8 Fishes

UNITED STATES COMMISSION OF FISH AND FISHERIES.

PART XX.

REPORT

OF

THE COMMISSIONER

FOR

THE YEAR ENDING JUNE 30, 1894.

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REPORT

OF THE

UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1894.

The appropriations for the work of the Commission for the period covered by this report were as follows:

Salaries	$172,120.00
Miscellaneous expenses:	
Administration	9,000.00
Propagation and distribution of food-fishes	92,181.94
Maintenance of vessels	30,500.00
Inquiry respecting food-fishes	10,800.00
Statistical inquiry	5,400.00
For completion of the following stations in—	
Texas, at San Marcos	8,300.00
Montana, at Bozeman	6,400.00
Vermont, at St. Johnsbury	8,500.00
For repairs to Armory Building occupied by the United States Fish Commission	7,100.00
Rent of temporary offices and transfer of records	2,000.00

Detailed report of the expenditures under these appropriations was made to Congress December 3, 1894 (House Mis. Doc. No. 19, Fifty-third Congress, third session).

REPAIRS TO OFFICES.

The building known as the Armory Building and occupied by the offices of the United States Fish Commission was built in 1855 for the care and preservation of military trophies of the Revolutionary and other wars, and for the use of the volunteers and militia of the District of Columbia. In 1874 it was condemned by Col. O. E. Babcock, in charge of public buildings and grounds, as old and unsightly, and its demolition was recommended. From 1877 to 1888 it was used by the United States National Museum for the storage of articles transferred from the Centennial Exhibition at Philadelphia, and the Secretary of the Smithsonian Institution states that the four floors, containing 5,000 square feet, were filled with these articles from top to bottom. These heavy loads had caused the floors to settle to such an extent as to cause apprehen-

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NOTE.—The operations of the Commission during the period under consideration were under the direction of Commissioner Marshall McDonald, whose declining health, however, prevented him from preparing a report covering them. His death occurred September 1, 1895. The accompanying report, prepared by the chief clerk of the Commission and the assistants in charge of the divisions, shows the work of the Commission during the fiscal year 1893–94.

sion as to the safety of the building, and it became necessary to make a thorough inspection of it. The examination showed the building to be in a very unsafe condition. Estimates of the cost for its repair, with a detailed report of the condition of the building, were transmitted to Congress, and an appropriation of $7,100 was made for its repair, to be done under the supervision and direction of the Architect of the Capitol.

On February 19, 1894, the offices were temporarily moved to the Atlantic Coast Line Building, corner Sixth street and Pennsylvania avenue. Soon thereafter the work of repairing was begun and was pushed so energetically that the building was ready for occupancy by June 6, and the offices were moved back to it, the Commission occupying the entire building, the Smithsonion Institution having vacated the portion formerly used by it.

OFFICE OF ARCHITECT AND ENGINEER.

The following is a condensed report of the work of construction at the different stations of the Commission during the year:

Green Lake Station, Maine.—The construction of new rearing ponds, supply flumes and pipes, drains, and grading of the grounds, begun in the preceding fiscal year, was finished. An ice-house was built and a number of minor repairs to the station made.

Craig Brook Station, Maine.—Finishing the constructions begun but not completed during the last year, viz, ice-house, food room, settling reservoir, new supply pipe for outdoor rearing troughs, grading, and making other minor repairs in superintendent's residence and barn.

Woods Hole Station, Massachusetts.—A new coal hoist and run was built in place of the old one, which had become decayed and unsafe.

St. Johnsbury Station, Vermont.—This station comprises 24.65 acres of ground on the west shore of Sleeper River, 1½ miles from St. Johnsbury, Vt. After all plans and specifications were made, the development of this station was begun with the construction of a dam across Sleeper River, from which to supply the hatchery and ponds with river water. The construction of a hatchery and barn was given out by contract; a railroad siding was provided, and roads through the grounds were built; a portion of the grounds was graded, some fencing was done, and the springs on the grounds were partly developed.

Battery Island Station, Maryland.—The damage done by extraordinarily high storm tides in September and again in October, 1893, was repaired. It consisted in repairs to the foundation, floors, porch, roof, and chimney of the dwelling house, the erection of a coal shed, a new front incline to hatchery building, and new foundation for water supply tank.

Fish Ponds, Washington, D. C.—A 2-inch supply pipe was laid from the foot of Seventeenth and B streets NW. to the new northeast pond. The office of the superintendent, which showed some settlement in the floor and partitions, was repaired.

Preliminary plans and an estimate of cost were made for the improvement of the Potomac Flats by a number of large and small ponds, a boulevard, and sea wall, a hatchery building, and extensive landscaping, all of which was laid before Congress with a view of obtaining an appropriation to carry the improvements into effect.

Northville Station, Michigan.—Several of the various ponds of this station were provided with new supply pipes; separate drains for all these ponds were laid; a new supply pipe of wood was substituted for one formerly of terra cotta; a number of springy places in the grounds were drained by blind ditching; and twelve new rearing ponds were constructed, complete with supply pipe, overflow, and drains. A number of repairs to the former pipe lines and reservoirs was also made, and a survey for a proposed new spring-water supply.

Neosho Station, Missouri.—At this station two small reservoirs, formerly of wood, were replaced by a construction of concrete. Two new ponds were constructed and some minor repairs were made to ice-house, pipe lines, and ponds.

San Marcos Station, Texas.—This station comprises 25 acres of land at the head of San Marcos River, close to the city of the same name. A supplementary topographical survey of the grounds was made. The new dam constructed by a committee of citizens at San Marcos was inspected and reported upon unfavorably.

Leadville Station, Colorado.—A survey was made with the view of constructing a dam across Rock Creek, thereby filling several large natural depressions in the hills above the hatchery for storage purposes and for obtaining a larger spring-water supply for the hatchery. The result of the survey showed the impracticability of said proposed construction. Steps were then taken to purchase additional adjoining land in which the Evergreen lakes are situated, and to control, through a new Executive order, all of Rock Creek above said lakes. The purchase of said land was consummated.

Bozeman Station, Montana.—This station comprises 77 acres of ground at the lower entrance to Bridger Canyon, 4 miles from Bozeman. A supplementary survey was made of the grounds, and plans for a hatchery and pond system were prepared.

OFFICE OF MECHANICAL ENGINEER.

The following report exhibits briefly the work done during the past fiscal year in the nature of repairs, alterations, and new work to and in the steam engineering departments at the different stations, upon the cars and in the steamers of the Commission, together with the work done in connection with aquarial exhibits at the different stations and the World's Columbian Exposition:

During the past fiscal year there has been a large amount of work done in the machine shop at Central Station by the machinists and firemen who have been detailed for duty there from time to time. This work has consisted not only in the machine work incident to the necessary overhauling and repairs to the steam launches and machinery of Central Station, Fish Ponds, Bryan Point Station, and Battery Station, but considerable machine work has been done in the above-mentioned shop for the Put-in-Bay, Duluth, Gloucester, and Woods Hole stations, as also repairs, alterations, and new work to the circulating and steam plants of cars Nos. 1, 2, 3, and 4.

For many years there was located on the third floor at Central Station a cylindrical wooden supply tank for supplying fresh water to the hatching tables. It was found advisable to discontinue this weight upon the floor. The tank was therefore removed, and a 3-inch Watson & McDaniel water-pressure regulating valve was purchased and connected in the main supply system, which proved entirely satisfactory.

The small vertical launch boiler, which was located in the machine shop at Central Station to assist the 15-horsepower horizontal boiler in heating Central Station and the general offices of the Commission, was removed from the shop and erected on car No. 4 to furnish steam for the water and air circulating plants on that car. This boiler being too small to properly assist in heating Central Station and general offices, it was found necessary to make some new arrangement for the increase of boiler power of this station. It was therefore decided to build a new boiler house of sufficient size to allow the introduction of a new 30-horsepower boiler. This boiler was purchased, but after its purchase it was found that the new boiler house could not be erected; and as such a boiler was needed at Woods Hole, it was transferred to that station and there erected.

The steam launch *Blue Wing* was hauled out on the railway and several seams in the hull were calked. The old cabin of this steamer was torn down and a new one erected, the inside and outside were thoroughly painted, the boiler and pumps were overhauled, and extensive repairs were made to the engine.

The steamer *Petrel* was hauled out on the railway, several pieces of rotten plank were removed, and new plank substituted. The moldings around upper deck were renewed, the forward part of the hurricane deck was cut, and a pilot house built. The side curtains were altered. The engine, pumps, boiler, and their attachments were thoroughly overhauled and repaired. The steamer was painted and varnished inside and out. A set of automatic water-glass gauge cocks were put on the boiler. A new steering gear was made and introduced.

The steamer *Canvasback* was hauled out on the railway and the hull repaired. The boiler of this steamer being old and worn out, a vertical steel boiler was purchased, erected, and connected, and the engine and pumps were overhauled and thoroughly repaired.

