jane	do	13.54	3	Gill-net	Coast of Maine and Massachusetts	Friendship, Me.

Mary J. Elliott	do	53.15	14	Purse-seine	Gulf of Maine and Gulf of Saint Lawrence	Booth Bay, Me.
* Mary Odell	do	48.47	14	do	Gulf of Maine	Gloucester, Mass.
Mary Snow	do	70.80	15	do	do	Provincetown, Mass.
* Mary S. Roundy	do	11.16	4	Hand-line	Coast of Maine and Massachusetts	Gloucester, Mass.
Mary Steel	do	69.96	14	Purse-seine	Gulf of Maine	Wellfleet, Mass.
* Maud Whitmore	do	11.43	4	Gill-net	Coast of Maine	Bucksport, Me.
* May Queen	do	5.66	3	do	do	Portland, Me.
McCloud	do	51.81	12	Hand-line and purse-seine	Gulf of Saint Lawrence	Boston, Mass.
* Mechanic	do	21.36	6	Hand-line	Coast of Maine	North Haven, Me.
* Meridian	Sloop	25.85	6	do	do	Isle au Haut, Me.
Merrimac	Schooner	54.43	13	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Wellfleet, Mass.
M. E. Torrey	do	57.95	13	do	Cape Hatteras to Gulf of Maine, inclusive	Sedgwick, Me.
*Miantonomah	do	77.45	14	do	Gulf of Saint Lawrence and Gulf of Maine	Newburyport, Mass.
*Millie Florence	do	16.90	5	Gill-net	Coast of Maine	Portland, Me.
Millie Washburn	do	74.23	15	Purse-seine	Gulf of Maine	Provincetown, Mass.
*Minnehaha	do	52.70	12	do	do	Swampscott, Mass.
Minnie Davis	do	14.16	2	Gill-net and purse-seine	Coast of Maine and Massachusetts	Friendship, Me.
*M. L. Rogers	do	64.00	12	Purse-seine	Gulf of Maine	Cranberry Island, Me.
M. L. Wetherell	do	69.42	12	do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
M. M. Chase	do	93.14	14	do	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
*Moneda	do	21.06	4	Gill-net	Coast of Maine	Do.
Morning Star	do	80.45	14	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Cohasset, Mass.
*Mystery	do	11.00	3	Hand-line and purse-seine	Gulf of Maine	Boston, Mass.
Mystic	do	83.09	14	Hand-line	Gulf of Saint Lawrence	Essex, Mass.
Nannie E. Waterman	do	79.75	13	Purse-seine	Gulf of Maine	Wellfleet, Mass.
Nathan Cleaves	do	69.89	14	do	do	Do.
Nathaniel Chase	do	69.37	16	do	do	Dennis, Mass.
Nellie Burns	do	67.65	14	do	Gulf of Saint Lawrence and Gulf of Maine	Portland, Me.
Nellie M. Snow	do	64.56	13	do	Gulf of Maine	Wellfleet, Mass.
Nellie T. Campbell	do	57.58	15	do	do	Harwich, Mass.
Neponset	do	73.51	15	do	do	Boston, Mass.
Nettie Moore	do	108.47	19	do	do	Chatham, Mass.
Newell B. Hawes	do	89.31	14	do	do	Wellfleet, Mass.
Nil Desperandum	do	79.37	13	do	do	Do.
*Northern Eagle	do	36.97	10	do	do	Gloucester, Mass.
*Nymph	do	6.44	3	Hand-line	Coast of Maine	Deer Isle, Me.
Oasis	do	56.24	12	Purse-seine	Cape Hatteras to Gulf of Maine, inclusive	North Haven, Mass.
*Oceanus	do	47.44	14	do	do	Gloucester, Mass.
Old Chad	do	71.07	13	do	Gulf of Maine	Booth Bay, Me.
*Olive A. Lewis	do	22.96	4	Hand-line	Coast of Maine and Massachusetts	Dennis, Mass.
Olive G. Tower	do	62.98	13	Purse-seine	Gulf of Maine	Boston, Mass.
*Onward	do	13.12	4	Hand-line	Coast of Maine	Isle au Haut, Me.
Ossipee	do	72.58	14	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
Pamet	do	21.19	4	do	do	Newburyport, Mass.
Pathfinder	do	67.26	14	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Phantom	do	30.05	8	do	Gulf of Maine	Do.
Phœbe and Emma Small	do	64.57	15	do	do	Harwich, Mass.
* Phenix	do	60.33	13	do	do	Gloucester, Mass.
Pontiac	do	9.93	4	Gill-net	Coast of Maine and Massachusetts	Barnstable, Mass.
Queen of the West	do	51.54	12	Purse-seine	Gulf of Maine	Swan's Island, Me.
Quivet	do	70.77	16	do	do	Dennis, Mass.
Racer	do	53.95	12	do	do	Gloucester, Mass.

List of American vessels engaged in the mackerel fishery in 1880—Continued.

Name of vessel.	Description of rig.	Tonnage.	No. of crew.	Mode of fishing.	Where fishing.	Where owned.
* Ralph E. Eaton	Schooner	68.96	15	Purse-seine	Gulf of Maine	Gloucester, Mass.
Rambler	do	66.91	14	do	Cape Hatteras to Gulf of Maine, inclusive	Do.
Rattler	do	82.72	14	do	Gulf of Saint Lawrence and Gulf of Maine	Do.
Rebecca J. Evans	do	78.29	17	do	Gulf of Maine	Harwich, Mass.
Redwing	do	17.13	5	Hand-line	Block Island	Dennis, Mass.
* Reform	do	16.73	4	Gill-net	Coast of Maine	Bremen, Me.
* Reporter	do	83.61	14	Purse-seine	Gulf of Maine	Gloucester, Mass.
* Reserve	do	5.60	2	Hand-line	Coast of Maine	Vinal Haven, Me.
* Rhoda Ann	do	10.70	5	do	do	North Haven, Me.
Richard S. Newcomb	do	69.66	14	Purse-seine	Gulf of Maine	Boston, Mass.
Right Bower	do	59.10	14	do	do	Do.
* Rising Star	do	29.48	7	do	do	Duxbury, Mass.
Robert D. Rhodes	do	60.91	13	do	Gulf of Maine, inclusive	Southport, Me.
Robert Pettis	do	65.58	13	do	Gulf of Maine	Wellfleet, Mass.
Robert Ripley	do	48.05	13	do	do	Camden, Me.
Rodger Williams	do	56.03	12	do	Cape Hatteras to Gulf of Maine, inclusive	North Haven, Me.
Rosedale	do	83.69	14	do	Gulf of Maine	Boston, Mass.
* Rozella	do	36.53	10	do	do	Cranberry Islands, Me.
* Rover's Bride	do	20.13	6	do	do	Portsmouth, N. H.
* Royal Tiger	do	11.34	4	Gill-net	Coast of Maine	Booth Bay, Me.
Rushlight	do	66.98	14	Purse-seine	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
S. A. Parkhurst	do	53.35	12	do	Gulf of Saint Lawrence	Salem, Mass.
* Saragossa	do	30.95	10	do	Gulf of Maine	Portland, Me.
* Sarah B. Harris	do	54.21	13	do	do	Boston, Mass.
* Sarah C. Wharff	do	51.43	12	do	do	Gloucester, Mass.
* Sarah E. Babson	do	49.10	15	do	Gulf of Saint Lawrence and Gulf of Maine	Newburyport, Mass.
Sarah E. Smith	do	56.15	13	do	Gulf of Maine	Wellfleet, Mass.
Sarah M. Jacobs	do	80.04	15	do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
* Satellite	do	22.25	8	do	Gulf of Maine	Rockport, Mass.
* Sea Flower	do	36.13	8	Hand-line	Coast of Maine	Belfast, Me.
* Sea Foam	do	73.19	12	Purse-seine	Gulf of Maine	Barnstable, Mass.
Sea Spray	do	52.49	13	do	Gulf of Saint Lawrence and Gulf of Maine	Eastport, Me.
* Sea Queen	do	18.44	4	Gill-net	Coast of Maine	Cushing, Me.
* Senator	do	17.60	5	Hand-line	do	Brooklyn, Me.
* Silk Worm	do	13.26	4	Gill-net	do	Cushing, Me.
* Siloam	do	9.56	5	Hand-line	Block Island	Harwich, Mass.
* S. L. Foster	do	48.14	12	Purse-seine	Gulf of Maine	Cranberry Islands, Me.
Starlight	do	10.38	3	Hand-line	Massachusetts Bay	Wellfleet, Mass.
* Star of the East	do	56.13	11	Purse-seine	Gulf of Maine	Gloucester, Mass.
Stella Sherman	do	92.49	14	do	do	Boston, Mass.
* Storm King	do	36.46	8	do	do	Duxbury, Mass.
Stowell Sherman	do	92.49	14	do	do	Orleans, Mass.
* Sunbeam	do	27.68	10	do	do	Tremont, Me.
* Susan	do	15.64	4	Hand-line	Coast of Maine	North Haven, Me.

* Susan	....do	16.75	3	Gill-net	......do	Waldoborough, Me.
Tanniscott	....do	28.59	10	Purse-seine	Gulf of Maine	Deer Isle, Me.
* Taloola	....do	13.82	4	Hand-line	Block Island	Dennis, Mass.
* Three Sisters	....do	17.40	6	......do	Coast of Maine	Deer Isle, Me.
* Tiger	....do	11.67	3	......do	......do	Bristol, Me.
Titmouse	....do	70.72	16	Purse-seine	Gulf of Maine	Dennis, Mass.
T. S. Mayo	....do	62.46	12	......do	Gulf of Saint Lawrence and Gulf of Maine	Gloucester, Mass.
* Traveler	....do	16.17	3	Gill-net	Coast of Maine	Friendship, Me.
* Treaty	....do	30.56	6	Hand-line	......do	Brooklyn, Me.
* Trifle	....do	8.56	2	......do	......do	Deer Isle, Me.
* Triumph	....do	16.16	6	......do	......do	North Haven, Me.
* Trumpet	....do	20.48	4	......do	......do	Lincolnville, Me.
* Two Brothers	....do	19.07	3	Gill-net	......do	Portland, Me.
* Una	....do	41.24	8	Purse-seine	Gulf of Maine	Portsmouth, N. H.
* Uncle Joe	....do	63.25	15	......do	......do	Southport, Me.
* Valiant	....do	14.96	3	Gill-net	Coast of Maine	Friendship, Me.
* Velocipede	....do	67.91	13	Purse-seine	Gulf of Maine	Portsmouth, N. H.
Venilia	....do	67.66	14	......do	Cape Hatteras to Gulf of Saint Lawrence, inclusive	Brooklyn, Me.
* Venus	....do	12.44	5	Hand line	Coast of Maine and Massachusetts	Gloucester, Mass.
Vidette	....do	58.07	13	Purse-seine	Gulf of Maine	Do.
Volunteer	....do	69.58	14	......do	Cape Hatteras to Gulf of Maine, inclusive	Do.
Walter L. Rich	....do	79.75	14	......do	Gulf of Maine	Wellfleet, Mass.
* Washington	....do	18.11	4	Gill-net	Coast of Maine	Hancock, Me.
* Washington	....do	14.11	4	Hand-line	......do	Tremont, Me.
* Wasp	....do	14.74	3	Gill-net	Coast of Maine and Massachusetts	Friendship, Me.
* Water Lily	....do	37.24	8	Purse-seine	Gulf of Maine	Portsmouth, N. H.
Waverly	....do	52.09	12	......do	......do	Rockport, Mass.
* Western Belle	....do	11.22	3	Hand-line	Coast of Maine	Deer Isle, Me.
Wide Awake	....do	63.41	13	Purse-seine	Gulf of Maine	Gloucester, Mass.
Wide Awake	....do	69.63	14	......do	Cape Hatteras to Gulf of Maine, inclusive	Cohasset, Mass.
Wildfire	....do	108.90	14	......do	Gulf of Maine	Gloucester, Mass.
William D. Daisley	....do	98.09	14	......do	......do	Boston, Mass.
William H. West	....do	67.80	15	......do	Coast of Maine and Massachusetts	Do.
William M. Gaffney	....do	74.65	14	......do	Cape Hatteras to Gulf of Maine, inclusive	Gloucester, Mass.
William S. Baker	....do	103.95	16	......do	......do	Do.
* William V. Hutchings	....do	62.68	12	......do	Gulf of Maine	Do.
* Willie G.	....do	59.00	12	......do	......do	Southport, Me.
Willie Irving	....do	74.59	15	......do	......do	Chatham, Mass.
Willie Parkman	....do	77.74	18	......do	......do	Dennis, Mass.
* Willie Smith	....do	32.00	6	Hand-line	Coast of Maine	Portland, Me.
* Willow	....do	12.98	4	......do	Block Island	Harwich, Mass.
* Winifred J. King	....do	63.61	11	Purse-seine	Gulf of Maine	Gloucester, Mass.
Winnie Weston	....do	47.84	12	......do	Cape Hatteras to Gulf of Maine, inclusive	Portland, Me.
* Yankee Lass	....do	5.33	2	Gill-net	Coast of Maine	Cushing, Me.
Yankee Lass	....do	78.65	14	Purse-seine	Gulf of Maine	Boston, Mass.
Young Sultan	....do	53.59	12	......do	......do	Wiscasset, Me.

XI. APPENDIX.—STATISTICS OF THE MACKEREL FISHERY IN THE GULF OF SAINT LAWRENCE.

56. THE CATCH OF MACKEREL BY AMERICAN SCHOONERS IN CANADIAN WATERS, 1873–1882.

The following statement, prepared by Colonel David W. Low, of Gloucester, shows the extent of the mackerel fishery as pursued by American vessels in the Gulf of Saint Lawrence since the year 1873. The number of vessels and their catch in the years 1873 to 1877, inclusive, is compiled from the reports of the collector of customs at Port Mulgrave, Nova Scotia; the number of vessels in 1878 and 1879 is from the same authority; the catch for 1878 and subsequent years and the number of vessels in 1880 and 1881 is from reports of the Boston Fish Bureau. The estimates of value and the catch within the three mile limit are from authentic sources. The value includes the labor of crews "messing" some of the fish by soaking, scraping, and cutting off their heads, thus increasing their market value. The quantity of mackerel caught within the three-mile limit, one-third of the total catch, is considered by competent authorities to be a very liberal estimate. The unusual number of vessels in the gulf in 1878 was caused by false reports and telegrams of great quantities of mackerel there. American vessels in the gulf-mackerel fishery must average four hundred barrels of mackerel each at ten dollars per barrel to pay the expenses of outfit, insurance, depreciation of vessel, crew's share, and master's commission.

The mackerel fishery by American vessels in the Gulf of Saint Lawrence for the years from 1873 to 1881, inclusive.

[Compiled by Col. David W. Low.]

Year.	Number of vessels in Gulf.	Catch in sea-packed barrels.	Shrinkage in same one-eighth.	Packed barrels.	Value when sold in United States per barrel, packing off.	Total value in United States of whole catch when sold.	Number of barrels caught inside three-mile limit, liberal.	Value in United States of mackerel caught within three-mile limit, liberal estimate.
1873	254	88,012	11,001	77,011	$10 46	$805,535	25,670	$268,508
1874	164	63,078	7,885	55,193	6 25	344,956	18,398	114,987
1875	95	13,006	1,626	11,380	14 18	161,368	3,793	53,785
1876	64	5,495	687	4,808	11 60	55,773	1,603	18,594
1877	60	8,365	1,046	7,319	11 10	81,241	2,439	27,072
1878	273	....	....	61,923	4 15	256,980	20,641	85,660
1879	44	....	....	10,796	2 50	26,990	3,599	8,997
1880	34	....	....	7,301	7 72	56,364	2,433	18,783
1881	3	....	....	470	8 50	3,995	156	1,326
1882	1	....	....	275	8 50	2,125	95	717
Total	992	....	....	236,476	....	1,795,327	78,827	598,429
Average per barrel	....	....	....	....	7 59	....	....	....

Yearly average catch per vessel, 238.

ALPHABETICAL INDEX.

V.—THE LOFFODEN FISHERY IN 1880.*

By Lieut. NIELS JUEL.

The following report concerning the Loffoden fishery in 1880 was prepared for His Majesty the King, by Niels Juel, first lieutenant in the navy, chief inspector of that fishery:

The work of inspection continued from January 16 to April 14, over the region from Loffoden to Guldvigen. The force consisted of 8 officers, 1 inferior officer, 2 mates, 3 foremen, 21 seamen, and 1 cook. Its distribution is shown in the annexed Table I. The time of its arrival at Loffoden was as follows: January 16, the chief inspector and 2 men. January 18, 1 officer and 4 men. January 25, 3 officers and 20 men. February 1, 7 officers and all the men. February 3, the entire inspection force.

Since, at the close of the month of January this year, fewer boats than usual had arrived, only 1,800 against 3,100 in 1879, and 2,200 in 1878, no serious detriment followed from the small inspecting force at the beginning of the fishery. The inspecting party was not ordered to meet earlier simply because of the scantiness of the appropriation. It will at the same time be unfortunate if such an arrangement be established as a rule; the fact that there was no further injury to the preservation of order or the service in general this year was simply because of the circumstance that from the 20th of January to the end of the month there were only three days in which the weather allowed the fishermen to cross West Fjord. Because of the steamer's schedule, the chief inspector, together with the officers and men, departed on the 13th of April, with the exception of one officer, who remained at stations in Flakstad until the inspection closed at midnight on the 14th. The officers were employed on the average seventy-eight days, and the men eighty-six, or, if the traveling-days be excluded, seventy-nine days. The pay of the inspecting force amounted to 140 crowns ($37.52) daily. The average combined pay of the officers was 624 crowns ($167.23), and of the crew 185 crowns ($49.58).

---

* *Fra Opsynschefen ved Lofotfiskeriet. Lofotfiskeriet,* 1880. *Kristiania. Trykt hos Chr. Schibsted.* Translated by TARLETON H. BEAN.

NOTE.—It will be observed that the totals in some of the statistical tables cannot be obtained by adding their component parts. Whether this is due to omissions of minor details or to typographical errors cannot now be determined, and the original is reproduced without change.—TR.

TABLE I.—*Distribution of the inspecting force.*

Sign of the district.	Inspection district.	Fishing stations.	Extent in sea-miles.	Maximum fleet.			Officers' assistants.		Inspecting officer.	Surgeon.
				Vessels.	Boats.	Men.	Mates.	Sailors.		
B & C.	Skroven	Skroven, Gudbrandsö, Vikan, Brettesnæs, Guldvig, Skjoldvær.	2	70	700	3,600		2	H. Kjelsberg	A. J. Sand (ward).
E, F, & S.	Svolvær	Östnæsfjord	2	*110	*700	*3,900		2	Th. Wislöff	E. Rode, from March 20.
		Svolvær, Osan								
H & I.	Vaagene	Kirkevaag, Kabelvaag, Storvaagen	½	100	950	5,200	1	2	J. Vinnem	Chr. Eger (infirmary).
K, L, & M.	Hopen	Molnosen, Örsvaag, Örsnæs, Hopen, Kalle	⅓	90	720	3,800	1	2	M. Kjelsberg	
N.	Henningsvær	Guldvigen, Festvaag, Sauöen, Henningsvær	½	150	1,100	6,200	1	2	J. Tönseth	U. F. M. Poppe (ward).
P, G, & T.	Stamsund	Valberg, Skokkelvigöerne	1½	130	1,050	5,700		3	H. Olsen	
		Hartvaagen, Svarholt, Stamsund, Æsöen, Upper and Lower Stene.								H. Kjelsberg (ward).
U.	Ure	Ure	¼	30	300	1,600			H. Jacobsen †(subordinate officer).	
V & W.	Balstad	Sandsund, Mortsund, Brandsholmene, Moholmene, Baarsund, Balstad, Kræmmervigen.	1	40	400	2,200	1	2	A. Öiestad	D. F. Schumacher (district infirmary).
X, Y, Z, Æ, Ö, & II.	Sörvaagen	Stromsö, Nufsfjord, Inner and Outer Næsland, Sund, Havnö, Olenilsö, Reine, Moskenæs, Sörvaagen, Bogen, Tind, Aa, Evenstad.	3½	80	750	4,200		2	J. J. Rokkonæss	H. Ommundsen (ward).
	"Lunnen"	Storvaagen, Östnæsfjord					1	2		
	Svolvær	As servants to the chief inspector and judge, and assistants to the officer and manager.						2		
				800	6,670	36,400	5	21		

*Not including Östnæsfjord.

†In Östnæsfjord, from March 18 to 25.

In the report of last year, pages 5 to 9, as well as in the estimate for 1881, I set forth strongly the necessity of an increased appropriation, partly because the inspection force is at present inadequate for the greatly increased labor of late years, partly because the wages are too low, absolutely as well as relatively to the requirements which ought to be found in the personnel of the inspection, and in part because many expenses, such as hoisting signals, placing beacons, lodging for the men, together with printing the report, amounted to not a little. I cannot sufficiently insist upon it that the claim which has been made for an increased appropriation has not been called forth by a desire to make the inspection more absolutely effective, but it is based upon the necessity of taking such measures as will prevent its retrograding as an institution, and it is doing this now, because the increased number of people and the exigencies of the times demand a larger force as well as increased capability and activity in it. From Table II it will be seen that while the proportion between the inspecting force and the total number of fishermen, mariners, and other tradesmen was, from 1861 to 1862, as 1 to 500, it was in 1880 as 1 to 840.

Under the last two heads are given the cost of the inspection, which has always been set forth as so considerable, deducting what was paid into the treasury in the shape of fines or for telegrams. Herefrom it will be seen that this has been from .82 to 1.33 crowns (22 cents to 36 cents) for each adult male who has been present during the fishing. If one compares the expenses of the inspection with the other expenses during the fishery he will find out that last year the loss of implements was 83 times as great as the cost of inspection; the cost of bait was 10 times as great as the cost of inspection; the wear and tear of skin-clothing was 10 times as great as the cost of inspection; the wear and tear of bed-clothing was twice as great as the cost of inspection.

If we remember that the inspection, whose operations include vessels in Loffoden, together with the mercantile class in many parts of the country, never costs one-half as much as the wear and tear of the fishermen's bed-clothing may be estimated at, the sum of 23,000 crowns ($6,164) seems insignificant. In comparison with the duties its cost was nearly the same as the import duties upon the sugar and coffee which were consumed during the fishing, and a couple of thousand crowns ($536) less than the duties upon fish imported.

Some have thought that the inspecting party might facilitate its work by associating with it a voluntary inspection by the people similar to that established at Söndmöre by a law of June 6, 1878. The chief duty of this inspection shall, according to law, consist in "seeking by injunction and warning to prevent as far as possible" violation of law at sea. How far the public morals will be improved hereby is, however, doubtful, for it is not through ignorance or lack of warning that offenses are committed at sea, but because the fisherman knows that it is extremely difficult to get full proof of them. Even if information to the police be made a duty of citizenship it still lacks the great essential to its promised utility, namely, the ability to procure conclusive proof; for this as a rule can be brought by the injured party alone, and often not by him, a thing of which the police records can furnish abundant examples. I cannot see that an inspection by the people, that is to say, organized in the manner proposed, can make any change in the existing state of things, because there is now just as little want of injunction and warning as of announcements. On the contrary, the result of it will probably be that when either a single trade or people from a particular district are present in a large majority in most of the stations they will tyrannize over those more weakly represented. So far as I have learned, the plan is based upon an opinion of certain people, but I think that where such is found it involves the idea of self-management, while in the legal method is found no trace of such an idea beyond the formal condition that there shall be a choice.

The inspection imposed in all 152 fines. The nature of the offenses is set forth in the annexed table III, which also contains a statement of the fines imposed by the inspection during the last five years. The number of fines this year is somewhat smaller than that of last year. The diminution occurs especially in transgressions of section 10, which is because of the fact that the fines were all imposed for individual infractions of one portion of that section; also in transgressions of section 11, which is for the reason that there was only one fishing-sea, and its limits were better known than last year when this division first took place.

The matter of making arrests (page 13 in the report for 1879) and of authority for sending vagrants to a house of correction (same report, pages 74 and 75) will probably be decided in the course of the year.

TABLE III.

Offenses.	Number of fines received or imposed.				
	1876.	1877.	1878.	1879.	1880.
Fines, total	334	*197	188	182	152
These consisted of:					
For disturbing the peace, § 6	17	24	36	25	32
For breaking the harbor regulations, § 7	....	3	5	1	4
For fishing without boat-marks, § 9	9	2	6	2	3
For fishing too early or too late, § 10	213	104	55	99	65
For setting in unlawful waters, § 11	10	25	35	25	8
For sabbath breaking, § 12	....	1	....	....	....
For throwing out ballast, § 13	....	....	1	....	1
For sailing in spite of warning, § 15	1	1	....	....	....
For improper clearance, § 16	16	7	19	11	8
For sailing on a holiday, § 19	8	3	15	2	1
For improper treatment of rescued gear	2	....	3	1	1
For violation of health regulations	31	2	....	4	1
For unlawful sale of whisky	13	16	3	6	16
For unlawful sale of beer and wine	12	1	5	3	11
For unlawful sale of other articles	2	2	5	3	1
Fines received by amicable arrangement in private matters.	18	20	20	20	13
Private matters otherwise treated, which are on the record.	162	252	257	428	368

* Includes for shooting eider duck, 6.

The fines amounted to 2,224 crowns ($596.03), of which 1,126 ($301.77) fell to the state treasury, 549 ($147.13) to various local treasuries, and 549 ($147.13) to the inspecting force as their share.

By amicable adjustment in private affairs were received 13 fines, amounting in all to 144 crowns ($32.59), of which 66 ($17.69) went to the poor-fund, 2 ($0.54) to the reading-room in Stamsund, and 76 ($20.37) to the projected reading-room in Henningsvær.

The inspecting force investigated and put on the register 188 private cases concerning fishery business exclusively and also 180 other private disputes.

Law Candidate Marcus Hegge Parelius, an attorney of the superior court, acted as judge extraordinary. The number of cases for this year and the four immediately preceding it is stated in table IV below:

TABLE IV.

Cases.	Cases managed by the judges.				
	1876.	1877.	1878.	1879.	1880.
Total	33	28	29	35	49
Of these were:					
Examinations	16	19	15	21	18
Police cases	15	4	9	5	17
Declarations	......	1	2	3	3
Protests	......	2	......	1	2
Executions	2	......	......	......	2
Tax cases	......	1	2	3	2
Private disputes	......	1	1	2	5
Number of cases relating to:					
Theft	12	11	10	9	13
Fraud	......	1	1	4	......
Concealing goods found	2	1	2	3	......
Chapter 18 of criminal laws	......	2	1	......	......
Other crimes	2	4	1	5	5

Of the five examinations included under "other offenses," four related to assault and one to opening letters. Of the examinations, 9 were decided and the rest closed. Of the police cases, three were adjudged and the rest settled after the fine was agreed upon. Two police cases were transferred for treatment outside the inspection district, since the parties concerned left before the judge found time to dispose of the cases. Of the cases before the special court, four were decided and one was settled after legal adjustment. Eleven public cases announced for the associate judge were sent to the superior court because time did not allow their treatment during the fishing season. Of these, seven related to theft and four to fraud. Of eight old cases which were sent from the superior court for continuation, time allowed the disposal of only one.

From the above it will be seen that the judge has disposed of more than one-half as many cases as the average of the four preceding years, four times as many as the average from 1872 to 1875 (see report for 1879, page 14), also nearly one-half as many as the two judges combined from 1860 to 1871. Eighteen examinations and two police cases, for lack of time to dispose of them during the fishing, were sent over to the common court, to which, for the same reason, a not inconsiderable number of special-court cases were referred. The management of the examinations by the common court will cost much more to the public treasury than by the associate judge; the chief inspector for two years has proposed to act on the budget, and during the fishing this year applied for it. On account of these increased expenses for the criminal fund the superior magistrate in the district of Nordland, so far as I know, has undertaken to obtain, through the department of justice, the necessary judicial assistance during the fishery. If such help can be had in this way it will be unnecessary to apply for any associate judge until the fishing begins. In the contrary event I cannot sufficiently emphasize the necessity of appointing such a one as soon as the number of cases demands it, although there is no license.

A. J. Sand, director of inspection in the district of Skroven and Östnæsfjord, brought, as physicians, O. Ch. Chr. Eger, district physician in Vaagen and the rest of the districts of Svolvær, Vaagen, and Hopen, U. F. M. Poppe, of the medical corps of Henningsvær district, Medical Candidate H. Kjlesberg of the Ure and Stamsund districts, D. F. Schumacher, district physician in Buksnæs in the district of Balstad, and H. Ommundsen, district physician of Flakstad and its dependencies. From March 20 Medical Candidate E. Rode took charge for a week of the medical inspection in Svolvær district, and later of Hopen district also. From February 23 Ch. A. Sellæg, district physician in Ofoten, took charge of the medical inspection in Værö and Röst.

The table below shows the number of sick treated in the different medical districts:

Medical district.	Sick treated. Total.	Of these are— In the infirmary.	Dead.
Skroven	294	18	3
Svolvær	53	1	....
Vaagene	856	127	9
Henningsvær	1,732	85	7
Stene	414	80	6
Balstad	355	52	5
Flakstad	392	13	1
Grand total	4,096	376	31

The number of patients in proportion to the fishermen, seamen, and other tradesmen present was larger than in any of the four preceding years, namely, 13.5 per cent. The number of cases of diarrhœa, chills and fever was greater than usual. The cases of chills may possibly in part be attributed to the want of proper house-room, since, on account of the overcrowding in many places, it was necessary to house the incoming fishermen in lofts and cow-houses (even pig-pens and summer cow-pens were not refused). The diarrhœa indeed had its origin partly in the same condition, partly also in the want of suitable drinking-water. Of exanthematous typhus 2 cases occurred, and of typhoid fever 77, of which 8 ended fatally. There were 54 cases of inflammation of the lungs, with 5 deaths. The other causes of death were: Incarcerated hernia, 4; paralysis of the brain, 3; inflammation of the brain, 2; acute diarrhœa, 2; dropsy, 2; epidemic cerebro-spinal-meningitis, 1; rheumatic fever, 1; twisting of the gut, 1; senile inflammation, 1; and gangrene 1.

The table following shows the number of cases of nervous fever and lung-inflammation treated at the Loffoden fishery since 1860. Through the generosity of the medical office the returns are now complete for the whole time, and they are here given entire.

Year.	Totals.			Year.	Totals.		
	Nervous fever.	Inflammation of the lungs.	Deaths.		Nervous fever.	Inflammation of the lungs.	Deaths.
1860	21	19	13	1872	23	12	4
1861	12	20	23	1873 †	54	18	10
1862	16	31	15	1874 ‡	146	17	13
1863	122	57	23	1875	56	18	....
1864	102	34	15	1876	28	140	46
1865	83	19	9	1877	6	38	9
1866	26	16	13	1878	8	51	17
1867 *	59	33	19	1879	55	38	15
1868	106	24	14	1880	72	54	31
1869	88	11	17				
1870	69	28	4	Average	....	....	15.9
1871	47	14	9				

* 3 cases of variola. † 6 cases of exanthemata. ‡ 1 case of exanthema.

Thus disease has claimed an average of 16 yearly, or 68.7 in 100,000, while the sea and accidents have taken off 25½, or 110 in 100,000. Of deaths there have occurred also during the Loffoden fishery through disease 1 for about every 1,500 of the population, through shipwreck 1 for every 900 men. Judging from statistics also, we must be prepared next year for a greater number of cases of nervous fever.

Venereal disease has increased, not only in the number of cases, but also in proportion to the fishing population. The inspection seeks in this matter, as far as possible, by controlling it, to prevent the spread of the plague, and next year it will also institute legal proceedings against any one who, being known to have this disease, communicates it to another.

The prevailing diseases have been:

Catarrh of the air-passages	481
Other acute catarrhal affections	216
Diarrhœa	450
Cardalgia and chronic gastritis	346
Swollen fingers	289
Wounds (*vulnera*)	226
Eye diseases	208
Simple fever	182
Chronic rheumatism	148

Nervous disorders	143
Boils, abscesses	139
Bruises and sprains	131
Senile inflammation	74
Total	3,033

Or three-fourths of all the sick treated.

Table V below shows the proportion, for the last five years, which the prevailing diseases have borne to the size of the fishing population. On the average there have been treated yearly:

For cardalgia and chronic gastritis, 12 in every 1,000 men.
For catarrh, 18 in every 1,000 men.
For diarrhœa, 10 in every 1,000 men.
For swollen fingers, 9 in every 1,000 men.
For wounds (*vulnera*), 6 in every 1,000 men.
For chronic rheumatism, 6 in every 1,000 men.

The difference has been greatest in the cases treated for catarrh of the air-passages, namely, from 6 to 16 in 1,000. The number of swollen fingers was smallest in 1878, which was due in part to the fact that the number of line-fishermen was smaller that year than in the others, but when compared with the two preceding years it must of course be attributed principally to the attention paid to the need of speedy treatment of the cuts which produce the inflammation; and when 1878 is compared with the two following years, it appears as if the so-called wound-varnish, whose distribution was opposed by all the doctors, has played an important part in securing the low number of this and a part of the following year. If we compare the number of swollen fingers with the number of line-fishermen, who are most afflicted by them, we shall see that there were, in 1876, 29 cases to every 1,000 line-fishermen; in 1877, 26 cases to every 1,000 line-fishermen; in 1878, 20 cases to every 1,000 line-fishermen; in 1879, 23 cases to every 1,000 line-fishermen; and in 1880, 28 cases to every 1,000 line-fishermen.

I think, therefore, that the attention not only of the fishermen, but also of the chemists, should be urgently directed to this important matter, since the wound-dressing which the royal apothecary, Ditten, distributed gratis in 1878 and part of 1879 was not entirely satisfactory.

TABLE V.

Prevailing diseases.	1876.	1877.	1878.	1879.	1880.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Cardalgia and chronic gastritis	1.2	1.0	1.3	1.5	1.1
Bronchial catarrh	1.6	0.6	0.9	1.2	1.5
Other catarrhal affections	0.7	0.6	0.6	0.5	0.7
Inflammation of the lungs	0.6	0.2	0.2	0.1	0.2
Diarrhœa	0.6	0.6	1.6	1.0	1.4
Eye disease	0.4	0.6	0.6	0.7	0.7
Nervous disease	0.5	0.4	0.7	0.7	0.5
Swollen finger	1.1	1.0	0.6	0.7	0.9
Chronic rheumatism	0.6	0.9	0.6	0.5	0.5
Wounds (*vulnera*)	0.5	0.5	0.6	0.5	0.7
Senile inflammation	....	0.2	0.5	0.2	0.2
Treated in all	12.2	11.0	12.0	12.8	13.5

Cases of sickness each month.

Medical district.	Cases treated.				
	January.	February.	March.	April.	Total.
Skroven	13	120	131	30	294
Svolvær	....	....	53	....	53
Vaagene	24	247	413	172	856
Henningsvær	155	685	748	144	1,732
Stene	14	148	201	51	414
Balstad	27	133	142	53	355
Flakstad	28	83	163	118	392
Væro and Röst	....	....	....	....	44
Total	261	1,416	1,851	568	4,140
	4,096				

Væro and Röst do not belong to the inspection district. As will be seen, the physician in Svolvær, during the single week of his practice there, had more patients than the doctor at Væro and Röst in the space of seven to eight weeks. Under ordinary circumstances the medical attendance during the Loffoden fishery is sufficient, except in Vaagen, during the East Loffoden fishing, when it will be desirable to have two physicians present from the middle of February to the close of March. (See report for 1879, page 16.) The table below shows the number of sick treated in the hospitals. In the middle of March these were inspected by the director of the civil medical department:

Hospital.	Hospital patients.				
	January.	February.	March.	April.	Total.
Skroven	....	9	8	1	18
Kabelvaag	....	....	....	....	128
Henningsvær	6	36	39	4	85
Stene	....	26	43	11	80
Gravdal	3	13	25	11	52
Reine	....	4	7	2	13
Total	....	....	....	....	376

Altogether 9.2 per cent., or one-eleventh, of the sick were placed in the hospital.

For the remaining details of this subject I venture to present the annexed Table VI, which contains a statement of the cases of sickness treated by the doctors. This, as well as the two preceding tables, was kindly prepared by the medical office:

TABLE VI.—*Summary of the cases treated by the physicians during the Loffoden fishery*, 1880.

	Total.	
	Treated.	Died.
Exanthem, typhus	2	....
Typhoid fever	77	8
Cerebro-spinal meningitis, epidemic	1	1
Simple fever	182	....
Chicken pox	5	....
Scarlet fever	1	....
Erysipelas	1	....
Diphtheritic inflammation of throat	4	....
Kusma	22	....
Bronchial catarrh	487	....
Other acute catarrhal affections	221	....
Inflammation of lungs	54	5
Pleurisy	31	....
Chronic bronchitis, asthma	33	....
Spitting of blood	6	....
Consumption	9	....
Heart disease, palpitation	12	....
Ague	1	....
Rheumatic fever	47	1
Chronic rheumatism	148	....
Muscular rheumatism, contracted at sea	15	....
Sting (stitch?)	72	....
Acute diarrhœa	450	2
Other acute affections of the digestive apparatus	56	1
Cardalgia, chronic gastritis	348	....
Scurvy	1	....
Brain fever	2	2
Nervous disorders	144	3
Mental diseases	3	....
Dropsy, *Morbus Brighti*	5	2
Disease of urinary organs	14	....
Skin disease	92	....
Worms	4	....
Syphilis	5	....
Gonorrhœa, urethritis	28	....
Epididymitis, orchitis	21	....
Wounds (*vulnera*)	233	....
Fractures and luxations	13	....
Bruises and sprains	134	....
Senile inflammation, *vakrom*	74	1
Disease of bones and joints	66	....
Lymfangit, phlebitis	5	....
Swollen fingers	297	....
Boils, abscesses, ulcers	139	....
Furuncles, carbuncles	57	....
Gangrene	1	1
Burns	19	....
Frostbites	36	....
Eye diseases	213	....
Ear diseases	75	....
Nasal affections, epistaxis	11	....
Tumors	10	....
Rupture	25	4
Diseases not indicated	116	....
Other affections	12	....
Total	4,140	31
Teeth extracted	116	....
Number of hospital cases	376	....

The county council of Nordland last year placed at the disposal of the superior magistrate of that district the necessary funds for improving the management of the water supply, and the county also will hereafter pay interest on the money borrowed from the medical fund (18,800 crowns—$5,038.40—in 1878). Moreover, I think it proper to call attention to the sums which are supplied from the medical fund for the expenses of the council incurred for vaccination, midwifery, and treatment of mental disorders.

For extraordinary clerical service during the fishery, were present O. S. Revers and L. A. Meek, assistant diocesan clergymen.

S. Nilssen, parish clerk of Melö, taught school forty-four days in Stamsund. The number of pupils was upwards of 60, most of them from Stegen and Lenvig. The course of study was the same as last year. The school-day, as a rule, was four hours. In Henningsvær school was established also, but the attendance was small. Since education is not compulsory, the patronage depends largely on the interest which the teachers can awaken in the school. On account of the not inconsiderable number of boys who are present during the Loffoden fishery, without taking any direct part in it, I think that a modification of the system of instruction for the fishing season is worthy of closer consideration. The time of these boys, to be sure, is partly occupied in baiting lines, cleaning, and cooking; but still a portion of them remain in idleness. The matter must, however, rest until we learn their number, and I shall undertake an enumeration next year.

There are chapels now in Svolvær, Vaagen, Hopen, and Stamsund, whilst in Ure one is being constructed. Churches are found in Kirkevaag, Henningsvær, Valberg, Stene, Gravdal, and Moskenæs. The following table gives the expenses of the chapels, the contributions by which they are erected, and also their debt:

Place.	Chapels.			
	Cost.	Contribution—		Debt.
		From the state.	Private.	
	Crowns.	*Crowns.*	*Crowns.*	*Crowns.*
Svolvær	4,400	2,500	1,900	....
Vaagene	2,000	....	2,000	....
Hopen	2,500	....	2,500	650
Stamsund	9,200	2,000	6,100	1,100
Ure	3,200	....	800	2,407

As a building fund for proposed chapels was collected: In Skroven, 1,700 crowns ($455.60); in Balstad, 140 crowns ($37.52); and in Nufsfjord, 300 crowns ($80.40).

There is at present one reading room (in Stamsund). One is being built in Ure, and in Henningsvær 1,200 crowns ($321.60) have been collected for a prospective reading room.

Libraries are to be found in Henningsvær, Stamsund, and Svolvær. In the last two places, however, the number of books is yet very small. In 1878 the county council of Nordland granted to each hospital 50 crowns ($13.40) from the medical fund for the purchase of books. In 1879 the grant was extended also to the wards in Loffoden. It is very desirable to repeat this grant for many years to come, in which case, however, I think it is proper to advise that the purchase of books be made according to a fixed plan, such as that established by direction of the diocese.

From the foregoing it would seem evident that there is a want of houses of worship in the larger places as well as in those more remote which are destitute of churches, since there are at present only five built and three projected. As the financial condition of the common people at present is discouraging, partly on account of low prices last year in Loffoden, and in part because of the unsuccessful herring fishery, and as we cannot expect to find among fishermen who move quickly from one place to another the same social spirit as in a settled community, there exists a state of financial depression in nearly all the churches. Here is, therefore, a proper object of public assistance. The want is greatest in Skroven, where as many as 3,000 people can often be assembled, and where all divine service hitherto has of necessity been held in the open air. Next in want is Nufsfjord, whose annual complement is nearly 400 men, and from which the distances to church are both long and troublesome. In this connection I think it proper to add that it will certainly be most prudent to make the contribution from the state contingent upon public control over the use of the chapels, which has not been the case hitherto.

Libraries have come to be appreciated of late, and their utility is incontestable. That they have not become general is principally because only a few places have taken the initiative in this matter. Not only should money be collected, but building should be entered upon, and the house once finished should be, during its use in the fishing-season, cared for by heating, lighting, and cleaning it as well as by providing newspapers and books. The fisherman, because of his occupation, cannot easily furnish anything except money. At the same time it certainly is essential that these libraries be subject to a wise control, for they may easily degenerate and become an injury instead of a source of use and comfort. I find this matter of such importance both for the fishermen and the public that I believe I should call attention to it, since the idea is a sound one, though it will hardly be initiated by the fisherman himself, and since unity in action will accomplish the end more quickly and surely.

The telegraph corps consisted of 23 operators, divided among 9 fixed and 3 field stations. On account of the fishing, the force at Lödingen station was augmented during the fishing-season by 2 operators. Of the 9 fixed stations the following 5 are open throughout the year: Svolvær, Vaagen, Henningsvær, Balstad, and Sörvaagen. Of the remaining stations the field station in Stene is closed on the 14th of April, and the stations in Skroven, Hopen, Ure, and Reine close April 30 after the service ends. Stamsund station is kept in operation later. During the fishing the Digermul field station is moved to Vaterfjord (Östnæsfjord) on March 15, and on the 30th from there to Stene, where it is opened on the 2d of April.

Table VII shows the number of telegrams sent and received at the above-named 12 stations between January 1 and April 30. The statement is a summary kindly communicated by J. B. Lie, inspector in the district of Tromsö:

TABLE VII.

Stations.	Distance in Norwegian miles.	Number of telegrams dispatched from January 1 to April 30.									
		January.		February.		March.		April.		Total.	
		Sent.	Received.	Sent.	Received.	Sent.	Received.	Sent.	Received.	1880.	1879.
Digermulen	0	18	17	20	24	138	116	93	62	488	147
Skroven	3	30	28	342	193	874	541	245	185	2, 438	2, 087
Svolvær	$\frac{3}{4}$	351	266	708	448	1, 594	1, 084	641	487	5, 579	4, 316
Vaagen	$\frac{1}{3}$	327	212	961	539	1, 690	1, 080	819	539	6, 167	6, 032
Hopen	$\frac{1}{2}$	74	46	475	181	477	352	188	120	1, 913	2, 011
Henningsvær	$\frac{3}{4}$	271	197	776	474	1, 050	949	559	371	4, 647	5, 626
Stamsund	$1\frac{1}{3}$	184	109	700	374	1, 112	1, 096	320	284	4, 179	3, 530
Ure	$\frac{3}{4}$	25	13	95	76	239	243	84	70	845	651
Balstad	$\frac{3}{4}$	236	144	345	188	614	425	378	278	2, 608	2, 259
Sund	$1\frac{1}{2}$	21	25	126	97	302	263	267	200	1, 301	1, 132
Reine	1	35	16	95	83	215	218	198	173	1, 033	1, 011
Sörvaagen	$\frac{1}{2}$	55	58	218	116	265	197	247	185	1, 341	1, 398
		1, 627	1, 131	4, 861	2, 793	8, 570	6, 564	4, 039	2, 954	32, 539	30, 200
		2, 758		7, 654		15, 134		6, 993		+ 2, 339	

For comparison the number of telegrams dispatched during the fishing-season in the last three years is appended:

Month.	Number of telegrams.		
	1878.	1879.	1880.
January	3, 472	2, 710	2, 758
February	7, 893	5, 463	7, 654
March	11, 703	13, 244	15, 134
April	7, 132	8, 795	6, 993
Total	30, 200	30, 212	32, 539

The number of telegrams exceeds that of last year by 2,300. The increase is marked at stations in East Loffoden, and, as to time, during the month of March.

In my report for 1878, as well as in that of 1879, I stated that the number of lines was too small for the amount of correspondence, a view which was shared by the telegraph department, which therefore in both of these years solicited Parliament for the necessary license to establish a new wire between Ure and Henningsvær, but in vain. I must therefore this year again emphasize the necessity of this line, for under existing circumstances the detention of messages, which is essentially due to the want of a sufficient number of wires, is frequently highly perceptible and has occasioned considerable loss of both time and money.

At any rate the number of lines is far from adequate to the amount of correspondence, a condition which should in justice be secured for a business so important to the country.

The table following shows the number of telegrams sent and received annually from 1870:

Year.	Telegrams.			Permanent stations.	
	Sent.	Received.	Total.	Number.	Open all the year.
1870	10,000	7,800	17,800	8	2
1871	10,300	7,500	17,800		
1872	11,600	7,600	19,200		
1873	12,800	9,000	21,800		
1874	14,800	10,900	25,700		
1875	17,700	12,400	30,100		
1876	22,100	16,600	38,700		
1877	26,200	18,600	44,800		
1878	24,200	17,500	41,700	9	5

From January 16 to April 14, 90 days, Loffoden has been called at by 114 line steamers besides local vessels. Of these there were—

Northward bound.

Packets *en route* from—

Bergen to Hammerfest	4
Bergen to Vadsö	2
Hamburg to Vadsö	7
Kristiania to Tromsö	14
Total	27

Private vessels between—

Bergen and Tromsö	10
Bergen and Vardö	4
Bergen and Vesteraalen	9
Bergen and Loffoden	2
Kristiania and Vardö	1
Loffoden and Vardö	3
Total	29

Southward bound.

Packets between—

Hammerfest and Bergen	3
Hammerfest and Hamburg	5
Vadsö and Hamburg	7
Tromsö and Kristiania	13
Total	28

Private vessels between—

Tromsö and Bergen	11
Vardö and Bergen	3
Vesteraalen and Bergen	10
Loffoden and Bergen	2
Vardö and Kristiania	1
Vardö and Loffoden	3
Total	30

Of the 27 north-bound packets 14 were delayed from one-half day to three days, as follows: 5 times, one-half day; 4 times, one day; 1 time, one and one-half days; 3 times, two and one-half days; and 1 time, three days.

In January occurred 4 detentions; in February, 6, and in the first half of March, 4.

Of the 19 packets, which in this space of time called at Loffoden, going north, 14 also were detained, or, if we overlook delays of a half day, 9 (one-half). The cause of these detentions was stated to be storms and fog. But since, at the season mentioned, one can never calculate on continuous good and clear weather, or on moonlight, the real reason must be sought for in the routes, which are established for speed; besides, I think that to make the service adequate it will be necessary to put one more vessel in commission. This will cause the steamship company concerned, or the state, an increased outlay. The results of the delays of the packets are felt at present not only in the principal route, but also in its numerous branches in the fjords and out to the sea-islands; and if we take into consideration the inconveniences which are associated with a sojourn at the calling-stations, where there may often be a want of accommodation, and where one must often keep a constant lookout because he cannot tell when the delayed steamer may arrive, as also the waste of time each delay causes, the saving or the occasional speed one may reach by a forced route will hardly counterbalance the indirect tax which this, through the above-named conditions, puts upon the population of Nordland and Tromsö. I must therefore this year also emphasize the universal, and, according to my judgment, rightful desire for a more regular steamer service.

The matter of the pay of country postmasters, according to information obtained, will be adjusted by the marine and mail department of the Royal Norwegian Government at the beginning of the fiscal year.

In 1879, 4 beacons were erected and 20 moorings for vessels were placed within the inspection district.

Up to and including 1875 were found in the inspection district 8 light-houses, 7 beacons, and 407 moorings; in 1876 were established 5 beacons; in 1877, 6 beacons, 22 moorings; in 1878, 11 beacons, 12 moorings; in 1879, 4 beacons, 20 moorings. Total at end of 1879, 8 light-houses, 33 beacons, and 461 moorings on a coast stretch of 14 (Norwegian) miles.

When the work proposed by the chief inspector this year is accomplished, and this will probably require a couple of years, the number of beacons and moorings may be considered sufficient. The proposed fixing of rings I have not been able in many places to recommend, since, in the case where a vessel lies moored for a long time, bow and stern, and this forms the majority as a rule, I regard it a matter of vital importance for a vessel to establish the mooring in a convenient place ashore, especially as this work can be accomplished with ease and with moderate expense. With two rings, a drill, and a hammer, a mooring may be placed in one hour, or at the most two hours, and I should regard it a wise precaution if the insurance companies require that these articles form a part of every vessel's outfit.

Last year Gloppen light (Sörvaagen) was changed from the sixth to the third class. Thereby Balstad light has become less important as a range light for West Fjord, and since it will also be more useful as a guiding light to Balstad, the light-house board has taken into consideration the question of its removal.

The appropriation of 27,900 crowns ($7,477.20) for inspection during the fiscal year will probably be spent. At the same time, of this amount will be returned to the public treasury: Fines, 1,126 crowns ($301.77); for telegrams, 3,200 crowns ($857.60).

The appropriation of 1,200 crowns ($321.60) for extraordinary expenses of inspection in Rast Sound was not used.

The implements saved and not required during the fishing are preserved in Svolvær and Sund. The disbursements amounted to 656.26 crowns ($167.57), exclusive of the pay of the inspecting force, and the receipts were 1,195.75 crowns ($320.46), of which 935.45 crowns ($250.70) arose from auction sales of implements saved over from last year.

The correspondence-record of the chief inspector shows, for the term, 1,610 outgoing and 870 incoming issues, including telegrams. The office work, which is done exclusively by the chief of inspection, is thus considerable. Besides, the chief inspector is accountant as well as writer of responses which are made in fishery matters to the Government, as well as to private individuals, (partly also in affairs which lie outside of the domain of the Loffoden fishery), involving much labor.

As I pass on to the report of the fishing itself and its progress, I may remark that the statistical data are repeated in most cases for the last 5 years, in order that the administration, scientists, legislators, fishermen, and merchants may have the summary needed; for a report which deals exclusively with a single year's fishing, and which is published a long while after the end of the fishery, will be valuable only historically. Although I have labored towards this end for the space of 5 years, the report will not, until 1881, take the form which I think it ought to have in order to be useful. I have, for instance, in prosecuting this work during the year, been able to dispose of the months of October, November, and December only.

The arrival of the fishermen was delayed by stormy weather in the last third of January and the beginning of February. On the first of February, consequently, not more than one-third of the fleet was present. The majority arrived between the 8th and the 14th, at which latter date not quite two-thirds had come out. At the close of the following week the fleet was assembled. Those which arrived late were partly deep-water fishermen, partly fishermen from neighboring districts, who went to Loffoden for the sake of the Östnæsfjord fishing, and partly fishermen who had previously carried on winter fishing in home waters.

The Finmark fishermen, as usual, begun to clear at the end of March; however, because of the fear of low prices, fewer than common were destined at first for Finmark waters. The cessation of the fishing in Östnæsfjord before Easter, and in East Loffoden immediately after, soon gave an opportunity for a general break-up in the first 8 days of April, after which time scarcely a single foreigner was fishing east of Balstad. Westward, nearly 1,000 boats were engaged.

Table VIII shows the number of boats which were present in the different inspection districts at the close of each week. For the weeks ending February 14 and March 20 there is given besides a special statement for the different methods, wherefrom it will be seen that nine-tenths of the line fishermen had come in the middle of February, against only a little over seven-tenths of the net fishermen; whereas the opposite proportion existed last year. Of the deep-water fishermen, as usual, only a little more than one-half had arrived.

Moving (shifting berth) during the fishery occurred to a greater extent in the latter half of February from East to West Loffoden, where, however, some were obliged to sail as far west as Reine for want of house room in the remaining stations; in the first half of March, also, they moved from Ure, Stamsund, Henningsvær, and a part of Hopen, to the more easterly stations and to Östnæsfjord.

TABLE VIII.

Week ending—	Raftsund.	Östnæsfjord.	Skroven.	Svolvær.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Reine.	Sörvaagen.	Total.
January 17	8	......	......	......	......	120	......	70	......	112	......	......	900
January 24	......	......	40	25	25	160	400	160	......	120	150	120	1,200
January 31	......	......	50	35	120	250	530	200	60	260	165	130	1,800
February 7	......	......	110	40	280	300	650	350	70	......	170	......	2,360
February 14	......	115	315	225	690	590	1,000	500	125	380	230	275	4,445
Netters	......	15	115	63	360	220	410	330	25	40	70	35	1,683
Liners	......	100	94	127	80	270	400	130	100	340	160	240	2,041
Deep water	......	......	106	35	250	100	190	40	......	......	......	......	721
February 21	......	90	430	380	830	680	1,040	670	170	340	560		5,190
February 28	......	30	440	300	860	......	1,050	780	190	......	580		5,250
March 6	......	......	170	110	620	670	1,100	1,050	300	400	450	400	5,270
March 13	......	150	300	550	800	720	1,070	900	220	380	640		5,730
March 20	......	400	700	700	950	460	770	600	160	360	650		5,750
Netters	......	......	......	......	......	......	......	......	......	......	......	......	2,209
Liners	......	......	......	......	......	......	......	......	......	......	......	......	2,358
Deep water	......	......	......	......	......	......	......	......	......	......	......	......	1,183
March 27	......	......	600	620	950	520	810	400	170	350	650		5,070
April 3	......	......	350	300	900	500	750	450	150	......	......	......	4,410
April 10	......	......	100	20	200	90	450	100	80	340	720		2,100
April 14						100					1,000		1,100

Table IX states the number of boats present at the close of each half-month during the last 5 years. In the table also is given the time of the Easter holiday, from which it will appear that it has had less to do with the departure of the fishermen than persons generally are disposed to think it has.

TABLE IX.

Time.	Number of boats present.				
	1876.	1877.	1878.	1879.	1880.
Middle of January	....	600	300	700	900
Beginning of February	2,000	1,800	2,200	3,100	1,800
Middle of February	3,800	3,200	3,000	4,200	4,450
Beginning of March	4,700	3,800	4,100	5,000	5,250
Middle of March	4,910	4,570	4,700	5,280	5,750
End of March	3,100	4,400	4,700	4,800	4,400
End of first week in April	1,700	4,000	3,000	3,100	2,100
First day of Easter	April 16.	April 1.	April 21.	April 13.	March 28.

Table X is a statement of the number of sailors engaged up to March 16, their nativity and distribution with regard to the different kinds of gear, also the number of servants. As usual, the majority of the night-line fishermen in East Loffoden became day-line fishermen in March; just as many of the deep-bait men employed lines after their arrival at Loffoden.

TABLE X.

District.	Net.				Trawl-line.			Deep bait (hand-line).			Total number.			
	Men.	Boatmen.	Boats.	Net boats having lines.	Men.	Boatmen.	Boats.	Men.	Boats. With lines.	Boats. Without lines.	Fishermen.	Boatmen.	Boats.	Servants.
Stavanger County: Soggendal, Haugesund	5	1	1	......	3	1	1	3	......	1	11	3	3	......
S. Bergenhus County: Sund	......	......	......	......	......	......	......	2	1	......	2	1	1	......
N. Bergenhus County: Bergen, Davigen, Selö	......	......	......	......	16	4	4	2	......	1	18	5	5	......
Romsdal County: Aalesund, Örskoug, Molde, Eid, Gryten, Christiansund	......	......	......	......	7	2	2	25	1	8	32	11	11	1
S. Trondhjem County: Trondhjem, Örkedalen, Hitteren, Hevne, Stadsbygden, Rissen, Örlandet, Bjugn, Aafjord, Björnör	596	109	110	1	18	5	5	727	11	209	1,341	334	335	145
N. Trondhjem County: Lexvigen, Stördalen, Værdalen, Stenkjær, Ytteröen, Inderöen, Sparbu, Stod, Beitstaden, Namsos, Fosnæs, Fladanger, Nærö, Kolvereid, Lekö	399	65	65	......	35	9	9	440	5	148	874	227	227	79
S. Helgeland Bailiwick: Bindalen, Brönö, Velfjorden, Vegö, Alstahaug, Stamnæs, Herö, Tjötö, Vefsen	2,247	378	390	59	1,485	329	332	908	18	314	4,640	1,039	1,054	1,072
N. Helgeland Bailiwick: Mo, Hemnæs, Næsne, Dönnæs Lurö, Lödö, Melö	3,063	333	337	......	140	31	31	259	8	81	2,462	453	457	670
Salten Bailiwick: Gildeskall, Beieren, Saltdalen, Bodö City, Bodö Parish, Skjerstad, Folden, Kjerringö, Stegen, Hammerö, Lödingen, Tysfjorden, Ofoten	3,475	569	619	62	2,386	545	598	387	49	90	6,248	1,253	1,356	602
Lofolen and Vesteraalen Bailiwick: Hadsel, Sortland, Bö, Dverberg, Flakstad, Buksnæs, Borge, Balberg, Vaagen, Gimsö	1,688	274	396	127	2,691	844	977	112	17	26	5,491	1,161	1,416	1,649
Nordland County: Kvædfjord, Ibestad, Trondenæs, Sand, Tranö, Dyrö, Maalselven, Lenvig, Hillesö, Berg, Balsfjorden	9,473	1,554	1,742	248	7,702	1,749	1,938	1,666	92	511	18,841	3,906	4,283	3,993
Tromsö County: Malangen, Tromsö Sound, Tromsö, Lyngen, Karlsö, Skjervö	2,975	480	486	3	2,502	585	592	618	109	85	6,095	1,259	1,272	196
Finmark County: Hammerfest Parish, Tanen, Vardö	......	......	......	......	9	3	3	9	2	2	18	7	7	......

RECAPITULATION.

Stavanger District	5	1	1	......	3	1	1	3	......	1	11	3	3	......
S. Bergenhus District	......	......	......	......	......	......	......	2	1	......	2	1	1	......
N. Bergenhus District	......	......	......	......	16	4	4	2	......	1	18	5	5	......

Romsdal District	......	......	......	......	7	2	2	25	1	8	32	11	11	1
S. Trondhjem District	596	109	110	1	18	5	5	727	11	209	1, 341	334	335	145
N. Trondhjem District	399	65	65	......	35	9	9	440	5	148	874	227	227	79
Nordland District	9, 473	1, 554	1, 742	248	7, 702	1, 749	1, 938	1, 666	92	517	18, 841	3, 906	4, 283	3, 993
Tromsö District	2, 975	480	486	3	2, 502	585	592	618	109	85	6, 095	1, 259	1, 272	196
Finmark District	......	......	......	......	9	3	3	9	2	2	18	7	7	......
Total	13, 448	2, 209	2, 404	252	10, 292	2, 358	2, 554	3, 492	221	965	27, 232	5, 753	6, 144	4, 414

The total number of fishermen was 27,232, representing 5,753 crews, which is the largest force recorded in Loffoden. Compared with last year the increase is 1,676 men, or 471 crews; and, as compared with 1872, when the fleet was the smallest, 10,459 men, representing 2,107 crews, or 58 per cent.

Table XI gives the number of fishermen from the different parishes for the last five years, as well as the relative proportions in the parishes.

TABLE XI.

Year.	Number of native fishermen.													
	South Trondhjem District.		North Trondhjem District.		South Helgeland Parish.		North Helgeland Parish.		Salten Parish.		Loffoden and Vesteraalen Parish.		Tromsö District.	
	Men.	Per cent.	Men.	Per cent.	Men.	Per cent.	Men.	Per cent.	Men.	Per cent.	Men.	Per cent.	Men.	Per cent.
1876	577	3	360	2	3,586	17	2,104	10	5,213	24	4,438	21	5,005	24
1877	619	....	390	....	3,747	18	2,126	....	5,110	....	4,464	....	4,778	22
1878	785	....	421	....	4,045	....	2,440	11	5,470	....	4,391	19	5,137	23
1879	1,200	5	601	..	4,330	17	2,662	10	6,023	....	4,798	....	5,867	....
1880	1,341	....	874	3	4,640	..	2,462	9	6,248	23	5,491	20	6,095	22
Increase in 5 years	764	132	514	143	1,054	29	358	17	1,035	20	1,053	24	1,090	22
Increase over last year.	141	....	273	....	310	....	200	....	225	....	693	..	228	....

The mass of the Loffoden fishermen (23 per cent.) are from Salten and from Senjen and Tromsö, 22 per cent. Next come Loffoden and Vesteraalen with 20 per cent., South Helgeland with 17 per cent., North Helgeland with 9 per cent., and, finally, the two Trondhjem counties with 8 per cent. jointly. This proportion has been kept comparatively unchanged of late years. In the beginning of the sixties, on the contrary, 14 to 16 per cent. of the Loffoden fleet was from Northern Helgeland, and only 15 to 17 per cent. from Loffoden and Vesteraalen. The increase, so far as Loffoden and Vesteraalen are concerned, is caused partly by a larger ratio of hired men in Flakstad and Buksnæs, partly by a considerably increased fishing fleet from Hadsel. The decrease from North Helgeland is due chiefly to Næsne and Rödö, whose fleets now carry on fishing from home stations to a greater extent than formerly.

For five years the increase of fishing at Loffoden has been greatest from the Trondhjem counties, reaching 132 and 143 per cent.; next from South Helgeland, 29 per cent. From the remaining bailiwicks the growth has been about 20 per cent.

In Table XII are named the districts from which the Loffoden fleet has been increased by over 50 men or diminished by more than 15 since last year. It will be seen that there has been a gain in nearly 74 per cent. of the districts.

TABLE XII.

Parish.	From 1879. Men. Increase.	Decrease.
Statsbygden	67	
Nærö	92	
Kolvereid	59	
Lekö	51	
Brönö	156	
Alstahoug	53	
Mo		33
Næsne		85
Lurö		47
Hadsel	85	
Sortland	90	
Buksnæs	202	
Vaagen	267	
Bodö		39
Folden	56	
Hammerö	65	
Lödingen	70	
Kvædfjord	69	
Ibestad	107	
Trondenæs		93
Sand	59	
Lenvig		76
Balsfjorden		32
Lyngen	110	
Total	1,649	405

Table XIII states the relations of the different modes of fishing during the last five years. Compared with last year, net-fishing has diminished and line-fishing increased, a result of the poorer net-fishery last year.

TABLE XIII.

Year.	Percentage of fishermen. Netters.	Trawl-line fishermen.	Deep-bait men (hand-lines).
1876	43	45	12
1877	50	41	9
1878	58	32	10
1879	56	33	11
1880	49	38	13

Table XIV shows the ratio for the different districts. In five years the number of netters has varied as follows:

In South Helgeland, between 41 and 55 per cent., or 14 per cent.

In North Helgeland, between 77 and 89 per cent., or 12 per cent.

In Salten, between 51 and 63 per cent., or 12 per cent.

In Loffoden and Vesteraalen, between 20 and 44 per cent., or 24 per cent.

In Senjen and Tromsö, between 44 and 57 per cent., or 13 per cent.

In the first two years of the five-year period this method increased, and in the last two it fell off. By next year it will probably increase somewhat again. The great difference between Loffoden and Vesteraalen districts, their proportion being double that of the others, is owing to the fact that net-fishing gradually decreased from 65 per cent. in 1862 to 9 per cent. in 1870. Later, in 1874, it advanced to 33 per cent., but in the following year it again fell off to 22 per cent.

TABLE XIV.—*Percentage of the population.*

Year.	MODE OF FISHING.																				
	South Trondhjem.			North Trondhjem.			South. Helgeland.			North Helgeland.			Salten.			Loffoden and Vesteraalen.			Senjen and Tromsö.		
	Net-fishermen.	Line.	Trawl.	Net.	Line.	Trawl.	Net.	Line.	Trawl.	Net.	Line.	Trawl.	Net.	Line.	Trawl.	Net.	Line.	Trawl.	Net.	Line.	Trawl.
1862..	20	...	80	32	1	67	78	7	15	89	5	6	65	27	8	46	51	3	65	31	4
1870..	17	6	77	21	5	74	38	39	23	69	18	13	33	63	4	9	90	1	37	58	5
1876..	45	5	50	50	1	49	41	38	21	77	8	15	51	44	5	20	79	...	44	44	12
1877..	49	...	51	....	7	43	47	36	17	83	6	11	59	37	4	25	74	....	51	43	6
1878..	52	1	47	57	5	38	52	32	16	88	3	9	63	32	5	44	55.5	0.5	57	32	11
1879..	46	2	52	58	4	....	55	30	15	89	4	7	61	....	7	38	61	1	54	38	8
1880..	44.5	1	54.5	46	...	50	48	32	20	84	5.5	10.5	56	38	6	31	67	2	49	41	10

Table XV, following, shows the changes in the use of the various methods during the last twenty-one years.

In all Loffoden net-fishing has varied between 34 and 66 per cent., or 32 per cent.; line-fishing has varied between 21 and 55 per cent., or 34 per cent.; deep-bait fishing has varied from 8 to 14 per cent., or 6 per cent.

The variation in net-fishing was as follows: In South Helgeland from 38 to 79 per cent., or 41 per cent.; in North Helgeland from 69 to 90 per cent., or 21 per cent.; in Salten from 33 to 65 per cent., or 32 per cent.; in Loffoden and Vesteraalen from 9 to 49 per cent., or 40 per cent.; in Senjen and Tromsö from 33 to 65 per cent., or 32 per cent.

The variation in trawl-line fishing was: In South Helgeland from 4 to 43 per cent., or 39 per cent.; in North Helgeland from 3 to 19 per cent., or 16 per cent.; in Salten from 25 to 63 per cent., or 38 per cent.; in Loffoden and Vesteraalen from 49 to 90 per cent., or 41 per cent.; in Senjen and Tromsö from 29 to 60 per cent., or 31 per cent.

Deep-bait fishing with hand lines has varied: In South Helgeland between 13 and 24 per cent., or 11 per cent.; in North Helgeland between 3 and 15 per cent., or 12 per cent.; in Salten between 3 and 12 per cent., or 9 per cent.; in Loffoden and Vesteraalen between ½ and 4 per cent., or 3½ per cent.; in Senjen and Tromsö between 4 and 14 per cent., or 10 per cent.

A regularity in this change from one method to another, which promises to become permanent, has been observed only in the two Trondhjem counties, where net-fishing has gradually replaced deep-bait fishing, and in South Helgeland, where trawl-line fishing has, by degrees, increased while net-fishing has fallen off.

TABLE XV.—*Percentage of fishermen.*

	Variation between the modes of fishing from 1860 to 1880.					
	Netters.		Trawl-line fishermen.		Deep-bait fishermen.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
Combined Loffoden fishermen	66	34	55	21	14	8
South Trondhjem District	53	12	6	0	80	47
North Trondhjem District	58	20	7	0	74	38
South Helgeland Bailiwick	79	38	43	4	24	13
North Helgeland Bailiwick	90	69	19	3	15	3
Salten	65	33	63	25	12	3
Loffoden and Vesteraalen	49	9	90	49	4	0.5
Senjen and Tromsö	65	33	60	29	14	4

Table XVI shows the increase or diminution since last year (marked with the sign—) in the number using the different methods. With the exception of a slight increase in the Trondhjem counties, the number of net-fishermen has everywhere decreased; the number of line and deep-bait fishermen (hand-liners), on the contrary, has increased.

TABLE XVI.—*Number of men.*

District.	Increase or decrease in methods since last year.		
	Net.	Trawl-line.	Deep bait.
South Trondhjem County	48	— 6	99
North Trondhjem County	48	10	215
South Helgeland Bailiwick	—118	190	238
North Helgeland Bailiwick	—305	37	68
Salten Bailiwick	—197	450	—28
Loffoden and Vesteraalen Bailiwick	—141	768	66
Senjen and Tromsö Bailiwick	—202	284	146
Total	—867	1,733	832

In the last column of Table X is stated the number of hired men employed in the different districts. Table XVII gives the number in the various counties and bailiwicks for the last three years. In South Trondhjem County, and in Loffoden and Vesteraalen Bailiwick, the number was increased by 700 and 9 per cent., respectively; in Senjen and Tromsö Bailiwick it was diminished by 14 per cent.; the remaining places were unchanged.

TABLE XVII.

District.	Hired men.		
	1878.	1879.	1880.
South Trondhjem County	5	18	145
North Trondhjem County	57	84	79
South Helgeland Bailiwick	897	1, 027	1, 072
North Helgeland Bailiwick	573	668	670
Salten Bailiwick	453	594	602
Loffoden and Vesteraalen Bailiwick	1, 182	1, 511	1, 649
Senjen and Tromsö Bailiwick	140	229	196
Total	3, 307	4, 131	4, 413

Table XVIII gives the number of hired men for the last three years in the districts which have more than 100. The increase has been greatest in Buksnæs and Vegö, whose population almost exclusively fishes from Balstad (Buksnæs). The increase from Tjötö is due to the fleet therefrom fishing at Henningsvær.

TABLE XVIII.

District.	Number of hired men.		
	1878.	1879.	1880.
Stadsbygden	2	17	105
Vegö	112	136	180
Alstahaug	234	143	130
Stamnæs		121	112
Herö	76	106	116
Tjötö	265	314	334
Vefsen	134	137	117
Hemnæs	154	145	182
Næsne	280	299	267
Gildeskaal	104	116	134
Skjærstad	63	108	142
Flakstad	272	437	430
Buksnæs	469	588	691
Vaagen	209	236	241
Hadsel	171	153	176
Total	2, 545	3, 056	3, 357

Table XIX shows the number of fishermen engaged at the different stations up to March 16, and their division according to the various modes of fishing. In Brettesnæs there were very few. In Kabelvaag there were 360 men less than last year, probably from the want of accommodations beyond Branden.

In most other places the fleet was larger than last year, especially in Henningsvær, which had 511 men more; in Stamsund, which had 312 men more; in Svolvær, which had 237 men more.

All the stations had a full fleet; consequently, during the shiftings, they became crowded.

TABLE XIX.

From what district.	Net. Men.	Net. Crews.	Net. Boats.	Net. Net boats furnished with lines.	Trawl-line. Men.	Trawl-line. Crews.	Trawl-line. Boats.	Deep bait. Men.	Deep bait. Boats. With lines.	Deep bait. Boats. Without lines.	Total number. Fishermen.	Total number. Crews.	Total number. Boats.	Total number. Number of hired men.
Eastward of Henningsvær: Brettesnæs, Skroven, Östnæsfjorden, Svolvær, Kabelvaag, Storvaagen, Örsvaag, Örsnæs, and Hopen	5, 863	943	975	12	4, 179	1, 024	1, 150	2, 333	216	596	12, 375	2, 779	2, 937	1, 017
Henningsvær	2, 496	423	423	..	1, 947	411	411	788	2	241	5, 231	1, 077	1, 077	950
Öerne to Ure: Öerne, Stamsuud, Stene, and Ure	3, 555	575	630	34	1, 258	271	302	355	3	122	5, 168	971	1, 057	844
Brandsholmene to Rufsfjord: Brandsholmene, Balstad, and Rufsjord	502	79	136	54	1, 741	370	376	12	...	4	2, 255	453	516	813
Sund to Loffoden Point: Sund, Reine, Moskenæs, Sörvaagen, Aa	1, 032	189	240	152	1, 167	282	315	4	...	2	2, 203	473	557	791
Westward of Henningsvær	5, 089	843	....	145	4, 166	923	.	371	3	128	9, 626	1, 897	.....	2, 448
Total in Loffoden	13, 448	2, 209	2, 404	252	10, 292	2, 358	2, 554	3, 492	221	965	27, 232	5, 753	6. 144	4, 414

In Table XX is stated the relation between the number of fishermen and the catch for the different groups of stations in the last five years.

TABLE XX.

Region.	Relation between the number of fishermen and the catch.									
	1876.		1877.		1878.		1879.		1880.	
	Fishermen.	Fish.	Fishermen.	Fish.	Fishermen.	Fish.	Fishermen.	Fish.	Fishermen.	Fish.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Raftsundet	4	3	5	3	......		......	......	......	......
Brettesnæs–Hopen	52. 5	46	46	44	52	42	47. 5	34	45. 5	52
Henningsvær	18	15. 5	18	18	18	22	18. 5	21	19. 2	16. 6
Öerne–Ure	8	11	12	15	12	16. 4	18	18	19	12. 4
Brandsholmene–Nufsfjord	9. 5	..	8	10	8	9. 8	8	13	8. 3	9
Næsland–Lofotodden	8	13. 5	10	9	10	9. 8	8	14	8	10
Eastward of Henningsvær	56. 5	49	51	47	52	42	47. 5	34	45. 5	52
Westward of Henningsvær	25. 5	35. 5	30	34	30	36	34	45	35. 3	31. 4

Eighteen hundred and eighty was the only year for five years in which the catch eastward of Henningsvær was proportionately larger than the registered population. Previous to that there was a marked difference between East Loffoden and West Loffoden fishing. There has been no such decided distinction of late years.

In 1876 the principal fishing was from Skroven eastward, and from Sund westward; in 1877, from Stamsund eastward; in 1878, from

Vaagene to Ure; in 1879, from Henningsvær westward, and partly in Skroven; in 1880, from Hopen eastward, and to some extent westward also.

The reason that the catch in East Loffoden is proportionally so large is, that nearly 500 boats, which had been engaged at stations farther west, participated here during ten to twelve days. The shares have, on the contrary, averaged larger from Balstad westward. The proportion between the number of fishermen and the catch has for five years given the following average:

Region.	Fishermen.	Fish.
	Pr. cent.	*Pr. cent.*
Brettesnæs-Hopen	48.7	41.6
Henningsvær	18.3	18.6
Öerne-Ure	13.8	14.6
Brandsholmene-Nufsfjord	8.4	10.6
Næsland-Lofotodden	8.8	11.3
Raftsund	1.8	1.2

Thus it appears that fishing has been comparatively better the farther west we go. The considerable number of small boats which from fear of the sea lie in East Loffoden has naturally contributed to the relatively light catch here. Moving during the fishery (shifting berth) has also had its influence in this number, not sufficient, however, to destroy the proportion entirely, especially westward of Urebjerg, since the shifting to or from this station is inconsiderable. It is evident that the table gives a correct expression of the proportion, because wherever there is, during one year, any great disproportion between the number of fishermen and the catch, this shows itself in the size of the fleet present there the next year. The same holds good also with regard to the choice of implements. Statistics prove, on the contrary, that in both respects it is impracticable to base judicious plans for the coming year's fishing upon the results of the foregoing year.

In last year's report, page 55, I directed attention to the comparatively good catch westward of Urebjerg from and during the year 1871, and I stated, as a proof of the profitable industry here, that hired help, in spite of the larger expenses of fitting out, had shown a considerable increase. This year the force in the region from Brandsholmene to Balstad is increased by 207 men, of which 85 was an addition to the number of hired men, and in the Flakstad stations there is a gain of 222 and 18 men respectively. Although the catch has been proportionally smaller this year than in most preceding years, I think I am justified in drawing the attention of fishermen to the more uniform annual fishery in these stations than in most of those lying farther to the eastward.

Table XXI shows the distribution of the fishermen in the different stations by districts. Of the large force of 6,100 men from Senjen and Tromsö this year, 73 remained west of Urebjerg, 9 of these west of Sund.

The increased frequenting of these stations has been perceptibly noticed from Salten and especially from Folden and Gildeskaal. The fleet from Örlandet, Stadsbygden, Melö, and part of Alstadhoug continue, as usual, almost exclusively in Henningsvær; the fleet from Vegö, in Balstad; that from Belfjorden and Veieren, west of Sund; and the force from Tjötö and Gildeskaal, partly in Henningsvær, partly in Flakstad stations. Of the fishermen south of Brönö only 26 remained westward of Urebjerg.

TABLE XXI.—*Statement of the distribution of fishermen from the different districts at the various stations.*

District.	Brettesnæs.	Skroven.	Östnæsfjorden.	Svolvær.	Kabelvaag.	Storvaagen.	Örsvaag.	Örsnæs.	Hopen.	Henningsvær.	Skokkelvigoerne.	Stamsund.	Stene.	Ure.	Sandsund.	Balstad.	Nufsfjord.	Sund.	Reine.	Moskenæs.	Sörvaagen.	Aa.	Total.
Soggendal	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Haugesund	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Sund	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Bergen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
Davigen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
Selö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Aalesund	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Örskoug	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Molde	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Eid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Gryten	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Christianssund	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12
Throndhjem	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	29
Orkedalen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Hitteren	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	33
Hevne	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Stadsbygden	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	403
Rissen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10
Örlandet	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	389
Bjugn	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	203
Aafjord	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	203
Björnör	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	65
Lexvigen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	52
Stördalen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11
Værdalen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Stenkjær	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Ytteröen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	37
Inderöen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12
Sparboen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6
Stod	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Beitstaden	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20
Namsos	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	19
Fosnæs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12
Fladanger	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23
Næro	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	226
Kolvereid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	127
Lekö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	321
Bindalen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	302
Brönö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	866
Velfjorden	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	111
Vegö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	496
Alstahaug	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	433
Stamnæs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	469
Herö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	587
Tjötö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	905
Vessen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	471
Mo	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	201
Ranen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Hemnæs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	505
Næsne	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	926
Donnæs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	67
Lurö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	284
Rödö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	224
Melö	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	251
Gildeskaal	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	591

TABLE XXI.—*Statement of the distribution of fishermen, &c.*—Continued.

District.	Brettesnæs.	Skroven.	Östnæsfjorden.	Svolvær.	Kabelvaag.	Storvaagen.	Örsvaag.	Örsnæs.	Hopen.	Henningsvær.	Skokkelvigoerne.	Stamsund.	Stene.	Ure.	Sandsund.	Balstad.	Nufsfjord.	Sund.	Reine.	Moskenæs.	Sörvaagen.	Aa.	Total.
Beieren																							160
Saltdalen																							407
Bodö																							490
Bodö Landsogn																							2
Skjerstad																							765
Folden																							642
Kjerringö																							29
Stegen																							760
Hammerö																							611
Lödingen																							719
Tysfjorden																							274
Ofoten																							798
Hadsel																							1,080
Sortland																							322
Bö																							24
Dverberg																							22
Flakstad																							928
Buksnæs																							1,586
Borge																							203
Valberg																							25
Vaagen																							1,290
Gimsö																							10
Kvædfjord																							590
Ibestad																							1,585
Throndenæs																							1,081
Sand																							162
Tranö																							492
Dyrö																							132
Maalselven																							42
Lenvig																							634
Hilleso																							8
Berg																							46
Balsfjorden																							212
Malangen																							105
Tromsösundet																							190
Tromsö																							182
Lyngen																							487
Karlsö																							99
Skjervö																							48
Hammerfest Lake																							5
Tanen																							3
Vardö																							10
Total																							27,232

Table XXII gives the number of vessels present in the different inspection districts at the end of each week. Lodging vessels, vessels laid up, and passenger vessels are not included in this enumeration, but only merchantmen. After March 16, 27 vessels arrived, 7 of them at Hopen and 17 at Sörvaagen inspection district.

TABLE XXII.—*Number of merchant vessels present.*

Week ending—	Ostnæsfjord.	Skroven.	Svolvær.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Reine.	Sorvaagen.	Total.
January 24	......	7	3	.....	3	17	1	......	......	.....	.....	31
January 31	......	9	6	2	6	28	9	......	......	......	.....	60
February 7	......	8	10	9	14	32	19	1	2	2		97
February 14	3	17	41	54	84	145	85	7	15	4		455
February 21	.....	22	50	73	77	135	87	12	18	10		484
February 28	1	21	51	80	73	138	97	16	24	36		537
March 6	......	10	21	60	58	152	126	26	40	25	25	543
March 13	22	13	70	61	69	122	115	23	40	52		587
March 20	62	46	101	100	75	77	65	13	22	51		612
March 27	......	70	111	......	90	68	44	7	27	50		467
April 3	......	32	65	70	75	90	56	11	29	60		488
April 10	......	22	18	30	37	50	32	7	25	82		303

Table XXIII shows the number of merchant vessels present for each half month during the last five years. From this it will be seen that the majority of the vessels came out earlier this year than usual, and also that they left earlier than last year, since only half of them remained at the close of the first week in April.

TABLE XXIII.—*Number of merchant vessels present.*

Date.	1876.	1877.	1878.	1879.	1880.
Middle of January	......		...	15	......
Beginning of February	80	120	80	140	60
Middle of February	300	340	240	280	455
Beginning of March	370	450	530	560	537
Middle of March	460	550	630	600	590
End of March	360	530	610	600	500
End of first week in April	......	500	530	480	300

Table XXIV contains a statement of the number of merchant vessels and passenger vessels (Bygdefarere) present in Loffoden March 16, also their home port, rig, draft, and complement of men. In the last column is given the number of lodging vessels and vessels laid up. Of these last, 33 were from Loffoden and Vesteraalen, of which number three or four have been previously included among the passenger vessels, and the rest among the merchantmen. The total number of vessels here March 16 was 676, with a combined tonnage of 350,000 tons and a force of 2,932 men, including the captains, this being the largest number of vessels known to have been assembled in Loffoden.

TABLE XXIV.—*Number of vessels present March 16.*

Town or bailiwick.	Steamers.	Schooners or galeas.	Sloops.	Yachts.	Square-rigged galeas or coasters. Merchant.	Square-rigged galeas or coasters. Passenger.	Smacks.	Total of vessels. Number.	Total of vessels. Crew.	Total tonnage.	Average of— Crew per vessel.	Average of— Draft in tons.	Lodging or storage vessels.
Farsund	....	1	....	....	....	......	....	1	6	850	6.0	850	....
Stavanger	...	5	....	4	....	......	....	9	50	7,200	5.5	800	....
Haugesund	....	2	....	6	....	......	1	9	48	6,290	5.3	699	....
Bergen	2	7	6	93	1	......	1	110	580	66,010	5.3	600	....
Florö	....	....	....	3	....	......	1	4	18	1,730	4.5	433	....
Aalesund	....	3	2	18	2	......	2	27	133	14,320	4.9	530	....
Molde	....	2	3	7	....	......	....	12	59	7,150	4.9	596	....
Kristianssund	...	6	2	43	5	......	5	61	282	27,870	4.6	457	....
Trondhjem	....	3	1	21	52	......	2	79	400	41,010	5.0	519	2
Levanger	....	....	....	......	1	......	....	1	7	600	7.0	600	....
Stenkjær	..	....	....	......	6	......	....	6	32	3,650	5.3	608	....
Namsos	..	....	....	2	4	......	....	6	25	2,720	4.1	453	1
Bodö	....	2	....	7	2	......	1	12	52	6,100	4.8	508	....
Tromsö	....	....	....	1	....	......	....	1	4	300	4.0	300	....
Total from towns	2	31	14	205	73	......	13	338	1,696	185,800	5.0	550	3
Söndhordland	....	....	...	20	....	......	....	20	100	11,180	5.0	599	....
Hardanger	....	...	1	12	....	......	....	13	65	6,660	5.0	512	....
Romsdalen	....	....	1	......	....	......	....	1	7	900	7.0	900	....
Nordmöre		....		1	....	......	....	1	4	400	4.0	400	....
Fosen	....	....	1	18	6	......	2	27	114	11,170	4.0	399	2
Inderöen	....	....	....	......	2	......	....	2	12	1,350	6.0	675	....
Namdalen	..	3	1	4	8	......	3	19	96	9,550	5.0	503	....
Helgeland	...	2	1	37	9	32*	9	90	311	45,980	3.5	511	4
Salten	...	4	3	50	7	8	5	77	328	34,340	4.3	446	..
Lofoten and Vesteraalen	...	....	....	5	5	2†	1	13	53	9,050	4.0	696	33
Senjen and Tromsö	....	5	2	15	4	.....	6	32	146	14,530	4.4	440	1
Total from country, excluding towns.	....	14	10	162	41	42	26	295	1,236	145,110	4.2	489	40
Grand total	2	45	24	367	114	42	39	633	2,932	330,910	4.6	521	43

* Three of which traded. † Both traded.

Table XXV states the number of merchant vessels fitted out since 1860 from the towns and country districts most interested in the Loffoden fishery. The number of coasting vessels at the close of 1876, according to official statistics, was as follows: from Bergen 59, from towns in Romsdal District 71, and from Trondhjem 27; but the majority of the merchant vessels fitted out in the towns belonged in country districts. The total number of coasters in Romsdal District was 169, of which 102, or 60 per cent., were in Loffoden this year; 67 per cent. of the coasters in Nordland District and 33 per cent. of those in the district of Tromsö were in Loffoden.

TABLE XXV.

Year.	Number of merchant-vessels fitted out in— Towns.							Bailiwicks.								
	Bergen.	Aalesund.	Molde.	Kristianssund.	Trondhjem.	Namsos.	Bodö.	Hardanger.	Romsdalen.	Örlandet and Fosen.	Stördalen and Værdalen, Inderöen.	Namdalen.	North and South Helgeland.	Salten.	Lofoten and Vesteraalen.	Senjen and Tromsö.
1860	30	7	4	29	130	...	...	...	...	16	33	26	45	63	38	16
1861	22	4	3	24	117	...	...	...	...	17	12	21	48	68	31	11
1862	23	3	...	26	94	...	...	...	...	6	17	23	45	69	24	12
1863	28	5	2	31	92	...	...	...	...	13	7	25	44	68	35	13
1864	25	...	1	32	83	...	...	...	...	15	1	19	48	73	24	24
1865	27		...	29	86	...	...	...	...	12	4	25	...	81	33	23
1866	15	1	...	24	77	...	4	...	...	18	3	24	...	79	19	27
1867	16	5	...	22	66		15	...	...	15	...	16	40	80	32	44
1868	26	3	1	24	75	2	18	...	...	25	1	23	57	87	28	41
1869	21	9	...	28	76	3	8	...	...	13	5	9	33	78	25	37
1870	24	8	...	24	64	...	10		...	19	7	5	41	68	30	25
1871	33	6	...	37	95	...	12	1	...	15	9	16	63	76	26	35
1872	31	2	1	38	59	...	19	...	...	11	1	17	30	55	30	25
1873	30	5		29	61	...	13	...	...	15	2	22	43	63	29	36
1874	45	12	3	27	57	1	6	...	1	13	...	19	51	70	32	26
1875	73	10	...	36	84	4	6	2	2	21	3	16	52	58	29	24
1876	61	16	4	46	65	...	15	6	5	14	...	...	75	63	31	31
1877	91	41	8	60	69	...	...	13	4	17	2	25	...	66	29	27
1878	115	34	6	63	64	5	14	17	3	33	5	15	62	85	32	33
1879	109	38	6	50	55	6	15	19	2	33	10	25	63	68	38	35
1880	110	27	12	61	79	6	12	13	1	27	12	19	58	69	11	32

Table XXVI gives the proportion between the fleets from towns and country districts since 1860. While the great majority of the merchant vessels up to 1876 were fitted out in country districts, the reverse has been the case of late years.

TABLE XXVI.—*Number of vessels.*

Year.	Merchantmen. From towns.	From country.	Total.	Passenger vessels (*Bygdefarere*).
1860	200	237	437	64
1861	170	208	378	66
1862	149	196	345	58
1863	158	205	363	48
1864	146	204	350	50
1865	148	226	374	49
1866	121	218	339	38
1867	126	227	353	34
1868	151	262	413	32
1869	145	200	345	32
1870	130	195	325	26
1871	186	241	427	36
1872	158	170	328	33
1873	141	211	352	38
1874	156	214	370	34
1875	215	207	422	31
1876	211	245	456	36
1877	292	265	557	40
1878	329	302	631	37
1879	311	304	615	4[illegible]
1880	338	*253	591	42

* Loffoden not included.

Table XXVII*a* shows the distribution of vessels at the different stations on the 16th of March.

TABLE XXVII *a*.—*Number of vessels present March* 16.

Fishing-station.	Steamers.	Schooners or galeas.	Sloops.	Yachts.	Merchant yachts.	Passenger yachts.	Smacks.	Lodging vessels or vessels laid up.	Number.
Östnæsfjorden	1	1	1	32	3	....	1	....	39
Svolvær	1	2	1	42	24	2	.....	4	76
Skroven	......	5	3	6	3	......	2	2	21
Kabelvaag	......	4	......	18	3	......	......	......	25
Storvaagen	......	4	......	26	8	4	5	2	49
Örsvaag	......	1	1	12	3	4	1	1	23
Örsnæes	......	......	1	6	3	....	1	1	12
Hopen	......	3	2	24	5	......	1	1	36
Henningsvær	......	10	4	78	20	14	6	15	147
Skokkelvigöerne	......	....	....	1	......	......	......	....	1
Stamsund	......	5	3	43	14	2	7	2	76
Stene	......	4	2	9	8	1	4	2	30
Ure	....	3	1	13	4	.....	1	....	22
Balstad	......	1	1	26	5	7*	3	4	47
Nufsfjord	......	1	2	9	4	1	1	....	18
Lund	......	....	......	8	3	....	2	1	14
Reine	......	1	2	8	3	3	2	1	20
Sörvaagen	......	....	......	6	1	4	2	7	20
Total	2	45	24	367	114	42	39	43	676

* Five of these traded.

The table below (XXVII *b*) shows the number of lodging vessels, or vessels laid up, and also their tonnage.

TABLE XXVII *b*.—*Lodging vessels, or vessels laid up, March* 16.

Fishing-stations.	Steamers.	Sloops.	Yachts.	Passenger vessels.	Smacks.	Number.	Total tonnage.
Svolvær	......	......	......	......	4	4	....
Skroven	......	......	1	....	1	2	650
Storvaagen	......	......	......	2	......	2	1,100
Örsvaag	......	......	1	......	......	1	250
Örsnæs	......	......	......	1	......	1	606
Hopen	......	......	......	1	......	1	450
Henningsvær	2	5	......	6	2	15	8,030
Stamsund	......	......	......	2	......	2	1,600
Stene	......	......	......	2	......	2	1,000
Balstad	......	......	......	4	......	4	2,400
Lund	......	......	......	1	...	1	600
Reine	......	......	......	......	1	1	300
Sörvaagen	......	2	......	3	2	7	2,500
Total	2	7	2	22	10	43	19,480

Table XXVIII states the percentage of merchant vessels present in the groups of stations named below during the last five years.

TABLE XXVIII.—*Merchant vessels present March* 16.

Region.	1876.	1877.	1878.	1879.	1880.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Raftsundet	3	5	......	......	......
Brettesnæs—Hopen	54	45	51	42	44
Henningsvær	16	18	22	29	20
Öerne—Ure	10	18	16	16	21
Brandsholmene—Nufsfjord	7	7	6	7	9
Næsland—Lofotodden	10	7	4	6	6
Eastward of Henningsvær	57	50	51	42	44
Westward of Henningsvær	27	32	26	29	36
Number present in Ostnæsfjord	12	9	1	......	39
Number present in Raftsundet	15	7	......	......	......

Table XXIX shows the number of vessels that traded during the fishery. The places whose vessels have not traded are omitted from the table. These are: Farsund, Stavanger, Florö, and Nordmöre, with a total of 15 vessels. One column shows how many vessels have traded, and the individual vessels which have dealt in two or more of the articles mentioned in the table are reckoned under each of these. Deducting the three passenger vessels from Helgeland and two from Lofoten and Vesteraalen, which have engaged in trading, 119 vessels or 20 per cent. of the 591 merchant vessels carried with them trading goods. Including the 30 merchant vessels from Loffoden, which were laid up, and which are omitted this year, the proportion becomes 19 per cent. In 1878 the number was 114, or 15 per cent.; last year 148, or 24 per cent. Of the vessels from Trondhjem 48 per cent. traded, and of those from Helgeland 29 per cent.

TABLE XXIX.—*Number of trading vessels.*

Home port.	Total number of merchant vessels.	NUMBER WHICH TRADED.							
		General trading.	Trading goods.						
			Dry goods.	Groceries.	General retail goods.	Grain and flour.	Chandler's wares.	Bait.	Wooden ware.
Haugesund	9	1	......	......	......	......	......	1	......
Söndhordland	20	2	......	......	......	2	......	......	......
Hardanger	13	1	......	......	......	1	......	......	......
Bergen	110	17	......	......	......	12	......	6	......
Aalesund	27	5	......	......	......	......	......	5	......
Molde	12	1	......	......	......	1	......	......	......
Romsdalen	1	1	......	......	......	1	......	......	......
Kristianssund	61	2	......	......	......	......	2	......	......
Trondhjem	79	38	10	15	19	6	2	......	......
Örlandet and Fosen	27	4	......	1	......	......	......	3	......
Stenkjær	6	2	......	......	2	2	......	......	......
Levanger	1	1	1	......	......	1	......	......	......
Trondhjemsfjorden	2	1	......	......	1	......	......	......	......
Namsos	6	2	......	1	......	......	......	......	1
Namdalen	19	2	1	......	......	1	......	......	1
Helgeland	58	20	7	6	6	3	2	1	2
Bodö	12	1	......	1	......	......	......	......	......
Salten	69	8	3	4	1	1	1	1	......
Loffoden and Vesteraalen	11	9	2	2	5	2	1	1	......
Senjen and Tromsö	32	5	2	2	2	......	......	1	......
Tromsö	1	1	......	......	......	......	......	1	......
Total	......	124	26	32	36	33	8	20	4

Table XXX gives the number of "other" outside industries attracted to Loffoden by the fishing.

TABLE XXX.—*Other outside industries represented March 27.*

Trade.	Skroven.	Svolvær.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Stene.	Ure.	Balstad.	Sörvaagen.	Total.
Merchants	20	19	62	2	26	20	3	3	4	3	162
Watchmakers§	2	1	7	2	9	4	2	......	4	6	37
Gold and silver smiths §	1	......	5	......	2	......	......	......	1	......	9
Other mechanics	5	2	19	2	8	14	1	1	3	9	64
Photographers	1	1	3	1	5	2	......	......	2	2	17
Laborers	18	10	10	......	65‡	13	1	2	6	......	125
Splitters	8	8	21	4	13	2	......	2	......	......	58
Wholesale buyers	28	45	80	39	110	42	20	6	18	22	410
Eating-house keepers	1	5	20†	......	1	5	......	......	......	......	32
Musicians	......	......	8	......	......	1	......	......	......	......	9
Panorama exhibitors	......	......	......	......	......	......	......	......	......	......	.
Acrobats, &c	......	......	7	......	7	1	......	......	......	......	15
Without regular work	2	4*	20	1	4	......	......	......	......	......	31
Total	86	95	262	51	250	104	27	14	38	42	969

* Two of whom were women.
† Fifteen of whom were women.
‡ Chiefly Hovedtrædere, p. 79.
§ Most of whom traded also.

For comparison with preceding years is appended, in Table XXXI, the number of "other" outside trades for the last five years. The number of dealers, including watchmakers, most of whom sell watches, was diminished by 32. The number of wholesalers was increased by 55, and of mechanics by 22. The number of photographers increased from 6 in 1876 to 17.

TABLE XXXI.

Trade.	Other outside industries.				
	1876.	1877.	1878.	1879.	1880.
Merchants	113	147	169	202	162
Watchmakers	......	......	14	29	37
Gold and silver smiths	35	53	39	9	9
Other mechanics	......	......		42	64
Photographers	......	......	6	12	17
Laborers	22	34	66	108	115
Splitters	21	37	61	75	58
Wholesale buyers	29	105	*317	365	410
Eating-house keepers	5	8	28	42	32
Musicians	......	12	10	18	9
Exhibitors of panoramas, &c	......	......	......	6	15
Without regular work	......	......	18	31	31
Total	225	396	728	939	959

*Herein are included those who belong in Loffoden.

Table XXXII shows the kinds of wares used in trade. As will be seen, only one man dealt in general retail goods, and 26 handled dry goods exclusively. The remainder, for the most part, sold chandler's wares and ready-made clothing, in connection, though to a small extent, with dry goods. All of the watchmakers and, so far as I know, about 15 of the dry-goods dealers had district licenses. Twelve such new licenses were issued this year—1 in Skroven, 8 in Vaagen, 1 in Henningsvær, and 2 in Balstad; 5 of these were granted to residents. The number of dealers this year was:

Residents	58
Inc mers	162
From vessels	124
Watchmakers	30
Goldsmiths	9
Total	383

or 1 for every 80 men who were present during the fishery.

TABLE XXXII.—*Number of incoming tradesmen.*

Kind of trade.	Skroven.	Svolvær.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Stene.	Ure.	Balstad.	Sörvaagen.	Total.
General retail goods	1	......	......	......	......	......	......	......	......	......	1
Chandler's wares	......	......	6	......	1	......	......	......	2	......	9
Dry goods	......	6	16	......	......	3	......	......	1	......	26
Ready-made clothing	......	7	22	1	2	4	3	......	1	......	40
Chandler's wares and clothing	10	......	......	......	4	2	......	3	......	3	22
Dry goods and clothing	8	5	......	1	14	......	......	......	......	......	28
Groceries and clothing	......	......	......	......	......	1	......	......	......	......	1
Ironware	......	......	3	......	......	......	......	......	......	......	3
Tinware	......	......	2	......	1	1	......	......	......	......	4
Watches and clocks	......	......	7	......	4	4	......	......	......	......	15
Books	1	1	6	......	......	4	......	......	......	......	12
Woodenware	......	......	......	......	......	1	......	......	......	......	1
Total	20	19	62	2	26	20	3	3	4	3	162

Table XXXIII states the number of persons who were entitled to sell spirituous liquors. The number is about the same as last year, that is, one for every 460 men present during the fishery.

TABLE XXXIII.

License.	Skroven.	Svolvær.	Vaagen.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Lund.	Sörvaagen.	Total.
Whisky:											
Wholesale and retail	2	......	1	......	......	1	1	......	......	......	5
Retail	......	1	......	1	......	......	......	......	......	......	2
Wholesale	......	1	......	......	1	1	......	......	......	2	5
Total	2	2	1	1	1	2	1	......	......	2	12
Wine:											
Wholesale and retail	2	......	4	1	2	5	......	1	1	5	21
Retail	......	......	......	......	......	......	......	......	......	......	......
Wholesale	......	1	1	......	......	1	......	1	......	......	4
Total	2	1	5	1	2	6	......	2	1	5	25
Beer:											
Wholesale and retail	2	1	7	1	2	5	......	1	1	5	25
Retail	......	......	1	......	......	1	......	......	......	......	2
Wholesale	......	1	......	......	......	1	......	1	......	......	3
Total	2	2	8	1	2	7	......	2	1	5	30
Total number of dealers, 1880	6	5	14	3	5	15	1	4	2	12	67
Total number of dealers, 1879	6	3	14	3	8	10	3	2	4	12	65

Table XXXIV gives the number of days, Sundays and holidays included, from January 16 to April 14, wherein the weather, either wholly or in part, prevented the fishermen from setting or hauling their implements. Altogether, in East Loffoden during 43 per cent., and in West Loffoden during 48 per cent. of the fishing season the weather was such as to interfere with the business. This year, also, most of the unfavorable days occurred in periods, for instance, from January 20 to February 5, from March 4 to 14, and from March 30 to April 4.

TABLE XXXIV.

Month.	Detained by weather between January 16 and April 14.			
	East Loffoden.		West Loffoden.	
	Whole day.	Part of day.	Whole day.	Part of day.
January	8	2	10	......
February	5	7	9	5
March	5	7	6	7
April	3	2	3	3
Total	21	18	28	15

Table XXXV gives the number of days of detention in port, because of bad weather, in the different inspection districts:

TABLE XXXV.—*Days of detention in port on account of weather from January 16 to April 14.*

Inspection district.	January.		February.		March.		April.		Total.	
	Wholly.	Partly.	Wholly.	Partly.	Wholly.	Partly.	Wholly.	Partly.	Wholly.	Partly.
Skroven	9	1	5	7	5	7	....	5	19	20
Svolvær	6	4	4	6	2	9	2	3	14	22
Vaagene	7	3	5	7	5	7	3	2	20	19
Hopen	9	1	5	7	6	6	3	2	23	16
Henningsvær	8	2	4	8	6	8	2	3	20	21
Stamsund	10	......	6	7	7	7	2	3	25	17
Ure	10	......	8	4	5	9	3	3	26	16
Balstad	10	......	11	6	7	8	4	2	32	16
Lund	9	1	10	5	6	5	4	2	29	13
Sörvaagen	9	1	9	5	4	8	4	2	26	16

The report for 1878 and for 1879 contains a similar table, and I venture to repeat this year also what I have previously mentioned with reference to this subject, since certain persons still seek to maintain the opinion that the fishermen should be prohibited from going to sea unless the weather allows all of them to use their implements. The essential hindrances to the enforcing of such a general provision in practice are, first, that "sea-weather" may be differently construed by different persons, and, second, that fishermen not only from different stations but also from different inspection districts, where there may be permanent differences in the stations, often have their implements placed in the same waters. It will frequently happen, therefore, that while one fisherman, who lives in a certain place, is legally entitled to haul his gear, another one who has his gear in the same waters may be forbidden to do so, because he lives at a different station. It is especially during the so-called partial sea-weather that so many different conditions, such as size of boat and crew, ability of the men, and their acquaintance with the water, distance of the gear from shore, situation of the place, currents, direction of the wind, condition of the fishery, &c., are to be considered in deciding to what extent the implements can be used, that the question can be settled only by the boatmen themselves.

Table XXXVI shows the average number of entire and partial storm-bound days since 1875. This year the weather has been nearly like the average of the last five years, and somewhat better than the average of the last four. On the other hand, the rough weather which occurred at the close of January and the beginning of February, during certain days, was unusually severe. The water, especially, was very high.

TABLE XXXVI.—*Average number of storm-bound days, partial and entire, from January 16 to April 14.*

Year.	January.	February.	March.	April.	Total.
1875	4.5	8	7.5	3	23
1876	5.5	11.5	8	9	34
1877	12	16.5	12.5	6.5	47.5
1878	8	15.5	13.5	3	40
1879	7	14.5	17	6.5	45
1880	10	13	12.5	5.5	41
Average number	7.8	13.2	11.8	5.6	38.4
Average per cent	49	46.5	38.1	40	43.1

Altogether 15 boats and one vessel were lost, in which six men perished while 71 were saved. The cause of the loss of the vessel at Henningsvær was dead calm combined with swell and current. The vessel was crushed, but the crew, consisting of five men, was saved. By other accidents three men were lost—one in Kabelvaag by a chance shot, one in Stamsund while trying in a state of intoxication to cross a foot-bridge, and one in Balstad through the sinking of his overloaded boat. Of those who perished by shipwreck at sea, five lived in Stamsund, and one in Moskenæs. The fishing season just closed has been the most fortunate since 1860 with regard to loss of human life at sea. The number of shipwrecks, on the other hand, was nearly as large as in 1876 and 1878, when 43 and 10 men were lost, respectively, and at the same time considerably larger than in 1875, when 17 men were lost. Table XXXVII states the time, place, cause, &c. (of loss), since 1875. This is based upon a form employed by pastor Eilert Sundt, in his time, and according to which the explanations of shipwrecks occurring of late years are recorded. In these six years 95 persons were lost by shipwreck, 21 by other accidents, and 282 were rescued; so that 75 per cent. of the shipwrecked were saved.

TABLE XXXVII

Year.	Total.	Month. January.	February.	March.	April.	Undetermined.	Place. Raftsundet.	Brettesnæs.	Ostnæsfjorden.	Svolvær.	Skroven.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Nufsfjord.	Sund.	Reine.	Sörvaagen.
1875	9	1	3	3	2	..	..	..	..	1	..	2	1	2	....	..	3	..	..	..	..
1876	16	2	7	3	4	..	..	..	..	1	3	....	2	2	2	1	....	1	2	1	1
1877	7	..	3	2	2	..	..	2	..	..	..	..	..	....	2	..	3	..	..	..	..
1878	14	2	4	8	..	..	..	..	..	..	..	1	5	5	1	..	....	..	1	..	1
1879	22	5	4	5	2	6	..	1	1	..	2	3	2	3	3	..	5	1	1	..	..
1880	15	..	4	10	1	..	..	..	..	1	1	4	2	3	3	..	....	..	..	..	1
Total	83	..	..	....	..	..	..	3	1	3	6	10	12	15	11	1	11	2	4	1	3

Year.	Occasion. During the fishing.	On the voyage.	Other cases.	Accountability. Unavoidable.	Avoidable.	Undetermined.	Number wrecked. Saved.	Lost.	Lost by other causes.	Lost. Total.	Proportion to 100,000.
1875	6	3	....	....	....	....	21	17	....	17	93
1876	13	3	....	2	....	....	40	43	4	47	221
1877	5	1	1	2	....	....	22	5	4	9	42
1878	12	2	....	6	8	....	58	10	3	13	57
1879	17	4	1	9	11	2	75	14	7	21	70
1880	11	4	....	1	6	8	66	6	3	9	29
Total	64	17	2	20	25	10	282	95	21	116	....

Table XXXVIII shows the mode in which the shipwreck took place, the cause so far as this has been ascertained, and the size of the boat. Of the 51 shipwrecks which have occurred in the last three years, 21, or 41 per cent., were caused by wind storms; 15 or 30 per cent., by heavy sea, and 9, or 18 per cent., by collision. Nearly the half (25) might have been avoided. Sixteen of these, or 64 per cent., were due to carelessness; 7, or 28 per cent., to rashness. Shipwreck occurred most frequently among line-boats, between four and five out of every 1,000 boats, which is a natural result of the business. Among net and deep-sea boats, there are two or three shipwrecks to every 1,000 boats.

TABLE XXXVIII.—*Loss of boats.*

Year.	Mode.								Cause assigned.							
	Total.	Filled or capsized by a sea.	Sailing in a gale.	Collision.	Run aground.	Sunk.	Overloading.	Other modes or unknown.	Total.	Carelessness.	Rashness.	Light ballast.	Bad equipment.	Drunkenness.	Ignorance.	Other causes.
1878	14	5	5	3	....	1	....	....	8	4	2	1	1	....	....	....
1879	22	7	7	3	1	1	2	1	11	8	3	....	....	....	....	....
1880	15	3	9	3	....	....	....	....	6	4	2	....	....	....	....	....
Total	51	15	21	9	1	2	2	1	25	16	7	1	1	....	....	....
Per cent*	....	30	41	18	2	4	4	2	50	64	28	4	4	....	....	....

Year.	Size of boat.								
	10-oared boats.	½-femterumming.	8-oared boats.	½-fjerderumming.	Trerumming.	Kjæks.	Yawls.	List boats.	Unknown.
1878	5	....	7	....	2	....	....	....	....
1879	4	....	11	5	1	....	1	....	....
1880	8	....	3	....	4	....	....	....	....
Total	17	....	21	5	7	....	1	....	....
Per cent*	†250	....	4	30	230	....	1	....	....

* Of 1,000 boats, 3.2. † Of 100,000 boats.

Table XXXIX shows the temperature of the air at Svolvær in degrees Celsius.

TABLE XXXIX.

Week ending—	Temperature of air.				Water temperature.		
	Average.		During the week.			Bottom.	
	Noon.	Lowest temperature.	Maximum.	Minimum.	Surface.	Five fathoms.	Ten fathoms.
January 24	−1.4	−4.4	2.8	−6.7	......	......	......
31	2.6	0.0	5.5	−3.9	3.2	3.5	......
February 7	1.5	−1.1	3.3	−4.4	......	3.6	......
14	1.4	−3.4	4.4	−6.7	2.4	......	......
21	−1.7	−4.6	1.7	−6.7	1.6	......	1.6
28	−0.6	−4.5	3.3	−8.9	1.2	......	2.1
March 6	−1.4	−6.5	3.3	−7.8	1.0	......	1.1
13	1.5	−3.0	4.4	−5.0	1.5	......	1.6
20	2.6	0.5	......	−3.9	2.0	......	2.2
27	3.6	−0.6	6.7	......	2.0	......	2.7
April 3	1.1	−5.6	......	−9.4	1.8	......	2.1
10	5.0	−0.6	8.3	−4.4	1.7	......	1.7
Average to April 14	1.3	−2.8	......	......	2.0	......	2.2

For comparison with the preceding years is here given the mean temperature at midday for each half month since 1877.

TABLE XL.

Time.	Air temperature at noon.			
	1877.	1878.	1879.	1880.
January 19 to 31	2.5	0.3	— 0.3	0.9
February 1 to 14	— 0.6	—0.9	— 5.0	1.4
February 15 to end	— 1.1	—0.2	0.4	—1.3
March 1 to 15	0.6	—0.3	0.9	0.1
March 16 to 31	0.9	2.2	2.5	3.3
April 1 to 14	2.1	4.8	3.8	2.7
Mean temperature	0.6	1.2	0.5	1.3
Mean low temperature	— 3.9	—3.0	— 4.0	—2.8
Maximum cold	—11.1	—9.4	—11.7	—8.9

Thus the mean temperature has been nearly the same as in 1878, whereas it has been one-half degree higher than in 1877, and nearly one degree higher than last year. The greatest cold, as in 1877, occurred in the latter half of February. While the severest cold in 1878 and 1879 was in the first half of this month, the temperature during the corresponding period this year was 2.0 degrees higher than in 1877; 2.3 degrees higher than in 1878; and 6.4 degrees higher than in 1879.

Comparing the air temperature with the fishing we find that the best catch was in the month of February: In 1877, during the third and fourth weeks* (the coldest); in 1878, during the second and fourth weeks (the coldest); in 1879, during the first and fourth weeks (the coldest and the warmest, especially the latter); in 1880, during the third and fourth weeks (the coldest).

Thus in these four years the best fishing in February has occurred in the last eight days of the month, which probably is simply a plain result of the time. The best fishing has occurred during the greatest cold. The air temperature, either at the time of the best fishing or during the days immediately preceding, appears, however, to have had no influence on the result of the fishery.

As a continuation of, and a necessary addition to, the observations of water temperature secured by the inspector during the winter of 1879, the telegraph inspector in Tromsö district, J. B. Lie, continued these at Lödingen, at depths of 30 and 100 fathoms, from May to December, both inclusive; 36 series of observations were taken at depths of 30, 36, and 100 fathoms. These are here given entire, since they are unique and of general interest. The inspector has kindly promised to have these observations continued this year at Lödingen and Sörvaagen.

*Not a calendar week, but a space of 7 days.

TABLE XLI.—*Observations made by direction of J. B. Lie, telegraph inspector in Tromsö District.*

	Date.	Air at 2 p. m.	Wind.		Weather.	Water temperature.												Remarks.
						30 fathoms.				100 fathoms.								
			Direction.	Force.		Surface.	10 fathoms.	20 fathoms.	30 fathoms.	Surface.	10 fathoms.	20 fathoms.	30 fathoms.	40 fathoms.	50 fathoms.	70 fathoms.	100 fathoms.	
May	1	2.7	SW.	$\frac{3}{4}$	10	3.2	3.3	3.5	4.0									
	3	5.4	S.	1	1					3.3	3.0	3.5	4.8	5.3	6.0	6.4	6.5	Southerly current.
	5	1.2	SW.	$\frac{2}{3}$	10	3.2	3.2	3.4	3.6									Snow.
	7	−0.5			1					3.0	2.9	3.0	3.1	3.8	4.9	6.0	6.4	
	10	7.4			8	3.5	3.0	3.0	3.4									
	12	6.1			2					3.5	3.0	3.0	3.4	4.1	5.8	6.3	6.4	
	14	1.9	W.	$\frac{0}{1}$	10	3.3	3.0	3.0	3.4									Sleet.
Average		3.5				3.3	3.17	3.22	3.6	3.27	2.97	3.17	3.77	4.40	5.57	6.23	6.43	
	16	4.7	NE.	2	1					3.7	3.6	3.1	3.1	4.0	5.5	6.2	6.4	
	19	6.5	ESE.	2	10	5.2	4.6	3.9	3.4									
	21	7.0	SW.	3	5					4.8	4.1	3.8	3.7	4.9	5.9	6.4	6.5	
	23	9.8	NE.	2	0	6.1	5.1	4.9	4.8									
	25	8.0	WSW.	3	8					5.1	4.8	4.0	4.5	5.7	6.0	6.3	6.4	
	27	8.1		0	10	6.0	5.2	4.4	4.6									Northerly current.
	29	8.8	NE.	3	10					6.2	5.7	4.4	4.8	5.3	5.5	6.0	6.4	Storm on 31st
Average		7.6				5.77	4.97	4.40	4.20	4.95	4.55	3.82	4.02	4.97	5.72	6.25	6.42	
June	3	11.1	NE.	2	0	6.9	6.0	4.7	5.6									
	5	14.6	NNE.							6.6	5.5	5.0	5.5	5.8	6.0	6.2	6.4	
	7	10.8	SN.			7.2	5.3	5.0	5.2									
	9	8.1			10					6.5	5.8	5.0	5.0	5.2	5.6	6.0	6.2	
	11	7.0		3		5.5	5.4	5.2	5.1									
	14	3.1	NW.	2						6.0	6.0	5.3	5.0	5.0	5.3	5.8	6.2	Fog and rain.
	16	7.6	NE.		8	6.3	6.3	5.8	5.5									Snow squalls.
	18	7.3		3	10					6.4	6.4	5.8	5.0	5.2	5.8	6.0	6.2	
	24	10.0			8	6.5	6.4	5.8	5.6									
	26	19.0		0	7					9.0	7.2	6.0	5.4	5.6	6.0	6.4	6.5	
	30	13.5	SW.	2	3	8.2	6.7	5.9	5.7									
Average		10.2				6.8	6.0	5.4	5.5	6.9	6.2	5.4	5.2	5.4	5.7	6.1	6.3	

TABLE XLII.

	Date.	Air.	Wind.		Weather.	Temperature of water.												Remarks.
						30 fathoms.				100 fathoms.								
			Direction.	Force.		Surface.	10 fathoms.	20 fathoms.	Bottom.	Surface.	10 fathoms.	20 fathoms.	30 fathoms.	40 fathoms.	50 fathoms.	70 fathoms.	Bottom.	
July	2	21.6		0	1					9.8	8.2	6.0	5.8	6.0	6.2	6.4	6.5	
	7	19.2		0	0	13.0	10.5	7.0	6.0									
	9	14.6	NNE.	3	1					12.0	11.8	8.0	5.9					
	11	10.8	NW.	2	3					8.7	8.0	6.2	5.7	5.8	6.0	6.2	6.5	
	14	10.4	SSW.	2	6	8.5	7.9	5.8	7.6									
	16	12.2	NE.	2	10					9.8	9.2	7.3	5.9	5.7			6.6	
	18	17.6	NE.	2	1	10.0	9.2	6.4	6.0									
	22	21.0		0	1					13.0	9.5	7.0	5.8	5.9		6.3		
	24	23.6		0	10	11.9	9.1	5.9	6.0									
	26	15.8	S.	1	6					12.8	9.0		5.7		6.1		6.5	
	28	23.1		0	0	12.6	9.4	7.0	6.0									
	30	23.7		0	0					14.0	10.5		6.0	6.0	6.2	6.4	6.6	
Average										11.4	9.5	6.9	5.8	5.8	6.1	6.3	6.5	

TABLE XLII—Continued.

	Date.	Air.	Wind.		Weather.	Temperature of water.												Remarks.
						30 fathoms.				100 fathoms.								
			Direction.	Force.		Surface.	10 fathoms.	20 fathoms.	Bottom.	Surface.	10 fathoms.	20 fathoms.	30 fathoms.	40 fathoms.	50 fathoms.	70 fathoms.	Bottom.	
August	1	26.7		0	4	14.5	10.0	6.9	6.5									
	11	19.7	NE.	2	2					14.5	12.5	8.0	6.0	6.0	6.0	6.2	6.5	
	13	18.4		1	0	14.0		7.3	6.3									
	15	19.3		0	1					14.8	9.5	7.7	6.1			6.3		
	17	23.7		0	0	13.2	10.5	7.8	6.2									
	19	16.8	NE.	2	2					13.5	10.0	7.2	6.3		6.1	6.2		
	23	14.4	WSW.	1	10	12.0	10.0	7.2	6.4									
	26	12.0	W.	3	7					9.3	9.2	8.5			6.0		6.4	
	28	14.0	NE.	1	2	10.8	10.2	9.5	7.1									
	30	12.0	NNE.	4	9					11.2	11.2	9.3	7.2			6.1	6.5	
Average										12.6	10.5	8.2	6.2	6.0	6.0	6.2	6.5	
Sept	1	12.0	NE.	2	2	11.3	11.0	9.2	10									
	4	8.4	NE.	2	10					10.5	10.2	10.0	7.6	6.2	6.0	6.2	6.4	Rain.
	6	10.2	WSW.	3–4	8	10.8	10.8	10.0	8.5									
	8	11.4	NE.	2	1					10.9	20.9	10.8	9.2	7.5	6.7	6.0		
	10	10.6	SW.	4	10	10.7	10.7	10.8	10.0									Rain.
	23	12.1	NNE.	1	1					10.4	10.4	10.5	10.6	10.8	10.2	8.9	6.2	
	25	10.2	SW.	4	10	10.3	10.3	10.4	10.5									
	30	11.2		1–2	5					10.9	10.8	10.7	10.8	10.6	10.6	9.9	6.2	
Average										10.8	10.6	10.5	9.5	8.8	8.4	7.7	6.3	
October	2	12.2	NE.	1	0	10.8	10.9	11.0	10.8									
	4	13.4	SE.	1	5					10.0	10.0	10.6	10.7	10.6	10.6	9.2	6.2	
	6	8.8	S.	1	10	9.7	10.0	10.0	10.6									
	23	1.0	E.	1	8					8.6	8.9	9.0	9.0	9.7	9.8	6.9	6.3	
	25	0.6	NE.	1	0	8.7	8.8	9.0	8.9									
	29	4.0	S.	5	10	8.0	8.5	8.6	8.5									Rain.
Average										9.3	9.4	9.8	9,8	10.1	10.2	8.0	6.2	
Nov	3	−1.4	N.	1	2	8.0	8.0	8.2	8.0									
	6	1.0		2	10					8.0	8.0	8.2	8.2	8.2	8.4	7.0	6.3	
	8	−0.9	NNE.	1	6	8.0	7.8	8.0	7.8									
	10	−0.2		3	5					7.3	7.5	7.7	7.8	8.0	7.0	7.0	6.4	
	12	4.0	NW.	2	8	6.8	7.0	7.4	7.3									
	26	2.9	W.	2	10					5.5	6.7	6.8	7.0	7.1	7.2	7.3	6.5	
	28	4.0	ESE.	1	7	5.4	5.8	6.0	6.3									
Average										3.9	7.1	7.6	7.7	7.8	7.5	7.1	6.4	
Dec	3	−5.1	ESE.	1	7					6.0	6.0	6.2	6.3	7.0	7.0	6.6	6.3	
	10	−3.4		0	8	5.0	5.2	5.2	5.4									
	18	−3.4	NW.	1	1					4.0	4.8	5.1	5.5	5.7	5.8	6.5	6.3	
January	5	−0.1	SW.	2	9					3.8	3.8	4.0	4.4	4.9	5.3	6.4	6.4	

NOTE.—The observations at 30 fathoms were made a cable's length from Lödingen light, those at 100 fathoms in the middle of the fjord. All the observations were taken in the afternoon.

Table XLIII shows the mean temperature of the water for each half month, also the mean temperature of the air at 2 o'clock p. m., which last was kindly communicated by Dean B. Kokk from daily observations made by him in Lödingen. All the temperatures are given in degrees of Celsius. From the observations it will be seen: First, that the summer heat has had little influence on the water temperature at depths greater than 40 fathoms and none at all at depths of more than 50 fathoms, at which depth the water has been uniformly 6 degrees if we except the slight deviations occasionally produced by the sinking of the surface water cooled during winter, bearing in mind, also, that three months, from the close of April to the end of July, elapse before the water recovers from the effects of the winter temperature. At the bottom, in 100 fathoms, the temperature has been constantly about 6.4. It is further evident from this table that the water has not begun to grow cool before October, and also that the cooling has not occurred gradually, but has been rather uniform throughout until the middle of December, also that a somewhat shorter time is required to effect the normal winter condition—the coldest water at the surface and a gradually increasing temperature towards the bottom—than is required in summer to produce the opposite condition—the warmest water at the surface and a decreasing temperature downward. After the middle of December the decrease of temperature has been slower. The water has been warmest from the middle of September to the beginning of October; the temperature during this time has been uniformly between 10 and 11 degrees from the surface down to a depth of 70 fathoms. The fact that the temperature of the stratum of water lying between 30 and 70 fathoms increased so considerably in the space of three weeks can only, so far as the uppermost portion is concerned, be ascribed to the direct influence of the warm water lying above it, if we admit that its greater saltness makes it a better conductor of heat; but may certainly be explained more readily by an afflux of warm water, probably from the shallow places in Ofotfjord.

TABLE XLIII.

	Mean temperature of air (2 p. m.).	Mean temperature of water.											
		30 fathoms.				100 fathoms.							
		Surface.	10 fathoms.	20 fathoms.	Bottom.	Surface.	10 fathoms.	20 fathoms.	30 fathoms.	40 fathoms.	50 fathoms.	70 fathoms.	Bottom.
May:													
First half	2.7	3.3	3.2	3.2	3.6	3.3	3.0	3.2	3.8	4.4	5.6	6.2	6.4
Second half	8.5	5.8	5.0	4.4	4.3	5.0	4.6	3.8	4.0	5.0	5.7	...	...
June:													
First half	9.3	6.5	5.6	5.0	5.2	6.4	5.8	5.1	5.2	5.3	5.6	6.0	6.3
Second half	11.5	7.0	6.5	5.8	5.6	7.7	6.8	5.9	......	5.4	5.8	6.2	....
July:													
First half	15.4	10.7	9.2	6.8	5.9	10.2	9.3	6.7	5.8	5.9	6.1	6.3	6.5
Second half	18.7	11.5	......	6.4	6.0	12.4	9.5	7.1	......	......	....	......	6.6
August:													
First half	19.4	14.2	10.0	7.1	6.4	14.7	11.0	7.8	6.0	6.0	6.0	6.2	6.5
Second half	15.1	12.0	10.2	8.2	6.6	11.3	10.1	8.3	6.6	......	6.0	6.1	6.5
September:													
First half	11.6	10.9	10.8	10.0	8.5	10.7	10.5	10.4	8.4	6.8	6.3	6.1	6.5
Second half	11.2	10.3	10.3	10.4	10.5	10.6	10.6	10.6	10.7	10.7	10.4	9.4	6.2
October:													
First half	6.8	10.2	10.4	10.5	10.7	10.0	10.0	10.6	10.7	10.6	10.6	9.2	6.2
Second half	1.6	8.3	8.6	8.8	8.7	8.6	8.9	9.0	9.0	9.7	9.8	6.9	6.3
November:													
First half	—1.5	7.6	7.6	7.9	7.7	7.6	7.7	7.8	8.0	8.1	7.7	7.0	6.3
Second half	0.6	5.4	5.8	6.0	6.3	5.5	6.7	6.8	7.0	7.1	7.2	7.3	6.5
December:													
First half	—2.4	5.0	5.2	5.2	5.4	6.0	6.0	6.2	6.3	7.0	7.0	6.6	6.3
Second half	1.6	......	......	......	......	4.0	4.8	5.1	5.5	5.7	5.8	6.5	6.3
January:													
First half	0.8	......	......	......	......	3.8	3.8	4.0	4.4	4.9	5.3	6.4	6.4

The temperature of the water has been taken daily at the surface and at depths of 5 and 10 fathoms. The results are set forth in Table XXXIX. The lowest temperature at the bottom and surface was 0.5 (in the beginning of March). The difference between the lowest weekly mean temperature at 10 fathoms last year and this year was only 0.2 at the surface and nothing at the bottom. The highest temperatures were 3.5 and 4.0 (beginning of February). Regular observations at greater depths, 30 and 80 fathoms, were not taken, for want of time. In all 38 series of observations were taken in 30 fathoms, and 40 at greater depths, against 63 and 58 last year. The same instruments were used in taking the observations as last year, namely, 2 Negretti and Zambra thermometers, which were kindly lent to the inspection party by the Meteorological Institute. The same instruments were used by Inspector Lie also. As the division into degrees is not very fine, an error in reading of ¼ degree is, of course, not rare. There appear, however, to be no more serious errors of observation. The observations were made first at the surface and gradually downwards towards the bottom.

TABLE XLIV.

Date.	Place.	Temperature of water at various depths from the surface to the bottom.											Condition of the fishery.
		Surface.	10 fathoms.	20 fathoms.	30 fathoms.	35 fathoms.	40 fathoms.	50 fathoms.	55 fathoms.	60 fathoms.	70 fathoms.	80 fathoms.	
Jan. 30	Svolvær	3.75	4.00	....	4.25	..	....	4.75	....	5.25	6.75	6.75	Irregular, mostly light.
Feb. 2		3.50	4.00	....	4.25	....	..	5.00	...	6.00	6.50	6.75	
6		2.75	4.00	....	...	....	....	4.50	....	5.00	6.00	6.00	
9		3.00	3.25	....	3.50	..	....	4.25	....	5.00	5.75	6.00	
16	Storvaagen	2.25	2.50	....	3.50	...	4.00	4.50	....	5.00	.	....	Few *trukket*, good fishing.
21		2.00	2.25	....	2.50	2.50	4.50	5.00	5.00	5.25	....	....	Irregular, mostly good.
25		1.75	2.25	3.50	4.50	....	....	5.00	5.00	6.25	...	....	Irregular, mostly light.
27	Stamsund	2.00	2.00	3.00	4.00	4.75	....	....	....	....	....	....	Uniformly good.
28		2.00	2.00	3.00	3.75	4.00	....	....	..	..	....	....	Fish abundant.
29		2.25	2.50	2.75	2.75	3.00	....	....	..	....	....	....	
Mar. 1		2.25	2.25	2.25	2.75	2.75	..	....	....	....	....	....	
3	(Strömmen)	1.50	1.75	1.75	2.00	2.00	....	....	....	...	..	....	
	Storvaagen	1.75	1.75	2.00	2.25	2.50	....	....	....	....	....	....	Exceedingly light.
10		1.25	2.25	4.00	5.00	5.50	....	....	..	....	....	....	Good fishing.
	Islændingen	3.00	3.75	4.75	4.75	...	5.00	....	..	....	....	...	Irregular, mostly light.
11		3.00	3.00	4.50	4.75	....	4.75	5.00	....	5.25	....	....	Exceedingly light.
	Sundsflaket	2.75	2.75	2.75	3.50	....	5.00	.	....	....	....	....	
12	Islændingen	2.50	2.50	3.00	3.25	....	4.50	5.00	....	5.50	6.25	6.25	Light.
15	Östnæsfjord	2.00	2.25	4.75	5.00	....		5.75	....	6.00	6.25	....	Good fishing.
18		2.00	2.00	2.50	3.25	....	4.00	5.00	....	6.00	6.00	....	
19		2.00	2.25	....	3.25	....	4.00	5.00	....	....	6.00	....	
	Stamsund	2.25	2.25	2.50	3.50	....	4.00	....	....		....	....	Light.
20	Östnæsfjord	2.00	2.25	....	3.25	....	3.75	5.25	....	5.50	6.00	6.00	Smaller, especially night-line.
21		2.50	2.25	3.25	4.50	....	....	5.50	....	....	6.00	6.25	Sunday.
22		2.50	2.50	..	3.25	....	....	4.50	....	6.00	6.00	6.25	Exceedingly light.
	Stamsund	2.25	2.25	2.50	3.00	....	4.50	....	....	....	....	....	Irregular, mostly good. Extremely light. In the rest of Loffoden no sea-going weather because of a SW. storm.
23		2.25	2.25	....	3.75	....	4.75	6.00	....	....	6.00	6.00	Almost no fishing.
24	Östnæsfjord	2.50	3.00	5.00	5.25	....	....	6.00	....	6.00	6.00	6.25	
25	Svolvær	2.50	3.00	5.00	5.25	....	....	6.00	....	6.00	6.00	6.25	Holiday.

TABLE XLV.

Date.	Place.	Temperature of water at various depths from the surface to the bottom. Surface.	10 fathoms.	20 fathoms.	30 fathoms.	35 fathoms.	40 fathoms.	50 fathoms.	60 fathoms.	70 fathoms.	80 fathoms.	Condition of the fishery.
Mar. 26	Svolvær	2. 50	2. 50	4. 00	5. 00	....	....	6. 00	6. 00	6. 00	6. 25	Holiday.
27	....	2. 25	2. 50	2. 75	4. 50	...	....	5. 50	6. 00	6. 00	6. 00	Good net-fishing.
28	....	2. 25	2. 50	....	4. 00	...	....	5. 50	6. 00	6. 00	6. 25	Holiday.
29	....	2. 00	2. 50	...	3. 50	..	....	5. 50	6. 00	6. 00	6. 25	
30	....	2. 00	2. 25	..	3. 00	...	...	5. 00	6. 00	6. 00	6. 00	Irregular; mostly light; few trukket.
31	....	2. 00	2. 25	...	3. 00	....	4. 50	6. 00	6. 00	6. 00	6. 00	Irregular; mostly light, though mostly good elsewhere.
	Stamsund...	2. 25	2. 50	2. 50	3. 25	..	4. 75	....	....	....	....	Irregular; mostly good.
Apr. 6	....	2. 00	2. 25	2. 25	2. 25	....	3. 75	...	....	....	....	Irregular; mostly good; less, however, than March 31.
6	....	2. 00	2. 00	2. 00	2. 25	...	2. 50	4. 00	5. 50	....	...	Net-fishing excellent; line light.
	Storvaagen..	2. 00	....	2. 25	3. 25	3. 25	....	....	....	....	..	
12	Svolvær	2. 00	3. 00	4. 25	5. 00	...	....	5. 75	....	6. 00	6. 25	
		2. 28	2. 54	....	3. 69	....	4. 27	5. 20	5. 70	...	6. 21	

TABLE XLVI *a*.

Date.	Place.	Water temperature. Surface.	10 fathoms.	20 fathoms.	30 fathoms.	Condition of the fishery.
		20 or 30 fathoms of water.				
Jan. 30	Svolvær	3. 50	3. 75	....	4. 25	
Feb. 2	....	....	....	......	....	
6	....	2. 75	....	....	4. 00	
9	....	3. 00	3. 00	...	3. 75	
16	Storvaagen	2. 25	2. 25	2. 25	....	
21	....	1. 25	1. 75	2. 00	....	
25	....	1. 50	2. 00	4. 00	....	
27	Stamsund	2. 00	2. 00	2. 75	....	Uniformly good.
28	....	2. 00	2. 00	2. 50	....	Very good.
29	....	2. 00	2. 00	2. 00	......	
Mar. 1	....	2. 00	2. 00	2. 25	....	
3	(Strömmen)	1. 25	1. 25	1. 75	....	
10	Islændingen	3. 00	4. 00	....	....	
	Storvaagen	2. 00	2. 75	......	3. 75	Very good.
11	Islændingen	2. 75	3. 00	4. 50	4. 75	
13	Sundsflaget	....	4. 00	....	....	
15	Östnæsfjorden	1. 75	2. 00	4. 25	4. 25	Very good.
18	Östnæstjorden	2. 00	....	2. 25	3. 00	
	Stene	2. 25	2. 50	2. 75	3. 75	
19	Stamsund	....	....	....	3. 00	
	Östnæsfjorden	2. 00	2. 00	....	....	Very good.
20	....	....	2. 25	....	3. 25	
	Stamsund	....	....	2. 25	2. 50	
21	Östnæsfjorden	2. 50	2. 50	3. 00	4. 00	Sunday.
22	....	2. 25	2. 50	....	3. 75	
	Stamsund	2. 25	2. 25	2. 50	3. 00	

TABLE XLVI *b*.

Date.	Place.	Water temperature. Depth, 30 fathoms. Surface.	10 fathoms.	20 fathoms.	Bottom.	Condition of fishery.
Mar. 23	Östnæsfjorden	2.25	2.25	....	3.50	
24		2.50	3.00	....	5.25	Very good.
26	Svolvær	2.25	2.50	3.75	4.50	Holiday.
27		1.75	2.25	....	3.75	Very good.
28		2.25	2.50	2.75	4.00	Holiday.
29		2.00	2.25	2.50	4.00	
30		1.75	2.25	....	2.50	
31		1.75	2.25	....	3.00	
	Stamsund	2.25	2.50	2.75	3.25	Irregular; mostly good.
Apr. 6		1.75	1.75	1.75	....	
	Storvaagen	2.00	1.75	2.50	....	
12	Svolvær	1.75	3.00	....	5.00	
		2.18	2.48	....	....	

As the observations at Lödingen in May, last year, agreed in the main with those taken at Loffoden in April, so also the observations at Lödingen on the 5th of January, this year, give the same result as in Svolvær on January 30; therefore the observation of the temperature of the water which has been conducted from January, 1879, to April, 1880, may be regarded as a continuous series.

The observations this year, as well as last, show that, as a rule, there is a rather sharp limit between a colder and a warmer stratum of water, while the mass of the layer increases and diminishes considerably in a comparatively short time. This fall of temperature appears not to have extended to as great depth as last year; the lowest temperature observed at 60 fathoms was 2.15, and, at 50 and 40 fathoms, 1.75, while this year the temperatures were 5.25, 4.00, and 2.50, respectively. In February and March a temperature as low as 2.25 has not been observed farther down than 20 fathoms from the surface in 80 fathoms of water, and it has been noticed only twice in the same depth of water 35 fathoms from the surface. It is possible, however, that observations taken between the 3d and the 10th of March would have given a different result; for the water appears to have been coldest this year at that time, although, because of the frequent and sometimes considerable changes at different depths, it is difficult to arrive at a definite conclusion about the subject.

Concerning the influence of the temperature of the water upon the fishery, allow me to state the arguments for and against this assumption.

The following statements favor the assumption:

1. This year the fish were always found either near the surface or in comparatively shallow water, and since the temperature at these depths was both rather uniform and rather high, at all events, in comparison

with last year, it is not improbable that the fish have been influenced thereby in their choice of locality.

2. Since fishing begun at Islændingen, the lower part of Sundströmmen, the temperature at 20 and 30 fathoms was $4\frac{3}{4}$ degrees. The floating implements placed 25 fathoms from the surface, and the bottom implements set in 25 fathoms, took plenty of fish, while nets placed on the bottom in 60 to 80 fathoms, where the temperature was six degrees, caught almost nothing. The same thing occurred in Östnæsfjorden and Svolvær during the fishing there. Many of the net-fishermen floated only a portion of their nets, and allowed the rest to remain on the bottom, and the catch was generally good in the floated portion, and exceedingly light in the bottom nets.

3. The excellent fishery at Stamsund and stations farther west at the close of February was associated with a rise in the water temperature, which, from 2.50 at a depth of 35 fathoms on the 21st, increased on the 25th to 4.50 in 30 fathoms, and 3.50 in 20 fathoms. The same was true of the good fishing which begun in Östlofoten March 10. The fishing mentioned in Buksnæsfjorden under "Fishing at the different stations," and also the advent of cod which was noticed, March 17, between Stamsund and Skokkelvigöerne, occurred at a time when the warm stratum of water had descended to 20 fathoms from the surface.

The conclusion which I reach from these observations is, that the temperature which appears best adapted to cod is between $3\frac{1}{2}$ and $4\frac{1}{2}$ degrees.

The circumstances which disprove the influence of the temperature of the water are the following:

1. Since there were some fish in the seines, though in smaller and comparatively unimportant numbers, it follows that a temperature of 5 to 6 degrees is, at all events, not a barrier to the presence of cod.

2. Although the good fishing westward of Stamsund begun with a temperature of 4 degrees in 30 fathoms, it remained good, and in the early part of March it was even unusually good here as well as at Gemsöströmmen, though the temperature gradually decreased to $1\frac{3}{4}$ degrees in 20 fathoms and 2 degrees in 35 fathoms—which again seems to indicate that comparatively cold water is not prejudicial to the thriving of cod.

3. The fishing, which was excellent at Sund March 10, was poor on the 11th, though the temperature conditions were the same on both days; so this appears to be no assurance of a permanently good fishery.

It is shown by the combined observations also that some good fishing has taken place in depths where the water temperature varied from 2 to 5 degrees. Since this is the greatest variation which has been observed during the winter on the banks, and since the taking capacity of a net is only 3 to 4 fathoms perpendicularly, I conclude that the temperature of the water does not play the role in the fishing that one would suppose, at first consideration, should be ascribed to it. Examinations of the temperature of the cod itself at different depths would have been interesting, but I had no thermometer which was suitable therefor.

The observations this year have indeed been few, although they were begun the same day or the day after the fishing commenced. Although the frequent and sometimes considerable and irregular falling and rising of the warm water scarcely allow any hope of a practical result, and in spite of the little encouraging conclusions whereto the year's observations have led, it is my intention to continue these observations as far as time allows.

Table XLVII shows how many livers made a barrel at different times during the fishery. The numbers above the line indicate those taken in nets, below the line those caught by lines. Compared with the four preceding years the fish this year have been distinctly fatter, and, especially, they have retained their fatness longer than usual. The increased proportion of liver in the districts of Stamsund and Sörvaagen at the close of February was associated with the excellent fishing there, and seems to indicate a new arrival (of fish). The stated proportion of liver at the end of the first week of March to the quantity of fish has not been so great in any of the four preceding years at the same time; and one may possibly, from this longer-retained proportion of liver, draw the conclusion that the East Loffoden fishery in March is due to the incoming of new fish and not to an afflux from West Loffoden. The observations are, however, highly uncertain, and cannot be otherwise; so it is difficult to base any decision upon them. On the average 385 cod are estimated to have yielded one barrel of livers, or 78 pots (0.65 barrel) of oil. According to the inspection tables, the proportion between fish and liver has been as follows:

	Cod.		Cod.
1869	450	1875	440
1870	350	1876	415
1871	400	1877	425
1872	350	1878	420
1873	390	1879	420
1874	400	1880	385

An average of 400 to the barrel of liver and 600 to a barrel of oil.

TABLE XLVII.—*Number of livers in a barrel.*

Week ending—	Östnæsfjorden.	Svolvær.	Skroven.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Sorvaagen.
January 24						0			0	
						300			300	
January 31		0			280	250				
		300			300	300				
February 7			280	280			300	350		200
			300	300			350	400		250
February 14	300	300		300			350	300		300
	340	350		350			400	350		350
February 21		300			300		280		0	350
		400			400		350		350	400

TABLE XLVII.—*Number of livers in a barrel*—Continued.

Week ending—	Östnæsfjorden.	Svolvær.	Skroven.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Sorvaagen.
February 28	350 / 450	350 / 450	300 / 350	......	......	300 / 350	......	......	350 / 400	300 / 400
March 6	......	......	......	320 / 370	350 / 450	......	......	......	......	300 / 350
March 13	......	......	350 / 400	350 / 450	......	350 / 400	350 / 400	400	400 / 450	400 / 500
March 20	400 / 450	400 / 500	400 / 500	400 / 550	400 / 500	400 / 500	300 / 350	......	......	500 / 600
March 27	......	......	......	400 / 500	......	480 / 550	350 / 450	450 / 500	450 / 500	......
April 3	......	......	......	420 / 550	450 / 600	......	400 / 480	....	500 / 550	......
April 10	......	......	......	480 / 0	......	480 / 600	......	......	550 / 600	......

Table XLVIII states the prices of net and line fish at different times during the fishing. The average price is assumed to have been about 15 öre for net fish, about 13 for line fish, 12 for deep-water fish, and in general, 13.70. Since 1860 there has only once been a lower price; this was in 1868, when the average was 13.33.

TABLE XLVIII.—*Prices of fish* (*in öre*).

Week ending—	Östnæsfjorden.	Svolvær.	Skroven.	Vaagene.	Hopen.	Henningsvær.	Stamsund.	Ure.	Balstad.	Sörvaagen.
January 17	......	......	......	......	......	12	......	......	0 / 12	......
January 24	......	......	......	14	......	......	......	......	......	......
January 31	......	14	......	......	12	......	0 / 10	......	......	......
February 7	......	16 / 14	12 / 11	15 / 14	......	14 / 13	0 / 13.5	12	......	......
February 14	14	......	16 / 12	16 / 14	18 / 16	17 / 14	16 / 15	14 / 13	......	14 / 12
February 21	......	17 / 15	17 / 16	17 / 15	19 / 17	......	17.5 / 16	16.5 / 15.5	......	......
February 28	......	......	18 / 16	17 / 16	......	18 / 16	18 / 16	18 / 16	15 / 14	16 / 12
March 6	......	18 / 16	....	......	18 / 16	......	15 / 13	14 / 13	......	......
March 13	10 / 9	15 / 13	17 / 16	14 – 16 / 10 – 12	17 / 15	......	14 / 13	18 / 15	14 / 12	15.5 / 12
March 20	14 / 10	13 / 10	12 / 10	12 – 13 / 10 – 11	15 / 13	16 / 14	16 / 14	......	14 / 13	14 / 12
March 27	......	16 / 12	14 / 13	12 – 14 / 10 – 11	13 / 11	15 / 14	14.5 / 13	14 / 12	......	15 / 12
April 3	......	......	12 / 11	13 – 15 / 10 – 11	......	......	16 / 15	......	14 / 13.14	13.5 / 12
April 10	......	......	14 / 13	0 / 10 – 11	14 / 12	12 / 10	16 / 14	17 / 15	......	17 / 12

Table XLIX gives the prices of the other fish products and of bait. The prices of roe have been somewhat higher, of liver a little lower than in the last few years. According to these prices the value of one fish round has been 20.8 öre. Bait has commanded an unusually high price.

TABLE XLIX.—*Prices (in öre).*

Inspection district.	Liver.		Roe.	Heads.	Bait.			
					Herring.		Cuttle-fish.	Mussels.
	Fresh.	Old.			Fresh.	Salted.		
	Barrel.*			Millions.	Barrel.			
Skroven	20 14	......	16 20	......	......	20	......	......
Svolvær	15 12	......	......	0.50 0.70	......	12 20	14 20	16
Vaagene	18 12	12 10	16 21	0.40 0.50	......	16	20 28	18 24
Hopen	18 12	16 12	15 22	0.50 0.70	......	16 20	16 20	10 20
Henningsvær	17 15	14 13	20 22	0.40 0.60	......	16 20	20	......
Stamsund	20 17	14 12	18 22	......	......	14	18	......
Ure	......	......	18 23	0.60 0.80	......	16 20	......	......
Balstad	15	......	21	0.40 0.60	......	13 18	19	......
Sörvaagen	16 12	......	18 22	0.50 0.60	20	14 20	18 16	......

* This probably means so many öre per fish by the barrel and so many per head by the million.—TR.

Table L gives the Loffoden prices and the export values since 1873. Up to and for 1877 the export values are taken from the official statistics; for 1878 and 1879 they are quoted from the generous communication of the supervisor of the merchants' clerks in Bergen. According to this statement the export prices have been—

Export prices.		1878.	1879.
Split cod	per vog*	$1 66	$1 27
Round fish	do	1 54	1 27
Coarse-cut:			
Ling	do	1 88	1 54
Cod	do	1 74	1 47
Brosmius	do	67	64
Titling:			
Cod	do	1 81	1 61
Haddock and Brosmius	do	80	54
Large coal-fish	do	94	87
Medium coal-fish	do	86	59
Small coal-fish	do	54	43
Medicinal oil	per barrel	13 53	11 79
Refined oil	do	13 13	11 26
Clear brown oil	do	12 86	10 99
Brown oil	do	10 99	9 92
Roe:			
First quality	do	8 04	7 77
Second quality	do	5 36	5 09

* Thirty-six Danish pounds.

Of the total export of roe 15 per cent. is assumed to be of the second quality. The cost of split cod may be estimated at 8.8 crowns ($2.36) per 1,000.

TABLE L.—*Prices.*

Year.	Fish.			Roe.		Liver.		
	Average Loffoden price.	Export price.		Loffoden price.	Export price.	Loffoden price.		Export price.
		Split cod.	Dried cod.			For medicinal oil.	For other oils.	
	Per hundred.			Per barrel.				
1873	$6 21	$9 29	$5 91	$9 18	$13 18	$6 48–$7 56	$6 48	$9 61
1874	6 48	9 72	5 75	$11 88–12 42	15 23	7 56– 8 64	$5 40–5 94	9 04
1875	5 94	8 75	......	8 64–10 80	11 45	6 48– 7 56	5 40	8 69
1876	5 40	11 34	6 45	8 64	11 96	7 29– 8 77	4 32–5 40	9 64
1877	5 94	8 48	6 18	7 02– 8 64	7 15	6 21– 8 64	5 40	9 10
1878	5 40	9 29	*5 75	4 32– 4 86	7 72	4 86– 7 56	4 59–4 86	8 42
1879	4 68	7 13	*4 75	4 86– 5 94	7 45	4 86– 6 48	3 78–4 86	7 21

* Round fish only.

Table LI shows the yield of fish in the Loffoden fishery at the close of each week for the last five years. In this, as also in the following tables, certain items are wanting for 1878, since it has been hitherto impossible to obtain a statement of medical taxes for this year.

TABLE LI.—*Yield of Loffoden fishery.*

Month.	1875.		1876.		1877.		1878.		1879.	
	Date.	1,000 fish.	Date.	1,000 fish.	Date.	1,000 fish.	Date.	1,000 fish.	Date.	1,000 fish.
February	....	....	1	200	...	....	...	....	...	....
	....	....	5	600	3	130	2	360	1	1,000
	13	2,500	11	1,500	10	500	9	700	8	2,000
	20	3,750	19	2,500	17	1,500	16	2,500	15	2,750
	28	6,000	26	4,200	24	3,000	23	3,000	22	5,000
March	...	....	...	....	3	4,750	2	5,500	1	6,750
	7	9,000	5	7,500	10	8,250	9	8,500	8	7,500
	14	13,500	12	9,000	17	11,500	16	11,750	15	11,000
	21	16,500	19	11,750	24	17,000	23	17,750	22	16,000
	28	18,500	26	15,500	31	20,250	30	22,250	29	21,000
April	...	....	2	20,250	...	....	...	....	...	....
	4	21,000	9	21,250	7	24,250	6	23,500	5	24,750
	11	23,000	15	22,000	14	28,000	13	24,750	12	25,500
After deducting medical tax		23,000,000		23,000,000		28,000,000		....		25,250,000
Caught after April 14		180,000		500,000		1,500,000		250,000		60,000
Caught in January and February		6,000		6,000		4,000		....		6,750
Caught in March		13,400		14,600		16,250		....		15,250
Caught in April		3,600		2,400		7,750		....		3,250

Table LII shows the combined yield of the different fish products since 1873. The yield of fish in millions will be seen to correspond nearly with the number of thousand barrels of roe. This year the inspection estimates 34 per cent. more roe proportionally than for the preceding year. How far 1870 has been exceptional, or the estimate of the inspection has been erroneous, can, however, not be determined until the close of the year.

TABLE LII.

Year.	Yield of Loffoden fishery, including the fishing after April 14.							
	Total.	Embracing—		Heads.	Roe.	Oil.		Value in million crowns.
		Split cod.	Dried cod.			Medicinal.	Other oil.	
	Millions.				1,000 barrels.			
1872	18.2	10.7	7.5	4.7	19	0.7	33	5.1
1873	19.5	12.4	.....	4.8	18	0.5	.....	6.0
1874	16.0	10.9	5.1	5.5	15	0.4	27	5.1
1875	23.2	15.5	7.7	14.5	21	0.9	35	7.2
1876	23.5	18.0	5.5	13.5	24	1.4	35	6.5
1877	29.5	25.3	4.2	15.0	29	4.4	36	8.8
1878	.....	.....	3.7	18.0	.....	3.0	.....	.....
1879	25.3	21.6	3.7	21.0	26	2.7	36	6.0

Table LIII gives the yield of the rest of the fisheries in the districts of Nordland and Tromsö. The fact that the quantity of oil in 1879 was twice as great as in 1876, though the yield of fish from the summer and autumn fisheries was the same, is due, in part, to the circumstance that the home consumption of fish in 1879, because of the unsuccessful herring fishery, was considerably greater, which, as a matter of course, has had its influence on the quantity exported; and in part to the very small fishery at Finmark in 1876, which again affected the export of oil from Tromsö, some of whose fishermen bring home livers. This and the prec ding table I have worked out from a critical examination of the different fishery reports, and I believe that even if there be found some errors of judgment, the statements may be regarded as tolerably correct in the main features and in relation to the amount of the different items.

TABLE LIII.

Year.	Yield of the fisheries in Nordland and Tromsö districts, excluding the Loffoden fishery.						
	Winter and spring fishery.					Summer and autumn fishery.	
	Total.	Divided into—		Roe.	Oil.	Oil.	Fish.
		Split cod.	Dried cod.				
	Millions.			1,000 barrels.			Millions.
1872	5.5	0.5	5.0	6.5	11.4	11.0	6.7
1873	4.5	.....	4.0	4.5	9.0	7.5	7.6
1874	2.3	0.3	2.0	2.5	4.5	9.5	10.2
1875	7.2	0.8	6.4	8.5	13.0	7.6	9.3
1876	8.0	1.4	6.6	10.0	14.0	6.7	9.2
1877	11.2	2.5	8.7	16.0	19.0	9.9	13.2
1878	4.4	0.4	4.0	5.4	7.6	.....	.....
1879	7.0	0.9	6.1	8.2	12.1	14.1	9.6
	6.2	0.9	5.3	7.7	11.3	9.5	9.4

Table LIV shows the inspector's statement of fish, roe, livers, and medicinal oil at the close of each week, also the number of fishing days. In the quantity of liver is not included that portion which is used in the manufacture of medicinal oil. Only a day on which there is fishing throughout the Loffoden Islands is considered an entire fishing day. The best yield in proportion to the number of fishing days and the size of the fleet was during the week from March 7 to March 13 (the most fish taken); the next best was in the week from March 14 to March 20. In January and February there were caught 6,000,000 (22.7 per cent.); in March, 18,500,000 (69.8 per cent.); and in April, 2,000,000 (7.5 per cent.). The number of fishing days from January 11 to April 14 made up 59 per cent. of the whole time.

TABLE LIV.—*Weekly statement of the yield.*

Week ending	1,000 fish.			1,000 barrels.			Fishing-days.	
	Total catch.	Salted.	Week's catch.	Liver.	Medicinal oil.	Roe.	Whole.	Part.
January .. 17	100	....	....	....	....	....	5	....
24	150	....	50	....	....	....	1	....
31	170	....	20	....	....	....	....	1
February .. 7	500	....	330	1.6	....	1.4	1	3
14	1,600	....	1,100	5.0	0.2	3.7	3	2
21	3,000	....	1,400	9.1	0.4	7.2	1	4
28	6,000	....	3,000	18.0	1.0	14.0	4	1
March ... 6	9,250	6,000	3,250	25.0	1.5	20.5	2	3
13	13,250	9,750	4,000	36.0	2.0	26.5	....	4
20	22,500	18,250	8,750	54.5	2.5	34.0	6	....
27	23,500	19,750	1,500	57.0	3.0	34.5	1	2
April 3	24,500	20,750	1,000	59.0	....	35.0	1	1
10	26,000	22,250	1,500	62.0	3.1	....	4	3
14	26,500	22,750	500	63.0	....	....	2	1
				Oil, 41.0			31	25

Table LV shows the yield of fish, liver, medicinal oil, roe, and heads used for the manufacture of guano in the different inspection districts.

TABLE LV.—*Distribution of the catch by inspection districts.*

Inspection district.	1,000 fish.				1,000 barrels.			Million heads.
	Total.	Salted.		Dried fish.	Liver.	Medicinal oil.	Roe.	
		Ashore.	At sea.					
Skroven*	2,050	280	1,670	100	4.9	0.350	1.8	1.5
Svolvær	4,000	390	3,400	210	8.9	0.330	3.4	2.5
Vaagene	4,500	410	3,980	110	9.6	0.815	3.3	3.2
Hopen	3,250	520	2,660	70	6.8	....	3.8	2.2
Henningsvær	4,400	540	3,360	500	10.3	0.800	8.5	3.7
Stamsund	2,570	640	1,650	280	7.2	0.670	4.0	2.0
Ure	710	150	360	200	1.9	....	1.4	0.2
Balstad	1,820	110	1,030	680	4.2	0.100	3.3	1.5
Sörvaagen†	3,200	290	1,310	1,600	9.2	....	5.5	1.5
Total	26,500	3,330	19,420	3,750	63.0	3.065	35.0	18.3
*Amount for Ostnæsfjord	1,230	110	930	190	2.8	....	1.2	....
†Amount for Nufsfjord	580	60	330	190	1.8	....	0.8	....

Table LVI gives the catch of fish by the different methods.

TABLE LVI.—*Yield by the different methods.*

Inspection district.	1,000 fish.		
	Net.	Trawl-line.	Deep bait.
Skroven	1,320	570	160
Svolvær	1,000	2,400	600
Vaagene	3,500	470	530
Hopen	1,750	1,400	100
Henningsvær	2,330	1,900	170
Stamsund	1,950	500	120
Ure	200	450	50
Balstad	250	1,570	....
Sörvaagen	1,000	2,190	10
Total	13,300	11,450	1,740

Table LVII shows the proportion between the different kinds of fishermen and the yield of the methods in the last five years. In the last three years the use of lines has given proportionally the best yield. A comparison of the last nine years shows that the use of lines has given the most certain yield, since there were only two years—1876 and 1877—wherein the catch was proportionally small in relation to the number of line-fishermen, while the use of nets has furnished a relatively small yield in six of the nine years.

TABLE LVII.

Year.	Proportionate yield of the various methods.					
	Net-fishing.		Trawl-line fishing.		Day-fishing.	
	Fishermen.	Fish.	Fishermen.	Fish.	Fishermen.	Fish.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1876	43.0	52.0	45.0	43.5	12.0	4.5
1877	50.0	55.5	41.0	35.5	9.0	9.0
1878	58.0	57.0	32.0	38.0	10.0	5.0
1879	56.0	43.0	33.0	52.0	11.0	5.0
1880	49.0	50.0	38.0	43.0	13.0	7.0

Table LVIII shows the yield of the guano factories in the last five years. This year a factory was erected with English capital in Brettesnæs, while the Norwegian fish-guano company (Lerosen factory) was dissolved.

TABLE LVIII.

Year.	Yield of guano factories.					
	Sauöen.	Lerosen.	Lyngvær.		Total.	Heads consumed.
			Guano.	Fish meal.		
	Sacks of 200 pounds.			2-pound packages.	200-pound sacks.	Millions.
1875	11,650	8,000	4,000	....	23,650	14.3
1876	10,000	9,960	3,100	1,900	23,060	14.0
1877	9,880	8,630	4,080	2,420	22,560	13.7
1878	13,500	6,150	2,210	1,200	21,869	13.2
1879	16,700	7,600	2,340	1,500	26,640	16.0
Average	12,350	8,070	3,140	....	23,550	10 6

Of medicinal oil manufactories there are now two in Skroven, one in Svolvær, two in Kabelvaag, two in Henningsvær, and one in each of the stations Stamsund, Stene, and Balstad. Altogether they can utilize about 500 barrels of livers daily.

For consumption during the fishery are used 750,000 fish. For use at home fully 250,000 are sent. This million is not included in the foregoing statement.

According to the statement of the treasurer of the medical fund, the medical taxes for 1879 amounted, in the counties of Norland and Tromsö, to 95,129.33 crowns ($25,494.65), divided as follows:

	Crowns.	Dollars.
187,677 times 120 split cod, 22,521,240 fish..	25,023.60	6,706 32
26,370 vogs of salted fish in vessel	293.00	78 52
718,013 vogs of dried cod,* 19,386,351 fish..	23,933.77	6,414 25
271,706 barrels herring..........................	18,113.73	4,854 48
597 barrels other salted fish..................	39.80	10 67
64,898 barrels oil................................	25,959.20	6,957 06
35,325 barrels roe................................	1,766.23	473 35
	95,129.33	25,494 65

For bait it is estimated that there were consumed 16,000 barrels of salted and 40 barrels of fresh herring, 8,000 barrels of cuttle fish, and 1,300 barrels of mussels, the combined value of which was 400,000 crowns ($107,200).

The *aggregate gross yield* of the Loffoden fishery is worth a little over 5,500,000 crowns ($1,474,000).

Table LIX gives the average share which has generally fallen to the different methods of fishing, also the greatest share, as far as known to the inspection officers. The average share was 200 crowns ($53.60).

* Wherever dried cod are reduced from weight to number, 27 fish are calculated to a vog (36 Danish pounds).

The average was, in 1874, 270 crowns = $72.36; in 1875, 390 crowns = $104.52; in 1876, 305 crowns = $81.74; in 1877, 410 crowns = $109.88; in 1878, 300 crowns = $80.40; and in 1879, 240 crowns = $64.32.

Wages of hired men were from 100 to 120 crowns ($26.80 to $32.16) and expenses. In East Loffoden they were occasionally reduced to 80 crowns ($21.44).

TABLE LIX.

Inspection district.	Average share.			Highest share.		
	Net-fishermen.	Trawl-line fishermen.	Deep-bait fishermen.	Net-fishermen.	Trawl-line fishermen.	Deep-bait fishermen.
Skroven	$64 32	$48 24	$26 80	....	....	....
Svolvær	53 60	42 88	37 52	$96 48	$85 76	....
Vaagene	75 04	....	32 16	160 80	53 60	$53 60
Hopen	64 32	48 24	34 84	134 00	107 20	....
Henningsvær	53 60	42 88	32 16	107 20	85 76	....
Stamsund	58 96	56 28	....	115 24	69 68	....
Ure	48 24	45 56	....	75 04	80 40	....
Balstad	69 68	69 68	....	....	....	....
Nufsfjord	80 40	72 36	....	99 16	107 20	....
Sund	75 04	75 04	....	93 80	142 04	....
Reine	80 40	....	....	91 12	107 20	....
Sörvaagen	67 00	80 40	....	88 44	125 96	....
Moskenæs	....	75 04	....	....	112 56	....
Aa	58 96	80 40	....	61 64	125 96	....

The loss of implements has been distinctly smaller than last year, especially so far as nets are concerned. In Skroven only one link was lost, and in Hopen ten to twelve, while, on the other hand, an individual in Kabelvaag has lost two settings. The loss of lines has been proportionally greater in Henningsvær and Balstad. The loss is everywhere attributed to a current, which set westward with unusual strength in the latter half of February. In the beginning of March it set eastward. From many places comes the complaint that the implements are too lightly weighted, both lines and nets, and a desire has been expressed that the law-making power should interfere. In order that the weights, which are at present insufficient, may be satisfactory they must be so heavy as to materially increase the labor of the ordinary daily business, so that it is doubtful how far they will secure any corresponding advantage. There was at one time an association in Stamsund whose members pledged themselves to use anchor-stones of a fixed weight; but, so far as I remember, it existed only one year, and I am not aware that the experiment was repeated.

Of floating implements floating lines were used exceptionally in East Loffoden and more commonly than before in West Loffoden. Floating nets were used only a little westward of Storvaagen, and then nets floated under water were always employed. Eastward nearly one-fourth of the men used surface-floating nets.

The Loffoden fishery this year has been next to the greatest known, as the number of fish caught was at least 27,500,000, including what were used during the fishing and carried in for use at home. It exceeds the catch of the preceding year by one million, and is only a little over a million less than the catch of the rich year of 1877, when the yield to April 14, was 28,750,000. For individual fishermen, on the contrary, the yield was smaller than in any preceding year since 1869, if we except 1869. The average catch, excluding what was used during the fishing or at home, was 970 cod for each fisherman, or 100 fish fewer than the average from 1869 to 1879, both inclusive, while the average price, 20.8 öre for a round fish, is smaller than at any time during the period named. In order that the fishermen, at the prices of the year, should have a net profit of 100 crowns ($26.80), the catch should have been somewhat over six millions greater, or 33,600,000 in all.

Table LX shows how the gross expenses of the fishery, 5,500,000 crowns ($1,474,000), were divided among the different items of expense.

TABLE LX.

Items of expense.	Division of expenses.	
	Total.	Per cent.
License ($14.20 per fisherman)	$385, 920 00	26. 0
Food	343, 040 00	23. 0
Leather goods	58, 960 00	4. 0
Wood and lodging	67, 000 00	4. 5
Bed-clothing	13, 400 00	1. 0
Expense of laying up	72, 360 00	5. 0
Boat hire	91, 120 00	6. 2
Interest and wear and tear	259, 960 00	17. 6
Loss	80, 400 00	5. 4
Bait	107, 200 00	7. 3
	1, 479, 360 00	100

The costs are divided as follows: For implements, 2,010,000 crowns, or 36.5 per cent.; personal expenses of fishermen during the fishery, 2,070,000 crowns, or 37.5 per cent.; and only one-fourth part, 1,440,000 crowns, or 26 per cent., remains for the support of the family and other expenses at home, partly during and partly outside of the fishing season.

The course of the fishery was, in the main, as follows: As early as the beginning of January a considerable number of cod appeared to be present from Vaagen westward, particularly at Stamsund and westward from Sund. Fishing was carried on, however, by several resident fishermen. In the middle of January 900 boats had arrived; but bad weather almost totally prevented work for the rest of the month and during the early part of February. From the middle of February to the 9th of March was the height of the fishing season from Henningsvær westward, and the fishing was partly good from February 24 to March 4, while it was poor eastward, except at Hopen February 27 and 28 and March 1, when it also became to some extent good here, especially with trawl-lines. On the 8th of March exceptionally good fishing began at all stations from Hopen eastward to and including Östnæsfjord; westward there was good fishing, also, everywhere until the 10th, when it became poor at stations from Balstad westward; at the remaining stations the good fishing continued until the 12th, after which date it was poor everywhere. In East Loffoden there was an especially good fishery from March 14 to the 20th, during which week 8,750,000 fish were taken, the largest week's catch known to have been made. The East Loffoden fishing closed, so far as Östnæsfjord is concerned, on the 20th, and at the remaining stations about a week later. At the close of March fishing began again to be sufficiently good, though irregular, from Henningsvær westward. It was, however, not permanent, except at the first-named station and in the region from Sund westward, where it was quite good even until the middle of April.

A peculiarity of this year's fishery was that the cod almost from the beginning remained near the shore; besides, they were found near the surface, and most of the fishing was done at depths of 30 to 40 fathoms, and sometimes less. Their presence in not inconsiderable numbers was proven, also, in many places inside the reef, where they ordinarily seldom appear, as at Islændingen, near Sund, and in various coves of Buksnæsfjord. On a voyage from Stamsund to Balberg Islands, on March 17, the inspection employés observed in many places, where the depth allowed the bottom to be seen, fish as large as cod, all of which were moving northward and towards the land.

Table LXI gives the percentage of fishing days on which there has been good fishing in the different inspection districts.

TABLE LXI *a*.

Inspection district.	Per cent. of good fishing days from January 16 to April 12.									
	Net fishermen.				Trawl-line fishermen.				Day fishermen.	
	January.	February.	March.	April.	January.	February.	March.	April.	February.	March.
Svolvær	......	27	76	......	14	30	70	......	22	78
Skroven	25	0	83	......	0	53	81	......	23	73
Vaagene	......	47	78	......	......	......	*50	......	31	64
Hopen	0	43	94	14	50	80	85	......	55	81
Henningsvær	......	85	50	37	67	95	69	100	64	56
Stamsund	100	..	......	15	......	59	53	......	67	50
Ure	......	90	62	......	0	100	72	......	......	......
Balstad	......	......	†60	......	67	69	74	30	......	......
Sund	......	89	44	100	80	93	47	70	......	......
Sörvaagen	......	80	......	......	......	......	64	70	......	......

*Not used from the middle of March. †Little used.

The course of the fishery this year appears at first view to indicate a movement of the schools of fish first from east to west, then from west to east, and finally again from east to west, since the fishing, which was tolerably good everywhere in the first half of February, was so in the second half and until March 8, almost exclusively from Henningsvær westward; later, on the contrary, and until the close of the month, that is, from the 15th, almost entirely from Hopen eastward. The following facts, however, antagonize this opinion:

1. Fishing began at all the easterly stations on the same day.
2. It continued in West Loffoden with a good yield many days after it had begun in East Loffoden.
3. It closed in West Loffoden at the same time at the majority of the stations.

If there was a marked advance from west to east this should have been shown by an increased fishery from west to east, if only for a short time. Of course from March 4 to the 14th there was no common fishing day, and four whole days were spent ashore, the 6th, 7th, 9th, and 13th, so that it was difficult to follow the course of the fishery. An advance should, moreover, have secured an exceptionally good catch for the implements employed; but this was not so marked as to be conclusive. No relation between the fishing at the different stations, therefore, can be shown this year with certainty. In order to reach a conclusion, if possible, in the future, I shall continue the detailed records of the fishery which I begun in 1878. In the following table is given a synopsis of the course of the fishery during the last three years:

TABLE LXI *b*.

Time.	1878.	1879.	1880.
First half of February.	Eastward of Henningsvær, to and including Svolvær, Raftsundet.	Henningsvær to Balstad.	Westward of Sund. Ordinarily quite good line fishing everywhere.
Second half of February.	Eastward of Henningsvær, to and including Svolvær.	Henningsvær to Stamsund, and part of Skroven.	Westward of Henningsvær.
First half of March	Ure to Hopen...........	Good fishing everywhere.	To the 8th, westward of Henningsvær; from the 8th, eastward of Hopen, to and including Östnæsfjord.
Second half of March ..	Balstad to Vaagen	Westward of Henningsvær.	Eastward of Hopen, to and including Östnæsfjord.
April....................	Westward of Stamsund.	Westward of Balstad	Henningsvær, and westward of Sund.

Since the conditions in Raftsundet, Östnæsfjorden and Gimsöströmmen appear to be, in a measure, similar, I have examined the fishery in these places of late years, as far as there was any to investigate, when I have had the materials to work upon. From the following table it will be seen, meanwhile, that there is no regularity here, as one year there may be fishing in all of the three places, during another year in only one of them. As is well known, all experienced fishermen have fixed signs by which they believe they can foretell the course of the fishery. Though such rules of experience are generally based only on observations within an extremely limited circle, they may possibly have some value, wherefore I seek, as far as possible, to confirm their correctness or incorrectness.

TABLE LXI c.

Year.	Condition of the fishery.		
	Raftsundet.	Östnæsfjorden.	Gimsöströmmen.
1866	Quite good during the first half of March.	Excellent from the end of February to the end of March.	
1868	Almost nothing taken	Good fishing from the end of February to the end of March.	Excellent from the 11th to the 28th of March.
1875	Excellent fishing from the middle of February to past the middle of March.		Small fishery.
1876	Good, partly excellent, about the middle of March.	Small in February	Nothing taken.
1877	Good, partly excellent, from the 5th of March to the beginning of April.	Partly good line fishing during the last half of March.	Quite good in the middle of March, especially from Stamsund.
1878	Quite good about the middle of February.	Small line fishery in the middle of March.	Good, partly excellent, fishing some days in the early part and middle of March.
1879	Nothing caught	Almost nothing taken	Good, partly excellent, 8 days from the middle of March.
1880	do	Excellent fishing from the 8th to the 20th of March.	Good, partly excellent, at the close of February and the beginning of March.

Comparing the catch of each fisherman for some years past, we find the following averages:

	Cod to each man.
In 1869	820
In 1870	1,170
In 1871	1,000
In 1872	1,080
In 1873	1,130
In 1874	850
In 1875	1,260
In 1876	1,080
In 1877	1,310
In 1878	1,090
In 1879	980
In 1880	940

An average of 1,060 cod to each man.

The difference between the highest and lowest catch was 490 cod. From this number, however, we cannot draw any conclusion, as the place where the fishing was done, the number of fishing days, the time at which these days fell, and the time of the arrival of the fleet have considerable influence upon the catch, and the data are accurately determined for the last four years only. Of really excellent fishery years there appear to have been only two during this twelve years period, 1875 and 1877; and of poor years there were also two, 1869 and 1874.

The fishing at the different stations was as follows:

Brettesnæs.—Here there was no fishing.

Skroven.—Inner side (east side). In February there was, in part, a good catch here with nets as well as with lines. There appears, however, to have been no important fishery. West side. In January the fishing was exceedingly small. In February and in the beginning of March it was irregular and light except with trawl-lines during the second and third weeks of February, when these implements brought good and occasionally even excellent results. From the 10th of March to the 22d, on the other hand, the fishing was exceptionally good for all of the implements. At the close of the month it declined, and in April it was poor. The principal fishing this year was at "Höla."

Svolvær.—Trawl-lines were first used December 30, and were hauled on the day following with a catch of 13 cod. The next attempt was made January 10 by three boats, which took 2, 8, and 11 cod respectively. At the close of January the catch amounted to 100 for each boat employed. In February and March the trawl-line fishing was irregular and light as a rule until the 8th, from which time it was uniform and good, sometimes excellent, almost to the close of the month. In April it was light again.

Nets were first used February 9. They were set on the 11th, and caught from 100 to 400. On the 12th the catch of nets set at night was from 100 to 700. If we except the 19th, when nets set at night exceptionally took 800, the fishery was irregular and light until March 8th, from which time it was excellent until the close of the month.

Deep-bait and day-line fishing were poor during the whole time except from the 8th to the 31st of March, when the boats frequently got two or three loads daily.

Östnæsfjorden.—Here the fish were found in January as well as in February, and were caught at Langestrand, even in quite large numbers, in the second week of February, especially with day lines. At the close of February and in the beginning of March the fishing was extremely uncertain until the 8th, at which date it became excellent, and continued so until the 20th, when it suddenly ceased. Thus on the 19th the catch in nets amounted to 2,000, and on night lines, 600; on the 20th these implements caught 900 and 80 respectively. The 21st was Sunday. On the 22d the fishing was extremely uncertain; on the 23d the nets and day lines were not once attempted, and the catch on trawl-lines was from none to 15.

Although the fish disappeared suddenly from Östnæsfjord, they remained in the neighboring district of Svolvær eight days longer; since as late as the 27th as many as 1,200 were caught in nets set at night, and as many as 400 on trawl-lines. The 28th and 29th were holidays. On the 30th the fish here, also, suddenly disappeared; the catch in nets set at night was from 5 to 50. As usual, there were some herring in the fjord.

Vaagene.—The lines set at night, six in number, were hauled for the first time on the 9th of January, and took from 50 to 150 cod per boat. In the first half of February this fishery became, towards the close, irregular, but quite good. Later it was poor until March 8, from which date boats as a rule returned with full loads until the close of the month. In April again it was poor.

Nets were first used January 16 by four boats, which caught 100 cod. In February there was occasional good sea weather, as on the 7th, when the average catch was 300, and from the 14th to the 21st. During the remaining time the fishing was poor, except from March 8 to the 21st, when it became good—in part excellent. On the last-named day the nets took as high as 1,400; on the next sea-going day, April 5, 50–1,200, being an average of 300; on the 6th, on the contrary, from none to 150.

The deep-bait and day-line fishing in February were somewhat better than in the districts previously named. In the plentiful period, from March 8 to 31, there were, however, some days, for instance, the 20th, 27th, and 31st, on which the fishing with this apparatus was poor, though the other implements did well.

Hopen.—Trawl-lines were first used on the 7th of January with a catch of 100 cod. During the rest of the month the catch varied from 20 and 30 to 150. From the 6th of February to the end of March, the trawl-line fishing was uniformly good, often excellent, if we except certain days in the beginning of the last-named month. Thus on the first of March the average catch was 350 fish; from the second to the fourth, on the contrary, only from 70 to 100, whereupon the fishing became uniformly good again, sometimes excellent.

Four nets were first used January 22, and took from 8 to 150 fish. In January and the first half of February the fishing was irregular, mostly poor; during the rest of the month, on the other hand, though generally irregular, it was mostly good. From March 8 to 31 it was uniformly good, though not so excellent as in the more easterly stations.

Deep-bait and day-line fishing, with occasional short interruptions, were next best from the middle of February to the close of March.

The rare occurrence on January 30 is stated of a great school of large and small coal-fish (*Merlangus carbonarius*) inside of "Bikja."

Henningsvær.—Four lines were set for the first time January 8. They were hauled on the 10th, when the highest catch was 150. In February the fishing increased and continued uniformly good, especially at the close of the month, until the middle of March, whereupon it became irregular, mostly poor. In April it increased again, and remained quite good until the middle of the month, when it ceased.

Nets were hauled for the first time, January 22, with a catch of 40 cod; the second time, January 28, with a catch of 250 cod. As the line fishing increased in February, so also did the net fishing, but the latter was more uniform. The best fishing occurred at the end of February and in the beginning of March. From the middle of March to the close of the fishery it was, with some exceptions, rather irregular and mostly poor.

Day-line and deep bait fishing became good, sometimes very good, at the end of February and the beginning of March. The rest of the time they were poor, and ceased in some places entirely from the middle of March, when the majority of the boats shifted eastward.

Gimsöströmmen.—Fishing was good here from the middle of February until near the middle of March, sometimes excellent during certain days at the beginning and end of the months named.

Stamsund.—Four lines set at night were hauled for the first time, January 10, near shore with a catch of 30 to 80 cod. During the four sea-going days which occurred in the week between the 11th and the 17th of January, the catch was uniformly good, up to 300 per boat. Between the end of January and the middle of February there were nearly two days of poor fishing; from the middle it remained good until towards the middle of March. Later it was irregular and poor.

Nets (set two or three nights) were first hauled January 17, and they took from 300 to 950 cod. If we except the close of the second week of February, this mode of fishing was good until the middle of March, whereupon it became poor, and so remained for the rest of the fishery.

Deep-bait fishing was good at the end of February and the beginning of March.

Ure.—Lines (set at night) were hauled first on the 8th of January with a yield of 40 to 50 cod, which catch on the following week increased to about 100 on two to three tubs of trawl. From the beginning of February to the middle of March fishing was uniformly good; later, with the exception of a couple of days at the close of the last-named month, on the contrary, it was poor.

One net set January 28 was first lifted February 4 and caught 12 cod. On the 5th two boats hauled one which was set at night, and they took 8 and 13, respectively. From February the fishing was nearly as in Stamsund, and likewise here during the last week of February and the early part of March it was excellent.

Day lines, which went into use in the beginning of March, did well until the middle of the month.

Balstad.—In the second week of February line fishing was variable and poor, but after that quite good until the middle of March. At the close of this month and in the beginning of April there was some good sea-going weather also.

Net fishing begun with March and then became quite good, and for a few days even very good, until the middle of the month.

In the middle of February cod were observed in Buksnæsfjord, as the native fishermen caught on night lines as well as day lines from 5 to 30 fish. There was no fleet up there, however, before the middle of March. Nets and lines set on the 16th in Gravdal Bay and Gjerstad Cove were hauled on the following day with a catch of 100 to 150. On the 18th the fishing was quite good, especially with nets, but extremely variable. On the 19th and 20th many fishermen gathered and succeeded well with nets—on the 20th exceedingly well even with day lines, while the night-line fishery was small. On the 22d the fishing was ended. Since small herring were seen at the same time in the fjord, the cod are supposed to have followed them. The cause of this fishery can hardly be ascribed exclusively to the herring, since these were present in large schools as well before the cod appeared in any abundance as after the close of the fishing. The fishing took place in from 16 to 30 fathoms of water.

Sund.—Lines were first used January 6, and caught from 50 to 100 cod. Later the fishing was done farther in, and the catch here appeared to be somewhat more uniform. In February and until March 11 the fishing was evenly good; later it was poor, until the close of the month, when it again became good. In April it was variable, mainly good, until the 9th, when it began to be small.

Nets were first used by two boats January 28, with a catch of 200 cod. After that this fishery became about like the line fishery.

On the 6th of March fish were observed at "Islændingen" (the lower part of Sundströmmen). In the following week fishing was carried on here by all kinds of implements; but the catch was extremely irregular, because the weather was unfavorable to the business.

Sörvaagen.—Trawl-line fishing here was somewhat better, net fishing somewhat smaller, than at Sund.

Table LXII shows the catch at the remaining cod fisheries which were of any importance.

TABLE LXII.

Place.	Yield of the cod fisheries in 1880.					
	Fish.			Liver.	Medicinal oil.	Roe.
	Total.	Kinds.				
		Salted.	Dried.			
	1,000 fish.			Barrels.		
Finmarken	23,000	13,500	9,500	3,400	....	....
Dverberg	278	44	234	700	24	300
Öksnæs	900	270	630	2,950	....	1,400
Bö	876	90	786	2,300	....	1,200
Gimsö	350	20	330	1,100	....	450
Borge	500	100	400	1,700	....	700
Væro and Röst	770	330	440	2,060	....	1,000
"Outside"	3,674	854	2,820	10,810	24	5,050
Skærvö	55	10	45	100	....	....
Lyngen	3	....	3	10	....	....
Berg and Torsken	40	40	....	120	....	70
Trondenæs	25	10	15	80	....	30
Tranö	4	3	1	10	....	....
Rödö	330	150	180	1,130	....	560
Herö	64	50	14	250	....	120
Lurö	300	50	250	700	....	200
Rest of Nordland and Tromsö	821	313	508	2,400	....	980
Namdalen	Small	....	....	....	....	....
Nordmöre	3,500	....	....	7,000		....
Romsdalen	1,500	....	....	*600	950	1,100
Söndmöre	5,800	....	....	†12,000		11,000
South Bergenhus	1,250	....	....	....	....	....

*Oil. †4,500 barrels of this was medicinal oil.

Table LXIII gives the yield of the winter and spring fisheries for the last five years, and the aggregate export, reckoning 50 fish to the hundred-weight of split cod and 75 of dried cod.

TABLE LXIII.

[In millions.]