In order to haul the steamers and other boats out at Battery Island Station, Maryland, a marine railway was constructed and introduced. During a heavy gale here the steamer *Plover* was sunk by having a hole punched through the planking in her hull below the water line.

The steamer was raised, hauled out on the railway, and hull repaired. Extensive repairs were made to its engine and pumps, and a new propeller wheel was purchased and put on. The boiler being old and worn out, a new one was purchased and introduced.

The independent air and feed pump in the steamer *Curlew* not being satisfactory, a new one was made in machine shop at Central Station.

The steamer *Cygnet* was hauled out on the railway and necessary repairs made to the hull. The boiler and pumps were thoroughly overhauled, and extensive repairs were made to the engine.

A new Scotch boiler was built for steamer *Shearwater*, to take the place of the Ward boiler now in the steamer.

Since the introduction about eight years ago of boiler and pumps for the water-circulating and steam-heating plants in car No. 2, it was found necessary to increase the capacity of this car for transporting fry and hatching eggs en route, and as this necessitated an increase of water circulation larger boiler and pumps were purchased, erected and connected in same, the car almost entirely repiped, and the air pump which was removed from car No. 4 erected and connected in order to furnish aeration for transporting tanks.

The 25-horsepower horizontal boiler, which has been in use at the Woods Hole Station for the past nine years, needed such extensive repairs that it was condemned, and the 30-horsepower horizontal boiler which had been purchased for Central Station was transferred to the Woods Hole Station and erected in the boiler room.

The 6-inch wooden suction pipe for the salt-water circulation at the Woods Hole Station, which had been in continual use for the past nine years, was in such bad condition that 225 feet of it was dug up, and new pipe of the same make was laid.

The 6-inch water cylinder of the main circulating pump at Battery Island Station being worn out, a new water cylinder, 10 inches in diameter, was purchased, and will be connected as soon as opportunity offers. There was also purchased and erected at this station a 6,000-gallon wooden supply tank for hatching apparatus, the old tank having been washed away during one of the floods.

As the water around the station at Lake Erie contains so much lime in solution, which causes the accumulation of scale in large quantities in the boilers, a pipe condenser was made in order to condense the exhaust steam from the pumps and radiators, and a small air and feed pump was transferred from the Woods Hole (Mass.) Station, and connected to this condenser. This arrangement allowed the station to be heated by the exhaust steam from pumps and the condensed water to be pumped back into the boilers. The arrangement has worked very satisfactorily.

As the gravity supply of the Duluth (Minn.) Station failed on several occasions on account of drought or freezing up, the steam pumping plant at this station was increased by the transfer from Battery Station of a pump which was there in stock. The wells located on the shore of the lake would not, during the severe cold of the winter, furnish enough water to supply the necessary amount required in the hatchery, and about 350 feet of 6-inch iron pipe was purchased and laid from the pumps, extending out into the lake about 250 feet into a depth of water of about 12 feet. This pipe was well anchored to the bottom, and since its introduction there has been no trouble in obtaining all the water required. It was found advisable to remodel the hatching apparatus, etc., of this station. A new system of jar battery, hatching and rearing troughs, etc., was made and erected, and the whole piping in the hatchery was rearranged. After the remodeling of the hatchery, it was found that a greater amount of work could be done with considerable saving in water, which has caused a saving in fuel.

WORLD'S COLUMBIAN EXPOSITION.

The exhibit of the Commission at the World's Columbian Exposition, the report covering which appears as an appendix to this volume, had for some time been in complete working order at the opening of the fiscal year. Dr. Tarleton H. Bean continued in charge as representative, assisted by W. DeC. Ravenel, as chief special agent; Prof. S. A. Forbes, as director of the aquarium, and other persons.

The section of Scientific Inquiry, prepared under the direction of Mr. Richard Rathbun, contained illustrations of the marine laboratory of the Commission; models of illustrations of vessels; specimens of seines, trawls, nets, dredges, and sounding machine used in deep-sea work; instruments used in making physical observations; a large series of flexible casts illustrating, chiefly, important economic species; charts and models of the ocean areas investigated, and specimens preserved in alcohol or in a dry state.

The section of Fish-Culture was directly in charge of Mr. W. DeC. Ravenel. In addition to what has already been mentioned it contained apparatus used in modern fish-culture, as well as an historical series showing the changes through which fish-cultural methods have passed; apparatus for collecting and transporting eggs and spawning fish; models and pictures of hatching and rearing establishments; collections showing methods and results of fish-culture; eggs in various stages of development preserved in brine or alcohol; illustrations of the food and enemies, and a collection of fish-cultural literature.

In the hatchery the eggs of the pike perch, yellow perch, and common sucker had all been developed, and about 7,000,000 of fry were planted in Lake Michigan near Jackson Park, and elsewhere. In July a consignment of eggs of the black-spotted trout was received from Leadville, and 70 per cent of them were hatched early in the month. Notwithstanding the high temperature of the water, the fry were kept without considerable loss until an accident to the machinery caused their death.

In the Fisheries section were shown models prepared under the personal supervision of Capt. J. W. Collins, illustrative of vessels and boats now engaged in the fisheries of New England, the Great Lakes, Chesapeake Bay, Gulf of Mexico, and the Pacific and Arctic oceans, as well as types of historical interest showing the development of fishing craft. This section was also materially improved by the addition of pictures of fishing operations, as well as statistical charts.

The aquarium contained marine fishes and plants obtained along the east and west coasts and the Gulf of Mexico, while the fresh-water supplies were secured from the Potomac, Mississippi, Great Lake basins, and the hatching stations of the Commission.

In the aquarium the salt water reached the very high temperature of 70° early in July, as it had done in the preceding month, and continued very warm, with an occasional fall of a few degrees, until about the middle of August. In September, again, the same difficulty was encountered, but the appliances for perfect aeration and circulation of the water prevented serious loss. In the fresh-water tanks the difficulty was very much greater, the high temperature being accompanied by an outbreak of a fungous disease and a scourge of parasitic protozoans. The fungus destroyed large numbers of catfish, trout, black bass, crappie, pike perch, and other species, while the protozoan was particularly fatal to trout and catfish. Notwithstanding all the drawbacks, the aquarium was one of the most frequented places in the Exposition, and the exhibit was in every way highly creditable.

Immediately after the close of the Exposition such of the aquarium contents as were not required by the Commission were, upon the direction of the Commissioner, transferred to Prof. S. A. Forbes for the State Laboratory of Natural History at Champaign, Ill.

The preparations for the World's Fisheries Congress began shortly before the opening of the Exposition, and were actively continued during the summer. The Commissioner associated with himself Dr. G. Brown Goode, Prof. S. A. Forbes, Dr. T. H. Bean, Mr. E. G. Blackford, Mr. A. Booth, Mr. N. K. Fairbank, and Mr. R. E. Earll as members of a general committee, and upon the invitation of Mr. C. C. Bonney, general chairman of the World's Congress, a large number of men prominent in fish-cultural investigations in various parts of the world were invited to form an advisory council. Invitations were sent out requesting attendance at the sessions of the congress and the preparation of papers to be read at the meetings. Numerous responses were received, and the communications brought together were of a very important character. They form the entire volume of the bulletin of this Commission for 1893.

The formal sessions of the congress were opened in a hall in the Memorial Art Palace, Chicago, October 16, 1893, the Commissioner making the opening address as chairman of the congress, Dr. G. Brown Goode, Hon. E. G. Blackford, and Dr. Hugh M. Smith acting as chairmen of the principal sections. The meetings were brought to a close on December 19 by a fish banquet in the banquet hall of the New York State building, Jackson Park.

Foreign visitors.—A great many persons from foreign countries made a special study of the apparatus and methods employed by the United States Fish Commission. Several of these visitors made reports to their Governments, embracing in them an account of the exhibit of the Commission.

Courtesies.—In addition to the articles deposited by the Commission in the National Museum that institution lent for exhibition numerous objects illustrating fish-culture and the fisheries.

The Bureau of Engraving and Printing furnished a supply of macerated greenback pulp for making casts.

The Department of Agriculture detailed a specialist to investigate a fish parasite which proved very destructive during the progress of the Exposition.

Through the instrumentality of the late Hon. F. B. Stockbridge a number of tank cars belonging to the Standard Oil Company were gratuitously lent for the purpose of conveying salt water from Morehead City, N. C., to Jackson Park, Chicago, the arrangement having been completed through the agent of the company, Mr. Howard Page.

The following railroads granted free transportation to United States Fish Commission cars while engaged in World's Fair work during the fiscal year 1893–94: Chesapeake and Ohio; Chicago and West Michigan; Chicago, Burlington and Quincy; Cleveland, Cincinnati, Chicago and St. Louis; Flint and Pere Marquette; Louisville and Nashville; Michigan Central; Wabash; Burlington, Cedar Rapids and Northern; Chicago and Northwestern; Des Moines, Northern and Western; Illinois Central; Lake Harbor; and Chicago, Milwaukee and St. Paul.