Fishery.	Yield of the winter and spring fisheries.									
	1875.		1876.		1877.		1878.		1879.	
	Split cod.	Dried cod.	Split cod.	Dried cod.	Split cod.	Dried cod.	Split cod.	Dried cod.	Split cod.	Dried cod.
Finmarken	9.9	9.8	2.2	3.1	8.9	8.6	6.3	5.6	11.2	7.4
Nordland & Tromsö	16.5	23.2	19.9	20.7	28.3	25.7	......	......	22.5	19.4
Namdalen	0.8	......	0.9	......	1.5	......	0.4	......	0.3	......
Fosen	1.3	......	0.9	......	1.3	......	0.9	......	0.8	......
Nordmör	2.5	......	1.7	......	2.7	......	2.4	......	2.0	......
Romsdalen	0.9	......	0.5	......	0.9	......	0.9	......	0.9	......
Söndmör	2.8	......	1.8	......	4.3	......	3.0	......	5.0	......
Sönd & Nordfjord	0.5	......	0.2	......	0.3	......	0.4	......	......	......
Söndre Bergenhus	......	......	......	......	......	......	0.03	......	......	......
Stavanger	......	......	......	......	......	......	0.03	......	......	......
Total	35.2	33.0	28.1	23.8	48.2	34.3	......	......	42.7	26.8
Exported	36.8	31.3	33.0	29.5	45.9	31.7	41.0	24.0	44.7	31.0

Tables LXIV to LXXII show the export of cod from Norway, Canada, St. John's (Newfoundland), the United States, Iceland, France, Scotland, and Holland from 1872 to 1878. Thus from the fish-exporting places returns are wanting from St. Pierre and Miquelon (Newfoundland) and the Faroe Islands only.

In the report for last year the export from Canada in 1876 is erroneously stated.

In the United States the fiscal year is reckoned from July 1 to June 30. In the other places, on the contrary, from January 1 to December 31.

In the Scotch fishery statistics it is not stated specially to what country the export was made. After comparing it with the English trade statistics, I believe that I have committed no important error in stating that the export to "the continent" went exclusively to Spain, and that to "places outside of Europe" to the British West Indies.

For Iceland, no official statistics are known to me, and I have taken as the basis of my calculation the export to Denmark and statements from a private individual for 1878 and 1879. According to an article by Hen. M. Lindeman, in Dr. A. Petermann's Mittheilungen, 60th part, the total export was:

	Split cod.	Dried cod.
	Pounds.	*Pounds.*
1873	6,500,000	230,000
1874	8,700,000	270,000
1875	5,900,000	190,000

My estimate was too high.*

* The fact that I have not undertaken any corrections in the tables is owing to their having been worked out last autumn, and I have not had time to change them, since it was necessary for me to finish my report as early as possible, in order to be able to attend the fishery exhibition at Berlin before its close.

Nor am I in possession of any official statistics for the Faroe Islands. According to the author named above, the export was—

	Split cod.	Dried cod.
	Pounds.	*Pounds.*
1868	1,700,000	150,000
1869	2,200,000	170,000
1870	3,700,000	140,000
1871	3,300,000	30,000
1872	2,900,000	20,000
1873	2,900,000	80,000
Average	2,780,000	100,000

or not quite one and one-half million fish (1,465,000) yearly, one-third of which were shipped to Denmark.

From Belgium was carried on a not unimportant bank fishery in the North Sea, though of late years not to the same extent as formerly. The catch, which for the most part was consumed within the country itself, was—

	Barrels.
In 1872	10,400
In 1873	11,500
In 1874	11,300
In 1875	9,700
In 1876	9,200
In 1877	9,400
In 1878	9,200
In 1879	7,600

An average of 9,800 barrels, or about one-half million fish yearly.

The export from Newfoundland must be greater than is given in the tables from St. John's. According to a statement received during the negotiations on the occasion of the fishery treaty between the United States and Canada the amount exported from the region extending from the Rameau Islands to Cape Race, and therefrom northward to Twillingate, was, in

	Quintals.
1868	829,000
1869	791,000
1870	915,000
1871	928,000
1872	847,000
1873	983,000
1874	1,183,000

An average of 925,000 quintals. For the last three years the average was 1,004,000 quintals, or 102,400,000 pounds, while the export from St. John's for the same time is given by the Commercial Journal as 76,300,000 pounds; the difference, 26,100,000 pounds, must have been sent out from other places on the coast. Since this discrepancy is considerable, and since Newfoundland competes with Norway in the English, Spanish, Portuguese, and Italian markets, the accuracy of the statement has considerable importance for Norwegian exporters, wherefore I venture to ask that inquiry may be made through the consulate as to whether and to what extent there is opportunity to obtain statements of Newfoundland's total export.

According to French reports the participation of St. Pierre and Miquelon in the Newfoundland fishery has increased not inconsiderably. I have, however, seen no report of the amount exported, wherefore I venture to beg that information in this respect may also be procured, so far as these places are concerned, through the consulate in Quebec.

The yield of the French fisheries is, for the greatest portion of the amounts given, from the weight of fish in salt. The bulk of the exported portion, however, is dried.

The yield of the fishery of the United States for 1876 and 1879 is stated to be only one-half that of the two preceding years. To judge from the number of incoming fishing vessels the reports for 1876 and 1877 cannot be correct.

TABLE LXIV.

[Times 100,000 pounds.]

Where to.	Export of split cod from Norway.								
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.	1879.
Great Britain and Ireland	24.0	16.2	21.3	40.5	43.9	58.3	20.3	32.1	38.7
Hamburg and Bremen	20.7	24.9	25.5	36.2	33.1	66.1	63.6	38.6	62.1
Portugal	41.2	27.1	16.1	55.3	58.7	121.7	146.6	66.7	105.4
Spain	465.5	422.2	463.7	515.9	474.2	582.8	531.8	493.7	643.9
Italy and Austria	1.7	0.9	0.7	19.8	10.6	29.4	18.1	11.6	17.5
Holland	0.7	1.0	0.2	0.7	0.7	1.0	0.4	0 7	0.5
West Indies	39.9	54.2	63.9	43.4	35.1	50.5	32.0	45.6	23.1
Brazil	13.1	10.9	5.9	19.5	....	3.9	3.2	8.1	....
Other countries	12.9	2.1	2.2	5.3	4.5	3.5	3.4	4.8	2.3*
Total	619.7	559.5	599.5	736.6	660.8	917.2	819.4	701.8	893.5
Million fish, estimating 50 per hundred-weight.	31.0	28.0	29.8	36.8	33.0	45.9	41.0	35.1	44.7

* To France 1.8; to Denmark 0.2.

TABLE LXV.

[Times 100,000 pounds.]

Where to.	Export of dried cod from Norway.								
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.	1879.
Sweden	69.0	70.9	64.4	70.6	79.6	80.2	63.2	71.1	45.1
Denmark	3.9	4.8	9.1	7.5	5.2	8.5	7.9	6.7	1.7
Great Britain and Ireland	6.1	3.8	4.1	5.2	4.5	3.1	4.2	4.4	7.2
Russia and Finland	21.2	25.4	30.5	38.9	34.3	26.4	32.1	29.8	28.3
German ports on the Baltic	0.8	1.9	2.6	1.4	1.0	1.0	2.0	1.5	0.9
Hamburg and Bremen	3.3	4.8	4.1	7.0	6.0	6.1	6.0	5.3	13.1
Holland	48.3	69.5	57.0	61.5	71.1	59.5	57.0	60.6	67.6
Belgium	15.9	22.0	19.2	24.4	18.9	21.6	14.7	19.5	18.1
France	1.0	3.3	....	3.3	3.0	4.7	4.3	2.8	2.0
Spain	4.5	3.8	16.7	9.1	1.2	6.1	12.6	7.7	7.6
Italy and Austria	173.0	151.2	176.8	187.4	166.8	205.1	114.4	167.8	220.0
United States	....	0.2	0.2	0.5	0.1	0.1	0.6	0.2	0.8
West Indies	0.3	0.5	0.8	0.5	0.5	0.1	0.6	0.5	0.4
China	2.6	5.2	....	....	....	....	....	1.1	....
Other countries	0.5	0.6	0.1	0.1	1.4	0.1	0.7	0.5	....
Total	350.4	367.9	385.6	417.4	393.6	422.6	320.6	379.7	412.8
Million fish, estimating 75 per hundred-weight.	26.3	27.6	28.9	31.3	29.5	31.7	24.0	28.5	30.9

TABLE LXVI.

[Times 100,000 pounds.]

Where to.	Export of split cod from Canada.								
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.	1879.
Great Britain and Ireland	21.9	26.5	32.7	20.1	10.7	17.9	18.0	21.1	40.1
Portugal	20.2	31.1	35.5	8.0	14.0	12.2	10.7	18.8	24.0
Spain	5.4	5.5	......	......	......	......	......	1.8	......
Italy	......	......	......	......	31.7	35.1	33.5	......	42.8
Italy and Austria	52.2	43.6	45.5	38.9	......	......	......	36.2	......
Austria	......	......	......	......	......	2.3	2.3	......	2.3
United States	19.9	47.6	70.6	44.7	43.2	91.1	87.5	57.8	82.2
Newfoundland	......	......	......	1.2	7.3	1.2	18.2	4.0	6.3
British West Indies	......	......	......	......	216.2	263.2	265.9	......	......
Spanish West Indies	......	......	......	......	154.9	189.6	181.5	......	......
French West Indies	......	......	......	......	51.2	42.7	55.9	......	......
Hollandish West Indies	544.5	474.3	544.4	512.1	493.4 {	506.00 { 0.1	512.5 { 0.1	504.7	583.7
Danish West Indies	......	......	......	......	5.4	3.1	4.8	......	......
Hayti	......	......	......	......	11.7	7.3	4.3	......	1.6
Guiana	......	......	27.9	......	31.8	32.7	25.5	16.8	29.5
South America	39.3	28.8	36.7	44.1	59.0	71.8	78.4	51.3	68.6
Madeira	......	......	......	......	3.0	6.4	3.4	1.8	0.3
Africa	......	......	..	......	0.3	0.1	......	......	......
Other countries	4.5	11.6	4.0	2.6	1.5	......	......	3.5	......
Total	707.9	690.6	797.3	671.7	641.9	776.8	790.0	725.2	881.4*
Million fish	35.4	34.5	39.9	33.6	32.1	38.8	39.5	36.3	44.1
Catch	41.0	44.9	40.7	38.1	42.3	41.6	46.0	42.1	57.3

*315.6 of these in the first 6 months, 565.8 in the last 6 months.

TABLE LXVII.

[Times 100,000 pounds.]

Where to.	Split cod exported from St. John's.								
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.	1879.
Great Britain and Ireland	24.5	47.7	42.3	24.9	24.9	43.0	39.4	35.4	48.3
Portugal	87.1	85.2	109.4	104.7	87.9	67.8	89.6	90.2	125.0
Spain	180.8	236.2	222.6	134.5	156.6	112.4	79.5	160.4	138.1
Italy	10.1	13.7	49.0	25.9	27.3	22.7	30.3	25.6	43.2
United States	8.2	8.6	17.1	3.1	3.8	5.3	10.3	8.1	17.8
Canada	2.3	21.3	15.4	0.5	1.5	......	2.1	6.2	7.1
British West Indies	68.4	75.1	91.9	67.4	58.3	66.5	50.4	68.3	57.6
Brazil	221.3	235.8	285.5	244.5	204.7	265.1	242.0	242.7	346.6
Other countries	35.2	43.6	51.5	49.3	13.3	26.1	19.7	34.1	15.3
Total	637.9	767.2	884.7	654.8	578.3	609.0	563.3	670.7	799.0
Million fish, estimating 50 to a hundred-weight.	31.9	38.4	44.2	32.7	28.9	30.4	28.2	33.5	39.9

TABLE LXVIII.

[Times 100,000 pounds.]

Where to.	Export of dried and smoked cod from the United States.				
	1876.	1877.	1878.	Average.	1879.
Great Britain and Ireland	....	0.4	1.1	....	9.9
Hamburg	....	0.1	....	....	....
Newfoundland and Labrador	2.7	11.8	25.6	19.6	0.4
Canada	21.3				18.6
Colambia	1.9	....	....	....	2.0
West Indies:					
Honduras and British West Indies.	3.8				6.5
Danish West Indies	16.5 { 0.1	15.1	17.0		0.6
St. Domingo	5.1				3.6
Porto Rico	150.4 { 7.5	143.1	157.2	150.2	132.5 { 1.3
Hayti	81.5	63.3	94.7		74.0
Cuba	14.5	18.9	7.3		25.7
French West Indies	19.2	20.3	21.6		20.8
Hollandish West Indies	19.1	25.5	16.6		0.4
British Guiana	1.2	....	....	....	0.9
Hollandish Guiana	....	....	....	....	15.7
Brazil	0.3	....	0.3	0.2	0.5
South America	1.0	1.8	1.4	1.4	11.0
Other countries	....	4.9	8.0	4.3	8.2
Total	178.0	161.9	193.6	177.8	200.0
Million fish, estimating fifty to a hundred-weight.	8.9	8.1	9.7	8.9	10.0
Yield of the cod fisheries, in hundred-weights.	728	735.4	306.1	....	325.1
Number of fishing vessels arriving.	....	461	732	....	752
Draught in tons	....	19,000	26,700	....	29,900

TABLE LXIX.

[Times 100,000 pounds.]

Year.	Denmark—dried and dry-salted cod.						
	Imported.					Exported.	Consumed.
	Faroe Islands.	Iceland.	Greenland.	Other countries.	Total.		
1872	9.6	21.0	0.4	2.4	33.4	10.2	23.2
1873	8.3	19.7	....	5.2	33.2	9.2	24.0
1874	8.1	22.8	0.3	6.7	37.9	12.6	25.3
1876	13.9	18.0	0.5	3.0	35.4	7.6	27.8
1877	10.5	35.6	....	5.5	51.6	13.9	37.7
1878	10.0	35.0	....	....	....	....	....

REMARK. In 1879 there was exported from Iceland 200,000 pounds of dried cod and 12,500,000 pounds of split cod, to the following places:

	Pounds.
Spain	6,850,000
Copenhagen	3,650,000
Great Britain and Ireland	2,000,000
	12,500,000

From the Faroe Islands were exported in 1879 2,000,000 pounds of split cod and 100,000 pounds of dried cod.

TABLE LXX.

[Times 100,000 pounds.]

Destination.	Salted and dried cod exported from France.							
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.
Great Britain and Ireland	0.1				0.5			0.1
Spain		7.4		3.1	3.2		3.3	2.8
Italy and Austria	43.2	38.4		42.6	37.7	27.2	34.7	37.3
Algiers	7.1	9.8		7.1	9.7	10.6	12.0	9.4
Greece	13.4	15.9		6.8	11.0	3.8	10.3	10.2
Turkey and Egypt	6.8	6.4		4.5	4.0	2.8	3.9	4.7
West Indies	0.3	8.5		1.0		5.7	1.6	2.8
South America	2.8	0.2						0.5
Other countries	3.9	5.4		10.0	3.7	10.6	11.1	7.4
Total	65.6	92.0	114.0	75.1	69.8	60.7	76.9	79.2
Million fish, estimating 50 to a hundred-weight.	3.3	4.6	5.7	3.8	3.5	3.0	3.8	4.0
Yield:								
In salt	615.9	668.2	582.6	558.1	549.1	589.3	673.4	605.2
Dried	148.0	127.8	123.2	87.0	101.0	83.1	81.8	107.4
Other products	18.3	18.9	23.1	22.5	17.5	19.3	22.3	20.3
Total	782.2	814.9	728.9	667.6	667.6	691.7	777.5	732.9

TABLE LXXI.

[Times 100,000 pounds.]

Year.	Split cod, exported from Scotland.				Millions of fish caught.
	Destination.			Total.	
	Ireland.	The Continent (Europe.)	Places outside of Europe.		
1872				53.6	
1873	38.4	23.1	8.6	70.1	
1874	30.3	21.3	9.4	61.0	4.5
1875	43.5	25.7	12.7	81.9	5.8
1876	28.9	25.0	5.9	59.8	3.5
1877	41.2	23.3	8.9	73.4	6.0
1878	42.9	40.3	11.8	95.0	0.2
Average	37.5	26.4	9.5	70.7	5.2
Millions of fish, estimating 50 per hundred-weight	1.9	1.3	0.5	3.5	

TABLE LXXII.

[Times 100,000 pounds.]

Year.	Cod, salted, in barrels, exported from Holland.			Catch, in millions.
	Belgium.	Germany.	Total.	
1872	8.1	4.8	12.9	1.4
1873	10.9	5.9	16.8	1.7
1874	5.4	8.1	13.5	1.4
1875	5.1	6.5	11.6	1.4
1876	10.6	8.3	18.9	1.4
1877	10.8	8.7	19.5	1.7
1878	6.7	5.3	12.0	1.4
Average	8.2	6.8	15.0	1.5
Fish, estimating 17 per hundred-weight	139,400	115,600	255,000	

Table LXXIII contains a summary of the annual export. Including the Faroe Islands, the total was 154,500,000 yearly, of which 28,500,000 was dried cod, and 126,000,000 split cod. Of the whole amount, again, 75,000,000 were caught in European and 79,500,000 in American waters. The amount exported was greatest from Norway, 63,600,000, or 41 per cent.; next from Canada, 36,300,000, or 23½ per cent.; next from St. John's, 33,500,000, or 21¾ per cent.; next from United States, 6,800,000, or 4½ per cent.; next from Iceland, 5,000,000, or 3¼ per cent.; next from France, 4,000,000, or 2½ per cent.; next from Scotland, 3,500,000, or 2¼ per cent.; next from Faroe Islands, 1,500,000, or 1 per cent.; finally from Holland, 300,000, or ¼ per cent.

TABLE LXXIII.

Where from.	Total export in millions.							
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.
Norway:								
Dried cod	26.3	27.6	28.9	31.3	29.5	31.7	24.0	28.5
Split cod	31.0	28.0	29.8	36.8	33.0	45.9	41.0	35.1
Canada	35.4	34.5	39.9	33.6	32.1	38.8	39.5	36.3
St. John's	31.9	38.4	44.2	32.7	28.9	30.4	28.2	33.5
United States	5.0	5.0	5.0	6.1	8.9	8.1	9.7	6.8
Iceland	4.5	4.5	5.0	5.0	4.0	5.6	5.6	5.0
France	3.3	4.6	5.7	3.8	3.5	3.0	3.8	4.0
Scotland	2.7	3.5	3.0	4.1	3.0	3.7	4.7	3.5
Holland, barreled fish	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.3
Total split cod	114.0	118.8	132.8	122.3	113.7	135.8	132.7	124.5
Total of fish	140.9	146.4	161.7	153.6	143.2	167.5	156.7	153.0

Table LXXIV gives a summary by weight of the split cod imported, and Table LXXV by number. The amount of dried cod imported is stated in Table LXV. The importation of cod during the last seven years has varied as follows: In the West Indies, 4,900,000 (35,300,000 to 40,200,000); in Spain, 3,600,000 (35,500,000 to 39,100,000); in Brazil, 4,400,000 (10,200,000 to 14,600,000).

In Portugal, Germany, and Denmark the importation has been steadily increasing. In most other countries the amount consumed appears to be tolerably uniform year by year. When the amount imported exceeds the average one year, it falls below it during the next two. The considerable increase in the manufacture of split cod which has taken place in Loffoden of late years, namely, from 10,000,000 to 11,000,000 in the beginning of the seven-year period to double that amount at the end of the period, exceeds by a couple of millions the difference between the lowest and the highest amount imported by the two countries (Spain and the West Indies) which consume three-fifths of the split cod, and one-half of all the cod in other forms which come upon the market.

The exports have varied as follows: From Norway, dried cod, 7,700,000 (24,000,000 to 31,700,000); split cod, 17,900,000 (28,000,000 to 45,900,000); total, 22,000,000 (55,600,000 to 77,600,000). From Canada, 7,800,000

(32,100,000 to 39,900,000); from St. John's, 16,000,000 (28,200,000 to 44,200,000); from United States, 4,700,000 (5,000,000 to 9,700,000); from Iceland, 2,500,000 (3,100,000 to 5,600,000); from France, 2,700,000 (3,000,000 to 5,700,000); from Scotland, 2,000,000 (2,700,000 to 4,700,000); from various countries, 26,600,000 (140,900,000 to 167,500,000).

TABLE LXXIV.

Destination.	Total import (of split cod). Times 100,000 pounds.								
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.	Million fish.
West Indies	751.1	714.7	803.6	751.0	705.6	780.7	765.5	753.2	37.7
Spain	732.7	754.4	772.6	746.2	711.0	781.5	717.9	745.2	37.3
Brazil	234.4	246.7	291.4	264.0	205.0	269.0	245.5	250.9	12.5
Portugal	148.5	143.4	161.0	168.0	160.6	201.7	246.9	175.7	8.8
Great Britain and Ireland	109.1	138.8	138.6	142.0	118.9	173.6	134.7	136.5	6.8
Italy and Austria	107.2	96.6	132.5	127.2	107.3	116.7	118.9	115.2	5.8
United States	28.1	56.2	87.7	47.8	47.0	96.4	97.8	65.9	3.3
South America	42.1	29.0	36.7	44.1	60.0	73.6	79.8	52.2	2.6
Germany	22.3	26.9	28.2	38.4	35.9	69.1	65.4	40.9	2.0
Denmark	30.6	28.0	30.9	35.4	31.9	46.1	45.0	35.4	1.8
British Guiana	......	......	27.9	......	33.0	32.7	25.5	29.8	1.5
Mediterranean	27.3	32.1	24.3	18.4	24.7	17.2	26.2	24.3	1.2
Canada	2.3	21.3	15.4	0.5	22.8	11.8	27.7	14.5	0.7
Newfoundland	......	......	......	1.2	10.0	1.2	18.2	4.4	0.2
Other countries	62.5	68.7	71.1	74.8	28.2	51.6	45.6	57.5	2.9
Total	2298.2	2346.8	2621.9	2459.0	2301.9	2722.9	2660.6	2501.6	125.1
Millions of fish	114.9	117.3	131.1	122.9	115.1	136.1	133.0	125.1	......

TABLE LXXV.

[Millions of fish.]

Country.	Total import (of split cod).							
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average.
West Indies	37.6	35.7	40.2	37.6	35.3	39.0	38.2	37.7
Spain	36.6	37.7	38.6	37.3	35.5	39.1	36.0	37.3
Brazil	11.7	12.3	14.6	13.2	10.2	13.4	12.3	12.5
Portugal	7.4	7.2	8.0	8.4	8.0	10.1	12.3	8.8
Great Britain and Ireland	5.5	6.9	6.9	7.1	5.9	8.7	6.7	6.8
Italy and Austria	5.4	4.8	6.6	6.4	5.4	5.8	5.9	5.8
United States	1.4	2.8	4.4	2.4	2.3	4.8	4.9	3.3
South America	2.0	1.4	1.8	2.2	3.0	3.7	4.0	2.6
Germany	1.1	1.3	1.4	1.9	1.8	3.5	3.3	2.0
Denmark	1.5	1.4	1.5	1.5	1.6	2.3	2.2	1.8
British Guiana	......	......	1.4	......	1.6	1.6	1.3	1.5
Mediterranean	1.4	1.6	1.2	0.9	1.2	0.9	1.3	1.2
Canada	0.1	1.1	0.8	......	1.1	0.6	1.4	0.7
Newfoundland	......	......	......	0.1	0.5	0.1	0.9	0.2
Other countries	3.1	3.4	3.6	3.7	1.4	2.6	2.3	2.9
Total	114.8	117.6	131.0	122.7	114.8	136.2	133.0	125.1

Table LXXVI contains a summary of the total import. Of the whole quantity exported, 57,600,000, or 37.4 per cent., went to America; 92,000,000, or 59.9 per cent., to Europe; and 4,000,000, or 2.6 per cent., to unknown places.

The most important markets were: Spain, which received 37,900,000, or 24.7 per cent.; West Indies, which received 37,700,000, or 24.5 per cent.; Italy and Austria, which received 18,400,000, or 12 per cent.; Brazil, which received 12,500,000, or 8.2 per cent.; Portugal, which received 8,800,000, or 5.8 per cent.; Great Britain and Ireland, which received 7,200,000, or 4.7 per cent.; Sweden, which received 5,300,000, or 3.4 per cent.; Holland, which received 4,500,000, or 2.9 per cent.

TABLE LXXVI.

Country.	Total average import from 1872-1878.	
	Millions.	Per cent.
Spain	37.9	24.7
West Indies	37.7	24.5
Italy and Austria	18.4	12.0
Brazil	12.5	8.2
Portugal	8.8	5.8
Great Britain and Ireland	7.1	4.7
Sweden	5.3	3.4
Holland	4.5	2.9
United States	3.3	2.2
South America	2.6	1.6
Germany	2.5	1.6
Denmark	2.3	1.5
Russia and Finland	2.2	1.5
Belgium	1.6	1.0
Mediterranean	1.4	0.9
British Guiana	1.5	0.9
Other countries	4.0	2.6
Total	153.6	100.

I shall furnish, toward the close of the year, to one of our newspapers, tables of export in 1879, just as I did last year. With these statistics, and a general abstract of the year's fisheries as a starting-point, one will have a tolerably accurate basis for judging the state of affairs in 1881. It will, therefore, be very useful if the consuls render, as soon as the fishery in a country ends, and also concerning the autumn cod fisheries, a short report on its results—that is to say, whether it has been unsuccessful, tolerably good, or good. According to the material which lies before us, the exports for 1879 will presumably exceed those of all preceding years. The effects hereof will be traced in 1881, and, since the Norwegian fisheries have given an unusually good yield this year, the prospects of fair prices during the coming Loffoden fishing are not promising, even if the other fisheries should reach the results of an average year.

INDEX.

VI.—EXTRACTS FROM NORWEGIAN OFFICIAL STATISTICS OF FISHERIES FOR THE YEAR 1880.*

By Boye Strôm, *Clerk.*

As the introduction to the fishery statistics for the year 1878 furnishes a full summary of the results of the Norwegian fishing industry during the decade from 1869 to 1878, I shall on the present occasion confine myself to setting forth the most important data presented by the statistics for 1880 as compared with those of 1879 and with those of the above-named decade.

The total money value of the Norwegian coast fisheries, the fishing for home use excepted, on the basis of the prices paid at the fishing-stations in 1880, was 22,579,000 crowns [$6,051,172]. In 1879 the yield was somewhat less, namely, 21,340,000 crowns [$5,719,120], but in the decade from 1869 to 1878 the average annual yield was 23,211,000 crowns [$6,220,548].

The values here quoted, which represent the annual gross receipts which the industry has yielded the fishermen, are thus divided among the different kinds of fisheries:

Fisheries.	1880.		1879.		Average 1869–1878.	
	Value.	Per cent.	Value.	Per cent.	Value.	Per cent.
Cod	$3, 360, 452	55. 5	$3, 666, 776	64. 1	$3, 731, 096	60. 1
Fat herring	1, 534, 568	25. 4	1, 038, 232	18. 1	1, 008, 484	16. 2
Sprat and other small herring	138, 288	2. 3	69, 948	1. 2	90, 048	1. 4
Great herring					349, 472	5. 6
Spring herring	230, 748	3. 8	210, 380	3. 7	272, 556	4. 4
Mackerel	186, 528	3. 1	182, 508	3. 2	194, 300	3. 1
Summer fishing for pollock, ling, &c	388, 064	6. 4	367, 428	6. 5	406, 556	6. 6
Salmon and sea trout	102, 376	1. 7	90, 048	1. 6	90, 048	1. 4
Lobster	108, 540	1. 8	91, 656	1. 6	75, 844	1. 2
Oyster	1, 608		2, 144		2, 144	
Total	6, 051, 172	100. 0	5, 719, 120	100. 0	6, 220, 548	100. 0

Of the total money value in 1880, the sum of 5,734,000 crowns [$1,536,712] was produced by the cod fishery in the Loffoden inspection district, which sum is a little less than the average result of this fishery, which may be estimated at about 6,500,000 crowns [$1,742,000].

As regards the catch in numbers, the cod fisheries in 1880 furnished a total yield of 68,273,000, which not only considerably exceeds the average of the above-named decade, this having been only 49,200,000,

* *Norges officielle Statistik. Ny Række. Udgiven i Aaret* 1882. *C. No.* 9. *Tabeller vedkommende Norges Fiskerier i Aaret* 1880 *samt Beretninger angaaende deres Drift m. v. Udgivne af det statstiske Central Bureau. Kristiania. I Kommission hos H. Aschehoug & Co.* Translated by Tarleton H. Bean.

but even surpasses the catch of the year 1877, which, until now, was the largest known. The fishery in the Loffoden inspection district yielded 27,500,000, while in 1879 26,300,000 were caught there, and the average annual catch from 1869 to 1878 was about 21,800,000, with, however, a maximum in 1877 of 28,400,000. The fat herring fisheries, which ever since 1876 have been decreasing, and which in 1879 did not yield more than 443,000 hectoliters [1,257,012½ bushels], increased greatly in 1880, and yielded not less than 720,000 hectoliters [2,043,000 bushels]. Of this amount 440,000 hectoliters [1,248,500 bushels] were taken in Loffoden and Vesteraalen inspection districts alone, and the great majority of these—about 420,000 hectoliters [1,191,750 bushels]—were caught in Eidsfjord.

For information concerning the prices of fish at the fishing stations is given the following tabular synopsis:

	1880	1879	1869–'78
Cod fisheries (excepting with capelin) .... per 1,000 round fish..	$58 96	$65 39	$84 15
Capelin fishery (for cod) .... do ..	30 55	37 25	52 26
Fat herring .... per hectoliter*..	2 14	2 33	} 1 54
Sprat and other small herring fishery .... do....	64	54	
Spring herring fishery .... do....	3 75	2 36	1 49
Mackerel fishery .... per 1,000 round fish..	32 43	30 02	30 82
Salmon and sea trout fishery .... per kilogram†..	29	28	29
Lobster fishery .... per 1,000..	90 05	81 74	‡79 86
Oyster fishery .... per hectoliter*..	6 70	6 16	....

* One hectoliter equals 2 bushels, 3.35 pecks, or 26.417 wine gallons.
† One kilogram equals 2.2046 pounds avoirdupois.
‡ In the years 1876–'78.

The number of men engaged in the fisheries in 1880 was as follows: The capelin fishery (for cod) employed 17,084 men against 18,996 in 1879, and 14,200 on the average during the years 1870–1878. In the remaining cod fisheries 63,357 fishermen took part; the number in 1879 was 64,593, and in the decade 1869–1878 the average was about 52,000. In the fat herring fisheries 35,130 fishermen were engaged this year as against 32,476 in 1879. During the years 1876–'78, on the contrary, the number of these fishermen was as high as 41,000.

The average catch which fell to each fisherman for the year 1880, compared with 1879, was as follows.

Fish yield.	Quantity per man.		Money value per man.	
	1880.	1879.	1880.	1879.
Cod fisheries (except with capelin)	707	708	$41 81	$46 36
Capelin fishery (for cod)	1,376	923	41 81	34 57
Fat herring fishery .... bushels..	58	38.8	43 68	31 89
Mackerel fishery with drag nets	1,618	1,948	52 53	58 42

In conclusion, several tables, compiled principally from trade statistics, are given, which show the exportation of fish products since 1856 and the prices obtained for them during the years 1871–1880.

CHRISTIANIA, *September* 29, 1882.

TABLE I.—*Synoptical table of the exports of fish products since 1856.**

Fish products.	Average amount annually.					Annual amount.				
	1856–1860.	1861–1865.	1866–1870.	1871–1875.	1876–1880.	1876.	1877.	1878.	1879.	1880.
A.—QUANTITY.										
1. Spring herring......hectt..	518, 300	702, 450	538, 092	84, 181	42, 395	27, 384	19, 256	41, 220	72, 633	51, 480
2. Other herring.........do...	174, 000	235, 946	466, 669	955, 446	735, 313	1, 013, 261	776, 042	744, 101	658, 312	484, 853
3. Anchovies............do...	386	539	1, 156	2, 521	7, 381	5, 983	4, 565	7, 181	7, 420	11, 755
4. Dried cod............lbs..	30, 455, 557	29, 386, 657	35, 063, 832	40, 519, 556	42, 670, 831	43, 394, 685	46, 648, 564	35, 329, 927	45, 536, 939	42, 444, 039
5. Split cod..............do...	42, 219, 523	43, 403, 834	57, 463, 450	66, 533, 726	95, 906, 983	72, 835, 685	101, 125, 112	90, 302, 731	98, 510, 699	116, 760, 686
6. Other salted fish ....hectt..	70, 980	58, 601	57, 072	80, 625	101, 099	106, 056	109, 679	71, 507	99, 904	118, 348
7. Cod-liver oil .... do...	69, 156	73, 255	99, 318	120, 482	142, 613	111, 933	152, 354	137, 059	143, 165	168, 555
8. Roe ....do...	33, 102	37, 071	42, 777	47, 198	63, 869	52, 435	62, 294	68, 305	58, 682	77, 630
9. Fish guano .... .lbs...	146, 606	830, 032	1, 535, 835	4, 415, 483	14, 098, 007	19, 999, 741	12, 509, 782	14, 478, 821	12, 167, 370	19, 334, 121
10. Fresh salmon ..... lbs... }	26, 455	4, 150, 159	{ 247, 688	411, 489	586, 018	619, 713	571, 542	583, 117	531, 309	624, 409
11. Fresh mackerel, &c..do... }			{ 6, 885, 627	6, 526, 630	3, 965, 573	3, 248, 919	2, 639, 016	4, 038, 166	5, 010, 130	4, 891, 633
12. Smoked salmon.... do.....	6, 894	3, 541	2, 425	2, 094	2, 359	1, 543	992	5, 070	3, 287	897
13. Lobsters......individuals..	889, 000	1, 464, 000	1, 462, 000	922, 000	1, 086, 000	1, 270, 000	1, 070, 000	1, 081, 000	1, 019, 000	991, 000
SUMMARY.										
1–3. Herring fisheries†.....lbs..	131, 647, 689	178, 440, 324	191, 171, 889	197, 985, 867	149, 056, 075	198, 884, 351	151, 193, 171	150, 581, 565	139, 958, 039	103, 863, 243
4–9. Cod fisheries†.........do ..	109, 094, 631	109, 414, 298	136, 398, 602	164, 566, 004	219, 190, 155	185, 389, 333	229, 819, 850	200, 478, 387	222, 432, 733	257, 830, 472
10–13. Other fisheries†.......do...	1, 036, 162	5, 875, 259	87, 632, 850	7, 956, 622	5, 751, 352	5, 270, 427	4, 390, 571	5, 818, 270	6, 668, 415	6, 609, 080
Total pounds	241, 778, 482	293, 729, 881	415, 203, 341	370, 508, 493	373, 997, 582	389, 544, 111	385, 403, 592	356, 878, 222	369, 059, 187	368, 302, 795
B.—VALUE.										
1. Spring herring	....	....	$1, 983, 548 40	$326, 477 60	$211, 827 20	$136, 010 00	$102, 322 40	$190, 467 60	$330, 926 40	$299, 382 80
2. Other herring	....	....	1, 673, 579 60	3, 937, 616 80	3, 247, 061 20	5, 007, 874 80	3, 516, 615 60	2, 502, 369 60	2, 960, 676 40	2, 247, 742 80
3. Anchovies	....	....	22, 458 40	46, 766 00	116, 365 60	114, 436 00	71, 207 60	93, 880 40	113, 578 40	188, 698 80
4. Dried cod	....	....	1, 114, 960 40	1, 617, 460 40	1, 610, 680 00	1, 888, 890 80	1, 949, 726 80	1, 318, 238 40	1, 483, 031 60	1, 413, 485 60
5. Split cod	....	....	2, 052, 719 20	2, 684, 154 00	3, 627, 058 40	3, 711, 585 60	3, 849, 820 00	3, 897, 068 40	3, 379, 185 20	3, 297, 606 00
6. Other salted fish	....	....	89, 110 00	187, 439 20	229, 086 40	284, 482 00	268, 000 00	160, 022 80	216, 892 40	215, 981 20
7. Cod-liver oil	....	....	1, 329, 816 00	1, 524, 223 20	1, 484, 854 00	1, 420, 614 40	1, 823, 820 40	1, 474, 187 60	1, 286, 668 00	1, 419, 006 40
8. Roe	....	....	394, 281 60	466, 293 20	422, 502 00	536, 670 00	381, 390 80	433, 972 40	344, 406 80	416, 096 80
9. Fish guano..............	....	....	30, 927 20	101, 759 60	271, 805 60	246, 690 80	228, 121 60	281, 614 40	256, 100 80	352, 554 00
10. Fresh salmon	....	....	44, 273 60	78, 497 20	109, 585 20	105, 458 00	104, 225 20	113, 417 60	103, 340 80	121, 457 60
11. Fresh mackerel, &c	....	....	132, 258 00	151, 259 20	103, 689 20	89, 458 40	77, 318 00	100, 902 00	126, 924 80	123, 789 20
12. Smoked salmon	....	....	482 40	482 40	562 80	375 20	241 20	1, 232 80	804 00	214 40
13. Lobsters	....	....	78, 282 80	75, 870 80	112, 211 60	129, 363 60	100, 339 20	115, 910 00	109, 290 40	106, 208 40

TABLE I.—*Synoptical table of the exports of fish products since* 1856—Continued.

Fish products.	Average amount annually.					Annual amount.				
	1856–1860.	1861–1865.	1866–1870.	1871–1875.	1876–1880.	1876.	1877.	1878.	1879.	1880.
SUMMARY.										
1–3. Herring fisheries‡	....	....	3, 679, 586 40	4, 310, 860 40	3, 575, 254 00	5, 258, 320 80	3, 690, 145 60	2, 786, 717 60	3, 405, 181 20	2, 735, 824 40
4–9. Cod fisheries‡	....	....	5, 011, 814 40	6, 581, 329 60	7, 645, 986 40	8, 082, 933 60	8, 500, 879 60	7, 565, 104 00	6, 966, 284 80	7, 114, 730 00
10–13. Other fisheries‡	....	....	255, 296 80	306, 109 60	326, 048 80	324, 655 20	282, 123 60	331, 462 40	340, 360 00	351, 669 60
Total	....	....	8, 946, 697 60	11,198,299 60	11,547,289 20	13,665,909 60	12,473,148 80	10,683,284 00	10,711,826 00	10,202,224 00

* In the table are not included the following articles, whose quantity and value in 1871–1880 were:

Export.	Average annual.				Annual.							
	1871–1875.		1876–1880.		1877.		1878.		1879.		1880.	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Smoked herring	413, 671	13, 721 60	289, 967	11, 282 80	60, 516	2, 358 40	246, 584	9, 594 40	339, 943	13, 212 40	255, 052	9, 916 00
Fish stomachs	3, 263	321 60	19, 974	2, 304 80	13, 117	1, 286 40	11, 243	1, 098 80	26, 301	3, 189 20	18, 893	2, 974 80
Fish meal	6, 658	268 00	4, 475	187 60	4, 630	187 60	3, 968	160 80	9, 094	348 40	2, 817	107 20

† One hectoliter equals 2 bushels 3.35 pecks, or 26.417 wine gallons.

‡ For calculating the weight the following equivalents are used:

	Pounds.
Herring, all kinds, one hectoliter equals 86 kilograms	189. 6
Anchovies, one hectoliter equals 84 kilograms	185
Other salted fish in "Foustager," one hectoliter equals 86 kilograms	189. 6
Other salted fish in vessels, one hectoliter equals 93 kilograms	205
Cod-liver oil, one hectoliter equals 93 kilograms	205
Roe, one hectoliter equals 120 kilograms	264. 5
Lobsters, each equals 0. 5 kilograms	1. 1

TABLE II.—*Table of export prices* 1871–1880.

Fish products.	Average.		Annual average.				
	1871–'75.	1876–'80.	1876.	1877.	1878.	1879.	1880.
Spring herring .... per hectoliter..	$4.33	$5.05	$4.97	$5.31	$4.62	$4.56	$5.82
Great herring ....do	4.82	5.49	6.01	5.78	....	4.82	5.36
Herring ....do	3.06	3.07	3.38	....	3.00	....	4.29
Fat herring ....do	3.94	4.60	5.08	4.71	3.47	4.69	5.07
Sprat...........................do	1.88	1.83	1.85	1.85	1.57	1.96	1.88
Dried cod................. per pound..	.04	.038	.044	.041	.038	.033	.033
Split cod ....do	.04	.039	.05	.038	.042	.034	.028
Cod-liver oil........... per hectoliter..	12.71	10.56	12.69	11.97	10.76	8.99	8.45
Roe ....do	9.91	6.79	10.23	6.12	6.35	5.87	5.36
Fish guano .... per pound..	.023	.019	.022	.018	.019	.019	.018
Fresh salmon ....do	.192	.19	.17	.18	.194	.194	.194
Fresh mackerel, &c............do	.023	.027	.028	.029	.025	.025	.025
Lobsters.................per hundred..	8.38	10.34	10.18	9.38	10.72	10.72	10.72
RECAPITULATION.							
Herring fishery.. products per pound..	.022	.024	.027	.024	.018	.024	.027
Cod fishery.....................do	.04	.035	.044	.036	.038	.032	.028
Other fishery...................do	.039	.057	.062	.064	.057	.051	.054
Average per pound...............	.03	.032	.035	.033	.03	.029	.028

TABLE III.—*Statement of the number of men engaged in the cod, fat herring, and mackerel fisheries in* 1880, *and of the yield of the combined coast fisheries, excepting the catch for home use, based upon the prices paid at the fishing-stations.*

Fishermen engaged—	
In cod fisheries	80,441
In fat-herring fisheries	35,130
In mackerel fisheries	3,719
Value of the coast fisheries:	
Cod	$3,360,526 00
Fat herring	1,534,654 00
Sprat and other small herring	138,343 00
Spring herring	230,700 00
Mackerel	186,558 00
Summer fisheries for pollock, ling, &c *	388,150 00
Salmon and sea trout	102,403 00
Lobster	108,455 00
Oyster	1,506 00
Total	6,051,297 00

TABLE IV.—*Detailed account of the cod fisheries in* 1880, *giving the number of fishermen and boats, and their equipment.*

Total number of fishermen	80,441
Fishermen furnished with—	
Nets only	25,809
Trawls only	16,865
Hooks and lines only	16,806
Both nets and trawls	3,094
Nets and hooks and lines	2,518
Trawls and hooks and lines	12,258
Nets, trawls, and hooks and lines	3,091
Total number of boats	18,475

* Including only the portions sold.

Boats furnished with—	
Nets only	4,156
Trawls only	4,633
Hooks and lines only	4,309
Nets and trawls	725
Nets and hooks and lines	388
Trawls and hooks and lines	3,663
Nets, trawls, and hooks and lines	601

TABLE V.—*A statement of the yield of the cod fisheries in* 1880, *giving the number of fish taken.*

Total catch	68,272,800
Taken by—	
Nets	25,003,000
Trawls	23,989,000
Hook and line	19,281,000
Barrels of livers	166,626
Barrels of roe	60,860
Fish-heads sold	45,578,300

TABLE VI.—*Statement of the yield of the winter and spring cod fisheries in* 1880, *giving the money value and the prices paid at the fishing-stations, from which the value is reckoned.*

Money value:	
Total value	$3,360,525 00
Value of the different products:	
Fish, without liver and roe	2,303,093 00
Livers	674,619 00
Roe	313,633 00
Fish-heads sold	69,180 00
Average price at fishing-stations:	
Of 100 cod	3 38
Of livers, per barrel	4 05
Of roe, per barrel	5 15
Of 100 fish-heads	16
Estimated price of 100 round fish	4 93

TABLE VII.—*Detailed statements concerning the persons, &c., engaged in, and the yield of, the fat-herring fisheries in* 1880, *and of prices paid at the fishing-stations.*

a. Men, &c., engaged in the fisheries:	
Whole number of fishermen	35,130
Division of fishermen:	
Net	17,261
Seine	17,869
Number of boats using nets	6,443
Number of seiners	1,258
b. Yield of the fisheries, and prices:	
Total catch ... barrels	517,874
Taken in—	
Nets ... barrels	148,900
Seines ... do	368,974
Value	$1,534,654 00
Average price per barrel	2 97

TABLE VIII.—*Detailed statements of the operations and the yield of the mackerel fisheries in quantity and value in 1880, and of the prices paid at the fishing-stations, from which the value is reckoned.*

Total number of fishermen	3,719
Number using drag-nets	3,477
Number of boats using drag-nets	966
Total number of fish caught	5,743,884
Number caught with drag-nets	5,627,384
Money value of the fishery	$186,558 00
Average price per 100 fish	3 24

TABLE IX.—*Statements concerning the yield of: 1. The sprat and other small herring fishery; 2. The lobster fishery; 3. The salmon and sea-trout fishery, and 4. The oyster fishery, in 1880.*

1. Sprat and other small herring:	
Total catch, in barrels	152,898
Money value	$138,343 00
Average price per barrel*	91
2. The lobster:	
Total catch	1,205,616
Money value	$108,455 00
Average price per 100 †	9 00
3. Salmon and sea-trout:	
Total catch, in barrels	57,085
Money value	$102,403 00
Average price per barrel*	1 80
4. The oyster:	
Total catch, in barrels	164
Money value	$1,506 00
Average price per barrel †	9 14

* At the fishing-stations. † At the place of capture.

VII.—ON THE EARLY SHAD FISHERIES OF THE NORTH BRANCH OF THE SUSQUEHANNA RIVER.*

By Harrison Wright.

History.—There can be no doubt but that the Indians, for years before the white people thought of settling at Wyoming, caught their shad there in large quantities. Their net-sinkers, though they have for years been collected by archæologists, are still very plenty, and can be found anywhere on the flats along the river in quantities, and the fragments of pottery show unmistakable markings with the vertebræ of the shad. These, together with the fact that the early settlers saw the Indians catching shad in a seine made of bushes (called a bush-net), point to the fact that shad on the North Branch were taken in quantities by the Indians.

The Connecticut people who settled here over a hundred years ago had, in the very start, their seines, and took the shad in numbers. As near as we can learn they were the first white people who seined the shad in the North Branch.

During the thirty years' war which the Connecticut settlers had with the Pennsylvania government for the possession of this valley of Wyoming the shad supply was a great element of subsistence. For this, unlike the fields, barns, and granaries, could not be burned by the Pennamites. An old settler says: "When we came back to the valley we found everything destroyed, and the only thing we could find to eat were two dead shad picked up on the river shore; these we cooked, and a more delicious meal was never partaken of by either of us." One of the most bitter complaints made against the Pennamites, in 1784, was that they had *destroyed the seines*.

After the Revolutionary war had ended, and the troubles between the Pennsylvania claimants and the Connecticut settlers had been quieted, the shad fisheries increased in numbers and value yearly, until about the year 1830, when the dams and canal were finished and an end put to the shad fisheries.

Run.—It would appear from the statements hereto appended that the male fish preceded the female fish by some eight to ten days in their

* This paper is condensed from the report of a committee of the Wyoming Historical and Genealogical Society, Harrison Wright, chairman (Wilkes-Barre, Luzerne Co., Pa.), which was published in the Fish Commission Bulletin for 1881, p. 352.—C. W. S.

ascent of the river, and between the ascent of the former and that of the latter there was generally a perceptible rise in the river, and immediately following it came the large roe-weighted females in great schools.

A map of the Susquehanna River from the junction of the West Branch at Northumberland to Towanda, near the New York State line, has been prepared. Upon this are noted the localities of the fisheries with as much accuracy as was attainable from the accounts received by us. Some have probably been omitted, especially in the stretch of river from Danville to a point four miles above Bloomsburg, where we were unsuccessful in our inquiries.

At Northumberland, or just below, was Hummel's fishery; between Northumberland and Danville there were eight fisheries, in order from Northumberland up as follows: 1. Line's Island lower fishery; 1. Line's Island middle fishery; 3. Smith's fishery; 4. Line's Island upper fishery; 5. Scott's fishery; 6. Grant's fishery; 7. Carr's Island fishery; 8. Rockafeller's. The next fishery of which we have a record was the fishery of Samuel Webb, located about four miles above Bloomburg. Above this point about four miles, and six miles below Berwick, was the fishery of Benjamin Boon; the next was located just above the town of Berwick, and about a mile and a half above Berwick was the Tuckahoe fishery (this last is the same as the Nescopeck fishery mentioned in Pearce's history); the next was at Beach Haven. Between this latter place and Nanticoke Dam there were three, viz, one at Shickshinny; one just below the mouth of Hunlock's Creek, and one, called the "Dutch" fishery, on Croup's farm. Above Nanticoke there was one belonging to James Stewart, about opposite Jameson Harvey's place, one at Fish Island, and one at Steele's Ferry, called the Mud fishery. The next was on Fish's Island, three-quarters of a mile below the Wilkes Barre bridge; the next was Bowman's fishery, immediately below the Wilkes Barre bridge; the next was the Butler fishery, a little above the bridge; the next was at Mill Creek, a mile above the bridge; the next was the Monocacy Island fishery; the next Carey's; the next was on Wintermoot Island, this last landing on the left bank above the ferry at Beauchard's; the next was at Scovel's Island, opposite Lackawanna Creek; this and the Falling Spring fishery next above belonged to parties living in Providence, away up the Lackawanna. The next above was at Harding's, in Exeter Township; the next above was at Keeler's, in Wyoming County; the next was at Taylor's (or Three Brothers,) Island; this latter fishery was no doubt the one referred to by P. M. Osterhout as being opposite McKune's Station, on the Lehigh Valley Railroad; the next was at Hunt's Ferry, *circa* five miles above Tunkhannock; the next was Grist's Bar, about a mile above Meshoppen; the next was at Whitcomb's Island, about a mile below Black Walnut Bottom; a half a mile above this fishery was the Sterling Island fishery, and the next above was Black Walnut, and half a mile further up was the Chapin Island fishery; the next was at the bend at Skinner's Eddy; the next was at Browntown, in Bradford County; the next was at Ingham's Island; the next was at the mouth of Wyalusing Creek; two miles further up was one at Terrytown; the next and last that we have any record of was at Standing Stone, about six miles below Towanda.

Thus it will be seen that between Northumberland and Towanda there were about forty permanent fisheries.

MONEY VALUE.—Our county records only go back to 1787. We spent a whole day in searching the first volumes, in hopes that we might find some entries of transfers of fishing rights, but our search was fruitless. We have, however, found among the papers of Caleb Wright a bill of sale of a half interest in a fishery between Shickshinny and Nanticoke, called the "Dutch fishery." The price paid was £20, "lawful money of Pennsylvania," equivalent to $53.33.*

Jameson Harvey says that Jonathan Hunlock's interest in the Hunlock fishery was worth from five to six hundred dollars per annum; it was a half interest. Henry Roberts says a right in a fishery was worth from ten to twenty-five dollars. Major Fassett's father was one of eleven owners in the Sterling Island fishery, and his interest was valued at $100.

Mr. Hollenback's information on the money value of the different fisheries is by far the most valuable. He says the Standing Stone fishery was worth from $300 to $400 per annum; the Terrytown fishery was worth about the same; the Wyalusing Creek fishery was worth about $250 per annum; the Ingham Island fishery $50 less; the Browntown and Skinner's Eddy fisheries about $150 per annum each.

Jameson Harvey says: "The widow Stewart, at the Stewart fishery, used often to take from $30 to $40 of a night for her share of the haul."

The data bearing upon this point are decidedly unsatisfactory, as they would only give to the forty fisheries an annual value of about $12,000, a large amount for those days, yet one we believe to be too small. The next topic, the "catch," should be taken with this one to form a basis for calculation.

CATCH.—At the eight fisheries near Northumberland large numbers of shad were taken; three hundred was a common haul; some hauls ran from three to five thousand. The Rockafeller fishery, just below Danville (about the year 1820), gave an annual yield of from three to four thousand, worth from 12½ cents to 25 cents apiece.

Mr. Fowler says that the fishery just above Berwick was one of the most productive, and that he has assisted there in catching "thousands upon thousands," but does not give the average annual yield. He also says that at the Tuckahoe fishery "many thousands were caught night and day in early spring," and at the Webb and Boon fisheries the hauls were immense. At the latter they got so many at a haul that they

* Caleb Wright's son received as his share of one night's fishing at this fishery 1,900 shad.

couldn't dispose of them, and they were actually hauled on Boon's farm for manure.

At Hunlock's fishery the annual catch must have been above ten thousand. At the Dutch fishery in one night thirty-eight hundred were taken. At the Fish Island fishery, at a single haul, nearly ten thousand shad were taken. Mr. Jenkins recollects of seeing a haul at Monocacy Island—just before the dam was put in—of twenty-eight hundred. At Scovel's Island the catch was from twenty to sixty per night; at Falling Spring fifty to three hundred per night; at Taylor's Island from two hundred to four hundred per night. At Wyalusing the annual catch was between two and three thousand, and at Sanding Stone between three and four thousand. The daily catch at the Terrytown fishery was about one hundred and fifty. Major Fassett says that at the Sterling Island fishery "over two thousand were caught in one day in five hauls."

It is a plain deduction from the above facts that the fisheries down the river were much more valuable than those above. Above Monocacy we hear of no catch over two thousand, while below that point they were much larger; and while from three to four hundred dollars seems to be the general annual value above, we find the fishery at Hunlock's, 12 miles below, was worth from a thousand to twelve hundred per annum. The shad farther up the river appear to have decreased in numbers, yet to have increased in size, and that brings us to the next head.

SIZE.—The opinion seems to be general that the great size attained by the Susquehanna shad was attributed to the long run up the fresh water stream (carrying the idea of the survival of the fittest). That they were of great size is beyond doubt; nearly every one who recollects them insists on putting their weight at almost double that of the average Delaware shad of to-day.

Mr. Van Kirk gives as the weight of the shad caught at the fisheries in Northumberland and Montour Counties as from three to nine pounds. Mr. Fowler says he has assisted in catching thousands weighing eight and nine pounds at the fisheries in Columbia County. Mr. Harvey, speaking of the Luzerne County shad, says: "Some used to weigh eight or nine pounds, and I saw one weighed, on a wager, which turned the scales at thirteen pounds!" Major Fassett, speaking of those caught in Wyoming County, says: "The average weight was eight pounds, the largest twelve pounds." Dr. Horton says of the shad caught in Bradford County, that he has seen them weighing nine pounds; ordinarily the weight was from four to seven pounds.

PRICE.—The price of the shad varied, according to their size, from 4*d.* to 25 cents, depending of course upon their scarcity or abundance, and as some of our correspondents remember the price in years when it was high, and others in those when there was a great plenty of fish, there arises what appear to be conflicting statements in their letters.

At the town meeting held at Wilkes Barre, April 21, 1778, prices were set on articles of sale, *inter alia*, as follows: Winter-fed beef, per pound, 7*d.*; tobacco, per pound, 9*d.*; eggs, per dozen, 8*d.*; shad, apiece, 6*d.* At one time they brought but 4*d.* apiece. A bushel of salt would at any time bring a hundred shad. At the time the dam was built they brought from 10 to 12 cents. On the day of the big haul Mr. Harvey says they sold for a cent apiece (Mr. Dana says 3 coppers). Mr. Isaac S. Osterhout remembers a Mr. Walter Green who gave twenty barrels of shad for a good Durham cow. Mr. Roberts says that in exchanging for maple sugar one good shad was worth a pound of sugar; when sold for cash shad were worth 12½ cents apiece. Major Fassett says the market price of the shad was $6 per hundred. Dr. Horton says the shad, *according to size*, were worth from 10 to 25 cents. Mr. Hollenback, in calculating the value of the fisheries near Wyalusing, has put the value of the shad at 10 cents apiece. In 1820 they were held in Wilkes Barre at $18.75 per hundred. Mr. Fowler says they were worth 3 cents or 4 cents apiece.

COUNTRY SUPPLY AND TRADE.—Every family along the river having some means had its half barrel, barrel, or more of shad salted away each season, and some smoked shad hanging in their kitchen chimneys; but not only those living immediately along the river were the beneficiaries, but the testimony shows that the country folk came from fifty miles away to get their winter supply, camping along the river's bank, and bringing in payment whatever they had of a marketable nature. They came from the New York State line, and from as far east as Easton, bringing maple sugar and salt, and from as far west as Milton, bringing cider, whisky, and the two mixed together as cider royal, and from down the river and away to the south towards Philadelphia, bringing leather, iron, &c.

Mr. Isaac S. Osterhout says when quite a boy (1822-'23) he went with a neighbor to Salina, N. Y., after salt, he taking shad and his neighbor whetstones, which they traded for salt. The teams hauling grain to Easton brought back salt. In good seasons the supply of this latter important item always seems to have been short of the demand.

The shad, as far as we can learn, appear never to have gone up the West Branch in such quantities as they did up the North Branch, and the same may be said of the Delaware, or else the fish were of inferior quality, for the dwellers from the banks of both of these streams came to Wyoming for their supply of shad.

Mr. P. M. Osterhout tells of a firm (Miller & McCord) living at Tunkhannock which did quite an extensive business in shad, sending the cured ones up the river into New York State, and far down the river.

Mr. Fowler says: "No farmer or man with a family was without his barrel or barrels of shad the whole year round. Besides furnishing food for the immediate inhabitants, people from Mahantango, Blue Mountains, and, in fact, for fifty miles around, would bring salt in tight barrels and trade it for shad."

Mr. Harvey says: "Boats coming up the river used to bring leather, cider, whisky, cider royal, salt, iron, &c., and would take back shad."

OTHER FISH.—We do not find that any other deep-sea fish (with the exception of eels) ever came up the river above Northumberland. The "Oswego bass," "Susquehanna salmon," "yellow bass," "striped bass," "Susquehanna bass" spoken of by the different correspondents appear to be the same fish, which is also sometimes called the wall-eyed pike, an excellent fish introduced into the river many years ago from Oswego Lake. They are not now as plenty as formerly, though within the past few years they have been increasing perceptibly. The other fish mentioned are nothing but the common river fish.

EFFECT OF DAMS.—There is no question that the building of the dams necessary to feed the canals put a stop at once to shad fishing; all our correspondents agree that after the Nanticoke dam was finished, in 1830, no shad were ever caught above it. As to the effect of the dams on the shad fishing, the following extracts from Hazard's Register are of interest:

1829, May 9, page 304. "Lewistown, Pa., May 2. It is stated that shad are caught in much greater abundance below the dam at North Island, in the Juniata, than has ever been known at any previous time. It is supposed that the dam in the Susquehanna immediately above the mouth of the Juniata has the effect of directing their course up the Juniata. The dam at North Island retards their farther passage, and the consequence is that the people farther up the Juniata are deprived of the luxury of fresh shad, which so abundantly falls to the lot of their neighbors a few miles lower down. But we must be content with these little deprivations by the promise of the immense advantages which are to accrue to the country from the canal."

1830, May 8, page 304. The Sunbury Beacon of Monday the 26th of April says: "Not less than from four to five thousand shad were caught on Saturday last within a quarter of a mile *below the dam*. Upwards of five hundred were taken by one dip-net, and several others averaged two and three hundred each. We understand that several hundred were caught with dip-nets yesterday."

1831, May 14, page 318. From the Wyoming Herald: "Wilkes Barre, May 6, 1831. While the raftsmen complain of the Nanticoke dam, the boys find in it a source of amusement. The bass which ascend at this season in great numbers, stopped by the dam, offer fine sport. Indeed, hooks, half a dozen at a time, without bait, are let down and suddenly drawn up often with two or three bass hooked by the side."

And on the same page, from the Susquehanna Democrat: "A short time since great quantities of bass were caught in a small eddy formed in the river directly below the abutment of the Nanticoke dam. The fish apparently lay there in schools, and by drawing hooks through the eddy numbers were caught. On Thursday and Friday last a number of fine shad were caught in the same way. One man drew out nine in one day, and sold them for 50 cents each. This is the first instance within our knowledge of shad being caught with a hook. We mention the fact as one altogether new, as well as to say to the down-river folks our market has not been altogether destitute of shad, though many a gentleman's table has."

We are informed that to-day the shad manage to get over the Columbia dam only to be received in nets spread for them at the head of the sluice-way by a pack of scoundrels, among whom, if we hear correctly, are parties connected with our State fish commission. If it were not for this we would have shad in small quantities as far up as the next dam at all events. The cutting off of this staple of food from tens of thousands of people in this section of country could not but be a great loss, and it has been questioned if it was not greater than the benefits derived from the great internal improvements. Some slight improvements in the sluice-way of the lower dams and a regular ladder-way in that of the Nanticoke dam; good protective laws, well enforced (with a double-barreled shot-gun for Columbia dam); certain days set for fishing along the river, and one good stocking with young shad would, we believe, give us shad in fair quantities all the way up the river.

We do not believe the expense would be very great, whereas the benefits would be incalculable. There is no doubt that the experiment is well worth trying. Luzerne County will contribute her share towards the necessary improvements.

WILKES BARRE, *May* 27, 1881.

1. *Statement of Joseph Van Kirk, Northumberland, Pa., May* 25, 1881.

My recollection of the shad fisheries dates back to the year 1820; in that year, and the succeeding two or three seasons, I fished at Rockafeller's fishery, near Danville. In our party there were six of us; we fished with a seine 150 yards long, and caught somewhere from 3,000 to 4,000 marketable shad, weighing from 3 to 9 pounds. At that time there were eight fisheries between Danville and Line's Island, located as follows: Rockafeller's, just below Danville; next Carr's Island; next Grant's fishery; next Scott's, near where my residence was; next Line's Island upper fishery; next Smith's fishery; next Line's Island middle and lower fisheries. At all these points large quantities of shad were caught, and they were sold from 12½ cents to 25 cents apiece. I have heard of hauls containing from 3,000 to 5,000, and 300 was a very common haul. People came from 12 to 15 miles for shad, and paid cash exclusively for them.

Salmon, rockfish, pike, eels, suckers, and a general variety of fish were caught in addition to shad, and we always had a ready market for them for cash. No shad have been taken since the canal was built, and all other fish have sensibly decreased since that time.

The cutting off of the shad supply was a great and serious loss to this community, from both a monetary and economic view, since this fish in its season was a staple article of food, and employed in the taking and handling quite a large proportion of the inhabitants. This industry was wholly abolished by the erection of these dams, and thousands of dollars of capital invested in the business were instantly swept out of existence. The first fishery below this place was known as Hummel's fishery, and its reputation was good. I never fished there myself, but was well acquainted with it by the speech of my neighbors. In fact all of these fisheries were profitable investments, and the loss of them to this section of the country was incalculable. All of the fisheries mentioned above, except Hummel's, were between Northumberland and Danville. Any mention of those good old times brings up a flood of recollections, and the difficulty is, not to remember what occurred in those days, but to sift out what would be useful in this connection.

2. *Statement of Henry Roberts, Falls, Pa., March* 24, 1881.

I reply to your inquiries regarding shad fisheries in the Susquehanna between Tunkhannock and Lackawanna Creeks, that, according to my recollections, the first was at the head of Scovel's Island, opposite Lackawanna Creek; not many shad were caught here, say from twenty to sixty per night. The next was at Falling Spring; same seine as that used at Scovel's Island; the number of shad caught here ran from fifty to three hundred per night. The next, above Falling Spring, was at Keeler's Ferry (now Smith's). This was a small fishery, and only used when the water was too high to fish at other points; the seine was hauled around a deep hole to bring in the shad. The next and only fishery between this and Tunkhannock Creek was at the head of Taylor's Island, or the "Three Brothers;" this was an important fishery; more shad were caught here than could be taken care of, on account of the scarcity of salt. I can speak of this fishery from experience since 1812. The catch per night ran from two to four hundred. The shareholders attended to it as closely as to their farming or other business, as it was our dependence in part for food. Shad were oftener exchanged for maple sugar than sold for cash—one good shad for a pound of sugar; large shad were worth 12½ cents apiece. A right in a fishery was worth from ten to twenty-five dollars. Shareholders made a practice of salting down more or less shad during the season. An incident in connection with shad-fishing presents itself to my mind, related often by my grandmother. A party of Indians returning from a treaty at Philadelphia landed their canoes, came to her house to borrow her big kettle to cook their dinner in. After building the fire and hanging over the kettle they put in the shad, just as they were taken from the river, with beans, cabbage, potatoes, and onions. My grandfather, David Morehouse, one of the early Connecticut settlers, then owned the same farm I now own and occupy. I am now in my eighty-seventh year.

3. *Statement of H. C. Wilson, Mount Vernon, Ohio, March* 19, 1881.

An article in the Union Leader in reference to the old shad fisheries of the Susquehanna River has brought back to my memory many things that happened in my boyhood days, among which were the old fishermen and the knitting of the shad seines. The seines were knit in sections by the shareholders, each one owning so many yards of the net, and each one receiving his share of fish according to the number of yards owned. I lived one year with Mr. Pierce Butler, where I learned to knit seines, and have never forgotten it. We used to knit on rainy and cold days and evenings, and when the sections were all done, Dick Covert, with the help of John Scott, would knit them together and hang the seine, put on the corks and leads; this was considered quite a trick, and but few would undertake the job.

I remember I used to go over on the beach on the line of the Butler and Dorrance farms and help the fishermen pick up the shad, and when the luck was good was always given one to take home. I remember seeing the shad put in piles on the beach, and after they were all equally divided some one would turn his back and the brailman would say, "Who shall have this?" until they all received their share, one pile left out for the poor women. The boats with the seine shipped would row up to the falls, and then hauled out down by the riffles opposite where Dick Covert used to live. I think it was a bad day for the people along the Susquehanna when the shad were prevented from coming up the river; the fish would be worth more to the people than the old canal. You had better buy the canal, put a railroad on the towing-path, burst up the dams, and increase the value of all the flats above the dams, and you would not have as high water at Wilkes Barre, and there would be less damage done to property; then you would have plenty of shad and all other kinds of fish, and then I think you could afford to send some to your friends out West. I got an old fish-dealer here to send to Baltimore for some shad last week, but they had been too long out of water and too far from home to be good. It used always to be said that there were no shad like the old Susquehanna shad.

4. *Statement of Alvan Dana, Kansas City, March* 22, 1881.

I have no remembrance of any shad being taken at or near Sheshequin, but at Wilkes Barre I have seen them caught in seines before any bridge was built there. The nets were drawn out on the north side of the river. I don't remember to what extent was the catch, but I have often heard my mother say that immense quantities were taken in the vicinity of her father's, who lived about a mile below the old "Red Tavern," in Hanover; that at one haul 9,999 were caught; that when they had got all they could procure salt to cure, or sell for three coppers, they gave to the widows and the poor, and hung up their nets, though the shad were as plenty as ever. In 1816 I went to Owego to live, and there became acquainted with a Mr. Duane, who was one of the men who drew the net. He said the actual number was 9,997, but two more were added to make the figures all nines.

When the Nanticoke dam was built the shad could not come above it, and men were in the habit of fishing there with a three-pronged hook, sinker, and stout line and pole. This was sunk, and after a few minutes quickly jerked up. I caught two in that way; others had better luck; and it was reported that one man caught seventy in one day, but I think a large reduction would come nearer the truth.

Probably E. Blackman, of Pittston, could give some information regarding shad fishing at Towanda and Sheshequin. Jesse Brown, long a resident of Sheshequin, and in his youth a resident of Wyalusing, I think—also Chester Park, of Athens, I presume—could give information upon the subject. The Park family kept the ferry at Athens at an early day. Both of the above named, I think, are over eighty years of age.

I have been examining some old Gleaners of 1811 and 1812, but don't find any of the spring numbers. Some years ago I gave to my son-in-law, L. B. Wyant, of Harford, McHenry County, Illinois, a roll of Gleaners of 1811 for his museum, which he opens at "Kay's Park," on Geneva Lake, Wisconsin, in summer.

5. *Statement of Alvah Fassett, Scottsville, March* 10, 1881.

In regard to shad fishing, I referred to father, and received the following answers: 1st. There were two permanent fisheries, one at Sterling's Island and one below Wyalusing Falls, besides other places where they sometimes fished, viz, Grist's Bar, Chapin's Island. Whitcomb Island was also fishing ground, but not permanent. 2d. Sterling's Island was the best ground. 3d. Over 2,000 were caught in one day at five hauls. 4th. The market price was $6 per hundred. 5th. The average weight was 8 pounds, the largest 12 pounds. 6th. They also caught suckers, yellow bass, and sunsbitches (what we call carp). 7th. None were caught after the canal and bridges were constructed, to my knowledge. 8th. The first fishing was done by the Connecticut people. Father says that in 1806 his father had a share in the Sterling fishery; there were eleven shares, valued at $100 each. Says his father was not much of a fisherman.

5. *Statement of C. Dorrance, Hot Springs, Ark., March* 24, 1881.

1st. "Fix the number of fisheries and their location as far as is now practicable."

My memory carries me back to the fishery at Monocacy Island, the one below the falls, near the mouth of Mill Creek, one at Plymouth (in part a night fishery), one at or immediately below Nanticoke Falls. No dam obstructed the shad at that point then.

The fishery near Mill Creek was regarded as the main or most reliable fishery, as it could be fished at stages of water when some of the others could not, and much the largest number of shad were taken there, sweeping as the fishermen did from the foot of the falls, nearly the entire river to the bar—drawing out upon the lands of my late father, where it was my business as a lad every evening, after school, to be with horse and wagon to receive our share of shad. No unpleasant duty, for well do I remember as they came sweeping in to the beach, the net in rainbow form. The corks indicating the position where "Captain" Bennett (father of the late John Bennett, esq.), would discharge his men from the sea or large boat with the outer brail, and passing out and along the net, on the discovery would shout, "Here's shad, boys; hold down the lead line; here's shad." True to the word, long before the main body of the net was drawn up to the shore we youngsters would take up the "captain's" cry, as the large shad darted back and forth between the incoming net and the shore. What think you, would not a return of such scenes start a shout from older heads?

2d. "As to the money values or rental of the fisheries."

Of this I have no data from which to form an opinion. As the fisheries were established by the first settlers, joining their limited means with the land owners, forming a company there by common consent to their children, none were rented as far as my knowledge extends. Owners of rights would allow men who had none to fish for them on shares, thus extending the benefits as far as possible. Good feeling pervaded the community in those days.

3d. "Were other fish taken in any considerable quantity; if so, what kinds?"

With the exception of an occasional striped bass, or, as they were then called, "Oswego bass," of large size (supposed to have been introduced to the headwaters of the Susquehanna from that lake), none of value were taken, as the nets were woven for large shad only.

I cannot better illustrate the value and importance of the shad fisheries at that early day to the people on the Susquehanna River than to repeat an anecdote told me long years after by a genial gentleman of New England, who in youth visited my father at his home in Wyoming.

Leaning on the front gate, after breakfast, as the little children were passing to school, each with a little basket, the universal answer from their cheery, upturned little faces was "Bread and shad," "Bread and shad" (corn bread at that).

Had that fish diet anything to do with the known enterprise of that generation? If so, would it not be well to make a strong and united effort to again introduce so valuable an element of brain material. I am greatly pleased that our society is agitating the subject of restoring the shad to the people on the North Branch, not as a luxury for the few, but for all, cheap and faithful, and coming at a season of the year when most desirable as food, for nowhere on this continent were finer shad found than those taken from the North Branch of the Susquehanna River. The long run of the pure, cold, spring-made waters of the Susquehanna made them large, hard, and fat, nowhere equaled.

7. *Statement of Hon. P. M. Osterhout, in the Tunkhannock Republican, April* 15, 1881.

The first shad fishing in the Susquehanna River was by the early settlers of the Wyoming Valley, who emigrated thither from Connecticut. The food of the early emigrants was, in the main, the fish of the streams and the game on the mountains. The first seine in the valley was brought from Connecticut, and upon the first trial, in the spring of the year, the river was found to be full of shad. These emigrants had settlements along the Susquehanna from Wyoming to Tioga Point, now called Athens, and each neighborhood would establish a fishery for their own accommodation. It was generally done in this way: Say ten men (and it took about that number to man a seine) would form themselves into a company for the purpose of a shad fishery. They raised the flax, their wives would spin and make the twine, and the men would knit the seine. The river being on an average forty rods wide, the seine would be from sixty to eighty rods long. The shad congregated mostly on shoals or the point of some island for spawning, and there the fisheries were generally established. Shad fishing was mostly done in the night, commencing soon after dark and continuing until daylight in the morning, when the shad caught would be made into as many piles as there were rights in the seine. One of their number would then turn his back and another would touch them off, saying, pointing to a pile, "Who shall have this?" and "Who shall have that?" and so on until all were disposed of, when the happy fishermen would go to their homes well laden with the spoils of the night. Between the times of drawing the net, which would be generally about an hour, the time was spent in the recital of fish stories, hair-breadth escapes from the beasts of the forests, the wily Indian, or the Yankee production, the ghosts and witches of New England.

As early as 1800 George Miller and John McCord moved from Coxestown—a small town on the Susquehanna about five miles above Harrisburgh—up the river in a Durham boat, and, bringing with them a stock of goods, located at Tunkhannock, where they opened a store. They were both young men and unmarried. In the spring of the year they dealt quite largely in shad, the different fisheries of the neighborhood furnishing them with large quantities for curing and barreling. Shad were plenty but salt scarce. There was no salt except what was wagoned from the cities or from the salt works at Onondaga, N. Y., and it was not unusual that a bushel of salt would purchase one hundred shad—in fact, it was difficult to procure salt to cure them. At this time the German population in the lower counties of the State had not learned the art of taking shad by means of the seine.

There were then no dams or other obstructions to the ascent of the fish up the river, and large quantities of the finest shad in the world annually ascended the Susquehanna, many of them when taken weighing from six to eight pounds each. The distance being so long (about 200 miles) from tidewater to the Wyoming Valley, the flavor of the shad was very much improved by contact with fresh water. The Susquehanna shad were superior to the Delaware, the Potomac, the Connecticut, or the North River shad. The reason generally given was their being so long in fresh water, which imparted to the fish a freshness and richness not found in the shad of other rivers. Then, none but the strong, healthy shad could stem the current and reach the upper waters of our beautiful river.

Miller and McCord cured and put up annually shad for the market. They boated down the river a large quantity for the times, and sold to the people on the lower Susquehanna. They also boated shad up the river as far as Newton, now Elmira; from thence they were carted to the head of Seneca Lake, a distance of twenty miles, and from there were taken to Geneva and other towns in what was then called the lake country, and sold.

There was a fishery on the upper point of the island opposite McKune's Station, on the Lehigh Valley Railroad. This island was known by the early settlers as one of the Three Brothers. There was also an important fishery at Hunt's Ferry, about five miles above Tunkhannock. Here large quantities of shad were caught every spring. This fishery was owned by twenty rights, ten fishing at alternate nights. There was also another fishery at Black Walnut, below Skinner's Eddy. At all these fisheries more or less Oswego bass were caught, called down the river Susquehanna salmon, a most excellent fish, but they are now nearly extinct. The river ought to be restocked with that same species. They are a fine-flavored fish, solid in meat, and grow to 12 or 15 pounds in weight. The late George M. Hollenbeck, esq., of Wilkes Barre, told me that this bass was brought from the Oswego Lake and put into the Susquehanna at Newton, now Elmira. They were called by the old settlers swager bass. Since the building of the dams across the Susquehanna there have been no shad caught above the Nanticoke dam. These dams also largely obstruct the passage of bass and other food fish up river. The Susquehanna is really one of the finest streams for fish in the United States—the water pure, the bottom rocky and pebbly, affording abundant means for spawning and rearing the young fish. The obstruction to the free passage of fish up the river ought to be removed.

Maj. John Fassett, of Windham Township, one of the oldest citizens of that town, as was his father before him, was written to on the subject of the early shad fisheries from Hunt's Ferry to Wyalusing. He mentions the one at Hunt's Ferry, also at Black Walnut, and others at different points up the river as far as Wyalusing. He says his father owned a right in the fishery at Black Walnut, which he valued at $100; here were large numbers of shad caught, which were valued at 6 cents each, and would weigh from 6 to 12 pounds each. The largest one he saw weighed was 12 pounds; the writer hereof thought he had got it pretty steep as to weight, but he was beaten by Jennison Harvey, esq., an old resident of Plymouth, Luzerne County, now of Wilkes Barre, who says that he saw a shad weighed—on a bet—that was caught in the river in the valley, and that it weighed 13 pounds. Some folks will think it a fish story. Harvey has decidedly the advantage of Major Fassett, as he had the last say.

8. *Statement of Gilbert Fowler.*

BERWICK, PA., *February* 23, 1881.

I was born February 23, 1792, in Briar Creek Township, Northumberland County, now Columbia. I write or dictate this letter on my eighty-ninth birthday. I have lived near the Susquehanna River ever since I was born. My knowledge and recollections about the shad fisheries extend from Wilkes Barre to old Northumberland. The first shad fishery near my home was Jacob's Plains. This was located just above the town of Berwick, and one of the most productive fisheries on the river. Here I have assisted in catching thousands upon thousands of the very finest shad, weighing 8 and 9 pounds, The next nearest was Tuckahoe fishery, situated about one and a half miles above Berwick, on the same side of the river. At this place many thousands were caught night and day in early spring. The next was down the river about six miles from Berwick. This was the fishery of Benjamin Boon. At this fishery I have known so many caught that they were actually hauled out by the wagon load on Benny Boon's farm for manure, so plenty were they. The next fishery was that of Samuel Webb, located about four miles this side of Bloomsburg. This was an immense shad fishery. From the banks of the river at this fishery could be seen great schools of shad coming up the river when they were a quarter of a mile distant. They came in such immense numbers and so compact as to cause or produce a wave or rising of the water in the middle of the river, extending from shore to shore. These schools, containing millions, commenced coming up the river about the 1st of April and continued during the months of April and May. There was something very peculiar and singular in their coming. The first run or the first great schools that made their appearance in the early spring were the male shad—no female ever accompanied them. In about eight or nine days after the male had ascended the river then followed the female in schools, heavily laden with eggs or roe. Those were much the largest and finest fish, and commanded the highest price. Those shad that were successful in eluding the seine and reached the hatching ground at the headwaters of the Susquehanna, after depositing their eggs, returned again in June and July, almost in a dying condition, so very poor were they. Many died and were found along the river shore. The young shad would remain at their hatching places till late in the fall, when they would follow the old shad to the salt water. During the summer they would grow from three to four inches in length. The Susquehanna shad constituted the principal food for all the inhabitants. No farmer or man with a family was without his barrel or barrels of shad the whole year round. Besides furnishing food for the immediate inhabitants, people from Mahantango, Blue Mountains, and, in fact, for fifty miles around, would bring salt in tight barrels and trade it for shad. They would clean and salt the shad on the river shore, put them in barrels, and return home. The common price of shad was three and four cents each. Besides shad there were many other kinds of food-fish. The most noted among them was the old Susquehanna salmon, weighing as high as fifteen pounds. These salmon were considered even superior to the shad and commanded a higher price. They were caught in seines, on hooks and lines, and were the sport to the gigger at night. Nescopeck Falls, directly opposite Berwick, near where the Nescopeck Creek empties into the river, was a noted place for salmon fishing with hook and line. Men standing on the shore with long poles and lines would often, in drawing out the fish, lodge them in the branches of the trees, giving them the appearance of salmon-producing trees. The shad fisheries which I have alluded to were not common property. The owner of the soil was the owner of the fishery, and no one was allowed to fish without a permit. The owners of the fishery also had the seines, and when not using them they would hire them out to others and take their pay in shad. The seiner's share was always one-half the catch. Shad were caught both night and day in seines. At the Webb fishery I have known eleven and twelve thousand shad taken at one haul. These fisheries were always considered and used as a source of great pleasure, value, and profit, and everybody depended on them for their annual fish and table supply. It was considered the cheapest and best food by all. Immediately after the erection of the river dams the shad became scarce, the seines rotted, the people murmured, their avocation was gone, and many old fishermen cursed Nathan Beach for holding the plow, and the driver of the six yokes of oxen, that broke the ground at Berwick for the Pennsylvania Canal. The people suffered more damage in their common food supply than the State profited by her "internal improvement," as it was called. Although eighty-nine years old to-day, I still hope to live long enough to see all the obstructions removed from one end of the noble Susquehanna River to the other, and that the old stream may yet furnish cheap food to two millions of people along its banks, and that I may stand again on the shore at the old Webb fishery and witness another haul of ten thousand shad.

9. *Statement of Nelson B. Hollenback, Wyalusing, March* 14, 1881.

Commencing at Standing Stone, about 10 miles from Wyalusing Village, and reaching down the road from that point to the Wyoming County line, there were five "old shad fisheries," viz:

(1) The Standing Stone fisheries. William Hank, Benjamin Brown, Cornelius Ennis, and Benjamin Bennet owned this. It was a valuable property, worth at that time from three to four hundred dollars a year.

There were from three to four thousand shad caught there annually. They caught no rock or striped bass, sturgeon, or herring there or at other fisheries in this vicinity.

(2) The Terrytown fishery. This was owned by Jonathan Terry, William Dodge, Edmund Dodge, Samuel Wells, and John Taylor, and was of about the same value as that at Standing Stone.

(3) The Wyalusing fishery, owned by John Hollenback, Benjamin Stalford, Joseph Stalford, and John Stalford. This fishery was worth about $250 a year, with a "catch" of from two to three thousand shad.

(4) The next was the "land" fishery at the head of Ingham's Island. Joseph Ingham owned this, and it was worth about $200 a year.

(5) Next was the Brown Town fishery, owned by Humphrey Brown, Allen Brown, and Samuel Brown, and was worth about $150 per annum.

(6) The next and last was called the "Bend fishery," and was located near the line between Bradford and Wyoming Counties. James Quick and James Anderson owned this, and it was worth about $150 a year.

The stoppage to the emigration of shad to this vicinity was a great loss to the people. For nearly two months every year the people for from 15 to 20 miles from the river, were bountifully supplied.

10. *Statement of George F. Horton, Wyalusing, March* 3, 1881.

I spent many a pleasant day in my boyhood with the men who ran the shad fishery in the Susquehanna, near where I now live. This fishery was about two miles above the mouth of the Wyalusing Creek, at the place we now call Terrytown; formerly all was Wyalusing along here. There were other fisheries above and below us, but this the only one I have any personal knowledge of. The proprietors were Jonathan Terry, esq., Maj. John Horton, sr., Maj. John Taylor, Edmund Dodge, Maj. Justus Gaylord, Gilbert Merritt, William Crawford, and William Wigton. Year after year, for a long time, these men operated this fishery, generally taking the month of May and a part of June of each year, always regaling themselves with a little good *old rye*, and having a fine sociable every night when counting off and distributing the shad caught during the day. Occasionally they sent substitutes, but the fishery never changed proprietors. Some seasons they caught largely; others not so many. I well recollect one draught or haul when they caught 500, but ordinarily 20 to 50 at one drawing of the seine was considered good. The average per day, according to the best of my recollection, would be about 150.

People came from the eastern part of the county, then just settling, up to Wyalusing, as far or nearly as far as from Montrose, to buy shad. The trade was quite large. Some of the time maple sugar was quite a commodity, brought down to exchange for shad.

Very few of any other kind of fish except shad were ever caught. Occasionally a striped bass, large pickerel, carp, sunfish, mullet, sucker, or a bull-head was taken; no small fish, as the meshes of the seine were large enough to let them through.

The shad were worth from 10 to 25 cents each, according to size. I have seen them caught here weighing nine pounds; ordinarily their weight was from four to seven pounds. If we could have that old shad trade here again it would make us all, if not rich, merry again. But very few are now left among us who saw those glorious old fishing days. The fishing for black bass of these days does not begin to compare with those old fishing days.

I can recollect of but one fishery between Wyalusing and Towanda, and only two between Wyalusing and Tunkhannock.

11. *Statement of S. Jenkins, Wyoming.*

The present inhabitants of Wyoming have but a faint idea of the value of fish to the early settlers. They performed as important a part at Wyoming as they have in the history of all new settlements. A careful study of the advance of immigration and the settlement of new regions shows that those settlements have been guided and controlled by the streams and waters in which fish abounded, and hence were made along their shores. Fish furnished the people a plentiful and healthful supply of food, easily attainable, until the forests could be hewn down, clearings made, crops raised, and cattle could increase and multiply.

It is unquestionable that the early progress made in settling up of our country was due in a large measure to the presence of fish, which furnished food in absolute abundance in the midst of desert lands; and it would be as idle to attempt to disparage the value in the economy of those times as it would be to prove the value now beyond the mere mention of the fact.

The fish that attracted the most attention and were the most highly considered in the early times were shad. The knowledge of these excellent fish in the Susquehanna, at Wyoming, has become almost entirely historical, if not entirely so. But few persons now resident at Wyoming have a personal knowledge of the shad fisheries there and their value to the people in the early days, and hence some of the stories told of the immense hauls of them made in "ye olden time" seem to the present generation more fabulous than real.

That we may the better understand the subject I will give extracts from the writings of strangers, and then conclude with an account or two of our own people and what I myself have seen.

In 1779, when General Sullivan passed through Wyoming on his western expedition against the Indians, a portion of his advance were located at Wyoming from May to the last of July. Many of his officers kept diaries, in which they noted their movements from day to day and touched slightly upon such objects of interest as attracted their attention. I will give a few extracts from these diaries relating to fish at Wyoming.

Dr. Crawford in his diary, under date of June 14, 1779, says:

"The river at Wyoming abounds with various kinds of fish. In the spring it is full of the finest shad. Trout and pickerel are also plenty here."

George Grant, under date of June 23, says:

"The Susquehanna River affords abundance of fish of various kinds and excellent."

Dr. George Elmer, under date of 23d June, says:

"Spent chief part of the day in fishing. Salmon, trout, suckers, bass, and common trout are plenty in the river, of which we catched a number with a seine."

Daniel Gookin, under date of 28th June, says:

"The river Susquehanna, on which this lies, abounds with fish. Shad in great plenty in the spring, as they go up to spawn. The shores are covered with these fish which have died up the river, through their too long stay in fresh water."

There were some twenty-five or thirty what we called shad fisheries within the bounds of old Wyoming. Every available point for casting out and hauling in a seine on the beach, whether on an island or on the mainland, was used as a fishery, and had its owners and its seine. The average number of shad taken at each of these fisheries in a season was from 10,000 to 20,000, beside other fish which were caught before and after the shad made their migration.

It is given on good authority that 10,000 were caught at one haul at the Stewart fishery, about midway between Wilkes Barre and Plymouth, about 1790. This was called the widows' haul.

The settlements, after the massacre of July 30, 1778, had so many widows and fatherless children among them that they made special provisions of bounty for them on many occasions, which were wrought out in such a way as neither to give offense nor to convey a sense of undue obligation.

Among the arrangements of this character was that of giving one of the hauls at each fishery every year, to the widows and fatherless of the neighborhood, and hence called the widows' haul. By common consent it was agreed that the widows should have a haul made of the first Sunday after the season of shad-fishing commenced, and they were to have all caught, whether more or less.

This big haul was made on Sunday.

At the rate I have given, which is made up more from general information upon the subject than from statistics, the number of fish caught annually was about a half a million, which at 30 cents each would make $150,000.

Were the Susquehanna as well stocked with shad to-day as it was a hundred years ago our keen and hungry fishermen would easily double the catch, and still, like Oliver Twist, "cry for more."

I recollect seeing, in the spring of 1826, a haul made in a cove at the lower end of Wintermoot Island, west side, numbering 2,800 shad. When thrown out they whitened a large space upon the shore.

Being the first haul of the season, the fish were largely distributed among the people, and even after that my grandfather had a half barrel for his right as owner of the seine and fishery.

About 1831 or '32, in the fall, an unusual catch of eels was made in a weir on the east side of Wintermoot Island. During one day and night 2,700 of them were caught, while many escaped from want of means to handle them and take them away as fast as they came in. Another day and night 900 of them were caught, when the basket floated off with the high water.

I herewith give you copies of two papers in my possession bearing upon the shad-fishery question. It will be seen by one of them that the price of shad in the early times was 4*d.* or 4⅓ cents each; quite a different price from what they sell at in our day. Tear the dam from the Susquehanna and we shall have plenty of shad, if not at 4*d.* each :

" Be it known that I, Peter Shafer, have sold all my right in and unto all my right in the Dutch fishery, so called, below the Nanticoke Falls, so called; for and in consideration thereof I, Jacob Cooley, do promise to deliver Seventy shad, unto William Miller, on account of me, the said Peter, on or before the 20th May instant; or otherwise settle with said Miller for what I am indebted for my part of said Seine, and likewise the said Cooley is to deliver Six gallons of Whiskey unto the said Peter, between this date and *Weat* harvest.

" Witness our hands this 14th day of May, 1800.

" PETER SHAFER.
" JACOB COOLEY."

" James Fox holds an order for 725 shad drawn by George Frazer on James Stewart, date April 27.

(Indorsed on the back in these words:) Credit for 350 shad received by me. David Morgan.

(Indorsed:) Copy of Frazey's order. Henry Thomas charges the Estate with 4*s.* 8*d.*, paid in Rye. Paid.

No. 40—725 shad, less received, 350, leaves 375 shad, at 4*d.*=125*s.*= £6 5*s.*, or $16.67. Add interest on same $9.50=$26.17. (£=$2.67.)

12. *Statement of Elisha Blackman, Pittston, March* 22, 1881.

I see that G. Fowler, of Berwick, tells a *big fish story.* I incline to think, however, that it is true. I recollect when I lived with my grandfather, in what is now South Wilkes Barre, perhaps 1798 or 1799 of last century, the great haul of shad at Nanticoke was made. I believe there were nine or ten thousand taken. A number of seines were engaged in it, and lawsuits were the consequence. Salt was scarce and dear. Northampton men came with pack-horses loaded with salt, and returned loaded with shad. I bought and kept the public house that had been kept by John Courtright on the Plains, Wilkes Barre Township, in the spring of 1815. There were then two fisheries between us and the Pittston Ferry—one at Monocacy Island landing, on the shore of Mr. Samuel Cary's land, the other starting at or near the Wintermoot Island and landing above the ferry at Blanchard's. That season I got my supply at the upper fishery; the first day's attendance was a "blank" day—few or no fish. The large schools of Mr. Fowler's times were dwindled greatly, undoubtedly because of the numerous fisheries that existed below, and the destruction of the young shad by the many eel-weirs in their descent to the ocean in the fall. My time was too valuable to attend on blank days. I left money with Mr. Joseph Armstrong, and he sent me my supply when successful. The next season (1816) the difficulty that had existed between the fishermen at Monocacy (twelve in number) and Mr. Cary, the owner of the land, was settled by giving him the thirteenth share, and ever after I got my supply from the fishery until the canal dams cut off our supply totally. It was a serious damage and inconvenience to us, as markets for fish and meat did not exist then as now. The Susquehanna shad had a far more delicious flavor than any we get now.

General Isaac Bowman, Samuel Moffit, and some of our Plains neighbors, having secured a landing on the Nommock, at the foot of Monocacy Island, fitted up a fine seine and necessary boats (canoes) and caught half a dozen shad, having fished twice as many days. I shared two, having found the whisky (before my temperance days); others outbid me, determined to taste the good of their labor. I am in my ninetieth year.

13. *Statement of Isaac Thompson, Lee, Lee County, Ill., April* 12, 1881.

I was born at Pittston in 1796. My father's farm lay along the side of the Susquehanna River. I lived on the farm fifty-one years. In regard to the shad fishing, as I grew up to manhood I fished many days in the shad-fishing season of the different years. The first run was the male shad—not near as good as the female. After catching the first run then if we could have a rise of water then came the female—a far better quality. The female put for the headwaters of the river, and there would spawn; then the old fish would come back down the river, and the wind would often drive them on the shore, and they would lay there rotting till they stunk. People used to come down from toward Easton, Northampton County, and bring whisky and salt, and trade for fish; also from the upper part of old Luzerne County, bringing maple sugar to trade for shad. One man by the name of Taylor bought fifteen and put them in a sack after they were cleaned, shouldered them and walked off with them. I have known upwards of a thousand caught in one day on the point of the island. As to the localities of the fisheries, there was one at Falling Spring, about four miles from where I lived, another on the point of Wintermoot Island, and the next on the side of the island between two and three miles from where I lived. They drew out on the beach of Samuel Cary's farm; another just below that, I think, drew out on the farm of Crandall Wilcox; another just below the falls. Please excuse me now, as I have done as well as my memory will allow me to. We have done no fishing since Nanticoke dam was built.

14. *Statement of Steuben Butler, a son of Col. Zebulon Butler, who led the patriots at the battle and massacre of Wyoming*, 1778.

I was born 1789; remember the old shad fisheries in the river here very well; was not a fisherman myself; after the run of shad had started I used to get in a boat and row up to the fishery and purchase my supply of shad and bring them down and salt them away. The price varied according to the abundance of the shad, some seasons being less expensive than others. As I recollect it, the Pettibones used to have charge of the fishery above Wilkes Barre.

15. *Statement of Dr. Charles F. Ingham.*

I remember the old shad fisheries in the North Branch, particularly the Butler fishery, which was on the bar opposite and a little above Union street, Wilkes Barre. Nanticoke dam was commenced in 1828 and finished in 1830, and I recollect that that ended our fishing. Although I saw shad caught below the dam by hooks attached to poles—think it was the year the Shamokin dam went out—yet I have never heard tell of or seen shad being caught since that time above the dam. The shad, as I remember them, were very fine and particularly large. I have seen the beach, after the drawing of the seine, for a hundred feet absolutely alive with flapping shad, each one reflecting the sunlight like a burnished mirror. I recollect having the salted and smoked shad during the fall and winter, and fine delicacies they were.

After our shad fishing was cut off a great number of salt shad were brought from Philadelphia and other points, meeting with ready sale, on account of general knowledge of their delicacy. I believe that at one time the people knew more of salt shad than they now know of salt mackerel, and more of smoked shad than now of smoked salmon.

I believe that a proper shad-way could now be put in the Nanticoke dam at an expense not to exceed $10,000, and probably for less, without interfering with navigation.

16. *Statement of Mr. Isaac S. Osterhout.*

In 1820 or 1821 we caught shad in very large quantities at Black Walnut Bottom. I remember well I went with a gentleman to Salina, N. Y., after salt, as we had run out of that article very early in the season; he had a load of whetstones and I a load of shad. I could have easily gotten rid of my shad on the first day had it not been that he and

I had agreed that the whetstones should sell the shad, and *vice versu.* So it was several days before we got our loads of salt, as the whetstones went terribly slow.

In 1822 and 1823 I was at Hunt's Ferry, where the shad were plenty. I came to Wilkes Barre in 1830, the early part of the year—the same year the Nanticoke dam was finished; do not recollect of any shad being caught after that. I recollect of a Mr. Water Greens, who came from New England and settled at Black Walnut Bottom, giving twenty barrels of shad for a good Durham cow.

17. *Statement of Miss Mary Coates.*

I was born in 1803; came to Wyoming Valley to live in the year 1823. I remember very well the catching of shad in large numbers by the inhabitants and the cleaning of them along the river shore. I remember, too, that the country people came in crowds during the season from miles away and returned home laden with fish. I remember the anger of Gildersleeve's negress one day, when it was said that Gildersleeve had made her wade out into the river after shad heads. The circumstance was as follows: While cleaning the shad she had cut off the heads and placed them on a board, saving this most delicate part of the fish for herself, and while she was busy the board, covered with shad heads, was either pushed by some one or drifted out into the river, when she waded out to get it. Do not know anything of the numbers caught. The people had shad from spring to spring. I do not remember of any shad being caught after the Nanticoke dam was put in.

18. *Statement of Capt. James P. Dennis.*

I remember the old shad fisheries in the river. There was one just below the bridge at Wilkes Barre, drawn out on the opposite shore; this was called the Bowman fishery. I recollect once holding the shore brail of the seine at this point, when William Alexander held the river brail. There was a fishery on Fish's Island, about three-quarters of a mile below the bridge.

19. *Statement of Jameson Harvey.*

I was born in 1796. I remember the old shad fishing in the North Branch of the Susquehanna River very well. James Stewart had a fishery opposite my place. The big haul was made at Fish Island fishery. I recollect it very well; they didn't know how many they caught. After all were disposed of that could be the rest were thrown on the fields, and pretty near stunk us to death; they were landed on the point of the island. There were two seines on Fish Island, one owned by Nanticoke parties the other by Buttonwood parties, who took turn about fishing. The Mud Fishery was at Steele's Ferry; they drew out on Shawnee side. The Dutch fishery was below the dam on Croup's place. Below Hunlock's Creek was another, that was called a Mud fishery. There was a fishery at Shickshinny. When the big haul was made the shad sold for a cent a piece; they sold as many as they could; there wasn't salt enough. In those days they didn't salt down so much pork; they depended upon the shad they caught; they gave the poor a chance after they got all they wanted. People on the West Branch used to own an interest in the Hunlock fishery, and a Mr. McPherson used to come in a boat to get their fish and take them back. They used to come from Easton bringing salt, with which they used to buy fish; you could get one hundred shad for a bushel of salt. Nanticoke dam was commenced in 1828 and finished in 1830. I only recollect of one shad being caught above the dam since it was put in, and that was on the flats after a big freshet. The people used to go off the bars with as many shad as they could carry; they came in from all around in crowds; they used to camp, and salt their fish down on the banks of the river. Mr. McPherson used to take his boats back to the West Branch loaded. He traded off cider, oil, and whisky. At the time the dam was put in shad were selling for 10 cents and 12 cents each. Widow Stewart used often to take in $30 or $40 of a night for her share of the haul.

Hunlock's, Dutch, and Mud fisheries were night fisheries. Stewart's and Fish Island were day and night fisheries. Farmers hauling grain to Easton often hauled back hundreds of bushels of salt. Boats coming up the river used to bring leather, cider, oil, salt, and iron; going back they would take shad.

McPherson and Hunlock owned the Hunlock fishery and had a large fish-house. Hunlock got as his share from five to six hundred dollars per year, besides all the shad he could use. We used to have shad until shad came again.

The owners of fish-houses used to have arrangements so that when they ran out of salt they could dry and smoke the shad, as they now do herring and salmon. Some of the shad used to weigh 8 or 9 pounds. I saw one weighed, on a wager, turning the scales at 13 pounds; about seventy or eighty would fill a barrel. The shad improved very much coming up the river, those caught in this valley being very much larger and finer than those caught at Columbia. I remember when Shamokin dam went out the shad came up to our dam and were caught.

20. *Extract from Miner's History, p. 209.*

April 21, 1778.—At a town meeting prices were set on articles of sale, &c.:

Winter fed beef, per lb	*7d*
Shad, apiece	*6d*
Tobacco, per lb	*9d*
Eggs, per doz	*8d*

21. *Extract from the Susquehanna Democrat.*

1818, *April* 17.—"Newark, N. J., April 7th, shad fishing. On Wednesday 3 shad were caught in the river Passaick. A pair of them weighed eleven pounds, and were sold to one of our public innholders at a shilling a pound. A solitary one was caught about 2 weeks before and sold to the same innkeeper."

1819, *May* 14.—"Shad are this season taken in unusual numbers; they have been sold in Philadelphia as low as $4.50 per hundred and at the Potomac fisheries as low as $3."

1820, *April* 21.—"At Alexandria shad *is* selling for $2.50 a hundred and Philadelphia they are selling for $3. In Wilkes Barré, notwithstanding the scarcity of money, they are held at $18.75."

1822, *April* 26.—"We congratulate our friends on the prospect of soon obtaining a supply of fresh shad; about sixty were caught here on Wednesday (24th), and yesterday (25th) upwards of three hundred. We learn that at Berwick they are caught in abundance."

The above was all that could be found in a file of fourteen years, 1810–1824, bearing upon shad. In the Federalist, printed at the same time, nothing was found.

22.–*Deed by Silas Smith of half his shad fishery.*

Know all men by these presents that I, Silas Smith, of the township of Newport, county of Luzerne, and State of Pennsylvania, have sold unto Caleb Wright of the district of Huntington, in the county and State aforesaid, one equal half share of a fishery on the lower end of my farm, for the consideration of twenty pounds ($53.33) lawful money of Pennsylvania to me in hand paid, the receipt of which I hereby own and acknowledge. I hereby bind myself, my heirs, executors, administrators, or assigns, and every of them, by these presents, to warrant and forever defend unto him, the said Caleb Wright, his heirs, executors, administrators, or assigns, the one-half of said fishery to the only proper use and benefit of him, the said Caleb Wright, his heirs, executors, administrators, or assigns.

In witness whereof I have hereunto put my hand and seal, this fourteenth day of May, in the year of our Lord one thousand eight hundred and four—1804.

23.–*Extract from Miner's History of Wyoming, p.* 141.

"The month of February, 1773, had so nearly exhausted the provisions of the Wilkes Barre settlement that five persons were selected to go to the Delaware, near Stroudsburg, for supplies. * * * The distance was fifty miles, through the wilderness, &c. * * * The men took each an hundred pounds of flour, and welcome was their return to their half-famished friends at Wilkes Barre. Never was an opening spring or the coming of the shad looked for with more anxiety or hailed with more cordial delight. The fishing season of course dissipated all fears, and the dim eye was soon exchanged for the glance of joy and the sparkle of pleasure, and the dry, sunken cheek of want assumed the plump appearance of health and plenty."

VIII.—THE FISH SUPPLY OF LONDON.

[From the LONDON QUARTERLY REVIEW.*]

1. *Report of Spencer Walpole, esq., Inspector of Fisheries to the Home Office, on the destruction of fish at Billingsgate, in consequence of the alleged inadequate accommodations at Billingsgate Market.* (*Ordered by House of Commons to be printed July* 20, 1881.)
2. *Report to the Common Council from the Fish Supply Committee appointed by the Corporation of the City of London.* (*October* 31, 1881.)
3. *Minutes of evidence taken before Special Committees of the Lords and Commons upon the London Riverside Fish Market Bill.* (*Session of* 1882.)

Nearly thirty years have passed since the publication in our pages of an article which produced no ordinary impression at the time of its appearance. In that article, having for its subject "The commissariat of London," we ask our readers to imagine that the principal meal of the day was proceeding in a well-to-do metropolitan home, and we endeavored to trace to their sources the various edibles consecutively put upon the table—the fish to its ocean-bed; the flocks and herds to their downs and pastures; the wild animal to its lair; the game to its covert; the fruit to its orchard; the bread to its parent cornfield—in order to point out how they are fattened, netted, trapped, captured, bagged, gathered, harvested, and conveyed to their ultimate destination, "the great red lane of London humanity."

It was natural under these circumstances that we should begin with fish. Although we devoted no more than nine pages to chronicling the operations then carried on in "Mr. Bunning's new market at Billingsgate," it could hardly have escaped the notice of an intelligent reader that "the harvest of the sea," being, as Mr. Spencer Walpole and Professor Huxley assure us, "practically inexhaustible," could not be thoroughly described, or, indeed, be more than glanced at within so brief a compass. We told our readers what fish are ordinarily brought to Billingsgate at that time; but of the fish which, were it not for the limited area and inaccessibility of London's only market, might be brought there, we said nothing. The total supply of fish sent annually to Billingsgate about the year 1853, as given in Mr. Horace Mayhew's "London Labor and the London Poor," seemed to us so enormous, that we submitted the table to an undeniable authority, who assured us that it was no over-statement. What would he now have said if

* No. CCCVIII, October, 1882. pp. 231 to 242.

told that the volume of fish sent to Billingsgate was nearly three times larger in 1880 than in 1853; that within the last six years it has increased from 95,000 to 130,000 tons per annum, and that this latter figure means a supply of 400 tons of fish for every working day, being, according to Mr. Edward Birkbeck, M. P.,, equivalent to a drove of 1,000 fat oxen entering London upon every one of 313 days in each current year?

Surprising as this statement may appear to many, it is nevertheless beyond a peradventure that of the cheaper and coarser kinds of fish which would enter directly into the consumption of the poorer classes an absolutely illimitable supply might be poured into the metropolis by river if a suitable market, open at all hours and accessible at all states of the tide, were available to receive it. Before showing what sort of fish market it is absolutely necessary that London should have, we propose to reveal what, at this moment, Billingsgate is. The materials for describing it lie close at hand. They may be gathered in abundance from Mr. Spencer Walpole's report to the home office; from that of the fish committee appointed by the corporation of the city of London, to which Billingsgate belongs; and, *passim*, from the evidence given before the two special committees of the Lords and Commons, which sat last session, to consider the "London Riverside fish market bill." Better, however, than any description would be the practical experience gained by a Londoner who had sufficient energy and curiosity to pay Billingsgate a visit between the hours of 5 and 9 upon a Friday morning, the best day in the week for seeing it to advantage. There is an Eastern saying, to the effect that the distance between the ear and the eye is very small, but the difference between hearing and seeing very great. Reading is but another form of hearing and to those who care to understand what the Billingsgate monopoly means, we would recommend a visit to the famous market upon the first morning of a week-day that may suit their convenience.

Billingsgate market (concerning the antiquity of which there is a difference of opinion between those who hold, with Mr. Walter Thornbury, that it owes its origin to Belin, a king of the native Britons, who flourished 400 years B. C., and others who maintain, with Stow, that a man called Billing, or Beling, owned a wharf upon the same spot, presumably in Queen Elizabeth's reign) is now and has been the property of the city of London for so long a time that it is not easy to calculate the amount of revenue already brought in by it. It has a frontage to the river of 200 feet, and a superficial area of 40,000 square feet, which area affords sites to seventeen shops and two large public houses, although, since the "Riverside fish market bill" came before Parliament, the site of one of these public houses has been voluntarily thrown into the market.

The interior of this metropolitan emporium of fish, being obviously far too narrow for the business transacted there, is divided into spaces or forms placed in such close contiguity to each other that the customers purchasing at one form interfere with those who would fain approach its neighbor. The price charged for the forms is excessively high, being at the rate of 9*d.* a square foot per week for each. Billingsgate is situated above that portion of the river call the Upper Pool, which carries more floating traffic than any other reach of water approaching it in size upon the face of the globe, so that the dangers of navigation to which cutters and steamers approaching the market by night are exposed exceed description. The width of the portion of the river opposite to Billingsgate left open for navigation does not exceed 200 feet. In front of the market, on the water side, there is a large floating pontoon, but the steamers are not allowed to come alongside it in order to unload, being compelled to lie off at a distance of nearly 100 feet from the market quay, and to land their fish along planks thrown out from the steamer to a barge, and from this barge to the floating pontoon. Every pound of fish brought by steamer and landed from the river at Billingsgate is carried along these planks upon men's heads. Only two roads, one from and one to the steamers, are permitted to exist, and as the men have no choice but to follow each other it is evidently impossible to land a large quantity of fish before the market closes at nine in the morning. The result is that fresh fish is often thrown away, because it will not keep until 5 o'clock upon the following morning. This being the plight to which fish-carrying steamers are reduced, the trials and difficulties awaiting sailing cutters entitle them to still greater commiseration. Being sharp-bottomed vessels they have to lie out in the stream, and to land their fish, at considerable expense, in barges. There were once some piles in the river to which the cutters could make fast, but the market authorities drew them. It ought, in addition, to be mentioned that the work of landing fish along the planks which we have just described is dangerous to the men engaged in it, and all the more so because during half the year it is done in the dark. Accidents happen frequently, and occasionally there is a loss of life. The unnecessary expense entailed in this manner upon those who consign fish to Billingsgate may be inferred from the fact which came out in evidence that the largest firm in the trade had in 1880 to pay £4,321 9*s.* 4*d.*, and in 1881, £4,854, 8*s.* 7*d.* for landing their cargoes, an outlay which, had it been possible for their steamers to moor at the market quay, would have been entirely avoided, and which, of course, came ultimately out of the pockets of the consumers.

The approach to Billingsgate market from the land side is along Lower Thames street, a thoroughfare which is from twenty-eight to thirty feet wide, and along which not more than two vans can pass abreast. It follows, therefore, that only two streams of traffic can flow along it at the same time, and thus, if a van is being unpacked at the market, one of the two streams is temporarily blocked. If an accident of the most trivial kind should occur the whole of the traffic is brought to a stand still. Six vans, and no more than six, can unload side by side at the same time. The market opens at 5 o'clock a. m., before which hour no fish is allowed to be sold. As there are no vacant spaces or "lay-byes," for carts, for costermonger's barrows, and for vans, the streets adjoining the market are completely blocked as the hour of 5 a. m. approaches. The scene is of a nature to fill the spectator who witnesses it for the first time with wonder that, in the largest and most civilized capital upon the face of the globe, such a disgraceful anachronism should have been tolerated for so a long a time. Every lane and street leading to Lower Thames street is choked with costermonger's barrows and with fishmonger's carts, which extend as far as Cannon Street Arch, King William street, Monument Yard, East-cheap, and Tower Hill. The market, as we have already laid, closes at 9 a. m. When the clock strikes nine the police interfere and clear all the closely-packed vehicles, sometimes amounting to nearly four thousand in number, out of the city, in order to make way for the ordinary day traffic of the streets.

The market being open for four hours only, it follows, as a matter of course, that there are many customers who cannot complete their purchases before their barrows and vehicles are driven away. The nearest points to which they can retire are Tower Hill, Tooley street, or some other convenient spot outside the city bounds, where they wait until the fish is brought to them upon the heads of porters who charge heavy fees, and waste, into the bargin, no small amount of precious time.

So far as costermongers and fishmongers are concerned, the Billingsgate trade ceases at 9 a. m. After that hour the reign of the middleman or "bummaree" commences. It is of little moment to inquire how old this word may be, or whether, as suggested by Mr. Walter Thornbury, it is of Dutch origin, but at least it is certain that bummarees were known to Robert Burns's friend, the antiquarian and wag, Captain Grose. We find in Jonathan Bee's Lexicon Balatronicum, or Slang Dictionary, published in 1823, that "bummaree" is defined as "the man who at Billingsgate takes the place of the salesman, and generally after 8 o'clock a. m. buys the last lot. Derived partly from mare, the sea, to which most of them have been addicted." Writing in 1853, Mr. Mayhes says: "The market opens at 4 a. m., but for the first two hours it is attended solely by the regular fishmongers and by bummarees. As soon as these are gone the costers' sale begins. Many of the costers who deal usually in vegetables buy a little fish, especially if it is cheap, on the Friday, which is the fast day of the Irish; not to mention that the wives of mechanics run short of money at the end of the week and are compelled to eke out their dinners with fish." Since Mr. Mayhew wrote these words there has been a slight change in the conduct of the market. At present the bummaree is the first to reach and the last to leave the market. He is still of great use, but not so necessary as in 1853. At that time fish were sold in large lots, which the bummaree, as a member of the Billingsgate ring, bought, and, having broken them up into smaller lots, sold to little buyers. Now, however, the large factors sell by auction, offering only one package or box containing at most 1 cwt. of fish at a time. This lot fetches from 1*s.* up to £7., according to the description and quality of fish contained in it. Thus the fishmonger and coster have a fair chance of bidding against what is called "the trade," but it is the bummaree's province to sort and divide the contents of each box into fish of different sizes for the convenience of the retailer. After 9 a. m. the auctioneers are obliged to sell or throw away the fish still left on hand, and the bummarees, acting in concert, have it in their power to fix the price at which it is knocked down. The result is that many lots are "for a song," and that occasionally large quantities are thrown away, which, if retail fishmongers and costermongers could make their way to the market at any hour of the day, would infallibly be sold at fair prices, instead of being sacrified or wasted as is now the case.

In his interesting evidence before the Lords committee, Mr. Spencer Walpole defined the position and occupation of the bummaree as follows:

"The ordinary course of business is for the wholesale salesman to sell fish to the retailer; but in Billingsgate the bummaree steps in between the two men. He buys the fish after market hours from the wholesale salesman, and takes the chance of selling it in the course of the day at a profit to the retailers. Therefore, as I understand the matter, he occupies very much the same position as the man who used to be called the 'forestaller' or 'regrater' in the corn market at the beginning of the century."

Far be it from us to rail against the bummaree. As the matter now stands he fulfills very useful functions, but it cannot be denied that his very existence is due to the deficiency and inadequacy of the market in which he conducts his operations. When a new wholesale and retail emporium has been established upon the river side we trust that the bummaree may emulate the example of that sagacious guard to the Edinburgh mail who got himself converted into a stroker, and thus found a new vocation to engage his attention. At present the bummaree stands between the costermongers, who represent the poor of London, and the fish for which they are clamoring. Billingsgate has bred and nurtured him, and with the Billingsgate monopoly it is to be hoped that he too will be improved off the face of the earth.

Two efforts, according to Mr. Walpole, have been made to divert the fish-trade of the metropolis from Billingsgate. In the first place a market was established at Hungerford Stairs. Being too far up the river and too remote from the East end it had but a brief span of existence. When we mention that a line drawn north and south across the center of London Bridge leaves a population of about one million six hundred thousand souls who live below the bridge, and about two million four hundred thousand souls who live above it, it will be seen at a glance that Hungerford Stairs are not easily accessible to costermongers engaged in supplying the dense masses of poor people who dwell at the the East end. The second attempt to supplement Billingsgate was due to the generosity of Lady Burdett Coutts, who caused a superb building to be constructed in East London, and gave it the name of Columbia Fish Market. It had a still shorter lease of life than its predecessor at Hungerford, the consequence being that the ancient tyrant flourished with greater vigor than ever. As time advanced the inconveniences of Billingsgate, always considerable, were enhanced by the increasing magnitude of the trade and by the altered conditions under which it was conducted. The railway soon began to supersede the river, and fish, instead of coming to London by water, found its road there in fast trains. It was bad enough for smacks, cutters, and steamers to thread their tortuous way to the metropolitan fish market along a river which is always choked with traffic, and through the mazes and intricacies of the "Upper Pool;" yet, while the market could be reached somehow or other by water, it had become almost unapproachable by land, and it was by land that two-thirds of the fish supply of London now came to Billingsgate.

The following table of the quantity of fish delivered at Billingsgate market, or its immediate vicinity, between the years 1875 and 1880 will show the proportions of railway-borne to water-borne fish, and we shall have something to say presently as to the comparative cost of the two modes of carriage:

	1875.	1876.	1877.	1878.	1879.	1880.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Delivered by railway	71,367	73,919	82,771	94,566	92,474	87,884
Landed at wharves	1,473	1,259	1,698	4,903	4,338	5,487
Water-carriage fish landed at the market	22,109	24,247	22,799	27,300	30,080	37,258
Total	94,949	99,425	107,168	126,769	126,892	130,629

How bad the land approaches to Billingsgate have always been we have already shown, but their badness was of comparatively slight importance so long as the bulk of the fish was brought thither by water. When, however, it became necessary to deal each year with some 90,000 tons of railway-borne fish, and to deliver them at Billingsgate through choked streets and narrow lanes which would disgrace a town of 50,000 inhabitants, the difficulties were so augmented that fish vans sometimes took eight hours to get from the Great Eastern or Great Northern Railway terminus to the market where they had to unload. Each succeeding year the block increased; and, moreover, it was still further aggravated by the development of the trade in dried and fresh fruits. The fruit salesmen, says Mr. Walpole, like the fish salesmen, naturally congregated at the river side. The fruit arriving in the docks were landed and carried through Thames street to Pudding Lane, where most of the fruit salesmen took premises; and the unfortunate street, which was altogether too small for the fish trade alone, was required to accommodate the fruit trade also.

It must not be supposed that the city fathers were blind to the growing inconveniences of their solitary fish market. Without going back further than twenty years we may notice that in 1862 Mr. Horace Jones, the city architect, suggested the only practicable scheme for making Billingsgate more accessible by land that has yet been laid before the common council. At an estimated cost of £88,000 he proposed to construct a new street from the corner of East-cheap and Fish Street Hill to Thames street. The common council approved, but allowed the proposition to lie on the table; and when, twelve years later, the improvement committee of the city of London sought to give effect to the city architect's plan it was found that in the interval between 1862 and 1874 the estimated cost had risen from £88,000 to £525,000.

Time went on, and matters at Billingsgate proceeded from bad to worse. At length, in 1878, Colonel Fraser, the chief commissioner of city police, reported to court of common council that, in the phrase so much dreaded by Lord Melbourne, " something must be done." Colonel Fraser protested emphatically that "the commerce had far outgrown the capacity of the streets for carrying it;" adding that "an overgrown business is carried on in thoroughfares or rather in lanes not wide enough to admit more than two lines of traffic," the consequence being " that the stoppage of one vehicle for any purpose brings the rest to a standstill." The only effect produced by his energetic remonstrance was that Monument Yard was paved as a street, so that many of the fruit vans and some of the fish vans were able to find standing room there.

Nothing else of a material nature was done or attempted with a view to improving the approaches until, in 1881, the corporation of the city of London resorted, not for the first time, to the evasive measure which is invariably adopted by the House of Commons when in perplexity. They appointed a committee to inquire into the fish-supply question, and about six months later the home secretary instructed Mr. Spencer Walpole to report upon the handling and distribution of fish at Billingsgate. Both reports are now before us, and between them there is substantially no difference, although Mr. Walpole's is the abler and more searching of the two. Both agree in stating that Billingsgate is far too small and too difficult of approach by land to fulfill the duties imposed upon it as the sole wholesale and retail market for supplying fish to a population of from five to six millions, resident within 7 miles of the Royal Exchange—that is to say, upon an area which embraces about 150 square miles of ground.

A few brief extracts from each of these important documents will be of service in elucidating the bearings of the question. From the report of the corporation's fish supply committee let us select the following passage:

" We now come to the question which directly affects the corporation as the market authority, viz, the sufficiency or otherwise of the present accommodation of Billingsgate market, and of the approaches thereto, to meet the requirements of the present day; and when, as regards the approaches, we plainly record our opinion of their absolute insufficiency, we make no new admission, but simply indorse the oft arrived at conclusion of this court. The prior question, however, as to the market accommodation is on a different footing. On three separate occasions, within little more than a generation, the market has been enlarged or entirely reconstructed, and therefore in this direction the corporation has given practical proof of its desire to keep pace with the requirements of the metropolitan fish supply; and yet, incredible as it may appear, not only the weight of evidence in this inquiry but the prior action of the court and a pending reference to the markets committee alike go to prove that even now additional market accommodation is absolutely necessary."

So far from it "appearing incredible" to us that additional market accommodation should be necessary, it would indeed be strange if a bit of land about twice the size of the site upon which Exeter Hall stands sufficed for the purposes to which it is now put, even if the land approaches to it were as ample and unobstructed as those which lead to Albert Hall or Kensington Gardens.

Reverting, however, to the report, we desire to call special attention to the following words:

"We now approach, not without diffidence, the crucial point of our duty, viz, the course of action which we deem it wise and right to recommend to the court. The whole of the information gathered together has received our closest attention, and we have the satisfaction of reporting that we have unanimously, though, as regards some members, not without altering a previous impression, arrived at the conclusion that one wholesale market is calculated to meet the requirements of the trade and the interests of the public. We are also of opinion that such market should be at the waterside; and, as a general principle we are further of opinion that there should be ample and sufficient approaches from all parts of the metropolis to the site of any wholesale fish market. We beg further to state that, although in our judgment the fish market ought to be at the waterside, yet, should the court be of opinion that an inland market for the reception and sale of railway-borne fish is also required, we in that event suggest either of the two sites, one in Farringdon road, to the north of Charterhouse street, and the other the site of the present Farringdon market, as appropriate for the purpose. Of the market itself, we are of the opinion that it should be one based upon the same system as that at present in existence in Paris, viz, a wholesale, a semi-wholesale, and a retail market, all under one roof. We recommend that no restriction whatever should be made as to hours of business, but that the market should be free and open at all reasonable hours calculated to facilitate the reception, sale, and distribution of fish. Finally, we are of opinion that, taken in connection with our earlier remarks as to destruction of spawn, and the taking of immature fish, and also the present rates charged for railway carriage, the following have, amongst other causes, contributed to the unsatisfactory state of the fish supply, viz:

"1. The small size of the market at Billingsgate.

"2. The utterly inadequate approaches thereto.

"3. The arrangement at present existing for its management.

"We have spoken frankly, and we fully realize that our recommendations involve important and costly changes, which, however, are called for by the present condition of things."

Before proceeding to show how utterly incompatible the recommendations of the corporation's fish committee are with the further existence of the Billingsgate monoply, it seems desirable to repudiate without further delay any agreement with the allegations of this report as to "the destruction of spawn and small fish, and the taking of immature fish." With this end in view we cannot do better than quote the words spoken at a meeting of the Society of Arts, upon the 10th of May last, by Professor Huxley, who is perhaps the highest authority in England upon such matters. In reply to a not very wise speech, complaining that the fish supply of London was falling off and the retail price of the article increasing, and attributing the mischief to the wholesale system of trawling now in vogue, "which destroys millions of small fish, and ruins no end of spawn," Professor Huxley rose and said that—

"He experienced much the same sensation as Rip Van Winkle must have felt when he awoke after his long sleep; for the speech he just heard was identical in spirit and almost in words with a great multitude of speeches which came before him about twenty years ago, when he had the honor of being a royal commissioner to inquire into the condition of our sea fisheries. That commission arose in this way: Mr. Milner Gibson, who was president of the board of trade, sent for him one day, and told him that a member for a northern county meant to move for a commission of inquiry into the destruction of the fisheries on the east coast by trawling, and asked him what he thought about it. He ventured to say that he thought it was all nonsense, and that Mr. Milner Gibson had better refuse the commission. He did so, but the member beat him in the House of Commons, and he sent for him (Mr. Huxley) next day and told him he must serve on the commission. He served on it for two years, during which time a larger body of evidence came before him than had come under the eyes of most people. The complaints then made of trawlers were precisely those they had just heard; that the damage done by line fishermen was destroying a great source of the supply of men to the navy; that it was destroying the breeding of fish in the North Sea, more especially cod, whiting, and haddock; and, not only so, but it was rapidly destroying that upon which the trawlers themselves subsisted. It came out in evidence, first and foremost, that the fishing population supplied no appreciable contingent to Her Majesty's navy. It came out, in the second place, that the charge made against trawlers, that they would destroy the spawn of the fish ordinarily caught by the long lines, had no foundation; for, although it might appear strange for him to say so, yet he believed there was no body of men more absolutely ignorant of everything relating to fish, except the catching of them, than fishermen. The first complaint which came before them was that trawlers were bringing up an enormous quantity of spawn every day in their trawls; but, upon inquiry it turned out that what was supposed to be spawn was nothing but gelatinous inhabitants of the sea, which had just about as much to do with fish as cocks and hens to do with Jumbo. With regard to the charge made against trawlers of destroying spawn, he might mention that such fish as haddock and cod did not lay eggs at the bottom of the sea; their eggs floated at the top, so that it was impossible for the trawlers to destroy the spawn. Since that time there was abundant evidence to prove that, while trawlers had gone on steadily increasing, there had been no diminution in the number of cod, haddock, and whiting caught. Lastly, as to the supposed injury that the trawlers were doing themselves, there was no question that up to the present moment the amount of capital invested in trawling vessels had steadily increased, and he could not understand shrewd and clear-headed people like the last speaker putting their money into a business if it did not pay expenses. He could not describe the audacity of the statements made at that time with respect to trawl fishing. Witnesses came before the commission and stated that trawled fish were unfit for human food; that they were poisonous; and one man summed up all the demerits and atrocities of trawl fish by saying that they were "mashiated," though what he meant by the remark it is impossible to say. Beyond all doubt, if anything were done to stop trawl fishing on the enormous scale on which it was now carried out in this country; it would no longer be a case of complaining of the price of fish, but ninety-one out of one hundred would not be able to buy any fish except herrings and the like, which were caught in the open sea by nets. He could not give the figures now, but he recollected it being stated some time ago that 800 trawlers hailed from the port of London, and therefore it was preposterous to talk of interfering with their fishery. No answers had been put forward to the arguments adduced in the report to which he had referred, namely, the constant increase of capital put into the trawling business and the constant increase in the tonnage of the vessels employed; and to such patent facts as these, that a town like Brixham was absolutely built out of trawled fish, and the trawlers who caught the fish had trawled over a comparatively small area close to Brixham for the last 70 or 80 years, but the fishing was going on now as well as ever."

In these words Professor Huxley was but echoing the opinions of his former colleague, Mr. Spencer Walpole, whose views we shall presently have occasion to quote. Before doing so, however, we invite our readers to observe that the recommendations of the corporation's committee require Billingsgate, as the sole fish market of the metropolis, to possess properties which are absolutely impossible and unattainable under the circumstances. In the first place, its land approaches could never be made sufficient without spending a sum of money which would stagger even the city fathers, and throw their yearly budget into inextricable confusion. Secondly, the approach by river through the Upper Pool will always present insurmountable difficulties. Thirdly, the area of the market is far too small, and cannot be increased unless the custom-house be given up to the city, which the Government has no thought of doing. So hopeless, indeed, did the retention of Billingsgate as the sole metropolitan fish market appear to be in the eyes of the civic committee that they were induced to turn their attention to other river-side sites, and specially to one near Blackfriars Bridge, the estimated outlay upon which would have entailed an expenditure of from £900,000 to £1,200,000, not to mention that the conservators of the river would be certain to forbid its selection, on the ground of the encroachment it would make on the water-way. Lastly, the committee avow their opinion that neither the enlargement of the area of Billingsgate nor the establishment of additional markets at Farringdon road or elsewhere "would supersede the necessity for providing better approaches for facilitating the traffic in that locality." A more damaging denunciation of Billingsgate than is supplied by the report of the corporation's own committee it would indeed be utterly impossible to conceive.

Mr. Walpole is equally explicit to the same effect. His report says:

"Fishing in the North Sea, the great source of the London fish supply, is carried on in two ways: (1.) By boats working in fleets on the Dogger Bank, on the Silver Pits, on the German coast, and on other favorable fishing grounds; and (2), by boats working grounds usually nearer home, either singly or with only one or two companions. When the boats work singly and near home they are rarely away for more than twenty-four or forty-eight hours; when they work in fleets they are away for weeks and even months at a time. In the former case the boats returning to port to unload the fish sell them on the fish quay; the fish are then packed by the buyers and sent to London by train. They are more or less exposed to the sun on the boat, and they are exposed on the fish quay; they are then packed, in ice it is true, in a truck which has perhaps been standing in the sun for some hours; they are brought up in a railway van to town and then carried in a van through the streets of London. But when the fish are caught by boats working in fleets fast steamers attend the fleet to carry the fish back to London. They are removed almost as soon as they are caught to the hold of the steamer, covered with ice, and never unpacked till the steamer reaches Billingsgate.

"It does not require much reflection to conclude that fish dealt with in this way are more likely to reach London in good order than those which are removed from the boat to the quay, from the quay to the railway van, from the railway van to the street, and from the street to the market. In fact I believe I am right in saying that no fish coming by water would be condemned if it were not for two reasons: (1.) It occasionally happens that the fleet has moved its position before the steamers arrive, and the steamers in consequence fail to find it. (2.) It also occasionally happens that the catch is so large that the steamers are unable to store the whole of it in their holds, and are forced to carry some portion of it on deck.

"It is obvious then that, except from accidental circumstances, there is and there need be no loss among the fish which reach London by water. Water-carriage is cheaper than land-carriage. A box of fish carried direct by water to Billingsgate costs 2*s.* 1*d.* for carriage. The same box carried by land costs 3*s.* 9½*d.*, viz, 1*s.* 7*d.*, its carriage to Grimsby, and 2*s.* 2½*d.*, its carriage to London. It is not surprising, therefore, that as the cost by water is less and as the fish arrive in better condition, the London salesmen should prefer water-borne fish, and should look for the solution of every difficulty by a further development of the water traffic."

Mr. Walpole proceeds to give his reasons for thinking that, despite its superior cheapness, water-carriage will never entirely supersede the land-carriage of fish. He states that with a view to discouraging the land-carriage of fish some of the merchants who came before him as witnesses went so far as to propose that single-boat fishing should be prohibited by Government, and the men forced to fish in fleets. This suggestion seemed, in Mr. Walpole's eyes, to be impracticable. Fishermen are influenced by the same motives as other men. They naturally object to a system of fishing which keeps them away from their families for weeks at a time, and prefer to it a system which enables them to return home once in every twenty-four hours, even though the result may be that their fish cost a little more for carriage to London and arrive there in rather worse order. Is it possible, asks Mr. Walpole, to provide that railway-borne fish shall reach London so that a very small proportion shall be in a condition to necessitate condemnation? The witnesses who appeared before him at Billingsgate were of opinion that if inspectors were appointed at the various ports to prevent the sending forward of fish which were already bad this highly desirable consummation might be attained. But where are these inspectors to reside? If at the principal ports the fishermen would certainly resort to other ports where there are no inspectors. If, however, inspectors were established at every port and village where boats can land the expense would be out of all proportion to the end aimed at. Nor could it be expected that the Government would consent to bear the charge of a duty which would primarily be of advantage to the metropolis alone. It would be still more hopeless to ask local authorities to incur expense for a purpose diametrically opposed to the trade of their neighborhood. The only possible course seems to be to condemn in London the fish which are bad when they reach Billingsgate, and to trust to the effects of this condemnation to prevent salesmen from wasting money by sending other bad fish to London.

"If this conclusion be correct," adds Mr. Walpole, "then the state, not of Billingsgate, but of the approaches to Billingsgate, must, in my judgment, be held responsible for some portion of the loss which arises from the necessary destruction of condensed fish. I have already endeavored to describe what those approaches are. The vans arriving from the railway station, the carts of the retail dealers arriving to buy, make them almost impassable, and the system on which the traffic is, perhaps unavoidably, conducted, makes confusion almost hopeless. On general grounds it would apparently be desirable that the vans which reach the market first should be unpacked first, and should then proceed as empties to their destination. But in practice this is never uniformly done. The vans which arrive first may contain fish for which there is no particular demand, while the vans which are perhaps in the rear of the line may contain other fish for which there is a great demand. The vans, therefore, instead of being unpacked, are forced to move on, and thread their way through the crowded thoroughfares of London till they are able to obtain a fresh place in the line. One van, whose case was exceptionally unfortunate, returned in this way, not merely time after time, but day after day, and for eleven days. The fish which it contained were of course ultimately condemned.

"How, then, is the difficulty to be obviated which at present exists? I believe it to be impossible to obviate it till the approaches to Billingsgate are reconstructed, or the market is itself removed. A market does not deserve the name which does not afford (1) accommodation for buyers and sellers; (2) standing room, and, where perishable articles are concerned, standing room under covered ways, for the vans which are being unpacked; and (3) easy access. Billingsgate fulfills the first of these conditions. It wholly fails to fulfill the second and third of them. A market without approaches is, in fact, as inconvenient as a house of many stories with-out a staircase. It is said that the amateur architect is apt to forget the staircase when he builds the house. I should very much regret to call the corporation of London an amateur architect, but it has undoubtedly committed the mistake of reconstructing the market and of forgetting the approaches."

We have said enough to show that Billingsgate is past praying for; nor can much sympathy be expected from the public with the efforts made last session by a portion of the common council to save its life by defeating the London riverside fishmarket bill before the special committee of the House of Lords. Thanks to the refusal of Lord Salisbury and of the Duke of Richmond to sustain the two mischievous clauses imported into the bill by the Lords' committee, and thanks also to the energetic speech of Lord Shaftesbury, these clauses were withdrawn, and there is at length a fair chance that London will shortly have a riverside fish market worthy of the largest and hungriest city in the world."

It remains for us to inquire what are the attributes and properties that a metropolitan fish emporium should possess, and to see how far they are supplied by the site at Shadwell, where it is understood that the new market authorized by the two Houses of Parliament is about to be established. What these essentials are was clearly laid down by the fish committee of the common council when they arrived at the following conclusions:

1. That one wholesale market is calculated to meet the requirements of the trade and the interests of the public.

2. That such a market should be at the water-side.

3. That there should be ample and sufficient approaches from all parts of the metropolis to the site of any wholesale fish market.

To these three very obvious conclusions a fourth might have been added to the effect that the market should be established at a point where the river is sufficiently wide for the sailing vessels and steamers moored at the market quay to be out of the way of the stream of floating traffic which passes ceaselessly to and fro along that crowded highway of nations.

That the site at Shadwell conforms to these conditions is evident from the following arguments which were deemed irrefutable by the special committees of the Lords and Commons when brought before them last session.

1. The London riverside fish-market bill authorizes its promoters to take about eight acres of land in the parish of St. Paul, Shadwell, four acres of which they bind themselves to appropriate for the new fish market and its approaches.

2. The site, like that of Billingsgate, is on the north side of the river, to which it has a frontage of 600 as against that possessed by the Billingsgate of 200 feet. It lies nearly two miles below London Bridge, at a point where the Thames is 1,100 feet wide, and being situated on the edge of a bay, out of the influence of the tide, and 500 feet clear of the ordinary traffic of the stream, it enables vessels approaching it to avoid the difficult and dangerous navigation of the Upper Pool, which is no ordinary advantage when we remember that the fish craft for the most part arrive in the dark.

3. The shore can be leveled so as to admit vessels of thirteen feet draught alongside the wharf at half tide. Vessels will lie next the wharf, and unload direct into the market, thus avoiding the expense, delay, and danger of the present system of discharging. There is a boat ferry at either end of the site, and a steam ferry is about to be reopened at a short distance to the west. This steam ferry can make from seven to

ten trips in an hour, and can take from seventy to ninety costermongers barrows at a time.

4. As regards the access to the market by land the streets and roads leading to the selected site at Shadwell are wide, unencumbered by ordinary traffic, and of easy gradients. Out of the eight acres acquired the market proper will occupy 75,000 square feet, or one acre and three-quarters, and the rest of the property will be laid out in ample approaches and in "lay byes" for carts and barrows, and also in the erection of the necessary shops, warehouses, and buildings connected with the market.

5. On the three land sides of the market there will be a broad street, so that four-and-twenty vans can lie side by side and unload simultaneously. Not a single fishmonger's cart or costermonger's barrow will be more than 150 yards away from the center of the market, so that the porterage will be reduced to a minimum and no time will be wasted. The market will be open all day, and accessible from a very early hour in the morning until late at night to ships approaching it by water and to costermongers approaching it by land. The maximum tolls fixed by the bill are very much lower than those charged at Billingsgate.

It will thus be seen that the Shadwell site fulfills all the conditions required by the reports of the corporation committee and of Mr. Walpole, who, having examined the spot, gave evidence in its favor before the House of Commons' committee. It should also be mentioned that no steps were taken by the promoters of this bill to get permission from parliament to make a new fish market at Shadwell until the corporation of London and the metropolitan board of works had been repeatedly urged, but in vain, to take the matter up. The want of additional market accomodations being admitted on all hands, what, it may be asked, is the corporation of London doing to supply it? With the exception of attempting to convert the fruit market at Farringdon into a fish market nothing has been or will be done; and it is admitted on all hands that an inland market of this kind will do little towards cheapening and making more abundant the coarser kinds of fish, which do not come to London by costly railway carriage but can only be brought by river.

These details can hardly be deemed uninteresting when we remember the stake at issue and the degree to which they affect it. There is and has long been a popular impression that many of our sea-fisheries are less fecund than of yore, and that the ocean is growing more and more to deserve the epithet of "barren," which Homer was so fond of applying to it. How far this is from being the case let the following passage from Mr. Walpole's speech, delivered before the Society of Arts upon the 10th of last May, suffice to attest:

"You are all acquainted," he said, "with the North Sea. You know that it is a comparatively small sea. It is fished by English, Scotch, Norwegian, Swedish, Danish, German, Dutch, Belgian, and French fishermen, and I think I could prove to you (only it is unnecessary to go into statistics) that the fish which these fishermen are drawing from the North Sea is worth at least £25,000,000 every year. That sum, if I may translate the figures again into an intelligible language, is more than equal to the whole interest of the national debt of this country. This evening I am not concerned with the fisheries of Europe, but with the fish supply of London; and what I wish to point out to you, and what is very imperfectly understood, is the proportion of fish consumed in London which is drawn from the North Sea. I have tried to analyze the return as far as I am able to do so, and I find that, out of the 130,000 tons of fish which were received in London in 1880, in round numbers 100,000 tons came from the North Sea; that is to say that, out of every four fish which we eat in London, three came from the North Sea. Now, if this is the case, it is really essential to the subject for us to consider, however shortly, what is happening in the North Sea, because I know there is a prevalent impression that the North Sea itself and the seas of this kingdom generally are being over-fished, and that they are in consequence in danger of approaching exhaustion. I am bound to say that you will hear this allegation supported on good authority in Billingsgate, and that you may also hear it in many fishing villages on the coasts of England. Now I will give you my reasons for thinking that the North Sea and the seas of this country generally are not in danger of exhaustion. In the first place the prophecy of approaching exhaustion is not a new one. It has influenced the legislature for centuries, and it may be found in our literature since the days of the Tudors. I, for one, think that when you find a series of predictions which have uniformly proved false you may pretty well afford to disregard the same predictions when they are made in our own time. You can hardly enter into a drawing-room—you certainly cannot go into any company interested in fisheries—without hearing complaints of the scarcity of soles; and I do not deny that soles were exceptionally scarce last year. But I recollect that I was told myself at Scarborough forty-five years ago, in the year in which the Queen came to the throne, that a fisherman landed at Scarborough with a pair of soles, which he placed on the pier and said: 'There are the two last soles in the North Sea.' I do not deny that scarcity may occur again, as it undoubtedly occurred last year. But I regard such scarcities as temporary accidents and not as any permanent failure of the great source of fish supply."

Mr. Walpole then reminded his hearers that, like all other animals, man included, fish have a tendency to produce their numbers in greater ratio than their food is generated, and consequently the natural waste which is always going on in the sea is far more exhausting than any effect that multitudes of fishermen produce upon the fish. In the same way a warm or a cold summer has an enormous influence upon the abundance or upon the scarcity of animal and vegetable life. Some years, for in-instance, we talk of a plague of flies, of caterpillars, or of gnats. The same thing goes on in the sea, and the minute forms of life upon which the fish feed are affected by the warmth or cold of particular years. When there is a defective production of these forms of alimentary life the fish are obliged to scatter in search of food, and are not collected together so as to be easily caught by the net or trawl. In conclusion, Mr. Walpole pointed out that, although man is singularly deficient in statistics bearing upon fish, it is possible to reason in some measure from the particular to the universal by examining the details of the herring fishing, with which we are more or less acquainted.

"We know," he continued, "that the Scotch fishermen on an average take one thousand million herrings a year. We know also that the Norwegian fishermen take from the North Sea another one thousand million herrings per annum, while I am sure that other fishermen who work the North Sea take at least another one thousand million. Therefore we may assume that the fishermen of Europe draw three thousand millions of herrings annually from the North Sea. I think it beyond doubt that the predacious fish and birds kill as many herrings annually as fishermen do, and therefore man and other enemies draw six thousand millions of herrings a year from the North Sea. Now I do not suppose that any one with the least acquaintance with the subject would say that all these enemies of the herring catch one in every hundred; but, to put myself beyond all possibility of error, I will assume they catch one in every two. Then at the end of the year the account must be, six thousand millions of herrings taken and six thousand millions left. Assuming that of those left half are females it is obvious that to maintain the stock these females must produce two herrings apiece to make twelve thousand millions next year. But a female herring does not lay two eggs; she lays from 20,000 to 30,000. Assuming that she lays 10,000 eggs, it is obvious that nature intends out of every 5,000 she lays that 4,999 should die. If it were not so the whole sea would be full of herrings."

The conclusion at which Mr. Walpole arrived is that "the North Sea is practically inexhaustible." These are encouraging words, and they are borne out by the evidence of Mr. Robert Hewett, who is the managing director of Hewett & Co., a limited company which owns eight steamers and sixty fishing smacks of its own, and has in addition nearly one hundred other fishing smacks under mortgage, and about thirty more associated with it. Mr. Hewett deposed that since 1864 the company which he manages—

"Have brought much more wet trawl fish to Billingsgate than any other firm or company; that the fleet under his control consists of 183 smacks; that the fleet fish during the night and in the morning put their catch, which is packed in boxes containing about ninety pounds of fish each, on board the steamers which wait upon them; that the boxes when taken on board the steamers are immediately put into the hold and buried in ice, and are thus brought direct to Billingsgate; that on arriving at Billingsgate the fish, on the opening of the market at 5 a. m., is taken out of the hold, carried ashore, and sold box by box; that the amount realized by Hewett & Co. for wet trawl fish sold at Billingsgate during the last seven years amounts collectively to £1,210,409; that in the trade wet trawl fish are divided into two classes, prime and offal; that the prime consists of turbots, brill, soles, John Dorey, and red mullet; and offal of plaice, haddock, cod, skate, roker, whiting, sturgeon, hake, dabs, thornback, and gurnard; that a very large proportion of the offal brought to market by Hewett & Co. could not have been sent by rail, as it would not have fetched the rate charged for carriage; that if there was no water-carriage for fish to market nothing but the prime and the best of the offal would be sent to London at all."

The evidence of Mr. Hewett is deserving of special attention, because it is to him and to his father that Billingsgate is indebted for many valuable suggestions and improvements of the conduct of its trade. His father was the first to bring fish by water from the fleet in the North Sea direct to Billingsgate, and for this purpose he caused a line of fast-sailing carrier cutters to be built in 1843. Up to that time, and for many years previously, it was the custom to land considerable quantities of fish at Yarmouth, which were sent up to London by rail, while other lots were brought by river to Gravesend and despatched thence to Billingsgate by hatch-boat. From 1843 to 1864 the swift-sailing cutters worked with great success, but in the latter year they were "run off the road," not by the railways but by steam carriers which were then started. The first ten sailing carriers were built and put on by the elder Hewett in 1843 and 1844; the first six steamers by the younger Hewett in 1864 and 1865. There are now not less than twenty-one steam carriers running to London. They belong to several companies, each of them distinct from the others, and they work in connection with five large fleets in the North Sea. Nor ought we to omit mentioning that the bulk of the fish came to Billingsgate packed in baskets until 1856, when boxes were for the first time tried by Hewett & Co. Four years later baskets had entirely died out, and in 1860 all trawl fish came to market, as they do now, in boxes containing from ninety to a hundred pounds apiece.

Enough has been said to show what weight attaches to Mr. Robert Hewett's testimony, when he affirms, "as the result of many years experience," that double the quantity of fish now sold in London could readily be disposed of if there were but proper accommodations at the river-side to receive it. It is well known, he adds, by all who deal extensively in the coarser kinds of fish, that however large the supply the demand more than keeps pace with it, and that the price is never lowered. There can, in fact, be no doubt that if, as he anticipates, Mr. Hewett and his company can pour three or four hundred tons of roker every day into the metropolis through Shadwell market they will be conferring a benefit upon the poor of which it would be impossible to overstate the magnitude. Roker—by which all fish of the ray family, excepting skate, are meant—is a favorite food of the working classes, to whom it could be supplied retail at three pence or less per pound. There are medical men, among whom Sir Henry Thompson and Dr. Priestley are, we believe, included, who hold that for delicate digestions nothing is so healthy and invigorating as a diet consisting almost exclusively of fish. But it is not in the interests of the rich that the enterprise was conceived which is about to give us a fish market with all the merits and none of the defects for which Billingsgate has long been noted. How can the value of a constant supply of fresh fish, obtainable at about one-fourth or one-fifth of the price exacted from him for fresh meat, be estimated and appraised by the workingman? The question is more than ever significant when it is borne in mind that there are many signs presaging a considerable rise in the price of beef, and still more of mutton, before the end of next year. According to the "Balance Sheet of the World," compiled by Mr. Michael G. Mulhall, F. S. S., Europe consumes annually 853,000 tons of meat beyond what she produces. From whence is England to derive her supplies of this precious commodity, which she produces at the rate of 1,205,000 tons and consumes at the rate of 1,800,000 tons per annum? To make up our yearly deficit, amounting to about 600,000 tons, the United States have, until lately, been the most liberal of our many contributors. But beef is at this moment as dear in New York as in London, and the power of the United States to supply England with meat is obviously declining. The rapid growth of the American population is enough to explain that, in a country already numbering about 55,000,000 inhabitants, 32,000,000 sheep and 13,000,000 bullocks are not much in excess of that country's own wants.

Doubtless we shall receive large consignments of frozen mutton from the Australian colonies; but years upon years will have to expire before the contributions from that source, added to others from Brazils, the Argentine Confederation, the River Plate, and possibly from Russia, will begin to make themselves sensibly felt in this country. The greatest perplexity, in short, with which statesmen can be threatened—a deficiency in one of the most essential staples of the nation's food—seems to be impending over Great Britain and Ireland. How is it to be met?

Lucan tells us in one of the finest passages of his Pharsalia, that Cæsar, upon returning to Rome, dismissed all thoughts of war from his breast, and addressed himself to the task of providing ample supplies of food for the fickle populace, conscious that it is famine alone which lashes cities into revolt, and that a "starving people knows no fear." Far be it from us to suggest that England is threatened, ever so remotely, with famine. But that beef and mutton are likely to rise in price is the undoubted opinion of our most competent authorities, and in the face of a serious deficiency in meat we can conceive nothing more useful or more welcome than a large and sustained addition to the fish supply of London.

IX.—THE EXTENT OF THE USE OF FISH GUANO AS A FERTILIZER.

By Chas. W. Smiley.

In the fall of 1879 the inquiry, "Is fish guano in any of its forms used by your farmers?" was addressed to every postmaster in the United States. From 30,022 returns, the following facts have been ascertained:

I. Fish guano is not used in any of the following twenty-one States and Territories: Alaska, 1; Arizona, 34; Arkansas, 435; Colorado, 161; Dakota, 184; Idaho, 45; Illinois, 1,154; Indiana, 792; Indian Territory, 46; Iowa, 836; Kansas, 749; Minnesota, 515; Missouri, 835; Montana, 64; Nebraska, 373; Nevada, 62; New Mexico, 54; Oregon, 211; Texas, 752; Utah, 113; and Wyoming, 46. The numbers given with each political division denote the number of negative replies received to the question, the total being 7,462, and covering every county in the divisions named.

II. In the following ten States and Territories there are indications of a very slight use of fish guano. In some cases the reporters may not have carefully distinguished between fish guano and other kinds, while others have evidently spoken of unmanufactured refuse of the fisheries. All reports that are believed to point to the use of fish in any form as a fertilizer are here quoted:

1. California.—"Shrimp shucks from San Francisco are used by Chinese gardeners to a considerable extent:" Grass Valley, Nevada County. "To some extent in vegetable and strawberry culture:" Santa Clara, Santa Clara County.

The following statement by A. W. Saxe, M. D., of Santa Clara, is of interest: "I know of no one in this vicinity using fish as a fertilizer, except Judge D. C. Thomas, who was induced to try it by Mr. A. Barstow, of San Francisco. The material is mostly dried shrimps and waste of codfish and salmon. On strawberry land he uses from 300 to 400 pounds per acre. It pays well in the increased yield and finer quality of fruit. In 1879 he used ten tons on his extensive strawberry plantation, and would have used more if he could have gotten it. He sows it broadcast on the land after the first plowing and cultivates it into the soil. It stimulates vegetation wonderfully. It is gathered by the Chinese fishermen at or near Point Arena, in Mendocino County, put up in bales after being sun-dried and shipped to China, probably to be used as a fertilizer but possibly as food, as there is nothing of organic nature the Chinaman will not eat. These bales weigh from 300 to 400 pounds each. The farmers in the vicinity of Point Arena have used it to some extent on wheat lands, and report it as increasing the crop from 30 to 50 per cent. At one time they used all they could get at the original price demanded by the Chinese; but the latter soon raised the price from $8 to $12 per ton, and it has not since been in as general use there as formerly."

"Nearly all farmers in the valley use it, obtaining it from Sacramento and San Francisco": Etna Mills, Siskiyou County. The foregoing constitute the affirmative reports. There are 486 negative reports on file from this State.

2. KENTUCKY.—"A very little used, which is obtained at our county seat, being brought from New York, Cincinnati, and Louisville": Wade's Mill, Clark County. "A little for experiment": Frankfort, Franklin County. "Very little is used, being obtained from Baltimore, Md., and Savannah, Ga.": Pulaski, Somerset County. There are 594 negative reports from this State.

3. LOUISIANA.—"Three hundred tons, obtained from Charleston, S. C., were used in 1880, principally by the Ames plantation": Gretna, Jefferson County. There are 205 negative reports from Louisiana.

4. MICHIGAN.—"What we use we manufacture ourselves, but are ignorant of the true way of doing it": Skanee, Baraga County. "A small amount, obtained at Grand Rapids and Jackson, is used, and by 15 or 20 men": Morgan, Bay County. "Fishermen use fish guano on their gardens somewhat; none bought or sold here": Mackinaw City, Cheboygan County. "Winegar, Miller & Co. use it on their farm at Martin's Island, Delta County": Escanaba, Delta County. "Only when fish are found dead on the lake shore, as is sometimes the case": Bear Lake, Manistee County. "What little is used here is bought by our farmers at Grand Rapids, 16 miles distant": South Blendon, Ottawa County. The number of negative reports from this State is 819.

5. MISSISSIPPI.—"The fish is used as a fertilizer": Bay Saint Louis, Hancock County. "Salt water sardines are used for guano and are very plentiful": Scranton, Jackson County. There are 332 negative reports from this State.

6. OHIO.—"Not in any quantity; $150 per year is about the limit": Powhatan Point, Belmont County. "They use fish for fertilizer on the lake shore": Dover, Cuyahoga County. "Offal from fish house and worthless fish are used on the fields": Vermillion, Erie County. "Fertilizers are used quite extensively, fish guano forming a part": Barlow, Washington County. "Yes": Toledo, Lucas County. The number of negative answers from Ohio is 1,228.

7. TENNESSEE.—"It is": Asbury, Knox County. "Yes, it is being used of late by quite a number of farmers. I suppose that at least 500 farmers, averaging to use 800 pounds each, and living in this vicinity,

employed it in the year 1880": Cash Point, Lincoln County. "In exceptional cases; it has not been introduced extensively": Muddy Creek, Loudon County. "It is; farmers buy it at Knoxville," Unitia, Loudon County. "Yes; four farmers used 80 tons in 1880; they bought it at Knoxville": Wave Hill, Union County. "Yes; about twenty-five men used 500 pounds in 1880; it was obtained at Richmond, Va.": Fain's, Washington County. There are 589 negative reports from Tennessee.

8. WASHINGTON.—"It is by those living near the sound": Kamilche, Mason County. "Carcasses of dogfish and the refuse of herring fisheries are used by gardeners on Fillalgo Island": Artondale, Pierce County. "Yes; a little": Sumner, Pierce County. "In some cases": Lowell, Snohomish County. "In some cases; as a rule, our farmers have not utilized fish guano": Olympia, Thurston County. "In limited quantities; from Cypress Island fisheries": Anacortes, Whatcom County. "There has been little fish scrap used by a few with good results": Fidalgo, Whatcom County. "It is": Semiahmoo, Whatcom County. There have 121 negative reports been received from Washington.

9. WEST VIRGINIA.—"A little from Delaware": Capon Bridge, Hampshire County. "About two tons were used in 1880, being obtained from Winchester, Va.": Dillon's Run, Hampshire County. "About one-fourth of all guano used here is fish guano; nearly all farmers use some kind of guano; it is obtained from Winchester, Va.": Hanging Rock, Hampshire County. At Mutton Run and other places in Hampshire County there is also evidence of the use of fish guano. "Fish guano is but little used here, though I have seen it occasionally in the market:" Kendalia, Kanawha County. "In 1880 six farmers used about five sacks each of fish guano obtained in Baltimore": Racoon, Preston County. There are also affirmative answers from Crump's Bottom, Summers County, and from Kanawha Station, Wood County. There are 381 negative reports from all parts of the State.

10. WISCONSIN.—"There has been considerable fish guano used in this county; it is a valuable fertilizer in Bailey's Harbor, Gibraltar, Jacksonport, and Sturgeon Bay; they have used the culled fish with great success for several years past, but in 1880 the fishermen found market for most all kinds of fish:" Ellison Bay, Door County. "Yes:" Naugart, Marathon County. "The offal of the fisheries is utilized to some extent by the farmers near by": Menekaunee, Marinette County. Seven hundred and forty-two negative reports are on file from this State.

III. In seventeen States a somewhat extensive use of fish guano is reported. Assuming that the percentage of Territory corresponds with the percentage of affirmative and of negative replies to the question, the use of fish guano would extend over—

1. 18 per cent. of the territory of Pennsylvania.
2. 24 per cent. of the territory of New York.

3. 30 per cent. of the territory of New Hampshire.
4. 32 per cent. of the territory of North Carolina.
5. 33 per cent. of the territory of Vermont.
6. 36 per cent. of the territory of Alabama.
7. 45 per cent. of the territory of Virginia.
8. 46 per cent. of the territory of Maine.
9. 46 per cent. of the territory of Georgia.
10. 48 per cent. of the territory of South Carolina.
11. 50 per cent. of the territory of Maryland.
12. 51 per cent. of the territory of Florida.
13. 58 per cent. of the territory of New Jersey.
14. 60 per cent. of the territory of Massachusetts.
15. 69 per cent. of the territory of Delaware.
16. 79 per cent. of the territory of Connecticut.
17. 86 per cent. of the territory of Rhode Island.

Taking up each of these States by the nine sections into which they have been divided by the Post-Office Department, and specifying the number of counties in which this fertilizer is used, the percentage of territory on which it is reported would be exhibited by the following tables:

1.—Pennsylvania.

Fish guano is used in 58 of its 67 counties and on 18 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 4 of the 5 northwestern counties	13
In the 8 western counties	9
In the 6 southwestern counties	8
	10

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 5 of the 7 northern counties	11
In 12 of the 16 central counties	12
In 5 of the six southern counties	22
	15

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In the 3 northeastern counties	8
In 7 of the 8 eastern counties	16
In the 8 southeastern counties	40
	21

2.—New York.

Fish guano is used in all the counties of the State except Lewis and Warren, and on 24 per cent. of its territory:

WESTERN AND SOUTHWESTERN COUNTIES.[1]

	Per cent.
In 10 western counties	25
In 5 southwestern counties	13
	19

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 3 of the 4 northern counties	15
In 9 central counties	17
In 4 southern counties	13
	15

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 4 of the 5 northeastern counties	09
In 8 eastern counties	23
In 15 southeastern counties	40
	24

3.—New Hampshire.

Fish guano is used in all the counties of this State, and on 30 per cent. of its territory:

SOUTHWESTERN COUNTIES.[2]

	Per cent.
In 2 southwestern counties	30

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 1 northern county	30
In 3 central counties	31
In 2 southern counties	28
	29

SOUTHEASTERN COUNTIES.[3]

	Per cent.
In 2 southeastern counties	35

4.—North Carolina.

Fish guano is used in 75 of the 94 counties of this State, and on 32 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 3 of the 6 northwestern counties	10
In 8 of the 12 western counties	19
In 9 of the 16 southwestern counties	18
	15

[1] There are no northwestern counties.

[2] There are no northwestern nor western counties.

[3] There are no northeastern nor eastern counties.

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In the 12 northern counties	33
In 13 of the 14 central counties	38
In the 7 southern counties	41
	37

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 11 of the 12 northeastern counties	60
In 10 of the 12 eastern counties	45
In 2 of the 3 southeastern counties	21
	42

5.—VERMONT.

Fish guano is used in all the counties of this State, and on 33 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 2 of the 3 northwestern counties	17
In 2 western counties	14
In 1 southwestern county	28
	19

NORTHERN AND CENTRAL COUNTIES.[4]

	Per cent.
In 2 northern counties	40
In 1 central county	33
	36

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 2 northeastern counties	38
In 2 eastern counties	43
In 1 southeastern county	55
	45

6.—ALABAMA.

Fish guano is used in 55 of the 66 counties of this State, and on 36 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 4 of the 9 northwestern counties	16
In the 5 western counties	29
In 5 of the 7 southwestern counties	11
	19

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In the 8 northern counties	47
In 7 of the 9 central counties	38
In 7 of the 8 southern counties	27
	37

[4] There are no southern counties.

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In the 5 northeastern counties	32
In the 7 eastern counties	71
In 7 of the 8 southeastern counties	52
	51

7.—Virginia.

Fish guano is used in 84 of the 99 counties of this State, and on 45 per cent. of its territory:

WESTERN AND SOUTHWESTERN COUNTIES.[5]

	Per cent.
In 5 of the 7 western counties	26
In 9 of the 17 southwestern counties	9
	17

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 14 of the 15 northern counties	42
In 18 of the 20 central counties	45
In the 13 southern counties	49
	45

EASTERN AND SOUTHEASTERN COUNTIES.[6]

	Per cent.
In 17 of the 19 eastern counties	88
In the 8 southeastern counties	67
	77

8.—Maine.

Fish guano is used in every county of Maine, and on 46 per cent. of its territory. In some parts of this State lobster shells are used as a fertilizer:

WESTERN AND SOUTHWESTERN COUNTIES.[7]

	Per cent.
In 2 western	26
In 6 southwestern	49
	37

CENTRAL AND SOUTHERN COUNTIES.[8]

	Per cent.
In 2 central counties	25
In 4 southern counties	64
	44

NORTHEASTERN AND EASTERN.[9]

	Per cent.
In 1 northeastern county	3
In 1 eastern county	76
	39

[5] There are no northwestern counties.
[6] There are no northeastern counties.
[7] There are no northwestern counties.
[8] There are no northern counties.
[9] There are no southeastern counties.

9.—GEORGIA.

Fish guano is used in 99 of the 137 counties of Georgia, and on 46 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN.

	Per cent.
In 11 of the 12 northwestern counties	45
In 17 of the 21 western counties	54
In 7 of the 16 southwestern counties	48
	49

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 14 of the 19 northern counties	40
In 18 of the 23 central counties	55
In 8 of the 13 southern counties	37
	44

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 7 of the 10 northeastern counties	39
In 7 of the 11 eastern counties	43
In 10 of the 12 southeastern counties	45
	42

10.—SOUTH CAROLINA.

Fish guano is used in all the counties of this State except Chesterfield and Georgetown Counties, and on 48 per cent. of its territory:

NORTHWESTERN AND WESTERN COUNTIES.[10]

	Per cent.
In 6 northwestern counties	53
In 4 western counties	52
	52

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 6 northern counties	47
In 5 central counties	43
In 4 southern counties	38
	42

NORTHEASTERN AND EASTERN COUNTIES.[11]

	Per cent.
In 5 northeastern counties	44
In 3 eastern counties	45
	44

11.—MARYLAND.

Fish guano is used in all the counties of this State except Alleghany County, and on 50 per cent. of its territory:

NORTHWESTERN COUNTIES.[12]

	Per cent.
In 4 northwestern counties	29

[10] There are no southwestern counties.

[11] There are no southeastern counties.

[12] There are no western nor southwestern counties.

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 3 northern counties	43
In 4 central counties	39
In 3 southern counties	71
	51

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 2 northeastern counties	52
In 3 eastern counties	52
In 4 southeastern counties	93
	65

12.—Florida.

Fish guano is used in all but 11 of the 39 counties of this State, and 51 per cent. of its territory:

NORTHWESTERN COUNTIES.[13]

	Per cent.
In 7 of the 10 northwestern counties	40

NORTHERN, CENTRAL, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 7 of the 12 northern counties	31
In 6 of the 7 central counties	60
In 1 of the 2 southwestern counties	27
	39

NORTHEASTERN AND EASTERN COUNTIES.[14]

	Per cent.
In 5 northeastern counties	65
In 2 eastern counties	76
	70

13.—New Jersey.

Fish guano is used in all the counties of this State, and on 58 per cent. of its territory:

NORTHWESTERN AND SOUTHWESTERN COUNTIES.[15]

	Per cent.
In 2 northwestern counties	32
In 4 southwestern counties	84
	58

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.

	Per cent.
In 3 northern counties	24
In 6 central counties	74
In 2 southern counties	100
	66

NORTHEASTERN COUNTIES.[16]

	Per cent.
In 4 northeastern counties	31

[13] There are no western nor southwestern counties.

[14] There are no southeastern counties.

[15] There are no western counties.

[16] There are no eastern nor southeastern counties.

14.—MASSACHUSETTS.

Fish guano is used in all the counties of this State, and on 60 per cent. of its territory:

NORTHWESTERN, WESTERN, AND SOUTHWESTERN COUNTIES.

	Per cent.
In 1 northwestern county	73
In 2 western counties	48
In 1 southwestern county	80
	67

CENTRAL COUNTY.[17]

	Per cent.
In 1 central county	38

NORTHEASTERN, EASTERN, AND SOUTHEASTERN COUNTIES.

	Per cent.
In 1 northeastern county	69
In 3 eastern counties	55
In 5 southeastern counties	74
	66

15.—DELAWARE.

Fish guano is used in all of the counties of Delaware, and on 69 per cent. of its territory:

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.[18]

	Per cent.
In 1 northern county	56
In 1 central county	78
In 1 southern county	75
	69

16.—CONNECTICUT.

Fish guano is used in all the counties of Connecticut, and on 79 per cent. of its territory:

NORTHWESTERN AND SOUTHWESTERN COUNTIES.[19]

	Per cent.
In 1 northwestern county	56
In 1 southwestern county	66
	61

NORTHERN AND SOUTHERN COUNTIES.[20]

	Per cent.
In 2 northern counties	88
In 2 southern counties	100
	94

[17] There are no northern nor southern counties.

[18] There are no northwestern, western, southwestern, northeastern, eastern, nor southeastern counties.

[19] There are no western counties.

[20] There are no central counties.

NORTHEASTERN AND SOUTHEASTERN COUNTIES.[21]

	Per cent.
In 1 northeastern county	56
In 1 southeastern county	90
	73

17.—Rhode Island.

Fish guano is used in all the counties of Rhode Island, and on 86 per cent. of its territory:

NORTHERN, CENTRAL, AND SOUTHERN COUNTIES.[22]

	Per cent.
In 1 northern county	86
In 1 central county	67
In 1 southern county	92
	82

EASTERN AND SOUTHEASTERN COUNTIES.[23]

	Per cent.
In 1 eastern county	100
In 1 southeastern county	100
	100

For the purpose of exhibiting in full the data from which the foregoing percentages were derived, tables will now be given showing the exact number of affirmative and of negative answers received from each county in the seventeen States under consideration and arranged by sections:

1. PENNSYLVANIA.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	CENTRAL COUNTIES (16).			
32	Blair	1	20	21
30	Cambria	2	16	18
46	Center	2	27	29
56	Clearfield	3	30	33
43	Columbia	7	10	17
37	Dauphin	6	15	21
17	Elk		9	9
58	Huntingdon	1	28	29
28	Juniata	3	12	15
58	Lycoming		25	25
22	Mifflin		11	11
7	Montour	1	4	5
43	Northumberland	7	21	28
38	Perry	2	16	18
25	Snyder		14	14
22	Union	2	11	13
562		37	269	306
	NORTHERN COUNTIES (7).			
106	Bradford	8	48	56
8	Cameron	1	6	7
33	Clinton	4	13	17
44	McKean	2	24	26
43	Potter		14	14
19	Sullivan		10	10
69	Tioga	3	33	36
322		18	148	166

[21] There are no eastern counties.

[22] There are no northwestern, western, nor southwestern counties.

[23] There are no northeastern counties.

1. PENNSYLVANIA—Continued.

Offices interrogated.	Counties.	Number of replies.		
		Yes.	No.	Total.
	NORTHEASTERN COUNTIES (3).			
66	Susquehanna	4	38	42
51	Wayne	1	26	27
35	Wyoming	2	17	19
152		7	81	88
	EASTERN COUNTIES (8).			
26	Carbon	....	12	12
42	Lackawanna	6	23	29
58	Lehigh	3	32	35
78	Luzerne	7	38	45
34	Monroe	3	11	14
46	Northampton	3	20	23
17	Pike	3	7	10
74	Schuylkill	7	29	36
375		32	172	204
	SOUTHEASTERN COUNTIES (8).			
112	Berks	10	39	49
95	Bucks	33	25	58
126	Chester	26	40	66
46	Delaware	12	8	20
147	Lancaster	16	52	68
30	Lebanon	1	16	17
99	Montgomery	29	15	44
20	Philadelphia	3	2	5
675		130	197	327
	SOUTHERN COUNTIES (6).			
38	Adams	7	12	18
49	Bedford	5	20	25
42	Cumberland	2	23	25
43	Franklin	4	18	22
26	Fulton	....	13	13
93	York	16	32	48
291		34	118	152
	SOUTHWESTERN COUNTIES (6).			
93	Allegheny	3	26	29
45	Fayette	2	24	26
51	Greene	3	18	21
50	Somerset	1	24	25
84	Washington	3	26	29
85	Westmoreland	3	48	51
408		15	166	181
	WESTERN COUNTIES (8).			
56	Armstrong	2	30	32
43	Beaver	2	19	21
55	Butler	1	22	23
52	Clarion	2	26	28
59	Indiana	4	26	30
34	Jefferson	1	16	17
25	Lawrence	1	6	7
46	Mercer	3	22	25
370		16	167	183
	NORTHWESTERN COUNTIES (5).			
66	Crawford	6	31	37
49	Erie	5	24	29
16	Forest	....	10	10
59	Venango	2	23	25
36	Warren	3	20	23
226		16	108	124

1. PENNSYLVANIA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	RECAPITULATION.			
562	Central counties	37	269	306
322	Northern counties	18	148	166
152	Northeastern counties	7	81	88
375	Eastern counties	32	172	204
675	Southeastern counties	130	197	327
291	Southern counties	34	118	152
408	Southwestern counties	15	166	181
370	Western counties	16	167	183
226	Northwestern counties	16	108	124
3,381		305	1,426	1,731

2. NEW YORK.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (9).			
58	Cayuga	13	22	35
49	Chenango	3	25	28
34	Cortland	3	12	15
51	Madison	1	24	25
85	Oneida	7	32	39
75	Onondaga	5	35	40
76	Oswego	7	31	38
63	Otsego	6	36	42
25	Seneca	2	16	18
516		47	233	280
	NORTHERN COUNTIES (4).			
45	Herkimer	5	18	23
66	Jefferson	7	33	40
44	Lewis	....	20	20
76	Saint Lawrence	7	33	40
231		19	104	123
	NORTHEASTERN COUNTIES (5).			
42	Clinton	2	21	23
42	Essex	1	19	20
31	Franklin	3	14	17
12	Hamilton	1	5	6
26	Warren	....	13	13
153		7	72	79
	EASTERN COUNTIES (8).			
52	Albany	5	15	20
32	Fulton	6	14	20
32	Montgomery	3	15	18
53	Rensselaer	9	21	30
59	Saratoga	5	24	29
13	Schenectady	1	4	5
44	Schoharie	6	15	21
57	Washington	4	23	27
342		39	131	170
	SOUTHEASTERN COUNTIES (15).			
62	Columbia	6	25	31
72	Delaware	7	34	41
102	Duchess	19	33	52
41	Greene	2	13	15
14	Kings	10	1	11
11	New York	....	....	....
69	Orange	8	26	34
18	Putnam	2	9	11
59	Queens	27	7	34
15	Richmond	6	5	11
25	Rockland	4	11	15
83	Suffolk	61	3	64
66	Sullivan	1	38	39
77	Ulster	5	29	34
68	Westchester	14	24	38
782		172	258	430

2. NEW YORK—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	SOUTHERN COUNTIES (4).			
57	Broome	2	26	28
26	Chemung	2	17	19
36	Tioga	3	15	18
42	Tompkins	4	13	17
161		11	71	82
	SOUTHWESTERN COUNTIES (5).			
58	Allegany	1	31	32
63	Cattaraugus	6	34	40
61	Chatauqua	5	28	33
31	Schuyler	4	8	12
81	Steuben	5	40	45
294		21	141	162
	WESTERN COUNTIES (10).			
91	Erie	8	32	40
32	Genesee	4	11	15
40	Livingston	6	22	28
51	Monroe	7	21	28
49	Niagara	2	19	21
43	Ontario	7	13	20
37	Orleans	3	11	14
44	Wayne	12	13	25
38	Wyoming	5	20	25
26	Yates	5	11	16
451		59	173	232
	RECAPITULATION.			
516	Central counties	47	233	280
231	Northern counties	19	104	123
153	Northeastern counties	7	72	79
342	Eastern counties	39	131	170
782	Southeastern counties	172	258	430
161	Southern counties	11	71	82
294	Southwestern counties	21	141	162
451	Western counties	59	173	232
2,930		375	1,183	1,558

3. NEW HAMPSHIRE.

	CENTRAL COUNTIES (3).			
23	Belknap	4	9	13
57	Carroll	14	23	37
67	Grafton	11	33	44
141		29	65	94
	NORTHERN COUNTIES (1).			
34	Coos	6	14	20
	SOUTHEASTERN COUNTIES (2).			
65	Rockingham	12	28	40
26	Strafford	7	8	15
91		19	36	55
	SOUTHERN COUNTIES (2).			
51	Hillsborough	10	29	39
58	Merrimack	11	26	37
109		21	55	76

3. NEW HAMPSHIRE—Continued.

Offices interrogated.	Counties.	Number of replies.		
		Yes.	No.	Total.
	SOUTHWESTERN COUNTIES (2).			
46	Cheshire	10	19	29
35	Sullivan	6	19	25
81		16	38	54
	RECAPITULATION.			
141	Central counties	29	65	94
34	Northern counties	6	14	20
91	Southeastern counties	19	36	55
109	Southern counties	21	55	76
81	Southwestern counties	16	38	54
456		91	208	299

4. NORTH CAROLINA.

	CENTRAL COUNTIES (14).			
35	Chatham	7	10	17
18	Cumberland		6	6
20	Davidson	3	6	9
16	Duplin	1	10	11
13	Harnett	4	5	9
18	Johnston	7		7
20	Montgomery	3	7	10
29	Moore	4	8	12
47	Randolph	5	17	22
20	Sampson	3	7	10
10	Stanley	2	2	4
31	Wake	9	4	13
9	Wayne	2	2	4
7	Wilson	2	1	3
293		52	85	137
	NORTHERN COUNTIES (12).			
23	Alamance	2	12	14
14	Caswell	2	8	10
19	Forsyth	2	6	8
8	Franklin	4	1	5
18	Granville	6	6	12
25	Guilford	3	10	13
8	Nash	3	1	4
14	Orange	1	7	8
16	Person	1	5	6
22	Rockingham	4	6	10
23	Stokes	2	9	11
13	Warren	5	1	6
203		35	72	107
	NORTHEASTERN COUNTIES (12).			
9	Bertie	4	3	7
6	Camden	1	1	2
4	Chowan		3	3
9	Currituck	3	4	7
6	Edgecombe	3	1	4
11	Gates	3		3
17	Halifax	7	5	12
8	Hertford	3	1	4
7	Martin	3	3	6
8	Northampton	4	3	7
2	Pasquotank	2		2
5	Perquimans	4	1	5
92		37	25	62

4. NORTH CAROLINA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	EASTERN COUNTIES (12).			
16	Beaufort	6	2	8
10	Carteret	4	3	7
8	Craven	4	2	6
8	Dare	2	2	4
8	Greene	1	2	3
11	Hyde		9	9
6	Jones		3	3
7	Lenoir	2	2	4
8	Pamlico	2	3	5
11	Pitt	3	5	8
3	Tyrrell	2		2
7	Washington	2	1	3
103		28	34	62
	SOUTHEASTERN COUNTIES (3).			
1	New Hanover		1	1
13	Onslow	1	4	5
18	Pender	2	6	8
32		3	11	14
	SOUTHERN COUNTIES (7).			
19	Anson	5	4	9
28	Bladen	1	11	12
7	Brunswick	1	4	5
20	Columbus	1	5	6
15	Richmond	5	3	8
24	Robeson	4	9	13
23	Union	9	2	11
136		26	38	64
	SOUTHWESTERN COUNTIES (16).			
14	Cabarrus	2	4	6
15	Cherokee		6	6
4	Clay		4	4
20	Cleaveland	2	7	9
14	Gaston	4	5	9
3	Graham		2	2
15	Haywood		9	9
14	Henderson	1	6	7
16	Jackson		9	9
11	Lincoln	1	2	3
9	Macon		6	6
18	Mecklenburg	5	3	8
13	Polk		5	5
20	Rutherford	1	9	10
6	Swain	1	2	3
11	Transylvania	1	4	5
203		18	83	101
	WESTERN COUNTIES (12).			
9	Alexander	1	6	7
26	Buncombe	1	7	8
15	Burke	1	4	5
14	Caldwell		4	4
16	Catawba	4	6	10
13	Davie	1	7	8
30	Iredell	5	9	14
12	McDowell		5	5
23	Madison	3	6	9
17	Mitchell		11	11
20	Rowan	2	8	10
15	Yancey		3	3
210		18	76	94

4. NORTH CAROLINA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	NORTHWESTERN COUNTIES (6).			
9	Alleghany	....	2	2
24	Ashe	....	17	17
22	Surry	2	11	13
20	Watauga	1	5	6
31	Wilkes	....	14	14
17	Yadkin	3	4	7
123		6	53	59
	RECAPITULATION.			
293	Central counties	52	85	137
203	Northern counties	35	72	107
92	Northeastern counties	37	25	62
103	Eastern counties	28	34	62
32	Southeastern counties	3	11	14
136	Southern counties	26	38	64
203	Southwestern counties	18	83	101
210	Western counties	18	76	94
123	Northwestern counties	6	53	59
1,395		223	477	700

5. VERMONT.

	CENTRAL COUNTIES (1).			
33	Washington	8	16	24
	NORTHERN COUNTIES (2).			
20	Lamoille	1	15	16
40	Orleans	17	12	29
60		18	27	45
	NORTHEASTERN COUNTIES (2).			
39	Caledonia	6	16	22
18	Essex	7	5	12
57		13	21	34
	EASTERN COUNTIES (2).			
44	Orange	11	18	29
53	Windsor	17	19	36
97		28	37	65
	SOUTHEASTERN COUNTIES (1).			
47	Windham	17	14	31
	SOUTHWESTERN COUNTIES (1).			
35	Bennington	7	18	25
	WESTERN COUNTIES (2).			
41	Addison	1	23	24
49	Rutland	6	19	25
90		7	42	49
	NORTHWESTERN COUNTIES (3).			
27	Chittenden	3	14	17
41	Franklin	4	17	21
10	Grand Isle	....	4	4
78		7	35	42

5. VERMONT—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	RECAPITULATION.			
33	Central counties	8	16	24
60	Northern counties	18	27	45
57	Northeastern counties	13	21	34
97	Eastern counties	28	37	65
47	Southeastern counties	17	14	31
35	Southwestern counties	7	18	25
90	Western counties	7	42	49
78	Northwestern counties	7	35	42
497		105	210	315

6. ALABAMA.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (9).			
8	Autauga	1	1	2
14	Bibb	4	4	8
10	Chilton	3	3	6
16	Coosa	4	6	10
13	Elmore		2	2
34	Jefferson	5	11	16
15	Perry		4	4
18	Shelby	5	4	9
20	Talladega	3	6	9
148		25	41	66
	NORTHERN COUNTIES (8).			
22	Blount	9	6	15
9	Cullman	1	3	4
16	Etowah	2	2	4
17	Limestone	5	4	9
24	Madison	5	8	13
19	Marshall	6	2	8
21	Morgan	2	11	13
23	Saint Clair	6	5	11
151		36	41	77
	NORTHEASTERN COUNTIES (5).			
20	Calhoun	4	6	10
27	Cherokee	8	10	18
19	Cleburne	3	3	6
26	De Kalb	2	5	7
35	Jackson	1	15	16
127		18	39	57
	EASTERN COUNTIES (7).			
14	Chambers	3	3	6
22	Clay	5		5
13	Lee	3	2	5
11	Macon	2	2	4
19	Randolph	5	3	8
12	Russell	3		3
18	Tallapoosa	6	1	7
109		27	11	38
	SOUTHEASTERN COUNTIES (8).			
22	Barbour	4	5	9
17	Bullock	6	5	11
8	Coffee	2	1	3
13	Dale	4	2	6
7	Geneva	4	1	5
13	Henry	3	1	4
13	Montgomery		4	4
15	Pike	2	4	6
108		25	23	48

6. ALABAMA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	SOUTHERN COUNTIES (8).			
12	Butler	3	3	6
14	Conecuh	5	2	7
13	Covington	....	2	2
15	Crenshaw	3	4	7
21	Dallas	1	12	13
12	Escambia	1	8	9
12	Lowndes	2	9	11
18	Wilcox	2	7	9
117		17	47	64
	SOUTHWESTERN COUNTIES (7).			
14	Baldwin	1	8	9
16	Choctaw	....	8	8
20	Clarke	2	8	10
22	Marengo	....	10	10
13	Mobile	1	9	10
17	Monroe	1	6	7
7	Washington	1	1	2
109		6	50	56
	WESTERN COUNTIES (5).			
10	Greene	1	3	4
16	Hale	1	7	8
19	Pickens	2	6	8
13	Sumter	1	9	10
28	Tuscaloosa	7	4	11
86		12	29	41
	NORTHWESTERN COUNTIES (9).			
13	Colbert	1	9	10
21	Fayette	5	7	12
12	Franklin	....	3	3
14	Lamar	....	4	4
12	Lauderdale	1	7	8
15	Lawrence	2	7	9
16	Marion	....	5	5
11	Winston	....	2	2
22	Walker	....	4	4
136		9	48	57
	RECAPITULATION.			
148	Central counties	25	41	66
151	Northern counties	36	41	77
127	Northeastern counties	18	39	57
109	Eastern counties	27	11	38
108	Southeastern counties	25	23	48
117	Southern counties	17	47	64
109	Southwestern counties	6	50	56
86	Western counties	12	29	41
136	Northwestern counties	9	48	57
1,091		175	329	504

7. VIRGINIA.

	CENTRAL COUNTIES (20).			
35	Albemarle	4	12	16
12	Amelia	3	2	5
20	Amherst	....	2	2
15	Appomattox	2	3	5
40	Bedford	4	11	15
20	Buckingham	7	7	14
22	Campbell	5	7	12
20	Caroline	6	....	6

7. VIRGINIA—Continued.

Offices interrogated.	Counties.	Number of replies.		
		Yes.	No.	Total.
	CENTRAL COUNTIES—Continued.			
15	Chesterfield	3	6	9
14	Cumberland	3	1	4
12	Fluvanna	5	4	9
18	Goochland	5	4	9
4	Greene	0	0	0
22	Hanover	3	6	9
9	Henrico	1	....	1
25	Louisa	9	6	15
21	Nelson	1	12	13
17	Orange	5	3	8
11	Powhatan	3	1	4
20	Spottsylvania	4	2	6
372		73	89	162
	NORTHERN COUNTIES (15).			
2	Alexandria	2	....	2
7	Clarke	1	2	3
19	Culpeper	4	2	6
30	Fairfax	10	5	15
32	Fauquier	6	13	19
28	Frederick	5	6	11
36	Loudoun	9	14	23
13	Madison	1	7	8
13	Page	3	3	6
26	Prince William	7	7	14
10	Rappahannock	....	4	4
41	Rockingham	6	15	21
33	Shenandoah	8	12	20
11	Stafford	4	1	5
11	Warren	2	1	3
312		68	92	160
	EASTERN COUNTIES (19).			
31	Accomack	17	1	18
7	Charles City	1	3	4
3	Elizabeth City	3	....	3
16	Essex	12	....	12
10	Gloucester	2	....	2
4	James City	2	....	2
12	King and Queen	10	....	10
14	King George	7	2	9
12	King William	3	3	6
11	Lancaster	9	....	9
7	Matthews	5	....	5
12	Middlesex	9	....	9
7	New Kent	....	3	3
13	Northampton	4	2	6
10	Northumberland	6	....	6
9	Richmond	7	....	7
1	Warwick	0	0	0
16	Westmoreland	11	....	11
3	York	2	1	3
198		110	15	125
	SOUTHEASTERN COUNTIES (8).			
7	Isle of Wight	3	1	4
14	Nansemond	7	1	8
12	Norfolk	5	1	6
10	Prince George	4	2	6
7	Princess Ann	2	2	4
20	Southampton	9	2	11
12	Surry	5	4	9
11	Sussex	2	5	7
93		37	18	55

7. VIRGINIA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	SOUTHERN COUNTIES (13).			
19	Brunswick	3	4	7
20	Charlotte	8	9	17
15	Dinwiddie	6	3	9
36	Franklin	4	12	16
6	Greenville	1	1	2
33	Halifax	12	5	17
21	Henry	3	3	6
23	Lunenburgh	5	4	9
26	Mecklenburgh	7	3	10
7	Nottoway	1	4	5
22	Patrick	1	7	8
41	Pittsylvania	9	7	16
7	Prince Edward	1	2	3
276		61	64	125
	SOUTHWESTERN COUNTIES (17).			
9	Bland	1	5	6
11	Buchanan		5	5
19	Carroll	1	8	9
22	Floyd	2	7	9
14	Giles		6	6
24	Grayson	2	13	15
23	Lee		12	12
17	Montgomery	1	3	4
9	Pulaski		6	6
10	Roanoke	2	3	5
22	Russell		12	12
19	Scott		9	9
20	Smyth	1	8	9
20	Tazewell		9	9
26	Washington	1	14	15
13	Wise	1	4	5
12	Wythe		4	4
292		12	128	140
	WESTERN COUNTIES (7).			
14	Alleghany	1	2	3
44	Augusta	7	16	23
12	Bath		6	6
22	Botetourt	4	5	9
9	Craig	1	4	5
13	Highland		6	6
20	Rockbridge	3	7	10
142		16	46	62
	RECAPITULATION.			
372	Central counties	73	89	162
312	Northern counties	68	92	160
198	Eastern counties	110	15	125
93	Southeastern counties	37	18	55
276	Southern counties	61	64	125
292	Southwestern counties	12	128	140
142	Western counties	16	46	62
1,685		377	452	829

8. MAINE.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (2).			
112	Penobscot	20	48	68
32	Piscataquis	3	20	23
144		23	68	91
	NORTHEASTERN COUNTIES (1).			
64	Aroostook	1	30	31

8. MAINE—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	EASTERN COUNTIES (1).			
58	Washington	31	10	41
	SOUTHERN COUNTIES (4).			
80	Hancock	46	13	59
33	Knox	7	15	22
42	Lincoln	21	8	29
58	Waldo	23	19	42
213		97	55	152
	SOUTHWESTERN COUNTIES (6).			
48	Androscoggin	9	23	32
80	Cumberland	42	12	54
65	Kennebec	14	23	37
76	Oxford	14	31	45
17	Sagadahoc	9	1	10
70	York	20	24	44
356		108	114	222
	WESTERN COUNTIES (2).			
33	Franklin	7	12	19
57	Somerset	7	28	35
90		14	40	54
	RECAPITULATION.			
144	Central counties	23	68	91
64	Northeastern counties	1	30	31
58	Eastern counties	31	10	41
213	Southern counties	97	55	152
356	Southwestern counties	108	114	222
90	Western counties	14	40	54
925		274	317	591

9. GEORGIA.

	CENTRAL COUNTIES (23).			
4	Baldwin		1	1
5	Bibb	2	1	3
6	Butts	1	1	2
5	Crawford	2		2
7	Dodge	3		3
7	Greene	2	2	4
7	Hancock	3	2	5
7	Houston	5	2	7
10	Jasper	3	2	5
4	Johnson	1	1	2
12	Jones	4	1	5
8	Laurens	2	2	4
11	Monroe	4	2	6
7	Montgomery		2	2
4	Morgan	1	2	3
5	Newton	1	2	3
4	Pulaski		1	1
2	Putnam	1		1
2	Rockdale		1	1
2	Taliaferro		2	2
9	Twiggs	3	1	4
8	Washington	2	2	4
7	Wilkinson	1	3	4
143		41	33	74

9. GEORGIA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	NORTHERN COUNTIES (19).			
16	Cherokee	3	3	6
2	Clarke	1	....	1
10	Cobb	4	2	6
10	Dawson	2	5	7
10	De Kalb	2	3	5
9	Fannin	....	6	6
9	Forsyth	2	3	5
8	Fulton	5	2	7
7	Gilmer	....	5	5
14	Gwinnett	2	2	4
15	Hall	3	3	6
16	Jackson	4	1	5
5	Lumpkin	....	1	1
4	Milton	1	....	1
3	Oconee	....	1	1
3	Towns	....	2	2
8	Union	1	4	5
8	Walton	2	....	2
7	White	1	5	6
164		33	48	81
	NORTHEASTERN COUNTIES (10).			
11	Banks	3	3	6
18	Elbert	1	6	7
16	Franklin	4	2	6
8	Habersham	2	5	7
11	Hart	3	2	5
5	Lincoln	....	3	3
4	Madison	2	....	2
9	Oglethorpe	2	2	4
6	Rabun	....	2	2
3	Wilkes	....	1	1
91		17	26	43
	EASTERN COUNTIES (11).			
6	Bulloch	2	1	3
14	Burke	4	3	7
9	Columbia	3	1	4
6	Effingham	1	3	4
7	Emanuel	....	1	1
1	Glascock	....	1	1
5	Jefferson	....	1	1
3	McDuffie	1	....	1
7	Richmond	....	4	4
19	Screven	4	6	10
6	Warren	1	....	1
83		16	21	37
	SOUTHEASTERN COUNTIES (12).			
7	Appling	4	....	4
4	Bryan	2	....	2
5	Camden	1	1	2
2	Charlton	0	....	0
2	Chatham	1	1	2
7	Glynn	....	5	5
8	Liberty	3	5	8
3	McIntosh	1	1	2
5	Pierce	1	2	3
8	Tattnall	3	1	4
7	Ware	1	2	3
11	Wayne	2	5	7
69		19	23	42
	SOUTHERN COUNTIES (13).			
11	Berrien	....	4	4
6	Brooks	....	3	3
5	Clinch	1	2	3
8	Coffee	4	1	5

9. GEORGIA—Continued.

Offices interrogated.	Counties.	Number of replies.		
		Yes.	No.	Total.
	SOUTHERN COUNTIES—Continued.			
6	Colquitt	1	3	4
9	Dooly	1	2	3
3	Echols		1	1
5	Irwin	1	1	2
9	Lowndes	3	2	5
8	Pickens		2	2
12	Telfair	1	4	5
5	Wilcox	2	2	4
9	Worth	3	2	5
96		17	29	46
	SOUTHWESTERN COUNTIES (16).			
3	Baker		2	2
6	Calhoun	1		1
2	Clay			
7	Decatur	4	1	5
6	Dougherty			
4	Early			
5	Lee		3	3
3	Miller	3		3
3	Mitchell		2	2
3	Quitman	1		1
3	Randolph	1	2	3
7	Stewart	3		3
6	Sumter	1		1
2	Terrell		2	2
7	Thomas		3	3
1	Webster	0	0	0
68		14	15	29
	WESTERN COUNTIES (21).			
6	Campbell	1	3	4
17	Carroll	6	1	7
5	Chattahoochee		2	2
10	Coweta	3		3
7	Douglas		1	1
4	Fayette	1	1	2
8	Haralson	1	2	3
12	Harris	1	1	2
10	Heard	2	3	5
9	Henry	3		3
7	Macon	1	1	2
6	Marion		2	2
14	Meriwether	5	3	8
2	Muscogee		1	1
10	Pike	3		3
5	Schley	4	1	5
4	Spalding	1	2	3
7	Talbot	2	1	3
4	Taylor		2	2
11	Troup	1	3	4
6	Upson	3	2	5
164		38	32	70
	NORTHWESTERN COUNTIES (12).			
15	Bartow	2	4	6
5	Catoosa	1	2	3
13	Chattooga	3	2	5
4	Clayton	3		3
7	Dade		4	4
15	Floyd	5	2	7
14	Gordon	3	5	8
9	Murray	1	2	3
8	Paulding	2	3	5
5	Polk	2		2
17	Walker	2	3	5
14	Whitfield	3	6	9
126		27	33	60

9. GEORGIA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	RECAPITULATION.			
143	Central counties	41	33	74
164	Northern counties	33	48	81
91	Northeastern counties	17	26	43
83	Eastern counties	16	21	37
69	Southeastern counties	19	23	42
96	Southern counties	17	29	46
68	Southwestern counties	14	15	29
164	Western counties	38	32	70
126	Northwestern counties	27	33	60
1,004		222	260	482

10. SOUTH CAROLINA.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (5).			
12	Clarendon	1	4	5
22	Lexington	3	3	6
16	Orangeburgh	3	4	7
9	Richland	2	2	4
15	Sumter	3	3	6
74		12	16	28
	NORTHERN COUNTIES (6).			
14	Chester	1	4	5
14	Fairfield	2	6	8
9	Kershaw	1	1	2
16	Lancaster	4	1	5
21	Union	6	3	9
23	York	3	4	7
97		17	19	36
	NORTHEASTERN COUNTIES (5).			
13	Chesterfield	......	6	6
14	Darlington	3	5	8
11	Horry	3	2	5
27	Marion	8	7	15
8	Marlborough	2	......	2
73		16	20	36
	EASTERN COUNTIES (3).			
19	Charleston	5	5	10
6	Georgetown	......	2	2
16	Williamsburgh	4	4	8
41		9	11	20
	SOUTHERN COUNTIES (4).			
20	Barnwell	3	8	11
12	Beaufort	1	4	5
25	Colleton	6	8	14
12	Hampton	4	3	7
69		14	23	37
	WESTERN COUNTIES (4).			
27	Abbeville	7	7	14
22	Aiken	5	5	10
40	Edgefield	9	9	18
14	Newberry	6	4	10
103		27	25	52

10. SOUTH CAROLINA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	NORTHWESTERN COUNTIES (6).			
25	Anderson	10	2	12
34	Greenville	5	9	14
29	Laurens	6	6	12
21	Oconee	6	6	12
15	Pickens	2	6	8
36	Spartanburgh	12	7	19
160		41	36	77
	RECAPITULATION.			
74	Central counties	12	16	28
97	Northern counties	17	19	36
73	Northeastern counties	16	20	36
41	Eastern counties	9	11	20
69	Southern counties	14	23	37
103	Western counties	27	25	52
160	Northwestern counties	41	36	77
617		136	150	286

11. MARYLAND.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (4).			
33	Anne Arundel	8	7	15
27	Howard	2	10	12
44	Montgomery	9	7	16
41	Prince George's	4	11	15
145		23	35	58
	NORTHERN COUNTIES (3).			
86	Baltimore	23	21	44
48	Carroll	5	18	23
46	Harford	9	11	20
188		37	50	87
	EASTERN COUNTIES (3).			
21	Caroline	7	6	13
11	Queen Anne	2	3	5
17	Talbot	5	4	9
49		14	13	27
	NORTHEASTERN COUNTIES (2).			
28	Cecil	12	6	18
18	Kent	3	8	11
46		15	14	29
	SOUTHEASTERN COUNTIES (4).			
29	Dorchester	17	....	17
14	Somerset	8	2	10
13	Wicomico	8	....	8
14	Worcester	7	1	8
70		40	3	43
	SOUTHERN COUNTIES (3).			
18	Calvert	6	4	10
25	Charles	8	4	12
25	St. Mary's	10	2	12
68		24	10	34

11. MARYLAND—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	NORTHWESTERN COUNTIES (4).			
16	Alleghany	....	11	11
59	Frederick	13	16	29
16	Garrett	1	5	6
34	Washington	5	15	20
125		19	47	66
	RECAPITULATION.			
145	Central counties	23	35	58
180	Northern counties	37	50	87
49	Eastern counties	14	13	27
46	Northeastern counties	15	14	29
70	Southeastern counties	40	3	43
68	Southern counties	24	10	34
125	Northwestern counties	19	47	66
683		172	172	344

12. FLORIDA.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (7).			
8	Hernando	4	2	6
13	Hillsborough	6	3	9
7	Levy	2	2	4
15	Marion	3	6	9
32	Orange	16	5	21
3	Polk	....	1	1
9	Sumter	4	4	8
87		35	23	58
	NORTHERN COUNTIES (12).			
17	Alachua	8	3	11
3	Baker	1	1	2
7	Bradford	....	1	1
10	Columbia	1	4	5
7	Hamilton	....	2	2
6	Jefferson	2	2	4
7	La Fayette	....	4	4
5	Leon	1	2	3
4	Madison	....	2	2
12	Suwannee	1	7	8
7	Taylor	1	3	4
7	Wakulla	....	2	2
92		15	33	48
	NORTHEASTERN COUNTIES (5).			
7	Clay	3	3	6
10	Duval	6	2	8
12	Nassau	2	3	5
22	Putnam	13	4	17
9	St. John's	2	2	4
60		26	14	40
	EASTERN COUNTIES (2).			
6	Brevard	3	3	6
17	Volusia	10	1	11
23		13	4	17
	SOUTHEASTERN COUNTIES (1).			
2	Dade	....	....	....