Acknowledgments are due to numerous parties for gifts or loans of models of vessels and boats, apparatus of capture, whaling apparatus, fish-cultural apparatus, angling apparatus, publications, etc., to which reference is made in the report upon the exhibit.

At the close of the Exposition the fishery exhibit of Japan was presented to the United States Fish Commission through Commissioner C. Matsudaira. This was one of the most interesting exhibits in the Fisheries building.

The total expenses of the exhibit to September 30, 1894, amounted to $89,789.60.

The affairs of the exhibit were wound up before the close of the fiscal year ending June 30, 1894, and the representative returned to his duty in charge of the division of fish-culture.

LIBRARY AND PUBLICATIONS.

The accessions of books to the library, mainly secured by exchange for the publications of the Commission, and by gift, numbered 958 volumes. The policy of distributing the various special papers forming parts of the annual reports and bulletins in advance of the issue of the completed volumes was continued.

The papers issued during the year were as follows:

Report on the European methods of oyster culture. By Bashford Dean. (Bulletin 1891, pp. 357 to 406.)
On the classification of the myxosporidia, a group of protozoan parasites infesting fishes. By R. R. Gurley. (Bulletin 1891, pp. 407 to 420.)
Report upon the investigations of the United States Fish Commission steamer *Albatross* from July 1, 1889, to June 30, 1891. By Z. L. Tanner. (Report 1889–1891, pp. 207 to 312.)
Report of observations respecting the oyster resources and oyster fishery of the Pacific Coast of the United States. By Charles H. Townsend. (Report 1889–1891, pp. 343 to 372.)
Report on the coast fisheries of Texas. By Charles H. Stevenson. (Report 1889–1891, pp. 373 to 420.)
A review of the sparoid fishes of America and Europe. By David S. Jordan and Bert Fesler. (Report 1889–1891, pp. 421 to 544.)
On fish entozoa from Yellowstone National Park. By Edwin Linton. (Report 1889–1891, pp. 545 to 564.)
Plankton studies: A comparative investigation of the importance and constitution of the pelagic fauna and flora. By Ernst Haeckel. Translated by George Wilton Field. (Report 1889–1891, pp. 565 to 641.)
The fishes of Texas and the Rio Grande basin, considered chiefly with reference to their geographical distribution. By Barton W. Evermann and William C. Kendall. (Bulletin 1892, pp. 57 to 126.)
A study of the fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. By Hugh M. Smith. (Bulletin 1892, pp. 299 to 355.)
The oyster industry of Maryland. By Charles H. Stevenson. (Bulletin 1892, pp. 203 to 297.)
Summary of the fishery investigations conducted in the North Pacific Ocean and Bering Sea from July 1, 1888, to July 1, 1892, by the U. S. Fish Commission steamer *Albatross*. By Richard Rathbun. (Bulletin 1892, pp. 127 to 201.)
List of fishes collected at Sea Isle City, N. J., during the summer of 1892. By H. F. Moore. (Bulletin 1892, pp. 357 to 364.)
Economic and natural history notes on fishes of the northern coast of New Jersey. By Hugh M. Smith. (Bulletin 1892, pp. 365 to 380.)
On the viviparous fishes of the Pacific Coast of North America. By Carl H. Eigenmann. (Bulletin 1892, pp. 381 to 478.)
Notes on two hitherto unrecognized species of American whitefish. By Hugh M. Smith. (Bulletin 1894, pp. 1 to 13.)
Extension of the recorded range of certain marine and fresh-water fishes of the Atlantic coast of the United States. By W. C. Kendall and Hugh M. Smith. (Bulletin 1894, pp. 15 to 21.)
Notes on fishes from the basin of the Mackenzie River in British America. By Charles H. Gilbert. (Bulletin 1894, pp. 23 to 25.)
An American fish in Finland. By Oscar Nordqvist. (Bulletin 1894, pp. 27 to 28.)
Two fertile cyprinoid hybrids. By Karl Knauthe. (Bulletin 1894, pp. 29 to 30.)
A report upon explorations made in Eel River basin in the northeastern part of Indiana in the summer of 1892. By Philip H. Kirsch. (Bulletin 1894, pp. 31 to 42.)
Notes on the fresh-water fishes of Washington County, Me. By William C. Kendall. (Bulletin 1894, pp. 43 to 54.)
World's Fisheries Congress. Report of the secretary of the general committee, by Tarleton H. Bean, and address of the chairman of the general committee, by Marshall McDonald. (Bulletin 1893, pp. 1 to 16.)
The assimilation of the fishery laws of the Great Lakes. By G. A. MacCallum. (Bulletin 1893, pp. 17 to 20.)
The decrease of food-fishes in American waters and some of the causes. By A. M. Spangler. (Bulletin 1893, pp. 21 to 35.)
The sea and coast fisheries. By Daniel T. Church. (Bulletin 1893, pp. 37 to 38.)
Our ocean fishes and the effect of legislation upon the fisheries. By J. M. K. Southwick. (Bulletin 1893, pp. 39 to 45.)
The past, present, and future of trout-culture. By W. L. Gilbert. (Bulletin 1893, pp. 47 to 48.)
The relation of scientific research to economic problems. By George Brown Goode. (Bulletin 1893, pp. 49 to 58.)
Biological research in relation to the fisheries. By John A. Ryder. (Bulletin 1893, pp. 59 to 63.)
On the influence of light on the periodical depth migrations of pelagic animals. By Jacques Loeb. (Bulletin 1893, pp. 65 to 68.)
The investigation of rivers and lakes with reference to fish environment. By Barton W. Evermann. (Bulletin 1893, pp. 69 to 73.)

The habits and development of the lobster, and their bearing upon its artificial propagation. By Francis H. Herrick. (Bulletin 1893, pp. 75 to 86.)
The origin of the food of marine animals. By W. K. Brooks. (Bulletin 1893, pp. 87 to 92.)
Atmospheric and other influences on the migrations of fishes. By J. J. Armistead. (Bulletin 1893, pp. 93 to 99.)
Some observations concerning fish parasites. By Edwin Linton. (Bulletin 1893, pp. 101 to 112.)
On the food of the menhaden. By James I. Peck. (Bulletin 1893, pp. 113 to 126.)
Some plankton studies in the Great Lakes. By Jacob E. Reighard. (Bulletin 1893, pp. 127 to 142.)
The aquarium of the United States Fish Commission at the World's Columbian Exposition. By S. A. Forbes. (Bulletin 1893, pp. 143 to 158.)
Description of the fresh and salt water supply and pumping plants used for the aquarium. By I. S. K. Reeves. (Bulletin 1893, pp. 159 to 161.)
Observations and experiments on saprolegnia infesting fish. By G. P. Clinton. Bulletin 1893, pp. 163 to 172.)
Report on a parasitic protozoan observed on fish in the aquarium. By Charles Wardell Stiles. (Bulletin 1893, pp. 173 to 190.)
Statistical review of fish-culture in Europe and North America. By N. Borodine. (Bulletin 1893, pp. 193 to 196.)
Some notes about American fish-culture. By Oscar Nordqvist. (Bulletin 1893, pp. 197 to 200.)
Fish-culture in Michigan. By Hoyt Post. (Bulletin 1893, pp. 201 to 211.)
History and methods of whitefish culture. By Frank N. Clark. (Bulletin 1893, pp. 213 to 220.)
Methods employed at Craig Brook Station in rearing young salmonoid fishes. By Charles G. Atkins. (Bulletin 1893, pp. 221 to 228.)
The propagation of black bass in ponds. By William F. Page. (Bulletin 1893, pp. 229 to 236.)
Fish and fishing in British Guiana. By J. J. Quelch. (Bulletin 1893, pp. 237 to 240.)
Fish-cultural investigations at St. Andrews marine laboratory, Scotland. By W. C. McIntosh. (Bulletin 1893, pp. 241 to 256.)
Description of the marine hatchery at Dunbar, Scotland. By T. Wemyss Fulton. (Bulletin 1893, pp. 257 to 262.)
The past, present, and future of the oyster industry of Georgia. By A. Oemler. (Bulletin 1893, pp. 263 to 272.)
Deep-water oyster culture. By H. C. Rowe. (Bulletin 1893, pp. 273 to 276.)
Breeding natural food artificially for young fish artificially hatched. By A. Nelson Cheney. (Bulletin 1893, pp. 277 to 279.)
What we know of the lobster. By Fred Mather. (Bulletin, 1893, pp. 281 to 286.)
Remarks on the maintenance and improvement of the American fisheries. By Hugh M. Smith. (Bulletin 1893, pp. 287 to 292.)
Reforms and improvements suggested for the fisheries of Great Britain and Ireland. By J. Lawrence-Hamilton. (Bulletin 1893, pp. 293 to 310.)
Foul fish and filth fevers. By J. Lawrence-Hamilton. (Bulletin 1893, pp. 311 to 334.)
Recent experiments in sturgeon hatching on the Delaware River. By Bashford Dean. (Bulletin 1893, pp. 335 to 339.)
The fisheries of Canada. By L. Z. Joncas. (Bulletin 1893, pp. 341 to 348.)
The fishing industry of Lake Erie, past and present. By C. M. Keyes. (Bulletin 1893, pp. 349 to 353.)
Notes on the Irish mackerel fisheries. By William Spotswood Green. (Bulletin 1893, pp. 357 to 360.)
Past and future of the fur seal. By Joseph Stanley-Brown. (Bulletin 1893, pp. 361 to 370.)
Notes on the fisheries and fishery industries of Puget Sound. By James G. Swan. (Bulletin 1893, pp. 371 to 380.)
Report on a collection of fishes from the rivers of central and northern Mexico. By Albert J. Woolman. (Bulletin 1894, pp. 55 to 65.)
Report of investigations respecting the fishes of Arkansas conducted during 1891, 1892, and 1893, with a synopsis of previous explorations in the same State. By Seth Eugene Meek. (Bulletin 1894, pp. 67 to 94.)
Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States. By Hugh M. Smith. (Bulletin 1894, pp. 95 to 99.)