12. FLORIDA—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	SOUTHERN COUNTIES (2).			
9	Manatee	3	6	9
3	Monroe	....	2	2
12		3	8	11
	NORTHWESTERN COUNTIES (10).			
6	Calhoun	2	2	4
9	Escambia	2	5	7
4	Franklin	1	1	2
8	Gadsden	4	2	6
3	Holmes	....	1	1
7	Jackson	2	1	3
4	Liberty	....	3	3
5	Santa Rosa	....	3	3
6	Walton	2	1	3
7	Washington	1	2	3
59		14	21	35
	RECAPITULATION.			
87	Central counties	35	23	58
92	Northern counties	15	33	48
60	Northeastern counties	26	14	40
23	Eastern counties	13	4	17
2	Southeastern counties	....	....	....
12	Southern counties	3	8	11
59	Northwestern counties	14	21	35
335		106	103	209

13. NEW JERSEY.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (6).			
54	Burlington	34	3	37
20	Mercer	9	4	13
25	Middlesex	15	7	22
61	Monmouth	36	9	45
27	Ocean	20	2	22
34	Somerset	5	17	22
221		119	42	161
	NORTHERN COUNTIES (3).			
58	Morris	13	24	37
22	Passaic	3	6	9
41	Sussex	2	26	28
121		18	56	74
	NORTHEASTERN COUNTIES (4).			
46	Bergen	7	12	19
21	Essex	4	9	13
16	Hudson	3	4	7
14	Union	1	8	9
97		15	33	48
	SOUTHERN COUNTIES (2).			
21	Atlantic	16	....	16
20	Cape May	17	....	17
41		33	....	33
	SOUTHWESTERN COUNTIES (4).			
19	Camden	12	....	12
29	Cumberland	15	5	20
21	Salem	6	2	8
36	Gloucester	19	3	22
105		52	10	62

13. NEW JERSEY—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	NORTHWESTERN COUNTIES (2).			
56	Hunterdon	16	16	32
45	Warren	6	30	36
101		22	46	68
	RECAPITULATION.			
221	Central counties	119	42	161
121	Northern counties	18	56	74
97	Northeastern counties	15	33	48
41	Southern counties	33	....	33
105	Southwestern counties	52	10	62
101	Northwestern counties	22	46	68
686		259	187	446

14. MASSACHUSETTS.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (1).			
122	Worcester	35	56	91
	NORTHEASTERN COUNTIES (1).			
65	Essex	29	13	42
	EASTERN COUNTIES (3).			
112	Middlesex	47	29	76
62	Norfolk	15	23	38
17	Suffolk	4	2	6
191		66	54	120
	SOUTHEASTERN COUNTIES (5).			
62	Barnstable	35	11	46
46	Bristol	28	4	32
7	Dukes	4	2	6
1	Nantucket	....	1	1
70	Plymouth	28	16	44
186		95	34	129
	SOUTHWESTERN COUNTIES (1).			
43	Hampden	20	5	25
	WESTERN COUNTIES (2).			
62	Berkshire	14	24	38
45	Hampshire	19	12	31
107		33	36	69
	NORTHWESTERN COUNTIES (1).			
54	Franklin	30	11	41
	RECAPITULATION.			
122	Central counties	35	56	91
65	Northeastern counties	29	13	42
191	Eastern counties	66	54	120
186	Southeastern counties	95	34	129
43	Southwestern counties	20	5	25
107	Western counties	33	36	69
54	Northwestern counties	30	11	41
768		308	209	517

15. DELAWARE.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	CENTRAL COUNTIES (1).			
30	Kent	14	4	18
	NORTHERN COUNTIES (1).			
44	New Castle	10	8	18
	SOUTHERN COUNTIES (1).			
33	Sussex	15	5	20
	RECAPITULATION.			
30	Central counties	14	4	18
44	Northern counties	10	8	18
33	Southern counties	15	5	20
107		39	17	56

16. CONNECTICUT.

Offices interrogated.	Counties.	Yes.	No.	Total.
	NORTHERN COUNTIES (2).			
76	Hartford	47	6	53
36	Tolland	18	3	21
112		65	9	74
	NORTHEASTERN COUNTIES (1).			
56	Windham	18	14	32
	SOUTHEASTERN COUNTIES (1).			
50	New London	35	4	39
	SOUTHERN COUNTIES (2).			
30	Middlesex	19	....	19
58	New Haven	37	....	37
88		56	....	56
	SOUTHWESTERN COUNTIES (1).			
66	Fairfield	29	15	44
	NORTHWESTERN COUNTIES (1).			
82	Litchfield	27	21	48
	RECAPITULATION.			
112	Northern counties	65	9	74
56	Northeastern counties	18	14	32
50	Southeastern counties	35	4	39
88	Southern counties	56	....	56
66	Southwestern counties	29	15	44
82	Northwestern counties	27	21	48
454		230	63	293

17. RHODE ISLAND.

Offices interrogated.	Counties.	Yes.	No.	Total.
	CENTRAL COUNTIES (1).			
18	Kent	8	4	12
	NORTHERN COUNTIES (1).			
43	Providence	30	5	35

17. RHODE ISLAND—Continued.

Offices interrogated.	Counties.	Number of replies. Yes.	No.	Total.
	EASTERN COUNTIES (1).			
6	Bristol	3	....	3
	SOUTHEASTERN COUNTIES (1).			
9	Newport	5	....	5
	SOUTHERN COUNTIES (1).			
34	Washington	24	2	26
	RECAPITULATION.			
18	Central counties	8	4	12
43	Northern counties	30	5	35
6	Eastern counties	3	....	3
9	Southeastern counties	5	....	5
34	Southern counties	24	2	26
110		70	11	81

Recapitulation of the seventeen States that use fish guano.

Offices interrogated.	States.	Number of replies. Yes.	No.	Total.	Per cent. of affirmative replies.
3, 381	1. Pennsylvania	305	1, 426	1, 731	18
2, 930	2. New York	375	1, 183	1, 558	24
456	3. New Hampshire	91	208	299	30
1, 395	4. North Carolina	223	477	700	32
497	5. Vermont	105	210	315	33
1, 091	6. Alabama	175	329	504	36
1, 685	7. Virginia	377	452	829	45
925	8. Maine	274	317	591	46
1, 004	9. Georgia	222	260	482	46
617	10. South Carolina	136	150	286	48
683	11. Maryland	172	172	344	50
335	12. Florida	106	103	209	51
686	13. New Jersey	259	187	446	58
768	14. Massachusetts	308	209	517	60
107	15. Delaware	39	17	56	69
454	16. Connecticut	230	63	293	79
110	17. Rhode Island	70	11	81	86
17, 124		3, 467	5, 774	9, 241	

SPECIAL AFFIRMATIVE STATEMENTS FROM DELAWARE.

For the purpose of testing the matter further in a State largely reported as using this fertilizer, special questions were sent out, in answer to which the statements quoted below were obtained. Time prevented prosecuting the inquiry in other States.

"The fish guano used here is obtained out of town, and amounts to very little." J. M. Martin, Cool Spring, Sussex County.

"Mr. J. F. Price and about four others use 30 tons annually, which they obtain in Baltimore." P. B. Alrich, Summit Bridge, New Castle County.

"The small amount used has been obtained from W. N. Needles, 42 South Delaware avenue, Philadelphia." William G. Herring, P. M., Milford, Kent County.

"Only used here in small quantities and obtained from Philadelphia mostly." J. A. Lynch, P. M., Robbins, Sussex County.

"Several thousand tons are used in this region by hundreds of farmers and truckers who sell vegetables in the city. Nearly all dealers in fertilizers in Pennsylvania and New Jersey sell it. They buy it from ourselves and others who prepare it. It is made on the coasts of Long Island, Connecticut, and Maine. It is shipped to us in bulk, by vessels, after which we grind and bag it." Walton, Ham & Co., Wilmington, Del.

"About one hundred tons are being used by forty farmers, among whom are W. Phillips & Bro., Phillips Hill, Del., G. P. Hickman and J. Single, Frankford, Del. Wilgus, Derickson & Co., Roxana, Del., and Gum & Bro., Frankford, Del., are dealers who buy it from a manufactory at Fenwick's Island, near Roxana, Del." J. T. Long, P. M., Frankford, Del.

"Fish guano is not much used. The farmers buy spoiled salt fish in Philadelphia, and manufacture it for their own use to some extent." L. W. Lattomus, Townsend, New Castle County.

"One hundred and fifty tons are used by seventy-five farmers, among whom are Spencer A. Phillips, Millsborough, Del., John Wilgus, Roxana, Del., and Horace Hickman, Frankford, Del. Holland, Wilgus & Co., E. Townsend, and John A. Gum are dealers, who buy mostly at Fenwick's Island, Del." J. E. Lynch, Roxana, Sussex County.

"There are two or three seines between Indian River and Fenwick's Island light-house that are hauled for fish to be used as fertilizer. Henry Hudson and William S. Evans have built a house for making the fish into guano, but the farmers here are so anxious for the fish that they go to the beach and buy them for manure before there is time to make them into guano. The fish we call 'old wives.' They are called moss bunkers, North. I have used them on my land and they are better than any guano I ever had." P. M., Ocean View, Sussex County.

"I used half a ton on strawberries last fall. It was made by the New Jersey Chemical Company, Camden, N. J., from alewives or mud shad, which are caught on the New Jersey shore." John T. Jakes, Wyoming, Kent County.

"It has been used on three farms, especially by Alexander Guthrie. It is brought from Wilmington." Jasper C. Way, P. M., Hockessin, New Castle County.

"Five tons are used annually by Thos. E. Woolens, George B. Dougherty, and seven or eight other farmers. They buy it from J. J. Allen's Sons, Philadelphia, Pa., and from John A. Wilson, Wilmington, Del." Charles Green, jr., Rockland, New Castle County.

"J. M. Arthurs and W. D. Wilds, Kenton, Del., sell to a few farmers here." J. B. Messick, Down's Chapel, Kent County.

"H. A. Murray, Dover, Del., formerly made it, but has engaged in other business. Those who formerly used fish guano here have discontinued it, finding by experience that other fertilizers were preferable." Julia S. Bradley, P. M., Canterbury, Kent County.

"Four or five tons are used by from five to ten persons, among whom are E. D. Hitchens and H. Hickman. T. E. Records and E. D. Hitchens deal in it, and buy it in Philadelphia and New York." D. W. Brereton, P. M., Lewes, Sussex County.

FERTILIZING PRODUCTS.

The following statement is by Mr. A. M. Wilcox, secretary of the Fish Bureau, Boston, Mass.: "During the past few years more attention has each year been given to the fertilizing qualities contained in the large amount of fish waste and scrap that was formerly constantly being thrown away. Three of the numerous factories in and around Boston use any fish products, making a specialty of this line, utilizing all the scrap and waste from the numerous boneless fish factories, menhaden chum, and the large amount of refuse from the market fishermen, such as fish heads, all kinds of unmarketable fish, in fact everything connected with the fish that was formerly thrown away is now utilized at the fertilizing factory, the fishermen receiving quite a sum for the same.

"The process of manufacture is simple and varies but little in any of the factories, fish scrap, bone phosphate, and sulphuric acid being the main ingredients used by all. The use of this fertilizing material has shown such favorable results, the demand is constantly on the increase. Dealers give the following as the distribution from the various factories of New England during 1879:

	Tons.
New York	40,000
North Carolina	20,000
South Carolina	20,000
Virginia	45,000
Georgia	45,000
New England	10,000

"Maryland and New Jersey take a less amount. The newer States of the West as yet care for but little if any fertilizing compounds. A large amount is also exported to the West Indies. Fourteen thousand tons were manufactured by the three factories here during 1879. The price ranged from $25 to $35 a ton."

The *proportional* part of the capital and products to the credit of the fishing industry is as follows:

Capital	$100,000
Men employed	90
Value of product	$140,000

APPENDIX C.

NATURAL HISTORY AND BIOLOGICAL RESEARCH.

X.—THE ANNELIDA CHÆTOPODA FROM PROVINCETOWN AND WELLFLEET, MASS.

By Prof. H. E. Webster and James E. Benedict.

The annelids on which this paper is based were collected from June to September, 1879, by the Summer Zoological Expedition of Union College. Of the 90 species found, by far the greater number live between tides. Not much dredging was done, and none at a greater depth than thirty fathoms. Two visits to Wellfleet procured a number of forms not found at Provincetown. Three genera and sixteen species are described as new. Of the genera, *Thaumastoma* seems not to belong to any described family. Eighteen species have their northern limit extended, having been previously found only to the south of the Cape. *Nerilla antennata* Schmidt and *Trichobranchus glacialis* Malmgren are European forms not previously found on our coast. *Syllides* Œrsted is also new to our coast, and is represented by a new species. *Capitella capitata* has not previously been reported from the United States, though found further north. The figures, except figs. 95—97, were made by H. E. Webster.

Family APHRODITIDÆ.

APHRODITA (*Linn.*) *Kinberg.*

Aphrodita aculeata *Linn.*

Aphrodita aculeata Linn. Systema Naturæ, ed. xii, vol. i, p. 1084. 1767.
Kinberg. Eugenies Resa, p. 3, pl. i, fig. 2. 1857.
Selenka. Das Gefässsystem der Aphrodita aculeata, ex Niederländisches Archiv für Zoologie, pls. iii–iv. 1873.
Verrill. Invertebrate animals of Vineyard Sound, in Report of U. S. Commissioner of Fish and Fisheries, Part i, p. 580. 1874.

No large specimens were taken; 20 to 28 fathoms, sand and shells.

Family POLYNOIDÆ.

LEPIDONOTUS (*Leach*) *Kinberg.*

Lepidonotus squamatus *Kinberg.*

Lepidonote armadillo Leidy. Marine Invert. Fauna, R. I. and N. J., Ex. Jour. Phila. Acad., series ii, vol. iii, p. 16, pl. xi, fig. 54. 1855.
Lepidonotus squamatus Knbg. Fregatten Eugenies Resa. Zoölögi, Annulata, p. 13, pl. xv, fig. 15. 1857.

Lepidonotus squamatus VERRILL. Invert. Animals of Vineyard Sound, etc., p. 581. 1874.
WEBSTER. Annelida Chætopoda of the Virginian Coast, in Trans. Albany Institute, vol. ix, p. 204, pl. i, figs. 1–5. 1879.
Annelida Chætopoda of New Jersey, in the Thirty-second report of the N. Y. State Museum, p. 101. 1880.

Specimens not large but abundant from low water to 29 fathoms.

NYCHIA *Malmgren.*

NYCHIA CIRROSA *Malmgren.*

Aphrodita cirrhosa PALLAS. Miscell. Zoöl., p. 95, pl. viii, figs. 3–6 (*teste Malmgren*). 1766.
Lepidonote assimilis ÖRSTED. Annulatorum Danicorum Conspectus, p. 13, figs. 3, 6, 14, 32, 33, 37, 38, 45, 46. 1843.
Nychia cirrosa MALMGREN. Nordiska Hafs-Annulater, p. 58, pl. viii, fig. 1. 1865.

The foot of this species is not correctly figured by Malmgren. The upper ramus is not shown in the figure (l. c. fig. 1 B), but the lower ramus is represented as bluntly rounded externally. In fact the outline of the foot is very nearly that of *Eunoë Örstedi* MGM. (l. c. pl. viii, fig. 3 B). The lower margin of the upper ramus and the upper margin of the lower ramus are drawn out into conical, finger-shaped projections.

Not common; 29 fathoms, sand and shells.

NYCHIA AMONDSENI *Malmgren.*

MALMGREN. *Annulata Polychæta,* p. 131, pl. ii, fig. 4. 1867.

The same defect exists in Malmgren's figure of the foot of this species (l. c. fig. 4 B) as in the previous species.

Only one specimen was taken. Sand and shells, 29 fathoms.

EUNOA *Malmgren.*

EUNOA NODOSA *Malmgren.*

Polynoë nodosa SARS. Christiana Vid. Selsk. Forh., p. 59, 1860.
Eunoë nodosa MALMGREN. Nord. Hafs-Ann., p. 64, pl. viii, fig. 4. 1865.
Eunoa nodosa MALMGREN. Annu. Polych., p. 132. 1867.

Only half-grown specimens of this species were found. They differ in some particulars from Malmgren's description. The elytra are less distinctly emarginate and not so nodose. However, there can be no doubt as to their specific identity.

Not common; 12 to 30 fathoms, sand and shells.

LAGISCA *Malmgren.*

LAGISCA RARISPINA *Malmgren.*

Nordiska Hafs-Annulater, p. 65, pl. viii, fig. 2. 1865.

Common; 12 to 30 fathoms, sand and shells.

HARMOTHOË (*Kinberg*) *Malmgren.*

HARMOTHOË IMBRICATA *Malmgren.*

MALMGREN. Nordiska Hafs-Annulater, p. 66, pl. ix, fig. 8. 1865. Annulata Polychæta, p. 134. 1867.
VERRILL. Invertebrate Animals of Vineyard Sound, etc., p. 582. 1874.

Common, from low water to 30 fathoms.

LEPIDAMETRIA *Webster.*

LEPIDAMETRIA COMMENSALIS *Webster.*

Annel. Chæt. of the Virginian Coast, p. 210, pl. iii, figs. 23–31. 1779.
Annel. Chæt. of New Jersey, etc., p. 103. 1879.

At Wellfleet we found *Amphitrite ornata* VERRILL quite common in coarse gravel and mud. As usual, *L. commensalis* occurred in the tubes of this species, but sparingly. Most of the specimens taken were young, from one-half inch to one inch in length. In these the stout, single-pointed setæ of the upper bundle, lower ramus, had not yet appeared; the attachments of the elytra were very prominent; otherwise they did not differ from the adult form.

Family SIGALIONIDÆ.

SIGALION *Aud. and M. Ed.*

SIGALION ARENICOLA *Verrill.*

Proceedings of the United States National Museum, p. 167. Nov., 1869.

This species has a close superficial resemblance to *Sthenelais picta* VERRILL, and occupies the same stations.

Not common. Sand; low water.

STHENELAIS *Kinberg.*

STHENELAIS PICTA *Verrill.*

VERRILL. Invert. Animal of Vin. Snd., etc., p. 582. 1874.
WEBSTER. Annel. Chæt. of the Virginia Coast, p. 213. 1879. Annel. Chæt. of New Jersey, p. 103. 1880.

Common at low water, in sand.

PHOLOË *Johnston.*

PHOLOË MINUTA *Malmgren.*

Aphrodita minuta O. FAB. Fauna Grönlandica, p. 314. 1780.
Pholoë minuta MALMGREN. Nordiska Hafs.—Ann., p. 89, pl. xi, fig. 13. 1865.
? Pholoë tecta STIMPSON. Marine Invertebrata of Grand Manan, p. 36. 1854.

Only young specimens were found. They agreed in all respects with *Pholoë minuta*, save that the elytra completely covered the dorsum.

This is also the case with Stimpson's *Pholoë tecta.* It is probable that *Pholoë tecta** is the young of *Pholoë minuta.*

Not common; low water; sand.

Family NEPHTHYIDÆ.

NEPHTHYS *Cuvier.*

NEPHTHYS INCISA *Malmgren.*

Nephthys incisa MGRN. Nordiska Hafs.—Ann., p. 105, pl. xii, fig. 21. 1865.
Nephthys ingens VERRILL. Invert. Ann. of Vin. Snd., etc., pl. 583, pl. xii, figs. 59, 60. 1874.
Nephthys incisa VERRILL. Check-List. 1879.

Common; 12 to 20 fathoms; mud.

NEPHTHYS BUCERA *Ehlers.*

EHLERS. Die Borstenwürmer, p. 617, pl. xxiii, fig. 8. 1868.
VERRILL. Invert. Animals of Vin. Snd., p. 583, pl. xii, fig. 58. 1874.

Not common; found in sand at low water. Very fine specimens were taken at Race Run, near Provincetown.

Family PHYLLODOCIDÆ.

ANAITIS *Malmgren.*

ANAITIS SPECIOSA *Webster.*

Annel. Chæt. of New Jersey, p. 104, pl. i, figs. 8, 9. 1880.

When first examined we regarded the specimens collected at Wellfleet as distinct from *Anaitis speciosa;* subsequent comparison of specimens has shown that the former must be regarded as a variety of the latter. As compared with specimens from New Jersey, these have the head a little narrower; the anterior emargination of the buccal segment, with the corresponding backward curvature of the posterior margin of the head, not so well marked.

The color is variable. In front of the eighth segment the color is yellowish-white; a dark-brown band covers the eighth segment and the anterior half of the ninth; behind this band the color is yellow or brownish-yellow; the middle third of the anterior margin of each segment is brown, while on the posterior segments this brown band runs entirely across the segment; the branchiæ for their inner two-thirds are yellowish-brown, outer third white; the brown band of the eighth and ninth segments includes the branchiæ, and is faintly perceptible below; body and branchiæ with numerous flake-white specks; head white with brown specks; or the general color may be white, green replacing the

* Examination of many specimens at Eastport, Me., has fully established the identity of *P. tecta* with *P. minuta.*

brown everywhere; the general color of the ventrum is the same as on the dorsum, though the brown or green is not so distinct.

Wellfleet; low water; on tubes of *Diopatra cuprea* CLPD.

PHYLLODOCE (*Sav.*) *Malmgren.*

PHYLLODOCE GRŒNLANDICA *Örsted.*

No adult specimens of this remarkably fine species were collected. A number of half-grown specimens were taken.

A minute, nearly spherical median papilla was seen in fresh specimens on the anterior projecting margin of the buccal segment; not visible on alcoholic specimens.

The transverse ridge between the segments is densely ciliated, and a line of long cilia runs down the outer face of the branchiæ near the posterior margin.

General color, dark green, with irregular brown markings; branchiæ brown, with light-green margin.

The anal cirri are about the length of the last five segments.

Low water, sand, to 25 fathoms, sand and shells.

PHYLLODOCE ARENÆ *Webster.*

Annel. Chæt. of New Jersey, p. 105, pl. ii, figs. 10–12. 1880.

Low water, sand, to 25 fathoms, sand and shells.

EUMIDA *Malmgren.*

EUMIDA MACULOSA *Webster.*

Annel. Chæt. of the Virginian coast, p. 215, pl. iv, figs. 38, 41, 1879. Annel. Chæt. of New Jersey, p. 106, 1880.

In the original description the anal cirri are said to arise from "stout basal articles, constituting one-third their entire length." This is a mistake; they have no basal article. Only two specimens were taken in Virginia, and but one of these had anal cirri, and these seem not to have been normal. Near the front of the head there is a slight constriction.

Low water, sand, common.

EULALIA (*Sav.*) *Malmgren.*

EULALIA GRACILIS *Verrill.*

Invert. Animals of Vineyard Sound, etc., p. 586. 1874.

Probably *gracilis;* though, as no figures accompany the original description, one can hardly be certain without comparison with the typical examples.

Both males and females have very long and delicate capillary setæ developed in addition to the ordinary setæ, not, as in the SYLLIDÆ, as a distinct bundle, but mixed with the ordinary setæ. They begin from the twenty-fifth to the thirtieth segment, short at first, but soon becoming as long or longer than the width of the body, while the ordinary setæ are quite short; they extend nearly to the posterior end. In the males the posterior two-thirds of the body is rounded, much swollen by the contained spermatozoa. After the twenty-fifth segment the body of the females is filled with numerous large eggs; these are very dark green, and determine the color of the body wherever they exist. The anterior part of the body has the same color as in the males and in asexual forms. This is gray, with lateral brown bands, one on each side, and with a darker brown spot at the base of each foot, both above and below.

There are three anal cirri on all forms, the odd one being median, ventral, and quite small.

Common on dredged shells, 20 to 30 fathoms; sand and shells.

EULALIA DUBIA *n. sp.*

(PL. VIII, FIGS. 101–105.)

This species we at first referred to *Eulalia annulata* VERRILL, but when the specimens were submitted to him he decided that they did not belong to his species.

The head (fig. 101) has the lateral margins evenly rounded, with a constriction just back of the origin of the antennæ. The inferior antennæ are concealed by the superior, but are similar to them in every respect. The median antenna is a trifle less stout than the anterior, otherwise the same. Eyes two, moderately large, circular, black.

Tentacular cirrus of the first segment and the lower cirrus of the second segment equal in length; about one-half as long as the other cirri; these reach about to the fourth setigerous segment.

The branchiæ are all acute, growing progressively longer and wider from the first segment (fig. 102) to the middle of the body (fig. 103), after which they continue to increase in length, but diminish in breadth, becoming very long and narrow on the posterior segments (fig. 104). The ventral cirri undergo similar changes, but not to the same extent. The segments of the posterior half of the body are crossed by a narrow raised band.

The setæ have very short terminal articles (fig. 105); the stem terminates in a series of minute teeth, with one much larger slightly curved tooth. The proboscis is long, cylindrical, densely covered with cylindrical papillæ. Segments, deeply incised.

Body, dark green; branchiæ, dark brown, with green margin; a dark brown spot at the base of the feet, both above and below.

The specimen from which the figure of the head was made had the head retracted, so that the first pair of tentacular cirri seem to originate beneath the head; in extended specimens the first segment is plainly visible. Some specimens had four eyes; in this case they are all on the same straight line, the outer pair smaller than the inner.

The transverse band crossing the segments is densely ciliated, and there is a line of cilia on the posterior face of the branchiæ (after the first few segments), near the inner margin.

Common. Low water to 20 fathoms.

ETEONE (*Sav.*) *Örsted.*

ETEONE ALBA *Webster.*

Annelida Chætopoda of New Jersey, p. 106, pl. ii, figs. 13-16, 1880.

We found this species in New Jersey, associated with *Streblospio Benedicti* WEBSTER, for the most part in mussel beds, in about 15 feet of water. We found it at Wellfleet, associated with the same species, but near high-water mark, in firm mud.

Not common.

ETEONE CINEREA *n. sp.*

(PL. I, FIGS. 1-5.)

Head convex above, flattened below, constricted just back of the origin of the superior antennæ, sides and anterior and posterior margin convex. (fig. 4.)

Antennæ stout, conical, white, one-third as long as the head.

Eyes two, minute, black, hardly perceptible in alcoholic specimens.

Buccal segment a little more than half as long as the head; from the middle of its anterior margin a small rounded papilla projects.

Tentacular cirri short; the lower a little longer than the upper, and with a sudden falling off in diameter at the outer third; inner two-thirds fusiform.

The dorsal cirri (branchiæ) have nearly the same shape throughout. On the anterior segments (fig. 1) not quite so large as on the middle segments, and closer to the foot; on the middle segments (fig. 2) remote from the foot; on the posterior segments (fig. 3) smaller even than the anterior, but not in contact with the foot; they are all thick, flattened, with nearly straight sides and bluntly rounded end. The ventral cirri are like the dorsal, but smaller.

The setæ are numerous, quite short; the stem (fig. 5) terminates in two sharp, elongated points; the appendix, three times as long as the stem, is wide at base, but narrows rapidly to a minute capillary termination.

Anal segment smooth, cylindrical, as long as the four segments preceding it, without cirri, they having probably been lost.

The anterior and posterior segments are crossed by a distinct impressed line; the middle segments by two lines. Along the middle third the segments are longer and wider than elsewhere; the body tapering a little forwards, rapidly along the posterior third; the posterior segments are about one-third the length and width of the median. The general color is light-gray, with a few scattered brown specks; anal segment, light-green; antennæ and tentacular cirri, white.

Greatest width, 2^{mm}. Length, 28^{mm}.

Single specimen, dredged; 20 fathoms; sand and shells.

Family HESIONIDÆ.

PODARKE *Ehlers.*

PODARKE OBSCURA *Verrill.*

VERRILL. Invert. Animals of Vin. Sound, etc., p. 589, pl. xii, fig. 61, 1874.
WEBSTER. Annel. Chæt. of the Virgn. Coast, p. 216, 1899. Annel. Chæt. of New Jersey, p. 107, 1879.

Provincetown and Wellfleet. Not common. Low water; sand and mud.

PODARKE CÆCA *n. sp.*

(PL. I, FIGS. 6–8.)

We found a few specimens of *Podarke* differing much from *Podarke obscura* VERRILL; it may be found to be the young of some species.

The head (fig. 6) was evenly rounded in front and at the sides; nearly straight behind; length to width as two to three; slightly convex; no eyes; antennæ arising from nearly cylindrical basal articles; posterior unpaired antenna, arising near the posterior margin, not quite so long or so stout as the others; upper (anterior) pair close to each other, near the anterior margin of the head; length (without basal articles) about equal to the length of the head; lower pair arise from the under surface of the head, just outside the upper pair; a trifle more delicate than the latter.

The first segment encroaches laterally on the head, reaching about to the middle line; it is nearly as long at the sides as the following segment, elsewhere about one-half as long.

The tentacular cirri are six on each side, not at all crowded, a single pair from each of the first three segments; they have stout and rather long cylindrical basal articles; are very variable in length; taper uniformly to a bluntly rounded apex. The feet (fig. 7) are quite large, pointed externally, much swollen at base, owing to the origin of the basal portion of the dorsal cirri.

The dorsal cirri do not extend beyond the feet, are delicate, conical; base a little swollen.

Ventral cirri given off at about the outer fourth of the foot; extend about to the end of the foot.

The segments are deeply incised, much wider than long, slightly convex, both from side to side and from before backwards.

On our specimens there were no setæ in the dorsal rami; as they were not in good condition, it seems probable that these setæ had been lost, as is often the case in *Podarke obscura*. The ventral setæ have the usual form; one in each bundle is very long, both in stem and appendix, those above and below it proportionately shorter as they are more remote; from 4 to 8 in each bundle.

The general color is yellowish white, crossed above and below by many transverse bands, made up of irregularly shaped, yellowish-brown spots and specks.

Width, without feet, at ninth segment, 2mm.

Length of first 10 segments, 10mm.

No entire specimen was found.

Low water; sand.

HESIONE (*Savigny*) *Quartrefages*.

HESIONE AGILIS *n. sp.*

(PL. I, FIGS. 9-11.)

The head of this species is very peculiar (fig. 6); anterior margin with a slight median convexity, otherwise straight; outer angles very broadly rounded; lateral margins concave; posterior margin very concave; posterior angles prolonged far backward, forming wide, obtusely rounded lappets.

The length of the head along the middle line is one-third the width of its anterior part, while the distance from the anterior to the posterior lateral angles is a little more than two-thirds the same length.

The posterior antennæ arise from rounded projections (basal articles), half way between the eyes and anterior margin of the head; they are conical, a little swollen at base, in length about double the length of the head along the line on which they stand; the anterior antennæ arise from the front margin of the head in front of and a trifle within the posterior antennæ; they have stout cylindrical basal articles, are conical, a little longer than the posterior pair.

There are two pairs of eyes, lateral; bright red; anterior pair oval, oblique, large; posterior pair a little within the anterior, in contact with them, more or less regularly crescentic.

The tentacular cirri have the form shown in the figure, but their length was not even approximately the same on any two specimens. The longest one figured would reach about to the fourth segment, but in some specimens one of the cirri reaches to the eighth or even to the tenth segment. Out of half a dozen specimens taken we could determine no law for the relative length of the cirri; nor could we even say whether, as a rule, the upper were longer or shorter than the lower.

It would seem that they are normally very long, from two to four times as long as figured, but readily lost and renewed. They have long and stout cylindrical basal articles, and taper uniformly to a bluntly rounded apex. The feet, dorsal cirri, and setæ are all very long, and increase in length from the first segment to the middle of the body, and then as regularly decrease. The superior ramus (fig. 7) bears a dorsal. cirrus, which is as long or even longer than its foot; and a bundle of very delicate capillary setæ, as long as the cirrus, and quite numerous; the ventral ramus is just below the dorsal and projects beyond it, forming nearly one-half of the foot; it ends in a minute conical cirrus, is obliquely truncated below, and bears on its lower posterior margin a conical ventral cirrus, which projects beyond the apex of the foot by about one-half its length. The ventral ramus has a fan of compound setæ (fig. 8) which decrease in length uniformly from the upper to the lower part of the fan; the appendix of these setæ is about one-third the length of the stem.

The anterior enlarged part of the digestive tract extends through the first four segments; it is nearly cylindrical, tapering somewhat along the posterior third; is finely but distinctly transversely striated; has a deep median dorsal longitudinal incision or depression of varying width. The transverse striæ can be seen passing to the bottom of this depression in front, but behind it seems to be carried completely through, giving two bluntly rounded posterior terminations to this organ. Back of this the intestine has a yellowish, granular appearance, and for six segments sends diverticula into the feet, one-third as long as the feet.

One, two, or three segments preceding the anal have rudimentary appendages. The annal segment is much like the others, bears two anal cirri, in all respects similar to the dorsal cirri. Body slightly convex above and below; colorless, except as colored by the contents of the digestive tract; tapering uniformly, but gradually, from the first segment to the last.

The largest specimen had 18 setigerous segments.

Length, 2.55^{mm}; width of middle segment, 0.25^{mm}; length of foot from middle segment, 0.36^{mm}.

Found near high-water mark in sandy-mud, Wellfleet, Mass.

The width was about the same in all the specimens, but in most a number of the posterior segments had been lost.

According to the diagnosis given by Ehlers (Borsten., p. 187), this species is a *Hesione*. Ehlers does not mention a definite number of tentacular cirri. Grube, in his Annulata Semperiana, speaking of *Fallacia* QUATREFAGES, which is established as a genus because it has four pairs of tentacular cirri on each side, says that this is also the case with *Hesione* SAVIGNY, as is plainly stated in the preliminary description of the genus, Système des Annelides, p. 9. Grube further claims that the figure of *Hesione splendida* (l. c., pl. iii, fig. 3) shows six tentacular cirri, and the basal joint of another, on each side, and remarks that the loss of tentacular cirri is common in this group.

Quatrefages has examined the specimen from which Savigny made his description. He regards it as having but six pairs of tentacular cirri, and succeeds in complicating matters by saying that the cirri of the feet are retractile ("Pedes longiusculi, cirri retractiles"), whereas Savigny says that the tentacular cirri are retractile, a thing sufficiently hard to believe. Langerhans (Zeitschrift für Wissenschaftliche Zoölogie, p. 306, 1879) adopts Grube's view as to *Hesione* and *Fallacia*, and refers *Hesione Steenstrupii* QUATREFAGES to *Halimede* RATHKE; but *Halimede* is regarded by Malmgren as a synonym of *Castalia* (SAV.) SARS, though on what grounds, if Rathke's description is in any way valid, it is hard to understand. The genera of Hesionidæ seem to be badly confused. Our specimens differ from most of the described genera in having the feet distinctly biramous, with two entirely distinct bundles of setæ. However, this is also the case with *Podarke* EHLERS, though expressly placed by Quatrefages among the uniramous forms.

Our specimens, though differing somewhat from the diagnoses, seem to belong to *Hesione* SAVIGNY as understood by Quatrefages; and to *Halimede* RATHKE as understood by Langerhans; while if regard be had strictly to the original descriptions of these genera, they could hardly be referred to either.

Örsted, in his diagnosis of *Castalia*, assigns to it maxillæ, and figures the maxillæ of *Castalia punctata* (Annulatorum Danicorum Conspectus, p. 23, fig. 65). It will be seen that similiar structures exist in our species, but they do not seem to be hard parts. We could spare only one specimen for this examination, but the parts in question appeared to be neither chitinous nor calcareous.

Family SYLLIDÆ.

SYLLIDES *Örsted.*

We accept the genus Syllides on the authority of Professor Langerhans, never having seen the original description. Marion-Bobretzky have described a species of the same genus, referring it to *Anoplosyllis* CLAPARÈDE. Before seeing Langerhans's work on the Syllidæ we proposed to refer our specimens to *Anoplosyllis*, though we were doubtful as to the propriety of so doing.

SYLLIDES CONVOLUTA, *n. sp.*

(PL. II, FIGS 12-16.)

Head (fig. 12) with anterior and posterior margins slightly convex; sides well rounded; length to breadth as three to two; eyes six, bright red; anterior pair very close to the anterior and lateral margins; of the posterior pairs, those in front are largest, and external, the eyes on either side being almost in contact.

The palpi are longer than the head; coalesce along their inner third; outer margin convex; inner margin concave; apex bluntly rounded.

A short conical cirrus, arising from the lower face of the palpi at about the middle point, extends directly downward. This is a peculiar feature, which seems not to have been previously described in any species of this family. The antennæ are claviform; the median longest, about twice the length of the head and palpi together, arising between the posterior eyes; the lateral antennæ arise very near the anterior margin of the head, just outside of the anterior eyes; they are about two-thirds as long as the median.

The tentacular cirri, in all respects similar to the lateral antennæ, arise very near the anterior margin of the segment; the lower cirrus is a little shorter than the upper.

The buccal segment is as long as the next segment.

The dorsal cirri of the first two setigerous segments are a little more slender than the tentacular cirri, but in other respects similar to them; those on the remaining segments are distinctly articulated; they vary in length from two to four times the width of the body. There are three anal cirri, two lateral articulated, a median not articulated. The pharynx reaches to the middle or to the posterior margin of the third segment; we did not make out clearly the structure of its anterior end. The stomach is a little longer than the pharynx, very large, nearly filling the segments, which it occupies; it has the structure common to this group, but in front shows a peculiar organ, as to the character of which we made no notes in the living specimens, having probably failed to observe it. This organ is transversely oval, convex in front, concave behind, and crossed by numerous waved lines, which radiate from the middle point behind. The feet are very long (fig. 16), and bear a long, conical, or finger-shaped ventral cirrus, which points either directly or obliquely backward.

The setæ are from five to seven in each foot, and of two kinds: one (fig. 14) compound, with the appendix delicate, elongated; the other, of which there is but one in each bundle, simple (fig. 15), with a small terminal button. The longest of the compound setæ are about as long as the foot, the others from one-half to two-thirds as long.

The body is much wider in the middle than at either extremity; segments deeply incised, especially along the middle third. Two of the median segments are shown in fig. 13; these are from the same specimen as fig. 12, and are magnified to the same extent.

Body slightly convex above, nearly flat below, colorless; intestine brown, yellowish brown, or reddish brown.

Dorsal cirri and antennæ readily lost. This species throws itself quickly into a coil, very much as is the habit of *Glycera* (*Rhynchobolus*).

Length, 25^{mm}.

Greatest width, 0.2^{mm} (about).

Number of segments, 45.

Number of segments varies from 35 to 50.

Low water, sand, Race Run, near Provincetown.

Marentzeller figures the setæ of *Syllis ochracea* as bidentate; Marion-Bobretzky represent the same setæ as ending in a single point, and both writers give additional simple setæ, which do not exist on our species, but which, as figured by these authors, do not agree with each other. The compound setæ on our species do not seem to be bidentate, but this may be owing to our object-glass not being sufficiently good. Marion-Bobretzky also show a peculiar destitution of the margin of the stem, near its end, not shown by Marentzeller, and not seen in our species.

STREPTOSYLLIS, *n. g.*

Antennæ, three; tentacular cirri, four; dorsal cirri, partly smooth, partly articulated; œsophagus unarmed, with a circle of papillæ at its anterior end; stomach passing directly into the intestines; setæ of two kinds, simple and compound, both kinds covered by a membrane externally;* palpi united for most of their length, turned downward so as not to be visible from above.

It will be seen that this genus agrees in some respects with *Amblyosyllis* GRUBE (*Pterosyllis* CLAPARÈDE), but the head is not "winged"; the setæ are very peculiar, and the dorsal cirri cannot be described either as smooth or moniliform, since both forms occur on the same specimen. It would, perhaps, be well to include the peculiar form of the setæ in the generic description. Unfortunately, we found but one species, and it seems better not to multiply characteristics on such a narrow basis.

STREPTOSYLLIS ARENÆ, *n. sp.*

(PL. II, III, FIGS. 17–23.)

Head convex, sides and front regularly rounded (fig. 17), posterior margin curved forward, posterior angles bluntly rounded. Eyes, six; anterior pair small, crescentic, just behind and outside the origin of the lateral antennæ; outer posterior pair largest, irregularly oval, in contact with the inner pair, or sometimes merged with them; inner posterior pairs small, circular.

The antennæ and tentacular cirri are never annulated, but are more or less regularly wrinkled. They vary much in form. They may taper quite regularly from base to apex, or only along their outer third or fourth, or they may be somewhat clavate. The lateral antennæ arise very close to the anterior margin of the head; they are from three to four times as long as the head. The median antenna, longer than the lateral, arises a little back of the eyes, near the posterior margin of the head.

The buccal segment in alcoholic specimens, or in living contracted specimens, is about one-half as long as the next segment, but in extension it may nearly equal the length of that segment. The upper tentacular cirrus is a little longer than the lower cirrus, a little shorter than the lateral antennæ.

* Stem of compound setæ terminating in four teeth or lobes.

The palpi are large, swollen at base, united along their inner two-thirds, then becoming somewhat flattened, and with their outer angle prolonged into a delicate conical cirrus (fig. 18). As noticed above, they cannot be seen in a dorsal view, being always turned directly downward.

The dorsal cirri are exceedingly variable in form, structure, and length. They may be conical or clavate; wrinkled irregularly (fig. 17); articulated with each article divided longitudinally (fig. 20); articulated without the longitudinal division; or nearly smooth (fig. 19). Their length may be less than the width of the body, or three times the width. All these variations occur on the same specimen, and without any apparent order.

The ventral cirri arise near the end of the foot (fig. 21), are short (relatively) on the first foot, but lengthen rapidly, becoming very long on the fourth segment. They are irregularly wrinkled, often with a deep constriction at the outer third or fourth. They are larger at base than the dorsal cirri of the same segment, and taper regularly to a bluntly rounded apex. They usually are directed backward, but often are coiled (fig. 20). They retain their length even on the posterior segments, and are there longer than the dorsal cirri. There are three anal cirri (fig. 19); a median, which may be as long as the ventral cirri, and two lateral, three to four times as long.

The anal segment is much narrower than the segment preceding it, convex above and below, margin regularly rounded.

The setæ are of two kinds. In every bundle there is one long simple seta (fig. 23), straight or slightly curved, bluntly rounded at its apex, where it is covered with a membrane, which is prolonged along the seta for nearly one-fourth of its length. This seta is always in the upper part of the bundle; in length it is about the same as the stem of the compound setæ.

The compound setæ are numerous, crowded, the terminal part of the stem divided into four distinct processes or lobes, between which the appendix is inserted (fig. 22). The length of the stem is always about equal to the length of the foot, and as the anterior feet are shortest, so also are the stem parts of the anterior setæ. The appendix on the anterior segments is very short, about one-half as long as the one figured, but not differing otherwise. In all the bundles a few of the short forms occur, but do not make up the bundle, as they do on the anterior segments. The appendix is covered with a membrane, which is prolonged down the sides. The œsophagus and stomach have about the same length and diameter, occupying together twelve segments. The œsophagus is strongly convoluted. The "glands" of the stomach are hexagonal, the rows very numerous; a small part of the anterior end of the stomach is without them. There are no special glands back of the stomach, but it is simply reduced in diameter, and prolonged into the intestine. The body is strongly convex above; less so below. The first segment is about one-half the width of the 10th; from this segment the diameter is nearly uniform, save that the last few segments fall off somewhat rapidly. Body colorless in front; œsophagus light brown; stomach white; back of the stomach the body is yellowish, or light brownish-yellow, with numerous white specks.

Length of largest specimen, 8^{mm}.

Greatest width, 0.5^{mm}.

Number of segments, 55.

Low water; sand.

GRUBEA (*Quatrefages*) *Claparède.*

GRUBEA DOLICHOPODA *Marentzeller.*

Grubea dolichopoda MARENTZELLER. Zur Kentniss der Adriatischen Anneliden, p. 26, pl. iv, fig. 1, 1874.

Grubea tenuicirrata WEBSTER. Annelida Chæt. of New Jersey, p. 109 (corrected in foot-note, p. 110, to *G. dolichopoda.*)

Prof. Langerhans, in his monograph of the SYLLIDÆ (*Zeitschrift für Wissens. Zoöl.*, p. 564, 1879), identifies *G. dolichopoda* MARENTZ. with *G. clavata* CLPD., and regards *G. tenuicirrata* CLPD. as a distinct species. If this conclusion is based only on the descriptions and figures given by Claparède and Marentzeller, and not on examination of the type specimens, it would seem hardly tenable. On the other hand, the differences indicated by Marentzeller between *G. dolichopoda* and *G. tenuicirrata* are very slight; so slight that it seems probable that these forms are identical. There is nothing in the text to indicate that Langerhans examined specimens of *G. tenuicirrata* CLPD., and the differences between this species and *G. clavata*, as understood by him, refer mainly to the terminal points of the compound setæ and to the position of the pharyngeal tooth. As to the fine points of the setæ, Claparède's figures in the *Glanures* are certainly not reliable; and the position of the pharyngeal tooth was not regarded as of so much consequence when he wrote his description as at the present time, when it is regarded not only as a good, but as a sufficient, generic character, at least by Langerhans in his monograph (*l. c.*, p. 526, SYLLIS. —, p. 541, OPISTHOSYLLIS). It may be further noted that Langerhans gives *G. clavata* four anal cirri, while *G. dolichopoda* Marentz. has but three.

Common on stones, shells, &c., at low water.

SPHÆROSYLLIS *Claparède.*

Langerhans, in commenting on the genus SPHÆROSYLLIS, says that Claparède did not sufficiently insist on the coalescence of the buccal segment with the head. He therefore adds as one of the important generic characteristics this union of head and buccal segment. The species described below, from Provincetown, have the buccal segment quite distinct; this is also the case with *S. fortuita* Webster, from Virginia. Claparède regards the form of the cirri and antennæ, swollen, spherical at base, as a generic characteristic. That this is not valid is shown by *S. fortuita* and also by one of the new forms described below.

SPHÆROSYLLIS BREVIFRONS, *n. sp.*

(PL. III, FIGS. 24–30.)

This species belongs to the typical SPHÆROSYLLIS in the form of the dorsal appendages, in the presence of numerous papillæ, and in general structure, but differs from any heretofore described in the shortness of the palpi, and from all save *S. fortuita* in the presence of a well-marked buccal segment, visible from above.

The head (fig. 24) is short, very wide, almost completely fused with the palpi in front, sides rounded; middle third of the posterior margin convex, encroaching on the buccal segment; the margin, external to the middle third, slightly concave. Eyes, six; the posterior pairs widely separated; those on each side close together; the external pair sometimes crescentic, sometimes oval; the internal small, circular; the anterior pair minute, situated just external to the bases of the lateral antennæ.

The palpi are short, coalesced, slightly emarginate in front.

The antennæ have a swollen, globular base, and a short cylindrical outer part.

The tentacular cirri are like the antennæ, but a little longer.

The buccal segment, according to the state of contraction, may be from one-third to three-fourths as long as the next segment.

The dorsal cirri have also a swollen base, which forms about one-half the entire length. Sometimes the base passes gradually into the outer part; in this case there is usually a single constriction (fig. 26); or the base may be separated by a well-defined constriction from the outer part, in which case the appendix may usually be regarded as composed of two articles (fig. 27).

The anal cirri (fig. 25) are stouter than the dorsal, much swollen at base, without constriction.

The ventral cirri (fig. 26) are slightly flattened, sides nearly straight, apex bluntly rounded, about one-half as long as the dorsal cirri.

In each bundle of setæ is one simple, straight, or slightly curved, seta (figs. 29, 30); the others are compound, and practically all of one kind (fig. 28), differing only in length of stem and appendix.

Pharynx occupying about three segments; stomach a little shorter than the pharynx.

Body, colorless; eyes, red.

Length, 1^{mm}.

Width, 0.17^{mm}.

Number of segments, 22.

Other specimens were larger and with more segments; in no case did the length exceed 1.5^{mm}.

Low water; sand.

A number of specimens, which we are quite unable to separate from this species, were collected by Mr. Benedict at South Norwalk, Conn. They differ only in the length of the buccal segment, which is hardly visible dorsally. This is probably due to different states of contraction, though it seems curious that all of the Provincetown specimens should show the buccal segment plainly, and that none of the specimens from South Norwalk should show it.

SPHÆROSYLLIS LONGICIRRATA, *n. sp.*

(PL. VIII, FIGS. 95–100.)

Head with the anterior and lateral margins (fig. 95) regularly rounded, posterior margin very slightly convex, nearly straight. The posterior part of the head, bounded in front by a curved line drawn through the bases of the antennæ, is elevated, convex, the part of the head in front of this line being thin, depressed; sometimes the depression is prolonged backward between the eyes for a varying width, giving lateral elevations, on which the four posterior eyes are found.

Eyes, six; the two posterior pairs large, circular, nearly on the same straight line; the anterior pair very small, just in front of the origin of the lateral antennæ.

The antennæ are somewhat fusiform, irregularly constricted, bluntly rounded at apex; median antenna one-third longer than the head and palpi; lateral a little shorter.

The tentacular cirri, dorsal, and anal cirri have the same structure as the antennæ. The dorsal cirri originate some distance within the foot, and are very long for the genus; there is usually a deep constriction at the outer third or fourth, setting off a fusiform appendix. The anal cirri may be double the length of the dorsal.

The buccal segment, in extension, is as long as the second segment.

The palpi are large, convex externally, concave internally, apex bluntly rounded, anterior third free, connected by a thick membrane along their posterior two-thirds; this membrane emarginate in front, and divided into lateral halves by an impressed line, which runs back to the head.

The pharynx occupies four segments, the stomach two.

The feet (fig. 97) are stout, nearly cylindrical, truncated externally. The ventral cirri, bluntly conical, are about one-half the length of the foot in front; behind, as long as the foot.

In each foot is a fan of compound setæ and one simple seta (fig. 100). The compound setæ are very delicate, differing from each other only in length (figs. 98, 99).

Body, colorless; stomach, white; intestines, brown or yellow.

Length, 4–5^{mm}.

Number of segments, 33.

Sexual (capillary) setæ on the male appear at the twelfth segment, and exist on all save the last 3–5 segments.

Common at low water on shells, &c.

PÆDOPHYLAX *Claparède.*

PÆDOPHYLAX HEBES, *n. sp.*

(PL. III, FIGS. 31–36.)

In this species the head (fig. 31) is very short, the width being more than double the length; the anterior angles are very broadly rounded; the anterior and posterior margins but slightly curved. Eyes, six; the anterior pair mere specks; the posterior pairs on each side very close to each other, sometimes in contact; large, circular.

Palpi very large, without indication of division above; below, a narrow sulcus; their length is more than double the length of the head.

The median antenna arises close to the posterior margin of the head, and reaches to the middle, or a little beyond the middle, of the palpi. Its form seems to be variable, but in general the inner third is narrow; the middle third somewhat enlarged; the outer part narrowed, but not so much as the basal part. The lateral antennæ are mere buds, about the size of the tentacular cirri.

The buccal segment is about one-half as long as the second segment; its cirri very short.

The pharynx, in one specimen, occupied the first five segments; the stomach three to four. In another the stomach occupied the eighth and ninth segments.

The dorsal cirri are a trifle larger than the tentacular cirri, but very small; and although the posterior cirri are a little larger than the anterior, they are always smaller than the ventral cirri. These last are conical, minute, arising from the body, within the foot, and reaching about to the apex of the foot. The feet are short, stout, fleshy.

There are two kinds of setæ, simple and compound, with certain slight form variations in each series. On the anterior segments the setæ are all compound (figs. 33, 34), short, with short appendix. At about the beginning of the middle third the simple setæ appear. These are, at first, straight, single pointed setæ (fig. 35), placed dorsally, one to each bundle. On a few of the posterior segments these are replaced by shorter setæ, which have a second sharp point developed below the terminal point (fig. 36).

The anal segment is a little longer than the segment preceding it; it bears three anal cirri—a short median and two lateral—which are double the length of the median antenna. They are more or less fusiform.

The body is widest in the middle; the length and width of the median segments are about equal; length of the anterior segments much less than the width.

Body gray or flesh color. According to the notes made on the living forms, one specimen had dark red eyes; another black eyes.

Length of largest specimen, 7^{mm}.

Number of segments, 44.

In confinement very sluggish, not at all inclined to move about.

From low water to 25 fathoms; sand and shells.

AUTOLYTUS (*Grube*) *Marentzeller*.

AUTOLYTUS CORNUTUS *A. Agassiz*.

A. AGASSIZ. Journal Boston Society Nat. Hist., vol. vii, p. 392, plates 9–11. **1863.**
VERRILL. Invert. Animals of Vin. Snd., etc., p. 590, pl. xii, figs. 65, 66. **1874.**

Wellfleet, low water, in sand.

Provincetown, 25 fathoms, sand and shells.

Not common.

NERILLA *Schmidt*.

(Family not determined.)

NERILLA ANTENNATA *Schmidt*.

Nerilla antennata SCHMIDT. Reise nach der Färör, p. 38, pl. iii, figs. 8, 8a. 1848.
GRUBE. Fam. der Ann., p. 62. 1856.
CLAPARÈDE. Beobachtungen, etc., p. 48, pl. xii, figs. 16–20. 1863.
Dujardinia antennata QUATREFAGES. Hist. Nat. des Annelés, vol. iii, p. 69. 1865.

We found this species quite abundant in sand at low water. It is unquestionably Schmidt's species.

Family NEREIDÆ.

NEREIS (*L.*) *Cuvier*.

NEREIS VIRENS *Sars*.

Nereis virens SARS. Beskrivelser og Jagttagelser, p. 58, pl. 10, fig. 27. 1835.
Nereis grandis STIMPSON. Marine Invertebrata of Grand Manan, p. 34, fig. 24. 1853.
Nereis Yankiana QUATREFAGES. Histoire des Annelés, vol. i, p. 153, pl. 17, figs. 7–8. 1865.
Atitta virens KINBERG. Annulata Nova, p. 172. 1865.
MALMGREN. Nordiska Hafs-Annulater, p. 183, et Annulata Polychæta, p. 56, pl. iii, fig. 19. 1867.
Nereis virens EHLERS. Borstenwürmer, p. 559, pl. xxii, figs. 29–32. 1868.
VERRILL. Invert. Animals of Vineyard Sound, p. 590, pl. xi, figs. 47–50. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 235. 1879.
TURNBULL. Anatomy and Habits of. Trans. Connecticut Academy, vol. iii. 1865.

This species we found, both abundant and large, between tides, ranging nearly to the top of high water.

At Provincetown it was the only shore Nereis, the *N. limbata*, so common everywhere south of the Cape, not being found at Provincetown at all, though found at Wellfleet.

NEREIS LIMBATA *Ehlers.*

EHLERS. Die Borstenwürmer, p. 567. 1868.
VERRILL. Invert. Animals of Vineyard Sound, etc., pp. 318, 590, pl. xi, fig. 51. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 235, pl. vi, figs. 70, 75. 1879.
Annel. Chæt. of New Jersey, p. 111, pl. iii, figs. 21, 22. 1880.

We found a number of specimens of this species at Wellfleet in sand and mud. All small. Not found at Provincetown at all, though carefully looked for. At Wellfleet, on some oysters lately brought from Chesapeake Bay, we found a living specimen of *N. limbata.*

NEREIS PELAGICA *Linn.*

This widely distributed species was common at all depths below fifteen fathoms. For synonomy up to 1868, see Ehler's Borstenwürmer, p. 511.

Nereis pelagica LINN. Syst. Nat., ed. x, p. 654; ed. xii, p. 1086.
VERRILL. Invert. Animals of Vineyard Sound, etc., p. 591, pl. xi, figs. 52–55. 1874.
MARENTZELLER. Südjapanische Anneliden, part i, p. 14. 1879.

NEREIS TENUIS *n. sp.*

(PL. III, IV, FIGS. 37–43.)

The width of the head (fig. 37), in its widest part, nearly equal to the length; posterior two-thirds convex, with convex sides; anterior third much narrowed and flattened, and with a median depression running back to the convex part of the head.

Eyes lateral, not quite so regular in outline as shown in the figure; posterior pair a trifle larger than the anterior.

Palpi long, and with long terminal articles, the basal part being a little longer than the head.

Antennæ conical, delicate, close to each other at base, half as long as the head.

The proboscis (fig. 38) has the basal and maxillary rings of about the same length. Paragnathi small, conical, black, arranged as follows: I, wanting; II, single curved series; III, a transverse series, near the posterior margin of the ring; IV, curved line; V, three at the angles of a triangle; VI, wanting; VII and VIII, merged, forming a series, in part single, in part double.

The jaws were not completely exposed; on the part seen there were five stout, rectangular teeth.

Buccal segment a little longer than the second segment.

Tentacular cirri with long cylindrical basal articles, the posterior superior cirrus reaching about to the fourth segment, the others shorter, as shown in the figure.

The dorsal cirri arise from the base of the lingula. On the anterior segments this cirrus is as long as its lingula; it grows progressively shorter to the tenth segment (fig. 39), after which it again lengthens, becoming longer than the lingula on the middle and posterior segments.

The superior lingula and single lip of the dorsal ramus are alike in all respects; stout, conical, close together on the anterior segments, shorter and more divergent behind.

The ventral ramus has but one lip, is shorter and wider than the dorsal, somewhat flattened in front, with the lower margin concave near the apex, but further back tapering regularly.

The ventral lingula is a little shorter than the upper lingula, in all other respects similar to it; on the posterior segments (fig. 40) turned downwards.

The ventral cirrus arises from a small elevation at the base of the ventral lingula; on the anterior segments fusiform (fig. 39), further back (fig. 40) more regularly conical.

The setæ are of three kinds (figs. 41, 42, 43). Those of the upper ramus are short, hardly reaching beyond the ramus, appendix very delicate, terminal points of stem of same length (fig. 41). Those of the lower ramus in two bundles; in the upper part of the upper bundle the setæ are the same as those described above (fig. 41); in the lower part of the same bundle a few with short appendix (falcate), curved near the end, apex bluntly rounded (fig. 43); in the lower bundle, anterior segments, many like fig. 43, a few like fig. 42; further back the falcate setæ become less numerous. In the single specimen found the setæ of the dorsal rami, after the first few segments, had all been lost. At first there is a single black acicula in each ramus; further back a second acicula, slender, uncolored, appears in the dorsal ramus.

The body was colorless except as colored by the blood, which showed through very plainly; bases of feet opaque white, this color being due to glands within them.

Length, 45^{mm}.

Width, 1.2^{mm}.

Posterior third tapering a trifle. This is the most delicate *Nereis* described from our coast. It is easily recognized by its extreme narrowness as compared with its length.

But one specimen was taken, off Race Run, near Provincetown; 20 to 25 fathoms, mud and sand.

Family EUNICIDÆ.

DIOPATRA *Quatrefages.*

DIOPATRA CUPREA *Claparède.*

Nereis cuprea, BOSC. Hist. Nat. des Vers., Vol. i, p. 143 (*teste* Claparède). 1802.
Eunice cuprea QUATREFAGES. Hist. Nat. des Annèles, vol. i, p. 331. 1865.
Diopatra cuprea CLAPARÈDE. Annel. Chét. du Golfe de Naples, p. 432. 1868.
VERRILL. Invert. Animals of Vin. Sound, p. 593, pl. xiii, figs. 67, 68. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 236. 1879. Annel. Chæt. of New Jersey, p. 115.

Found sparingly at Provincetown; very common at Wellfleet, in the harbor, at low water; sand and sandy mud.

NINOE Kinberg.

NINOE NIGRIPES *Verrill.*

Invertebrate Animals of Vineyard Sound, p. 595. 1874.

Dredged in from 12 to 20 fathoms; sand, shells.

LUMBRINEREIS (*Blainville*) *Ehlers.*

LUMBRINEREIS FRAGILIS *Audouin and M. Edwards.*

Lumbricus fragilis MÜLLER. Prodr. Zool. Dan. p. 216, n. 2611 (*teste* Malmgren). Zool. Dan. vol. 1, p. 22, pl. xxii, figs. 1–3. 1788.
Scoletoma fragilis BLAINVILLE. Dict. des Sci. Nat., Article *Vers*, p. 492 (*teste Aud. and M. Ed.*).
Lumbrinereis fragilis AUDOUIN and M. EDWARDS. Littoral de la France, vol. i, p. 170. 1834.
QUATREFAGES. Hist. Nat. des *Annèles,* vol. i, p. 365. 1865.
Lumbriconereis fragilis ÖRSTED. Consp. Ann. Dan. p. 15, figs. 1, 2. 1843. Danielssen, Reise, p. 50. 1857. Reise, p. 116. 1858. (*teste* Malmgren).
MALMGREN. Annulata Polychæta, p 177, pl. xv, figs. 83–83 D. 1867.
EHLERS. Die Borstenwüvmur, p. 395. 1868.
VERRILL. Invert. Animals of Vineyard Sound, p. 594. 1874.
LANGERHANS. Zeitschrift für wissenschaftliche Zoölogie, p. 297. 1879.
Lumbriconereis borealis KINBERG. Annulata Nova Öfvers af K. Vet.-Akad Förh, No. 10, p. 568. 1864.
Lumbriconereis madeirensis. KINBERG. l. c., p. 559 (*teste* Langerhans).

Very fine large specimens were dredged. Its resemblance to *Ninoe nigripes* Verrill is very striking.

Twenty to thirty fathoms; sand and shells.

LUMBRINEREIS TENUIS *Verrill.*

Invert. Animals of Vin. Sound, etc., p. 594. 1874.

This species was not often taken. Sand, low water.

DRILONEREIS *Claparède.*

DRILONEREIS LONGA *Webster.*

Annel. Chæt. of the Virginian Coast, etc., p. 240, pl. vii, figs. 84–88. 1879. Annel. Chæt. of New Jersey, p. 116. 1880.

Quite abundant in sand at low water.

ARABELLA (*Grube*) *Ehlers.*

ARABELLA OPALINA *Verrill.*

Lumbriconereis splendida LEIDY. Marine Invert. Fauna of R. I. and N. J., p. 10. 1855.
Lumbriconereis opalina VERRILL. Invert. An. of Vin. Sound, p. 594, pl. xiii, figs. 69, 70. 1874.
Arabella opalina VERRILL. Proc. Acad. Nat. Sciences, Philadelphia, for 1878, p. 299.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 242. 1879. Annel. Chæt. of New Jersey, p. 116. 1880.

Very common at low water in sand.

STAUROCEPHALUS (*Grube*) *Ehlers.*

STAUROCEPHALUS PALLIDUS *Verrill.*

VERRILL. Invert. Animals of Vineyard Sound, p. 595. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 242. 1879. Annel. Chæt. of New Jersey, p. 116. 1880.

Very rare. Only two specimens were taken. Sand; low water.

STAUROCEPHALUS CÆCUS *n. sp.*

(PL. IV, FIGS. 44, 44*a*–48.)

The head of this species is constricted just in front of the origin of the antennæ, the widest part being back of the antennæ, where the width exceeds the length; the anterior part is regularly curved, obtuse (fig. 44). There are no eyes.

The antennæ are quite long, composed of about fifteen articles; increasing slightly in diameter from origin along the inner third, then tapering gradually to the end; the last three or four articles elongated.

The palpi are stout, transversely wrinkled, canaliculate; terminal article fusiform, bluntly rounded at apex, forming nearly one-third the entire length.

The first two segments are about equal in length, a little longer than those following them.

The dorsal cirri (fig. 45) have a terminal article shaped like the corresponding part of the palpi; they are nearly cylindrical, reach just beyond the foot.

The ventral cirri are short, fusiform, arising near the apex of the foot and reaching a little beyond it.

The foot ends in three rounded lobes, of which the upper (fig. 45) is very large, the two lower small and projecting beyond the upper, divergent. The anterior feet are in length about one-half the width of the body, growing progressively longer along the anterior third, from which point their length equals the width of the segments to which they are attached.

The anal segment is about double the length of the segment preceding it. There are three anal cirri; the lateral cirri are made up of from three to five nearly cylindrical articles, each one slightly less in diameter than the one preceding it, and in length equal to the anal segment; the median cirrus is in all respects similar to the basal article of the lateral.

There are two kinds of setæ in the upper bundle; in the upper part one to three very delicate capillary setæ (fig. 46) minutely denticulated along one edge for some distance; below these, two or three having a very peculiar form (fig. 47); these are about two-thirds as long as the first form, inner three-fourths of uniform diameter, near the end denticulated, external tooth sharp pointed, prolonged nearly in the line of the main part of the seta; external to the base of this tooth the seta becomes suddenly very delicate, capillary. These setæ may be curved, as in the figure, or straight. In the lower bundle only compound setæ (fig. 48) are found. These are arranged in a fan, growing progressively shorter from the upper to the lower part of the fan, the shortening, for the most part, affecting the appendix. With such magnifying power as we had the appendix of these setæ seemed to have the apex bluntly rounded, without tooth.

The body was convex above and at the sides, flattened below; the segments distinctly separated from each other by well-impressed lines of segmentation.

The general color was white.

Length of largest specimen, 8^{mm}.

Width, 0.5^{mm}.

Number of segments, 51.

In young specimens the antennæ and palpi appear as mere buds. The head is larger relatively than in adults. The dorsal cirri have no basal articles, but arise, like the ventral cirri in mature forms, from the side of the foot, near the end. They moved with a perfectly uniform gliding motion, due, no doubt, to the action of cilia, without any apparent effort of the body or feet. In a more advanced stage the palpi were club-shaped, lacking the terminal article.

Very common in sand at low water. The young forms were especially numerous.

Family GLYCERIDÆ.

RHYNCHOBOLUS *Claparède.*

RHYNCHOBOLUS DIBRANCHIATUS *Verrill.*

Glycera dibranchiata EHLERS. Borstenwürmer, p. 670, pl. xxiv, figs. 1, 10–28. 1868.
GRUBE. Jahres-Bericht der Schles. Gesell. für vater län Cultur, p. 64. 1869.
Rhynchobolus dibranchiatus VERRILL. Invert. An. of Vin. Sound, etc., p. 596, pl. x, figs. 43, 44. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, etc., p. 245. 1879. Annel. Chæt. of New Jersey, p. 117. 1880.

Very common in sand at low water.

GONIADA *Audouin and M. Edwards.*

GONIADA GRACILIS *Verrill.*

(PL. V, FIGS. 49–52.)

Eone gracilis VERRILL. Invert. An. of Vin Sound, etc., p. 596. 1874.
Goniada gracilis VERRILL. Proceedings U. S. National Museum, p. 174. 1879.

We found in the fine sand of the harbor, at about half-tide, a number of specimens evidently referable to *Goniada*, and which we regarded as undescribed. Professor Verrill, however, regarded them as belonging to the species described by him as *Eone gracilis*, since changed to *Goniada gracilis*, as above.

The apex of the head (fig. 49) is nearly hexagonal.

The antennæ are composed of three articles, of which the inner forms over half the entire length; the outer articles are about equal in length; the diameter decreases progressively; external article very delicate.

The first and sixth segments of the head bear each a pair of minute eyes; those on the sixth segment not always demonstrable in alcoholic specimens.

The dorsal cirri on a few of the anterior segments and the ventral cirri back of the middle of the body are rounded; elsewhere they are somewhat flattened, as is, also, the lower lip of the lower ramus.

The dorsal ramus appears at the 27th segment.

The setæ of this ramus are short, simple, a little curved at the apex.

From the 26th–30th segment the long compound setæ of the ventral ramus become much elongated, the appendix, especially, being very long and delicate. (Compare fig. 50 with fig. 52.)

This may be a sexual peculiarity; but, as all the specimens taken were sexually mature, we had no means of determining this point.

The normal color would seem to be yellowish-white; this changes to pure white in the males after the 30th, and to flesh-color, varying from light to dark, in the females, after the 20th segment. The eggs are large, crowded, flesh-colored, determining the color of the body, in the females, given above.

In confinement they were very active, moving about rapidly, and throwing themselves into coils, after the manner of *Rhynchobolus*.

Length in contraction, 35—50^{mm}.

Greatest diameter—1^{mm}.

They taper rapidly along a few of the anterior and posterior segments; otherwise the diameter is uniform.

Found sparingly, burrowing in the finest sand of the harbor; half-tide to low water.

Family ARICIIDÆ.

ARICIA (*Savigny*) *Audouin and M. Edwards.*

ARICIA ORNATA *Verrill.*

Invert. An. of Vin. Sound, etc., p. 596. 1874.

Not common. A few very fine large specimens were taken at extreme low water, in sandy mud.

SCOLOPLOS *Örsted.*

SCOLOPLOS ROBUSTA.

Anthostoma robustum VERRILL. Op. cit., p. 597, pl. xiv, fig. 76. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 258. 1879.

All the specimens taken were small. Sand; low water.

SCOLOPLOS FRAGILIS.

Anthostoma fragile VERRILL. Op. cit., p. 598. 1874.
WEBSTER. Annel. Chæt. of Virginian Coast, p. 258. 1879. Of New Jersey, p. 121. 1880.

Common, especially at Wellfleet. Sand; low water.

Family OPHELIIDÆ.

OPLILIA (*Savigny*) *M. Edwards.*

OPHELIA LIMACINA *Sars.*

Ammotrypane limacina H. RATHKE. Nov. Act. Nat. Cur., vol. xxi, p. 190, pl. x, figs. 4–8. 1840.
GRUBE. Fam. der Ann., p. 70. 1851.
KOREN. Nyt. Mag., vol. ix, p. 94 (*teste* Malmgren).
JOHNSTON. Cat. Brit. Mus., p. 217. 1865.
QUATREFAGES. Hist. Nat. des Ann., vol. ii, p. 279. 1865.

Ophelia bicornis ÖRSTED. Grönlands Annulata Dorsibranchiata, p. 32, figs. 104, 105, 115, 116, 121. 1843.

Ophelia bicornis SARS. Nyt. Mag., vol. vi, p. 207.
Ophelia limacina SARS. Nyt. Mag., vol. vii, p. 381 (*teste* Malmgren).
Ophelia borealis QUATREFAGES. Hist. Nat, des. Ann., vol. ii, p. 273. 1865.

Quite common in the sand, at low water.

AMMOTRYPANE *H. Rathke.*

AMMOTRYPANE FIMBRIATA *Verrill.*

Invert. An. of Vin. Sound, etc., p. 604, pl. xv., fig. 79. 1874.

Only one specimen was taken. Sand; low water. Wellfleet.

Family THELETHUSIDÆ.

ARENICOLA *Lamarck.*

ARENICOLA MARINA *Malmgren.*

Lumbricus marinus LINN. Syst. Nat., ed. xii, vol. i, p. 1077.
Lumbricus papillosus O. FABRICIUS. Fauna Grönlandica, p. 283. 1780.
Arenicola piscatorum LAMARCK. Syst. d. An. sans. Vert., p. 324. Hist. Nat. An. sans. Vert., 2d ed., vol. v, p. 580 (t. Malmgren).
AUD. AND M. EDWARDS. Littoral de la France, vol. ii, p. 285, pl. 8, figs. 8–12. 1834.
JOHNSTON. Cat. Brit. Mus., p. 287. 1865.
Arenicola marina malmgren Annulata Polychæta, p. 188. 1867.

The specimens of this species were all collected in one locality, at Race Run, in coarse sand. We did not find it in Provincetown harbor or at Wellfleet, though the conditions seemed to be favorable, and we looked for it with care. At Race Run were obtained numerous specimens, but they were all small.

Family CHLORÆMIDÆ.

TROPHONIA *M. Edwards.*

TROPHONIA AFFINIS *Verrill.*

Siphonostomum affine LEIDY. Marine Invert. Fauna of R. I. and N. J., p. 16, 1855.
Trophonia affinis VERRILL. Op. cit., p. 605, pl. xiv, fig. 75. 1874.

Only two specimens were collected. Low water; sand.

Family STERNASPIDÆ.

STERNASPIS *Otto.*

STERNASPIS FOSSOR *Stimpson.*

STIMPSON. Marine Invert. of Grand Menan, p. 29, fig. 19. 1854.
VERRILL. Invert. An. of Vin. Sound, p. 606, pl. xiv, fig. 74.

Abundant; dredged; 20–30 fathoms.

Family CHÆTOPTERIDÆ.

SPIOCHÆTOPTERUS *Sars.*

SPIOCHÆTOPTERUS OCULATUS *Webster.*

Annel. Chæt. of the Virginian Coast, etc., p. 247, pl. viii, figs. 98–102. 1879.—Annel. Chæt. of New Jersey, p. 118. 1880.

We found this species in great numbers at Wellfleet. Here a great area of sand-flat is exposed at low water, drained by swiftly running streams. It is along the borders of these streams that this species is most abundant. Often 6 or 8 could be obtained from a single "dig" of the spade. It occured under the same conditions in Virginia and New Jersey, but much more sparingly. These three localities are the only ones reported up to this time.

Family SPIONIDÆ.

SCOLECOLEPIS *Blainville.*

SCOLECOLEPIS VIRIDIS *Verrill.*

VERRILL. Invert. Animals of Vin. Sound, etc., p. 600. 1874.
WEBSTER. Annel. Chæt. of New Jersey, p. 118. 1880.

Wellfleet. Rare, only one specimen taken. Sand, low water.

SCOLECOLEPIS CIRRATA *Malmgren.*

Nerine cirrata SARS. Nyt. Mag., vol. vi, p. 207 (*teste* Malmgren).
Scolecolepis cirrata MALMGREN. Annulata Polychæta, p. 199, pl. x, fig. 54. 1867.
VERRILL. Invert. An. of Vin. Sound, p. 602. 1874.

Not common. Dredged in from 20–30 fathoms; sand.

SPIO (*O. Fabr.*) *Örsted.*

SPIO SETOSA *Verrill.*

VERRILL. Op. cit., p. 602, pl. xiv, fig. 71. 1874.
WEBSTER. Annel. Chæt. of N. J., p. 119. 1880.

Provincetown; low water to 25 fathoms.
Wellfleet; low water, sand.
Common.

(SPIO RATHBUNI, *n. sp.*

(PL. V, FIGS. 53–59.)

Head oval (fig. 53), length about double the width, sides very slightly convex; anterior end divided into two rounded lobes; posterior end a little narrower than the anterior; the anterior third of the head, together with a narrow lateral space, depressed, flattened; the remaining part of the head somewhat elevated.

Eyes small, black; variable both in number, position, and form; not the same in any of these respects on any two specimens.

Tentacles of the form usual in this group, rather stout, reaching back to the eighth segment, tapering slightly, the diameter at the apex being about one-half that at the base.

The buccal segment is very large, reaching in front to the anterior margin of the head; at the sides and behind extending far beyond the head; it has both dorsal and ventral rami, of the same form as those of the next segment, but not quite so large.

The dorsal rami of the non-branchiated segments consist of an anterior, low, rounded, lobe; and a posterior, somewhat elongated and flattened, cirrus.

The ventral rami of the first ten segments do not differ materially from the dorsal rami; after the tenth segment the ventral cirri grow progressively smaller and disappear; the anterior lobe, now become lateral and transverse, is lengthened and depressed (fig. 55).

On the branchiated segments nothing remains of the dorsal ramus but a conical elevation from which the setæ arise.

The branchiæ begin on the thirteenth segment (fig. 55). They are slightly wider at either extremity than in the middle, apex very widely rounded; outer margin with a wide membrane reaching from base to apex; inner margin, as well as an elevated membranous ridge uniting the bases of the opposite branchiæ, with very long, densely crowded cilia; on the largest specimen taken there were 23 pair of branchiæ followed by 15 non-branchiated segments.

The setæ of the first eight segments are all capillary, mostly long and delicate; those of the dorsal rami longer than the ventral. In both rami are a few shorter setæ, somewhat wider along their inner two-thirds (fig. 56).

The dorsal setæ of the branchiated region are a little shortened, but back of the branchiæ grow long again, and are even more delicate than in front.

On the 9th segment the ventral setæ are changed to hooks (fig. 58), of which there are from 4 to 7 in each rami; they project but slightly beyond the setigerous lobe, and are covered by a delicate membrane.

The anal segment ends in four short, stout, bluntly conical lobes (fig. 59). The body is flattened above, convex laterally and below. Impressed lines, running along the ventral surface, include the middle half of this surface; these, being crossed by the lines of segmentation, furnish median ventral plates.

The extended proboscis was not seen.

The posterior margin of the mouth is crenulated; the anterior margin of the buccal segment is divided by a longitudinal median incision into two rounded lobes, which may be widely separated or closely approximated.

Largest specimen.

Length, 10mm.
Width, 0.5mm.
Number of segments, 49.
This species lives in delicate sand tubes; low water.

PRIONOSPIO (*Malmgren*) *Sars.*

PRIONOSPIO (species not determined).

A single specimen, too much injured for identification, was dredged in the harbor. Bottom muddy, covered with dead eel-grass.

STREBLOSPIO *Webster.*

STREBLOSPIO BENEDICTI *Webster.*

(PL. V, FIGS. 60–64.)

Annel. Chæt. of New Jersey, p. 120, pl. v, figs. 48–50. 1880.

The head (fig. 6) is emarginate in front. The lobes of the dorsal and ventral rami do not disappear as stated in the original description, but become much smaller; the error arose from not studying transverse sections.

We found this species in great numbers at Wellfleet, above the harbor, living in soft, black mud, which formed a layer, two or three inches thick, over compact sand. The tubes were placed vertically in the mud, very close together. They were not as large as the specimens found in New Jersey.

The anal segment has a shallow sucker (fig. 64), with thick, rounded margin.

SPIOPHANES *Grube.*

SPIOPHANES VERRILLI *n. sp.*

(PL. VI, FIGS. 65–72.)

Head (fig. 66) resting on the buccal segment; posterior half raised, presenting somewhat the appearance of a carina; anterior half rapidly widening, thin, depressed, with anterior angles much prolonged. Eyes four, small, black, lateral; anterior pair about on the middle line; posterior pair half way between the anterior pair and the posterior margin of the head.

We were unable to find the minute posterior antenna represented as belonging to this genus.

Tentacles (fig. 65) reaching back to the eighth segment; canaliculate, margins of canal rounded and scolloped.

The dorsal cirri on the anterior segments are wide at base, narrowed at about the middle, with their outer half conical (fig 67); the base gradually becomes more swollen, the apex more attenuated, until the middle line is reached, when the basal part becomes smaller, the outer part longer, with a slight increase in its diameter. Back of the dorsal cirri of the anterior segments is a thin plate, with convex margin, in front of which the setæ arise. This plate exists on all segments, but after a few of the anterior becomes narrower, longer, conical (fig. 69).

The ventral cirri of the first four segments are a little smaller than the dorsal cirri; they have a straight upper, a convex lower, margin; behind them is a plate or lobe similar to the dorsal ramus; back of the fourth segment the cirrus disappears, and the ventral ramus moves gradually towards the ventral margin (fig. 69). After the fourth segment a projecting, arched plate, similar to the ventral ramus, is found about half way between the two rami.

From the sixth segment a membranous densely ciliated ridge (fig. 68) connects the bases of the opposite dorsal cirri. At first this ridge is quite low, but afterwards becomes well marked.

The dorsal setæ of the anterior segments are very long (fig. 70), delicate, margined on one edge; they shorten a little backwards, but behind the middle again increase in length.

The ventral setæ (fig. 71) are shorter, more curved, and a little wider; in other respects similar to the dorsal setæ. On the sixth segment the ventral setæ change to uncini (fig. 72). These project very slightly. There are a few capillary setæ at the lower end of each series of uncini. The anal segment is bluntly rounded, with two delicate filiform cirri.

On the anterior segments the dorsum is flat; the sides and ventral surface convex; further back the dorsum becomes convex; the sides nearly straight; the ventral surface flat, or slightly convex.

General color of the body red; head, sides of body, and feet, white. Only two specimens were found.

Length of largest specimen, 21^{mm}.

Width, 1^{mm}.

Number of segments, 82.

Found at Wellfleet, in sand, at low water.

POLYDORA *Bosc.*

POLYDORA LIGNI *Webster.*

Annel. Chæt. of New Jersey, etc., p. 119, pl. v, figs. 45–47. 1880.

Our specimens were found living on the valves of *Pecten irradians*, their tubes occupying the spaces between the ribs.

Low water; not common.

POLYDORA CONCHARUM *Verrill.*

Proceedings of the United States National Museum, p. 174. November, 1879.

This large and peculiar species was very common, from near high water mark to 30 fathoms.

Family CIRRATULIDÆ.

CIRRATULUS *Lamarck.*

CIRRATULUS GRANDIS *Verrill.*

VERRILL. Invert. Animals of Vineyard Sound, etc., p. 606, pl. xv, figs. 80, 81. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, etc., p. 258. 1879. Annel. Chæt. of New Jersey, p. 122. 1880.

Specimens rare, not large. Found under stones, at low water.

DODECACERIA *Örsted.*

DODECACERIA CONCHARUM *Örsted.*

ÖRSTED. Ann. Dan. Consp., p. 44, fig. 99. 1843.
JOHNSTON. Catl. Brit. Museum, p. 212. 1865.
QUATREFAGES. Hist. Nat. des Ann., vol. i,, p. 464. 1865.
MALMGREN. Annulata Polychæta, p. 206. 1867.
VERRILL. Proceedings United States National Museum, p. 178. 1879.

One specimen only. Twenty to twenty-five fathoms; sand and shells.

Family CAPITELLIDÆ.

NOTOMASTUS *Sars.*

NOTOMASTUS FILIFORMIS *Verrill.*

VERRILL. Invert. An. of Vin. Sound, etc., p. 611. 1874.
WEBSTER. Annel. Chæt. of New Jersey, p. 123, pl. v, figs. 51–54. 1880.

Very abundant at low water, in the sand.

NOTOMASTUS LURIDUS *Verrill.*

VERRILL. Op. cit., p. 610. 1874.
WEBSTER. Op. cit., p. 123. 1880.

Quite common at low water; sand.

CAPITELLA *Blainville.*

CAPITELLA CAPITATA *Van Beneden.*

Lumbricus capitatus FABRICIUS. Fauna Grön., p. 279. 1780.
Capitella Fabricii BLAINVILLE. Dict. des Sc. Nat., vol. 57, p. 443. 1828 (*teste* Clpd.).
Lumbriconais capitata FREY and LEUCK. Beiträge z. Kenntn. wirbelloser Thiere, p. 141. 1847.
Capitella capitata VAN BENEDEN. Bull. Acad. de Belg., vol. iii, 1857, *teste* Claparède
CLAPARÈDE, Rech. Anat. Annélides des Hébrides, p. 42, pl. i, figs 9–14. 1861. Annel. Chæt. du G. de N., part ii, p. 10, pl. xxvii fig. 1. 1868.
Capitella capitata MALMGREN. Annulata Polychæta, p. 207. 1867.
MCINTOSH. Annelida of the cruise of the Valorous to Davis Strait, p. 507. 1877.
Valla ciliata JOHNSTON. Cat. British Worms, p. 67. 1865.

We found a few specimens of *Capitella*, which we are not able to separate from *C. capitata*. Sexual setæ on the eighth and ninth segments; all segments before the eighth with capillary setæ only; after the ninth, with uncini only. On one young specimen capillary setæ were found only on three segments. Another had five segments with capillary setæ; still another had capillary setæ on seven segments, but there were a few uncini in the seventh ventral ramus.

Near high water mark, in sand.

Family MALDANIDÆ.

NICOMACHE *Malmgren.*

NICOMACHE LUMBRICALIS *Malmgren.*

Sabella lumbricalis O. FABRICIUS. Fauna Grön., p. 374. 1780.
Clymene lumbricalis SARS. Fauna littoralis norvegiæ, vol. ii, p. 16, pl. ii, figs. 23–26. 1856.
Nicomache lumbricalis MALMGREN. Nordiska Hafs-Annulater, p. 190. 1865. Annulata Polychæta, p. 209, pl. xi, fig. 60. 1867.

Dredged, 12 to 28 fathoms.

PRAXILLA *Malmgren.*

PRAXILLA ELONGATA *Webster.*

Annel. Chæt. of New Jersey, p. 124, pl. vi, figs. 55–59. 1880.

We found this species quite common both at Provincetown and Wellfleet, living in sand and gravel. At Wellfleet associated with *Amphitrite ornata* VERRILL.

CLYMENELLA *Verrill.*

CLYMENELLA TORQUATA *Verrill.*

Clymene torquatus LEIDY. Marine Invert. Fauna of Rhode Island and New Jersey, p. 14. 1855.
Clymenella torquata. VERRILL. Invert. An. of Vin. Sound, p. 608, pl. xiv, figs. 71–73. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 258. 1879. Of New Jersey, p. 123. 1880.

Very abundant, low water, sand and gravel.

Family AMPHICTENIDÆ.

CISTENIDES *Malmgren.*

CISTENIDES GOULDII *Verrill.*

Pectinaria Belgica GOULD. Invertebrata of Mass., ed. i, p. 7, pl. i, fig. 1. 1841.
Pectinaria auricoma LEIDY. Marine Invert. Fauna of Rhode Island and New Jersey, p. 14. 1855.
Cistenides Gouldii VERRILL. Op. cit., p. 612, pl. xvii, figs. 87, 87 a. 1874.
WEBSTER. Op. cit. (N. J.), p. 127. 1880.

Common and very large. Low water. Wellfleet and Provincetown.

AMPHARETIDÆ.

MELINNA *Malmgren.*

MELINNA CRISTATA *Malmgren.*

Sabella cristata SARS. Fauna littoralis Norvegiæ, vol. ii, p. 19, pl. ii, figs. 1–7. 1856.
Melinna cristata MALMGREN. Nordiska Hafs-Annulater, p. 371, pl. xx, fig. 50. 1865.
Ann. Polych., p. 215. 1867.
VERRILL. Op. cit., p. 613. 1874.
Phenacia cristata QUATREFAGES. Hist. Nat. des Ann., vol. ii, p. 377. 1865.

Single much injured specimen. Dredged; 25 fathoms.

Family TEREBELLIDÆ.

AMPHITRITE (*Müller*) *Malmgren.*

AMPHITRITE ORNATA *Verrill.*

Terebella ornata LEIDY.—Marine Invert. Fauna of R. I. and N. J., p. 14, pl. xi, figs. 44, 45. 1855.
Amphitrite ornata VERRILL.—Invert. An. of Vineyard Sound, etc., p. 613, pl. xvi, fig. 82. 1874.
Amphitrite ornata WEBSTER.—Annel. Chæt. of the Virginian Coast, p. 262. 1879. Annel. Chæt. of N. J., p. 127. 1880.

This species was very rare at Provincetown, but we found it in great numbers at Wellfleet, in coarse sand and mud, very near high water mark.

AMPHITRITE BRUNNEA *Verrill.*

Terebella brunnea STIMPSON.—Marine Invert. of Grand Manan, p. 31. 1854.
Amphitrite Johnstoni MALMGREN.—Nord. Hafs-Annulater, p. 377, pl. xxi, fig. 51. 1865. Annulata Polychæta, p. 216. 1867.
Amphitrite brunnea VERRILL.—Check-list.

Professor Verrill regards *A. Johnstoni* MALMGREN as a synonym of *T. brunnea* STIMPSON. Stimpson's description, however, is very imperfect. We found two specimens which agree in most particulars, though not in all, with Malmgren's figures of *A. Johnstoni.* They have twenty-four segments with capillary setæ. A very fine large species, dredged in deep water by the Fish Commission, and regarded at first by Professor Verrill as *A. brunnea*, has twenty-five segments with capillary setæ. Our specimens of *A. brunnea* were found under stones, at low-water.

NICOLEA *Malmgren.*

NICOLEA VIRIDIS *n. sp.*

(PL. VI, FIGS. 73, 74.)

The frontal membrane is very large; the tentacles numerous and long, some of them as long as the body.

The branchiæ are divided from near the base, flattened, ending in short blunt subdivisions (fig. 73). The anterior branchiæ are much larger than the posterior.

The uncigerous tori on the segments bearing capillary setæ are large, projecting, convex externally; then follow eight segments, on which the tori are much smaller, and square; then three segments, apparently without setæ; then a short anal segment, with crenulated margin.

No lines of segmentation can be made out in living specimens on the dorsum and sides as far back as the last segment with capillary setæ; on alcoholic specimens they are faintly perceptible.

The cirri of the third and fourth setigerous segments of the male form are small, flattened, quadrangular.

The uncinate setæ have one very large tooth at the apex (fig. 74).

The body tapers very gradually, the diameter of the last segment being about one-half that of the anterior segments.

The general color is green; anterior two-thirds with numerous irregular black specks on the dorsum and sides; these become larger and confluent on the posterior segments, forming spots or blotches. First segment crossed by a band of dark reddish-brown specks (? eye specks), closely crowded; tentacles light flesh-color; branchiæ with dark-brown center.

A single specimen, a male, was taken in sand, at low water.

Length, 9^{mm}.

Greatest width, 1^{mm}.

PISTA *Malmgren.*

In the Invertebrate Animals of Vineyard Sound, etc., Professor Verrill has described a new genus, *Scionopsis*, which he says is closely related to *Pista*, differing from that genus in the extent of the membrane on the third segment, and in the structure of the branchiæ. We found at Wellfleet a form which seems to be intermediate between *Pista* and *Scionopsis*. In the form of the uncinate setæ and in the lateral membrane on the second and third segments it agrees with *Pista;* until closely examined the branchiæ seem also to agree with *Pista*, since, owing to the arrangement on the stem, they present the same peculiar form. However, in the method of branching they agree with *Scionopsis*. It seems best, for the present at least, to refer both this new form and *Scionopsis* VERRILL to *Pista*.

PISTA INTERMEDIA *n. sp.*

(PL. VI, FIGS. 75–78.)

The branchiæ in this species arise from an elongated central stalk, the basal portion of which is naked (without branches) for a variable length, depending upon the size of the branchiæ. The branches are given off from the stem very close to each other, and appear to be arranged in a very slowly ascending spiral. Each main branch subdivides close to its origin, and again divides; there is a strong tendency to terminate in a short bifurcation, one branch of which is a little longer than the other (fig. 75). The lowest main branches are the largest. They are convex externally, concave internally, directed upward and a little outward. The main branches grow rapidly shorter from base to summit, and tend more directly outward. The result of this arrangement is an egg-shaped branchia, the small end outward. There would appear to be normally four branchiæ, but none of our specimens show more than three.

The tentacular cirri are short, numerous.

The lateral membrane of the second segment is short but high; outer margin convex; the corresponding membrane of the third segment is lower, but extends from the dorsal to the ventral surface.

The anterior ventral shields are very short; the others are variable in form; they may be square, or their length may be more or less than their width.

There are two series of capillary setæ (figs. 76, 77), the setæ not differing much from each other except in length.

The uncini of the anterior segments (fig. 78) do not differ much from those further back, and will be seen to closely resemble those of *Pista cristata*, as figured by Malmgren. The elongated inferior process, said by Malmgren to exist on the uncini of the first six uncigerous segments in this species, we found on all uncini. It does not seem, however, to be a process of the uncini, but a tendon or cord, derived from a membrane, which, in part at least, covers each uncinus. We were able to trace this membrane to the extent shown in fig. 78. On all the species of this family which we have had an opportunity to examine we have found a similar membrane and similar cords, when sufficient care has been taken with the preparation of the uncini for examination. It may further be noted, both as regards this species and *Pista palmata*, that the uncini are not simply flattened with a single series of terminal points, but that the apex is much widened, with transverse series of points, each series composed of from three to five points, corresponding to the single series seen when the uncinus is viewed from the side.

The notes on color were made by Professor Verrill. Anterior region dull olive-green dorsally, sometimes tinged with reddish, and usually with more or less distinct transverse lines of reddish between the segments, these lines less marked in front. On the sides each torus is surrounded by a broad band of dark blood-red, and above each setigerous fascicle, except in front, there is a red spot. On the sides, between the segments, are narrow pale-olive sutural bands. Ventral surface pale-olive or yellowish-green. Each ventral shield with a conspicuous red spot on the lateral borders, those on the posterior shields being connected with the lateral bands. Feet, pale greenish. Posterior portion of body plain yellowish-green or olive green. Branchiæ greenish, or yellowish, or flesh-color with bright red blood vessels showing through.

Length of largest specimen, 75^{mm}.

Tube formed of coarse sand.

Found at Wellfleet in sand at low water.

Not common.

PISTA PAIMATA.

(PL. VII, FIG. 79.)

Scionopsis palmata VERRILL. Invert. Animals of Vin. Sound, p. 614. 1874.
Scionopsis palmata WEBSTER. Annel. Chæt. of the Virginia Coast, p. 262, 1879. Of New Jersey, p. 128. 1880.

Found sparingly at low water.

The considerations that lead us to unite this form to *Pista* have been stated above.

TRICHOBRANCHUS *Malmgren.*

TRICHOBRANCHUS ? GLACIALIS *Malmgren.*

Nord. Hafs-Ann., p. 395, pl. xxiv, fig. 65. 1865.—Ann. Polycht., p. 220. 1867.

We found but one specimen of this genus, and that without branchiæ, and otherwise much injured. Depending mainly on the setæ, we refer it with some doubt to Malmgren's species.

Sand; low water.

POLYCIRRUS *Grube.*

POLYCIRRUS EXIMIUS *Verrill.*

Torquea eximea LEIDY. Marine Invert. Fauna of R. I. and N. J., p. 14, pl. xi, 51, 52. 1855.
Polycirrus eximius VERRILL. Invert. An. Vin. Sound, etc., p. 616, pl. xvi, *f.* 85, 1879.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 263, 1879. Of New Jersey, p. 128. 1880.

ENOPLOBRANCHUS *Verrill.*

ENOPLOBRANCHUS SANGUINEUS *Verrill.*

Chætobranchus sanguineus VERRILL. Op. cit., p. 616, 1874.
Enoplobranchus sanguineus VERRILL. Check-list (advance sheets).
WEBSTER. Annel. Chæt. of the Virginia Coast, p. 263. 1879.

Found only at Wellfleet. Sandy mud; low water; abundant.

Family SABELLIDÆ.

SABELLA (*L.*) *Malmgren.*

SABELLA MICROPHTHALMA *Verrill.*

VERRILL. Invert. Animals of Vin. Sound, p. 618. 1874.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 275. 1879. Of New Jersey, p. 128. 1880.

Not common. Found at low water.

POTAMILLA *Malmgren.*

POTAMILLA NEGLECTA *Malmgren.*

(PL. VII, FIGS. 80-84.)

Nordiska Hafs-Annulater, p. 401, pl. xxvii, fig. 84. 1865. Annulata Polychæta p. 222. 1867.

The specimens, which we refer, without much doubt, to this species, were pure white, very beautiful. The ventral sulcus, contrary to the generic diagnosis, was continued on the dorsum, although seen with difficulty in alcoholic specimens. The branchial cirri were readily lost.

Length, 60^{mm}.

Diameter, 3^{mm}.

Length of branchiæ, $9–13^{mm}$.

Length of first eight segments, 9^{mm}.

Dredged in 25 fathoms; sand and shells.

POTAMILLA RENIFORMIS *Malmgren.*

Sabella reniformis LEUCKART. Archiv. f. Naturg., p. 183, pl. 3, fig. 8. 1849 (*teste* Malmgren).

Sabella oculifera LEIDY. Marine Invert. Fauna of R. I. and N. J., p. 13, pl. xi., figs. 55-61. 1855.

QUATREFAGES. Hist. Nat. des Annéles, vol. ii, p. 461. 1865.

Sabella aspersa KRÖYER. Bidrag till Sabellerne, p. 19. 1856.

Sabella oculata KRÖYER. Bidrag till Sabellerne, p. 22. 1856.

Sabella reniformis SARS. Christ. vid. Selsk. Forh., p. 123. 1861.

Sabella (*Potamilla*) *reniformis* MARION-BOBRETZSKY. Annales des Sci. Nat., vol. ii, p. 91, pl. xi, fig. 22. 1875.

Potamilla reniformis MALMGREN. Annulata Polych., p. 222, pl. xiv, fig. 77. 1867.

Potamilla oculifera VERRILL. Invert An. of Vin. Sound, p. 617, pl. xvii, fig. 86. 1874.

Potamilla reniformis VERRILL. Check-list.

We collected but one specimen of this species. Dredged in 25 fathoms; sand and shells.

OTHONIA *Johnston.*

OTHONIA FABRICII *Johnston.*

Othonia Fabricii, JOHNSTON. Lond. Mag. Nat. Hist., vol. viii, 181, fig. 19 (*teste* Malmgren and Claparède).

Fabricia Leidyi VERRILL. Op. cit., p. 619. 1874.

For the remaining synonomy of the species see Malmgren, Annulata Polychæta, p. 225. Also Claparède, Annel. Chet. du Golfe de Naples, p. 151. Malmgren's rejection of Fabricia seems to be valid, and Claparède's claim for *Othonia*, as opposed to *Amphicora*, seems equally sound; but his retention of *Fabricia* is not desirable. On decaying wood, near high water mark.

MYXICOLA (*Koch*) *Malmgren.*

MYXICOLA STEENSTRUPI *Kröyer.*

Myxicola Steenstrupi KRÖYER. Bidrag til Kunds., om Sabellerne, p. 35. 1856.
MALMGREN. Nord. Hafs-Ann., p. 408. 1865. Pl. xix, fig. 90.
Annulata Polychæta, p. 227. 1867.
Myxicola Sarsi KRÖYER. Op. cit., p. 9. 1856.
SARS. Christ. Vid. Selsk. Forh., p. 130. 1861.

Body white or yellowish white. The anterior segments, 3–6, may be brown, or white, or mottled. After the fourth segment there may be one, two, or three circular brown specks on the sides of each segment. These spots fail on a few of the posterior segments, but on the sides of the anal segment they are numerous, from four to twelve on each side, according to the size of the specimen. The branchiæ are greenish yellow at base, with their outer two-thirds reddish brown, or they may be greenish white throughhout; branchial cirri of the same color as the branchiæ.

Dredged in 25 fathoms; sand and shells.

Family SERPULIDÆ.

HYDROIDES *Gunnerus.*

HYDROIDES DIANTHUS *Verrill.*

Serpula dianthus VERRILL. Invert. An. of Vin. Sound, p. 620. 1874.
Hydroides dianthus VERRILL. Proc. Acad. Nat. Sci., p. 300. 1878.
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 266. 1879.—
Of New Jersey, p. 128. 1880.

Not common. Low water, on shells, etc.

SPIRORBIS *Daudin.*

SPIRORBIS BOREALIS *Daudin.*

Very common at low water, on sea weed, etc.

Genus incertæ sedis.

We collected a single injured specimen, which we have so far been unable to refer to any described family. It presents, however, so many peculiarities that it seems desirable to describe it as far as possible.

THAUMASTOMA *n. g.*

Head rounded behind, flattened and elongated in front; without appendages. Proboscis protrusible, digitate at extremity. No jaws. First segment with median cirrus. Dorsal setæ of first segment much elongated, directed forward. Ventral setæ of first two segment in two series;

one capillary; the other stout, spinous; all other setæ capillary. Each ramus, after the first segment, furnished with a transverse plate, thin, lateral, projecting, outer margin lobed. All segments biramous.

THAUMASTOMA SINGULARE *n. sp.*

(PL. VII, FIGS. 85–94.)

Head composed of two parts; anterior two-thirds flattened (fig. 85), nearly quadrangular, slightly emarginate in front; posterior third rounded, convex, bearing two pairs of minute black eyes; destitute of appendages.

The proboscis was seen extended to a length about equal to that of the head; the incisions dividing it into lobes were observed to run back about one-half this length. In alcohol the proboscis was nearly withdrawn, showing only its anterior end (fig. 86); its inner surface was densely ciliated.

The dorsal ramus of the first segment is composed (fig. 85) of two stout, conical cirri, longer than the head; the upper of these points forward; the lower forward and outward; between their bases rise two distinct bundles of capillary setæ, which are directed forward, and reach beyond the head. The lower ramus of the first segment consists of a transverse, convex, fleshy lobe, terminating above in a short, stout, blunt, rounded process; in front of this plate are two rows of setæ; those forming the anterior series (fig. 93) similar to the posterior (fig. 92), only longer and more delicate, but still having rather the form of spines than of capillary setæ, these anterior setæ are very light colored, nearly white; the posterior series is composed of 6–8 stout yellow spines (fig. 92).

The second segment has its dorsal ramus composed of a depressed fleshy lobe (not seen in the figure, which is a front view), from which arises a fan of capillary setæ (figs. 87, 94), while in front of this lobe is a thin, projecting plate, divided along its outer margin (fig. 87) into six unequal, bluntly rounded lobes.

This lower ramus is much like the corresponding ramus of the first segment, but lacks the superior process. In this ramus is a posterior row of black spines, similar to those of the first segment, except in color, and an anterior series of very fine capillary setæ, much shorter and more delicate than the capillary setæ of the segments behind, shorter even than the spines of the same ramus. Behind the second segment all the setæ are capillary and arise from more or less well-marked rounded lobes.

On the third segment a digitated plate runs down the side of the body, in front of both rami. It has twenty-one lobes (fig. 88) along its outer margin, and runs from above the dorsal ramus to below the ventral. On the fourth segment there are two such lobes (fig. 89). After the fourth segment the dorsal lobe steadily shortens, till on the seventeenth segment (fig. 91) it is reduced to a single, flattened, tapering projection. Meanwhile the ventral lobe retains about the same size on all segments, but shows great irregularities in the number and depth of the incisions forming its lateral lobes. From the eighth segment the dorsal rami and setæ have an upward direction; on the eighth they are even directed inward, but as this does not occur on the segments behind the eighth, it may be due to accidental distortion; in like manner the ventral rami of the eighth segment are turned (displaced ?) upward; on all segments behind the eighth the ventral setæ point directly outward, instead of obliquely downward, as on the preceding segments.

After the first two segments the setæ of both rami are much alike, but those of the dorsal rami, after the fourth segment, are much more numerous, forming a stout, closely crowded bundle.

The general outline of the body is shown in figs. 87–91, which are half segments; it is depressed with slightly convex dorsal and median fields as far back as the sixteenth segment; here the dorsum becomes more convex (fig. 91). It is possible that this change may take place somewhat more gradually than this statement would indicate, as the dorsum is somewhat injured for a few segments anterior to the sixteenth.

No color notes were made, but as we remember it the general color was dirty white.

Length of 22 segments, 15^{mm}.

Greatest width (at twelfth segment), 5^{mm}. This width diminishes a little forwards, the width of the first segment being 3^{mm}.

Dredged on a sandy bottom in about 20 fathoms.

EXPLANATION OF PLATES.

PLATE I.

ETEONE CINEREA *n. sp.*

FIG. 1.—Anterior foot, × 16.
2.—Middle foot, × 16.
3.—Posterior foot, × 16.
4.—Head and buccal segment, × 16.
5.—Seta, × 300.

PODARKE CÆCA *n. sp.*

FIG. 6.—Head and anterior segments, × 70.
7.—Eighth and ninth segments, × 70.
8.—Seta, × 450.

HESIONE AGILIS *n. sp.*

FIG. 9.—Head and anterior part of alimentary canal, × 45.
10.—Foot, from middle of body, × 45.
11.—Compound seta, × 400.

PLATE II.

SYLLIDES CONVOLUTA *n. sp.*

FIG. 12.—Head and anterior segments, × 85.
13.—Outline of middle segments, × 85.
14.—Compound seta, × 750.
15.—Simple seta (acicula), × 750.
16.—Foot, × 150.

STREPTOSYLLIS ARENÆ *n. g., n. sp.*

FIG. 17.—Head and first two segments, × 65.
18.—Outline of under surface of head, × 85.
19.—Posterior segments, × 35.
20.—Foot with articulated jointed cirrus, × 85.
21.—Foot, to show ventral cirrus, × 85.

PLATE III.

STREPTOSYLLIS ARENÆ *n. g., n. sp*

FIG. 22.—Compound seta, × 400.
23.—Simple seta, × 400.

SPHÆROSYLLIS BREVIFRONS *n. sp.*

FIG. 24.—Head and first two segments, × 130.
25.—Posterior segments, × 130.
26.—Foot with cirri, × 230.
27.—Single dorsal cirrus with double constriction, × 230.
28.—Compound seta, × 750.
29.—Simple seta, × 750.
30.—Simple seta, × 750.

PÆDOPHYLAX HEBES *n. sp.*

FIG. 31.—Head and anterior segments, × 85.
32.—Posterior segments, × 85.
33.—Anterior compound seta, × 750.
34.—Posterior compound seta, × 750.
35.—Ordinary simple seta, × 750.
36.—Posterior simple seta, × 750.

NEREIS TENUIS *n. sp.*

FIG. 37.—Head and first two segments, × 25.

PLATE IV.

NEREIS TENUIS *n. sp.*

FIG. 38.—Proboscis, ventral view, × 25.
39.—Foot from tenth segment, posterior view, × 50.
40.—Posterior foot, posterior view, × 50.
41.—Seta of dorsal ramus and upper part of ventral ramus, × 750.
42.—Seta of lower bundle, lower ramus, × 750.
43.—Seta of ventral ramus, × 750.

STAUROCEPHALUS CÆCUS *n. sp.*

FIG. 44.—Head and first two segments, × 130.
44*a*.—Lower jaw, × 130.
45.—Foot from large specimen, × 130.
46.—Seta, upper part of upper bundle, × 750.
47.—Seta, lower part of upper bundle, × 750.
48.—Seta, lower bundle, × 750.

PLATE V.

GONIADA GRACILIS *Verrill.*

FIG. 49.—Head and first segment, × 50.
50.—Anterior foot, × 85.
51.—Foot from twenty-seventh segment, × 85.
52.—Middle foot, × 85.

SPIO RATHBUNI *n. sp.*

FIG. 53.—Head and first two segments, without tentacles, × 85.
54.—Foot of second segment, anterior view, × 160.
55.—Branchiated segment, × 160.
56.—Short setæ, found sparingly in both rami, × 750
51.—Ordinary dorsal seta, × 750.
58.—Ventral uncinus, × 750.
59.—Anal cirri, × 85.

STREBLOSPIO BENEDICTI *Webster.*

FIG. 60.—Head and first segment, without tentacles, showing origin of branchiæ side view, × 130.
61.—Head, dorsal view, × 130.
62.—Fourth segment, transverse section, × 85.
63.—Posterior segments, transverse section, × 85.
64.—Posterior segments, with anal sucker, × 130.

PLATE VI.

SPIOPHANES VERRILLI *n. sp.*

FIG. 65.—Head with tentacles, × 25.
66.—Head without tentacles, × 25.
67.—Fourth segment, transverse section, × 25.
68.—Sixth segment, transverse section, × 25.
69.—Fifteenth segment, transverse section, × 25.
70.—Dorsal seta, × 450.
71.—Anterior ventral seta, × 450.
72.—Ventral uncinus, × 450.

NICOLEA VIRIDIS *n. sp.*

FIG. 73.—Anterior branchia, × 70.
74.—Uncinus, × 750.

PISTA INTERMEDIA *n. sp.*

FIG. 75.—Single branch of branchia, × 35.
76.—Long capillary seta, × 130.
77.—Short capillary seta, × 130.
78.—Anterior uncinus, × 450.

PLATE VII.

PISTA PALMATA (*Verrill*).

FIG. 79.—Anterior uncinus, × 450.

POTAMILLA NEGLECTA *Malmgren.*

FIGS. 80, 81.—Anterior capillary setæ, × 230.
82, 83.—Anterior pointed uncini, × 230.
FIG. 84.—Anterior uncinus, × 230.

THAUMASTOMA SINGULARE *n. g., n. sp.*

FIG. 85.—Head and first segment, × 15.
86.—Anterior end of proboscis, × 15.
87.—One-half of second segment, transverse section, × 15.
88.—One-half of third segment, transverse section, × 15.
89.—One-half of fourth segment, transverse section, × 15.
90.—One-half of eighth segment, transverse section, × 15.
91.—One-half of seventeenth segment, transverse section, × 15.

FIGS. 92, 93.—Setæ from first segment, × 85.
FIG. 94.—Ordinary seta, × 85.

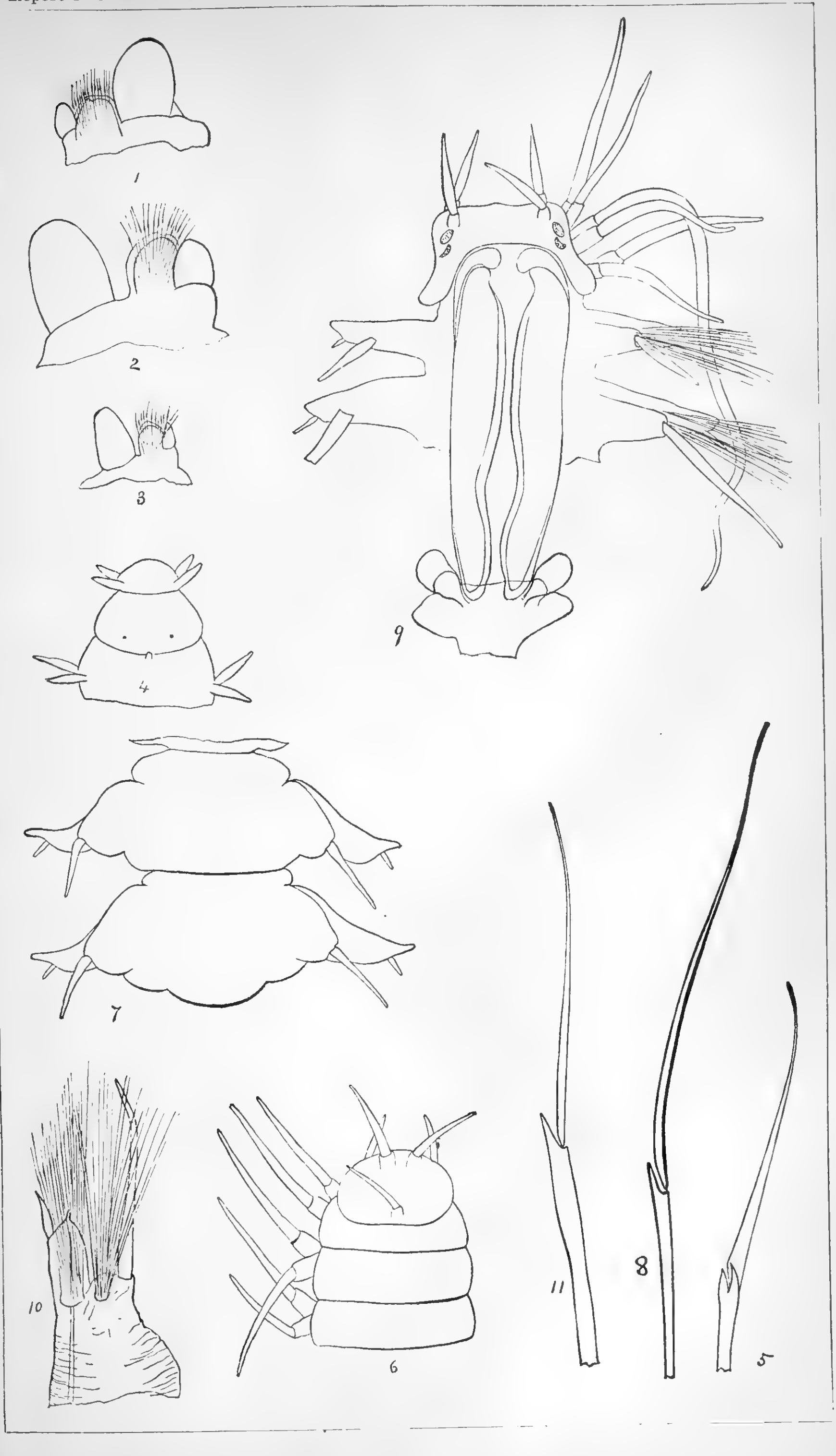
PLATE VIII.

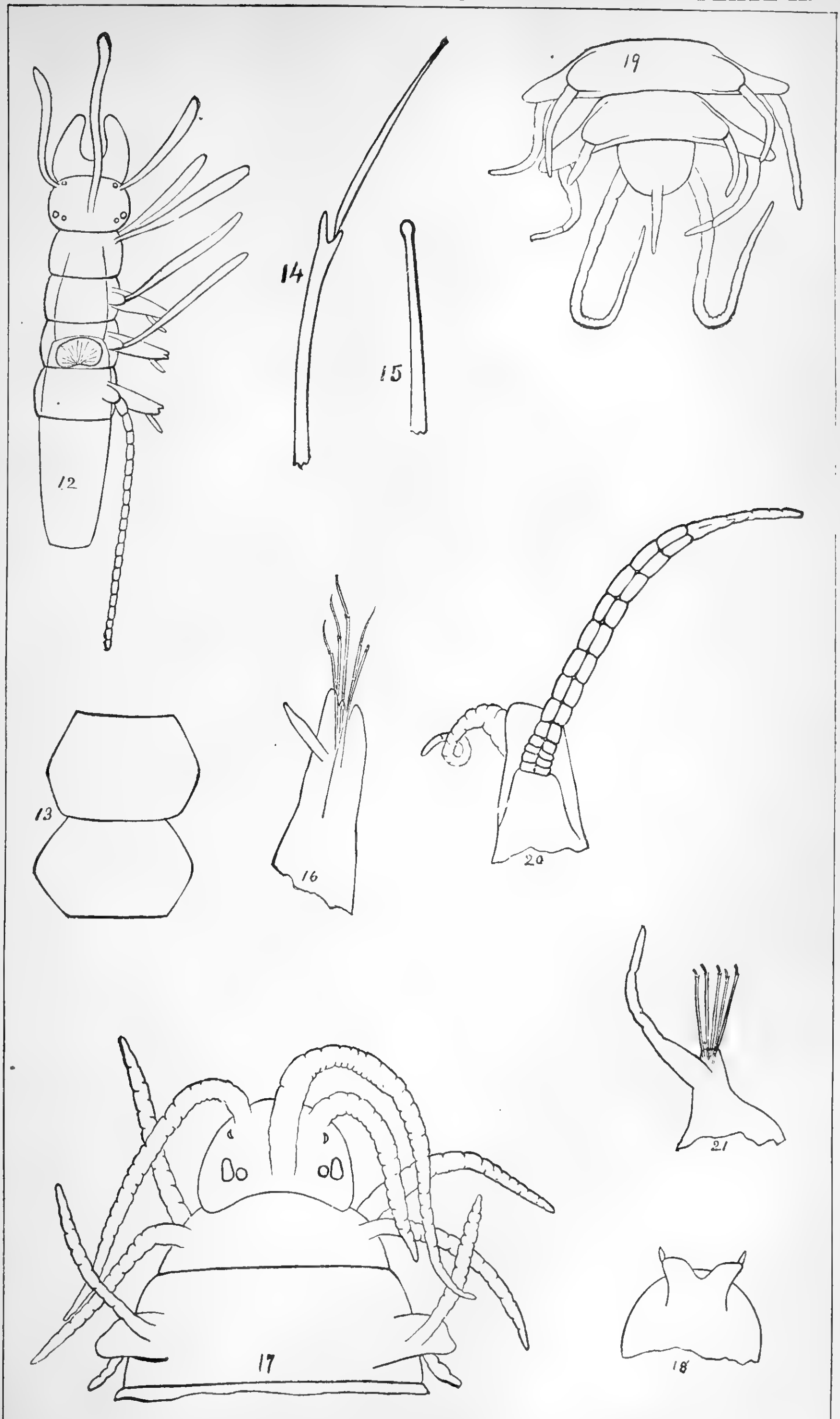
SPHÆROSYLLIS LONGICIRRATA *n. sp.*

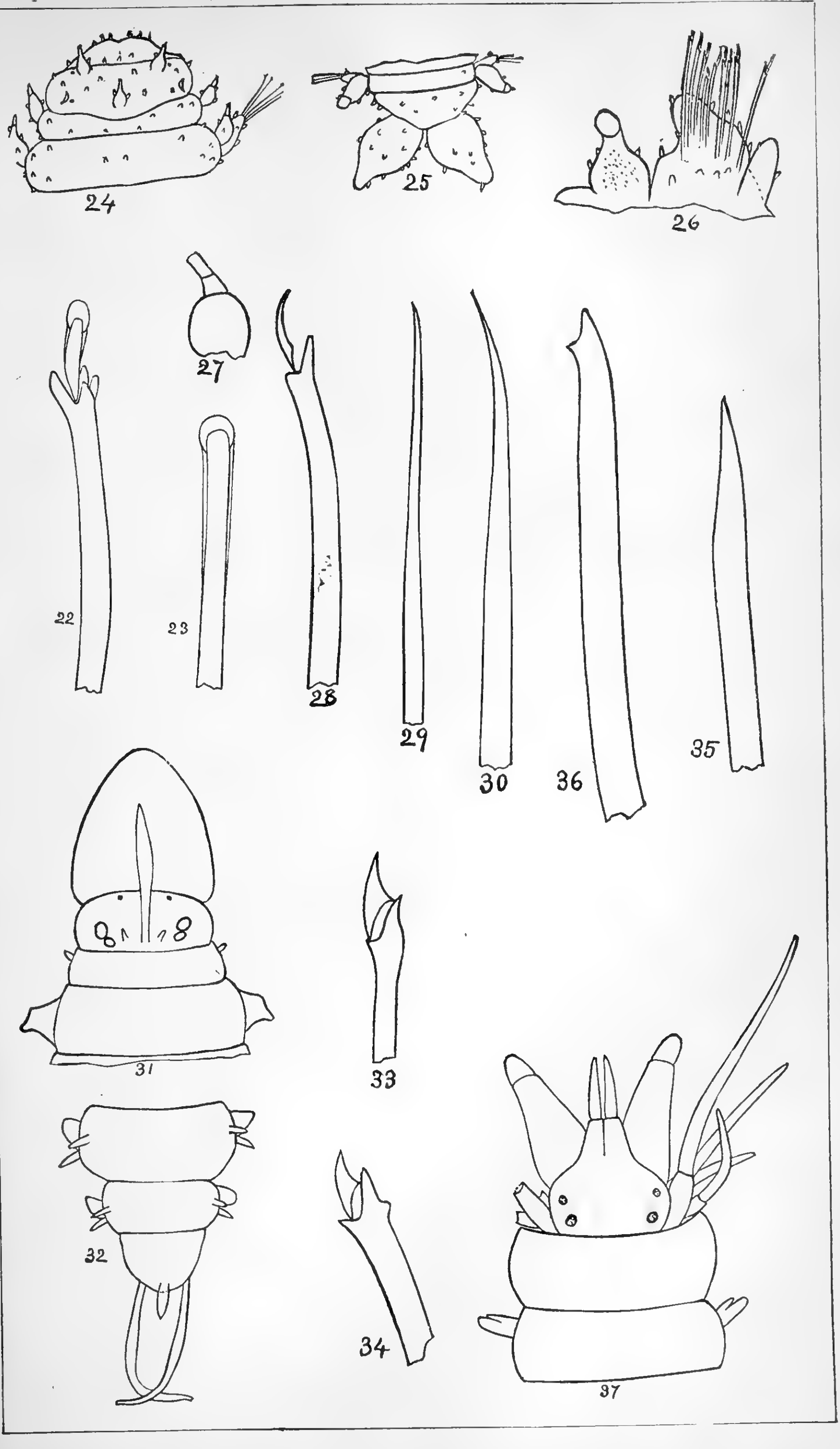
FIG. 95.—Anterior part of body, × 85.
96.—Posterior segments, × 130.
97.—Foot with cirri, × 215.
98.—Long compound seta, terminal part, × 750.
99.—Short compound seta, × 750.
100.—Simple seta, × 750.

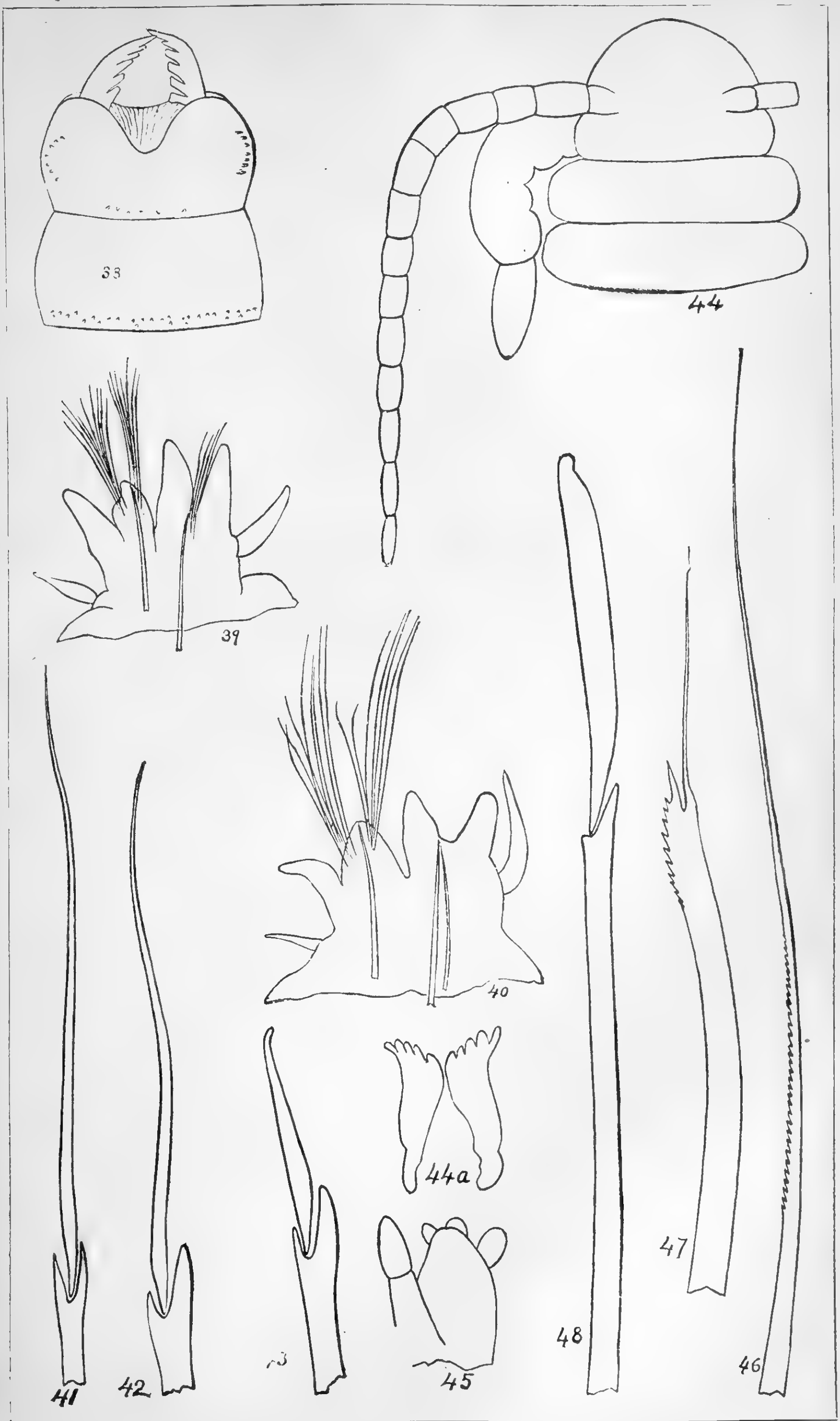
EULALIA DUBIA *n. sp.*

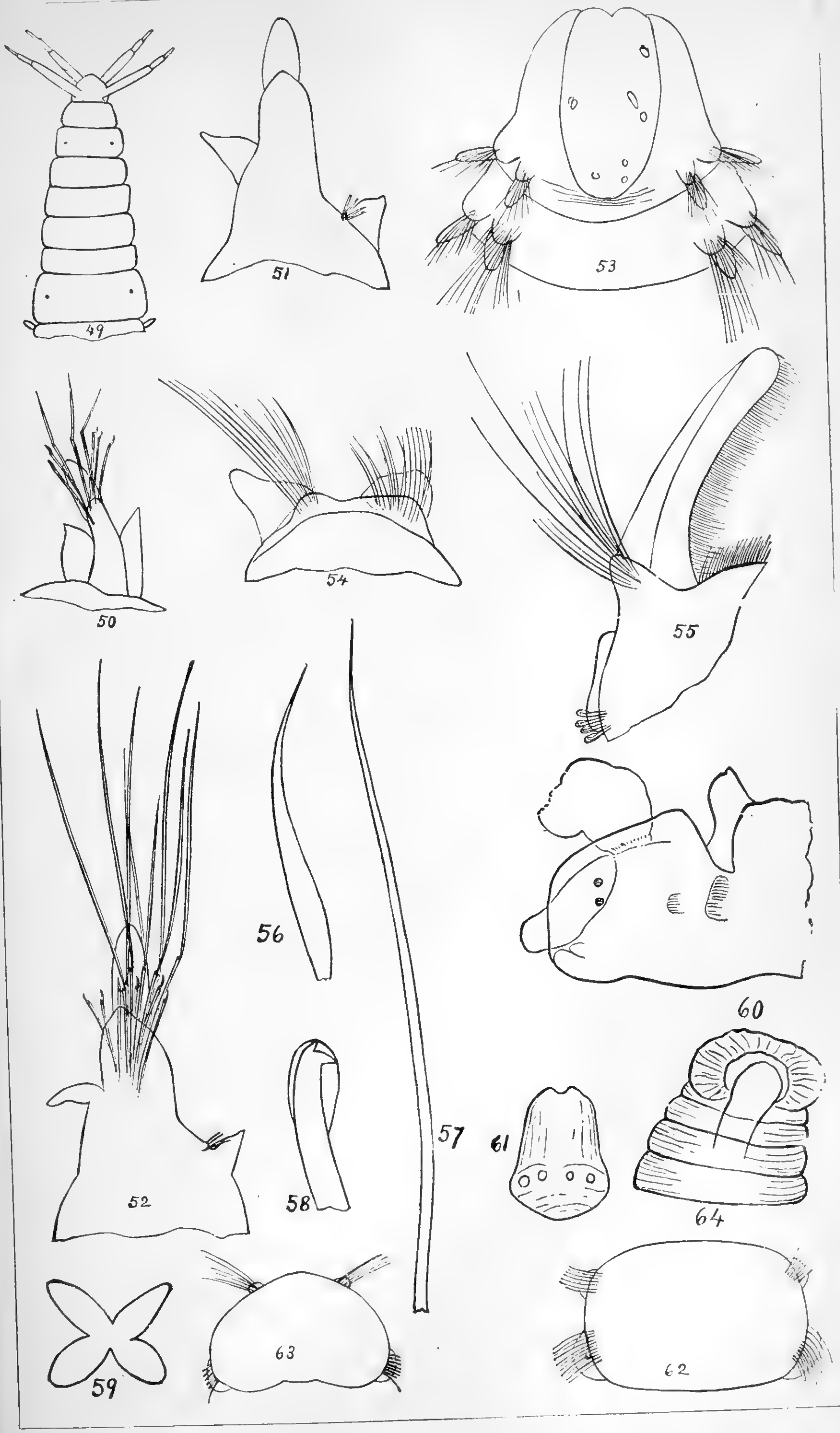
FIG. 101.—Head and first two segments, × 18.
102.—Anterior foot, × 50.
103.—Middle foot, × 50.
104.—Posterior foot, × 50.
105.—Seta, × 500.

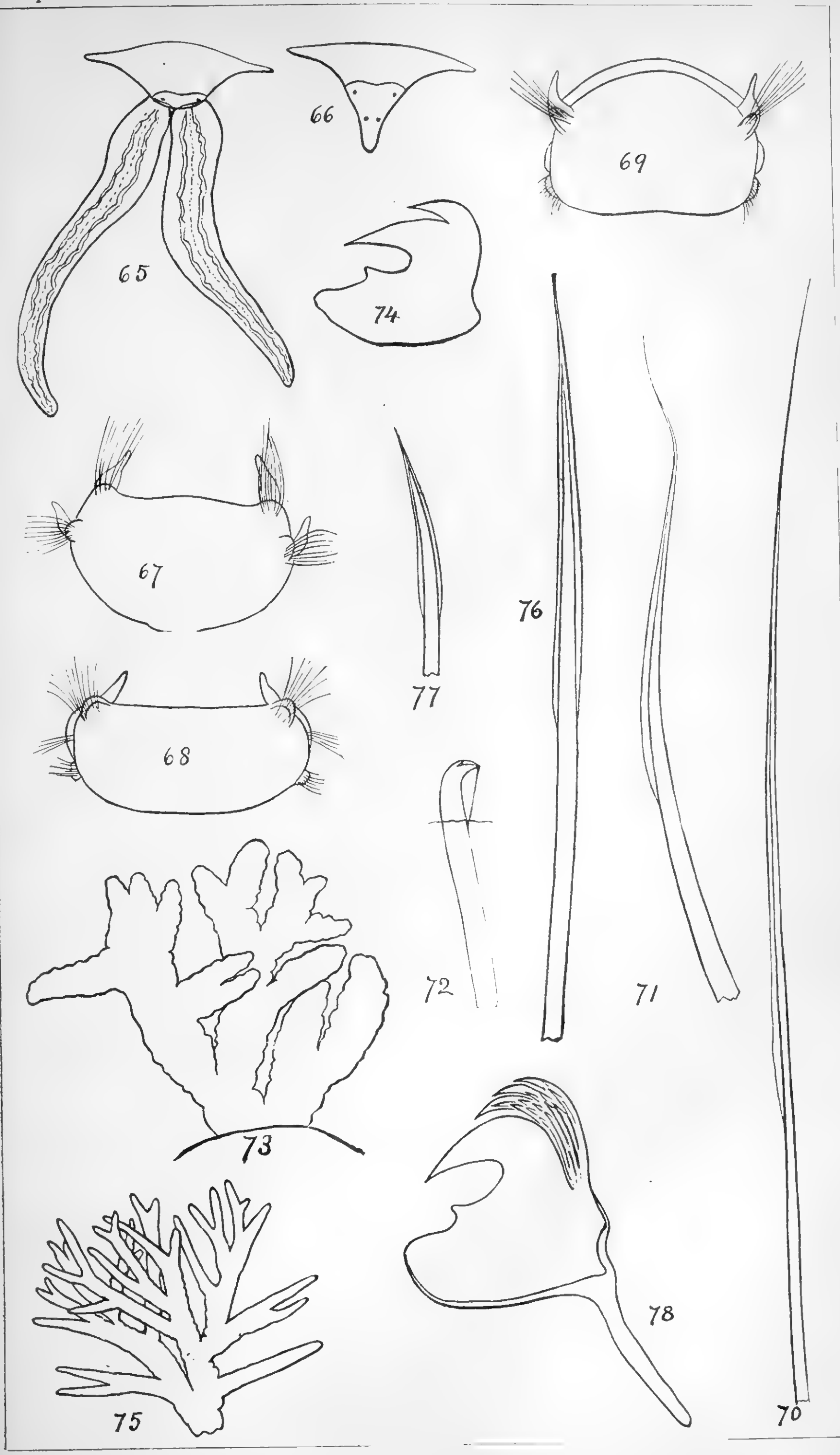

1
2
3
4
7
10
6
9
11
8
5

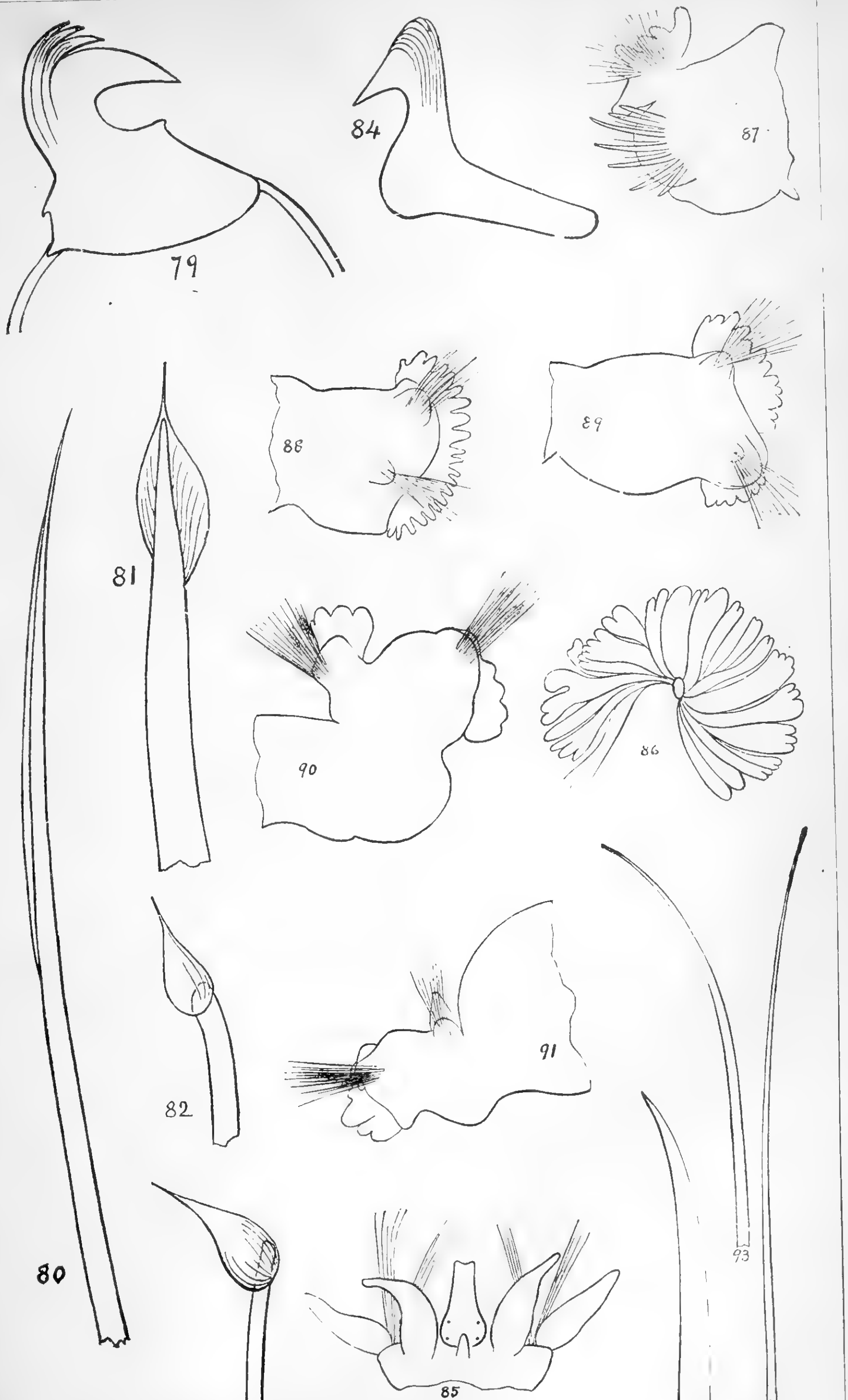

12
13
14
15
16
17
18
19
20
21

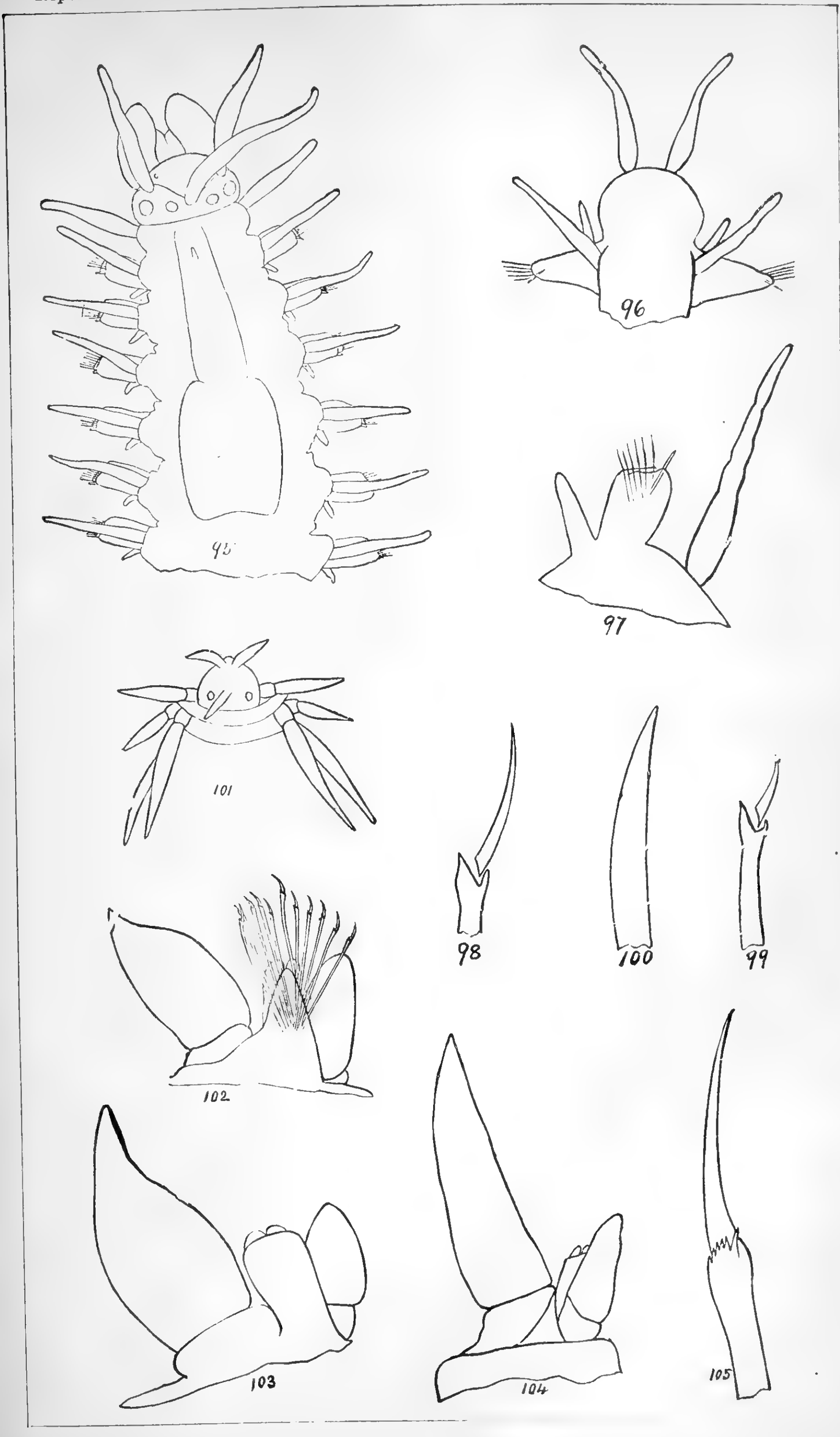

24
25
26
27
22
23
28
29
30
36
35
31
33
32
34
37


38
44
39
40
44a
41
42
45
48
47
46


49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64


65
66
69
74
67
77
76
68
72
71
73
78
75
70


79
84
87
88
89
81
90
86
82
91
80
93
83
85
92
94


95
96
97
101
98
100
99
102
103
104
105

INDEX.

XI.—BIOLOGICAL ACTION OF THE SALTS CONTAINED IN SEA-WATER FROM THE POINT OF VIEW OF THE MAINTENANCE OF MARINE ANIMALS.*

By H. A. Coutance.

[*Professor at the schools of naval medicine, pharmacist in chief to the Navy, and President of the Academical Society of Brest.*]

Marine animals are organisms of excessive sensibility, and are subject to the varied influences of the element in which they live. The disposition of the fauna of the sea is dependent on the composition of the salt water, the nature and quantity of the gases dissolved, and the temperature, force, and operation of the currents. The succession of species of marine animals in geological strata, little different from each other in the nature of the deposits, shows plainly that influences which appear to us but of slight importance, have governed this succession itself.

I wished to ascertain the influences which the modifications in the nature of the salts dissolved might have on the marine animals, and with this view I entered upon a series of researches for the purpose of establishing a biological parallel between these salts. My experiments have been solely devoted to the molluscs of our shores, especially those which form articles of food for our population.

The sea water contains for every 1,000 grams an average of 35 grams of different salts in solution, among which chloride of sodium appears to exercise the most important influence on animal life. The supposition is doubtless permissible that the other substances are useful to a certain limited extent, and have, apparently at least, no hurtful influence.

* "*Action biologique des sels de l'eau de mer au point de vue de l'entretien des animaux marins.*" From *Bulletin mensuel de la Société nationale d'Acclimatation de France*, 3d series, vol. X, No. 2, February, 1883. Read at the 19th meeting of the learned societies, in 1882, in general session. Translated from the French by Herman Jacobson.

I have prepared eight solutions containing 35 grams per 1,000 of distilled water, of the fellowing substances:

Solution No. 1:	Chloride of sodium	$\frac{35}{1000}$
No. 2:	Chloride of magnesium	$\frac{35}{1000}$
No. 3:	Sulphate of magnesia	$\frac{35}{1000}$
No. 4:	Bromide of potassium	$\frac{35}{1000}$
No. 5:	Ioduret of potassium	$\frac{35}{1000}$
No. 6:	Chloride of potassium	$\frac{35}{1000}$
No. 7:	Sulphate of soda	$\frac{35}{1000}$
No. 8:	Sulphate of potash	$\frac{35}{1000}$

Here we have eight solutions, each containing one of these natural elements of the sea-water, in the proportion in which it contains all of them. The sulphate of soda alone does not belong, properly speaking, to sea-water, although its elements are contained in it.

Three other solutions have been prepared, in which all the elements are found united, but in which the quantitative preponderance which in the water of the sea belongs to the sea-salt, is given (1) to chloride of magnesium, (2) to chloride of potassium, (3) to sulphate of magnesia. The following is the composition of these solutions:

Solution No. 9:

Chloride of magnesium	27.00
Chloride of potassium	0.75
Chloride of sodium	3.70
Sulphate of magnesia	2.30
Sulphate of lime	1.50
Bromide of potassium	0.02
Distilled water	1000.00

Solution No. 10:

Chloride of potassium	27.00
Chloride of magnesium	3.70
Chloride of sodium	0.75
Sulphate of magnesia	2.30
Sulphate of lime	1.50
Bromide of potassium	0.02
Distilled water	1000.00

Solution No. 11:

Sulphate of magnesia	27.00
Chloride of magnesium	3.70
Chloride of potassium	0.75
Chloride of sodium	2.30
Sulphate of lime	1.50
Bromide of potassium	0.02
Distilled water	1000.00

Another solution was composed as follows:

Solution No. 12:

Chloride of sodium	8
Chloride of potassium	8
Chloride of magnesium	8
Chloride of calcium	8

Besides these solutions, or means of experimentation, there were also employed:

Solution No. 13: Natural Vichy water (Célestins).
No. 14: Common water (springs at Brest).
No. 15: Natural sea-water (roads of Brest).
No. 16: Atmospheric air.

The Vichy water represented an aqueous element different from the sea-water, but rich in salts of soda. It was also necessary to compare the action of the artificial elements with that of the natural element, the sea-water, and to observe whether mollusks, well enclosed in their shells, could not live for some time in fresh water, or even in the air.

METHOD OF EXPERIMENTATION.—The above solutions were poured into porcelain capsules, placed in the light at an average temperature of 12°. Every two days the evaporated water was replaced by distilled water, so as to keep the solutions in the same state of concentration. Every day these solutions were strongly aërated and shaken, with the view of maintaining conditions analogous to those of sea-water. Mollusks recently caught were placed at the bottom of the capsules at a distance of 20 centimeters from the surface of the liquid.

SUBJECTS OF EXPERIMENTATION.—A very small number of species have been subjected to these physiological experiments.* They are:

The reticulated venus-shell (*Venus reticulata*).
The common mussel (*Mytilus edulis*).
The *palourde* (*Venus decussata*).
The common periwinkle (*Littorina vulgaris*).
The *buccin* of the British Channel (*Tritonium undatum*).

By reason of their different organization these mollusks have given very different results. The bivalves, mussels and venuses, which can shut themselves up between their valves, have as a general rule showed greater resistance than the opercular spiral-shelled mollusks, periwinkles and buccins. Of these the periwinkles, whose operculum can close entirely, prudently retired into the remotest coils of the spiral, and were thus better protected than the buccins, whose opening does not shut tightly, and into which the water can easily enter by the canal at the mouth of the shell.

The bivalves, which can resist external influences, whilst inclosed between their valves, do not by any means act in the same manner. In

* Oysters, subjected to the same experiments, have shown great variableness of impressions, and have generally succumbed very rapidly in the different solutions.

artificial elements the mussel resists less than the venuses; and among these latter the reticulated venus or *clovisse* shows less resistance than the palourde (*Venus decussata*), which exhibits a remarkable degree of resistance. In the solution of sulphate of magnesia, for instance, the mussel succumbed after ten days, the reticulated venus-shell after fifteen, whilst the palourde was still alive after sixty days. These proportions were very nearly maintained in the other solutions relatively to the duration of life in these mediums.

Below is given the result of these experiments as regards the palourdes (*Venus decussata*). Five specimens of this kind were on the 10th January, 1882, placed, under the same conditions, in each of the different solutions mentioned above. The same care was bestowed on all of them, and they were properly aërated every day. At the same time a certain number of these mollusks were placed, near to the former, in vessels containing natural sea-water.

January	10.	Experiments commenced with the palourdes.
	25.	They succumbed in the ioduret of potassium.
February	10.	They succumbed in the chloride of potassium.
	15.	They succumbed in the air.
	18.	They succumbed in the sulphate of potassium.
	18.	They succumbed in the common water.
	20.	They succumbed in the solution No. 10.
	20.	They succumbed in the bromide of potassium.
	20.	They succumbed in the chloride of magnesium.
	25.	They succumbed in the Vichy water.
	22.	They succumbed in the chloride of sodium.
	22.	They succumbed in the solution No. 12.
	24.	They succumbed in the solution No. 9.
March	10.	They succumbed in the sulphate of magnesia.
	10.	They succumbed in the solution No. 11.
	15.	Some palourdes are still living in the sulphate of soda.
	15.	The palourdes placed in the sea-water are alive.

OBSERVATIONS ON THESE FACTS.—It appears from these experiments that, in spite of the possibility of shutting thems lves up between their valves, the venuses yield to the action of the surrounding mediums, since their power of resistance is not equal.

Salts of potash seem much less favorable than the salts of magnesia, and especially than salts of soda. Life ceased first in the ioduret, the bromide, the chloride, and the sulphate of potassium, and in solution No. 10, the prevailing element of which is chloride of potassium.

The salts of soda and magnesia still maintained life when the animals had succumbed in the salts of potash. Solution No. 9, for instance, the principal element of which is chloride of magnesium, preserved its inhabitants alive much longer, and the same applies to the sulphate of magnesia alone and in solution No. 11.

The resistance of the palourdes in the Vichy water shows the favorable action of salts of soda on the preservation of life in marine animals; for forty days the palourdes lived in this mineral water!

It was in the sulphate of magnesia and the sulphate of soda that life was sustained longest, the latter excelling the former. On the 12th March I tasted some of the *Venus decussata* which had been kept in sulphate of soda for sixty days, and found their flavor excellent and without any trace of a bitter flavor. This observation might prove useful in alimentary economy, as the palourde is a highly prized shell-fish, and sulphate of soda can be bought cheap.

It is a fact worthy of remark that it was only in the solutions of sulphate of soda and sulphate of magnesia that green algæ commenced to make their appearance at the end of sixty days. The conditions favorable to marine animal life are then apt to develop vegetable life. There is nothing surprising in this parallelism, but it receives from the present circumstance a curious confirmation. One singularity appears: the solution of chloride of sodium (impure marine salt) did not sustain life as long as the solutions of salt of magnesia and sulphate of soda, and yet salt is an essential element of the sea-water. This proves that the mollusks are adapted, not to pure salt, but to that peculiar mixture which constitutes the natural sea-water; and that the secondary elements, as regards their quantity, play an important part. This gives us reason to suppose that the accidental modifications of the water of the sea during the different geological periods must have had a great deal to do with the extinction of various species.

The venus remained closed in most of the solutions, the nature of which they doubtless learned to know by opening their valves a very little. Meanwhile they occasionally put their siphons outside the shell, for instance in the sulphate of magnesia and in the sulphate of soda. In the solution of chloride of sodium and in the sea-water they had their siphons out nearly all the time.

The palourdes can live for more than a month in the air in a cool place. For about twenty days they remain shut; later they open their valves and protrude their siphons. At the least touch they draw them in and close their valves. Then comes the moment when the striped muscles which bring the valves together have no longer the strength to do this, although the smooth muscles which retain them will still do so, when one closes the valves. In all the solutions in which these mollusks have lived these same phenomena could be observed.

The weakening of the muscles showed itself first in the striped part of the adductors, which draw the valves together, and later in the smooth part of the same muscles, which held the valves artificially closed for a constantly decreasing period.*

The *Venus reticulata*, or clovisses, showed the same phenomena; the order of extinction of vitality in the different solutions was the same;

*See *De l'énergie et de la structure musculaire chez les mollusques acéphales.* [On the energy and muscular structure of the acephala.] By J. B. Baillière, Paris.

but these mollusks did not live as long as the preceding ones. They succumbed a month after they had been placed in the solutions, first in the salts of potash, then in the salts of magnesia, and finally in the salts of soda.

The periwinkles resisted longer than the bivalves, and showed less repugnance to sulphate of soda, in which they lived forty days.

The great buccin succumbs much quicker, as it cannot close its shell hermetically like the periwinkles. At the end of twenty-four days it died in most of the solutions employed, especially in the salts of potash. Its life was prolonged forty-eight hours in solution No. 12, in the sulphate of magnesia, and in the sulphate of soda, but soon came to an end.

During all the time these experiments were going on, from January 10 to March 15, the palourdes and the periwinkles lived in the sea-water of the laboratory, the *Venus reticulata* and the mussels not quite so long, and the buccins only a few days.

It is a very important fact, to which we direct special attention, that the salts which constitute the sea-water and the different solutions which we employed gave to the water the faculty of dissolving variable quantities of atmospheric air. We proved by direct experiments that the solutions of salts of soda retain more air when agitated by it than the solutions of salts of potash. This would, therefore, prove that the poisonous character of the salts mentioned in our experiments is caused in part by the circumstance that they do not let their solutions become sufficiently aërated; their action produced asphyxia. This explains why the sulphate of potash and the sulphate of soda, neutral salts to which the mollusks are by no means adapted, act so differently upon them, the salts of potash killing them quickly and the salts of soda preserving them for some time.

From these experiments the following conclusions have been reached:

1. The saline elements of the sea-water act very differently on mollusks.

2. Every modification in the composition of the sea-water finally becomes fatal to the life of these animals.

3. Their greater or less resistance depends on their organization. Bivalves resist better than spiral shells, and in these two groups the results vary according to the different species.

4. Salts of potash are less favorable to the life of mollusks than salts of magnesia; and salts of magnesia are less favorable than salts of soda.

5. Outside of the salts dissolved in sea-water the sulphate of soda seems to possess a well-established preserving neutrality.

6. The death of the bivalves is caused by a general weakening of the muscles.

7. As the muscles can no longer either draw together or open the valves, the animal is exposed to the unfavorable or poisonous action of the element.

XII.—THE PROTOZOA AND PROTOPHYTES CONSIDERED AS THE PRIMARY OR INDIRECT SOURCE OF THE FOOD OF FISHES.*

By John A. Ryder.

In the course of observations made during the last few years the writer has been more and more impressed with the importance of the Protozoa and Protophytes as an indirect or primary source of much of the food consumed by man. This is notably true of what is known as fish and shell-fish food. As very striking instances of the truth of these propositions we need only to allude to the various edible species of the herring family, the shad, herring, and sardine, the gill-rakers of which are modified so as to enable them to strain the minute living organisms out of the water which is passed through the mouth in respiration; the menhaden or *Brevoortia*, which is of the same family and swarms along our coast, and which in its turn furnishes a large proportion of its food to the edible bluefish, and so serves this tyrant of the sea as a strainer, elaborator, and accumulator, as it were, of the minuter life of the oceanic wastes which it inhabits. The oyster, in like manner, subsisting as it does entirely upon Protozoa, Diatoms, minute ciliated larvæ, &c., reminds us forcibly that for some of the most savory luxuries of the table we are indirectly indebted to the existence of countless hosts of living marine beings which can be rendered visible only with the help of a microscope.

Comparatively few fishes appear to be able to utilize the Protozoa directly as a source of food. The most remarkable exception to this rule was first made known by Professor S. A. Forbes, of Illinois, who found the intestines of certain young suckers or *Catostomidæ* packed with the shells or tests of Difflugian Rhizopods. In the Proceedings of the Academy of Natural Sciences of Philadelphia for 1881, Professor Leidy states that upon examining two slides containing some of the intestinal contents of young *Myxostoma macrolepidotum* and *Erimyzon sucetta* submitted to him for examination by Professor Forbes he was able to distinguish the shells of six distinct species of Rhizopods or test-covered Amœboid Protozoa. The habits of the fishes in question are, however, mud-loving, and since they are provided with a more or less suctorial mouth it is easy to understand how they might readily con-

* Second edition, revised.

sume large numbers of these Protozoans where the surface of the ooze of the bottoms of the streams and pools inhabited by the fishes was favorable to the propagation and healthy existence of the former.

In order to render the vast multitude of Protozoa available as fish-food it is necessary that they be consumed by larger organisms, which in their turn may be consumed by the fishes. Upon investigating the literature relating to the food of the smaller crustaceans, especially of the Entomostraca, which enters so largely into the food supplies of most young fishes and very many adult forms, I find that the almost unanimous testimony of various observers is to the effect that these creatures are largely carnivorous, and subsist mostly upon Protozoa, or the lowest grade of animal existence. In proof of the foregoing the following extracts are here introduced.

In his Natural History of the British Entomostraca, page 6 of the introduction, Dr. W. Baird remarks: "I have no doubt that most of the Entomostraca are essentially carnivorous, and I have frequently seen specimens of *Cypris* in their turn, as soon as dead, attacked immediately by quantities of *Cyclops quadricornis*, which in a few minutes had fasttened themselves upon the dead animal, and were so intent upon their prey that they were scarcely frightened away from it by being touched with a brush. In a short time the *Cypris* might be seen lying at the bottom of the vessel, the valves of the shell separated and emptied of its contents. Leeuwenhoek and De Geer not only maintain that the *Cyclops quadricornis* lives upon animalcules, but that it even preys upon its own young, a fact which I have also noticed myself. Jurine asserts that the *Cyclops quadricornis* is carnivorous from taste, and only herbivorous from necessity; while the *Daphnia pulex* he distinctly affirms lives upon animalcules. Place a few Entomostraca, such, for example, as the *Daphniæ*, *Chirocephali*, *Lyncei*, etc., in a vessel with pure, clear water and only some vegetable matters in it, and they gradually become languid, transparent, and finally die; but mix with this water some which contains numerous Infusoria, and the Entomostraca will then be seen speedily to assume another aspect. They become lively and active, and the opacity of their alimentary canal testifies sufficiently the cause of it. When, indeed, we consider the amazing quantity of animals which swarm in our ponds and ditches, and the deterioration of the surrounding atmosphere which might ensue from the putrefaction of their dead bodies, we see a decided fitness in these Entomostraca being carnivorous, thus helping to prevent the noxious effects of putrid air which might otherwise ensue; whilst they in their turn become a prey to other animals which, no doubt, serve their purposes also in the economy of nature."

"The food of the *Lynceidæ*," says Baird, "consists of both animal and vegetable matter, and while they prey upon animalcules smaller than themselves they in their turn are devoured in great numbers by insects larger than they are."

According to Pritchard the *Chyodorus sphæricus* is the choice food of a species of a fresh water *Nais* which he calls *Lurco*. "So great is the voracity," he says, "of this creature that I have seen a middle-sized one devour seven *Lyncei* in half an hour."

Referring to the *Daphniadæ*, our author again observes: "The food of these animals, according to Straus, consists of vegetable matter, and not animal; but I have found that of two groups placed in separate vessels of clear water, the one having only particles of vegetable matter placed beside them, while with the other there were also introduced infusorial animalcules, the latter were much stronger, more active, and throve better than the former."

This appears to be very strong evidence in favor of the animalcular diet of these crustaceans. Other evidence, too, of quite as convincing a character is not wanting. Those who have been in the habit of collecting quantities of microscopic material from ponds and ditches have frequently observed very large schools of Entomostraca in such places where the water as a rule is not absolutely stagnant, but where an abundance of duck-weed, fresh-water algæ of many kinds, as well as various water plants of the higher orders make a splendid nidus for all kinds of Monads and ciliated and Amœboid Protozoa. These are the places where *Cyclops*, *Daphnia*, and allies flourish inland in fresh water. The writer has also noticed them particularly abundant in the wide river flats near the mouth of the Susquehanna at Havre de Grace, where there are large areas many acres in extent which are covered with a luxuriant growth of *Potamogeton*, *Anacharis*, and *Vallisneria*, making a dense mat of delicate stems and leaves upon which countless multitudes of Protozoa may fix themselves and abide. If in rowing through such masses of aquatic vegetation one will stop the boat and stir carefully among the plants with the hand over the side, and cautiously watch the result, one will often notice that great numbers of Entomostraca have been frightened from their leafy retreats. These are the places where young shad ought to be liberated; in such places they would find an abundance of food at an early period, or as soon as they are fitted to partake of nutriment by swallowing.

Just as we find the fresh-water forms of Entomostraca take to the shelter of aquatic vegetation at the mouths of rivers, so it appears that many of the marine forms seek protection, and probably food, under cover of the fronds of marine algæ. Here is what their most recent monographer says in relation to this point: "A large number of species haunt almost exclusively the forests of *Laminariæ* which grow on rocky coasts at and below low-water mark; the fronds of *Laminaria saccharina* in particular are the favorite abode of many species." (Brady, Monog. Brit. Copep., Introd., i, p. 7.) Again, on page 9, he remarks "The washing of the fronds and roots of *Laminariæ*, which may be dragged up by means of the hooked grapnels used on many coasts by kelp burners, often affords multitudes of Copepoda."

They appear in many cases to be surface swimmers. I have myself seen schools of several thousands of *Daphniadæ* of a greenish yellow color in the ditches south of Camden, N. J., swimming at the surface of the water at midday in the bright sunlight. In the vicinity of Woodbury, in the same State, my friend Mr. W. P. Seal has taken great numbers of a bright-red colored Copepod, apparently related to the genus *Pontella*, and perhaps undescribed. They were sufficiently abundant in some cases to impart a red tinge to the water.

Brady (Monograph British Copepoda) observes in his introduction, vol. i, page 9: "The beds of fresh-water lakes seem to be very sparsely populated with Copepoda, and as to swimming species it may, as a general rule, be said that the weedier the pool and the smaller its extent the more abundant in all probability the Entomostraca.

"Many of the marine species pass their life apparently near the surface of the open sea, and some of these, such as *Calanus finmarchianus*, Gunner, and *Anomolocera Patersonii*, Templeton, are frequently found in immense profusion, the first-named species having been said to form a very important part of the food of the Greenland whale, and it is remarkable that in the Arctic seas not only do the Entomostraca attain an enormous development in point of numbers, but also in individual size, Arctic specimens, for example, of *Calanus finmarchianus* and *Metridia armata* being many times the bulk of those taken in our own latitude." (*l. c.*)

According to H. Woodward, in his article Crustacea, Encyclopædia Britannica, the fecundity of the Copepoda is truly surprising. "*Cyclops quadricornis* is often found with thirty or forty eggs on each side, and though those species which have but a single ovisac do not carry so many, their number is still very considerable. Jurine isolated specimens of Cyclops, and found them to lay eight or ten times within three months, each time about forty eggs. At the end of a year one female would have produced 4,442,189,120 young! Cetochilus is so abundant both in the northern seas and in the South Atlantic as to serve for food to such an immense animal as the whale. They color the sea for many miles in extent, and when the experienced whaler sees this ruddy hue upon the ocean he knows he has arrived at the 'pasture of the whales.' They are to be seen in vast quantities off the Isle of May, in the Firth of Forth, during the summer months. Many Cetacea are attracted thither, and vast shoals of fish also come to feed upon them. One anomalous type of free Copepod is the *Notodelphys ascidicola*, described by Allman, which is found swimming freely in the branchial sack of *Ascidia communis*."

The writer, in passing, would remark that he has frequently met with Copepoda swimming freely in the ventral part of the branchial space of *Mya arenaria*, in which the animals were probably not parasitical or commensal, but had been drawn from without into the respiratory space of the mollusk through the incurrent part of its siphon.

In the same article as previously quoted Woodward observes: "The Cladocera are chiefly fresh water, and are distributed over the whole world. Of this order the *Daphnia pulex*, so abundant in our [British] fresh waters, is a good example. So numerous are they in our ponds in summer as frequently to impart a blood-red hue to the water for many yards in extent. In order to realize the wonderful fecundity of this and allied genera, it is necessary to realize that when a *Daphnia* is only ten days old eggs commence to be formed within the carapace, and under favorable conditions of light and temperature it may have three broods a month, or even a greater number, the larger species having as many as forty or fifty eggs at once."

The remarkable fecundity of the Copepoda explains the extraordinary abundance of the free-swimming species upon the high seas, and even bays, where vast schools of these crustaceans become, in turn, the food of vast schools of herrings, menhaden, and shad. Doubtless, the movements of these fishes on the high seas are determined by the abundance of their favorite food in various localities; that, like the whale, they seek their marine pasture of crustaceans, as argued by Möbius. Even larger forms of fishes, such as the huge basking shark (*Cetiorhinus maximus*), have their branchial apparatus adapted to capture small pelagic organisms in the same way as the Clupeoids. The prodigious numbers of herrings and menhaden is a proof of the abundance of the minute pelagic organisms upon which, with scarcely a doubt, it may be supposed they subsist. It is also not improbable that the vast schools of pelagic Entomostracans are in pursuit of still smaller protozoan prey, upon which they subsist and maintain their marvellous reproductive powers. Mosely, in his "Notes by a Naturalist on the Challenger," observes: "The dead pelagic animals must fall as a constant rain of food upon the habitation of their deep-sea dependents. Maury, speaking of the surface Foraminifera, wrote, 'The sea, like the snow-cloud, with its flakes in a calm, is always letting fall upon its bed showers of microscopic shells.'" Mosely records that he estimated, from experimental data, that it would take four days and four hours for a dead *Salpa* to fall to the bottom where the sea was 2,000 fathoms in depth. The deep-sea fauna is probably well supplied with food from such sources. The researches of Mr. John Murray, of the Challenger, fully confirm, and greatly expand the significance of the views of Lieutenant Maury in relation to the destiny of the marine foraminiferal shells. Wyville Thompson, Voyage of the Challenger, I, 210, observes: "Mr. Murray has combined with a careful examination of the soundings a constant use of the tow-net, usually at the surface, but also at depths from ten to a thousand fathoms; and he finds the closest relation to exist between the surface fauna of any particular locality and the deposit which is taking place at the bottom. In all seas, from the equator to the polar ice, the tow-net contains *Globigerinæ*." Some of these surface Foraminifera are relatively large, *Orbulina universa* being as much as a fiftieth of an inch in diameter, and hence of a sufficient size to be preyed upon by a larger arthropod. The remarkable *Pyrocystis noctiluca*, discovered by Mr. Murray, and nearly a millimeter in diameter, is another interesting surface form, as is also the *P. fusiformis*, which is allied to it. Both are phosphorescent surface swimmers, and fall within the reach of other surface animals as a probable source of food. To these may be added the curious group of the *Challengerida*, together with the whole of the *Radiolaria*, with their siliceous shells, which, in the warmer parts of the high seas, actually tinge the surface when some of the highly-colored forms are abundant. From the surface of the mid-Atlantic the Challenger crew obtained stalked infusorians fixed to the shell of *Spirula*; also an abundance of large radiolarians. Haeckel, Monograph of the Radiolaria, says the largest living Radiolaria measure only a few lines in diameter, but most of them are much smaller, and attain scarcely a tenth down to a twentieth of a line in diameter. At Saint Jerome's Creek, Maryland, in one of its arms which is now used as an oyster park, the writer found an abundance of a fresh-water Heliozoan, not specificially distinguishable from *Actinophrys sol.* They were found in great abundance at times on the surface of the slate collectors which had been put down for the purpose of enabling the free-swimming fry of the oyster to fix itself. This raises the question whether the fresh-water protozoan fauna does not overlap the marine. The water in the situation mentioned was not simply brackish, but positively salt. In the same place great numbers of stalked and tube or test building ciliate forms of Protozoa were also found. The magnificent bottle-green *Freia producta* was found in the same locality in the greatest profusion. Sometimes several hundred might have been counted on a single square inch of the surface of oyster shells, slates, or boards, giving such surfaces a dark-greenish or speckled tint from their numbers. Very small species of nudibranchiate mollusks (*Æolis* and *Doris*) were found creeping amongst and over the forest of Protozoa, pasturing off of them. Amongst the tubes of the *Freia*, and attached to them, a small operculate *Cothurnia*, with a rich brown-colored test, was found in abundance, and, rarely, a very curious form of *Tintinnus*, with a tubular, subulate test, to the inside of which the stalk of the inhabitant was attached, at one side, about half way up from its base. The open or mouth end of the perfectly hyaline test was very strongly toothed, or serrate. The species may be named *Tintinnus Fergusonii.* Another species of *Freia* has been detected on the coast of New Jersey, by Professor Leidy, and, from a verbal description given me by Dr. H. C. Evarts, a species occurs in the vicinity of Beaufort, N. C. So abundant was *Freia producta* in Saint Jerome's Creek that I apprehend that in its free-swimming young state, previous to the time that it commenced to build its test, it afforded not an inconsiderable proportion of food to the oysters planted in some parts of those waters. Besides the *Freia* there were innumerable individuals of *Vorticella* observed. One of these had a very thick brownish cuticle; but for numbers these were again very greatly exceeded by the compound stalked genera of bell-animalcules. Upon the very common alga, *Laminaria*, these were abundant, and upon the fronds of another alga, the *Grinnellia*, in three or four fathoms of water, near the middle of the Chesapeake, their number was truly astounding. In a few such places where these algæ were dredged up from the bottom, covered with innumerable colonies of protozoans, it would doubtless be much within bounds to state that there were 1,000 individual protozoan zoöids to the superficial square inch of frond surface. At this rate there would be 39,204,000 zoöids found to populate a single square rod of frond surface. Estimating the number at only 100 per square inch, which is low, and which would, I think, represent a fair average over considerable areas where the conditions of life were favorable, there would still be a stalked protozoan population of nearly four millions to the square rod. The most abundant of these compound forms was one which very much resembles *Zoöthamnium alternans*, Claperède, found on the west coast of Norway. The same form was again found in vast abundance upon algæ in Cherrystone River, near the mouth of the Chesapeake, during the season of 1881. Upon one occasion I found it in great abundance growing on the parts of the body of a *Pinnotheres* which was living in the gill cavity of an oyster, its swarmers, or young, as they were thrown off, in all probability forming part of the food supply of the mollusk.