The completed volumes issued during the year were the Bulletin for the year 1891, and a report covering the years beginning July 1, 1889, and ending June 30, 1891.

The distribution of publications during the year consisted of 2,800 copies of the complete volumes of reports and bulletins, and 8,300 copies of the separate articles appearing in them.

Under the general title "Reports on an Exploration off the West Coasts of Mexico, Central and South America, and off the Galapagos Islands, in charge of Alexander Agassiz, by the U. S. Fish Commission steamer *Albatross*, during 1891, Lieut. Commander Z. L. Tanner, U. S. N., commanding," the following papers were published in the Bulletins of the Museum of Comparative Zoology, Cambridge, Mass.:

Report upon rocks collected from the Galapagos Islands. By George P. Merrill. (XVI, No. 13.)
Preliminary descriptions of new species of Crustacea. By Walter Faxon. (XXIV, No. 7.)
The Orthoptera of the Galapagos Islands. By Samuel H. Scudder. (XXV, No. 1.)
Compte-Rendu sur les Pantopodes. Par W. M. Schimkéwitsch. (XXV, No. 2.)
Report on the Turbellaria. By W. McM. Woodworth. (XXV, No. 4.)
Note Préliminaire sur les Alcyonaires. Par Théophile Studer. (XXV, No. 5.)
The Hydroids. By Samuel F. Clarke. (XXV, No. 6.)

There were also issued during the year in the "Proceedings of the United States National Museum," under the general title "Scientific results of explorations by the United States Fish Commission steamer *Albatross*," the following papers:

Report on the *Actiniæ* collected by the United States Fish Commission steamer *Albatross* during the winter of 1887–88. By J. Playfair McMurrich.
Descriptions of new genera and species of crabs from the west coast of North America and the Sandwich Islands. By Mary J. Rathbun.
Report on the mollusk-fauna of the Galapagos Islands, with descriptions of new species. By Robert E. C. Stearns.
Report on the pteropods and heteropods collected by the United States Fish Commission steamer *Albatross* during the voyage from Norfolk, Va., to San Francisco, Cal., 1887–88. By James I. Peck.
Catalogue of a collection of birds made in Alaska by Mr. C. H. Townsend during the cruise of the United States Fish Commission steamer *Albatross*, in the summer and autumn of 1888. By Robert Ridgway.
On *Cetomimidæ* and *Rondeletiidæ*, two new families of bathybial fishes from the northwestern Atlantic. By G. Brown Goode and Tarleton H. Bean.
A revision of the order *Heteromi*, deep-sea fishes, with a description of the new generic types *Macdonaldia* and *Lipogenys*. By G. Brown Goode and Tarleton H. Bean.
On *Harriotta*, a new type of chimæroid fish from the deeper waters of the northwestern Atlantic. By G. Brown Goode and Tarleton H. Bean.
Descriptions of new genera and species of crabs of the family *Lithodidæ*, with notes on the young of *Lithodes camtschaticus* and *Lithodes brevipes*. By James E. Benedict.
Report upon the crustacea of the order *Stomatopoda* collected by the steamer *Albatross* between 1885 and 1891, and other specimens in the United States National Museum. By Robert Payne Bigelow.

COURTESIES RECEIVED AND EXTENDED.

The Treasury Department, through Mr. J. Stanley-Brown, furnished base-maps of the seal rookeries of the Pribilof Islands showing their condition in the years 1891 and 1892, and negatives of photographs of the rookeries taken during the latter year; also enlarged photographic reproductions of the charts of the same region made by Mr. Henry W. Elliott in 1890.

The United States Coast and Geodetic Survey supplied its charts as issued, and also met special requests for additional copies of charts needed for use in the inquiries conducted by the Commission. At the request of the Fish Commission, Mr. Homer P. Ritter, assistant, was detailed to take charge of a survey of the oyster grounds of Mobile Bay and vicinity.

The General Land Office of the Interior Department furnished copies of maps of Montana, New Mexico, and Nevada.

The Post-Office Department supplied a full mounted set of post-route maps of the United States.

Acknowledgments are due Gen. Albert Ordway, commanding the District of Columbia militia, for the loan of tents and accessories for use at the Bryan Point Station of the Commission during the shad-hatching season.

From the health officer of the District of Columbia were received monthly returns of the receipts of fishery products at the Washington markets.

Acknowledgment is due to the Commercial Department of the London, England, Board of Trade for statistics of the fisheries of the coasts of England and Wales, and to the Fishery Board of Scotland, Edinburgh, for similar statistics of the fisheries of the coast of Scotland.

The Boston Fish Bureau, Boston, Mass., furnished daily reports of the receipts of fish at the Boston markets.

In accordance with the instructions of the President of April 9, 1894, the Commission's steamer *Albatross* was transferred to the Navy Department to assist in the patrol of Bering Sea and the North Pacific Ocean, for the enforcement of the regulations governing vessels engaged in fur-seal fishing provided for by the Paris Tribunal of Arbitration. In this duty she was employed till October 15, when she was returned to the Commission.

The United States Coast and Geodetic Survey was furnished with hydrographic data secured by the vessels and field parties of the Commission.

At the request of the Commissioners of the District of Columbia, the steam launch *Blue Wing* was placed at their disposal as a patrol boat pending repairs to the municipal harbor boat.

In compliance with the request of Mr. H. B. Vincent, president of the Ohio Fish and Game Commission, the United States Fish Commission operated the State hatchery at Sandusky during the season of the propagation of the pike-perch, commencing April 5, 1894. The aggregate of eggs placed in the hatchery was 54,800,000. The output of fry was 32,600,000, of which 13,700,000 were distributed in Kentucky waters, and 18,900,000 placed at the disposition of the Ohio Commission. The last shipment of fry was made May 10.

At the request of the governor of Virginia, the launch *Petrel* and crew were detailed in the work of surveying the natural oyster grounds of Virginia, under the direction of Mr. J. B. Baylor, assistant, United States Coast and Geodetic Survey.

PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

The work accomplished during the year in the propagation of food-fishes is exhibited by the following summary of production:

Summary of fish and eggs furnished by stations.

Source of supply.	Species.	Eggs.	Fry.	Adults and yearlings.
Craig Brook, Me	Atlantic salmon	170,000		233,398
	Landlocked salmon		6,000	1,005
	Brook trout			7,330
	Rainbow trout		500	471
	Swiss Lake trout			36
	Lock Leven trout			46
	Von Behr trout			18
Green Lake, Me	Landlocked salmon	79,000		143,481
	Sea salmon			3,908
	Brook trout	46,000		5,500
	Lock Leven trout			21,468
	Von Behr trout			36,803
	Rainbow trout			400
	Lake trout		25,000	
Gloucester, Mass	Cod		24,617,000	
	Haddock		19,500	
	Lobster		9,332,000	
Woods Hole, Mass	Cod		1,254,000	
	Flatfish		1,795,000	
	Lobster		69,066,000	
Delaware River (steamer *Fish Hawk*).	Shad	1,500,000	5,768,000	
Battery Island, Md	Shad	5,634,000	22,645,000	
	Yellow perch			150
Bryan Point, Md	Shad	27,334,000		
Central Station, Washington, D. C.	Shad		21,082,000	
	Whitefish		3,800,000	
	Landlocked salmon		2,500	
	Brook trout		19,500	
	Rainbow trout		22,000	
Fish Ponds, Washington, D. C.	Shad			1,000,000
	Carp			51,802
	Tench			10,022
	Golden tench			431
	Goldfish			8,427
	Golden ide			1,947
	Black bass			12,330
Wytheville, Va	Rainbow trout	104,500	15,000	90,640
	Rock bass			20,750
	Black bass			40
	Carp			790
	Goldfish			2,649
Put-in-Bay, Ohio	Whitefish	6,000,000	21,710,000	
	Pike perch	5,000,000	177,700,000	
	Lake herring		30,005,000	
	Lake trout		121,000	
	Yellow perch		70,000	
Northville, Mich	Brook trout	105,000	6,000	29,100
	Von Behr trout	100,000		8,472
	Loch Leven trout	65,000	24,000	10,600
	Lake trout	1,100,000	102,000	19,593
	Quinnat salmon		40,000	
Alpena, Mich	Whitefish	200,000	13,050,000	
Duluth, Minn	Whitefish		10,190,000	
	Lake trout		2,540,000	
	Brook trout		10,000	
	Pike perch		8,000,000	
Quincy, Ill	Black bass			13,642
	Crappie			8,542
	Catfish			16,597
	Warmouth bass			2,328
	Sunfish			219
	Yellow perch			262
	Pike			100
	Rock bass			30
Neosho, Mo	Rainbow trout	267,500	2,000	52,513
	Catfish			1,059
	Black bass			630
	Rock bass			4,710
	Tench			9,210
	Carp			2,275
	Goldfish			4,231
	Golden ide			18

Summary of fish and eggs furnished by stations—Continued.