I have been interested upon several occasions to observe that the very minute stalked, collared monads, *Salpingœca* and *Codosiga*, are frequently to be found attached to the stems of the compound colonies of bell-animalcules, or gathered about in the vicinity of the point of attachment of a single one. In such cases the monads appear to derive a benefit from the currents or vortices set up in the water by the waving of the ciliary crowns of their giant neighbors, which bring particles of food to their very doors as it were. On one occasion I found individuals of a species of *Vorticella* fixed to the egg-membrane of the ova of the cod-fish at Wood's Holl, Massachusetts, as had been previously observed by R. E. Earll, and in their vicinity were several colonies of a compound stalked monad, resembling the *Dinobryon* of Ehrenberg. On another occasion I found something like *Poteriodendron* on the *Zoöthamnium* which covered a *Pinnotheres* inhabiting an oyster; but the chain of parasitism did not stop here, for on the monad as well as on the bell-animal there were rod-like bodies attached which were presumably bacteroid, as has been supposed by Stein. Stalked monads are probably much more common than has been supposed, which reminds me that I have detected the occurrence of *Rhipidodendron splendidum* in the bogs and ponds of New Jersey, a form which was described originally by Stein from Bohemia. Minute as the stalked monads are, they must live on still minuter beings, probably upon Microbia, or *Schizomycetës*, a group of fungi, now known to be the active agents in putrefactive changes and proven in some cases to be at least the vehicles of infection in certain diseases. These organisms, which are very minute, are the first to appear in disintegrating or putrefying organic infusions. If small Protozoans, such as *Paramœcium*, are left to die in improperly aërated water, or water otherwise hurtful to them, they are, under favorable conditions, immediately attacked by these *Microbia*,* which then in their turn become an indirect source of supply of food for the grades next above them, such as the free and fixed ciliate Protozoa, which feed upon monads which have themselves fed on Bacteria or Bacillus-like organisms, and so onward the matter of life takes its upward way.

The process of swallowing of many ciliate infusorians is as peculiar as it is interesting. An opening, oftenest at one side of the body, is the mouth, from which a short blind canal passes into the soft substance of the animal's body. The rapid vibration of rows of cilia in the vicinity of the mouth creates currents which set in the direction of the throat, the lower end of which is dilated into a globular space by the force of the currents produced by the cilia, in which the particles of food are rotating in the contained water. This space enlarges gradually until eventually its connection with the throat is suddenly broken by a collapse of the walls which join the globular space with the former. In this way food-vesicle after food-vesicle is taken into the body of the animalcule, from which the creature will abstract whatever is useful and cast out near the mouth whatever is contained in the food-vesicles that is indigestible. The writer has seen the process in a number of forms, and it is not unusual to observe a dozen or more food-vesicles in the body of a single Protozoan. Many parasitic forms, however, are mouthless, such as *Opalina*, *Benedenia*, *Pyrsonympha*, *Trichonympha*, etc., where the nourishment is probably obtained from their hosts by transudation through the body-walls. In other forms again comparatively large objects are swallowed with apparent ease, judging from shells of other protozoan types which are found within their bodies. Such a form I encountered in a slightly brackish water pool near New Point Comfort, Virginia, during the summer of 1880. It was apparently a very large species of *Prorodon* of an irregular cylindrical form which had in a number of instances swallowed five or six large Difflugians, *Arcella vulgaris*, the shells of which remained within the animal to testify to the nature of the food it had been devouring. Some other mode of swallowing such large prey is probably practiced by this large ciliate, very different from the method first described. In the same pool a very

* Or *Schizomycetës*, the germs of which are abundant in the surrounding air, and from which the infection in such cases is derived. In some cases it may be observed that the body of the dead Protozoan is attacked at one side, which becomes the center of multiplication, from whence the putrefactive organism multiples by germination, gradually invading and appropriating the dead protoplasm of the organism upon which it feeds. These forms seem to have little or no power of forming living matter *de novo* from ammonia, carbonic dioxide, and water, but, like animals, appropriate pre-existing living matter, or such as has ceased to manifest vital phenomena.

peculiar form of hypotrichous Infusorian was detected, which was clearly very nearly allied to *Chilodon cucullulus* of Ehrenberg, but the dorsal, non-ciliated side of its body was not gently rounded, but flat, with a prominent crenate rim surrounding it. From this peculiarity it may be called *Chilodon coronatus*.

The mode of swallowing their food adopted by the fresh-water Rhizopods has been elaborately described in a few instances by Professor Leidy in his splendid monograph of this group, published by the Geological Survey of the Territories. Their food appears to be mainly vegetable, and consists, for the most part, of diatoms and desmids, though a ciliated Protozoan or Rhizopod was occasionally met with in the body of *Amœba*. The marine Rhizopods appear to be herbivorous as well as carnivorous, remains of both Protophytes and Protozoa having been detected in their bodies. *Vampyrella* has been described as almost parasitic upon the clustered frustules of *Gomphonema*.

Some aberrant ciliated forms, like the *Gastrotricha* and *Coleps*, are somewhat peculiar in their organization, and we know little of their feeding habits.

The *Suctoria* or *Tentaculifera*, which are abundant in some places, both in fresh and salt water, appear to be indiscriminately herbivorous, as well as carnivorous. In fresh water I have met with them infesting the back of the common water leech, *Clepsine*, the species being apparently *Podophrya quadripartita*. Of marine forms I have seen but two that I could regard as distinct from each other; the one, a very common form, is the old and well-known *Acineta tuberosa* of Ehrenberg, with two clusters of suckers. This form I have frequently seen with diatoms which it had seized and from which it was abstracting nutriment. The other form was much larger than the preceding and appears to be identical with the species described under the name *Podophrya gemmipara* by Hertwig. It has the same robust stalk, with the same close transverse annular markings, the same taper, and is similar in the form of the tentacles, which are often irregularly bearded or swollen. I was enabled to observe in part its development, which is also similar to that of the Helgoland species of the North Sea, above mentioned. They were found in great abundance on the surface of the fronds of *Laminaria*, together with the *Acineta tuberosa;* not as abundantly, of course, as the *Zoöthamnium*, but in sufficient numbers to make them a very considerable factor in the protozoan life found in the vicinity of New Point Comfort.

The majority of the free Protozoa and many Monads, such as *Nocti luca*, have scarcely been considered, but enough has been said, I think, to give some idea of the actual importance of the minute animal and vegetable life of the sea to make it clear that there is a most intimate relation of dependence existing between the lowest and the intermediate forms of life. Why is it, for example, that we should find the Copepoda so abundant among the *Laminaria* along the sea-coast? Have we not shown that on the fronds of these algæ there exists, in most instances, almost a forest of protozoan life upon which these creatures may be supposed to pasture? We do not find the *Laminaria* itself eaten. Again, the foraminiferal and radiolarian fauna of the high seas appears to be in great measure, a surface fauna, according to the evidence of a number of investigators. This fact appears to have an important relation to the vast shoals of Copepoda observed at the surface of the sea by various naturalists and expeditions. It is not to be supposed, however, from what has been said, that the Copepoda are the only consumers of this vast array of individual Protozoa. Cross sections through the oyster, which the writer has prepared and mounted, show the tests of various genera and species of diatoms mixed among the indigestible earthy matters and sediment which has been swallowed along with the food. It is probable that the oyster swallows and digests many of its own embryos, and not improbably many embryos of such forms as Bryozoa and Sponges, besides the Diatoms, Desmids, and Protozoa which make up the most of its food. Ordinarily the contents of the stomach of the oyster are too much disorganized to learn much about what it has recently swallowed, hence we are at a great loss to know just exactly of what all of its food consists. Just so with the Copepoda; they themselves are doubtless eaten by other Crustacea, these in turn by others. We saw that *Doris* and *Æolis* pastured upon the forests of fixed Protozoa, just as *Planorbis*, *Lymnaeus*, and *Physa* pasture upon the Protozoa, Algæ, Diatoms, and Desmids, in fresh water. The great abundance of Copepoda and Amphipoda is, however, the best evidence of the abundance of still smaller forms adapted to furnish them with food. What multitudes of forms besides Copepoda must largely subsist upon the Protozoa and Protophytes? Of such groups we may name the Lamellibranchs, Pteropods, Worms, Bryozoa, Porifera, and, doubtless, many Cœlenterata. Some of these, notably the Lamellibranchs, could probably not exist were it not for the numerous Protozoa and Protophytes, upon which, from necessity, they are compelled to feed.

What is true of the fauna of the sea appears to be in an equally great measure true of the faunæ of fresh water ponds, lakes, and streams. Recently I investigated some *Daphniadæ* which had been kept for some time in an aquarium; to my surprise I did not find any recognizable remains of animal food in the intestines. The latter were, however, entirely filled with a sarcode-like material, doubtless in part a digestive secretion, together with what might have in part been animal food. The vegetable food, consisting of Diatoms, unicellular Algæ, spores of Fungi, fragments of Oscillatoriæ, were so sparingly mixed with the intestinal contents that they could not be regarded as contributing much to the nutrition of the animal. The black or brown material, sometimes filling the intestine of Entomostraca, I find to consist in great part of humus, particles of quartz sand and earthy matters, which are of course indigestible, being thrown out of the vent, as in *Chirocpehala*, in the form of cylindrical casts.

The most valuable contribution to our knowledge of the food of the fresh-water fishes of the western United States has been made by Professor S. A. Forbes, in Bulletins Nos. 2 and 3 of the Illinois State Laboratory of Natural History, for the years 1878 and 1880. With the most painstaking care the results of a vast number of examinations are recorded. He finds that the Darters, Perches, *Labracidæ*, Centrarchoids or sun-fishes, Sciænoids, Pike, Bony Gars, Clupeoids, Cyprinoids, Suckers, Cat-fishes, and *Amia*, both the young and adults, consume large numbers of small aquatic, and occasionally small terrestrial organisms, notably the smaller Arthropods. While many of the more voracious species, both young and adult, feed on their immediate allies, the dietary of the fishes of Illinois, according to this observer, includes Mollusks, Worms, fresh-water Polyzoa, Hydrachnidæ, insects of both mature and and larval forms; Crustacea, embracing Decapods, Tetradecapods, Amphipods, Isopods, and Entomostraca of the groups Cladocera, Copepoda, and Oscracoda; Rotifera, Protozoa, vegetable matter, and Algæ. In his first paper he also gives a list of the organisms found in the stomachs and intestines of the Pirate Perches, *Gasterosteidæ*, *Atherinidæ*, *Cyprinodontidæ*, *Umbridæ*, *Hyodontidæ*, and *Polyodontidæ*. Both are accompanied by elaborate comparative tables, and, in an economical sense, are of the greatest practical importance in their bearing upon fish culture.

It has, however, been known long ago that fishes consume large quantities of small *Crustacea*, as will be seen from the following extract from Dr. Baird's work:

"That the Entomostraca form a considerable portion of the food of fishes has long been observed, and it is very probable that the quality of some of our fresh-water fishes may in some degree depend upon the abundance of this portion of their food. Dr. Parnell informs me that the Lochlevin trout owes its superior sweetness and richness of taste to its food, which consist of small shells and Entomostraca. The color of the Lochlevin trout, he further informed me, is redder than the common trout of other localities. When specimens of this fish have been removed from the loch and conveyed to lakes in other places the color remains, but they very soon lose that peculiar delicacy of flavor which distinguishes so remarkably the trout of Lochlevin. The experiment has been repeatedly tried and always with the same results. The banstickle (*Gastrosteus trachinus*) devours them with great rapidity, and I have seen two or three individuals clear in a single night a large basin swarming with Daphinæ and Cyclops, etc."

The writer would also refer to articles on the food of fishes in the Reports of the United States Fish Commission for 1872 and 1873 by Professors Milner and Smith, and to papers by Widegren and Ljungman on the Copepodan food of herring. Also a paper by Dr. C. C. Abbot in the same report, for 1875 and 1876, on the winter habits of the fishes of the Delaware. Möbius has found pieces of Algæ, besides Shells, Snails, Crabs, and fishes in the stomach of the cod. The writer has found the stomach of the sheep's-head filled with the remains of the shells of mussels and large quantities of the slender branches of the common bright red sponge, *Microciona proliferum*, bitten off in short fragments by the incisor-like teeth of the fish, and with the red sponge sarcode partly digested out of its skeleton. It is presumed that the sponge feeds upon protozoan life, and on account of its peculiar dentary armature the sheep's-head is singularly well fitted to pasture upon sponges and thus indirectly appropriate Protozoa as nourishment. The same remark applies to the molluscan food of this fish.

In young shad from Capehart's fishery, Albemarle Sound, said to have been three weeks old, I found the remains of a number of adult *Tipulidæ*, or crane-flies, in the intestine. This reminds me that in examining the larvæ of crane-flies some years ago I was struck with the fine comb-like fringes which garnish the edges of their wide oral appendages, and which are so extended in life when the larva is in motion as to constitute a sort of basket which opens downwards and forwards apparently to strain out of the water the small organisms which constitute its food. Here again we have young shad feeding upon an arthropod which has passed its larval existence feeding in great part upon Protozoa. Westwood (Introd., ii, 511) I find makes a similar observation in regard to the larvæ of the gnat or mosquito family. He says: "The head is distinct, rounded, and furnished with two inarticulated antennæ, and several ciliated appendages, which serve them for obtaining nourishment from their food."

The fixed Tunicates are probably as dependent upon the microscopic life swimming about them in the water as the Lamellibranchs. The Barnacles in like manner, immovably fixed during their adult existence, kick their minute food into their mouths with their filiform legs, as remarked by Huxley. In *Pedicellina americana*, abundant in Saint Jerome's Creek, I have observed that there are rows of vibratory cilia continuous with those of the tentacles around the edge of the lophophore, which appear to lie in grooves, which blend on either side of the excentrically placed mouth. In this manner the microscopic food of this curious Bryozoan is conveyed in ciliated grooves to the mouth from all points of the oral disk. With these we may close our survey of the modes in which the protozoan grade of life is appropriated the smaller Arthropods, Pteropods, Polyzoa, Annelids, and Tunicates, but we must remember that upon these again the larger forms subsist, which are either food for each other or for man. As we pass in succession the larger forms, we may note the Lamellibranchiates, with this garniture of vibratory cilia covering the gills and palps, and which carry the particles of food and sediment suspended in the water used in respiration to the mouth to be swallowed. The Clupeoids and *Cetio-*

rhinus with their branchial sieves are particularly noteworthy for the perfection of the apparatus of prehension, but we must not forget that the gill-rakers of all fishes, whenever developed to any extent, probably subserve a similar function. Lastly, the right-whales, with their closely ranged plates of baleen suspended from the upper jaws, forming in reality a huge strainer or filter for the large volumes of sea-water which pass through the mouth, and from which the food of these marine giants is so simply obtained, will enable us in a measure to comprehend the importance of the minute life of the world, and its indirect but important economical relation to man.

THE FOOD OF THE YOUNG SHAD.

The periods of yelk-absorption.—In a previous paper by the writer on the retardation of the development of the shad it was stated that the yelk-sack disappeared on the fourth to the fifth day after the young fish had left the egg. Although this statement is in a broad sense true, I find upon more accurate investigation that there is a small amount of yelk retained in the yelk-sack for a much longer time. It appears in fact that there are really two periods of absorption of the yelk which may be very sharply distinguished from each other. The first extends from the time of hatching to the end of the fourth or fifth day, according to temperature, during which time the most of the yelk is absorbed. The small quantity which remains after this time is not visible externally, being contained in a small fusiform sack, all that remains of the true yelk-sack inclosed by the abdominal walls, and causes little or no visible prominence on the under side of the young fish. Viewed as a living transparent object from the side, we see it in the young fish lying below the œsophageal portion of the alimentary canal immediately in front of the very elongate liver, and behind the heart, with the venous sinus of which it appears to communicate by a narrow duct formed of the anterior portion of the yelk hyboblast, which formerly covered the distended yelk-sack. The appearances presented by the living transparent objects are fully confirmed by the evidence obtained from transverse sections of embryos from ten to twelve days old. It appears that the yelk-sack of the California salmon probably behaves in a somewhat similar manner as indicated by transverse sections. I even find this slight rudiment of the yelk-sack in shad embryos fourteen to sixteen days old, but this seems to be about the period of its disappearance. The second period of the absorption of the yelk therefore extends in the shad over about twice that of the first, or about ten days. The first period extends to the time when the yelk-sack is no longer visible externally, the second from the time the remains of the yelk-sack become inclosed in the abdomen until its final and complete absorption. The function of the yelk-sack during the first period appears to be to build up the structures of the growing embryo; during the second, not so much to build it up as to sustain it in vigorous health until it can capture food to swallow and digest, so that it may no longer be dependent upon the store of food inherited from its parent.

The appearance of the teeth.—Minute conical teeth make their appearance on the lower jaws and in the pharynx of the young shad about the second or third day after hatching. Sections through the heads of embryos show that these teeth are derived from the oral, hypoblastic lining of the mouth. There are none on the upper jaw; there are four arranged symmetrically on the lower jaw, or rather Meckel's cartilage. In the throat, in the vicinity of the fifth and last branchial arch, there are two rows of lower pharyngeal teeth, the first of six, three on a side; the last of four, two on a side. These teeth are of the same form and size as those on the jaws.

The age at which it begins to take food.—Although peristaltic contractions of the walls of the intestine of young shad may be observed soon after hatching, I have never observed food in the alimentary canal until ten or twelve days after the young fish had left the egg. At about the beginning of the second week considerable may be seen in living specimens. But the intestine is often not yet very densely packed with food even at this period. At the age of three weeks an abundance of food is found in the intestine, that portion which becomes the stomach and which extends from the posterior extremity of the liver to near the vent being greatly distended with aliment.

Upon investigating the nature of this food material we learn that it consists almost entirely of exceedingly small crustaceans, in reality for the most part of the very youngest *Daphniadæ* and *Lynceidæ;* only once did I find what I thought might be very small *Ostracoda* or *Cypridæ*. In some instances the undeveloped larvæ of *Daphniæ* were noticed. In a few cases green cellules were observed in the intestines of shad larvæ, resembling *Protococcus*, but as this material appeared to be accidental it is probably not an important element of shad food. In the young fishes the dark, indigestible remains of the food of the *Daphniæ* always remained, together with the hard chitinous parts, as long-curved cylindrical casts which preserved the shape of the intestines of the crustaceans. In one young shad, twenty-two days old from the time of impregnation, measuring 14 millimeters in length, I estimated from a series of sections through the specimen that it must have consumed over a hundred minute crustaceans.

The oldest specimens of artificially reared shad which came into my hands were some that had been overlooked in some of the hatching apparatus at Dr. Capehart's fishery in North Carolina, where they remained for three weeks after hatching. In that time they had grown to a length of 23 millimeters, or almost one inch. The air-bladder was more developed and the stomach was more decidedly differentiated than in any previous stage. In the intestines of these I found, beside black, earthy, and vegetable indigestible matter, the remains of the chitinous coverings of small larval Diptera, and the remains of a very small adult crane-fly, besides Entomostraca allied to *Lynceus*. In these specimens the dorsal fin had the rays developed, the continuous median larval natatory folds having by this time disappeared.

The mode in which the young fish capture their Entomostracan prey may be guessed from their oral armature. Most fish larvæ appear to be provided with small, conical, somewhat backwardly recurved teeth on the jaws. Rathke, in 1833, described the peculiar hooked teeth on the lower jaw of the larvæ of the viviparous blenny, and Forbes has observed minute teeth on the lower jaw of the young *Coregonus albus*. I have also met with similar teeth on the lower jaw of the larval Spanish mackerel.

THE FOOD OF THE ADULT SHAD.

The mouth of the adult shad, as is well known, is practically toothless, and in the throat there are no functionally active teeth, as in the larvæ, so that the latter, in reality, have a relatively much better developed dentary system than their parents. The adult, moreover, probably feeds in the same way as the generality of the Clupeoids, that is to say, by swimming along with the mouth held open, as I have frequently observed is the habit of the menhaden in its native element. In this way the water which passes through the branchial filter is deprived of the small animals which are too large to pass through its meshes and be swallowed.

It is a common remark of the fishermen that it is seldom that one finds food in the stomach of the adult shad in fresh water; indeed, from personal observation, it is rare or exceptional. The writer has heard many fishermen express their belief, based on this singular fact, that this fish did not feed at all in fresh water during the spawning season. With this unreasonable opinion I cannot coincide, and I have no doubt but that the shad feeds in fresh water, as well as in the sea, upon such small animals as are liable to be captured by its prehensile apparatus. That it does probably capture large numbers of small crustacea in fresh water the following observation will show: A spawning female, captured about twenty miles from Washington, down the Potomac, when the stomach was opened, was found to contain about a tablespoonful of Copepoda, apparently a *Cyclops*, and very similar to the common fresh-water species. This is the only instance in which I found a large amount of food which appeared to have been recently captured, since the carapaces and joints of the antennae and body were still hanging together, with the soft parts partially intact, showing that they had probably been recently swallowed and but partially digested. Upon examining the intestine, however, I invariably found the remains of Copepoda imbedded in the intestinal mucus, the most conspicuous and constant evidence of which was the presence of the hard chitinous jaws of these creatures. This was the invariable rule, even where there was no food discernible in the stomach. Besides the remains of Copepoda observed, there were almost invariably present in the intestine green cells, apparently of algous origin; occasionally there were also seen the remains of large crustaceans, possibly shrimps or Amphipods, but these were so mutilated and disorganized that the evidence of their presence is founded only upon the occurrence of single joints or fragments. The tests of rotifers and the shells of Diatoms of both discoidal and naviculoid forms were also observed.

Upon the foregoing facts the writer bases his conclusion that the shad does feed in fresh water.

If it were of any advantage we might speculate upon the relations subsisting between the smaller and larger aquatic and marine forms of life, but perhaps enough has been said to show that there is an extensive basis of fact to support what is implied by the title of this paper. The manifold adaptations and contrivances by which food is obtained by organisms which prey upon others, and how the tendency to accumulate the vast amount of the "physical basis of life," represented by the existing Protozoa and Protophytes is practically realized by the hordes of Entomostraca and other small animals with which both fresh and salt waters teem. How these again are accumulated in appreciable quantities so as to furnish an important source of food is shown by the immense numbers, amounting to many thousands, which may be taken from the stomach of a single fish. In the case where the large quantity of Copepoda was obtained from the stomach there were probably more than 100,000 individuals of these crustaceans, which would average a fifteenth of an inch long and a fiftieth of an inch wide. This fact will serve to show how fine the meshes of the branchial sieve must be to prevent the prey of the shad from escaping from this remarkable collecting apparatus. The soft parts, too, of the individual crustaceans were so well preserved that one could distinguish the pigment of the eyes, the muscles, and intestine with its contents, while the vast number of their eggs mixed amongst their bodies testified to the multitudes of females which had been swallowed. These facts would appear to indicate most positively that the fish had captured its food quite recently and after it had reached quite fresh water.

XIII.—THE FIRST FOOD OF THE COMMON WHITEFISH.

(*Coregonus clupeiformis, Mitch.*)

By S. A. Forbes.

In a very large lake the conditions of life are remarkably uniform. The volume of water remains, of course, constant from season to season and from year to year, and the extremes of summer heat and winter cold have but a moderate effect upon the temperature of the lake as a whole. Consequently both plant and animal life exhibit there a regularity and stability which are in remarkable contrast to their fluctuations in smaller bodies of water and on the surrounding land. Not only do the relative numbers of individuals in the various species remain about the same, but the absolute number of each must necessarily change but little, as a rule.

Such a state of affairs is eminently favorable to an exact and *economical* balance of supply and demand, of income and expenditure, of multiplication and destruction, among the inhabitants of the lake. Here every species of animal, whether predaceous or vegetarian, must find, in the surplus products of growth and reproduction among the species upon which it depends for food, a far more constant and unvarying supply for its needs than elsewhere; and the species fed upon must be subject to a far more regular drain upon their surplus numbers or unessential structures. Where there is little fluctuation there is little waste.

A system of life like this, running on with relatively even tenor for centuries, must of course be much less *flexible* than one where wide and violent fluctuation and continual readjustment are the rule; and a species in any way deeply affected will here have within itself far less recuperative power than one which has been forced again and again—each year, perhaps—to rally against the most destructive attacks as the price of its continued existence. Disturbances of the natural balance of life, of the primitive and spontaneous system of reactions by which the different groups of organisms are related, will therefore be unusually serious and lasting; and where such disturbances result from human interference, as by the yearly capture of large numbers of any important fish, it is especially desirable that artificial means of compensation be taken to restore the disturbed balance as nearly as possible. Excessive loss will be made good by natural reactions far more slowly than if it occurred to a pond or river species, accustomed, as most of the latter are, to fill up rapidly enormous gaps in their numbers.

On the other hand, to multiply *unduly* by artificial measures any species naturally abundant in such a lake will have scarcely a less disturbing influence than to *diminish* its numbers in the same ratio. The relatively nice balance between the demand for food and food supply which here naturally obtains is such that an extraordinary increase in a species must soon react to diminish greatly its food resources—a fact which will then take effect on the species itself, reducing it below its natural original level; and if both excessive capture and excessive multiplication go on side by side we shall have this result finally aggravated to an extreme degree.

As fishes are caught before the end of their natural lives, but planted by the fish-culturist when young, it is evidently the food of the young which will be first and most seriously affected by overproduction. Only a part of the adults, perhaps a small fraction, will live a life of ordinary natural length, many being captured before they have attained even the average size; but a far greater number, perhaps nearly every one, must survive the earliest period and must consequently draw most heavily upon the earliest food resources of the species when these differ from those of the adult.

The above considerations are brought forward here to show the especial importance to us of a study of the system of natural interactions by which the animals of our great lakes affect each other, if we would avoid the necessarily injurious consequences of our own interference with the natural order there obtaining, and above all to show the extraordinary value of a knowledge of the food habits and food capital of the *young*. They apply perhaps more forcibly to the whitefish than to any other species in the lakes; because this is for several reasons the most important purely fresh-water fish of the Great Lake region, and proves to have a distinctly different food when young from that upon which it is dependent later.

According to the recent census report,* more than twenty-one million pounds of whitefish were taken in the Great Lakes in 1879, valued at over three-quarters of a million dollars, and representing nearly half the total sum derived from the lake fisheries of all kinds. These fisheries employ over five thousand men, and a fixed capital of one million three hundred and forty-six thousand dollars. When we reflect that this enormous drain upon the number of the species is necessarily, to a considerable extent, an addition to the natural tax levied upon it by its enemies other than man, we see that there must be an artificial supply provided, or the fisheries will gradually fail.

The importance of the knowledge of the food of so valuable a species needs no demonstration, especially when we consider that, consistently

*Census Bulletin No. 261, September 1, 1881.

with what has been said above, it may not be difficult to overdo the work of propagation.

If the whitefish were to be multiplied indefinitely, without any attention to the character or abundance of its food supply, it would soon reach such a number that it must infringe upon its own food capital, diminish the average number of the animals upon which it depends for subsistence, and so finally indirectly cripple itself. Then the money and labor expended in its culture would be principally lost, and the last state of the species would be worse than the first. An acquaintance with the food of the young is especially necessary, because they are planted by the fish-culturist when, having already absorbed the egg-sack (the supply of food by which they are under natural conditions supported until they have time to scatter themselves widely through the water), they are in a peculiarly helpless condition, unable to wander far in search of subsistence, and compelled to find food speedily or perish. One would say, therefore, that their alimentary resources and habits should be well and thoroughly known, that the range, period, and abundance of the organisms upon which they feed should be carefully determined, and that each locality where the young are deposited should be closely searched for the purpose of ascertaining whether their food species occur there at the time in sufficient quantity to prevent immediate starvation.

Previous studies of the food of young fishes of a variety of families, reported in the third paper of this series, had shown that, with exceptions presently to be mentioned, the earliest food of all the families studied consisted almost wholly of various species of Entomostraca and some equally minute and delicate dipterous larvæ. When that paper was prepared, I had, however, no opportunity to study the food of the young of any members of the family Salmonidæ, to which the whitefish belongs, neither could I learn that any such studies had been made by others; and I could only infer the same fact with regard to this family from the general character of the results obtained by the study of the other groups. Even this inference, however, was rendered doubtful by the discovery that the youngest individuals of two of the toothless families (Catostomidæ and Cyprinidæ) were not strictly dependent upon the food elements above mentioned, but were likewise able to draw upon much smaller organisms, namely, the minutest Protozoa and unicellular Algæ; and as the adult whitefish is likewise destitute of teeth, it was not by any means certain that their young would not fall under the latter category. Upon looking up the literature of the subject, I found that, although the food of the adult had been very well made out in a general way,* only two items had been published respecting the food of the young. In the report of the United States Fish Commission for 1872–'73, an assistant commissioner, Mr. J. W. Milner, made some experiments on young whitefish hatched artificially, sup-

* Report of the United States Fish Commission for 1872–'73, pp. 44–46.

plying them with a number of articles of food, in the hope of finding something suitable for their nourishment.

"A few crawfish," he says, "were procured and pounded to a paste, and small portions put into jar No. 1; the young fish ate it readily. They were fed at night, and the next morning every one of them was found to be dead. Jar No. 2 was supplied with bread crumbs, and the fish were seen to take small particles in their mouths; they did not die so suddenly. Jar No. 3 was supplied with sweet cream, but no evidence was afforded that the occupants fed upon it. A quantity of rain-water was exposed to the rays of the sun for the purpose of generating minute forms of life, and a teaspoonful was poured into jar No. 4, morning and evening, in the hopes that their proper food was of this character. In jar No. 5 a variety of food was provided—dry, fresh beef, milk, boiled potato, and bread. The crumbs of bread and the scrapings from the beef were all that the fish were seen to take into their mouths. They died, one after another, very rapidly, and in a few days all were dead." He further remarks: "This difficulty of procuring a suitable food for the young whitefish has been the experience of the few fish-culturists who have hatched them."

With the hope of ascertaining the natural food of these fishes, a few specimens, representing young captured in the Detroit River, and others from the hatchery, were submitted by Mr. Milner to Mr. S. A. Briggs, a microscopist, of Chicago. Four examples were examined by Mr. Briggs, two from each of the above situations. Those from the hatchery contained nothing whatever, while those from Detroit River contained numerous specimens of two species of Diatomaceæ, viz, *Fragilaria capucina* and *Stephanodiscus niagaræ.* The only fact at that time known would consequently indicate that the earliest food of the species consisted of Diatomaceæ.

The whitefish, as is well-known, lays its eggs in the open lake in autumn, the young not appearing until early in the following spring. At this cold and stormy season, in the exposed situations where they are to be sought it is practically impossible to find the young fish; a fact which rendered the study of their earliest food a subject of unusual difficulty. There seemed, in fact, no practicable way to reach satisfactory conclusions upon it except by experiment upon individuals artificially hatched.

In December, 1880, I made an arrangement, through the kindness of Professor Baird, of the Smithsonian Institution, with Mr. F. N. Clark, superintendent of the United States fish hatchery at Northville, Mich., for a supply of young whitefish to be sent me at intervals from the hatchery under his control. The specimens furnished were taken from two lots. The fishes of one lot, hatched January 18, were kept in a tank in the hatchery, where they were supplied with water from a spring, which had been cooled by exposure to the air in artificial ponds before entering the hatchery, in order to retard the development of the fry. The ordinary range of temperature in the tank was from 35° to 39°. These fishes were fed daily with a paste made by grinding small amphipod crustaceans (Gammarus) in a mortar.

The second lot, hatched January 20, was kept, unfed, in a perforated tin box, in a rivulet flowing from a spring, about 60 feet from its source. The water had a uniform temperature of 47°.

Those in the spring, being in warmer water than the others, developed much more rapidly, and it was believed that the character and source of this water was such as to furnish them at least a small supply of such food as young fishes are accustomed to appropriate.

Ninety specimens were received from the hatchery February 9, at which time they were three weeks old. They were thirteen mm. (half an inch) in length by one in depth. The egg-sac was but partially absorbed in most of the lot, but in those most advanced was represented by an oil globule back of the head. The pectoral fins were well developed, but no trace of the ventrals had as yet appeared. The single median fin extended well in front of the vent, and forwards on the back nearly to the head. The opercles did not fully cover the gills. The most highly developed specimens—those whose gill-sacs had nearly disappeared—had, at a short distance on either side of the symphysis of the lower jaw, a sharp, strong, raptatorial tooth, curved backwards and slightly inwards. The base of this tooth was very broad, and the point acute and slender. At a point behind each of these teeth, about half their distance from each other, was a second much smaller tooth, directed almost exactly inwards. The upper jaw was, however, wholly toothless.

These fishes were all passed under the microscope, after having been rendered transparent, but only four of them contained anything whatever; three a little dirt, and the fourth a minute fragment of the crust of the Gammarus, with which they had been fed.

Of one hundred and eleven specimens received February 17, seventeen had taken food. I dissected nine of these and found fragments of Gammarus and nothing else. Ninety specimens from the same lot were examined February 25, and food was found in fourteen. Four of these had eaten Gammarus fragments; two, larvæ of gnats; one, a small Cypris, and eight contained small fragments of the leaves and stems of vascular plants, including a bit of a netted-veined leaf and a little piece of pine wood. Thirty-nine specimens, the last of the lot, were received March 15, and food was found in fourteen. I dissected nine of these, finding fragments of Gammarus in four, a larva of a gnat, a Chironomus larva, a larva of some undetermined fly, a minute vegetable fragment, a Cyclops, a Cypris, and an undetermined Entomostracan each in one. Three hundred and forty fry from the hatching-house were examined in all, in forty-seven of which (fourteen per cent.) more or less food was discernible. Of the thirty-five dissected, eighteen had eaten Gammarus fragments; five, minute insect larvæ; four, Entomostraca, and eight, small particles of vegetation.

Only four lots were received from the spring, on the 9th, 14th, 17th, and 25th of February, after which all died of starvation. In the first hundred only one was found which had taken food, and this had eaten a trace of filamentous Algæ and a minute fragment of the parenchyma of some higher plant, with a few diatoms. But one of the second hundred contained even a trace of food, a minute quantity of some thread-like Alga, the cells of which still contained a little chlorophyll. In the third hundred likewise, food was found in but one. This consisted of a few particles of vegetable parenchyma, doubtless derived from the decaying plant structure in or around the water. In the third lot of only forty-two specimens, six showed traces of food, consisting almost entirely of a few filamentous Algæ (including a fragment of Oscillatoria) and a little vegetable parenchyma. Desmids and diatoms were observed in trivial numbers.

The total number received from the spring was two hundred and forty-two, of which but eight were found to have eaten anything (a little over three per cent. of the whole), and these had taken only Algæ and vegetable fragments.

An example of the water of the spring sent me contained many Algæ but no animals larger than rotifers. The water of the hatchery, being exposed in ponds of considerable size, afforded a better opportunity for the development of animal life, to which fact was doubtless due the occurrence of insect larvæ and Entomostraca in the intestines of the fishes reared in it. The situation of the spring, on the other hand, was particularly unfavorable, as it was under the hatchery, and consequently in the dark.

The observations above described on the specimens kept in spring water have but little value, for the reason that evidently very little food was contained in the water flowing through their cage. The vegetation in the streams being chiefly filamentous Algæ and the number of Entomostraca apparently trivial, very little of either vegetable or animal food could reach the little prisoners. It is not surprising, therefore, that, notwithstanding their greater age and the higher temperature of the water in which they were kept, a much smaller ratio of the specimens had taken food than of those captured in the hatchery. From the contents of their intestines we can only infer that these fishes, reduced to a desperate strait by starvation, will snatch at almost anything contained in the water. The result obtained by a study of those from the hatching-house was more significant, but still unsatisfactory. It seemed to indicate that in confinement whitefish fry will feed upon both animal and vegetable structures to some extent, and that they can be induced to take minute fragments of the higher crustaceans, but not in sufficient quantity to keep them alive. The fact that animal food was more abundant than vegetable in this last lot indicates nothing of their natural preference, since it was doubtless also more abundant in the water containing them.

More light was thrown upon the earliest food habits of these fishes by the discovery of raptatorial teeth upon the lower jaw than by these dissections of their alimentary canals. All the families of fishes which I had previously studied, whose young were provided with teeth, were found strictly dependent at first upon Entomostraca and the minuter insect larvæ; while only those whose young were toothless fed to any considerable extent upon other forms. The discovery of teeth in the young whitefish, therefore, placed this species definitely in the group of those carnivorous when young. The fact that the adult was itself toothless interfered in no way with this inference, because other toothless fishes (Dorsoma) whose young were furnished with teeth had been found carnivorous at an early age.

The inconclusive character of the results thus far obtained made it necessary to attempt to imitate more closely the natural conditions of the young when hatched in the lake. In February, 1881, I obtained, through the kindness of Mr. Clarke, twenty-five specimens of living young whitefish, saved from a lot which he was planting in the waters of Lake Michigan, off Racine, Wis. I succeeded in conveying these to the laboratory without loss, and there kept them for several days in a glass aquarium and supplied them with an abundance of the living objects to be obtained by drawing a fine muslin net through the stagnant pools of the vicinity. These consisted of many diatoms and filamentous fresh-water Algæ, of two or three species of Cyclops, of *Canthocamptus illinoisensis*, and *Diaptomus sanguineus* among the Copepoda, and of two rather large Cladocera, *Simocephalus vetulus* and *S. americanus*. These little fishes were kept under careful observation for several days, the water in the aquarium being frequently aerated by pouring. Many of them had, however, been injured by handling, and eleven of the specimens died without taking food. It was soon evident that the larger Entomostraca (the Simocephalus, and even the Diaptomus) were quite beyond the size and strength of these little fishes, and that only the smaller Copepoda among the animals available could afford them any food at first. These they followed about from the beginning with signs of peculiar interest, occasionally making irresolute attempts to capture them. Two days after their arrival, one of the young whitefish had evidently taken food, which proved, on dissection, to be a small Cyclops. During the next two days nine others began to eat, dividing their attentions between the Cyclops above mentioned and the Canthocamptus, and on the 22d two others took a Cyclops each and a third a Canthocamptus. One of these fishes contained still a large remnant of the egg-sac, showing that the propensity to capture prey must antedate the sensation of hunger. On the 25th the fourteenth and last remaining fish captured its Cyclops and was itself sacrificed in turn. As an indication of the efficiency of the raptatorial teeth, it may be worth while to note that I saw one of the smallest fishes make a spring at a Cyclops, catch it, give three or four violent wriggles, and drop it dead to the bottom of the tank.

As a general statement of the result of the observations made on these fourteen fishes, we may say that eight of them ate a single Cyclops each, that one took two, and another three of the same, that one took a single Canthocamptus, that two specimens captured two each of this genus, and that finally a single fish ate Cyclops and Canthocamptus both. The final conclusion was a highly probable inference that the smallest Entomostraca occuring in the lake would prove to be the natural first food of the species.

In order to test this conclusion with precision, I arranged a similar experiment on a larger scale and under more natural conditions. Through the generosity of the Exposition Company, of Chicago, I was allowed the use of one of the large aquarium tanks in the exposition building on the lake shore, and by the repeated kindness of Mr. Clarke, of Northville, Mich., I was furnished with a much larger number of living whitefish. Five thousand fry were shipped to me in a can of water, but through unfortunate delays in changing cars at intermediate points, about two-thirds of these were dead when they reached my hands. Those living were immediately transferred to the tank through which the water, taken from the city pipes, had already been allowed to run for several hours. As this water is derived from Lake Michigan at a distance of two miles from the shore, and had at this time the exact temperature of the open lake, the conditions for experiment were as favorable as artificial arrangements could well be made.

Sending a man with a towing net out upon the lake with a boat, or upon the remotest breakwaters, immense numbers of all organic objects in the water were easily obtained. After inclosing the exit of the tank with a fine wire screen, to prevent the escape of objects placed in it, we poured these collections of all descriptions indiscriminately into the water from day to day, thus keeping the fishes profusely supplied with all the various kinds of food which could possibly be accessible to them in their native haunts. From this tank one hundred fishes were taken daily and placed in alcohol for dissection and microscopic study, to determine precisely the objects preferred by them for food. These were examined at a later date, and all contents of the intestines were mounted entire as microscopic slides, and permanently preserved. A careful study was of course made of the organisms of the lake, as shown by the product of the towing net, and when the experiment was finally ended an equally careful examination followed of the living contents of the water of the tank at that time.

These fishes, like those previously described, had already reached the age and condition at which it is customary to "plant" them in the lake. The ventrals were still undeveloped, the egg-sac had nearly disappeared, the four mandibular teeth were present, and the median fin extended from the tips of the pectorals on the belly to a point opposite the middle of the same fins on the back. In most the egg-sac did not protrude externally, being reduced in some to a droplet of oil, but remaining in a few of a size at least as great as that of the head. The alimentary canal was, of course, a simple straight tube, without any distinction of stomach and intestine.

The sufferings of these fry in transit had doubtless weakened the vitality of the survivors, and although every care was taken to keep the water of the tank fresh and pure, about one-third of those remaining died during the progress of the experiment. The aquarium in which they were confined was built of glass, and had a capacity of about one hundred cubic feet. The temperature, tried repeatedly, stood at 42° F. A steady current of the water of the lake was maintained through this tank, entering through a rose, from which it fell in a spray, thus insuring perfect aeration.

By far the greater part of the organic contents of the water of the lake, as shown by the product of the towing-net, consisted of diatoms in immense variety, which formed always a greenish mucilaginous coating upon the inner surface of the muslin net. In this were entangled a variety of rotifers, occasional filamentous Algæ, and many Entomostraca, the latter belonging chiefly to the genera Cyclops, Diaptomus, and Limnocalanus among the Copepoda, and to Daphnia among the Cladocera.

As the Entomostraca proved to be far the most important elements of this food supply, the particulars respecting them may be properly more fully given. The smallest of all was a Cyclops, then new, but since described by me under the name of *Cyclops thomasi*.* This little Entomostracan is only .04 inch long, by .011 wide. The next in size, and by far the most abundant member of this group, was a Diaptomus, likewise new, described in the paper just cited, under the name of *Diaptomus sicilis*. This appears in two forms, one evidently young in the stage just preceding the adult. Full-grown individuals were .065 inch long by one-fourth that depth. The Limnocalanus was a much larger form, evidently preying, to a considerable extent, upon the two just mentioned. All the Cladocera noticed were *Daphnia hyalina*, an elegant and extremely transparent species, occurring likewise in the lakes of Europe. A single insect larval form (Chironomus) should likewise be mentioned in this connection, since it had about the same size and consistence of the Entomostraca, and was consequently equally available for food.

The specimens of each of the above species from a certain quantity of these collections were counted, in order to give a definite idea of their relative abundance in the lake. The Diaptomus numbered 225, the Cyclops 75, Limnocalanus 7, Daphnia 3, and Chironomus larvæ 1.

* On some Entomostraca of Lake Michigan and adjacent waters. American Naturalist, Vol. XVI., No. VIII, August, 1882, pp. 640 and 649.

It was a curious fact, however, that when the water was drawn off at the end of the experiment, more than half the Entomostraca were Limnocalanus; a fact partly to be explained by the predaceous habit of the latter, and partly by the facts relating to the food of the fishes themselves, which are presently to be detailed.

The fry were placed in the tank and supplied with their first food on the evening of the 12th of March. On the 14th, one hundred specimens were removed, and twenty-seven of these were dissected. Twenty were empty, but the remaining seven had already taken food, all Cyclops or Diaptomus. Three had eaten Cyclops only, and six Diaptomus, while two had eaten both. Fourteen of these Entomostraca, seven of each genus, were taken by these seven fishes. From those captured the next day, twenty-five specimens were examined, of which nineteen were without food. Of the remaining six, three had eaten Diaptomus and three Cyclops; five of the former being taken in all, and ten of the latter. Three specimens were next examined from those caught on the 19th of March, two of which had devoured Diaptomus and a third a single *Cyclops thomasi* and a shelled rotifer, *Anuræa striata.* The character of the food at these earliest stages was so well settled by these observations that I deemed it unnecessary to examine the subsequent lots in detail, but passed at once to the specimens taken on the 23d. Twenty-six of these were examined, and found to have eaten thirty-three individuals of *Cyclops thomasi*, fourteen of *Diaptomus sicilis*, and fourteen of the minute rotifer already mentioned (*Anuræa striata*). Two had taken a few diatoms (*Bacillaria*), and one had eaten a filament of an Alga. Cyclops was found in sixteen of the specimens, Diaptomus in nine, and Anuræa in eight, only two of them being empty. The amount of food now taken by individual fishes was much greater than before, one specimen dissected having eaten two Cyclops and six *Diaptomus sicilis*, male and female. Another had taken five Cyclops, one Diaptomus, and five examples of *Anuræa striata.* Still another had eaten four of the Cyclops, four Diapotomus, and one Anuræa.

Twenty five specimens were examined from those removed on the 24th of the month, at which time the water of the tank was drawn off and all the remaining fishes bottled. Four of these had not eaten, but the twenty-one others had devoured fifty specimens of *Diaptomus sicilis*, forty-seven of *Cyclops thomasi*, fourteen of *Anuræa striata* and a single *Daphnia hyalina*, the latter being the largest object eaten by any of the fishes. A few examples of their capacity may well be given. The ninth example had eaten six Diaptomus, two *Cyclops thomasi*, and one Anuræa; the tenth had taken eight Diaptomus, two Cyclops, and an Anuræa; and the twentieth, seven Diaptomus and three *Cyclops thomasi.* In two of these examples were small clusters of orange globules, probably representing unicellular Algæ.

Summarizing these data briefly, we find that of the 106 specimens dissected sixty-three had taken food, and that the ratio of those which were eating increased rapidly the longer the fishes were kept in the aquarium. Only one-fourth of those examined on the 14th of the month had taken food, while more than five-sixths of those bottled ten days later had already eaten. The entire number of objects appropriated by these sixty-three fishes was as follows: *Cyclops thomasi*, ninety-seven; *Diaptomus sicilis*, seventy-eight; *Anuræa striata*, twenty-nine; *Daphnia hyalina*, one. Seven of the fishes had eaten unicellular Algæ, two had eaten diatoms, and one filamentous Algæ.

From the above data we are compelled to conclude that the earliest food of the whitefish consists almost wholly of the smallest species of Entomostraca occurring in the lake, since the other elements in their alimentary canals were evidently either taken accidentally or else appeared in such trivial quantity as to contribute nothing of importance to their support. In fact, two species of Copepoda, *Cyclops thomasi* and *Diatomus sicilis*, are certainly very much more important to the maintenance of the whitefish in this earliest stage of independent life than all the other organisms in the lake combined. As the fishes increase in size, vigor, and activity they doubtless enlarge their regimen by capturing larger species of Entomostraca, especially Daphnia and Limnocalanus.

A few words respecting the relative abundance of these species at different seasons of the year and their distribution in the lake will have some practical value. We may observe here an excellent illustration of the remarkable uniformity of the life of the lake as contrasted with that of smaller bodies of water already referred to in the introduction to this paper. While in ponds minute animal life is largely destroyed or suspended during the winter, the opening spring being attended by an enormous increase in numbers and rate of multiplication, in Lake Michigan there is but little difference in the products of the collecting apparatus at different seasons of the year.* There is a slight increase in the number of individuals during spring and early summer, but scarcely enough appreciably to affect the food supply of fishes dependent upon them. They are not by any means equally distributed, however, throughout the lake, my own observations tending to show that there are relatively very few of these minute crustaceans to be found at a distance of a few miles from shore, and that in fact by far the greater part of them usually occur within a distance of two or three miles out. Indeed, the mouths of the rivers flowing into the lake are ordinarily much more densely populated by these animals than the lake itself, as has been particularly evident at Racine and South Chi-

* For definite assurance of this fact, I am indebted less to my own observations (which are, however, consistent with it as far as they go) than to the statements of B. W. Thomas, esq., of Chicago, who, while making a specialty of the Diatomaceæ of the lake, has collected and studied all its organic forms for several years, obtaining them from the city water by attaching a strainer to a hydrant many times during every month throughout the year.

cago. Neither are they commonly equally distributed throughout the waters in which they are most abundant, but, like most other aquatic animals, occur in shoals. In the deeper portions of the lake many species shift their level according to the time of day, coming to the surface by night, and sinking again when the sun is bright.

These facts make it important to the fish-culturist that the particular situation where it is proposed to plant the fry should be searched at the time when these are to be liberated, to determine whether they will find at once sufficient food for their support. A little experience will easily enable one to estimate the relative abundance of the Entomostraca at any given time and place, and they require nothing for their capture more complicated or difficult of management than a simple ring net of cheese-cloth or similar material, towed behind a boat. This may be weighted and sunk to any desired depth, so that the contents of the water either at the surface or at the bottom may be ascertained by a few minutes' rowing.

In conclusion, I wish again to express my great obligation to the United States Fish Commissoner, Prof. S. F. Baird, and to Frank N. Clark, superintendent of the United States hatchery at Northville, Mich., through whom, as already stated, the specimens were derived upon which these studies were made. My best thanks are also due to the Exposition Company of Chicago, and especially to their secretary, the Hon. John P. Reynolds, for the use of a tank in the Exposition building, and for many courtesies received while the experiment there was in progress.

XIV.—REPORT OF EXPERIMENTS FOR DETERMINING THE SMALLEST AMOUNT OF WATER IN WHICH YOUNG SHAD AND EGGS CAN BE KEPT.

By Frank N. Clark.

June 8, 1880, I was requested to conduct a series of experiments at the shad-hatching station at Washington navy-yard, and to use as small a quantity of water as possible both for the eggs and young fish. I accordingly arranged one of the cones with an aërator attachment for Experiment No. 1.

June 9.—In the morning I placed in Cone No. 1 a portion of the eggs taken the evening before (125,000), and also placed in Cone No. 2 the same number. I commenced on Cone No. 1 by running 35 gallons of water per hour. On Cone No. 2 there were 218 gallons per hour. The aërator attached to No. 1 was doing the same work the larger amount of water was doing in Cone No. 2. In the course of the day I reduced the amount of water in Cone No. 1 to 23 gallons per hour, and found the eggs had equally as good a motion as with the larger amount of water. The motion of eggs in Cone No. 1 was considered as good as in No. 2.

June 10.—Eggs were examined in both cones and found to be equally as good in Cone No. 1 as in No. 2.

June 11.—Eggs were examined in both cones. In Cone No. 1, with aërator attachment, I found more fungoid growth on the unimpregnated eggs than in No. 2. They were, however, kept free from the good eggs by the force of air and water. In cones of eggs I have worked for the last few years I have frequently found eggs with the fungoid growth to attach themselves to the good eggs. It was especially so when the water was quite warm. I have always found it necessary in such cases to add a greater flow of water.

June 12.—The fish were all out and appeared in as healthy a condition in Cone No. 1 as in No. 2. So far I have been unable to note any difference in the eggs or in their hatching other than is mentioned in this report. In the evening of this day I removed 25,000 fish from each cone, leaving 75,000 in each of the cones, with same amounts of water (23 and 218 gallons). I find the fish in Cone No. 1 are not forced against the perforated tin edges as in Cone No. 2. Accordingly it is not necessary to attend to them as in No. 2, where it was absolutely necessary to brush the fish away from the edges at least once in an hour to keep them from filling the perforated tin and running over the top of the cone. This I think one great advantage.

June 13.—Fish were examined; found them equally as good in No. 1 as in No. 2. The force of air in Cone No. 1 seems to be rather violent for the fish. I took the wire cloth from bottom of cone. It made a slight change in the air-bubbles, they were in finer particles.

June 14.—The fish appeared in a healthy condition. At 12 m. I arranged one of the cylinder cans with an aërator attachment for conducting air and water to the bottom of the can. The water and air passed down through the pipe, and the overflow was through fine perforated tin at the top of the can into the overflow chamber, where the water passed out.

After arranging the can I immediately put into it 50,000 young shad 48 hours old. It had not been running more than ten minutes before I discovered fish were running out the overflow in consequence of the perforated tin at the overflow being too small a surface. I immediately removed the fish and informed Major Ferguson of what had occurred, and gave him my idea of what was wanted for the can. He had the cover of the can made with a larger surface of perforated tin, and this, after putting the 50,000 fish back in the can, I found held the fish.

June 15.—In the morning I discovered the fish in Cone No. 1 appearing weak, in consequence, as I thought, of the violence of air and water forcing them to top of cone, where the air-bubbles would break and throw the fish to one side. In the course of the day I found the fish were dying. In the can, which I shall designate as No. 3, I drew from the bottom of the can about 50 dead fish. The balance of the fish were looking well.

June 16.—There was a thorough examination made of all the different experiments. The fish in cones were found to be in about the same condition as the day before. The can, however, I did not find the same. During the night there had been a stoppage of the water, in consequence of which the fish were found all dead.

June 17.—The fish in Cones Nos. 1 and 2 were five days old. In Cone No. 1, with aërator attachment, the fish were dying quite fast. My opinion is still the same, that the violence of air-bubbles is too severe for the young fish, and weakens them or wears them out.

June 18.—I arranged another cone (No. 4) with aërator attachment, and immediately placed in it 100,000 eggs taken the evening before. There was an effort made to use a smaller quantity of water on this cone, but without success. As soon as the water was reduced below 23 gallons per hour the aërator would not take in air. Thus it will be readily seen the aërator will not supply the quantity of air with a less amount of water than 23 gallons per hour. This lot of eggs was examined from day to day until all were hatched, and nothing of note occurred different from No. 1.

June 19.—This morning I found the fish in Cone No. 1 all dead. The probable cause was the violence of water and air. The fish in Cone No. 2 were still doing nicely. They were turned loose in the Potomac at 6 p. m. There were 40,000 young shad put in Can No. 3 to again try the aërator. The fish in Can No. 3 did very well until the third day, when I found them dying very fast, probably from the impure water caused by the can being closed.

June 22.—I arranged Cone No. 1 with the aërator attachment, and put in 125,000 eggs taken the evening before. The same amount of water, 23 gallons, was used on this occasion as on the others. Cone No. 4 all hatched and appeared in a very healthy condition. Out of the lot of eggs in Cone No. 4 there were about 90,000 fish, making a very good percentage. I took one-half of these fish and put them in Can No. 5, running a smaller quantity of water than on any of the other cones. There was no aërator attached to this cone. There were 18 gallons of water per hour running in this cone. These cones were kept running and were examined from day to day until June 25, when the fish were deposited in the Potomac in good condition.

June 26.—On this morning I found the eggs in Cone No. 1 all hatched. The eggs had been examined from day to day; found to be about the same as the cones hatched before. On this day I was directed to discontinue operations at the navy-yard station, to move what fish I had on hand, about 100,000, to the Smithsonian Institution, and to continue my experiments there. The young fish were moved to the Smithsonian on the morning of June 27, where they were placed in cones and cans. In Cone No. 1, with aërator attachment, I placed 20,000; in Cone No. 2, 20,000; in Can No. 1, with aërator attachment, 20,000; the balance were placed in Can No. 2. My experiments consisted of one cone with aërator attachment, running 23 gallons of water per hour; Cone No. 2, with no attachment, running 15 gallons of water per hour. This was afterwards reduced to 10 gallons per hour. In Can No. 1 I ran 15 gallons per hour until the rubber hose conducting the water burst, during the night of June 27, when, of course, the fish all died. In Can No. 2 there was no change of water during the night. The next morning I found the fish all dead. The cones were examined from day to day, and at this writing, July 3, the fish in Cone No. 1 are nearly all dead. The fish in Cone No. 2 are looking well. They are seven days old to-day.

From my experiments I have come to the following conclusions:

When a small quantity of water is to be used in hatching it is absolutely necessary to use the aërator to introduce the air with the water at the bottom of cones in order to give the eggs the motion desired. In every case where the aërator was in use, and they were kept until the fifth day, they commenced dying, and in twenty-four or forty-eight hours all were dead. My opinion is that the violence of air-bubbles and water weakened or wore them out. When it is desired to keep the fish in cones for any length of time, and to use a small quantity of water, I should advise that a small quantity of water be run in the cone, as when it is desired to use a limited supply of water a smaller quantity can be used than with the aërator. In every case the experiment tried with the can in which no change was given the fish proved disastrous in from six to ten hours, according to the quantity of fish in the cans.

WASHINGTON, D. C., *July* 3, 1880.

Record of temperature observations made at Washington, D. C., from June 9, 1880, to July 3, 1880, by Frank N. Clark.

Date.	Cone No. 1.			Cone No. 2.			Cone No. 3.			Cone No. 4.			Cone No. 5.		
	8 a. m.	12 m.	6 p. m.	8 a. m.	12 m.	6 p. m.	8 a. m.	12 m.	6 p. m.	8 a. m.	12 m.	6 p. m.	8 a. m.	12 m.	6 p. m.
1880.															
Wednesday, June 9	72	74	74	72	73	74	...	...	...	...	...	...	...	...	...
Thursday, June 10	73	74	75	72	73	73	...	...	...	...	...	...	...	...	...
Friday, June 11	74	75	76	73	73	74	...	...	...	...	...	...	...	...	...
Saturday, June 12	75	76	77	73	74	75	...	...	...	...	...	...	...	...	...
Sunday, June 13	76	77	78	75	75	75	...	...	...	...	...	...	...	...	...
Monday, June 14	76	77	78	75	76	76	...	...	...	...	...	...	...	...	...
Tuesday, June 15	76	76	77	74	74	74	74	75	75	...	...	...	...	...	...
Wednesday, June 16	75	76	77	73	74	74	(*)	(*)	(*)	...	...	...	...	...	...
Thursday, June 17	76	77	78	73	74	75	...	...	...	...	...	...	...	...	...
Friday, June 18	76	78	79	74	75	76	...	...	...	74	76	77	...	...	...
Saturday, June 19	76	(*)	(*)	74	74	75	†74	†75	†76	75	76	77	...	...	...
Sunday, June 20	...	...	...	(‡)	(‡)	(‡)	75	76	77	76	77	77	...	...	...
Monday, June 21	...	...	...	...	...	...	75	77	78	75	77	78	...	...	...
Tuesday, June 22	†75	†76	†77	...	...	...	76	(*)	(*)	76	77	78	75	77	78
Wednesday, June 23	76	77	78	...	...	...	...	...	...	75	77	78	75½	77	78
Thursday, June 24	75	76	77	...	...	...	...	...	...	75	77	78	75	76	77
Friday, June 25	76	77	77	...	...	...	...	...	...	75	76	77	76	77	77
Saturday, June 26	76	77	78	...	...	...	...	...	...	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
Sunday, June 27	76	75	75	...	75	75	...	75	75	...	...	...	...	...	...
Monday, June 28	75	76	76	75	76	76	75	(*)	(*)	...	...	...	...	...	...
Tuesday, June 29	75	75	76	75	76	76	...	...	...	...	...	...	...	...	...
Wednesday, June 30	75	76	76	75	76	76	...	...	...	...	...	...	...	...	...
Thursday, July 1	76	76	76	76	76	76	...	...	...	...	...	...	...	...	...
Friday, July 2	75	76	76	75	76	76	...	...	...	...	...	...	...	...	...
Saturday, July 3	74	75	75	74	75	75	...	...	...	...	...	...	...	...	...

NOTE.—The cones were moved to the Smithsonian Institution Saturday evening, June 26.

* Fish all dead. † New eggs. ‡ Fish released.

XV.—EXPERIMENTS UPON RETARDING THE DEVELOPMENT OF EGGS OF THE SHAD, MADE IN 1879, AT THE UNITED STATES SHAD-HATCHING STATION AT HAVRE DE GRACE, MD.

By H. J. Rice, Sc. D.

The report hereby submitted gives somewhat in detail the methods and results of the experiments in retarding the development of impregnated shad-spawn which were carried on by Mr. F. N. Clark and myself during the month of June, 1879, at the United States Fish Commission barges, near Havre de Grace, Md. These investigations were instituted principally for the purpose of ascertaining the possibility and practicability of transporting shad-spawn across the ocean, with a view to introducing American fish into European waters, and all of our efforts were made with that end in view. Normally, as is well known, or as is generally considered at the present time, shad-spawn requires for its development a constant although slight motion, and a continuous exchange of fresh water. Under these conditions, whether produced naturally or artificially, the spawn after impregnation will proceed in its development, and the young shad come to maturity, quickly or slowly according to the temperature of the water in which they are placed. With a temperature of 68° to 74° the ova will hatch out in from three to five days. If the water is of a lower temperature, or about 56°, the development will be much prolonged and the hatching take place in about eleven days. Upon an ocean voyage the great difficulty to be surmounted would be the lack of fresh water. Motion can be given to the eggs, and the temperature can be kept at any point which may be desired by means of ice, but all the water used with the eggs must be such as can be taken on board at the beginning of the trip.

The questions to be answered, then, in regard to a shipment of the kind proposed were, "Can shad ova be carried, and will they go on in their development, in stagnant water, or in water which, although changed as often as thought necessary, is not absolutely fresh; or can they be carried in some other manner, as for instance in an ice-chest, as is done with some other kinds of fish-spawn, as that of the white-fish of the Great Lakes for example?" It is quite evident that if it could be shown to be possible, even with considerable care, to carry shad-ova in either of these ways, it would not be very difficult to transport any quantity which might be desired to the other side of the Atlantic, and thus introduce there a species of fish which upon this side of the water is considered one of the table delicacies of the season. We began our experiments by endeavoring to solve the second question first. For this purpose an ice-chest was constructed under the supervision of Mr. Clark. It consisted of a covered wooden box (Fig. 1, *a*) about 3 feet in each dimension, within which was a second box or well, *b*, of about one-half the size of the outer one. This well opened upon one side of the chest by a box-door, *c*, about 5 inches in thickness, and so arranged with slats, 1, 2, 3, 4, upon the inside that a large or small quantity of ice could be packed in it. The well was free from the other sides of the chest all around and on top by a space of about 8 inches, and beneath it was a drawer *d*, of about 6 inches in depth. The well could thus be entirely surrounded with ice, and the temperature regulated by the amount of ice placed in the chest, and by more or less completely closing the door of the well and the cover of the chest. In practice it was found that with a small amount of ice around the sides of the well and in the drawer and door, and a large cake upon the top of the well, an even and moist temperature could be maintained throughout the chest with very little trouble.

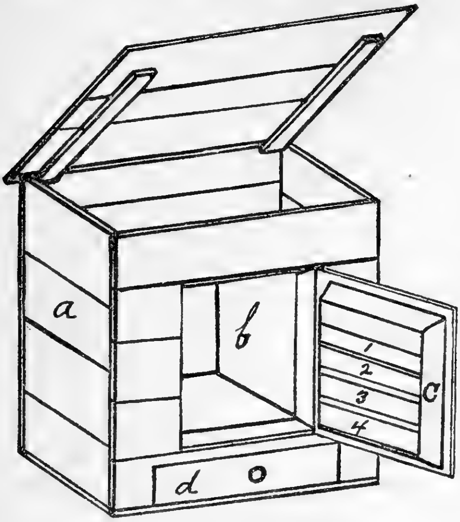


FIG. 1.—Ice-chest for shad-eggs.

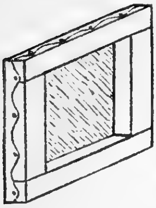


FIG. 2.—Tray for ice-chest.

Within the well a series of trays (Fig. 2) were placed one above the other. They were made with wooden frames about 1 inch in thickness, and were covered upon the bottom with cotton-flannel. When wanted for use the cotton-flannel bottom of the tray was thoroughly moistened, and about 7,000 to 8,000 freshly impregnated eggs placed upon it and carefully spread out with a feather. The temperature of the eggs was then lowered very gradually until it was the same as that of the well of the chest, the chest having previously been partially filled with ice. The tray was then placed in the chest and kept at a uniform temperature during the time of the experiment. The first lot of eggs was placed in the chest on the evening of the 7th of June. This lot consisted of about 25,000 eggs which were taken fresh from the spawners and distributed upon three or four trays. The temperature was reduced very gradually to 37° when they were placed in the well, and kept at 37° and 38° until about 8 o'clock p. m. of the 9th of June. At this time they appear to be all dead, and the temperature was allowed to rise to 55° which was about 10 o'clock p. m. same date, when a second lot of freshly-taken eggs, of about the same number as the first, was placed in the chest.

The temperature was then allowed to sink to 48°, and kept there, not running below 47° nor above 49°. About 10 a. m. of the 12th the eggs of the first lot were found to be all dead and were thrown away, but those of the second lot appeared to contain some good ones, and one trayful was placed in a cone of fresh running water at a temperature of about 75°. On the third day after, or on the 15th of June, about 20 or 30 young fish hatched from this lot.

At 12 m. of the 12th, after the trayful of eggs had been transferred to the cone, a third lot of eggs was placed in the chest. These eggs had been taken on the night of the 11th and kept in a cone of fresh running water until the segmentation cap had entirely covered the yelk and the young fish could be seen as a dark band along the side of the vitellus. The temperature was now allowed to sink to 43°, and kept at about 45° until 6 p. m. of the 14th, when all the eggs of both second and third lots were found to be dead. Forty three degrees is thus undoubtedly too low a temperature for shad-spawn; otherwise we ought to have had some live eggs in either the second lot, which furnished live ones at 48°, or in the third lot, which had been subjected to the low temperature for only about two days. On June 17th, 10 p. m., a fourth lot of freshly-taken eggs was placed in the chest, where the temperature showed 64°, and on the 20th a fifth lot was consigned to the well. In these latter ova the young fish were so far advanced as to show the eyes, protovertebræ, ear-cavity, and the heart as a single-chambered pulsatile organ. When these were placed in the chest the temperature was 55°, and it was kept at this point until the 23d, when both eggs and young fish were found to be dead. In order to keep the temperature at 55° or 56° very little ice was necessary, and it is possible that the eggs did not have moisture enough to maintain them in good condition, since they appeared to melt down into a mat-like mass after being in the chest for a day or so. This was not noticed, or but very slightly, in the other cases. Our only success, or partial success, with the ice-chest, then, was with that portion of the second lot of eggs which was kept at a temperature of 48°. The young fish which were hatched from these eggs were exceedingly vigorous and hearty, and when we broke camp on the 24th, or nine days after they had escaped from the eggs, they were about five-eighths of an inch in length, with the rays of the dorsal, anal, and caudal fins well advanced, the end of the notochord turned up very prominently, and the caudal fin slightly forked. They were about one-third larger than some older fish which were in another cone and which had been hatched out in the ordinary manner. In the stomachs of all of these young fish I found a great many shells and remains of daphniæ and other small animals, and saw them, and especially the older ones above mentioned, eat the dead of their own species.

The trials which we have thus made seem to indicate that it is impracticable to carry shad-spawn in an ice-chest, as can be done with many kinds of spawn, especially such as is laid in the fall or winter season. But it is possible that more trials and greater precautions are necessary before we can be positive in this respect, particularly as I am informed that Mr. Welcher, now of the Michigan fish commission, has kept shad-spawn in an ice-chest for a considerable time, and afterwards hatched out

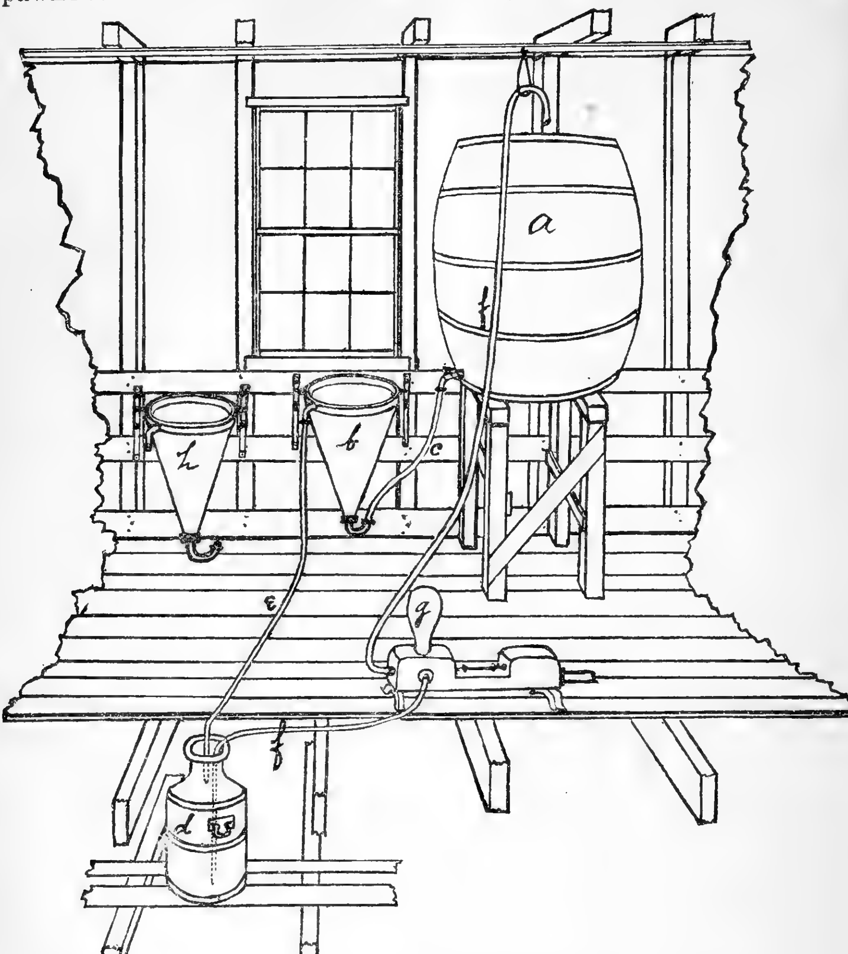


FIG. 3.—Apparatus for using the same water over again in hatching shad.

young shad from such spawn. I am not conversant, however, with his method, nor do I know to what extent he was successful in such experiments. But judging alone from our efforts, the results seem to show that an ice-chest is seriously detrimental to the integrity of shad-ova. So far, then, as our experiments have been carried, and as regards the ice-chest, the question would have to be answered in the negative.

Our second set of experiments were then begun for the purpose of testing the feasibility of using the same water over and over again when its temperature is kept below the normal condition.

Our apparatus, Fig. 3, as arranged for these experiments, consisted of two reservoirs, a hatching-cone, and a steam-pump, and their connections. The first or supply reservoir (Fig. 3, *a*), was a small hogshead elevated about three feet above the floor or just above the level of the hatching-cone *b*, which was of the ordinary pattern, with a rim of wire sieving around the inside at the top with a gateway in it for the purpose of letting dead eggs pass off into the gutter, which ran around the top of the cone outside of the sieve rim and so into the escape-pipe. The cone was swung on braces attached to the side of the wall, and was connected with the supply tank by means of a rubber pipe, *c*, passing from the bottom of the reservoir to the bottom of the cone. The second reservoir, *d*, was smaller than the first, and was placed under the floor and below the hatching-cone with which it communicated by means of an escape-pipe, *e*, passing from one side of the gutter at the top of the cone down and over the edge of the reservoir can.

The apparatus was completed by placing the two reservoirs in communication by means of a long tube, *f*, passing through the steam-pump *g* and entering the top of the first reservoir. Water being placed in the large reservoir a flow would take place into the cone, and the cone when full, would overflow into the second reservoir, from whence the once-used water could be pumped back by the pump into the supply-tank, again to run its circuit through the cone. In this manner we had a constant flow of water in our cone, and as the end of the escape-pipe from the cone into the lower reservoir and that of the supply-pipe from the pump into the supply-tank were considerably above the level of the water in their respective reservoirs, there was also a slight amount of aëration from the falling water.

The temperature of the water was regulated by keeping ice in greater or less quantity in the supply-reservoir. Our first trial of this apparatus was begun on the evening of June 8. The supply-reservoir and cone were filled with water from the bay and 50,000 freshly-taken eggs placed in the cone. The temperature of the water was reduced to 45°, then allowed to rise to 52°, and kept at that temperature until the morning of the 11th, when the eggs were found to be dead and were thrown away, and the apparatus thoroughly cleaned. It is probable that the low temperature of the water had its effect in destroying this lot. At 10 a. m. of the 12th the reservoir and cone were refilled and a second lot of eggs placed in the cone. The temperature was 67°, and was gradually reduced to 56°, and kept for the most part at that point, although on the 15th it rose to 64°, for lack of ice, consequent upon our change of locality, but was brought back to 56° on the 16th. These eggs had been taken on the night of the 11th and kept until 10 a. m. of the 12th in fresh running water, at 77°, before being placed in the cone. When placed in the cone the segmentation cap entirely covered the yelk, and the young fish, as was the case with lot No. 3 which was placed in the ice-chest, could be seen as a dark band around one side of the yelk. These eggs continued their development, or at least a goodly proportion of them did, up to the middle of the fourth day, when they were well developed, showing eyes, protovertebræ, ear-cavity, and the heart as a single-chambered pulsatile organ. They appeared to be healthy and in good condition; but gradually the water became filled with sloughs and decomposing animal matter, and early in the fifth day, or by the morning of the 17th of June, the fish were all dead. The eggs were accordingly thrown away and the apparatus again cleaned and placed in readiness for a third trial.

It had become pretty evident that the trouble was in the water, and we determined to try the next time the effect of more thorough aëration upon it. Accordingly at 10 p. m. of June 17 a third lot of about 50,000 eggs was placed in the cone, with the water in the supply-reservoir at 72°. By 7 a. m. of the 18th the temperature had been brought down to 64°, and by 12 a. m. to 53°. It was kept thereafter during the trial at an average of 54°. At intervals of two to three hours after the water had commenced running, the water in the supply reservoir and that in a second cone, Fig. 3, *h*, which had been arranged to receive the outflow of the first before the water passed into the second reservoir, was thoroughly agitated for five to ten minutes. This was accomplished by the use of a dipper, running the dipper down deep in the vessels and getting the water from near the bottom, then lifting the dipper high above the vessels before pouring it back, so as to give the water as much of a fall as possible. In addition to this method of purifying the water a certain quantity was taken two or three times each day from the surface of the hatching-cone. In this manner it was intended to take of that water which had just passed over the eggs about the same quantity that would be added to the supply-tank as fresh water by the melting of the ice, and in taking it from the hatching-cone any sloughs or dirt which had accumulated around the top of the cone could be included. Under this treatment the eggs progressed in their development and appeared in fine condition up to the middle of the fifth day, or one day longer than those of the second lot. At this time they were at the same stage of development as the second lot upon the fourth day; but it is to be borne in mind that the second lot was started in warmer and fresh water before being placed in the cone, while these passed through their entire development in the stale water. On the afternoon of the fifth day the water, despite the constant aëration, began to have a rank, fishy odor and to foam slightly in the supply-reservoir. Notwithstanding this the eggs appeared in a good and healthy condition. On the morning of the sixth day, however, or the 23d of June, the foam on the water was very considerable in amount and the eggs were quite noticeably affected. As much of the water as could possibly be spared was then taken off through the hatching-cone, together with as much of the slough and dead material as could be separated from the good eggs, and a filter of charcoal placed under the supply-tube of the supply-reservoir. But this did not seem to stop the death of the eggs, and in order to save the remainder they were transferred at noon of the sixth day to a cone of fresh water at a temperature of about 73°. The stale water had, however, apparently been too injurious to them and they all finally died. It appeared to be pretty evident from this trial that while artificial aëration would increase to a certain extent the time during which the water could sustain the eggs in good condition, yet four and a half or five days were about the utmost limit of time the same water could be used over and over again. When used for this length of time the entire vitality appeared to be taken from it. This was probably from the using up of the oxygen contained in it, although the decaying organic material, sloughs, and dead eggs, of which there are always more or less mixed with good eggs, may have played a very important part in rendering the water unfit for sustaining life.

The end of the season was now at hand and good spawn was very difficult to obtain. We were thus prevented from trying other methods of using the water. The next method would have been to take enough water on board at the beginning of the experiment, in addition to that in the reservoir and cone, to enable us to give the eggs a complete change of water, drawing off the old and putting the other in its place once every three days.

If unused water—water which contains its normal amount of oxygen and which has not passed over the eggs so as to become tainted with decaying organic material—is all that is required to replace the used or partially exhausted water of the cone, then there would be no difficulty in keeping the eggs in good condition for a voyage of twelve or fifteen days, for it would be an easy matter to carry sufficient water in extra casks to make complete changes every three days for this length of time, or even longer. But as a trip can be made in from eight to nine days, or as that would be the length of time which would elapse before fresh water could be obtained, it would hardly be required to make over two, or perhaps three, changes. From our experience this year it seems highly probable that such an attempt would be entirely successful, and that a good proportion of eggs thus treated could be hatched out and the young fish distributed wherever it was desired to take them. In such an experiment the larger the amount of water passing over the eggs the longer the time required to exhaust it or render it foul. If the experiment should be tried again and for the same purpose, that is, transportation across the ocean, the apparatus should be just such as would be employed on ship board, and with the supply-reservoir made as large as could be conveniently carried. Then, by changing the water, aëration, and the use of a filter for the used water before it re-entered the supply-tank, it would seem as if success could be assured. At least, if this method cannot be made to answer the purpose it is very questionable whether any can. Several cones instead of one could be used, if desired, by simply connecting one cone with the next, each cone taking the outflow from the one preceding. In this case it would be necessary to have the cones arranged in a series, each one with its top or outlet considerably higher than the one into which it flowed, as in Fig. 3 with the two cones, so that there should be sufficient motion in the water to keep the eggs stirring.

It may not be out of place to notice the fact that the eggs kept in the stale water were almost entirely free from any fungoid growth. Why these eggs should be favored in this manner is hard to say, and may be a question worthy of farther research. As regards the influence upon the development of the germ, there was a very marked difference in the two methods employed. In the ice-chest, in the case of freshly impregnated ova, segmentation would go on until the "mulberry" stage had been reached, or until a small limb or protuberance of small cells had been formed upon one side of the vitellus. After this there appeared to be an entire cessation of all development as long as the egg remained in the chest or until the vitellus disintegrated.

In most cases disintegration or death did not take place for two or three days, and up to this time the eggs had every appearance (otherwise than that they did not develop) of being alive and in fair condition. In the cone, however, development went on regularly and slowly from the very first, and continued until the water became of such a nature as to fail to longer nourish the embryos.

This development was such that in about two hours the "mulberry" stage had been reached; in sixty hours the segmentation cap entirely surrounded the yelk, and the young fish formed a prominent welt along one side of the vitellus; in seventy-two hours the eyes commenced to show; and in one hundred and eight hours, or four and one-half days, the tail portion, or that part free from the yelk, was as long as the portion attached to the yelk, the eyes very prominent, with the crystalline lens formed, the ear-cavity forming a semi-circular depression upon the side of the body above the yelk, the protovertebræ numerous, and the heart a small, single-chambered body, situated just back of the head, between the yelk and anterior end of the central canal, and just beginning to exhibit regular although somewhat spasmodic beats. In an embryo developed in fresh running water, at a temperature of 68° to 74°, those stages would be passed through, respectively, in four, ten, twelve, twenty, to twenty-six hours, showing a retardation in the case of the embryo kept in water at 56° of from three to three and one-half days. At this rate the young fish in the colder water ought to hatch out in about eleven to twelve days, and would probably, from their slower growth, be more hardy than those hatched in three to three and one-half days. It is to be regretted that these experiments could not have been begun earlier in the season, thus giving plenty of time for thoroughly studying the questions and arriving at some definite results, for although it would appear as if the method last suggested might be successful, yet a trial seems to be absolutely necessary before undertaking an ocean voyage.

WASHINGTON, D. C., *July* 3, 1879.

XVI.—ON THE RETARDATION OF THE DEVELOPMENT OF THE OVA OF THE SHAD (ALOSA SAPIDISSIMA), WITH OBSERVATIONS ON THE EGG FUNGUS AND BACTERIA.*

By John A. Ryder.

Several series of experiments at different times were undertaken by persons connected with the United States Fish Commission having for their object the solution of the following problems: "Is it possible to lower the temperature of the water in which shad eggs are incubated so as to greatly retard and prolong the process?" "Is it possible to prolong the period of incubation so that large quantities of embryonized ova may be carried for long distances by land or water, so as to effectively stock distant or foreign waters?" These two queries, I think, clearly state the objects of the experiments, and also tacitly indicate the important results which would follow in case practical results should be attained.

That a decrease in temperature would impede or retard the development of ova has been known for a long time, and, without encumbering this essay with references it may be asserted as a truth based on physical reasons and facts. Physiologists and biological philosophers, such as H. Milne-Edwards and Herbert Spencer, have recognized and discussed the influence of fluctuations of temperature on physiological processes. Every genus and perhaps even every species of fishes, in the course of the early development of its ova, appears to present some idiosyncrasy of behavior which demands that its characteristics shall be studied before it is ventured to proceed with experiments of this character. Practically the peculiarities of the ovum of the shad are perhaps as well known as those of any species we are called upon to deal with.

Shad-eggs after impregnation are relatively large, measuring from one-eighth to one-seventh of an inch in diameter. When first extruded from the parent fish they measure about one-fourteenth of an inch in diameter, are somewhat flattened and irregularly rounded in form; the egg-membrane, a true *zona radiata*, is much wrinkled and lies in close contact with the contained vitellus. Immediately after impregnation this membrane becomes tense, is filled with water which has found its way through the membrane from the outside, and is now per-

* Second edition, revised.

fectly spherical, having apparently gained very much in bulk. This gain in size is, however, delusive; it is only the wrinkled egg-membrane which has been distended with water; the vitellus or true germinal and nutritive portion has gained nothing in size. The latter now lies in contact with the lowermost part of the egg-membrane when the whole ovum is at rest, and is always more or less depressed from above in the form of an oblate spheroid. After the germ has been developed, which is discoidal in form and placed on the surface of the vitelline sphere, it usually also occupies a lateral position on the vitellus when the ovum is at rest.

The vitellus rolls about and changes its position inside the egg membrane as the latter's position is altered. The vitellus is heavier than water. A large space filled with fluid now exists between the vitellus and membrane. No adhesive material is found on the outside of the membrane, as in the eggs of the white perch and herring, as may be readily demonstrated with the microscope, although when first extruded they are covered with a somewhat sticky ovarian mucus. The ova are heavier than water and rapidly sink to the bottom of the vessels in which they are undergoing development. All of the hatching apparatus now used for their incubation in water is operated on the principle of a continuous flow, which keeps the ova constantly in motion. So much for the physical behavior and constitution of the shad-egg, which is necessary for the comprehension of what will be said subsequently.

It has been the experience of those intrusted with the work of looking after the artificial incubation of the eggs of the shad that when the temperature of the water was highest the process was completed soonest, and when lowest it took a disproportionately longer time. In illustration of this fact the subjoined data, supplied by Mr. W. F. Page, are of interest, from the records which were kept at the station on the Potomac during the present spring (1881):

	Lot No. 1.	Lot No. 2.	Lot No. 3.
Time in hatching	148 hours.	109 hours.	70 hours.
Average temperature of water	57.2° F.	64.5° F.	74° F.
Average temperature of air	61° F.	66.1° F.	76.25° F.

This series of data shows that with a fall in the temperature of the water down to 57.2° F. it took six days and four hours to complete the development in the egg; with a rise in the temperature of the water to 74° F. the process was complete in a little less than three days. The difference in the times of hatching between lots No. 1 and 3 is 78 hours; the difference in the temperature of the water used is only 16.8° F. Is there a limit to the possibilities of retardation? Experiment has shown that there is. The temperature of ice-water, 38° F., was found to be fatal at the morula or germinal disk stage of development of the shad egg, in the course of experiments made at Havre de

Grace, Md., in 1880. The cells of the germinal disk became brownish, the cleavage furrows obliterated, the disk tended to spread out and become larger across. These phenomena indicated stagnation of development and death. The second series of experiments, conducted by what is known as the "dry method," in a refrigerator box provided with canton flannel trays, devised by Mr. F. N. Clark especially for these experiments, gave better results. We found that the ova merely kept damp on the trays in an air temperature of 52° appeared to develop quite normally, the only serious drawback being the rapid and more or less fatal development of fungus, the mycelium of which would soon grow over the eggs, penetrate the membranes, cause them to collapse, transform the protoplasm of the vitellus into fungus protoplasm, and kill the ova.

The following abstract from my note-book, recording what was observed in watching the results obtained from a trial of Mr. Clark's apparatus, speaks for itself, though it would facilitate the comprehension of the matter if a series of explanatory figures could be introduced:

"Eggs taken June 8 and put into refrigerator at 9 o'clock p. m.; examined June 9 at 9 o'clock a. m.; exposed for 12 hours to a temperature ranging from 54° to 60° F. Cleavage has advanced to the morula stage; *i. e.*, the germinal portion of the egg is still discoidal, lies on one side of the vitellus or yelk, and has not advanced beyond the condition ordinarily reached in three hours with the temperature 72° F.

"Same lot, June 9, 2.30 p. m., advanced but a little beyond the stage just described above; the germinal disk still maintains its characteristics; development normal; temperature 54° F.

"Same lot, June 10, examined at 9.30 a. m.; segmentation cavity developed and blastoderm forming; incipient embryo making its appearance at one side. The blastoderm, however, does not yet cover more than half of the upper hemisphere of the vitellus, a condition ordinarily attained in six hours with the temperature of the water at 72° F. Temperature in refrigerator box now ranging from 52° to 54° F. Eggs of the same age, 36½ hours, in a hatching-jar, have the vitellus completely inclosed by the blastoderm, the embryo formed, with eyes, ears, and brain distinguishable, and the tail is budding out as a small, rounded knob at the posterior end of the embryonic axis, which curves around one side and now extends from one pole of the egg to the other, embracing an arc of 180°.

"Same lot, in refrigerator, examined June 10, at 8.30 p. m., or nearly forty-eight hours after impregnation, shows that the blastoderm has grown down half way over the vitellus, like a hemispherical cap; the keel or carina has been developed. Temperature 53° F. in refrigerator all day. Eggs in a cone of the same age, temperature of the water 65° F., have the embryos well advanced, with the tail free and as long as the portion of the body still in contact with the yelk, but the natatory fold is not developed.

"Eggs which had progressed a considerable way in development, so that the tail was somewhat more advanced than the stage last described, and which did not yet have the eyes pigmented, were also experimented upon at this time. In consequence it was learned that such might be suddenly transferred from the water in which they had previously been undergoing development to the damp cotton-cloth trays without injury from such sudden and continued exposure to an air temperature of 53° F. A most striking fact was that in such as had the choroid or pigmented coat of the eyes in process of development had the formation of the pigment arrested in correspondence with the general arrest of development observed.

"Returning to the eggs of the 8th June, these were examined June 11, 9 a. m. Development is still normal; the eyes are perfecting, but the perfectly normal blastoderm does not yet quite cover the vitellus, the diameter of the opening at the caudal pole, where the vitellus or yelk is still exposed, being equal to about one-seventh of the circumference of the egg. Temperature during the night 49.5° F.

"Other lots of ova, taken on the 6th and 7th of June, and removed from the hatching-cones and put on the cloth trays in the refrigerator box, have been greatly retarded, but the development is normal, no abnormalities whatever having been observed. The lot taken on the 8th and put into the refrigerator on the 9th, after having been in the water for twenty-four hours, are well advanced, the tail being twice as long as the portion of the embryo's body attached to the yelk, and the fin-folds being nearly fully developed dorsally and ventrally.

"The eggs first put into the refrigerator on the evening of the 8th June now show a disposition to wrinkle, *i. e.*, part with the water inclosed between the egg-membrane and the vitellus, and are collapsing. Perhaps this is due to evaporation."

Afterwards I abandoned the view that evaporation was the cause of the collapse and wrinkling of the egg-membranes. I am now fully convinced that it was due to the invasions of a fungus.

"Same lot of eggs of June 8 examined June 11, at 7 p. m. Blastoderm not yet quite but very nearly closed over the vitellus. Only a very small round opening at the tail of the embryo marks the point where its closure is about to take place. Temperature 53° F. in refrigerator. Development normal in those which are not collapsing, after remaining seventy hours on the trays.

"June 12, 11 a. m., eggs of June 8 in refrigerator for the most part still alive. Temperature 52° F. Development has been normal up to this point; the blastoderm has closed over the vitellus, and the tail is just beginning to bud out as a rounded knob, as in twenty four to thirty-six hour embryos hatched in water ranging from 80° to 72° F.

"Eggs of June 7, partially developed, have commenced to collapse in the refrigerator box. This appears to be due to the growth of the fungus on the ova.

"June 13, 10 a. m., examined the eggs put into the refrigerator on the night of the 8th. They are now nearly all dead. Those not affected with fungus mycelium still plump and normal in development; caudal knob but a little more prominent than when examined on the 12th, at 11 a. m. Temperature in box 53° F."

We may sum up the result of these experiments as follows:

After a little more than four and a half days the ova of the shad exposed on cloth trays to a temperature of about 52° F. have not advanced further than they would have done in water at a temperature of 80° F. in 24 hours, or in 30 to 36 hours in water at a temperature of 74° to 68° F.

But after four and a half days our embryos have not yet passed through half of their development, so that it would be safe to say that the period of incubation at this rate could be prolonged for nine days, or a period long enough to readily admit of the transportation of ova so retarded across the Atlantic to England, France, or Germany. The bar to our complete success, however, was the rapid and fatal development of the fungus, which is probably a saprolegnious form identical with the one commonly productive of more or less loss in hatching out ova in water in all the forms of apparatus which I have seen used. If attention were directed to a means of destroying the germs of these organisms I think success might be very confidently anticipated. To effect the complete destruction of the spores in the water used, and to prevent their ever coming into contact with the eggs, upon which they lodge, germinate, and grow, are the preventive measures to be adopted. These measures are, I believe, feasible, but may involve some trouble in their execution. The experiments of Tyndall and Pasteur have taught us that it is possible to sterilize any fluid and render it absolutely free from all forms of organic germs by energetic boiling, taking care afterwards to exclude the germ-laden air by means of stoppers of cotton wool, or by hermetically sealing the vessel. Such a method would, of course, not answer in this case, as in sealing up a vessel containing the eggs in sterilized water they would be smothered. The precautions which are practicable, however, are these: (1) Take care to scald and thoroughly sterilize the pans into which the fish are spawned; (2) take care to wipe the spawning fish clean, and, above all, avoid rubbing off the scales or to allow these to drop into the spawn or milt; (3) use only sterilized water to "bring up" or water-swell the eggs; (4) take care to scald out the refrigerator and cloth trays, so as to sterilize these of any germs; (5) it would also be necessary to boil and sterilize enough water to keep the eggs and cloth trays moist during the process of retardation; (6) the sterilized water should be kept tightly covered in a clean vessel; (7) in managing the refrigerator care should be taken in opening and closing it, and in order to ventilate it the opening in the upper part of the chamber for the admission of air should be provided with a filter of cotton-wool; (8) it would be necessary to scald and sterilize new cotton cloths, since these are almost always laden with germs. These precautions observed with scrupulous care would insure success, as far as the danger from fungus is concerned, in conducting this mode of retarding development.

The second series of experiments were conducted at Washington, in association with Col. M. McDonald, this gentleman having kindly undertaken to aid in the work of experimentation, by means of various ingenious forms of small and convenient hatching apparatus of his own devising, mostly made of glass. The method pursued consisted partly in treating the eggs for some time on the dry principle on trays, completing the incubation afterwards in the glass apparatus fed with water from a coil of tin pipe kept under ice in a refrigerator. This enabled us to maintain the temperature of the water supply at a pretty constant point, ranging from 60° to 63° F. It was necessary, on account of the distance which the eggs had to be transported, to use trays covered with damp cloths, on which the impregnated, water-swollen ova were carried in transit from the spawning grounds. The experiments were conducted in the basement of the Smithsonian Institution, where some of the trays of eggs were placed in a refrigerator and others put directly into the water at the temperature stated above, using the McDonald apparatus. The results of these experiments were of great interest and of considerable value, as giving us data for certain precautions to be observed in the conduct of future work and experimentation, as may be learned from the account of them which follows.

Colonel McDonald found it necessary to devise some ready means of transporting the ova from the spawning grounds over a score of miles down the Potomac. This necessity for an expedient proved that the transportation of ova by the dry method immediately after they had been water-swollen was possible, and that it would answer for long distances. To illustrate: some were kept on the trays in good condition for seventeen hours, in the ordinary temperature of the air, 70° to 80° F., prevailing at that season of the year (July). When the temperature of the air was up to 90° F. it was found that the ova carried on trays and allowed to remain on them would tend to spoil quickly, as *Bacteria* and *Vibriones* were distinguishable on all the spoiled putrescent ova carefully examined under the microscope. It is therefore evident that in warm weather, in transporting ova by the dry method for long distances, it would be necessary to take certain precautions to prevent the access of the germs of such putrefactive organisms to the eggs. Essentially the same method of procedure recommended to guard against the introduction of the spores of the saprolegnious fungus to the eggs would apply here. Such precautions, however, would only be necessary where it was desired to retard the development for a long time, in case it was desired to transport the ova long distances. I think it would be found practicable to carry eggs on trays on damp cloths for a period of twenty-four to forty-eight hours without the least difficulty, provided a refrigerating apparatus was constructed in which the temperature could be kept at 60° to 65° F.; below this temperature it would not be safe to go for the ordinary purposes of transportation from the spawning grounds remote from the hatching stations. An important matter to attend to in the application of the above plan will be to effectively scald the cloths which are laid in the trays each time before they are again used, or else they will become the nidus of untold myriads of putrefactive germs which will lodge from the air in dust, and the retention and development of which would be favored by whatever of mucus, dead eggs, egg-membranes, and blood might adhere to the cloths from one time to another.

The putrefactive germs always liable to be conveyed in the impalpable dust constantly suspended in the air of houses in this latitude are consequently much more insidious in their approaches than the germs or spores of the saprolegnious fungus, which ordinarily causes a considerable loss of eggs in the hatching-cones. The eggs attacked by the fungus in the water first turn white; the egg-membrane then shows a disposition to wrinkle or become flaccid; the mycelium or growing stage of the fungus is now in active progress. The mycelium is simply a felted meshwork of branching fungus cells, which appropriates the substance of the egg and completely envelops its membrane. In this stage it is comparatively harmless. Afterwards from the felted mycelium threads club-shaped cellular prolongations grow out, which radiate in all directions like the seeds on a dandelion seed-head. In time each one of these club-shaped heads of the fungus, to the number of hundreds on every affected egg, develop a large number of spores or germs on the inside; directly the end bursts open and the minute spores swarm out of the club-shaped spore-case in great numbers. Each of the spores is capable of independent movement by means of long vibrating filaments attached to it at one end. These wander about in the water, lodge on healthy eggs, and grow on and destroy them, so it is important that infested eggs should be removed as soon as they make their appearance in the hatching apparatus. Kühne and Cohn have shown, however, that a temperature of 140° F. is sufficient to kill the germs of *Bacteria* and other putrefactive organisms, and it is very likely that such a temperature or less than the boiling point of water, 212° F., would be quite sufficient to clear off and kill any fungus germs which might adhere to the pans, trays, and cloths used in the transportation of ova.

The preceding account of the development, destructive growth, and maturation of the spores is from personal observations made on eggs infested with fungus in the hatching-cones on the barges at Havre de Grace in 1880, and it is only introduced here to direct attention to some possible means of staying or mitigating its ravages. I do not pretend to know the species by its botanical name. I leave its identification for the cryptogamic botanists; practically a knowledge of its life-history suffices for our purposes.

The following record of the most salient features of my observations, made in association with Colonel McDonald, is on the whole not as encouraging as the experiment made at Havre de Grace, Md., but it is of value on account of the pathological changes or deformities which it was found were induced in embryos when they were subjected to too low a temperature. Only in the very late stages did they appear to be comparatively free from this influence tending to the production of deformities.

A lot of eggs which had the germinal disk biscuit-shaped and normally developed were placed on trays in the refrigerator in the evening, in an air temperature of 45° F. They were found in apparently normal condition after twenty-four hours had elapsed, but had made little or no progress in development. After twenty-four hours more, or after exposure for forty-eight hours to an air temperature of 45° F. on damp cloth trays, the germinal disk was found to be deformed and dead, being helmet-shaped, with one or two constrictions or furrows running round it. The vitellus or yelk still retained its normal appearance, however, the vitelline spheres being clear, with the protoplasmic mesh-work enveloping them in a normal way. Of the same lot, those which were taken out of the air temperature of 45° F. and put into water at 74° F. hatched out normally in a good percentage, without deformities, showing that a sudden transfer to water at a much higher temperature was not attended with difficulties. The prolonged stay of forty-eight hours of the the same lot in the refrigerator at 45° F. showed that complete arrest of development and death would supervene, and that a profound abnornormal change in the form of the germinal disk would result.

Another series of experiments with eggs kept in a temperature of 64° F. showed the same tendency to retard development as was shown by the Havre de Grace experiments. Embryos of the same age in water at 74° F. developed nearly twice as rapidly.

Other experiments showed that eggs which had been retarded in development at a temperature a little below 52° F. for two days exhibited a tendency to develop abnormally. The abnormal phenomena which were noticed principally affected the notochord or embryonic axial cartilaginous rod, which had a tendency to become bent and twisted, while constrictions were also apt to appear, giving it an irregular, beaded, and generally misshapen appearance. Such deformities seemed to affect only the caudal portion of the notochord, the portion toward the head end of the embryo being normal in its appearance. In this way great deformities of the tail arose, so that in a microphotograph of an embryo two-thirds developed the tail, instead of being gracefully bent flatwise to one side, is abruptly bent downwards and then upwards, so as to be approximately V-shaped as seen from the side.

Sometimes the deformation of the tail would only be noticeable at its extremity; at others the deformed portion of the notochord would extend some way forward over the yelk beyond the point where the tail originated, as it budded out from above the point where the blastoderm closed. In no instance was it observed that any deformity or disturbance of the structure of the yelk took place, or that the epiblastic or hypoblastic coverings of the latter were distorted.

The epiblastic coverings of the tail, however, showed a tendency to crumple and become distorted. It was also commonly noticed that the epiblast showed a tendency to proliferate or throw out masses of cells in the form of irregular knob-like clusters. These increased rather than diminished in size as development progressed. No other structure of epiblastic origin took part in the tendency to become misshapen. The eyes, nasal pits, and ear capsules were normal in every respect. The heart pulsated more slowly than in embryos hatched in water of the usual temperature. This was probably due to the benumbing effects of the low temperature.

When deformed embryos were transferred to water of 74° F. they showed no signs of regaining their normal shape, but, on the contrary, the deformity seemed rather to be aggravated as development proceeded. This was the case also when transferred to water ranging from a temperature of 60° to 64° F. Once established, any deformity in development seemed irremediable by any further stages which might be necessary to complete the developmental processes undergone in the egg.

In the light of these researches, taken in their entirety, it would therefore appear that 55° to 53° F. is about the limit to which we can with safety reduce the temperature in which the ova of the shad will undergo their normal development. This temperature would give us, approximately, nine days as the longest period of incubation attainable, time sufficient, added to the four days required for the young to absorb the yelk-sack, or thirteen days in all, to take embryos to be incubated on the route all the way across the Atlantic, or even as far as the Danube or Black Sea. Even this period may be somewhat extended, since it is possible to retard the absorption of the yelk-sack of the young fish by keeping them in water of 60° to 65° F. A temperature of 55° F. would probably not be injurious at this stage. I have kept the young in water at 38° F. for half an hour without apparent injury. They had been hatched only a short time before. The cold would benumb them, and they would lie quietly at the bottom of the vessel until restored to activity as they were warmed up in water of over 70° F., to which they were at once transferred without harm. The muscular masses at the sides of the body were benumbed, as indicated by the quiescent behavior of the embryos. Tissue metamorphosis would be hindered by such a fall in the temperature of the water. We saw that the cold caused the pulsations of the heart to diminish in rapidity. This abatement in the activity of the forces concerned in the transformation of the stored protoplasm of the yelk into the structures of the growing embryo would be very marked in consequence of subjecting young shad to a temperature of 55° F. By this means, reasoning from what we know of the other phases of development when exposed to like temperatures, the absorption of the yelk might be retarded so as not to be completed for six or seven days. This would give us, added to the maximum period of incubation of nine days at 53° F., a total of fifteen days, a period certainly long enough for all practical purposes in the transportation of young fish for stocking purposes.

I would take this opportunity to remark that it must, however, be borne in mind that the growth of an embryo in the egg is different from the growth of the young animal after it has been hatched and begins to feed. The fish embryo has a store of food, which is inclosed in the yelk-sack, which can scarcely be said even to be transformed; it only suffers a change of place, as particle after particle of the yelk substance is removed and built up into the structures of the growing embryo. This transfer is effected through the blood, and also by apposition from below. The young growing animal in feeding must truly transform the protoplasm which it eats; it must digest it; it is carried into the blood as chyle, and so to all parts of the body to repair the waste incident to the exhibition of life. The two processes, upon careful comparison, are wholly unlike. A fall in the temperature diminishes the rate at which this transfer of the yelk substance to the structures of the growing embryo takes place. The frequency of the pulsations of the heart decreases; consequently the yelk substance which is in contact with vascular sinuses below the embryo is not taken into the blood as rapidly. The result of all this is that the absorption of the yelk is impeded and made to minister to the development and growth in size of the young fish for a longer period.

A few other points and I have done with this part of the subject for the present. Most steamships now use fresh water distilled by an apparatus specially constructed for the purpose. This water, provided the most ordinary care was exercised in the storage, would be well fitted to use in the process of retardation. The eggs carried on the trays ought to be occasionally sprinkled with pure sterilized water. The distilled water supplied aboard steamships answers this description fully, and almost everything is accordingly ready to our hands. To reduce the temperature of the water used in the latter stages of development, when it would be necessary to transfer the eggs to water, say on the eighth day, or after they had been for eight days on the damp trays, it would be desirable to avoid contamination of the water from the ice. To avoid this the water should pass through coils of block-tin pipe, placed in tubs, and kept filled with cracked ice; thus we could lower the temperature to at least 60° to 58° F. The same water might be used several times over, because with care it would be so slightly contaminated with organic matter that putrefactive processes could not go on to any hurtful extent. The low temperature would also tend to arrest any tendency to putrescence. How to maintain a uniform temperature in the refrigerators, so as to guard against dangerous fluctuations of temperature, appears to me to be a matter of some difficulty, because sudden meteorological changes, such as we sometimes experience in this latitude, would influence the working of the apparatus. The best regulator would probably be a faithful attendant. The control of the temperature of the water flowing through coils surrounded with ice is, in the light of experience, a comparatively easy matter, as it has been found that in a coil of a given length the fluctuation in the temperature will not vary more than three or four degrees, if a little attention is bestowed in regulating the flow and keeping a good supply of ice packed around the coils.

The prevention of leakage or loss of water from the apparatus would be entirely overcome, both on board cars and steamships, by the adoption of the closed glass hatching-jars, of various forms, devised by Colonel McDonald. They appear to be cheap, and are very economical of room. There can therefore be no objection to the introduction of the apparatus into vessels and railway express cars on the score that it makes objectionable slop and slush on the floors or decks.

The foregoing, it appears to me, is an approximate solution of the problems which we set out to answer. Whether we are right another season's work ought to enable us to decide practically and finally, as we can now take up the subject intelligently. The preliminary experimental work has been completed.

LATER OBSERVATIONS ON THE RETARDATION OF THE DEVELOPMENT OF THE OVA OF THE SHAD.

The following data supplement and confirm in a somewhat remarkable manner the arguments put forth above. The facts there recorded were the results of experiments carried out with the help of apparatus specially designed to artificially lower the temperature of either the air or water in which the eggs were hatched. The value of the present series of observations depends entirely upon the fact that no artificial means were resorted to for the purpose of lowering the temperature, but that the eggs experimented upon, obtained, as they were, as early as the 9th of April, were, in consequence of the then prevailing low temperature of the water, subjected to no extraordinary or artificial condition arising from the use of a complex water or air cooling apparatus. The temperature of the water of the Potomac during the progress of the incubation of the eggs in question was at times as low as 48° F., but as a rule the water then in use in the McDonald hatching-jars, the apparatus utilized in the experiment, fluctuated only between 50° and 56° F., and even then very gradually, as the variation during any one period of twelve hours was rarely more than 1° F. There was a gradual but very slight rise in the temperature of the water from the beginning to the end of the experiment, which covered seventeen days. This gradual rise was covered by 6° or 7° F., as already stated. The average temperature of the water for the whole period was $53\frac{3}{4}$° F., which, as we see, was only a little above the "danger point," 52° F., if we may so call it, as indicated by my observations made in association with Messrs. McDonald and Clark last year. The results of this experiment have shown us that it is possible to retard the development of shad ova so as to prolong the period of incubation for a period five times that normally occupied in the process in the height of the spawning season, or for almost fifteen days. During my somewhat extended observations on the eggs of this species no such length of time of incubation has been recorded, nor has any one, to the best of my knowledge, recorded the fact that under such conditions of temperature the progress of the evolution of the embryo was perfectly normal, as was the case in the instance now to be described. Several persons have insisted that shad ova developing in too low a temperature would be found to be imperfect, especially the eyes, which, it was said, did not apparently develop at all. The lowest temperature in which I have seen shad-ova develop normally was 49.5° F., as recorded in my report of the experiments during the spring of 1881. Neither in those nor in the embryos which are the subject of this paper was any abnormality observed in the development of the eyes or optic vesicles.

Now for the history of the progress of the experiment and the ova. The latter were taken at one of the Potomac stations organized upon the plan proposed by Colonel McDonald. They were impregnated on the 9th of April at 7 p. m., and brought to the Armory on trays and spread out on damp cloths by Spawntaker Jones. They were placed in one of the McDonald jars on the morning of the 10th of April, but, unfortunately for the fullest fruition of our hopes, during the night, owing to an accidental occurrence or to the meddlesomeness of some irresponsible busy-body, too large a supply of water was turned on, causing the largest proportion of the eggs to be thrown out by way of the escape-pipe of the jar. What were then left, amounting to probably two or three thousand, had to suffice for the material for this account of their development.

On the 11th of April the temperature of the water was 57° F. It had been about the same or a little lower on the 9th and 10th; the water of the Potomac, from which they were obtained at Ferry Landing, was on those dates as low at 48° F. On the 12th the thermometer indicated a temperature in the hatching apparatus ranging from 50° to 51.5° F. On the 13th the temperature ranged from 51° to 52° F. This was the fourth day, and sketches taken from the eggs at this time showed that the blastoderm was just about to close, a condition ordinarily attained in a temperature of 74° F. in somewhat less than twenty-four hours. On the 14th of April the temperature was 52° to 54° F.; on the 15th, 53° Fahr.; on this, the sixth day, the tail began to bud out. On the 16th the temperature was the same as on the previous day, and the tail had by this time, the seventh day, grown to about one-third the length of that of the just-hatched embryo. On the 17th, the temperature was 53.5° F.; on the 18th, 51.5° to 52° F.; on the 19th, 53° to 53.5° F.; development still normal. On the 20th the temperature ranged from 53° to 54°; on the 21st, 55° to 55.5° F., and about this time, or on the twelfth day, the eyes began to show the first signs of pigmentation, becoming a shade darker than hitherto, verging toward brown. On the 22d the temperature of the water was 56°, falling to 55.5° F. On this, the thirteenth day, a few began to hatch; the eyes were now fully pigmented and normal in their development. On the 23d the temperature of the water was 55.5° to 54° F. On the 24th the temperature was from 54° to 54.5° F. During the 23d and 24th days of April the hatching continued, most of the embryos having ruptured their inclosing membranes on the 24th of April, or the fifteenth day of incubation. On the 25th the temperature ranged between 54.5° to 55° F., and on this date, or the sixteenth day, a few of the ova still remained unhatched. On the 26th the temperature was 55° F.; all of the ova were now hatched, and no abnormalities of any sort were noticed. The embryos, however, were for the most part lost, owing, as I think, to the circumstance that the water was allowed to flow too rapidly and violently through the hatching-jar.

The behavior of the hatching-jar was most admirable, but would have been still better had there been a larger quantity of eggs put into the apparatus. The most meritorious feature of the apparatus is the almost entire non-development of the saprolegnious fungus, which causes so great a mortality in some other forms of hatching contrivances in which all of the ova are not in continual movement. The very gradual, gentle, and continual rolling movement of the ova upon each other in the jar apparently prevents the spores of the fungus from adhering. The cleanliness of the apparatus is also to be commended, whereby the use of skim-nets for cleaning is dispensed with, while the material of which it is made—glass—enables one to watch the progress of development very satisfactorily from the outside of the jar with a hand-glass or pocket lens of moderate power.

On the seventeenth day of the experiment the hatched embryos were in the condition of those normally developed at 70° to 75° F., the yelk being ovoidal, clear, and plump. At the rate at which the development progressed it would take five times as long to absorb the bulk of the yelk of an embryo in a temperature of 53.75° F. as at 75° F., or about twenty-five days. This period, added to the prolonged time of incubation at 53.75° F., would cover a space of forty days, or more than twice the time required to carry embryo shad to the farthest confines of Europe. The probability therefore, is that we have exceeded the lowest temperature practically required for this purpose, 55° F. being a much more favorable and less dangerous temperature than that prevailing during the successful experiment of which we have just given a detailed account.

ON THE RATIONALE OF RETARDATION.

Every developing ovum is made up of certain cellular elements, each one of which is provided with a central nuclear body, which appears in the light of recent researches to be the directive dynamic center of all further changes involved in the successive cleavages undergone by the cellular elements constituting that portion of the egg immediately concerned in the formation of the embryo. The assumed disappearance of the nucleus of the egg has been proved not to take place in the act of impregnation, in not only invertebrate ova but also in vertebrate ones as well.*

The hypothetical assumption of a *Cytode* or *Moneron* stage of development in the ova of all forms by Haeckel does not, therefore, appear to be sustained by facts. These and other known facts, such as the recent observation of the metamorphoses of the nuclei of Rhizopods in the act of division (multiplication) also throws doubt on the existence of the *Monera* themselves, as Hensen has suggested.† Nuclear networks inside of cells, as well as intranuclear networks, seem to be of almost universal occurrence, according to the researches of Flemming, Klein, the Hertwigs, Pfitzner, Fol, and others on animals and man, and by Strasburger on plants. Indeed, so strikingly is this true that Strasburger has been tempted to utter the dictum *omnis nucleus e nucleo*, which in English means that all nuclei originate from pre-existing nuclei, just as formerly Schwann expressed himself to the same effect in relation to the genesis of cells. Such intracellular granular networks extending outwards from the nucleus through the protoplasm enveloping it may be seen well developed in the coarse vesicular connective tissue cells of the American oyster, of which I have mounted preparations. Vastly more complex intranuclear reticuli are found in the nucleus of the unripe eggs of the common slipper-limpet, *Crepidula glauca*. I have seen the granular threads in these undergoing the most wonderful active changes of form. Spindle-shaped nuclei, the opposite poles of which were joined by granular threads, have been observed in the eggs of Elasmobranch fishes by Balfour. These were in the act of division, or in the diastole condition spoken of by Flemming. Œllacher has seen granular threads radiating from the nuclei embedded in the cells of th. germinal disk of the trout in its early stages of development. These

* This disappearance is more apparent than real, and while the nucleus may disappear temporarily it soon reappears, showing that nuclear matter still exists in the cell in a concealed or disguised form.

† A. Brass has recently demonstrated the presence of a denser central body in some of the so-called *Monera* by the use of reagents; this central body he regards as answering to the nucleus, while his studies also show these organisms to be far from homogeneous. Huxley, in 1877, had doubts as to the constancy of this distinctive character of the *Monera;* see p. 73 of his Anatomy of the Invertebrates. The Hertwigs have since shown the *Faraminifera* to be nucleated, and Leidy has shown that a nucleus is not always absent in some types, as in *Biomyxa*, for example.

nuclear transformations consequently occur in the cellular elements of fish embryos. These observations are further supported by the fact that both Brooks and myself have observed undoubted evidence of the rythmical nature of segmentation in fish-ova, which ought to be the fact, since it has been shown that the metamorphoses of the nuclei are likewise rythmical in character.

The metamorphoses or changes in the form and structure of the nucleus, are in large part connected with the genesis of new cells, in the successive acts of cleavage or segmentation; their metamorphoses doubtless also play an important part in the functions of rejuvenescence and depuration of cells, or in the general functions, repair and waste, as well as in the excretory and secretory functions of organs. But in retardation we have nothing to do with these latter kind of nuclear metamorphosis; we are only concerned with the alternate elongation and contraction of the nucleus attendant upon the process of segmentation or the fissiparous genesis of new cells, in which the pre-existing nucleus of a cell, about to divide, elongates, becomes severed into two parts, which become, respectively, the nuclei of two new cells. In the process of cleavage it has been shown that during the act of cleavage the nucleus of the cleaving cell elongates, becomes spindle-shaped; that the opposite poles of the spindle become, respectively, the nuclei of the two new cells resulting from the completed process of segmentation. During the active stage the two poles of the spindle are joined by a barrel or spindle-shaped series of granular threads. When the segmentation is about to be consummated these threads, half way between the poles, are found to have developed nodes or swellings; these mark the point through which the segmentation furrow will pass, so as to separate the old cell into two new ones. The segmentation furrow, accordingly, passes at right angles across the long axis of the spindle-shaped nucleus. As soon as the segmentation has been effected the granular threads are withdrawn from the nodal points at the place where the segmentation furrow severed them, and are finally retracted into what were formerly the two poles of the spindle. These poles are now the nuclei of the two new cells, and as soon as the granular threads are withdrawn towards these new polar nuclear centers the latter become globular and pass into the resting stage. Afterwards they both elongate and go through the same process as here described in the course of subsequent cleavage. This alternate elongation of nuclei into a spindle-form and contraction into a spherical form in the process of cleavage has been called by Flemming the *diastole* and *systole* of the nucleus. They accompany the rhythmical phenomena of segmentation and give us a rational and philosophical interpretation of the phenomena of segmentation. It must, I think, be plain to any one that this is essentially a dynamic process, in which the Artisan of organization almost makes His methods of work visible.

It also affords a scientific explanation of the phenomena of retardation. Inasmuch as we have lowered the temperature of the air and water, the media in which the ova of the shad underwent their development, and find that it is retarded in consequence, we must naturally conclude that the rate of segmentation, upon which the rate of development directly depends, has been in some way interfered with or impeded in its progress. Since we also saw that the rhythmical metamorphoses of the nuclei were directly concerned in the process of segmentation—that in them the *vis essentialis*, essential force of segmentation, really resides—it appears to me that we are also really bound to conclude that the fall in the temperature has affected the activity of this *vis essentialis* of the nuclei, which are retarded in their metamorphoses, in consequence of which the rate of segmentation and development is retarded. This fully and clearly accounts for the resulting prolongation of the normal period of development when the temperature of the media in which the ova undergo their evolution is lowered as much as is consistent with their regular, healthful incubation.

If retardation is possible it ought also to be possible to accelerate development. For centuries it has been the practice to accelerate and maintain the growth of plants in hot-houses and forcing-pits during inclement seasons of the year. This is proof enough, as far as the vegetable kingdom is concerned, that acceleration of the processes of growth, which simply means that the acceleration of fissiparous cellular proliferation or segmentation is here possible. Its philosophy is the same in principle as that of retardation; acceleration is the converse or reciprocal principle as opposed to the former. According to a table given by Mr. R. E. Earll, in his paper on the development of the cod, in the United States Fish Commissioner's report for 1878, page 724, we learn that the minimum time of incubation for the ova of this fish is thirteen days, temperature of sea-water 40° F.; the maximum time, according to the same authority, is fifty days, temperature of sea-water 31° F. Our own experience at Wood's Holl last winter taught us that the development of the ova of the cod was capable of being accelerated, for those in a glass cone near a warm stove hatched out in a shorter space of time (sixteen days) than any others. Our power to accelerate the rate of development of the cod may be of use, as we may thereby be enabled to hatch out a large percentage of ova in a very few days. Whether the young would be as vigorous as those incubated in the natural way remains to be learned.

Acceleration, like retardation of development, is accomplished by influencing the rate of the rhythmical metamorphoses of the nuclei of the cells of the embryo. Accelerate the rate of these metamorphoses and segmentation is hastened so as to cause development to proceed more rapidly. The stimulus is heat, a mode of motion, and we are forced to believe from what has preceded that the nuclear metamorphoses are simply the specific modes of motion of the cellular life centers. The molecules of the nuclear spindles, reticuli, &c., are made to move more or less actively in obedience to the fluctuations in the activity of this external stimulus. All this goes without saying, however, that the protoplasm, which in the case of every cell invests the nucleus, may not also share in the process; it is but natural that it should, because free nuclei, independent of any investment of protoplasm, are unknown to histologists.

Inasmuch as the granular particles of nuclear fibers and reticuli exhibit certain modes of motion which appear to be characteristic in the course of segmentation, and since we find that heat, admittedly a mode of motion, accelerates or retards the motion of living nuclear matter in its segmentational metamorphoses, are we not warranted in assuming both of these kinds of motion to be in a degree correlated and interdependent? The significance of the views here set forth in their bearings upon general physiology and pathology would appear to warrant the belief that we may yet be able to solve some of the knottiest problems in biology. Their practical significance in relation to the problems which have presented themselves for solution to the Fish Commission will also be apparent.

APPENDIX D.

PROPAGATION OF FOOD-FISHES.

XVII.—REPOPULATION OF THE WATER-COURSES IN BELGIUM.

By BARON DE SELYS LONGCHAMPS.*

[Member of the Royal Academy of Belgium and president of the Senate.]

Belgium has finally decided to attempt the repopulation of her water-courses. Our river fisheries, formerly so rich, especially in salmonoids and crawfish, are in greater danger than those of almost any other country. The causes of destruction are manifold, and they can be partially overcome only by great and persistent efforts.

Our two great rivers, the Meuse and the Scheldt [Escaut], differ in their character, and consequently produce different fish. From Antwerp downward the Scheldt becomes an arm of the salty sea, and the tide can even be noticed above that city. In this portion of the river the existence of fish does not seem to be endangered by the pollution of the waters. They catch there, at the proper seasons, the *Alosa finta*, the *Osmerus eperlanus*, and the *Coregonus oxyrhynchus;* but the last-mentioned fish cannot be very common, for in the Brussels market I have only found it in rare cases, and mixed with the *Osmerus eperlanus.*

The eel (*Anguilla vulgaris*) and the small plaice (*Pleuronectes flesus*) are very common there at all times. The sturgeon (*Acipenser sturio*) ascends as far up the river. In its upper parts and its tributaries towards Flanders, Hainault, and Brabant the Scheldt is fearfully polluted by the factories of Roubaix, Turcoing, Ghent, and Brussels. Formerly it was full of fish, although the fish suffered greatly from the pollution of the waters caused by the retting of flax in those parts of Flanders where this industry is carried on.[1]

The Meuse was celebrated for its salmon (*Salmo salar*), which ascended this river in order to spawn in its fresh-water tributaries which flow into it from the Ardennes and other mountainous regions on its right bank. The shad (*Alosa communis*) used to ascend the Meuse in spring

* "*Repeuplement des cours d'eau en Belgique,*" *par M. C. Baron de Selys Longchamps.* [From *Bulletin mensuel de la Société d' Acclimatation de France*, 3d *série, tome x, No.* 3, *Mars,* 1883, *Paris.*] Translated from the French by HERMAN JACOBSON.

[1]Under the title "*Suppression totale du rouissage putride par l'application dex système de M. Lefèbre*" (Total suppression of putrid retting by the application of Mr. Lefèbre's system) an important pamphlet has appeared, which was read at the meeting of the Central Society of Agriculture of Belgium, June 13, 1881. (Brussels, E. Guyot, 1881.) The practical results of this method are given in detail.

in enormous numbers, but rarely higher than Huy. Most of the rivers which flow into the Meuse, the Vesdre, Ourthe, Hayoux, Bocq, Lesse, Semoi, and their tributaries, were full of trout (*Salmo fario*) and ombres (*Thymallus vexillifer*), not to mention other food-fish which are found throughout the whole middle portion of Western Europe.

This paradise of fishermen has well-nigh been destroyed. To meet the needs of boating and navigation towards France great river improvements have been made along the entire course of the Meuse. The dams in the river prevent the greater part of the salmon from ascending it. Those fish which succeed in clearing these obstacles are scarcely able to do it except by favor of high tides and occasional inundations.

As regards the shad, which not long ago gave rise to truly miraculous fisheries near the city of Liège,[2] it is stopped by the dams found farther down the river; and I do not think that it will be able to clear the salmon ladders which are going to be established, let us hope under better conditions than those which have hitherto been tried. We may not indulge in the flattering hope of seeing the waters of the Vesdre again rendered sufficiently pure to support fish. They have been too strongly poisoned by the washing of wool and the dyeing establishments and cloth manufactures of Verviers.

It might not be impossible, however, to arrive at a satisfactory solution of the question by leading the polluted waters of Verviers as far as the Meuse through channels running parallel with the Vesdre. Works of this kind are now constructed, at a moderate expense, for leading the juice of the beets from the places where they are grown and first ground to the sugar-refineries, a distance of several miles. As a work of this kind on a larger scale we may mention the collecting channel of the Senne, at Brussels, and also the works constructed in England to lead the refuse water of London into the sea. This last-mentioned work has been so successful that recently trout have been caught in the Thames, where they had long since disappeared. In the water-courses of the right bank of the Thames, where the water has remained pure, trout is found, but unlicensed fishing is there carried on on a large scale.

As regards the tributaries of the right bank of the Meuse, the industries which there kill the fish are manufactures of chemicals, sugar-refineries, and to a less degree distilleries.

Excellent laws have been made for regulating the fisheries and for suppressing the mischievous destruction of fish, but as it is out of the question for us to restore the salubrity of the waters by taking measures which would render industry impossible, we must appeal to science if we wish to obtain the means for rendering healthy the poisoned waters of our rivers.

When pisciculture came into vogue, almost forty years ago, it was

---

[2]At the end of April and in the beginning of May I remember to have seen taken near Liège, at one haul of the net, as many as two hundred and fifty and even three hundred large shad.

thought people had solved the problem of the repopulation of our rivers. The founding of the Society of Acclimatization in France, and the establishment of the piscicultural station at Hüningen gave the first impetus. Prior to this the King of the Belgians, Leopold I, had successfully engaged in fish culture on his estates in the Ardennes, following the old methods of the German foresters.

In 1853 M. Ernest von den Peereboom had spoken in favor of fish-culture in the Chamber of Representatives. Experiments which were made at the time, but in waters very little suited to the purpose and with defective apparatus, did not prove successful.

Some time afterward a more important society of fish-culture was formed, and serious efforts were made. This society, however, only existed a short time. The mistake had been made to embrace in its work too many branches of this new science, and to attempt, moreover, the culture of oysters and salt-water fish at Nieuport, which place did not possess all the conditions necessary for such culture. People finally entertained the idea, which was widely spread at the time, that trout and even salmon could live in all the pure waters of the country and prosper, even when shut up and in a state of confinement. Hence the mistakes and finally the dissolution of the society, which was composed in great part of persons whose property was not in the region where salmonoids can live.

Although for twenty years the question may be said to have slept, from a practical point of view it has at least not been buried, for several times during this period it has given rise to public discussions and various publications. It is necessary to give a brief historical sketch of the phases through which this question has passed before its active awakening.

In 1865 and 1866 the provincial council of Brabant appointed a commission whose duties were to study the best means for purifying the water-courses, and to find means for repopulating our brooks. The late M. de Gronckel prepared the report of this commission, and stated in it that in this matter the most powerful interests centered, which it has became the duty of the authorities to protect, to harmonize, and conciliate as much as possible, above everything the interests of health and security from inundations. To this must be added, he says, a question of alimentation and national wealth, viz, that of preserving and multiplying the fresh-water fish.

The "Free Society of Emulation" of Liège, at the instance of my regretted friend, Theodore Lacordaire, professor of zoology at the University of Liège, set a prize for the best answer to the following question: "*To determine the causes which for the last twenty years have brought about a degeneration of fish in the rivers of the province of Liège, and to indicate the means for remedying this state of affairs.*"

The prize essay, which was printed, came from the pen of the late Charles Lehardy de Beaulieu, a well-known and highly esteemed engineer and economist. He attributes the decrease of fish to the excess of consumption over production. He strongly recommends pisciculture and a proper regulation of the ownership of water-courses, the use of which he would like to see placed in the hands of associations whose interest and perseverance would finally succeed in discovering the various causes by which the water becomes impure. He thinks that, forced by sheer necessity, people would endeavor to utilize as manure, or in some other way, the hurtful substances, which at present they find convenient to throw into the river. He cites the example of the city of Reims, where the soap water which has served for cleaning wool is used in the manufacture of gas[3].

In the same year (1866) I was a member of a commission appointed by the Government for studying on our coasts various questions relating to the sea-fisheries. This commission expressed the wish that a similar inquiry might be made relative to the fresh-water fisheries. In December, 1866, I read, at the meeting of the division of science of the Royal Academy of Belgium, an essay *On the River Fisheries in Belgium*, which was published, accompanied by notes and documents.[4] It would be useless to give an analysis of it in this place, for it would only be a repetition of a statement of facts, which are but too well known to the public, relative to the causes of the depopulation of our rivers and the means to lessen their evil effect. The portion of the evil which must be attributed to the pollution of the water has grown considerably since that time.

The draft of a fishery law which, as I announced in a postscript, had been prepared by the Government, had to wait for fourteen long years before it was discussed and voted on by the Chamber of Representatives.

In 1879 M. Emile Gens, doctor of natural sciences and professor at the College of Verviers, published a very interesting little brochure on the protection of fresh-water fish in Belgium (*De la protection du poisson d'eau douce en Belgique*). The author, after having sketched in brief outline the deplorable condition of our river-fisheries, proposes the following measures for remedying the evil: (1) Prohibition of fishing in all rivers and canals during the months of April and May; (2) prohibition of fishing from September 15 to January 1 in all water-courses on the right bank of the Meuse (it is here that the salmonoids live), permitting, however, the fishing of salmon after November 15, the spawning having then taken place; (3) severe fines for employing dynamite and *Cocculus indicus;* a systematized supervision of the rivers. (4) prohibition of the sale of *Cocculus indicus* in drug-stores; (5) prohibition of all night fishing; (6) prohibition of fishing in streams by means of

---

[3]The memoir of M. Lehardy de Beaulieu, preceded by the report of M. Lacordaire, was published in 1866, in vol. iii (new series) of the *Mémoires de la Société libre d'Émulation de Liége.*

[4] *Bulletins de l'Académie royale de Belgique,* 2d series, vol. xxii, 1866.

weirs or dams which lay dry for a time a portion of the bed; (7) regulating the size of meshes so as to allow all fish measuring less than 15 centimeters to escape from the nets; (8) establishing salmon-ways wherever obstructions exist of such a nature as to prevent the migration of fish; (9) prohibition of fishing with the hand, &c.; (10) measures to prevent as much as possible the pollution of the waters by manufactures established on their banks; (11) serious efforts at organized fish-culture; (12) committees of surveillance, furnished with the necessary authority to prohibit fishing locally and temporarily, in the interest of the repopulating of the rivers.

In the following year (1880) M. Gens was commissioned by the Government to visit the Berlin Fishery Exposition, and attend the Piscicultural Congress which opened its sessions in that city in April. His report was published in the *Moniteur belge* for September 19, 1880.

Our honored colleague M. Raveret-Wattel has in the *Bulletin Mensuel de la Société d'Acclimatation de France* produced such an excellent and complete work that I deem it unnecessary to give an epitome of M. Gens's work on the same subject. I will confine myself to pointing out some of its details. The author mentions the fact that several essays had been written on the problem of rendering the water from manufactures harmless to the fish in those parts of the river where such waters are emptied. It is well known that the King of Saxony had set a prize for the answer to this question, which is of great interest to us in Belgium. M. Gens also mentions a simple means, which had been spoken of at the congress, of rendering small water-courses, such as those which drive mills, pure. If the dam is constructed on an inclined plane, it is sufficient to place a beam obliquely across this place, which is certainly inexpensive, and should be done in all cases. In chapter 4 he takes up the principles laid down in his pamphlet of 1879, mentioned above, and supplements his former statement by giving a list of nearly all fresh-water fish found in Belgium, which he, according to their nature, classes in three groups: those which are common to our two regions, those which are found in the mountainous region, and those which are found in the plains.

In a special chapter M. Gens treats of piscicultural establishments.

Belgium did not possess a large sheet of water combining purity, coldness, and depth, where it might be hoped that the salmonoids of the Swiss lakes could be acclimatized. To-day this is different. In order to check the temporary inundations of the Vesdre, and at the same time to supply water to the city of Verviers, which at certain seasons suffered from the want of it, there has been constructed from one mountain to the other, near the mouth of the Gileppe, at the height of 241 meters above the level of the sea, a gigantic dam, 47 meters in height, which when filled holds 12,000,000 cubic meters of the waters of that sub-Alpine river, which receives all which flows into this dam from a forest of about 4,000 hectares called the "Hertogenwald," and from the marshy regions called the "Hautes-Fagnes," which at their highest point rise to a height of 700 meters. The Lake of Gileppe, which has thus been formed, has an area of 800,000 square meters, and the water in the dam has a depth, varying from 25 to 45 meters.

Here I would advise the introduction of the great lake trout (*Salmo lacustris*) and the trout of the Alps (*Salmo salvelinus*), of the *Coregona fera*, and of certain American salmonoids which do not go into the sea, and which would find all possible levels for spawning from the dam to the river flowing in its pebbly bed and feeding the lake.

Our minister of public works commissioned M. de Clercq, chief engineer of bridges and roads, to prepare some propositions as to the best mode of repopulating the navigable rivers. The remarkable work of this skilled engineer was published in 1881.

The propositions which he makes for remedying the depopulation of our waters are classed in the following order:

(1.) To prevent the pollution of the waters.

(2.) To prohibit the destruction of sedentary fish during the spawning season, and to regulate the catching of migratory fish.

(3.) To construct fishways at all dams in the Meuse and its tributaries which are too high for the salmon to leap over.

(4.) To arrange spawning-places where the fish find all the conditions favorable to reproduction.

(5.) To engage in practical fish-culture as far as the salmonoids are concerned.

These various points are carefully treated by a man fully competent to do justice to the subject. I will quote what he says relative to the pollution of the waters, because this is, in my opinion, the principal obstacle in the way of repopulation:

"There can be no question of prohibiting industries which are closely interwoven with the general welfare of our country, but it is important to prohibit the throwing of substances into the water without having been treated in the most efficient manner for freeing it from those substances which are hurtful to fish, and at least as much so to other animals which drink this polluted water. The pollution cannot be considered as sufficiently weakened unless the waters are rendered fit for fish to live in."

There is another chapter in this work which will repay careful perusal, the one in which M. de Clercq describes in detail the construction of good salmon-ways, and indicates the defects which make some salmon-ways worthless. We must here point out, in a humbler sphere than the management of great rivers and the interests of the salmon fisheries, the obstacle which many water-mills present to the repopulating the small streams. I refer to those mills which are placed near small water-courses in plains which have but a slight grade. When the mill is not placed on a channel branching off from the river, but blocks the river entirely, it interrupts the circulation of the fish. The level of the water will under these circumstances vary constantly: sometimes, when the mill is at rest, it will be very high; at other times, when all the water is utilized by the mill, it will be so low as almost to lay the river dry. Under these conditions the reproduction and the very existence of fish becomes impossible. If one takes account from another point of view, of the enormous harm which is done to rivers by the fact that the water in these water-courses is nearly always kept at too high a level, thus making the rivers marshy; if furthermore it is remembered that mills render temporary inundations more dangerous, that great damage is done to agriculture, and finally that public health is endangered, it is to be desired that the water-mills of which I have spoken should as soon as possible, be replaced by wind-mills, or, still better, that they should obtain their motive power from a small steam-engine.[5]

By the provisions of the "Law of the river fisheries," passed by our Chambers towards the end of the year 1881, the supervision and preservation of these fisheries is placed in the hands of the administration of forests. The right of fishing in navigable rivers and canals belongs to the Government, which farms out the fisheries, thus deriving a profit therefrom. Fishing with a line held in the hand, however, is free to all citizens. In other water-courses than those mentioned above the people living on the banks possess the right of fishing. The season when fishing is allowed and the implements to be used are determined by the Government, which also regulates the sale of fish. Fishing is allowed at all times to proprietors of ponds and reservoirs whose waters have no natural communication with the rivers. Boatmen are prohibited from having on board any fishing apparatus but lines. As regards the throwing into the water of hurtful substances, when not done with the object of destroying fish, it is regulated by the "Law on water-courses," previously passed by the Chambers. As, unfortunately, the carrying out of these regulations is in the hands of provincial and communal authorities, which are elective, much remains to be desired. In my opinion the central Government ought to have charge of this supervision.

After the law on river fisheries had been passed a member of the division of science of the Royal Academy of Belgium thought that a favorable time had come for encouraging scientific researches and practical experiments in repopulating the polluted water-courses. He placed at the disposal of the Academy the sum of 3,000 francs as a prize to be given, in 1884, to the author of an essay which would indicate a satisfactory solution of this problem.

At the end of this article I shall give the conditions of this competition as they are found in the transactions of the Academy, with the view of directing to it the attention of scientists and practical pisciculturists who might feel inclined to compete for the prize.

Although the conditions mention certain local questions which spe-

---

[5] This last-mentioned system has recently been recommended in a petition of the inhabitants of the banks of the Geer, a tributary of the Meuse on its left bank, in which petition they ask the Belgian Government to order the suppression of all water-mills, as a measure of public usefulness.

cially concern Belgium, it is my opinion that any one capable of answering the principal questions could easily put himself in possession of the necessary information. I am moreover convinced that many parts of France are situated like Belgium as regards rivers whose depopulation is caused by the pollution of the water.

It was on the 1st of April, 1882 (a very appropriate day for discussing the fish question), that the Academy, by a great majority, passed the resolution to invite competition for the prize referred to above. It was not a public session, but I believe that I shall not be guilty of an indiscretion if I state in a general manner the principal objections raised against this proposition by conscientious men of science. One of them thought that this would draw the Academy into an administrative sphere, which was not, properly speaking, its domain, and that it would look as if the Academy was under the impression that the laws of the land were not properly executed, especially that of May 7, 1877, "on water-courses not suitable for navigation and rafting," which imposes fines on persons who throw into the water substances liable to pollute or change it. The law also provides that owners of water-courses who have in this manner had their property injured may bring the matter into court.

Another member of the Academy remarked that he had made many researches with the view of finding a suitable and practical method for purifying the waters from manufactories, but that all these researches had failed to lead to a satisfactory end. He mentioned the evaporation of polluted water which certain manufactures are compelled to introduce, which process, however, produces a smoke having an odor which becomes almost unbearable for persons living in the neighborhood. He moreover thought that with our elective system few persons would dare to strictly carry out the necessary measures. He finally felt certain that the question was full of dangers on account of the exigencies which would arise if the present condition of the waters was made widely known, and it was stated at the same time that so far no remedy had been found for this deplorable condition.

A third member asked that statistics be prepared showing the amount of capital invested in the industries in question, and that this sum should then be compared with the value of the fish destroyed by waters polluted by manufactures. The author of the proposition has answered, in substance, that the scientific solution of this problem comes very properly within the province of the Academy; that there is no idea of finding fault with the administration, as, on the contrary, it was intended to call science to its aid to furnish it with the practical means of attaining the object for which the law was intended. He calls attention to the fact that the programme invites research for the purpose of finding means of purifying the water, which would make it possible for fish to live in it, with the express reservation that these remedies shall not endanger the existence of manufactures. In his opinion the value of the manufactures and that of the fish which they destroy by rendering the water impure are not, strictly speaking, comparable, because manufactures are private enterprises whilst water-courses and fish are of general use to all the inhabitants of the regions through which the rivers flow.

Soon after the Academy had passed the resolution referred to we received the programme of the Great International Exposition of the Products and Apparatus of Fisheries which was to open in London on the 1st May, 1883. It has given me great satisfaction to find in this programme two paragraphs which agree entirely with the demands of the Belgian Academy. Under Class IV (pisciculture) we read (division 39): "It is desired to show a system for destroying the hurtful effects to fish of rivers and streams impregnated with water from sewers, chemical and other products, a system illustrated by models and designs." In division 40 we read the request for the solution of a problem intimately connected with the one just mentioned, viz, "physico-chemical researches of the quality of fresh and sea water which is hurtful to aquatic aninals," &c.

The Belgian Government, recognizing the necessity that our country should not remain behindhand in this great movement which is going on everywhere, has appointed a commission of six members to study the questions relating to the repopulation of our water-courses.

This commission is composed of Lieutenant-General Baron Goethals, president; Baron de Selys-Longchamps, president of the Senate and member of the Academy; Willequet, member of the Chamber of Representatives from Ghent; Edouard von Beneden, professor of the University of Liège, member of the Academy; De Clercq, inspector-general of bridges and roads, Brussels; Emile Gens, doctor of natural sciences, professor at Verviers; Leyder, professor of the Agricultural School of Gemblous; Mousel, inspector of waters and forests, Arlon; Denis, merchant pisciculturist, Brussels; and Bernard, chief of division in the department of the interior, secretary. This commission, appointed October 27, 1882, has already held several meetings, at each of which different communications have been made, and have led to discussions having for their object the study of the proper measures which should be taken to satisfy the wishes of the Government. We have reason to believe that this activity will not relax, and that active work will soon be begun.

Here follows the programme for competing for the prize, adopted by the Academy:

ROYAL ACADEMY OF SCIENCES, LITERATURE, AND FINE ARTS OF BELGIUM.

Class of Sciences—Extraordinary competition for 1884.

The Government has proposed and the Chambers have passed a law which has for its object the preservation of fish and the repopulation of our rivers.

The principal obstacle in the way of attaining this end is the pollution of the water in the small streams which are not suitable for navigation or rafting, which are corrupted by solid or liquid substances thrown into the water by various manufactures, and which are hurtful to the reproduction and existence of fish.

The Academy appeals to science to aid in the accomplishment of the objects had in view by the authorities. Accepting the proposition of one of its members, who has generously placed at its disposal the sum of three thousand francs, it requests that a thorough study should be made of the following questions, both chemical and biological:

(1.) Which are the special substances in the principal industries which when mingling with the water of small streams render them incompatible with the existence of fish and unfit for the use of man and beast.

(2.) Prepare a list of the Belgian rivers which have become depopulated from this cause, indicating the industries peculiar to each of the rivers, and give a list of the food-fish which used to live in these rivers before the establishment of the manufactures.

(3.) Indicate practical means for purifying the water before it leaves the manufactories, so as to render it fit for fish to live in, without endangering the industries, by combining the aids afforded by the construction of clearing-basins, by filtering, and by the employment of chemical agents.

(4.) Make special experiments relative to the substances which in each industry cause the death of fish; and also relative to the degree of resistance which each kind of food-fish can offer to its destruction by the causes above mentioned.

The treatises must be written legibly, and should be addressed, prepaid, to M. Liagre, permanent secretary, at the Palace of the Academy, not later than October 1, 1884. The Academy requests that all quotations should be exact. Authors will, therefore, indicate the edition and the pages from the works quoted. Illustrations will only be admitted when drawn by hand. Authors will not sign their name to their treatise, but will simply sign by some mark, which they will reproduce in a note containing their name and address. Failure to comply with this formality will prevent a person from obtaining the prize. Treatises sent in after the above-mentioned date, or those whose authors make themselves known in any way whatever, will be excluded from the competition.

The Academy deems it proper to call the attention of authors sending in treatises to the circumstance that from the time when such treatises are submitted to the Academy they are and will remain deposited in its archives. Authors, however, can have copies of their treatises made, at their own expense, by addressing their request to the permanent secretary.

XVIII.—A STATISTICAL REVIEW OF THE PRODUCTION AND DISTRIBUTION TO PUBLIC WATERS OF YOUNG FISH, BY THE UNITED STATES FISH COMMISSION, FROM ITS ORGANIZATION IN 1871 TO THE CLOSE OF 1880.

By CHAS. W. SMILEY,
[Chief of the Division of Records, Statistics, and Publications.]

The following tables were prepared with a primary view to furnishing the Tenth Census with suitable summaries of the work done by the United States Fish Commission. The data have been obtained from the records of the United States and State Commissions and by official correspondence, in the name of Prof. Spencer F. Baird, with the persons to whom he ordered eggs or fish to be sent. The tables have been prepared with great care and labor. They are as full and accurate as possible under the circumstances, and may be considered as very exact. Much of the clerical work upon these tables, as well as upon the index thereto, which follows, has been performed, under my careful supervision, by Mr. Carl Brandes, Mr. S. S. Alden, and Mr. C. E. Latimer, each of whose honest and painstaking labor I desire to make public mention of.

These tables consist of four series, marked A, B, C, D.

PRODUCTION.

A. This table gives the stations operated for shad-hatching from 1872 to 1880, inclusive. It shows a total of 41 stations operated in the 9 years, with a total production of 102,388,350 shad, of which nearly 44,000,000 were released where hatched, and nearly 54,000,000 transported to other waters.

B. This series of three tables relates to the production of California salmon. The first table shows the disposition made of 50,761,000 salmon eggs, 4,000,000 of which were sent abroad, 15,000,000 hatched and returned to the McCloud River, and 31,000,000 sent overland to the Eastern States. The second table shows the success in hatching these 31,000,000 eggs, the data being arranged by years, while the third table shows the same data arranged by States. These show an average loss of 25 per cent.

DISTRIBUTION.

C. This series of six tables summarizes by States the distributions of (1) shad, (2) California salmon, (3) Schoodic salmon, (4) Penobscot salmon, (5) whitefish, and (6) California trout, during each year from its commencement to 1880, inclusive.

D. This series of six tables corresponds to the precedings series of six, and gives in detail the items which are summarized there.

A.—*Shad-hatching stations operated by the United States Fish Commission, or by some State commission, to furnish young shad for distribution by the United States Fish Commission, 1872 to 1880, inclusive.*

[NOTE.—At some of these stations much additional work has been done by State authority, and which is therefore not included herein.]

Dates.		Location of stations.		Person in charge.	Number of shad hatched by the United States Fish Commission and released where they were hatched.	Transported by the United States Fish Commission to other waters of the United States and there planted.	Number lost in attempting to transport in the United States.	Number hatched for miscellaneous purposes.	Total product of shad at each station.	Remarks.
Season began—	Season ended—	Water.	Place.							
1872.	1872.									
June 30	July 5	Hudson River	Coeymans, N. Y	Seth Green	....	55,000	....	....	55,000	Station opposite Castleton, N. Y.
July 3	July 7	Connecticut River	South Hadley Falls, Mass.	Conn. and Mass. commissioners.	....	804,000	1,196,000	....	2,000,000	See trip of Rev. W. Clift with 2,000,000 fish. Rport of 1872.
					....	859,000	1,196,000	....	2,055,000	
1873.	1873.									
Apr. 20	Apr. 28	Savannah River	Augusta, Ga	Seth Green	....	....	....	....	....	Station failed for lack of ripe fish.
Apr. 29	May 13	Neuse River	New Berne, N. C	do	45,000	....	....	....	45,000	
May 15	May 30	Roanoke River	Welden, N. C	do	....	....	....	....	....	100,000 rock fish were hatched at this station.
June 10	June 30	Delaware River	Point Pleasant, Pa	J. H. Slack, M. D	433,000	15,000	....	....	448,000	Station opposite Lambertsville, N. J.
May 17	June 10	Potomac River	Jackson City, Va	J. W. Milner	1,370,000	70,000	20,000	....	1,460,000	Station opposite Washington, D. C.
June 13	June 30	Hudson River	Coeymans, N. Y	M. A. Green	....	270,000	....	....	270,000	Station opposite Castleton, N. Y.
July 2	July 22	Connecticut River	South Hadley Falls, Mass	Conn. and Mass. commissioners.	....	800,000	....	....	800,000	
					1,848,000	1,155,000	20,000	....	3,023,000	
1874.	1874.									
June 24	July 3	Hudson River	Coeymans, N. Y	J. W. Milner	....	400,000	10,000	100,000	510,000	100,000 started for Germany; lost on the way.
July 13	Aug. 15	Connecticut River	South Hadley Falls, Mass.	do	....	2,631,000	5,000	....	2,636,000	
June 28	July 15	Delaware River	Point Pleasant, Pa	G. A. Anderson	530,000	....	....	....	530,000	
					530,000	3,031,000	15,000	100,000	3,676,000	
1875.	1875.									
Apr. 14	May 10	Neuse River	Kinston, N. C	J. W. Milner	....	....	....	....	....	No ripe fish obtainable.

May 12	May 20	Pamunkey River	Fish Haul, Va	F. Mather	....	....	....	....	....	Do.
June 11	June 25	Hudson River	Coeymans, N. Y	N. Y. commissioners	....	425,000	....	....	425,000	
July 2	July 30	Connecticut River	South Hadley Falls, Mass	C. C. Smith	4,500,000	2,045,000	....	400,000	6,945,000	400,000 started for Germany; lost on the way.
May 26	June 7	Potomac River	Moxley Point, Md	J. Mason	1,182,500	....	....	....	1,182,500	
July 8	July 16	Delaware River	Point Pleasant, Pa	N. J. commissioners	....	200,000	....	....	200,000	
May 15	May 25	Potomac River	Free Stone Point, Va	J. Mason	1,156,750	....	....	....	1,156,750	
May 18	June 5	....do	Jackson City, Va	H. W. Welcher	1,072,800	....	....	....	1,072,800	
May 21	May 29	....do	Ferry Landing, Va	....do	1,473,500	....	....	....	1,473,500	
					9,385,550	2,670,000	....	400,000	12,455,550	As in other years, there was probably a very slight loss in transportation, though none was reported.
1876.	1876.									
May 8	May 24	Potomac River	Ferry Landing, Va	J. W. Milner	586,000	98,000	2,000	....	686,000	
May 9	May 22	Patuxent River	Bristol Landing, Md	W. H. Hines	175,000	....	....	....	175,000	
May 10	May 31	Chesapeake Bay	Carpenters Point, Md	W. F. Wroten	822,500	748,400	89,100	....	1,660,000	
May 26	June 3	Susquehanna River	Swan Creek, Md	W. H. Hines	80,000	45,000	....	....	125,000	
May 28	June 14	... do	Havre de Grace, Md	F. N. Clark	272,000	453,000	137,000	....	862,000	
June 3	June 21	....do	Fishing Battery, Md	W. Hamlen	459,000	....	....	....	459,000	
June 1	June 10	Chesapeake Bay	Swan Creek, Md	W. F. Wroten	200,000	325,000	....	....	525,000	
June 12	June 20	Susquehanna River	Havre de Grace, Md	W. H. Hines	125,000	....	....	....	125,000	
July 3	Aug. 5	Connecticut River	South Hadley Falls, Mass	A. D. Hagar	924,000	1,017,500	16,500	....	1,958,000	
					3,643,500	2,686,900	244,600	....	6,575,000	
1877.	1877.									
May 8	May 20	Susquehanna River	Havre de Grace, Md	T. B. Ferguson	4,982,500	....	....	....	4,982,500	
May 21	June 10	....do	Spesutie Narrows, Md	do	739,800	2,856,000	....	....	3,595,800	
June 26	Aug. 6	Connecticut River	South Hadley Falls, Mass	J. W. Milner	917,000	1,688,000	....	....	2,605,000	
					6,639,300	4,544,000	....	....	11,183,300	There was probably some loss from the 4,544,000 said to have been transported, though none was reported by the messengers.
1878.	1878.									
Apr. 1	May 2	Roanoke River	Avoca, N. C	J. W. Milner	2,345,500	3,070,000	940,000		6,355,500	
May 15	June 4	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett	5,105,000	4,920,000	....	....	10,025,000	
May 23	June 4	Potomac River	Steamer Lookout	T. B. Ferguson	575,000	150,000	....	....	725,000	
					8,025,500	8,140,000	940,000	....	17,105,500	
1879.	1879.									
Apr. 18	May 14	Roanoke River	Avoca, N. C	S. G. Worth	875,000	4,065,000	1,110,000	....	6,050,000	
May 16	June 14	Chesapeake Bay	Spesutie Narrows, Md	T. B. Ferguson	4,587,000	5,517,500	142,500	....	10,247,000	
June 2	June 14	....do	Old Bay Fishery, Md	....do	125,000	420,000	....	....	545,000	
					5,587,000	10,002,500	1,252,500	....	16,842,000	
1880.	1880.									
May 7	June 15	Chesapeake Bay	Havre de Grace, Md	T. B. Ferguson	7,863,000	2,910,000	150,000	....	10,923,000	
May 7	June 27	Potomac River	Steamer Lookout	....do	1,600	17,851,400	27,000	670,000	18,550,000	670,000 used at Washington for experiments.
					7,864,600	20,761,400	177,000	670,000	29,473,000	

RECAPITULATION.

Year.	Extreme limits of dates.	Number of stations.	Number of shad hatched by United States Fish Commission and released where they were hatched.	Transported by United States Fish Commission to other waters of the United States and there planted.	Number lost in attempting to transport in the United States.	Number hatched for miscellaneous purposes.	Total product of shad each year.
1872	June 30 to July 7	2	....	859,000	1,196,000	....	2,055,000
1873	Apr. 20 to July 22	7	1,848,000	1,155,000	20,000	....	3,023,000
1874	June 24 to Aug. 15	3	530,000	3,031,000	15,000	100,000	3,676,000
1875	Apr. 14 to July 30	9	9,385,550	2,670,000	....	400,000	12,455,550
1876	May 8 to Aug. 5	9	3,643,500	2,686,900	244,600	....	6,575,000
1877	May 8 to Aug. 6	3	6,639,300	4,544,000	....	....	11,183,300
1878	Apr. 1 to June 14	3	8,025,500	8,140,000	940,000	....	17,105,500
1879	Apr. 18 to June 14	3	5,587,000	10,002,500	1,252,500	....	16,842,000
1880	May 7, o June 27	2	7,864,600	20,761,400	177,000	670,000	29,473,000
			43,523,450	53,849,800	3,845,100	1,170,000	102,388,350

B.—TABLE I.—*Table showing the number of eggs of California salmon* (salmo quinnat) *taken at the United States station, McCloud River, Baird, California, and the disposition made of them,* 1872–1880, *inclusive.*

I.—HATCHED AND PLANTED ON PACIFIC COAST.

States.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1872–1880.
California*		20, 000	850, 000	2, 230, 000	1, 800, 000	2, 450, 000	2, 500, 000	2, 500, 000	2, 810, 000	15, 160, 000
Oregon						300, 000				300, 000
Total		20, 000	850, 000	2, 230, 000	1, 800, 000	2, 750, 000	2, 500, 000	2, 500, 000	2, 810, 000	15, 460, 000

II.—CONSIGNED TO COMMISSIONERS OF STATES.

States.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1872–1880.
Colorado			25, 000	240, 000	300, 000					565, 000
Connecticut		130, 000	300, 000	480, 000	500, 000					1, 410, 000
Illinois			50, 000	80, 000	250, 000	150, 000	400, 000		100, 000	1, 030, 000
Iowa			300, 000	300, 000		100, 000	300, 000	50, 000		1, 050, 000
Kansas						100, 000	100, 000	100, 000	100, 000	400, 000
Kentucky					200, 000	155, 000				355, 000
Maine		50, 000	150, 000				15, 000			215, 000
Maryland			375, 000	560, 000	1, 210, 000	400, 000	1, 000, 000	700, 000	400, 000	4, 645, 000
Massachusetts		50, 000	200, 000	80, 000	210, 000	200, 000				740, 000
Michigan		120, 000	900, 000	1, 788, 000	500, 000	150, 000	450, 000			3, 908, 000
Minnesota			275, 000	400, 000	300, 000	250, 000	1, 000, 000	400, 000	200, 000	2, 825, 000
Missouri							200, 000		210, 000	410, 000
Nebraska						10, 000	100, 000	200, 000	400, 000	710, 000
Nevada							250, 000			250, 000
New Hampshire						105, 000	450, 000			555. 000
New Jersey	30, 000	600, 000	225, 000			250, 000	575, 000	500, 000	300, 000	2, 480, 000
New York		220, 000	425, 000	400, 000	90, 000					1, 135, 000
North Carolina						350, 000	350, 000	200, 000	200, 000	1, 100, 000
Ohio						250, 000	50, 000	200, 000		500, 000
Pennsylvania		170, 000	450, 000	480, 000	515, 000	275, 000	250, 000	300, 000		2, 440, 000
Rhode Island			100, 000	240, 000						340, 000
South Carolina								50, 000	200, 000	250, 000
Tennessee					100, 000					100, 000
Utah		40, 000	200, 000	160, 000	50, 000	100, 000	50, 000			600, 000
Virginia			50, 000	320, 000		100, 000	300, 000	500, 000		1, 270, 000
West Virginia						10, 000	500, 000	150, 000	150, 000	810, 000
Wisconsin			80, 000	80, 000	100, 000	320, 000	220, 000	300, 000		1, 100, 000
Total	30, 000	1, 380, 000	4, 105, 000	5, 608, 000	4, 325, 000	3, 275, 000	6, 569, 000	3, 650, 000	2, 260, 000	31, 193, 000

* Including those hatched and deposited in the McCloud River.

B.—TABLE I.—*Table showing the number of eggs of California salmon, &c.*—Continued.

III.—CONSIGNED TO FOREIGN COUNTRIES.

Countries.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1872–1880.
Canada										
England			25, 000	80, 000	10, 000	150, 000	500, 000	100, 000	50, 000	915, 000
France						50, 000	100, 000	50, 000		200, 000
Holland						58, 000	100, 000	100, 000	100, 000	358, 000
Germany						100, 000	100, 000	100, 000	200, 000	500, 000
New Zealand						100, 000	250, 000	100, 000	380, 000	830, 000
Australia			25, 000	50, 000	400, 000	500, 000	200, 000			1, 175, 000
Sandwich Islands						50, 000		50, 000		100, 000
					30, 000					30, 000
Total			50, 000	130, 000	440, 000	1, 008, 000	1, 250, 000	500, 000	730, 000	4, 108, 000

RECAPITULATION.

	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1872–1880.
California and Oregon		20, 000	850, 000	2, 230, 000	1, 800, 000	2, 750, 000	2, 500, 000	2, 500, 000	2, 810, 000	15, 460, 000
Eastern States	30, 000	1, 380, 000	4, 105, 000	5, 608, 000	4, 325, 000	3, 275, 000	6, 560, 000	3, 650, 000	2, 260, 000	31, 193, 000
Foreign			50, 000	130, 000	440, 000	1, 008, 000	1, 250, 000	50, 000	730, 000	4, 108, 000
Total	30, 000	1, 400, 000	5, 005, 000	7, 968, 000	6, 565, 000	7, 033, 000	10, 310, 000	6, 650, 000	5, 800, 000	50, 761, 000

B.—TABLE II.—*Table showing the success in transporting and hatching 31,193,000 eggs of California salmon* (Salmo quinnat) *taken from McCloud River, California, and consigned to commissioners of Eastern States,* 1872–1880.

I.—ARRANGED BY YEARS.

1872.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
New Jersey	30,000	30,000	24,000	80	6,000	20
Total	30,000	30,000	24,000	80	6,000	20

1873.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Number lost.	Per cent.	Number.	Per cent.
Connecticut	130,000	110,000	89,000	89	21,000	11
Maine	50,000	50,000	5,000	10	45,000	90
Massachusetts	50,000	48,000	21,000	44	27,000	56
Michigan	120,000	80,000	2,000	3	78,000	97
New Jersey	600,000	600,000	50,000	8	550,000	92
New York	220,000	220,000	20,000	9	200,000	91
Pennsylvania	170,000	170,000	169,000	99	1,000	1
Utah	40,000	40,000	2,000	5	38,000	95
Total	1,380,000	1,318,000	358,000	27	960,000	73

1874.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Number lost.	Per cent.	Number.	Per cent.
Colorado	25,000	25,000	2,100	9	22,900	91
Connecticut	300,000	300,000	60,000	20	240,000	80
Illinois	50,000	50,000	15,000	30	35,000	70
Iowa	300,000	300,000	41,300	14	258,700	86
Maine	150,000	100,000	70,000	70	30,000	30
Maryland	375,000	250,000	106,000	42	144,000	58
Massachusetts	200,000	200,000	193,000	96	7,000	4
Michigan, I	750,000	750,000	150,000	20	600,000	80
Michigan, II	150,000	150,000	25,000	17	125,000	83
Minnesota, I	150,000	160,000	110,000	69	50,000	31
Minnesota, II[1]	125,000	.....	.....	.....	.....	.....
New Jersey	225,000	225,000	60,000	26	165,000	74
New York, I	400,000	400,000	80,990	20	319,010	80
New York, II[2]	25,000	.....	.....	.....	.....	.....
Pennsylvania	450,000	360,000	55,000	15	305,000	85
Rhode Island	100,000	100,000	35,000	35	65,000	65
Utah	200,000	200,000	14,000	7	186,000	93
Virginia[3]	50,000	50,000	25,000	50	25,000	50
Wisconsin	80,000	100,000	39,000	39	61,000	61
Total	4,155,000	3,720,000	1,081,390	29	2,638,610	71

1875.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Number lost.	Per cent.	Number.	Per cent.
Colorado	240,000	240,000	40,000	17	200,000	83
Connecticut	480,000	480,000	20,000	4	460,000	96
Illinois	80,000	80,000	21,300	27	58,700	73
Iowa	300,000	300,000	16,000	5	284,000	95
Maryland	560,000	560,000	291,236	52	268,764	48
Massachusetts	80,000	80,000	5,000	6	75,000	94
Michigan, I	800,000	800,000	32,000	4	768,000	96
Michigan, II[4]	988,000	988,000	235,300	24	752,700	76
Minnesota	400,000	400,000	100,000	25	300,000	75
New York	400,000	300,000	27,000	9	273,000	91
Pennsylvania	480,000	515,000	2,000	1	513,000	99
Rhode Island	240,000	120,000	5,000	4	115,000	96
Utah	160,000	160,000	40,000	25	120,000	75
Virginia	320,000	320,000	160,000	50	160,000	50
Wisconsin	80,000	80,000	40,000	50	40,000	50
Total	5,608,000	5,423,000	1,034,836	19	4,388,164	81

[1] Consigned to David Day, Saint Paul, and by him to Seth Green.
[2] Consigned to H. H. Thomas, Randolph, N. Y.
[3] Loss in hatching estimated.
[4] By F. N. Clark, on account of U. S. Fish Commission.

B.—TABLE II.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

I.—ARRANGED BY YEARS—Continued.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
1876.						
Colorado	300,000	300,000	50,000	17	250,000	83
Connecticut	500,000	500,000	22,714	5	477,286	95
Illinois, I	100,000	100,000	80,000	80	20,000	20
Illinois, II	150,000	150,000	12,000	8	138,000	92
Kentucky	200,000	200,000	153,775	76	46,225	24
Maryland	1,210,000	1,100,000	148,000	13	952,000	87
Massachusetts, I	200,000	200,000	20,000	10	180,000	90
Massachusetts, II[1]	10,000	......	......	......	......	......
Michigan[2]	500,000	500,000	99,100	20	400,900	80
Minnesota	300,000	300,000	152,900	51	147,100	49
New York	90,000	60,000	16,800	28	43,200	72
Pennsylvania	515,000	515,000	38,000	7	477,000	93
Tennessee[3]	100,000	......	......	......	......	......
Utah	50,000	50,000	12,500	25	37,500	75
Wisconsin	100,000	100,000	22,600	23	77,400	77
Total	4,325,000	4,075,000	828,389	21	3,246,611	79
1877.						
Illinois, I[4]	50,000	50,000	5,000	10	45,000	90
Illinois, II	50,000	50,000	20,000	40	30,000	60
Illinois, III	50,000	50,000	29,000	58	21,000	42
Iowa	100,000	100,000	10,000	10	90,000	90
Kansas	100,000	100,000	1,000	1	99,000	99
Kentucky, I[5]	150,000	150,000	78,500	52	71,500	48
Kentucky, II	5,000	......	......	......	......	......
Maryland	400,000	380,000	91,400	24	288,600	74
Massachusetts	200,000	200,000	20,000	10	180,000	90
Michigan	150,000	100,000	16,000	16	84,000	84
Minnesota	250,000	167,500	28,850	17	138,650	83
Nebraska[6]	10,000	......	......	......	......	......
New Hampshire	105,000	100,000	8,500	9	91,500	91
New Jersey	250,000	250,000	25,000	10	225,000	90
North Carolina	350,000	350,000	116,000	33	234,000	67
Ohio	250,000	250,000	25,000	10	225,000	90
Pennsylvania, I	75,000	75,000	37,500	50	37,500	50
Pennsylvania, II	200,000	200,000	60,000	30	140,000	70
Utah	100,000	100,000	25,000	25	75,000	75
Virginia	100,000	100,000	8,000	8	92,000	92
West Virginia	10,000	10,000	125	1	9,875	99
Wisconsin	320,000	320,000	120,000	37	200,000	63
Total	3,275,000	3,102,500	724,875	23	2,377,625	77
1878.						
Illinois, I	100,000	100,000	10,000	10	90,000	90
Illinois, II[7]	100,000	......	......	......	......	......
Illinois, III	200,000	200,000	160,000	80	40,000	20
Iowa	300,000	300,000	18,500	6	281,500	94
Kansas	100,000	100,000	5,000	5	95,000	95
Maine	15,000	15,000	2,300	15	12,700	85
Maryland	1,000,000	1,050,000	386,264	37	663,736	63
Michigan, I	250,000	250,000	34,579	14	215,421	86
Michigan, II[8]	200,000	250,000	25,000	10	225,000	90
Minnesota	1,000,000	1,000,000	959,000	96	41,000	4
Missouri	200,000	200,000	50,000	25	150,000	75
Nebraska[9]	100,000	......	......	......	......	......
Nevada	250,000	250,000	50,000	20	200,000	80
New Hampshire	450,000	367,500	29,460	8	338,040	92
New Jersey	575,000	525,000	70,800	13	454,200	87
North Carolina	350,000	367,500	67,500	18	300,000	82
Ohio	50,000	50,000	2,500	5	47,500	95
Pennsylvania, I	100,000	100,000	25,000	25	75,000	75

[1] Boston Aquarium, for exhibition.
[2] By F. N. Clark, account of U. S. Fish Commission.
[3] Consigned to M. S. Rodgers, Knoxville, Tenn.
[4] Consigned to W. D. Andrews, Rockford, Ill.
[5] Industrial Exhibition, Louisville, Ky.
[6] Consigned to J. G. Romaine, South Bend, Nebr.
[7] Consigned to Dr. W. A. Pratt, Elgin, Ill.
[8] By F. N. Clark, account U. S. Fish Commission.
[9] Consigned to J. G. Romaine, South Bend, Nebr.

B.—TABLE II.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

I.—ARRANGED BY YEARS—Continued.

1878—Continued.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
Pennsylvania, II	150, 000	150, 000	14, 000	9	136, 000	91
Utah	50, 000	75, 000	21, 000	28	54, 000	72
Virginia	300, 000	315, 000	39, 000	12	276, 000	88
West Virginia	500, 000	525, 000	25, 000	5	500, 000	95
Wisconsin	220, 000	230, 000	30, 000	13	200, 000	87
Total	6, 560, 000	6, 420, 000	2, 024, 903	32	4, 395, 097	68

1879.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Number lost.	Per cent.	Number.	Per cent.
Iowa[1]	50, 000	100, 000	1, 000	1	99, 000	99
Kansas	100, 000	100, 000	10, 000	10	90, 000	90
Maryland, I	500, 000	500, 000	62, 724	12	437, 276	88
Maryland, II	200, 000	200, 000	43, 400	21	156, 600	79
Minnesota	400, 000	400, 000	376, 000	94	24, 000	6
Nebraska	200, 000	200, 000	10, 000	5	190, 000	95
New Jersey	500, 000	500, 000	80, 000	16	420, 000	84
North Carolina	200, 000	200, 000	146, 000	73	54, 000	27
Ohio	200, 000	200, 000	100, 000	50	100, 000	50
Pennsylvania, I	100, 000	100, 000	23, 000	23	77, 000	77
Pennsylvania, II	200, 000	200, 000	60, 000	30	140, 000	70
South Carolina	50, 000	33, 000	8, 000	24	25, 000	76
Virginia, I	400, 000	400, 000	112, 000	28	288, 000	72
Virginia, II	100, 000	100, 000	14, 500	14	85, 500	86
West Virginia	150, 000	125, 000	11, 250	9	113, 750	91
Wisconsin	300, 000	300, 000	48, 800	16	251, 200	84
Total	3, 650, 000	3, 658, 000	1, 106, 674	29	2, 551, 326	71

1880.

State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Number lost.	Per cent.	Number.	Per cent.
Illinois	100, 000	100, 000	10, 000	10	90, 000	90
Kansas	100, 000	100, 000	4, 000	4	96, 000	96
Maryland	400, 000	400, 000	46, 577	12	353, 423	88
Minnesota	200, 000	200, 000	25, 000	12	175, 000	88
Missouri, I	200, 000	200, 000	14, 000	7	186, 000	93
Missouri, II[2]	10, 000					
Nebraska	400, 000	400, 000	100, 000	25	300, 000	75
New Jersey	300, 000	300, 000	20, 571	7	279, 429	93
North Carolina	200, 000	200, 000	40, 000	20	160, 000	80
South Carolina	200, 000	300, 000	113, 000	37	187, 000	63
West Virginia	150, 000	125, 000	11, 250	9	113, 750	91
Total	2, 260, 000	2, 325, 000	384, 398	17	1, 940, 602	83

RECAPITULATION BY YEARS.

Years.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
1872	30, 000	30, 000	24, 000	80	6, 000	20
1873	1, 380, 000	1, 318, 000	358, 000	27	960, 000	73
1874	4, 105, 000	3, 720, 000	1, 081, 390	29	2, 638, 610	71
1875	5, 608, 000	5, 423, 000	1, 034, 836	19	4, 388, 164	81
1876	4, 325, 000	4, 075, 000	828, 389	21	3, 246, 611	79
1877	3, 275, 000	3, 102, 500	724, 875	23	2, 377, 625	77
1878	6, 560, 000	6, 420, 000	2, 024, 903	32	4, 395, 097	68
1879	3, 650, 000	3, 658, 000	1, 106, 674	29	2, 551, 326	71
1880	2, 260, 000	2, 325, 000	384, 398	17	1, 940, 602	83
	31, 193, 000	30, 071, 500	7, 567, 465	25	22, 504, 035	75

[1] Hatched in Iowa for State of Missouri.
[2] Consigned to J. Ed. Humes, Versailles, Morgan County, Missouri; all lost in transit.

B.—TABLE III.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

II.—ARRANGED BY STATES.

Years.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
1.—Colorado.						
1874	25,000	25,000	2,100	9	22,900	91
1875[1]	240,000	245,000	40,000	17	200,000	83
1876	300,000	300,000	50,000	17	250,000	83
Total	565,000	565,000	92,100	16	472,900	84
2.—Connecticut.						
1873	130,000	110,000	89,000	89	21,000	11
1874	300,000	300,000	60,000	20	240,000	80
1875	480,000	480,000	20,000	4	460,000	96
1876	500,000	500,000	22,714	5	477,286	95
Total	1,410,000	1,390,000	191,714	13	1,198,286	87
3.—Illinois.						
1874	50,000	50,000	15,000	30	35,000	70
1875	80,000	80,000	21,300	27	58,700	73
1876, I	100,000	100,000	80,000	80	20,000	20
1876, II	150,000	150,000	12,000	8	138,000	92
1877, I	50,000	50,000	5,000	10	45,000	90
1877, II	50,000	50,000	20,000	40	30,000	60
1877, III	50,000	50,000	29,000	58	21,000	42
1878, I	100,000	100,000	10,000	10	90,000	90
1878, II[2]	100,000	....	....	....	....	....
1878, III	200,000	200,000	160,000	80	40,000	20
1880	100,000	100,000	10,000	10	90,000	90
Total	1,030,000	930,000	362,300	39	567,700	61
4.—Iowa.						
1874	300,000	300,000	41,300	14	258,700	86
1875	300,000	300,000	16,000	5	284,000	95
1877	100,000	100,000	10,000	10	90,000	90
1878	300,000	300,000	18,500	6	281,500	94
1879[3]	50,000	100,000	1,000	1	99,000	99
Total	1,050,000	1,100,000	86,800	8	1,013,200	92
5.—Kansas.						
1877	100,000	100,000	1,000	1	99,000	99
1878	100,000	100,000	5,000	5	95,000	95
1879	100,000	100,000	10,000	10	90,000	90
1880	100,000	100,000	4,000	4	96,000	96
Total	400,000	400,000	20,000	5	380,000	95
6.—Kentucky.						
1876	200,000	200,000	153,775	76	46,225	24
1877, I	150,000	150,000	78,500	52	71,500	48
1877, II[4]	5,000	....	....	....	....	....
Total	355,000	350,000	232,275	66	117,725	34
7.—Maine.						
1873	50,000	50,000	5,000	10	45,000	90
1874	150,000	100,000	70,000	70	30,000	30
1878	15,000	15,000	2,300	15	12,700	85
Total	215,000	165,000	77,300	47	87,700	53
8.—Maryland.						
1874	375,000	250,000	106,000	42	144,000	58
1875	560,000	560,000	291,236	52	268,764	48
1876	1,210,000	1,100,000	148,000	13	952,000	87
1877	400,000	380,000	91,400	24	288,600	74
1878	1,090,000	1,050,000	386,264	37	663,736	63
1879, I	500,000	500,000	62,724	12	437,276	88
1879, II	200,000	200,000	43,400	21	156,600	79
1880	400,000	400,000	46,577	12	353,423	88
Total	4,645,000	4,440,000	1,175,601	29	3,264,399	71

[1] Consigned to W. H. Cushman, Georgetown, Colo.
[2] Consigned to Dr. W. A. Pratt, Elgin, Ill.
[3] Hatched in Iowa for State of Missouri.
[4] Industrial Exhibition, Louisville, Ky.

B.—TABLE III.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

II.—ARRANGED BY STATES—Continued.

Years.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
9.—MASSACHUSETTS.						
1873	50,000	48,000	21,000	44	27,000	56
1874	200,000	200,000	193,000	96	7,000	4
1875	80,000	80,000	5,000	6	75,000	94
1876, I	200,000	200,000	20,000	10	180,000	90
1876, II[1]	10,000	.....	.....	.....	.....	.....
1877	200,000	200,000	20,000	10	180,000	90
Total	740,000	728,000	259,000	36	469,000	64
10.—MICHIGAN.						
1873	120,000	80,000	2,000	3	78,000	97
1874, I	755,000	750,000	150,000	20	600,000	80
1874, II	150,000	150,000	25,000	17	125,000	83
1875, I	800,000	800,000	32,000	4	768,000	96
1875, II	988,000	988,000	235,300	24	752,700	76
1876	500,000	500,000	99,100	20	400,900	80
1877	150,000	100,000	16,000	16	84,000	84
1878, I	250,000	250,000	34,579	14	215,421	86
1878, II[2]	200,000	250,000	25,000	10	225,000	90
Total	3,908,000	3,868,000	618,979	16	3,249,021	84
11.—MINNESOTA.						
1874, I	150,000	160,000	110,000	69	50,000	31
1874, II[3]	125,000	.....	.....	.....	.....	.....
1875	400,000	400,000	100,000	25	300,000	75
1876	300,000	300,000	152,900	51	147,100	49
1877	250,000	167,500	28,850	17	138,650	83
1878	1,000,000	1,000,000	959,000	96	41,000	4
1879	400,000	400,000	376,000	94	24,000	6
1880	200,000	200,000	25,000	12	175,000	88
Total	2,825,000	2,627,500	1,751,750	64	875,750	36
12.—MISSOURI.						
1878[4]	200,000	200,000	50,000	25	150,000	75
1880, I	200,000	200,000	14,000	7	186,000	93
1880, II[5]	10,000	.....	.....	.....	.....	.....
Total	410,000	400,000	64,000	16	336,000	84
13.—NEBRASKA.						
1877[6]	10,000	.....	.....	.....	.....	.....
1878[6]	100,000	.....	.....	.....	.....	.....
1879	200,000	200,000	10,000	5	190,000	95
1880	400,000	400,000	100,000	25	300,000	75
Total	710,000	600,000	110,000	18	490,000	82
14.—NEVADA.						
1878	250,000	250,000	50,000	20	200,000	80
Total	250,000	250,000	50,000	20	200,000	80
15.—NEW HAMPSHIRE.						
1877	105,000	100,000	8,500	9	91,500	91
1878	450,000	367,500	29,460	8	338,040	92
Total	555,000	467,500	37,960	8	429,540	92
16.—NEW JERSEY.						
1872	30,000	30,000	24,000	80	6,000	20
1873	600,000	600,000	50,000	8	550,000	92
1874	225,000	225,000	60,000	26	165,000	74
1877	250,000	250,000	25,000	10	225,000	90
1878	575,000	525,000	70,800	13	454,200	87
1879	500,000	500,000	80,000	16	420,000	84
1880	300,000	300,000	20,571	7	279,429	93
Total	2,480,000	2,430,000	330,371	14	2,099,629	86

[1] Boston Aquarium, for exhibition.
[2] By Frank N. Clark, account of U. S. Fish Commission.
[3] Consigned to David Day, Saint Paul, Minn., and by him to Seth Green.
[4] Hatched for Missouri at Anamosa, Iowa.
[5] Consigned to J. Ed. Humes, Versailles, Morgan County, Mo.; all lost in transit.
[6] Consigned to J. G. Romaine, South Bend, Nebr.

B.—Table III.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

II.—ARRANGED BY STATES—Continued.

Years.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters.		Young actually introduced.	
			Number lost.	Per cent.	Number.	Per cent.
17.—New York.						
1873	220,000	220,000	20,000	9	200,000	91
1874, I	400,000	400,000	80,990	20	319,010	80
1874, II[1]	25,000					
1875	400,000	300,000	27,000	9	273,000	91
1876	90,000	60,000	16,800	28	43,200	72
Total	1,135,000	980,000	144,790	15	835,210	85
18.—North Carolina.						
1877	350,000	350,000	116,000	33	234,000	67
1878	350,000	367,500	67,500	18	300,000	82
1879	200,000	200,000	146,000	73	54,000	27
1880	200,000	200,000	40,000	20	160,000	80
Total	1,100,000	1,117,500	369,500	33	748,000	67
19.—Ohio.						
1877	250,000	250,000	25,000	10	225,000	90
1878	50,000	50,000	2,500	5	47,500	95
1879	200,000	200,000	100,000	50	100,000	50
Total	500,000	500,000	127,500	26	372,500	74
20.—Pennsylvania.						
1873	170,000	170,000	169,000	99	1,000	1
1874	450,000	360,000	55,000	15	305,000	85
1875	480,000	515,000	2,000	1	513,000	99
1876	515,000	515,000	38,000	7	477,000	93
1877, I	75,000	75,000	37,500	50	37,500	50
1877, II	200,000	200,000	60,000	30	140,000	70
1878, I	100,000	100,000	25,000	25	75,000	75
1878, II	150,000	150,000	14,000	9	136,000	91
1879, I	100,000	100,000	23,000	23	77,000	77
1879, II	200,000	200,000	60,000	30	140,000	70
Total	2,440,000	2,385,000	483,500	20	1,901,500	80
21.—Rhode Island.						
1874	100,000	100,000	35,000	35	65,000	65
1875	240,000	120,000	5,000	4	115,000	96
Total	340,000	220,000	40,000	18	180,000	82
22.—South Carolina.						
1879	50,000	33,000	8,000	24	25,000	76
1880	200,000	300,000	113,000	37	187,000	80
Total	250,000	333,000	121,000	36	212,000	64
23.—Tennessee.						
1876[2]	100,000					
Total	100,000					
24.—Utah.						
1873	40,000	40,000	2,000	5	38,000	95
1874	200,000	200,000	14,000	7	186,000	93
1875	160,000	160,000	40,000	25	120,000	75
1876	50,000	50,000	12,500	25	37,500	75
1877	100,000	100,000	25,000	25	75,000	75
1878	50,000	75,000	21,000	28	54,000	72
Total	600,000	625,000	114,000	18	510,500	82
25.—Virginia.						
1874[3]	50,000	50,000	25,000	50	25,000	50
1875	320,000	320,000	160,000	50	160,000	50
1877	100,000	100,000	8,000	8	92,000	92
1878	300,000	315,000	39,000	12	276,000	88
1879, I	400,000	400,000	112,000	28	288,000	72
1879, II	100,000	100,000	14,500	14	85,500	86
Total	1,270,000	1,285,000	358,500	28	926,500	72

[1] Consigned to H. H. Thomas, Randolph, N. Y.
[2] Consigned to M. S. Rodgers, Knoxville, Tenn.
[3] Loss in hatching estimated.

B.—TABLE III.—*Table showing the success in transporting and hatching* 31,193,000 *eggs, &c.*—Continued.

II.—ARRANGED BY STATES—Continued.

Years.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters. Number lost.	Loss in hatching and transporting to waters. Per cent.	Young actually introduced. Number.	Young actually introduced. Per cent.
26.—WEST VIRGINIA.						
1877	10, 000	10, 000	125	1	9, 875	99
1878	500, 000	525, 000	25, 000	5	500, 000	95
1879	150, 000	125, 000	11, 250	9	113, 750	91
1880	150, 000	125, 000	11, 250	9	113, 750	91
Total	810, 000	785, 000	47, 625	6	737, 375	94
27.—WISCONSIN.						
1874	80, 000	100, 000	39, 000	39	61, 000	61
1875	80, 000	80, 000	40, 000	50	40, 000	50
1876	100, 000	100, 000	22, 600	23	77, 400	77
1877	320, 000	320, 000	120, 000	37	200, 000	63
1878	220, 000	230, 000	30, 000	13	200, 000	87
1879	300, 000	300, 000	48, 800	16	251, 200	84
Total	1, 100, 000	1, 130, 000	300, 400	27	829, 600	73

RECAPITULATION BY STATES.

Number.	State to which consigned.	Number of eggs sent from McCloud River.	Received at State hatcheries.	Loss in hatching and transporting to waters. Number lost.	Loss in hatching and transporting to waters. Per cent.	Young actually introduced. Number.	Young actually introduced. Per cent.
1	Colorado	565, 000	565, 000	92, 100	16	472, 900	84
2	Connecticut	1, 410, 000	1, 390, 000	191, 714	13	1, 198, 286	87
3	Illinois	1, 030, 000	940, 000	362, 300	39	567, 700	61
4	Iowa	1, 050, 000	1, 100, 000	86, 800	8	1, 013, 200	92
5	Kansas	400, 000	400, 000	20, 000	5	380, 000	95
6	Kentucky	355, 000	350, 000	232, 275	66	117, 725	34
7	Maine	215, 000	165, 000	77, 300	47	87, 700	53
8	Maryland	4, 645, 000	4, 440, 000	1, 175, 601	29	3, 264, 399	71
9	Massachusetts	740, 000	728, 000	259, 000	36	469, 000	64
10	Michigan	3, 908, 000	3, 868, 000	618, 979	16	3, 249, 021	84
11	Minnesota	2, 825, 000	2, 627, 500	1, 751, 750	64	875, 750	36
12	Missouri	410, 000	400, 000	64, 000	16	336, 000	84
13	Nebraska	710, 009	600, 000	110, 000	18	490, 000	82
14	Nevada	250, 000	250, 090	50, 000	20	200, 000	80
15	New Hampshire	555, 000	467, 500	37, 960	8	429, 540	92
16	New Jersey	2, 480, 000	2, 430, 000	330, 371	14	2, 099, 629	84
17	New York	1, 135, 000	980, 000	144, 790	15	835, 210	85
18	North Carolina	1, 100, 000	1, 117, 500	369, 500	33	748, 000	67
19	Ohio	500, 000	500, 000	127, 500	26	372, 500	74
20	Pennsylvania	2, 440, 000	2, 385, 000	483, 500	20	1, 901, 500	80
21	Rhode Island	340, 000	220, 000	40, 000	18	180, 000	82
22	South Carolina	250, 000	333, 000	121, 000	36	212, 000	64
23	Tennessee	100, 000	(*)	(*)	(*)	(*)	(*)
24	Utah	600, 000	625, 000	114, 500	18	510, 500	82
25	Virginia	1, 270, 000	1, 285, 000	358, 500	28	926, 500	72
26	West Virginia	810, 000	785, 000	47, 625	6	737, 375	94
27	Wisconsin	1, 100, 000	1, 130, 000	300, 400	27	829, 600	73
	Total	31, 193, 000	30, 071, 500	7, 567, 465	25	22, 504, 035	75

* No report received.

C.—TABLE I.—*Summary table of the number of shad* (Alosa sapidissima) *introduced into the waters of the different States by the United States Fish Commission*, 1872–1880, *inclusive.*

[NOTE.—Nearly all of these fish were not only introduced but also hatched by the United States Fish Commission.]

States.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Total.
Alabama					90, 000	75, 000	266, 000	340, 000		771, 000
Arkansas					79, 200	80, 000	100, 000	125, 000		384, 200
California		35, 000			99, 000	100, 000	150, 000		215, 000	599, 000
Colorado	2, 000									2, 000
Connecticut		90, 000	280, 000	100, 000						470, 000
Delaware						100, 000		195, 000	1, 350, 000	1, 645, 000
District of Columbia							400, 000	160, 000	7, 655, 000	8, 215, 000
Florida								120, 000		120, 000
Georgia				60, 000	243, 200	410, 000	320, 000	562, 500	1, 188, 000	2, 783, 700
Illinois		70, 000	70, 000	60, 000			300, 000			500, 000
Indiana	400, 000	40, 000	315, 000	100, 000			165, 000	150, 000	200, 000	1, 370, 000
Iowa			100, 000	90, 000	148, 500		100, 000			438, 500
Kansas						100, 000		160, 000		2[illegible]0, 000
Kentucky						160, 000	395, 000	350, 000	700, 000	1, 605, 000
Louisiana				60, 000			100, 000	200, 000		360, 000
Maine		100, 000	300, 000	100, 000		85, 000			675, 000	1, 260, 000
Maryland				1, 182, 500	2, 311, 500	7, 319. 300	7, 485, 000	7, 057, 000	14, 323, 000	39, 678, 300
Massachusetts			350, 000	5, 225, 000	459, 000	1, 077, 000				7, 111, 000
Michigan		210, 000	160, 000							370, 000
Minnesota	25, 000		100, 000			100, 000				225, 000
Mississippi				100, 000	148, 000	100, 000	614, 000	375, 000		1, 337, 000
Missouri	1, 000				300, 000	400, 000	220, 000	350, 000	200, 000	1, 471, 000
New Hampshire						125, 000				125, 000
New York	430, 000									430, 000
North Carolina		45, 000			164, 900	434, 000	3, 434, 500	3, 200, 000		7, 278, 400
Ohio	1, 000	50, 000	325, 000	175, 000	134, 700		60, 000	100, 000	200, 000	1, 045, 700
Pennsylvania		448, 000	530, 000					140, 000	450, 000	1, 568, 000
Rhode Island			36, 000	50, 000		100, 000				186, 000
South Carolina				80, 000	50, 000		100, 000	75, 000	1, 310, 000	1, 615, 000
Tennessee				260, 000	396, 800	118, 000	100, 000	285, 000		1, 159, 800
Texas			60, 000	60, 000				575, 000		695, 000
Utah		5, 000								5, 000
Vermont		400, 000	935, 000	550, 000	645, 000	90, 000				2, 620, 000
Virginia		1, 410, 000		3, 803, 050	860, 600	110, 000	1, 856, 000	545, 000	160, 000	8, 744, 650
West Virginia		30, 000			200, 000			525, 000		755, 000
Wisconsin		70, 000				100, 000				170, 000
Total	859, 000	3, 003, 000	3, 561, 000	12, 055, 550	6, 330, 400	11, 183, 300	16, 165, 500	15, 589, 500	28, 626, 000	97, 373, 250

RECAPITULATION, 1872-1880, INCLUSIVE.

Hatched and returned to same waters	43, 523, 450	
Transported and planted in new waters	53, 849, 800	
		97, 373, 250
Lost in efforts to transport in the United States		3, 845, 100
Lost in efforts to transport to Germany		500, 000
Used for experiments		670, 000
Grand total of shad hatched artificially by United States Fish Commission		102, 388, 350

NOTE.—The figures in this and the following five tables are made to agree with those in the six specific lists of distribution which follow under D. For 1880, the returns were not complete when these tables were made up, and hence the figures are somewhat too small. They should be corrected by means of the various tables in the report for that year.

C.—TABLE II.—*Summary table of the number of California salmon* (Salmo quinnat) *introduced into the waters of the different States, as specified in the tables of waters, having been hatched from eggs taken by the United States Fish Commission, 1872–1880, inclusive.*

States.	From eggs of 1872.	From eggs of 1873.	From eggs of 1874.	From eggs of 1875.	From eggs of 1876.	From eggs of 1877.	From eggs of 1878.	From eggs of 1879.	From eggs of 1880.	Total decade.
Alabama					28, 600		2, 000			30, 600
Arkansas							11, 000			11, 000
California		500, 000	500, 000	850, 000	1, 520, 000	3, 200, 000	3, 703, 000	2, 000, 000	2, 000, 000	14, 273, 000
Colorado			22, 900							22, 900
Connecticut		11, 000	284, 700	460, 000	477, 286					1, 232, 986
Delaware					10, 400				11, 000	21, 400
Georgia					50, 000		29, 000			79, 000
Illinois			80, 000	38, 700	160, 500	61, 000	90, 000			430, 200
Indiana			31, 000	319, 000	93, 500					443, 500
Iowa			258, 700		25, 000		281, 500			565, 200
Kansas						99, 000	97, 000	97, 000	96, 000	389, 000
Kentucky				25, 000	46, 475	71, 500				142, 975
Louisiana			15, 000		28, 200					43, 200
Maine		5, 000	30, 000				12, 700			47, 700
Maryland			129, 000	265, 264	789, 340	288, 100	592, 936	572, 276	354, 223	2, 991, 139
Massachusetts		27, 000	7, 000	75, 000	90, 000	89, 100				288, 100
Michigan		76, 230	306, 600	784, 700		75, 400	215, 421			1, 458, 351
Minnesota			27, 700	216, 375	149, 630	139, 600	42, 000	25, 200		600, 505
Mississippi					71, 800					71, 800
Missouri					31, 000		150, 000	190, 000	175, 000	546, 000
Nevada							200, 000			200, 000
New Hampshire					100, 000	100, 000	367, 000			567, 000
New Jersey		375, 000	5, 000		58, 000	67, 000	448, 000	420, 000	279, 429	1, 652, 429
New York		277, 000	304, 000	187, 000	27, 200					795, 200
North Carolina					18, 500	229, 000	297, 500	54, 400	160, 000	759, 400
Ohio		46, 000	10, 000	150, 000	50, 000	220, 000	44, 000	100, 000		620, 000
Pennsylvania	6, 000	76, 000	183, 000	513, 000	478, 000	174, 000	210, 000	217, 000		1, 857, 000
Rhode Island			68, 000	115, 000						183, 000
South Carolina					11, 000		29, 000	31, 000		71, 000
Tennessee				40, 000	38, 000					78, 000
Texas			14, 000	180, 000	20, 000					214, 000
Utah		38, 000	195, 900	112, 000	34, 200	75, 000				455, 100
Vermont		35, 000								35, 000
Virginia		45, 000	30, 000	160, 000	148, 400	92, 000	276, 000	373, 500		1, 124, 900
West Virginia					33, 000	9, 875	523, 000	227, 000		792, 875
Wisconsin			29, 000	47, 000	75, 000	137, 300	200, 000	251, 200	90, 000	829, 500
Total	6, 000	1, 511, 230	2, 531, 500	4, 538, 039	4, 663, 031	5, 127, 875	7, 821, 057	4, 558, 576	3, 165, 652	33, 922, 960

C.—TABLE III.—*Summary table of the number of Schoodic salmon* (Salmo salar *subs.* sebago) *introduced into the waters of the different States by the United States Fish Commission*, 1873–1880, *inclusive.*

State.	From eggs of 1873.	From eggs of 1874.	From eggs of 1875.	From eggs of 1876.	From eggs of 1877.	From eggs of 1878.	From eggs of 1879.	Total.
California					39, 950			39, 950
Connecticut			135, 000	62, 500	165, 000	178, 715	91, 000	632, 215
Illinois					4, 400			4, 400
Indiana					25, 000		10, 000	35, 000
Iowa					20, 000			20, 000
Kansas						20, 000	93, 000	113, 000
Kentucky					5, 500			5, 500
Maine	2, 000		250, 000	110, 000	497, 200	449, 500		1, 308, 700
Maryland					40, 081	26, 500	16, 900	83, 481
Massachusetts			195, 000	151, 200	218, 000	221, 000	176, 000	961, 200
Michigan	2, 000		20, 000		29, 500		20, 000	71, 500
Minnesota		4, 750		7, 750	8, 000	48, 500		69, 000
New Hampshire					20, 000	104, 000	61, 400	185, 400
New Jersey					58, 000	66, 794		124, 794
New York					2, 000	39, 000		41, 000
North Carolina					15, 500			15, 500
Ohio			34, 000		12, 000	6, 000		52, 000
Pennsylvania					48, 494	35, 500	18, 500	102, 494
Rhode Island			19, 600		9, 500			29, 100
South Carolina							15, 000	15, 000
Vermont			40, 000		24, 000			64, 000
Virginia		2, 500		10, 500	40, 300	27, 350	23, 500	104, 150
West Virginia					8, 500	44, 419		52, 919
Wisconsin			38, 000		5, 000	37, 000		80, 000
Total	4, 000	7, 250	731, 600	341, 950	1, 295, 925	1, 304, 278	525, 300	4, 210, 303

C.—TABLE IV.—*Summary table of the number of Penobscot salmon* (Salmo salar) *introduced into the waters of the different States by the United States Fish Commission*, 1872–1880, *inclusive.*

State.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Total.
California			305							305
Connecticut		73, 937		115, 000		97, 500				286, 437
Illinois			25, 000	19, 000						44, 000
Iowa				70, 000	70, 000					140, 000
Maine		154, 750	228, 613	209, 000	320, 000					912, 363
Maryland				72, 800					58, 729	131, 529
Massachusetts		24, 310	47, 000		50, 000					121, 310
Michigan		14, 900	112, 000	5, 000						131, 900
Minnesota				24, 600						24, 600
New Hampshire		14, 500	162, 000	80, 000	200, 000					456, 500
New Jersey		33, 000	168, 000	79, 000				20, 572		300, 572
New York		62, 500		125, 000						187, 500
Ohio		2, 500		50, 000						52, 500
Pennsylvania	10, 000	25, 000	137, 000						23, 000	195, 000
Rhode Island		6, 400	59, 000	15, 000	125, 000					205, 400
Vermont		7, 000	221, 000	71, 500						299, 500
Wisconsin		19, 000	15, 000	20, 000						54, 000
Total	10, 000	437, 797	1, 174, 918	955, 900	765, 000	97, 500		20, 572	81, 729	3, 543, 416

C.—TABLE V.—*Summary table of the number of white-fish* (Coregonus albus) *introduced into the waters of the different States by the United States Fish Commission*, 1872–1880, *inclusive.*

State.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Total.
California	25, 000	25, 000	......	20, 000	......	300, 000	......	565, 000	....	935, 000
Indiana	......	......	......	....	100, 000	....	......	....	....	100, 000
Iowa	......	......	......	....	100, 000	....	......	....	....	100, 000
Michigan	......	......	......	....	1, 470, 000	....	......	....	200, 000	1, 670, 000
New Jersey	......	......	......	....	....	....	......	90, 000	....	90, 000
Ohio	......	......	......	....	600, 000	....	......	....	....	600, 000
Wisconsin	......	......	......	100, 000	100, 000	....	......	....	....	200, 000
Total	25, 000	25, 000	......	120, 000	2, 370, 000	300,000	......	655, 000	200, 000	3, 695, 000

C.—TABLE VI.—*Summary table of the number of California trout* (Salmo irideus) *introduced into the waters of the different States by the United States Fish Commission*, 1880.

State.	1880.
Illinois	2, 500
Iowa	1, 000
Maryland	22, 500
Michigan	5, 102
Minnesota	1, 900
New Hampshire	2, 000
North Carolina	4, 300
Pennsylvania	700
South Carolina	3, 500
West Virginia	500
Total	44, 002

Recapitulation of young fish introduced into waters of the United States by the United States Fish Commission, 1872–1880, *inclusive.*

Table	I. Shad	102, 388, 350
"	II. California salmon	33, 922, 960
"	III. Schoodic salmon	4, 210, 303
"	IV. Penobscot salmon	3, 643, 416
"	V. White fish	3, 695, 000
"	VI. California trout	44, 002
	Total	147, 804, 031

In addition to the above there were carp distributed in 1879 and 1880 to the number of 61,410; for the particulars of which see Report of 1880, pp. xli and xlii.

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive.*

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Alabama	July 11, 1876	Montgomery, Ala	Alabama River	Mobile River	South Hadley Falls, Mass	Kumlien and Bean	90,000
	May 29, 1877	Montgomery, Ala	Tallapoosa River	Alabama River	Spesutie Narrows, Md	L. Kumlien	75,000
	Apr. 13, 1878	Demopolis, Ala	Tombigbee River	Mobile River	Avoca, N. C	J. F. Ellis	116,000
	May 24, 1878	Pollard, Ala	Escambia River	Pensacola Bay	Havre de Grace, Md	F. A. Ingalls	100,000
	June 9, 1878	Salisbury, Ala	Tallapoosa River	Alabama River	Havre de Grace, Md	J. M. Donaldson	50,000
	May 13, 1879	Union Springs, Ala	Pea River	Choctawhatchee River	Avoca, N. C	L. Kumlien	90,000
	May 13, 1879	Union Springs, Ala	Conecha River	Escambia River	Avoca, N. C	L. Kumlien	85,000
	June 13, 1879	Lebanon, Ala	Big Wills Creek	Coosa River	Old Bay Fishery, Md	J. F. Ellis	45,000
	June 13, 1879	Tuscaloosa, Ala	Black Warrior River	Tombigbee River	Old Bay Fishery, Md	J. F. Ellis	45,000
	May 13, 1879	Columbia, Ala	Tombigbee River	Mobile Bay	Old Bay Fishery, Md	C. W. Schuermann	75,000
Arkansas	Aug. 7, 1876	Newport, Ark	White River	Mississippi River	South Hadley Falls, Mass	Anderson and Smith	79,200
	July 14, 1877	Fulton, Ark	Red River	Mississippi River	South Hadley Falls, Mass	R. E. Earll	80,000
	June 1, 1878	Benton, Ark	Saline River	Washita River	Havre de Grace, Md	H. E. Quinn	50,000
	June 1, 1878	Arkadelphia, Ark	Caddo River	Washita River	Havre de Grace, Md	H. E. Quinn	50,000
	June 11, 1879	White County, Ark	Little Red River	White River	Old Bay Fishery, Md	W. M. Russ	20,000
	June 11, 1879	Saline County, Ark	Saline River	Washita River	Old Bay Fishery, Md	W. M. Russ	25,000
	June 11, 1879	Clark County, Ark	Ouachita River	Black River	Old Bay Fishery, Md	W. M. Russ	40,000
	June 11, 1879	Fulton, Ark	Red River	Mississippi River	Old Bay Fishery, Md	W. M. Russ	40,000
California	July 2, 1873	Tehama, Cal	Sacramento River	San Francisco Bay	Coeymans, N. Y	Livingston Stone and H. W. Welsher.	35,000
	Aug. 8, 1876	Tehama, Cal	Sacramento River	San Francisco Bay	South Hadley Falls, Mass	Clark and Bean	99,000
	June 6, 1877	Tehama, Cal	Sacramento River	San Francisco Bay	Spesutie Narrows, Md	F. N. Clark	100,000
	June 11, 1878	Tehama, Cal	Sacramento River	San Francisco Bay	Havre de Grace, Md	F. N. Clark	150,000
	June 18, 1880	Tehama, Cal	Sacramento River	San Francisco Bay	Potomac Station	Ellis and Davenport	215,000
Colorado	July 7, 1872	Denver, Colo	Platte River	Missouri River	South Hadley Falls, Mass	Rev. Wm. Clift	2,000
Connecticut	July 8, 1873	New Milford, Conn	Housatonic River	Naugatuck River	South Hadley Falls, Mass	J. W. Milner and J. Mason.	90,000
	July 22, 1874	Noank, Conn	(Used for experiments)		South Hadley Falls, Mass	Mather and Vealey	20,000
	July 23, 1874	Putnam, Conn	Thames River	Long Island Sound	South Hadley Falls, Mass	Mather and Vealey	110,000
	Aug. 3, 1874	New Milford, Conn	Housatonic River	Naugatuck River	South Hadley Falls, Mass	F. N. Clark	100,000
	Aug. 15, 1874	Noank, Conn	(Used for experiments)		South Hadley Falls, Mass	C. D. Griswold	50,000
	July 9, 1875	Canterbury, Conn	Quinnebaug River	Thames River	South Hadley Falls, Mass	H. E. Quinn	100,000
Delaware	June 12, 1877	Seaford, Del	Nanticoke River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	100,000
	May 24, 1879	Seaford, Del	Nanticoke River	Chesapeake Bay	Spesutie Narrows, Md	Thomas Hughlett, jr	20,000
	June 13, 1879	Blackbird, Del	Appoquinimink Creek	Delaware Bay	Old Bay Fishery, Md	Thomas Hughlett, jr	50,000
	June 13, 1879	Clayton, Del	Duck Creek	Delaware Bay	Old Bay Fishery, Md	Thomas Hughlett, jr	25,000
	June 13, 1879	Milford, Del	Mispillion Creek	Delaware Bay	Old Bay Fishery, Md	Thomas Hughlett, jr	100,000
	May 25, 1880	Seaford, Del	Nanticoke River	Chesapeake Bay	Havre de Grace, Md	N. Simmons	1,050,000
	May 25, 1880	Wilmington, Del	Christiana Creek	Delaware River	Havre de Grace, Md	N. Simmons	120,000
	May 25, 1880	Dover, Del	Jones Creek	Delaware Bay	Havre de Grace, Md	N. Simmons	180,000
District of Columbia.	May 27, 1878	Washington, D. C	Potomac River	Chesapeake Bay	Havre de Grace, Md	U. S. Fish Commission	400,000
	June 11, 1879	Georgetown, D. C	Little Falls of Potomac River.	Chesapeake Bay	Spesutie Narrows, Md	J. F. Ellis	160,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
District of Columbia—Continued.	May 8, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	William P. Sauerhoft	335,000
	May 9, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	William P. Sauerhoff	50,000
	May 11, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	110,000
	May 15, 1880	Washington, D. C	Potomac River	Chesapeake Bay	Potomac Station	C. W. Schuermann	60,000
	May 16, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	20,000
	May 17, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	100,000
	May 18, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	200,000
	May 20, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	Sauerhoff & Hamlen	400,000
	May 21, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	Sauerhoff & Hamlen	200,000
	May 22, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	600,000
	May 24, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	Clark and Schuermann	800,000
	May 25, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	400,000
	May 26, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	C. W. Schuermann	400,000
	May 27, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	450,000
	May 28, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	150,000
	May 29, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	200,000
	June 1, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	30,000
	June 4, 1880	Georgetown, D. C	Little Falls of Potomac River.	Chesapeake Bay	Potomac Station	F. N. Clark	500,000
	June 4, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	175,000
	June 5, 1880	Georgetown, D. C	Little Falls of Potomac River.	Chesapeake Bay	Potomac Station	William H. Jenkins	600,000
	June 5, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	300,000
	June 6, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	300,000

	June 8, 1880	Georgetown, D. C	Little Falls of Potomac River.	Chesapeake Bay	Potomac Station	S. M. Rixey	400,000
	June 12, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	75,000
	June 12, 1880	Georgetown, D. C	Little Falls of Potomac River.	Chesapeake Bay	Potomac Station	W. H. Jenkins, jr	500,000
	June 13, 1880	Washington, D. C	East Branch of Potomac River.	Potomac River	Potomac Station	F. N. Clark	300,000
Florida	May 2, 1879	Jefferson County, Fla	Ocilla River	Gulf of Mexico	Avoca, N. C	C. W. Schuermann	60,000
	May 2, 1879	Midway, Fla	Ockolockonee River	Gulf of Mexico	Avoca, N. C	C. W. Schuermann	60,000
Georgia	July 22, 1875	Rome, Ga	Coosa River	Alabama River	South Hadley Falls, Mass	Clark and Quinn	60,000
	June 2, 1876	Atlanta, Ga	Chattahoochee River	Apalachicola River	Havre de Grace, Md	A. A. Anderson	122,500
	June 2, 1876	Macon, Ga	Oemulgee River	Altamaha River	Havre de Grace, Md	T. H. Bean	79,800
	June 3, 1876	Milledgeville, Ga	Oconee River	Altamaha River	Havre de Grace, Md	L. Kumlien	40,900
	May 22, 1877	Macon, Ga	Oemulgee River	Altamaha River	Spesutie Narrows, Md	H. E. Quinn	100,000
	May 31, 1877	Milledgeville, Ga	Oconee River	Altamaha River	Spesutie Narrows, Md	C. D. Griswold	100,000
	June 9, 1877	Covington, Ga	Oemulgee River	Altamaha River	Spesutie Narrows, Md	C. D. Griswold	100,000
	July 13, 1877	Columbus and West Point, Ga.	Chattahoochee River	Apalachicola River	South Hadley Falls, Mass	C. D. Griswold	100,000
	July 13, 1877	West Point, Ga	Chattahoochee River	Apalachicola River	South Hadley Falls, Mass	C. D. Griswold	10,000
	Apr. 25, 1878	Macon, Ga	Oemulgee River	Altamaha River	Avoca, N. C	H. E. Quinn	60,000
	Apr. 25, 1878	Albany, Ga	Flint River	Apalachicola River	Avoca, N. C	H. E. Quinn	60,000
	May 25, 1878	Montezuma, Ga	Flint River	Apalachicola River	Havre de Grace, Md	J. F. Ellis	150,000
	June 9, 1878	Cartersville, Ga	Etowah River	Coosa River	Havre de Grace, Md	J. M. Donaldson	50,000
	Apr. 28, 1879	Columbus, Ga	Chattahoochee River	Apalachicola River	Avoca, N. C	L. Kumlein	75,000
	May 2, 1879	Stockton, Ga	Allapaha River	Suwanee River	Avoca, N. C	C. W. Schuermann	40,000
	May 2, 1879	Ousley, Ga	Little River	Suwanee River	Avoca, N. C	C. W. Schuermann	40,000
	May 3, 1879	Macon, Ga	Oemulgee River	Altamaha River	Avoca, N. C	J. F. Ellis	100,000
	May 7, 1879	Covington, Ga	Ulcofauhatchee River	Oemulgee River	Avoca, N. C	C. W. Schuermann	60,000
	May 7, 1879	Conyers, Ga	Yellow River	Oemulgee River	Avoca, N. C	C. W. Schuermann	60,000
	May 29, 1879	Habersham County, Ga	Tugaloo River	Savannah River	Spesutie Narrows, Md	H. E. Quinn	50,000
	May 29, 1879	Gainesville, Ga	Chattahoochee River	Apalachicola River	Spesutie Narrows, Md	H. E. Quinn	37,500
	May 29, 1879	Resaca, Ga	Coosa River	Alabama River	Spesutie Narrows, Md	H. E. Quinn	100,000
	May 25, 1880	Greene County, Ga	Oconee River	Altamaha River	Potomac Station	J. F. Ellis	296,000
	May 25, 1880	Covington, Ga	Yellow River	Oemulgee River	Potomac Station	J. F. Ellis	296,000
	May 25, 1880	Boltonville, Ga	Chattahoochee River	Apalachicola River	Potomac Station	J. F. Ellis	296,000
	June 13, 1880	Milledgeville, Ga	Oconee River	Altamaha River	Potomac Station	C. W. Schuermann	150,000
	June 13, 1880	Albany, Ga	Flint River	Apalachicola River	Potomac Station	C. W. Schuermann	150,000
Illinois	June 16, 1873	South Chicago, Ill	Calumet River	Lake Michigan	Coeymans, N. Y	J. Mason	70,000
	July 9, 1874	Rockford, Ill	Rock River	Mississippi River	Coeymans, N. Y	Welsher and Chase	70,000
	July 31, 1875	Rockford, Ill	Rock River	Mississippi River	South Hadley Falls, Mass	Chase and Ingalls	60,000
	May 27, 1878	Farlow, Ill	Kaskaskia River	Mississippi River	Havre de Grace, Md	C. W. Schuermann	100,000
	June 2, 1878	Rockford, Ill	Rock River	Mississippi River	Havre de Grace, Md	C. W. Schuermann	100,000
	June 9, 1878	Charleston, Ill	Embarras River	Wabash River	Havre de Grace, Md	W. H. Hines	50,000
	June 9, 1878	Marion, Ill	Mississinewa River	Wabash River	Havre de Grace, Md	W. H Hines	50,000
Indiana	July 4, 1872	Indianapolis, Ind	White River	Ohio River	South Hadley Falls, Mass	Rev. Wm. Clift	400,000
	June 30, 1873	Logansport, Ind	Wabash River	Ohio River	Coeymans, N. Y	J. W. Milner and J. Mason.	40,000
	June 30, 1874	Logansport, Ind	Wabash River	Ohio River	Coeymans, N. Y	Mather and Vealey	75,000
	July 22, 1874	Indianapolis, Ind	White River	Ohio River	South Hadley Falls, Mass	Mason and Clark	80,000
	July 30, 1874	Elkhart, Ind	Saint Joseph River	Lake Michigan	South Hadley Falls, Mass	F. N. Clark	80,000
	July 31, 1874	Columbus, Ind	White River	Ohio River	South Hadley Falls, Mass	H. J. Brooks	80,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Indiana—Cont'd	June 13, 1875	Indianapolis, Ind	White River	Ohio River	Coeymans, N. Y	F. N. Clark	100,000
	June 1, 1878	Elkhart, Ind	Elkhart River	Lake Michigan	Havre de Grace, Md	J. F. Ellis	100,000
	June 9, 1878	Terre Haute, Ind	Wabash River	Ohio River	Havre de Grace, Md	H. E. Quinn	65,000
	June 7, 1879	Terre Haute, Ind	Wabash River	Ohio River	Spesutie Narrows, Md	H. E. Quinn	100,000
	June 12, 1879	Indianapolis, Ind	White River	Wabash River	Spesutie Narrows, Md	Newton Simmons	50,000
	June 20, 1880	Lafayette, Ind	Wabash River	Ohio River	Potomac Station	H. E. Quinn	200,000
Iowa	July 30, 1874	Ottumwa, Iowa	Des Moines River	Mississippi River	South Hadley Falls, Mass	Mather and Vealey	60,000
	July 30, 1874	Des Moines, Iowa	Des Moines River	Mississippi River	South Hadley Falls, Mass	Mather and Vealey	40,000
	June 27, 1875	Des Moines, Iowa	Des Moines River	Mississippi River	Coeymans, N. Y	Clark and Quinn	90,000
	July 16, 1876	Des Moines, Iowa	Des Moines River	Mississippi River	South Hadley Falls, Mass	Quinn, Cory, and Shaw	148,500
	June 12, 1878	Cedar Rapids, Iowa	Cedar River	Mississippi River	Havre de Grace, Md	B. F. Shaw	40,000
	June 12, 1878	Logan, Iowa	Boyer River	Mississippi River	Havre de Grace, Md	B. F. Shaw	20,000
	June 12, 1878	Moingona, Iowa	Des Moines River	Mississippi River	Havre de Grace, Md	B. F. Shaw	40,000
Kansas	June 1, 1877	Topeka, Kans	Big Blue River	Kansas River	Spesutie Narrows, Md	H. E. Quinn	100,000
	June 1, 1879	La Cygne, Kans	Marais des Cygnes River	Osage River	Spesutie Narrows, Md	J. F. Ellis	20,000
	June 1, 1879	Manhattan, Kans	Blue River	Kansas River	Spesutie Narrows, Md	J. F. Ellis	15,000
	June 1, 1879	Davis County, Kans	Republican River	Kansas River	Spesutie Narrows, Md	J. F. Ellis	15,000
	June 1, 1879	Saline County, Kans	Solomon River	Kansas River	Spesutie Narrows, Md	J. F. Ellis	15,000
	June 1, 1879	Ellsworth, Kans	Smoky Hill River	Kansas River	Spesutie Narrows, Md	J. F. Ellis	15,000
	June 1, 1879	Reading, Kans	Marais des Cygnes River	Osage River	Spesutie Narrows, Md	J. F. Ellis	5,000
	June 1, 1879	Emporia, Kans	Neosho River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	10,000
	June 1, 1879	Cottonwood Falls, Kans	Cottonwood River	Neosho River	Spesutie Narrows, Md	J. F. Ellis	2,000
	June 1, 1879	Florence, Kans	Cottonwood River	Neosho River	Spesutie Narrows, Md	J. F. Ellis	3,000
	June 1, 1879	Florence, Kans	Doyle Creek	Neosho River	Spesutie Narrows, Md	J. F. Ellis	3,000
	June 1, 1879	Halstead, Kans	Little River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	5,000
	June 1, 1879	Hutchinson, Kans	Cow River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	5,000
	June 1, 1879	El Dorado, Kans	Walnut River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	10,000
	June 1, 1879	Great Bend, Kans	Walnut River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	10,000
	June 1, 1879	Larned, Kans	Pawnee River	Arkansas River	Spesutie Narrows, Md	J. F. Ellis	27,000
Kentucky	June 1, 1877	Mount Sterling, Ky	Licking River	Ohio River	Spesutie Narrows, Md	F. A. Ingalls	50,000
	July 18, 1877	Munfordsville, Ky	Green River	Ohio River	South Hadley Falls, Mass	F. N. Clark	110,000
	May 26, 1878	Somerset, Ky	Cumberland River	Ohio River	Havre de Grace, Md	H. E. Quinn	60,000
	May 26, 1878	McKinney's Station, Ky	Green River	Ohio River	Havre de Grace, Md	H. E. Quinn	60,000
	June 3, 1878	Bowling Green, Ky	Big Barren River	Green River	Havre de Grace, Md	William Russ	100,000
	June 4, 1878	Mercer County, Ky	Kentucky River	Ohio River	Havre de Grace, Md	F. A. Ingalls	130,000
	June 4, 1878	Scott County, Ky	Elkhorn Creek	Kentucky River	Havre de Grace, Md	F. A. Ingalls	45,000
	May 28, 1879	Shepherdsville, Ky	Salt River	Ohio River	Spesutie Narrows, Md	J. F. Ellis	200,000
	June 1[illegible], 1879	Shepherdsville, Ky	Salt River	Ohio River	Spesutie Narrows, Md	N. Simmons	150,000
	June 7, 1880	Shepherdsville, Ky	Salt River	Ohio River	Potomac Station	Hon. William Griffith	700,000
Louisiana	July 29, 1875	Tickfaw, La	Notalbany River	Lake Pontchartrain	South Hadley Falls, Mass	Mather and Bell	60,000
	May 27, 1878	Tickfaw, La	Amite River	Lake Pontchartrain	Havre de Grace, Md	W. M. Russ	100,000
	May 8, 1879	Railroad, Madison County, La.	Roundaway Creek	Mississippi River	Avoca, N. C	H. E. Quinn	30,000

	May 8, 1879	Railroad, Madison County, La.	Tensas River	Mississippi River	Avoca, N. C	H. E. Quinn	35,000
	May 8, 1879	Railroad, Richland County, La.	Bayou Macon	Tensas River	Avoca, N. C	H. E. Quinn	30,000
	May 8, 1879	Railroad, Richland County, La.	Boeuf River	Washita River	Avoca, N. C	H. E. Quinn	35,000
	May 8, 1879	Railroad, Richland County, La.	Clear Lake	Black River	Avoca, N. C	H. E. Quinn	35,000
	May 8, 1879	Monroe, La	Washita River	Red River	Avoca, N. C	H. E. Quinn	35,000
Maine	July 12, 1873	Mattawamkeag, Me	Mattawamkeag River	Penobscot River	South Hadley Falls, Mass	J. W. Milner & J. Mason	100,000
	July 25, 1874	Waterville, Me	Kennebec River	Atlantic Ocean	South Hadley Falls, Mass	Mason and Clark	100,000
	July 28, 1874	Mattawamkeag, Me	Mattawamkeag River	Penobscot River	South Hadley Falls, Mass	Welsher and Griswold	100,000
	Aug. 14, 1874	Mattawamkeag, Me	Mattawamkeag River	Penobscot River	South Hadley Falls, Mass	H. J. Brooks	100,000
	July 12, 1875	Mattawamkeag, Me	Mattawamkeag River	Penobscot River	South Hadley Falls, Mass	Quinn and Griswold	100,000
	Aug. 7, 1877		Penobscot River	Penobscot Bay	South Hadley Falls, Mass	H. J. Rice	85,000
	June 15, 1880	Waterville, Me	Kennebec River	Atlantic Ocean	Havre de Grace, Md	H. E. Quinn	337,500
	June 15, 1880	Mattawamkeag, Me	Penobscot River	Penobscot Bay	Havre de Grace, Md	H. E. Quinn	337,500
Maryland	May 31, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	185,000
	June 1, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	282,500
	June 3, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	220,000
	June 4, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	210,000
	June 5, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	105,000
	June 6, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	70,000
	June 7, 1875	Moxley Point, Md	Potomac River	Chesapeake Bay	Moxley Point, Md	Not transferred	110,000
	May 10, 1876	Bristol Landing, Md	Patuxent River	Chesapeake Bay	Bristol Landing, Md	Not transferred	50,000
	May 11, 1876	Bristol Landing, Md	Patuxent River	Chesapeake Bay	Bristol Landing, Md	Not transferred	75,000
	May 12, 1876	Bristol Landing, Md	Patuxent River	Chesapeake Bay	Bristol Landing, Md	Not transferred	50,000
	May 18, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	108,000
	May 19, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	108,000
	May 22, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	162,000
	May 23, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	168,000
	May 24, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	46,000
	May 26–7, '76	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	110,000
	May 29, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	105,500
	May 31, 1876	Carpenter's Point, Md	North East River	Chesapeake Bay	Carpenter's Point, Md	Not transferred	15,000
	May 31, 1876	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Swan Creek, Md	Not transferred	30,000
	June 2, 1876	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Swan Creek, Md	Not transferred	50,000
	June 6, 1876	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Swan Creek, Md	Not transferred	80,000
	June 7, 1876	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Swan Creek, Md	Not transferred	70,000
	June 7, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Fishing Battery Station	Not transferred	90,000
	June 9, 1876	Cumberland, Md	Potomac River	Chesapeake Bay	Havre de Grace, Md	Anderson and Kumlien	178,000
	June 10, 1876	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Swan Creek, Md	Not transferred	50,000
	June 10, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Fishing Battery Station	Not transferred	190,000
	June 1–14, '76	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace Station, No. 1.	Not transferred	272,000
	June 16, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace Station, No. 2.	Not transferred	70,000
	June 17, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace Station, No. 2.	Not transferred	30,000
	June 18, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace Station, No. 2.	Not transferred	25,000
	June 20, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Fishing Battery Station	Not transferred	79,000

D.—TABLE I.—*Distribution of shad from* 1872 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Maryland—Continued.	June 21, 1876	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Fishing Battery Station	Not transferred	100, 000
	May 17, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	200, 000
	May 18, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	785, 000
	May 19, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	350, 000
	May 20, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	3, 055, 500
	May 21, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	50, 000
	May 22, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	10, 000
	May 24, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	153, 000
	May 25, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Noi transferred	85, 000
	May 26, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	50, 000
	May 27, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	50, 000
	May 28, 1877	Havre de Grace, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	60, 000
	May 30, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	46, 000
	May 31, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	100, 000
	June 1, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	56, 000
	June 1, 1877		Elk River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	150, 000
	June 1, 1877	Cumberland, Md	Potomac River	Chesapeake Bay	Spesutie Narrows, Md	L. Fairfax	100, 000
	June 1, 1877		Bohemia River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	126, 000
	June 1, 1877		Sassafras River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	285, 000
	June 1, 1877	Cumberland, Md	Potomac River	Chesapeake Bay	Spesutie Narrows, Md	L. Fairfax	150, 000
	June 2, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	127, 000
	June 3, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	12, 800
	June 5, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	100, 000
	June 5, 1877	Denton, Md	Choptank River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	510, 000
	June 6, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	72, 000
	June 7, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	30, 000
	June 7, 1877	Laurel, Md	Patuxent River	Chesapeake Bay	Spesutie Narrows, Md	C. D. Griswold	160, 000
	June 8, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	50, 000
	June 9, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	20, 000
	June 10, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	60, 000
	June 11, 1877	Havre de Grace, Md	Spesutie Narrows	Susquehanna River	Spesutie Narrows, Md	Not transferred	20, 000
	June 12, 1877	Salisbury, Md	Wicomico River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	100, 000
	June 12, 1877	Pocomoke City, Md	Pocomoke River	Chesapeake Bay	Spesutie Narrows, Md	J. W. Milner	100, 000
	June 12, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	10, 000
	June 13, 1877	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	36, 000
	June 13, 1877	Cockeysville, Md	Gunpowder River	Chesapeake Bay	Spesutie Narrows, Md	L. Fairfax	50, 000
	Apr. 21, 1878	Various points	Potomac River	Chesapeake Bay	Avoca, N. C	William Hamlen	100, 000
	May 1, 1878	Point of Rocks, Md	Potomac River	Chesapeake Bay	Avoca, N. C	William Hamlen	100, 000
	May 17, 1878	Greensborough, Md	Choptank River	Chesapeake Bay	Havre de Grace, Md	Thomas Hughlett	100, 000
	May 23, 1878	Neabsco Mills, Md	Neabsco River	Potomac River	Steamer Lookout	Not transferred	50, 000
	May 24, 1878	Federalsburg, Md	Nanticoke River	Chesapeake Bay	Havre de Grace, Md	Thomas Hughlett	100, 000
	May 24, 1878	Glymont, Md	Potomac River	Chesapeake Bay	Steamer Lookout	Not transferred	75, 000
	May 25, 1878	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	150 000
	May 26, 1878	Cecil County, Md	North East River	Chesapeake Bay	Havre de Grace, Md	Not transferred	350, 000

May 26, 1878	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	100,000
May 27, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	200,000
May 28, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	400,000
May 28, 1878	Fort Washington, Md	Potomac River	Chesapeake Bay	Steamer Lookout	Not transferred	100,000
May 28, 1878	Glymont, Md	Potomac River	Chesapeake Bay	Steamer Lookout	Not transferred	300,000
May 29, 1878	Salisbury, Md	Wicomico River	Chesapeake Bay	Havre de Grace, Md	Thomas Hughlett	175,000
May 29, 1878	Princess Anne, Md	Manokin River	Tangier Sound	Havre de Grace, Md	Thomas Hughlett	75,000
May 29, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	1,500,000
May 30, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	500,000
May 31, 1878	Millington, Md	Chester River	Chesapeake Bay	Havre de Grace, Md	Thomas Hughlett	250,000
June 1, 1878	Easton, Md	Tread Haven	Choptank River	Havre de Grace, Md	S. M. Rixey	50,000
June 1, 1878	Easton, Md	Miles River	Eastern Bay	Havre de Grace, Md	S. M. Rixey	75,000
June 1, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	500,000
June 3, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	500,000
June 3, 1878	Greensborough, Md	Choptank River	Chesapeake Bay	Havre de Grace, Md	S. M. Rixey	100,000
June 3, 1878	Hillsborough, Md	Tuckahoe River	Choptank River	Havre de Grace, Md	S. M. Rixey	50,000
June 5, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Havre de Grace, Md	J. M. Donaldson	150,000
June 6, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Havre de Grace, Md	David Scott	150,000
June 6, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	500,000
June 10, 1878	Snow Hill, Md	Pocomoke River	Chesapeake Bay	Havre de Grace, Md	S. M. Rixey	150,000
June 10, 1878	Perryman, Md	Bush River	Chesapeake Bay	Havre de Grace, Md	W. F. Page	150,000
June 10, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	100,000
June 11, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	185,000
June 14, 1878	Cockeysville, Md	Gunpowder River	Chesapeake Bay	Havre de Grace, Md	N. Simmons	80,000
June 14, 1878	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	120,000
May 16, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	300,000
May 17, 1879	Cordova Station, Md	Miles Creek	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	60,000
May 17, 1879	Cordova Station, Md	Wye Mills Creek	Miles Creek	Spesutie Narrows, Md	T. Hughlett, jr	80,000
May 18, 1879	Salisbury, Md	Wicomico River	Chesapeake Bay	Spesutie Narrows, Md	L. Campbell	150,000
May 19, 1879	Savage, Md	Patuxent River	Chesapeake Bay	Spesutie Narrows, Md	J. F. Ellis	115,000
May 19, 1879	Laurel, Md	Patuxent River	Chesapeake Bay	Spesutie Narrows, Md	J. F. Ellis	110,000
May 19, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	100,000
May 21, 1879	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	25,000
May 21, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	100,000
May 24, 1879	Federalsburg, Md	Nanticoke River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	80,000
May 24, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
May 26, 1879	Whaleysville, Md	Pocomoke River	Chesapeake Bay	Spesutie Narrows, Md	L. Campbell	100,000
May 26, 1879	Berlin, Md	Saint Michael's River	Chesapeake Bay	Spesutie Narrows, Md	L. Campbell	50,000
May 26, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
May 27, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	100,000
May 28, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	125,000
May 29, 1879	Henderson, Md	Choptank River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	100,000
May 29, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	50,000
May 30, 1879	Millington, Md	Chester River	Chesapeake Bay	Spesutie Narrows, Md	L. Campbell	140,000
May 30, 1879	Centreville, Md	Corsica River	Chester River	Spesutie Narrows, Md	L. Campbell	60,000
May 30, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	200,000
May 30, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
May 31, 1879	Middletown, Md	Sassafras River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	100,000
May 31, 1879	Middletown, Md	Bohemia River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	100,000
May 31, 1879	Battery Light, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	400,000
June —, 1879	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	40,000
June 1, 1879	Elkton, Md	Elk River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	200,000

D.—TABLE I.—*Distribution of shad from* 1872 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred	Estimated number of fish.
Maryland—Continued.	June 1, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	300,000
	June 1, 1879	Battery Light	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	400,000
	June 2, 1879	Port Deposit, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	300,000
	June 2, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	200,000
	June 2, 1879	Old Bay Fishing	Susquehanna River	Chesapeake Bay	Old Bay Fishery, Md	Not transferred	120,000
	June 3, 1879	Princess Anne, Md	Manokin River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	150,000
	June 3, 1879	Newtown, Md	Pocomoke River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	125,000
	June 3, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
	June 4, 1879	Cockeysville, Md	Gunpowder River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	175,000
	June 4, 1879	Battery Light	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
	June 6, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	100,000
	June 7, 1879	Old Bay Fishery	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	85,000
	June 8, 1879	Relay Station, Md	Patapsco River	Chesapeake Bay	Spesutie Narrows, Md	W. Hamlen	175,000
	June 8, 1879	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	100,000
	June 9, 1879	Old Bay Fishery	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	137,000
	June 10, 1879	Point of Rocks, Md	Potomac River	Chesapeake Bay	Spesutie Narrows, Md	J. F. Ellis	200,000
	June 10, 1879	Patuxent, Md	Patuxent River	Chesapeake Bay	Spesutie Narrows, Md	W. M. Russ	125,000
	June 10, 1879	Federalsburg, Md	Nanticoke River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	50,000
	June 10, 1879	Airey's Station, Md	Transquaking River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	25,000
	June 10, 1879	Cambridge, Md	Blackwater River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	25,000
	June 10, 1879	Hillsborough, Md	Tuckahoe River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	50,000
	June 10, 1879	Henderson, Md	Choptank River	Chesapeake Bay	Spesutie Narrows, Md	T. Hughlett, jr	50,000
	June 11, 1879	Battery Light	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	150,000
	June 11, 1879	Baltimore County, Md	Gunpowder River	Chesapeake Bay	Spesutie Narrows, Md	N. Simmons	105,000
	June 14, 1879	Port Deposit, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	75,000
	June 14, 1879	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	Not transferred	200,000
	May 7, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	10,000
	May 8, 1880	Laurel, Md	Patuxent River	Chesapeake Bay	Potomac Station	C. W. Schuermann	300,000
	May 10, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	413,000
	May 11, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	250,000
	May 11, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	150,000
	May 11, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Potomac Station	W. H. Jenkins, jr	200,000
	May 12, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	145,000
	May 12, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	100,000
	May 13, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	190,000
	May 13, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	350,000
	May 14, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	270,000
	May 15, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	215,000
	May 15, 1880	Cumberland, Md	Spesutie Narrows	Chesapeake Bay	Potomac Station	H. E. Quinn	300,000
	May 16, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Potomac Station	N. Simmons	300,000
	May 17, 1880	Point of Rocks, Md	Potomac River	Chesapeake Bay	Potomac Station	J. F. Ellis	300,000
	May 18, 1880	Havre de Grace, Md	Spesutie River	Chesapeake Bay	Havre de Grace, Md	Not transferred	225,000
	May 19, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	250,000
	May 20, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	285,000

	May 20, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	200,000
	May 20, 1880	Swan Creek, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	200,000
	May 21, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	350,000
	May 21, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	50,000
	May 21, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	25,000
	May 21, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Potomac Station	J. F. Ellis	600,000
	May 22, 1880	Havre de Grace, Md	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	460,000
	May 22, 1880	Fort Washington, Md	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	200,000
	May 23, 1880	Fort Washington, Md	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	25,000
	May 24, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	240,000
	May 25, 1880	Moxley Point	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	500,000
	May 25, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Potomac Station	C. W. Schuermann	500,000
	May 26, 1880	Moxley Point	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	500,000
	May 26, 1880	Laurel, Md	Patuxent River	Chesapeake Bay	Potomac Station	C. J. Huske	1,500,000
	May 27, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	1,070,000
	May 28, 1880	Havre de Grace, Md	Spesutie Narrows	Chesapeake Bay	Havre de Grace, Md	Not transferred	75,000
	May 29, 1880	Perrymansville, Md	Bush River	Chesapeake Bay	Havre de Grace, Md	N. Simmons	150,000
	May 29, 1880	Deer Park, Md	Little Youghiogheny River.	Youghiogheny River	Potomac Station	S. M. Rixey	50,000
	June 2, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	50,000
	June 2, 1880	Moxley Point	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	275,000
	June 3, 1880	Perrymansville, Md	Bush River	Chesapeake Bay	Havre de Grace, Md	M. Gleason	285,000
	June 4, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	485,000
	June 6, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	460,000
	June 7, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	55,000
	June 7, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Potomac Station	S. M. Rixey	375,000
	June 8, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	650,000
	June 9, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	140,000
	June 9, 1880	Fort Washington, Md	Potomac River	Chesapeake Bay	Potomac Station	Not transferred	100,000
	June 12, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	400,000
	June 12, 1880	Off Watson Island	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	Not transferred	100,000
Massachusetts	Aug. 8, 1874	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	H. J. Brooks	60,000
	Aug. 10, 1874	Westfield, Mass	Westfield River	Connecticut River	South Hadley Falls, Mass	C. D. Griswold	80,000
	Aug. 13, 1874	Westfield, Mass	Westfield River	Connecticut River	South Hadley Falls, Mass	F. A. Smith	210,000
	July 8, 1875	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Mason and Quinn	250,000
	July 13, 1875	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Mason and Quinn	250,000
	July 16, 1875	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Mason and Quinn	225,000
	July 7–31, '75	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Charles C. Smith	4,500,000
	July 12, 1876	Bridgewater, Mass	Taunton River	Narragansett Bay	South Hadley Falls, Mass	R. R. Holmes	80,000
	July 14, 1876	Westfield, Mass	Westfield River	Connecticut River	South Hadley Falls, Mass	R. R. Holmes	80,000
	July 15, 1876	Middleborough, Mass	Taunton River	Narragansett Bay	South Hadley Falls, Mass	R. R. Holmes	100,000
	July 26, 1876	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Not transferred	150,000
	July 29, 1876	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Not transferred	4,000
	Aug. 1, 1876	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Not transferred	5,000
	Aug. 2, 1876	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Not transferred	40,000
	July 4, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	12,000
	July 16, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	145,000
	July 17, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	207,000
	July 20, 1877	South Hadley Falls, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass		60,000
	July 23, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Clark & Atkins	165,000
	July 23, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	50,000
	July 28, 1877	Middleborough, Mass	Taunton River	Narragansett Bay	South Hadley Falls, Mass	R. R. Holmes	50,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Massachusetts—Continued.	July 30, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	William Smith	100,000
	July 31, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	80,000
	July 31, 1877	Bridgewater, Mass	Taunton River	Narragansett Bay	South Hadley Falls, Mass	R. R. Holmes	50,000
	Aug. 1, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	33,000
	Aug. 3, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	C. G. Atkins	27,000
	Aug. 4, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	William Smith	14,000
	Aug. 7, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	William Smith	22,000
	Aug. 8, 1877	Smith's Ferry, Mass	Connecticut River	Long Island Sound	South Hadley Falls, Mass	William Smith	62,000
Michigan	June 17, 1873	Lansing, Mich	Grand River	Lake Michigan	South Hadley Falls, Mass	George H. Jerome	50,000
	June 24, 1873	Detroit, Mich	Detroit River	Lake Erie	South Hadley Falls, Mass	J. W. Milner and J. Mason	20,000
	June 24, 1873	Ionia, Mich	Grand River	Lake Michigan	South Hadley Falls, Mass	J. W. Milner and J. Mason	80,000
	June 28, 1873		Flint River	Saginaw River	South Hadley Falls, Mass	George H. Jerome	10,000
	June 28, 1873	Monroe, Mich	Raisin River	Lake Erie	South Hadley Falls, Mass	George H. Jerome	10,000
	June 28, 1873	Niles, Mich	Saint Joseph River	Lake Michigan	South Hadley Falls, Mass	George H. Jerome	30,000
	June 28, 1873	Kalamazoo County, Mich	Long Lake	Kalamazoo River	South Hadley Falls, Mass	George H. Jerome	10,000
	Aug. 1, 1874	Detroit, Mich	Detroit River	Lake Erie	South Hadley Falls, Mass	Chase & Griswold	80,000
	Aug. 6, 1874	Corunna, Mich	Shiawassee River	Lake Huron	South Hadley Falls, Mass	F. N. Clark	80,000
Minnesota	July 5, 1872	Saint Paul, Minn	Mississippi River	Gulf of Mexico	Coeymans, N. Y	Seth Green	25,000
	Aug. 5, 1874	Saint Paul, Minn	Mississippi River	Gulf of Mexico	South Hadley Falls, Mass	Chase and Vealey	100,000
	July 20, 1877	Saint Paul, Minn	Mississippi River	Gulf of Mexico	South Hadley Falls, Mass	H. E. Quinn	100,000
Mississippi	July 16, 1875	Jackson, Miss	Pearl River	Gulf of Mexico	Point Pleasant, Pa	Anderson and Schwartz	100,000
	June 13, 1876	Jackson, Miss	Pearl River	Lake Borgne	Havre de Grace, Md	A. A. Anderson	74,000
	June 13, 1876	Abbeville, Miss	Yazoo River	Mississippi River	Havre de Grace, Md	Anderson and Abbott	74,000
	June 4, 1877	Canton, Miss	Big Black River	Mississippi River	Spesutie Narrows, Md	F. A. Ingalls	100,000
	Apr. 13, 1878	Vaughan, Miss	Big Black River	Mississippi River	Avoca, N. C	C. W. Schuermann	144,000
	Apr. 23, 1878	Friar's Point, Miss	Sunflower River	Yazoo River	Avoca, N. C	J. F. Ellis	100,000
	Apr. 23, 1878	Holly Springs, Miss	Cold Water River	Yazoo River	Avoca, N. C	C. W. Schuermann	40,000
	Apr. 23, 1878	Lafayette County, Miss	Tallahatchie River	Yazoo River	Avoca, N. C	C. W. Schuermann	40,000
	Apr. 23, 1878	Grenada, Miss	Yalabusha River	Yazoo River	Avoca, N. C	C. W. Schuermann	40,000
	May 15, 1878	Fulton, Miss	Tombigbee River	Mobile Bay	Havre de Grace, Md	J. F. Ellis	90,000
	May 15, 1878	Aberdeen, Miss	Tombigbee River	Mobile Bay	Havre de Grace, Md	J. F. Ellis	60,000
	May 23, 1878	Meridian, Miss	Okatibee Creek	Chickasawha River	Havre de Grace, Md	R. E. Earle	100,000
	Apr. 26, 1879	Jackson, Miss	Pearl River	Gulf of Mexico	Avoca, N. C	J. F. Ellis	150,000
	May 13, 1879	Meridian, Miss	Chunky River	Chickasawha River	Avoca, N. C	C. W. Schuermann	25,000
	May 20, 1879	Ripley, Miss	Tippah River	Tallahatchie River	Spesutie Narrows, Md	J. F. Ellis	50,000
	May 20, 1879	La Fayette County, Miss	Tallahatchie River	Yazoo River	Spesutie Narrows, Md	J. F. Ellis	50,000
	May 20, 1879	La Fayette, Miss	Yocana River	Yazoo River	Spesutie Narrows, Md	J. F. Ellis	50,000
	May 20, 1879	Grenada, Miss	Yalobusha River	Yazoo River	Spesutie Narrows, Md	J. F. Ellis	50,000
Missouri	July 5, 1872	Washington, Mo	Missouri River	Mississippi River	South Hadley Falls, Mass	Rev. Wm. Clift	500
	July 5, 1872	Hermann, Mo	Missouri River	Mississippi River	South Hadley Falls, Mass	Rev. Wm. Clift	500
	June 8, 1876	Poplar Bluff, Mo	Black River	Mississippi River	Havre de Grace, Md	Ingalls and Fairfax	20,000
	June 9, 1876	Callao, Mo	Chariton River	Missouri River	Havre de Grace, Md	B. S. Cory, jr	61,000
	July 13, 1876	Pacific, Mo	Meramec River	Mississippi River	South Hadley Falls, Mass	Clark and Fairfax	99,500
	Aug. 9, 1876	Kansas City, Mo	Kansas River	Missouri River	South Hadley Falls, Mass	Anderson and Smith	119,500

	May 21, 1877	Saint Louis, Mo	Mississippi River	Gulf of Mexico	Spesutie Narrows, Md	L. Fairfax	100,000
	June 4, 1877	Saint Joseph, Mo	Missouri River	Mississippi River	Spesutie Narrows, Md	L. Fairfax	100,000
	July 4, 1877	Springfield, Mo	James River	White River	South Hadley Falls, Mass	F. A. Ingalls	90,000
	July 5, 1877	Mexico, Mo	Salt Creek	Mississippi River	South Hadley Falls, Mass	C. D. Griswold	110,000
	May 20, 1878	Neosho, Mo	Shoal Creek	Arkansas River	Havre de Grace, Md	C. W. Schuermann	120,000
	June 8, 1878	Saint Louis, Mo	Mississippi River	Gulf of Mexico	Havre de Grace, Md	F. A. Ingalls	100,000
	May 31, 1879	Franklin, Mo	Meramec River	Mississippi River	Spesutie Narrows, Md	L. Kumlien	50,000
	May 31, 1879	Piedmont, Mo	Big Black River	White River	Spesutie Narrows, Md	L. Kumlien	75,000
	May 31, 1879	Poplar Bluffs, Mo	Big Black River	White River	Spesutie Narrows, Md	L. Kumlien	75,000
	June 14, 1879	Webster County, Mo	James River	White River	Spesutie Narrows, Md	L. Kumlien	75,000
	June 14, 1879	Arcadia, Mo	San François River	Black River	Spesutie Narrows, Md	L. Kumlien	75,000
	June 4, 1880	Jerome, Mo	Gasconade River	Missouri River	Potomac Station	S. M. Rixey	40,000
	June 4, 1880	Henry County, Mo	Grand River	Missouri River	Potomac Station	J. F. Ellis	20,000
	June 4, 1880	Shelby County, Mo	Salt River	Mississippi River	Potomac Station	J. F. Ellis	20,000
	June 4, 1880	Schell City, Mo	Osage River	Missouri River	Potomac Station	G. G. Davenport	40,000
	June 4, 1880	Macon County, Mo	Chariton River	Missouri River	Potomac Station	J. F. Ellis	20,000
	June 5, 1880	Nodaway County, Mo	Platte River	Missouri River	Potomac Station	J. F. Ellis	20,000
	June 5, 1880	Nodaway County, Mo	One Hundred and Two River.	Platte River	Potomac Station	J. F. Ellis	20,000
	June 5, 1880	Nodaway, Mo	Nodaway River	Missouri River	Potomac Station	J. F. Ellis	20,000
New Hampshire	July 24, 1877	Tilton, N. H	Winnipesaukee River	Merrimac River	South Hadley Falls, Mass	Weber and Powers	75,000
	July 28, 1877	Contoocook, N. H	Contoocook River	Merrimac River	South Hadley Falls, Mass	Weber and Powers	50,000
New York	June 30, 1872	Salamanca, N. Y	Allegheny River	Ohio River	Coeymans, N. Y	Seth Green	30,000
	July 3, 1872	Salamanca, N. Y	Allegheny River	Ohio River	South Hadley Falls, Mass	Rev. Wm. Clift	400,000
North Carolina	May 13, 1873	New Berne, N. C	Neuse River	Pamlico Sound	New Berne, N. C	Not transferred	45,000
	May 26, 1876	Raleigh, N. C	Neuse River	Pamlico Sound	Ferry Landing, Va	C. D. Griswold	98,000
	June 12, 1876	Catawba, N. C	Catawba River	Santee River	Havre de Grace, Md	L. Kumlien	66,900
	May —, 1877	Wake County, N. C	Neuse River	Pamlico Sound	Havre de Grace, Md		134,000
	July 18, 1877	Rowan County, N. C	Yadkin River	Great Pedee River	South Hadley Falls, Mass	J. F. Ellis	70,000
	July 19, 1877	Alamance County, N. C	Haw River	Cape Fear River	South Hadley Falls, Mass	Ellis and Ingalls	70,000
	July 19, 1877	Catawba, N. C	Catawba River	Santee River	South Hadley Falls, Mass	F. A. Ingalls	60,000
	July 25, 1877	Wilson County, N. C	Contentnea Creek	Neuse River	South Hadley Falls, Mass	C. D. Griswold	50,000
	July 25, 1877	Granville County, N. C	Tar River	Pamlico Sound	South Hadley Falls, Mass	C. D. Griswold	50,000
	Apr. 11, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	2,500
	Apr. 11, 1878	Weldon, N. C	Roanoke River	Albemarle Sound	Avoca, N. C	W. G. Williamson	139,000
	Apr. 12, 1878	Neuse, N. C	Neuse River	Pamlico Sound	Avoca, N. C	S. G. Worth	100,000
	Apr. 12, 1878	Branchville, N. C	Meherrin River	Chowan River	Avoca, N. C	W. G. Williamson	150,000
	Apr. 15, 1878	The Mill, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	120,000
	Apr. 20, 1878	Raleigh, N. C	Neuse River	Pamlico Sound	Avoca, N. C	H. E. Quinn	50,000
	Apr. 22, 1878	Granville County, N. C	Tar River	Pamlico Sound	Avoca, N. C	Thomas Taylor	100,000
	Apr. 24, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	800,000
	Apr. 24, 1878	Lockville, N. C	Cape Fear River	Atlantic Ocean	Avoca, N. C	Col. L. L. Polk	100,000
	Apr. 25, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	200,000
	Apr. 25, 1878	Colerain, N. C	Chowan River	Albemarle Sound	Avoca, N. C	Not transferred	200,000
	Apr. 25, 1878	Scotch Hall, Avoca, N. C	Albemarle Sound	Atlantic Ocean	Avoca, N. C	Not transferred	115,000
	Apr. 26, 1878	Plymouth, N. C	Roanoke River	Albemarle Sound	Avoca, N. C	Not transferred	250,000
	Apr. 26, 1878	Avoca, N. C	Chowan River	Albemarle Sound	Avoca, N. C	Not transferred	25,000
	Apr. 26, 1878	Scotch Hall, Avoca, N. C	Albemarle Sound	Atlantic Ocean	Avoca, N. C	Not transferred	70,000
	Apr. 26, 1878	Sampson County, N. C	Six Runs	North East Cape Fear River.	Avoca, N. C	Thomas Taylor	100,000
	Apr. 26, 1878	Duplin County, N. C	Goshen Creek	North East Cape Fear River.	Avoca, N. C	Thomas Taylor	100,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
North Carolina—Continued.	Apr. 28, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	300, 000
	Apr. 29, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	18, 000
	May 1, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	45, 000
	May 2, 1878	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	Not transferred	200, 000
	May 2, 1878	Granville County, N. C	Tar River	Pamlico Sound	Avoca, N. C	Thomas Taylor	150, 000
	June 7, 1878	Salisbury, N. C	Yadkin River	Great Pedee River	Havre de Grace, Md	S. G. Worth	50, 000
	June 7, 1878	Catawba, N. C	Catawba River	Santee River	Havre de Grace, Md	S. G. Worth	50, 000
	Apr. 18, 1879	Weldon, N. C	Roanoke River	Albemarle Sound	Avoca, N. C	C. J. Huske	100, 000
	Apr. 21, 1879	Warsaw, N. C	Six Runs	Cape Fear River	Avoca, N. C	Thomas Taylor	100, 000
	Apr. 21, 1879	Rocky Mount, N. C	Tar River	Pamlico Sound	Avoca, N. C	J. A. Woodward	100, 000
	Apr. 24, 1879	Warsaw, N. C	Six Runs	Cape Fear River	Avoca, N. C	C. J. Huske	100, 000
	Apr. 24, 1879	Pollocksville, N. C	Trent River	Pamlico Sound	Avoca, N. C	Thomas Taylor	145, 000
	Apr. 24, 1879	Raleigh, N. C	Neuse River	Pamlico Sound	Avoca, N. C	Wm. M. Russ	115, 000
	Apr. 24, 1879	Avoca, N. C	Albemarle Sound	Atlantic Ocean	Avoca, N. C	J. P. Haywood	60, 000
	Apr. 24, 1879	Duplin County, N. C	Six Runs	Cape Fear River	Avoca, N. C	C. J. Huske	100, 000
	Apr. 24, 1879	Avoca, N. C	Albemarle Sound	Atlantic Ocean	Avoca, N. C	S. G. Worth	50, 000
	Apr. 25, 1879	Mount Olive, N. C	Goshen Creek	Cape Fear River	Avoca, N. C	J. A. Woodward	100, 000
	Apr. 25, 1879	Rocky Mount, N. C	Tar River	Pamlico Sound	Avoca, N. C	W. M. Russ	100, 000
	Apr. 29, 1879	Weldon, N. C	Roanoke River	Albemarle Sound	Avoca, N. C	J. A. Woodward	150, 000
	Apr. 29, 1879	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	J. A. Woodward	75, 000
	May 2, 1879	Weldon, N. C	Roanoke River	Albemarle Sound	Avoca, N. C	J. A. Woodward	100, 000
	May 2, 1879	Raleigh, N. C	Neuse River	Pamlico Sound	Avoca, N. C	C. J. Huske	90, 000
	May 3, 1879	Branchville, N. C	Meherrin River	Chowan River	Avoca, N. C	J. A. Woodward	150, 000
	May 6, 1879	Salisbury, N. C	Yadkin River	Great Pedee River	Avoca, N. C	Huske and Taylor	100, 000
	May 9, 1879	Avoca, N. C	Salmon Creek	Albemarle Sound	Avoca, N. C	W. M. Russ	210, 000
	May 8, 1879	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	G. H. Williams	15, 000
	May 9, 1879	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	G. H. Williams	215, 000
	May 12, 1879	Avoca, N. C	Salmon Creek	Chowan River	Avoca, N. C	W. M. Russ	250, 000
	May 13, 1879	Camden County, N. C	North River	Albemarle Sound	Avoca, N. C		500, 000
Ohio	July 3, 1872	Kent, Ohio	Cuyahoga River	Lake Erie	South Hadley Falls, Mass	Rev. Wm. Clift	1, 000
	June 24, 1873	Ashtabula, Ohio	Ashtabula River	Lake Erie	Coeymans, N. Y	J. Mason	50, 000
	June 25, 1874	Eagleville, Ohio	Grand River	Lake Erie	Coeymans, N. Y	Chase and Mather	60, 000
	June 26, 1874	Fremont, Ohio	Sandusky River	Lake Erie	Coeymans, N. Y	H. W. Welsher	60, 000
	July 9, 1874	Bellefontaine, Ohio	Buckingahela River	Ohio River	Coeymans, N. Y	Mather and Vealey	75, 000
	July 18, 1874	Elyria, Ohio	Black River	Ohio River	South Hadley Falls, Mass	O. M. Chase	65, 000
	July 18, 1874	Monroeville, Ohio	Huron River	Ohio River	South Hadley Falls, Mass	H. W. Welsher	65, 000
	June 15, 1875	Columbus, Ohio	Scioto River	Ohio River	Coeymans, N. Y	Mason and Ingalls	75, 000
	June 23, 1875	Bayard, Ohio	Muskingum River	Ohio River	Coeymans, N. Y	F. N. Clark	100, 000
	June 13, 1876	Janesville, Ohio	Muskingum River	Ohio River	Havre de Grace, Md	Ingalls and Fairfax	59, 700
	June 26, 1876	Columbus, Ohio	Scioto River	Ohio River	Havre de Grace, Md	J. H. Klippart	75, 000
	June 9, 1878	Fremont, Ohio	Sandusky River	Lake Erie	Havre de Grace, Md	H. E. Quinn	60, 000
	June 7, 1879	Fremont, Ohio	Sandusky River	Lake Erie	Spesutie Narrows, Md	H. E. Quinn	100, 000
	June 18, 1880	Fremont, Ohio	Sandusky River	Lake Erie	Potomac Station	C. W. Schuermann	200, 000
Pennsylvania	June 18, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	28, 000

	June 21, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	35,000
	June 25, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	30,000
	June 25, 1873	Greensburgh, Pa	Monongahela River	Ohio River	Point Pleasant, Pa	Dr. J. H. Slack	15,000
	June 26, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	100,000
	June 29, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	140,000
	June 30, 1873	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	100,000
	June 28, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	35,000
	June 29, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not rransferred	75,000
	June 30, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	85,000
	July 2, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	60,000
	July 4, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	90,000
	July 6, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	20,000
	July 7, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	20,000
	July 8, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	65,000
	July 9, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	40,000
	July 15, 1874	Point Pleasant, Pa	Delaware River	Delaware Bay	Point Pleasant, Pa	Not transferred	40,000
	June 11, 1879	Harrisburgh, Pa	Susquehanna River	Chesapeake Bay	Spesutie Narrows, Md	J. P. Creveling	140,000
	May 17, 1880	Georgetown, Pa	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	J. P. Creveling	200,000
	May 22, 1880	Harrisburgh, Pa	Susquehanna River	Chesapeake Bay	Havre de Grace, Md	J. P. Creveling	250,000
Rhode Island	July 28, 1874	Bristol County, R. I	Warren River	Providence River	South Hadley Falls, Mass	J. F. Ellis	5,000
	July 28, 1874	Washington County, R. I	Pawcatuck River	Little Narragansett Bay	South Hadley Falls, Mass	J. F. Ellis	7,000
	July 28, 1874	Providence County, R. I	Pawtuxet River	Providence River	South Hadley Falls, Mass	J. F. Ellis	12,000
	July 28, 1874	Providence County, R. I	Blackstone River	Providence River	South Hadley Falls, Mass	J. F. Ellis	12,000
	July 23, 1875	Bristol County, R. I	Warren River	Providence River	South Hadley Falls, Mass	J. Mason *et al*	8,300
	July 23, 1875	Washington County, R. I	Pawcatuck River	Little Narragansett Bay	South Hadley Falls, Mass	J. Mason *et al*	13,800
	July 23, 1875	Providence County, R. I	Pawtuxet River	Providence River	South Hadley Falls, Mass	J. Mason *et al*	22,300
	July 23, 1875	Bristol County, R. I	Barrington River	Warren River	South Hadley Falls, Mass	J. Mason *et al*	5,600
	July 14, 1877	Providence County, R. I	Blackstone River	Providence River	South Hadley Falls, Mass	Mr. Rounds	50,000
	July 18, 1877	Bristol County, R. I	Warren River	Providence River	South Hadley Falls, Mass	Mr. Rounds	25,000
	July 18, 1877	Bristol County, R. I	Barrington River	Warren River	South Hadley Falls, Mass	Mr. Rounds	25,000
South Carolina	July 10, 1875	Gaffney's, S. C	Broad River	Santee River	South Hadley Falls, Mass	Clark and Quinn	80,000
	June 9, 1876	Spartanburgh C. H., S. C	Broad River	Santee River	Havre de Grace, Md	Griswold and Quinn	50,000
	June 1, 1878	Marion County, S. C	Great Pedee River	Winyah Bay	Havre de Grace, Md	S. G. Worth	50,000
	June 1, 1878	Columbia, S. C	Broad River	Santee River	Havre de Grace, Md	S. G. Worth	50,000
	May 3, 1879	Charleston County, S. C	Cooper River	Charleston Harbor	Avoca, N. C	J. A. Woodward	75,000
	May 24, 1880	Marion County, S. C	Great Pedee River	Winyah Bay	Potomac Station	S. M. Rixey	40,000
	May 24, 1880	Nichols, S. C	Little Pedee River	Great Pedee River	Potomac Station	S. M. Rixey	40,000
	May 24, 1880	Gaffney City, S. C	Broad River	Congaree River	Potomac Station	C. J. Huske	375,000
	May 24, 1880	Seneca, S. C	Seneca River	Savannah River	Potomac Station	C. J. Huske	375,000
	May 24, 1880	Rock Hill, S. C	Catawba River	Wateree River	Potomac Station	J. F. Ellis	60,000
	May 24, 1880	Columbia, S. C	Broad River	Santee River	Potomac Station	J. F. Ellis	140,000
	May 24, 1880	Richland County, S. C	Wateree River	Santee River	Potomac Station	S. M. Rixey	40,000
	May 24, 1880	Sumter County, S. C	Lynch's Creek	Great Pedee River	Potomac Station	S. M. Rixey	40,000
	May 30, 1880	Columbia, S. C	Broad River	Santee River	Potomac Station	C. J. Huske	200,000
Tennessee	July 10, 1875	Nashville, Tenn	Cumberland River	Ohio River	South Hadley Falls, Mass	Chase and Boehm	80,000
	July 16, 1875	Nashville, Tenn	Cumberland River	Ohio River	South Hadley Falls, Mass	Chase and Boehm	80,000
	July 16, 1875	Knoxville, Tenn	Holston River	Tennessee River	South Hadley Falls, Mass	Mason and Ingalls	100,000
	May 31, 1876	Knoxville, Tenn	Holston River	Tennessee River	Havre de Grace, Md	J. D. McNaughton	72,200
	May 31, 1876	Athens, Tenn	Eastanalbee River	Tennessee River	Havre de Grace, Md	B. S. Cory, jr	54,300
	May 31, 1876	Chattanooga, Tenn	Tennessee River	Ohio River	Havre de Grace, Md	F. A. Ingalls	72,300
	July 17, 1876	Jackson, Tenn	Forked Deer River	Mississippi River	South Hadley Falls, Mass	S. M. Gilmore	99,000
	July 17, 1876	Brownsville, Tenn	Big Hatchee River	Mississippi River	South Hadley Falls, Mass	C. D. Griswold	99,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Tennessee—Continued.	July 12, 1877	Jackson, Tenn	Forked Deer River	Mississippi River	South Hadley Falls, Mass	F. A. Ingalls	118,000
	May 18, 1878	Humboldt, Tenn	Middle Fork	Forked Deer River	Havre de Grace, Md	H. E. Quinn	50,000
	May 18, 1878	Huntingdon, Tenn	South Fork of Obion River	Mississippi River	Havre de Grace, Md	H. E. Quinn	50,000
	June 2, 1879	Nashville, Tenn	Cumberland River	Ohio River	Spesutie Narrows, Md	C. W. Schuermann	100,000
	June 2, 1879	Johnsonville, Tenn	Tennessee River	Ohio River	Spesutie Narrows, Md	C. W. Schuermann	75,000
	June 2, 1879	Dresden, Tenn	East Obion River	Mississippi River	Spesutie Narrows, Md	C. W. Schuermann	25,000
	June 2, 1879	Paducah Junction, Tenn	West Obion River	Mississippi River	Spesutie Narrows, Md	C. W. Schuermann	50,000
	June 13, 1879	Knoxville, Tenn	Holston River	Tennessee River	Old Bay Fishery, Md	J. F. Ellis	20,000
	June 13, 1879	Chattanooga, Tenn	Tennessee River	Ohio River	Old Bay Fishery, Md	J. F. Ellis	15,000
Texas	July 3, 1874	Hempstead, Tex	Brazos River	Gulf of Mexico	Coeymans, N. Y	Milner and Mason	20,000
	July 4, 1874	Austin, Tex	Colorado River	Matagorda Bay	Coeymans, N. Y	Milner and Clark	40,000
	July 4, 1875	Austin, Tex	Colorado River	Matagorda Bay	Coeymans, N. Y	Mason and Marks	60,000
	May 19, 1879	Mineola, Tex	Sabine River	Gulf of Mexico	Spesutie Narrows, Md	H. E. Quinn	100,000
	May 19, 1879	Dallas, Tex	Trinity River	Gulf of Mexico	Spesutie Narrows, Md	H. E. Quinn	100,000
	May 21, 1879	Hearne, Tex	Brazos River	Gulf of Mexico	Spesutie Narrows, Md	L. Kumlien	90,000
	May 21, 1879	Austin, Tex	Colorado River	Gulf of Mexico	Spesutie Narrows, Md	L. Kumlien	85,000
	May 22, 1879	Columbus, Tex	Colorado River	Gulf of Mexico	Spesutie Narrows, Md	C. W. Schuermann	50,000
	May 22, 1879	Luling, Tex	San Marcus River	Guadalupe	Spesutie Narrows, Md	C. W. Schuermann	50,000
	May 22, 1879	Seguin, Tex	Guadalupe River	Gulf of Mexico	Spesutie Narrows, Md	C. W. Schuermann	50,000
	May 22, 1879	San Antonio, Tex	San Antonio River	Gulf of Mexico	Spesutie Narrows, Md	C. W. Schuermann	50,000
Utah	June 30, 1873	Jordan, Utah	Jordan River	Great Salt Lake	Coeymans, N. Y	L. Stone and H. W. Welsher.	5,000
Vermont	July 5, 1873	Burlington, Vt	Winooski River	Lake Champlain	South Hadley Falls, Mass	J. W. Milner and J. Mason.	100,000
	July 20, 1873	Vergennes, Vt	Otter Creek	Lake Champlain	South Hadley Falls, Mass	J. W. Milner and J. Mason.	100,000
	July —, 1873	Brattleboro', Vt	West River	Connecticut River	South Hadley Falls, Mass	U. S. Fish Commission	100,000
	July —, 1873	Bellows Falls, Vt	Saxton's River	Connecticut River	South Hadley Falls, Mass	U. S. Fish Commission	100,000
	July 15, 1874	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Mather and Vealey	215,000
	July 27, 1874	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Chase and Brooks	140,000
	July 28, 1874	Vergennes, Vt	Otter Creek	Lake Champlain	South Hadley Falls, Mass	Chase and Brooks	150,000
	Aug. 1, 1874	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Mather and Vealey	120,000
	Aug. 11, 1874	Winooski, Vt	Winooski River	Lake Champlain	South Hadley Falls, Mass	Brooks and Griswold	120,000
	Aug. 12, 1874	Swanton, Vt	Missisquoi River	Lake Champlain	South Hadley Falls, Mass	Brooks and Griswold	80,000
	Aug. 12, 1874	Georgia, Vt	Lamoille River	Lake Champlain	South Hadley Falls, Mass	Brooks and Griswold	80,000
	Aug. 20, 1874	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	H. J. Brooks	30,000
	July 7, 1875	South Vernon, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Griswold and Quinn	200,000
	July 17, 1875	South Vernon, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	Griswold and Quinn	280,000
	July 28, 1875	Georgia, Vt	Lamoille River	Lake Champlain	South Hadley Falls, Mass	O. M. Chase	70,000
	July 10, 1876	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	A. D. Hager	300,000
	July 28, 1876	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	A. D. Hager	75,000
	July 30, 1876	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	A. D. Hager	30,000
	Aug. 7, 1876	Bellows Falls, Vt	Connecticut River	Long Island Sound	South Hadley Falls, Mass	A. D. Hager	240,000
	July 9, 1877	Waterbury, Vt	Winooski River	Lake Champlain	South Hadley Falls, Mass	R. E. Earll	90,000

Virginia	May 25, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	200,000
	May 26, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	220,000
	May 27, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	275,000
	May 28, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	155,000
	May 29, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	100,000
	May 30, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	50,000
	May 31, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	50,000
	June 5, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	100,000
	June 6, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	75,000
	June 7, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	125,000
	June 8, 1873	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	20,000
	July 10, 1873	Central, Va	New River	Kanawha River	Jackson City, Va	H. W. Welsher	40,000
	May 21, 1875	Free Stone Point, Va	Potomac River	Chesapeake Bay	Free Stone Point, Va	Not transferred	103,500
	May 22, 1875	Free Stone Point, Va	Potomac River	Chesapeake Bay	Free Stone Point, Va	Not transferred	215,000
	May 23, 1875	Free Stone Point, Va	Potomac River	Chesapeake Bay	Free Stone Point, Va	Not transferred	472,000
	May 24, 1875	Free Stone Point, Va	Potomac River	Chesapeake Bay	Free Stone Point, Va	Not transferred	266,250
	May 25, 1875	Free Stone Point, Va	Potomac River	Chesapeake Bay	Free Stone Point, Va	Not transferred	100,000
	May 23–6, '75	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	102,000
	May 24–6, '75	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	220,000
	May 27, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	185,000
	May 28, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	260,000
	May 29, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	250,000
	May 27–9, '75	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	110,000
	May 30, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	200,000
	May 31, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	300,000
	May 31, 1875	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	20,000
	June 1, 1875	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	58,500
	June 1–4, '75	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	540,800
	June 5–8, '75	Jackson City, Va	Potomac River	Chesapeake Bay	Jackson City, Va	Not transferred	300,000
	July 8, 1875	Staunton Station, Va	Staunton River	Roanoke River	Point Pleasant, Va	Anderson & Bell	100,000
	May 8–24, '75	Ferry Landing, Va	Potomac River	Chesapeake Bay	Ferry Landing, Va	Not transferred	586,000
	May 25, 1876	Staunton Station, Va	Staunton River	Roanoke River	Havre de Grace, Md	B. S. Cory, jr	59,900
	May 25, 1876	Central, Va	New River	Kanawha River	Havre de Grace, Md	F. A. Ingalls	59,500
	May 27, 1876	Marion, Va	Holston River	Tennessee River	Havre de Grace, Md	Anderson & Kumlien	74,700
	June 11, 1876	Danville, Va	Dan River	Roanoke River	Havre de Grace, Md	T. H. Bean	80,500
	July 16, 1877	Halifax County, Va	Dan River	Roanoke River	South Hadley Falls, Mass	H. E. Quinn	110,000
	Apr. 11, 1878	Nottoway, Va	Nottoway River	Chowan River	Avoca, N. C	W. G. Williamson	111,000
	Apr. 13, 1878	Richmond, Va	James River	Chesapeake Bay	Avoca, N. C	W. G. Williamson	115,000
	Apr. 22, 1878	Suffolk, Va	South branch Nansemond River.	James River	Avoca, N. C	H. B. Nicholas	40,000
	Apr. 24, 1878	Salem, Va	Roanoke River	Albemarle Sound	Avoca, N. C	W. F. Page	100,000
	Apr. 25, 1878	Petersburg, Va	Appomattox River	James River	Avoca, N. C	H. B. Nicholas	60,000
	Apr. 30, 1878	Milford, Va	Mattapony River	York River	Avoca, N. C	H. B. Nicholas	90,000
	May 1, 1878	Milford, Va	Mattapony River	York River	Avoca, N. C	H. D. Johnson	90,000
	May 1, 1878	Taylorsville, Va	Little River	South Anne River	Avoca, N. C	W. F. Page	100,000
	May 2, 1878	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	Thomas Taylor	150,000
	May 2, 1878	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	Thomas Taylor	100,000
	May 3, 1878	Suffolk, Va	South branch Nansemond River.	James River	Avoca, N. C	Page & Johnson	50,000
	May 23, 1878	Freestone, Va	Potomac River	Chesapeake Bay	Steamer Lookout	Not transferred	50,000
	May 28, 1878	Riverton, Va	Shenandoah River	Potomac River	Havre de Grace, Md	W. F. Page	200,000
	June 1, 1878	Shadwell, Va	Rivanna River	James River	Havre de Grace, Md	W. F. Page	175,000

D.—TABLE I.—*Distribution of shad from 1872 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where fish were hatched.	By whom transferred.	Estimated number of fish.
Virginia—Continued.	June 4, 1878	Waynesborough, Va	South River	Shenandoah River	Steamer Lookout	W. F. Page	150,000
	Apr. 26, 1878	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	Thomas Taylor	200,000
	Apr. 26, 1878	Suffolk, Va	Nansemond River	Hampton Roads	Avoca, N. C	W. G. Williamson	75,000
	May 2, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	Thomas Taylor	120,000
	May 3, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	S. G. Worth	25,000
	May 6, 1879	Nottoway, Va	Nottoway River	Chowan River	Avoca, N. C	Woodward & Williams	100,000
	May 7, 1879	Nottoway, Va	Nottoway River	Chowan River	Avoca, N. C	G. H. Williams	75,000
	May 7, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	J. A. Woodward	150,000
	May 7, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	W. M. Russ	75,000
	May 7, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	W. M. Russ	95,000
	May 13, 1879	Nottoway, Va	Nottoway River	Chowan River	Avoca, N. C	Taylor & Woodward	100,000
	May 14, 1879	Franklin, Va	Blackwater River	Chowan River	Avoca, N. C	J. F. Ellis	80,000
	May 19, 1880	Petersburg, Va	Appomattox River	James River	Potomac Station	S. M. Rixey	160,000
West Virginia	June 6, 1873	Ronceverte, W. Va	Greenbrier River	Kanawha River	Jackson City, Va	J. W. Milner	30,000
	June —, 1876	Piedmont, W. Va	Potomac River	Chesapeake Bay	Havre de Grace, Md	U. S. Fish Commission	200,000
	June 3, 1879	Piedmont, W. Va	Potomac River	Chesapeake Bay	Spesutie Narrows, Md	H. E. Quinn	200,000
	June 9, 1879	Rowlesburg, W. Va	Cheat River	Ohio River	Spesutie Narrows, Md	L. Kumlien	65,000
	June 9, 1879	Grafton, W. Va	Tygart's Valley River	Ohio River	Spesutie Narrows, Md	L. Kumlien	65,000
	June 9, 1879	Clarksburg, W. Va	West Fork River	Ohio River	Spesutie Narrows, Md	L. Kumlien	70,000
	June 13, 1879	Hinton, W. Va	New River	Ohio River	Spesutie Narrows, Md	H. E. Quinn	65,000
	June 13, 1879	Ronceverte, W. Va	Greenbrier River	Kanawha River	Spesutie Narrows, Md	H. E. Quinn	60,000
Wisconsin	June 20, 1873	Appleton, Wis	Fox River	Lake Michigan	Coeyman's, N. Y	J. W. Milner & J. Mason	70,000
	June 12, 1877	Appleton, Wis	Fox River	Green Bay	Spesutie Narrows, Md	J. W. Milner	100,000
							97,373,250

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive.*

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Alabama	Dec. 18, 1876	Montgomery, Ala	Alabama River	Mobile River	Northville, Mich	28,600
	Dec. 29, 1878	Oxford, Ala	Cold Water Creek	Coosa River	Baltimore, Md	2,000
Arkansas	Dec. —, 1878	Little Rock, Ark	Arkansas River	Mississippi River	Northville, Mich	1,000
	Dec. —, 1878	Little Rock, Ark	Arkansas River	Mississippi River	Northville, Mich	1,000
	Dec. —, 1878	Arkadelphia, Ark	Quactuto River	Washita River	Northville, Mich	1,000
	Dec. —, 1878	Newport, Ark	White River	Mississippi River	Northville, Mich	1,000
	Dec. —, 1878	Benton, Ark	Saline River	Washita River	Northville, Mich	1,000
	Dec. —, 1878	Benton, Ark	Saline River	Washita River	Northville, Mich	1,000
	Dec. —, 1878	Arkadelphia, Ark	Quactuto River	Washita River	Northville, Mich	1,000
	Dec. —, 1878	Newport, Ark	White River	Mississippi River	Northville, Mich	1,000
	Dec. —, 1878	Arkadelphia, Ark	Quactuto River	Washita River	Northville, Mich	1,000
California	Sept. —, 1873	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	500,000
	Sept. —, 1874	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	500,000
	Sep.-Oct., '75	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	850,000
	1876	San Francisco, Cal	Private fish farm	Sacramento River	Alameda County	10,000
	1876	San Francisco, Cal	Woodward's Gardens	Sacramento River	San Francisco, Cal	10,000
	Sep.-Oct., '76	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	1,500,000
	Sept. —, 1877		Clackamas River	Columbia River	Clackamas River	1,000,000
	Oct. —, 1877	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	2,200,000
	Oct. —, 1878	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	2,500,000
	Dec. —, 1878		Clackamas River	Columbia River	Clackamas River	1,203,000
	Oct. —, 1879	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	2,000,000
	Oct. —, 1880	Baird, Cal	McCloud River	Sacramento River	U. S. Station, McCloud River	2,000,000
Colorado	1874	Georgetown, Colo	Green Lake	South Platte River	Georgetown, Colo	11,450
	1874	Georgetown, Colo	Clear Lake	South Platte River	Georgetown, Colo	11,450
	1875	Georgetown, Colo	Green Lake	South Platte River	Georgetown, Colo	200,000
	1876	Georgetown, Colo	Green Lake	South Platte River	Georgetown, Colo	250,000
Connecticut	Dec. 11, 1873	Colebrook, Conn	Farmington River	Connecticut River	Waltonian hatching-house	5,000
	Dec. 20, 1873	Northford, Conn	West River	Connecticut River	North Branford, Conn	6,000
	Jan. 1, 1874	Durham, Conn	West River	Connecticut River	North Branford, Conn	15,000
	Spring, 1874	North Branford, Conn	Mill River	Long Island Sound	North Branford, Conn	24,000
	Dec. 18, 1874	New Milford, Conn	Butler Brook	Housatonic River	Westport, Conn	50,000
	Dec. 18, 1874	———, Conn	Quinnepiac River	Long Island Sound	N. Y. State hatching-house	2,700
	Dec. 21, 1874	Pine Meadow, Conn	Farmington River	Connecticut River	Westport, Conn	50,000
	Dec. 23, 1874	Pine Meadow, Conn	Farmington River	Connecticut River	Westport, Conn	20,000
	Dec. 26, 1874		Shetucket River	Thames River	North Branford, Conn	50,000
	Dec. 30, 1874	Durham, Conn	Cocnochogue River	Connecticut River	North Branford, Conn	50,000
	Jan. 20, 1875	New Haven, Conn	Farm River	Long Island Sound	North Branford, Conn	20,000
	Feb. 10, 1875	———, Conn	Quinnepiac River	Long Island Sound	N. Y. State hatching-house	3,000
	Dec. —, 1875	North Windham, Conn	Natchaug River	Thames River	Westport, Conn	50,000
	Dec. —, 1875	New Milford, Conn	Housatonic River	Long Island Sound		110,000
	Dec. —, 1875	New Hartford, Conn	Farmington River	Connecticut River		300,000
	1876		Farmington River	Connecticut River		300,000
	1876		Housatonic River	Long Island Sound		100,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Connecticut—Continued.	1876		Saugatuck River	Long Island Sound		27,286
	1876		Natchaug River	Thames River		50,000
Delaware	Dec. 6, 1876	Seaford, Del	Nanticoke River	Tangier Sound	Baltimore, Md	10,400
	Dec. 16, 1878	Seaford, Del	Nanticoke River	Tangier Sound	Baltimore, Md	10,000
	Nov. 28, 1880	Seaford, Del	Little Nanticoke River	Chesapeake Bay		6,000
	Dec. 3, 1880	Seaford, Del	Little Nanticoke River	Chesapeake Bay		5,000
Georgia	Dec. 22, 1876	Resaca, Ga	Coosa River	Alabama River	Baltimore, Md	5,000
	Dec. 22, 1876	Cartersville, Ga	Etowah River	Alabama River	Baltimore, Md	5,000
	Dec. 22, 1876	Oconee, Ga	Oconee River	Altamaha River	Baltimore, Md	10,000
	Dec. 22, 1876	Crawfordsville, Ga	Ogeechee River	Ossabaw Sound	Baltimore, Md	10,000
	Jan. 10, 1877	Tocoa, Ga	Tugalo River	Savannah River	Baltimore, Md	5,000
	Jan. 10, 1877	Crawfordsville, Ga	Ogeechee River	Ossabaw River	Baltimore, Md	7,500
	Jan. 10, 1877	Norcross, Ga	Chattahoochee River	Apalachicola River	Baltimore, Md	7,500
	Dec. 21, 1878	Milledgeville, Ga	Oconee River	Altamaha River	Baltimore, Md	3,750
	Dec. 21, 1878	Macon, Ga	Ocmulgee River	Altamaha River	Baltimore, Md	3,750
	Dec. 21, 1878	Covington, Ga	Yellow River	Ocmulgee River	Baltimore, Md	3,750
	Dec. 21, 1878	Covington, Ga	Ocmulgee River	Altamaha River	Baltimore, Md	3,750
	Dec. 28, 1878	Gainesville, Ga	Chattahoochee River	Apalachicola River	Baltimore, Md	3,000
	Dec. 28, 1878	Baldings Mills, Ga	Chastatee River	Chattahoochee River	Baltimore, Md	3,000
	Dec. 28, 1878	Jonesborough, Ga	Flint River	Apalachicola River	Baltimore, Md	4,000
	Dec. 28, 1878	Cartersville, Ga	Etowah River	Coosa River	Baltimore, Md	2,000
	Dec. 28, 1878	Resaca, Ga	Coosa River	Alabama River	Baltimore, Md	2,000
Illinois	May 12, 1874	Kensington, Ill	Calumet River	Lake Michigan	Pokagon, Mich	25,000
	Dec. 22, 1874	Rockford, Ill	Rock River	Mississippi River	Northville, Mich	15,000
	Dec. 14, 1874	Elgin, Ill	Fox River	Mississippi River	Pokagon, Mich	20,000
	Jan. 26, 1875	Rockford, Ill	Rock River	Mississippi River	Northville, Mich	20,000
	Dec. 29, 1875	Elgin, Ill	Fox Lake	Mississippi River	Northville, Mich	18,700
	Dec. 29, 1875	Elgin, Ill	Twin Lake	Mississippi River	Northville, Mich	20,000
	Dec. 29, 1876	Sand Lake, Ill	Deep Lake	Illinois River	Northville, Mich	2,500
	Fall of 1876	Belleville, Ill	Prairie du Pont River	Mississippi River	Belleville, Ill	20,000
	Fall of 1876		Kankakee River	Illinois River	Elgin, Ill	25,000
	Fall of 1876		Illinois River	Mississippi River	Elgin, Ill	25,000
	Fall of 1876		Rock River	Mississippi River	Elgin, Ill	15,000
	Fall of 1876		Fox River	Illinois River	Elgin, Ill	73,000
	Spring, 1877	Belleville, Ill	Prairie du Pont River	Mississippi River	Belleville, Ill	10,000
	Spring, 1877	Belleville, Ill	Kaskaskia River	Mississippi River	Belleville, Ill	10,000
	Spring, 1877	Belleville, Ill	Mississippi River	Gulf of Mexico	Belleville, Ill	10,000
	Oct. —, 1877	Burritt, Ill	Knapp's Creek	Pecatonia River	Rockford, Ill	25,000
	Nov. —, 1877	Owen, Ill	Brown's Creek	Rock River	Rockford, Ill	10,000
	Nov. —, 1877	Rockford, Ill	Kent's Creek	Rock River	Rockford, Ill	10,000
	Dec. 14, 1877	Jacksonville, Ill	Lake	Illinois River	Elgin, Ill	10,000
	Dec. 25, 1877	McHenry, Ill	Column Lake	Fox River	Elgin, Ill	5,000
	Dec. 28, 1877	Mount Carroll, Ill	Carroll Creek	Plum River	Elgin, Ill	5,000
	1877	Arlington Heights, Ill	Small Lake	Des Moines River	Elgin, Ill	1,000

	Jan. —, 1878		Kankakee River	Illinois River	Elgin, Ill	10,000
	Jan. —, 1879	Crystal Lake, Ill	Crystal Lake	Fox River	Geneva Lake, Ill	20,000
	Jan. —, 1879	Rockford, Ill	Rock River	Illinois River	Geneva Lake, Ill	50,000
	Jan. —, 1879	Cary Station, Ill	Fox River	Illinois River	Geneva Lake, Ill	20,000
	Spring, 1879	Mount Carroll, Ill	Carroll Creek	Plum River	Mount Carroll, Ill	40,000
Indiana	Dec. 16, 1874	Indianapolis, Ind	White River	Wabash River	Pokagon, Mich	16,000
	Dec. 24, 1874	Guilford, Ind	Tanner's Creek	Ohio River	Pokagon, Mich	15,000
	Dec. 4, 1875	Laporte, Ind	Kankakee River	Illinois River	Northville, Mich	30,000
	Dec. 14, 1875	Warren, Ind	Grapevine Creek	Kankakee River	Pokagon, Mich	262,000
	Jan. 4, 1876	Wabash, Ind	Wabash River	Ohio River	Northville, Mich	25,000
	Jan. 17, 1876	Michigan City, Ind	Kankakee River	Illinois River	Northville, Mich	2,000
	Dec. 21–6, '76	Wabash, Ind	Wabash River	Ohio River	Northville, Mich	73,500
	Dec. 30, 1876	Guilford, Ind	Tanner's Creek	Ohio River	Northville, Mich	20,000
Iowa	Dec. 2, 1874	Des Moines, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	5,200
	Dec. 5, 1874	Waterloo, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	3,500
	Dec. 8, 1874	Monticello, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	7,000
	Dec. 11, 1874	Maquoketa, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	7,000
	Dec. 12, 1874	Cedar Rapids, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	12,000
	Dec. 12, 1874	Marion, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	3,000
	Dec. 15, 1874	Farley, Iowa	Little Maquoketa River	Mississippi River	Anamosa, Iowa	2,500
	Dec. 15, 1874	Epworth, Iowa	Little Maquoketa River	Mississippi River	Anamosa, Iowa	3,500
	Dec. 15, 1874	Fredericksburgh, Iowa	Upper Iowa River	Mississippi River	Anamosa, Iowa	300
	Dec. 15, 1874	McGregor, Iowa	Bloody Run	Mississippi River	Anamosa, Iowa	5,700
	Dec. 18, 1874	Tipton, Iowa	Cedar Run	Mississippi River	Anamosa, Iowa	4,100
	Dec. 18, 1874	Iowa Falls, Iowa	Iowa River	Cedar River	Anamosa, Iowa	10,000
	Dec. 18, 1874	Fort Dodge, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	15,000
	Dec. 27, 1874	Clinton Junction, Iowa	Mississippi River	Gulf of Mexico	Anamosa, Iowa	2,500
	Dec. 27, 1874	Charlotte, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	2,500
	Dec. 28, 1874	Dixon, Iowa	Big Rock Creek	Wapsipinicon River	Anamosa, Iowa	2,500
	Dec. 28, 1874	Big Rock, Iowa	Big Rock Creek	Wapsipinicon River	Anamosa, Iowa	2,500
	Dec. 28, 1874	Anamosa, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	5,000
	Jan. 4, 1875	Waukon, Iowa	Paint Creek	Mississippi River	Anamosa, Iowa	700
	Jan. 4, 1875	Worthington, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	2,000
	Jan. 5, 1875	Atlantic, Iowa	Nishnabotany River	Missouri River	Anamosa, Iowa	6,000
	Jan. 6, 1875	Delhi, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	400
	Jan. 6, 1875	Hopkinton, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	400
	Jan. 6, 1875	Greeley, Iowa	Volga River	Turkey River	Anamosa, Iowa	600
	Jan. 6, 1875	Fayette, Iowa	Volga River	Turkey River	Anamosa, Iowa	14,000
	Jan. 6, 1875	Delaware, Iowa	Spring Creek	Maquoketa River	Anamosa, Iowa	4,600
	Jan. 11, 1875	Ottumwa, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	11,000
	Jan. 12, 1875	Des Moines, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	5,200
	Jan. 12, 1875	Polk County, Iowa	Brown's Creek	Mississippi River	Anamosa, Iowa	500
	Jan. 12, 1875	Polk County, Iowa	Raccoon Creek	Des Moines River	Anamosa, Iowa	500
	Jan. 18, 1875	Oxford, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	10,500
	Jan. 18, 1875	Iowa City, Iowa	Iowa River	Mississippi River	Anamosa, Iowa	3,500
	Jan. 18, 1875	Wilton, Iowa	Cedar River	Iowa River	Anamosa, Iowa	3,500
	Jan. 18, 1875	Anamosa, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	6,000
	Jan. 27, 1875	Springville, Iowa	Cedar River	Iowa River	Anamosa, Iowa	3,500
	Jan. 27, 1875	Independence, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	10,500
	Jan. 27, 1875	Walker, Iowa	Cedar River	Iowa River	Anamosa, Iowa	3,500
	Jan. 27, 1875	Clermont, Iowa	Turkey River	Mississippi River	Anamosa, Iowa	3,500
	Jan. 27, 1875	Maynard, Iowa	Volga River	Turkey River	Anamosa, Iowa	3,500

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Iowa—Continued.	Feb. 1, 1875	Cherokee, Iowa	Little Sioux River	Missouri River	Anamosa, Iowa	10,000
	Feb. 1, 1875	Le Mars, Iowa	Floyd River	Missouri River	Anamosa, Iowa	5,000
	Feb. 1, 1875	Sioux City, Iowa	Floyd River	Missouri River	Anamosa, Iowa	5,000
	Feb. 1, 1875	Webster City, Iowa	Boone River	Des Moines River	Anamosa, Iowa	9,800
	Feb. 1, 1875	Pomeroy, Iowa	Twin Lakes	North Coon River	Anamosa, Iowa	10,000
	Feb. 1, 1875	Storm Lake, Iowa	Storm Lake	North Coon River	Anamosa, Iowa	10,000
	Feb. 1, 1875	Manchester, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	200
	Feb. 13, 1875	Tipton, Iowa	Cedar River	Iowa River	Anamosa, Iowa	4,000
	Mar. 6, 1875	Linn County, Iowa	Storm Spring	Mississippi River	Anamosa, Iowa	4,000
	Mar. 10, 1875	Decorah, Iowa	Upper Iowa River	Mississippi River	Anamosa, Iowa	8,000
	Apr. 7, 1875	Anamosa, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	5,000
	Dec. 9, 1875	Plymouth County, Iowa	Deep Creek	Floyd River	Anamosa, Iowa	10,000
	Dec. 11, 1875	Chickasaw County, Iowa	Wapsie River	Mississippi River	Anamosa, Iowa	8,000
	Dec. 21, 1875	Winneshiek County, Iowa	Upper Iowa River	Mississippi River	Anamosa, Iowa	10,000
	Jan. 14, 1876	Winneshiek County, Iowa	Turkey River	Mississippi River	Anamosa, Iowa	5,000
	Jan. 14, 1876	Fayette County, Iowa	Volga River	Turkey River	Anamosa, Iowa	5,000
	Jan. 15, 1876	Marion County, Iowa	White Breast Creek	Des Moines River	Anamosa, Iowa	5,000
	Jan. 15, 1876	Union County, Iowa	Grand River	Missouri River	Anamosa, Iowa	5,000
	Jan. 15, 1876	Union County, Iowa	Twelve Mile Creek	Grand River	Anamosa, Iowa	5,000
	Jan. 15, 1876	Union County, Iowa	Platte River	Missouri River	Anamosa, Iowa	5,000
	Jan. 20, 1876	Council Bluffs, Iowa	Missouri River	Mississippi River	Anamosa, Iowa	20,000
	Jan. 21, 1876	Mills County, Iowa	Silver Creek	Nishnabotany River	Anamosa, Iowa	5,000
	Feb. 4, 1876	Buchanan County, Iowa	Buffalo Creek	Wapsipinicon River	Anamosa, Iowa	5,000
	Feb. 4, 1876	Floyd County, Iowa	Red Cedar River	Cedar River	Anamosa, Iowa	3,000
	Feb. 4, 1876	Floyd County, Iowa	Little Cedar River	Red Cedar River	Anamosa, Iowa	3,000
	Feb. 17, 1876	Mills County, Iowa	Nishnabotany River	Missouri River	Anamosa, Iowa	5,000
	Feb. 21, 1876	Plymouth County, Iowa	Clear Creek	Little Sioux River	Anamosa, Iowa	1,000
	Feb. 21, 1876		Cedar Creek	Mississippi River	Anamosa, Iowa	2,500
	Feb. 21, 1876		Iowa River	Cedar River	Anamosa, Iowa	2,500
	Feb. 21, 1876	Mahaska County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	3,000
	Feb. 21, 1876	Mahaska County, Iowa	Skunk River	Mississippi River	Anamosa, Iowa	3,000
	Feb. 21, 1876	Montgomery County, Iowa	Walnut Creek	Nishnabotany River	Anamosa, Iowa	5,000
	Feb. 23, 1876		Iowa River	Cedar River	Anamosa, Iowa	10,000
	Mar. 1, 1876		Des Moines River	Mississippi River	Anamosa, Iowa	10,000
	Mar. 2, 1876	Crawford County, Iowa	Boyer River	Missouri River	Anamosa, Iowa	10,000
	Mar. 2, 1876	Missouri Valley, Iowa	Lakes	Boyer River	Anamosa, Iowa	10,000
	Mar. 6, 1876	Henry County, Iowa	Big Creek	Skunk River	Anamosa, Iowa	5,000
	Mar. 6, 1876	Davis County, Iowa	Fox River	Mississippi River	Anamosa, Iowa	2,500
	Mar. 6, 1876	Jefferson County, Iowa	Cedar Creek	Skunk River	Anamosa, Iowa	2,500
	Mar. 6, 1876	Lucas County, Iowa	Chariton River	Missouri River	Anamosa, Iowa	5,000
	Mar. 6, 1876	Marion County, Iowa	White Breast Creek	Des Moines River	Anamosa, Iowa	5,000
	Mar. 6, 1876	Montgomery County, Iowa	Nodaway River	Missouri River	Anamosa, Iowa	5,000
	Mar. 6, 1876	Mills County, Iowa	Nishnabotany River	Missouri River	Anamosa, Iowa	5,000
	Mar. 6, 1876	Montgomery County, Iowa	Walnut Creek	Nishnabotany River	Anamosa, Iowa	5,000

Mar. 6, 1876	Mills County, Iowa	Silver Creek	Nishnabotany River	Anamosa, Iowa	5,000
Mar. 6, 1876	Mills County, Iowa	Keg Creek	Missouri River	Anamosa, Iowa	5,000
Mar. 7, 1876		Cedar River	Mississippi River	Anamosa, Iowa	3,000
Mar. 14, 1876	Chickasaw County, Iowa	Wapsie River	Mississippi River	Anamosa, Iowa	10,000
Mar. 20, 1876	Hancock County, Iowa	Iowa River	Cedar River	Anamosa, Iowa	3,000
Mar. 20, 1876	Hancock County, Iowa	Boone River	Des Moines River	Anamosa, Iowa	3,000
Mar. 20, 1876	Kossuth County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	3,000
Mar. 20, 1876	Plymouth County, Iowa	Big Sioux River	Missouri River	Anamosa, Iowa	3,000
Mar. 20, 1876	Plymouth County, Iowa	Floyd River	Missouri River	Anamosa, Iowa	3,000
Mar. 20, 1876	Calhoun County, Iowa	Twin Lakes	North Coon River	Anamosa, Iowa	5,000
Mar. 20, 1876	Storm Lake, Iowa	Storm Lake	North Coon River	Anamosa, Iowa	3,000
Mar. 20, 1876	Dickinson County, Iowa	Spirit Lake		Anamosa, Iowa	3,000
Mar. 20, 1876	Dickinson County, Iowa	Okoboji Lake	Little Sioux River	Anamosa, Iowa	3,000
Mar. 20, 1876	Hancock County, Iowa	Crystal Lake	Iowa River	Anamosa, Iowa	3,000
Mar. 27, 1876	Floyd County, Iowa	Shell Rock River	Cedar River	Anamosa, Iowa	3,000
Mar. 27, 1876	Butler County, Iowa	Beaver Creek	Shell Rock River	Anamosa, Iowa	5,000
Mar. 27, 1876	Butler County, Iowa	West Fork	Cedar River	Anamosa, Iowa	3,000
Mar. 29, 1876		Lyman Creek		Anamosa, Iowa	3,000
Mar. 29, 1876	Floyd County, Iowa	Little Cedar Creek	Red Cedar River	Anamosa, Iowa	3,000
Mar. 29, 1876	Hancock County, Iowa	Iowa River	Cedar River	Anamosa, Iowa	3,000
Mar. 29, 1876	Kossuth County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	3,000
Mar. 29, 1876	Clear Lake, Iowa	Clear Lake	Shell Rock River	Anamosa, Iowa	2,500
Mar. 29, 1876	Hancock County, Iowa	Eagle Lake	Iowa River	Anamosa, Iowa	2,500
Mar. 29, 1876	Hancock County, Iowa	Crystal Lake	Iowa River	Anamosa, Iowa	2,500
Mar. 29, 1876	Winnebago County, Iowa	Twin Lakes	Shell Rock River	Anamosa, Iowa	2,500
Apr. 3, 1876		Cedar River	Mississippi River	Anamosa, Iowa	5,000
Dec. 26, 1876	Sundry places	Des Moines River	Mississippi River	Northville, Mich	25,000
Apr. 4, 1878		Iowa River	Cedar River	Anamosa, Iowa	5,000
Apr. 4, 1878		Copper Creek	Mississippi River	Anamosa, Iowa	5,000
Apr. 29, 1878	Floyd County, Iowa	Shell Rock River	Cedar River	Anamosa, Iowa	5,000
Apr. 29, 1878	Kossuth County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	10,000
Apr. 29, 1878	Mills County, Iowa	Silver Creek	Nishnabotany River	Anamosa, Iowa	5,000
June 10, 1878	Dallas County, Iowa	Raccoon River	Mississippi River	Anamosa, Iowa	5,000
June 10, 1878	Mahaska County, Iowa	Skunk River	Mississippi River	Anamosa, Iowa	5,000
June 10, 1878	Warren County, Iowa	Badger River	North River	Anamosa, Iowa	5,000
June 16, 1878	Linn County, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	5,000
June 16, 1878	Jones County, Iowa	Wapsie River	Mississippi River	Anamosa, Iowa	5,000
Jan. 27, 1879	Sioux City, Iowa	Big Sioux River	Missouri River	Anamosa, Iowa	4,000
Jan. 31, 1879	Clay County, Iowa	Mud Lake	Mississippi River	Anamosa, Iowa	10,000
Jan. 31, 1879		Skunk River	Mississippi River	Anamosa, Iowa	10,000
Jan. 31, 1879	Sac County, Iowa	Wall Lake		Anamosa, Iowa	10,000
Jan. 31, 1879		Towner's Lake	Mississippi River	Anamosa, Iowa	7,000
Jan. 31, 1879		Iowa River	Cedar River	Anamosa, Iowa	7,000
Feb. 12, 1879	Boone County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	10,000
Feb. 12, 1879	Greene County, Iowa	East Coon River	Mississippi River	Anamosa, Iowa	10,000
Feb. 12, 1879	Guthrie County, Iowa	Middle River	Des Moines River	Anamosa, Iowa	10,000
Feb. 12, 1879	Sac County, Iowa	Wall Lake	Mississippi River	Anamosa, Iowa	20,000
Feb. 12, 1879	Ida County, Iowa	Maple River	Little Sioux River	Anamosa, Iowa	10,000
Feb. 20, 1879	Maquoketa, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	10,600
Mar. 10, 1879	Anamosa, Iowa	Wapsie River	Mississippi River	Anamosa, Iowa	10,000
Mar. 17, 1879	Big Rock, Iowa	Wapsipinicon River	Mississippi River	Anamooa, Iowa	3,000
Mar. 20, 1879	Winneshiek County, Iowa	Turkey River	Mississippi River	Anamosa, Iowa	3,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Iowa—Continued	Mar. 22, 1879	Hancock County, Iowa	Boone River	Des Moines River	Anamosa, Iowa	10,000
	Mar. 22, 1879	Kossuth County, Iowa	Des Moines River	Mississippi River	Anamosa, Iowa	10,000
	Mar. 22, 1879	Plymouth County, Iowa	Plymouth Creek	Missouri River	Anamosa, Iowa	15,000
	Mar. 24, 1879	Lisbon, Iowa	Lisbon Creek	Red Cedar River	Anamosa, Iowa	4,000
	Mar. 28, 1879		Cedar River	Mississippi River	Anamosa, Iowa	5,000
	Apr. 1, 1879	Keokuk County, Iowa	North Skunk River	Skunk River	Anamosa, Iowa	2,500
	Apr. 1, 1879	Mahaska County, Iowa	South Skunk River	Skunk River	Anamosa, Iowa	2,500
	May 14, 1879	Kellogg, Iowa	North Skunk River	Skunk River	Anamosa, Iowa	2,500
	May 19, 1879	Southern Iowa	Streams along C. B. & Q. R. R.	Mississippi River	Anamosa, Iowa	12,000
	May 20, 1879	Independence, Iowa	Wapsipinicon River	Mississippi River	Anamosa, Iowa	4,000
	May 20, 1879	Fayette County, Iowa	Volga River	Turkey River	Anamosa, Iowa	5,000
	May 20, 1879	Fayette County, Iowa	Turkey River	Mississippi River	Anamosa, Iowa	5,000
	May 30, 1879	Franklin County, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	10,000
	May 30, 1879	Franklin County, Iowa	Spring Creek	Cedar River	Anamosa, Iowa	5,000
Kansas	Oct. —, 1877	Ellsworth, Kans	Smoky Hill River	Kansas River	Ellsworth, Kans	99,000
	Dec. —, 1878	Stranger, Kans	Stranger River	Missouri River	Cedar Rapids, Iowa	2,500
	Dec. —, 1878	Independence, Kans	Verdigris River	Missouri River	Cedar Rapids, Iowa	2,500
	Dec. , 1878	Delaware, Kans	Delaware River	Missouri River	Cedar Rapids, Iowa	3,000
	Dec. —, 1878	Centralia, Kans	Red Vermillion River	Kansas River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Wetmore, Kans	Spring Creek	Kansas River	Cedar Rapids, Iowa	1,000
	Dec. —, 1878	Washington, Kans	Mill Creek	Big Blue River	Cedar Rapids, Iowa	1,000
	Dec. —, 1878	Frankfort, Kans	Black Vermillion River	Big Blue River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Barrett, Kans	Clear Creek	Kansas River	Cedar Rapids, Iowa	1,000
	Dec. —, 1878	Blue Rapids, Kans	Big Blue River	Kansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Waterville, Kans	Little Blue River	Big Blue River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Concordia, Kans	Republican River	Kansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Beloit, Kans	Solomon River	Kansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Topeka, Kans	Soldier River	Kansas River	Cedar Rapids, Iowa	1,000
	Dec. —, 1878	Silver Lake, Kans	Silver Lake	Kansas River	Cedar Rapids, Iowa	500
	Dec. —, 1878	Wamego, Kans	Vermillion River	Kansas River	Cedar Rapids, Iowa	2,500
	Dec. —, 1878	Manhattan, Kans	Big Blue River	Kansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Junction City, Kans	Republican River	Kansas River	Cedar Rapids, Iowa	3,000
	Dec. —, 1878	Chapman, Kans	Chapman's Creek	Kansas River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Solomon City, Kans	Solomon River	Kansas River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Salina, Kans	Saline River	Smoky Hill River	Cedar Rapids, Iowa	3,000
	Dec. —, 1878	Brookville, Kans	Spring Creek	Smoky Hill River	Cedar Rapids, Iowa	1,000
	Dec. —, 1878	Ellsworth, Kans	Smoky Hill River	Kansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Hayes City, Kans	Big Creek	Smoky Hill River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Ellis, Kans	Big Creek	Smoky Hill River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Ottawa, Kans	Wakarusa River	Kansas River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Reading, Kans	Osage River	Missouri River	Cedar Rapids, Iowa	2,500
	Dec. —, 1878	Emporia, Kans	Neosho River	Arkansas River	Cedar Rapids, Iowa	5,000
	Dec. —, 1878	Florence, Kans	Cottonwood River	Neosho River	Cedar Rapids, Iowa	2,000
	Dec. —, 1878	Eldorado, Kans	Walnut River	Arkansas River	Cedar Rapids, Iowa	3,000

Dec. —, 1878	Halstead, Kans	Little Arkansas River	Arkansas River	Cedar Rapids, Iowa	2,500
Dec. —, 1878	McPherson, Kans	Lake Inman	Little Arkansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1878	Hutchinson, Kans	Cow Creek	Arkansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1878	Great Bend, Kans	Walnut River	Arkansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1878	Larned, Kans	Pawnee Creek	Arkansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Blue Rapids, Kans	Big Blue River	Kansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Waterville, Kans	Little Blue River	Big Blue River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Concordia, Kans	Republican River	Kansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Beloit, Kans	Solomon River	Kansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Topeka, Kans	Soldier River	Kansas River	Cedar Rapids, Iowa	1,000
Dec. —, 1879	Silver Lake, Kans	Silver Lake	Kansas River	Cedar Rapids, Iowa	500
Dec. —, 1879	Wamego, Kans	Vermillion River	Kansas River	Cedar Rapids, Iowa	2,500
Dec. —, 1879	Manhattan, Kans	Big Blue River	Kansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Junction City, Kans	Republican River	Kansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Chapman, Kans	Chapman's Creek	Kansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Solomon City, Kans	Solomon River	Kansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Salina, Kans	Saline River	Smoky Hill River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Brookville, Kans	Spring Creek	Smoky Hill River	Cedar Rapids, Iowa	1,000
Dec. —, 1879	Ellsworth, Kans	Smoky Hill River	Kansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Hayes City, Kans	Big Creek	Smoky Hill River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Ellis, Kans	Big Creek	Smoky Hill River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Ottawa, Kans	Wakarusa River	Kansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Reading, Kans	Osage River	Missouri River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Emporia, Kans	Neosho River	Arkansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Florence, Kans	Cottonwood River	Neosho River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Eldorado, Kans	Walnut River	Arkansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Halstead, Kans	Little Arkansas River	Arkansas River	Cedar Rapids, Iowa	2,500
Dec. —, 1879	McPherson, Kans	Lake Inman	Little Arkansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Hutchinson, Kans	Cow Creek	Arkansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Great Bend, Kans	Walnut River	Arkansas River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Larned, Kans	Pawnee Creek	Arkansas River	Cedar Rapids, Iowa	5,000
Dec. —, 1879	Stranger, Kans	Stranger River	Missouri River	Cedar Rapids, Iowa	2,500
Dec. —, 1879	Independence, Kans	Verdigris River	Missouri River	Cedar Rapids, Iowa	2,500
Dec. —, 1879	Delaware, Kans	Delaware River	Missouri River	Cedar Rapids, Iowa	3,000
Dec. —, 1879	Centralia, Kans	Red Vermillion River	Kansas River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Wetmore, Kans	Spring Creek	Kansas River	Cedar Rapids, Iowa	1,000
Dec. —, 1879	Washington, Kans	Mill Creek	Big Blue River	Cedar Rapids, Iowa	1,000
Dec. —, 1879	Frankfort, Kan	Black Vermillion River	Big Blue River	Cedar Rapids, Iowa	2,000
Dec. —, 1879	Barrett, Kans	Clear Creek	Kansas River	Cedar Rapids, Iowa	1,000
Feb. 2, 1881	Topeka, Kans	Wakarusa River	Kansas River	Ellsworth, Kans	3,500
Feb. 2, 1881	Burlingame, Kans	Dragoon Creek	Kansas River	Ellsworth, Kans	4,000
Feb. 2, 1881	Burlingame, Kans	Lake Lyndon	Kansas River	Ellsworth, Kans	3,000
Feb. 2, 1881	Reading, Kans	Marais des Cygnes River	Missouri River	Ellsworth, Kans	3,000
Feb. 2, 1881	Emporia, Kans	Neosho River	Arkansas River	Ellsworth, Kans	15,000
Feb. 2, 1881	Florence, Kans	Cottonwood River	Neosho River	Ellsworth, Kans	15,000
Feb. 2, 1881	Clay Centre, Kans	Republican River	Kansas River	Ellsworth, Ksns	5,000
Feb. 2, 1881	Clifton, Kans	Republican River	Kansas River	Ellsworth, Kans	5,000
Feb. 2, 1881	Concordia, Kans	Republican River	Kansas River	Ellsworth, Kans	5,000
Feb. 2, 1881	Valley Falls, Kans	Delevan River	Kansas River	Ellsworth, Kans	5,000
Feb. 2, 1881	Wamego, Kans	Vermillion River	Kansas River	Ellsworth, Kans	5,000
Feb. 2, 1881	Manhattan, Kans	Big Blue River	Kansas River	Ellsworth, Kans	5,000
Feb. 2, 1881	Chapman, Kans	Chapman's Creek	Smoky Hill River	Ellsworth, Kans	2,500

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Kansas—Continued	Feb. 2, 1881	Solomon City, Kans	Solomon River	Smoky Hill River	Ellsworth, Kans	3,000
	Feb. 2, 1881	Salina, Kans	Saline River	Smoky Hill River	Ellsworth, Kans	3,000
	Feb. 2, 1881	Ellsworth, Kans	Smoky Hill River	Kansas River	Ellsworth, Kans	3,000
	Feb. 2, 1881	Hays City, Kans	Big Creek	Smoky Hill River	Ellsworth, Kans	5,000
	Feb. 2, 1881	Ellis, Kans	Big Creek	Smoky Hill River	Ellsworth, Kans	3,000
	Feb. 2, 1881	Fort Harker, Kans	Spring Creek	Smoky Hill River	Ellsworth, Kans	3,000
Kentucky	Jan. 6, 1876	Lexington, Ky	Kentucky River	Ohio River	Northville, Mich	25,000
	Nov. 27, 1876	Jefferson County, Ky	Floyd's Fork	Salt River	Louisville, Ky	1,500
	Dec. 7, 1876	Shelby County, Ky	Clear Creek	Salt River	Louisville, Ky	700
	Dec. 7, 1876	Shelby County, Ky	Mulberry Creek	Salt River	Louisville, Ky	700
	Dec. 7, 1876	Shelby County, Ky	Gist Creek	Salt River	Louisville, Ky	600
	Dec. 14, 1876	Hardin County, Ky	Middle Creek	Nolin Creek	Louisville, Ky	2,000
	Dec. 14, 1876	Hart County, Ky	Bumgartner's Creek	Green River	Louisville, Ky	1,000
	Dec. 20, 1876	Adair County, Ky	Russell Creek	Green River	Louisville, Ky	1,000
	Dec. 20, 1876	Boyle County, Ky	Dick's River	Kentucky River	Louisville, Ky	1,000
	Dec. 20, 1876	Garrard County, Ky	White Oak Creek	Dick's River	Louisville, Ky	1,000
	Dec. 20, 1876	Madison County, Ky	Silver Creek	Kentucky River	Louisville, Ky	500
	Dec. 20, 1876	Madison County, Ky	Otter Creek	Kentucky River	Louisville, Ky	500
	Dec. 20, 1876	Lincoln County, Ky	Hanging Fork	Dick's River	Louisville, Ky	1,000
	Dec. 20, 1876	Casey County, Ky	Green River	Ohio River	Louisville, Ky	1,000
	Dec. 20, 1876	Lincoln County, Ky	Dick's River	Kentucky River	Louisville, Ky	1,000
	Dec. 20, 1876	Mercer County, Ky	Salt River	Ohio River	Louisville, Ky	500
	Dec. 20, 1876	Mercer County, Ky	Chaplin River	Ohio River	Louisville, Ky	500
	Dec. 27, 1876	Woodford County, Ky	Dunlap's Branch	Kentucky River	Louisville, Ky	1,000
	Dec. 27, 1876	Henry County, Ky	East and West Forks	Little Kentucky River	Louisville, Ky	500
	Dec. 27, 1876	Henry County, Ky	North and East Forks	Floyd's Fork	Louisville, Ky	500
	Dec. 27, 1876	Clark County, Ky	Lulbregrud Creek	Red River	Louisville, Ky	200
	Dec. 27, 1876	Clark County, Ky	Howard's Upper Creek	Kentucky River	Louisville, Ky	200
	Dec. 27, 1876	Clark County, Ky	Howard's Lower Creek	Kentucky River	Louisville, Ky	200
	Dec. 27, 1876	Clark County, Ky	Stoner Creek	Licking River	Louisville, Ky	200
	Dec. 27, 1876	Clark County, Ky	Strode's Creek	Stoner Creek	Louisville, Ky	200
	Dec. 27, 1876	Scott County, Ky	Big Spring Branch	North Elkhorn River	Louisville, Ky	300
	Dec. 27, 1876	Scott County, Ky	Lane's Run	North Elkhorn River	Louisville, Ky	100
	Dec. 27, 1876	Scott County, Ky	Cane Run	North Elkhorn River	Louisville, Ky	100
	Dec. 27, 1876	Scott County, Ky	McConnell's Run	North Elkhorn River	Louisville, Ky	100
	Dec. 27, 1876	Scott County, Ky	Thomas' Spring Branch	North Elkhorn River	Louisville, Ky	200
	Dec. 27, 1876	Scott County, Ky	Saunder's Spring Branch	North Elkhorn River	Louisville, Ky	200
	Jan. 2, 1877	Marion County, Ky	North and East Fork	Rolling Fork	Louisville, Ky	1,000
	Jan. 2, 1877	Taylor County, Ky	Pittman Creek	Green River	Louisville, Ky	1,000
	Jan. 2, 1877	Nelson County, Ky	Rolling Fork	Salt River	Louisville, Ky	1,000
	Jan. 10, 1877	Laurel County, Ky	White Oak Branch	Little Rockcastle River	Louisville, Ky	2,000
	Jan. 10, 1877	Rockcastle County, Ky	Round Stone Creek	Rockcastle River	Louisville, Ky	2,000
	Jan. 10, 1877	Rockcastle County, Ky	Hardin Durham's Branch	Rockcastle River	Louisville, Ky	2,000
	Jan. 28, 1877	Green County, Ky	Booker's Branch	Green River	Louisville, Ky	500

Kentucky—Cont'd.	Jan. 28, 1877	Green County, Ky	Cave Spring Branch	Green River	Louisville, Ky	500
	Feb. 1, 1877	Fulton County, Ky	Small streams	Green River	Louisville, Ky	2,000
	Feb. 1, 1877	Caldwell County, Ky	Eddy Creek	Cumberland River	Louisville, Ky	500
	Feb. 1, 1877	Trigg County, Ky	Little River	Cumberland River	Louisville, Ky	500
	Feb. 1, 1877	Crittenden County, Ky	Hurricane Creek	Ohio River	Louisville, Ky	500
	Feb. 3, 1877	Bullitt County, Ky	Knob Creek	Salt River	Louisville, Ky	1,000
	Feb. 7, 1877	Montgomery County, Ky	Spencer Creek	Licking River	Louisville, Ky	1,000
	Feb. 7, 1877	Montgomery County, Ky	Big Slate Creek	Licking River	Louisville, Ky	2,000
	Feb. 7, 1877	Montgomery County, Ky	Little Hinkston Creek	Licking River	Louisville, Ky	1,000
	Feb. 7, 1877	Woodford County, Ky	South Elkhorn	Kentucky River	Louisville, Ky	1,000
	Feb. 7, 1877	Franklin County, Ky	Kentucky River	Ohio River	Louisville, Ky	200
	Feb. 10, 1877	Jefferson County, Ky	Lunatic Asylum Pond		Louisville, Ky	25
	Feb. 13, 1877	Warren County, Ky	Barren River	Green River	Louisville, Ky	8,000
	Nov. 30, 1877	Gallatin County, Ky	Eagle Creek	Kentucky River	Louisville, Ky	5,000
	Dec. 14, 1877	Meade County, Ky	Doe Run	Ohio River	Louisville, Ky	5,000
	Dec. 21, 1877	Hardin County, Ky	Rough Creek	Green River	Louisville, Ky	5,000
	Dec. 21, 1877	Hardin County, Ky	Nolin Creek	Green River	Louisville, Ky	5,000
	Dec. 29, 1877	Hopkins County, Ky	Drake's Creek	Green River	Louisville, Ky	17,500
	Jan. 3, 1878	Warren County, Ky	Jasper River	Green River	Louisville, Ky	2,000
	Jan. 3, 1878	Warren County, Ky	Barren River	Green River	Louisville, Ky	12,000
	Jan. 12, 1878	Woodford County, Ky	Pond	Kentucky River	Louisville, Ky	500
	Jan. 12, 1878	Woodford County, Ky	Pond	Kentucky River	Louisville, Ky	1,500
	Jan. 12, 1878	Bourbon County, Ky	Elmwood Creek	Ohio River	Louisville, Ky	2,000
	Jan. 12, 1878	Jessamine County, Ky	Hickman Creek	Kentucky River	Louisville, Ky	2,000
	Jan. 12, 1878	Jessamine County, Ky	Jessamine Creek	Kentucky River	Louisville, Ky	2,000
	Jan. 12, 1878	Franklin County, Ky	Pond	Kentucky River	Louisville, Ky	200
	Jan. 12, 1878	Franklin County, Ky	Pond	Kentucky River	Louisville, Ky	800
	Jan. 28, 1878	Christian County, Ky	Little River	Cumberland River	Louisville, Ky	4,000
	Feb. 1, 1878	Caldwell County, Ky	Eddy Creek	Cumberland River	Louisville, Ky	3,000
	Feb. 12, 1878	Carter County, Ky	Tygert River	Big Sandy River	Louisville, Ky	2,000
	Feb. 13, 1878	Carter County, Ky	Little Sandy River	Ohio River	Louisville, Ky	2,000
Louisiana	Jan. 1, 1875		Tangipahoa River	Lake Pontchartrain	Pokagon, Mich	15,000
	Dec. 22, 1876	Tickfaw, La	Notalbany River	Lake Maurepas	Northville, Mich	14,200
	Dec. 22, 1876	Amite City, La	Tangipahoa River	Lake Pontchartrain	Northville, Mich	14,200
Maine	Feb. —, 1874	Bucksport, Me	Craig's Pond	Penobscot River	Bucksport, Me	4,900
	Feb. —, 1874	Bucksport, Me	Hatching-House Pond	Penobscot River	Bucksport, Me	100
	Spring, 1875	Bucksport, Me	Craig's Pond	Penobscot River	Bucksport, Me	30,000
	Feb. 6, 1879	Keen's Lake, Me	Keen's Lake Stream	Saint Croix River	Pembroke, Me	9,700
	Feb. 13, 1879	Pembroke, Me	Pennaquan River	Bay of Fundy	Pembroke, Me	3,000
Maryland	Nov. 25, 1874	Hagerstown, Md	Antietam Creek	Potomac River	Green Springs, Md	3,000
	Nov. 25, 1874	Wakefield, Md	Pipe Creek	Monocacy River	Green Springs, Md	1,500
	Nov. 25, 1874	Union Bridge, Md	Pipe Creek	Monocacy River	Green Springs, Md	1,000
	Nov. 25, 1874	Slabtown, Md	Owen's Creek	Monocacy River	Green Springs, Md	1,500
	Nov. 30, 1874	Freeland, Md	Gunpowder River	Gunpowder River	Green Springs, Md	10,000
	Nov. 30, 1874	Tank, Md	North Patapsco River	Patapsco River	Green Springs, Md	6,000
	Dec. 1, 1874			Chesapeake Bay	Green Springs, Md	6,000
	Dec. 2, 1874	Mechanicstown, Md	Owen's Creek	Monocacy River	Green Springs, Md	6,000
	Dec. 2, 1874	Hagerstown, Md	Conococheague River	Potomac River	Green Springs, Md	10,000
	Dec. 2, 1874	Tannery, Md	Evitts Creek	Potomac River	Green Springs, Md	5,000
	Dec. 2, 1874	Jennings Run, Md	Wills Creek	Potomac River	Green Springs, Md	5,000
	Dec. 3, 1874	Franklinville, Md	Savage Creek	Potomac River	Green Springs, Md	15,000
	Dec. 5, 1874	Liberty Grove, Md	Octorora Creek	Susquehanna River	Green Springs, Md	10,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Maryland—Cont'd.	Dec. 5, 1874	Monrovia, Md	Bush Creek	Monocacy River	Green Springs, Md	4,000
	Dec. 5, 1874	Hood's Mills, Md	Patapsco River	Chesapeake Bay	Green Springs, Md	6,000
	Dec. 9, 1874	Howard County, Md	Patuxent River	Chesapeake Bay	Green Springs, Md	8,000
	Dec. 9, 1874	Fort Pendleton, Md	North Branch	Potomac River	Green Springs, Md	15,000
	Dec. 15, 1874	Savage, Md	Patuxent River	Chesapeake Bay	Green Springs, Md	10,000
	Dec. 15, 1874	Maryland Line, Md	Deer Creek	Susquehanna River	Green Springs, Md	6,000
	Dec. 15, 1875	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	7,000
	Dec. 15, 1875	Patuxent, Md	Little Patuxent River	Patuxent River	Baltimore, Md	7,000
	Dec. 15, 1875	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	14,000
	Dec. 21, 1875	Point of Rocks, Md	Potomac River	Chesapeake Bay	Baltimore, Md	45,000
	Jan. 3, 1876	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	14,500
	Jan. 5, 1876	Tank, Md	North Patapsco River	Patapsco River	Baltimore, Md	10,000
	Jan. 5, 1876	Slabtown, Md	Owen's Creek	Monocacy River	Baltimore, Md	13,000
	Jan. 5, 1876	Baltimore, Md	Baltimore Water Works	Patapsco River	Baltimore, Md	5,000
	Jan. 7, 1876	Glencoe, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	18,000
	Jan. 14, 1876	Phœnix, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	30,000
	Jan. 24, 1876	Baltimore, Md	Baltimore Water Works	Patapsco River	Baltimore, Md	500
	Jan. 26, 1876	Weverton, Md	Potomac River	Chesapeake Bay	Baltimore, Md	5,000
	Feb. 10, 1876	Cedar Point, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	164
	Mar. 16, 1876	Aberdeen, Md	Tobacco Run	Deer Creek	Baltimore, Md	15,000
	Mar. 16, 1876	Aberdeen, Md	Archer's Run	Deer Creek	Baltimore, Md	500
	Mar. 16, 1866	Aberdeen, Md	Green Spring Run	Deer Creek	Baltimore, Md	500
	Mar. 19, 1876	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	6,000
	Mar. 21, 1876	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	13,000
	Mar. 23, 1876	Hagerstown, Md	Antietam Creek	Potomac River	Baltimore, Md	4,000
	Mar. 23, 1876	Tank, Md	North Patapsco River	Patapsco River	Baltimore, Md	2,000
	Mar. 23, 1876	Slabtown, Md	Owen's Creek	Monocacy River	Baltimore, Md	3,000
	Mar. 23, 1876	Double Pipe Creek, Md	Double Pipe Creek	Monocacy River	Baltimore, Md	2,000
	Mar. 25, 1876	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	6,000
	Mar. 29, 1876	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	12,000
	Apr. 3, 1876	Monkton, Md	Little Gunpowder River	Gunpowder River	Baltimore, Md	7,000
	Apr. 6, 1876	Ellicott City, Md	North Branch	Patuxent River	Baltimore, Md	3,200
	Apr. 7, 1876	Magnolia, Md	Winter's Run	Bush River	Baltimore, Md	1,000
	Apr. 14, 1876	Westminster, Md	Pipe Creek	Monocacy River	Baltimore, Md	2,000
	Apr. 17, 1876	Rowlandville, Md	Octorora Creek	Susquehanna River	Baltimore, Md	1,900
	Apr. 17, 1876	Williamsport, Md	Conococheague River	Potomac River	Baltimore, Md	2,000
	Nov. 6, 1876	Parkton, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	30,000
	Nov. 8, 1876	Tank, Md	North Patapsco River	Patapsco River	Baltimore, Md	10,000
	Nov 8, 1876	Wakefield, Md	Pipe Creek	Monocacy River	Baltimore, Md	15,000
	Nov. 8, 1876	Mechanicstown, Md	Owen's Creek	Potomac River	Baltimore, Md	25,000
	Nov. 10, 1876	Pennsylvania Line, Md	Deer Creek	Susquehanna River	Baltimore, Md	30,000
	Nov. 14, 1876	Savage, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	43,000
	Nov. 14, 1876	Sykesville, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	48,000
	Nov. 21, 1876	Monkton, Md	Little Gunpowder River	Gunpowder River	Baltimore, Md	33,600

Nov. 21, 1876	Mount Airy, Md	North Patuxent River	Patuxent River	Baltimore, Md	46,400
Nov. 22, 1876	Tank, Md	North Patapsco River	Patapsco River	Baltimore, Md	10,400
Nov. 22, 1876	Hagerstown, Md	Conecocheague River	Potomac River	Baltimore, Md	34,240
Nov. 22, 1876	Chewsville, Md	Antietam Creek	Potomac River	Baltimore, Md	29,400
Nov. 24, 1876	Bohemia Bridge, Md	Bohemia Creek	Elk River	Baltimore, Md	12,800
Nov. 24, 1876	Frederick, Md	Sassafras River	Chesapeake Bay	Baltimore, Md	22,640
Nov. 27, 1876	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	75,780
Dec. 1, 1876	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	24,000
Dec. 1, 1876	Cockeysville, Md	Western River	Gunpowder River	Baltimore, Md	24,000
Dec. 6, 1876	Federalsburgh, Md	Marsh Hope Creek	Nanticoke River	Baltimore, Md	9,600
Dec. 6, 1876	Greensborough, Md	Choptank River	Chesapeake Bay	Baltimore, Md	10,400
Dec. 6, 1876	Hillsborough, Md	Tuckahoe Creek	Choptank River	Baltimore, Md	9,600
Dec. 8, 1876	Crisfield, Md	Crisfield Harbor	Tangier Sound	Baltimore, Md	8,000
Dec. 8, 1876	Newtown, Md	Pocomoke River	Pocomoke Sound	Baltimore, Md	24,000
Dec. 8, 1876	Point of Rocks, Md	Potomac River	Chesapeake Bay	Baltimore, Md	56,800
Dec. 11, 1876	Elkton, Md	Elk River	Chesapeake Bay	Baltimore, Md	20,000
Dec. 11, 1876	Millington, Md	Chester River	Chesapeake Bay	Baltimore, Md	20,000
Dec. 15, 1876	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	75,780
Dec. 28, 1876	Oakland, Md	Youghiogheny River	Monongahela River	Baltimore, Md	9,900
Jan. 30, 1877	Monkton, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	4,000
Jan. 30, 1877	Monkton, Md	Little Gunpowder River	Gunpowder River	Baltimore, Md	10,000
Mar. 19, 1877	Harford County, Md	Winter's Run	Bush River	Baltimore, Md	800
Apr. 11, 1877	Harford County, Md	Private pond	Bush River	Baltimore, Md	50
May 8, 1877	Deer Park, Md	Youghiogheny River	Monongahela River	Baltimore, Md	2,000
May 31, 1877		Private ponds		Baltimore, Md	150
Nov. 19, 1877	Fort Pendleton, Md	Potomac River	Chesapeake Bay	Baltimore, Md	29,000
Nov. 22, 1877	Swanton, Md	Savage River	Potomac River	Baltimore, Md	12,000
Dec. 7, 1877	Phœnix, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	20,000
Dec. 10, 1877	Tank, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	8,000
Mar. 4, 1878	Weverton, Md	Pond	Potomac River	Baltimore, Md	600
Mar. 7, 1878	Spencerville, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	500
Mar. 11, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	10,000
Mar. 12, 1878	Parkton, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	10,000
Mar. 16, 1878	Hood's Mills, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	10,000
Mar. 18, 1878	Savage, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	12,000
Mar. 21, 1878	Weverton, Md	Potomac River	Chesapeake Bay	Baltimore, Md	12,000
Mar. 22, 1878		Pond	Bear Creek	Baltimore, Md	1,000
Mar. 25, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	8,000
Apr. 1, 1878	Tank, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	5,000
Apr. 1, 1878	Double Pipe Creek, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	7,000
Apr. 1, 1878	Hood's Mills, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	6,000
Apr. 3, 1878	Weverton, Md	Potomac River	Chesapeake Bay	Baltimore, Md	35,000
Nov. 6, 1878	Cockeysville, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	28,000
Nov. 7, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	24,000
Nov. 7, 1878	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	18,000
Nov. 8, 1878	Scintman's Mills, Cecil County, Md.	Big Elk River	Chesapeake Bay	Baltimore, Md	7,500
Nov. 8, 1878	Rock Church, Cecil County, Md.	Little Elk River	Chesapeake Bay	Baltimore, Md	7,500
Nov. 9, 1878	North East, Md	North East Creek	North East River	Baltimore, Md	15,000
Nov. 9, 1878	Tank, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	10,000
Nov. 9, 1878	New Windsor, Md	Pipe Creek	Monocacy River	Baltimore, Md	13,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Maryland—Cont'd.	Nov. 9, 1878	Mechanicstown, Md	Owen's Creek	Patapsco River	Baltimore, Md	13,000
	Nov. 11, 1878	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	25,000
	Nov. 11, 1878	Savage, Md	Little Patuxent River	Patuxent River	Baltimore, Md	12,500
	Nov. 12, 1878	Millington, Md	Chester River	Chesapeake Bay	Baltimore, Md	15,000
	Nov. 13, 1878	Hillsborough, Md	Tuckahoe Creek	Choptank River	Baltimore, Md	5,500
	Nov. 13, 1878	Sykesville, Md	Patapsco Creek	Chesapeake Bay	Baltimore, Md	15,000
	Nov. 27, 1878	Monkton, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	20,000
	Nov. 28, 1878	Monkton, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	20,000
	Nov. 29, 1878	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	20,000
	Nov. 30, 1878	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	20,000
	Dec. 1, 1878	Fort Pendleton, Md	North Branch	Potomac River	Baltimore, Md	24,500
	Dec. 2, 1878	Swanton, Md	North Branch	Potomac River	Baltimore, Md	20,000
	Dec. 4, 1878	Henderson, Md	Choptank River	Chesapeake Bay	Baltimore, Md	20,000
	Dec. 6, 1878	Boyds, Md	Ten Mile Creek		Baltimore, Md	6,000
	Dec. 6, 1878	Boyds, Md	Lonem Creek	Potomac River	Baltimore, Md	8,000
	Dec. 6, 1878	Boyds, Md	Brick Lodge Creek		Baltimore, Md	6,000
	Dec. 7, 1878		Monocacy River	Chesapeake Bay	Baltimore, Md	20,000
	Dec. 9, 1878	Hillsborough, Md	Nanticoke River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 12, 1878	Mitchell's Bridge, Md	Pocomoke River	Chesapeake Bay	Baltimore, Md	12,000
	Dec. 12, 1878	Above Snow Hill, Md	Pocomoke River	Chesapeake Bay	Baltimore, Md	8,000
	Dec. 12, 1878	Townson, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	20,000
	Dec. 13, 1878	Mount Airy, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	20,000
	Dec. 14, 2878	Herring Run, Md	Back River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 17, 1878	Millington, Md	Chester River	Chesapeake Bay	Baltimore, Md	1,200
	Dec. 17, 1878	Middletown, Md	Great Gunpowder River	Chesapeake Bay	Baltimore, Md	1,000
	Dec. 19, 1878	Liberty Grove, Md	Octorora Creek	Susquehanna River	Baltimore, Md	10,000
	Dec. 21, 1878	Parkton, Md	Deer Creek	Susquehanna River	Baltimore, Md	20,000
	Feb. 1, 1879	Wilna, Md	Winter's Run	Bush River	Baltimore, Md	4,000
	Feb. 1, 1879	Savage, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	10,000
	Feb. 13, 1879	Millington, Md	Chester River	Chesapeake Bay	Baltimore, Md	12,000
	Feb. 21, 1879	Henderson, Md	Choptank River	Chesapeake Bay	Baltimore, Md	8,000
	Feb. 24, 1879	Henderson, Md	Choptank River	Chesapeake Bay	Baltimore, Md	7,000
	Feb. 26, 1879	Cambridge, Md	Blackwater River	Tangier Sound	Baltimore, Md	3,000
	Feb. 26, 1879	Dorchester County, Md	Chicacomico River	Transquaking River	Baltimore, Md	3,000
	Feb. 26, 1879	Airey's, Md	Transquaking River	Tangier Sound	Baltimore, Md	3,000
	Feb. 28, 1879	Hood's Mills, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	12,000
	June 6, 1879	Airey's, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	236
	Oct. 30, 1879	Fort Pendleton, Md	Potomac River		Baltimore, Md	125,000
	Nov. 26, 1879		North Branch	Potomac River	Baltimore, Md	187,276
	Nov. 26, 1879	Parkton, Md	Big Gunpowder River	Chesapeake Bay	Baltimore, Md	15,000
	Nov. 29, 1879	Parkton, Md	Deer Creek	Susquehanna River	Baltimore, Md	15,000
	Dec. 4, 1879	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	20,000
	Dec. 4, 1879	Savage, Md	Middle Patuxent River	Patuxent River	Baltimore, Md	20,000
	Dec. 5, 1879	Federalsburgh, Md	Nanticoke River	Chesapeake Bay	Baltimore, Md	5,000

	Dec. 5, 1879	Linkwood, Md	Transquaking River	Tangier Sound	Baltimore, Md	1,000
	Dec. 5, 1879	Flemings Mills, Md	Chicacomico River	Transquaking River	Baltimore, Md	1,500
	Dec. 5, 1879	Barn's Farm, Md	Blackwater River	Tangier Sound	Baltimore, Md	1,500
	Dec. 9, 1879	De Graw's, Md	Octorora River	Chesapeake Bay	Baltimore, Md	6,000
	Dec. 9, 1879	Hereford, Md	East River	Chesapeake Bay	Baltimore, Md	5,000
	Dec. 10, 1879	Saint Marks, Md	Big Elk River	Chesapeake Bay	Baltimore, Md	6,000
	Dec. 10, 1879	Millington, Md	Andover Branch	Chester River	Baltimore, Md	5,000
	Dec. 11, 1879	Hood's Mills, Md	Patapsco River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 11, 1879	Mount Airey, Md	Little Patuxent River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 12, 1879	Salisbury, Md	Humphrey's Lake	Wicomico Creek	Baltimore, Md	1,000
	Dec. 12, 1879	Salisbury, Md	Wicomico Creek	Wicomico River	Baltimore, Md	4,000
	Dec. 12, 1879	Whaleysville, Md	Pocomoke River	Chesapeake Bay	Baltimore, Md	2,000
	Dec. 12, 1879	Berlin, Md	Trappe River	Choptank River	Baltimore, Md	2,000
	Dec. 12, 1879	Berlin, Md	Herring Creek	Atlantic Ocean	Baltimore, Md	2,000
	Dec. 13, 1879	Hagerstown, Md	Antietam River	Potomac River	Baltimore, Md	10,000
	Dec. 13, 1879	Hagerstown, Md	Conococheague River	Potomac River	Baltimore, Md	20,000
	Dec. 15, 1879	Middleburgh, Md	Big Pipe Creek	Monocacy River	Baltimore, Md	10,000
	Dec. 15, 1879	Mechanicstown, Md	Owen's Creek	Monocacy River	Baltimore, Md	10,000
	Dec. 15, 1879	Tank, Md	North Patapsco River	Patapsco River	Baltimore, Md	5,000
	Dec. 16, 1879	Parkton, Md	Deer Creek	Susquehanna River	Baltimore, Md	10,000
	Dec. 16, 1879	Sandy Branch, Md	Sassafras River	Chesapeake Bay	Baltimore, Md	1,000
	Dec. 16, 1879	Cecil County, Md	Bohemia River	Elk River	Baltimore, Md	1,000
	Dec. 16, 1879	Carter's Bridge, Md	Great Choptank River	Chesapeake Bay	Baltimore, Md	6,000
	Dec. 17, 1879	Cockeysville, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 18, 1879	Laurel, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	10,000
	Dec. 18, 1879	Savage, Md	Middle Patuxent River	Patuxent River	Baltimore, Md	10,000
	Dec. 23, 1879	Towson, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	10,000
	Mar. 9, 1880	Sandy Spring, Md	Pond	Patuxent River	Baltimore, Md	1,000
	Mar. 25, 1880	Buckeystown, Md	Pond	Monocacy River	Baltimore, Md	800
	Nov. 12, 1880	De Graw's, Md	Octorora River	Susquehanna River	Baltimore, Md	12,000
	Nov. 13, 1880		North East Creek	North East River	Baltimore, Md	6,000
	Nov. 13, 1880	Scintman's Mill, Md	Big Elk River	Chesapeake Bay	Baltimore, Md	6,000
	Nov. 15, 1880	Millington, Md	Chester River	Chesapeake Bay	Baltimore, Md	18,000
	Nov. 17, 1880	Henderson, Md	Choptank River	Chesapeake Bay	Baltimore, Md	18,000
	Nov. 19, 1880	Salisbury, Md	Wicomico River	Chesapeake Bay	Baltimore, Md	9,000
	Nov. 19, 1880	Whaleysville, Md	Pocomoke River	Chesapeake Bay	Baltimore, Md	9,000
	Nov. 22, 1880	Fort Pendleton, Md	Pocomoke River	Potomac River	Baltimore, Md	72,396
	Nov. 23, 1880	Salisbury, Md	Wicomico River	Chesapeake Bay	Baltimore, Md	9,000
	Nov. 23, 1880	Berlin, Md	Trappe River	Synapuxet River	Baltimore, Md	9,000
	Nov. 26, 1880	Federalsburgh, Md	Nanticoke River	Chesapeake Bay	Baltimore, Md	6,000
	Nov. 29, 1880	Cecil County, Md	Bohemia River	Elk River	Baltimore, Md	5,000
	Nov. 29, 1880	Cecil County, Md	Sassafras River	Chesapeake Bay	Baltimore, Md	5,000
	Dec. 1, 1880	Harris Dam, Md	Octorora River	Susquehanna River	Baltimore, Md	16,500
	Dec. 1, 1880	North East, Md	Sharon's Run	Susquehanna River	Baltimore, Md	1,500
	Dec. 3, 1880	Federalsburg, Md	Nanticoke River	Chesapeake Bay	Baltimore, Md	5,000
	Dec. 16, 1880	Phœnix, Md	Gunpowder River	Chesapeake Bay	Baltimore, Md	5,013
	Dec. 17, 1880	Savage, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	5,014
Massachusetts	Fall of 1873	Winchester, Mass	Mystic River	Boston Bay	Winchester, Mass	20,000
	Fall of 1873		Red Brook		Winchester, Mass	7,000
	Fall of 1874	Winchester, Mass	Mystic River	Boston Bay	Winchester, Mass	7,000
	Spring, 1876	Plymouth County, Mass	North River	Massachusetts Bay	Winchester, Mass	25,000
	Fall of 1876	Saugus, Mass	Saugus River	Broad Sound	Winchester, Mass	10,000

D.—TABLE II.—*Distribution of California salmon from* 1873 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Massachusetts—Continued.	Fall of 1876	Marshfield, Mass	North River	Massachusetts Bay	Winchester, Mass	30,000
	Fall of 1876	Lancaster, Mass	Nashua River	Merrimac River	Winchester, Mass	50,000
	Dec. —, 1877	Essex County, Mass	Ipswich River	Atlantic Ocean	Winchester, Mass	7,000
	Dec. —, 1877	Worcester County, Mass	Nashua River	Merrimac River	Winchester, Mass	30,000
	Dec. —, 1877	Marshfield, Mass	North River	Massachusetts Bay	Winchester, Mass	25,000
	Dec. —, 1877	Saugus, Mass	Saugus River	Broad Sound	Winchester, Mass	7,000
	Dec. —, 1877	Bridgewater, Mass	Winetuxet River	Taunton River	Winchester, Mass	10,000
Michigan	Dec. 25, 1873	Hillsdale County, Mich	Butternut Creek	Saint Joseph River	Jackson, Mich	6,000
	Dec. 25, 1873	Hillsdale County, Mich	Sand Creek	Saint Joseph River	Jackson, Mich	9,000
	Dec. 25, 1873	Pokagon, Mich	State Hatchery Pond	Saint Joseph River	Jackson, Mich	700
	Dec. 27, 1873	Kalamazoo County, Mich	Gull Creek	Kalamazoo River	Jackson, Mich	3,000
	Dec. 27, 1873	Ross Township, Mich	Lake	Kalamazoo River	Jackson, Mich	200
	Dec. 29, 1873	Jackson, Mich	East Branch	Kalamazoo River	Jackson, Mich	15,000
	Dec. 30, 1873	Jackson County, Mich		Grand River	Jackson, Mich	12,000
	Jan. 1, 1874		Sandstone Creek	Grand River	Jackson, Mich	8,000
	Jan. 2, 1874	Grand Rapids, Mich	Perkins and Hess Pond	Grand River	Jackson, Mich	100
	Jan. 2, 1874		Sandstone Creek	Grand River	Jackson, Mich	8,000
	Jan. 3, 1874		Sandstone Creek	Grand River	Jackson, Mich	8,000
	Jan. 3, 1874	Grand Rapids, Mich	Perkins and Hess Pond	Grand River	Jackson, Mich	100
	Jan. 6, 1874	Jackson, Mich	Crouch's Creek	Grand River	Jackson, Mich	4,000
	Jan. 6, 1874	Jackson County, Mich	Crouch's Creek	Grand River	Jackson, Mich	2,000
	May 8, 1874	Kalamazoo, Mich	Lunatic Asylum Pond	Kalamazoo River	Jackson, Mich	130
	Dec. 18, 1874		William's Creek	Dowagiac Creek	Pokagon, Mich	5,000
	Dec. 18, 1874		Emmon's Creek	Dowagiac Creek	Pokagon, Mich	5,000
	Dec. 18, 1874	Reed City, Mich	Hersey Creek	Muskegon River	Pokagon, Mich	50,000
	Dec. 22, 1874		Cullom's Creek	Dowagiac Creek	Pokagon, Mich	10,000
	Dec. 23, 1874	Crawford County, Mich	Au Sable River	Lake Huron	Pokagon, Mich	50,000
	Dec. 23, 1874	Calhoun County, Mich	Metcalf's Lake	Lake Michigan	Pokagon, Mich	7,000
	Dec. 26, 1874	Kalamazoo, Mich	Spring Brook Creek	Kalamazoo River	Pokagon, Mich	40,000
	Dec. 30, 1874	Negaunee, Mich	Carp River	Lake Superior	Pokagon, Mich	60,000
	Jan. 14, 1875	Cass County, Mich	Burke's Creek	Dowagiac Creek	Pokagon, Mich	3,000
	Jan. 15, 1875		Crystal Springs Creek	Dowagiac Creek	Pokagon, Mich	6,000
	Jan. 15, 1875		Mendenhall Creek	Dowagiac Creek	Pokagon, Mich	4,000
	Jan. 16, 1875		Pokagon Creek	Dowagiac Creek	Pokagon, Mich	7,000
	Jan. 16, 1875	Owosso, Mich	Shiawassee River	Saginaw River	Pokagon, Mich	35,000
	Jan. 16, 1875	Battle Creek, Mich	Gongeac Lake	Kalamazoo River	Pokagon, Mich	3,000
	Feb. 27, 1875	Saint Joseph, Mich	Ponds	Lake Michigan	Pokagon, Mich	500
	Mar. 22, 1875	Monroe, Mich	River Raisin	Lake Erie	Pokagon, Mich	10,000
	Mar. 30, 1875	Oakland County, Mich	Lake Orion	Great Lakes	Pokagon, Mich	10,000
	April 1, 1875	Pokagon, Mich	Ponds	Saint Joseph River	Pokagon, Mich	1,000
	July 3, 1875	Kalamazoo, Mich	Baptist Seminary Pond		Pokagon, Mich	100
	Dec. 8, 1875	Cass County, Mich	Indian Creek	Dowagiac River	Pokagon, Mich	15,000
	Dec. 8, 1875	Cass County, Mich	William's Creek	Dowagiac River	Pokagon, Mich	8,000
	Dec. 8, 1875	Cass County, Mich	Peavine Creek	Dowagiac River	Pokagon, Mich	15,000

Dec. 8, 1875	Pokagon, Mich	Pokagon Creek	Dowagiac River	Pokagon, Mich	10,000
Dec. 11, 1875	Niles, Mich	Saint Joseph River	Lake Michigan	Pokagon, Mich	33,000
Dec. 15, 1875	Otsego Lake, Mich	Otsego Lake	Au Sable River	Northville, Mich	20,000
Dec. 16, 1875	Kalamazoo County, Mich	Twin Lakes	Au Sable River	Pokagon, Mich	4,000
Dec. 16, 1875	Kalamazoo County, Mich	Putty Lake	Au Sable River	Pokagon, Mich	2,000
Dec. 16, 1875	Kalamazoo County, Mich	Indian Lake	Saint Joseph River	Pokagon, Mich	2,000
Dec. 16, 1875	Kalamazoo County, Mich	Portage River	Saint Joseph River	Pokagon, Mich	4,000
Dec. 16, 1875	Barry County, Mich	Long Lake	Grand River	Pokagon, Mich	2,000
Dec. 16, 1875	Kalamazoo County, Mich	Lyon's Lake	Lake Michigan	Pokagon, Mich	2,000
Dec. 16, 1875	Kalamazoo County, Mich	Wood's Lake	Lake Michigan	Pokagon, Mich	4,000
Dec. 16, 1875	Kalamazoo County, Mich	McMartin's Lake	Lake Michigan	Pokagon, Mich	4,000
Dec. 16, 1875	Kalamazoo County, Mich	Lewis Lake	Lake Michigan	Pokagon, Mich	2,000
Dec. 16, 1875	Calhoun County, Mich	Metcalf Lake	Lake Michigan	Pokagon, Mich	2,000
Dec. 16, 1875	Calhoun County, Mich	Bruce Lake	Lake Michigan	Pokagon, Mich	4,000
Dec. 16, 1875	Kalamazoo County, Mich	Gull Lake	Kalamazoo River	Pokagon, Mich	4,000
Dec. 16, 1875	Calhoun County, Mich	Gongeac Lake	Kalamazoo River	Pokagon, Mich	4,000
Dec. 20, 1875	Paw Paw, Mich	Paw Paw River	Lake Michigan	Pokagon, Mich	16,000
Dec. 21, 1875	Flint County, Mich	Flint River	Saginaw River	Northville, Mich	10,000
Dec. 21, 1875	Bay County, Mich	Rifle River	Saginaw Bay	Northville, Mich	8,000
Dec. 22, 1875	Midland, Mich	Tittabawassee River	Saginaw River	Northville, Mich	10,000
Dec. 22, 1875	Midland, Mich	Chippewa River	Pine River	Northville, Mich	10,000
Dec. 22, 1875	Dearborn, Mich	Rouge River	Detroit River	Northville, Mich	10,000
Dec. 23, 1875	Oakland County, Mich	Orchard Lake	Rouge River	Northville, Mich	8,000
Dec. 23, 1875	Utica, Mich	Clinton River	Saint Clair Lake	Northville, Mich	12,000
Dec. 23, 1875	Somerset, Mich	River Raisin	Lake Erie	Northville, Mich	10,000
Dec. 23, 1875	Brooklyn, Mich	River Raisin	Lake Erie	Northville, Mich	10,000
Dec. 23, 1875	Oakland County, Mich	Horitoon Lake	Great Lake	Northville, Mich	10,000
Dec. 25, 1875	Port Huron, Mich	Saint Clair River	Lake Huron	Northville, Mich	14,000
Dec. 25, 1875	Port Huron, Mich	Black River	Saint Clair River	Northville, Mich	12,000
Dec. 25, 1875	Ionia, Mich	Maple River	Grand River	Northville, Mich	6,000
Dec. 25, 1875	Clinton County, Mich	Round Lake	Grand River	Northville, Mich	6,000
Dec. 28, 1875	Barry County, Mich	Carter Lake	Lake Michigan	Northville, Mich	6,000
Dec. 28, 1875	Barry County, Mich	Thorn Apple Lake	Grand River	Northville, Mich	6,000
Dec. 28, 1875	Eaton County, Mich	Thorn Apple Lake	Grand River	Northville, Mich	6,000
Dec. 28, 1875	Lenawee County, Mich	Raisin River	Lake Erie	Northville, Mich	10,000
Dec. 28, 1875	Branch County, Mich	Coldwater Lake	Saint Joseph River	Northville, Mich	4,000
Dec. 28, 1875	Branch County, Mich	Lake of the Woods	Saint Joseph River	Northville, Mich	4,000
Dec. 28, 1875	Branch County, Mich	Morrison Lake	Saint Joseph River	Northville, Mich	8,000
Dec. 30, 1875	Cass County, Mich	Barrow Lake	Saint Joseph River	Pokagon, Mich	8,000
Jan. 1, 1876	Cass County, Mich	Muncy Lake	Saint Joseph River	Pokagon, Mich	1,000
Jan. 3, 1876	Cass County, Mich	Diamond Lake	Saint Joseph River	Pokagon, Mich	8,000
Jan. 3, 1876	Three Rivers, Mich	Portage River	Saint Joseph River	Pokagon, Mich	4,000
Jan. 3, 1876	Colon, Mich	Sturgeon Lake	Saint Joseph River	Pokagon, Mich	4,000
Jan. 3, 1876	Three Rivers, Mich	Saint Joseph River	Lake Michigan	Pokagon, Mich	8,000
Jan. 3, 1876	Pontiac, Mich	Lord's Lake	Clinton River	Northville, Mich	15,000
Jan. 6, 1876	Battle Creek, Mich	Hamblin Lake	Kalamazoo River	Pokagon, Mich	1,000
Jan. 6, 1876	Grand Rapids, Mich	Reed Lake	Grand River	Pokagon, Mich	4,000
Jan. 6, 1876	Kent County, Mich	Church Lake	Grand River	Pokagon, Mich	2,000
Jan. 6, 1876	Kent County, Mich	Pickerel Lake	Grand River	Pokagon, Mich	2,000
Jan. 6, 1876	Kent County, Mich	Lamberton Lake	Grand River	Pokagon, Mich	2,000
Jan. 6, 1876	Kent County, Mich	Soft Water Lake	Grand River	Pokagon, Mich	2,000
Jan. 7, 1876	Clam Lake, Mich	Clam Lake	Muskegon River	Pokagon, Mich	10,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Michigan—Cont'd	Jan. 7, 1876	Kalkaska, Mich	North Boardman River	Grand Traverse Bay	Pokagon, Mich	8,000
	Jan. 7, 1876	Kalkaska County, Mich	Rapid River	Torch Lake	Pokagon, Mich	12,000
	Jan. 8, 1876	Boyne Falls, Mich	Boyne River	Pine Lake	Pokagon, Mich	6,600
	Jan. 8, 1876	Charlevoix County, Mich	Bear Creek	Little Traverse Bay	Pokagon, Mich	4,000
	Jan. 12, 1876	Petoskey, Mich	Pine Lake	Lake Michigan	Pokagon, Mich	26,500
	Jan. 12, 1876		Rifle River	Lake Huron	Pokagon, Mich	23,750
	Jan. 12, 1876		Au Sable River	Lake Huron	Pokagon, Mich	23,750
	Jan. 13, 1876	Lake County, Mich	Big Star Lake	Pere Marquette River	Northville, Mich	14,000
	Jan. 14, 1876	Charlevoix County, Mich	Bear Creek	Walloon Lake	Northville, Mich	16,000
	Jan. 17, 1876		Menomonee Lake	Lake Michigan	Pokagon, Mich	30,000
	Jan. 19, 1876	Marquette County, Mich	Michigamee Lake	Menominee River	Northville, Mich	24,000
	Jan. 19, 1876	Marquette County, Mich	Three Lakes	Menominee River	Northville, Mich	8,000
	Feb. 9, 1876	Northville, Mich	Rouge River	Detroit River	Northville, Mich	20,000
	Dec. 21, 1876	Jackson, Mich	Grand River	Lake Michigan	Pokagon, Mich	27,500
	Dec. 22, 1876	Detroit, Mich	Detroit River	Lake Erie	Northville, Mich	20,000
	Dec. 25–8, '76	Holly, Mich	Shiawassee River	Saginaw River	Northville, Mich	75,200
	Dec. 25–8, '76	Crawford County, Mich	Au Sable River	Lake Huron	Northville, Mich	30,000
	Dec. 28, 1876	Washtenaw County, Mich	Huron River	Lake Erie	Northville, Mich	8,000
	Nov. 1, 1877	Wayne County, Mich	Detroit River	Lake Erie	Pokagon, Mich	2,000
	Nov. 18, 1877	Niles, Mich	Private ponds	Saint Joseph River	Pokagon, Mich	300
	Jan. 2, 1878	Cass County, Mich	Pokagon Creek	Saint Joseph River	Pokagon, Mich	3,500
	Jan. 3, 1878	Van Buren County, Mich	Sister Lakes	Lake Michigan	Pokagon, Mich	3,000
	Jan. 9, 1878	Cass County, Mich	Miller Creek		Pokagon, Mich	1,000
	Jan. 10, 1878	Cass County, Mich	Indian Lake		Pokagon, Mich	2,000
	Jan. 22, 1878	Allegan County, Mich	Dumont Lake	Kalamazoo River	Pokagon, Mich	3,500
	Jan. 22, 1878	Allegan County, Mich	Minor Lake	Lake Michigan	Pokagon, Mich	3,500
	Jan. 23, 1878	Charlevoix County, Mich	Wallow Lake	Lake Michigan	Pokagon, Mich	5,000
	Feb. 5, 1878	Howard, Mich	Barron Lake	Lake Michigan	Pokagon, Mich	5,000
	Feb. 14, 1878	Woodstock, Mich	Mallory Lake	Lake Erie	Pokagon, Mich	2,500
	Feb. 14, 1878	Woodstock, Mich	Tiffin River	Maumee River	Pokagon, Mich	2,500
	Feb. 14, 1878	Palmyra, Mich	Palmyra Pond	Raisin River	Pokagon, Mich	2,500
	Feb. 14, 1878	Raisin Centre, Mich	Southard's Lake	Raisin River	Pokagon, Mich	2,500
	Feb. 14, 1878	Hillsdale, Mich	Baw-Beese Lake	Saint Joseph River	Pokagon, Mich	3,000
	Mar. 1, 1878	Watervliet, Mich	Big Paw Paw River	Lake Michigan	Pokagon, Mich	4,000
	Mar. 2, 1878	Saint Joseph, Mich	Ponds	Saint Joseph River	Pokagon, Mich	300
	Mar. 2, 1878	Benton Harbor, Mich	Ponds	Lake Michigan	Pokagon, Mich	300
	Mar. 4, 1878	Calhoun County, Mich	Town Line	Lake Michigan	Pokagon, Mich	2,000
	Mar. 4, 1878	Woodstock, Mich	Silver Lake	Lake Erie	Pokagon, Mich	2,000
	Mar. 4, 1878	Woodstock, Mich	Goose Lake	Lake Erie	Pokagon, Mich	2,000
	Mar. 4, 1878	Putnam, Mich	Patterson Lake	Huron River	Pokagon, Mich	2,000
	Mar. 4, 1878	Putnam, Mich	Half Moon Lake	Huron River	Pokagon, Mich	2,000
	Mar. 4, 1878	Dexter, Mich	Island Lake	Huron River	Pokagon, Mich	2,000
	Mar. 4, 1878	Rochester, Mich	Private pond	Clinton River	Pokagon, Mich	1,000
	Mar. 4, 1878	Dexter, Mich	Silver Lake	Huron River	Pokagon, Mich	2,000

	Apr. 12, 1878	Surrey, Mich	Crooked Lake	Muskegon River	Pokagon, Mich	7,000
	Apr. 29, 1878	Calhoun County, Mich	Goguac Lake	Kalamazoo River	Pokagon, Mich	3,500
	May 3, 1878	Richland, Mich	Gull Lake	Kalamazoo River	Pokagon, Mich	3,000
	May 3, 1878	Richland, Mich	Long Lake	Kalamazoo River	Pokagon, Mich	500
	Nov. 1, 1878	Wayne County, Mich	Detroit River	Lake Erie	Pokagon, Mich	100
	Jan. 6, 1879	Wayne County, Mich	Rouge River	Detroit River	Pokagon, Mich	20,000
	Jan. 8, 1879	Van Buren County, Mich	Buck's Creek	Paw Paw River	Pokagon, Mich	15,000
	Jan. 8, 1879	Van Buren County, Mich	Mill Stream	Paw Paw River	Pokagon, Mich	10,000
	Jan. 9, 1879	Cass County, Mich	Pokagon Creek	Dowagiac River	Pokagon, Mich	10,000
	Jan. 10, 1879	Cass County, Mich	Peavine Creek	Dowagiac River	Pokagon, Mich	5,000
	Jan. 10, 1879	Cass County, Mich	Pine Creek	Lake Michigan	Pokagon, Mich	10,000
	Jan. 23, 1879	Berrien County, Mich	Saint Joseph River	Lake Michigan	Pokagon, Mich	20,000
	Jan. 30, 1879	Jackson County, Mich	Grand River	Lake Michigan	Pokagon, Mich	30,000
	Feb. 7, 1879	Wexford County, Mich	Manistee River	Lake Michigan	Pokagon, Mich	25,000
	Feb. 13, 1879	Monroe, Mich	Raisin River	Lake Erie	Pokagon, Mich	30,000
	Feb. 14, 1879	Saginaw County, Mich	Cass River	Saginaw River	Pokagon, Mich	30,000
	Feb. 26, 1879	Kalamazoo County, Mich	Gourd Neck Lake	Lake Michigan	Pokagon, Mich	2,000
	Feb. 26, 1879	Allegan County, Mich	Miner Lake	Lake Michigan	Pokagon, Mich	1,000
	Feb. 26, 1879	Allegan County, Mich	Mineler Lake	Lake Michigan	Pokagon, Mich	1,000
	Feb. 26, 1879	Allegan County, Mich	Wetmore Lake	Lake Michigan	Pokagon, Mich	1,000
	Feb. 26, 1879	Allegan County, Mich	Lake Sixteen	Lake Michigan	Pokagon, Mich	1,000
	Apr. 19, 1879	Oceana County, Mich	Crystal Lake	Lake Michigan	Pokagon, Mich	500
	Apr. 19, 1879	Oceana County, Mich	Round Lake	Lake Michigan	Pokagon, Mich	500
	July 12, 1879	Romeo, Mich	Private ponds	Clinton River	Pokagon, Mich	346
	Aug. 27, 1879	Cass County, Mich	Barron Lake		Pokagon, Mich	1,500
	Aug. 27, 1879	Cass County, Mich	Salmon Lake		Pokagon, Mich	900
	Fall of 1879	Calhoun County, Mich	Lyon Lake		Pokagon, Mich	130
	Fall of 1879	Calhoun County, Mich	Gougeac Lake		Pokagon, Mich	125
	Fall of 1879	Kalkaska County, Mich	Blue Lake		Pokagon, Mich	200
	Fall of 1879	Roscommon County, Mich	Higgins Lake		Pokagon, Mich	120
Minnesota	May —, 1875	Pine County, Minn	Twin Lakes	Saint Louis River	Saint Paul, Minn	500
	May —, 1875	Pine County, Minn	Big Lake	Saint Louis River	Saint Paul, Minn	500
	May —, 1875	Chisago County, Minn	Saint Croix River	Mississippi River	Saint Paul, Minn	5,000
	May —, 1875	Washington County, Minn	Stillwater	Mississippi River	Saint Paul, Minn	5,000
	May —, 1875	Washington County, Minn	Saint Croix River	Mississippi River	Saint Paul, Minn	5,000
	May —, 1875	Washington County, Minn	Cornelia Lake	Mississippi River	Saint Paul, Minn	750
	May —, 1875	Washington County, Minn	Corman's Lake	Mississippi River	Saint Paul, Minn	410
	May —, 1875	Washington County, Minn	Mayo's Lake	Mississippi River	Saint Paul, Minn	410
	May —, 1875	Washington County, Minn	Soulé's Lake	Mississippi River	Saint Paul, Minn	410
	May —, 1875	Washington County, Minn	May's Lake	Mississippi River	Saint Paul, Minn	410
	May —, 1875	Washington County, Minn	Lilly Lake	Mississippi River	Saint Paul, Minn	410
	May —, 1875	Ramsey County, Minn	White Bear Lake	Saint Croix River	Saint Paul, Minn	300
	May —, 1875	Ramsey County, Minn	Bass Lake	Saint Croix River	Saint Paul, Minn	100
	May —, 1875	Ramsey County, Minn	Lake Como	Saint Croix River	Saint Paul, Minn	100
	May —, 1875	Ramsey County, Minn	Lake Johanna	Saint Croix River	Saint Paul, Minn	100
	May —, 1875	Rice County, Minn	Cannon River	Mississippi River	Saint Paul, Minn	1,000
	May —, 1875	Rice County, Minn	Cedar Lake	Minnesota River	Saint Paul, Minn	1,000
	May —, 1875	Faribault County, Minn	Minnesota Lake	Mississippi River	Saint Paul, Minn	1,000
	May —, 1875	Breckenridge, Minn	Red River of the North	Lake Winnipeg	Saint Paul, Minn	500
	May —, 1875	Dakota County, Minn	Farmington River	Mississippi River	Saint Paul, Minn	1,000
	May —, 1875	Freeborn County, Minn	Lake Albert Lea	Iowa River	Saint Paul, Minn	1,000
	May —, 1875	Mower County, Minn	Iowa River	Cedar River	Saint Paul, Minn	300

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Minnesota—Cont'd.	May —, 1875	Chisago County, Minn	Taylor's Falls	Mississippi River	Saint Paul, Minn	1,000
	May —, 1875	Hennepin County, Minn	Lake Minnetonka	Mississippi River	Saint Paul, Minn	500
	May —, 1875	Steele County, Minn	Owatonna River	Mississippi River	Saint Paul, Minn	1,000
	Jan. 14, 1876	Blue Earth County, Minn	Lake Madison	Mississippi River	Red Wing, Minn	275
	May 11, 1876	Ramsey County, Minn	Lake Phalon	Mississippi River	Red Wing, Minn	500
	May 11, 1876	Ramsey County, Minn	Lake Josephine	Mississippi River	Red Wing, Minn	300
	May 11, 1876	Ramsey County, Minn	Lake Johanna	Mississippi River	Red Wing, Minn	300
	May 11, 1876	Ramsey County, Minn	Lake Vaduais	Mississippi River	Red Wing, Minn	250
	May 11, 1876	Ramsey County, Minn	Lake Big Butts	Mississippi River	Red Wing, Minn	250
	May 11, 1876	Ramsey County, Minn	Lake Little Butts	Mississippi River	Red Wing, Minn	250
	May 11, 1876	Dakota County, Minn	Lake Sunfish	Mississippi River	Red Wing, Minn	500
	May 11, 1876	Dakota County, Minn	Lake Kennedy	Mississippi River	Red Wing, Minn	200
	May 11, 1876	Ramsey County, Minn	Lake Como	Mississippi River	Red Wing, Minn	500
	May 11, 1876	Ramsey County, Minn	Lake McCann's	Mississippi River	Red Wing, Minn	500
	May 15, 1876	Washington County, Minn	Butts' Lake	Mississippi River	Red Wing, Minn	500
	May 16, 1876	Hennepin County, Minn	Lake Harriet	Mississippi River	Red Wing, Minn	1,250
	May 16, 1876	Hennepin County, Minn	Lake Calhoun	Mississippi River	Red Wing, Minn	1,250
	May 18, 1876	Ramsey County, Minn	White Bear Lake	Mississippi River	Red Wing, Minn	4,000
	May 18, 1876	Ramsey County, Minn	Bald Eagle Lake	Mississippi River	Red Wing, Minn	2,000
	May 23, 1876	Kandiyohi County, Minn	Green Lake	Crow River	Red Wing, Minn	1,000
	May 23, 1876	Kandiyohi County, Minn	Eagle Lake	Mississippi River	Red Wing, Minn	1,000
	....	Stevens County, Minn		Pomme de Terre River	Red Wing, Minn	500
	May 23, 1876	Wright County, Minn	Crow River	Mississippi River	Red Wing, Minn	1,000
	May 23, 1876	Swift County, Minn	Chippewa River	Minnesota River	Red Wing, Minn	1,500
	May 23, 1876	Stevens County, Minn	Pomme de Terre River	Minnesota River	Red Wing, Minn	1,500
	May 23, 1876	Grant County, Minn	Mustinka River	Rabbit River	Red Wing, Minn	1,000
	May 25, 1876	Sherburne County, Minn	Hand Lake	Mississippi River	Red Wing, Minn	500
	May 28, 1876	Hennepin County, Minn	Minnetonka Lake	Mississippi River	Red Wing, Minn	10,000
	May 29, 1876	Hennepin County, Minn	Hokah Lake	Mississippi River	Red Wing, Minn	1,500
	May 29, 1876	Rice County, Minn	Lake	Mississippi River	Red Wing, Minn	2,000
	May 29, 1876	Dakota County, Minn	Lake Crystal	Mississippi River	Red Wing, Minn	5,000
	May 29, 1876	Rice County, Minn		Mississippi River	Red Wing, Minn	6,000
	May 29, 1876	Scott County, Minn	Prior Lake	Mississippi River	Red Wing, Minn	20,000
	May 29, 1876	Washington County, Minn	Marine Lake	Mississippi River	Red Wing, Minn	700
	May 29, 1876	Washington County, Minn	Cornelian Lake	Mississippi River	Red Wing, Minn	700
	May 29, 1876	Washington County, Minn	Square Lake	Mississippi River	Red Wing, Minn	600
	June 2, 1876	Ramsey County, Minn	Lake Turtle	Mississippi River	Red Wing, Minn	1,000
	June 2, 1876	Ramsey County, Minn	Lake Josephine	Mississippi River	Red Wing, Minn	1,000
	June 2, 1876	Ramsey County, Minn	Lake Kingsley	Mississippi River	Red Wing, Minn	2,000
	June 2, 1876	Ramsey County, Minn	Lake Hallaron	Mississippi River	Red Wing, Minn	1,000
	June 2, 1876	Carver County, Minn	Lake	Mississippi River	Red Wing, Minn	1,000
	June 2, 1876	Scott County, Minn	Lake	Mississippi River	Red Wing, Minn	5,000
	June 2, 1876	Washington County, Minn	Brown's Creek	Mississippi River	Red Wing, Minn	1,000
	June 2, 1876	Wabasha County, Minn	Mazeppa Creek	Zumbro River	Red Wing, Minn	1 000

June 2, 1876	Washington County, Minn	Eagle Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Washington County, Minn	School Section	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Washington County, Minn	Tury Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Washington County, Minn	Round Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Washington County, Minn	McKusic's Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Washington County, Minn	Pine Tree Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Lanesborough, Minn		Root River	Red Wing, Minn	2,500
June 2, 1875	Wright County, Minn	Baytown Lake	Mississippi River	Red Wing, Minn	250
June 2, 1876	Washington County, Minn	Lake	Mississippi River	Red Wing, Minn	500
June 2, 1876	McLeod County, Minn	Lake Morrison	Crow River	Red Wing, Minn	250
June 2, 1876	Renville County, Minn	Lake Preston	Mississippi River	Red Wing, Minn	250
June 2, 1876	Washington County, Minn	Lakeland	Mississippi River	Red Wing, Minn	250
June 2, 1876	Dakota County, Minn		Mississippi River	Red Wing, Minn	1,500
June 2, 1876	Rice County, Minn	French Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Rice County, Minn	Cedar Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Rice County, Minn	Dudley Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Rice County, Minn	Robert Lake	Mississippi River	Red Wing, Minn	1,000
June 2, 1876	Rice County, Minn	Shield Lake	Cannon River	Red Wing, Minn	1,000
June 5, 1876	Carver County, Minn	Clear Lake	Mississippi River	Red Wing, Minn	500
June 7, 1876	Cottonwood County, Minn	String Lake	Mississippi River	Red Wing, Minn	300
June 16, 1876	Sherburne County, Minn	Big Lake	Mississippi River	Red Wing, Minn	300
June 16, 1876	Stearns County, Minn	Pearl Lake	Mississippi River	Red Wing, Minn	900
June 16, 1876	Stearns County, Minn	Pleasant Lake	Mississippi River	Red Wing, Minn	900
June 16, 1876	Stearns County, Minn	Grand Lake	Mississippi River	Red Wing, Minn	900
June —, 1876	Blue Earth County, Minn	Loon Lake	Mississippi River	Red Wing, Minn	500
June —, 1876	Watonwan County, Minn	Madelia Lake	Watonwan River	Red Wing, Minn	1,000
June —, 1876	Cottonwood County, Minn	Bingham Lake	Watonwan River	Red Wing, Minn	1,500
June —, 1876	Cottonwood County, Minn	Windom Lake	Des Moines River	Red Wing, Minn	1,000
June —, 1876	Cottonwood County, Minn	Welder Lake	Mississippi River	Red Wing, Minn	1,600
June —, 1876	Noble County, Minn	Okabena Lake	Des Moines River	Red Wing, Minn	1,000
June —, 1876	Blue Earth County, Minn	Eagle Lake	Minnesota River	Red Wing, Minn	1,000
June —, 1876	Blue Earth County, Minn	Madison Lake	Mississippi River	Red Wing, Minn	1,000
June —, 1876	Waseca County, Minn	Elysian Lake	Minnesota River	Red Wing, Minn	1,000
June —, 1876	Waseca County, Minn	Clear Lake	Mississippi River	Red Wing, Minn	1,000
June —, 1876	Le Sueur County, Minn	Lake Emily	Mississippi River	Red Wing, Minn	2,000
June —, 1876	Freeborn County, Minn	Lake Albert Lea	Mississippi River	Red Wing, Minn	1,000
June —, 1876	Freeborn County, Minn	Pickerel Lake	Mississippi River	Red Wing, Minn	1,000
June —, 1876	Faribault County, Minn	Minnesota Lake	Mississippi River	Red Wing, Minn	500
June —, 1876	Faribault County, Minn	Bass Lake	Mississippi River	Red Wing, Minn	1,000
June —, 1876	Blue Earth County, Minn	Lake Laura	Mississippi River	Red Wing, Minn	500
June —, 1876	Kandiyohi, Minn	Green Lake	Crow River	Red Wing, Minn	500
June —, 1876	Chisago County, Minn	Chisago Lake	Mississippi River	Red Wing, Minn	500
June —, 1876	Washington County, Minn	Forest Lake	Mississippi River	Red Wing, Minn	500
June —, 1876	Redwing, Minn	Mississippi River	Gulf of Mexico	Red Wing, Minn	10,000
June —, 1876	Stillwater, Minn	Saint Croix River	Mississippi River	Stillwater, Minn	90,000
June —, 1876	Breckenridge, Minn	Red River	Red River of the North	Red Wing, Minn	500
Feb. 6, 1877	Lake City, Minn	Lake Pepin	Mississippi River	Red Wing, Minn	250
Mar. 24, 1877	Hennepin County, Minn	Lake Armstrong Lake Johnson	Mississippi River Mississippi River	Red Wing, Minn	250
Apr. 14, 1877	Red Wing, Minn	Skillman Pond	Mississippi River	Red Wing, Minn	250
Apr. 19, 1877	Minnetonka, Minn	Long Lake	Mississippi River	Red Wing, Minn	8,000
Apr. 24, 1877	Scott County, Minn	Prior Lake	Mississippi River	Red Wing, Minn	10,000