Source of supply.	Species.	Eggs.	Fry.	Adults and yearlings.
Leadville, Colo	Brook trout		23,000	35,900
	Loch Leven trout			19,800
	Black-spotted trout			11,100
	Rainbow trout		11,000	950
	Von Behr trout			1,450
	Yellow-finned trout			700
Baird, Cal	Quinnat salmon	7,500,000	438,500	
Fort Gaston, Cal	Rainbow trout			5,450
	Steelhead trout	50,000		
Korbel, Cal	Silver salmon		280,000	
	Steelhead trout	25,000	308,500	
Clackamas, Oreg	Quinnat salmon		213,000	

The details of the distribution of the foregoing product are given in the accompanying report of the assistant in charge of the division of fish-culture. Thirty-three species of fishes and one crustacean, the lobster, were distributed, the kinds and number of each being given in the following table:

Summary of distribution.

Kind of fish.	Eggs.	Fry.	Adults and yearlings.	Total.
Spotted catfish			16,556	16,556
Catfish (common)			1,059	1,059
Carp			47,757	47,757
Tench			17,820	17,820
Goldfish			13,391	13,391
Golden ide			1,780	1,780
Golden tench			272	272
Shad	3,324,000	a 53,509,000	1,000,000	57,833,000
Quinnat salmon	7,500,000	690,500		8,190,500
Silver salmon		280,000		280,000
Atlantic salmon	170,000		235,306	405,306
Landlocked salmon	79,000	8,500	140,434	227,934
Steelhead trout	75,000	308,500		383,500
Loch Leven trout	65,000	24,000	50,914	139,914
Rainbow trout	372,000	52,500	137,058	561,558
Von Behr trout	100,000		45,774	145,774
Black-spotted trout			11,000	11,000
Brook trout	138,000	58,000	75,079	271.079
Yellow-finned trout			700	700
Lake trout	1,100,000	2,781,000	19,390	3,900,390
Whitefish	6,200,000	48,750,000		54,950,000
Lake herring		30,005,000		30,005,000
Pike perch	5,000,000	181,700,000		186,700,000
Pike			100	100
Yellow perch		70,000	340	70,340
Black bass			22,783	22,783
Rock bass			18,981	18,981
Warmouth bass			2,161	2,161
Crappie			8,218	8,218
Sunfish			170	170
Cod		25,871,000		25,871,000
Haddock		19,500		19,500
Flatfish		1,795,000		1,795,000
Lobster		78,398,000		78,398,000
Total	24,123,000	424,320,500	1,867,043	450,310,543

a In addition to these, 2,109,000 were deposited for rearing in the fish ponds, Washington, D. C.

NOTE.—In addition to the foregoing there were furnished for distribution, but lost in transit, during the year: 684,000 shad fry, 7,000 lake-trout fry, 4,000,000 pike-perch fry, and the following adults and yearling fish; 41 spotted catfish, 7,110 carp, 1,412 tench, 1,916 goldfish, 1,990 Atlantic salmon, 4,052 landlocked salmon, 1,000 Loch Leven trout, 13,336 rainbow trout, 969 Von Behr trout, 100 black-spotted trout, 751 brook trout, 239 lake trout, 72 yellow perch, 3,859 black bass, 6,509 rock bass, 167 warmouth bass, 824 crappie, 49 sunfish, and 68 golden ide.

There were also collected from sloughs and deposited in the St. Francis River near Marked Tree, Ark., 8,500 fingerling crappie, and from the sloughs and deposited in the Illinois River near Meredosia, Ill., 21,100 white perch, 25,000 sunfish, 23,000 carp, 2,900 warmouth bass, 500 pike perch, 3,600 white bass, 1,000 black bass, 2,000 crappie, and 8,900 pike; but none of these figures are included in the above table.

STATE FISH COMMISSIONS.

The policy of extending all possible aid to the fish commissions of the different States and Territories in the stocking of their respective waters was continued, and the aid thus given during the year is here shown:

State or Territory.	Species.	Eggs.	Fish.
California	Quinnat salmon	7,500,000	
	Steelhead trout	50,000	
	Loch Leven trout	20,000	
Colorado	Rainbow trout		475
Connecticut	Atlantic salmon	25,000	
	Von Behr trout	20,000	
	Lake trout	100,000	
	Whitefish	200,000	
Georgia	Carp		3,000
	Goldfish		30
	Golden ide		100
	Rock bass		600
Illinois	Catfish		a2,800
	Black bass		a802
	Rock bass		a30
	Warmouth bass		a150
	Crappie		a1,006
Iowa	Spotted catfish		300
	Tench		50
	Goldfish		100
	Black bass		100
Kansas	Goldfish		30
Maine	Rainbow trout		471
Massachusetts	Lake trout	100,000	
Minnesota	Carp		2,500
	Goldfish		50
	Golden ide		25
	Loch Leven trout	20,000	
	Rainbow trout	42,000	
	Von Behr trout	20,000	
	Brook trout	20,000	
	Lake trout	100,000	
Missouri	Goldfish		100
	Golden ide		50
	Rainbow trout	50,000	
Nebraska	Rainbow trout	23,000	
	Brook trout	20,000	
	Lake trout	100,000	
Nevada	Rainbow trout	40,000	
New Hampshire	Atlantic salmon	25,000	
New York	Carp		5,000
	Shad	2,000,000	b5,414,000
	Atlantic salmon	60,000	
	Landlocked salmon	30,000	
	Lake trout	300,000	
	Whitefish	6,000,000	
	Pike perch	5,000,000	
Ohio	Pike perch		b18,900,000
Pennsylvania	Atlantic salmon	60,000	
Utah	Lake trout	100,000	
Vermont	Landlocked salmon		1,000
	Rainbow trout	30,000	
	Von Behr trout	20,000	
	Brook trout	20,000	
	Lake trout	300,000	
Wisconsin	Goldfish		100
Wyoming	Rainbow trout	45,000	
	Von Behr trout	15,000	

a Deposited by U. S. Fish Commission in waters designated by State commissioners. b Fry.

FISH-CULTURAL AID EXTENDED TO FOREIGN COUNTRIES.

During the year eggs of fishes propagated by the Commission were furnished the following foreign countries:

Canada.—Mr. W. Greenough, Portneuf, was furnished with eggs of the rainbow trout.

Mexico.—Eggs of the Loch Leven trout and Von Behr trout were supplied to E. Chazari for the Mexican Government.

United States of Colombia.—At the request of Lieut. H. R. Lemly yearling golden tench and eggs of the landlocked salmon and brook trout were forwarded to the Government of the United States of Colombia.

Belgium.—Maj. W. Turner, of Bertrix, was supplied with eggs of the rainbow trout.

France.—Eggs of the rainbow trout were shipped to Mr. A. Geoffroy St. Hilaire and Mr. Raveret-Wattel for the Société Nationale d'Acclimatation at Paris.

Scotland.—Brook-trout eggs were sent to Mr. J. J. Armistead, Killywhan, Scotland.

Switzerland.—At the request of the Swiss Government eggs of the brook trout were shipped to Switzerland, and upon arrival were reported in very good condition.

Japan.—Eggs of the steelhead trout were forwarded to Japan through the Japanese consul at San Francisco, Cal.

FREE TRANSPORTATION FURNISHED BY RAILROADS.

The limited appropriation made for the conduct of the fish-cultural work of the Commission would necessitate the distribution of the product of the different stations to neighboring waters, thereby preventing the introduction of desirable food-fishes in suitable waters distant from the source of supply, were it not for the generous aid extended by many of the railway companies of the country. Even at the very favorable rate granted by the roads demanding compensation for the transportation for the cars and messengers of the Commission, the value of the transportation furnished during the year would have aggregated a cost of over $13,000. In the following table is given the names of the railway companies extending this aid, and the amount of mileage respectively furnished:

Table showing aid extended by railroads.