D.—TABLE II.—*Distribution of California salmon from* 1873 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Minnesota—Cont'd.	Apr. 26, 1877	Ramsey County, Minn	Lake Phalon	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Washington County, Minn	Silver Lake	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Ramsey County, Minn	Lake Josephine	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Faribault County, Minn	Bass Lake	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Ramsey County, Minn	McCann's Lake	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Stearns County, Minn	Pleasant Lake	Mississippi River	Red Wing, Minn	250
	Apr. 26, 1877	Ramsey County, Minn	Lake Como	Mississippi River	Red Wing, Minn	250
	Apr. 27, 1877	Hennepin County, Minn	Lake Harriet	Mississippi River	Red Wing, Minn	250
	Apr. 27, 1877		Medicine Lake		Red Wing, Minn	250
	Apr. 27, 1877		Shady Oak Lake		Red Wing, Minn	250
	Apr. 27, 1877	Rice County, Minn	Cedar Lake	Mississippi River	Red Wing, Minn	250
	May 2, 1877	Cottonwood County, Minn	Eagle Lake	Mississippi River	Red Wing, Minn	500
	May 2, 1877	Cottonwood County, Minn	Mountain Lake	Mississippi River	Red Wing, Minn	500
	May 2, 1887	Jackson County, Minn	Heron Lake	Des Moines River	Red Wing, Minn	1,500
	May 2, 1877	Nobles County, Minn	Okabeena Lake	Mississippi River	Red Wing, Minn	800
	May 2, 1877	Nobles County, Minn	Ocheeda Lake	Mississippi River	Red Wing, Minn	700
	May 2, 1877	Jackson County, Minn	Lake	Mississippi River	Red Wing, Minn	1,500
	May 2, 1877	Windom, Minn	Des Moines River	Mississippi River	Red Wing, Minn	1,500
	May 2, 1877	Blue Earth County, Minn	Loon Lake	Minnesota River	Red Wing, Minn	750
	May 2, 1877	Blue Earth County, Minn	Clear Lake	Minnesota River	Red Wing, Minn	750
	May 2, 1877	Madelia, Minn	Watonwan River	Minnesota River	Red Wing, Minn	1,500
	May 8, 1877	Chisago County, Minn	Forest Lake	Mississippi River	Red Wing, Minn	1,200
	May 8, 1877	Chisago County, Minn	North Branch	Mississippi River	Red Wing, Minn	3,000
	May 8, 1877	Chisago County, Minn	Rush Lake	Mississippi River	Red Wing, Minn	4,000
	May 8, 1877	Chisago County, Minn	Danewood Lake	Mississippi River	Red Wing, Minn	30
	May 8, 1877	Northfield, Minn	Cedar Lake	Cannon River	Red Wing, Minn	1,000
	May 8, 1877	Faribault, Minn	Fox Lake	Mississippi River	Red Wing, Minn	3,000
	May 8, 1877	Northfield, Minn	Roberts Lake	Cannon River	Red Wing, Minn	1,000
	May 8, 1877	Rice County, Minn	French Lake	Mississippi River	Red Wing, Minn	1,000
	May 11, 1877	Washington County, Minn	Cornelian Lake	Mississippi River	Red Wing, Minn	3,000
	May 11, 1877	Washington County, Minn	Twin Lakes	Mississippi River	Red Wing, Minn	2,000
	May 11, 1877	Washington County, Minn	McKusic's Lake	Mississippi River	Red Wing, Minn	2,500
	May 12, 1877	Scott County, Minn	Prior Lake	Mississippi River	Red Wing, Minn	10,000
	May 15, 1877	Scott County, Minn	O'Dowd's Lake	Mississippi River	Red Wing, Minn	1,000
	May 18, 1877		East Lake		Red Wing, Minn	2,500
	May 18, 1877		West Lake		Red Wing, Minn	2,500
	May 18, 1877		Graham Lake		Red Wing, Minn	2,000
	May 18, 1877		Clear Lake		Red Wing, Minn	2,000
	May 22, 1877	Todd County, Minn	Sauk Lake	Sauk River	Red Wing, Minn	3,000
	May 22, 1877	Douglas County, Minn	Long Prairie River	Crow Wing River	Red Wing, Minn	5,000
	May 22, 1877	Stearns County, Minn	Sauk River	Mississippi River	Red Wing, Minn	1,000
	May 22, 1877	Austin, Minn	Mill Pond	Cedar River	Red Wing, Minn	1,500
	May 22, 1877	Owatonna, Minn	Cannon River	Mississippi River	Red Wing, Minn	3,000
	May 22, 1877	Faribault, Minn	Cannon River	Mississippi River	Red Wing, Minn	1,500

May 22, 1877	Rice County, Minn	Roberts Lake	Mississippi River	Red Wing, Minn	1,500
May 22, 1877	Rice County, Minn	French Lake	Mississippi River	Red Wing, Minn	1,000
May 24, 1877	Rochester, Minn	South Branch	Zumbro River	Red Wing, Minn	1,000
May 24, 1877	Rochester, Minn	Orono River		Red Wing, Minn	500
May 24, 1877	Olmstead County, Minn	Root River		Red Wing, Minn	500
May 26, 1877	Ramsey County, Minn	Lake Johanna	Mississippi River	Red Wing, Minn	600
May 26, 1877	Ramsey County, Minn	Rice's Pond	Mississippi River	Red Wing, Minn	600
May 26, 1877	Washington County, Minn	Bass Lake	Mississippi River	Red Wing, Minn	1,200
May 31, 1877	Hennepin County, Minn	Lake Independence	Mississippi River	Red Wing, Minn	800
May 31, 1877		Christmas Lake	Mississippi River	Red Wing, Minn	800
May 31, 1877	Anoka County, Minn	Round Lake	Mississippi River	Red Wing, Minn	800
May 31, 1877	Meeker County, Minn	Koronis Lake	Mississippi River	Red Wing, Minn	1,000
May 31, 1877	Meeker County, Minn	Ripley Lake	Mississippi River	Red Wing, Minn	1,000
May 31, 1877	Meeker County, Minn	Minnebelle Lake	Mississippi River	Red Wing, Minn	1,200
May 31, 1877		Clearwater Lake	Mississippi River	Red Wing, Minn	2,400
June 5, 1877	Chisago County, Minn	Green Lake	Mississippi River	Red Wing, Minn	1,600
June 5, 1877	Chisago County, Minn	Chisago Lake	Mississippi River	Red Wing, Minn	1,600
June 5, 1877	Pine City, Minn	Snake River	Saint Croix River	Red Wing, Minn	1,600
June 5, 1877	Carlton County, Minn	Moose Lake	Kettle River (Red River of the North).	Red Wing, Minn	800
June 5, 1877	Becker County, Minn	Detroit Lake	Pelican River	Red Wing, Minn	3,200
June 5, 1877	Hawley, Minn	Buffalo River	Red River of the North	Red Wing, Minn	800
June 5, 1877	Moorhead, Minn	Red River of the North	Lake Winnipeg	Red Wing, Minn	2,400
June 5, 1877	Olmstead County, Minn	Root River	Mississippi River	Red Wing, Minn	1,000
June 11, 1877	Wright County, Minn	Lake Charlotte	Mississippi River	Red Wing, Minn	600
June 11, 1877	Kandiyohi County, Minn	Diamond Lake	Mississippi River	Red Wing, Minn	600
June 11, 1877	Kandiyohi County, Minn	Green Lake	Mississippi River	Red Wing, Minn	600
June 11, 1877	Kandiyohi County, Minn	Eagle Lake	Mississippi River	Red Wing, Minn	600
June 11, 1877	Kandiyohi County, Minn	George Lake	Mississippi River	Red Wing, Minn	600
June 11, 1877	Morris, Minn	Pomme de Terre River	Minnesota River	Red Wing, Minn	600
June 11, 1877	Stevens County, Minn		Pomme de Terre River	Red Wing, Minn	1,200
June 11, 1877	Benson, Minn	Chippewa River	Minnesota River	Red Wing, Minn	1,200
June 11, 1877	Swift County, Minn	Saint Mary's Lake	Minnesota River	Red Wing, Minn	600
June 11, 1877	Swift County, Minn	Saint Malashy's Lake	Minnesota River	Red Wing, Minn	600
June 11, 1877	Stevens County, Minn	McCarthy's Lake	Minnesota River	Red Wing, Minn	600
June 11, 1877	Morris, Minn	Pomme de Terre River	Minnesota River	Red Wing, Minn	600
June 11, 1877	Wilkin County, Minn	Bois de Sioux River	Red River of the North	Red Wing, Minn	300
June 11, 1877	Otter Tail County, Minn	Otter Tail River	Red River	Red Wing, Minn	300
June 15, 1877	Blue Earth County, Minn	Madison Lake	Minnesota River	Red Wing, Minn	4,000
June 19, 1877	Wright County, Minn	Sugar Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Wright County, Minn	Pulaski	Mississippi River	Red Wing, Minn	500
June 19, 1877	Anoka County, Minn	Round Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Sherburne County, Minn	Clear Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Todd County, Minn	Osakin Lake	Sauk River	Red Wing, Minn	1,500
June 19, 1877	Sherburne County, Minn	Briggs Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Stearns County, Minn	Cornelian Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Stearns County, Minn	Kimball Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Stearns County, Minn	Silver Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877	Avon, Minn	Spunk Creek	Mississippi River	Red Wing, Minn	500
June 19, 1877	Anoka County Minn	Crooked Lake	Mississippi River	Red Wing, Minn	500
June 19, 1877		George Lake		Red Wing, Minn	500
June 16, 1877		Coon Lake		Red Wing, Minn	500

D.—TABLE II.—*Distribution of California salmon from* 1873 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Minnesota—Cont'd.	June 29, 1877	Kasota, Minn	Minnesota River	Mississippi River	Red Wing, Minn	1,500
	June 29, 1877	Sibley County, Minn	Silver Lake	Mississippi River	Red Wing, Minn	500
	June 29, 1877	Sibley County, Minn	Horse Shoe Lake	Mississippi River	Red Wing, Minn	500
	June 29, 1877	Le Sueur County, Minn	Lake Emily	Mississippi River	Red Wing, Minn	1,000
	June 29, 1877	Blue Earth County, Minn	Lake Crystal	Mississippi River	Red Wing, Minn	1,500
	June 29, 1877		Long Lake		Red Wing, Minn	500
	June 29, 1877		McKinsie Lake		Red Wing, Minn	500
	June 29, 1877		Mary's Lake		Red Wing, Minn	1,000
	June 29, 1877	Watonwan County, Minn	Saint James' Lake	Watonwan River	Red Wing, Minn	500
	Aug. 6, 1877	Scott County, Minn	Prior Lake	Mississippi River	Red Wing, Minn	5,000
	Spring, 1878	Blue Earth County, Minn	Minnesota River	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Brown County, Minn	Sleepy Eye Lake	Cottonwood River	Willow Brook, Minn	1,000
	Spring, 1878	Brown County, Minn	Clear Lake	Minnesota River	Willow Brook, Minn	1,000
	Spring, 1878	Brown County, Minn	Hanska Lake	Minnesota River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Moose Lake	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Bear Lake	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Cub Lake	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Moose-Horn Lake	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Chubb Lake	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Carlton County, Minn	Hanging Horn	Kettle River	Willow Brook, Minn	1,000
	Spring, 1878	Fond du Lac, Minn	Saint Louis River	Lake Superior	Willow Brook, Minn	2,000
	Spring, 1878	Carver County, Minn	Waconia Lake	Mississippi River	Willow Brook, Minn	2,000
	Spring, 1878	Carver County, Minn	Mennewasta River	Mississippi River	Willow Brook, Minn	500
	Spring, 1878	Dakota County, Minn	Kennedy Lake	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Dakota County, Minn	Lake Early	Mississippi River	Willow Brook, Minn	500
	Spring, 1878	Dakota County, Minn	South Branch	Vermillion River	Willow Brook, Minn	500
	Spring, 1878	Dakota County, Minn	Farquhar Lake	Mississippi River	Willow Brook, Minn	200
	Spring, 1878	Dakota County, Minn	McGrath's Lake	Mississippi River	Willow Brook, Minn	500
	Spring, 1878	Dakota County, Minn	Twin Lakes	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Freeborn County, Minn	Alden Lake	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Freeborn County, Minn	Pickerel Lake	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Grant County, Minn	Patchen's Lake		Willow Brook, Minn	2,000
	Spring, 1878	Grant County, Minn	Twin Lakes		Willow Brook, Minn	2,000
	Spring, 1878	Grant County, Minn	Haskins Lake		Willow Brook, Minn	2,000
	Spring, 1878	Goodhue County, Minn	Bell Creek	Cannon River	Willow Brook, Minn	5,000
	Spring, 1878	Hennepin County, Minn	Minnetonka Lake	Mississippi River	Willow Brook, Minn	3,000
	Spring, 1878	Hennepin County, Minn	Lake Rebecca	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Hennepin County, Minn	Lydard Lake	Mississippi River	Willow Brook, Minn	1,000
	Spring, 1878	Houston County, Minn	Hokah Creek	Root River	Willow Brook, Minn	2,000
	Spring, 1878	Houston County, Minn	Silver Lake	Mississippi River	Willow Brook, Minn	2,000
	Spring, 1878	Houston County, Minn	Como Lake	Mississippi River	Willow Brook, Minn	4,000
	Spring, 1878	Le Sueur County, Minn	Lake Emily	Mississippi River	Willow Brook, Minn	2,000
	Spring, 1878	Le Sueur County, Minn	Lake Washington	Cannon River	Willow Brook, Minn	1,000
	Spring, 1878	Le Sueur County, Minn	Lake Jefferson	Cannon River	Willow Brook, Minn	3,000

Spring, 1878	Mower County, Minn	Little Iowa River	Mississippi River	Willow Brook, Minn	3,000
Spring, 1878	Pope County, Minn	Lake Peterson	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Pope County, Minn	Chippewa River	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Ramsey County, Minn	Krameroth's Pond	Mississippi River	Willow Brook, Minn	200
Spring, 1878	Ramsey County, Minn	Gervais Lake	Mississippi River	Willow Brook, Minn	3,500
Spring, 1878	Rice County, Minn	Roberts Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Dudley Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Cedar Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	French Lake	Mississippi River	Willow Brook, Minn	2,000
Spring, 1878	Rice County, Minn	Shields Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Union Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Circle Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Horse Shoe Lake	Mississippi River	Willow Brook, Minn	2,000
Spring, 1878	Rice County, Minn	Spring Creek	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Cannon River	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Rice County, Minn	Gillmore's Creek	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Scott County, Minn	Credit Lake	Mississippi River	Willow Brook, Minn	3,500
Spring, 1878	Scott County, Minn	Prior Lake	Mississippi River	Willow Brook, Minn	3,500
Spring, 1878	Scott County, Minn	Spring Lake	Mississippi River	Willow Brook, Minn	4,000
Spring, 1878	Scott County, Minn	O'Dowd's Lake	Mississippi River	Willow Brook, Minn	4,000
Spring, 1878	Sherburne County, Minn	Briggs Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Sherburne County, Minn	Rush Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Sherburne County, Minn	Lake Julia	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Stearns County, Minn	Pearl Lake	Sauk River	Willow Brook, Minn	2,000
Spring, 1878	Stearns County, Minn	Pleasant Lake	Mississippi River	Willow Brook, Minn	4,000
Spring, 1878	Stearns County, Minn	Grand Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Stearns County, Minn	Kimball Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Stearns County, Minn	Cornelian Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Stearns County, Minn	Saint John's Lake	Mississippi River	Willow Brook, Minn	3,000
Spring, 1878	Stevens County, Minn	Gavin's Lake	Minnesota River	Willow Brook, Minn	1,000
Spring, 1878	Stevens County, Minn	Eagle Lake	Minnesota River	Willow Brook, Minn	1,000
Spring, 1878	Stevens County, Minn	Frog Lake	Minnesota River	Willow Brook, Minn	1,000
Spring, 1878	Stevens County, Minn	Donnelly Lake	Minnesota River	Willow Brook, Minn	1,000
Spring, 1878	Swift County, Minn	Hassel Lake	Chippewa River	Willow Brook, Minn	1,000
Spring, 1878	Mazeppa, Minn	Zumbro River	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Wabasha County, Minn	N. Br., Zumbro River	Mississippi River	Willow Brook, Minn	2,000
Spring, 1878	Washington County, Minn	Clear Lake	Mississippi River	Willow Brook, Minn	1,000
Spring, 1878	Washington County, Minn	Tanner's Lake	Mississippi River	Willow Brook, Minn	500
Spring, 1878	Wilkin County, Minn	Red River of the North	Winnipeg River	Willow Brook, Minn	3,000
Spring, 1878	Winona County, Minn	Brown's Mill Pond	Mississippi River	Willow Brook, Minn	200
Spring, 1878	Wright County, Minn	Clearwater Lake	Mississippi River	Willow Brook, Minn	3,000
Apr. 24, 1879	Goodhue County, Minn	Mill-pond	Mississippi River	Willow Brook, Minn	2,000
May 13, 1879	Stacy, Minn	Goose Creek		Willow Brook, Minn	3,000
May 23, 1879	Washington County, Minn	Silver Lake	Saint Croix River	Willow Brook, Minn	1,000
June 20, 1879	Mower County, Minn	Mary's Lake	Mississippi River	Willow Brook, Minn	1,000
June 24, 1879	Watonwan County, Minn	Cedar Lakes	Minnesota River	Willow Brook, Minn	3,000
July 1, 1879	Renville County, Minn	Lake Alley	Minnesota River	Willow Brook, Minn	2,000
July 1, 1879	Renville County, Minn	Lake Preston	Minnesota River	Willow Brook, Minn	2,000
July 21, 1879	Martin County, Minn	Chain Lake	Blue Earth River	Willow Brook, Minn	5,000
July 24, 1879	Le Sueur County, Minn	Lake Letook	Minnesota River	Willow Brook, Minn	2,500
July 24, 1879	Le Sueur County, Minn	Lake Takota	Minnesota River	Willow Brook, Minn	2,500
July 31, 1879	Waseca County, Minn	Lake Elysian	Minnesota River	Willow Brook, Minn	5,000

D.—TABLE II.—*Distribution of California salmon from* 1873 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Minnesota—Cont'd.	Sept. 18, 1879	Douglas County, Minn	Lakes	Minnesota River	Willow Brook, Minn	3,000
	Sept. 18, 1879	Wright County, Minn	Pelican Lake	Mississippi River	Willow Brook, Minn	3,000
	Oct. 23, 1879	Washington County, Minn	Lake Elmo	Saint Croix River	Willow Brook, Minn	2,000
	Nov. 11, 1879		Lake Koronis	Crow River	Willow Brook, Minn	3,000
	Nov. 11, 1879	Stevens County, Minn	Lake Foss	Pomme de Terre River	Willow Brook, Minn	2,000
	May 4, 1880	Ortonville, Minn	Big Stone Lake	Pomme de Terre River	Willow Brook, Minn	3,000
	June 3, 1880	Nobles County, Minn	Round Lake	Mississippi River	Willow Brook, Minn	4,000
	June 7, 1880	Crookston, Minn	Red Lake River	Red River of the North	Willow Brook, Minn	4,000
	June 24, 1880	Dakota County, Minn	Twin Lakes	Mississippi River	Willow Brook, Minn	2,000
	July 1, 1880	Blue Earth County, Minn	Crystal Lake	Minnesota River	Willow Brook, Minn	3,000
	July 12, 1880	Waseca County, Minn	Elysian Lake	Maple River	Willow Brook, Minn	4,000
	July 23, 1880	Frazee City, Minn	Otter Tail River	Red River of the North	Willow Brook, Minn	3,000
	July 23, 1880	Lake Park, Minn	Lake	Buffalo River	Willow Brook, Minn	1,000
	Aug. 30, 1880	Minneapolis, Minn	Mississippi River	Gulf of Mexico	Willow Brook, Minn	200
	Nov. 6, 1880		Christmas Lake		Willow Brook, Minn	1,000
Mississippi	Dec. 11, 1876	Abbeville, Miss	Yazoo River	Mississippi River	Northville, Mich	10,800
	Dec. 11, 1876	Meridian, Miss	Chickasawha River	Pascagoula River	Northville, Mich	15,200
	Dec. 11, 1876	Jackson, Miss	Forked Deer River	Pearl River	Northville, Mich	6,600
	Dec. 12, 1876	Kosciusko, Miss	Pearl River	Lake Borgne	Northville, Mich	10,800
Missouri	Dec. 15, 1876	Pacific, Mo	Meramec River	Mississippi River	Northville, Mich	15,600
	Dec. 15, 1876	Jerome, Mo	Gasconade River	Missouri River	Northville, Mich	15,400
	Dec. —, 1878	Pierce City, Mo	Capo Creek		Northville, Mich	1,000
	Dec. —, 1878	Pierce City, Mo	Capo Creek		Northville, Mich	1,000
	Dec. —, 1878	Franklin, Mo	Meramec River	Mississippi River	Anamosa, Iowa	75,000
	Dec. —, 1878	Carthage, Mo	Spring River	Arkansas River	Anamosa, Iowa	75,000
	Dec. 18, 1879	Wayne County, Mo	Saint Frances River	Mississippi River	Cedar Rapids, Iowa	15,000
	Dec. 18, 1879	Wayne County, Mo	Black River	White River	Cedar Rapids, Iowa	30,000
	Dec. 18, 1879	Doniphan, Mo	Currant River	White River	Cedar Rapids, Iowa	15,000
	Dec. 18, 1879	Carthage, Mo	Spring River	Arkansas River	Cedar Rapids, Iowa	30,000
	Dec. 18, 1879	Saint Mary, Mo	Saline River	Mississippi River	Cedar Rapids, Iowa	10,000
	—— —, 1879	Franklin, Mo	Meramec River	Mississippi River	Cedar Rapids, Iowa	90,000
	Jan. 21, 1880	Saint Joseph, Mo	Missouri River	Mississippi River	Saint Joseph, Mo	20,000
	Jan. 24, 1880	Buchanan County, Mo	Lake Contrary	Missouri River		20,000
	Feb. 9, 1880	Platte County, Mo	Sugar Lake	Missouri River	Saint Joseph, Mo	5,000
	Feb. 9, 1880	Platte County, Mo	Bean's Lake	Missouri River	Saint Joseph, Mo	5,000
	Feb. 22, 1880	Buchanan County, Mo	Platte River	Missouri River	Saint Joseph, Mo	5,000
	Feb. 22, 1880	Buchanan County, Mo	One-Hundred-and-Two River	Platte River	Saint Joseph, Mo	5,000
	Feb. 24, 1880	Gentry County, Mo	Grand River	Missouri River	Saint Joseph, Mo	10,000
	Mar. 4, 1880	Shelby County, Mo	Salt River	Mississippi River	Saint Joseph, Mo	10,000
	Mar. 4, 1880	Macon County, Mo	Chariton River	Missouri River	Saint Joseph, Mo	10,000
	Mar. 8, 1880	Jerome, Mo	Gasconade River	Missouri River	Saint Joseph, Mo	10,000
	Mar. 15, 1880	Lexington, Mo	Missouri River	Mississippi River	Saint Joseph, Mo	10,000
	Mar. 19, 1880	Independence, Mo	Blue River		Saint Joseph, Mo	10,000
	Mar. 23, 1880	Schell City, Mo	Osage River	Missouri River	Saint Joseph, Mo	10,000

	Mar. 23, 1880	Morgan County, Mo	Lamine River	Missouri River	Saint Joseph, Mo	10,000
	Apr. 5, 1880	Clinton County, Mo	Smith's Fork of Platte River	Missouri River	Saint Joseph, Mo	10,000
	Apr. 11, 1880	Buchanan County, Mo	Missouri River	Mississippi River	Saint Joseph, Mo	15,000
	June —, 1880	Saint Joseph, Mo	Hatchery Ponds		Saint Joseph, Mo	2,500
Nebraska	Jan. —, 1880	Lincoln, Nebr	Salt Creek	Platte River	South Bend, Nebr	5,000
	Jan. 21, 1880	Beatrice, Nebr	Big Blue River	Kansas River	South Bend, Nebr	5,000
	Jan. 29, 1880	McArdleville, Nebr	Big Papillion	Platte River	South Bend, Nebr	5,000
	Jan. —, 1880	Otoe County, Nebr	Four Mile Creek	Little Nemaha River	South Bend, Nebr	5,000
	Jan. —, 1880	North Platte, Nebr	Birdwood Creek	North Platte River	South Bend, Nebr	5,000
	Jan. —, 1880	Clarksville, Nebr	Prairie Creek	Platte River	South Bend, Nebr	5,000
	Jan. —, 1880	Fremont, Nebr	Rawhide Creek	Elkhorn River	South Bend, Nebr	5,000
	Jan. —, 1880	Pebble, Nebr	Pebble Creek	Elkhorn River	South Bend, Nebr	5,000
	Jan. —, 1880	Crete, Nebr	Big Blue River	Kansas River	South Bend, Nebr	5,000
Nevada	Mar. —, 1879	Reno, Nev	Truckee River	Bear River	McCloud River Station	190,000
	Mar. —, 1879	Carson River, Nev	Mexican Dam	Carson River	McCloud River Station	10,000
New Hampshire	Spring, 1876	Warren, N. H	Baker's River	Merrimac River	Winchester, Mass	50,000
	Dec. 5, 1876	Campton, N. H	Pemigewasset River	Merrimac River	Winchester, Mass	40,000
	Dec. 5, 1876	Plymouth, N. H	Pemigewasset River	Merrimac River	Winchester, Macs	40,000
	Dec. 5, 1876	Warren, N. H	Baker's River	Merrimac River	Winchester, Mass	20,000
	Dec. —, 1877	Woodstock, N. H	Headwaters	Merrimac River	Winchester, Mass	10,000
	Jan. 11, 1878	Plymouth, N. H	Baker's River	Merrimac River	Plymouth, N. H	20,000
	Jan. 12, 1878	Hillsborough Bridge, N. H	Contoocook River	Merrimac River	Plymouth, N. H	20,000
	Jan. 14, 1878	Campton, N. H	Pemigewasset River	Merrimac River	Plymouth, N. H	30,000
	Jan. 14, 1878	Plymouth, N. H	Pemigewasset River	Merrimac River	Plymouth, N. H	30,000
	Feb. 1, 1879	Campton, N. H	Pemigewasset River	Merrimac River	Plymouth, N. H	158,500
	Feb. 1, 1879	Plymouth, N. H	Pemigewasset River	Merrimac River	Plymouth, N. H	158,500
	Mar. 14, 1879	Wakefield, N. H	Newechewannock Lake	Salmon Falls	Plymouth, N. H	5,000
	Mar. 14, 1879	Wilton, N. H	Tri Echo Lake	Salmon Falls	Plymouth, N. H	5,000
	Mar. 14, 1879	Wakefield, N. H	Lorewell's Pond	Salmon Falls	Plymouth, N. H	5,000
	Mar. 14, 1879	Brookfield, N. H	Cook's Pond	Salmon Falls	Plymouth, N. H	5,000
	Mar. 14, 1879	Wolfborough, N. H	Smith's Pond	Lake Winnipesaukee	Plymouth, N. H	10,000
	Mar. 14, 1879	Hillsborough Bridge, N. H	Contoocook River	Merrimac River	Plymouth, N. H	20,000
New Jersey	Jan. 1, 1874	Bloomsbury, N. J	Delaware River	Delaware Bay	Bloomsbury, N. J	10,000
	Jan. 10, 1874	Bloomsbury, N. J	Pohatcong River	Delaware River	Bloomsbury, N. J	10,000
	Jan. 13, 1874	Raritan, N. J	Pattenburgh Creek	Raritan River	Bloomsbury, N. J	12,000
	Jan. 14, 1874	Bloomsbury, N. J	Pohatcong River	Delaware River	Bloomsbury, N. J	13,000
	Jan. 26, 1874	Bloomsbury, N. J	Musconetcong River	Delaware River	Bloomsbury, N. J	25,000
	Feb. 6, 1874	Bloomsbury, N. J	Musconetcong River	Delaware River	Bloomsbury, N. J	30,000
	Feb. 7, 1874	Raritan, N. J	Pattenburgh Creek	Raritan River	Bloomsbury, N. J	35,000
	Feb. 14, 1874	Bloomsbury, N. J	Musconetcong River	Delaware River	Bloomsbury, N. J	50,000
	Feb. 16, 1874	Bloomsbury, N. J	Ponds	Delaware River	Bloomsbury, N. J	50,000
	Jan. —, 1875	Warren County, N. J	Pequest River	Delaware River	Bloomsbury, N. J	50,000
	Jan. —, 1875	Hunterdon County, N. J	Musconetcong River	Delaware River	Bloomsbury, N. J	50,000
	Jan. —, 1875	Hunterdon County, N. J	South Branch, Raritan River	Delaware River	Bloomsbury, N. J	40,000
	Jan. —, 1875	Paterson, N. J	Ramapo River	Passaic River	Bloomsbury, N. J	2,000
	Jan. —, 1875	Hunterdon County, N. J	North and South Branch	Raritan River	Bloomsbury, N. J	3,000
	Nov. 28, 1876	Tuckahoe, N. J	Tuckahoe River	Great Egg Harbor River	New York City Aquarium	2,000
	Dec. 1, 1876	Dennisville, N. J	Dennis Creek	Delaware Bay	New York City Aquarium	2,500
	Dec. 4, 1876	Allowaystown, N. J	Alloway's Creek	Delaware River	New York City Aquarium	2,000
	Dec. 11, 1876	Vineland, N. J	Maurice River	Delaware Bay	New York City Aquarium	2,500
	Dec. 15, 1876	May's Landing, N. J	Great Egg Harbor River	Great Egg Harbor	New York City Aquarium	3,000
	Dec. 18, 1876	Glassborough, N. J	Mantua Creek	Delaware River	New York City Aquarium	1,500

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
New Jersey—Continued.	Dec. 20, 1876	Woodstown, N. J	Salem Creek	Delaware River	New York City Aquarium	3,000
	Dec. 22, 1876	Swedesborough, N. J	Oldman's Creek	Delaware River	New York City Aquarium	2,500
	Dec. 27, 1876	Williamstown, N. J	Great Egg Harbor River	Great Egg Harbor	New York City Aquarium	3,500
	Jan. —, 1877	Wenonah, N. J	Mantua Creek	Delaware River	New York City Aquarium	12,000
	Jan. —, 1877	Bloomfield, N. J	Greenwood Lake	Wallkill River	New York City Aquarium	2,000
	Feb. 1, 1877	Weymouth, N. J	Great Egg Harbor River	Great Egg Harbor	New York City Aquarium	2,000
	Feb. 5, 1877	Bridgeton, N. J	Cohansey Creek	Delaware River	New York City Aquarium	2,500
	Feb. 16, 1877	Burlington County, N. J	Mullicus River	Little Egg Harbor	New York City Aquarium	2,000
	Feb. 19, 1877	Winslow, N. J	Great Egg Harbor River	Great Egg Harbor	New York City Aquarium	2,300
	Feb. 22, 1877	Woodbury, N. J	Woodbury Creek	Delaware River	New York City Aquarium	250
	Feb. 22, 1877	Woodbury, N. J	Timber Creek	Delaware River	New York City Aquarium	250
	Feb. 23, 1877	Egg Harbor City, N. J	Mullicus River	Little Egg Harbor	New York City Aquarium	2,000
	—— —, 1877	Wenonah, N. J	Mantua Creek	Delaware River	New York City Aquarium	11,000
	Dec. 8, 1877	Cumberland County, N. J	Maurice River	Delaware Bay	New Hope, Pa	3,000
	Dec. 13, 1877	Atlantic County, N. J	Great Egg Harbor River	Great Egg Harbor	New Hope, Pa	6,000
	Dec. 13, 1877	Burlington County, N. J	Mullicus River	Little Egg Harbor	New Hope, Pa	6,000
	Dec. 17, 1877	Gloucester County, N. J	Mantua Creek	Delaware River	New Hope, Pa	3,000
	Dec. 20, 1877	Cumberland County, N. J	Cohansey Creek	Delaware River	New Hope, Pa	7,000
	Dec. 20, 1877	Cumberland County, N. J	Maurice River	Delaware Bay	New Hope, Pa	7,000
	Dec. 22, 1877	Gloucester County, N. J	Mantua River	Delaware River	New Hope, Pa	1,000
	Dec. 22, 1877	Gloucester County, N. J	Raccoon Creek	Delaware River	New Hope, Pa	1,000
	Dec. 22, 1877	Gloucester County, N. J	Oldman's Creek	Delaware River	New Hope, Pa	1,000
	Dec. 24, 1877	Gloucester County, N. J	Timber Creek	Delaware River	New Hope, Pa	3,000
	Dec. 26, 1877	Burlington County, N. J	Mullicus River	Little Egg Harbor	New Hope, Pa	6,000
	Dec. 29, 1877	Allowaystown, N. J	Alloway's River	Delaware River	New Hope, Pa	6,000
	Jan. 3, 1878	Burlington County, N. J	Mullicus River	Little Egg Harbor	New Hope, Pa	3,000
	Jan. 3, 1878	Atlantic County, N. J	Great Egg Harbor River	Great Egg Harbor	New Hope, Pa	3,000
	Jan 4, 1878	Gloucester County, N. J	Mantua Creek	Delaware River	New Hope, Pa	1,000
	Jan. 7, 1878	Cumberland County, N. J	Maurice River	Delaware Bay	New Hope, Pa	6,000
	Jan. 25, 1878	Cape May County, N. J	Tuckahoe River	Great Egg Harbor River	New Hope, Pa	4,000
	Fall, 1878	Trenton, N. J	Shoemaker's Eddy	Delaware River	Bloomsbury, N. J	150,000
	Fall, 1878	Atlantic County, N. J	Great Egg Harbor River	Great Egg Harbor	Bloomsbury, N. J	50,000
	Fall, 1878	Salem County, N. J	Alloway's Creek	Delaware River	Bloomsbury, N. J	25,000
	Fall, 1878	Cumberland County, N. J	Maurice River	Delaware Bay	Bloomsbury, N. J	25,000
	Fall, 1878	Gloucester County, N. J	Raccoon Creek	Delaware River	Bloomsbury, N. J	25,000
	Fall, 1878	Burlington County, N. J	Mullicus River	Little Egg Harbor	Bloomsbury, N. J	25,000
	Fall, 1878	Passaic County, N. J	Greenwood Lake	Greenwood Lake	Bloomsbury, N. J	22,000
	Spring, 1879	Somerset County, N. J	North Branch	Raritan River	Bloomsbury, N. J	30,000
	Spring, 1879	Somerset County, N. J	Rockaway River	Passaic River	Bloomsbury, N. J	30,000
	Spring, 1879	Bergen County, N. J	Hackensack River	Newark Bay	Bloomsbury, N. J	30,000
	Spring, 1879	Morris County, N. J	Lake Hopatcong		Bloomsbury, N. J	5,000
	Spring, 1879		Shaungum Lake		Bloomsbury, N. J	5,000
	Spring, 1879		Silver Lake		Bloomsbury, N. J	3,000
	Spring, 1879	Sussex County, N. J	Swartswood Lake		Bloomsbury, N. J	10,000

	Spring, 1879		Verona Lake		Bloomsbury, N. J	3,000
	Spring, 1879		Cline's Pond		Bloomsbury, N. J	10,000
	—— —, 1879	Trenton, N. J	Shoemaker's Eddy	Delaware River	Bloomsbury, N. J	390,000
	—— —, 1879	Warren County, N. J	Paulinskill Creek	Delaware River	Bloomsbury, N. J	30,000
	Dec. 6, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 7, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 13, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 14, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 17, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 18, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 20, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Dec. 23, 1880	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	30,000
	Mar. 24, 1881	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	14,000
	Mar. 25, 1881	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	14,000
	Mar. 26, 1881	Shoemaker's, Pa	Shoemaker's Eddy	Delaware River	State Hatchery	11,429
New York	Dec. 22, 1873	Monroe County, N. Y	Allen Creek	Genesee River	Caledonia, N. Y	15,000
	Dec. 23, 1873		Fortville Creek	Hudson River	Caledonia, N. Y	24,000
	Dec. 25, 1873		Beaver Creek	Salmon River	Caledonia, N. Y	17,000
	Dec. 26, 1873		Caledonia Springs	Genesee River	Caledonia, N. Y	2,000
	Dec. 27, 1873	Liberty, N. Y	Cohocton River	Susquehanna River	Caledonia, N. Y	16,000
	Dec. 29, 1873		Fish Creek	Oswego River	Caledonia, N. Y	18,000
	Dec. 30, 1873	Monroe County, N. Y	Allen Creek	Genesee River	Caledonia, N. Y	16,000
	Jan. 6, 1874		Sauquoit Creek	Hudson River	Caledonia, N. Y	6,000
	Jan. 6, 1874		Oriskany River	Hudson River	Caledonia, N. Y	6,000
	Jan. 19, 1874	Queens County, N. Y		Long Island Sound	Caledonia, N. Y	4,000
	Jan. 23, 1874		Brooklyn Waterworks	Long Island Sound	Bloomsbury, N. J	30,000
	Feb. 3, 1874	Herkimer County, N. Y	West Canada Creek	Hudson River	Caledonia, N. Y	1,500
	Feb. 5, 1874	Dutchess County, N. Y	Fishkill Lake	Hudson River	Caledonia, N. Y	700
	Feb. 5, 1874		Silver Lake	Hudson River	Caledonia, N. Y	800
	Feb. 10, 1874		Oneida Lake	Oswego River	Caledonia, N. Y	13,000
	Feb. 10, 1874	Sayville, N. Y	Roosevelt Creek	Long Island Sound	Caledonia, N. Y	90,000
	Feb. 14, 1874	Herkimer County, N. Y	Jocks Lake	Hudson River	Caledonia, N. Y	1,000
	Feb. 18, 1874	Herkimer County, N. Y	Mud or Hydraulic Lake	Hudson River	Caledonia, N. Y	2,000
	Feb. 18, 1874	Herkimer County, N. Y	West Canada Creek	Hudson River	Caledonia, N. Y	1,500
	Feb. 24, 1874		Cayuga Lake	Oswego River	Caledonia, N. Y	6,000
	Feb. 24, 1874	Seneca County, N. Y	Seneca Lake	Hudson River	Caledonia, N. Y	2,000
	Feb. 24, 1874	Chenango County, N. Y	Round Lake	Long Island Sound	Caledonia, N. Y	2,000
	Mar. 2, 1874		Honeoye Falls	Genesee River	Caledonia, N. Y	500
	Mar. 3, 1874	Herkimer County, N. Y	Spruce Creek	Hudson River	Caledonia, N. Y	2,000
	Dec. 9, 1874	Skaneateles, N. Y	Oswego River	Lake Ontario	Caledonia, N. Y	21,000
	Dec. 10, 1874		Fish Creek	Oswego River	Caledonia, N. Y	20,000
	Dec. 11, 1874	Fulton, N. Y	Oswego River	Lake Ontario	Caledonia, N. Y	2,000
	Dec. 15, 1874	Caledonia, N. Y	Caledonia Spring Creek	Genesee River	Caledonia, N. Y	6,750
	Dec. 15, 1874	Monroe County, N. Y	Allen Creek	Genesee River	Caledonia, N. Y	25,000
	Dec. 17, 1874	Orleans County, N. Y	Oak Orchard Creek	Lake Ontario	Caledonia, N. Y	30,000
	Dec. 18, 1874		Oneida Lake	Oswego River	Caledonia, N. Y	20,000
	Dec. 21, 1874	Fort Edward, N. Y	Fortville Creek	Hudson River	Caledonia, N. Y	15,000
	Dec. 21, 1874	Fort Edward, N. Y	Peatwig Creek	Hudson River	Caledonia, N. Y	15,000
	Dec. 21, 1874	Fort Edward, N. Y	Inglesby Creek	Hudson River	Caledonia, N. Y	15,000
	Dec. 22, 1874	Caledonia, N. Y	Caledonia Spring Creek	Genesee River	Caledonia, N. Y	6,750
	Dec. 25, 1874	Orleans County, N. Y	Sandy Creek	Lake Ontario	Caledonia, N. Y	10,000
	Dec. 30, 1874	Sand Bank, N. Y	Beaver Creek	Salmon River	Caledonia, N. Y	10,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
New York—Continued.	Dec. 30, 1874		Mohawk River	Hudson River	Caledonia, N. Y	27,000
	Jan. 2, 1875	Livingston County, N. Y	Conesus Lake	Genesee River	Caledonia, N. Y	10,000
	Jan. 9, 1875	Oneida County, N. Y	Sequoit Creek	Mohawk River	Caledonia, N. Y	8,000
	Jan. 11, 1875		Mohawk River	Hudson River	Caledonia, N. Y	20,000
	Jan. 26, 1875	Caledonia, N. Y	Caledonia Spring Creek	Genesee River	Caledonia, N. Y	6,750
	Feb. 24, 1875	Chautauqua County, N. Y	Chautauqua Lake	Allegany River	Caledonia, N. Y	1,000
	Mar. 2, 1875	Caledonia, N. Y	Caledonia Spring Creek	Genesee River	Caledonia, N. Y	6,750
	Mar. 2, 1875	Skaneateles, N. Y	Oswego River	Lake Ontario	Caledonia, N. Y	3,000
	Mar. 15, 1875	Monroe County, N. Y	Allen Creek	Genesee River	Caledonia, N. Y	25,000
	Jan. —, 1877	Long Island, N. Y	Conetquoit River		New York City Aquarium	14,000
	Jan. —, 1877		Adirondack streams		New York City Aquarium	8,000
	Jan. —, 1877	Roslyn, N. Y			New York City Aquarium	2,000
	Jan. —, 1877	Long Island, N. Y	Great River		New York City Aquarium	2,000
	Jan. —, 1877	Sayville, N. Y	Willow Brook	Hudson River	New York City Aquarium	200
	Jan. —, 1877	Morrisania, N. Y	Creek	Long Island Sound	New York City Aquarium	1,000
	Jan. 7, 1878	Caledonia, N. Y	Caledonia Spring Creek	Genesee River	Caledonia, N. Y	6,000
	Jan. 12, 1878	Wheatland, N. Y	Spring Brook	Lake Ontario	Caledonia, N. Y	4,000
	Jan. 17, 1878	Tompkins County, N. Y	Spring Creek	Cayuga Lake	Caledonia, N. Y	35,000
	Jan. 29, 1878	Oneida County, N. Y	Spring Creek	Mohawk River	Caledonia, N. Y	1,000
	Feb. 8, 1878	Monroe County, N. Y	Walter Creek	Genesee River	Caledonia, N. Y	1,000
	Mar. 11, 1878	Jefferson County, N. Y	Bowell Creek	Black River	Caledonia, N. Y	18,000
	Apr. 11, 1878	Monroe County, N. Y	Spring Creek	Blue Pond	Caledonia, N. Y	35,000
	Apr. 12, 1878	Monroe County, N. Y	Spring Brook	Lake Ontario	Caledonia, N. Y	1,000
	Dec. 5, 1878	Greene County, N. Y	Catskill Creek	Hudson River	Caledonia, N. Y	20,000
	Dec. 31, 1878	Monroe County, N. Y	Spring Creek	Genesee River	Caledonia, N. Y	10,000
	Jan. 15, 1879	Livingston County, N. Y	Spring Creek	Lake Ontario	Caledonia, N. Y	10,000
	Feb. 26, 1879	Ontario County, N. Y	Spring Brook	Hemlock Lake	Caledonia, N. Y	36,000
	Mar. 1, 1879	Cayuga County, N. Y	Spring Brook	Summer Hill Lake	Caledonia, N. Y	9,000
	Mar. 11, 1879	Livingston County, N. Y	Spring Creek	Lake Ontario	Caledonia, N. Y	1,000
North Carolina	Jan. 9, 1877	Third Creek Station, N. C	Yadkin River	Pedee River	Baltimore, Md	5,500
	Jan. 10, 1877	Graham, N. C	Reedy Fork of Haw River	Cape Fear River	Baltimore, Md	8,000
	Jan. 10, 1877	Charlotte, N. C	Catawba River	Santee River	Baltimore, Md	5,000
	Jan. 10, 1877	Raleigh, N. C	Neuse River	Pamlico Sound	Baltimore, Md	10,000
	Dec. 15, 1877	Salisbury, N. C	Yadkin River	Pedee River	Henry's, N. C	60,000
	Dec. 17, 1877	Asheville, N. C	Pigeon River	Tennessee River	Henry's, N. C	10,000
	Dec. 21, 1877	Marion, N. C	Broad River	Santee River	Henry's, N. C	25,000
	Dec. 22, 1877	Buncombe County, N. C	Swanunoa River	French Broad River	Henry's, N. C	27,000
	Jan. 1, 1878	Jamestown, N. C	Deep River	Cape Fear River	Henry's, N. C	15,000
	Jan. 5, 1878	Bridgewater, N. C	Linville River	Catawba River	Henry's, N. C	12,000
	Jan. 8, 1878	Morganton, N. C	Johns River	Catawba River	Henry's, N. C	30,000
	Jan. 9, 1878	Old Fort, N. C	Catawba River	Wateree River	Henry's, N. C	50,000
	Dec. 16, 1878	Patterson's, N. C	Yadkin River	Pedee River	Henry's, N. C	30,000
	Dec. 18, 1878	Patterson's, N. C	Yadkin River	Pedee River	Henry's, N. C	30,000
	Dec. 20, 1878	Hendersonville, N. C	Green River	Broad River	Henry's, N. C	30,000

	Dec. 27, 1878	Jamestown, N. C	Bull Run Creek	Cape Fear River	Henry's, N. C	20,000
	Dec. 31, 1878	Jamestown, N. C	North Fork Deer River	Cape Fear River	Henry's, N. C	24,500
	Jan. 2, 1879	Friendship, N. C	North Fork Deep River	Cape Fear River	Henry's, N. C	18,000
	Jan. 10, 1879	Morganton, N. C	Johns River and Upper Creek	Catawba River	Henry's, N. C	30,000
	Jan. 11, 1879	Bridgewater, N. C	Linville River	Catawba River	Henry's, N. C	30,000
	Jan. 13, 1879	Danbury, N. C	Dan River	Roanoke River	Henry's, N. C	20,000
	Jan. 15, 1879	Hickorynut Gap, N. C	Broad River		Henry's, N. C	45,000
	Jan. 18, 1879	Germanton, N. C	Town Creek	Roanoke River	Henry's, N. C	20,000
	Dec. 10, 1879	Patterson's, N. C	Yadkin River	Great Pedee River	Morganton, N. C	15,000
	Dec. 12, 1879	Morganton, N. C	Johns River	Catawba River	Morganton, N. C	10,000
	Dec. 13, 1879	Morganton, N. C	Linville River	Catawba River	Morganton, N. C	5,000
	Dec. 15, 1879	Old Fort, N. C	Catawba River	Wateree River	Morganton, N. C	5,000
	Dec. 19, 1879	Salisbury, N. C	Yadkin River	Great Pedee River	Morganton, N. C	5,000
	Dec. 19, 1879	Newton, N. C	Clark's Creek	Catawba River	Morganton, N. C	2,000
	Dec. 25, 1879	Morganton, N. C	South Fork	Catawba River	Morganton, N. C	12,000
	Dec. —, 1879	Raleigh, N. C	Ponds	Neuse River	Morganton, N. C	200
	Dec. —, 1879		Ponds		Morganton, N. C	200
	Dec. —, 1880	Morganton, N. C	Catawba River	Wateree River	Morganton, N. C	160,000
Ohio	Dec. 10, 1873	Millbrook, Ohio	Muskingum River	Ohio River	Caledonia, N. Y	20,000
	—— —, 1873	Castalia, Ohio	Castalia Spring		Caledonia, N. Y	4,000
	Jan. 13, 1874	Bucyrus, Ohio	Sandusky River	Lake Erie	Caledonia, N. Y	12,000
	Jan. 13, 1874	Eagleville, Ohio	Grand River	Lake Erie	Caledonia, N. Y	10,000
	Dec. 9, 1874	Monroeville, Ohio	Huron River	Lake Erie	Northville, Mich	10,000
	Dec. 8, 1875	Wapakoneta, Ohio	Auglaize River	Lake Erie	Northville, Mich	45,000
	Dec. 8, 1875	Sidney, Ohio	Little Miami River	Ohio River	Northville, Mich	105,000
	Jan. 1, 1877		Maumee River	Lake Erie	Northville, Mich	20,000
	May —, 1877	Elmore, Ohio	Portage River	Lake Erie	Northville, Mich	15,000
	May —, 1877	South Toledo, Ohio	Maumee River	Lake Erie	Northville, Mich	15,000
	Dec. 10, 1877	Coshocton, Ohio	Walhonding River	Ohio River	Toledo, Ohio	30,000
	Dec. 10, 1877	Coshocton, Ohio	Muskingum River	Ohio River	Toledo, Ohio	15,000
	Dec. 25, 1877	Put-in-Bay, Ohio	Lake Erie	Saint Lawrence River	Toledo, Ohio	40,000
	Dec. 25, 1877	Castalia, Ohio	Cold Creek	Lake Erie	Toledo, Ohio	10,000
	Feb. —, 1878	Columbus, Ohio	Whitstone River	Ohio River	Toledo, Ohio	20,000
	Feb. —, 1878	Newcomerstown, Ohio	Tuscarawas River	Ohio River	Toledo, Ohio	30,000
	Mar. —, 1878	Toledo, Ohio	Maumee Rapids	Lake Erie	Toledo, Ohio	30,000
	Mar. —, 1878	Defiance, Ohio	Maumee River	Lake Erie	Toledo, Ohio	30,000
	Mar. —, 1878	Huron, Ohio	Huron River	Lake Erie	Toledo, Ohio	30,000
	Mar. 10, 1879	Dayton, Ohio	Miami River	Ohio River	Toledo, Ohio	15,000
	Apr. 28, 1879	Geauga County, Ohio	Newberry Pond	Cuyahoga River	Toledo, Ohio	1,000
	May 5, 1879	Mount Vernon, Ohio		Muskingum River	Toledo, Ohio	3,000
	May 6, 1879	Licking County, Ohio	Licking Reservoir	Scioto River	Toledo, Ohio	15,000
	—— —, 1879	Castalia, Ohio	Cold Creek	Lake Erie	Toledo, Ohio	10,000
	Mar. —, 1880	Fremont, Ohio	Sandusky River	Lake Erie	Toledo, Ohio	20,000
	Mar. —, 1880	Waterville, Ohio	Maumee River	Lake Erie	Toledo, Ohio	35,000
	Spring, 1880	Toledo, Ohio	Spring Brook	Lake Erie	Toledo, Ohio	45,000
Pennsylvania	Mar. 1, 1873	Harrisburg, Pa	Susquehanna River	Chesapeake Bay	Bloomsbury, N. J	6,000
	Dec. 2, 1873	Mechanicsburg, Pa	Yellow Breeches Creek	Susquehanna River	Bloomsbury, N. J	10,000
	Dec. 8, 1873	Chambersburg, Pa	Conecocheague River	Potomac River	Marietta, Pa	10,000
	Dec. 23, 1873	Upper Paxton, Pa	Mahatonga River	Susquehanna River	Bloomsbury, N. J	10,000
	Jan. —, 1874	Donegal, Pa	Donegal Springs	Susquehanna River	Bloomsbury, N. J	16,000
	Jan. 27, 1874	Bellefonte, Pa	Bald Eagle River	Susquehanna River	Bloomsbury, N. J	15,000
	Jan. 30, 1874	Bellefonte, Pa	Bald Eagle River	Susquehanna River	Bloomsbury, N. J	15,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Pennsylvania—Continued.	Dec. 6, 1874		Conedoquinet Creek	Susquehanna River	Bloomsbury, N. J	6,000
	Dec. 21, 1874	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	60,000
	Dec. 22, 1874	Swatara, Pa	Swatara River	Susquehanna River	Marietta, Pa	30,000
	Dec. 26, 1874	Williams Mill, Pa	Yellow Breeches Creek	Susquehanna River	Marietta, Pa	30,000
	Fall, 1874	Bellefonte, Pa	Spring Creek	Bald Eagle Creek	Bloomsbury, N. J	20,000
	Fall, 1874		Mahatonga River	Susquehanna River	Bloomsbury, N. J	12,000
	Jan. 5, 1875		Buffalo Creek	Susquehanna River	Marietta, Pa	10,000
	Jan. 5, 1875		Pine Creek	Susquehanna River	Marietta, Pa	15,000
	Fall, 1875	Bushkill, Pa	Delaware River	Delaware Bay	Marietta, Pa	60,000
	Fall, 1875	Reading, Pa	Schuylkill River	Delaware River	Marietta, Pa	7,000
	Fall, 1875	Williams Mill, Pa	Yellow Breeches Creek	Susquehanna River	Marietta, Pa	30,000
	Fall, 1875	Lancaster County, Pa	Chiquesalonga Creek	Susquehanna River	Marietta, Pa	15,000
	Fall, 1875	Swatara, Pa	Swatara River	Susquehanna River	Marietta, Pa	30,000
	Fall, 1875	Marietta, Pa	Columbia Dam	Susquehanna River	Marietta, Pa	60,000
	Fall, 1875	Donegal, Pa	Donegal Springs	Susquehanna River	Marietta, Pa	8,000
	Nov. 10, 1875				Baltimore, Md	500
	Spring, 1876	Bushkill, Pa	Bushkill Creek	Delaware River	Marietta, Pa	200,000
	Spring, 1876	Williams Mill, Pa	Yellow Breeches Creek	Susquehanna River	Marietta, Pa	18,000
	Spring, 1876	Marietta, Pa	Susquehanna River	Chesapeake Bay	Marietta, Pa	30,000
	Spring, 1876	Columbia, Pa	Susquehanna River	Chesapeake Bay	Marietta, Pa	50,000
	Spring, 1876		Maiden Run	Susquehanna River	Marietta, Pa	5,000
	Fall, 1876	Brandywine, Pa	Brandywine Creek	Delaware River	Marietta, Pa	15,000
	Fall, 1876	Chickies, Pa	Chiquesalonga Creek	Susquehanna River	Marietta, Pa	30,000
	Fall, 1876	Swatara, Pa	Swatara River	Susquehanna River	Marietta, Pa	50,000
	Fall, 1876		Stony Creek	Spsquehanna River	Marietta, Pa	20,000
	Fall, 1876	Cumberland County, Pa	Conedoquinet Creek	Susquehanna River	Marietta, Pa	20,000
	Fall, 1876	Harrisburg, Pa	Susquehanna River	Chesapeake Bay	Marietta, Pa	20,000
	Fall, 1876	Wilkes Barre, Pa	Bowman's Run	Susquehanna River	Marietta, Pa	50,000
	Fall, 1876		Maiden Creek	Susquehanna River	Marietta, Pa	5,000
	Fall, 1876	Greene County, Pa		Monongahela River	Marietta, Pa	500
	Jan. 6, 1877	Bushkill, Pa		Delaware River	Marietta, Pa	78,000
	Jan. 6, 1877	Lancaster County, Pa	Chiquesalonga Creek	Susquehanna River	Marietta, Pa	32,000
	Jan. 8, 1877	Newville, Pa	Spring Creek	Susquehanna River	Marietta, Pa	22,000
	Jan. 9, 1877	Newport, Pa		Juniata River	Marietta, Pa	20,000
	Jan. 11, 1877	Bushkill, Pa		Delaware River	Marietta, Pa	23,000
	Jan. 22, 1877	Perry County, Pa	Trout Run	Juniata River	Marietta, Pa	22,000
	Jan. 25, 1877	Swatara, Pa	Swatara River	Susquehanna River	Marietta, Pa	25,000
	Apr. 2, 1877	Philadelphia, Pa	Schuylkill River	Delaware River	Marietta, Pa	15,000
	May 11, 1877	Marietta, Pa		Susquehanna River	Marietta, Pa	22,000
	May 12, 1877	Marietta, Pa		Susquehanna River	Marietta, Pa	20,000
	May 12, 1877	Marietta, Pa		Susquehanna River	Marietta, Pa	13,000
	May 14, 1877	Lancaster County, Pa	Chiquesalonga Creek	Susquehanna River	Marietta, Pa	20,000
	Dec. 28, 1877	Snyder County, Pa	Penn's Creek	Susquehanna River	Marietta, Pa	15,000
	Dec. 28, 1877	Chillisquaque, Pa	North Branch	Susquehanna River	Marietta, Pa	10,000

	Jan. 15, 1878	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	20,000
	Jan. 18, 1878	Wilkes Barre, Pa	Bowman's Creek	Susquehanna River	Marietta, Pa	25,000
	Jan. 22, 1878	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	20,000
	Jan. 28, 1878	Westport, Pa	Kettle Creek	Susquehanna River	Marietta, Pa	15,000
	Mar. 22, 1878	Pottstown, Pa		Schuylkill River	Marietta, Pa	4,000
	Dec. 6, 1878	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	22,000
	Dec. 14, 1878	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	25,000
	Dec. 18, 1878	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	25,000
	Dec. 26, 1878	Reading, Pa	Schuylkill River	Delaware River	Marietta, Pa	25,000
	Dec. 28, 1878	William's Mill, Pa	Yellow Breeches Creek	Susquehanna River	Marietta, Pa	25,000
	Jan. 9, 1879	Lewisburg, Pa	Buffalo Creek	Susquehanna River	Marietta, Pa	25,000
	Jan. 11, 1879	Williamsport, Pa	Trout Run	Susquehanna River	Marietta, Pa	25,000
	Jan. 24, 1879	Wilkes Barre, Pa	Bowman's Creek	Susquehanna River	Marietta, Pa	16,000
	Spring, 1879	Cameron County, Pa	Driftwood Brook		Corry, Pa	28,000
	Spring, 1879	Potter County, Pa	Sinnemahoning Creek		Corry, Pa	2,000
	Dec. 9, 1879	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	20,000
	Dec. 11, 1879	Tyrone, Pa	Juniata River	Susquehanna River	Marietta, Pa	18,000
	Dec. 15, 1879	Mifflinburgh, Pa	Penn Creek	Susquehanna River	Marietta, Pa	20,000
	Dec. 17, 1879	Easton, Pa	Bushkill Creek	Delaware River	Marietta, Pa	20,000
	Dec. 19, 1879	William's Mill, Pa	Yellow Breeches Creek	Susquehanna River	Marietta, Pa	18,000
	Feb. 26, 1880	Dallas, Pa	Harvey's Lake	Susquehanna River	Marietta, Pa	8,000
	Feb. 26, 1880	Wilkes Barre, Pa	Bear Lake	Delaware River	Marietta, Pa	8,000
	Mar. 10, 1880	Marietta, Pa	Susquehannah River	Chesapeake Bay	Marietta, Pa	18,000
	Spring, 1880	Cameron County, Pa	Driftwood Brook	Sinnemahoning Creek	Corry, Pa	10,000
	Spring, 1880	Cameron County, Pa	Driftwood Brook	Sinnemahoning Creek	Corry, Pa	62,000
	Spring, 1880	Blair County, Pa	Juniata River	Susquehanna River	Corry, Pa	15,000
Rhode Island	Fall of 1874	Providence County, R. I	Slatersville Branch	Blackstone River	Ponaganset, R. I	12,000
	Fall of 1874	Providence County, R. I	Pawtuxet River	Providence River	Ponaganset, R. I	35,000
	Fall of 1874	Washington County, R. I	Pawcatuck River	Little Narragansett Bay	Ponaganset, R. I	20,000
	Fall of 1874	Washington County, R. I	Artificial ponds	Pawcatuck River	Ponaganset, R. I	1,000
	Fall of 1875	West Greenwich, R. I	Wood River	Pawcatuck River	Ponaganset, R. I	10,000
	Fall of 1875	Washington County, R. I	Pawcatuck River	Little Narragansett Bay	Ponaganset, R. I	10,000
	Fall of 1875	Providence County, R. I	Slatersville Branch	Blackstone River	Ponaganset, R. I	15,000
	Fall of 1875	Providence County, R. I	Pawtuxet River	Providence River	Ponaganset, R. I	80,000
South Carolina	Jan. 10, 1877	Gaffney City, S. C	Broad River	Santee River	Baltimore, Md	5,000
	Jan. 11, 1877	Branchville, S. C	Edisto River		Baltimore, Md	4,000
	Jan. 11, 1877	Charleston, S. C	Cooper River	Charleston Bay	Baltimore, Md	2,000
	Dec. 28, 1878	Seneca, S. C	Seneca River	Savannah River	Baltimore, Md	4,000
	Jan. 7, 1879	Charlotte, N. C	Catawba River	Wateree River	Baltimore, Md	1,500
	Jan. 7, 1879	Columbia, S. C	Broad River	Santee River	Baltimore, Md	4,500
	Jan. 7, 1879	Spartanburg C. H., S. C	Packlette River	Broad River	Baltimore, Md	4,500
	Jan. 7, 1879	Greenville C. H., S. C	Saluda River	Santee River	Baltimore, Md	4,500
	Jan. 7, 1879	Orangeburg C. H., S. C	Edisto River		Baltimore, Md	5,000
	Jan. 8, 1879	Charleston County, S. C	Cooper River	Charleston Bay	Baltimore, Md	5,000
	1879		Enoree River	Broad River	Morganton, N. C	5,000
	1879		Saluda River	Santee River	Morganton, N. C	3,000
	1879		Seneca River	Savannah River	Morganton, N. C	3,000
	1879		Mossy Creek	Broad River	Morganton, N. C	3,000
	1879		Little River	Savannah River	Morganton, N. C	2,000
	1879		Martinus Creek	Savannah River	Morganton, N. C	3,000
	1879		Tugaloo River	Savannah River	Morganton, N. C	5,000
	1879		Pedee River		Morganton, N. C	7,000

D.—TABLE II.—*Distribution of California salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
South Carolina—Continued.	Spring, 1880		Enoree River	Broad River	Morganton, N. C	5,000
	Spring, 1880	Greenville C. H., S. C.	Saluda River	Santee River	Morganton, N. C	3,000
	Spring, 1880	Seneca, S. C	Seneca River	Savannah River	Morganton, N. C	3,000
	Spring, 1880		Mossy Creek	Broad River	Morganton, N. C	3,000
	Spring, 1880		Little River	Broad River	Morganton, N. C	2,000
	Spring, 1880		Martinus Creek	Savannah River	Morganton, N. C	3,000
	Spring, 1880		Tugaloo River	Savannah River	Morganton, N. C	5,000
	Spring, 1880		Pedee River		Morganton, N. C	7,000
	1880		Broad River	Santee River	Morganton, N. C	25,000
	1880	Seneca, S. C	Seneca River	Savannah River	Morganton, N. C	25,000
	1880		Wateree River	Santee River	Morganton, N. C	30,000
	1880		Saluda River	Santee River	Morganton, N. C	25,000
	1880		Edisto River		Morganton, N. C	20,000
	1880		Black River	Pedee River	Morganton, N. C	20,000
	1880		Three Runs	Savannah River	Morganton, N. C	12,000
Tennessee	Dec. 25, 1875	Memphis, Tenn	Wolf River	Mississippi River	Northville, Mich	40,000
	Dec. 10, 1876	Humboldt, Tenn	Forked Deer River	Mississippi River	Northville, Mich	2,200
	Dec. 10, 1876	Jackson, Tenn	Forked Deer River	Mississippi River	Northville, Mich	12,400
	Dec. 22, 1876	Chuck Creek, Tenn	French Broad River	Tennessee River	Baltimore, Md	5,000
	Dec. 22, 1876	Athens, Tenn	Eastannallee River	Tennessee River	Baltimore, Md	5,000
	Dec. 25, 1876	Jackson, Tenn	Forked Deer River	Mississippi River	Northville, Mich	13,400
Texas	Dec. —, 1874	Hempstead, Tex	Clear Creek	Brazos River	Niles, Mich	2,000
	Dec. —, 1874	Austin, Tex		Colorado River	Niles, Mich	12,000
	1873–1875		Streams		Niles, Mich	180,000
	Dec. 10, 1876	Hempstead, Tex	Clear Creek	Brazos River	Northville, Mich	2,000
	Dec. 11, 1876	Austin, Tex		Colorado River	Northville, Mich	18,000
Utah	Aug. —, 1873	Jordan, Utah	Jordan River	Great Salt Lake	Jordan, Utah	32,000
	Oct. —, 1874	Jordan, Utah	Jordan River	Great Salt Lake	Jordan, Utah	195,900
	Nov. —, 1875	Jordan, Utah	Jordan River	Great Salt Lake	Jordan, Utah	112,000
	Fall of 1876	Weber County, Utah	Ogden River	Great Salt Lake	Jordan, Utah	1,750
	Fall of 1876	Weber County, Utah	Weber River	Great Salt Lake	Jordan, Utah	1,750
	Fall of 1876	Cache County, Utah	Blacksmith's Fork	Lower Bear River	Jordan, Utah	8,000
	Fall of 1876	Box Elder County, Utah	Box Elder Creek		Jordan, Utah	4,000
	Fall of 1876	Tooele County, Utah	Twin Spring Creek		Jordan, Utah	2,500
	Fall of 1876	Rich County, Utah	Upper Bear River	Great Salt Lake	Jordan, Utah	11,000
	Fall of 1875	Juab County, Utah	Silver Creek		Jordan, Utah	4,000
	Fall of 1876	Davis County, Utah	Jenning's Pond	Great Salt Lake	Jordan, Utah	1,200
	Fall of 1877	Davis County, Utah	Jenning's Pond	Great Salt Lake	Jordan, Utah	2,000
	Fall of 1877	Utah County, Utah	Mill Creek	Jordan River	Jordan, Utah	16,000
	Fall of 1877	Jordan, Utah	Jordan River	Great Salt Lake	Jordan, Utah	57,000
	Spring, 1879	White's Bridge, Utah	Jordan River	Great Salt Lake	Jordan, Utah	32,000
	Spring, 1879	Forrest Farm, Utah	Spring Creek	Jordan River	Jordan, Utah	2,500
	Spring, 1879	Tooele County, Utah	Twin Spring Creek		Jordan, Utah	4,000
	Spring, 1879	Sanpete County, Utah	San Pitch River	Sevier River	Jordan, Utah	1,500
	Spring, 1879	Salt Lake County, Utah	Mill Creek	Jordan River	Jordan, Utah	4,000

	Spring, 1879	Mill Creek, Utah	Mill Creek	Jordan River	Jordan, Utah	3,000
	Spring, 1879	Jordan, Utah	Jordan River	Great Salt Lake	Jordan, Utah	7,000
Vermont	Sept. 29, 1873	Highgate, Vt	Kelly Brook	Lake Champlain	Bucksport, Me	10,000
	Dec. 22, 1873	Swanton, Vt	Missisquoi River	Lake Champlain	Bucksport, Me	15,000
	Dec. 27, 1873	Highgate, Vt	Hunkeford Brook	Missisquoi River	Bucksport, Me	5,000
	Dec. 27, 1873	Highgate, Vt	Missisquoi River	Lake Champlain	Bucksport, Me	10,000
Virginia	Jan. —, 1874	Winchester, Va	Cedar Creek	Potomac River	Bloomsbury, N. J	30,000
	Fall, 1874	Lynchburg, Va	James River	Chesapeake Bay	Lynchburgh, Va	25,000
	1874			James River	Bloomsbury, N. J	5,000
	Dec. 22, 1874	Salem, Va		Roanoke River	Bloomsbury, N. J	5,000
	Dec. 22, 1874	Central, Va	New River	Great Kanawha River	Bloomsbury, N. J	10,000
				Rappahannock River	Bloomsbury, N. J	10,000
	Jan. —, 1876	Nelson County, Va	Tye River	James River	Lexington, Va	17,000
	Jan. —, 1876	Amherst County, Va	Pedlar River	James River	Lexington, Va	10,000
	Jan. —, 1876	Alleghany County, Va	Jackson River	James River	Lexington, Va	15,000
	Jan. —, 1876	Giles County, Va	Mountain Lake	James River	Lexington, Va	3,000
	Jan. —, 1876	Botetourt County, Va	Tributaries of	James River	Lexington, Va	37,500
	Jan. —, 1876	Rockbridge County, Va	Tributaries of	James River	Lexington, Va	37,500
	Jan. —, 1876		Tributaries of	Roanoke River	Blacksburgh, Va	40,000
	Dec. 4, 1876	Strasburg, Va	Cedar Creek	Shenandoah River	Baltimore, Md	9,600
	Dec. 4, 1876	Strasburg, Va	North Fork	Shenandoah River	Baltimore, Md	29,600
	Dec. 4, 1876	Mount Jackson, Va	North Fork	Shenandoah River	Baltimore, Md	39,200
	Dec. 13, 1876	Rectortown, Va	Goose River	Potomac River	Baltimore, Md	40,000
	Dec. 13, 1876	Broad Run Station, Va	Broad Run	Occoquan Falls	Baltimore, Md	20,000
	Dec. 21, 1876	Big Spring Depot, Va	Staunton River	Roanoke River	Baltimore, Md	10,000
	1878	Lexington, Va	North River	James River	Lexington, Va	92,000
	Nov. 1, 1878	Kerr's Creek, Va	North River	James River	Lexington, Va	30,000
	Nov. 23, 1878	Buffalo Mills, Va	Buffalo Creek	James River	Lexington, Va	25,000
	Nov. 23, 1878	Lexington, Va	South River	James River	Lexington, Va	25,000
	Nov. 29, 1878	Greenville, Va	South River	Shenandoah River	Lexington, Va	65,000
	Dec. 30, 1878	Lynchburgh, Va	James River	Chesapeake Bay	Lexington, Va	60,000
	Dec. 30, 1878	Rapid Ann Station, Va	Rapidan River	Rappahannock River	Lexington, Va	40,000
	Jan. 16, 1879	Rapid Ann Station, Va	Rapidan River	Rappahannock River	Lexington, Va	20,000
	Feb. 20, 1879	Richmond, Va	New Reservoir	James River	Lexington, Va	1,000
	Feb. 24, 1879	Botetourt County, Va	Streams	James River	Lexington, Va	5,000
	Mar. 27, 1879	Kerr's Creek, Va	North River	James River	Lexington, Va	5,000
	Dec. 16, 1879	Wythe County, Va	Totes Run	New River	Wytheville, Va	20,000
	Dec. 19, 1879	Wythe County, Va	Totes Run	New River	Wytheville, Va	20,000
	Dec. 22, 1879	Wythe County, Va	Reed Creek	New River	Wytheville, Va	40,000
	Jan. 1, 1880	Atkin's Tank, Va	Middle Fork of Holston River	Tennessee River	Wytheville, Va	40,000
	Jan. 2, 1880	Sharon Springs, Va	North Fork of Holston River	Tennessee River	Wytheville, Va	50,000
	Jan. 5, 1880	Burnt Bridge, Va	North River	James River	Lexington, Va	12,500
	Jan. 5, 1880	Collierstown, Va	Collier's Creek	James River	Lexington, Va	16,000
	Jan. 5, 1880	Lexington, Va	South River	James River	Lexington, Va	16,000
	Jan. 5, 1880	Monmouth, Va	Kerr's Creek	James River	Lexington, Va	16,000
	Jan. 8, 1880	Big Spring Depot, Va	South Fork of Staunton River	Roanoke River	Wytheville, Va	38,000
	Jan. 13, 1880	Alone, Va	Buffalo Creek	James River	Lexington, Va	25,000
	Jan. 14, 1880	Montgomery White Sulphur Springs, Va.	Staunton River	Roanoke River	Wytheville, Va	20,000
	Jan. 14, 1880	Salem, Va	Staunton River	Roanoke River	Wytheville, Va	20,000
	Jan. 19, 1880	Alleghany Springs, Va	Staunton River	Roanoke River	Wytheville, Va	8,000
	Jan. 21, 1880	Prospect, Va	Appomattox River	James River	Wytheville, Va	30,000

D.—TABLE II.—*Distribution of California salmon from* 1873 *to* 1880, *inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Estimated number of fish.
Virginia—Cont'd	Jan. 31, 1880	Wytheville, Va	Totes Run	New River	Wytheville, Va	2,000
West Virginia	Jan. —, 1874	Romney, W. Va	South Fork	Potomac River	Bloomsbury, N. J	15,000
	Dec. 31, 1875	Sir John's Run, W. Va	Potomac River	Chesapeake Bay	Baltimore, Md	15,000
	Dec. 27, 1876	Keyser, W. Va	Potomac River	Chesapeake Bay	Baltimore, Md	25,000
	Dec. 28, 1876	Clarksburgh, W. Va	West Fork	Monongahela River	Baltimore, Md	8,000
	Feb. 1, 1877	Cherry Run Depot, W. Va	Cherry Run	Potomac River		14,000
	Nov. 22, 1877	Piedmont, W. Va	Potomac River	Chesapeake Bay		15,000
	Dec. —, 1877	Wheeling, W. Va				10,000
	Dec. 5, 1877	Sir John's Run, W. Va	Potomac River	Chesapeake Bay		25,000
	Dec. 7, 1877	West Union, W. Va	Middle Island Creek	Ohio River	Wheeling, W. Va	3,300
	Dec. 7, 1877	Littleton, W. Va	Fish Creek	Ohio River	Wheeling, W. Va	3,300
	Dec. 7, 1877	Wheeling, W. Va	Wheeling Creek	Ohio River	Wheeling, W. Va	3,275
	Mar. 22, 1878	Sir John's Run, W. Va	Potomac River	Chesapeake Bay		12,000
	Mar. 26, 1878	Keyser, W. Va	Potomac River	Chesapeake Bay		20,000
	Nov. —, 1878	West Union, W. Va	Middle Island Creek	Ohio River	Wheeling, W. Va	25,000
	Nov. —, 1878	Pennsborough, W. Va	Hugh's River	Ohio River	Wheeling, W. Va	25,000
	Nov. —, 1878	Wakersville, W. Va	West Fork Monongahela River	Ohio River	Wheeling, W. Va	25,000
	Nov. —, 1878	Erving's Mill, W. Va	Little Kanawha River	Ohio River	Wheeling, W. Va	25,000
	Nov. 9, 1878	Ronceverte, W. Va	Greenbrier River	Ohio River	Wheeling, W. Va	63,000
	Nov. 9, 1878	Caldwell, W. Va	Greenbrier River	Ohio River	Wheeling, W. Va	88,000
	Nov. —, 1878	Lewisburgh, W. Va	Sinking Creek	Ohio River	Wheeling, W. Va	2,000
	Nov. —, 1878	Charleston, W. Va	Kanawha River	Ohio River	Wheeling, W. Va	60,000
	Nov. —, 1878			Potomac River		40,000
	Dec. 4, 1878			Potomac River	Baltimore, Md	20,000
	Dec. —, 1878	Mannington, W. Va	Fishing Creek	Ohio River	Wheeling, W. Va	37,500
	Dec. 4, 1878	Littleton, W. Va	Fish Creek	Ohio River	Wheeling, W. Va	37,500
	Dec. —, 1878	Cold Spring, W. Va	Wheeling Creek	Ohio River	Wheeilng, W. Va	25,000
	Dec. —, 1878	Bethany, W. Va	Buffalo Creek	Ohio River	Wheeling, W. Va	25,000
	Dec. —, 1878	Fairview, W. Va	King's Creek	Ohio River	Wheeling, W. Va	25,000
	Dec. 10, 1879	Harper's Ferry, W. Va	Potomac River	Chesapeake Bay	Druid Hill, Md	15,000
	Jan. 1, 1880	Keyser, W. Va	Potomac River	Chesapeake Bay	Druid Hill, Md	8,000
	1879–1880	Burton, W. Va	Fish Creek	Ohio River	Wheeling, W. Va	20,000
	1879–1880	Bethany, W. Va	Buffalo Creek	Ohio River	Wheeling, W. Va	20,000
	1879–1880	Parkersburgh, W. Va		Ohio River	Wheeling, W. Va	5,000
	1879–1880	Littleton, W. Va	Fish Creek	Ohio River	Wheeling, W. Va	35,000
	1879–1880	Bellton, W. Va	Fish Creek	Ohio River	Wheeling, W. Va	40,000
	1879–1880	Hampshire County, W. Va	Tributaries of	Potomac River	Wheeling, W. Va	19,500
	1879–1880	Grant County, W. Va	Luney's Creek		Wheeling, W. Va	20,000
	1879–1880	Grant County, W. Va	William's Ponds		Wheeling, W. Va	3,500
	1879–1880	Barbour County, W. Va	Tygart's Valley River		Wheeling, W. Va	5,000
	1879–1880	Randolph County, W. Va	Tygart's Valley River		Wheeling, W. Va	5,000
	1879–1880	Marion County, W. Va			Wheeling, W. Va	2,000
	1879–1880	Mineral County, W. Va		Potomac River	Wheeling, W. Va	500
	1879–1880	Jefferson County, W. Va		Potomac River	Wheeling, W. Va	1,000
	1879–1880	Hampshire County, W. Va		Potomac River	Wheeling, W. Va	800

	1879-1880	Hampshire County, W. Va		Potomac River	Wheeling, W. Va	200
	1879-1880		Greenbrier River	Kanawha River	Wheeling, W. Va	10,000
	1879-1880	Ronceverte, W. Va	Greenbrier River	Kanawha River	Wheeling, W. Va	12,000
	1879-1880	Hinton, W. Va	New River	Ohio River	Wheeling, W. Va	10,000
	1879-1880	Charleston, W. Va	Elk River	Kanawha River	Wheeling, W. Va	10,000
Wisconsin	1874	Grant County, Wis	Streams	Mississippi River	Boscobel, Wis	6,000
	1874	Crawford County, Wis	Streams	Mississippi River	Boscobel, Wis	6,000
	1874	La Fayette County, Wis	Streams	Mississippi River	Boscobel, Wis	7,000
	Dec. —, 1874	Green Lake County, Wis	Green Lake		Boscobel, Wis	10,000
	1875	Walworth, Wis	Geneva Lake	White River	Geneva Lake, Wis	25,000
	Jan. 17, 1876		Tributaries	Mississippi River	Boscobel, Wis	22,000
	1876	Walworth, Wis	Geneva Lake	White River	Geneva Lake, Wis	60,000
	Jan. 17, 1877	Geneva, Wis	Geneva Lake	White River	Geneva Lake, Wis	15,000
	1877	Sauk County, Wis	Spirit Lake	Wisconsin River	Madison, Wis	10,000
	1877	Walworth County, Wis	Geneva Lake	White River	Madison, Wis	15,000
	1877	Waushara County, Wis	Wautoma Lake	Fox River	Madison, Wis	6,000
	1877	Waukesha County, Wis	Oconomowoc Lake	Oconomowoc Creek	Madison, Wis	4,800
	1877	Dane County, Wis	Mendota Lake	Catfish River	Madison, Wis	15,800
	1877	Ravine County, Wis	Brown's Lake	Lake Michigan	Madison, Wis	2,400
	1877	Chippewa County, Wis	Three-Mile Lake	Chippewa River	Madison, Wis	8,500
	1877	Madison, Wis	Pond at hatching	Catfish River	Madison, Wis	8,060
	1877	Richland Centre, Wis	Pine River	Wisconsin River	Madison, Wis	2,000
	Oct. 5, 1877	Boscobel, Wis	Streams	Wisconsin River	Madison, Wis	6,000
	Oct. 18, 1877	Madison, Wis	Mendota Lake	Catfish River	Madison, Wis	6,000
	Jan. 18, 1878	Madison, Wis	Creek	Mendota Lake	Madison, Wis	50
	Mar. 22, 1878	Lodi, Wis	Spring Creek	Wisconsin River	Madison, Wis	15,000
	Mar. 23, 1878	Poynette, Wis		Wisconsin River	Madison, Wis	15,000
	Mar. 24, 1878	Hartman, Wis		Wisconsin River	Madison, Wis	12,000
	Apr. 4, 1878	Boscobel, Wis	Streams	Wisconsin River		600
	Apr. 27, 1878	Walworth County, Wis	Perch Lake		Madison, Wis	5,000
	Apr. 29, 1878	Walworth County, Wis	Boothe's Creek		Madison, Wis	10,000
	June 13, 1878	Portage, Wis	Silver Lake	Wisconsin River	Madison, Wis	150
	June 13, 1878	Portage, Wis	Wisconsin River	Mississippi River	Madison, Wis	8,000
	1878	Walworth County, Wis	Geneva Lake	White River	Geneva Lake, Wis	200,000
	1879	Tunnel City, Wis	Lemonweir River	Wisconsin River	Madison, Wis	4,000
	1879	Richfield, Wis	Cedar Creek	Milwaukee River	Madison, Wis	5,000
	1879	Brodhead, Wis	Sugar River	Rock River	Madison, Wis	10,000
	1879	Tomah, Wis	Lemonweir River	Wisconsin River	Madison, Wis	2,100
	1879		Ponds (Mr. Labar's)		Madison, Wis	1,000
	1879	Clear Lake, Wis	Willow River	Mississippi River	Madison, Wis	1,500
	1879	Tunnel City, Wis	Lemonweir River	Wisconsin River	Madison, Wis	60
	1879	Sparta, Wis	La Crosse River	Mississippi River	Madison, Wis	15,000
	1879		(D. Anthony)		Madison, Wis	1,000
	1879		Mr. Severance		Madison, Wis	1,000
	1879		Fish Lake	Red Cedar River	Madison, Wis	250
	1879		Pond (D. Sykes)		Madison, Wis	800
	1879		Nagawica Lake	Menomonee River	Madison, Wis	1,500
	1879	Racine County, Wis	Brown's Lake		Madison, Wis	5,000
	1879		Nine Springs Creek		Madison, Wis	3,000
	1879	Walworth County, Wis	Geneva Lake	White River	Madison, Wis	200,000
	Dec. 15, 1880	Geneva, Wis	Creek	Geneva Lake	Madison, Wis	90,000

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive.*

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
California	1878	Nevada County, Cal	Donner Lake	Truckee River	San Leandro, Cal	5,000
	1878	Placer County, Cal	Sereno Lake		San Leandro, Cal	5,000
	1878	San Mateo County, Cal	Felch's Lake		San Leandro, Cal	5,000
	1878	Monterey County, Cal	Espinoza Lake		San Leandro, Cal	5,000
	1878	San Francisco, Cal	Woodward Aquarium		San Leandro, Cal	500
	1878	Tulare County, Cal	Tulare Lake		San Leandro, Cal	15,000
	1878	Alameda County, Cal	Lake Chabot		San Leandro, Cal	2,500
	1878	Alameda County, Cal	Arroyo Laguna		San Leandro, Cal	700
	1878	San Francisco County, Cal	Laguna Honda		San Leandro, Cal	1,000
	1878	El Dorado County, Cal	Echo Lake		San Leandro, Cal	250
Connecticut	1876	South Kent, Conn	Spectacle Pond		Westport and Waltonia, Conn	10,000
	1876	Winsted, Conn	Long Lake		Westport and Waltonia, Conn	10,000
	1876	Chapinville, Conn	Twin Lakes		Westport and Waltonia, Conn	10,000
	1876	Lakeville, Conn	Wononscoponuc Lake		Westport and Waltonia, Conn	10,000
	1876	Norfolk, Conn	Smith Pond		Westport and Waltonia, Conn	10,000
	1876	Warren, Conn	Waramang Lake		Westport and Waltonia, Conn	10,000
	1876	Litchfield, Conn	Bantam Lake		Westport and Waltonia, Conn	15,000
	1876	Voluntown, Conn	Beach Pond		Westport and Waltonia, Conn	10,000
	1876	East Hampton, Conn	Hampton Pond		Westport and Waltonia, Conn	10,000
	1876	Rockville, Conn	Snipsic Lake		Westport and Waltonia, Conn	10,000
	1876	Lyme, Conn	Rogers Lake		Westport and Waltonia, Conn	10,000
	1876	Windham, Conn	Shetucket Waters		Westport and Waltonia, Conn	10,000
	1876	Salem, Conn	Gardiner's Lake		Westport and Waltonia, Conn	10,000
	1877	New Preston, Conn	Waramang Lake		Westport and Waltonia, Conn	5,000
	1877	Litchfield, Conn	Bantam Lake		Westport and Waltonia, Conn	5,000
	1877	Lyme, Conn	Hog Lake		Westport and Waltonia, Conn	5,000
	1877	Salem, Conn	Gardiner's Lake		Westport and Waltonia, Conn	5,000
	1877	Salisbury, Conn	Twin Lakes		Westport and Waltonia, Conn	5,000
	1877	Lakeville, Conn	Wononscoponuc Lake		Westport and Waltonia, Conn	5,000
	1877	Kent, Conn	Spectacle Ponds		Westport and Waltonia, Conn	5,000
	1877	Rockville, Conn	Snipsic Lake		Westport and Waltonia, Conn	5,000
	1877	East Hampton, Conn	Hampton Pond		Westport and Waltonia, Conn	5,000
	1877	Winsted, Conn	Long Lake		Westport and Waltonia, Conn	5,000
	1877	South Coventry, Conn	Wangambourg Pond		Westport and Waltonia, Conn	5,000
	1877	South Windham, Conn	Balahack Brook		Westport and Waltonia, Conn	5,000
	1877	East Haven, Conn	Saltonstall Lake		Westport and Waltonia, Conn	1,000
	1877	Branford, Conn	Roger's Pond		Westport and Waltonia, Conn	1,000
	1877	Woodbridge, Conn	Valley Pond		Westport and Waltonia, Conn	500
	1878	Salisbury, Conn	Twin Lakes		North Branford, Conn	10,000
	1878	Kent, Conn	Spectacle Ponds		North Branford, Conn	10,000
	1878	Sherman, Conn	Square Pond		North Branford, Conn	5,000
	1878	Sherman, Conn	Green Pond		North Branford, Conn	5,000
	1878	Salem, Conn	Gardiner's Lake		North Branford, Conn	10,000
	1878	Lyme, Conn	Hog Lake		North Branford, Conn	10,000

	1878	Rockville, Conn	Snipsic Lake		North Branford, Conn	10,000
	1878	East Hampton, Conn	Hampton Pond		North Branford, Conn	10,000
	1878	Litchfield, Conn	Bantam Lake		North Branford, Conn	10,000
	1878	South Coventry, Conn	Wauramang Lake		North Branford, Conn	10,000
	1878	West Winsted, Conn	Long Lake		North Branford, Conn	10,000
	1878	Stafford Springs, Conn	Stafford Springs Reservoir		North Branford, Conn	10,000
	1878	Thompsonville, Conn	Brooks	Connecticut River	North Branford, Conn	10,000
	1878	Lyme, Conn	Rogers Lake		North Branford, Conn	15,000
	1878	Willimantic, Conn	Brooks	Thames River	North Branford, Conn	15,000
	1878	New Haven, Conn	Salterstall Lake		North Branford, Conn	10,000
	1878	Woodbridge, Conn	Valley Pond		North Branford, Conn	5,000
	1879	Ridgefield, Conn	Round Pond	Housatonic River	Westport, Conn	10,000
	1879	Danbury, Conn	Lake Kenosha	Housatonic River	Westport, Conn	10,000
	1879	Chapinville, Conn	Twin Lakes	Housatonic River	Westport, Conn	5,000
	1879	Sherman, Conn	Green Pond	Housatonic River	Westport, Conn	5,000
	1879	Lakeville, Conn	Wononscoponuc Lake	Housatonic River	Westport, Conn	5,000
	1879	Stafford Springs, Conn	Stafford Springs Reservoir	Thames River	Westport, Conn	10,000
	1879	West Winsted, Conn	Long Lake	Naugatuck River	Westport, Conn	10,000
	1879	East Haven, Conn	Saltonstall Lake		Westport, Conn	10,000
	1879	Lyme, Conn	Hog Lake	Connecticut River	Westport, Conn	10,000
	1879	Salem, Conn	Gardiner's Lake	Thames River	Westport, Conn	10,000
	1879	Newtown, Conn	Tributary	Housatonic River	Westport, Conn	10,000
	1879	New Preston, Conn	Wauramang Lake	Housatonic River	Westport, Conn	10,000
	1879	Litchfield, Conn	Bantam Lake	Housatonic River	Westport, Conn	10,000
	1879	East Hampton, Conn	Lake Pocatapang	Connecticut River	Westport, Conn	10,000
	1879	Willimantic, Conn	Tributaries	Thames River	Westport, Conn	10,000
	1879	South Coventry, Conn	Wangabonig Lake	Thames River	Westport, Conn	10,000
	1879	West Hartford, Conn	Reservoir	Connecticut River	Westport, Conn	3,715
	1879	Melrose, Conn	Melrose Pond	Connecticut River	Westport, Conn	10,000
	1879	Rockville, Conn	Snipsic Lake	Connecticut River	Westport, Conn	10,000
	1879	Southport, Conn	Southport Pond	Mill River	Westport, Conn	10,000
	1880	Durham, Conn	Pitsquog Pond	Connecticut River	Poquonock, Conn	5,000
	1880	Higganum, Conn	Higganum Reservoir	Connecticut River	Poquonock, Conn	5,000
	1880	Lyme, Conn	Rogers Lake	Long Island Sound	Poquonock, Conn	5,000
	1880	Guilford, Conn	Limepaug Lake	Long Island Sound	Poquonock, Conn	5,000
	1880	Sandy Hook, Conn	Halfway River	Housatonic River	Poquonock, Conn	5,000
	1880	Falls Village, Conn	Canaan Mountain Pond	Housatonic River	Poquonock, Conn	5,000
	1880	Danbury, Conn	Kanesiac Pond	Housatonic River	Poquonock, Conn	5,000
	1880	Brookfield, Conn	Still River	Housatonic River	Poquonock, Conn	5,000
	1880	Woodbury, Conn	Pomeraug River	Naugatuck River	Poquonock, Conn	5,000
	1880	Southport, Conn	Perry's Pond	Long Island Sound	Poquonock, Conn	5,000
	1880	Mianus, Conn	Mianus River	Long Island Sound	Poquonock, Conn	5,000
	1880	Middlebury, Conn	Quasepaug Lake	Naugatuck River	Poquonock, Conn	5,000
	1880	Plainville, Conn	Plainville Reservoir	Farmington River	Poquonock, Conn	5,000
	1880	Meriden, Conn	Black Pond	Quinipiac River	Poquonock, Conn	5,000
	1880	Bolton, Conn	Bolton Reservoir	Hockanum River	Poquonock, Conn	5,000
	1880	Windsor, Conn	Scantic River	Connecticut River	Poquonock, Conn	5,000
	1880	Broad Brook, Conn	Broad Brook	Connecticut River	Poquonock, Conn	5,000
	1880	Granby, Conn	Salmon River	Farmington River	Poquonock, Conn	5,000
	1880	Hartford, Conn	Colt's Reservoir		Poquonock, Conn	1,000
Illinois	1878	Richmond, Ill	Twin Lakes		Elgin, Ill	4,000
	1878	Elgin, Ill	Pond		Elgin, Ill	200

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
Illinois—Continued	1878	Trenton, Ill	Pond		Elgin, Ill	200
Indiana	1878				Pokagon, Mich	25,000
	1880	La Porte, Ind	Stony Lake		Pokagon, Mich	10,000
Iowa	1878	De Witt, Clinton County, Iowa	Silver Creek		Anamosa, Iowa	3,000
	1878	Clear Lake, Cerro Gordo County, Iowa.	Clear Lake		Anamosa, Iowa	3,000
	1878	Cedar Rapids, Iowa	Cedar River		Anamosa, Iowa	3,000
	1878	Tama City, Iowa	Iowa River		Anamosa, Iowa	3,000
	1878	Boone, Iowa	Des Moines River		Anamosa, Iowa	3,000
	1878	Anamosa, Iowa	Hatching ponds		Anamosa, Iowa	5,000
Kansas	1879	Ellsworth County, Kans	Smoky Hill River	Kansas River	Ellsworth, Kans	10,000
	1879	McPherson County, Kans	Inman Lake		Ellsworth, Kans	10,000
	1880	Fort Harker, Kans	Howard's Lake	Smoky Hill River	Ellsworth, Kans	1,000
	1880	Wilson, Kans	Pond	Smoky Hill River	Ellsworth, Kans	600
	1880	Ellsworth, Kans	Pond	Smoky Hill River	Ellsworth, Kans	200
	1880	Venango, Kans	Pond	Smoky Hill River	Ellsworth, Kans	500
	1880	Bluffville, Kans	Bluff Creek	Smoky Hill River	Ellsworth, Kans	500
	1880	Trivoli, Kans	Bradley Spring	Smoky Hill River	Ellsworth, Kans	500
	1880	Farisville, Kans	Elm Creek	Smoky Hill River	Ellsworth, Kans	500
	1880	Farisville, Kans	Clear Creek	Smoky Hill River	Ellsworth, Kans	500
	1880	Farisville, Kans	Clear Creek	Smoky Hill River	Ellsworth, Kans	500
	1880	Trivoli, Kans	Spring Creek	Smoky Hill River	Ellsworth, Kans	500
	1880	Ellsworth, Kans	Ash Creek	Smoky Hill River	Ellsworth, Kans	1,000
	1880	Fort Harker, Kans	Spring Creek	Smoky Hill River	Ellsworth, Kans	3,000
Kentucky	1878	Taylorsville, Ky	Asher's Creek	Salt River	Louisville, Ky	1,000
	1878	Somerset, Ky	Pitman Creek	Cumberland River	Louisville, Ky	1,000
	1878	Smith's Grove, Ky	Pond		Louisville, Ky	500
	1878	Versailles, Ky	Pond		Louisville, Ky	500
	1878	Elizabethtown, Ky	Nolin Creek	Green River	Louisville, Ky	1,000
	1878	Covington, Ky	Glasser's Lake		Louisville, Ky	500
	1878	Vanceburgh, Ky	Kinniconick Creek	Ohio River	Louisville, Ky	1,000
Maine	1874		Kennebago Stream			2,000
	1876		Grand Lake	Saint Croix Stream		250,000
	1877		Grand Lake	Saint Croix Stream		110,000
	1878	Charlotte, Me	Moosehorn Waters	Pemaquan River	Pembroke, Me	15,000
	1878	Charlotte, Me	Sprague's Pond	Pemaquan River	Pembroke, Me	5,000
	1878	Cooper, Me	Cathance Lake	Denny's River	Pembroke, Me	10,000
	1878	Charlotte, Me	Crocker's Lake	Pemaquan River	Pembroke, Me	5,000
	1878	Aroostook County, Me	Drew's Lake	Meduxnekeag River	Houlton, Me	3,000
	1878	Aroostook County, Me	Limerick Lake	Meduxnekeag River	Houlton, Me	2,000
	1878	Enfield, Me	Cold Spring Pond	Penobscot River	Bucksport, Me	5,000
	1878	Newport, Me	Newport Pond	Kennebec River	Bucksport, Me	4,000
	1878	Washington County, Me	Grand Lake	Saint Croix River	Bucksport, Me	437,000
	1878	Calais, Me	Keene's Lake	Saint Croix River	Grand Lake Stream, Me	10,000

	1879	Mount Kineo, Me	Moosehead Lake	Kennebec River	Bucksport, Me	20,000
	1879	Damariscotta, Me	Pond		Bucksport, Me	5,000
	1879	Unity, Me	Pond		Bucksport, Me	5,000
	1879	Auburn, Me	Pond		Bucksport, Me	5,000
	1879	Dexter, Me	Pond		Bucksport, Me	5,000
	1879	Glenburn, Me	Pushaw Pond		Bucksport, Me	10,000
	1879	Manchester, Me	Cobbosseecontee Lake		Bucksport, Me	5,000
	1879	Washington County, Me	Grand Lake	Saint Croix River	Grand Lake Stream, Me	384,000
	1879	Calais, Me	Nash's Lake	Saint Croix River	Grand Lake Stream, Me	10,600
Maryland	1878	Weverton, Md	Pond	Potomac River	Baltimore, Md	500
	1878	Spencerville, Md	Stream	Patuxent River	Baltimore, Md	500
	1878	Emmittsburgh, Md	Crystal Iron Springs	Monocacy River	Baltimore, Md	2,500
	1878	Forestville, Md	Pond	Patuxent River	Baltimore, Md	1,000
	1878	Hood's Mills, Md	Pond	Patapsco River	Baltimore, Md	3,500
	1878	Roisterstown, Md	Pond	Gwynn's Falls	Baltimore, Md	250
	1878	Cockeysville, Md	Gunpowder River		Baltimore, Md	23,000
	1878	Elk Ridge Landing, Md	Cascade Branch	Patapsco River	Baltimore, Md	500
	1878	Westminster, Md	Pond	Patapsco River	Baltimore, Md	1,000
	1878	Deer Park, Md	Pond		Baltimore, Md	7,831
	1879	Baltimore, Md	Stream	Beaverdam Creek	Baltimore, Md	750
	1879		Stream	Susquehanna River	Baltimore, Md	1,000
	1879	Baltimore, Md	Pond	Charles River	Baltimore, Md	500
	1879	Baltimore, Md	Druid Hill Lake		Baltimore, Md	8,000
	1879	Baltimore, Md	Druid Hill Lake		Baltimore, Md	2,000
	1879	Baltimore, Md	Druid Hill Lake		Baltimore, Md	2,000
	1879	Westminster, Md	Pond	Little Pipe Creek	Baltimore, Md	1,000
	1879	Westminster, Md	Cobb's Branch	Little Pipe Creek	Baltimore, Md	2,000
	1879	Hampton, Md	Pond	Gunpowder River	Baltimore, Md	1,000
	1879	Baltimore, Md	Lake	Stony Run	Baltimore, Md	500
	1879	Union Bridge, Md	Pond	Big Pipe Creek	Baltimore, Md	500
	1879	Union Bridge, Md	Pond	Big Pipe Creek	Baltimore, Md	1,000
	1879	Reisterstown, Md	Lake	Patapsco Falls	Baltimore, Md	500
	1879	Baltimore, Md	Druid Hill Pond		Baltimore, Md	2,000
	1879	Harford County, Md	Green Spring Run	Jones Falls	Baltimore, Md	1,500
	1879	Baltimore, Md	Druid Hill Lake	Jones' Falls	Baltimore, Md	1,000
	1879	Easton, Md	Pond	Miles' Creek	Baltimore, Md	250
	1879	Easton, Md	Pond		Baltimore, Md	250
	1879	Easton, Md	Pond	Miles' Creek	Baltimore, Md	500
	1879	Easton, Md	Pond	Miles' Creek	Baltimore, Md	250
	Mar. 22, 1880	Buckeystown, Md	Pond	Monocacy River	Baltimore, Md	200
	Apr. 5, 1880	Oakland, Md	Little Youghiogheny	Potomac River	Baltimore, Md	3,000
	Apr. 15, 1880	Buckeystown, Md	Pond	Monocacy River	Baltimore, Md	500
	Apr. 18, 1880	Pikesville, Md	Pond	Gwynn's Falls	Baltimore, Md	500
	Apr. 19, 1880	Green Spring, Md	Pond	Lake Roland	Baltimore, Md	500
	Apr. 19, 1880	Carrollton, Md	Pond	Patapsco Falls	Baltimore, Md	500
	Apr. 20, 1880	Oakland, Md	Pond	Patuxent River	Baltimore, Md	500
	Apr. 20, 1880	Baltimore, Md	Pond	Patuxent River	Baltimore, Md	500
	Apr. 20, 1880	Airy Hill, Baltimore County, Md.	Pond	Gwynn's Falls	Baltimore, Md	500
	Apr. 20, 1880	Baltimore, Md	Trout Branch	Patuxent River	Baltimore, Md	500
	Apr. 21, 1880	Unionville, Md	Pond	Linganore Creek	Baltimore, Md	500
	Apr. 22, 1880	Wilna, Md	Winter's Run	Bush River	Baltimore, Md	500

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
Maryland—Cont'd.	Apr. 24, 1880	Baltimore, Md	Pond	Gunpowder River	Baltimore, Md	500
	Apr. 26, 1880	Catonsville, Md	Pond	Gwynn's Falls	Baltimore, Md	500
	Apr. 28, 1880	Clear Spring, Md	Mill-dam	Potomac River	Baltimore, Md	500
	Apr. 28, 1880	Bel Air, Md	Pond	Bush River	Baltimore, Md	500
	Apr. 30, 1880	Eden, Md	Pond	Patapsco River	Baltimore, Md	500
	May 1, 1880	Baltimore, Md	Patuxent River	Chesapeake Bay	Baltimore, Md	500
	May 4, 1880		Dripping Spring	Gunpowder River	Baltimore, Md	200
	May 6, 1880	Long Green, Md	Pond	Big Gunpowder River	Baltimore, Md	500
	May 8, 1880	Norrisville, Md	Pond	Deer Creek	Baltimore, Md	500
	May 11, 1880	Frederick, Md	Monocacy River	Potomac River	Baltimore, Md	500
	May 13, 1880	Mount Pleasant, Md	Pond	Monocacy River	Baltimore, Md	500
	May 14, 1880	Denton, Md.	Pond	Choptank River	Baltimore, Md	500
	May 17, 1880	Baltimore, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 18, 1880	Fairview, Md	Bush Run	Conocheague River	Baltimore, Md	500
	May 18, 1880	Sulphur Spring, Md	Pond	Patapsco River	Baltimore, Md	500
	May 24, 1880	York Road, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 27, 1880	Sandy Spring, Md	Pond	Patuxent River	Baltimore, Md	500
	May 27, 1880	Sandy Spring, Md	Pond	Northwest River	Baltimore. Md	500
Massachusetts	1876	Sandwich, Mass	Spectacle Pond		Winchester, Mass	3,500
	1876	Winchendon, Mass	Dennison Lake		Winchester, Mass	3,000
	1876	Lunenburgh, Mass	Unkechewalom Pond		Winchester, Mass	4,000
	1876	Lincoln, Mass	Sandy Pond		Winchester, Mass	3,000
	1876	Boxford, Mass	Mitchell's Pond	Ipswich River	Winchester, Mass	4,000
	1876	Westfield, Mass	Congamond Lake		Winchester, Mass	5,000
	1876	South Weymouth, Mass	Weymouth Great Pond		Winchester, Mass	3,000
	1876	Pittsfield, Mass	Pontoosuc Lake		Winchester, Mass	4,000
	1876	North Sandwich, Mass	Great Herring		Winchester, Mass	5,000
	1876	Mendon, Mass	Nipmug Pond		Winchester, Mass	3,000
	1876	South Abington, Mass			Winchester, Mass	3,000
	1876	Wellesley, Mass			Winchester, Mass	3,000
	1876	North Andover, Mass	Great Pond		Winchester, Mass	5,000
	1876	Plymouth, Mass	Halfway Pond		Winchester, Mass	3,000
	1876	Ashburnham, Mass	Nankeag Lake		Winchester, Mass	5,000
	1876	Lancaster, Mass	Ponds		Winchester, Mass	15,000
	1876	Pittsfield, Mass	Pontoosuc Lake		Winchester, Mass	8,000
	1876	South Carver, Mass			Winchester, Mass	3,000
	1876	Cotuit, Mass			Winchester, Mass	4,000
	1876	Berlin, Mass	Gates Pond		Winchester, Mass	3,000
	1876	Athol, Mass			Winchester, Mass	3,000
	1876	Natick, Mass	Dug Pond		Winchester, Mass	3,500
	1876	Framingham, Mass	Sudbury River		Winchester, Mass	3,000
	1876	Winchester, Mass	Wedge Pond		Winchester, Mass	3,000
	1876	Winchester, Mass	Mystic Lake		Winchester, Mass	3,000
	1876	Plymouth, Mass	Halfway Pond		Winchester, Mass	90,000

1877	Wakefield, Mass	Lake Quannapowitt		Winchester, Mass	4,000
1877	Waltham, Mass	Ponds		Winchester, Mass	1,200
1877	Lunenburgh, Mass	Unkechewalom Pond		Winchester, Mass	4,000
1877	Lincoln, Mass	Sandy Pond		Winchester, Mass	4,000
1877	Middleborough, Mass	Assawampsett Lake		Winchester, Mass	20,000
1877	Newton, Mass	Crystal Lake		Winchester, Mass	3,000
1877	South Weymouth, Mass	Weymouth Great Pond		Winchester, Mass	4,000
1877	Winchendon Mass	Dennison Lake		Winchester, Mass	4,000
1877	Greenwood, Mass	Crystal Lake		Winchester, Mass	4,000
1877	East Bridgewater, Mass	Sautucket River		Winchester, Mass	4,000
1877	Ashburnham, Mass	Nankeag Lake		Winchester, Mass	5,000
1877	Boxford, Mass	Mitchell's Pond	Ipswich River	Winchester, Mass	3,000
1877	Middleton, Mass	Middleton Pond		Winchester, Mass	2,500
1877	Wellfleet, Mass	Gull Pond		Winchester, Mass	5,000
1877	Georgetown, Mass	Pentucket Pond		Winchester, Mass	2,000
1877	Georgetown, Mass	Rock Pond		Winchester, Mass	2,000
1877	Wilbraham, Mass	Nine-Mile Pond		Winchester, Mass	5,000
1877	Sandwich, Mass	Spectacle Pond		Winchester, Mass	4,000
1877	Framingham, Mass	Sudbury River		Winchester, Mass	5,000
1877	Natick, Mass	Dug Pond		Winchester, Mass	4,000
1877	Pittsfield, Mass	Pontoosuc Lake		Winchester, Mass	5,000
1877	Nantucket, Mass	Hummock Pond		Winchester, Mass	2,500
1877	Berlin, Mass	Gates Pond		Winchester, Mass	3,000
1877	Braintree, Mass	Great Pond		Winchester, Mass	3,000
1877	Lancaster, Mass	Ponds		Winchester, Mass	15,000
1877	Duxbury, Mass	Island Creek Pond		Winchester, Mass	6,000
1877	Plymouth, Mass	Halfway Pond		Winchester, Mass	10,000
1877	Billerica, Mass	Shawshine River		Winchester, Mass	8,000
1877	Huntington, Mass	Norwich Pond		Winchester, Mass	3,000
1877	Medford, Mass	Mystic Lake		Winchester, Mass	1,000
1877	Winchester, Mass	Wedge Pond		Winchester, Mass	1,000
1877	Essex, Mass	Chebacco Pond		Winchester, Mass	4,000
1878	Wellfleet, Mass	Gull Pond		Winchester, Mass	8,000
1878	Middleborough, Mass	Assawampsett Lake		Winchester, Mass	30,000
1878	Natick, Mass	Dug Pond		Winchester, Mass	4,000
1878	Winchendon, Mass	Dennison Lake		Winchester, Mass	4,000
1878	Winchendon, Mass	Whitney's Pond		Winchester, Mass	4,000
1878	Winchester, Mass	Wedge Pond		Winchester, Mass	4,000
1878	Winchester, Mass	Mystic Lake		Winchester, Mass	4,000
1878	Milton, Mass	Houghton's Pond		Winchester, Mass	7,000
1878	Harvard, Mass	Bear Hill Pond		Winchester, Mass	4,000
1878	Lynn, Mass	Spring Pond		Winchester, Mass	1,500
1878	Lynn, Mass	Flax Pond		Winchester, Mass	1,500
1878	Wenham, Mass	Wenham Lake		Winchester, Mass	4,000
1878	North Rochester, Mass	Snow's Pond		Winchester, Mass	5,000
1878	North Andover, Mass	Great Pond		Winchester, Mass	4,000
1878	East Bridgewater, Mass	Sautucket River		Winchester, Mass	4,000
1878	West Scituate, Mass	Scituate Ponds		Winchester, Mass	4,000
1878	Stockbridge, Mass	Lake Mahkeenac		Winchester, Mass	20,000
1878	Stoneham, Mass	Spot Pond		Winchester, Mass	8,000
1878	Lawrence, Mass	Pond		Winchester, Mass	8,000
1878	Hubbardston, Mass	Asnaconcomic Pond		Winchester, Mass	5,000

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
Massachusetts—Continued.	1878	North Sandwich, Mass	Great Herring Pond		Winchester, Mass	4,000
	1878	Ashburnham, Mass	Nankeag Lake		Winchester, Mass	8,000
	1878	Fall River, Mass	Sucker Brook		Winchester, Mass	2,500
	1878	Fall River, Mass	Borden Pond		Winchester, Mass	2,500
	1878	Salem, Mass	Suntaug Lake		Winchester, Mass	5,000
	1878	Salem, Mass	Wenham Lake		Winchester, Mass	5,000
	1878	Holyoke, Mass	Ashley Pond		Winchester, Mass	7,000
	1878	Pittsfield, Mass	Pontoosuc Lake		Winchester, Mass	16,000
	1878	Braintree, Mass	Great Pond		Winchester, Mass	8,000
	1878	Wakefield, Mass	Lake Quannapowitt		Winchester, Mass	6,000
	1878	Greenwood, Mass	Crystal Lake		Winchester, Mass	8,000
	1878	Waltham, Mass	Hardy's Pond		Winchester, Mass	4,000
	1878	Plymouth, Mass	Halfway Pond		Winchester, Mass	4,000
	1878	South Weymouth, Mass	Weymouth Great Pond		Winchester, Mass	4,000
	1879	Harvard, Mass	Bear Hill Pond		Winchester, Mass	6,000
	1879	East Brookfield, Mass	Furnace Pond		Winchester, Mass	10,000
	1879	Winchendon, Mass	Dennison Lake		Winchester, Mass	2,000
	1879	Winchendon, Mass	Whitney's Pond		Winchester, Mass	2,000
	1879	Natick, Mass	Dug Point		Winchester, Mass	3,000
	1879	Milton, Mass	Houghton's Pond		Winchester, Mass	6,000
	1879	Wenham, Mass	Wenham Lake		Winchester, Mass	10,000
	1879	Framingham, Mass	Farm Pond		Winchester, Mass	8,000
	1879	Lynnfield, Mass	Suntaug Lake		Winchester, Mass	8,000
	1879	Ashburnham, Mass	Nankeag Lake		Winchester, Mass	20,000
	1879	Hubbardston, Mass	Asnaconcomic Pond		Winchester, Mass	10,000
	1879	East Brookfield, Mass	Furnace Pond		Winchester, Mass	8,000
	1879	Acton, Mass	Magog Lake		Winchester, Mass	9,000
	1879	Wakefield, Mass	Lake Quannapowitt		Winchester, Mass	3,000
	1879	Middleborough, Mass	Assawamsett Lake		Winchester, Mass	20,000
	1879	Great Barrington, Mass	Lake Buel		Winchester, Mass	6,000
	1879	Stockbridge, Mass	Lake Mahkeenac		Winchester, Mass	20,000
	1879	Mendon, Mass	Nipmug Pond		Winchester, Mass	3,000
	1879	West Scituate, Mass	Scituate Ponds		Winchester, Mass	3,000
	1879	Paxton, Mass	Asnebumskitt Ponds		Winchester, Mass	6,000
	1879	Westfield, Mass	Congamond Lake		Winchester, Mass	20,000
	1879	Rochester, Mass	Mary's Pond		Winchester, Mass	4,000
	1879	Westborough, Mass	Hockomocke Pond		Winchester, Mass	4,000
	1879	Essex, Mass	Chebacco Lake		Winchester, Mass	10,000
	1879	Holyoke, Mass	Wright Pond		Winchester, Mass	6,000
	1879	Milford, Mass	Nipmug Pond		Winchester, Mass	3,000
	1879	Falmouth, Mass	Fresh Pond		Winchester, Mass	3,000
	1879	Mashpee, Mass	Crystal Lake		Winchester, Mass	6,000
	1879	Waltham, Mass	Hardy's Pond	Charles River	Winchester, Mass	2,000
	1880	Mendon, Mass	Nipmug Pond		Winchester, Mass	15,000

	1880	Pittsfield, Mass	Pontoosuc Lake		Winchester, Mass	18,000
	1880	Holliston, Mass	Pond		Winchester, Mass	5,000
	1880	Ashburnham, Mass	Naukeag Lake		Winchester, Mass	10,000
	1880	Sharon, Mass	Pond		Winchester, Mass	5,000
	1880	Groton, Mass	Pond		Winchester, Mass	4,000
	1880	Brewster, Mass	Pond		Winchester, Mass	8,000
	1880	Falmouth, Mass	Fresh Pond		Winchester, Mass	4,000
	1880	Waltham, Mass	Hardy's Pond	Charles River	Winchester, Mass	2,000
	1880	Otis, Mass	Pond		Winchester, Mass	6,000
	1880	Wenham, Mass	Wenham Lake		Winchester, Mass	8,000
	1880	Millbury, Mass	Ponds		Winchester, Mass	4,000
	1880	Sandwich, Mass	Spectacle Pond		Winchester, Mass	2,000
	1880	Braintree, Mass	Great Pond		Winchester, Mass	4,000
	1880	Rochester, Mass	Mary's Pond		Winchester, Mass	4,000
	1880	Stockbridge, Mass	Lake Mahkeenac		Winchester, Mass	20,000
	1880	Great Barrington, Mass	Lake Buel		Winchester, Mass	20,000
	1880	Melrose, Mass	Pond		Winchester, Mass	2,000
	1880	Westfield, Mass	Congamond Lake		Winchester, Mass	20,000
	1880	Yarmouth, Mass	Ponds		Winchester, Mass	8,000
	1880	Winchester, Mass	Wedge Pond		Winchester, Mass	3,500
	1880	Medford, Mass	Mystic Lake		Winchester, Mass	3,500
Michigan	1874	Pokagan, Mich	Dowagiac Creek		Pokagon, Mich	2,000
	May 18, 1876	Richland, Mich	Parker Lake		Pokagon, Mich	4,000
	May 18, 1876	Kalamazoo County, Mich	Long Lake		Pokagon, Mich	1,000
	May 19, 1876	Kalkaska County, Mich	Log Lake		Pokagon, Mich	5,000
	June 1, 1876	Calhoun County, Mich	Hamblin Lake		Pokagon, Mich	3,000
	June 1, 1876	Calhoun County, Mich	Gognac Lake		Pokagon, Mich	3,000
	June 1, 1876	Calhoun County, Mich	Reese Ponds		Pokagon, Mich	1,000
	June 1, 1876	Marshall, Mich	Reed's Ponds		Pokagon, Mich	3,000
	1878	Niles, Mich	Tinkham Lake		Pokagon, Mich	5,000
	1878	Calhoun County, Mich	Metcalfe Lake		Pokagon, Mich	4,000
	1878	Battle Creek, Mich	Gognac Lake		Pokagon, Mich	4,000
	1878	Surry, Mich	Crooked Lake		Pokagon, Mich	4,500
	1878	Clare County, Mich	Roney Lake		Pokagon, Mich	1,500
	1878	Pierson, Mich	Whitefish Lake		Pokagon, Mich	7,000
	1878	Northville, Mich	Rough River		Northville, Mich	4,500
	1880	Roscommon County, Mich	Higgins Lake		Pokagon, Mich	20,000
Minnesota	June —, 1875	Fond du Lac, Minn	Saint Louis River	Lake Superior	Red Wing, Minn	500
	June —, 1875	Ramsey County, Minn	White Bear Lake		Red Wing, Minn	500
	June —, 1875	Ramsey County, Minn	Bass Lake		Red Wing, Minn	100
	June —, 1875	Ramsey County, Minn	Lake Como		Red Wing, Minn	100
	June —, 1875	Ramsey County, Minn	Lake Johanna		Red Wing, Minn	100
	June —, 1875	Rice County, Minn	Near Faribault		Red Wing, Minn	300
	June —, 1875	Rice County, Minn	Northfield Lake		Red Wing, Minn	150
	June —, 1875	Waseca County, Minn	Lake Elysian		Red Wing, Minn	500
	June —, 1875	Breckenridge County, Minn	Red River of the North		Red Wing, Minn	500
	June —, 1875	Steele County, Minn	Near Owatonna		Red Wing, Minn	500
	June —, 1875	Becker County, Minn	Detroit Lake		Red Wing, Minn	200
	June —, 1875	Hennepin County, Minn	Minnetonka Lake		Red Wing, Minn	1,000
	June —, 1875	Meeker County, Minn	Near Litchfield		Red Wing, Minn	100
	June —, 1875		Otter River		Red Wing, Minn	200
	Apr. 14, 1877	Red Wing, Minn	Skillman Pond		Red Wing, Minn	250

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
Minnesota—Cont'd	Apr. 14, 1877	Ramsey County, Minn	White Bear Lake		Red Wing, Minn	7,500
	1878	Ramsey County, Minn	McCann's Lake		Red Wing, Minn	3,500
	1878	Ramsey County, Minn	Rice Pond		Red Wing, Minn	3,500
	1878	Rice County, Minn	Northfield Lake		Red Wing, Minn	1,000
	May —, 1879	Cass County, Minn	Sandy Lake		Willow Brook and Red Wing	5,000
	May —, 1879	Dakota County, Minn	Spring Lake		Willow Brook and Red Wing	5,000
	May —, 1879	Houston County, Minn	Lake Como		Willow Brook and Red Wing	3,000
	June —, 1879	Houston County, Minn	Barnum's Pond		Willow Brook and Red Wing	500
	June —, 1879	Duluth, Minn	Canosia Lake		Willow Brook and Red Wing	5,000
	June —, 1879	Rice County, Minn	Robert's Lake		Willow Brook and Red Wing	4,000
	June —, 1879	Rice County, Minn	Cedar Lake		Willow Brook and Red Wing	4,000
	June —, 1879	Watonwan County, Minn	Long Lake		Willow Brook and Red Wing	3,000
	June —, 1879	Martin County, Minn	Cedar Lake		Willow Brook and Red Wing	3,000
	July —, 1879	Renville County, Minn	Lake Alley		Willow Brook and Red Wing	5,000
	July —, 1879	Renville, County, Minn	Lake Preston		Willow Brook and Red Wing	5,000
	July —, 1879	Wabasha County, Minn	Skeelman's Pond		Willow Brook and Red Wing	5,000
	July —, 1879	Rice County, Minn	Cannon River		Willow Brook and Red Wing	1,000
New Hampshire	1878	Madison, N. H	Silver Lake		Winchester, Mass	5,000
	1878	New Durham, N. H	Merry Meeting Lake		Winchester, Mass	5,000
	1878	Newbury, N. H	Sunapee Lake		Winchester, Mass	6,000
	1878	Grantham, N. H	Stocker's Pond		Winchester, Mass	4,000
	May —, 1879	Raymond, N. H	Jones' Pond		Plymouth, N. H	5,000
	May —, 1879	New Durham, N. H	Merry Meeting Lake		Plymouth, N. H	5,000
	May —, 1879	Wakefield, N. H	East Lake		Plymouth, N. H	5,000
	May —, 1879	Ossipee, N. H	Ossipee Lake		Plymouth, N. H	5,000
	May —, 1879	Manchester, N. H	Massabesic Lake		Plymouth, N. H	5,000
	May —, 1879	Piermont, N. H	Tarlton Pond		Plymouth, N. H	5,000
	June —, 1879	Newbury, N. H	Sunapee Lake		Plymouth, N. H	10,000
	June —, 1879	Springfield, N. H	Star Pond		Plymouth, N. H	1,500
	June —, 1879	Franconia, N. H	Echo Lake		Plymouth, N. H	2,500
	June —, 1879	Bridgewater, N. H	Newfound Lake		Plymouth, N. H	5,000
	June —, 1879	Holderness, N. H	Squam Lake		Plymouth, N. H	10,000
	June —, 1879	Enfield, N. H	Masconia Lake		Plymouth, N. H	5,000
	June —, 1879	Pittsburgh, N. H	Connecticut Lake		Plymouth, N. H	8,000
	June —, 1879	Centre Harbor, N. H	Winnipesaukee Lake		Plymouth, N. H	5,000
	July —, 1879	Sandwich, N. H	Pond		Plymouth, N. H	5,000
	July —, 1879	Manchester, N. H	Nutt's Pond		Plymouth, N. H	5,000
	July —, 1879	Bradford, N. H	Bradford's Pond		Plymouth, N. H	5,000
	July —, 1879	Northfield, N. H	Chestnut Pond		Plymouth, N. H	2,000
	July —, 1879	Cheshire County, N. H	Sundry Ponds		Plymouth, N. H	10,000
	May 4, 1880	Nelson, N. H	Tolman Pond	Merrimack River	Plymouth, N. H	4,000
	May 13, 1880	Sandwich, N. H	Adams Pond	Merrimack River	Plymouth, N. H	1,500
	May 18, 1880	Laconia, N. H	Winnesquam Lake	Merrimack River	Plymouth, N. H	5,000
	May 19, 1880	Stark, N. H	North Pond	Connecticut River	Plymouth, N. H	4,000

	May 20, 1880	Pittsfield, N. H	Berry Pond	Merrimack River	Plymouth, N. H	1,200
	May 21, 1880	Chesterfield, N. H	Spofford Lake	Connecticut River	Plymouth, N. H	3,000
	May 21, 1880	Epsom, N. H	Chestnut Pond		Plymouth, N. H	1,250
	May 25, 1880	Stewartstown, N. H	Diamond Pond	Connecticut River	Plymouth, N. H	2,500
	May 26, 1880	Peterborough, N. H	Cunningham Pond	Merrimack River	Plymouth, N. H	2,500
	May 26, 1880	Rindge, N. H	Emerson Pond	Merrimack River	Plymouth, N. H	2,500
	May 26, 1880	Jaffrey, N. H	Gilmore Pond	Merrimack River	Plymouth, N. H	2,500
	May 28, 1880	Conway, N. H	Walker's Pond	Saco River	Plymouth, N. H	6,000
	June 2, 1880	Nelson, N. H	Newfound Lake	Merrimack River	Plymouth, N. H	3,000
	June 2, 1880	Canaan, N. H	Hart's Pond	Merrimack River	Plymouth, N. H	2,500
	June 8, 1880	Boscawen, N. H	Walker's Pond	Merrimack River	Plymouth, N. H	2,000
	June 9, 1880	Benton, N. H	Long Pond	Connecticut River	Plymouth, N. H	3,000
	June 10, 1880	Newbury	Sunapee Lake	Connecticut River	Plymouth, N. H	4,000
	June 10, 1880	Warner, N. H	Bean Pond	Merrimack River	Plymouth, N. H	3,000
	June 10, 1880	Acworth, N. H	Cold Pond	Connecticut River	Plymouth, N. H	3,000
	June 14, 1880	Franconia, N. H	Echo Lake	Connecticut River	Plymouth, N. H	3,000
	June 17, 1880	Sandwich, N. H	North Pond	Merrimack River	Plymouth, N. H	2,000
New Jersey	1878	Morris County, N. J	Green Pond		Bloomsbury, N. J	10,000
	1878	Sussex County, N. J	Morris Pond		Bloomsbury, N. J	9,000
	1878	Andover, N. J	Strubel's Lake		Bloomsbury, N. J	39,000
	1879	Sussex County, N. J	Drake's Pond	Paulinskill River	Bloomsbury, N. J	1,000
	1879	Passaic County, N. J		Passaic River	Bloomsbury, N. J	2,000
	1879	Ringwood, N. J	Shepherd's Lake	Passaic River	Bloomsbury, N. J	9,400
	1879	Oxford, N. J	Greens Pond	Pequest River	Bloomsbury, N. J	4,000
	1879	Drakesville, N. J	Lake Hopatkong	South Branch Raritan River	Bloomsbury, N. J	16,994
	Dec. —, 1879	Morris County, N. J	Lakes		Bloomsbury, N. J	18,000
	Dec. —, 1879	Bergen County, N. J	Lakes		Bloomsbury, N. J	11,400
	Dec. —, 1879	Warren County, N. J	Lakes		Bloomsbury, N. J	4,000
New York	1878	Caledonia, N. Y	Spring Creek		Caledonia, N. Y	2,000
	1879	Herkimer County, N. Y	Woodhull Lake		Caledonia, N. Y	5,000
	1879	Monroe County, N. Y	Allen Creek	Lake Ontario	Caledonia, N. Y	10,000
	1879	Duchess County, N. Y	Sylvan Lake		Clove, N. Y	3,000
	1879	Duchess County, N. Y	Upton's Pond		Clove, N. Y	3,000
	1879	Duchess County, N. Y	Long Pond		Clove, N. Y	3,000
	1879	Duchess County, N. Y	Furnace Pond		Clove, N. Y	10,000
	1879	Duchess County, N. Y	Little Thala Pond		Clove, N. Y	5,000
North Carolina	Apr. —, 1878	Morganton, N. C	John's River	Catawba River	Baltimore, Md	1,000
	Apr. —, 1878	Morganton, N. C	Linnville River	Catawba River	Baltimore, Md	4,400
	Apr. —, 1878	Charlotte, N. C	Ponds	Catawba River	Baltimore, Md	500
	Apr. —, 1878	Greensborough, N. C	Ponds	Cape Fear River	Baltimore, Md	2,000
	Apr. —, 1878	Morganton, N. C	Ponds	Catawba River	Baltimore, Md	600
	Apr. —, 1878	Salisbury, N. C	Ponds	Yadkin River	Baltimore, Md	1,000
	Apr. —, 1878	Rockingham, N. C	Moyo River	Dan River	Baltimore, Md	3,000
	Apr. —, 1878	Danbury, N. C	Dan River	Roanoke River	Baltimore, Md	3,000
Ohio	1876	Put-in Bay, Ohio	Lake Erie		Toledo, Ohio	20,000
	1876		Maumee Rapids		Toledo, Ohio	9,000
	1876	Fremont, Ohio	Sandusky River		Toledo, Ohio	5,000
	1878	Toledo (12 miles above), Ohio	Maumee River	Lake Erie	Toledo, Ohio	12,000
	1879		Maumee River	Lake Erie	Toledo, Ohio	6,000
Pennsylvania	1878	Solebury, Pa	Aquetong Lake	Delaware River	New Hope, Pa	9,444
	1878	Schuylkill County, Pa	Schuylkill River	Delaware River	Marietta, Pa	2,300
	1878	Wayne County, Pa	Jones' Lake		Marietta, Pa	5,000

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
Pennsylvania—Continued.	1878	Luzerne County, Pa	Beaver Lake		Marietta, Pa	2,500
	1878	Hazleton, Pa			Marietta, Pa	4,000
	1878	Pike County, Pa	Lakes		Marietta, Pa	2,500
	1878	Monroe County, Pa	Lakes		Marietta, Pa	2,500
	1878	Somerset County, Pa			Marietta, Pa	250
	1878	Wilkes Barre, Pa	Harvey's Lake	Susquehanna River	Marietta, Pa	5,000
	1878	Wayne County, Pa			Marietta, Pa	5,000
	1878	Warren County, Pa	Pond		Corry, Pa	7,000
	1878	Corry, Pa	Hatching ponds		Corry, Pa	3,000
	1879	Wilkes Barre, Pa	Harvey's Lake	Susquehanna River	Marietta, Pa	6,000
	1879	Scranton, Pa	Tobyhanna Lake	Lehigh River	Marietta, Pa	3,000
	1879	Scranton, Pa	Paupock Lake	Lehigh River	Marietta, Pa	11,500
	1879	White Haven, Pa	Big Pond	Lehigh River	Marietta, Pa	1,500
	1879	White Haven, Pa	Moses Wood Pond	Lehigh River	Marietta, Pa	1,500
	1879	Erie, Pa	Bay	Lake Erie		10,000
	1879	Potter County, Pa			Corry, Pa	2,000
	Apr. 8, 1880	Luzerne County, Pa	Bear Lake	Susquehanna River	Marietta, Pa	5,000
	Apr. 8, 1880	Susquehanna County, Pa	Heart Lake	Susquehanna River	Marietta, Pa	4,000
	Apr. 8, 1880	Susquehanna County, Pa	Tigley Lake	Wyalusing Creek	Marietta, Pa	1,000
	Apr. 12, 1880	Lancaster County, Pa	Donegal Run	Susquehanna River	Marietta, Pa	500
	1880	Erie County, Pa	Conneaut Creek		Corry, Pa	2,000
	1880	Erie County, Pa	Le Boeuf Creek		Corry, Pa	2,000
	1880	Erie County, Pa	French Creek		Corry, Pa	2,000
	1880	Westmoreland County, Pa	Allegheny River	Ohio River	Corry, Pa	2,000
Rhode Island	1876	Burrillville, R. I	Wallum Pond	Swamp Pascoag Reservoir	Ponegansett, R. I	2,500
	1876	North Scituate, R. I	Moswansicut Pond		Ponegansett, R. I	2,500
	1876	North Scituate, R. I	Steers' Pond		Ponegansett, R. I	2,500
	1876	Foster, R. I	Searles' Pond	Pawtuxet River	Ponegansett, R. I	2,500
	1876	Foster, R. I	Lilly Pond	Pawtuxet River	Ponegansett, R. I	2,500
	1876	Warwick, R. I	Gorton's Pond	Providence River	Ponegansett, R. I	2,500
	1876	Warwick, R. I	Warwick Pond	Providence River	Ponegansett, R. I	2,500
	1876	Richmond, R. I	Beach Pond	Beaver River	Ponegansett, R. I	2,100
	1878	Burrillville, R. I	Wallum Pond	Swamp Pascoag Reservoir	Ponegansett, R. I	5,000
	1878	Kingston, R. I	Warden's Pond	Pawcatuck River	Ponegansett, R. I	2,000
	1878	North Scituate, R. I	Moswansicut Pond		Ponegansett, R. I	2,000
	1878	North Scituate, R. I	Steer's Pond		Ponegansett, R. I	500
South Carolina	1880			Seneca River	N. C. Hatchery	8,000
	1880		Hampton Creek			3,000
	1880		Mill Creek			4,000
Vermont	Apr. 19, 1876	Fairfield, Vt	Fairfield Pond			5,000
	May 2, 1876	Franklin, Vt	Franklin Pond			5,000
	May 3, 1876	Salisbury, Vt	Dunmore Lake			5,000
	May 5, 1876	Essex, Vt	Winooski River			6,000
	May 11, 1876	Washington County, Vt	Kettle Pond			1,000

	May 15, 1876	Barton, Vt	Barton Pond			1,500
	1876	Brattleborough, Vt				2,000
	1876	Castleton, Vt	Ponds			4,000
	1876	Hubbardton, Vt	Ponds			3,000
	1876	Orwell, Vt	Ponds			3,000
	1876	Bennington County, Vt	Ponds			2,000
	May 15, 1876	Barnet, Vt	Harvey's Pond	Connecticut River		1,000
	May 19, 1876	Morgan, Vt	Seymour Lake			1,500
	1878	Saint Johnsbury, Vt	Small ponds	Connecticut River	Saint Johnsbury, Vt	3,000
	1878	Danville, Vt	Joe's Pond	Connecticut River	Saint Johnsbury, Vt	6,000
	1878	Waterford, Vt	Style's Pond	Connecticut River	Saint Johnsbury, Vt	3,000
	1878	Westmore, Vt	Lake Willoughby	Lake Memphremagog	Saint Johnsbury, Vt	3,500
	1878	Barton, Vt	Bellwater Pond	Lake Memphremagog	Saint Johnsbury, Vt	3,500
	1878	Greensborough, Vt	Greensborough Pond		Saint Johnsbury, Vt	2,500
	1878	Barnet, Vt	Harvey's Pond	Connecticut River	Saint Johnsbury, Vt	2,500
Virginia	1875	Central, Va	New River			2,500
	1877		Shenandoah	South Branch		3,000
	1877	Smyth County, Va	Holston River			1,000
	1877	Rockbridge County, Va	Irish Creek			250
	1877	Nelson County, Va	Tye River			2,750
	1877	Rockbridge County, Va	Buffalo Creek	James River		3,500
	1877	Wytheville, Va	New River	Kanawha River		3,000
	1878		Tom's River	New River		22,000
	1878		Strouble's Creek	New River		5,000
	1878	Wytheville, Va	Pond	New River	Blacksburgh, Va	2,000
	1878	Blacksburgh, Va	Streams	New River	Blacksburgh, Va	8,000
	1878	Lexington, Va	North River	James River	Lexington, Va	300
	May 31, 1879	Farmville, Va	Appomattox River	James River	Lexington, Va	6,000
	June 7, 1879	Lexington, Va	South River	James River	Lexington, Va	2,500
	June 9, 1879	Staunton, Va	Middle River	Shenandoah River	Lexington, Va	6,500
	June 12, 1879	Lexington, Va	Buffalo Creek	James River	Lexington, Va	250
	June 14, 1879	Lexington, Va	McKee's Spring	James River	Lexington, Va	300
	June 16, 1879	Clifton Forge, Va	Jackson River	James River	Lexington, Va	6,500
	July 7, 1879	Fincastle, Va	Craig's Creek	James River	Lexington, Va	2,800
	July 23, 1879	Lexington, Va	North River	James River	Lexington, Va	2,500
	Mar. 25, 1880	Wytheville, Va	Barret's Pond	New River	Wytheville, Va	4,000
	Mar. 29, 1880	Salem, Va	Lake Spring	Roanoke River	Wytheville, Va	250
	Mar. 31, 1880	Wythe Lead Mines, Va	New River	Kanawha River	Wytheville, Va	8,000
	April 2, 1880	Saltville, Va	North Fork Holston River	Holston River	Wytheville, Va	7,000
	April 5, 1880	Central, Va	New River	Kanawha River	Wytheville, Va	4,000
	April 5, 1880	Wytheville, Va	New River	Kanawha River	Wytheville, Va	250
West Virginia	1878	Wetzel County, W. Va	Fishing Creek		Romney, W. Va	5,000
	1878	Parkersburgh, W. Va	Bartlett's Pond		Romney, W. Va	100
	1878	Marion County, W. Va	Dent's River		Romney, W. Va	200
	1878	Marion County, W. Va	Meadow Run		Romney, W. Va	200
	1878	Marion County, W. Va	Branch of Buffalo Creek		Romney, W. Va	100
	1878	Marion County, W. Va	Prichard's Run		Romney, W. Va	200
	1878	Marion County, W. Va	Buffalo Creek		Romney, W. Va	100
	1878	Hampshire County, W. Va	Mill Creek		Romney, W. Va	500
	1878	Hampshire County, W. Va	Dillon's Creek		Romney, W. Va	800
	1878	Hardy County, W. Va	Trout Run		Romney, W. Va	300
	1878	Randolph County, W. Va	Tributaries	Tygart's Valley Run	Romney, W. Va	1,000

D.—TABLE III.—*Distribution of Schoodic salmon from 1874 to 1880, inclusive*—Continued.

State.	Date.	Nearest post-office, town, or village.	Waters in which fish were placed.	Tributary of—	Where finally hatched.	Number of fish.
West Virginia—Continued.	1879	Romney, W. Va	Pond at Institution for Deaf	Potomac River	Romney, W. Va	400
	1879	Hampshire County, W. Va	Dillon's Run	Potomac River	Romney, W. Va	600
	1879	Parkersburgh, W. Va	Pond		Romney, W. Va	200
	1879	Romney, W. Va	Fountain at Institution for Deaf, etc.	Potomac River	Romney, W. Va	50
	1879	Clarksburgh, W. Va	West Fork	Monongahela River	Romney, W. Va	2,000
	1879	Weston, W. Va	West Fork	Monongehela River	Romney, W. Va	1,500
	1879	Cold Spring, W. Va	Wheeling Creek	Ohio River	Romney, W. Va	5,000
	1879	Littleton, W. Va	Fish Creek	Ohio River	Romney, W. Va	5,000
	1879	White Sulphur Springs, W. Va	Dry Fork	Greenbrier River	Romney, W. Va	3,000
	1879	Williamsport, W. Va	William's Spring	Patterson's Creek	Romney, W. Va	1,000
	1879	Hamot's Mill, Hampshire County, W. Va.	Mill Creek	Potomac River	Romney, W. Va	500
	1879	Hamot's Mill, Hampshire County, W. Va.	Mill Creek	Potomac River	Romney, W. Va	1,500
	1879	Hampshire County, W. Va	Tributaries	South Branch, Potomac River	Romney, W. Va	3,000
	1879	Romney, W. Va	Tributaries	South Branch, Potomac River	Romney, W. Va	15,000
	1879	Hinton, W. Va	Greenbrier River	New River	Romney, W. Va	5,669
Wisconsin	1876	Madison, Wis	Lake		Palmer's Hatchery	10,000
	1876		Oconomowoc Lake			10,000
	1876					10,000
	1876	Walworth County, Wis	Geneva Lake	Illinois River	Geneva Lake	8,000
	1878	Walworth County, Wis	Geneva Lake	Illinois River	Geneva Lake	5,000
	1879		Clear Lake		Madison, Wis	2,000
	1879		Silver Lake		Madison, Wis	10,000
	1879	Walworth County, Wis	Geneva Lake		Madison, Wis	10,000
	1879		Nagawicka Lake		Madison, Wis	12,000
	1879		Green River		Madison, Wis	3,000

D.—TABLE IV.—*Distribution of Penobscot salmon from 1873 to 1880, inclusive.*

State.	Date.	Locality.	Tributaries.	Waters stocked.	Where finally hatched.	Number of fish.
California	1874	Redding, Cal		Sacramento River		305
Connecticut	1873			Saugatuck River	Poquonock, Conn	1,300
	1873			Southport River	Poquonock, Conn	1,360
	1873		Tributaries	Connecticut River	Poquonock, Conn	34,880
	1873		Main River	Mystic River	Westport, Conn	1,516
	1873		Tributaries	Thames River	Westport, Conn	3,032
	1873	North Branford, Conn		Main River	North Branford, Conn	10,616
	1873		Main River	Housatonic River	North Branford, Conn	21,233
	1875	New Hartford, Conn	Farmington River	Connecticut River	Westport, Conn	65,000
	1875	New Milford, Conn	Butter Brook	Housatonic River	Westport, Conn	20,000
	1875	Guilford, Conn	Guilford Creek		Westport, Conn	10,000
	1875	Willimantic, Conn	Shetucket River	Thames River	Westport, Conn	10,000
	1875	Southport, Conn	Mill River		Westport, Conn	5,000
	1875	Westport, Conn	Saugatuck River		Westport, Conn	5,000
	May 13, 1877	Southport, Conn	Mill River		Westport, Conn	2,500
	May 16, 1877	New Milford, Conn	Housatonic River	Long Island Sound	Westport, Conn	12,500
	May 17, 1877		Natchaug Branch	Thames River	Westport, Conn	12,500
	May 19, 1877	New Hartford, Conn	Farmington River	Connecticut River	Westport, Conn	72,100
Illinois	1874	Kensington, Ills	Calumet River	Lake Michigan	Pokagon, Mich	10,000
	1874	Wildwood, Ills	Calumet River	Lake Michigan	Pokagon, Mich	8,000
	1874	South Lawn, Ills	Calumet River	Lake Michigan	Pokagon, Mich	7,000
	1875	Elgin, Ills	Fox River	Illinois River	Elgin, Ill	19,000
Iowa	May —, 1875	Dubuque, Iowa	Dubuque Creek	Mississippi River	Anamosa, Iowa	3,000
	June 6, 1875	Council Bluffs, Iowa		Mississippi River	Anamosa, Iowa	10,000
	June 6, 1875	Cedar Rapids, Iowa	Cedar River	Mississippi River	Anamosa, Iowa	4,000
	June 10, 1875	Waverly, Iowa		Mississippi River	Anamosa, Iowa	25,000
	June 17, 1875	West Union, Iowa	Turkey River	Mississippi River	Anamosa, Iowa	15,000
	1875	Marshalltown, Iowa	Iowa River	Mississippi River	Anamosa, Iowa	5,000
	July 2, 1875	Manchester, Iowa	Maquoketa River	Mississippi River	Anamosa, Iowa	2,000
	July 2, 1875	Worthington, Iowa	North Maquoketa River	Mississippi River	Anamosa, Iowa	2,000
	July 3, 1875	Monmouth, Iowa	Bear Creek	Mississippi River	Anamosa, Iowa	4,000
	June 23, 1876		Boyer River	Missouri River	Anamosa, Iowa	5,000
	July 14, 1876		Clear Lake	Coon River	Anamosa, Iowa	10,000
	July 14, 1876		Marion Lake		Anamosa, Iowa	10,000
	July 14, 1876	Emmet County, Iowa	Lakes		Anamosa, Iowa	10,000
	July 24, 1876		Storm Lake	Coon River	Anamosa, Iowa	20,000
	July 24, 1876		Spirit Lake	Sioux River	Anamosa, Iowa	10,000
	July 24, 1876		Twin Lakes		Anamosa, Iowa	5,000
Maine	1873			Penobscot River	Bucksport, Me	50,250
	1873			Saint Croix River	Bucksport, Me	7,500
	1873			Androscoggin River	Bucksport, Me	97,000
	1874	Eaton, Me	Mattawamkeag River	Penobscot River	Bucksport, Me	22,500
	1874	Danforth, Me	Mattawamkeag River	Penobscot River	Bucksport, Me	22,500
	1874		Salmon Streams	Penobscot River	Bucksport, Me	25,000

D.—TABLE IV.—*Distribution of Penobscot salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Tributaries.	Waters stocked.	Where finally hatched.	Number of fish.
Maine—Continued	1874		Tributaries of Baskahegan River.	Penobscot River	Bucksport, Me	5,000
	1874		Passadumkeag River	Penobscot River	Bucksport, Me	10,000
	1874	Whitney Ridge, Me	Sebovis River	Penobscot River	Bucksport, Me	25,000
	1874	Howland, Me	Sebovis River	Penobscot River	Bucksport, Me	25,000
	1874	Milo, Me	Piscataquis River	Penobscot River	Bucksport, Me	15,000
	1874	Brownville, Me	Pleasant River	Penobscot River	Bucksport, Me	15,000
	1874	Dover, Me	Piscataquis River	Penobscot River	Sebec Lake, Me	25,000
	1874		Sebec Lake	Penobscot River	Sebec Lake, Me	20,000
	1874	Dobsis Stream, Me	Schoodic Lake	Saint Croix River	Dobsis Stream, Me	10,000
	1874			Penmaquan River	Pembroke, Me	8,613
	1875	Howland, Me	Sebovis River	Penobscot River	Bucksport, Me	30,000
	1875		Madaceunk Stream	Penobscot River	Bucksport, Me	15,000
	1875		Salmon Stream	Penobscot River	Bucksport, Me	5,000
	1875	Bancroft, Me	Mattawamkeag River	Penobscot River	Bucksport, Me	20,000
	1875			Penobscot River	Bucksport, Me	45,000
	1875			Penobscot River	Bucksport, Me	94,000
	1876		Penquaman River		Pembroke, Me	35,000
	1876		Denny's River		Pembroke, Me	35,000
	1876	Surry, Me	Patten's Brook		Bucksport, Me	100,000
	1876	Bancroft, Me	Mattawamkeag River	Penobscot River	Bucksport, Me	50,000
	1876	Kingman, Me	Mattawamkeag River	Penobscot River	Bucksport, Me	50,000
	1876	Winn, Me		Penobscot River	Bucksport, Me	50,000
	1876	Livermore Falls, Me	Androscoggin River			100,000
Maryland	1875	Fort Pendleton, Md	North Branch	Potomac River	Green Spring Valley, Md	16,000
	1875		Deer Creek	Susquehanna River	Green Spring Valley, Md	19,000
	1875			Gunpowder River	Green Spring Valley, Md	18,900
	1875			Patuxent River	Green Spring Valley, Md	18,900
	Mar. 23, 1880		Upper Waters of	Susquehanna River	Druid Hill Park, Md	23,000
	Mar. 24, 1880	Mechanicstown, Md	Hunting Creek	Monocacy River	Druid Hill Park, Md	3,000
	Apr. 5, 1880	Oakland, Md	North Fork	Potomac River	Druid Hill Park, Md	10,000
	Apr. 6, 1880	Piedmont, Md	South Fork	Potomac River	Druid Hill Park, Md	10,000
	Apr. 9, 1880	Greencastle, Pa		Conococheague River	Druid Hill Park, Md	5,000
	Apr. 9, 1880	Gettysburgh, Pa	Rock Creek	Monocacy River	Druid Hill Park, Md	7,729
Massachusetts	1873			Merrimac River	Winchester, Mass	21,450
	1873			Mystic River	Winchester, Mass	1,430
	1873			Red Brook	Winchester, Mass	1,430
	1874	Palmer, Mass	Quobaug Pond	Red Brook	Westbrook, Conn	30,000
	1874		Westfield River	Connecticut River	State Hatchery	17,000
	Spring, 1876	Cotuit, Mass	Cotuit River		Winchester, Mass	10,000
	Spring, 1876	Lancaster, Mass	Nashua River		Winchester, Mass	40,000
Michigan	1873	Pontiac, Mich	Lord's Lake	Lake Saint Clair	Clarkston, Mich	400
	1873	Oakland County, Mich	Orchard Lake	Lake Saint Clair	Clarkston, Mich	500
	1873	Oakland County, Mich	Wall's Lake	Lake Saint Clair	Clarkston, Mich	500

	1873	Washtenaw County, Mich	Whitmore Lake	Lake Saint Clair	Clarkston, Mich	500
	1873	Hillsdale County, Mich	Gun Lake	Lake Saint Clair	Clarkston, Mich	500
	1873	Hillsdale County, Mich	Barrier Lake	Lake Saint Clair	Clarkston, Mich	500
	1873		Diamond Lake	Lake Saint Clair	Clarkston, Mich	1,000
	1873		Barrier Lake	Lake Erie	Clarkston, Mich	500
	1873	Calhoun County, Mich	Lake near Marshall	Lake Erie	Clarkston, Mich	500
	1873	Hillsdale County, Mich	Headwaters Saint Joseph River.	Lake Michigan	Clarkston, Mich	500
	1873		North Branch Saint Joseph River.	Lake Michigan	Clarkston, Mich	1,000
	1873	Saint Joseph, Mich	North Branch Saint Joseph River.	Lake Michigan	Clarkston, Mich	1,000
	1873		Tributaries of Saint Joseph River.	Lake Michigan	Clarkston, Mich	1,500
	1873	Jackson County, Mich	Headwaters Kalamazoo River	Lake Michigan	Clarkston, Mich	500
	1873	Jackson County, Mich	Grand River	Lake Michigan	Clarkston, Mich	500
	1873	Jackson County, Mich	Muskegon River	Lake Michigan	Clarkston, Mich	1,500
	1873		Manistee River	Lake Michigan	Clarkston, Mich	1,500
	1873	Roscommon County, Mich	Au Sable River	Lake Huron	Clarkston, Mich	2,000
	1874		Pine River	Manistee River	Pokagon, Mich	40,000
	1874		Salmon Creek	Boardman River	Pokagon, Mich	40,000
	1874	Roscommon County, Mich	Higgin's Lake	Muskegon River	Pokagon, Mich	7,000
	1874			Saint Mary's River	Pokagon, Mich	25,000
	1875		Dowagiac River	Saint Joseph River	Pokagon, Mich	5,000
Minnesota	June —, 1875	Ramsey County, Minn	White Bear Lake	Chippewa River	Red Wing, Minn	7,000
	June —, 1875	Ramsey County, Minn	Bass Lake	Mississippi River	Red Wing, Minn	300
	June —, 1875	Ramsey County, Minn	Como Lake	Mississippi River	Red Wing, Minn	500
	June —, 1875	Ramsey County, Minn	Johanna Lake	Mississippi River	Red Wing, Minn	500
	June —, 1875	Rice County, Minn	Faribault Lake	Mississippi River	Red Wing, Minn	1,000
	June —, 1875	Rice County, Minn	Robert's Lake	Mississippi River	Red Wing, Minn	400
	June —, 1875	Rice County, Minn	Dudley Lake	Mississippi River	Red Wing, Minn	400
	June —, 1875	Rice County, Minn	Jackson Lake	Mississippi River	Red Wing, Minn	400
	June —, 1875	Rice County, Minn	Lakes	Mississippi River	Red Wing, Minn	400
	June —, 1875	Rice County, Minn	Barry Hunt's Lake	Mississippi River	Red Wing, Minn	400
	June —, 1875	Rice County, Minn	Cedar Lake	Mississippi River	Red Wing, Minn	1,000
	June —, 1875	Dakota County, Minn	Farmington River	Mississippi River	Red Wing, Minn	500
	June —, 1875	Saint Peter, Minn		Minnesota River	Red Wing, Minn	800
	June —, 1875	Mankato, Minn		Minnesota River	Red Wing, Minn	800
	June —, 1875	Waseca County, Minn	Elysian Lake	Minnesota River	Red Wing, Minn	1,000
	June —, 1875	Breckenridge, Minn	Red River of the North	Winnipeg Lake	Red Wing, Minn	3,000
	June —, 1875	Crow Wing County, Minn	Withington Lake	Mississippi River	Red Wing, Minn	500
	June —, 1875	Crow Wing County, Minn	Brainerd Lake	Mississippi River	Red Wing, Minn	500
	June —, 1875	Steele County, Minn	Owatonna Lake	Mississippi River	Red Wing, Minn	100
	June —, 1875	Becker County, Minn	Detroit Lake	Red River of the North	Red Wing, Minn	800
	June —, 1875	Freeborn County, Minn	Albert Lea	Mississippi River	Red Wing, Minn	500
	June —, 1875	Perham, Minn	Pine Lakes	Red River of the North	Red Wing, Minn	500
	June —, 1875	Hennepin County, Minn	Minnetonka Lake	Mississippi River	Red Wing, Minn	1,000
	June —, 1875	Wright County, Minn	Howard Lake	Mississippi River	Red Wing, Minn	500
	June —, 1875	Litchfield, Minn	Crow River	Mississippi River	Red Wing, Minn	500
	June —, 1875	Willmar, Minn	Foote Lake		Red Wing, Minn	500
			Otter River		Red Wing, Minn	800
New Hampshire	1873	Woodstock, N. H	Headwaters	Merrimac River	Meredith, N. H	3,000

D.—TABLE IV.—*Distribution of Penobscot salmon from 1873 to 1880, inclusive*—Continued.

State.	Date.	Locality.	Tributaries.	Waters stocked.	Where finally hatched.	Number of fish.
New Hampshire—Continued.	1873	Thornton, N. H		Merrimac River	Meredith, N. H	3,000
	1873	West Campton, N. H		Merrimac River	Meredith, N. H	3,000
	1873	Campton, N. H		Merrimac River	Meredith, N. H	3,000
	1873	Plymouth, N. H		Merrimac River	Meredith, N. H	2,500
	1874	Sundry places	Headwaters	Connecticut River	Concord, N. H	50,000
	1874	Charlestown, N. H		Connecticut River	Charlestown, N. H	15,000
	1874	Sundry places	Headwaters and Tributaries	Connecticut River	Winchester, Mass	97,000
	1875	Plymouth, N. H	Pemigewasset River	Merrimac River	Winchester, Mass	70,000
	1875		Contoocook River	Merrimac River	Winchester, Mass	10,000
	1876	Franklin, N. H	Pemigewasset River	Merrimac River	Winchester, Mass	50,000
	1876	Warren, N. H	Baker River	Merrimac River	Winchester, Mass	50,000
New Jersey	1873		Salmon Run	Raritan River	Bloomsbury, N. J	15,000
	1873		Musconetcong River	Delaware River	Bloomsbury, N. J	18,000
	1874			Delaware River	Bloomsbury, N. J	12,000
	1874		Musconetcong River	Delaware River	Bloomsbury, N. J	65,000
	1874			Raritan River	Bloomsbury, N. J	31,000
	1874			Hackensack River	Bloomsbury, N. J	10,000
	1874			Passaic River	Bloomsbury, N. J	50,000
	1875	Morristown, N. J	Whippaug River	Passaic River	Bloomsbury, N. J	1,000
	1875	Dover, N. J	Rockaway River	Passaic River	Bloomsbury, N. J	1,000
	1875	South Branch, N. J	South Branch	Raritan River	Bloomsbury, N. J	3,000
	1875		Paulinskill River	Delaware River	Bloomsbury, N. J	24,666
	1875		Pohatcong River	Delaware River	Bloomsbury, N. J	24,666
	1875		Musconetong River	Delaware River	Bloomsbury, N. J	24,668
	Dec. 26, 1879	80 miles north of Trenton, N. J.	Shumaker's Eddy	Delaware River	Bloomsbury, N. J	20,572
New York	1873			Hudson River	Caledonia, N. Y	30,000
	1873		Salmon River	Lake Ontario	Caledonia, N. Y	15,000
	1873		Oswego River	Lake Ontario	Caledonia, N. Y	15,000
	1873		Small tributaries	Long Island Sound	Bloomsbury, N. J	2,500
	1875	Monroe County, N. Y	Allen's Creek	Lake Ontario	Caledonia, N. Y	10,000
	1875	Rome, N. Y	Mohawk River	Hudson River	Caledonia, N. Y	20,000
	1875	West Plattsburgh, N. Y	Saranac River	Hudson River	Charlestown, N. H	36,500
	1875	Peru, N. Y	Salmon River	Hudson River	Charlestown, N. H	10,000
	1875	Ellenburgh, N. Y	Chazy River	Hudson River	Charlestown, N. H	48,500
Ohio	1873	Castalia, Ohio	Castalia Spring Stream	Lake Erie	Castalia, Ohio	2,500
	1875	Toledo, Ohio	Maumee River	Maumee Bay	Castalia, Ohio	10,000
	1875	Fremont, Ohio	Sandusky River	Sandusky Bay	Castalia, Ohio	10,000
	1875	Put-in-Bay, Ohio		Lake Erie	Castalia, Ohio	30,000
Pennsylvania	1872	Bushkill, Pa	Bushkill Creek	Delaware River	State Hatchery	10,000
	1873	Easton, Pa	Hitzman Spring Brook	Delaware River	Easton, Pa	25,000
	1874	Northampton County, Pa	Bushkill Creek	Delaware River	Marietta, Pa	55,000
	1874	Dauphin County, Pa	Swatara Creek	Susquehanna River	Marietta, Pa	30,000
	1874	Lancaster County, Pa	Chiquesalonga Creek	Susquehanna River	Marietta, Pa	25,000
	1874		Donegal Creek	Susquehanna River	Marietta, Pa	12,000

	1874		Codoru's Creek	Susquehanna River	Marietta, Pa	15,000
	Mar. 23, 1880	Ralston, Pa	Trout Run	Susquehanna River	Donegal Springs, Pa	12,000
	Mar. 23, 1880	Huntingdon, Pa	Juniata River	Susquehanna River	Donegal Springs, Pa	11,000
Rhode Island	1873			Blackstone River	Ponagansett, R. I	2,000
	1873			Pawcatuck River	Ponagansett, R. I	2,200
	1873			Pawtuxent River	Ponagansett, R. I	2,200
	1874	14 places	Slatersville Branch	Blackstone River	Ponagansett, R. I	4,000
	1874	18 places		Pawcatuck River	Ponagansett, R. I	15,000
	1874	28 places		Pawtuxent River	Ponagansett, R. I	40,000
	1875	31 places		Pawtuxent River	Ponagansett, R. I	10,000
	1875	10 places	Slatersville Branch	Blackstone River	Ponagansett, R. I	5,000
	1876		Slatersville Branch	Blackstone River	Ponagansett, R. I	15,000
	1876	Sundry places	North Branch	Pawtuxent River	Ponagansett, R. I	55,000
	1876	Sundry places	South Branch	Pawtuxent River	Ponagansett, R. I	55,000
Vermont	1873		Winooski River	Lake Champlain	Caledonia, N. Y	3,500
	1873		Lamoille River	Lake Champlain	Caledonia, N. Y	3,500
	1874	Wheelock, Vt	Pasumpsic tributaries	Connecticut River	Westport, Conn	10,000
	1874	Concord, Vt	Connecticut River	Long Island Sound	Westport, Conn	5,000
	1874	Barnet, Vt	Connecticut River	Long Island Sound	Westport, Conn	30,000
	1874	McIndoe's Falls, Vt	Connecticut River	Long Island Sound	Westport, Conn	25,000
	1874		Wells River	Connecticut River	Westport, Conn	25,000
	1874	Newbury, Vt	Connecticut River	Long Island Sound	Westport, Conn	25,000
	1874	Rockingham, Vt	Saxton River	Connecticut River	Westport, Conn	5,000
	1874	Royalton, Vt	White River	Connecticut River	Charlestown, N. H	12,000
	1874	Georgia, Vt	Lamoille River	Connecticut River	Charlestown, N. H	36,000
	1874	Northfield, Vt	Dog River	Connecticut River	Charlestown, N. H	48,000
	1875	Ferrisburgh, Vt	Lewis Creek	Lake Champlain	Charlestown, N. H	24,000
	1875	Manchester, Vt	Battenkill Creek	Hudson River	Charlestown, N. H	47,500
Wisconsin	1873		Menomonee River	Lake Michigan	Waterville, Wis	7,000
	1873	Oconomowoc, Wis	Oconomowoc Lake	Lake Michigan	Waterville, Wis	1,000
	1873	Wauwatosa, Wis	Milwaukee River	Lake Michigan	Waterville, Wis	11,000
	1874		Madison Lake	Rock River	Waterville, Wis	7,500
	1874		Geneva Lake	Illinois River	Waterville, Wis	7,500
	1875	Sheboygan County, Wis	Elkhart Lake	Illinois River	Boscobel, Wis	6,000
	1875	Sheboygan County, Wis	Devil's Lake	Illinois River	Boscobel, Wis	7,000
	1875	Sheboygan County, Wis	Cedar Rock Lake	Illinois River	Boscobel, Wis	7,000

D.—TABLE V.—*Distribution of white-fish from 1872 to 1880, inclusive.*

State.	Date.	Locality.	Tributaries.	Waters stocked.	Where finally hatched.	Number of fish.
California	1872	Lake County, Cal		Clear Lake	State Hatchery	25,000
	1873	Lake County, Cal		Clear Lake		25,000
	Mar. —, 1875	Tulare County, Cal		Tulare Lake	Berkeley, Cal	20,000
	Spring, 1877	Nevada County, Cal		Donner Lake	Berkeley, Cal	75,000
	Spring, 1877	Placer County, Cal		Senero and other lakes	Berkeley, Cal	50,000
	Spring, 1877			Tahoe Lake	Berkeley, Cal	175,000
	Jan. 11, 1879	Placer County, Cal		Tahoe Lake	San Leandro, Cal	70,000
	Jan. 11, 1879	Nevada County, Cal		Donner Lake	San Leandro, Cal	70,000
	Jan. 11, 1879	Nevada County, Cal		Lakes	San Leandro, Cal	60,000
	Jan. 18, 1879	Lassen County, Cal		Eagle Lake	San Leandro, Cal	225,000
	Jan. 21, 1879	Tulare County, Cal		Tulare Lake	San Leandro, Cal	100,000
	Feb. 1, 1879	Sonoma County, Cal		Mark West Creek	San Leandro, Cal	10,000
	Feb. 17, 1879	Santa Clara County, Cal		San José Water Company's Reservoir.	San Leandro, Cal	10,000
	Feb. 17, 1879	Alameda County, Cal		Chabot Lake	San Leandro, Cal	20,000
Indiana	Mar. 8, 1876	Rome, Ind		Rome City Lake	Northville, Mich	100,000
Iowa	Mar. 1, 1876	Iowa County, Iowa		Clear Lake	Northville, Mich	100,000
Michigan	Feb. 8, 1876	Northville, Mich		Rough River	Northville, Mich	200,000
	Feb. 9, 1876	Northville, Mich		Rough River	Northville, Mich	200,000
	Feb. 15, 1876	Northville, Mich		Rough River	Northville, Mich	200,000
	Feb. 19, 1876	Oak County, Mich		Walled Lake	Northville, Mich	50,000
	Feb. 19, 1876	Oak County, Mich		Strait's Lake	Northville, Mich	35,000
	Feb. 19, 1876	Oak County, Mich		Oxbow Lake	Northville, Mich	40,000
	Feb. 19, 1876	Northville, Mich	Rough River	Yerkes Lake	Northville, Mich	100,000
	Feb. 21, 1876	Le Roy, Mich		Rose Lake	Northville, Mich	25,000
	Feb. 21, 1876	Fife Lake, Mich		Fife Lake	Northville, Mich	25,000
	Feb. 21, 1876	Crofton, Mich		Bass Lake	Northville, Mich	125,000
	Feb. 21, 1876	Crofton, Mich		Loon Lake	Northville, Mich	125,000
	Feb. 21, 1876	Petosky, Mich		Twin Lakes	Northville, Mich	20,000
	Feb. 21, 1876	Petosky, Mich		Round Lake	Northville, Mich	20,000
	Feb. 21, 1876	Petosky, Mich		Crooked Lake	Northville, Mich	20,000
	Feb. 21, 1876	Cheboygan, Mich		Burt's Lake	Northville, Mich	40,000
	Feb. 24, 1876	Dexter, Mich		Silver Lake	Northville, Mich	12,500
	Feb. 24, 1876	Dexter, Mich		Portage Lake	Northville, Mich	20,000
	Feb. 24, 1876	Dexter, Mich		Big Portage Lake	Northville, Mich	20,000
	Feb. 24, 1876	Dexter, Mich		Base Lake	Northville, Mich	20,000
	Feb. 24, 1876	Dexter, Mich		Half-Moon Lake	Northville, Mich	20,000
	Feb. 24, 1876	Dexter, Mich		Patterson Lake	Northville, Mich	20,000
	Feb. 24, 1876	Dexter, Mich		Blind Lake	Northville, Mich	10,000
	Feb. 24, 1876	Dexter, Mich		Bruin Lake	Northville, Mich	10,000
	Feb. 24, 1876	Dexter, Mich		Island Lake	Northville, Mich	10,000
	Feb. 24, 1876	Dexter, Mich		Woodburn Lake	Northville, Mich	10,000
	Feb. 24, 1876	Chelsea, Mich		Round Lake	Northville, Mich	7,500
	Feb. 24, 1876	Chelsea, Mich		Lowe Lake	Northville, Mich	10,000

	Feb. 26, 1876	Linden, Mich		Day Lake	Northville, Mich	25,000
	Feb. 26, 1876	Linden, Mich		Cooke's Lake	Northville, Mich	10,000
	Feb. 26, 1876	Linden, Mich		Silver Lake	Northville, Mich	40,000
	Feb. 26, 1876	Linden, Mich		Round Lake	Northville, Mich	25,000
	Feb. 28, 1876	New Buffalo, Mich		Lake Michigan	Northville, Mich	130,000
	Feb. 28, 1876	Battle Creek, Mich		Lakes	Northville, Mich	70,000
	Spring, 1880	Monroe, Mich				200,000
New Jersey	Feb. 17, 1879	Morris County, N. J		Shepherd's Pond	Bloomsbury, N. J	45,000
	Feb. 17, 1879	Morris County, N. J		Lake Hopatcong	Bloomsbury, N. J	45,000
Ohio	Feb. 17, 1876	Toledo, Ohio		Lake Erie	Northville, Mich	100,000
	Feb. 21, 1876	Toledo, Ohio		Lake Erie	Northville, Mich	500,000
Wisconsin	1875	Reshena, Wis		Lakes		100,000
	1876	Reshena, Wis		Lakes		100,000

D.—TABLE VI.—*Distribution of California trout*, 1880.

State.	Date.	Locality.	Tributaries.	Waters stocked.	Where finally hatched.	Number of fish.
District of Columbia	May 1, 1880	Anacostia, D. C	Pond	Anacostia River	Baltimore, Md	500
Iowa	1880	Anamosa, Iowa	Ponds at Hatchery		Anamosa, Iowa	1,000
Maryland	Apr. 15, 1880		Stream	Gwynn's Falls	Baltimore, Md	500
	Apr. 15, 1880	Buckeystown, Md	Pond	Monocacy River	Baltimore, Md	300
	Apr. 16, 1880	Patuxent, Md	Streams	Little Patuxent River	Baltimore, Md	500
	Apr. 17, 1880	Waverly, Md	Stony Run	Jones Falls	Baltimore, Md	500
	Apr. 17, 1880	Catonsville, Md	Pond	Patapsco River	Baltimore, Md	500
	Apr. 17, 1880	Long Green, Md		Gunpowder River	Baltimore, Md	500
	Apr. 18, 1880	Pikesville, Md	Stream	Gwynn's Falls	Baltimore, Md	500
	Apr. 19, 1880	Green Spring, Md	Pond	Lake Roland	Baltimore, Md	500
	Apr. 19, 1880	Carrollton, Md	Pond	Patapsco River	Baltimore, Md	500
	Apr. 20, 1880		Rocky Run	Patuxent River	Baltimore, Md	500
	Apr. 20, 1880	Airy Hill, Md	Stream	Gwynn's Falls	Baltimore, Md	500
	Apr. 20, 1880	Oakland, Md	Pond	Patuxent River	Baltimore, Md	500
	Apr. 20, 1880		Trout Branch	Patuxent River	Baltimore, Md	500
	Apr. 21, 1880		Pond	Gwynn's Falls	Baltimore, Md	500
	Apr. 21, 1880	New Market, Md	Bush Creek	Monocacy River	Baltimore, Md	500
	Apr. 21, 1880	Unionville, Md	Pond	Linganore River	Baltimore, Md	500
	Apr. 21, 1880	New Market, Md	Bush Creek	Monocacy River	Baltimore, Md	500
	Apr. 22, 1880	Wilna, Md	Plum Tree Run	Bush River	Baltimore, Md	500
	Apr. 22, 1880	Phœnix, Md	Stream	Great Gunpowder River	Baltimore, Md	500
	Apr. 22, 1880	Phœnix, Md	Stream	Great Gunpowder River	Baltimore, Md	500
	Apr. 22, 1880	Phœnix, Md	Stream	Great Gunpowder River	Baltimore, Md	500
	Apr. 26, 1880	Westminster, Md	Pond	Pipe Creek	Baltimore, Md	500
	Apr. 26, 1880	Westminster, Md	Pond	Patapsco River	Baltimore, Md	500
	Apr. 27, 1880	Arlington, Md	Stream	Gunpowder River	Baltimore, Md	500
	Apr. 27, 1880	Dripping Spring, Md	Gunpowder River	Patuxent River	Baltimore, Md	1,000
	Apr. 28, 1880	Clear Spring, Md	Frantz Mill Dam	Potomac River	Baltimore, Md	500
	Apr. 28, 1880	Bel Air, Md	Stony Branch	Bush River	Baltimore, Md	500
	Apr. 30, 1880	Eden, Md	Pond	Patapsco River	Baltimore, Md	500
	May 1, 1880	Baltimore, Md	Stream	Patuxent River	Baltimore, Md	500
	May 3, 1880	Uniontown, Md	Pond	Big Pipe Creek	Baltimore, Md	500
	May 4, 1880	White Hall, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 4, 1880		Stream		Baltimore, Md	500
	May 7, 1880	Govanstown, Md	Stream	Back River	Baltimore, Md	500
	May 8, 1880	Norrisville, Md	McDonald's Run	Deer Creek	Baltimore, Md	500
	May 11, 1880	Frederick, Md	Monocacy River	Potomac River	Baltimore, Md	500
	May 13, 1880	Mount Pleasant, Md	Pond	Monocacy River	Baltimore, Md	500
	May 15, 1880	Baltimore, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 17, 1880	Warren, Md		Gunpowder River	Baltimore, Md	500
	May 18, 1880	Sulphur Spring, Md	Pond	Patapsco River	Baltimore, Md	500
	May 18, 1880	Sykesville, Md	Stream	Potomac, West Branch	Baltimore, Md	500
	May 18, 1880	Fairview, Md	Bush Run	Conococheague River	Baltimore, Md	2,500
	May 19, 1880	Ijamsville, Md	Pond	Monocacy River	Baltimore, Md	500

	May 20, 1880	Baltimore, Md	Stony Run	Jones Falls	Baltimore, Md	500
	May 21, 1880	Ellicott City, Md	Stream	Patapsco River	Baltimore, Md	500
	May 21, 1880	Ellicott City, Md		Patapsco River	Baltimore, Md	500
	May 24, 1880	York Road, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 25, 1880	Greenwood, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 27, 1880	Sandy Spring, Md	Stream	Patuxent River	Baltimore, Md	500
	May 29, 1880	Saint James, Md	Pond	Gunpowder River	Baltimore, Md	500
	May 29, 1880	Rockville, Md	Rock Creek	Potomac River	Baltimore, Md	5,000
	May 31, 1880	Barnesville, Md	Pond	Monocacy River	Baltimore, Md	500
	June 1, 1880	Port Deposit, Md	Pond	Susquehanna River	Baltimore, Md	500
	June 1, 1880	Port Deposit, Md	Pond	Susquehanna River	Baltimore, Md	500
	June 4, 1880	Monrovia, Md	Pond	Bennett's Creek	Baltimore, Md	500
	June 14, 1880	Dickerson, Md	Pond	Potomac River	Baltimore, Md	200
	June 15, 1880	Ijamsville, Md	Pond	Bush Creek	Baltimore, Md	500
	June 24, 1880		Stream	Western Run	Baltimore, Md	500
	1880	Bella Vista, Md	Pond	Gunpowder River	Baltimore, Md	500
Michigan	1880	Northville, Mich	Ponds	Rouge River	Pokagon, Mich	2,100
	1880	Almena, Mich	North Branch	Paw Paw River	Pokagon, Mich	684
	1880	Charlevoix County, Mich		Boyne River	Pokagon, Mich	684
	June 25, 1880	Pokagon, Mich	Ponds at Hatchery		Pokagon, Mich	684
	1880	Battle Creek, Mich	Sheppard's Brook	Kalamazoo River	Battle Creek, Mich	750
	1880	Battle Creek, Mich	Ponds at Hatchery		Battle Creek, Mich	200
Minnesota	1880	Willow Brook, Minn	Ponds at Hatchery			1,900
New Hampshire	1880	Plymouth, N. H	Baker's River	Pemigewasset River		1,000
	1880	Plymouth, N. H	Pemigewasset River	Merrimac River		1,000
North Carolina	Mar. 22, 1880	Watauga County, N. C	Ponds	New River		500
	Mar. 22, 1880	McDowell County, N. C	Mill Creek	Catawba River		1,000
	Mar. 22, 1880	Buncombe County, N. C	Swannanoa River	French Broad River		500
	Mar. 22, 1880	Buncombe County, N. C	Ponds	French Broad River		800
	Mar. 22, 1880	Burke County, N. C	Upper Creek	Catawba River		500
	Mar. 22, 1880	Burke County, N. C	John's River	Catawba River		1,000
Pennsylvania	1880	Corry, Pa	Ponds at Hatchery			700
South Carolina	1880		Seneca River			1,500
	1880		Mill Creek			1,000
	1880		Hampton Creek			1,000
West Virginia	1880	Romney, W. Va	Mill Run	South Branch Potomac River		500
Wisconsin	1880	Geneva, Wis	Ponds	Geneva Lake		2,500

XIX.—INDEX TO THE DISTRIBUTION, MADE UNDER THE AUSPICES OF THE UNITED STATES FISH COMMISSION, OF FISH IN PUBLIC WATERS OF THE UNITED STATES, DURING THE DECADE ENDING 1880.

By CHAS. W. SMILEY.

NOTE.—To ascertain whether fish have been deposited in any given locality, look either for the name of the stream or for names of places or counties at the headwaters of that stream. In many cases deposits were made at railroad bridges at some distance from villages or post-offices. In these cases the effort has been made to give the name of the nearest post-office. For fuller particulars of deposits, see the tables of distribution, pages 843 to 915, inclusive, of this volume.

Albert Lea, Freeborn County, Minn. Penobscot salmon, 1875; California salmon, 1875, 1876.
Alden Lake, Freeborn County, Minn. California salmon, 1878.
Allamakee County, Iowa. (See Waukon, Iowa.)
Allapahaw River, Stockton, Ga. Shad, 1879.
Allegan County, Mich., Dumont Lake. California salmon, 1878.
Allegan County, Mich., Minckler Lake. California salmon, 1879.
Allegan County, Mich., Minor Lake. California salmon, 1878, 1879.
Allegan County, Mich., Sixteen Lake. California salmon, 1879.
Allegan County, Mich., Wetmore Lake. California salmon, 1879.
Alleghany County, Md. (See Cumberland, Md.; Tannery, Md.)
Alleghany County, Va., Jackson River. California salmon, 1876.
Alleghany County, Va. (See Clifton Forge, Va.)
Alleghany Springs, Va., Roanoke River. California salmon, 1880.
Allegheny River, Salamanca, N. Y. Shad, 1872.
Allegheny River. (See tributary: Chautauqua Lake.)
Allegheny River, Westmoreland County, Pa. Schoodic salmon, 1880.
Allen Creek, Monroe County, N. Y. California salmon, 1873, 1874, 1875; Penobscot salmon, 1875; Schoodic salmon, 1879.
Alley Lake, Renville County, Minn. California salmon, 1879; Schoodic salmon, 1879.
Alloway's Creek, Allowaystown, N. J. California salmon, 1876, 1877, 1879.
Allowaystown, N. J., Alloway's Creek. California salmon, 1876, 1877, 1879.
Almena, Mich., North Branch of Paw-Paw River. California trout, 1880.
Alone, Va., Buffalo Creek. California salmon, 1880.
Altamaha River. (See tributaries: Oconee River and Ocmulgee River.)
Amherst County, Va., Pedlar River. California salmon, 1876.
Amite City, La., Tangipahoa River. California salmon, 1876.
Amite River, Tickfaw, La. Shad, 1878.
Anacostia, D. C., pond. California trout, 1880.
Anamosa, Iowa, Hatching Ponds. California trout, 1880; Schoodic salmon, 1878.
Anamosa, Iowa, Wapsipinicon River. California salmon, 1874, 1875.
Andover Branch, Millington, Md. California salmon, 1879.
Andover, Sussex County, N. J., Strubel's Lake. Schoodic salmon, 1878.
Androscoggin County, Me. (See Auburn, Me.)
Androscoggin River, Me., tributary of. Penobscot salmon, 1873.
Anne Arundel County, Md. (See Patuxent, Md.; Sappington, Md.)
Anoka County, Minn., Crooked Lake. California salmon, 1877.
Anoka County, Minn., Round Lake. California salmon, 1877.
Anthony's Pond, Wis. California salmon, 1879.
Antietam Creek, Chewsville, Md. California salmon, 1876.
Antietam Creek, Hagerstown, Md. California salmon, 1874, 1876, 1879.

Atlantic, Iowa, Nishnabottomy River. California salmon, 1875.

Attala County, Miss. (See Kosciusko, Miss.)

Auburn, Me., pond. Schoodic salmon, 1879.

Audrain County, Mo. (See Mexico, Mo.)

Auglaize County, Ohio. (See Wapakoneta, Ohio.)

Auglaize River, Wapakoneta, Ohio. California salmon, 1875.

Augusta County, Va. (See Greenville, Va., Staunton, Va., Waynesborough, Va.)

Au Sable River, Crawford County, Mich. California salmon, 1874, 1876.

Au Sable River, Roscommon County, Mich. Penobscot salmon, 1873.

Au Sable River. (See tributary: Otsego Lake.)

Austin, Minn., Mill Pond. California salmon, 1877.

Austin, Texas, Colorado River. Shad, 1874, 1875, 1879; California salmon, 1874, 1876.

Avoca, N. C., Chowan River. Shad, 1878.

Avoca, N. C., near Roanoke River Light, 1879.

Avoca, N. C., Salmon Creek. Shad, 1878, 1879.

Avoca, N. C., Scotch Hall Fishery, Albemarle Sound. Shad, 1878, 1879.

Avon, Minn., Spunk Creek. California salmon, 1877.

Back River, Herring Run, Md. California salmon, 1878.

Badger River, Iowa. California salmon, 1878.

Baird, Cal., McCloud River. California salmon, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880.

Baker's River, N. H. California salmon, 1875.

Baker's River, Plymouth, N. H. California salmon, 1878; California trout, 1880.

Baker's River, Warren, N. H. California salmon, 1876; Penobscot salmon, 1876.

Balahack Brook, South Windham, Conn. Schoodic salmon, 1877.

Bald Eagle Creek. (See tributary: Spring Creek.)

Bald Eagle Lake, Ramsey County, Minn. California salmon, 1876.

Bald Eagle River, Bellefonte, Pa. California salmon, 1874.

Balding's Mill, Ga., Chastatee River. California salmon, 1878.

Baldwin County, Ga. (See Milledgeville, Ga.)

Baltimore County, Md., Railroad Crossing of Gunpowder River. Shad, 1879.

Baltimore County, Md. (See Airy Hill, Md.; Arlington, Md.; Baltimore, Md.; Catonsville, Md.; Cockeysville, Md.; Dripping Spring, Md.; Freeland, Md.; Glencoe, Md.; Green Spring, Md.; Greenwood, Md.; Govanstown, Md.; Hampton, Md.; Hereford, Md.; Herring Run, Md.; Long Green, Md.; Monkton, Md.; Parkton, Md.; Phœnix, Md.; Pikesville, Md.; Reisterstown, Md.; Relay Station, Md.; Saint James, Md.; Towsontown, Md.; Warren, Md.; Waverly, Md.; White Hall, Md.)

Baltimore, Md., Baltimore Water Works. California salmon, 1876, 1876.

Baltimore, Md., Beaver Dam Creek. Schoodic salmon, 1879.

Baltimore, Md., Charles River. Schoodic salmon, 1879.