Name of railroad.	Cars.	Messengers.	Total.
Atchison, Topeka and Santa Fe	1,278	183	1,461
Baltimore and Ohio	766		766
Burlington, Cedar Rapids and Northern	1,466		1,466
Baltimore and Lehigh		39	39
Chesapeake and Ohio	2,988	70	3,058
Chesapeake, Ohio and Southwestern	337		337
Chicago and Great Western		170	170
Chicago and Northwestern	1,163		1,163
Chicago and West Michigan	548		548
Chicago, Burlington and Quincy	6,540	264	6,804
Chicago, Milwaukee and St. Paul	1,028	191	1,219
Chicago, St. Paul, Minneapolis and Omaha	372		372
Cleveland, Cincinnati, Chicago and St. Louis	4,079	140	4,219
Delaware and Hudson River	533	294	827
Denver and Rio Grande	1,048	2,025	3,073
Des Moines, Northern and Western	34		34
Detroit, Bay City and Alpena	2,254		2,254
Duluth and Iron Range	12		12
Duluth, South Shore and Atlantic	168		168
Flint and Pere Marquette	3,588		3,588
Fremont, Elkhorn and Missouri Valley		18	18
Fort Worth and Denver City		678	678
Grand Rapids and Indiana	222	218	440
Great Northern	144		144
Illinois Central	619	17	636

Table showing aid extended by railroads—Continued.

Name of railroad.	Cars.	Messengers.	Total.
International and Great Northern	234		234
Jacksonville Southeastern	206		206
Jacksonville, Tampa and Key West	112		112
Kansas City, Fort Scott and Memphis	676	282	958
Kansas City, Pittsburg and Gulf	170		170
Lake Erie and Western	161		161
Lake Harbor	20		20
Louisville and Nashville	2,205	432	2,637
Maine Central		3	3
Missouri, Kansas and Texas	2,568		2,568
Missouri Pacific	1,444		1,444
Michigan Central	10,868	76	10,944
Minneapolis, St. Paul and Sault Ste Marie	322		322
Mobile and Ohio	126		126
Northern Pacific	3,312	2,020	5,332
Quincy, Omaha and Kansas City		108	108
St. Louis and San Francisco	2,142	353	2,495
St. Louis, Iron Mountain and Southern	544		544
Texas and Pacific	1,026	342	1,368
Union Pacific	5,038	909	5,947
Wabash Railroad	2,700	879	3,579
Wabash, Chester and Western	28		28
West Virginia and Pittsburg	208		208
Wilmington and Northern		82	82
Wisconsin Central	1,796		1,796
Total	65,093	9,793	74,886

ADDITIONAL FISH-CULTURAL STATIONS.

On June 9, 1894, Hon. H. H. Bingham introduced in the House of Representatives the following resolution:

Resolved, That the United States Fish Commissioner be, and is hereby, directed to report to the House of Representatives the desirability of the Government establishing a fish-hatchery in the grounds of the Zoological Society, Philadelphia, on the Schuylkill River, in the city of Philadelphia, State of Pennsylvania.

A similar resolution was presented to the Senate on July 19, 1894, by Hon. M. S. Quay.

In replying to this resolution the Commissioner expressed an opinion adverse to the establishment of a station as proposed thereby, for the reason that it would be improper to locate Government works on property not freely open to the public, the Zoological Society charging an admission fee for entrance to its grounds. It was also ascertained that title to the site proposed for a station could not be vested in the United States, as required by law.

Fish-hatchery at San Marcos, Tex.—The release of the trustees under the trusts given to secure certain bonds issued by the San Marcos Water Company, mentioned in a previous report as required by the Attorney-General as necessary before the deed of said company conveying to the United States certain rights would vest a valid title to the same, were secured, and on September 27, 1893, the Attorney-General certified to their sufficiency to convey with the deed a proper transfer of the easements mentioned. Pending the erection of the dam across the San Marcos River, agreed to be built by the San Marcos Water Company and the citizens of San Marcos, settlement of the consideration to be paid was deferred. Payment for the tract of land purchased from Mr. W. D. Wood was made June 18, 1894.

Fish-hatchery, New York.—During July, 1893, a further investigation for a suitable site for the establishment of a fish-cultural station for the propagation of salmon as well as whitefish was made by Mr. Frank N. Clark, superintendent of the Northville, Mich., Station. The result of this examination demonstrated the impracticability of securing, within the limited territory specified in the appropriation act, a location such as was necessary for a station to be conducted on the plan originally contemplated. It was therefore decided to confine our attention to the increase of the principal commercial fishes of Lake Ontario—whitefish, lake trout, and the pike perch. On May 26, 1894, instructions were given the chief clerk and the engineer of the Commission, Mr. Gill and Mr. Reeves, to examine the eastern shore of Lake Ontario in New York for a location affording facilities for the propagation of these fishes. They recommended Cape Vincent, on the St. Lawrence River at the outlet of the lake, and secured options for the sale of two pieces of property affording the necessary requirements. One of these embraced a lot having a water front of about 115 feet on the river and extending about 200 feet to the main street of the village, and in near proximity to the railroad station, improved by a substantial stone building 60 feet by 40 feet, with a lean-to of 24 feet by 65 feet, and a large detached brick chimney tower. This building, which was formerly used as a grist mill, has walls between 2 and 3 feet thick, with their foundations on the solid rock, and is in close proximity to the river. It has three floors, a basement, and an attic, which afford ample facilities for hatcheries and office and sleeping accommodations. The option also provided in case of sale for the construction of a stone-crib wharf into the river in front of the building for the proper placing of the necessary water pipes for the supply of the hatcheries. The compensation to be paid was fixed at $3,500. The proposal has been accepted, and the necessary steps will be taken for the acquisition of the property.

Tennessee.—Under provision of an act approved August 5, 1892, authorizing an "investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Tennessee," investigations were made in that State during the September and October, 1893, and a report thereon submitted to Congress January 24, 1894 (Mis. Doc. No. 52, Fifty-third Congress, second session). The site appearing to offer the more favorable conditions for a station was one several miles distant from the town of Athens, McMinn County, though its distance from Athens, where the labor and supplies needed for the maintenance of a station must be obtained, would prove a serious drawback. It was recommended, however, that a final selection be deferred, should Congress direct the establishment of a station in Tennessee, till further comparisons of the sites mentioned in the report could be made. For the establishment of the station an item of $12,000 was submitted.

Iowa, Nebraska, South Dakota, and Wyoming.—Reference is made in the Commissioner's preceding report to the investigations in these States for the purpose of determining, as directed by Congress, the advisability of establishing in them fish-cultural stations. The results of these investigations were presented to Congress on January 24, 1894 (Mis. Doc. No. 53, Fifty-third Congress, second session). In this report the following conclusion was submitted:

> From a consideration of the foregoing results of the examinations in the States of Wyoming, South Dakota, Iowa, and Nebraska, I would recommend the establishment of but one station to supply the needs of South Dakota, Iowa, and Nebraska, Wyoming to be cared for by the station now being established at Bozeman, Mont. If a new station is authorized, either Manchester or Decorah, Iowa, should be selected. Which to recommend, however, I am not ready to say, final selection being dependent upon a careful consideration of the respective sites from an engineering standpoint, the certainty of their being secured by the Government, their cost, the expense of adapting the water supply, etc., questions which can not be determined in advance of the actual authorization of a station.

In case a station was authorized, an appropriation of $15,000 was recommended.

PROTECTION OF FISH IN POTOMAC RIVER.

By act approved March 12, 1894, provisions of the act of March 2, 1885, entitled "An act to protect the fish in the Potomac River in the District of Columbia, and to provide a spawning ground for shad and herring in the said Potomac River," were continued for a period of ten years. Under this law, if properly enforced, reasonable hopes can be entertained for still more appreciable results from the Commission's efforts in stocking this river with shad.

VISITS FROM OFFICIALS OF FOREIGN COUNTRIES.

During this year the offices were visited by a number of representatives of foreign countries, detailed by their governments to the World's Columbian Exposition, Chicago, for the purpose of studying the fisheries and fish-cultural methods of the United States. Among these may be mentioned Dr. Henri de Varigny, delegate of the minister of commerce, Paris, France; Dr. Oscar Nordqvist, inspector of fisheries of Finland, Helsingfors; Dr. Nicolas Borodine, Uralsk, Russia; Dr. L. Wittmack, of Berlin, accompanied by Mr. Alfred Schillinger, of Munich, president of the fish-cultural department of the Bavarian State Fishery Association, in Sternberg, and Mr. Lewis Landau, of the Hungarian ministry of agriculture; Dr. Ernst Ehrenbaum, of the Royal Biological Station, Helgoland; Mr. Sakaye Sawatari, commissioner of the Japanese Fisheries Society, and Mr. J. J. Armistead, proprietor of the Solway fisheries, Dumfries, Scotland.

REPORT ON THE PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

By TARLETON H. BEAN, *Assistant in Charge.*

The important features of the work of the division of fish culture at the numerous stations are shown in the abstracts of the annual reports of the superintendents. Certain experiments in the treatment of eggs and fish are grouped in a chapter of notes on the habits, diseases, fatalities, enemies, treatment, transportation, etc., of the species under observation.