Bass Lake, Ramsey County, Minn. Schoodic salmon, 1875; California salmon, 1875; Penobscot salmon, 1875.
Bass Lake, Washington County, Minn. California salmon, 1877.
Battenkill Creek, Manchester, Vt. Penobscot salmon.
Battery Light, Md., Susquehanna River. Shad, 1879.
Battle Creek, Calhoun County, Mich., Goquack Lake. California salmon, 1875; Schoodic salmon, 1878.
Battle Creek, Mich., Hamblin Lake. California salmon, 1876.
Battle Creek, Mich., lakes. Whitefish, 1876; California trout, 1880.
Battle Creek, Mich., Sheppard's Brook. California trout, 1880.
Bayard, Ohio, Muskingum River. Shad, 1875.
Bay County, Mich., Rifle River. California salmon, 1875.
Bay, Erie, Pa. Schoodic salmon, 1879.
Bayou Macon, Railroad Crossing, Richland Parish, La. Shad, 1879.
Baytown Lake, Wright County, Minn. California salmon, 1876.
Beach Pond, Richmond, R. I. Schoodic salmon, 1876.
Beach Pond, Volumtown, Conn. Schoodic salmon, 1876.
Bean Pond, Warner, N. H. Schoodic salmon, 1880.
Bean's Lake, Platte County, Mo. California salmon, 1880.
Bear Creek, Charlevoix County, Mich. California salmon, 1876, 1876.
Bear Creek, Iowa, Bear Creek. Penobscot salmon, 1875.
Bear Creek, tributary of, Md. California salmon, 1878.
Bear Hill Pond, Harvard, Mass. Schoodic salmon, 1878, 1879.
Bear Lake, Carleton County, Minn. California salmon, 1878.
Bear Lake, Wilkes Barre, Pa. California salmon, 1880; Schoodic salmon, 1878, 1880.
Bear River. (See tributary: Truckee River.)
Beaver Creek, N. Y. California salmon, 1873.
Beaver Creek, Sand Bank, N. Y. California salmon, 1874.
Beaver County, Pa. (See Georgetown, Pa.)
Beaver Dam Creek, Baltimore, Md. Schoodic salmon, 1879.
Becker County, Minn., Detroit Lake. California salmon, 1877; Schoodic salmon, 1875; Penobscot salmon, 1875.
Becker County, Minn. (See Frazee City, Minn.; Lake Park, Minn.)
Bel Air, Md., pond. Schoodic salmon, 1880.
Bel Air, Md., Stony Branch. California trout, 1880.
Belknap County, N. H. (See Centre Harbor, N. H.; Tilton, N. H.)
Bella Vista, Md., pond tributary to Gunpowder River. California trout, 1880.
Bell Creek, Goodhue County, Minn. California salmon, 1878.
Bellefontaine, Ohio, Buckingahela River. Shad, 1874.
Bellefonte, Pa., Bald Eagle River. California salmon, 1874.
Bellefonte, Pa., Spring Creek. California salmon, 1874.
Belleville, Ill., Kaskaskia River. California salmon, 1877.
Belleville, Ill., Mississippi River. California salmon, 1877.
Belleville, Ill., Prairie du Pont River. California salmon, 1876, 1877.

Bigler Lake. (See tributary: Tahoe Lake.)
Big Paw-Paw River, Watervliet, Mich. California salmon, 1878.
Big Pipe Creek, tributary to, Union Bridge, Md., pond. Schoodic salmon, 1879.
Big Pipe Creek, Middleburg, Md. California salmon, 1879.
Big Pond, White Haven, Pa. Schoodic salmon, 1879.
Big Portage Lake, Dexter, Mich. Whitefish, 1876.
Big Rock Creek, Big Rock, Iowa. California salmon, 1874.
Big Rock Creek, Walker, Iowa. California salmon, 1875.
Big Rock, Iowa, Big Rock Creek. California salmon, 1874.
Big Rock River, Iowa. California salmon, 1879.
Big Sandy River. (See tributary: Tygert River.)
Big Slate Creek, Montgomery County, Ky. California salmon, 1877.
Big Spring Branch, Scott County, Ky. California salmon, 1876.
Big Spring Depot, Va., Roanoke River. California salmon, 1876, 1880.
Big Star Lake, Lake County, Mich. California salmon, 1876.
Big Stone County, Minn. (See Ortonville, Minn.)
Big Stone Lake, Ortonville, Minn. California salmon, 1880.
Big Wills Creek, Lebanon, Ala. Shad, 1879.
Billerica, Mass., Shawshine River. Schoodic salmon, 1877.
Bingham Lake, Cottonwood County, Minn. California salmon, 1876.
Blackbird, Del., Appoquinimink River. Shad, 1879.
Black Hawk County, Iowa. (See Waterloo, Iowa.)
Black River, Elyria, Ohio. Shad, 1874.
Black River, Poplar Bluff, Mo. Shad, 1876.
Black River, Port Huron, Mich. California salmon, 1875.
Black River, Wayne County, Mo. California salmon, 1879.
Black River, S. C. California salmon, 1880.
Black River. (See tributary: Ouachita, or Washita, River.)
Black River. (See tributary: San Francois River.)
Black River. (See tributary: Bowell Creek.)
Blacksburgh, Va., New River. Schoodic salmon, 1878.
Blacksmith's Fork, Cache County, Utah. California salmon, 1876.
Blackstone River, R. I. Penobscot salmon, 1873.
Blackstone River, Providence County, R. I. Shad, 1874, 1877.
Blackstone River. (See tributary: Slatersville Branch.)
Blackstone River, tributary of, R. I. California salmon, 1874, 1875.
Black Vermillion River, Frankford, Kans. California salmon, 1878, 1879.
Black Warrior River, Tuscaloosa, Ala. Shad, 1879.
Blackwater River, Barn's Farm, Md. California salmon, 1879.
Blackwater River, Cambridge, Md. California salmon, 1879; shad, 1879.
Blackwater River, Franklin, Va. Shad, 1878, 1879.
Blair County, Pa., Juniata River. California salmon, 1880.
Blair County, Pa. (See Tyrone, Pa.)

Botetourt County, Va., tributary of James River. California salmon, 1876.
Botetourt County, Va. (See Fincastle, Va.)
Bourbon County, Ky., Elmwood Creek. California salmon, 1878.
Bowell Creek, Jefferson County, N. Y. California salmon, 1878.
Bowling Green, Ky., Green River. Shad, 1878.
Bowman's Run, Wilkes Barre, Pa. California salmon, 1876, 1878, 1879.
Box Elder County, Utah, Box Elder Creek. California salmon, 1876.
Box Elder Creek, Box Elder County, Utah. California salmon, 1876.
Boxford, Mass., Mitchell's Pond. Schoodic salmon, 1876, 1877.
Boyd's, Md., Brick Lodge. California salmon, 1878.
Boyd's, Md., Little Lorrem. California salmon, 1878.
Boyd's, Md., Ten-Mile Creek. California salmon, 1878.
Boyer River, Iowa. Penobscot salmon, 1876.
Boyer River, Logan, Iowa. Shad, 1878.
Boyle County, Ky., Dick's River. California salmon, 1876.
Boyne Falls, Mich., Boyne River. California salmon, 1876.
Boyne River, Boyne Falls, Mich. California salmon, 1876.
Boyne River, Charlevoix County, Mich. California trout, 1880.
Bradford, N. H., Bradford's Pond. Schoodic salmon, 1879.
Bradford's Pond, Bradford, N. H. Schoodic salmon, 1879.
Bradley Springs, Trivoli, Kans. Schoodic salmon, 1880.
Brainerd, Crow Wing County, Minn. Penobscot salmon, 1875.
Braintree, Mass., Great Pond. Schoodic salmon, 1877, 1878, 1880.
Branch County, Mich., Coldwater Lake. California salmon, 1875.
Branch County, Mich., Lake of the Woods. California salmon, 1875.
Branch County, Mich., Morrison Lake. California salmon, 1875.
Branchville, N. C., Meherrin River. Shad, 1878, 1879.
Branchville, S. C., Edisto River. California salmon, 1877.
Brandywine, Pa., Brandywine Creek. California salmon, 1876.
Branford, Conn., Roger's Pond. Schoodic salmon, 1877.
Brazos River, Hearne, Tex. Shad, 1879.
Brazos River, Hempstead, Tex. Shad, 1874.
Brazos River. (See tributary: Clear Creek.)
Breckenridge, Minn., Red River of the North. California salmon, 1875; Penobscot salmon, 1875; Schoodic salmon, 1875.
Breckenridge, Minn., branch of Red River. California salmon, 1876.
Bremen County, Iowa. (See Waverly, Iowa.)
Brewster, Mass., ponds. Schoodic salmon, 1880.
Brick Lodge, Boyd's, Md. California salmon, 1878.
Bridgeton, N. J. Cohansey Creek. California salmon, 1877.
Bridgewater, Mass., Fall River. California salmon, 1877.
Bridgewater, Mass., Taunton River. Shad, 1876, 1877.
Bridgewater, N. H., Newfound Lake. Schoodic salmon, 1879.
Bridgewater, N. C., Linville River. California salmon, 1878, 1879.
Briggs Lake, Sherburne County, Minn. California salmon, 1877, 1878.

Buckeystown, Md., pond. California salmon, 1880; California trout, 1880; Schoodic salmon, 1880.

Buckingahela River, Bellefontaine, Ohio. Shad, 1874.

Bucks County, Pa. (See Point Pleasant, Pa.)

Buck's Creek, Van Buren County, Mich. California salmon, 1879.

Bucksport, Me., Craig's Pond. California salmon, 1874, 1875.

Bucksport, Me., Hatching-house Pond. California salmon, 1874.

Bucyrus, Ohio, Sandusky River. California salmon, 1874.

Buel Lake, Great Barrington, Mass. Schoodic salmon, 1879, 1880.

Buffalo Creek, Bethany, W. Va. California salmon, 1878, 1879, 1880.

Buffalo Creek, branch of, Marion County, W. Va. Schoodic salmon, 1878.

Buffalo Creek, Lewisburgh, Pa. California salmon, 1879.

Buffalo Creek, Lexington, Va. Schoodic salmon, 1879.

Buffalo Creek, Marion County, W. Va. Schoodic salmon, 1878.

Buffalo Creek, Pa. California salmon, 1875.

Buffalo Creek, Alone, Va. California salmon, 1880.

Buffalo Creek, Rockbridge County, Va. Schoodic salmon, 1877.

Buffalo Creek, Buffalo Mills, Va. California salmon, 1878.

Buffalo Mills, Va., Buffalo Creek. California salmon, 1878.

Buffalo River, Hawley, Minn. California salmon, 1877.

Buffalo River. (See tributary: Lake.)

Bullitt County, Ky. (See Shepherdsville, Ky.)

Bullitt County, Ky., Knob Creek. California salmon, 1877.

Bullock County, Ala. (See Union Springs, Ala.)

Bull Run Creek, Jamestown, N. C. California salmon, 1878.

Bumgartner's Creek, Hart County, Ky. California salmon, 1876.

Buncombe County, N. C., ponds. California trout, 1880.

Buncombe County, N. C., Swannanoa River. California salmon, 1877; California trout, 1880.

Buncombe County, N. C. (See Asheville, N. C.)

Burke County, N. C., John's River. California trout, 1880.

Burke County, N. C., Upper Creek, California trout, 1880.

Burke County, N. C. (See Bridgewater, N. C.; Morganton, N. C.)

Burke's Creek, Cass County, Mich. California salmon, 1875.

Burlingame, Kans., Dragoon. California salmon, 1870.

Burlingame, Kans., Lyndon Lake. California salmon, 1880.

Burlington County, N. J., Mullica River. California salmon, 1879.

Burlington, Vt., Winooski River. Shad, 1874.

Burnsides, Harford County, Md., Green Spring Run. Schoodic salmon, 1879.

Burnt Bridge, Va., North River. California salmon, 1880.

Burrellville, R. I., Wallum Pond. Schoodic salmon, 1876, 1878.

Burritt, Ill., Knapp's Creek. California salmon, 1877.

Burton, W. Va.. Fish Creek. California salmon, 1879, 1880.

Burt's Lake, Cheboygan, Mich. Whitefish, 1876.

Calhoun County, Mich., Metcalf Lake. California salmon, 1874, 1875; Schoodic salmon, 1878.

Calhoun County, Mich., Reese Pond. Schoodic salmon, 1876.

Calhoun County, Mich., Town Line. California salmon, 1878.

Calhoun County, Mich. (See Marshall, Mich.)

Calhoun Lake, Hennepin County, Minn. California salmon, 1876.

Callao, Mo., Chariton River. Shad, 1876.

Calumet County, Wis. (See New Holstein, Wis.)

Calumet River, Kensington, Ill. California salmon, 1874; Penobscot salmon, 1874.

Calumet River, Wildwood, Ill. Penobscot salmon, 1874.

Calumet River, South Lawn, Ill. Penobscot salmon, 1874.

Calumet River, South Chicago, Ill. Shad, 1873.

Cambridge, Md., Black Water, River. California salmon, 1879; shad, 1879.

Camden County, N. J. (See Camden, N. J.; Winslow, N. J.)

Camden, N. J., Mullica River. California salmon, 1877.

Camden County, N. C., North River. Shad, 1879.

Cameron County, Pa., Driftwood Branch. California salmon, 1879, 1880.

Cameron County, Minn., Rice County, Minn. California salmon, 1878.

Campbell County, Va. (See Lynchburgh, Va.)

Camp Creek, Fillmore County, Minn. California salmon, 1878.

Campton, N. H., tributary of Merrimac River. Penobscot salmon.

Campton and Plymouth, N. H., Pemigewasset River. California salmon, 1876, 1878, 1879.

Canaan Mountain Pond, Falls Village, Conn. Schoodic salmon, 1880.

Canaan, N. H., Hart's Pond. Schoodic salmon, 1880.

Canes Run, Scott County, Ky. California salmon, 1876.

Canosia Lake, Duluth, Minn. Schoodic salmon, 1879.

Cannon River, Faribault, Minn. California salmon, 1877.

Cannon River, Owatonna, Minn. California salmon, 1877.

Cannon River, Rice County, Minn. California salmon, 1875; Schoodic salmon, 1879.

Cannon River. (See tributaries: Shields, Cedar Lake, Roberd's Lake, Bell Creek, Washington Lake, Jefferson Lake.)

Canterbury, Conn., Quinnebaug River. Shad, 1875.

Canton, Miss., Big Black River. Shad, 1877.

Cape Fear River, Lockville, N. C. Shad, 1878.

Cape Fear River, Greenesborough, Guilford County, N. C., ponds. Schoodic salmon, 1878.

Cape Fear River. (See tributaries: Deep River, Bull Run Creek, N. Fork Deep River, Haw River, Goshen Creek, Six Runs.)

Cape May County, N. J. (See Dennisville, N. J.; Tuckahoe, N. J.)

Capo Creek, Pierce City, Mo. California salmon, 1878.

Carleton County, Minn., Bear Lake. California salmon, 1878.

Carleton County, Minn., Chubb Lake. California salmon, 1878.

Cass County, Mich., Dowagiac River. California salmon, 1875, 1875, 1875.
Cass County, Mich., Indian Creek. California salmon, 1875.
Cass County, Mich., Indian Lake. California salmon, 1878.
Cass County, Mich., Millen Creek. California salmon, 1878.
Cass County, Mich., Muncy Lake. California salmon, 1876.
Cass County, Mich., Peavine Creek. California salmon, 1875, 1879.
Cass County, Mich., Pine Creek. California salmon, 1879.
Cass County, Mich., Pokagon Creek. California salmon, 1878, 1879.
Cass County, Minn., Sandy Lake. Schoodic salmon, 1879.
Cass County, Mich., Williams' Creek. California salmon, 1875.
Cass County, Mich. (See Howard, Mich.; Pokagon, Mich.)
Cass River, Saginaw County, Mich. California salmon, 1879.
Castalia, Ohio, Castalia Spring. California salmon, 1873.
Castalia, Ohio, Castalia Spring Stream. Penobscot salmon, 1873.
Castalia, Ohio, Cold Creek. California salmon, 1877, 1879.
Castalia Spring, Castalia, Ohio. California salmon, 1873.
Castalia Spring Stream, Castalia, Ohio. Penobscot salmon, 1873.
Castleton, Vt., pond. Schoodic salmon, 1876.
Catawba County, N. C. (See Catawba, N. C.; Newton, N. C.)
Catawba, N. C., Catawba River. Shad, 1876, 1877, 1878.
Catawba River, Catawba, N. C. Shad, 1876, 1877, 1878.
Catawba River, Charlotte, N. C. California salmon, 1872.
Catawba River, Charlotte, N. C. California salmon, 1879. (See S. C.)
Catawba River, Morganton, N. C. California salmon, 1880.
Catawba River, Old Fort, N. C. California salmon, 1878, 1879.
Catawba River, tributaries of, Charlotte, Mecklenburgh County, N. C., ponds. Schoodic salmon, 1878.
Catawba River, tributaries of, Morganton, N. C., ponds. Schoodic salmon, 1878.
Catawba River, Rock Hill, S. C. Shad, 1880.
Catawba River. (See tributaries: Linville River, John's River, Upper Creek, Clark's Creek, Mill Creek.)
Catfish River. (See tributary: Mendota Lake.)
Cathance Lake, Cooper, Me. Schoodic salmon, 1878.
Catonsville, Md., Gwynn's Falls. California trout, 1880; Schoodic salmon, 1880.
Cattaraugus County, N. Y. (See Salamanca, N. Y.)
Cave Spring Branch, Green County, Ky. California salmon, 1877.
Cayuga County, Spring Brooks. California salmon, 1879.
Cayuga Lake, N. Y. California salmon, 1874.
Cayuga Lake, N. Y. (See tributary: Spring Creeks.)
Cecil County, Md., Bohemia River. California salmon, 1879, 1880.
Cecil County, Md., Northeast River. Shad, 1878.
Cecil County, Md., Sassafras River. California salmon, 1880.

Chapman, Kans., Chapman's Creek. California salmon, 1878, 1879, 1881.
Chapman's Creek, Chapman, Kans. California salmon, 1878, 1879, 1881.
Chariton River, Callao, Mo. Shad, 1876.
Chariton River, Macon County, Mo. California salmon, 1880; shad, 1880.
Charles County, Md. (See Glymont, Md.)
Charles River, Baltimore, Md. Schoodic salmon, 1879.
Charleston County, S. C. (See Charleston, S. C.)
Charleston County, S. C., Cooper River. California salmon, 1879; shad, 1879.
Charleston, Ill., Embarrass River. Shad, 1878.
Charleston, Kanawha County, W. Va., Kanawha River. California salmon, 1878.
Charleston, S. C., Cooper River. California salmon, 1877.
Charleston, W. Va., Elk River. California salmon, 1879, 1880.
Charlestown, N. H., Connecticut River. Penobscot salmon, 1874.
Charlevoix County, Mich., Bear Creek. California salmon, 1876, 1876.
Charlevoix County, Mich., Boyne River. California trout, 1880.
Charlevoix County, Mich., Wallow Lake. California salmon, 1878.
Charlevoix County, Mich. (See Boyne Falls, Mich.)
Charlotte, Iowa, Maquoketa River. California salmon, 1874.
Charlotte Lake, Wright County, Minn. California salmon, 1877.
Charlotte, Me., Crocker's Lake. Schoodic salmon, 1878.
Charlotte, Me., Moosehorn Waters. Schoodic salmon, 1878.
Charlotte, Me., Sprague's Pond. Schoodic salmon, 1878.
Charlotte, Mecklenburgh County, N. C., ponds tributaries to Catawba River. Schoodic salmon, 1878.
Charlotte, N. C., Catawba River. California salmon, 1872, 1879.
Chase County, Kans. (See Cottonwood Falls, Kans.)
Chastatee River, Balding's Mill, Ga. California salmon, 1878.
Chatham County, N. C. (See Lockville, N. C.)
Chattahoochee River, Atlanta, Ga. Shad, 1876.
Chattahoochee River, Boltonville, Ga. Shad, 1880.
Chattahoochee River, Columbus, Ga. Shad, 1877, 1879.
Chattahoochee River, Gainesville, Ga. California salmon, 1878; shad, 1879.
Chattahoochee River, Norcross, Ga. California salmon, 1877.
Chattahoochee River, West Point, Ga. Shad, 1877.
Chattanooga, Tenn., Tennessee River. Shad, 1876, 1879.
Chautauqua County, N. Y., Chautauqua Lake. California salmon, 1875.
Chautauqua Lake, Chautauqua County, N. Y. California salmon, 1875.
Chazy River, Ellenburgh, N. Y. Penobscot salmon, 1875.
Cheat River, Rowlesburgh, W. Va. Shad, 1879.
Chebacco Lake, Essex, Mass. Schoodic salmon, 1877, 1879.

Chisago County, Minn., Taylor's Falls. California salmon, 1875.
Chisago County, Minn. (See Stacy, Minn.)
Chisago Lake, Chisago County, Minn. California salmon, 1876, 1877.
Chittenden County, Vt. (See Burlington, Vt.; Essex, Vt.)
Choctawhatchee River. (See tributary: Pea River.)
Choptank River, Denton, Md. Shad, 1877.
Choptank River, Greensborough, Md. California salmon, 1876; shad, 1878.
Choptank River, Henderson, Md. California salmon, 1878, 1879, 1880; shad, 1879.
Choptank River. (See tributaries: Tread Haven, Tuckahoe River, Tuckahoe Creek, Trappe River.)
Chowan River, Avoca, N. C. Shad, 1878.
Chowan River, Coleraine, N. C. Shad, 1878.
Chowan River. (See tributaries: Salmon Creek, Meherrin River, Nottoway River.)
Chowan River. (See tributaries: Nottoway River, Blackwater River.)
Christiana Creek, Wilmington, Del. Shad, 1880.
Christian County, Ky., Little River. California salmon, 1878.
Christmass Lake, Minn. California salmon, 1877, 1880.
Chubb Lake, Carleton County, Minn. California salmon, 1878.
Chuck Creek, Tenn., French Broad River. California salmon, 1876.
Chunky River, Meridian, Miss. Shad, 1879.
Church Lake, Kent County, Mich. California salmon, 1876.
Circle Lake, Rice County, Minn. California salmon, 1878.
Clackamas River, Cal. California salmon, 1877, 1878.
Clam Lake, Clam Lake, Mich. California salmon, 1876.
Clam Lake, Mich., Clam Lake. California salmon, 1876.
Clare County, Mich., Crooked Lake. Schoodic salmon, 1878.
Clare County, Mich., Roney Lake. Schoodic salmon, 1878.
Clare County, Mich. (See Surrey, Mich.)
Clark County, Ark., Ouachita River. Shad, 1879.
Clark County, Ark. (See Arkadelphia, Ark.)
Clark County, Ky., Howard's Lower Creek. California salmon, 1876.
Clark County, Ky., Howard's Upper Creek. California salmon, 1876.
Clark County, Ky., Stoner Creek. California salmon, 1876.
Clark County, Ky., Strode's Creek. California salmon, 1876.
Clark County, Ky., Lulbregrud Creek. California salmon, 1876.
Clarksburgh, W. Va., West Fork of the Monongahela River. California salmon, 1876; Schoodic salmon, 1879.
Clarksburgh, W. Va., West Fork River. Shad, 1879.
Clark's Creek, Newton, N. C. California salmon, 1879.
Clay Centre, Kans., Republican River. California salmon, 1880.
Clay County, Kans. (See Clay Centre, Kans.)
Clay County, Minn. (See Hawley, Minn.; Moorhead, Minn.)
Clayton County, Ga. (See Jonesborough, Ga.)

Cobb's Branch, Westminster, Md. Schoodic salmon, 1879.
Cobosecontee Lake, Manchester, Me. Schoodic salmon, 1879.
Cockeysville, Md., Gunpowder River. California salmon, 1878, 1879; Schoodic salmon, 1878; shad, 1877, 1878, 1879.
Cockeysville, Md., Western River. California salmon, 1876.
Cocnochogue River, Durham, Conn. California salmon, 1874.
Codorus Creek, Pa. Penobscot salmon, 1874.
Cohansey Creek, Bridgeton, N. J. California salmon, 1877.
Cohansey Creek, N. J. California salmon, 1877.
Cohocton River, Liberty, N. Y. California salmon, 1873.
Cold Creek, Castalia, Ohio. California salmon, 1877, 1879.
Cold Pond, Acworth, N. H. Schoodic salmon, 1880.
Cold Spring Pond, Enfield, Me. Schoodic salmon, 1878.
Cold Spring, W. Va, Wheeling Creek. California salmon, 1878; Schoodic salmon, 1879.
Cold Water Creek, Oxford, Ala. California salmon, 1878.
Coldwater Lake, Branch County, Mich. California salmon, 1875.
Cold Water River, Holly Springs, Miss. Shad, 1878.
Colebrook, Conn., Farmington River. California salmon, 1873, 1873.
Colerain, N. C., Chowan River. Shad, 1878.
Coles County, Ill. (See Charleston, Ill.)
Collier's Creek, Collierstown, Va. California salmon, 1880.
Collierstown, Va., Collier's Creek. California salmon, 1880.
Colon, Mich., Sturgeon Lake. California salmon, 1876.
Colorado County, Tex. (See Columbus, Tex.)
Colorado River, Austin, Tex. Shad, 1874, 1875, 1879; California salmon, 1874, 1876.
Colorado River, Columbus, Tex. Shad, 1879.
Colt's Reservoir, Hartford, Conn. Schoodic salmon, 1880.
Columbia, Ala., Tombigbee River. Shad, 1879.
Columbia County, Wis. (See Hartman, Wis.; Lodi, Wis.; Portage, Wis.; Poynette, Wis.)
Columbiana County, Ohio. (See Bayard, Ohio.)
Columbia, Pa., tributary of Susquehanna River. California salmon, 1876.
Columbia, S. C., Broad River. Shad, 1878, 1880, 1880; California salmon, 1879.
Columbus, Ga., Chattahoochee River. Shad, 1877, 1879.
Columbus, Ind., White River. Shad, 1874.
Columbus, Ohio, Scioto River. Shad, 1875, 1876.
Columbus, Ohio, Whetstone River. California salmon, 1878.
Columbus, Tex., Colorado River. Shad, 1879.
Column Lake, McHenry, Ill. California salmon, 1877.
Como Lake, Houston County, Minn. California salmon, 1878; Schoodic salmon, 1879.
Como Lake, Ramsey County, Minn. Schoodic salmon, 1875; Penobscot salmon, 1875; California salmon, 1875, 1876, 1877.

Cook's Pond, Brookfield, N. H. California salmon, 1879.
Coon Lake, Minn. California salmon, 1877.
Coon River. (See Raccoon.)
Cooper, Me., Cathance Lake. Schoodic salmon, 1878.
Cooper River, Charleston County, S. C. California salmon, 1879; shad, 1879.
Cooper River, Charleston, S. C. California salmon, 1877.
Coosa River, Cartersville, Ga. California salmon, 1876.
Coosa River, Resaca, Ga. California salmon, 1878; shad, 1879.
Coosa River, Rome, Ga. Shad, 1875.
Coosa River. (See tributaries: Tombigbee River, Cold Water Creek, and Etowah River.)
Coos County, N. H. (See Pittsburgh, N. H.; Stark, N. H.; Stewartstown, N. H.)
Cooper Creek, Iowa. California salmon, 1878.
Cordova Station, Md., Miles Creek. Shad, 1879.
Cordova Station, Md., Wye Mills Creek. Shad, 1879.
Cornelian Lake, Stearns County, Minn. California salmon, 1877.
Cornelian Lake, Washington County, Minn. California salmon, 1876, 1877.
Corry, Pa., Hatching Ponds. Schoodic salmon, 1878; California trout, 1880.
Corsica River, Centreville, Md. Shad, 1879.
Corunna, Mich., Shiawassee River. Shad, 1874.
Coshocton, Ohio, Walhonding River. California salmon, 1877.
Coshocton County, Ohio. (See Coshocton, Ohio.)
Cottonwood County, Minn., Bingham Lake. California salmon, 1876.
Cottonwood County, Minn., Eagle Lake. California salmon, 1877.
Cottonwood County, Minn., Mountain Lake. California salmon, 1877.
Cottonwood County, Minn., String Lake. California salmon, 1876.
Cottonwood County, Minn., Welder Lake. California salmon, 1876.
Cottonwood County, Minn., Windom Lake. California salmon, 1876.
Cottonwood County, Minn. (See Windom, Minn.)
Cottonwood Falls, Kans., Cottonwood River. Shad, 1879.
Cottonwood River, Cottonwood Falls, Kans. Shad, 1879.
Cottonwood River, Florence, Kans. California salmon, 1878, 1879, 1880; shad, 1879.
Cottonwood River. (See tributary: Sleepy Eye Lake.)
Cotuit, Mass., Cotuit River. Penobscot salmon, 1876; Schoodic salmon, 1876.
Cotuit River, Cotuit, Mass. Penobscot salmon, 1876.
Council Bluffs, Iowa, tributary of Missouri River. Penobscot salmon, 1875.
Covington, Ky., Glasser's Lakes. Schoodic salmon, 1878.
Covington, Ga., Ocmulgee River. California salmon, 1878; shad, 1877.
Covington, Ga., Ulcofanhanchee River. Shad, 1879.

Cumberland County, Pa. (See Mechanicsburgh, Pa.; Newville, Pa.; Williams Mill, Pa.)
Cumberland, Md., Potomac River. Shad, 1876, 1877, 1880.
Cumberland River, Nashville, Tenn. Shad, 1875, 1875, 1879.
Cumberland River, Pulaski County, Ky.
Cumberland River, Somerset, Ky. Shad, 1878.
Cumberland River. (See tributaries: White Oak Branch, Round Stone Creek, Hardin Durham's Branch, Little River, Eddy Creek.)
Cunningham Pond, Petersborough, N. H. Schoodic salmon, 1880.
Currant River, Doniphan, Mo. California salmon, 1879.
Cuyahoga River, Kent, Ohio. Shad, 1872.
Cuyahoga River. (See tributary: Newberry Pond.)
Dakota County, Minn. California salmon, 1876.
Dakota County, Minn., Crystal Lake. California salmon, 1876.
Dakota County, Minn., Lake Early. California salmon, 1878.
Dakota County, Minn., Farmington River. California salmon, 1875; Penobscot salmon, 1875.
Dakota County, Minn., Farquhar Lake. California salmon, 1878.
Dakota County, Minn., Kennedy Lake. California salmon, 1876, 1878.
Dakota County, Minn., McGrath's Lake. California salmon, 1878.
Dakota County, Minn., S. Branch Vermillion River. California salmon, 1878.
Dakota County, Minn., Spring Lake. Schoodic salmon, 1879.
Dakota County, Minn., Sunfish Lake. California salmon, 1876.
Dakota County, Minn., Twin Lakes. California salmon, 1878, 1880.
Dallas County, Tex. (See Dallas, Tex.)
Dallas, Pa., Harvey's Lake. California salmon, 1880.
Dallas, Tex., Trinity River. Shad, 1879.
Damariscotta, Me., pond. Schoodic salmon, 1879.
Danbury, Conn., Lake Kenosha. Schoodic salmon, 1879.
Danbury, Stokes County, N. C., Dan River. Schoodic salmon, 1878.
Dane County, Wis., Mendota Lake. California salmon, 1877.
Dane County, Wis. (See Madison, Wis.)
Danewood Lake, Chisago County, Minn. California salmon, 1877.
Danforth, Me., Mattawamkeag River. Penobscot salmon, 1874.
Danforth, Me., tributary of Penobscot River. Penobscot salmon, 1875.
Dan River, Danbury, N. C. California salmon, 1879.
Dan River, Danbury, Stokes County, N. C. Schoodic salmon, 1878.
Dan River, Halifax County, Va. Shad, 1877.
Danville, Vt., Joe's Pond. Schoodic salmon, 1878.
Dauphin County, Pa., Swatara Creek. Penobscot salmon, 1874; California salmon, 1877.
Dauphin County, Pa. (See Harrisburg, Pa.; Upper Paxton, Pa.)
Davidson County, Tenn. (See Madison, Tenn.; Nashville, Tenn.)
Davis County, Kans., Republican River. Shad, 1879.
Davis County, Kans. (See Junction City, Kans.)

Dennisville, N. J., Dennis Creek. California salmon, 1876.
Denny's River, Me. Penobscot salmon, 1876.
Denton, Md., Choptank River. Shad, 1877.
Denton, Md., pond. Schoodic salmon, 1880.
Dent's River, Marion County, W. Va. Schoodic salmon, 1878.
Denver, Colo., Platte River. Shad, 1872.
Des Moines, Iowa, Des Moines River. California salmon, 1874, 1874; shad, 1874, 1875, 1876.
Des Moines River, Boone, Boone County, Iowa. Schoodic salmon, 1878.
Des Moines River, Cedar Rapids, Iowa. Shad, 1878.
Des Moines River, Des Moines, Iowa. California salmon, 1874, 1875; shad, 1874, 1875, 1876.
Des Moines River, Fort Dodge, Iowa. California salmon, 1874.
Des Moines River, Iowa. California salmon, 1875, 1876, 1878, 1879, 1879.
Des Moines River, Moingona, Iowa. Shad, 1878.
Des Moines River, Ottumwa, Iowa. California salmon, 1875; shad, 1874.
Des Moines River, Pomeroy, Iowa. California salmon, 1875.
Des Moines River, Storm Lake, Iowa. California salmon, 1875.
Des Moines River, Webster City, Iowa. California salmon, 1875.
Des Moines River, Windom, Minn. California salmon, 1877.
Des Moines River. (See tributaries: Windom Lake, Okabena Lake, Heron Lake.)
Detroit Lake, Becker County, Minn. California salmon, 1877; Penobscot salmon, 1875; Schoodic salmon, 1875.
Detroit, Mich., Detroit River. California salmon, 1876.
Detroit River, Detroit, Mich. California salmon, 1876; shad, 1873, 1874.
Detroit River, Wayne County, Mich. California salmon, 1878.
Detroit River. (See tributaries: Rouge River, Orchard Lake.)
Devil Lake, Wis. Penobscot salmon, 1875.
De Witt, Clinton County, Iowa, Silver Creek. Schoodic salmon, 1878.
Dexter, Me., pond. Schoodic salmon, 1879.
Dexter, Mich., Base Lake. Whitefish, 1876.
Dexter, Mich., Big Portage Lake. Whitefish, 1876.
Dexter, Mich., Blind Lake. Whitefish, 1876.
Dexter, Mich., Bruin Lake. Whitefish, 1876.
Dexter, Mich., Half Moon Lake. Whitefish, 1876.
Dexter, Mich., Island Lake. Whitefish, 1876; California salmon, 1878.
Dexter, Mich., Patterson Lake. Whitefish, 1876.
Dexter, Mich., Portage Lake. Whitefish, 1876.
Dexter, Mich., Silver Lake. California salmon, 1878; whitefish, 1876.
Dexter, Mich., Woodburn Lake. Whitefish, 1876.
Diamond Lake, Cass County, Mich. California salmon, 1876.
Diamond Lake, Kandiyohi County, Minn. California salmon, 1877.
Diamond Lake, Mich. Penobscot salmon, 1873.

Drake's Pond, Sussex County, N. J. Schoodic salmon, 1879.
Drakesville, Morris County, N. J., Lake Hopatcong. Schoodic salmon, 1879.
Dresden, Tenn., East Obion River. Shad, 1879.
Drew's Lake, Aroostook County, Me. Schoodic salmon, 1878.
Driftwood Branch, Cameron County, Pa. California salmon, 1879, 1880.
Dripping Spring, Md., Gunpowder River. California trout, 1880; Schoodic salmon, 1880.
Druid Hill Lake, Baltimore, Md. Schoodic salmon, 1879.
Dry Fork, White Sulphur Springs, W. Va. Schoodic salmon, 1879.
Dubuque County, Iowa. (See Dubuque, Iowa; Epworth, Iowa; Farley, Iowa; Worthington, Iowa.)
Dubuque Creek, Dubuque, Iowa. Penobscot salmon, 1875.
Dubuque, Iowa, Dubuque Creek. Penobscot salmon, 1875.
Duck Creek, Clayton, Del. Shad, 1879.
Dudley Lake, Rice County, Minn. Penobscot salmon, 1875; California salmon, 1876, 1878.
Dug Pond, Natick, Mass. Schoodic salmon, 1876, 1877, 1878, 1879.
Duluth, Minn., Canosia Lake. Schoodic salmon, 1879.
Dumont Lake, Allegan County, Mich. California salmon, 1878.
Dunlap's Branch, Woodford County, Ky. California salmon, 1876.
Dunmore Lake, Salisbury, Vt. Schoodic salmon, 1876.
Duplin County, N. C., Six Runs. Shad, 1879.
Duplin County, N. C., Goshen Creek. Shad, 1877.
Duplin County, N. C. (See Warsaw, N. C.)
Durham, Conn., Cocnochogue River. California salmon, 1874.
Durham, Conn., Pitsquog Pond. Schoodic salmon, 1880.
Durham, Conn., West River. California salmon, 1874.
Dutchess County, N. Y., Fishkill Lake. California salmon, 1874.
Dutchess County, N. Y., Furnace Pond. Schoodic salmon, 1879.
Dutchess County, N. Y., Little Thala Pond. Schoodic salmon, 1879.
Dutchess County, N. Y., Long Pond. Schoodic salmon, 1879.
Dutchess County, N. Y., Silver Lake. California salmon, 1874.
Dutchess County, N. Y., Sylvan Lake. Schoodic salmon, 1879.
Dutchess County, N. Y., Upton's Pond. Schoodic salmon, 1879.
Duxbury, Mass., Island Creek Pond. Schoodic salmon, 1877.
Eagle Creek, Gallatin County, Ky. California salmon, 1877.
Eagle Lake, Blue Earth County, Minn. California salmon, 1876.
Eagle Lake, Cottonwood County, Minn. California salmon, 1877.
Eagle Lake, Kandiyohi County, Minn. California salmon, 1876, 1877.
Eagle Lake, Lassen County, Cal. Whitefish, 1879.
Eagle Lake, Washington County, Minn. California salmon, 1876.
Eagleville, Ohio, Grand River. California salmon, 1874; shad, 1874.
Early Lake, Dakota County, Minn. California salmon, 1878.
Eastanalbee River, Athens, Tenn. California salmon, 1876; shad, 1876.
East Bridgewater, Mass., Satucket River. Schoodic salmon, 1877, 1878.

Elk River, Charleston, W. Va. California salmon, 1879, 1880.
Elk River, Elkton, Md. California salmon, 1876; shad, 1879.
Elk River, Md. Shad, 1877.
Elk River. (See tributary: Bohemia Creek, of Big Elk River.)
Elkton, Md., Elk River. California salmon, 1876; shad, 1879.
Ellenburgh, N. Y., Chazy River. Penobscot salmon, 1875.
Ellicott City, Md., North Branch Patuxent River. California salmon, 1876.
Ellicott City, Md., Patapsco Falls. California trout, 1880.
Ellicott City, stream. California trout, 1880.
Ellis County, Kans. (See Ellis, Kans.; Hays City, Kans.)
Ellis, Kans., Big Creek. California salmon, 1878, 1879.
Ellis, Kans., Smoky Hill River. California salmon, 1880.
Ellsworth County, Kans., Smoky Hill River. Schoodic salmon, 1879.
Ellsworth County, Kans. (See Bluffville, Kans.; Ellsworth, Kans.; Farisville, Kans.; Fort Harker, Kans.; Trivoli, Kans.; Venango, Kans.; Wilson, Kans.)
Ellsworth, Kans., Ash Creek. Schoodic salmon, 1880.
Ellsworth, Kans., pond. Schoodic salmon, 1880.
Ellsworth, Kans., Smoky Hill River. California salmon, 1877, 1878, 1879, 1880; shad, 1879.
Elm Creek, Farisville, Kans. Schoodic salmon, 1880.
Elmo Lake, Washington County, Minn. California salmon, 1879.
Elmore, Ohio, Portage River. California salmon, 1877.
Elmwood Creek, Bourbon County, Ky. California salmon, 1878.
Elyria, Ohio, Black River. Shad, 1874.
Elysian Lake, Waseca County, Minn. California salmon, 1876, 1879, 1880; Penobscot salmon, 1875; Schoodic salmon, 1875.
Embarrass River, Charleston, Ill. Shad, 1878.
Emerson Pond, Rindge, N. H. Schoodic salmon, 1880.
Emily Lake, Le Sueur County, Minn. California salmon, 1876, 1877, 1878.
Emmet County, Iowa, lakes. Penobscot salmon, 1876.
Emmet County, Mich. (See Petoskey, Mich.)
Emmittsburgh, Md., Crystal Iron Springs. Schoodic salmon, 1878.
Emmon's Creek, Mich. California salmon, 1874.
Emporia, Kans., Neosho River. California salmon, 1878, 1879, 1880; shad, 1879.
Enfield, Me., Cold Spring Pond. Schoodic salmon, 1878.
Enfield, N. H., Mascoma Lake. Schoodic salmon, 1879.
Engle Lake, Stevens County, Minn. California salmon, 1878.
Enoree River, S. C. California salmon, 1880.
Epsom, N. H., Chesnut Pond. Schoodic salmon, 1880.
Epworth, Iowa, Little Maquoketa River. California salmon, 1874.
Erie County, Ohio. (See Castalia, Ohio; Huron, Ohio.)

Faribault Lake, Rice County, Minn. Penobscot salmon, 1875; Schoodic salmon, 1875.

Farisville, Kans., Clear Creek. Schoodic salmon, 1880.

Farisville, Kans., Elm Creek. Schoodic salmon, 1880.

Farley, Iowa, Little Maquoketa River. California salmon, 1874.

Farlow, Ill., Kaskasia River. Shad, 1878.

Farmington River, Colebrook, Conn. California salmon, 1873, 1873.

Farmington River, Conn. California salmon, 1876.

Farmington River, Dakota County, Minn. California salmon, 1875; Penobscot salmon, 1875.

Farmington River, New Hartford, Conn. California salmon, 1875; Penobscot salmon, 1875, 1877.

Farmington River, Pine Meadow, Conn. California salmon, 1874, 1874.

Farm Pond, Framingham, Mass. Schoodic salmon, 1879.

Farm River, New Haven, Conn. California salmon, 1875.

Farmville, Va., Appomattox River. Schoodic salmon, 1879.

Farquhar Lake, Dakota County, Minn. California salmon, 1878.

Fauquier County, Va. (See Broad Run Station, Va.; Rectorstown, Va.)

Fayette County, Iowa. (See Clermont, Iowa; Fayette, Iowa; West Union, Iowa.)

Fayette County, Ky. (See Lexington, Ky.)

Fayette, Iowa, Turkey River. California salmon, 1875.

Fayette, Iowa, Volga River. California salmon, 1875.

Federalsburgh, Md., branch of Nanticoke River. California salmon, 1876.

Federalsburgh, Md., Nanticoke River. California salmon, 1879, 1880; shad, 1878, 1879.

Felch's Lake, San Mateo County, Cal. Schoodic salmon, 1878.

Ferguson Creek, Winona County, Minn. California salmon, 1878.

Ferrisburgh, Vt., Lewis Creek. Penobscot salmon, 1875.

Ferry Landing, Fairfax County, Va., Potomac River. Shad, 1875, 1875, 1876.

Fife Lake, Mich., Fife Lake. Whitefish, 1876.

Fillmore County, Minn., Benton Creek. California salmon, 1878.

Fillmore County, Minn., Camp Creek. California salmon, 1878.

Fillmore County, Minn., Jordan's Creek. California salmon, 1878.

Fillmore County, Minn., Kingsley Creek. California salmon, 1878.

Fillmore County, Minn., Middle Branch of Root River. California salmon, 1878.

Fillmore County, Minn., North Branch of Root River. California salmon, 1878.

Fillmore County, Minn., North Branch of Watson Creek. California salmon, 1878.

Fillmore County, Minn., Rush Creek. California salmon, 1878.

Fillmore County, Minn., South Branch of Root River. California salmon, 1878.

Garrett County, Md. (See Deer Park, Md.; Fort Pendleton, Md.; Franklinville, Md.; Oakland, Md.; Swanton, Md.)
Gasconade County, Mo. (See Herman, Mo.)
Gasconade River, Jerome, Mo. California salmon, 1876, 1880; shad, 1880.
Gaston County, N. C. (See Dallas, N. C.)
Gates' Pond, Berlin, Mass. Schoodic salmon, 1876, 1877.
Gavin's Lake, Stevens County, Minn. California salmon, 1878.
Geauga County, Ohio, Newberry Ponds. California salmon, 1879.
Genesee County, Mich. (See Linden, Mich.)
Genesee River, Caledonia, N. Y. California salmon, 1874, 1875.
Genesee River, Livingston County, N. Y. California salmon, 1875.
Genesee River, N. Y. California salmon, 1873, 1873, 1874, 1874, 1875.
Genesee River. (See tributaries: Spring Creek, Caledonia Spring Creek, Walter Creek.)
Geneva Lake, Geneva, Wis. California salmon, 1877, 1878, 1879, 1880.
Geneva Lake, Walworth County, Wis. California salmon, 1875, 1876, 1877, 1878, 1879; California trout, 1880; Schoodic salmon, 1876, 1878, 1879; Penobscot salmon, 1874.
Geneva, Wis., Geneva Lake. California salmon, 1877, 1878, 1879, 1880.
Gentry County, Mo., Grand River. California salmon, 1880.
George Lake, Kandiyohi County, Minn. California salmon, 1877.
George Lake, Minn. California salmon, 1877.
Georgetown, Colo., Clear Lake. California salmon, 1874.
Georgetown, Colo., Green Lake. California salmon, 1874.
Georgetown, D. C., Little Falls of the Potomac River. Shad.
Georgetown, Mass., Pentucket Pond. Schoodic salmon, 1877.
Georgetown, Mass., Rock Pond. Schoodic salmon, 1877.
Georgetown, Pa., Susquehanna River. Shad, 1880.
Georgia, Vt., Lamoille River. Penobscot salmon, 1874; shad, 1874, 1875.
Germanton, N. C., Town Creek. California salmon, 1879.
Gervais Lake, Ramsey County, Minn. California salmon, 1878.
Gibson County, Tenn. (See Humboldt Tenn.; Trenton, Tenn.)
Giles County, Va., Mountain Lake. California salmon, 1876.
Gillmore's Creek, Rice County, Minn. California salmon, 1878.
Gilmore Pond, Jaffrey, N. H. Schoodic salmon, 1880.
Gist Creek, Shelby County, Ky. California salmon, 1876.
Glassborough, N. J., Mantua Creek. California salmon, 1876.
Glasser's Lakes, Covington, Ky. Schoodic salmon, 1878.
Glenburn, Me., Pushaw Pond. Schoodic salmon, 1879.
Glencoe, Md., Gunpowder River. California salmon, 1876.
Gloucester County, N. J., Raccoon Creek. California salmon, 1879.
Gloucester County, N. J. (See Glassborough, N. J.; Swedesborough, N. J.; Wenonah, N. J.; Williamstown, N. J.; Woodbury, N. J.)
Glymont, Md., Potomac River. Shad, 1878, 1878.
Goguac Lake, Battle Creek, Calhoun County, Mich. California salmon, 1875; Schoodic salmon, 1878.

Guilford, Conn., East River. Penobscot salmon, 1875.
Guilford, Conn., Limepaug Lake. Schoodic salmon, 1880.
Guilford County, N. C. (See Friendship, N. C.; Greensborough, N. C.; Jamestown, N. C.)
Guilford, Ind., Tanner's Creek. California salmon, 1874, 1876.
Gull Lake, Kalamazoo County, Mich. California salmon, 1873, 1875.
Gull Lake, Richland, Mich. California salmon, 1878.
Gull Pond, Wellfleet, Mass. Schoodic salmon, 1877, 1878.
Gun Lake, Hillsdale County, Mich. Penobscot salmon, 1873.
Gunpowder River, Cockeysville, Md. California salmon, 1878, 1879; shad, 1877, 1878, 1879; Schoodic salmon, 1878.
Gunpowder River, Dripping Spring, Md. California trout, 1880.
Gunpowder River, Freeland, Md. California salmon, 1874.
Gunpowder River, Glencoe, Md. California salmon, 1876.
Gunpowder River, branch of, Long Green, Md. California trout, 1880.
Gunpowder River, Md. Penobscot salmon, 1875.
Gunpowder River, Monkton, Md. California salmon, 1877.
Gunpowder River, Parkton, Md. California salmon, 1876, 1878.
Gunpowder River, Phœnix, Md. California salmon, 1876, 1877, 1880.
Gunpowder River, pond tributary to, Hampton, Md. Schoodic salmon, 1879.
Gunpowder River, Railroad Crossing, Baltimore County, Md. Shad, 1879.
Gunpowder River, Towsontown, Md. California salmon, 1878, 1879.
Gunpowder River, Warren, Md. California trout, 1880.
Gunpowder River. (See tributaries: Little Gunpowder River, Western River.)
Gwinnett County, Ga. (See Norcross, Ga.)
Gwynn's Falls, Airy Hill, Md. California trout, 1880; Schoodic salmon, 1880.
Habersham County, Ga., Tugaloo River. Shad, 1879.
Habersham County, Ga. (See Balding's Mills, Toccoa, Ga.)
Hackensack River, Bergen County, N. J. California salmon, 1879.
Hackensack River, tributary of, N. J. Penobscot salmon, 1874.
Hagerstown, Md., Antietam Creek. California salmon, 1874, 1876, 1879.
Hagerstown, Md., Conococheague River. California salmon, 1874, 1876, 1879.
Hale County, Ala. (See Greensborough, Ala.)
Half Moon Lake, Dexter, Mich. Whitefish, 1876.
Half Moon Lake, Putnam, Mich. California salmon, 1878.
Halfway Pond, Plymouth, Mass. Schoodic salmon, 1876, 1877, 1878.
Halfway River, Sandy Hook, Conn. Schoodic salmon, 1880.
Halifax County, N. C. (See Weldon, N. C.)
Halifax County, Va., Dan River. Shad, 1877.
Hall County, Ga. (See Gainesville, Ga.)
Halloran Lake, Ramsey County, Minn. California salmon, 1876.

Hardy's Pond, Waltham, Mass. Schoodic salmon, 1877 (?), 1878, 1879, 1880.

Harford County, Md. (See Aberdeen, Md.; Bel Air, Md.; Burnsides, Md.; Havre de Grace, Md.; Magnolia, Md.; Norrisville, Md.; Perryman, Md.; Pleasantville, Md.; Savage, Md.; Swan Creek, Md.; Wilna, Md.)

Harford County, Md., Winter's Run. California salmon, 1877.

Harford County, Md., Green Spring Run. California salmon, 1879.

Harper's Ferry, W. Va., Potomac River. California salmon, 1879.

Harriott Lake, Hennepin County, Minn. California salmon, 1876, 1877.

Harrisburg, Pa., Susquehanna River. Shad, 1879, 1880.

Harrisburg, Pa., Susquehanna River. California salmon, 1873, 1876.

Harris Dam, Cecil County, Md., Octorara River. California salmon, 1880.

Harrison County, Iowa. (See Logan, Iowa.)

Harrison County, Tex. (See Marshall, Tex.)

Harrison County, W. Va. (See Clarksburgh, W. Va.; New Salem, W. Va.)

Hart County, Ky., Bumgartner's Creek. California salmon, 1876.

Hart County, Ky. (See Mumfordsville, Ky.)

Hartford, Conn., Colt's Reservoir. Schoodic salmon, 1880.

Hartford County, Conn. (See Avon, Conn.; Bristol, Conn.; Broad Brook, Conn.; East Hartford, Conn.; East Windsor, Conn.; Farmington, Conn.; Forestville, Conn.; Granby, Conn.; Hartford, Conn.; Manchester, Conn.; Melrose, Conn.; Newington, Conn.; Thompsonville, Conn.; West Hartford, Conn.; Windsor, Conn.)

Hartman, Wis., tributaries of Wisconsin River. California salmon, 1878.

Hart's Pond, Canaan, N. H. Schoodic salmon, 1880.

Harvard, Mass., Bear Hill Pond. Schoodic salmon, 1878, 1879.

Harvey County, Kans. (See Halstead, Kans.)

Harvey's Lake, Dallas, Pa. California salmon, 1880.

Harvey's Lake, Wilkesbarre, Pa. Schoodic salmon, 1878, 1879.

Harvey's Pond, Barnet, Vt. Schoodic salmon, 1876, 1878.

Hassel Lake, Swift County, Minn. California salmon, 1878.

Havre de Grace, Md., North East River. Shad, 1878.

Havre de Grace, Md., Spesutic Narrows. Shad, 1877 (12 deposits), 1878 (10 deposits), 1879 (15 deposits), 1880 (10 deposits).

Havre de Grace, Md., Susquehanna River. Shad, 1876, 1877, 1878, 1879, 1880.

Hawley, Minn., Buffalo River. California salmon, 1877.

Haw River, Graham, N. C. California salmon, 1877.

Haw River, Allamance County, N. C. Shad, 1877.

Hayes City, Kans., Big Creek. California salmon, 1878, 1879.

Hayes City, Kans., Smoky Hill River. California salmon, 1880.

Haywood County, Tenn. (See Brownsville, Tenn.)

Hickman Creek, Jessamine County, Ky. California salmon, 1878.
Hickory-Nut Gap, N. C., Broad River. California salmon, 1879.
Higganum, Conn., Higganum Reservoir. Schoodic salmon, 1880.
Higganum Reservoir, Higganum, Conn. Schoodic salmon, 1880.
Higgin's Lake, Roscommon County, Mich. Penobscot salmon, 1874; California salmon, 1879; Schoodic salmon, 1880.
High Bridge, Ky. Shad, 1878.
Highgate, Vt., Hunkerford Brook. California salmon, 1873.
Highgate, Vt., Kelly Brook. California salmon, 1873.
Highgate, Vt., Missisquoi River. California salmon, 1873.
Hillsborough Bridge, N. H., Contoocook River. California salmon, 1878, 1879.
Hillsborough County, N. H. (See Antrim, N. H.; Hillsborough Bridge, N. H.; Manchester, N. H.; Milford, N. H.; Peterborough, N. H.)
Hillsborough, Md., Nanticoke River. California salmon, 1878.
Hillsborough, Md., Tuckahoi Creek. California salmon, 1876, 1878; shad, 1878, 1879.
Hillsdale County, Mich, Barrier Lake. Penobscot salmon, 1873.
Hillsdale County, Mich., Butternut Creek. California salmon, 1873.
Hillsdale County, Mich., Gun Lake. Penobscot salmon, 1873.
Hillsdale County, Mich. (See Hillsdale, Mich.)
Hillsdale County, Mich., Saint Joseph River, headwaters of. Penobscot salmon, 1873.
Hillsdale County, Mich., Sand Creek. California salmon, 1873.
Hillsdale County, Mich. (See Somerset, Mich.)
Hillsdale, Mich., Baro Beese Lake. California salmon, 1878.
Hinds County, Miss. (See Jackson, Miss.)
Hinton, W. Va., Greenbrier River. Schoodic salmon, 1879.
Hinton, W. Va., New River. California salmon, 1879, 1880; shad, 1879.
Hockomocko Pond, Westborough, Mass. Schoodic salmon, 1879.
Hog Lake, Lyme, Conn. Schoodic salmon, 1877, 1878, 1879.
Hokah Lake, Houston County, Minn. California salmon, 1878.
Hokah Lake, Hennepin County, Minn. California salmon, 1876.
Holderness, N. H., Squam Lake. Schoodic salmon, 1879.
Holliston, Mass., ponds. Schoodic salmon, 1880.
Holly, Mich., Shiawassee River. California salmon, 1876.
Holly Springs, Miss. Cold Water River. Shad, 1878.
Holston River, Knoxville, Tenn. Shad, 1875, 1876, 1879.
Holston River, Smyth County, Va. Schoodic salmon, 1877.
Holston River, North Fork of Saltville, Va. Schoodic salmon, 1880.
Holston River, North Fork of, Sharon Springs, Va. California salmon, 1880.
Holston River, South Fork of, Atkins' Tank, Va. California salmon, 1880.
Holyoke, Mass., Ashley Pond. Schoodic salmon, 1878, 1879.
Holyoke. Mass., Wright Pond. Schoodic salmon, 1879.

Hugh's River, Pennsborough, W. Va. California salmon, 1878.
Humboldt, Tenn., Forked Deer River. California salmon, 1876.
Humboldt, Tenn., Middle Fork of Forked Deer River. Shad, 1878.
Hummock Pond, Nantucket, Mass. Schoodic salmon, 1877.
Humphreys County, Tenn. (See Johnsonville, McEwen's Station, Tenn.)
Hunkerford Brook, Highgate, Vt. California salmon, 1873.
Hunterdon County, N. J. (See Bloomsbury, N. J.)
Huntingdon County, Pa. (See Huntingdon, Pa.)
Huntingdon, Pa., Juniata River. Penobscot salmon, 1880.
Huntingdon, Tenn., South Fork of Obion River. Shad, 1878.
Huntington, Mass., Norwich Pond. Schoodic salmon, 1877.
Huntington County, Ind. (See Warren, Ind.)
Huron County, Ohio. (See Monroeville, Ohio.)
Huron Lake, tributary to, South Lawn, Ill. Penobscot salmon, 1874.
Huron Lake, tributary to, Wildwood, Ill. Penobscot salmon, 1874.
Huron Lake. (See tributaries: Saugeen River, Au Sable River, Rifle River, Shiawassee River.)
Huron, Ohio, Huron River. California salmon, 1878.
Huron River, Huron, Ohio. California salmon, 1878.
Huron River, Monroeville, Ohio. California salmon, 1874; shad, 1874.
Huron River, Washtenaw County, Mich. California salmon, 1876.
Hurricane Creek, Crittenden County, Ky. California salmon, 1877.
Huskin's Lake, Grant County, Minn. California salmon, 1878.
Hutchinson, Kans., Cow Creek. California salmon, 1878, 1879; shad, 1879.
Ijamsville, Md., pond. California trout, 1880.
Illinois River, Ill. California salmon, 1876, 1877.
Illinois River, Ind., Kankakee River.
Illinois River. (See tributaries: Rock River, Fox River, Kankakee River, Geneva Lake, Elkhart, Cedar Rock, and Devil's Lakes.)
Independence, Iowa, Wapsipinecon River. California salmon, 1875.
Independence, Kans., Verdigris River. California salmon, 1778, 1879.
Independence, Mo., Blue River. California salmon, 1880.
Independence Lake, Hennepin County, Minn. California salmon, 1877.
Independence River, Iowa. California salmon, 1879.
Indiana County, Pa. (See Black Lick Station, Pa.)
Indianapolis, Ind., White River. California salmon, 1874; shad, 1872, 1874, 1875, 1879.
Indian Creek, Cass County, Mich. California salmon, 1875.
Indian Lake, Kalamazoo County, Mich. California salmon, 1775.
Indian Lake, Cass County, Mich. California salmon, 1878.
Ingham County, Mich. (See Lansing, Mich.)
Inglesby Creek, Fort Edward, N. Y. California salmon, 1874.
Inman Lake, McPherson County, Kan. Schoodic salmon, 1879; California salmon, 1878, 1879.
Institution for Deaf, Romney, W. Va., pond. Schoodic salmon, 1879, 1879.

Kalkaska County, Mich., Blue Lake. California salmon, 1879.
Kalkaska County, Mich. (See Crofton, Mich.; Kalkaska, Mich.)
Kalkaska County, Mich., Log Lake. Schoodic salmon, 1876.
Kalkaska County, Mich., Rapid River. California salmon, 1876.
Kalkaska County, Mich., Torch Lake. California salmon, 1876.
Kalkaska, Mich., North Boardman River. California salmon, 1876.
Kanawha County, West Va. (See Charleston, W. Va.)
Kanawha River, Charlestown, Kanawha County, W. Va. California salmon, 1878.
Kanawha River. (See tributaries: Greenbrier River, Elk River, New River.)
Kandiyohi County, Minn., Diamond Lake. California salmon, 1877.
Kandiyohi County, Minn., Eagle Lake. California salmon, 1876, 1877, 1877.
Kandiyohi County, Minn., George Lake. California salmon, 1877.
Kandiyohi County, Minn., Green Lake. California salmon, 1876, 1877, 1877.
Kandiyohi County, Minn. (See Wilmar, Minn.)
Kane County, Ill. (See Elgin, Ill.)
Kanesiac Pond, Danbury, Conn. Schoodic salmon, 1880.
Kankakee River, Ill. California salmon, 1876, 1877, 1878.
Kankakee River, La Porte, Ind. California salmon, 1875.
Kankakee River, Michigan City, Ind. California salmon, 1876.
Kankakee River. (See tributary: Grapevine Creek.)
Kansas City, Mo., Kansas River. Shad, 1876.
Kansas River, Kansas City, Mo. Shad, 1876.
Kansas River. (See tributaries: Red Vermillion, Big Blue, Republican, Solomon, Soldier, Vermillion, and Smoky Hill Rivers; Spring, Clear, Chapman's, Wakarusa, Dragoon, and Delevan Creeks; Silver and Lyndon Lakes.)
Kaskaskia River, Belleville, Ill. California salmon, 1877.
Kaskaskia River, Farlow, Ill. Shad, 1878.
Kasota, Minn., Minnesota River. California salmon, 1877.
Keene's Lake, Calais, Me. Schoodic salmon, 1878, 1879.
Keene's Lake, Keene's Lake Stream. California salmon, 1879.
Keene's Lake Stream, Keene's Lake, Me. California salmon, 1879.
Kelly Brook, Highgate, Vt. California salmon, 1873.
Kennebago Stream, Me. Schoodic salmon, 1874.
Kennebec County, Me. (See Manchester, Me.; Waterville, Me.)
Kennebec River, Waterville, Me. Shad, 1880.
Kennebec River, Waterville, Me. Shad, 1874.
Kennedy Lake, Dakota County, Minn. California salmon, 1876, 1878.
Kenosha Lake, Danbury, Conn. Schoodic salmon, 1879.
Kensington, Ill., Calumet River. California salmon, 1874; Penobscot salmon, 1874.

Labar's Pond, Wis. California salmon, 1879.
Laberton Lake, Kent County, Mich. California salmon, 1876.
Lackawanna County, Pa. (See Scranton, Pa.)
La Crosse River, Sparta, Wis. California salmon, 1879.
La Cygne, Kans., Marais des Cygnes River. Shad, 1879.
La Fayette County, Miss. (See Abbeville, Miss.)
La Fayette County, Miss., Tallahatchie River. Shad, 1878, 1879.
La Fayette County, Miss., Yocana River. Shad, 1879.
La Fayette County, Wis., streams. California salmon, 1874.
La Fayette, Ind., Wabash River. Shad, 1880.
Laguna Honda, San Francisco, Cal. Schoodic salmon, 1878.
Lake City, Minn., Mississippi River. California salmon, 1877.
Lake County, Cal., Clear Lake. Whitefish, 1872, 1873.
Lake County, Ill. (See Sand Lake, Ill.)
Lake County, Mich., Big Star Lake. California salmon, 1876.
Lakeland, Washington County, Minn. California salmon, 1876.
Lake of the Woods, Branch County, Mich. California salmon, 1875.
Lake Park, Minn., lake. California salmon, 1880.
Lake Spring, Salem, Va. Schoodic salmon, 1880.
Lakeville, Conn., Wanonscoponus Lake. Schoodic salmon, 1876, 1877, 1879.
Lambertville, N. J. (See Point Pleasant, Pa.)
Lamine River, Morgan County, Mo. California salmon, 1880.
Lamoille River, Vt. Penobscot salmon, 1873.
Lamoille River, Georgia, Vt. Penobscot salmon, 1874; shad, 1874, 1875.
Lancaster County, Pa. (See Chickies, Pa.; Columbia, Pa.; Lancaster, Pa.; Marietta, Pa.; Salisbury, Pa.)
Lancaster County, Pa., Chiquesalunga Creek. California salmon, 1875, 1877; Penobscot salmon, 1874.
Lancaster County, Pa., Donegal Run. Schoodic salmon, 1880.
Lancaster, Mass., Nashua River. California salmon, 1876; Penobscot salmon, 1876.
Lancaster, Mass., ponds. Schoodic salmon, 1876, 1877.
Lanesborough, Minn., tributary of Root River. California salmon, 1876.
Lane's Run, Scott County, Ky. California salmon, 1876.
Lansing, Mich., Grand River. Shad, 1873.
La Porte County, Ind. (See La Porte, Ind.; Michigan City, Ind.)
La Porte, Ind., Kankakee River. California salmon, 1875.
La Porte, Ind., Stony Lake. Schoodic salmon, 1880.
Larned, Kans., Pawnee Creek. California salmon, 1878, 1879, 1880; shad, 1879.
Lassen County, Cal., Eagle Lake. Whitefish, 1879.
La Sueur County. (See Kasota, Minn.)
Lauderdale County, Miss. (See Meridian, Miss.)
Laura Lake, Blue Earth County, Minn. California salmon, 1876.

Limepang Lake, Guilford, Conn. Schoodic salmon, 1880.
Limerick Lake, Aroostook County, Me. Schoodic salmon, 1878.
Lincoln County, Ky., Dick's River. California salmon, 1876.
Lincoln County, Ky., Hanging Fork. California salmon, 1876.
Lincoln County, Ky. (See McKinney's Station, Ky.)
Lincoln County, Me. (See Damariscotta, Me.)
Lincoln, Mass., Sandy Pond. Schoodic salmon, 1876, 1877.
Linden, Mich., Cook's Lake. Whitefish, 1876.
Linden, Mich., Day Lake. Whitefish, 1876.
Linden, Mich., Round Lake. Whitefish, 1876.
Linden, Mich., Silver Lake. Whitefish, 1876.
Linkwood, Md., Transquaking River. California salmon, 1879.
Linn County, Iowa. (See Cedar Rapids, Iowa; Marion, Iowa; Springville, Iowa; Walker, Iowa.)
Linn County, Kans. (See La Cygne, Kans.)
Linsey's Creek, Grant County, W. Va. California salmon, 1879, 1880.
Linville River, Bridgewater, N. C. California salmon, 1878, 1879.
Linville River, Morganton, N. C. California salmon, 1879.
Linville River, Morganton, Burke County, N. C. Schoodic salmon, 1878.
Lisborn River, Iowa. California salmon, 1879.
Litchfield, Conn., Bantam Lake. Schoodic salmon, 1876, 1877, 1878, 1879.
Litchfield County, Conn. (See Chapinville, Conn.; Colebrook, Conn.; Falls Village, Conn.; Kent, Conn.; Lakeville, Conn.; Litchfield, Conn.; New Hartford, Conn.; New Milford, Conn.; New Preston, Conn.; Norfolk, Conn.; Pine Meadow, Conn.; Salisbury, Conn.; South Kent, Conn.; Warren, Conn.; West Winsted, Conn.; Winsted, Conn.; Woodbury, Conn.)
Litchfield, Meeker County, Minn. Penobscot salmon, 1875; Schoodic salmon, 1875.
Little Arkansas River, Halstead, Kans. California salmon, 1878, 1879.
Little Arkansas River. (See tributary: Lake Inman.)
Little Blue River, Waterville, Kans. California salmon, 1878, 1879.
Little Butts Lake, Ramsey County, Minn. California salmon, 1876.
Little Elk River, Rock Church, Md. California salmon, 1878.
Little Falls of the Potomac River, Georgetown, D. C. Shad, 1879, 1880.
Little Gunpowder River, Monkton, Md. California salmon, 1876, 1876, 1877, 1878.
Little Hinkston Creek, Montgomery County, Ky. California salmon, 1877.
Little Iowa, Mower County, Minn. California salmon, 1878.
Little Kanawha River, Erwingsville, W. Va. California salmon, 1878.
Little Kentucky, East and West forks of, Henry County, Ky. California salmon, 1876.
Little Lorrim, Boyd's, Md. California salmon, 1878.

Madison, Wis., Lake Mendota. California salmon, 1877.
Madison, Wis., pond. California salmon, 1877.
Madison County, Ky., Otter Creek. California salmon, 1876.
Madison County, Ky., Silver Creek. California salmon, 1876.
Magnolia, Md., Winter's Run. California salmon, 1876.
Magog Lake, Acton, Mass. Schoodic salmon, 1879.
Mahantonga River, Pa. California salmon, 1874.
Mahantonga River, Upper Paxton, Pa. California salmon, 1873.
Mahkunac Lake, Stockbridge, Mass. Schoodic salmon, 1878, 1879, 1880.
Maiden Run, Pa. California salmon, 1876.
Main River, Conn. Penobscot salmon, 1873.
Main River, North Branford, Conn. Penobscot salmon, 1873.
Mallory Lake, Woodstock, Mich. California salmon, 1878.
Manchester, Iowa, Maquoketa River. California salmon, 1875; Penobscot salmon, 1875.
Manchester, Me., Cobosecontee Lake. Schoodic salmon, 1879.
Manchester, N. H., Nutt's Pond. Schoodic salmon, 1879.
Manchester, N. H., Wassabesic Lake. Schoodic salmon, 1879.
Manchester, Vt., Battenkill Creek. Penobscot salmon.
Manhattan, Kans., Big Blue River. California salmon, 1878, 1879, 1880.
Manhattan, Kans., Blue River. 1879.
Manistee River, Mich. Penobscot salmon, 1873.
Manistee River, Wexford County, Mich. California salmon, 1879.
Manistee River. (See tributary: Pine River.)
Mankato, Minn. Penobscot salmon, 1875.
Mannington, W. Va., Fishing Creek. California salmon, 1878.
Manokin River, Princess Anne, Md. Shad, 1878, 1879.
Mantor Brook, Dodge County, Minn. California salmon, 1878.
Mantua Creek, Glassborough, N. J. California salmon, 1876, 1877, 1878.
Mantua River, Wenonah, N. J. California salmon, 1877.
Maple River, Ionia, Mich. California salmon, 1875.
Maple River, Iowa. California salmon, 1879.
Maple River. (See tributary: Elysian Lake.)
Maquoketa, Iowa, Maquoketa River. California salmon, 1874.
Maquoketa River, Iowa. California salmon, 1879.
Maquoketa River, Charlotte, Iowa. California salmon, 1874.
Maquoketa River, Delaware, Iowa. California salmon, 1875.
Maquoketa River, Delhi, Iowa. California salmon, 1875.
Maquoketa River, Hopkinton, Iowa. California salmon, 1875.
Maquoketa River, Manchester, Iowa. California salmon, 1874, 1875; Penobscot salmon, 1875.
Maquoketa River, Monticello, Iowa. California salmon, 1874.
Maquoketa River, Worthington, Iowa. California salmon, 1875.

Massabesic Lake, Manchester, N. H. Schoodic salmon, 1879.
Mattapony River, Milford, Va. Shad, 1878, 1878.
Mattawamkeag, Me., Mattawamkeag River. Shad, 1873, 1874, 1874, 1875.
Mattawamkeag, Me., Penobscot River. Shad, 1880.
Mattawamkeag River, Bancroft, Me. Penobscot salmon, 1875, 1876.
Mattawamkeag River, Eaton, Me. Penobscot salmon, 1874.
Mattawamkeag River, Danforth, Me. Penobscot salmon, 1874.
Mattawamkeag River, Kingman, Me. Penobscot salmon, 1876.
Mattawamkeag River, Mattawamkeag, Me. Shad, 1873, 1874, 1874, 1875.
Maumee Rapids, Ohio. Schoodic salmon, 1876.
Maumee Rapids, Toledo, Ohio. California salmon, 1878.
Maumee River, Defiance, Ohio. California salmon, 1878.
Maumee River, Ohio. California salmon, 1877.
Maumee River, South Toledo, Ohio. California salmon, 1877.
Maumee River, Toledo, Ohio. Penobscot salmon, 1875; Schoodic salmon, 1878, 1879.
Maumee River, Waterville, Ohio. California salmon, 1880.
Maumee River. (See tributary: Tiffin River.)
Maurepas Lake. (See tributary: Notalbany River.)
Maurice River, Cumberland County, N. J. California salmon, 1879.
Maurice River, N. J. California salmon, 1877, 1878.
Maurice River, Vineland, N. J. California salmon, 1876.
Maynard, Iowa, Turkey River. California salmon, 1875.
Mayo River, Rockingham County, N. C. Schoodic salmon, 1878.
May's Landing, N. J., Great Egg Harbor River. California salmon, 1876.
Mazeppa Creek, Mazeppa, Minn. California salmon, 1876.
Mazeppa, Minn., Mazeppa Creek. California salmon, 1876.
Mazeppa, Minn., Zumbro River. California salmon, 1878.
Meade County, Ky., Doe Run. California salmon, 1877.
Meadow's Run, Marion County, W. Va. Schoodic salmon, 1879.
Mechanicsburgh, Pa., Yellow Breeches Creek. California salmon, 1873.
Mechanicstown, Md., Owen's Creek. California salmon, 1874, 1878, 1879.
Mecklenburgh County, N. C. (See Charlotte, N. C.)
Medford, Mass., Mystic Lake. Schoodic salmon, 1877, 1880.
Medford, Mass., Wedge Pond. Schoodic salmon, 1877, 1880.
Medicine Lake, Minn. California salmon, 1877.
Meeker County, Minn., Litchfield. Penobscot salmon, 1875; Schoodic salmon, 1875.
Meeker County, Minn. (See Litchfield, Minn.)
Meherrin River, Branchville, N. C. Shad, 1878, 1879.
Melrose, Conn., Melrose Pond. Schoodic salmon, 1879.
Melrose, Mass., ponds. Schoodic salmon, 1880.
Melrose Pond, Melrose, Conn. Schoodic salmon, 1879.

Michigan Lake, Buffalo, Mich. Whitefish, 1876.
Michigan Lake. (See tributaries: Calumet River, Elkhart River, Kankakee River; Boyree, Saint Joseph, Grand, and Manistee Rivers; Bear Creek, Pine Creek; Ground Neck, Minckler, Wetmore, Sixteen, Crystal, Round, Lyons, Woods, McMartin's, Lewis, Metcalf, Carter, Twin, Putty, Pine, Menomonee, Miner, Big Paw Paw, Barrow, Wallow, and Sister Lakes; Brown's Lake, Fox River; Menomonee, Oconomowoc, and Milwaukee Rivers.)
Middleborough, Mass., Assawampsett Lake. Schoodic salmon, 1877, 1878, 1879.
Middleborough, Mass., Taunton River. Shad, 1876, 1877.
Middle Branch, Fillmore County, Minn. California salmon, 1878.
Middleburgh, Md., Big Pipe Creek. California salmon, 1879.
Middlebury, Conn., Quaspaugh Lake. Schoodic salmon, 1880.
Middle Creek, Hardin County, Ky. California salmon, 1876.
Middle Fork of Forked Deer River, Humboldt, Tenn. Shad, 1878.
Middle Island Creek, West Union, W. Va. California salmon, 1877, 1878.
Middle Patuxent River, Savage, Md. California salmon, 1879.
Middle River, Iowa. California salmon, 1879.
Middle River, Staunton, Va. Schoodic salmon, 1879.
Middlesex County, Conn. (See Durham, Conn.; East Hampton, Conn.; Higganum, Conn.)
Middlesex County, Mass. (See Acton, Mass.; Billerica, Mass.; Farmingham, Mass.; Greenwood, Mass.; Groton, Mass.; Holliston, Mass.; Lincoln, Mass.; Medford, Mass.; Melrose, Mass.; Natick, Mass.; Newton, Mass.; Stoneham, Mass.; Wakefield, Mass.; Waltham, Mass.; Winchester, Mass.)
Middleton, Mass., Middleton Pond. Schoodic salmon, 1877.
Middleton Pond, Middleton, Mass. Schoodic salmon, 1877.
Middletown, Md., Sassafras River. Shad, 1879.
Middletown, Md., stream. California salmon, 1878.
Middletown, Md., Bohemia River. Shad, 1879.
Midland County, Mich. (See Midland, Mich.)
Midland, Mich., Chippewa River. California salmon, 1875.
Midland Mich., Tittabawassee River. California salmon, 1875.
Midway, Fla., Ockolockone River. Shad, 1879.
Mifflinburgh, Pa., Penn Creek. California salmon, 1879.
Miles Creek, Cordova Station, Md. Shad, 1879.
Miles Creek, pond tributary to Easton, Md. Schoodic salmon, 1879.
Miles Creek. (See tributary: Wye Mills.)
Miles River, Easton, Md. Shad, 1878.
Milford, Del., Mispillion Creek. Shad, 1879.
Milford, Mass., Kipmuck Pond. Schoodic salmon, 1879.
Milford, Va., Mattapony River. Shad, 1878, 1878.
Millbrook, Ohio, Muskingum River. California salmon, 1873.

Minnetonka Lake, Minn., Long Lake. California salmon, 1877.
Minnewasta Lake, Carver County, Minn. California salmon, 1878.
Minor Lake, Allegan County, Mich. California salmon, 1878, 1879.
Mispillion Creek, Milford, Del. Shad, 1879.
Missisquoi River, Highgate, Vt. California salmon, 1873.
Missisquoi River, Swanton, Vt. California salmon, 1873; shad, 1874.
Mississinewa River, Marion, Ill. Shad, 1878.
Mississippi River, Belleville, Ill. California salmon, 1877.
Mississippi River, Lake City, Minn. California salmon, 1877.
Mississippi River, Red Wing, Minn. California salmon, 1876.
Mississippi River, Saint Louis, Mo. Shad, 1877, 1878.
Mississippi River, Saint Paul, Minn. Shad, 1872, 1874, 1877.
Mississippi River, tributary of, Avon Station, Minn. California salmon, 1877.
Mississippi River, tributary of, Clinton Junction, Iowa. California salmon, 1874.
Mississippi River, tributary of, Storm Spring, Iowa, California salmon, 1875.
Mississippi River, tributary of, Waukon, Iowa. California salmon, 1875.
Mississippi River, tributary of, Waverly, Iowa. Penobscot salmon, 1875.
Mississippi River, Wis., tributary of. California salmon, 1876.
Missouri River, Herman, Mo. Shad, 1872.
Missouri River, Mo. California salmon, 1880.
Missouri River. (See tributaries: Boyer River, Sioux, Nishnabottomy, Little Sioux and Floyd Rivers, Stranger, Verdigris, Delaware, Osage, and Marais des Cygnes Rivers, Gasconade, Platte, Grand, Chariton, and Osage Rivers; Sugar and Bean's Lakes.)
Missouri River, Lexington, Mo. California salmon, 1880.
Missouri River, Buchanan County, Mo. California salmon, 1880.
Missouri River, Saint Joseph, Mo. Shad, 1877; California salmon, 1880.
Missouri River, tributary of, Council Bluffs, Iowa. Penobscot salmon, 1875.
Missouri River, Washington, Mo. Shad, 1872.
Mitchell County, Kans. (See Beloit, Kans.)
Mitchell's Bridge, Md., Worcester County, Pocomoke River. California salmon, 1878.
Mitchell's Pond, Boxford, Mass. Schoodic salmon, 1877.
Mobile River. (See tributary: Alabama River.)
Modoc County, Cal. (See Clear Lake, Cal.)
Mohawk River, N. Y. California salmon, 1874, 1875.
Mohawk River, Oneida County, N. Y. California salmon, 1875.
Mohawk River, Rome, N. Y. Penobscot salmon, 1875.
Mohawk River. (See tributaries: Spring Creeks.)
Moingona, Iowa, Des Moines River. Shad, 1878.

Montgomery, Ala., Alabama River. Shad, 1876.
Montgomery, Ala., tributary of Alabama River. California salmon, 1876.
Montgomery, Ala., Tallapoosa River. Shad, 1877.
Montgomery County, Ky., Big Slate Creek. California salmon, 1877.
Montgomery County, Ky., Little Hinkston Creek. California salmon, 1877.
Montgomery County, Ky., Spencer Creek. California salmon, 1877.
Montgomery, White Sulphur Springs, Va., Roanoke River. California salmon, 1880.
Monticello, Iowa, Maquoketa River. California salmon, 1874.
Moorhead, Minn., Red River of the North. California salmon, 1877.
Moosehead Lake, Mount Kineo, Me. Schoodic salmon, 1879.
Moose Horn Lake, Carleton County, Minn. California salmon, 1878.
Moosehorn Waters, Charlotte, Me. Schoodic salmon, 1878.
Moose Lake, Carleton County, Minn. California salmon, 1877, 1878.
Morgan, Vt., Seymour Lake. Schoodic salmon, 1876.
Morgan County, Ill. (See Jacksonville, Ill.)
Morgan County, Mo., Lamine River. California salmon, 1880.
Morgan County, W. Va. (See Cherry Run Depot, W. Va.; and Sir John's Run, W. Va.)
Morganton, N. C., Catawba River. California salmon, 1880.
Morganton, N. C., ponds tributary to Catawba River. Schoodic salmon, 1878.
Morganton, N. C., John's River. California salmon, 1878, 1879; Schoodic salmon, 1878.
Morganton, N. C., Linville River. California salmon, 1879.
Morganton County, N. C., Linville River. Schoodic salmon, 1878.
Morganton, N. C., South Fork River. California salmon, 1879.
Morganton, N. C., Upper Creek. California salmon, 1879.
Morris County, N. J., Lake Hopatcong. California salmon, 1879; whitefish, 1876.
Morris County, N. J., lakes. Schoodic salmon, 1879.
Morris County, N. J., Shepherd's Pond. Whitefish, 1876.
Morris County, N. J. (See Dover, N. J.; Drakesville, N. J.; Morristown, N. J.)
Morrisania, N. Y., creek. California salmon, 1876, 1877.
Morrison Lake, Branch County, Mich. California salmon, 1875.
Morrison Lake, McLeod County, Minn. California salmon, 1876.
Morristown, N. J., Whippany River. Penobscot salmon, 1875.
Moses Wood Pond, White Haven, Pa. Schoodic salmon, 1879.
Mossy Creek, S. C. California salmon, 1880.
Moswansicut Pond, North Scituate. Schoodic salmon, 1876, 1878.
Moultrie County, Ill. (See Farlow, Ill.)
Mountain Lake, Cottonwood County, Minn. California salmon, 1877.
Mountain Lake, Giles County, Va. California salmon, 1876.
Mount Airy, Md., Little Patuxent River. California salmon, 1879.

Mystic River. (See tributary: Main river.)
Nagawica Lake, Wis. California salmon, 1879; Schoodic salmon, 1879,
Nankeag Lake, Ashburnham, Mass. Schoodic salmon, 1876, 1877, 1878. 1879, 1880.
Nansemond County, Va. (See Suffolk, Va.)
Nansemond River, south branch of Seaboard and Roanake Railroad crossing, Va. Shad, 1878, 1878.
Nansemond River, South Branch, Suffolk, Va. Shad, 1878.
Nanticoke River, branch of, Federalsburgh, Md. California salmon, 1876.
Nanticoke River, Federalsburgh, Md. California salmon, 1879, 1880; shad, 1878, 1879.
Nanticoke River, Hillsborough, Md. California salmon, 1878.
Nanticoke River, Seaford, Del. California salmon, 1876, 1878, 1880; shad, 1877, 1879, 1880.
Nantucket, Mass., Hummock Pond. Schoodic salmon, 1877.
Nash's Lake, Calais, Me. Schoodic salmon, 1879.
Nashua River, Lancaster, Mass. California salmon, 1876, 1877; Penobscot salmon, 1876.
Nashville, Tenn., Cumberland River. Shad, 1875, 1875, 1879.
Natchaug branch of Thames River, Conn. Penobscot salmon, 1877.
Natchaug River, Conn. California salmon, 1876.
Natchaug River, North Windham, Conn. California salmon, 1875.
Natick, Mass., Dug Pond. Schoodic salmon, 1876, 1877, 1878, 1879.
Neabsco Mills, Md., Neabsco River. Shad, 1878.
Neabsco River, Neabsco Mills, Md. Shad, 1878.
Negaunee, Mich., Carp River. California salmon, 1874.
Nelson County, Ky., Rolling Fork of Salt River. California salmon, 1877.
Nelson County, Va., Tye River. California salmon, 1876; Schoodic salmon, 1877.
Nelson, N. H., Newfound Lake. Schoodic salmon, 1880.
Nelson, N. H., Tolman Pond. Schoodic salmon, 1880.
Nemaha County, Kans. (See Centralia, Kans.)
Neosho River, Emporia, Kans. California salmon, 1878, 1879, 1880; shad, 1879.
Neosho, Mo., Shoal Creek. Shad, 1878.
Neosho River. (See tributaries: Cottonwood River and Doyle Creek.)
Neuse River, New Berne, N. C. Shad, 1873.
Neuse River, Neuse, N. C. Shad, 1878.
Neuse River, Wake County, N. C. Shad, 1877.
Neuse River, Raleigh, N. C. Shad, 1877, 1878, 1879.
Neuse River. (See tributary: Contentnea Creek.)
Neuse, N. C., Neuse River. Shad, 1878.
Nevada County, Cal., Donner Lake. Schoodic salmon, 1878; whitefish, 1877.
Nevada County, Cal., Sereno Lake. Schoodic salmon, 1878.

Nichols, S. C., Little Pee Dee River. Shad, 1880.
Nicollet County, Minn. (See Saint Peter, Minn.)
Niles, Berrien County, Mich., Tinkham Lake. Schoodic salmon, 1878.
Niles, Mich., private ponds. California salmon, 1877.
Niles, Mich., Saint Joseph's River. California salmon, 1875; shad, 1873.
Nine Mile Pond, Wilbraham, Mass. Schoodic salmon, 1877.
Nine Springs Creek, Wis. California salmon, 1879.
Nipmug Pond, Mendon, Mass. Schoodic salmon, 1876, 1879, 1880.
Nishnabottomy River, Atlantic, Iowa. California salmon, 1875.
Noble County, Ind. (See Rome City, Ind.)
Noble County, Minn., Ochuda Lake. California salmon, 1877.
Noble County, Minn., Okabena Lake. California salmon, 1876, 1877.
Noble County, Minn., Round Lake. California salmon, 1880.
Nodaway River, R. R. crossing, Nodaway County, Mo. Shad, 1880.
Nodaway County, Mo., Nodaway River, Platte River, and One Hundred and Two River. Shad, 1880.
Nolin Creek, Elizabethtown, Ky. Schoodic salmon, 1878.
Nolin Creek, Hardin County, Ky. California salmon, 1877.
Norcross, Ga., Chattahoochee River. California salmon, 1877.
Norfolk, Conn., Smith Pond. Schoodic salmon, 1876.
Norfolk County, Mass. (See Braintree, Mass.; Milton, Mass.; Nantucket, Mass.; Sharon, Mass.; South Weymouth, Mass.; Wellesley, Mass.)
Norrisville, Md., McDonald's Run. California trout, 1880.
Norrisville, Md., pond. Schoodic salmon, 1880.
Northampton County, Pa., Bushkill Creek. Penobscot salmon, 1874.
Northampton County, Pa. (See Easton, Pa.)
North Andover, Mass., Great Pond. Schoodic salmon, 1876, 1878.
North Boardman River, Kalkaska, Mich. California salmon, 1876.
North Branford, Conn., Main River. Penobscot salmon, 1873.
North Branford, Conn., Mill River. California salmon, 1874.
North East Creek, Md. California salmon, 1880.
North East Creek, North East, Md. California salmon, 1878.
North East, Md., North East Creek. California salmon, 1878.
North East, Md., Sharon's Run. California salmon, 1880.
North East River, Cecil County, Md. Shad, 1878.
North East River, Carpenter's Point, Md. Shad, 1876.
North East River, Havre de Grace, Md. Shad, 1878.
North East River. (See tributary: North East Creek.)
Northfield Lake, Rice County, Minn. Schoodic salmon, 1878.
Northfield, Minn., Cedar Lake. California salmon, 1877.
Northfield, Minn., Robert's Lake. California salmon, 1877.
Northfield, Minn. Schoodic salmon, 1875.
Northfield, Merrimac County, N. H., Chestnut Pond. Schoodic salmon, 1879.
Northfield, Vt., Dog River. Penobscot salmon, 1874.

Obion County, Tenn. (See Paducah Junction, Tenn.)
Obion River, South Fork of, Huntingdon, Tenn. Shad, 1878.
Occoquan Falls. (See tributary: Broad Run.)
Oceana County, Mich., Crystal Lake. California salmon, 1879.
Oceana County, Mich., Round Lake. California salmon, 1879.
Ochuda Lake, Noble County, Minn. California salmon, 1877.
Ocilla River, Jefferson County, Fla. Shad, 1879.
Ockolockonee River, Midway, Fla. Shad, 1879.
Ocmulgee River, Covington, Ga. California salmon, 1878; shad, 1877.
Ocmulgee River, Macon, Ga. California salmon, 1878; shad, 1868, 1877, 1878, 1879.
Ocmulgee River. (See tributaries: Ulcofanhanchee River and Yellow River.)
Oconee County, S. C. (See Seneca, S. C.)
Oconee, Ga., Oconee River. California salmon, 1876.
Oconee River, R. R. Crossing, Greene County, Ga. California salmon, 1876.
Oconee River, Milledgeville, Ga. California salmon, 1878; shad, 1876, 1877, 1880.
Oconee River, R. R. Crossing, Ga. Shad, 1880.
Oconomowoc Creek. (See tributary: Oconomowoc Lake.)
Oconomowoc Lake, Oconomowoc, Wis. Penobscot salmon, 1873.
Oconomowoc Lake, Waukesha County, Wis. California salmon, 1877.
Oconomowoc, Wis., Oconomowoc Lake. Penobscot salmon, 1873.
Octorora Creek, Liberty Grove, Md. California salmon, 1874.
Octorora Creek, Rowlandville, Md. California salmon, 1876, 1878.
Octorora River, De Graw's, Cecil County, Md. California salmon, 1879, 1880.
Octorora River, Harris Dam, Cecil County, Md. California salmon, 1880.
O'Dowd's Lake, Scott County, Minn. California salmon, 1877, 1878.
Ogden River, Weber County, Utah. California salmon, 1876.
Ogeechee River, Crawfordsville, Ga. California salmon, 1877.
Ohio County, W. Va. (See Cold Spring, W. Va.; Wheeling, W. Va.)
Ohio River, Parkersburgh, W. Va. California salmon, 1879, 1880.
Ohio River. (See tributaries: Tanner's Creek, Wabash River, White River, Floyd's Fork, Clear, Mulberry, Gut, Stoner, Pittman, Knob, Spencer, Big State, Eddy, Hurricane Creeks, Kentucky, Little Sandy, Green, Little Kentucky, Little Hinkston, South Elkhorn, Barren and Little Rivers, Rolling Fork, Booker's Branch, Cave Spring Branch, Doe Run, Licking, Cumberland, Salt, Allegheny, Buckingahela, Scioto, Black, Huron, Muskingum, Walhonding, Whitstone, Tuscarawas, Miami, Little Miama, Monongahela, Tennessee, Cheat, Tygart's Valley, West Fork, New, Hugh's, Little Kanawha, Green Brier Rivers; Castalia Springs, Middle Island, Fish, Wheeling, Sinking, Fishing, Buffalo, and Kings Creeks.)

Otis, Mass., ponds. Schoodic salmon, 1880.
Otsego County, Mich. (See Otsego Lake, Mich.)
Otsego Lake, Otsego County, Mich. California salmon, 1875.
Ottawa County, Ohio. (See Elmore, Ohio; Put-in Bay, Ohio.)
Ottawa, Kans., Wakasa River. California salmon, 1878, 1879.
Ottawa River. (See tributary: North River.)
Otter Creek, Madison County, Ky. California salmon, 1876.
Otter Creek, Vergennes, Vt. Shad, 1873, 1874.
Otter River, Minn. Penobscot salmon, 1875; Schoodic salmon, 1875.
Otter Tail County, Minn. (See Perham, Minn.)
Otter Tail River, Frazer City, Minn. California salmon, 1880.
Otter Tail, Forks of, and Bois des Sioux River, Stevens County, Minn. California salmon, 1877.
Ottumwa, Iowa, Des Moines River. California salmon, 1875; shad, 1874.
Ouachita County, La. (See Monroe, La.)
Ouachita River, Clark County, Ark. Shad, 1879.
Ouachita River, Monroe, La. Shad, 1879.
Ouachita River. (See tributaries: Sabine, Bœuf, Caddo, and Saline Rivers, Washita.)
Ousley, Ga., Little River. Shad, 1879.
Outagamie County, Wis. (See Appleton, Wis.)
Owatonna, Minn., Cannon River. California salmon, 1877.
Owatonna River, Steele County, Minn. California salmon, 1875; Schoodic salmon, 1875; Penobscot salmon, 1875.
Owen, Winnebago County, Ill. Brown's Creek. California salmon, 1877.
Owen's Creek, Mechanicstown, Md. California salmon, 1874, 1878, 1879.
Owen's Creek, Slabtown, Md. California salmon, 1874, 1876, 1876, 1876.
Owosso, Mich., Shiawassee River. California salmon, 1875.
Oxbow Lake, Oak County, Mich. Whitefish, 1876.
Oxford, Ala., Cold Water Creek. California salmon, 1878.
Oxford, Iowa, Wapsipinicon River. California salmon, 1875.
Oxford, Warren County, N. J., Green's Pond. Schoodic salmon, 1879.
Pacific, Mo., Meramec River. California salmon, 1876; shad, 1876.
Packlette River, Spartanburg C. H., S. C. California salmon, 1879.
Paducah Junction, Tenn., West Obion River. Shad, 1879.
Palmer, Mass., Quobaug Pond. Penobscot salmon, 1874.
Palmyra, Mich., Palmyra Pond. California salmon, 1878.
Palmyra Pond, Palmyra, Mich. California salmon, 1878.
Pamlico Sound. (See tributary: Tar River.)
Parker Lake, Richland, Mich. Schoodic salmon, 1876.
Parkersburgh, W. Va., Bartlett's Pond. Schoodic salmon, 1878.
Parkersburgh, W. Va., Ohio River. California salmon, 1879, 1880.
Parkersburgh, W. Va., ponds. Schoodic salmon, 1879.
Parkton, Md., Big Gunpowder River. California salmon, 1878.

Patuxent River, Mount Airy, Md. California salmon, 1878.
Patuxent River, North Branch of, Ellicott City, Md. California salmon, 1876.
Patuxent River, Patuxent, Md. Shad, 1879.
Patuxent River, Savage, Md. California salmon, 1874, 1876, 1878, 1878, 1878, 1879, 1880; shad, 1879, 1880, 1880, 1880, 1880.
Patuxent River, Spencerville, Md. California salmon, 1878.
Patuxent River, Tank Station, Md. California salmon, 1878.
Patuxent River. (See tributaries: Little Patuxent River, Middle Patuxent River and Pond, Rocky Run, Pond, Trout Branch, and Gunpowder River.)
Patuxent River, tributary of, Spencerville, Md. Schoodic salmon, 1878.
Paulinskill River, N. J. Penobscot salmon, 1875.
Paulinskill Creek, Warren County, N. J. California salmon, 1879.
Paupock Lake, Scranton, Pa. Schoodic salmon, 1879.
Pawcatuck River, R. I. Penobscot salmon, 1873.
Pawcatuck River, ponds tributary to, R. I. California salmon, 1876.
Pawcatuck River, Washington County, R. I. California salmon, 1875; shad, 1874, 1875.
Pawcatuck River, tributary of, R. I. California salmon, 1876; Penobscot salmon, 1874.
Pawnee County, Kans. (See Larned, Kans.)
Pawnee Creek, Larned, Kans. California salmon, 1878, 1879.
Pawnee River, Larned, Kans. Shad, 1879.
Paw Paw, Mich., Paw Paw River. California salmon, 1875.
Paw Paw River, North Branch of, Almena, Mich. California trout, 1880.
Paw Paw River, Paw Paw, Mich. California salmon, 1875.
Paw Paw River. (See tributaries: Bucks Creek, Mill Stream, North Branch of Big Paw Paw River.)
Pawtuxet River, R. I. California salmon, 1875.
Pawtuxet River, North Branch of, sundry places, R. I. Penobscot salmon, 1876.
Pawtuxet River, R. I. Penobscot salmon, 1873.
Pawtuxet River, Providence County, R. I. Penobscot salmon, 1875; shad, 1874, 1875.
Pawtuxet River, South Branch of, sundry places, R. I. Penobscot salmon, 1876.
Pawtuxet River, tributary of, R. I. California salmon, 1876; Penobscot salmon, 1874.
Pawtuxet River. (See tributaries: North and South Branch.)
Paxton, Mass., Asnebumskitt Pond. Schoodic salmon, 1879.
Pea River, Union Springs, Ala. Shad, 1879.
Pearl Lake, Stearns County, Minn. California salmon, 1876, 1878.
Pearl River, Jackson, Miss. Shad, 1875, 1876, 1879.
Pearl River, Kosciusko, Miss. California salmon, 1876.
Pearl River. (See tributary: Forked Deer River.)

Petosky, Mich., Pine Lake. California salmon, 1876.
Petosky, Mich., Round Lake. Whitefish, 1876.
Petosky, Mich., Twin Lake. Whitefish, 1876.
Phalon Lake, Ramsey County, Minn. California salmon, 1876, 1877.
Phelps County, Mo. (See Jerome, Mo.)
Philadelphia County, Pa. (See Philadelphia, Pa.)
Philadelphia, Pa., Schuylkill River. California salmon, 1877.
Phœnix, Md., Gunpowder River. California salmon, 1876, 1877, 1880.
Phœnix, Md., stream. California trout, 1880, 1880, 1880.
Pickerel Lake, Freeborn County, Minn. California salmon, 1876, 1878.
Pickerel Lake, Kent County, Minn. California salmon, 1876.
Piedmont, Mo., Big Black River. Shad, 1879.
Piedmont, W. Va., Potomac River. California salmon, 1877; shad, 1876, 1879.
Pierce City, Mo., Capo Creek. California salmon, 1878.
Piermont, N. H., Tarlton Pond. Schoodic salmon, 1879.
Pierson, Montcalm County, Mich., Whitefish Lake. Schoodic salmon, 1878.
Pigeon River, Asheville, N. C. California salmon, 1878.
Pike County, Pa., several lakes. Schoodic salmon, 1878.
Pike County, Pa. (See Bushkill, Pa.)
Pikesville, Md., pond. Schoodic salmon, 1880.
Pikesville, Md., stream. California trout, 1880.
Pilot Mound, Minn., tributary of Root River. California salmon, 1878.
Pine City, Minn., tributaries of Saint Croix River. California salmon, 1877.
Pine County, Minn., Big Lake. California salmon, 1875.
Pine County, Minn., Saint Louis River. California salmon, 1875, 1875.
Pine County, Minn., Twin Lakes. California salmon, 1875.
Pine County, Minn. (See Pine City, Minn.)
Pine Creek, Cass County, Mich. California salmon, 1879.
Pine Creek, Pa. California salmon, 1875.
Pine Creek, Winona County, Minn. California salmon, 1878.
Pine Lake, Petosky, Mich. California salmon, 1876.
Pine Lakes, Perham, Minn. Penobscot salmon, 1875.
Pine Meadow, Conn., Farmington River. California salmon, 1874, 1874.
Pine River, Mich. Penobscot salmon, 1874.
Pine River, Richland Centre, Wis. California salmon, 1877.
Pine Tree Lake, Washington County, Minn. California salmon, 1876.
Pipe Creek, New Windsor, Md. California salmon, 1878.
Pipe Creek, Union Bridge, Md. California salmon, 1874.
Pipe Creek, Wakefield, Md. California salmon, 1874, 1876.
Pipe Creek, Westminster, Md. California salmon, 1876.
Piscataquis County, Me. (See Brownville, Me.; Dover, Me.; Milo, Me.; Mount Kineo, Me.)
Piscataquis River, Dover, Me. Penobscot salmon, 1874.

Poynette, Wis., tributary of Wisconsin River. California sâlmon, 1878.
Prairie Du Pont River, Belleville, Ill. California salmon, 1876, 1877.
Preston County, W. Va. (See Rowlesburgh, W. Va.)
Preston Lake, Renville County, Minn. California salmon, 1876, 1878, 1879.
Prichard's Run, Marion County, W. Va. Schoodic salmon, 1878.
Prince Edward County, Va. (See Farmville, Va.; Prospect, Va.)
Prince George's County, Md. (See Cedar Point, Md.; Forestville, Md.; Fort Washington, Md.; Laurel, Md.; and Moxley Point, Md.)
Princess Anne, Md., Manokin River. Shad, 1878, 1879.
Prince William County, Va. (See Freestone, Va.; Freestone Point, Va.; Neabsco Mills, Va.)
Prior Lake, Scott County, Minn. California salmon, 1876, 1877, 1878.
Prospect, Va., Appomattox River. California salmon, 1880.
Providence County, R. I., Pawtuxet River. Penobscot salmon, 1875; Shad, 1874, 1875.
Providence County, R. I., Blackstone River. Shad, 1874, 1877.
Providence County, R. I. (See Burrellville, R. I., Foster, R. I.)
Pulaski County, Ark. (See Little Rock, Ark.)
Pulaski County, Ky., Cumberland River. Shad, 1878.
Pulaski County, Ky. (See Somerset, Ky.)
Pulaski County, Va., New River. Schoodic salmon, 1880.
Pulaski County, Va. (See Central, Va.)
Pulaski Lake, Wright County, Minn. California salmon, 1877.
Pushaw Pond, Glenburn, Me. Schoodic salmon, 1879.
Put-in Bay, Ohio, Lake Erie. California salmon, 1877; Penobscot salmon, 1875; Schoodic salmon, 1876.
Putnam, Conn., Thames River. Shad, 1874.
Putnam, Livingston County, Mich., Half Moon Lake. California salmon, 1878.
Putnam, Livingston County, Mich., Patterson Lake. California salmon, 1878.
Putty Lake, Kalamazoo County, Mich. California salmon, 1875.
Quactuto River, Arkadelphia, Ark. California salmon, 1878, 1878, 1878.
Quamapowitt Lake, Wakefield, Mass. Schoodic salmon, 1877, 1878, 1879.
Quasepaug Lake, Middlebury, Conn. Schoodic salmon, 1880.
Queen Anne County, Md. (See Centreville, Md.)
Queen's County, N. Y., tributary of Long Island Sound. California salmon, 1874.
Queen's County, N. Y. (See Roslyn, N. Y.)
Quinnebaug River, Canterbury, Conn. Shad, 1875.
Quinnepiac River, Conn. California salmon, 1874.
Quobaug Pond, Palmer, Mass. Penobscot salmon, 1874.
Racine County, Wis., Brown's Lake. California salmon, 1877, 1879.
Raccoon Creek, Gloucester County, N. J. California salmon, 1879.

Rapid River, Kalkaska County, Mich. California salmon, 1876.
Rappahannock River, tributary of, Va. California salmon, 1876.
Rappahannock River. (See tributary: Rapid Ann River.)
Raritan, N. J., Pattenburgh Creek. California salmon, 1874.
Raritan River, North Branch, Somerset County, N. J. California salmon, 1879.
Raritan River, South Branch of, South Branch, N. J. Penobscot salmon, 1875.
Raritan River. (See tributaries: Pattenburgh Creek, Salmon Run, and South Branch of Raritan River.)
Raritan River, tributary of, N. J. California salmon, 1874, 1875; Penobscot salmon, 1874.
Raymond, N. H., Jones Pond. Schoodic salmon, 1879.
Reading, Kans., Marais des Cygnes River. Shad, 1879; California salmon, 1881.
Reading, Pa., Schuylkill River. California salmon, 1875, 1878.
Rebecca Lake, Hennepin County, Minn. California salmon, 1878.
Rectorstown, Va., Goose Creek. California salmon, 1876.
Red Brook, Mass. California salmon, 1876.
Red Brook, tributary of, Mass. Penobscot salmon, 1873.
Red Brook. (See tributary: Quobaug.)
Red Cedar River. (See tributary: Fish Lake.)
Reading, Kans., Osage River. California salmon, 1878, 1879.
Redding, Cal., tributary of Sacramento River. Penobscot salmon, 1874.
Red Lake River, tributary of, Crookston, Minn. California salmon, 1880.
Red River, Fulton, Ark. Shad, 1877, 1879.
Red River of the North, Breckenridge, Minn. California salmon, 1875; Penobscot salmon, 1875; Schoodic salmon, 1875.
Red River of the North, Moorhead, Minn. California salmon, 1877.
Red River of the North. (See tributaries: Buffalo River, Detroit Lake, and Perham.)
Red River of the North, Wilkin County, Minn. California salmon, 1878.
Red Vermillion River, Centralia, Kans. California salmon, 1878, 1879.
Red Wing, Minn., Mississippi River. California salmon, 1876.
Red Wing, Minn., Skillman Pond. California salmon, 1877; Schoodic salmon, 1877.
Reed City, Mich., Hersey Creek. California salmon, 1874.
Reed Creek, Wythe County, Va. California salmon, 1879.
Reed Lake, Grand Rapids, Mich. California salmon, 1876.
Reed's Pond, Marshall County, Mich. Schoodic salmon, 1876.
Reese Pond, Calhoun County, Mich. Schoodic salmon, 1876.
Reisterstown, Md., lake tributary to Patapsco Falls. Schoodic salmon, 1879.
Reisterstown, Md., pond. Schoodic salmon, 1878.
Relay Station, Baltimore County, Md., Patapsco River. Shad, 1879.

Richland County, La., Bayou Mason. Shad, 1879.
Richland County, La., Bœuf River. Shad, 1879.
Richland County, S. C., Wateree River. Shad, 1880; California salmon, 1880.
Richland County, S. C. (See Columbia, S. C.)
Richland, Mich., Gull Lake. California salmon, 1878.
Richland, Mich., Long Lake. California salmon, 1878.
Richland, Mich., Parker Lake. Schoodic salmon, 1876.
Richmond, McHenry County, Ill., Twin Lakes. Schoodic salmon, 1878.
Richmond, Washington County, R. I., Beach Pond. Schoodic salmon, 1876.
Richmond, Va., James River. Shad, 1878.
Richmond, Va., Reservoir. California salmon, 1879.
Ridgefield, Conn., Round Pond. Schoodic salmon, 1879.
Rifle River, Crawford, Mich. California salmon, 1876.
Rifle River, Bay County, Mich. California salmon, 1875.
Riley County, Kans. (See Manhattan, Kans.)
Rindge, N. H., Emerson Pond. Schoodic salmon, 1880.
Ringwood, N. J., Shepherd's Lake. Schoodic salmon, 1879.
Ripley County, Mo. (See Doniphan, Mo.)
Ripley, Miss., Tippah River. Shad, 1879.
Ripley Lake, Meeker County, Minn. California salmon, 1877.
Ritchie County, W. Va. (See Pennsborough, W. Va.)
Rivanna River, Shadwell, Va. Shad, 1878.
Riverton, Va., Shenandoah River. Shad, 1878.
Roanoke County, Va. (See Salem, Va.)
Roanoke River, Alleghany Springs, Va. California salmon, 1880.
Roanoke River, Big Spring Depot, Va. California salmon, 1880.
Roanoke River Light, N. C. (See Avoca, N. C.)
Roanoke River, Montgomery, White Sulphur Springs, Va. California salmon, 1880.
Roanoke River, Plymouth, N. C. Shad, 1878.
Roanoke River, Salem, Va. California salmon, 1880; shad, 1878.
Roanoke River, tributary of, Salem, Va. California salmon, 1874.
Roanoke River, tributary of, Va. California salmon, 1876.
Roanoke River, Weldon, N. C. Shad, 1878, 1879, 1879, 1879.
Roanoke River. (See tributaries: Town Creek, Staunton River, and Dan River.)
Roberts Lake, Northfield, Minn. California salmon, 1877.
Roberts Lake, Rice County, Minn. California salmon, 1876, 1877, 1878; Penobscot salmon, 1875; Schoodic salmon, 1879.
Robertson County, Tex. (See Hearne, Tex.)
Robeson County, N. C. (See Branchville, N. C.)
Rochester, Mass., Mary's Pond. Schoodic salmon, 1879, 1880.
Rochester, Mich., private pond. California salmon, 1878.
Rochester, Minn., Orono River. California salmon, 1877.

Rome City, Ind. Rome City Lake. Whitefish, 1876.
Rome City Lake, Rome City, Ind. Whitefish, 1876.
Rome, Ga., Coosa River. Shad, 1875.
Ro e, N. Y., Mohawk River. Penobscot salmon, 1875.
Romeo, Mich., private ponds. California salmon, 1879.
Romney, W.Va., Mill Run. California trout, 1880.
Romney, W.Va., Pond at Institution for Deaf, &c. Schoodic salmon, 1879, 1879.
Romney, W. Va., South Branch of Potomac River. Schoodic salmon, 1879.
Romney, W. Va., South Fork of Potomac River. California salmon, 1876.
Ronceverte, W. Va., Greenbrier River. California salmon, 1878, 1879, 1880; shad, 1873, 1879.
Roney Lake, Clare County, Mich. Schoodic salmon, 1878.
Roosevelt Creek, Sayville, N. Y. California salmon, 1874.
Root River, Olmstead County, Minn. California salmon, 1877, 1877.
Root River, Middle Branch of, Fillmore County, Minn. California salmon, 1878.
Root River, tributary of, Lanesborough, Minn. California salmon, 1876.
Root River, tributary of, Pilot Mound, Minn. California salmon, 1878.
Root River, tributary of, Spring Valley, Minn. California salmon, 1878.
Root River, North Branch of, Fillmore County, Minn. California salmon, 1878, 1878.
Root River, South Branch of, Fillmore County, Minn. California salmon, 1878.
Roscommon County, Mich., Au Sable River. Penobscot salmon, 1873.
Roscommon County, Mich., Higgins Lake. California salmon, 1879; Penobscot salmon, 1874; Schoodic salmon, 1880.
Rose Lake, Le Roy, Mich. Whitefish, 1876.
Roslyn, N. Y., streams. California salmon, 1876, 1877.
Ross, Mich., lake tributary to Kalamazoo River. California salmon, 1873.
Rouge River, Dearborn, Mich. California salmon, 1875.
Rouge River, Northville, Mich. California salmon, 1876; Schoodic salmon, 1878; whitefish, 1876, 1876, 1876.
Rouge River, Oakland County, Mich. California salmon, 1875.
Rouge River. (See tributary: Yerkes Lake.)
Rough Creek, Hardin County, Ky. California salmon, 1877.
Roundaway Creek, R. R. crossing, Madison County, La. Shad, 1879.
Round Lake, Anoka County, Minn. California salmon, 1877, 1877.
Round Lake, Chelsea, Mich. Whitefish, 1876.
Round Lake, Chenango County, N. Y. California salmon, 1874.
Round Lake, Clinton County, Mich. California salmon, 1875.
Round Lake, Linden, Mich. Whitefish, 1876.
Round Lake, Noble County, Minn. California salmon, 1880.
Round Lake, Oceana County, Mich. California salmon, 1879.

Sand Bank, N. Y., Salmon River. California salmon, 1874.
Sand Creek, Hillsdale County, Mich. California salmon, 1873.
Sand Lake, Ill., Deep Lake. California salmon, 1876.
Sandstone Creek, Mich. California salmon, 1874.
Sandusky County, Ohio. (See Fremont, Ohio.)
Sandusky River, Bucyrus, Ohio. California salmon, 1874.
Sandusky River, Fremont, Ohio. California salmon, 1880; Penobscot salmon, 1875; Schoodic salmon, 1876; shad, 1874, 1878, 1879, 1880.
Sandwich, Mass., Spectacle Pond. Schoodic salmon, 1876, 1877, 1880.
Sandwich, N. H., Adams' Pond. Schoodic salmon, 1880.
Sandwich, N. H., North Pond. Schoodic salmon, 1880.
Sandwich, N. H., pond. Schoodic salmon, 1879.
Sandy Branch, Cecil County, Md., Sassafras River. California salmon, 1879.
Sandy Creek, Orleans County, N. Y. California salmon, 1874.
Sandy Hook, Conn., Halfway River. Schoodic salmon, 1880.
Sandy Lake, Cass County, Minn. Schoodic salmon, 1879.
Sandy Pond, Lincoln, Mass. Schoodic salmon, 1876, 1877.
Sandy Spring, Md., pond. California salmon; Schoodic salmon, 1880.
Sandy Spring, Md., stream. California trout, 1880.
Sandy Spring, Md., pond. Schoodic salmon, 1880.
San Francisco, Cal., Laguna Honda. Schoodic salmon, 1878.
San Francisco, Cal., tributary of Sacramento River. California salmon, 1876.
San Francisco, Cal., Woodward's Aquarium. Schoodic salmon, 1878.
San Francisco County, Cal. (See San Francisco, Cal.)
San Jose Water Co's Reservoir, Cal. Whitefish, 1879.
San Marcus River, Luling, Tex. Shad, 1879.
San Mateo County, Cal., Felch's Lake. Schoodic salmon, 1878.
Santa Clara County, Cal., San Jose Water Company's Reservoir. Whitefish, 1879.
Santee River. (See tributaries: Broad River, Catawba River, Broad River, and Saluda River.)
Sappington, Anne Arundel County, Md., tributary of Patuxent River. 1879.
Sequoit Creek, N. Y. California salmon, 1874.
Saranac River, West Plattsburgh, N. Y. Penobscot salmon, 1875.
Sassafras River, Cecil County, Md. California salmon, 1880.
Sassafras River, Frederick, Md. California salmon, 1876.
Sassafras River, Md. Shad, 1877.
Sassafras River, Middletown, Md. Shad, 1879.
Sassafras River, Sandy Branch, Md. California salmon, 1879.
Satucket River, East Bridgewater, Mass. Schoodic salmon, 1877, 1878.
Saugatuck River, Conn. California salmon, 1876.
Saugatuck River, Westport, Conn. Penobscot salmon, 1875.
Saugatuck River. (See tributary: Main River.)

Scott County, Minn., lake. California salmon, 1876.
Scott County, Minn., O'Dowd's Lake. California salmon, 1877, 1878.
Scott County, Minn., Prior Lake. California salmon, 1876, 1877, 1877, 1877, 1878.
Scott County, Minn., Spring Lake. California salmon, 1878.
Scranton, Pa., Paupock Lake. Schoodic salmon, 1879.
Scranton, Pa., Tobyhanna Lake. Schoodic salmon, 1879.
Seaford, Del., Little Nanticoke River. California salmon, 1880.
Seaford, Del., Nanticoke River. California salmon, 1876, 1878, 1880; shad, 1877, 1879, 1880.
Searle's Pond, Foster, R. I. Schoodic salmon, 1876.
Sebec Lake, Me. Penobscot salmon, 1874.
Seboois River, Howland, Me. Penobscot salmon, 1875.
Seboois River, Howland, Me. Penobscot salmon, 1874.
Seboois River, Whitney Ridge, Me. Penobscot salmon, 1874.
Seguin, Tex., Guadalupe River. Shad, 1879.
Seneca, S. C., Seneca River. California salmon, 1878; shad, 1880.
Seneca County, N. Y., Seneca Lake. California salmon, 1874.
Seneca Lake, Seneca County, N. Y. California salmon, 1874.
Seneca River, Seneca, S. C. California salmon, 1878; shad, 1880.
Seneca River, S. C. California trout, 1880; California salmon, 1880, 1880; Schoodic salmon, 1880.
Sequoit Creek, Oneida County, N. Y. California salmon, 1875.
Sereno Lake, Nevada County, Cal. Schoodic salmon, 1878.
Sereno Lake, Placer County, Cal. Schoodic salmon, 1878.
Sereno Lake, Summit, Placer County, Cal. Whitefish, 1877.
Severance's Ponds, Wis. California salmon, 1879.
Seymour Lake, Morgan, Vt. Schoodic salmon, 1876.
Shadwell, Va., Rivanna River. Shad, 1878.
Shady Oak Lake, Minn. California salmon, 1877.
Sharon, Mass., ponds. Schoodic salmon, 1880.
Sharon Springs, Va., North Fork Holston River. California salmon, 1880.
Sharon's Run, Northeast, Md. California salmon, 1880.
Shasta County, Cal. (See Baird, Cal.; Redding, Cal.)
Shawano County, Wis. (See Keshena, Wis.)
Shawnee County, Kans. (See Silver Lake, Kans.; Topeka, Kans.)
Shawngum Lake, N. J. California salmon, 1879.
Shawshine River, Billerica, Mass. Schoodic salmon, 1877.
Sheboygan County, Wis., Elkhart Lake. Penobscot salmon, 1875.
Shelby County, Ky., Clear Creek. California salmon, 1876.
Shelby County, Ky., Gist Creek. California salmon, 1876.
Shelby County, Ky., Salt River. Shad, 1880.
Shelby County, Ohio. (See Sidney, Ohio.)
Shelby County, Tenn. (See Memphis, Tenn.)
Shell Rock River, Iowa. California salmon, 1878.

Silver Lake, N. J. California salmon, 1879.
Silver Lake, Portage, Wis. California salmon, 1878.
Silver Lake, Sibley County, Minn. California salmon, 1877.
Silver Lake, Silver Lake, Kans. California salmon, 1878, 1879.
Silver Lake, Stearns County, Minn. California salmon, 1877.
Silver Lake, Washington County, Minn. California salmon, 1877, 1879.
Silver Lake, Wis. Schoodic salmon, 1879.
Silver Lake, Woodstock, Mich. California salmon, 1878.
Sinking Creek, Lewisburgh, Greenbrier County, W. Va. California salmon, 1878.
Sinnemahoning, Potter County, Pa. California salmon, 1879.
Sioux City, Iowa, Floyd River. California salmon, 1875.
Sioux River, Iowa. California salmon, 1879.
Sioux River. (See tributary: Spirit Lake.)
Sir John's Run, W. Va., Potomac River. California salmon, 1875, 1877, 1878.
Sister Lakes, Van Buren County, Mich. California salmon, 1878.
Six Runs, Duplin County, N. C. Shad, 1879.
Six Runs, Sampson County, N. C. Shad, 1878.
Six Runs, Warsaw, N. C. Shad, 1879, 1879.
Sixteen Lake, Allegan County, Mich. California salmon, 1879.
Skaneateles, N. Y., Oswego River. California salmon, 1874, 1875.
Skeelman's Pond, Wabasha County, Minn. Schoodic salmon, 1879.
Skillmans Pond, Red Wing, Minn. California salmon, 1877; Schoodic salmon, 1877.
Skunk River, Iowa. California salmon, 1878, 1879.
Slabtown, Frederick County, Md., Owens Creek. California salmon, 1874, 1876, 1876, 1876.
Slatersville Branch, R. I. Penobscot salmon, 1874, 1875, 1875, 1876.
Slatersville River, R. I. California salmon, 1875.
Sleepy Eye Lake, Brown County, Minn. California salmon, 1878.
Smith Fork of Platte River, Clinton County, Mo. California salmon, 1880.
Smith Pond, Norfolk, Conn. Schoodic salmon, 1876.
Smith's Ferry, Mass., Connecticut River. Shad, 1874, 1875, 1877.
Smith's Grove, Ky., pond. Schoodic salmon, 1878.
Smith's Pond, Wolfeborough, N. C. California salmon, 1879.
Smoky Hill River, Ellis, Kans. California salmon, 1880.
Smoky Hill River, Ellsworth County, Kans. Schoodic salmon, 1879.
Smoky Hill River, Ellsworth, Kans. California salmon, 1877, 1878, 1879, 1880; shad, 1879.
Smoky Hill River, Hayes City, Kans. California salmon, 1880.
Smoky Hill River, Fort Harker, Kans. California salmon, 1880.
Smoky Hill River. (See tributaries: Saline River, Spring Creek, Big Creek, Chapman's Creek, Solomon and Salina Rivers.)
Smyth County, Va., Holston River. Schoodic salmon, 1877.

Southport, Conn., Southport Pond. Schoodic salmon, 1879.
Southport Pond, Southport, Conn. Schoodic salmon, 1879.
Southport River. (See tributary : Main River.)
South River, Greenville, Va. California salmon, 1878.
South River, Lexington, Va. California salmon, 1878, 1880; Schoodic salmon, 1879.
South River, Waynesborough, Va. Shad, 1878.
South Toledo, Ohio, Maumee River. California salmon, 1877.
South Vernon, Windham County, Vt., Connecticut River. Shad, 1875, 1875.
South Weymouth, Mass., Weymouth Great Pond. Schoodic salmon, 1876, 1877, 1878.
South Windham, Conn., Balahack Brook. Schoodic salmon, 1877.
Spartanburgh County, S. C. (See Gaffney City, S. C.; Spartanburgh, Court-House, S. C.
Spartanburgh Court-House, S. C., Broad River. Shad, 1876.
Spartanburgh Court-House, S. C., Packlette River. California salmon, 1879.
Sparta, Wis., La Crosse River. California salmon, 1879.
Spectacle Pond, Sandwich, Mass. Schoodic salmon, 1876, 1877, 1880.
Spectacle Pond, South Kent, Conn. Schoodic salmon, 1876.
Spectacle Ponds, Kent, Conn. Schoodic salmon, 1877, 1878.
Spencer County, Ky. (See Taylorsville, Ky.)
Spencer Creek, Montgomery County, Ky. California salmon, 1877.
Spencerville, Md., Patuxent River. California salmon, 1878.
Spencerville, Md., tributary of Patuxent River. Schoodic salmon, 1878.
Spesutie Narrows, Havre de Grace, Md. Shad, 1877 (12 deposits), 1878 (10 deposits), 1879 (15 deposits), 1880 (10 deposits).
Spirit Lake, Iowa. Penobscot salmon, 1876.
Spirit Lake, Sauk County, Wis. California salmon, 1877.
Spofford Lake, Chesterfield, N. H. Schoodic salmon, 1880.
Spot Pond, Stoneham, Mass. Schoodic salmon, 1878.
Sprague's Pond, Charlotte, Me. Schoodic salmon, 1878.
Spring Branch, Iowa. California salmon, 1879.
Spring Brook Creek, Kalamazoo, Mich. California salmon, 1874.
Spring Brook, Cayuga County, N. Y. California salmon, 1879.
Spring Brook, Ontario County, N. Y. California salmon, 1879.
Spring Brook, Toledo, Ohio. California salmon, 1880.
Spring Brook, Wheatland, N. Y. California salmon, 1878.
Spring Creek, Bellefonte, Pa. California salmon, 1874.
Spring Creek, Brookville, Kans. California salmon, 1878, 1879.
Spring Creek, Caledonia, Livingston County, N. Y. Schoodic salmon, 1878.
Spring Creek, Delaware, Iowa. California salmon, 1875.
Spring Creek, Fillmore County, Minn. California salmon, 1878.
Spring Creek, Fort Harker, Kans. Schoodic salmon, 1880.

Steele County, Minn. (See Owatonna, Minn.)
Steers' Pond, North Scituate, R. I. Schoodic salmon, 1876, 1878.
Stevens County, Minn. California salmon, 1876.
Stevens County, Minn., Donnelly Lake. California salmon, 1878.
Stevens County, Minn., Engle Lake. California salmon, 1878.
Stevens County, Minn., forks of Otter Tail and Bois des Sioux Rivers. California salmon, 1877.
Stevens County, Minn., Frog Lake. California salmon, 1878.
Stevens County, Minn., Gavin's Lake. California salmon, 1878.
Stevens County, Minn., Lake Foss. California salmon, 1879.
Stevens County, Minn., McCarthy's Lake. California salmon, 1877.
Stevens County, Minn., Pomme de Terre River. California salmon, 1877, 1877, 1877.
Stewartstown, N. H., Diamond Pond. Schoodic salmon, 1880.
Still River, Brookfield, Conn. Schoodic salmon, 1880.
Stillwater, Minn., Saint Croix River. California salmon, 1876.
Stockbridge, Mass., Lake Mahkeenac. Schoodic salmon, 1878, 1879, 1880.
Stocker's Pond, Grantham, N. H. Schoodic salmon, 1879.
Stockton, Ga., Allapahaw River. Shad, 1879.
Stokes County, N. C. (See Germanton, N. C.)
Stoneham, Mass., Spot Pond. Schoodic salmon, 1878.
Stoner Creek, Clark County, Ky. California salmon, 1876.
Stoney Branch, Bel Air, Md. California trout, 1880.
Stoney Run, Baltimore, Md. California trout, 1880; Schoodic salmon, 1879.
Stoney Run, Waverly, Md. California trout, 1880.
Stony Creek, Pa. California salmon, 1876.
Stony Lake, La Porte, Ind. Schoodic salmon, 1880.
Storm Lake, Iowa. Penobscot salmon, 1876.
Storm Lake, Iowa, Des Moines River. California salmon, 1875.
Storm Lake, Iowa, Storm Lake. California salmon, 1875.
Storm Lake, Storm Lake, Iowa. California salmon, 1875.
Storm Spring, Iowa., tributary of Mississippi River. California salmon, 1875.
Strafford County, N. H. (See Milton, N. H.; New Durham, N. H.)
Straits Lake, Oak County, Mich. Whitefish, 1876.
Stranger, Kans., Stranger River. California salmon, 1878, 1879.
Stranger River, Stranger, Kans. California salmon, 1878, 1879.
Strasburgh, Va., Cedar Creek. California salmon, 1876.
Strasburgh, Va., North Fork, Shenandoah River. California salmon, 1876.
String Lake, Cottonwood County, Minn. California salmon, 1876.
Strode's Creek, Clark County, Ky. California salmon, 1876.
Strouble's Creek, Va. Schoodic salmon, 1878.

Susquehanna River, Old Bay Fishery, Md. Shad, 1879, 1879, 1879.
Susquehanna River, Port Deposit, Md. Shad, 1879, 1879.
Susquehanna River, Swan Creek, Md. Shad, 1876, 1880.
Susquehanna River, tributary of, Coneloquinet, Pa. California salmon, 1876.
Susquehanna River, tributary of, Chiques, Pa. California salmon, 1876.
Susquehanna River, tributary of, Columbia, Pa. California salmon, 1876.
Susquehanna River, tributary of, Harrisburg, Pa. California salmon, 1872, 1873, 1876.
Susquehanna River, tributary of, Marietta, Pa. California salmon, 1876.
Susquehanna River, tributary of, Swatara, Pa. California salmon, 1876.
Susquehanna River, upper waters of, Pa. Penobscot salmon, 1880.
Susquehanna River, Watson's Island, Md. Shad, 1880 (8 items).
Susquehanna River. (See tributaries: Blackston, Pawcatuck and Patuxent Rivers, Deer Creek, Octorora Creek, Spesutie Narrows, North East, Cohocton River, Swatara Creek, Chiquesalunga Creek, Donegal Creek, Codorus Creek, Yellow Breeches Creek, Donegal Springs, Pine Creek, Coneloquinet Creek, Mahantonga River, Bald Eagle River, Buffalo Creek, Stony Creek, Maiden Run, Bowman's Creek, Maiden Creek, Spring Creek, Penn's Creek, Kettle Creek, Trout Run, Juniata River, Harvey's Lake.)
Sussex County, Del. (See Seaford, Del.)
Sussex County, N. J., Drake's Pond. Schoodic salmon, 1879.
Sussex County, N. J., Swartswood Lake. California salmon, 1879.
Sussex County, N. J. (See Andover, N. J.)
Suwanee River. (See tributaries: Allapahaw River and Little River.)
Swan Creek, Harford County, Md., Susquehanna River. Shad, 1876, 1880.
Swannanoa River, Buncombe County, N. C. California salmon, 1877; California trout, 1880.
Swanton, Md., North Branch of Potomac River. California salmon, 1878.
Swanton, Md., Savage River. California salmon, 1877.
Swanton, Vt., Missisquoi River. California salmon, 1873; shad, 1874.
Swartswood Lake, Sussex County, N. J. California salmon, 1879.
Swatara Creek, Dauphin County, Pa. Penobscot salmon, 1874.
Swatara Creek, Pa. California salmon, 1874.
Swatara, Pa., Swatara River. California salmon, 1875, 1876, 1877.
Swatara River, Swatara, Pa. California salmon, 1875, 1876, 1877.
Swedesborough, N. J., Oldman's Creek. California salmon, 1876.
Swift County, Minn., Hassel Lake. California salmon, 1878.
Swift County, Minn., Saint Malachy's Lake. California salmon, 1877.
Swift County, Minn., Saint Mary's Lake. California salmon, 1877.
Swift County, Minn. (See Benson, Minn.)
Syke's Pond, Wis. California salmon, 1879.
Sykesville, Md., Patapsco River. California salmon, 1876, 1878.

Tensas River, R. R. crossing, Madison County, La. Shad, 1879.
Tensas River, (See tributary: Bayou Macon.)
Terre Haute, Ind., Wabash River. Shad, 1878, 1879.
Terry Lake, Washington County, Minn. California salmon, 1876.
Thames River, brooks tributary to, Willimantic, Conn. Schoodic salmon, 1878, 1879.
Thames River, tributary of, Conn. Penobscot salmon, 1873.
Thames River, Putnam, Conn. Shad, 1874.
Thames River. (See tributaries: Quinnebaug River, Shetucket River, Natchaug Branch, Natchaug River.)
The Mill, Bertie County, N. C., Salmon Creek. Shad, 1878.
Thomas' Spring Branch, Scott County, Ky. California salmon, 1876.
Thompsonville, Conn., tributaries of the Connecticut River. Schoodic salmon, 1878.
Thorn Apple Lake, Barry County, Mich. California salmon, 1875.
Thorn Apple Lake, Eaton County, Mich. California salmon, 1875.
Thornton, N. H., tributary of Merrimack River. Penobscot salmon, 1873.
Three Lakes, Marquette County, Mich. California salmon, 1876.
Three Mile Lake, Chippewa County, Wis. California salmon, 1877.
Three Rivers, Mich., Portage River. California salmon, 1876.
Three Rivers, Mich., Saint Joseph River. California salmon, 1876.
Three Runs, S. C. California salmon, 1880.
Tickfaw, La., Amite River. Shad, 1878.
Tickfaw, La., Notalbany River. California salmon, 1876; shad, 1875.
Tiffin River, Woodstock, Mich. California salmon, 1878.
Tigley Lake, Susquehanna County, Pa. Schoodic salmon, 1880.
Tilton, N. H., Winnipesaukee River. Shad, 1877.
Timber Creek, Woodbury, N. J. California salmon, 1877.
Timber Creek, N. J. California salmon, 1877.
Tinkham Lake, Miles, Berrien County, Mich. Schoodic salmon, 1878.
Tippah County, Miss. (See Ripley, Miss.)
Tippah River, Ripley, Miss. Shad, 1879.
Tippecanoe County, Ind. See La Fayette, Ind.
Tipton, Iowa, Cedar River. California salmon, 1874, 1875.
Tittabawassee River, Midland Mich. California salmon, 1875.
Tobacco Run, Aberdeen, Md. California salmon, 1876.
Tobyhanna Lake, Scranton Pa. Schoodic salmon, 1879.
Toccoa, Ga., tributary of Savannah River. California salmon, 1877.
Todd County, Minn., Osakin Lake. California salmon, 1877.
Todd County, Minn., Sauk Lake. California salmon, 1877.
Toledo, Ohio, Lake Erie. Whitefish, 1876, 1876.
Toledo, Ohio, Maumee Rapids. California salmon, 1878.
Toledo, Ohio, Maumee River. Penobscot salmon, 1875; Schoodic salmon, 1878, 1879.
Toledo, Ohio, Spring Brook. California salmon, 1880.

White Oak Creek, Garrard County, Ky. California salmon, 1876.
White River, Columbus, Ind. Shad, 1874.
White River, Indianapolis, Ind. California salmon, 1874; shad, 1872, 1874, 1875, 1379.
White River, Newport, Ark. California salmon, 1878, 1878; shad, 1876.
White River, Royalton, Vt. Penobscot salmon, 1874.
White River. (See tributaries: Little Red River, Black River, Currant River, James River, Big Black River, and Geneva Lake.)
White Sulphur Springs, W. Va., Dry Fork. Schoodic salmon, 1879.
Whitmore Lake, Washtenaw County, Mich. Penobscot salmon, 1873.
Whitney Ridge, Me., Seboois River. Penobscot salmon, 1874.
Whitney's Pond, Winchendon, Mass. Schoodic salmon, 1878, 1879.
Whitstone River, Columbus, Ohio. California salmon, 1878.
Wicomico Creek, Salisbury, Md. California salmon, 1879, 1880; shad, 1877, 1878, 1879.
Wicomico River. (See tributary: Wicomico Creek.)
Wicomico County, Md. (See Salisbury, Md.)
Wilbraham, Mass., Nine Mile Pond. Schoodic salmon, 1877.
Wildwood, Cook County, Ill., Calumet River. Penobscot salmon, 1874.
Wilkes Barre, Pa., Bear Lake. California salmon, 1880.
Wilkes Barre, Pa., Bowman's Run. California salmon, 1876, 1878, 1879.
Wilkes Barre, Pa., Harvey's Lake. Schoodic salmon, 1878, 1879.
Wilkin County, Minn., Red River of the North. California salmon, 1878.
Wilkin County, Minn. (See Breckenridge, Minn.)
William's Creek, Cass County, Mich. California salmon, 1875.
William's Creek, Mich. California salmon, 1874.
Williams Mill, Pa., Yellow Breeches Creek. California salmon, 1874, 1875, 1876, 1878, 1879.
Williamson County, Ill. (See Marion, Ill.)
Williams Pond, Grant County, W. Va. California salmon, 1879, 1880.
Williamsport, Md., Conococheague River. California salmon, 1876.
Williamsport, Pa., Trout Run. California salmon, 1879.
Williamsport, W. Va., Williams Spring. Schoodic salmon, 1879.
Williams Spring, Williamsport, W. Va. Schoodic salmon, 1879.
Williamstown, N. J., Great Egg Harbor River. California salmon, 1876.
Willimantic, Conn., brooks tributary to Thames River. Schoodic salmon, 1878, 1879.
Willimantic, Conn., Shetucket River. Penobscot salmon, 1875.
Willoughby Lake, Westmore, Vt. Schoodic salmon, 1878.
Willow Brook, Minn., ponds. California trout, 1880.
Willow Brook, Sayville, N. Y. California salmon, 1876, 1877.
Willow Creek, Fillmore County, Minn. California salmon, 1878.
Willow River, Clear Lake, Wis. California salmon, 1879.
Wills Creek, Jennings Run, Md. California salmon, 1874.

XX.—REPORT OF WORK AT THE UNITED STATES HATCHERY, NORTHVILLE, MICH., 1881-'82.

By Frank N. Clark.

The following report, in connection with the work of this station, for the year ending June 30, 1882, is respectfully submitted.

The work performed during the period covered by this report includes the collection and subsequent disposition of the eggs or fry proceeding from 22,500,000 eggs of whitefish (*Coregonus albus*); 140,000 eggs of brook trout (*Salvelinus fontinalis*) from the ponds of this station; about 5,000 eggs of the red-banded or rainbow trout of California (*Salmo irideus*), also from the ponds of this station, and 57,000 eggs of lake trout (*Cristivomer namaycush*); the forwarding of 75,000 eggs of California trout received from the United States station at Baird, Cal., and the care and disposal of the resultant fry; the forwarding of 46,500 eggs of Schoodic salmon received from the United States station at Grand Lake Stream, Me., and the distribution of the fry; and the distribution of 1,500 young carp received from the national carp ponds at Washington.

In addition to this work, the old trout ponds were reconstructed and reoutlined during the months of September and October, and an additional pond built to accommodate the increased stock of breeders. A survey of the premises was made in July, and a map of the same, showing the proposed improvements, was soon after submitted to the United States Commissioner.

For the purpose of creating a large stock of parent fish from which to supply the increasing demand for eggs of California trout, several thousand of the young of these fish were retained from the lot hatched in February and March of the present year, and 12 new tanks fitted for their temporary accommodation. Anticipating the increased accommodations required by these fish later on, excavations for three new ponds were begun in April, and these are now nearly completed.

During the first two months of the year under consideration—July and August—no special work was carried forward, the time being occupied with work that is, for the most part, current throughout the year. This includes the preparing and dispensing of aliment to the growing and adult fish; devising and executing plans for their protection from poachers; affording to the relatively smaller fishes protection from their greatest enemies—the larger ones—by keeping them assorted according to size, irrespective of age; directing and equalizing the inflow of water proportionate to the number and size of the fishes in each pond; guarding all possible avenues of escape of the fishes from one pond to another, as well as into the waste channel, and in removing the masses and collections of the ever-generating algæ floating against and clogging the screens—a source of great annoyance on hot, sunny days that are especially favorable to its formation.

At the hatchery, but little preparation for the hatching season was necessary, everything having been put in order at the close of this branch of work in April, 1881, and left in readiness to resume operations again at the proper time. The few essential preliminaries in this direction, as well as in connection with the water facilities and adjuncts, were therefore arranged in September and October, cotemporaneously with the work of revising the trout ponds.

As the estimates contemplated increased work in the way of propagating whitefish, increased hatching capacity was provided by displacing a double row of hatching-boxes with a tier of tanks, which were subsequently equipped with hatching-jars.

Possible and manifestly weak places in connection with the spring pond and its three outlets were repaired and strengthened to better guard against leakage and imminence of danger of outbursts. The discharging channels alluded to provide for drainage, for overflow, and for conveying the water to the reservoir from which the tank room is supplied. Being made of wood and laid underground, they have usually lasted not to exceed 4 or 5 years, and, in spite of their being thoroughly caulked when laid, leak more or less after a time. Then, the draught-pipe between the spring pond and reservoir must, of necessity, pierce the dam near its surface to give sufficient head of water in the hatchery, and, being so near the surface, has been lifted from its bed by upheavals of frost, the water percolating underneath. The overflow being still nearer the top of the dam is even more liable to be thus forced from position; and nothing short of constant vigilance at times has prevented the water getting sufficient start in this way to wash a gorge across the highway that creates the dam, which would soon draw the pond below the draught pipe, and thus discontinue the supply for the hatchery. The overflow in use having become quite unserviceable through age, I decided to guard against further insecurity at this point by replacing it with pipes of iron firmly imbedded in cement and gravel. This was accordingly done, and no further trouble from this source is anticipated. The drainage and draught pipes, after being thoroughly caulked, were considered safe for another season—the one just closed. But as there is now more or less leakage, which is a constant menace to the safety of the dam, and as it is important to secure immunity from danger of destroying the water power during the hatching period, these must also be replaced by iron conductors of sufficient caliber for the purpose, surrounded by an impervious mass of cement and gravel. Until this is done it will not be possible to command the entire yield of the supplying springs, nor to dictate through what channels the water shall be discharged.

The cooling or intermediate reservoir between the spring pond and hatchery had been leaking quite too freely to be compatible with safety, so that repairs were considered essential. We therefore girted it with a 10-inch band or rim of 2-inch planking, the water level touching the middle of the rim, while the planks themselves are firmly held against the outer wall by spikes driven to stakes set in front. Then, a double coat of cement, lapping on the edge of this rim and covering the entire interior surface of the reservoir, was spread, thus effectually closing all possible chances for leakage. The test of eight months' use of this receptacle has shown it to be absolutely water-tight and perfectly safe.

NOTES AND TABLES IN REFERENCE TO COLLECTING THE SUPPLY OF WHITEFISH EGGS.

Most of the eggs laid in were secured at the "Bass" islands of Lake Erie, which are, on the whole, quite as reliable as any locality for this work. Certain other points in Lake Erie, as well as in Lakes Huron and Michigan, may show heavier catches of fish, but they are, so far as I have been able to ascertain, less prolific of ripe fish, in proportion to the number caught. At the islands, too, as well as at all other points, the yield of eggs from the various fisheries is quite disproportionate to the catch of adult fish. The fact that whitefish are caught in any given locality during their nominal spawning period does not necessarily signify that ripe fish will be found at such places, for the devices for their capture—the stationary trap net or portable gill-net—may not be set on or near those grounds naturally selected by the fish for the deposition of spawn, but at points in the paths or runways leading to and quite remote from the objective point of the fish in their migrations from the feeding to the spawning grounds. From these nets ripe fish are found, if at all, with the exception of an occasional straggler, in the later runs at the last of the season. Such fisheries, although quite profitable for the fishermen, are generally unreliable for the collection of spawn, especially when adverse weather compels a suspension of work before the last migrations occur.

There are certain spawning grounds in the vicinity of the islands that can invariably be depended on. These are well known, and have become favorites with the spawn-gatherers, not only because of their reliability and certainty of being visited by schools of ripe fish, but ripe fish usually appear several days earlier than at other points, some of which furnish heavier catches. Indeed, the privilege of collecting eggs from the nets set on these fruitful grounds is so much sought after by the representatives of various fish commissions that, naturally enough, considerable rivalry for the control thereof is developed. Naturally enough, too, the State commissions can wield a greater influence than others over net-owners, their work being practically of a local character, and carried on for the express purpose of increasing the stock of fishes by propagation.

Notwithstanding this opposition, however, I arranged with Messrs. Snide and Fox, of North Bass Island, for the eggs from their three trap-nets, which were established on spawning grounds not surpassed by any in Lake Erie. Fourteen and a half million eggs were taken from these three nets, or nearly 5,000,000 to the net, as will be seen by referring to the tables. A glance at the tables will show also that eggs were taken here seven days earlier than at Middle Bass Island, and eight days earlier than at Kelley's Island.

Four nets were worked at each of the last two islands mentioned, the former yielding 1,000,000 to the net and the latter about 650,000.

During the fall season whitefish and herring comprise the great mass of fish caught at the islands, or, for that matter, throughout Lake Erie. Indeed, the combined catch of all other kinds is insignificant in comparison.

The lake remained open much later than the preceding season (1880), increasing the product of the fisheries to correspond. Notwithstanding this, however, the greater demand and brisker competition of buyers combined to produce a decided advance in prices. Thus in the fall of 1880 the fishermen received $3\frac{1}{4}$ to $3\frac{1}{2}$ cents per pound for whitefish and 50 cents per hundred weight for herring, while during the period under consideration they received $4\frac{1}{4}$ to $4\frac{1}{2}$ cents for whitefish and 75 cents to $1 for herring.

Pending the appearance of ripe fish the "egg-man" must bide his time with patience, disposing of the time which would otherwise hang heavily in collecting notes by the wayside, and making frequent tours of the docks as the fish-boats come in to note the condition and catch of fish, often being compelled, through courtesy, to listen to the oft-repeated tale of some superannuated fisherman, who tells what "piles" of fish *he* used to catch in "them days," such fabulous figures being noted as to induce the belief that the original number had increased in geometrical progression through the intervening years.

Following are the tables of spawn-taking operations at North Bass, Middle Bass, and Kelley's Island:

AT NORTH BASS.

Date.	Females used.	Males used.	Number eggs taken.
Nov. 10	1	3	15,000
11	4	10	45,000
13	12	18	250,000
14	34	50	640,000
16	49	60	960,000
18	45	80	950,000
20	50	70	1,000,000
21	90	120	2,000,000
22	53	100	1,250,000

AT NORTH BASS—Continued.

Date.	Females used.	Males used.	Number eggs taken.
Nov. 23	40	65	900,000
26	58	85	1,250,000
27	85	110	1,825,000
28	20	25	375,000
29	24	34	450,000
30	28	40	500,000
Dec. 1	26	50	450,000
2	38	45	800,000
3	20	25	440,000
4	18	22	300,000
5	6	9	100,000
Total			14,500,000

AT MIDDLE BASS.

Date.	Females used.	Males used.	Number eggs taken.
Nov. 17	18	35	400,000
18	16	35	325,000
20	30	50	550,000
21	18	32	325,000
23	32	48	650,000
26	40	55	725,000
27	20	60	475,000
28	22	38	450,000
30	6	13	100,000
Total			4,000,000

AT KELLEY'S ISLAND.

Date.	Females used.	Males used.	Number eggs taken.
Nov. 18	6	10	125,000
19	5	10	75,000
20	10	18	200,000
22	16	28	300,000
23	42	70	850,000
25	25	40	450,000
26	21	36	400,000
Dec. 1	4	10	100,000
3	4	9	75,000
Total			2,575,000

The eggs were packed and conveyed to the hatchery in the flannel-tray shipping-cases, substantially in the same manner noted in my last report (1880-'81).

At Alpena, Mich., whence I anticipated receiving a large number of eggs, a very decidedly off year for the fishermen, and in consequence for the spawn-gatherer, was experienced. The continued warm weather of October and November delayed the cooling of the water to that degree necessary to drive the fish from the deep waters to the shoals and reefs for the purpose of spawning, until near the usual time for winter to set in; so that the fishermen, fearing a repetition of the experiences of the preceding season, when winter was precipitated upon them so suddenly that a large amount of fishing appurtenances were frozen in and destroyed, entailing heavy losses, were affrighted at the first cold snap, and had relegated all their paraphernalia to winter quarters before the ebb-tide of whitefish—the fisherman's bonanza—had set in.

In this section the first runs during the fall season are made up almost wholly of lake trout (*Cristivomer namaycush*), and usually a sufficient number are caught to compensate for cost of fitting up and setting the nets and current operating expenses, leaving the measure of profits to be determined by the length of time the work can hold out against the weather during the whitefish run. This would seem to be and invariably is sufficient inducement to incur the taking of great risks; but the fishermen seemed only to remember the disasters and losses of the previous season, forgetting that the early and intense cold of that period was quite exceptional. A feeling of overcaution was produced, manifested by the great haste of interested parties to consign their trappings to the protection of harbors and twine-houses. But as day after day of moderate weather—for the time of year—followed the first blizzard, they saw how premature their alarm had been, and it is safe to predict for the coming season a relapse into the other extreme of an entire disregard of the premonitions of winter.

The season could doubtless have been made a successful one for both fisherman and spawn-taker, as the weather was such as to admit of a continuance of operations long after the field was abandoned. Even as it was, fishing was carried on ten days later than last year, but should have continued still fifteen days longer to correspond with the weather and runs of fish. The number of whitefish actually brought to port at Alpena during the season was quite insignificant compared with some former years, and a very decided falling off from the average. Of course quite a large number were caught in the aggregate, from which many millions of eggs might have been obtained had there been a heavy sprinkling of ripe spawners; but only the advance guard was captured, and this is invariably made up of a great preponderance of males—mostly ripe—and a few unripe females. Just as mature spawners began to appear, a brief period of severe weather came on, nets were withdrawn as rapidly as possible, so that eggs were taken only on four days, and then in insignificant numbers, with one exception. In no other branch of the work is success or failure so dependent upon and associated with the condition of the weather.

Certain well-known and well-defined localities are sure to receive the annual visitations of hordes of whitefish laden with spawn; but as the climax of their spawning period is reached only at the verge of winter, when the elements are liable at any time to combine to prevent their capture, a considerable degree of uncertainty in regard to laying in a very large number of eggs is of necessity unavoidable.

However, I can but regard Alpena and vicinity as a favorable locality for the collection of whitefish eggs. Large numbers of the parent fish are captured, and very rarely, indeed, are the fisheries abandoned before the height of the spawning season is reached. This fact, coupled with the great fecundity of the fish, makes it a matter of comparative ease to obtain vast numbers of eggs under favorable circumstances. Having plenty of ripe fish at command, one man can readily take two or three million eggs daily. I have taken, on more than one occasion, under partial adverse circumstances, 2,000,000 eggs in a day. It will be seen, then, that but few days in the aggregate, *at the right time*, are required to secure great numbers. Indeed, taking the seasons as they average, only a small corps of spawn-gatherers are necessary to collect any reasonable number of eggs.

Mr. Wires, with one assistant, obtained eggs as follows:

Nov. 16	25,000 from 2 females.
Nov. 19	100,000 from 6 females.
Nov. 20	100,000 from 7 females.
Nov. 21	200,000 from 11 females.
Nov. 22	1,000,000 from 40 females.

Those taken November 16 were from trap-nets, the remainder from gill-nets. Besides the 1,425,000 whitefish eggs taken and sent on to Northville in good condition by Mr. Wires, some 60,000 eggs of lake trout were taken from 10 spawners on the last day of October, and forwarded to Northville in good shape the day following.

Below is Mr. Wires's record of temperatures and weather observations made each day at 12 m.:

Date.	Temperature of air.	Temperature of water.	Direction of wind.	Intensity.	Condition of sky.	Remarks.
1881.	°	°				
Oct. 28	48	50	S.	High	Cloudy	Raining nearly all day.
29	56	50	SE.	do	Clear	Went out with fishing tug Seawing.
30	46	50	W.	Fresh	Cloudy	Do.
31	48	50	N.	Light	Clear	Do.
Nov. 1	50	50	S.	do	do	Remained at Alpena.
2	49	49	SE.	Fresh	Cloudy	Went out with the Seawing.
3	41	48	SW.	Strong	do	Light snow-storm. Visited Partridge Point fishing grounds.
4	30	47	NW.	do	do	Raining. Aboard the Seawing.
5	34	47	NE.	do	do	Stormy. At Alpena.
6	54	47	S.	Fresh	Clear	Went to Scarecrow Island.
7	50	47	SE.	do	Cloudy	Went to North Point.
8	49	47	S.	Very strong	do	Blowing a gale; no nets lifted.
9	46	46	W	Strong	do	At Alpena. No spawning white-fish found yet.
10	38	46	W.	Fresh	do	Do.
11	39	46	E.	Light	do	Do.
12	43	46	W.	Strong	do	Squally. Aboard the fishing tug Grayling.
13	41	45	NW.	Light	do	At Alpena.
14	38	44	SW.	Strong	do	Snowing. At Partridge Point.
15	26	40	W.	do	do	Went to fishing grounds at Ossineke.
16	36	40	W.	Light	do	First eggs of white-fish taken at Ossineke.
17	48	40	SW.	Very strong	do	Blowing a gale; no nets lifted.
18	30	39	W.	Strong	do	Trap nets being taken up at Ossineke.
19	30	38	N.	do	do	Cold rain and sleet. Aboard the Seawing.
20	24	37	SW.	do	do	Storming. Aboard the Seawing.
21	30	37	NW.	do	do	Do.

Date.	Temperature of air.	Temperature of water.	Direction of wind.	Intensity.	Condition of sky.	Remarks.
1881.	°	°				
Nov. 22	25	36	SE.	Light	do	Aboard the Tom Merrill.
23	46	36	SW.	Very strong	do	Blowing a gale. Boats remained in port.
24	18	34	W.	Strong	do	Do.
25	24	33	SW.	do	do	Blowing strong. Boats remained in port.
26	30	33	NW.	do	do	Went out with the Tom Merrill. Fish in nets mostly dead; nets not reset.
27	23	32½	NW.	do	do	At Alpena. Nets of all kinds being withdrawn as fast as weather will permit.
28	35	32½	S.	do	Clear	Do.
29	48	32½	SW.	do	do	Do.
30	34	32½	E.	Light		Squalls of snow and sleet.

NOTE.—Left Alpena for Northville December 2, arriving the day following.

OPERATIONS AT THE HATCHERY.—DISTRIBUTION OF EGGS AND FRY.

Twenty-two million five hundred thousand eggs were shipped from the spawning grounds, all arriving at the hatchery in good condition. The first lot came from the islands November 21, and the last lot from the same source December 8. Upon arrival the eggs are washed from the trays of each case successively into a tub of water, and dipped thence with a skimmer into the hatching jars. All the jars on hand were filled before the last shipment of eggs but one came to hand from the spawning grounds. Pending the arrival of a number of jars daily expected, the eggs of this lot were allowed to remain in the shipping cases, which were placed in a room varying in temperature from 38° to 55°. The jars soon came along, but some little time was consumed in fitting them up for the reception of eggs; so that ten days had elapsed from the time the eggs were arranged in the cases at the islands until their removal therefrom at the hatchery, yet no special loss on this account was shown. Up to this time the eggs remained nearly intact, although conferva had begun to develop from the dead eggs. However, a few matted chunks adhered to the trays when emptied, and these, with others rapidly forming, would soon have caused serious loss had they been allowed to remain undisturbed much longer.

For experiment, we took from this lot of eggs as soon as they reached the hatchery about 25,000, and placed them in a hatching box, where, of course, the water is constantly renewed, but the eggs themselves lie nearly or quite motionless on the trays. Here we allowed them to remain 7 days without removing the dead eggs. At the end of this time they had collected in masses and bunches, scarcely any remaining that were not held by the outreaching fingers of conferva. Fully one-half were already destroyed, and we succeeded in saving a portion of the remainder only by agitating the collections and chunks violently in water, passing the freed eggs through a sieve. The results serve only to verify prior experiments, which show that the greatest enemy of the egg—conferva—generates much faster in water than in atmosphere of the same or even a higher temperature, and that in consequence eggs are far safer out of water than in unless provision for the removal of the confervaceous egg is made. For incubating the eggs, the Chase automatic jar was used, 136 being required at first. They were arranged as follows:

84 jars, at 175,000 each	14,700,000
52 jars, at 150,000 each	7,800,000
	22,500,000

The number of eggs the jar will contain while in operation is in an inverse ratio to the volume of water used. When the minimum of water is used, or just barely enough to impart sufficient motion to the eggs to keep them detached, the jars will hold 175,000 eggs each. Well-filled jars, with a gentle circulation, work much better than those partially filled and given a brisk or violent action; in fact, the former show the very best movement obtainable. But jars to be operated in this way must be perfect in form and have evenly ground tubes, otherwise no motion whatever will be imparted to a portion of the eggs. Then, too, if there is a considerable sprinkling of dead eggs—frequently the case at the beginning of the season—a gentle movement will not always prevent the putrid eggs from uniting or collecting in chunks or masses, which will settle to the bottom of the jar instead of being thrown off. For this reason "Hospital" jars have to be given a liberal supply of water in the shape of very energetic currents.

Several experiments were made with a view to improving on the hatchers in use. The "Improved Shad Hatcher," described in Forest and Stream of June 16, 1881, was tried and found to give a more perfect movement to the eggs than the Chase jar. To secure this, however, either a greater volume or head of water was required, owing to the force of the current as it entered the jar being partially arrested in the hollow of the upright cup or cone.

To overcome this drawback, Assistant Bower advised the use of a solid double cone, the inverted section of which would simply divert or radiate the water without breaking its force, and by its own weight retain its position. The suggestion being acted upon, an equalized current compelling a uniform and perfect movement of the eggs was produced, with the minimum supply of water.

Into this jar or hatcher the water is introduced at the bottom; in the Chase jar at the top, being directed to the bottom by a glass tube resting on feet, which frequently obstruct and disconcert the currents throughout the egg-chamber. Assistant Wires succeeded in amending this defect, thereby greatly improving the efficiency of the Chase instrument, by using a tin tube with a wide flange or rim at the bottom, conical in shape to conform to the lower section of the above-mentioned double cone over which it was set, the cone being inverted so that the strips of tin serving as feet when used with the other jar, would raise the tube to allow the water to escape uniformly from the outer edge of its flange or rim.

Mr. Bower also fitted up a rectangular box or tank for an incubator, so constructed that the eggs rise from the center and settle down the outside, exactly reversing the jar movement. It is 12 inches wide, 13 deep, and 30 long, although its length might be extended indefinitely without disturbing or changing its operation. It is divided into upper and lower sections, and, as with the jars, a water-pressure or head is required. The desired movement of the eggs is obtained by introducing the water into the lower section, whence it is admitted to the upper section, which is the egg-chamber, through a sixteenth-inch crevice running lengthwise of the box. From either side and 6 inches from the top the partition which divides the box into two sections slants downward to converge the eggs to the center where the current forced through the crevice carries them up again to settle back, fountain-like, as before. Overflows with wire gates are provided at intervals around the top of the box. This apparatus was not tried until the eggs had already begun hatching, so that no opportunity to correct its faults by a practical test was given. It worked very well, however, although after trying it we were well satisfied that it should be given greater depth, less width, and a greater head of water. Doubtless a little more experimenting with this or a similar device will produce an incubator that will be entirely satisfactory, as the principles by which the water currents are obtained and controlled are correct; while it would have the merit of being easily operated, and furnishing capacity for many millions of eggs at a merely nominal cost.

Spring water alone is used for hatching purposes at this station, and where it first issues from the earth varies but little from a temperature of 47°. In consequence of the very moderate weather which prevailed the past winter, our arrangements for securing a lower temperature—continued exposure to the air before reaching the hatchery—were of little avail. The eggs, therefore, progressed very rapidly from the first until all were hatched.

The first orders for whitefish eggs to be filled were from Herr von Behr and G. Ebrecht, Germany. The eggs were packed in separate cases and started on their journey December 19, consigned to Fred. Mather, Newark, N. J., whence they were reshipped to destination. These and subsequent lots were prepared for shipping substantially as follows: First, a sufficient number of trays of canton flannel are made, also a substantial case for the same, of the proper size to allow 4 to 6 inches space all around for the packing material. The trays are then anchored in a tank of water. A quantity of eggs are transferred from the hatching vessels to a number of wire trays in the picking trough, and carefully feathered over to show up the dead and unimpregnated eggs, which are removed with nippers. After collecting the eggs by overturning and submerging the trays into a large tin vessel partially filled with water, they are skimmed up and measured in an 8-ounce graduate (equivalent to 10,000 eggs) and poured thence into the shipping trays. These are then removed to the packing room, or where the temperature is between 30° and 40° Fahrenheit, tilted and drained, and the eggs spread with a feather uniformly two layers in depth, a half inch margin being left around the outside. A single fold of dampened millinet is then thrown over the eggs, and a sufficient quantity of live moss, previously picked, washed and wrung out just enough to prevent dripping or drainage, piled on to fill the tray when rather snugly pressed down. When practicable, the trays are allowed to stand a few moments in a temperature of 27° to 32°, or until needles of ice have begun to form in the moss, then placed one above the other and firmly held to position by cleats nailed to top and bottom boards. The package is then transferred to the shipping case, having a 4-inch coating of fine, dry, hardwood shavings in the bottom, and surrounded with the same material quite firmly pressed in. The case is now soon ready for its journey, not, however, until the usual printed instructions and precautions to express messengers are pasted to the cover, and which, if observed and heeded, would deliver the eggs to consignees in practically the same condition as when packed ninety-nine times out of a hundred.

Following is the table of shipments:

Date.	Number of eggs shipped.	Consignees.
1881.		
December 19	300, 000	F. Mather, Newark, N. J., for von Behr, Germany.
19	12, 000	F. Mather, Newark, N. J., for G. Ebrecht, Germany.
23	250, 000	B. B. Redding, California.
24	250, 000	Do.
31	10, 000	Prof. S. F. Baird, Washington, D. C.
1882.		
January 7	250, 000	F. Mather, Newark, N. J., for France.
13	500, 000	B. F. Shaw, Iowa.
16	10, 000	H. J. Fenton, Connecticut.
23	250, 000	B. B. Redding, California.
31	100, 000	Prof. S. F. Baird, Washington, D. C.
31	100, 000	Mrs. J. H. Slack, New Jersey.
Total	2, 032, 000	

I am unable to report the condition in which the transatlantic shipments reached their destination, correspondence relating thereto having been made directly with the United States Commissioner, or with Mr. Mather. Indirectly, however, or from Circular No. 1, 1882, of the German Fishery Association, I learn that the whitefish eggs arrived "in the very finest condition, fine beyond comparison"; from the same source, also, that of the 20,000 lake trout eggs shipped from Northville, December 10, "only 100 were dead."

Mr. Redding reported that the two lots of a quarter million each, shipped December 23 and 24, arrived at San Leandro, Cal., ten days later, in rather poor condition; accounted for in part by their having taken the Southern Pacific Road, which passes through a warmer climate, besides being four days longer in transit than if they had gone over the Central Pacific. The third quarter-million lot, consigned from Northville January 3, arrived at San Leandro in very good condition. Mr. Woodbury, superintendent of the San Leandro hatchery, reported the hatching of 90 per cent. of this lot, and about 35 per cent. of the others, the fish being planted as follows:

Jan.	19—Donner and Tahoe Lakes	75,000
	30—Shafters Lake (Marin County)	5,000
Feb.	1—Clear Lake, Lake County	75,000
March	7—Concow Lake, Butte County	10,000
	4—Lake Tahoe, Placer County	100,000
	9—Clear Lake, Lake County	100,000
	10—Radcliff Lake, Santa Cruz County	20,000
	11—Lake Chabot, Alameda County	5,000
		390,000

Mr. B. F. Shaw, Commissioner of Fisheries, reported that 75 per cent. of the eggs sent him for the State of Iowa hatched, and that the minnows were released in Lake Okibozi and Spirit Lake, Iowa.

Mr. Fenton reported that the 10,000 eggs forwarded him for the State of Connecticut arrived January 20, and upon opening the package about 2,000 of them were found frozen to death. The subsequent loss was a little over 900, leaving about 7,000 fish, which were set free in Long Lake, Litchfield County, Connecticut.

Mr. Anderson, who had charge of the hatchery of the New Jersey Commission, in which the eggs consigned to Mrs. Slack were developed, reported that the eggs reached Bloomsburg February 3, at 4.39 p. m., in very good condition. About 90 per cent. were hatched by the 11th of February, or 90,000 fish in all, of which one-half were liberated in Shepherd's Lake, and the remainder in Greenwood Lake.

At the Northville hatchery the fish began hatching from the oldest eggs January 27, and all were out by the 25th of February. At least three-fourths of them hatched between the 6th and 12th of the latter month, taxing the capacity of the receiving tanks to their utmost. Perforated tin boxes are fitted to these tanks near the overflows, to keep the fish away from the currents at that point, which would be too strong for them to resist. They are also provided with compartments which are supposed to catch the shells; but while the fish were hatching so freely, a sufficient number of shells would float over these divisions to clog the screen-boxes every few moments, so that unremitting attention was demanded day and night to keep the outlets unimpeded.

The United States Fish Commission car, with Messrs. Ellis, Moore, and Simmons to assist in the work of distributing and planting the minnows, reached Northville February 3. Arrangements for the gratuitous transportation of the car and its messengers having previously been made with all the railroad companies, with one exception, whose lines were to be traversed, the distribution proceeded smoothly and with little expense from the initial trip, February 7, until the successful termination of the work, March 2. Much credit is due Mr. Ellis, who had charge of the trips, and also to his experienced assistants. The car itself was also a great convenience, as well as an important and efficient factor in carrying forward this work.

Following are the railroad companies to whom acknowledgments are due for free transportation of car and messengers: The Flint and Pere Marquette; Michigan Central; Chicago and West Michigan; Milwaukee, Lake Shore and Western; Chicago and Grand Trunk; Great Western; Rome, Watertown and Ogdensburg; and Lake Shore and Michigan Southern.

Table of distribution.

Date of deposit.	Number of fish released.	Point of deposit.	Waters in which the fish were set free.
February 7	1,500,000	Saint Joseph, Mich	Lake Michigan.
8	1,500,000	Muskegon, Mich	Do.
13	2,000,000	Port Huron, Mich	Lake Huron.
16	1,750,000	Racine, Wis	Lake Michigan.
16	1,750,000	Sheboygan, Wis	Do.
21	3,500,000	Oswego, N. Y	Lake Ontario.
24	3,500,000	Islands of Lake Erie	Lake Erie.
28	1,000,000	Ludington, Mich	Lake Michigan.
March 2	1,250,000	Detroit, Mich	Detroit River.
Total	17,750,000		

TROUT-WORK.

When the trout-ponds in connection with this station were established the stock of breeding fish was comparatively small, and the ponds themselves were mere excavations irregularly outlined. At the beginning of the year under consideration the embankments were quite unsafe, having been burrowed and undermined by muskrats, while the pond-room was quite inadequate to properly accommodate the increased stock of fishes. The work of enlarging and otherwise improving them, and the construction of an additional pond and new raceways, was therefore begun in the latter part of August and carried forward to completion by the last of October, or barely in time to give the ripening spawners undisturbed possession of the new premises during their spawning season. Three new ponds were also built the following spring, as before noted, making 7 altogether, 6 of which are 83 by 20 feet, and the other 51 by 14, showing a total pond area of 10,674 square feet.

The ponds are planked all around, the planks being spiked to stakes driven in front. Between and around all the ponds, and of the same height as the planking, is a pier of earth 8 feet wide, and across this are laid pieces of 2 by 4 firmly spiked to the stakes to which the planks are nailed. Being thus secured it is quite impossible for the earth to cave in or the sides of the pond to bend in or out. The bottom plank is set in a bed of gravel and blue clay, and a heavy body of the same material, well champed in, backs the planking up to the top of the pier, so that the ponds are practically water-tight, while the efforts of musk-rats to invade them by burrowing underneath will be futile. Each pond is usually filled to within a foot of the top, the bottom sloping gradually from the head, where the water is 18 inches in depth, to the foot, where it is 4 to 5 feet. The overflow gates of the discharging flumes are easily raised by a lever attachment at the bottom, so that the water can be drawn off in a few moments. The gates are made in sections, one or more of which can be removed to give any desired depth of water.

As quite a number of fish will spawn in the ponds instead of running up the raceways, if the former have gravel bottoms, which they should have, those in which the breeders are placed during the spawning season are divided into two sections by a temporary partition, and the bottom of the upper section covered with boards. The fish all being placed in this, but few, if any, eggs will be lost, and as fast as the fish are handled from the raceways they are transferred to the lower section. At the close of the spawning season the partition is removed.

At the mouth of the flume connecting the upper section with the race-way a trap-gate, sprung with a string leading to the hatchery, is fitted, a simple but very useful device, for no matter how stealthily one approaches, nor from what direction, some of the fish in the raceway will detect the movement and dart back to the pond before the gate can be dropped to head them off.

The fish are given access to the raceways at all seasons of the year, and hither they resort largely at other than spawning time. A raceway fed directly from a copious spring of cold water, and given sufficient fall to create a sparkling current over its clean, gravelly bottom, affords an attractive "summer resort" to trout having admission to it, and here, in warm weather, many of them congregate, lying nearly motionless, with head up stream, for hours together. At the approach of cold weather, when an equally satisfactory temperature is found in the ponds, this practice is discontinued, except with the ripening females, which, with a heavy body-guard of males, and in response to that instinct which impels them to deposit their eggs in a current, begin to prepare spawning beds in the raceway, whence they are easily captured at the proper time for the purpose of expressing their eggs.

The breeding fish are quartered in ponds nearest the feeding springs for some time preceding the spawning season, and, when most convenient, continuously. This gives them the least variance of temperature obtainable, and ripens them at about the same time each season, there being but little fluctuation of temperature in these ponds at corresponding periods of one year with another.

The spawning season therefore opens almost invariably from the 1st to the 5th of November, and closes practically from the 10th to the 15th of January, although much the greater portion of the fish spawn from the middle of November to the middle of December. During the past season, perhaps a half-dozen spawned later than the latest date mentioned, and from one of these eggs were not taken until February 2.

Some 140,000 were taken altogether. The first 120,000 turned out very well, a loss not to exceed 10 per cent. occurring during incubation; but the last 20,000 showed a loss of 50 per cent., due to the plan of handling the fish from which they were taken. A majority having spawned, we placed the remaining fish in the raceway, and carefully examined them every morning. As a result of this repeated dipping up and inspection of the fish for several mornings in succession, we were compelled to pick away quite half of the eggs so taken—which is pretty good evidence that the less the fish are disturbed or manipulated while ripening, the better the eggs produced.

The following statement accounts for the disposition of the eggs and fry:

Total number eggs taken		140, 000
Loss during incubation	22, 000	
January 10, shipped to F. Mather, for reshipment to France	20, 000	
January 24, shipped to Druid Hill hatchery, Baltimore, Md	30, 000	
		72, 000
Number fry hatched		68, 000
March 8, planted in Washtenaw County, Michigan, in spring brook tributary to river Rouge		10, 000
March 15, planted in spring brook near the Northville hatchery, and tributary to river Rouge		10, 000
May 8, shipped per United States Fish Commission car, in charge of J. F. Ellis		30, 000
Loss on fry since hatching		8, 000
Fry now on hand in nursery tanks		10, 000
		68, 000

Average period of incubation, 84 days.

As our breeding force of brook trout will receive large accessions next fall from the stock of growing fishes, we confidently expect to take at least a half million eggs during the next spawning season.

HATCHING AND DISTRIBUTION OF CALIFORNIA TROUT.

On January 24, Mr. Myron Green, of the United States station at Baird, Cal., consigned to the Northville hatchery a case containing 45,000 eggs of the rainbow trout, and on February 6 a second lot of 30,000. The first shipment reached Northville February 2, and the last February 14, both in excellent condition. Number of dead eggs picked from first lot on arrival, 615; from the last, 272; subsequent loss on eggs, about 2,600. The fish began hatching February 24, and all were out by the middle of March.

Shortly after these fish hatched an accident occurred by which 18,000 of them perished. On the night of March 21 a flooding rain-storm washed into the feeding reservoir, and thence into the tanks supplying the hatching boxes, a sufficient quantity of moss, leaves, and *débris* generally to almost wholly clog the screens, diverting to the overflow or waste channel the water that should have passed through the trays on which the fish were still retained. The oldest fry fared much worse than those more recently hatched, and especially those in boxes at the foot of the row, the limited amount of fresh water still running having become de-oxygenated before reaching them. In the head boxes, and also in an adjoining row of boxes containing fry of brook trout (of about same age, but much smaller), the loss was merely nominal. In a third row containing the Schoodic salmon, just hatched, there was no loss whatever.

I had felt that everything was secure and free from danger of accidents—that every precaution for the safety of the fish had been observed; but since meeting with so serious a loss from a source wholly unanticipated, I can but feel that the only safeguard against accidents or insecurity lies in never leaving the fish alone, and shall, therefore, in the future, employ a nightwatch so long as fish in any considerable numbers remain in the hatchery.

Appended is a statement of distribution, &c.:

Number eggs received from California		75,000
Loss on eggs during incubation		3,500
Number fish hatched		71,500
Loss by accident, as noted	18,000	
Loss of fry to date (June 30) in nursery tanks	3,500	
Fry on hand in nursery tanks	10,000	
April 28—Deposited at Beitner Station, Grand Traverse County, Michigan, in Boardman River, tributary to Grand Traverse Bay	3,000	
May 2—Delivered to A. C. Lanier, of Madison, Ind	3,000	
May 7—Deposited by George N. Matheson, of Sarnia, Ontario, in small stream in Western Ontario, tributary to Lake Saint Clair	3,000	

May 16—Deposited by James R. Bull, of Saint Louis, Mo., in Island Lake, Monroe County, Illinois	3,000	
May 29—Deposited in Oakland County, Michigan, in Deer Lake, through which flows the Clinton River, tributary to Lake Saint Clair	10,000	
June 1—Deposited in Oakland County, Michigan, in Straits Lake, through which flows the Huron River, tributary to Detroit River	10,000	
June 3—Deposited in Wayne County, Michigan, in northeastern branch of river Rouge	8,000	
		71,500

From eight adult California trout, five of which are females, all brought from California four years ago and since confined in the ponds here, we took 5,150 eggs between the 13th and the 29th of March, which hatched on an average in 38 days. The loss on eggs was 850; and on April 26, 1,200 eggs were shipped to F. Mather for reshipment to Herr von Behr, Germany. The 3,100 fish that hatched were deposited May 16, by James R. Bull, of Saint Louis, Mo., in Murdoch Lake, Monroe County, Illinois.

Next spring we expect to take at least 100,000 eggs from the stock of California trout now on hand, that will then make their début as spawners. About half of these fish are the progeny of the eight adult fish above mentioned. They were two years old last spring, an age at which a majority of our brook trout have always spawned, although a portion of them, perhaps one-fifth, do not until three years old. We had therefore anticipated getting a nice supply of eggs from them, but failed to find a single mature spawner. Several females were opened at various times through the winter, with the result of finding only minute ova to mature a year later; still, we felt confident that a few of them at least would spawn, thinking we had missed the right ones; all the more so, too, from the fact that ripe males were numerous even three or four months in advance of the regular spawning season; in fact, the eggs taken from the adult California trout were mostly impregnated with milt from the two-year-olds. Failure to obtain a single egg from these fish, of which there are at least four or five hundred females, leaves little room to doubt the conclusion that the *iridea* seldom, if ever, spawn when two years old, at least where they are confined in ponds from infancy.

HATCHING AND DISTRIBUTION OF EGGS OF SCHOODIC SALMON.

On the 28th of February, Mr. Charles G. Atkins shipped from Grand Lake Stream, Maine, for the Northville hatchery, a case of 46,500 eggs of Schoodic or land-locked salmon. They arrived March 4, and opened up in excellent condition, only 45 dead eggs being observed on unpacking. Previous to hatching, 1,065 more were picked away, showing a total loss of 1,110 eggs after arrival.

The fish began to come out March 16, rather slowly for two or three days, the water being down to 43½° on an average; but on the 19th the water ran up to 54° at noon, and the fish then came out with a rush, scarcely an egg remaining the day following. Quite a number of monstrosities and imperfect fish were observed, outside of which, however, they looked unexceptionally fine. They were also exceedingly active and strong in view of the great disproportion between their large, kidney-shaped sacs and light, slender bodies.

Soon after they began hatching, the novel spectacle of occasionally seeing the body of a fish on one side of the tray, with its sac underneath, was presented—due to the wonderful mobility of the sac, which sometimes permitted the downward current to draw it through the mesh of the tray, although four or five times larger than the aperture through which it had passed; after passing through it would soon assume its natural shape, protruding like an immense hernia, from which position the fish would be quite unable to extricate themselves. By inverting the tray and agitating in water, the soft, ductile pouch would soon pass back, releasing the fish unharmed. To overcome this difficulty, which at one time threatened to become quite annoying, the hatching boxes were reversed, so that the water passed upward through the trays instead of down, as before.

Below is the statement of distribution:

Number of salmon hatched		45,390
Imperfect and dead fish picked from hatching boxes and nursery tanks	4,540	
Fish now on hand in nursery tanks	2,850	
April 27—Deposited in Long Lake, Mecosta County, Michigan	6,000	
April 28—Deposited in Higgins Lake, Roscommon County, Michigan	3,000	
April 27—Deposited in Chippewa Lake, Lake County, Michigan	6,000	
May 1—Deposited by N. A. Osgood in Goguac Lake, near Battle Creek, Michigan, (fish shipped by express)	3,000	
May 3—Deposited at Piqua, Ohio, in water-works reservoir, containing 150 acres	6,000	
May 10—Deposited in Union Lake, township of Pontiac, Oakland County, Michigan	8,000	
May 15—Shipped per express from Toledo, Ohio, to S. E. Williams, La Porte, Ind	3,000	
May 15—Shipped per express from B. & O. junction with the Wabash, to T. B. Wightman, Cedar Beach, Ind	3,000	
		45,390

The fish were all planted in excellent condition, with the exception of the last two lots. Mr. Wightman reported that the fish sent him were all dead on arrival, and Mr. Williams that nearly all were dead when received, the remainder being deposited in a lake near La Porte.

After successfully shipping 3,000 by express to Battle Creek, using in transit three to four hours, I was not a little surprised at the non-success of the other shipments; all the more so from the fact that those to Battle Creek were sent in one 10-gallon can without the loss of a single fish, whereas with each of the other lots two 10-gallon cans were used, which would more than offset the difference in time occupied in transit to their respective destinations. In all three consignments the water was reduced to icy coldness before starting.

The results attending these shipments, which were, to a certain extent, in the nature of an experiment, justify the conclusion that with the transportation of live fish success in one instance fails to establish a basis for calculations in other instances, where even the conditions and circumstances are, to all intents and purposes, alike; and that the chances of failure are reduced to the minimum only when the fish are under the constant surveillance of an experienced messenger.

DISTRIBUTION OF EGGS OF LAKE TROUT. (*Cristivomer namaycush.*)

When Mr. Wires started for Alpena in the latter part of October to look after the collection of whitefish eggs at that point, instructions were given him to obtain, if possible, a few eggs of lake trout if he arrived too early for the whitefish work. As the few whitefish then being captured in the inshore fisheries showed little indications of spawning, Mr. Wires, on the last day of October, put out about forty miles to the gill-net fisheries, where he found the lake trout nearly all spent, but succeeded in getting 57,000 eggs. These were shipped by boat to Bay City, whence they were met by special messenger and delivered to the Northville hatchery, November 2.

The loss of eggs while in the hatchery was 3,600; December 10, 20,000 were consigned to Mr. F. Mather for reshipment to Herr von Behr, Germany; and on January 3, 30,000 were forwarded to Commissioner Shaw of Iowa, who reported that they arrived in prime condition January 6 and commenced hatching the day following, the total loss on eggs and fish being less than 5 per cent. The eggs were now well along in advancement; in fact a few hatched the same day that the Iowa shipment was made; nevertheless a package of 2,000 was shipped to Newark January 7 to be transmitted by Mr. Mather to France, if their condition when received by him would warrant it; but despite their being reduced to a temperature of 31° before leaving the hatchery, a few hatched on their way to Newark, and Mr. Mather, therefore, hatched the remainder, the fry being subsequently released in Culver's Lake, Sussex County, New Jersey.

The stock of embryos and alevins was now reduced to 1,400; and these, after the hatching and sac-consuming process was completed, were placed in one of the largest nursery tanks, where they still remain. Less than two dozen have died since hatching; they now average 3 inches in length, and are doing remarkably well, having learned to devour the liver and kidney "hash" given them as greedily as the brook trout in the ponds.

SUMMARY OF THE WORK AND ITS COST.

Number of eggs of whitefish shipped	2,032,000
Number of fry of whitefish planted	17,750,000
Number of eggs of brook trout shipped	50,000
Number of fry of brook trout planted	58,000
Number of fry of brook trout on hand	10,000
Number of eggs of California trout shipped	1,200
Number of fry of California trout planted	43,100
Number of fry of California trout on hand	10,000
Number of fry of Schoodic salmon planted	32,000
Number of fry of Schoodic salmon on hand	2,850
Number of eggs of lake trout shipped	52,000
Number of fry of lake trout on hand	1,400
Number of carp shipped	1,500
Approximate cost of the work, including the construction of seven new trout-ponds with their raceways, twelve new nursery tanks, and the cost of fish food for the year	$5,000

Temperature of Lake Erie from March 20 to June 1, 1882, taken daily at 12 m., near North Bass Island, by Chas. Hasford.

Date.	Temperature.	Date.	Temperature.	Date.	Temperature.	Date.	Temperature.
	°F.		°F.		°F.		°F.
March 20	38	April 8	45	April 26	46	May 14	49
21	37	9	44	27	48	15	48
22	36	10	42	28	49	16	49
23	38	11	41	29	49	17	51
24	37	12	42	30	49	18	53
25	37	13	42	May 1	49	19	54
26	38	14	42	2	48	20	54
27	40	15	43	3	50	21	54
28	39	16	44	4	50	22	54
29	41	17	47	5	49	23	53
30	40	18	49	6	48	24	54
31	39	19	47	7	48	25	55
April 1	40	20	46	8	49	26	56
2	42	21	47	9	49	27	56
3	42	22	46	10	50	28	55
4	44	23	46	11	49	29	56
5	43	24	46	12	49	30	58
6	44	25	47	13	49	31	58
7	45						

UNITED STATES COMMISSION OF FISH AND FISHERIES.

Record of temperature observations made at Northville, Mich., from November 15, 1881, *to April* 15, 1882.

DATE.		TEMPERATURE AT—						WIND AT—						CONDITION OF—		
		8 a.m.		1 p.m.		5 p.m.		8 a.m.		1 p.m.		5 p.m.		Sky.		
Day of week.	Day of month.	Air.	Water.	Air.	Water.	Air.	Water.	Direction.	Intensity.	Direction.	Intensity.	Direction.	Intensity.	8 a.m.	1 p.m.	5 p.m.
Tuesday	Nov. 15	27	38	36	40	32	42	West.	Brisk.	West.	Light.	West.	Light.	Cloudy.	Cloudy.	Clear.
Wednesday	16	34	42	46	43	42	45	East.	Light.	South.	Light.	South.	Light.	Cloudy.	Clear.	Cloudy.
Thursday	17	48	44	54	46	51	48	South.	Light.	SW.	Brisk.	SW.	Brisk.	Cloudy.	Cloudy.	Cloudy.
Friday	18	38	48	40	46	40	46	North.	Light.	East.	Mild.	East.	Light.	Cloudy.	Cloudy.	Snowing.
Saturday	19	32	41	34	42	30	42	West.	Light.	West.	Light.	West.	High.	Cloudy.	Cloudy.	Cloudy.
Sunday	20	24	37	28	39	26	42	West.	Light.	West.	Light.	West.	Light.	Cloudy.	Clear.	Clear.
Monday	21	33	39	39	41	36	42	SW.	Light.	SW.	Brisk.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	22	22	39	36	41	26	41	East.	Light.	SE.	Calm.	NW.	Calm.	Cloudy.	Cloudy.	Clear.
Wednesday	23	27	39	40	42	30	43	SW.	Light.	SW.	Light.	West.	Light.	Cloudy.	Clear.	Cloudy.
Thursday	24	20	35	24	36	25	36	West.	Light.	SW.	Brisk.	West.	Brisk.	Cloudy.	Cloudy.	Cloudy.
Friday	25	18	33	28	35	26	35	SW.	Light.	South.	Brisk.	SE.	Brisk.	Clear.	Cloudy.	Cloudy.
Saturday	26	34	37	36	39	35	40	SW.	Brisk.	West.	Brisk.	SW.	Brisk.	Cloudy.	Clear.	Cloudy.
Sunday	27	34	39	42	40	35	41	SW.	Brisk.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	28	31	40	41	43	36	44	SW.	Light.	South.	Light.	South.	Light.	Cloudy.	Clear.	Clear.
Tuesday	29	38	42	48	44	50	46	West.	Light.	SW.	Light.	SW.	Light.	Clear.	Clear.	Clear.
Wednesday	30	44	46	57	48	44	48	SW.	Light.	SW.	Light.	SW.	Light.	Cloudy.	Clear.	Cloudy.
Thursday	Dec. 1	36	46	37	48	36	45	SW.	Light.	West.	Brisk.	West.	Brisk.	Cloudy.	Cloudy.	Cloudy.
Friday	2	32	43	38	44	36	44	SW.	Fresh.	South.	Light.	South.	Light.	Cloudy.	Cloudy.	Cloudy.
Saturday	3	35	43	42	44	38	45	NW.	Light.	West.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Sunday	4	34	43	40	43	39	46	SW.	Light.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	5	32	43	39	43	32	42	West.	Light.	NW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	6	36	41	40	42	42	43	SW.	Light.	South.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Wednesday	7	32	40	32	41	28	40	West.	Strong.	West.	Strong.	West.	Light.	Clear.	Clear.	Clear.
Thursday	8	26	39	36	39	32	39	SE.	Light.	SW.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Friday	9	29	39	32	40	29	40	West.	Light.	West.	Light.	West.	Light.	Clear.	Clear.	Clear.
Saturday	10	10	36	29	38	26	39	West.	Light.	West.	Light.	NW.	Light.	Clear.	Clear.	Clear.
Sunday	11	24	37	32	38	31	38	SW.	Light.	SE.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	12	36	41	42	41	43	42	South.	Light.	SW.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	13	50	45	56	47	53	48	South.	Light.	SW.	Fresh.	SW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Wednesday	14	36	44	32	44	28	43	NW.	Fresh.	NW.	Fresh.	West.	Light.	Cloudy.	Cloudy.	Clear.
Thursday	15	18	39	28	40	24	41	West.	Light.	SW.	Light.	West.	Light.	Clear.	Clear.	Clear.
Friday	16	24	38	40	39	37	41	West.	Light.	South.	Light.	South.	Fresh.	Clear.	Cloudy.	Cloudy.
Saturday	17	30	39	48	41	40	43	South.	Light.	South.	Light.	South.	Light.	Clear.	Clear.	Cloudy.

Record of temperature observations made at Northville, Mich., &c.—Continued.

DATE.		TEMPERATURE AT—						WIND AT—						CONDITION OF—		
		8 a. m.		1 p. m.		5 p. m.		8 a. m.		1 p. m.		5 p. m.		Sky.		
Day of week.	Day of month.	Air.	Water.	Air.	Water.	Air.	Water.	Direction.	Intensity.	Direction.	Intensity.	Direction.	Intensity.	8 a. m.	1 p. m.	5 p. m.
Sunday	Dec. 18	32	41	44	42	32	44	SW.	Light.	NW.	Light.	NW.	Light.	Clear.	Clear.	Clear.
Monday	19	28	41	46	43	40	45	West.	Light.	SW.	Light.	South.	Light.	Clear.	Clear.	Cloudy.
Tuesday	20	38	44	44	45	40	44	SE.	Light.	NW.	Light.	NE.	Light.	Cloudy.	Cloudy.	Cloudy.
Wednesday	21	36	44	40	43	41	46	NE.	Light.	East.	Fresh.	East.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Thursday	22	42	47	46	48	40	48	NW.	Light.	NW.	Light.	NW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Friday	23	28	40	32	41	28	40	North.	Strong.	North.	Strong.	NW.	Light.	Clear.	Clear.	Clear.
Saturday	24	20	39	32	40	32	42	South.	Light.	South.	Light.	SW.	Light.	Clear.	Clear.	Clear.
Sunday	25	28	40	40	41	36	44	West.	Light.	SW.	Light.	SW.	Light.	Clear.	Cloudy.	Cloudy.
Monday	26	38	44	44	45	40	48	SW.	Light.	SW.	Light.	NW.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	27	32	42	44	43	40	44	NE.	Light.	NE.	Light.	NW.	Calm.	Clear.	Cloudy.	Cloudy.
Wednesday	28	42	45	48	46	46	48	SW.	Light.	SW.	Light.	SW.	Calm.	Cloudy.	Cloudy.	Cloudy.
Thursday	29	32	44	42	46	38	46	SW.	Calm.	SW.	Light.	West.	Calm.	Clear.	Clear.	Clear.
Friday	30	22	41	26	42	22	39	SW.	Calm.	SW.	Light.	SW.	Fresh.	Clear.	Cloudy.	Cloudy.
Saturday	31	21	37	26	38	22	38	SW.	Fresh.	West.	Light.	West.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Sunday	Jan. 1	16	36	20	36	19	36	NW.	Fresh.	West.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	2	5	36	22	38	26	38	SW.	Light.	SW.	Light.	SW.	Light.	Clear.	Clear.	Cloudy.
Tuesday	3	22	38	24	38	16	38	SW.	Fresh.	NE.	Fresh.	North.	Light.	Cloudy.	Cloudy.	Cloudy.
Wednesday	4	16	36	20	37	17	36	NE.	Light.	East.	Fresh.	East.	Light.	Cloudy.	Cloudy.	Cloudy.
Thursday	5	13	35	26	37	28	37	NE.	Light.	NE.	Light.	NE.	Light.	Cloudy.	Cloudy.	Cloudy.
Friday	6	28	38	30	38	33	40	North.	Light.	West.	Fresh.	West.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Saturday	7	33	40	38	41	36	41	North.	Light.	East.	Light.	East.	Light.	Cloudy.	Cloudy.	Cloudy.
Sunday	8	44	43	52	46	41	41	West.	Calm.	SW.	Fresh.	SW.	Strong.	Cloudy.	Cloudy.	Cloudy.
Monday	9	29	41	32	40	32	41	West.	Fresh.	SW.	Fresh.	West.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	10	26	39	34	40	33	39	West.	Calm.	East.	Light.	East.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Wednesday	11	30	39	40	41	36	41	SW.	Light.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Thursday	12	10	38	42	40	30	40	SW.	Calm.	South.	Light.	SE.	Light.	Clear.	Cloudy.	Cloudy.
Friday	13	24	40	38	42	38	44	South.	Light.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Saturday	14	20	38	22	38	22	38	SW.	Fresh.	SW.	Light.	SW.	Light.	Cloudy.	Clear.	Clear.
Sunday	15	28	38	40	39	36	42	SW.	Calm.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	16	28	40	26	39	20	39	West.	Calm.	West.	Light.	West.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	17	6	35	17	38	10	38	West.	Calm.	West.	Light.	West.	Calm.	Clear.	Clear.	Clear.
Wednesday	18	4	36	20	38	22	38	West.	Calm.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Thursday	19	27	38	28	40	23	41	West.	Calm.	SW.	Calm.	SW.	Calm.	Clear.	Clear.	Clear.
Friday	20	24	38	34	40	33	41	West.	Calm.	SW.	Light.	SW.	Light.	Clear.	Clear.	Cloudy.
Saturday	21	34	31	37	44	34	44	SW.	Light.	SW.	Light.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.

Sunday		22	15	35	16	35	10	34	SW.	Strong.	SW.	Strong.	SW.	Strong.	Cloudy.	Cloudy.	Cloudy.
Monday		23	5	34	10	36	12	37	West.	Light.	West.	Light.	NW.	Light.	Clear.	Clear.	Cloudy.
Tuesday		24	2	35	16	36	12	37	SW.	Calm.	South.	Fresh.	SW.	Light.	Clear,	Clear.	Cloudy.
Wednesday		25	22	36	34	37	34	39	South.	Calm.	South.	Light.	South.	Light.	Cloudy.	Cloudy.	Cloudy.
Thursday		26	36	41	44	42	42	44	South.	Calm.	South.	Calm.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Friday		27	30	38	34	40	33	44	SW.	Light.	SW.	Light.	SE.	Light.	Clear.	Clear.	Clear.
Saturday		28	30	40	48	42	30	41	SW.	Calm.	SW.	Fresh.	West.	Strong.	Cloudy.	Cloudy.	Clear.
Sunday		29	11	32	20	35	18	36	NW.	Fresh.	NW.	Fresh.	SW.	Strong.	Clear.	Clear.	Clear.
Monday		30	13	34	30	37	28	38	SW.	Light.	SW.	Light.	SW.	Light.	Clear.	Clear.	Cloudy.
Tuesday		31	22	38	34	40	28	42	NW.	Light.	NW.	Calm.	NW.	Calm.	Cloudy.	Cloudy.	Cloudy.
Wednesday	Feb.	1	30	40	40	42	35	42	SW.	Light.	SW.	Fresh.	SW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Thursday		2	24	40	40	42	40	44	SW.	Light.	SW.	Light.	South.	Light.	Clear	Clear.	Clear.
Friday		3	20	40	30	41	28	44	West.	Calm.	NE.	Light.	NE.	Calm.	Clear.	Clear.	Clear.
Saturday		4	26	40	38	44	36	43	West.	Calm.	West.	Light.	West.	Fresh.	Clear.	Clear.	Cloudy.
Sunday		5	20	40	40	43	38	44	SW.	Calm.	SW.	Light.	SW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Monday		6	28	42	37	44	36	44	SW.	Calm.	South.	Calm,	SE.	Light.	Clear.	Clear.	Cloudy.
Tuesday		7	38	42	48	44	46	44	SW.	Calm.	SW.	Fresh.	SW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Wednesday		8	29	40	36	44	32	46	SW.	Calm.	SW.	Light.	SW.	Calm.	Clear.	Clear.	Clear.
Thursday		9	20	41	40	43	36	46	West.	Calm.	West.	Calm.	West.	Calm.	Clear.	Clear.	Cloudy.
Friday		10	30	40	36	42	32	41	West.	Light.	West.	Light.	SW.	Light.	Clear.	Clear.	Cloudy.
Saturday		11	32	41	42	42	40	44	SW.	Calm.	SW.	Calm.	SW.	Calm.	Clear.	Cloudy.	Cloudy.
Sunday		12	44	46	54	48	52	49	SW.	Calm.	SW.	Fresh.	South.	Fresh.	Cloudy.	Cloudy.	Clear.
Monday		13	44	49	42	48	40	49	SW.	Fresh.	SW.	Strong.	SW.	Fresh.	Cloudy.	Clear.	Clear.
Tuesday		14	26	43	42	46	40	48	SW.	Calm.	SW.	Fresh,	SW.	Light.	Clear.	Clear.	Cloudy.
Wednesday		15	32	42	48	46	42	50	South.	Calm.	SW.	Fresh.	South.	Light.	Clear.	Clear.	Clear.
Thursday		16	34	45	46	46	50	48	SW.	Fresh.	SW.	Calm.	SW.	Calm.	Cloudy.	Cloudy.	Cloudy.
Friday		17	28	43	26	42	47	42	SW.	Calm.	NW.	Fresh.	North.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Saturday		18	22	38	32	40	22	42	NE.	Calm.	NE.	Fresh.	NE.	Fresh.	Clear.	Clear.	Clear.
Sunday		19	36	42	46	44	30	44	NW.	Calm.	West.	Light.	West.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday		20	30	42	36	42	40	42	North.	Fresh.	NE.	Light.	NE.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Tuesday		21	32	41	26	39	30	38	SW.	Fresh.	SW.	Strong.	SW.	Strong.	Cloudy.	Cloudy.	Cloudy.
Wednesday		22	20	35	22	38	26	37	SW.	Fresh.	SW.	Strong.	SW.	Strong.	Clear.	Cloudy.	Cloudy.
Thursday		23	14	36	30	39	16	40	SW.	Light.	West.	Light.	SW.	Light.	Clear.	Cloudy.	Cloudy.
Friday		24	18	38	29	41	22	45	NW.	Light.	NW.	Light.	NE.	Light.	Clear.	Clear.	Clear.
Saturday		25	14	39	30	40	20	39	NW.	Light.	NW.	Light.	NW.	Light.	Clear.	Clear.	Clear.
Sunday		26	30	42	42	45	28	44	SW.	Light.	SW.	Light.	SW.	Light.	Clear.	Cloudy.	Clear.
Monday		27	38	45	48	46	43	46	SW.	Light.	SW.	Light.	SW.	Light.	Clear.	Clear.	Clear.
Tuesday		28	43	46	44	46	42	47	South.	Light.	SW.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Wednesday	Mar.	1	48	48	55	52	46	50	South.	Light.	South.	Light.	South.	Light.	Clear.	Clear.	Clear.
Thursday		2	46	48	62	55	44	53	South.	Light.	South.	Light.	South.	Light.	Clear.	Clear.	Clear.
Friday		3	44	48	48	52	47	51	West.	Fresh.	West.	Fresh.	West.	Light.	Clear.	Clear.	Clear.
Saturday		4	33	45	46	47	44	47	NE.	Fresh.	East.	Fresh.	East.	Light.	Cloudy.	Cloudy.	Cloudy.
Sunday		5	48	48	58	54	52	52	SE.	Light.	SE.	Light.	South.	Light.	Cloudy.	Clear.	Clear.
Monday		6	36	45	52	50	50	49	SW.	Light.	SE.	Light.	SE.	Light.	Cloudy.	Clear.	Clear.
Tuesday		7	38	46	56	53	51	49½	SE.	Fresh.	SE.	Fresh.	SE.	Fresh.	Cloudy.	Clear.	Clear.
Wednesday		8	41	46	58	54	50	49	SE.	Fresh.	SE.	Fresh.	SE.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Thursday		9	34	42	38	43	36	44	NE.	Light.	NE.	Light.	NE.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Friday		10	30	42	34	42	31	42	NW.	Light.	NW.	Fresh.	NW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Saturday		11	30	42	36	44	31	45	West.	Fresh.	NW.	Fresh.	NW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Sunday		12	33	44	36	46	31	45	NE.	Light.	NE.	Light.	NE.	Light.	Cloudy.	Clear.	Cloudy.
Monday		13	28	42	32	45	30	45	NE.	Fresh.	NE.	Fresh.	NE.	Light.	Clear.	Clear.	Cloudy.
Tuesday		14	28	42	38	45	40	48	West.	Light.	NW.	Light.	NW.	Light.	Clear,	Clear.	Cloudy.

Report of temperature observations made at Northville, Mich., &c.—Continued.

Date: Day of week.	Date: Day of month.	Temperature at— 8 a.m.: Air.	8 a.m.: Water.	1 p.m.: Air.	1 p.m.: Water.	5 p.m.: Air.	5 p.m.: Water.	Wind at— 8 a.m.: Direction.	8 a.m.: Intensity.	1 p.m.: Direction.	1 p.m.: Intensity.	5 p.m.: Direction.	5 p.m.: Intensity.	Condition of— Sky: 8 a.m.	Sky: 1 p.m.	Sky: 5 p.m.
Wednesday	Mar. 15	30	41	34	44	32	43	SE.	Light.	SE.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Thursday	16	33	42	40	44	34	46	South.	Light.	South.	Light.	South.	Light.	Cloudy.	Cloudy.	Clear.
Friday	17	28	40	44	45	30	41	East.	Light.	East.	Light.	East.	Fresh.	Clear.	Cloudy.	Cloudy.
Saturday	18	36	43	44	45	46	46	East.	Light.	SE.	Light.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Sunday	19	34	43	52	54	50	52	NW.	Light.	NW.	Light.	NW.	Light.	Clear.	Clear.	Cloudy.
Monday	20	40	47	48	49	40	48	NE.	Light.	NE.	Light.	NE.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Tuesday	21	34	44	32	44	26	43	West.	Light.	West.	High.	West.	High.	Cloudy.	Cloudy.	Cloudy.
Wednesday	22	24	41	30	42	30	42	NW.	Fresh.	NW.	Fresh.	NW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Thursday	23	30	41	44	47	48	48	SE.	Light.	SE.	Fresh.	West.	Light.	Clear.	Clear.	Cloudy.
Friday	24	21	40	30	44	26	44	NW.	Light.	NW.	Fresh.	NW.	Light.	Clear.	Clear.	Clear.
Saturday	25	26	41	35	43	30	42	NW.	Light.	SE.	Fresh.	SE.	Light.	Clear.	Cloudy.	Cloudy.
Sunday	26	38	44	54	50	58	52	SE.	Light.	SE.	Fresh.	SE.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	27	38	50	48	50	36	48	SW.	Light.	West.	Fresh.	West.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Tuesday	28	26	42	49	50	47	49	NE.	Light.	NE.	Light.	NE.	Light.	Clear.	Clear.	Clear.
Wednesday	29	36	42	56	44	58	51	SE.	Light.	SE.	Light.	SE.	Light.	Clear.	Clear.	Clear.
Thursday	30	35	42	42	48	40	47	SW.	Fresh.	SW.	Fresh.	West.	Light.	Clear.	Clear.	Clear.
Friday	31	34	42	44	46	38	46	SW.	Fresh.	SW.	Fresh.	SW.	Light.	Cloudy.	Cloudy.	Cloudy.
Saturday	Apr. 1	40	45	62	54	68	56	SW.	Light.	SW.	Light.	SW.	Light.	Clear.	Clear.	Clear.
Sunday	2	60	50	70	56	62	55	SW.	Light.	SW.	Light.	NE.	Light.	Clear.	Clear.	Clear.
Monday	3	38	48	68	56	64	54	SE.	Light.	South.	Light.	South.	Light.	Clear.	Clear.	Clear.
Tuesday	4	50	50	66	55	60	53	South.	Light.	SW.	Fresh.	SW.	Fresh.	Cloudy.	Cloudy.	Cloudy.
Wednesday	5	48	50	67	56	58	54	West.	Fresh.	West.	Fresh.	West.	Fresh.	Clear.	Cloudy.	Cloudy.
Thursday	6	52	51	58	53	50	51	NW.	Fresh.	NW.	Fresh.	NW.	Fresh.	Clear.	Clear	Clear.
Friday	7	51	49	57	51	56	50	West.	Fresh.	West.	Fresh.	West.	Fresh.	Clear.	Clear	Clear.
Saturday	8	42	48	52	50	50	50	NE.	Light.	NE.	Light.	NE.	Light.	Cloudy.	Cloudy.	Cloudy.
Sunday	9	51	49	44	48	44	48	East.	Fresh.	East.	Light.	East.	Light.	Cloudy.	Cloudy.	Cloudy.
Monday	10	42	48	30	42	24	41	East.	Fresh.	East.	Fresh.	East.	Light.	Cloudy.	Cloudy.	Cloudy.
Tuesday	11	40	47	28	41	29	42	NW.	Light.	NW.	Fresh.	NW.	Fresh.	Clear.	Cloudy.	Clear.
Wednesday	12	26	41	40	44	38	44	NW.	Light.	North.	Fresh.	North.	Light.	Cloudy.	Clear.	Clear.
Thursday	13	22	40	42	45	46	47	NW.	Light.	North.	Light.	NE.	Light.	Cloudy.	Cloudy.	Cloudy.
Friday	14	30	40	40	44	45	45	NE.	Light.	NE.	Light.	NE.	Light.	Cloudy.	Cloudy.	Cloudy.
Saturday	15	36	44	48	50	45	49	North.	Light.	NE.	Light.	NE.	Light.	Clear.	Clear.	Cloudy.

INDEX.

XXI.—THE REPORT OF OPERATIONS AT THE UNITED STATES SALMON-BREEDING STATION ON THE McCLOUD RIVER, CALIFORNIA, DURING THE SEASON OF 1881.

By Livingston Stone.

Hon. Spencer F. Baird:

Sir: I beg leave to report as follows: When my last report closed in October, 1880, 2,000,000 salmon eggs had been left in the McCloud River hatching-house to be hatched by the State of California for the Sacramento River and its tributaries. These were successfully hatched and placed in the McCloud River before Christmas, when all work at this station was discontinued for the season.

Up to this time the rainfall had not been unusually large. Indeed, there had been more than the customary number of fair days until the 18th of December, when it began to rain and continued to rain eleven days in succession, the river rising on the 25th 8 feet and 2 inches above its summer level. This was nothing extraordinary, however, and no fears or even misgivings were entertained of any disaster from flood to the fishery buildings, they being built from 18 to 19 feet above the river. There was a dense fog over the McCloud River the last two days of December, but no rain, and when the new year opened the river had fallen back to within a foot and a half of its usual level.

The month of January, however, was attended by a rainfall wholly unprecedented in Northern California since its settlement by white men.*

Forty-seven inches of water fell at Shasta during this month, and in the mountains where the fishery is situated the fall must have been much greater. On the 27th of January the McCloud had risen 12½ feet, but the water had been higher than that in previous years, and still no one supposed that the buildings were in danger. Again the river fell, but this time the fall was succeeded by the greatest rise of water ever known in this river before, either by white men or Indians now living. During the first days of February the rain poured down in torrents. It is said by those who saw it that it did not fall as rain usually falls, but it fell as if thousands of tons of water were dropped in a body from

* Rainfall at Shasta, January, 1881	47	inches.
Rainfall at Shasta, February, 1881	17.5	inches.
Total rainfall for season	109.7	inches.

I hereby certify the above to be correct.

JAMES E. ISAACS,
Weather Observer, Shasta, Cal.

Shasta, Cal., *August* 1, 1881.

the sky at once. Mr. J. B. Campbell relates that near his house, in a cañon which is dry in summer, the water in not many minutes became 30 feet deep, and the violence of the current was so great that trees a hundred feet long were swept down, trunk, branches and all, into the river. On the 2d of February the McCloud River began to rise at the rate of a foot an hour. By 9 o'clock in the evening it was 16 feet and 8 inches above its ordinary level. This was within 4 inches of the danger-mark, and two young men who were at the fishery, Richard D. Hubbard and Oscar Fritze, made an attempt, at the risk of their lives, to save some of the most valuable movable property in the buildings. With great courage and determination they waded through the fierce current, in the blinding rain and pitchy darkness, and rescued many valuable things, but the water around the house was then up to their shoulders and the unequal struggle could not be long maintained. These young men are, however, entitled to great credit for succeeding in rescuing what they did from the flood on that frightful night.

The water was soon a foot above the danger-mark, and the buildings began to rock and totter as if nearly ready to fall. There was now no hope of saving them or anything in them. At half-past two in the morning of the 3d of February, they toppled over with a great crash and were siezed by the resistless current and hurried down the river.

When the day dawned nothing was to be seen of the main structures which composed the United States salmon-breeding station on the McCloud River. The mess-house, where the workmen had eaten and slept for nine successive seasons, and which contained the original cabin, 12 feet by 14 feet, where the pioneers of the United States Fish Commission on this coast lived during the first season of 1872; the hatching-house, which, with the tents that preceded it, had turned out 70,000,000 salmon eggs, the distribution of which had reached from New Zealand to St. Petersburg; the large dwelling-house, to which improvements and conveniences had been added each year for five years—these were all gone, every vestige of them, and nothing was to be seen in the direction where they stood except the wreck of the faithful wheel which through summer's sun and winter's rain had poured 100,000,000 gallons of water over the salmon eggs in the hatchery, and which now lay dismantled and ruined upon the flat-boats which had supported it, and which were kept from escaping by two wire cables made fast to the river bank. The river continued to rise the next forenoon until it reached a maximum height of 26 feet and 8 inches above its summer level. This, of course, is not a very extraordinary rise for a slow-moving river, but when it is remembered that the McCloud is at low water a succession of cascades and rapids, having an average fall of 40 feet to the mile, it will be seen at once what a vast volume of water must have been poured into this rapid river in a very short time, and with what velocity it must have come to have raised the river 26 feet when its natural fall was sweeping it out of the cañon so swiftly.

Those who saw this mighty volume of water at it highest point, rushing through its mountain cañon with such speed, say that it was appalling, while the roar of the torrent was so deafening that persons standing side by side on the bank could not hear each other when talking in an ordinary tone of voice.

It must be over two centuries since the McCloud River rose, if ever, as high as it did last winter. There is very good evidence of this on the very spot where the fishery was located, for just behind the mess-house, and exactly under where the fishery flag floats with a good south breeze, is an Indian grave-yard, where the venerable chiefs of the McCloud have been taken for burial for at least two hundred years, and there is no knowing how much longer. One-third of this grave yard was swept away by the high water last winter, and the ground below was strewn with dead men's bones.

Now, the fact that the Indians have been in the habit of burying their dead in this spot for two centuries proves that the river has never risen to the height of last winter's rise within that time, for nothing could induce Indians to bury their fathers where they thought there was the least danger of the sacred bones being disturbed by floods.

When the waters subsided, it became apparent what a clean sweep the river had made. Here and there the stumps of a few posts, broken off and worn down nearly to the ground by the driftwood rubbing over them, formed the only vestiges whatever to indicate that anything had ever existed there but the clean rocky bar that the falling water had left.

The inventory showed that over $4,000 worth of hatching apparatus, house furniture, tools, and other articles were lost or destroyed by the flood, besides the buildings themselves. The whole loss could not have been less than $15,000.*

At the time of the disaster all communication with the outside world was shut off by the high water in the rivers. On the 6th of February, Mr. Myron Green succeeded with great difficulty in taking a telegram from the trout ponds to Redding, a distance of 25 miles. Mr. Green was three days in accomplishing the journey, and in several instances swam the intervening creeks, carrying his clothes on his head. As soon as the news reached Professor Baird he telegraphed to Hon. B. B. Redding, of San Francisco, to telegraph Senator Booth, at Washington, to obtain an appropriation for rebuilding the fishery. It was now almost at the close of the Congressional session, but Senator Booth succeeded in securing an appropriation of $10,000, to be expended under the direction of Professor Baird in restoring the buildings and property destroyed by the flood. As soon as this appropriation was made Professor Baird gave me instructions to proceed at an early date to the McCloud River and enter at once upon the work of restoring the fishery.

* An account of the effects of the high water at the United States trout ponds, 4 miles farther up the McCloud River, will be found in the report of operations at that point.

In pursuance of these instructions I arrived at the fishery on the 19th of May, having previously arranged to have 30,000 feet of lumber delivered on the premises before my arrival. I immediately engaged workmen and ordered material, and on Monday morning, May 23, the work of rebuilding was under full headway, with a force of upwards of twenty white men and about a dozen Indians. There being no building of any magnitude left, we lived in tents until the mess-house was finished, one large tent, 60 feet by 30 feet, divided by a partition into two compartments, serving for a sleeping-room and dining-room for the workmen.

We encountered one serious difficulty at the very outset in putting up the new buildings. When we first built here it was supposed that the flat or nearly flat land lying 12 or 15 feet above the level of the river was safe from high water, and we accordingly erected our buildings there, protecting them from a possible rise of 3 or 4 feet more by a very ponderous breakwater. As the water last winter rose to the almost incredible height of 26 feet above the river's natural level, we were only left the alternative of putting the buildings on the hill-tops or on the hill-sides. The first being out of the question, of course we were driven by necessity to build on the hill-sides. This involved a great deal of grading, which in turn necessitated very laborious digging and excavating, sometimes even into the solid rock. It was a long, slow, and expensive work. It was a provoking paradox that here where land was as free as air and almost as boundless, it should cost, as it did in some instances, $1,000 an acre. It seemed at first as if we should never get through digging, but after the foundations were all laid the work went on rapidly, and progressed without any drawbacks, except a lack of means, until everything was done. The lack of means resulted from an attempt to accomplish with $10,000 what could not be done for less than $15,000, but it was work which could not be done by halves, and I concluded to go on and finish the work and trust to subsequent action of Congress for indemnification.

On the 1st of September we had on the fishery grounds a mess-house, hatching-house, and stable. We had also built a bridge 150 feet long across the river, and had added to it as usual a firmly built fence or rack that allowed the water to pass down but prevented the salmon from going up the river.

The mess-house is a well-built and nicely painted two-story house, 40 feet by 25 feet, containing a kitchen, pantry, store-room, dining-room, and men's room on the lower floor, with three large sleeping apartments on the second floor. It is well supplied with running water from a spring on the hill behind the house, so that there is always a full tank of fresh cold water in the kitchen, another tank on the second floor to be used in case of fire, and another on the porch where the men wash. This abundant supply of cold water in this very hot climate is a great convenience, not to say luxury. The mess-house rests on bed-rock, well up above high-water mark, and is perfectly safe from any future floods.

The stable is a well-built, substantial two-story building, 40 feet by 20 feet, with accommodations for four horses. It has two commodious store-rooms and a loft. On the north side, where it is protected from the sun in summer and the storms in winter, a shed is built joining the barn.

The hatching-house is a large, handsome, painted building 80 feet long and 30 feet wide. It stands well above the danger mark of high water, and is provided with forty hatching troughs, each 16 feet long, furnished with seven hatching baskets, each 2 feet long, making two hundred hatching baskets in all. These baskets will carry 35,000 salmon eggs each, giving a total hatching capacity to the whole house in round numbers of 10,000,000 salmon eggs.

The hatching-house is provided with nine windows on each side, one window in each gable end, and five sky-lights on the roof, all of which combined furnish a good supply of light even on the dark, rainy days in the fall when the salmon are being hatched for the restocking of the tributaries of the Sacramento. On the east end of the house is a large shed built for the purpose of furnishing room and shelter while packing the eggs intended for distribution. The water supply for hatching the eggs is lifted to the house by a current-wheel in the river. This wheel is a fine piece of workmanship, and a credit to the builders. It is 32 feet in diameter, is furnished with thirty-two arms and thirty-two paddles, and revolves on a shaft 18 inches in diameter. It rests on two very substantially built boats, each 36 feet long and 8 feet wide. On these there rests, sustained on suitable supports, the current-wheel. The boats and wheel are placed at a point in the river where the current has the greatest velocity, which gives the wheel a lifting capacity of 24,000 gallons an hour.

In addition to the structures already mentioned, there was the post-office building, which was washed off its original foundation and somewhat injured by the high water, but which had been replaced, raised higher, and somewhat enlarged. This is now used as a dwelling-house. A small store-house which survived the flood, and the spawning-house for taking the eggs, complete the list of buildings at the McCloud River salmon fishery as it is now restored.

As may be supposed, some of the methods of work employed here are of a primitive character. To illustrate this, allow me to trace the boat gunwales through their various stages of progress till they were framed into the boats.

The boats' gunwales were to be 36 feet long and 29 inches wide. It was therefore necessary to find a tree which would furnish a stick of good timber 37 feet long and 30 inches wide; and we hoped at first to find a tree from which could be cut a rectangular joist 30 inches by 24 inches, and 37 feet in length. The work of getting out the gunwales began, therefore, with finding the tree. With this object in view, Mr. Campbell spent three or four days in the hills hunting for a suitable tree, but could not find one within four miles of the fishery. He did find, however, a tree which would furnish a stick of timber of the required length and width and 12 inches in depth. This being the largest tree that could be discovered within a reasonable distance, it was cut down. Then four men spent three days scoring and hewing the log to get it reduced to the proper dimensions and shape to be sawed into two gunwales. When this was done a saw-pit was made and the timber was hoisted on the pit. Then two men spent nearly two days sawing it in two, lengthwise, with a whip-saw, one sawyer standing under the log and one above it. We now had in the rough two solid plank gunwales of the required length, width, and depth. As they lay on the saw-pit they weighed nearly a ton apiece, and were too heavy for even ten men to move any distance, so we forded the river with a pair of horses and drew the planks down the hill-side to the river. From here they were floated down the stream and across the river to the landing nearest the point where the boats were to be built. From here they were drawn by horses again to the "ship-yard," as we called it. Then after considerable hewing and finishing they were framed into the boats, making two very solid and satisfactory gunwales. After these were got in, the same process was repeated with another tree with the same results, from which we obtained two more gunwales for the other boat. I mention these details to show that we have something more to do here when we want a thing of this sort than to go to the lumber yard and order it.

In the four gunwale planks just described there were 1,600 feet of lumber. But this was not all the work of this kind that we had to do, for before the season was over we got out from the woods over 20,000 feet of square timber.

The hatching house and the wheel, and the flume for carrying the water from the wheel to the house, were no sooner completed than the salmon began to spawn. This was in the last week of August. The first ripe salmon, indeed, was caught August 25.

This reminds me that I must mention the work that had to be done on the seining ground, a large nearly circular basin in the river, where we draw the seine for capturing parent salmon. When we left off fishing last fall the ground over which we drew the seine was smooth and safe for seining. When we examined it this spring, after the floods, it was found to have been plowed through and through by the violence of the current. Such deep cuts had been made through the former bed of the river that both bowlders and sharp points of bed rock, before entirely covered, now projected 8 or 10 feet above the general level of the river bed, and made it wholly impossible, of course, to draw the seine over them. Our attempts to draw the seine before repairing the ground resulted in getting snagged the first few times and finally tearing the net entirely in two.

The restoring of the seining ground being absolutely necessary, we went to work at it as soon as the mess building was completed and the workmen had a house to eat and sleep in. We began with carefully examining the ground by going over it with a boat, and by feeling of the bottom of the river with long poles. After finding out in this way where both the depressions and projections were, we went to work with giant powder and blasted for two or three days till we had broken up and leveled down to a great extent the projecting ledges and bowlders. We then took one of our large flat boats or scows and ran it out over the places to be filled up, and, bridging over the space between the boat and the shore, we set a force of a dozen Indians or so at work on a soft bank on the shore. The Indians with picks and shovels cut down the bank, and then with wheelbarrows carried the earth and gravel out to the scow and dumped them into the holes where the earth was needed in the seining ground. This work was carried on until all the depressions on the seining ground were filled up, and the tops of the broken rocks wholly covered over. After this was done a few hauls of the net smoothed the whole place over, and the seining ground was as good or better than before.

Before proceeding further with the taking of the salmon eggs, I ought to say that a strange and fatal disease made its appearance among the salmon of the river about the 25th of June. We first discovered it from observing dead salmon collecting in the eddies, and others floating down the river. Dead salmon during and after the spawning season are common enough in the river, but to see them in June was a very unusual sight. In fact it was a sight never seen before in our ten years' experience on the McCloud. The chief peculiarity of the disease was that many, if not most, of the dying fish presented a perfectly healthy exterior. They were clean, plump, silvery fish, free from fungus and parasites, and without a mark or sign on the surface to show that anything was wrong about them. I examined several to discover the cause of the mortality. In most of the fish that I dissected the mouth and gills seemed healthy and intact, while the viscera were very much congested with dark blood, and the spleen was very much enlarged. Later in the season, those that I examined all had unhealthy gills. The gills in these cases were very much abraded on the outer edges, and were almost stuck together by a slimy or gummy substance, as if the gills had been injured and had freely maturated. This was found to be the case with many living fish which were caught in the seine. Neither of the symptoms just described were ever observed here in the salmon before this year. I preserved in alcohol several specimens of the viscera of salmon dying from this disease, and sent them to the National Museum at Washington, where an examination of them will probably throw some light upon the causes of this mysterious epidemic.

Proceeding now with the taking of salmon eggs, I will go on to say that the number of ripe salmon caught at each haul in the seine soon commenced to increase, and on the 18th of August I thought it safe to begin to collect salmon eggs for the hatching house. On that day we took 140,000 eggs, the parent salmon appearing to be very thick in the river. The next day we took 225,000, and by September 2 we had exceeded half a million a day. The next day we took more yet, and from this time till we stopped fishing we could have taken a million a day if necessary. Ripe salmon never were so abundant before in the fishing season. We caught frequently at one haul of the seine more than we used to catch, a few years ago, in twenty-four hours. The salmon were very large, too, the average weight of the spawned fish being several pounds more than last year, and the average number of eggs to the fish being 4,205 against about 3,000 in 1880 and a still smaller number in 1879. In consequence of the abundance of spawning fish, combined with their large size and average of eggs, the fishing season was made comparatively easy this year.

When salmon are scarce we have been in the habit of drawing the seine continuously night and day through the twenty-four hours. When they are plentiful the regular time for drawing the seine is from 4 a. m. to 10 a. m., and from 5 p. m. to 10 p. m. This year, on account of the extraordinary abundance of the fish, we frequently had to make but two or three hauls a day, and even at this rate we took all the eggs needed (7,500,000) before the spawning season was half over—a piece of good luck that never came within our experience before.

I may add here that this vast increase in the number of salmon in the river is the direct result of the artificial hatching of young salmon at this place. For several years past the United States Fish Commission has presented to the State of California 2,000,000 salmon eggs or more each year. These eggs the State fish commission has hatched each year at its own expense and has placed the young salmon in tributaries of the Sacramento. This artificial stocking of the river has resulted in a wonderful and wholly unprecedented increase of salmon in this river. So great has been the increas ethat the annual catch of salmon in the Sacramento River is worth nearly half a million dollars more than it was seven years ago, before the hatching operations were resorted to. This one result of the work done by the United States Fish Commission on the McCloud River would be ample compensation for all the outlay which has been made there, supposing that it were attended with no other results.

There was not much else done during the fishing season except to catch parent salmon and to collect eggs, as it takes nearly all hands to draw the seine and to take care of the eggs when taken. However, some work was done in adding conveniences to the hatching house and in preparing for shipping the eggs.

The last eggs for the regular season's supply were taken on the 8th of September, making a total of 7,500,000. The salmon in the river on the day we left off fishing seemed thicker than ever. If they had been needed I think we could have taken 20,000,000 eggs this season.

The time between the end of the season's spawning and the beginning of the packing for shipment was devoted to the taking care of the eggs, to making crates and boxes to ship the eggs in, to picking over the moss to pack with, and to cleaning up generally for the season.

Everything went on smoothly till packing time, and without accident, with one exception. This exception, however, was one of the gravest character, and consisted of an accident to the wheel, which filled us all with consternation and alarm. It happened the 18th of September, on a remarkably quiet and pleasant Sunday morning. The white men employed at the fishery were scattered over the grounds, and there were three or four Indians about. No one had the slightest expectation of any disaster. Everything connected with the hatching of the eggs seemed to be going on with the utmost success and safety, when suddenly, in the direction of the current-wheel, which lifts the water for the hatching house, an ominous sound of a blow was heard, followed by a crash, like the breaking of a board—then another and another—and those who happened to be in sight of the wheel saw that it had begun to break up and was rapidly going to pieces. A moment before, hardly half a dozen men could be seen. A moment after, more than twenty men, white and red, were gathered on the bar opposite to where the wheel was stationed. It seemed at first as if the wheel would be torn to pieces in a moment. It was revolving at the rate of five revolutions a minute in a very rapid and powerful current. But the injury itself was the cause of its own cessation.

Though no one knows positively the cause of the accident, it is supposed that it was occasioned by driftwood coming down the river and catching somewhere about the wheel so as to obstruct it. The momentum of the current here being so great that it forced the wheel around, notwithstanding the obstruction, there could be but one result —the breaking up of the wheel. But, of course, after five or six paddles were broken off on one side of the wheel, there was a large space on the circumference of the wheel, where it did not reach the water at all; when this part of the wheel came around again to the surface of the water, there being no paddles to reach the current, the wheel stopped of its own accord.

As soon as the accident was discovered not a moment was lost in establishing a line of buckets from the river to the hatching house to supply water to the eggs. Every white man and Indian that could be pressed into the service was employed, and in less than ten minutes we had three lines, of eight or ten men each, bringing water from the river in buckets, tubs, watering-pots, and anything that could be found, that would hold water. This being accomplished, and the eggs released from immediate danger, I gave attention to the wheel. It appeared that seven paddles were broken off, with a portion of each arm attached. The question now was whether the men could hold out bringing water till the wheel could be repaired. I do not know what we could have done in this emergency without the Indians; but I do not think we could have saved the eggs except by their aid. They worked splendidly, most of them from eleven o'clock in the morning, when the wheel broke down, until four o'clock the next morning, when it was started again—seventeen hours of continuous work, with two very short interruptions, when I allowed them, three at a time, to run to the house to get something to eat. During all this seventeen hours some of them were carrying buckets of water that weighed sixty or seventy pounds each. They did not work as if they were working merely for pay; but they worked with genuine enthusiasm. They kept in good spirits, too, till an hour or two after midnight. But about two or three o'clock in the morning it was evident that it was all they could do to keep at it. I do not think they could have held out much longer. I have seen white men look as tired as they did, but I never saw such a tired look on Indians' faces before as there was on the faces of those red heroes who saved our salmon eggs. When it is remembered that we consider 10,000 gallons of water an hour necessary to keep all the eggs in good condition, an idea may be formed of the labor that was involved in bringing the water to the eggs. I must not forget to say here that the white men worked as heroically as the Indians, though their work was not as exhausting, and I must especially mention Mr. J. B. Campbell, who took charge of repairing the wheel, and who worked with all his might from the time it broke till it was fully repaired. At four o'clock in the morning the wheel was again making its accustomed revolutions and raising the regular current of water to the hatching house. When this had been accomplished the rest of us, leaving one man to watch the wheel till breakfast time, retired to sleep the remainder of the night.

Before leaving the subject of the accident to the wheel, I will mention a contrivance which we adopted for furnishing water to the eggs, which, though very simple, saved an enormous amount of labor and is strongly recommended for any hatching house that may be unfortunate enough to have its water supply cut off for any length of time.

The device was as follows: A long, large, receiving tank was placed under the outlet of the hatching troughs so as to catch and hold the water that flowed from them. In addition to this, a line of raised spouts was erected from the outlet end of the hatching house to the filtering tank at the other end, sufficiently elevated to deliver into the filtering tank the water that was poured in at the other end. Several men then went to work at the outlet end of the house to dip the water up in buckets from the receiving tank and to pour it into the head of the elevated line of spouts. The water so dipped up flowed down the line of spouts into the filtering tank, and thence over the eggs again into the receiving tank.

In this way a constant circulation was kept up through the hatching troughs by the small stationary force of men dipping and pouring at the elevated spout. This, with the water that was also being brought from the river, formed an adequate supply, and the eggs were kept in perfect condition all night, and, strangely enough, there was no perceptible loss of eggs during the whole time of the stoppage of the wheel, although there were 7,500,000 salmon eggs in the hatching house.

Everything went on smoothly and prosperously after the wheel was restored, the eggs matured with less loss than usual, and on the 24th of September they were ready to be packed for shipment. On that day we packed and crated 1,450,000 eggs. On the next day we packed and crated 1,700,000, and on the third day we packed and crated 450,000, making in all 36 crates, containing a total of 3,600,000 eggs. These were all taken to Redding in wagons and then loaded into a car as usual, nearly all the spare space in the car being filled with ice.

This car left with the passenger train for the East on Wednesday morning, September 28, and arrived at Chicago on Monday, October 3. From Chicago the eggs were distributed by the United States Express Company as follows:

Record of the distribution of salmon eggs from the United States salmon-breeding station on the McCloud River, California, during the season of 1881.

Applicants.	Destination.	Number of eggs.
T. B. Ferguson	Druid Hill, Baltimore, Md	500,000
R. O. Sweney	Saint Paul, Minn	200,000
R. R. Livingston	Omaha, Nebr	500,000
A. H. Powers	Plymouth, N. H	50,000
H. G. Parker	Carson City, Nev	50,000
Seth Weeks	Corry, Pa	100,000
C. J. Huske	Walhalla, S. C	300,000
C. S. White	Romney, W. Va	100,000
S. Wilmot	New Castle, Ontario	500,000
Percy C. Ohl	Plainfield, N. J	50,000
Curtis Johnson	Saint Petersburg, Pa	50,000
Fred Mather	Newark, N. J	500,000

Besides the eggs mentioned in the above table 50,000 were sent on the 21st of September to the New South Wales Zoological Society, Sydney, New South Wales.

There were also sent, on the 28th of September, from Sacramento, by express, to Hon. B. B. Redding, California fish commission, 200,000 eggs; and to the Lenni Fish Propagating Company, Sonoma, Cal., 500,000 eggs.

Allow me to say, in conclusion, that this closes the tenth season of the labors of the United States Fish Commission in taking salmon eggs at this station. During that period nearly 70,000,000 salmon eggs have been taken and distributed, and, though sometimes great difficulties—and some that appeared insurmountable at the time—have been encountered, fortune has favored us through the decade, so that every year of the ten has been a successful one.

Below will be found tables showing—

(*a*.) The daily record of eggs taken.

(*b*.) The number of fish taken in the seine.

(*c*.) The temperature of air and water during the season.

(*d*.) The various collections sent to the Smithsonian Institution.

Table showing the number of female salmon spawned each day and the number of salmon eggs taken each day during the season of 1881.

Date.	Number of fish spawned.	Number of eggs taken.
Aug. 28	35	175,000
29	55	225,000
30	98	370,000
31	81	331,000
Sept. 1	104	439,000
2	172	665,000
3	179	770,000
4	190	945,000
5	221	914,000
6	200	836,000
7	213	875,000
8	181	725,000
Total	1,729	7,270,000

Average number of eggs to fish, 4,205. Average weight of females, 11⅝ pounds.

Table giving list of specimens collected for the Smithsonian Institution.

[Catalogue of alcoholic specimens from McCloud River, California. Contributed by Livingston Stone.]

No.

700. Dolly Varden trout. 1881.
701. Salmon. June, 1881.
702. Salmon. June, 1881.
703. Salmon. June, 1881.
704. Salmon. June, 1881.
705. Salmon, male. August 26, 1881.
706. Salmon, male. August 26, 1881.
707. Salmon, male. August 26, 1881.
708. Salmon, male. August 26, 1881.
709. Jar of trout from trout ponds. 1881.
710. Jar of trout from trout ponds. 1881.
711. Salmon, female. August 31, 1881.
712. Salmon, female. August 31, 1881.
713. Salmon, female. August 31, 1881.
714. Salmon, female. August 31, 1881.
715. Jar containing—
    - 1 split-tail fish. June, 1881.
    - 2 young humming-birds. June, 1881.
    - 1 beetle. June, 1881.
    - 1 young mole. June 12, 1881.
    - 1 young rat. June 12, 1881.
    - 2 spleens. June 16, 1881.
    - 1 insect. June 16, 1881.
    - 5 lizard eggs. June 16, 1881.
716. Jar containing gills and viscera of a female salmon that died of the disease prevailing in the McCloud River during the summer of 1881. The spawn was very far advanced but not loose. August 4, 1881. Also viscera of three more. August 5, 1881.

717. Viscera of diseased salmon. July, 1881.
718. Female salmon. August 31, 1881.
719. Female salmon. August 31, 1881.
720. Head of salmon. Gills and eyes partly destroyed by fungus and healed again. July 8, 1881.
721. Jar containing—
    1 rattlesnake. June, 1881.
    1 king snake. June, 1881.
    1 king snake. July, 1881.
    1 small striped snake. July, 1881.
    1 small snake. June, 1881.
    1 lizard. June, 1881.
    1 lizard. July, 1881.

Memorandum of nests and eggs of birds collected on the McCloud River from May 29 to June 12, 1881.

1. King oriole. Nest and young.
2. Redheaded woodpecker. Found in stump of tree.
3. Male and female linnet nest and 3 eggs. Found on rafters of barn.
4. Female blue jay. Nest found in tall live oak.
5. Flycatcher (male) and nest.
6. Humming-bird. Nest and 1 egg.
7. Cat-bird and nest.
8. Goldfinch and nest.
9. Unknown nest.
10. Unknown nest.
11. Humming-bird's nest.
12. Quail's nest. Four eggs.
13. Dove and egg. Found in hollow of ground (no other nest).
14. Quail's nest. Seven eggs.
15. Unknown nest. Three eggs.
16. Unknown nest.
17. Sundry unknown nests.
18. Oriole's nest.
19. A yellow-breasted bird and nest.
20. A yellow-bird's nest.
21. Unknown nest and egg.
22. Meadow-lark's nest and 4 eggs.
23. Unknown nest and 2 eggs.
24. Humming-bird's nest.
25. Flycatcher. Nest and 2 eggs.
26. Unknown bird and nest. Found on ground.
27. Unknown bird. Nest and 4 eggs.

List of geological specimens contributed by Livingston Stone.

1. Bones from Cave Bear Cave, McCloud River, California. July 29, 1881.
2. Teeth, McCloud River, California. July 29, 1881.
3. Portion of skull, supposed to be that of a bear, from new chamber of Cave Bear Cave, McCloud River, California. July 29, 1881.
4. Portion of jaw-bone, from new chamber of Cave Bear Cave, McCloud River, California. July 29, 1881.
5. Bones from Cave Bear Cave, McCloud River, California. July 29, 1881.

6 to 12, inclusive. Bones from Cave Bear Cave, McCloud River, California. July 29, 1881.

Table showing the number of salmon taken daily in the seine, with temperature of air and water, during the season of 1881.

[Record of salmon operations conducted at United States Salmon Hatchery, on the McCloud River, California, from August 25, 1881, to September 9, 1881, on account of the United States Fish Commission, by Livingston Stone.]

Date.	Hour.	Temperature of—		Fish taken.		Ripe fish.	
		Air.	Surface water.	Males.	Females.	Males.	Females.
Aug. 25	5.30 p. m.						10
26	5.30 p. m.	70	59	200	100	About one-eighth.	8
28	9.00 a. m.	70	60	200	150	..do	27
28	6.30 p. m.	65	59	250	100	..do	19
29	7.40 a. m.	64	54	150	100	..do	30
29	9.30 a. m.	72	54	150	50	..do	12
29	5.15 p. m.	78	58	100	50	..do	1
29	5.45 p. m.			15	10	..do	2
29	7.10 p. m.	72	60	175	75	..do	11
29	8.10 p. m.	63	56	200	200	..do	17
29	9.15 p. m.	58	56	250	250	..do	11
30	5.20 a. m.	45	54	150	150	..do	9
30	5.40 a. m.	45	55	125	125	..do	3
30	8.00 a. m.	63	56	100	25	..do	12
30	9.30 a. m.	68	54	40	40	..do	
30	5.00 p. m.	86	56	25	25	..do	2
30	5.30 p. m.	86	56	60	30	..do	8
30	7.15 p. m.	66	54	30	30	..do	14
30	7.45 p. m.	66	54	300	300	About one-fourth.	16
30	9.15 p. m.	55	54	150	150	..do	10
31	5.00 a. m.	45	56	300	300	..do	32
31	5.30 a. m.	45	56	50	50	..do	5
31	7.12 a. m.	47	56	20	20	..do	6
31	9.15 a. m.	65	56	20	5	..do	3
31	5.15 p. m.	84	56	75	25	..do	10
31	5.40 p. m.	82	55	250	250	About one-eighth.	5
31	7.00 p. m.	72	54	350	350	..do	25
31	9.00 p. m.	62	54	250	250	..do	10
Sept. 1	5.00 a. m.	48	53	300	300	..do	30
1	6.10 a. m.	47	54	200	200	..do	15
1	7.30 a. m.	55	54	10	10	..do	5
1	9.00 a. m.	62	55	50	50	..do	5
1	4.15 p. m.	82	57	250	250	..do	28
1	4.40 p. m.	82	56	175	175	..do	12
1	7.30 p. m.	75	56	125	125	..do	11
1	8.30 p. m.	60	56	150	150	About one-fourth.	11
2	5.15 a. m.	58	56	600	600	..do	51
2	6.30 a. m.	57	56	400	400	..do	35
2	8.10 a. m.	60	56	150	150	..do	14
2	10.00 a. m.	61	56	250	250	..do	13
2	4.20 p. m.	71	56	350	350	..do	39
2	5.05 p. m.	63	56	200	200	..do	17

Table showing the number of salmon taken daily in the seine, &c.—Continued.

Date.	Hour.	Temperature of— Air.	Surface-water.	Fish taken. Males.	Females.	Ripe fish. Males.	Females.
Sept. 2	8.20 p. m.	60	51	750	750	....do	86
3	5.00 a. m.	50	54	250	250	....do	38
3	8.20 a. m.	60	53	300	300	....do	54
3	10.00 a. m.	69	54	240	110	....do	41
3	4.25 p. m.	80	57	250	250	....do	45
3	7.40 p. m.	60	55	800	800	....do	118
4	9.10 a. m.	73	55	300	300	One-half	33
4	10.40 a. m.	80	56	250	150	....do	22
4	11.15 a. m.	80	56	150	150	About one-half.	20
4	4.45 p. m.	85	57	255	255	....do	27
4	7.40 p. m.	78	58	400	400	Nearly all	137
5	7.30 a. m.	67	56	300	300	....do	95
5	9.30 a. m.	73	56	150	150	....do	42
5	11.30 a. m.	80	57	25	25	....do	6
5	7.00 p. m.	76	60	800	400	....do	156
6	8.00 a. m.	70	54	200	200	....do	64
6	10.10 a. m.	80	54	200	150	....do	16
6	11.20 a. m.	81	55	200	200	....do	21
6	4.40 p. m.	77	58	150	150	....do	20
6	7.35 p. m.	64	55	200	200	... do	39
6	8.00 p. m.	64	55	300	300	... do	25
7	5.30 a. m.	52	54	200	100	....do	13
7	6.15 a. m.	52	54	125	125	....do	15
7	7.35 a. m.	57	55	110	110	....do	8
7	9.45 a. m.	78	55	200	200	....do	46
7	11.55 a. m.	87	56	150	150	....do	6
7	2.30 p. m.	92	57	125	125	....do	9
7	3.00 p. m.	92	57	50	50	....do	6
7	5.15 p. m.	88	58	275	275	....do	20
7	5.40 p. m.	73	58	100	100	....do	8
7	7.15 p. m.	66	56	130	130	....do	20
7	8.40 p. m.	65	54	250	200	....do	27
8	6.00 a. m.	48	54	175	175	....do	28
8	7.50 a. m.	50	54	200	150	....do	18
8	9.20 a. m.	70	56	160	160	....do	24
8	10.30 a. m.	74	56	125	125	....do	8
8	11.50 a. m.	87	57	115	115	....do	11
8	4.35 p. m.	82	58	50	50	....do	12
8	5.50 p. m.	80	57	50	25	....do	9
8	7.15 p. m.	68	54	150	150	....do	24
8	7.50 p. m.	66	54	300	200	....do	19

Table of temperatures taken at the United States salmon-breeding station, McCloud River, California, during the season of 1881.

Month.	Air. Shade. 7 a. m.	Shade. 3 p. m.	Shade. 7 p. m.	Sun. 3 p. m.	Water. 7 a. m.	Water. 3 p. m.	Water. 7 p. m.	Wind, 7 a. m.	Weather.
	°	°	°	°	°	°	°		
Apr. 16	49	55	....	....	57	51	....	SW.	Rain.
17	48	56	....	....	50	50	....	SW.	Do.
18	49	56	....	....	50	50	....	SW.	Do.
19	49	....	....	91	51	....	....	SW.	Clear.
20	49	57	....	92	50	50	....	....	
21	48	58	....	....	50	....	....	....	Rain p. m.
22	48	58	....	....	50	....	....	....	Showers.
23	49	57	....	....	49	49	....	....	Rain a. m.; clear p. m.
24	42	70	....	96	....	....	....	....	Clear.
25	43	74	....	100	50	51	....	....	Do.
26	53	79	....	104	51	53	....	S.	Do.
27	49	....	....	105	51	....	....	S.	Do.
28	54	85	....	110	52	56	....	S.	Do.
29	55	86	....	114	....	56	....	S.	Do.
30	55	....	....	....	52	....	....	S.	Do.
May 1	....	80	....	100	....	57	....	S.	Do.

Table of temperatures taken at the United States salmon-breeding station, &c.—Continued.

Month.	Air.				Water.			Wind, 7 a. m.	Weather.
	Shade.			Sun.					
	7 a. m.	3 p. m.	7 p. m.	3 p. m.	7 a. m.	3 p. m.	7 p. m.		
	°	°	°	°	°	°	°		
May 2	55	78	....	96	54	58	....	S.	Clear.
3	55	84	....	109	54	57	....	S.	Do.
4	53	79	....	81	54	55	....	S.	Rain through night.
5	56	80	....	96	54	....	....	S.	
6	60	78	....	104	52	54	....	S.	Clear.
7	56	....	....	....	52	52	....	S.	Rain.
8	59	68	....	....	53	55	....	S.	Heavy rain.
9	61	65	....	82	54	54	....	S.	Clear.
10	47	....	....	91	50	52	....	NW.	Do.
11	57	84	....	94	51	52	....	NW.	Do.
12	56	77	....	89	53	56	....	NW.	Do.
13	....	86	....	106	53	56	....	NW.	Do.
14	58	86	....	104	53	57	....	NW.	Do.
15	59	....	....	....	54	....	....	NW.	Do.
16	65	84	....	101	53	56	....	NW.	Do.
17	....	85	....	98	....	56	....	NW.	Do.
18	56	90	....	106	53	56	....	NW.	Do.
19	55	91	....	111	54	57	....	NW.	Do.
20	58	88	....	100	55	58	....	NW.	Do.
21	60	75	....	88	55	57	....	NW.	Cloudy.
22	60	60	....	90	55	57	....	S.	Clear.
23	51	72	....	....	52	54	....	NW.	Do.
24	51	79	....	91	52	55	....	SW.	Do.
25	57	86	....	101	52	56	....	NW.	Do.
26	57	80	....	82	54	56	....	NW.	Do.
27	54	81	....	52	53	54	....	NW.	Do.
28	51	....	....	....	52	....	....	NW.	Do.
29	....	85	....	100	....	56	....	SW.	Do.
30	60	69	....	....	53	54	....	....	Do.
31	61	79	....	105	52	57	....	....	Do.
June 1	63	84	....	109	55	58	....	SW.	Do.
2	62	85	....	102	56	59	....	SW.	Heavy rain; thunder.
3	63	67	....	....	56	56	....	SW.	Clear a. m.; rain p. m.
4	59	81	....	103	53	57	....	SW.	Heavy rain at night.
5	60	73	....	....	53	56	....	SW.	Clear.
6	61	66	....	....	53	55	....	SW.	Do.
7	53	66	....	....	52	53	....	S.	Do.
8	55	68	....	....	52	54	....	S.	Do.
9	....	77	....	97	54	55	....	NW.	Do.
10	61	68	....	....	....	55	....	S.	Do.
11	....	77	....	82	....	57	....	S.	Do.
12	....	84	....	101	....	58	....	NW.	Do.
13	62	80	....	....	54	59	....	....	Cloudy.
14	63	84	....	....	53	59	....	....	Clear.
15	63	84	64	108	54	59	56	....	
16	62	85	....	114	54	58	....	....	
17	....	86	66	109	....	59	56	N.	
18	65	81	....	94	55	59	....	S.	
19	....	70	66	93	....	59	....	S.	
20	60	75	65	94	55	58	57	S.	
21	64	82	68	108	54	58	57	NE.	
22	64	89	79	110	55	58	50	NE.	
23	61	91	....	103	55	....	....	....	
24	61	90	78	114	56	60	60	....	
25	64	94	....	116	57	60	....	....	Hazy.
26	68	96	80	124	57	61	60	....	
27	68	97	82	123	57	61½	61	NW.	
28	68	84	80	103	58	61½	61	SW.	
29	60	73	69	84	57	59	58	SW.	Clear.
30	53	74	70	89	55	60	57	SW.	Do.
July 1	54	79	74	106	55	57	57	SW.	Do.
2	52	72	64	92	55	57	56	SW.	Do.
3	....	90	71	110	....	57	57	NE.	Do.
4	58	95	....	122	55	59	....	NE.	Do.
5	55	94	84	117	55	60	59	SW.	Do.
6	54	87	74	111	56	60	58	SW.	Do.
7	62	84	77	105	55	58	58	NE.	Do.
8	62	78	77	97	55	57	56	SW.	Do.
9	53	80	74	102	53	58	58	SW.	Do.
10	....	91	81	115	56	60	59	NE.	Do.
11	72	93	81	116	56	60	60	NE.	Do.

XXII.—REPORT OF OPERATIONS AT THE UNITED STATES TROUT PONDS, McCLOUD RIVER, CALIFORNIA, FOR THE SEASON OF 1881.

By Livingston Stone.

Hon. Spencer F. Baird:

Sir: I beg leave to report as follows: At the date of my last report, December 31, 1880, everything at the trout-hatching station on the McCloud River appeared to predict an unusually prosperous season. No exertion had been spared to collect breeding fish for the ponds, and it is estimated that at the beginning of the year the ponds contained 3,000 very large breeding trout, none of which weighed less than a pound, while half of them weighed over five, and a few upwards of eight pounds. The average weight of the whole number was not less than three pounds. It was undoubtedly the finest collection of living trout in America, if not in the world. They would easily have yielded nearly a million eggs. But the bright promise of Christmas week was doomed to bring only disappointment and disaster. As I said, everything was favorable at that time. There had been no great rainfall up to the 1st of January, the trout were healthy and doing well, the water was good, the spawning time was close at hand, and the trout ponds seemed to be on the verge of a great success. But never were appearances more deceitful. In January it began to rain as it had never rained before in this region since white men came here. Four solid feet of water, lacking an inch, fell at Shasta City during this month, and here in the mountains the rainfall must have been much greater. The McCloud rose to an alarming height, but still no danger was apprehended at the trout ponds, because this station was built so far above the river, and no injury did come from the rise in the river. The mischief that was done proceeded from an entirely unexpected source, which well illustrates the fact that in a new country like this when trouble begins no one can tell what will come next.

The calamity that befell the trout, and it was a most serious one, was caused directly by *mud*, and only indirectly by water. The enormous volume of water poured down from the sky almost literally liquified the soil on the hill-sides, so that it actually flowed down into the valleys below. In some instances on a steep hill-side a whole acre of soil to an unknown depth, completely saturated with water, would in this way flow down into the gulch beneath.*

The effect on the creeks into which this enormous mass of earth descends is indescribable.

The first result is that the creek is completely dammed up by the avalanche. Now, if this were a dam of dry earth the creek would rise till it overflowed the crest of the dam, and then, cutting a channel over the top, it would finally wear a gap down through the dam to its own natural level. But in this case, instead of being dry earth, the dam is almost mud, and the water above it as it rises pushes this saturated mass before it instead of waiting to rise up over it, and mingles with it, the whole commingled mass then flowing down through the cañon to the river below.

What has just been described as happening to creeks generally when land-slides occur from an excessive rainfall is what actually occurred in the stream on which the United States trout ponds are built. The consequences to the ponds were terrible. The trout-pond station was built so far above the McCloud that the river could not reach it. It was also so guarded from high water in the creek that the floods could not reach it in that direction. But for this invasion of mud no provision had been made. It had not even been dreamed of, nor did the possibility of its occurring ever enter any one's mind until it came.

As the mass of mud rolled down the creek towards the ponds nothing could be done but to let it come into the ponds, because to shut off the mud would also shut off the water-supply from the trout, which would soon be fatal. On it came, increasing in volume till it began to fill the upper trout pond. In a very short time this pond was filled nearly to the top with mud, and then the men had to get into the pond and shovel out the mud. By the time this pond was excavated it was time

* These land-slides furnished a rude and rather novel method of determining what could be discovered in no other way, namely, the intervals at which great rains have fallen in past generations. It is as follows: The size of these land-avalanches corresponds very considerably with the amount of rainfall at the time the slide occurred. The greater the rainfall the larger the slides, so that when a very large slide is found we know that when the slide occurred there was a very large rainfall. Now, as vegetation begins very soon to cover a land-slide after it has subsided, it follows that the age of a slide occurring in past seasons can be approximated by ascertaining the age of the vegetable growth above it. For instance, if we find that a very large slide has occurred in some place we know that there must have been a very large rainfall the year that the slide moved, and if we find a tree a hundred years old growing on the slide we know that it must have been over a hundred years since the great rainfall came which made the slide.

A good illustration of this is furnished by the experience of Mr. J. B. Campbell, who found the remains of a very large land-slide on Town Creek, near Pittsburgh, about 10 miles from the fishery. The size of this slide indicated that when it occurred there must have been as great a flood as there was last winter. Now, there was a tree growing on this slide which on being felled was found to be two hundred years old. We know, therefore, that upwards of two hundred years ago there was a season when there was a very heavy rainfall.

to dig out the lower pond. No screens or nettings availed anything, for they became completely clogged up in a moment. This went on for eight nights and days, and so great was the accumulation of earth in the creek channel where the slide occurred that it was two weeks before the mud subsided so as not to require constant attention.

The direct mischief which it caused, of filling up the ponds, was bad enough, but the ulterior injury resulting from it was worse. This arose from the mud getting into the gills of the trout and producing an inflammation in them. Some were killed from it immediately, others survived for some weeks and even months, but succumbed at last. The total loss was very great, for when summer came there were not over a thousand fish left of the magnificent collection which the ponds contained in the fall. Those, however, which were left alive, on the 1st of June were all healthy, and no more deaths occurred after that time from inflamed gills.

During all this trying time of the floods, there were only four white men at the trout-pond station, and the labor and hardships entailed upon them were very great. These four men were Mr. Myron Green, Mr. Loren Green, Mr. Robert Radcliff, and Mr. George Hume. The energy and courage with which, for two weeks, in the solitude of these mountains and with the rain pouring down in more than torrents, they combatted with an enemy wholly unknown to them before, and which could neither be overcome nor successfully resisted, entitles them to a great deal of credit. They certainly showed no hesitation in encountering hardships and exposure which could not be expected of them for any mere pecuniary compensation.

By the end of the month of February the rainfall had very much decreased, and, though there were times when great vigilance and care were necessary, no serious trouble occurred after the 1st of March.

It so happened that the trout began to spawn just before the time of the highest water. The spawning season opened very auspiciously, and Mr. Myron Green, who had charge of the trout ponds, sent to the railroad station at Redding on the 26th of January 75,000 trout eggs for distribution at the East.*

At this time Pit River, 7 miles south of the trout ponds, was very high, though not quite impassable, and Mr. Green succeeded, at considerable risk, in getting the eggs across the Pit. By the time they reached the Little Sacramento at Reid's Ferry this river had become all but impassable, and no one could be found who was willing to venture to cross it. The eggs consequently lay there several days. In the meantime the floods had spread over the whole country, and the California Pacific Railroad for a hundred miles below Redding was more or less under water. The consequence was that the trout eggs spoiled in the crates long before they could be started on their eastern journey. I know

*These eggs were directed as follows: T. B. Ferguson, Baltimore, Md., 25,000; B. F. Shaw, Anamosa, Iowa, 25,000; N. K. Fairbanks, Geneva Lake, Wis., 25,000.

that some dissatisfaction was felt by the eastern consignees of these eggs, but if they could realize the difficulties which had to be encountered at the other end of the route in shipping the eggs they would not want to attach any blame to any one.

It was over three weeks before the waters had subsided sufficiently to allow the forwarding of any more trout eggs, and it was not till the 18th of February that Mr. Green succeeded in getting any through to Redding, Cal., which is the terminus of the California Pacific Railroad and the nearest railroad point to the McCloud River trout ponds. On the 18th of February 25,000 eggs were sent to Hon. B. B. Redding, secretary of the California Fish Commission at San Francisco. On the 19th 15,000 more were sent to Mr. Redding, and on the 23d of February 10,000 were forwarded to Mr. N. K. Fairbanks, of Chicago, Ill., and 10,000 to Mr. B. F. Shaw, of Anamosa, Iowa. From that time until May 1 Mr. Green continued at intervals to ship eggs to eastern points. There were still occasional washouts in various places on the overland roads, so that many of the eggs were sixteen or seventeen days making a journey of five, in consequence of which some lots were lost en route. On the other hand, where no delays occurred, the eggs went through in good order. There will be found appended to this report a memorandum of the distribution of trout eggs from this station.

There was one result of the land slides that made us a good deal of work, and this was that in many places portions of trails that we had built along the hill-sides slid away entirely, so that not a vestige of a path was left. This often happened where the slide itself was only a small one. There are fifteen miles of trails along the river that we keep in repair, and we had spent a good deal of time and labor upon them in order to facilitate the bringing in of the live trout that were caught for the ponds; and it was a work of no small magnitude to get these trails into good order again after the injuries caused by the rains.

When the rebuilding of the salmon fishery began, about the 1st of June, most of the trout-pond force came down to the salmon-hatching station to assist in the work there, only one or two men remaining at the trout ponds, and their time was chiefly occupied in taking care of the breeding trout, in capturing wild ones, and in making general repairs and improvements about the place. The condition of the trout continued to improve throughout the summer, and on the 1st of September they were all in splendid condition. I may add here that their food in winter is mostly beef, venison, and dried salmon. In summer it is chiefly boiled salmon, with beef and venison, often enough to keep them in good condition.

I mentioned in my report on the salmon-hatching station that during a short period in July and in August, a large number of salmon in the McCloud River died of a mysterious disease. A good deal of alarm was felt when it was reported one morning that the disease had extended to the trout in the river, and that they also were dying like the salmon. The alarm was a very short-lived one, however, for the mortality among the trout only lasted a few days, and it was found upon investigation that only a very few trout died, and it is quite possible that these were made sick by feeding on the salmon that had died of the disease. No trout in the ponds were affected by the sickness at all, which showed at least that the cause of the mortality among the trout, whatever it was, did not extend up into the creeks.

After the season closed at the salmon-breeding station in October, the fishing for parent trout was vigorously prosecuted, and much hard work was done in repairing the trails and catching and bringing to the ponds live trout, which had to be carried in some instances several miles.

The winter's wood was also cut and brought in, and on the ditch which takes the water from the creek to the trout ponds a deep pond was sunk a short distance above the trout ponds, to catch the mud that is brought down by the water in the ditch.

No great rains fell during the fall up to the present writing (December 31). The river had not risen to any considerable extent except once, when it was 4 or 5 feet above the summer level. The breeding trout at present in the ponds are looking well, and unless there is an excessive rainfall like that of last winter there seems to be no reason why we should not take several hundred thousand eggs during the next spawning season, the beginning of which now appears to be close at hand.

Table showing the distribution of California trout (Salmo iridea) eggs from the McCloud River station in 1881.

1881.			
Jan.	26.	T. B. Ferguson, Maryland	25,000
	26.	B. F. Shaw, Iowa	25,000
	26.	N. K. Fairbanks, Illinois	25,000
Feb.	18.	B. B. Redding, California	25,000
	19.	B. B. Redding, California	15,000
	25.	N. K. Fairbanks, Illinois	10,000
	25.	B. F. Shaw, Iowa	10,000
March	4.	S. Webber, New Hampshire	4,000
	14.	T. B. Ferguson, Maryland	700
	31.	T. B. Ferguson, Maryland	10,000
April	7.	T. B. Ferguson, Maryland	700
	16.	J. G. Portman, Michigan	6,000
	16.	R. O. Sweeney, Minnesota	8,000
	29.	Philo Dunning, Wisconsin	5,000
	29.	William Griffith, Kentucky	5,000
	29.	J. P. Creveling, Pennsylvania	5,000
	29.	Eugene G. Blackford, New York	500
Total			179,900

XXIII.—REPORT ON THE PROPAGATION OF PENOBSCOT SALMON IN 1881-'82.

By Charles G. Atkins.

The routine work of the season went on with so little novelty that there is not much to report beyond the summaries of work accomplished.

It has been the ordinary practice to defer the purchase of salmon until the market price has declined to about twenty-five cents per pound. This generally happens from June 1 to 10, depending mainly on the supply of salmon from Canadian rivers.

This year the first salmon were received June 1, and the last July 2, the supply coming from the same parties and the transfer being in the same hands as the previous year. The total number bought was 514; 5 of them died in transit, and 509 were deposited in apparently good condition in the inclosure. They were of uncommonly large size, the average being 16.55 pounds, as estimated by Mr. Whitmore—doubtless a very close approximation to the actual weight. This is the largest average that has occurred since the propagation of Penobscot salmon began, in 1871. It is thought by the fishermen to be the highest within their experience. The next highest since 1870 was the season of 1874, when the average of those purchased reached 14.03 pounds. Another phenomenon worthy of notice is the fact that the average size of the fish was as great during the last days of purchase as during the earliest. The ordinary experience of fishermen is that the mean weight of the fish decreases from the beginning to the end of the season.

The mortality in the inclosure was this year remarkable, 146 being found dead. No progress has been made toward a discovery of the cause. The symptoms were, as befoie, an opacity of the eyes, (accompanied, doubtless, by total blindness), subsequent protrusion and bursting of the eye, and, soon after this, of the fish. Ninety-six per cent. of these deaths occurred in June and July. This agrees with previous experience, which teaches us to expect the survival of nearly all those that reach the month of August alive. The greatest heat of the water generally occurs in August. This year the averages were as follows: from May 19 to 31, 57.8° F.; June 1 to 30, 59.4° F.; July 1 to 31, 63.5° F.; August 1 to 31, 63.7° F.; September 1 to 30, 59° F.; October 1 to 31, 45.8° F. The highest temperature noted was 73° F., August 6. The mean for the first eight days of August was 70.9° F. These averages are based on observations made exclusively in the morning, from 5 to 7 o'clock, generally precisely at 6. Midday temperatures were undoubtedly higher.

The recapture of the salmon in October was successfully accomplished, but four fish eluding us; 358 of both sexes were manipulated, 232 females and 126 males. The females (135 were measured) averaged 33.37 inches in length; 15.67 pounds in weight before spawning, 11.85 pounds after spawning. The males (71 were measured) had a mean length of 34.8 inches and a mean weight of 13.6 pounds. There were obtained 515 pounds of spawn, counting as afterwards ascertained, 2,693,009 eggs. The average yield was 11,608 eggs from each female. As compared with former experience, these means are all much higher, indicating the accuracy of the estimate of weight made when the salmon were purchased. The first eggs were taken October 26, the last November 17.

At the hatching we had, previous to this season, used water directly from the brook, tapping it within 50 feet of the house. The original supply is from "Craig's Pond," a very pure natural lakelet as cold as ordinary lakes in this latitude. But a few hundred feet above the hatchery it receives the waters of some copious springs which have the effect of maintaining a high temperature in the lower part of the brook during the early part of the winter, and thereby forcing the eggs into early development. In 1879 and 1880 we were forced to pack and ship the most forward lots of spawn early in December—a very inconvenient date—and all of them were ready for shipment earlier than it is supposed would be best for the young fish, if hatched in northern localities. In the winter of 1880–'81 a temporary hatchery was constructed on the brook above the point where the springs enter, to retard the development of a portion of the spawn, and served an excellent purpose, although it was in many respects unsatisfactory. It appeared on the whole advisable to conduct a supply of cold water into the main hatchery, and an aqueduct was projected, tapping the brook above the springs. This was executed in August and September, 1881. It was built of cement mortar, laid around a wooden core four and a half inches in diameter, the core being drawn ahead as fast as the cement set. It is believed to be practically permanent, being laid at the bottom of a trench below the reach of frost. It is about 1,600 feet long, and cost $737.30. In the hatchery we have, therefore, a choice, during late fall and early winter, between warm and very cold water.

In 1881 the spawn was kept at first wholly in the aqueduct water, which had a mean temperature through November of 40.7° F., and through December of 35.2° F. The brook, meanwhile, had a temperature of 47.4° F. in November and 41° F. in December. The lower temperature of the former enabled us to hold back the earliest eggs until the middle of January, more than a month later than in 1880.

The first shipments were made January 16, 1882, and to suit the convenience of consignees the last of them were held until March 13. The eggs were, as usual, packed in wet moss, inclosed in dry leaves or chaff, and forwarded by express.

The eggs rejected for lack of impregnation numbered 50,550; those rejected for whiteness, from time to time through the season, numbered 28,459; I suppose that 20 per cent of the latter may have been impregnated; and this gives us 56,242 as the whole number of eggs that failed of impregnation, being 2.2 per cent of those taken from the fish—surely a very satisfactory result.

The eggs remaining at time of shipment, measured out in tin cans, amounted to 2,614,000; if to these we add those rejected, we obtain 2,693,009 as the original number taken from the fish.

Divided pro rata among the parties supporting the establishment, the eggs were assigned as follows:

To the United States	1,006,500
To Maine	1,147,000
To Massachusetts	286,000
To Connecticut	172,000
Total shipped	2,611,500

The transfer of all those eggs was accomplished with a loss of but 1,739, of which the greater number were probably unimpregnated eggs that escaped the scrutiny given to the spawn before shipment. The hatching was also attended with excellent success at nearly all points, and as the net result of the year's work there were planted in the waters of the country 2,397,132 salmon fry, as shown in detail in Table III.

TABLE I.—*Schedule of breeding salmon bought at the Bucksport-Orland establishment*, 1881.

Date.	Number of salmon received.	Aggregate weight.	Average weight.
1881.		*Pounds.*	*Pounds.*
June 1	18	297	16.50
2	19	277	14.62
3	44	694.2	15.80
4	42	707.4	16.84
6	35	621.2	18.03
7	22	347.6	15.80
8	33	537.1	16.28
10	12	176.7	14.72
11	20	271	13.55
13	15	214	14.27
14	13	252	19.38
15	19	259	13.63
16	30	494.6	16.49
17	17	285	16.76
18	21	355	17.85
20	36	596	16.56
23	18	296	16.44
25	23	425	18.48
27	20	339.5	16.97
29	30	563.3	18.77
July 2	17	312	18.35
11	10	182.7	18.27
Total	514	8,503.3	16.55

TABLE II.—*Transfer of Penobscot salmon eggs from Orland, Me.*, 1882.

Date.	Consignee.	Address.	Final Destination.	No. of cases.	Number of eggs. Belonging to States.	Number of eggs. Belonging to United States.	Number of eggs. Total.	Date of unpacking.	Condition on unpacking.	No. eggs dead.
1882.										
Jan. 16	A. H. Powers	Plymouth, N. H	Plymouth, N. H	1	80,000		80,000	Jan. 18	"Good"	39
16	E. A. Brackett	Winchester, Mass	Winchester, Mass	1	40,000		40,000		"Good"	339
16	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	80,000		80,000	Jan. 18	"Good"	17
19	E. G. Blackford	New York, N. Y	Roslyn, N. Y	2		120,000	120,000	Jan. 29	"Excellent"	144
23	H. J. Fenton	Windsor, Conn	Poquonock, Conn	2		95,000	95,000	Jan. 26	"Good"	26
23	E. J. Anderson	Bloombury, N. J	Bloomsbury, N. J	2		95,000	95,000	Jan. 26	"Good"	8
23	E. G. Blackford	New York, N. Y	Roslyn, N. Y	1		80,000	80,000	Feb. 5	"Excellent"	37
25	Chas. G. Atkins	Grand Lake Stream, Me	Grand Lake Stream, Me	1	20,000		20,000	Jan. 30	"Excellent"	23
Feb. 8	do	do	do	3	130,000	50,000	180,000	Feb. 12	"Good"	3
9	E. G. Blackford	New York, N. Y	Roslyn, N. Y	1		37,500	37,500	Feb. 19	"Excellent"	93
9	A. H. Powers	Plymouth, N. H	Plymouth, N. H	3	80,000	95,000	175,000	Feb. 11	"A No. 1"	145
9	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	85,000		85,000	Feb. 14	"Good"	86
13	E. G. Blackford	New York, N. Y	Roslyn, N. Y	1		50,000	50,000	Feb. 19	"Excellent"	115
13	Dr. R. O. Sweeny	Saint Paul, Minn	Saint Paul, Minn	3		200,000	200,000	Feb. 19	"Good"	51
13	Seth Weeks	Corry, Pa	Corry, Pa	2		100,000	100,000	Feb. 17	"Good"	62
14	O. A. Dennen	Mount Kineo, Me	Mount Kineo, Me	3	200,000		200,000	Feb. 17	"Good in fine condition"	50
14	A. H. Powers	Plymouth, N. H	Plymouth, N. H	1	70,000		70,000	Feb. 15	"Good"	250
15	F. C. Hewey	Rangely, Me	Rangely, Me	3	200,000		200,000	Feb. 20	"Very good"	15
15	J. R. Dillingham	Songo Lock, Naples, Me	Songo Lock	2	100,000		100,000	Feb. 19	"Good"	12
16	Ellis Hanscom	Machias, Me	Machias, Me	1	30,000		30,000	Feb. 21	"Good"	16
16	D. H. Harmon	Norway, Me	Norway, Me	2	100,000		100,000	Feb. 18	"Good"	54
21	A. J. Darling	Enfield, Me	Enfield, Me	5	300,000		300,000	Feb. 22	"Good"	25
Mar. 7	Chas. G. Atkins	Grand Lake Stream, Me	Grand Lake Stream, Me	1	67,000		67,000	Mar. 11	"Good"	17
7	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	7,000		7,000	Mar. 9	"Good"	2
7	A. H. Powers	Plymouth, N. H	Plymouth, N. H	1	16,000		16,000	Mar. 8	"Good"	10
13	S. F. Baird	Washington, D. C	Wytheville, Va	1		27,000	27,000	Mar. 18	"First class"	13
13	E. G. Blackford	New York, N. Y	Roslyn, N. Y	1		57,000	57,000	Mar. 17	"Excellent"	87
			Total	47	1,605,000	1,006,500	2,611,500			1,739

TABLE III.—*Planting of Penobscot salmon fry reared from eggs gathered in* 1881.

State.	Where hatched.	Water stocked.	Tributaries in which fry were placed.	Locality of deposit.	Date of transfer.	Number of fish set free.
Connecticut	Poquonock	Mill River		Southport, Fairfield County		10,000
		Connecticut River	West Branch Farmington River	Riverton		255,439
Maine	Enfield	Penobscot River	Cold Stream	Enfield	June 10	10,000
		do	do	do	June 11	20,000
		do	do	do	June 15	30,000
		do	Mattawamkeag River	Danforth	June 13	40,000
		do	do	do	June 14	40,000
		do	do	do	June 15	55,000
		do	do	Bancroft	June 16	40,000
		do	do	do	June 19	40,000
		do	Main River	Lincoln	June 20	22,000
	Grand Lake Stream	Saint Croix River	Grand Lake	Hinkley, Washington County	May 22, 30	266,214
	Machias	Machias River	Brooks and streams	Near Machias	June —	29,800
	Mount Kineo	Kennebec River	Moosehead Lake and tributaries.		June —	198,000
	Naples	Presumpscot River	Tributaries Sebago Lake	Cumberland County	May —	30,000
	Norway	do	Crooked River	Ryefield Bridge	May —	40,000
		do	do	Steep Falls	May —	58,919
	Rangely	Androscoggin River	Kennebago and Rangely streams	Rangely, Franklin County	June 15	194,600
Massachusetts	Winchester	Merrimac River	Nashua River			36,000
New Hampshire	Plymouth	do	Pemigewasset River			334,302
Minnesota	Saint Paul	Saint Louis River		Fond du Lac	Apr. 27	70,000
		do		do	May 3	70,000
		do		do	May 10	59,750
New York	Roslyn	Hudson River	Carr's Brook	Warren County		35,000
		do	Balm of Gilead Brook	do		40,000
		do	Glen Brook	do		50,000
		do	Ramont Brook	do		45,000
		do	Gulf Brook, &c			55,000
		Salmon River	Beaver-dam Brook	Oneida County		25,000
		do	Trout Brook	do		20,000
		Clapham's Brook		Glen Head, L. I		10,500
		Stream tributary to South Bay.		Long Island		1,000
Pennsylvania		Delaware River	Marshall's Creek	Near Shawnee, Monroe County	Apr. 22	30,000
		do	do	do	Apr. 24	30,000
		do	do	do	Apr. 25	32,417

XXIV.—REPORT ON THE PROPAGATION OF SCHOODIC SALMON IN 1881-'82.

By CHARLES G. ATKINS.

1.—PREPARATIONS.

Hatchery No. 3 was the principal scene of activity during August, September, and October, 1881. The location of this hatchery is an exceedingly favorable one, and it is a matter of regret that the facilities existing at this spot were not discovered at the initiation of the establishment. The ground was, in its original condition, heavily strewn with bowlders, large and small, and beneath them were interstices through which the water of the spring stole away in such a manner as to give the impression that the supply was not only small but inconstant. It was only after the tangled maze of shrubs was torn away and part of the surface earth removed that the permanent character of the spring could be observed. Meanwhile three other sites had been occupied, and the main part of the work of developing the spawn and hatching the reserve had been for years carried on at great disadvantage with an inadequate supply of water (spring water at that), no facilities for aeration, and a liability to occasional flooding by rains. I make no doubt that all the serious losses which during the early years occasionally befell the stocks of eggs in development and transportation might have been avoided had we then possessed the facilities of hatchery No. 3. Among the minor disadvantages which we might have escaped may be mentioned the labor and risk of carrying the eggs by hand from the fishing grounds over half a mile of rough road, often by night; the difficulty of guarding well the property so far out of sight and hearing; and the many weary days spent by Mr. Munson in the transfer of the young fish from the house to the stream in the month of June, amid tormenting clouds of mosquitoes and black flies. The new hatchery is at the head of a small cove that indents the west shore of Grand Lake within a few rods of its outlet, and not over 20 feet from the water's edge when the lake is full, as is always the case in June. The fish cans are taken in a boat, and easily rowed to the place of liberation, with great economy of time and effort. The fishing and spawning ground is not over 300 feet distant and almost in sight. Within stone's-throw, an excellent site for the superintendent's house has been secured, and will be occupied another season, so that the premises will always be under surveillance. The surface of the ground presents a steep incline, of which advantage has been taken to arrange the floors of the hatchery in a descending series, with a total difference in elevation of about 11 feet. The water is introduced upon the highest of the six floors devoted to the development of the embryos, with ample room for aeration and reaeration at each plunge. The latter circumstance atones for the small minimum volume (9 gallons per minute was the lowest observed this season), and in part for the fact that it is wholly spring water. The volume is least from August to early March, after which the spring rains and the melting of the snows produce so great an augmentation that there is a great surplus during all the season of hatching the reserved spawn and growing the alevins. The minimum volume can be augmented by the introduction of water from other, not very distant, springs.

This house was founded in haste, in December, 1880, and was at first only 30 feet long and 20 wide, but this season we have added wings that increase the floor area to about 1,500 square feet. The floors have all been cemented, and the foundation walls, of massive masonry carried up to a height of from 1 to 8 feet above the ground. Cement pipes were laid to introduce the water from the principal spring, and an aqueduct, partly of bored logs and partly of assorted gravel, brings in the water from another spring 600 feet distant. This will henceforth be the headquarters of the establishment. Here the eggs will be packed for shipment, and the reserve hatched. Here will be the storerooms and workshops.

The fixtures for the development of the eggs are similar to those in use at the other houses and also at the Penobscot establishment. Plain wooden troughs are furnished with movable frames in which the egg-trays are arranged in tiers ten deep, with provision for change of water by a horizontal current. A single new feature has been introduced in the method of aeration. Two troughs are placed side by side and the water allowed to pour from one to the other nearly the whole length, exposing a very broad and thin current to the action of the air, and increasing the opportunity of aeration probably twenty-fold over that afforded by a connecting open spout 6 inches wide. In a rough way it may be estimated that by the repeated use of this arrangement in the new house a gallon of water there is fully equal in efficiency to five gallons in hatchery No. 1.

No change has been made in the location of the fishing ground or the fixtures and appliances pertaining to the work of spawning, except trifling alterations in the form and proportions of the inclosures.

2.—FISHING AND SPAWNING.

The spring fishing of 1881 was much better than usual, both as regards the numbers and size of the fish taken. Through the summer there was more rain than usual, and in August and September the lake and the stream were higher than any year since 1875. A sudden rise of water, owing to copious rains in August, 1880, had been followed by an abundance of fish in the stream early in September. The high water of 1881 did not have the same effect on the fish, scarcely any salmon entering the stream till after the middle of September. The inference naturally suggested is that the condition of the stream favorable to a late summer or early fall run of salmon is not so much a high stage of water as a sudden rise; but the phenomena observed are hardly sufficient for confident generalization. Moreover, during ten days in August the gates at the dam were closed for certain repairs on a dam at Calais, and meanwhile the flow of water was confined to that entering the canal. From August 3 to September 10 there was a fall of 5½ inches, and from September 10 to October 29 a further fall of 15½ inches; November 5, a rise of 2 inches, owing to rains on the two preceding days; and after that date there was neither rise nor fall until December.

The usual nets were placed across the stream and canal about the middle of September, but no preparations for the capture of the salmon were made until October 29, when it was observed that the most forward of them had begun to form their ridds above our nets. On the night of October 31 the capture of fish began. The manipulation was delayed until November 8, when some hundreds of salmon had been collected, and a part of them exhibited great uneasiness, a few actually beginning to spawn in the inclosures. The work proceeded as usual until November 19, when all the salmon taken had been deprived of their spawn, and the almost entire cessation of the catch told that the season was at a close.

An accident during the work of spawning confused the different lots of fish so that the number taken from day to day cannot be stated with the usual accuracy, but the tally-book shows exactly the number of females that were manipulated, and enables me to make an estimate of the total number of males, which, I am very confident, is within 15 of the true number. According to these estimates there were taken 652 female salmon, 370 males, and one of unknown sex—total, 1,023. There were 621 females that yielded spawn, and the eggs obtained from them are estimated at 947,000, being an average of 1,525 eggs from each female.

3.—Shipment of spawn.

The development of the eggs intended for earliest shipment was carried on in hatchery No. 3, the remainder being kept in the colder water of No. 2. It is from the latter that the reserve is always selected, since the retardation of their development will bring them out in the spring much nearer the natural date than if developed in the warmer water.

The shipment of eggs began January 12 and closed March 1. The losses up to the time of the division of the eggs, when they were either shipped or set aside for the reserve, aggregated 87,091, of which 62,159 are known to have been unimpregnated eggs. From this we may fix the proportion impregnated at 92.9 per cent. Total losses before division $9\frac{2}{10}$ per cent,—about the ordinary rate.

The eggs were shipped in the customary method—packed in wet moss, inclosed in dry moss—and sent down to Princeton, 12 miles distant, in the afternoon; thence by stage 28½ miles to Forest Station, the next forenoon; this part of the journey occupying about 5½ hours, during which the cases of eggs were exposed, with little or no protection, to the wintry blasts.

Excellent success attended the transportation, with a single exception. A case containing 32,000 eggs, addressed to Mr. Brackett, at Winchester, Mass., packed in an experimental manner, which proved to be less efficient than our ordinary mode, was partly frozen on the way, and 8,000 eggs lost. The temperature of the air at the time this package started on its 28½-mile ride in the open air was 20 degrees below zero. In 22 other packages (including all save three, which were not reported on), the entire number of dead eggs on unpacking was reported at 1,806, being three-tenths of one per cent., or three in one thousand.

An attempt was made to economize in bulk, and thereby in freight charges, by the use of asbestos felt in place of moss, but it was found that bulk for bulk it was in no wise superior, while at the same time it was far heavier and more costly. The experiments tried in this connection gave results indicating that, considering only the question of bulk, the best material to save from freezing was wet moss; but if the weight and consequent freight charges be taken into account then the best material is dry moss, which is exceedingly light and as efficient as an equal thickness of asbestos felt or building-paper.

The division of the spawn available for shipment, pro rata with the contributions made by the several parties, was as follows:

United States received	311,750
Maine received	64,500
Massachusetts received	107,500
Connecticut received	107,500
New Hampshire received	53,750

The distribution of the share of the United States will be seen in detail by referring to the subjoined schedule of shipments of eggs.

The hatching of spawn retained (215,000) was accomplished with the insignificant loss of 212 eggs, and of the young fish but 1,691 died; 213,097 young fish were planted in Grand Lake, scattered along shore as usual.

The hatching of the transported eggs and the planting of the young fish were in most instances accomplished with less than the usual mortality. A schedule is subjoined showing the details of the planting.

4.—Extracts from diary.

Grand Lake Stream, *August* 3, 1881.—The season has been very rainy here. The lake stands at 3 feet 11 inches on our gauge. The water still covers our spawning-house floor, and in hatchery No. 2 it is still several inches above the tops of the troughs. Five gates are open and a great volume passing off, yet Munson thinks the water has been rising lately. The total volume of water now flowing in hatchery No. 1 is 28.6 gallons per minute. In hatchery No. 3 [only one aqueduct was then in operation] the volume is 9.6 gallons per minute. Temperatures of water observed to-day: At hatchery No. 1, 46½° F.; at hatchery No. 3, 53½° F. [the water here is open to sun outside the building]; at Grand Lake, at surface, near dam, 72½° F.

Munson says that the fish hatched out this year were by far the best he ever hatched, stronger and more active. All visitors admired them. None of the fry were planted this year below the dam. They were scattered along the shores of the lake as far as Munson's Island. A number, estimated to have been about 2,000, were taken in a can with six or eight gallons of water, and in turning them out a canful would stretch along several rods of shore.

Both Forbes and Munson testify to the abundance of the young of Schoodic salmon below the dam this year. They often followed and seized the hook intended for large fish. The fishing at the regular season (May and June) this year was excellent. Munson says they took very fine fish and a good many of them, and the fishermen were well satisfied.

September 10, 1881.—Arrived from Bucksport on 9th via Big Lake. The lakes are high, but I hardly think Grand Lake is any higher than in 1875, when, I remember, we used to run canoes down through the sluice-gate of the dam without touching. It stands now on our gauge at 3 feet 5½ inches, with a very light northerly wind. This, it appears, is 5½ inches lower than on August 3. It is now 1 inch below our spawning-house floor. It is 1 foot 7¼ inches higher than November 7, 1880. For about ten days in August the gates were all closed on account of the bursting of the Union dam in Calais. The rest of the time there have been five gates open. The water is believed to be now falling rapidly. In Big Lake the water is very high, there being but two gates open at Princeton.

None of our nets have been put into the water yet, it appearing to Mr. Munson to be unnecessary, because the fish have not come until within a few days. None were caught until Mr. Ferguson's arrival, on the 9th, when he took one. Crossing the bridge on the 9th I saw five of the salmon under the bark-mill. Mr. Ferguson also took two to-day, one just below the dam and one at Big Falls. I have seen several leap above the dam.

October 6.—Third visit to Grand Lake Stream. The nets to intercept the fish in their descent have been in place since the middle of September. Work on the extension and the foundation of hatchery No. 3 is going rapidly forward.

October 26.—Arrived from Bucksport about 11 a. m. The addition to hatchery No. 3 is nearly finished; cement floors all hard. The stream house (hatchery No. 2) has been put in order for eggs.

October 29.—We put in some of the pound nets to-day. Fish are beginning to spawn above our nets.

October 31.—To-day we put in the second pound, and are now prepared to capture fish.

November 1.—A good many fish ran into pound 2, and were driven through into the large pound. Munson estimates them at 175 at 9 p. m.—say 30 more in the morning. About 40 fish driven in this evening. Very few salmon have got past our nets into either canal or stream.

November 2.—A pretty good run of fish this morning. Munson found in the pound what he called a female sea salmon of 12 pounds weight (afterwards found to be 36 inches long, and probably heavier than this estimate). At 10 a. m. I saw a male sea salmon also within our inclosures.

November 5.—There were good runs of fish on nights of November 2 and 3. Last night about 15 salmon came in before 9 o'clock, and during the remainder of the night a very large school. Yesterday and the day before were rainy, and it cleared at 7 last evening.

November 7.—A good run of fish every night; last two nights less than a hundred each, we judge.

November 8.—To-day we begin the taking of spawn. All the fish captured prior to this date are gathered in a single large inclosure. From this stock we to-day manipulated 591 Schoodic salmon, 210 being males, 192 unripe females, 166 ripe females, and 13 spent females. The predominance of females at so early a date indicates that the majority of the salmon we shall catch have already entered our inclosures. It is usual to take a larger number of males until the season is well advanced, the later catches being mostly of females. The large number of unripe females taken indicates that the delay in beginning manipulation was judicious. Thirty of the females spawned (=18 per cent) yielded some defective eggs, commonly but very few each. This includes only such eggs as bore some visual sign of imperfection. In most cases they were chalky-white in color; in some there were only small white spots. In others there was the color and transparency of good eggs, but the yelks were collapsed and rolled together. This phenomenon has always been present with the Schoodic salmon, but no exact record made of the matter before. Besides the Schoodic salmon we handled to-day 2 sea salmon and 11 small togue (*Salmo* (*Cristivomer*) *namaycush*). The sea salmon were 1 female 36 inches long, gravid, and 1 male 31½ inches long. The togue ranged in length from 17 to 21 inches, being, apparently, all spent fish. The eggs taken to-day (235,000) are placed in hatchery No. 1.

November 11.—Spawning proceeds daily. There are more togue than usual, among the salmon; 22 of them were found to-day, all small. One salmon found to-day whose sex could not be distinguished. It measured 16 inches in length.

November 13.—First snow of the season last night—a mere trace. The temperature of the lake has fallen since November 4 from 49 to 41. Spawning still continues. No large runs of salmon; on night of 11th and 12th only 25 in all. Yesterday we began to put eggs into the stream house, hatchery No. 2.

November 14.—Two nights have brought in but 50 salmon. It appears that the season is drawing to a close.

November 19.—The last day of spawning. We had but 27 gravid females on hand this morning. Twenty of them yielded spawn, and they, with the 7 remaining unripe, were placed in the final inclosure, whence they are to be taken up the lake and liberated. The work of transportation begins to-day.

November 21.—The transportation of fish concluded to-day, and part of the inclosures taken from the water. The main nets are left in place for some days, to prevent the fish that have been turned loose descending the canal and stream, which many of them (perhaps 20 per cent.) attempt to do immediately after they are set free, notwithstanding they are freed one or two miles up the lake. Two inches of snow on the night of 19th. All the eggs deposited in hatchery No. 1 are transferred to No. 3, the latter, with No. 2, having ample accommodations for them.

November 22.—Returned to Bucksport, leaving everything in charge of Mr. Munson.

January 11, 1882.—Arrived from Bucksport at 8.20 p. m.

January 12.—To-day I find at hatchery No. 3 that the west aqueduct is delivering 20 gallons of water per minute, and the south aqueduct 10 gallons. Munson says the volume has been about the same all the winter, except immediately after heavy rains, when it was greater. We have now 485,000 eggs in the new hatchery, and 200,000 additional will be immediately brought up from the river house to hasten their development, so that they may be ready for shipment before March. Munson thinks the rate of impregnation is better than usual this year. We took a tray of lot 1 (earliest eggs), picked out 110 contiguous eggs, and found only 5 of them unimpregnated.

January 13.—Transferred 200,000 eggs from No. 2 to No. 3. These have been in very cold water, averaging a little less than 34° since they were put in the troughs in November, and their eyes are not yet formed.

January 17.—This p. m. Munson picked the unfertilized from six stacks of eggs (120,000 nearly) in two hours forty-seven minutes. He took out 6,700 white eggs, being at the rate of $40\frac{1}{8}$ eggs per minute, no allowance being made for moving stacks back and forth, shifting trays, &c. Such speedy work can only be accomplished by a practiced hand. The unfertilized have been induced to turn white by previous agitation. To attempt to remove them while retaining their natural color would be tedious and uncertain.

January 18.—To-day we began shipment of spawn, sending 60,000 to E. A. Brackett, Winchester, Mass., and 50,000 to H. J. Fenton, Windsor, Conn. The outer packing of both cases was dry moss. While packing I observed that not all of the unimpregnated eggs had been removed, and there were some impregnated that were not healthy, small embryos and irregular development. I saw three or four bursted eggs. Now I cannot think that these defects are owing to any fault in our management. The inside moss in part of our boxes was rather drier than ordinary, and I think that all or most of these went to Fenton. (Both packages arrived at their destinations in good order. Mr. Brackett reported condition "excellent." Mr. Fenton said, "good, except some indented." Dead on unpacking in latter lot, 47; subsequent losses, light.)

January 23.—Shipped another lot of eggs (32,000) to Mr. Brackett. I had a case made on purpose for it, intending to have a space of 2 inches all around for outside packing, but by mistake it was made so shoal as to leave but $1\frac{1}{4}$ inch above and below. I lined it with two thicknesses of asbestos roofing felt on all sides and packed the remaining space with the ordinary dry moss. The case is of half inch pine. The felt used was about $3\frac{1}{2}$ pounds. (Without laps there would have been needed only $2\frac{1}{2}$ pounds.) It costs in Boston 20 cents per pound—here, about 22 cents. It weighs about 1 pound per square yard, and its cost can be put at $2\frac{1}{2}$ cents per square foot. The package weighed, in detail, as follows:

	Lbs.	Oz.	Lbs.	Oz.
3 boxes eggs packed in wet moss	40	9		
Cover, side cleats, and nails	1	7		
Total of inner package			42	0
Moss	6	9		
Asbestos felt	3	8		
Case	20	4		
Total of envelope			30	5
Total of entire package			72	5

A package with a protecting envelope of dry moss one inch thicker than the above on all sides would weigh about 3 pounds 14 ounces more. Supposing the two modes equally efficient in protecting against cold, we save near 4 pounds weight, and corresponding amount on freight by an outlay of 77 cents for asbestos and the trouble of lining the cases with it. I believe this will hardly pay. [Subsequent experiments showed that not even the above economy of space would be effected by the use of asbestos felt, its resistance to the escape of heat being not much, if any, greater than that of an equal thickness of moss alone.] Temperature of air at 7 a. m., 0° F. It has been below zero on six mornings this month previous to this date, and once in December.

January 25.—Cold weather has shrunk the volume of water at the hatchery from 30 to 20 gallons within two weeks.

January 27.—This morning we had a smart rain for several hours; yesterday a thaw. No material change in the volume of water in the hatching-house. Grand Lake is rising; the water is just beginning to flow on our spawning-house floor.

January 28.—Mr. Brackett writes that the case of eggs sent him on 23d arrived at Winchester, Mass., on evening of 25th, and on unpacking next morning were found to be "frozen through and through, with the possible exception of a small space in the center." [But this proved to be an exaggerated statement, the actual loss being 8,000 eggs out of 32,000.] These eggs went down to Princeton on stage on 23d. Next morning, with the temperature of the air at 20° F. below zero, and a high wind, they went to Forest on the stage, a drive of five and one-half hours, thence to Boston by rail in a car warmed by a stove. Doubtless the freezing was accomplished before the package reached the railroad. This was the first instance of the kind that has occurred since this establishment was organized. Probably the protecting power of asbestos felt is less than I supposed.

February 2, 1882.—*Experiment with packing materials.*—Last night I took a box made out of an old packing-tray, 12 inches long, 9 wide, and 3¼ deep; ends one-half inch thick; top and bottom about one-fourth of an inch; all pine, joints open, construction loose. On the bottom I put 4 thicknesses of asbestos felt, then a board one-fourth of an inch thick; then I filled it with wet moss, just such as we use in packing eggs, and pressed it in hard with my hands; then put on another quarter-inch board, and finally the cover. This was put together in our shop, temperature 50° or 60° F. The moss was from the moss storeroom, the temperature of which is from 35° to 40° F. About 9 p. m. this box was put out of doors on our shop platform, stood on end, and there allowed to remain till 7 a. m. I then took it in and opened it. The out-door temperature at 6 p. m. was +8° F; at 7 a. m. it was +18° F. On opening the box I found the moss frozen nine thirty-seconds of an inch on the bottom (the felted side). On the top (the board side) twelve thirty-seconds of an inch, on the side without either board or felt, three-fourths of an inch. Reckoning from the inside of the cover, the penetration of the frost was, through felt and board and moss, about twenty-five thirty-seconds of an inch; through board and moss, twenty thirty-seconds of an inch; through moss alone, on narrow side, twenty-four thirty-seconds of an inch; in the latter case had the side been broader I think the frost would not have penetrated so far.

[Other experiments with packing materials were tried February 4, and the results may be stated with tolerable accuracy, thus: Asbestos felt and common building paper vary very little in conducting power, frost penetrating through five-eighths of an inch of either material, and further into wet moss, .25 to .35 inch in case of the asbestos envelope, and .31 to .37 inch in case of the paper envelope. Dry moss is about the same as asbestos and paper, the frost penetrating through the asbestos 1.60 inch, and through dry moss, under the same circumstances, 1.62 inch. Through wet moss the frost penetrated only from .7 to .9 inch under same circumstances, showing that the latter material is more effective, bulk for bulk, than either dry moss, dry paper, or dry asbestos felt. This agrees with the results of other experiments I have tried with wet moss, yet I think the weight of the latter will forbid its employment in ordinary cases. The paper and asbestos are excluded by their cost and also by their weight. The relative weights of the several substances are about as follows: Asbestos felt, 82; paper, 50; wet moss, 20; dry moss, 3. The comparative weights of the asbestos and paper are given exactly. Those of wet and dry moss are correct relatively to each other, but possibly a little too low relatively to the other substances. But evidently none of the other substances can rival dry moss for our purpose, when efficiency and economy are both considered.]

February 13.—The shipment of eggs, suspended since January 24, is resumed to-day.

February 22.—As in former years we measure our eggs for shipment in old corn cans, each one holding about 2,500. On 13th instant Mr. Munson found that, filled as usual, a measure counted out 2, 720 eggs; twice since then he has counted a measure full and found in one case 2,710, and in another 2,725. The record of shipments before 13th is corrected accordingly, and since that date the measures have been filled not quite so full, with intention to have 2,500 in each as near as possible.

February 23.—To-day I examined the most forward eggs in the river house (No. 2): The eyes have not yet begun to color. To try their hardiness for packing, I took a tray of them and rapped it smartly six or eight times on the table, making the eggs rebound into the air.

February 25.—There were picked from the above tray 94 white eggs and all were unimpregnated. So I should dare to pack these eggs now.

March 1.—Shipment of eggs concluded to-day; 645,000 have been sent away, and 215,000 remain to be hatched and planted in Grand Lake.

March 3.—I return to Bucksport, leaving Mr. Munson in charge.

5.—NOTES FROM MR. MUNSON'S RECORD BOOK.

February 28.—The earliest eggs received from the Penobscot station commence to hatch to-day. [Two hundred and sixty-seven thousand eggs of Penobscot salmon were hatched here at the charge of Mr. Frank Todd, of Milltown, N. B., the same being furnished free by the State of Maine, to be planted in the Saint Croix, the boundary river between Maine and New Brunswick. For the hatching and expenses Mr. Todd paid the establishment $91.26. The eggs were received in three lots, January 30, February 12, and March 11.—C. G. A.]

March 14.—First lot of Schoodic eggs begin to hatch [taken Nov. 8th, and kept meanwhile in hatcheries Nos. 1 and 3, water ranging from 48° to 34½° F. and averaging 39°.1 F. The time occupied has been 126 days to the commencement of hatching.]

March 16.—Lot 1 all hatched.

March 21.—Lot 4 [taken November 11] begins to hatch.

March 23.—Lot 4 all hatched.

March 25.—Moved all eggs from hatchery No. 2 to No. 3.

March 28.—Penobscot eggs received February 12, begin to hatch.

March 30.—Gates all shut down.

March 31.—Penobscot eggs received February 12, all hatched.

April 18.—Penobscot eggs received March 11, begin to hatch.

April 21.—Same all hatched.

May 7.—Lot 6 of Schoodic eggs begin to hatch. [These were taken November 14, and have been since then until March 25 in the cold water of the stream, averaging 34° F., and from that date to the present in spring and snow water averaging 37° F. The general average of temperature has been 34.7° F., and the total time to the commencement of hatching has been 174 days. One more day, 175 days from the beginning, will be the average time of the hatching of this lot of eggs.]

To-day, May 7. The ice broke up in Big Lake.

May 9.—Eggs taken November 14 are all hatched.

May 10.—Ice broke up in Grand Lake.

May 11.—Lot 7, Schoodic eggs, begin to hatch [taken November 16].

May 14.—Lot 7 all hatched. Lot 8 [taken November 18], begins to hatch.

May 15.—Lot 8 all out; lot 9 [taken November 19] begins to hatch.

May 17.—Lots 9 and 10 all hatched. These are the last eggs.

May 22.—Lots 1 and 4 turned out. Also the earliest of the Penobscot fry.

May 26.—Second lot of Penobscot fish turned out.

May. 30.—The last of the Penobscot fish turned out. [In number, 266,240; there having been a loss of 760.]

June 15.—Three men took 84 Schoodic salmon with fly to-day: wind southwest, strong.

June 26.—The last Schoodic salmon turned out.

June 28.—Closed up.

TABLE I.—*Spawning operations at Grand Lake Stream, Maine, November,* 1881.

Date.	Fish at first handling.*							Females spawned.			Eggs taken.		
	Total.	Males.	Females.				Sex unknown.	First time.	Second time.	Females yielding defective eggs.†	Weight.		Number.‡
			Unripe.	Ripe.	Spent.	Total.					*Lbs.*	*oz.*	
1881.													
Nov. 8	609	238	192	166	13	371	......	166	......	30	86	15	235,000
9	94	44	21	20	....	50	......	29	......	3	12	11	40,000
10	123	48	28	46	1	75	......	61	......	(†)	37	4	110,000
11	109	32	36	40	....	76	1	51	254	9	47	2	130,000
12	33	12	6	15	....	21	......	101	49	10	44	12	116,000
14	50	17	16	15	2	33	......	105	101	10	59	8	150,000
16	18	2	10	5	1	16	......	52	105	16	37	13	90,000
18	15	5	2	6	2	10	......	36	45	11	19	12	47,000
19	....	....	......	....	....	....	......	20	37	6	11	9	29,000
	1,051	398	311	322	19	652	1	621	601	95	357	6	947,000

*In these columns each fish is recorded when it first comes to hand, and the footings show the total catch.

†In most cases the defective eggs were few in number, sometimes but 1, 2, or 3. Doubtless there were some with defective eggs that the workmen neglected to report, and probably the blank on the 10th is in consequence of some such omission.

‡These figures are obtained by adding the number rejected at the daily pickings to the number measured out at the time of dividing the eggs in winter.

TABLE II.—*Transfer of Schoodic salmon eggs from Grand Lake Stream, Maine, in* 1882.

Date.	Consignee.	Address.	Final destination.	No. of cases.	Weight.	Number of eggs.			Miles transported.	Hours en route.	Condition on unpacking.	Dead on unpacking.
						Belonging to States.	Belonging to United States.	Total.				
1882.					*Pounds.*							
Jan. 18	E. A. Brackett	Winchester, Mass	Winchester, Mass	1	(?) 150	65,000	....	....	389	70	Excellent	*350
18	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	(?) 150	53,750	250	54,000	502	73	Good, except some indented.	47
23	E. A. Brackett	Winchester, Mass	Winchester, Mass	1	72	32,000	....	32,000	389	70	Partly frozen	8,000
24	A. H. Powers	Plymouth, N. H	Plymouth, N. H	1	120	54,000	....	54,000	508	70	Good	73
24	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	93	43,000	....	43,000	502	73	Good	11
Feb. 13	Mrs. J. H. Slack	Bloomsbury, N. J	Bloomsbury, N. J	1	75	....	22,000	22,000	683	104	"Good, but much indented; a few hatched, and some bursting sack."	106
13	Seth Green	Mumford, N. Y	Mumford, N. Y	1	45	....	11,000	11,000	840	102	"Splendid"	23
13	T. B. Ferguson	Baltimore, Md	Baltimore, Md	1	50	....	11,000	11,000	805	120	"Good, but too far advanced."	25
13	Seth Weeks	Corry, Pa	Corry, Pa	1	48	....	11,000	11,000	972	122	"Good"	85
14	J. M. Haven	Rutland, Vt	Rutland, Vt	1	45	....	10,000	10,000	525	64	"Good"	3
14	E. G. Blackford	New York	Roslyn, N. Y	1	45	....	10,000	10,000	640	....	Good	....
14	C. H. Brownell	Saint Joseph, Mo	Saint Joseph, Mo	1	85	....	25,000	25,000	1,847	120	"Very superior"	47
15	B. F. Shaw	Anamosa, Iowa	Anamosa, Iowa	1	81	....	25,000	25,000	1,607	168	"Good"	147
15	M. T. Bailey	Madison, Wis	Madison, Wis	1	84	....	25,000	25,000	1,536	120	Good	191
16	R. O. Sweeny	Saint Paul, Minn	Saint Paul, Minn	1	81	....	25,000	25,000	1,789	192	"Good"	167
16	J. G. Portman	Paris, Mich	Paris, Mich	1	81	....	25,000	25,000	1,431	156	"Good"	304
24	F. Mather	Newark, N. J	Germany	1	63	....	20,000	20,000	3,840	....	Good	....
27	E. A. Brackett	Winchester, Mass	Winchester, Mass	1	52	10,500	5,000	15,500	389	72	"Excellent"	10
27	H. J. Fenton	Windsor, Conn	Poquonock, Conn	1	53	10,500	5,000	15,500	502	74	"Good"	11
27	B. B. Redding	San Francisco, Cal	San Francisco, Cal	1	51	....	10,000	10,000	3,818	270	"Good"	100
27	A. H. Powers	Plymouth, N. H	Plymouth, N. H	1	30	....	4,750	4,750	508	72	"A No. 1"	0
27	E. M. Russell	Paris, Tenn	Paris, Tenn	1	20	....	5,000	5,000	1,660	144	"Excellent"	20
28	F. N. Clark	Northville, Mich	Northville, Mich	1	150	....	56,750	56,750	1,158	98	"Best lot of salmon eggs I ever received."	44
28	O. A. Dennen	Mount Kineo, Me	Mount Kineo, Me	1	(?) 80	23,000	....	23,000	232	190	"Good"	20
Mar. 1	F. C. Hewey	Rangely, Me	Rangely, Me	1	(?) 80	23,000	....	23,000	300	72	"Very good"	10
1	A. J. Darling	Enfield, Me	Enfield, Me	1	(?) 80	18,500	5,000	23,500	103	50	"Good"	12
			Total	26	1,973	333,250	311,750	645,000				9,806

*Including those that died for several days after unpacking.

TABLE III.—*Planting of Schoodic salmon reared from eggs gathered in 1881.*

State.	Where hatched.	Waters in which the fry were placed.	Tributary to what other water.	Locality of deposit.	Date of transfer.	No. of fish.
					1882.	
California	San Leandro	Prosser Creek	Truckee River	Near Boca, Nevada County	Apr. 7	1,986
		Blue Lakes		Lake County	Apr. 13	2,447
		Lake Honda		San Francisco County	Apr. 7	1,000
Connecticut	Poquonock	Shaker Pond	Connecticut River	Enfield		5,000
		Housatonic River		New Milford		5,000
		Twin Lakes	Housatonic	Salisbury		10,000
		Wanouscoponous Lake	Housatonic River	Lakeville		10,000
		Square Pond	Connecticut River	Ellington		10,000
		do	Willimantic	Stafford		10,000
		Canterbury Pond	Quinnebaug River	Plainfield		10,000
		Bantam Lake	Connecticut River	Moodus		10,000
		Ball's Pond	Housatonic River	New Fairfield		10,000
		Bride Pond		East Lyme		11,449
		Snipsic Lake	Connecticut River	Rockville		10,000
Indiana	Northville, Mich	Lake		Laporte	May 15	1,000
Iowa	Anamosa	Clear Lake	Shell Rock and Cedar River	Clear Lake, Cerro Gordo County		7,500
		Okiboji Lake	Little Sioux River	Spirit Lake, Dickinson County		7,500
Maine	Enfield	Cold Pond	Penobscot River	Enfield		10,000
	Grand Lake Stream	Grand Lake	Schoodic River	Hinkley, Washington County	May 22 to June 26	213,097
	Mount Kineo	Moosehead Lake	Kennebec River	Piscataquis County	June —	21,000
	Rangely	South Bog Stream	Rangely Lake	Franklin County	June 15	5,000
		Kennebago Stream	Mooselucmaguntic Lake	do	June 15	4,560
		Rangely Stream	do	do	June 15	5,000
		Bemis Stream	do	do	June 15	3,000
		Androscoggin River	Richardson Lake	Oxford County	June 15	5,000
Maryland	Baltimore	Deer Creek	Susquehanna River	Harford County	Apr. 22	9,474
Massachusetts	Winchester			Stockbridge		14,000
				Worcester		14,000
				Falmouth		21,000
				Great Barrington		14,000
				Northampton		14,000
				Wayland		7,000
				Scituate		7,000
				Harvard		11,000
Michigan	Northville	Long Lake		Mecosta County	Apr. 27	6,000
		Higgins' Lake		Roscommon County	Apr. 28	3,000
		Chippewa Lake		Lake County	Apr. 27	6,000
		Goguac Lake		Battle Creek, Calhoun County	May 1	3,000
		Union Lake		Pontiac, Oakland County	May 15	8,000
Minnesota	Saint Paul	White Bear Lake		Ramsey, Washington County	May 16	2,000
		Lake Minnetonka		Hampshire County	May 17	2,000
		Cedar Lake		Rice County	May 18	2 000

Minnesota	Saint Paul	Lakes		Fillmore and Olmstead Counties	May 19	2,000
		Streams		Winona County	June 16	5,000
Missouri	Saint Joseph	Contrary Lake		Buchanan County	Feb. 19	12,500
		Bean Lake		do	Feb. 19	5,000
		Sugar Lake		do	Feb. 19	5,000
New Hampshire	Plymouth	Pleasant Pond		Francestown, Hillsborough County	May 24	4,000
		Three Ponds		Milton, Strafford County	May 27	5,000
		Sunapee Lake		Newbury, Merrimack County	May 27	5,000
		Star Pond		Springfield, Sullivan County	May 27	5,000
		Newfound Lake		Hebron, Grafton County	May 30	12,000
		Long Pond		Hancock, Hillsborough County	May 31	5,000
		Mount William Pond		Weare, Hillsborough County	May 31	2,500
		Squam Lake		Holderness, Grafton County	May 31	12,000
		North Pond		Sandwich, Carroll County	May 31	5,000
New Jersey	Bloomsbury	Greenwood Lake		Cooper	May 1	5,000
		Strubel Lake		Sussex County	May 3	16,274
New York	Roslyn	Waters of South Side Sportsmen's Club				5,350
		Skaneateles Lake		Onondaga County		5,350
	Caledonia	Caledonia Creek		Mumford, Monroe County		(?)10,000
Ohio	Northville, Mich	Waterworks reservoir		Piqua	May 3	6,000
Pennsylvania	Corry	A small lake	Delaware River	Near Hawley and Carbondale		9,133
Tennessee	Paris	Private pond		Paris		3,500
Vermont	Rutland	Shrewsbury Pond		Near Rutland		9,900

XXV.—STATISTICS OF THE SHAD-HATCHING OPERATIONS CONDUCTED BY THE UNITED STATES FISH COMMISSION IN 1881.

By Chas. W. Smiley.

From the reports of the various persons in charge of shad-hatching stations during the spring of 1881, and from the reports of messengers in charge of shipments, I have prepared a series of six tables to show the operations at each station, and the seventh for a summary exhibit. From these it will appear that 87,441,000 eggs were obtained and hatched with an average loss of 20 per cent. A comparison with the number of shad hatched in previous years is of interest, and the constant increase gratifying.

Number of shad hatched:

1879	16,842,000
1880	29,473,000
1881	70,035,000
1872–1881 inclusive	172,423,350

Of the fish hatched, a part were deposited in waters near the several hatching stations, as follows:

Deposited in local waters:

1879	5,587,000
1880	7,864,600
1881	46,518,500

Of the fish hatched, the number transported to other waters was as follows:

Transported to other waters:

1879	10,002,500
1880	20,761,400
1881	23,516,500

The number of shad deposited within the waters of the different States the present year was as follows:

Connecticut	1,000,000
Delaware	940,000
District of Columbia	205,000
Georgia	1,800,000
Iowa	1,100,000

Kansas	200,000
Kentucky	707,000
Maine	1,150,000
Maryland	24,705,000
North Carolina	4,357,500
Ohio	1,020,000
Pennsylvania	3,500,000
Rhode Island	500,800
South Carolina	620,000
Tennessee	400,000
Texas	277,000
Virginia	24,280,000
West Virginia	175,000
Total	67,002,500

Fuller particulars of these deposits, the time, streams, places, &c., will be found in the tables of distribution—Tables VIII and IX.

For comparison with the number of shad sent to the various States in the years 1872–'80, see summary tables published in another part of this volume.

TABLE I.—*Record of shad-hatching operations conducted by United States steamer Fish Hawk, Lieut. Z. L. Tanner, commanding, at Capehart's Wharf, in Salmon Creek, Avoca, N. C., from April* 12 *to April* 30, 1881.

Date.	Ripe shad taken.		Eggs obtained.	Eggs lost.	Fish released in local waters.	Transported to other waters.
	Males.	Females.				
April 12	3	3	66,000	66,000		
13	2	2	66,000			
14	4	4	117,000			
15	1	1	34,000			
19	9	8	132,000			
20	3	3	107,000			
21	11	11	332,000			
22	21	21	649,000	149,000		
23	18	18	489,000	83,000		
25	28	28	929,000	41,500		
26	34	32	979,000	52,000		
27	32	30	931,000	16,000		
28	11	10	298,000	41,000		
29	13	13	432,000	34,000	498,000	
30	5	5	166,000	8,000	830,000	*3,029,500
May 1				500,000		
2				379,000		
Total	195	189	5,727,000	1,369,500	1,328,000	3,029,500

*Captain Tanner states that these eggs were transferred to North Carolina Fish Commission at various times.

TABLE II.—*Record of shad-hatching operations conducted by M. McDonald, at Gunston and other places on the Potomac River, under the direction of the United States Fish Commission, from April* 20 *to May* 30 *inclusive,* 1881.*

Date.	Length in fathoms of haul seines.	Shad taken.	Ripe females.	Eggs obtained.	Eggs lost.	Fish released in local waters.	Fish transported to other waters.	Where released in local waters.†
1881.								
April 20	5,000	3,534	4	125,000	...	...	...	
21	5,000	2,479	1	25,000	...	...	...	
22	5,000	2,801	5	150,000	...	...	...	
23	5,000	3,597	...	235,000	...	...	...	
25	5,000	4,616	30	910,000	...	...	...	
26	5,000	4,567	28	830,000	...	...	...	
27	5,000	4,783	11	325,000	151,000	234,000	...	Pomonkey, Md.
28	5,300	3,997	31	930,000	...	...	...	
29	5,300	4,938	21	610,000	97,000	...	...	
30	5,300	5,046	20	570,000	...	1,383,000	...	Guuston, Va.
May 1	5,300	3,761	15	400,000	25,000	...	...	
2	5,000	2,635	20	510,000	175,000	625,000	...	Gunston, Va.
3	6,650	7,067	50	1,420,000	...	1,510,000	...	Do.
4	6,650	5,178	90	2,320,000	...	...	...	
5	6,650	5,678	90	2,225,000	50,000	...	...	
6	6,350	4,682	50	1,530,000	310,000	1,130,000	...	Gunston, Va.
7	6,350	5,101	101	3,090,000	300,000	230,000	...	Do.
8	...	...	...	...	133,000	...	...	
9	6,350	4,951	51	1,565,000	101,000	2,887,000	...	Gunston, Va.
10	6,350	4,698	17	500,000	100,000	1,834,000	...	Do.
11	6,350	2,977	41	1,220,000	119,000	1,730,000	...	Do.
12	6,350	1,907	36	1,060,000	10,000	2,576,000	250,000	Do.
13	6,350	2,909	21	620,000	650,000	40,000	250,000	Do.
14	6,350	3,191	4	100,000	...	...	350,000	
15	6,350	2,059	17	510,000	330,000	...	...	
16	6,350	2,357	46	1,360,000	...	2,585,000	...	Gunston, Va.
17	3,650	2,840	63	1,880,000	...	...	...	
18	3,650	1,835	162	4,870,000	...	...	...	
19	3,650	1,797	27	800,000	1,520,000	...	...	
20	3,650	1,937	77	2,290,000	...	1,125,000	...	Gunston, Va.
21	3,650	1,656	30	900,000	...	...	1,000,000	
22	4,850	...	...	...	...	...	300,000	
23	3,650	1,481	17	500,000	545,000	...	1,100,000	
24	3,650	1,544	107	3,215,000	...	5,490,000	300,000	Gunston, Va.
25	3,650	1,046	54	1,620,000	350,000	...	...	
26	2,350	1,481	4	120,000	...	140,000	1,000,000	Gunston, Va.
27	850	1,554	43	1,290,000	200,000	...	1,000,000	
28	850	1,397	74	2,200,000	250,000	1,905,000	...	Fort Washington, Md.
29	850	826	12	375,000	...	...	...	
30	550	1,144	...	...	870,000	1,096,000	400,000	Fort Washington, Md.
30	...	...	...	...	‡1,619,000	...	...	
Total...	184,150	120,047	1,470	§43,200,000	7,905,000	26,515,000	5,950,000	

* For a more detailed statement of this work see report of M. McDonald.
† For details of deposits of fish see tables of distribution.
‡ 220,000 of these eggs were used in experiments; the rest are unaccounted for; probably a loss
§ Of this amount 2,630,000 eggs were sent to navy-yard station.

TABLE III.—*Record of shad-hatching operations conducted by Frank L. Donnelly, at Navy-Yard Station, Potomac River, under the direction of the United States Fish Commission, from May* 4 *to June* 2, 1881.

Date.	Eggs obtained.	Eggs lost.	Fish released in local waters.	Fish transported to other waters.	Messenger in charge of transfer.*
1881.					
May 4	200,000	10,000	....	....	
5	200,000	5,000	....	....	
6	270,000	5,000	....	....	
7	370,000	10,000	....	....	
9	430,000	20,000	....	....	
10	300,000	10,000	105,000	85,000	J. Frank Ellis.
11	230,000	10,000	....	....	
12	65,000	5,000	....	460,000	G. G. Davenport.
13	100,000	10,000	100,000	260,000	Do.
15	....	....	....	410,000	N. Simmons and C. W. Schuermann.
16	35,000	2,000	....	290,000	C. A. Stewart and C. W. Schuermann.
17	70,000	3,000	....	....	
18	180,000	10,000	....	....	
19	300,000	20,000	....	220,000	H. E. Quinn.
20	865,000	65,000	....	150,000	C. W. Schuermann.
21	450,000	....	....	....	
22	....	....	....	100,000	C. W. Schuermann.
23	375,000	....	....	....	
24	500,000	....	....	....	
25	†1,600,000	....	....	170,000	N. Simmons.
26	....	....	....	280,000	N. Simmons and C. A. Stewart.
27	†720,000	....	....	500,000	Geo. H. H. Moore
28	†120,000	....	....	....	
29	....	....	....	....	
30	†355,000	‡3,465,000	....	....	
June 2	....	200,000	....	150,000	W. H. Jenkins, jr.
Total ...	§7,730,000	3,850,000	205,000	3,075,000	

* For final destination of these fish, see tables of distribution.
† Of these eggs, 2,630,000 were received from Potomac barges.
‡ Eggs unaccounted for; probably lost.
§ Of this number, 600,000 were reported turned over to M. McDonald on his assuming charge of the Navy-Yard Station.

TABLE IV.—*Record of shad-hatching operations conducted by Frank N. Clark, at Havre de Grace, Md., on the Susquehanna River, under the direction of the United States Fish Commission, from May* 15 *to June* 13, *inclusive*, 1881.

Date.	Eggs obtained.	Eggs lost.	Fish hatched.	Fish released in local waters.	Fish transported to other waters.	Messenger in charge of transfer.*
1881.						
May 15†	6,625,000	504,000	4,101,000	4,101,000	....	
16	275,000	64,000	1,566,000	566,000	1,000,000	J. P. Creveling.
17	375,000	5,000	100,000	100,000	....	
18	135,000	....	....	....	....	
19	105,000	....	....	....	....	
20	150,000	25,000	260,000	260,000	....	
21	210,000	....	....	....	....	
22	400,000	....	....	....	....	
23	900,000	....	....	....	....	
24	1,410,000	....	....	....	....	
25	705,000	92,000	1,048,000	48,000	1,000,000	J. P. Creveling.
26	750,000	30,000	330,000	330,000	....	
27	765,000	40,000	365,000	365,000	....	
28	450,000	290,000	825,000	825,000	....	
29	325,000	75,000	1,900,000	400,000	1,500,000	J. P. Creveling.
30	250,000	....	675,000	....	....	
31	....	110,000	925,000	400,000	900,000	C. W. Schuermann.
June 1	50,000	75,000	100,000	....	....	
2	....	....	260,000	....	....	

* For final destination of these fish, see tables of distribution.
† May 15 includes a number of previous days' operations which cannot be given specifically.

TABLE IV.—*Record of shad-hatching operations, &c.*—Continued.

Date.	Eggs obtained.	Eggs lost.	Fish hatched.	Fish released in locol waters.	Fish transported to other waters.	Messenger in charge of transfer.
1881.						
June 3			115,000		775,000	C. W. Schuermann.
4	100,000					
6	300,000	10,000				
7	450,000		50,000			
8	300,000		40,000			
9				90,000		
10		150,000				
11			150,000			
12			450,000			
13			300,000	*900,000		
Total	15,030,000	1,470,000	13,560,000	8,385,000	5,175,000	

* Remained on hand at close of daily reports; probably deposited in local waters.

TABLE V.—*Record of shad-hatching operations conducted by Marshall McDonald, at Navy-Yard Station, Potomac River, under the direction of the United States Fish Commission, from June 1 to June 25, inclusive, 1881.**

Date.	Length in fathoms of visited—		Shad taken.	Ripe females.	Eggs obtained.	Eggs lost.	Fish transported to other waters.	Messenger in charge of transfer.
	Haul-seines.	Gill-nets.						
June 1					†60,000			
2	550	7,200	471	4	75,000		300,000	W. H. Jenkins, jr.
3	250	7,200	140	2	40,000			
4	250	7,200	205	13	380,000		120,000	F. L. Donnelly.
5	250	7,200	221	6	175,000	150,000		
6	250	7,200	209	10	250,000			
7	250	7,200	153	12	370,000	10,000	100,000	J. F. Ellis.
8	250	7,200	139	4	75,000		200,000	C. J. Huske.
9		7,200				20,000	200,000	H. E. Quinn.
10		7,200						
11		3,200			45,000		200,000	N. Simmons.
12		3,200					150,000	G. G. Davenport.
13		3,200		12	330,000		670,000	Ellis and Moore.
14		3,200		25	450,000			
15		3,200		10	270,000			
16		3,200		7	200,000			
17		3,200		11	290,000	60,000		
18		3,200		6	170,000		400,000	Quinn, Schuermann, and Simmons.
19		3,200		1	10,000		200,000	F. N. Clark.
20								
21		3,200		2	40,000		1,140,000	J. F. Ellis.
22		3,200		2	40,000		120,000	C. A. Stewart.
23		3,200						
24		3,200						
25		3,200			30,000			
Total	2,050	109,600	1,538	127	3,840,000	240,000	3,800,000	

* For a more detailed statement of this work, see report of M. McDonald.
† Received from Frank L. Donnelly's navy-yard station.

TABLE VI.—*Record of shad-hatching operations conducted by United States steamer Fish Hawk, Lieut. Z. L. Tanner commanding, at Havre de Grace, Md., in the Susquehanna and North East Rivers, from May* 5 *to June* 5, 1881.

Date.	Ripe shad taken.		Eggs obtained.	Eggs lost.	Fish released in local waters.	Fish transported to other waters.
	Males.	Females.				
May 5	6	6	182, 000			
6	17	17	462, 000			
8	21	21	506, 000			
9	49	47	1, 660, 000			
10	11	11	341, 000			
11	28	28	913, 000			
12	30	30	979, 000		660, 000	
13	8	8	265, 000		1, 660, 000	
14	9	9	348, 000		830, 000	
15	14	12	357, 000		598, 000	
16	10	11	357, 000		979, 000	
17	10	13	424, 000			
18	9	8	257, 000		498, 000	
19	12	14	423, 000		166, 000	
20	20	25	781, 000			
21	53	54	1, 792, 000			
22	18	19	291, 000			
23	17	23	650, 000		325, 000	
24	14	15	463, 000		313, 000	
25	28	31	781, 000		275, 000	
26	40	43	1, 062, 000		406, 000	
27	22	22	625, 000		1, 250, 000	
28	22	25	675, 000		500, 000	
29	10	10	369, 000			
30	2	2	50, 000		1, 000, 000	
31	6	6	106, 000			1, 250, 000
June 1	8	8	187, 000			500, 000
2	2	2	38, 000		625, 500	312, 000
3	2	2	50, 000			125, 000
4	2	2	50, 000			
5						300, 000
Total	500	524	15, 444, 000	2, 871, 500	10, 085, 500	2, 487, 000

TABLE VII.—*Summary of work at shad-hatching stations operated by the United States Fish Commission during the spring of* 1881.

Dates.		Location of stations.		Person in charge of station.	Eggs obtained.	Eggs lost.	Fish hatched.	Fish released in local waters.	Fish transported to other waters.
Season began.	Season ended.	Water.	Place.						
....	....	Albemarle Sound	Avoca, N. C	Z. L. Tanner	5, 727, 000	1, 369, 500	4, 357, 500	1, 328, 000	3, 029, 500
April 20	May 30	Potomac River	Barges	M. McDonald	40, 570, 000	7, 905, 000	32, 665, 000	26, 515, 000	5, 950, 000
May 4	June 2	......do	Navy-Yard	F. L. Donnelly	7, 130, 000	3, 850, 000	3, 280, 000	205, 000	3, 075, 000
May 15	June 13	Susquehanna River	Havre de Grace, Md	F. N. Clark	15, 030, 000	1, 470, 000	13, 560, 000	8, 385, 000	5, 175, 000
June 1	June 25	Potomac River	Navy-Yard	M. McDonald	3, 840, 000	240, 000	3, 600, 000	....	3, 800, 000
May 5	June 5	Susquehanna River	Havre de Grace, Md	Z. L. Tanner	15, 444, 000	2, 871, 500	12, 572, 500	10, 085, 500	2, 487, 000
					87, 741, 000	17, 706, 000	*70, 035, 000	46, 518, 500	23, 516, 500

* The tables of distribution show the destination of 67,353,000 of these fish. There were also used for experiments at Armory 180,000, and for Minnesota experiments 40,000. The remaining 2,462,000 either died before delivery to messengers or were deposited without a record being made.

TABLE VIII.—*Chronological record of distribution of young shad made under the direction of the United States Commissioner of Fish and Fisheries, from April 27, 1881, to June 22, 1881.*

Date.	Where fish were hatched.	Number of fish— Started with.	Number of fish— Actually planted.	Introduction of fish. State.	Introduction of fish. Town or place.	Introduction of fish. Stream.	Introduction of fish. Tributary of—	Transfer in charge of—
April 12–30	Steamer Fish Hawk	*3,029,500	3,029,500					
29	do	498,000	498,000	North Carolina	Avoca	Salmon Creek	Albemarle Sound	Z. L. Tanner.
30	do	830,000	830,000	do	do	do	do	Do.
27	Potomac barges	234,000	234,000	Maryland	Pomonkey	Potomac River	Chesapeake Bay	M. McDonald.
30	do	1,383,000	1,383,000	Virginia	Gunston	do	do	Do.
May 2	do	625,000	625,000	do	do	do	do	Do.
5	do	1,510,000	1,510,000	do	do	do	do	Do.
6	do	1,130,000	1,130,000	do	do	do	do	Do.
7	do	230,000	230,000	do	do	do	do	Do.
9	do	2,887,000	2,887,000	do	do	do	do	Do.
10	do	1,834,000	1,834,000	do	do	do	do	Do.
10	Navy-yard	85,000	85,000	Maryland	Cumberland	do	do	J. F. Ellis.
10	do	105,000	105,000	Dist. of Columbia	Washington	do	do	F. L. Donnelly.
11	Potomac barges	1,730,000	1,730,000	Virginia	Gunston	do	do	M. McDonald.
12	do	2,571,000	2,571,000	do	do	do	do	Do.
12	Steamer Fish Hawk	660,000	660,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
12	Potomac barges	250,000	250,000	do	Weaverton	Potomac River	Chesapeake Bay	N. Simmons.
12	Navy-yard	460,000	460,000	do	Laurel	Patuxent River	do	G. G. Davenport.
13	Potomac barges	40,000	40,000	Virginia	Gunston	Potomac River	do	M. McDonald.
13	Navy-yard	260,000	260,000	Maryland	Laurel	Patuxent River	do	G. G. Davenport.
13	do	100,000	100,000	Dist. of Columbia	Washington	Potomac River	do	F. L. Donnelly.
13	Steamer Fish Hawk	1,660,000	1,660,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
14	Potomac barges	250,000	250,000	do	Point of Rocks	Potomac River	Chesapeake Bay	N. Simmons.
14	do	175,000	175,000	do	Relay House	Patapsco River	do	G. G. Davenport.
14	Steamer Fish Hawk	830,000	830,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
15	Potomac barges	175,000	175,000	West Virginia	Wheeling	Ohio River	Mississippi River	J. F. Ellis.
15	Navy-yard	300,000	300,000	Maryland	Laurel	Patuxent River	Chesapeake Bay	N. Simmons.
15	Steamer Fish Hawk	598,000	598,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
16	Potomac barges	2,585,000	2,585,000	Virginia	Gunston	Potomac River	Chesapeake Bay	M. McDonald.
16	Havre de Grace	4,101,000	4,101,000	Maryland	Battery Island	Susquehanna River	do	F. N. Clark.
16	Steamer Fish Hawk	979,000	979,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
17	Havre de Grace	566,000	566,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
17	Navy-yard	200,000	200,000	South Carolina	Charlotte	Catawba River	Wateree River	C. W. Schuermann.
17	Havre de Grace	1,000,000	1,000,000	Pennsylvania	Sunbury	Susquehanna River	Chesapeake Bay	J. P. Creveling.
18	do	100,000	100,000	Maryland	Battery Island	do	do	F. N. Clark.
18	Steamer Fish Hawk	498,000	498,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
18	Navy-yard	200,000	200,000	Kentucky	Bowling Green	Barron River	Green River	C. A. Steuart.
19	do	220,000	170,000	Ohio	Defiance	Maumee River	Lake Erie	H. E. Quinn.
19	Steamer Fish Hawk	166,000	166,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.

	20	Navy-yard	150,000	150,000	do	Laurel	Patuxent River	Chesapeake Bay	C. W. Schuermann.
	20	Potomac barges	1,125,000	1,250,000	Virginia	Gunston	Potomac River	do	M. McDonald.
	21	Havre de Grace	260,000	260,000	Maryland	Battery Island	Susquehanna River	do	F. N. Clark.
	21	Potomac barges	1,000,000	1,000,000	do	Denton	Choptank River	do	T. B. Ferguson.
	23	Steamer Fish Hawk	325,000	325,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	24	Potomac barges	5,490,000	5,490,000	Virginia	Gunston	Potomac River	Chesapeake Bay	M. McDonald.
	24	Navy-yard	200,000	192,000	Kentucky	High Bridge	Kentucky River	Ohio River	C. A. Steuart.
	24	Steamer Fish Hawk	313,000	313,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	25	Potomac barges	1,000,000	1,000,000	Georgia	Macon	Ocmulgee River	Altamaha River	C. W. Schuermann.
	25	Steamer Fish Hawk	275,000	275,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	26	Potomac barges	140,000	140,000	Virginia	Gunston	Potomac River	Chesapeake Bay	M. McDonald.
	26	Havre de Grace	1,000,000	1,000,000	Pennsylvania	Mifflin	Juniata River	Susquehanna River	J. P. Creveling.
	26	do	48,000	48,000	Maryland	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
	26	Steamer Fish Hawk	406,000	406,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	27	Havre de Grace	330,000	330,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
	27	Navy-yard	500,000	500,000	do	Laurel	Patuxent River	do	Geo. H. H. Mooré.
	27	do	200,000	175,000	Kentucky	Shepherdsville	Salt River	Rolling River	C. A. Steuart.
	27	Potomac barges	1,000,000	850,000	Ohio	Steubenville	Ohio River	Mississippi River	N. Simmons.
	27	Steamer Fish Hawk	1,250,000	1,250,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	28	Havre de Grace	365,000	365,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
	28	Fort Washington	1,905,000	1,905,000	do	Fort Washington	Potomac River	do	M. McDonald.
	28	Steamer Fish Hawk	500,000	500,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	29	Havre de Grace	825,000	825,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
	30	do	400,000	400,000	do	do	do	do	Do.
	30	do	1,500,000	1,500,000	Pennsylvania	Newport	Juniata River	Susquehanna River	J. P. Creveling.
	30	Fort Washington	1,096,000	1,096,000	Maryland	Fort Washington	Potomac River	Chesapeake Bay	M. McDonald.
	30	Steamer Fish Hawk	1,000,000	1,000,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	31	Potomac barges	1,000,000	1,000,000	Virginia	Lynchburg	James River	Chesapeake Bay	J. F. Ellis.
June	1	Havre de Grace	500,000	500,000	Maryland	Battery Island	Susquehanna River	do	F. N. Clark.
	1	do	1,000,000	940,000	Delaware	Seaford	Nanticoke River	do	C. W. Schuermann.
	1	Navy-yard	200,000	200,000	Kentucky	Mumfordsville	Green River	Ohio River	C. A. Steuart.
	1	do	200,000	200,000	Georgia	Crawfordsville	Oconee River	Altamaha River	N. Simmons.
	1	do	220,000	220,000	South Carolina	Railroad Crossing	Pedee River	Atlantic Ocean	H. E. Quinn.
	2	do	150,000	150,000	Maryland	Laurel	Patuxent River	Chesapeake Bay	W. H. Jenkins, jr.
	2	Steamer Fish Hawk	625,500	625,500	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
	3	Havre de Grace	1,000,000	1,000,000	Connecticut	Warehouse Point	Connecticut River	Long Island Sound	C. W. Schuermann.
	3	do	500,000	500,000	Rhode Island	Warren	Palmer's River	Narragansett Bay	H. E. Quinn.
	4	Navy-yard	120,000	120,000	Maryland	Weaverton	Potomac River	Chesapeake Bay	F. L. Donnelly.
	7	Havre de Grace	100,000	100,000	do	Battery Island	Susquehanna River	do	F. N. Clark.
	8	Navy-yard	200,000	200,000	South Carolina	Columbia	Congaree River	Santee River	C. J. Huske.
	9	do	200,000	200,000	Georgia	Crawfordsville	Little River	Savannah River	H. E. Quinn.
	9	Havre de Grace	90,000	90,000	Maryland	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
	13	Navy-yard	100,000	100,000	Georgia	Albany	Flint River	Appalachicola River	N. Simmons.
	13	do	100,000	100,000	do	Montezuma	do	do	F. L. Donnelly.
	14	do	150,000	135,000	Texas	Railroad Crossing	Sabine River	Gulf of Mexico	G. G. Davenport.
	15	do	58,000	56,000	do	Austin	Colorado River	do	G. H. H. Moore.
	15	do	32,000	30,000	do	Railroad Crossing	San Marcus River	do	G. G. Davenport.
	15	do	28,000	26,000	do	do	Brazos River	do	Do.
	15	do	32,000	30,000	do	do	San Antonio River	do	Do.
	15	do	525,000	525,000	Maine	Waterville	Kennebec River	Atlantic Ocean	J. F. Ellis.

* Captain Tanner states that he turned these over to S. G. Worth, superintendent of fisheries of North Carolina.

TABLE VIII.—*Chronological record of distribution of young shad, &c.*—Continued.

Date.		Where fish were hatched.	Number of fish.		Introduction of fish.				Transfer in charge of—
			Started with.	Actually planted.	State.	Town or place.	Stream.	Tributary of—	
June	15	Havre de Grace	625,000	625,000	Maine	Mattawamkeag	Mattawamkeag River	Penobscot River	J. F. Ellis.
	18	Navy-yard	200,000	200,000	Georgia	Milledgeville	Oconee River	Altamaha River	H. E. Quinn.
	20	do	200,000	200,000	Tennessee	Johnsonville	Tennessee River	Ohio River	N. Simmons.
	20	do	200,000	200,000	Kansas	Kansas City	Missouri River	Mississippi River	F. N. Clark.
	24	do	1,140,000	1,106,000	Iowa	Dubuque	Mississippi River	Gulf of Mexico	J. F. Ellis.
	24	do	60,000	60,000	Tennessee	Union Depot	Holston River	Tennessee River	C. A. Steuart.
	24	do	70,000	70,000	do	Fullen's	Nalachucky River	do	Do.
	24	do	70,000	70,000	do	Carter's Depot	Wautaga River	do	John Horan.
			67,353,000	67,003,000					

NOTE.—Since the preparation of these tables a report has been received from Mr. S. G. Worth, from which it appears that instead of the number given as "actually planted" April 12–30, three items should be inserted which aggregate 1,769,500 less. Hence this number should be deducted from the total in the above table. Mr. Worth says: "The only thing received by me was 1,800,000 eggs at 5.30 p. m. April 30. They were estimated on board the Fish Hawk. From these I released on May 1st 700,000 shad fry into Salmon Creek; on May 4th, 200,000 at Moncure, into Haw River, a tributary to the Cape Fear River; and on May 5th, 360,000 into Salmon Creek, making a total of 1,260,000. The other 540,000 eggs were lost in hatching."

After the retirement of the Fish Hawk, however, Mr. Worth, in behalf of the State of North Carolina, took 4,632,000 eggs, from which he hatched out and released 3,485,000 more shad. (See Report of Board of Agriculture, session of 1883, pp. 64, 65.)

TABLE IX.—*Geographical record of distribution of young shad made under the direction of the United States Commissioner of Fish and Fisheries from April 27, 1881, to June 22, 1881.*

Date.	Where fish were hatched.	Number of fish—Started with.	Number of fish—Actually planted.	Introduction of fish.—State.	Introduction of fish.—Town or place.	Introduction of fish.—Stream.	Introduction of fish.—Tributary of—	Transfer in charge of—
June 3	Havre de Grace	1,000,000	1,000,000	Connecticut	Warehouse Point	Connecticut River	Long Island Sound	C. W. Schuermann.
1	do	1,000,000	940,000	Delaware	Seaford	Nanticoke River	Chesapeake Bay	Do.
May 10	Navy-yard	105,000	105,000	Dist. of Columbia	Washington	Potomac River	do	F. L. Donnelly.
13	do	100,000	100,000	do	do	do	do	Do.
25	Potomac barges	1,000,000	1,000,000	Georgia	Macon	Ocmulgee River	Altamaha River	C. W. Schuermann.
June 1	Navy-yard	200,000	200,000	do	Crawfordsville	Oconee River	do	N. Simmons.
9	do	200,000	200,000	do	do	Little River	Savannah River	H. E. Quinn.
13	do	100,000	100,000	do	Albany	Flint River	Appalachicola River	N. Simmons.
18	do	100,000	100,000	do	Montezuma	do	do	F. L. Donnelly.
18	do	200,000	200,000	do	Milledgeville	Oconee River	Altamaha River	H. E. Quinn.
24	do	1,140,000	1,106,000	Iowa	Dubuque	Mississippi River	Gulf of Mexico	J. F. Ellis.
20	do	200,000	200,000	Kansas	Kansas City	Missouri River	Mississippi River	F. N. Clark.
May 18	do	200,000	200,000	Kentucky	Bowling Green	Barren River	Green River	C. A. Steuart.
24	do	200,000	192,000	do	High Bridge	Kentucky River	Ohio River	Do.
27	do	200,000	175,000	do	Shepherdsville	Salt River	Rolling River	Do.
June 1	do	200,000	200,000	do	Mumfordsville	Green River	Ohio River	Do.
15	do	525,000	525,000	Maine	Waterville	Kennebec River	Atlantic Ocean	J. F. Ellis.
15	Havre de Grace	625,000	625,000	do	Mattawamkeag	Mattawamkeag River	Penobscot River	Do.
April 27	Potomac barges	234,000	234,000	Maryland	Pamunkey	Potomac River	Chesapeake Bay	M. McDonald.
May 10	Navy-yard	85,000	85,000	do	Cumberland	do	do	J. F. Ellis.
12	Potomac barges	250,000	250,000	do	Weaverton	do	do	N. Simmons.
12	Navy-yard	460,000	460,000	do	Laurel	Patuxent River	do	G. G. Davenport.
12	Steamer Fish Hawk	660,000	660,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
13	Navy-yard	260,000	260,000	do	Laurel	Patuxent River	Chesapeake Bay	G. G. Davenport.
13	Steamer Fish Hawk	1,660,000	1,660,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
14	Potomac barges	250,000	250,000	do	Point of Rocks	Potomac River	Chesapeake Bay	N. Simmons.
14	do	175,000	175,000	do	Relay House	Patapsco River	do	G. G. Davenport.
14	Steamer Fish Hawk	830,000	830,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
15	Navy-yard	300,000	300,000	do	Laurel	Patuxent River	Chesapeake Bay	N. Simmons.
15	Steamer Fish Hawk	598,000	598,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
16	Havre de Grace	4,101,000	4,101,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
16	Steamer Fish Hawk	979,000	979,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
17	Havre de Grace	566,000	566,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
18	Steamer Fish Hawk	498,000	498,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
18	Havre de Grace	100,000	100,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
19	Steamer Fish Hawk	166,000	166,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
20	Navy-yard	150,000	150,000	do	Laurel	Patuxent River	Chesapeake Bay	C. W. Schuermann.
21	Havre de Grace	260,000	260,000	do	Battery Island	Susquehanna River	do	F. N. Clark.
21	Potomac barges	1,000,000	1,000,000	do	Denton	Choptank River	do	T. B. Ferguson.

TABLE IX.—*Geographical record of distribution of young shad, &c.*—Continued.

Date.	Where fish were hatched.	Number of fish— Started with.	Number of fish— Actually planted.	Introduction of fish. State.	Introduction of fish. Town or place.	Introduction of fish. Stream.	Introduction of fish. Tributary of—	Transfer in charge of—
May 23	Steamer Fish Hawk	325,000	325,000	Maryland	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
24	do	313,000	313,000	do	do	do	do	Do.
25	do	275,000	275,000	do	do	do	do	Do.
26	do	406,000	406,000	do	do	do	do	Do.
26	Havre de Grace	48,000	48,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
27	do	330,000	330,000	do	do	do	do	Do.
27	Navy-yard	500,000	500,000	do	Laurel	Patuxent River	do	G. H. H. Moore.
27	Steamer Fish Hawk	1,250,000	1,250,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
28	Havre de Grace	365,000	365,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
28	Fort Washington	1,905,000	1,905,000	do	Fort Washington	Potomac River	do	M. McDonald.
28	Steamer Fish Hawk	500,000	500,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
29	Havre de Grace	825,000	825,000	do	Battery Island	Susquehanna River	Chesapeake Bay	F. N. Clark.
30	do	400,000	400,000	do	do	do	do	Do.
30	Steamer Fish Hawk	1,000,000	1,000,000	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
30	Fort Washington	1,096,000	1,096,000	do	Fort Washington	Potomac River	Chesapeake Bay	M. McDonald.
June 1	Havre de Grace	500,000	500,000	do	Battery Island	Susquehanna River	do	F. N. Clark.
2	Navy-yard	150,000	150,000	do	Laurel	Patuxent River	do	W. H. Jenkins, jr.
2	Steamer Fish Hawk	625,500	625,500	do	Havre de Grace	North East River	Susquehanna River	Z. L. Tanner.
4	Navy-yard	120,000	120,000	do	Weaverton	Potomac River	Chesapeake Bay	F. L. Donnelly.
7	Havre de Grace	100,000	100,000	do	Battery Island	Susquehanna River	do	F. N. Clark.
9	do	90,000	90,000	do	do	do	do	Do.
April 12–30	Avoca	3,029,500	3,029,500	North Carolina				S. G. Worth.*
29	do	498,000	498,000	do	Avoca	Salmon Creek	Albemarle Sound	Z. L. Tanner.
30	do	830,000	830,000	do	do	do	do	Do.
May 19	Navy-yard	220,000	170,000	Ohio	Defiance	Maumee River	Lake Erie	H. E. Quinn.
27	Potomac barges	1,000,000	850,000	do	Steubenville	Ohio River	Mississippi River	N. Simmons.
17	Havre de Grace	1,000,000	1,000,000	Pennsylvania	Sunbury	Susquehanna River	Chesapeake Bay	J. P. Creveling.
26	do	1,000,000	1,000,000	do	Mifflin	Juniata River	Susquehanna River	Do.
30	do	1,500,000	1,500,000	do	Newport	do	do	Do.
June 3	do	500,000	500,000	Rhode Island	Warren	Palmer's River	Narragansett Bay	H. E. Quinn.
May 17	Navy-yard	200,000	200,000	South Carolina	Charlotte	Catawba River	Wateree River	C. W. Schuermann.
June 1	do	220,000	220,000	do	Railroad Crossing	Pedee River	Atlantic Ocean	H. E. Quinn.
8	do	200,000	200,000	do	Columbia	Congaree River	Santee River	C. J. Huske.
20	do	200,000	200,000	Tennessee	Johnsonville	Tennessee River	Ohio River	N. Simmons.
24	do	60,000	60,000	do	Union Depot	Holston River	Tennessee River	C. A. Steuart.
24	do	70,000	70,000	do	Fullen's	Nolachucky River	do	Do.
24	do	70,000	70,000	do	Carter's Depot	Wantaga River	do	John Horan.
14	do	150,000	135,000	Texas	Railroad Crossing	Sabine River	Gulf of Mexico	G. G. Davenport.
15	do	58,000	56,000	do	Austin	Colorado River	do	G. H. H. Moore.
15	do	32,000	30,000	do	Railroad Crossing	San Marcus River	do	G. G. Davenport.

	15	do	28,000	26,000	do	do	Brazos River	do	Do.
	15	do	32,000	30,000	do	do	San Antonio River	do	Do.
April	30	Potomac barges	1,383,000	1,383,000	Virginia	Gunston	Potomac River	Chesapeake Bay	M. McDonald.
May	2	do	625,000	625,000	do	do	do	do	Do.
	5	do	1,510,000	1,510,000	do	do	do	do	Do.
	6	do	1,130,000	1,130,000	do	do	do	do	Do.
	7	do	230,000	230,000	do	do	do	do	Do.
	9	do	2,887,000	2,887,000	do	do	do	do	Do.
	10	do	1,834,000	1,834,000	do	do	do	do	Do.
	11	do	1,730,000	1,730,000	do	do	do	do	Do.
	12	do	2,571,000	2,571,000	do	do	do	do	Do.
	13	do	40,000	40,000	do	do	do	do	Do.
	16	do	2,585,000	2,585,000	do	do	do	do	Do.
	20	do	1,125,000	1,125,000	do	do	do	do	Do.
	24	do	5,490,000	5,490,000	do	do	do	do	Do.
	26	do	140,000	140,000	do	do	do	do	Do.
	31	do	1,000,000	1,000,000	do	Lynchburg	James River	do	J. F. Ellis.
	15	do	175,000	175,000	West Virginia	Wheeling	Ohio River	Mississippi River	Do.
			67,353,000	67,003,000					

* For waters in which planted see note at close of Table VIII.

XXVI.—REPORT OF DISTRIBUTION OF CARP, DURING THE SEASON OF 1881-'82, BY THE UNITED STATES FISH COMMISSION.

By Marshall McDonald.

The first applications for German carp were filed in 1876, one year subsequent to the successful importation of this fish and to the establishment of breeding ponds at Druid Hill Park. The total number of applications filed during this year was 3. In 1877 the number increased to 20; in 1878 to 98; and in 1879, when the first distribution was made, the number of applications for the year was 324.

The fragmentary records of this first distribution show that there were distributed directly to 181 applicants 6,203 carp, being an average of 34 to each applicant. In addition there were distributed to State Commissioners and agents of distribution 4,743 carp, making a total distribution for the year of 10,946 carp.

In 1880 the number sent to applicants direct had risen to 31,443, and to State Commissioners and agents 19,021, making a total for the season of 50,464.

In 1881 we were confronted with the problem of distributing 160,000 fish over a much wider geographical range and at a consequent increase in the cost per applicant.

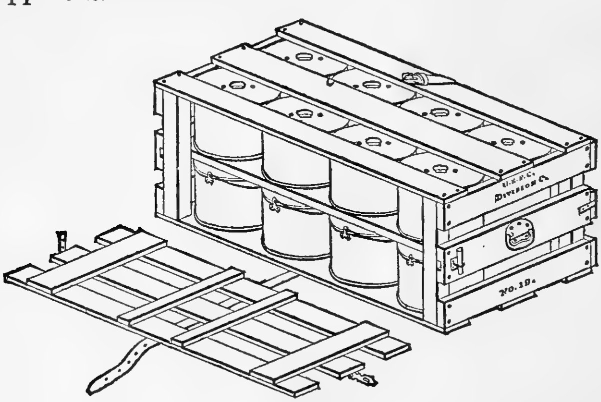
To relieve the messenger service of the pressure of the increased work, and to reduce the cost of the distribution, recourse was had to express shipments in all cases where applicants were willing to defray the increased cost of delivering. The shipping packages first used were wood-bound tin cans, holding about eight gallons of water, and making a shipping package weighing about 65 pounds. The principal lines of express transportation promptly responded to the request of the Commissioner and arranged a tariff of reduced rates of charges to all points reached by their routes. Even at the reduced rates the cost to applicants of express delivery was quite a serious matter, ranging from $1 for the nearest points to $6, $8, $10, and $12 for the more remote. Early in the season, by direction of the Commissiener, a half can was substituted for the can first used. This materially reduced the weight of the shipping package and the express charges in each case. Parties receiving these cans had the option of retaining them at a stipulated price or of returning them. When parties declined taking the cans, they were, under our arrangements with the express companies, returned free.

The distribution made prior to December 15 was accomplished by the methods above indicated; meanwhile experiments were inaugurated looking to reduction both in the weight and bulk of the shipping packages.

An account of the result of these experiments will be found in Vol. I, p. 215, Bulletin of the United States Fish Commission. So satisfactory were they that early in December I was instructed by the Commissioner to take charge of the Division of Distribution, and to inaugurate, systematize, and perfect the more economical methods of distribution rendered practicable by the reduction in the cost, size, and weight of the shipping packages. The standard package adopted was a covered tin bucket having a capacity of 4 quarts. For facility of aeration several holes were punched in the cover of each bucket.

A shipping-tag with room for the address on one side and the requisite printed instructions on the other was devised by Mr. S. C. Brown, so as to inclose securely a blank postal receipt, to be filled and returned by applicant on receipt of the fish. The buckets were to be returned by the applicants in all cases, the cost of the same (20 cents) being added to the express charges, and collected from the express agent in advance.

Where a number of buckets were to be sent to one destination, for convenience in handling and better safety in transmission, light crates were prepared, each having a capacity of 16 buckets, and weighing about 100 pounds. As from their shape several of the crates may be stacked up on each other, it is practicable to pack 1,000 fish on a floor-space not greater than that occupied by two of our ordinary transportation cans. The convenience and economy of these methods of transportation is therefore apparent.



Shipping crate.

All arrangements having been perfected and all necessary material having been collected, express shipments were made in the small buckets instead of the larger tin cans, to all points within a radius of 500 miles from Washington. The weight of the shipping packages was thus reduced from 60 pounds to about 8 pounds, with corresponding reduction in express charges.

At the time I was placed in charge of the work of distribution messenger shipments were in progress in the South Atlantic and Gulf States, portions of Georgia, Alabama, Mississippi, and Tennessee, and all of Florida being at that date (December 15) still unsupplied. The messenger lists necessary to regulate the distribution were at once prepared, and the fish destined for the supply of Southern Georgia and Florida sent forward in charge of Mr. Newton Simmons. Mr. George H. H. Moore and Mr. F. L. Donnelly were then in the field, one in Alabama, the other in Mississippi. They were directed not to return to Washington, but to await instructions at Meridian and Jackson, Miss. To these points messenger lists and explicit instructions and the number of carp necessary to complete the distribution were forwarded by express from Washington. These bucket shipments reached them in excellent condition, and by December 24 the distribution in the sections referred to had been completed. Texas, with 950 applicants, Arkansas, Indian Territory, Western Louisiana, and Missouri, with an aggregate of 150 widely scattered applicants, still remained to be supplied. It was planned to accomplish this work by one movement of our refrigerator car No. 1. All details of the distribution were arranged before we left Washington, the route to be traversed definitely determined, and notices forwarded by mail to each applicant informing him at about what date to expect his fish. So far as practicable, arrangements were made by which each should receive his fish either from the car *en route* or from one of the messengers temporarily detached for the purpose of supplying those remote from the route traversed by the car. It was not thought safe to attempt to carry more than 12,000 fish in the car. It was therefore arranged to have the additional number needed forwarded by express in lots of 2,000. Arrangements were made to have the fish rested and the water changed at Saint Louis. As these methods were novel, and the results considered doubtful by the most experienced messengers, it was thought best that I should accompany the expedition in order to enforce the observance of the necessary conditions of success and to take the responsibility of whatever failure there should be. It was thought prudent to make use of both methods of transportation. The complement of the car was therefore made up as follows: 40 large cans containing each 100 carp; 7 large cans containing each 150 carp; 18 crates containing each 320 carp; 3 crates containing each 400 carp. This made a total of 12,000 fish in the car.

The crew of the car consisted of Mr. J. F. Ellis, messenger in charge; Newton Simmons, George H. H. Moore, M. S. Thompson, messengers; and the cook.

We left Washington at 4 p. m. January 3, 1882, going through to Saint Louis on the fast express of the Pennsylvania Railroad. I did not think it necessary to examine the fish or change the water until we reached Saint Louis, where all the cans and buckets were overhauled and the water changed except in the crates containing 400 fish each, which were left undisturbed until we reached Texarkana. The fish were all found to be in good condition and the change was made rather as a precaution than as a necessity. At Washington I had placed 100 fish in a 6-quart bucket as an extreme test. At Saint Louis these carp showed signs of suffering and were turned over to Dr. Steedman. From Saint Louis seven buckets of fish were forwarded by express, to applicants in the first Congressional district of Iowa, who had been overlooked in the previous distribution. They reached their destination safely, though two days *en route* and in very severe weather.

On the 5th of January at 9 p. m. the car left Saint Louis by the Iron Mountain route and reached Texarkana the next day. On the way fish were delivered to all applicants in Arkansas who were accessible, postal notifications having been previously sent from Washington directing them when and where to meet us. At Texarkana a complete change of water was made on all the fish. The three crates of 1,200 fish which had not been touched since leaving Washington were found to be in fair condition, though a few were dead and the remainder apparently weak. They had traveled three and a half days without any change of water.

The rise in temperature as we proceeded south made it prudent to take measures looking to refrigeration. Application to the railroad authorities procured a ton of ice, which was placed in the ice-chests, and the refrigerator portion of the car maintained at a temperature of 50° from that time onward until the distribution was completed.

At Texarkana I detached Mr. Moore with a supply of fish for Shreveport, Western Louisiana, and for such applicants in Texas as he could reach conveniently by the route he traveled. Mr. Simmons was sent with a supply for applicants along the narrow-guage road between Texarkana and Waco.

After remaining at Texarkana twenty-four hours in order to rest the fish and to give due notice of our coming, we started Sunday morning, January 8, for Sherman, Tex., delivering fish on the way to all applicants in that section of the State. Moore rejoined the car at Dallas, and Simmons at Fort Worth, while I proceeded from Sherman to the Indian Territory to supply applicants in the Choctaw Nation, and returned via Sherman to Dallas.

Dallas being the point to which the express shipments were to be sent, I had arranged to rendezvous the car and all the messengers there, and thought it best to await the arrival of all the express shipments, as it would be safer to transport the fish south in the car than to trust to their being forwarded by express. The first lot forwarded from Washington came as far as Saint Louis in charge of Messenger Donnelly; there the water was changed, and the fish expressed to Dallas. Donnelly remained at Saint Louis to re-ship subsequent lots, which followed at intervals of twenty-four hours. These shipments, amounting to about 6,000 fish (scale carp), reached Dallas in fair condition, though they were much weaker than the leather variety brought in the car, and less fitted to endure rough travel.

From Dallas the car with the full complement of messengers proceeded to Austin via Hearne, supplying as arranged all applicants along the route. In order to provide for supplying the numerous applicants in the vicinity of Corsicana it was found necessary to lie over at that place twelve hours, the train agent kindly making arrangements to take us up on the next train. On reaching Austin I was met by Mr. R. R. Robertson, the Texas Fish Commissioner, who was kind enough to take charge of the delivery of carp to applicants in that vicinity. From Austin we proceeded to San Antonio, where I remained, but sent the car on to Laredo. At Laredo Mr. Ellis was detached with enough fish to supply applicants in the extreme south of the State. From San Antonio we returned via the Sunset route to Houston, where I left the car, and with Messenger Thompson proceeded via New Orleans to Washington. I delivered on the way fish to isolated persons who could not be reached in any other way. Meanwhile the car proceeded to Houston and was here joined by Mr. Ellis, who had been instructed from Washington to take the car to Saint Louis and await further orders.

The routes traveled by the car and detached messengers were planned so as to completely reach every part of the State, and the measures taken beforehand to notify applicants were so thorough that of upwards of 800 applicants not more than 7 were unsupplied.

The fish were delivered to the applicants or their authorized agents, or else they were left at the most accessible point and the recipient so notified.

The satisfactory issue of our work is largely due to the liberal facilities accorded us by the various lines of railroad traversed. Anything in the way of supplies or service was unfailingly rendered. Special acknowledgments are due Mr. H. M. Hoxie, the general manager of the Saint Louis, Iron Mountain, and Southern Railway. From Saint Louis westward until our return to that point, free transportation for car was granted on all lines of railroad traversed by us.

The result of the work demonstrated that in making shipments by the car-load we can carry a much greater number of fish by using small buckets instead of cans, and also that buckets can be used with great advantage and economy in shipping by express, provided the passage does not last more than thirty-six or forty-eight hours. I am not satisfied, however, that this mode of shipment is practicable in warm weather. This must be decided by experiments.

The State of Texas seems to possess extraordinary facilities for raising carp, and as many of the recipients went to great expense to prepare ponds it is believed that carp-raising will soon become a valuable industry in that State.

The following summary of the distribution by States is respectfully submitted:

Summary of carp distribution for the year 1881-'82.

State.	Number of counties represented.	Number of applicants supplied by express.	Number of applicants supplied by messenger.	Total number of applicants supplied.	Total number of fish furnished.	Number of applicants remaining unsupplied.	Total number of applicants.
Alabama	38	28	60	88	1,856	70	158
Arizona	2	......	......	......	......	7	7
Arkansas	17	5	28	33	818	5	38
California	24	......	......	......	......	38	38
Colorado	9	1	......	1	20	18	19
Connecticut	8	21	71	92	2,220	14	106
Dakota	5	......	......	......	......	8	18
Delaware	3	16	42	58	2,100	1	59
District of Columbia	......	1	3	4	86	7	11
Florida	11	2	23	25	432	5	30
Georgia	94	30	380	410	7,681	133	543
Idaho	2	......	......	......	......	2	2
Illinois	62	23	139	162	2,844	24	186
Indiana	52	135	10	145	3,896	27	172
Indian Territory	1	......	16	16	317	......	16
Iowa	29	1	15	16	292	28	44
Kansas	45	5	105	110	2,366	17	127
Kentucky	70	7	489	496	9,732	84	580
Louisiana	24	1	51	52	1,276	6	58
Maine	6	6	......	6	116	5	11
Maryland	28	15	240	255	22,424	9	264
Massachusetts	10	24	3	27	745	21	48
Michigan	20	3	37	40	1,848	9	49
Minnesota	18	4	1	5	100	17	22
Mississippi	55	139	389	528	9,445	97	625
Missouri	50	2	208	210	4,126	54	264
Montana	2	......	......	......	......	2	2
Nebraska	11	6	1	7	120	8	15
Nevada	2	......	......	......	......	2	2
New Hampshire	6	6	......	6	140	5	11
New Jersey	19	49	21	70	1,352	11	81
New Mexico	3	......	......	......	......	6	6
New York	40	140	50	190	4,616	68	258
North Carolina	56	47	115	162	3,104	91	253
Ohio	62	172	35	207	4,258	89	296
Oregon	13	......	......	......	......	35	35
Pennsylvania	54	209	141	350	7,256	73	423
Rhode Island	4	5	20	25	1,140	2	27
South Carolina	26	9	236	245	11,884	11	256
Tennessee	46	34	165	199	4,200	55	254
Texas	112	15	926	941	16,580	9	950
Utah	5	5	......	5	130	5	10
Vermont	3	4	......	4	76	2	6
Virginia	68	172	304	476	11,669	30	506
Washington	......	......	......	......	......	11	11
West Virginia	21	35	41	76	1,935	6	82
Wisconsin	19	10	4	14	296	15	29
Wyoming	1	......	2	2	200	2	4
Total	1,256	1,387	4,371	5,758	143,696	1,244	7,002

The number actually sent out in 1881 was from six to eight thousand greater than appears from the subjoined table, many having been distributed through agents whose reports were not available when this table was made. There should also be added the number of carp distributed in the spring of 1882, those being of the 1881 crop and amounting to five or six thousand. The crop of 1881 aggregated about 160,000.

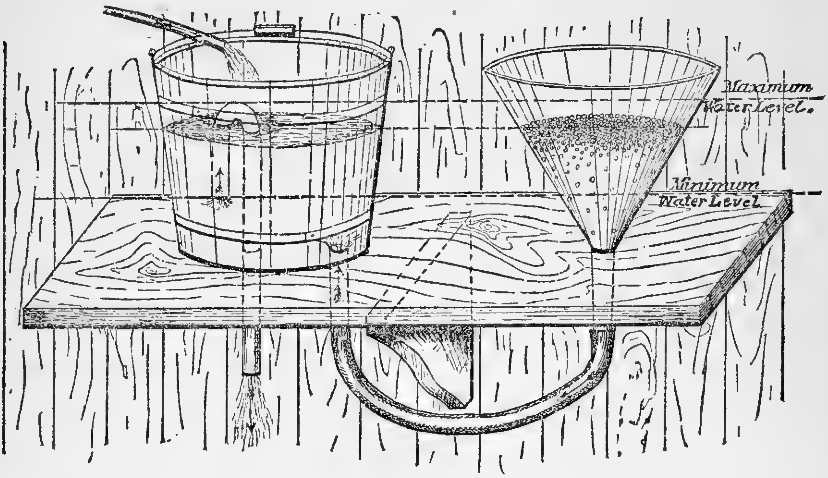
XXVII.—EXPERIMENTAL INVESTIGATIONS UPON COD HATCHING AT WOOD'S HOLL, MASS., DURING THE WINTER OF 1880-'81.

By Marshall McDonald.

In November, 1880, a station was established at Wood's Holl, Mass., with a view of continuing the experiments in cod-hatching which had been conducted at Provincetown the previous winter. Capt. H. C. Chester was in charge of station, which was equipped with engine, pumps, and reservoir for the purpose of securing constant circulation of salt water through hatching apparatus. Having submitted to the Commissioner plans of an apparatus which it was thought would be adapted for the hatching of floating eggs, I was directed by him to proceed to Wood's Holl and conduct the experimental investigations there.

The form of apparatus first proposed was an inverted funnel, the lower end of which dipped below the surface of water contained in the trough, upon which it rested, the supply of water being brought in by a tube at the upper or smaller end of the funnel, so that when once filled with water the column was maintained by the pressure of the air. In this way the movement of the water through the cone, or funnel, was similar to that in the ordinary upright cone used for hatching heavy eggs, except that the current was from above down instead of from below up. It was supposed that the buoyancy of the eggs would counterbalance the downward movement of the current of water, so that the eggs would be kept in suspension in the funnel. This apparatus answered very well for a few days after impregnation of the eggs, when they were much more buoyant than at a subsequent stage. In a short time, however, either by becoming loaded with sediment, or by actual increase of specific gravity, the buoyancy became less and less, and the eggs were carried out and lost. This apparatus, though promising in results on first appearance, proved in practice to be a failure, no eggs whatever having been hatched in it, the several lots used being entirely lost.

As all eggs require constant accessions of fresh water in order to secure development, it was evident that some form of apparatus must be had recourse to in which the water could be continually renewed without carrying off the eggs in its efflux. These eggs being buoyant and occupying a layer at the surface of the water, it was thought that by introducing the water into the lower part of the vessel containing them and then withdrawing it through the same opening the necessary change of water could be effected. In order, however, to accomplish this alternate influx and efflux of the water conveniently, it was necessary to make use of some automatic device, so that the work could go on without the continual supervision of some expert. The method by which this was effected is shown in the accompanying sketch.



Apparatus for hatching buoyant fish eggs.

In all of the various forms of apparatus that were used at different times during the season, a certain percentage of eggs was hatched, where no accident intervened to terminate the experiment abruptly. The percentage of loss, however, was very large—much larger than could be tolerated in any method where practical results in hatching were to be looked for. These losses were to be attributed mainly to two causes: the increase in the density of the eggs as incubation went on by the accumulation of sediment, and the inferior density of the water employed as compared with sea water. Could these methods have been used where water of the density of the sea was available, and where perfect means of filtration could be provided, I have no doubt but that all the forms of apparatus used would have given good results in hatching.

The largest percentage of hatching was attained in the upright glass funnels, in which the eggs, twice a day, were thoroughly washed by a jet of water, the effect being, by the attrition of the eggs upon each other, to keep the surfaces perfectly clean and to maintain their buoyancy. The percentage of hatching in the majority of the cases was very small, not more than from 5 per cent. to 15 per cent. of the total number of eggs employed. In one experiment with a glass funnel, containing 40,000 eggs, the water in which, from its location near the stove, was uniformly several degrees higher in temperature than the water in the hatchery, 25,000 young fish were obtained. These were sent in charge of special messenger to Annapolis and deposited in the Chesapeake Bay at that point.

The range of the investigation at Wood's Holl was largely limited from the fact that we were able to obtain during the time that I was there, only a single lot of spawning fish, from which, though some millions of eggs were secured, the larger part were lost, and we obtained only some four or five thousand fry. The succession of spawning fish that we had hoped for was not obtained, the extreme cold weather having prevented it. The station was accordingly abandoned, and the experiments discontinued before the appearance of the schools in Ipswich Bay. Had the station been kept open, and the supplies of eggs obtained, which would have been available from this source, I have no doubt the result of the winter's work would have been to establish precise methods and forms of apparatus for the hatching of the cod egg on a large scale.

In connection with this work important investigations were conducted by Professor Ryder in regard to the embryology of the cod-fish. Results of these investigations have already been communicated in detail by him to the Commissioner.

XXVIII.—SPANISH MACKEREL—INVESTIGATIONS AT CHERRYSTONE, VA., DURING THE SUMMER OF 1881.

By Marshall McDonald.

The Spanish mackerel is the most valuable species of the salt-water fish taken in the Chesapeake Bay. It enters the capes in large schools about the 1st of June, each year, and is found in the bay during the whole summer, being taken in large quantities by the pounds on the eastern shores of Virginia, and at New Point, on the western shore, and in the middle ground of the Chesapeake, off Tangier Island, by gill-net fishermen. Until the investigations of Col. M. McDonald and Mr. R. E. Earll, which were conducted at New Point during the summer of 1880, it was not known that this species spawned in the Chesapeake. As soon as the fact was announced to the Commissioner he, appreciating the importance of the discovery, later in the season sent Mr. R. E. Earll to the vicinity of Crisfield, Md., with suitable apparatus to determine the possibility of obtaining eggs in large numbers, and to study the methods and apparatus of hatching adapted to them. Mr. Earll was able to report, as the result of his investigation, that the eggs could be obtained in vast quantities, and could be hatched readily by methods requiring little apparatus or attention on the part of the observer. The result of Mr. Earll's investigations, and of cotemporaneous investigations conducted upon the western shore by the steamer Lookout, have already appeared in the official publications of the Fish Commission.

The following season (1881) it was determined to see what could be done in the way of the artificial propagation of this species on a large scale. Accordingly, after the close of the shad hatching, the steamer Fish Hawk, in charge of Lieut. Z. L. Tanner, was sent to Cherrystone, on the eastern shore of Virginia, to establish a station there; Cherrystone being selected on account of its convenience to the large pounds on the bay shore between that point and Cape Charles, in which the larger proportion of the catch of Spanish mackerel in the Chesapeake Bay is taken. It being necessary to detach the Fish Hawk for summer work along the coast, I proceeded, by the direction of the Commissioner, to Cherrystone, in July, 1881, with instructions to establish there a shore station, and to continue the study of methods and apparatus as long as material for the purpose could be obtained.

The embryological investigations were conducted by Professor Ryder. Messrs. Sauerhoff and Walke, two of the most experienced fish-culturists connected with the work of the Commission, were detailed for service at the station. A Herreshoff launch furnished convenient means for the collection and transportation of the eggs from the pound nets to the hatching station. The methods and apparatus employed here were, in the main, those that had been used in the experiments in cod hatching the previous winter at Wood's Holl. Fair results were obtained in the use of nearly all the forms of apparatus employed. The great drawback, however, to the station was the inability to obtain eggs in sufficient numbers for the purpose of hatching. Of course, large numbers of Spanish mackerel were taken in the pounds. It was found, however, much to our surprise, that the fish were either spent or in various degrees of immaturity. Only in two or three instances were we able to secure full-ripe fish. This is probably to be attributed to the fact that the pounds are mainly fished on the first low water in the morning. The mackerel, when unrestrained, probably spawns early in the evening. Ripe fish, therefore, taken in pound and kept confined all night, crowded and worried by other fish, would spend their eggs during the night.

If Cherrystone is, therefore, to be made a center for fish-cultural operations connected with the Spanish mackerel it will be necessary to adopt means for securing the fish independent of the pounds now fished on that shore. A pound net owned and operated by the Commission, so that it could be fished whenever and as often as convenient, would probably give large results in the way of eggs.

In August, disappointed at the promise of eggs, which we had so confidently looked for at Cherrystone, I made a visit to Tangier Island and Crisfield by one of the "run" boats carrying fish from the eastern shore of Virginia to Crisfield. At this place I had opportunity to inspect the mackerel boats fishing off Tangier Island, all of which run to Crisfield with their fish in the morning after a night's fishing. In a single one of these boats, containing 200 or 300 mackerel, I found 52 full-ripe female fish, which would have yielded over 5,000,000 eggs, a number larger by far than we obtained from the pounds near Cherrystone during the entire season.

Inquiry at Crisfield of the fishermen handling the Spanish mackerel showed that the ripe fish in largest numbers make their appearance in the markets there from the middle of June to the first of July, which seems to be the height of the spawning season. Indeed, it is probable that the natural spawning grounds of the mackerel are much higher up the bay than Cherrystone. All indications would seem to point to the middle ground off Tangier Island as their breeding place. If in the future it be decided to develop the work of the artificial propagation of the mackerel, I should recommend the establishment of a station at or in the vicinity of Tangier Island and the erection of a pound by the Commission, to be operated by its own men, for the purpose of securing a supply of eggs. I have no doubt but that eggs in any quantity desirable may be obtained in this manner. While the practical results of Cherrystone Station were negative, yet the investigations conducted by Professor Ryder in regard to the embryology of various species of fish taken there were of surpassing interest. Full reports of these have already been submitted by Professor Ryder and published in the official reports of the Commission.

INDEX.

NOTE.—This index contains general references to the entire volume. More detailed indexes to six papers will be found at the pages indicated.

R.

S.

W.

Y.

Z.