The resources of the division were tested to their utmost by its duties in connection with the World's Columbian Exposition. It was called upon to provide and maintain a great aquarium of marine as well as fresh-water animals and plants, a hatchery for the eggs of shad, pike, perch, salmon, trout, and other fishes, together with a general exhibit of its methods and results, and, at the same time, to continue its usual work of hatching and distribution to meet the increasing demands of applicants in all parts of the United States.

The exhibit of the Fish Commission is made the subject of a separate report by its representative on the Government Board of Management and Control, Dr. Tarleton H. Bean. During his absence from Washington Mr. S. G. Worth performed the duties of acting assistant, serving from January 14, 1393, until February 20, 1894, when the assignment to World's Fair duty was completed.

Superintendent Page was detailed for special duty in the summer of 1893, to collect fishes from overflow ponds in the lowlands of St. Francis River, Arkansas, and has made a report upon the experimental work of the season.

The duties of the Commission at the World's Fair, combined with the regular work of distribution, entailed much additional labor upon the car and messenger service. The necessity of continuing the transportation of many kinds of fish during almost the entire year makes the natural difficulties of transportation very great.

A great burden was removed from the division near the close of 1893, when the Commissioner ordered the discontinuance of the general distribution of gold fish to individuals after the close of that season.

STATION OPERATIONS.

The number of active stations was the same as during the last fiscal year. The World's Fair having been made a temporary base of operations, offset the closed landlocked salmon station on Grand Lake Stream, Maine. A new station, located at St. Johnsbury, Vt., was nearly completed at the time of closing this report. Mr. John W. Titcomb was appointed inspector of construction September 1, 1893, and superintendent March 1, 1894. This is intended as a hatching and rearing station for landlocked salmon and various kinds of trout. Its water supply is obtained from Sleeper River and from springs.

The following is a list of stations:

Craig Brook Station, Me.
Green Lake Station, Me.
Gloucester Station, Mass.
Woods Hole Station, Mass.
Delaware River Station (steamer *Fish Hawk*).
Battery Island Station, Md.
Bryan Point Station, Md.
Central Station, Washington, D. C.
Fish Ponds, Washington, D. C.
Wytheville Station, Va.
Put in Bay Station, Ohio.
Northville Station, Mich.
Alpena Station, Mich.
Duluth Station, Minn.
Quincy Station, Ill.
World's Fair Station, Chicago, Ill.
Neosho Station, Mo.
Leadville Station, Colo.
Baird Station, Cal.
Fort Gaston Station, Cal.
Clackamas Station, Oreg.

CRAIG BROOK STATION, MAINE (CHARLES G. ATKINS, SUPERINTENDENT).

The fish on hand at the station, July 1, 1893, were as follows:

Species.	Hatched in the year—							Total.
	1893.	1892.	1891.	1890.	1889.	1888.	1888 and 1889 mixed.	
Atlantic salmon	257,775			34		33		257,842
Atlantic salmon, domestic	1,700	156						1,856
Landlocked salmon	6,764			29			26	6,819
Brook trout	9,013	14			28			9,055
Rainbow trout	1,012				13			1,025
Loch Leven trout				49				49
Saibling				1				1
Swiss lake trout				29				29
Scotch sea trout			63					63
Von Behr trout			47					47
Whitefish		1						1
Total	276,264	171	110	142	41	33	26	276,787

The Atlantic salmon were fed through the summer in troughs on chopped liver and other meat and on maggots. In November it was found that 234,367 of them had survived. Of these, 231,367 were liberated in local waters, 2,000 were transferred to other parties, and 1,000 were reserved for wintering. Of the fish wintered over, 867 were alive June 30, 1894.

Eggs of the Atlantic salmon were collected at the Penobscot Station in May and June, 1893, with the cooperation of the State of Maine. From 146 fish—51 males and 95 females—806,000 eggs were obtained. On March 1, 1894, after the ordinary losses and the rejection of the unfertilized eggs, there remained 745,300 eggs, 435,000 of which were given to the United States Fish Commission and 310,300 to the Maine Commission. From the United States Fish Commission's share 170,000 eggs of the Atlantic salmon were shipped to the following parties in accordance with instructions:

Date.	Consignee.	Number.
Jan. 30	Fred Mather, Cold Spring Harbor, N. Y.	60,000
30	J. P. Creveling, Allentown, Pa	60,000
Mar. 7	D. C. McLine, Plymouth, N. H	25,000
7	R. E. Follett, Lime Rock, Conn	25,000
	Total	170,000

There were reserved for hatching at the station 265,000. The number of fish actually hatched from these eggs was 264,612, and of these there were on hand June 30, 1894, 214,000. Of the 33 fish hatched in 1888 only 11 were left at the end of the year; and 31 of those hatched in 1890 were liberated in November, 1893.

The year began with two lots of domesticated salmon; 156 fish hatched in 1892, and 1,700 in 1893. The former were kept through the year in two troughs, and grew slowly, and fell off in numbers to 131; the latter were also kept in troughs, and 1,348 of them were left at the end of the year. Domesticated salmon eggs were obtained in October, 1893, from the Atlantic salmon that had been in confinement since 1888, to the number of 4,800 eggs; but the parent fish being of inferior quality, the 1,677 fish hatched from the eggs declined to 600 on June 30, 1894.

Indications of the presence of an epidemic were observed on April 23, and it continued to ravage the Atlantic salmon for several weeks, causing a loss of about 15,000. No other species was attacked, though the fry of some other kinds suffered seriously from a disease of a different character.

Of the 26 landlocked salmon hatched in 1888 and 1889 only 17 remained on June 30, 1894. The 29 hatched in 1890 were reduced to 20 in November, 1893, when they were liberated. The 6,764 hatched in 1893 received in September an addition of 1,500 fish of the same age from Green Lake; making a total of 8,264. Of these, 7,050 were transferred to other parties during the summer, and the remainder were liberated in the fall.

From the oldest lot of landlocked salmon there was taken in the fall a lot of spawn estimated at 8,500, from which were hatched 6,330 very weak fish, of which the last one died June 1, 1894.

The 9,013 brook trout on hand June 30, 1893, were fed until fall, when 2,825 were transferred to Green Lake Station and 4,476 liberated in Craig Pond. The 14 hatched in 1892 were kept until November 27, and then put in Craig Pond. Of the 28 hatched in 1889, a count on November 27 showed but 14 remaining, and these were placed in Craig Pond.

A few eggs were taken from brook trout in the fall of 1893:

From fish of 1889	4,600
From wild fish caught from time to time and held in confinement at station (taken at station)	4,600
Total	9,200
Received from Green Lake, February 20, 1894	10,000
Total	19,200

From these eggs 17,190 fish were hatched, of which 9,000 were on hand June 30, 1894.

The rainbow trout were fed in troughs during the summer. On September 21st, 500 were transferred to Green Lake, and November 15th, 471 were delivered to the agent of the Maine commissioners. Of the 13 fish hatched in 1889, only 6 remained at the end of the year.

The Loch Leven, Swiss Lake, and Von Behr trout on hand at the beginning of the year had become intermixed by dislocated partitions in the ponds, and, in accordance with instructions, were all liberated together in Heart Pond, 2 miles from the station.

Of the 63 Scotch sea trout on hand July 1, 1893, only 27 were left in November, by reason of mink having gained access to the pond. The fish spawned in the autumn of 1893, and yielded, November 2, 1893, about 6,000 eggs, from which 3,178 very weak fish were hatched, the last of which died June 11, 1894.

The fish have been fed during the year, as formerly, on chopped material derived from butcher's offal, and on maggots produced at the station. Considerable attention has been given to the production of natural food—live food in the station ponds—one man being kept nearly the entire time from April to July in the collection of material, its distribution in the ponds, observations on the pond temperatures, and the growth and multiplication of the entomostraca, etc., of which the collections mainly consisted.

The maximum and minimum temperatures of the air and water during the year were as follows:

Month.	Air temperature.		Water temperature.	
	Maximum.	Minimum.	Maximum.	Minimum.
1893.	°F	°F	°F	°F
July	90	56	68	56
August	92½	55	70	58
September	75	38	64	53
October	72	27	63	46
November	55	11	53	34
December	37½	*a* 14	44	32
1894.				
January	40	*a* 24	38	32
February	39	*a* 22	37½	32
March	52	14	43	33
April	70	16	51½	33½
May	82	43	60	42
June	87½	50	71	52

a Below zero.

Green Lake Station, Maine.

On July 1, 1893, the affairs of this station were temporarily put under the direction of the foreman, William H. Munson.

On July 5, Richard Dana reported at the station for the purpose of keeping the records and attending to the correspondence.

On August 2, 1893, in accordance with instructions from the Commissioner, E. M. Robinson took charge as acting superintendent and received a probationary appointment (under civil-service rules) as superintendent September 16, 1893.

Mr. Robinson reported the fish on hand at the station August 21, 1893, as follows:

Kind.	Hatching of the year—		
	1893.	1892.	1891.
Landlocked salmon	157,839	4,656	3,676
Sea salmon	3,420		
Loch Leven trout	27,373	1,788	
Lake trout	5,000		
Von Behr trout	45,494	1,142	
Brook trout	4,004		
Total	243,130	7,586	3,676

One of the first subjects that received the attention of the superintendent was the collection of salmon and trout eggs in localities not too far removed from the station. A thorough reconnoissance was made of all the neighboring brooks, and Mann and Winkenpaugh brooks were selected as being the most suitable. In addition to the traps at those streams a net trap was put in at the outlet of Green Lake for the capture of landlocked salmon and the one at Great Brook was repaired.

During the season 133 landlocked salmon were taken. Of these, 90 were females and 43 males. The yield of eggs from the 90 females was 311,000, or an average of 3,477 to each fish. The first salmon was caught on September 26 at Mann Brook and the last on November 22 at Great Brook. After these fish were through spawning they were released in the lake.

On October 6 a trap was built at the head of Branch Pond, some 10 miles west of the hatchery; and on the 14th, after a heavy rain, 59 trout were taken. The season's catch of brook trout is as follows: Winkenpaugh Brook, 110; Great Brook, 14; Mann Brook, 1; total, 125. Of these 37 were males and 88 females. Eleven of the females were spent before being captured and only 15 of the males were found to be of any use.

The first eggs of the season were taken October 26; total for the season, 105,146.

During the season there were distributed from the station: Landlocked salmon, 143,481; sea salmon, 3,908; Loch Leven trout, 21,468; lake trout, 25,000; Von Behr trout, 36,803; brook trout, 5,500; rainbow trout, 400; total, 236,560.

Nearly all of these were planted in New England waters and principally in Maine.

Landlocked-salmon and brook-trout eggs were distributed from the station during the season, as follows:

Date.	Consignee.	Variety.	Number.	Remarks.
1894.				
Jan. 23	J. J. Armistead, Scotland	Brook trout	20,000	Received in good order.
24	W. H. Van Sickle, Bevans, N. J	do	10,000	Do.
31	Lieut. H. R. Lemly, South America	do	3,000	Did not sail; eggs opened at Central Station.
Feb. 10	do	Landlocked salmon.	3,000	Nothing heard from shipment.
15	W. Hamlin, Tuxedo Park Association, New York.	do	3,000	Received in good order.
15	R. C. Alexander, Adirondack League Club, New York.	do	5,000	Do.
19	Caleb Gilman, Calais, Me	do	5,000	Received in bad order.
20	C. G. Atkins, Craig Brook Station, Me.	Brook trout	10,000	Received in good order.
20	Edmund Hayes, president Wilmurt Club, Buffalo, N. Y.	Landlocked salmon.	5,000	Do.
20	A. E. Adams, Boston, Mass	do	5,000	
20	W. L. Gilbert, Plymouth, Mass	do	1,000	Do.
26	Gardner Smith, Ragged Lake, N. Y	do	5,000	Do.
26	E. R. Hewett, Ringwood, N. J	do	5,000	
26	W. T. Haynes, Oakland, Me	do	5,000	Do.
28	Henry Studor, White Corners, N. Y	do	5,000	Do.
28	John G. Roberts, superintendent Saranac Inn Station, N. Y.	do	30,000	Do.

The receipt of eggs at the station during the season was as follows:

Date.	Consignor.	Variety.	Number.	Remarks.
1894.				
Jan. 19	F. N. Clark, Northvile, Mich	Von Behr trout	25,000	Fair condition.
19	do	Loch Leven trout.	20,000	Do.
20	do	Lake trout	50,000	Good condition.
23	W. F. Page, Neosho, Mo	Rainbow trout	50,000	Bad condition.
Mar. 1	J. J. Armistead, Killywhan Station, Scotland.	Loch Leven trout.	20,000	All dead on arrival.

Early in May the larva of the caddis fly was seen in the hatching troughs, and during the month 31,745 landlocked salmon fry were destroyed thereby. Other losses from the same cause were: Von Behr trout, 553; Loch Leven trout, 731; lake trout, 1,686.

The fry and other stock on hand for month ending June 30, 1894, at the station was as follows:

Varieties.	Fry.	Hatching of—			Hatching of 1890 or older.
		1893.	1892.	1891.	
Landlocked salmon	149,941		4,656	3,376	2
Lake trout	16,012				
Von Behr trout	11,674		1,140		
Loch Leven trout	15,678		1,788		
Brook trout		263			90
Total	193,305	263	7,584	3,376	92

The temperatures during the year were as follows:

Month.	Air.		Water.	
	Max.	Min.	Max.	Min.
	° F.	° F.	° F.	° F.
July	95	60	76	67
August	98	59	78	63
September	78	46	68	50
October	70	39	66	47
November	55	12	48	34
December	40	*a* 8	38	33½
January	39	*a* 28	34	32½
February	42	*a* 25	33	32½
March	60	28	36	33
April	74	25	51½	34
May	82	42	63	47
June	88	52	77	56

a Below zero.

GLOUCESTER STATION, MASSACHUSETTS (A. C. ADAMS, MASTER SCHOONER GRAMPUS, IN CHARGE).

This station was in care of a custodian from July 1, being practically closed until the arrival of Mr. Adams on October 9, 1893, at which time the machinist and crew of the schooner *Grampus* were engaged in getting the station in order for the season's operations. Capt. A. C. Adams resigned his position as master of the *Grampus* in order to become fish-culturist and custodian of the Gloucester Station.

On November 16, instructions were received from the Commissioner to begin work, and on that date three men were sent to Kittery Point, Maine, to arrange for a supply of cod eggs. On the 18th of November 200,000 cod eggs were taken in Ipswich Bay, and 453,000 were received from Kittery Point on the 20th. These began to hatch December 1, with a mean water temperature of 42°. By the end of November 3,557,000 eggs were on hand.

The following table shows the number of cod eggs collected monthly during the season, and the number of fry hatched therefrom and liberated:

Month.	Number of eggs collected.	Number of fry hatched and liberated.
November, 1893	3,557,000	1,574,000
December, 1893	8,200,000	3,109,000
January, 1894	16,421,000	5,697,000
February, 1894	16,126,000	5,300,000
March, 1894	18,513,000	8,053,000
April, 1894	1,302,000	884,000
May, 1894	656,000	

A snowstorm occurred on December 10, and by the 14th the temperature fell from 42° to 35°, retarding the hatching of all eggs taken previously. The water density also was from 24° to 24.5°, not enough to allow the eggs to float after a few days' development.

Shipments of cod eggs to the Woods Hole Station were as follows:

Date.	Number.	Method.
February 10	1,110,000	By messenger.
10	413,000	By express.
13	1,159,000	Do.
15	695,000	Do.
21	450,000	Do.
Total	3,827,000	

On April 16, 18,000 haddock fry were planted, and 1,500 on May 14.

Both haddock and cod eggs were taken March 21, and on April 7 the two species hatched with a mean temperature of about 37° for the 17 hatching days.

The entire number of codfish eggs collected during the season was 64,775,000, and of these 24,617,000 were hatched and liberated.

The lobster work was begun May 3, when 20 egg lobsters were secured, from which 274,000 eggs were taken and placed in McDonald hatching jars. The whole number of egg lobsters obtained in May was 293, and these produced 3,757,000 eggs, of which 3,380,000 were hatched and planted in the outer harbor off Gloucester.

On May 18, Mr. Adams was detailed to work under the direction of Mr. Richard Rathbun, assistant in charge of the division of inquiry respecting food-fishes, and the lobster work was continued with Mr. W. P. Sauerhoff in charge.

The collections of egg lobsters in June amounted to 482, and yielded 6,530,000 eggs; from these, 5,953,000 young lobsters were liberated.

The whole number of egg lobsters purchased during the season to July 1 was 775; whole number of eggs taken from these, 10,287,000; whole number of lobsters hatched from these, 9,332,000; percentage hatched, 90.7.

Woods Hole Station, Massachusetts (John Maxwell, Superintendent).

The fish-cultural work covered a period of eight months—from November to the end of July.

Codfish.—Between February 9 and 20, 3,903,000 codfish eggs were received from Kittery, Me., from which 1,254,000 fry were produced and liberated in Vineyard Sound within twenty-four hours after hatching. The storage of brood cod was improved by placing live-boxes or cars in the salt-water reservoir in the basement of the hatchery building, where exhaust steam from the pumps could be used if necessary to heat the water in severe winter weather.

Flatfish.—Between February 13 and March 26, 17 adult flatfish were obtained by means of a fyke net set in Woods Hole Harbor. These yielded 2,227,000 eggs, which produced 1,795,000 fry; and the latter well deposited in Buzzards Bay and Vineyard Sound. Both the cod and flatfish were hatched in McDonald boxes and Chester jars, operated by tide motion.

Lobster.—The lobster-hatching season covered the months of April, May, and June. From 4,026 egg lobsters 97,635,000 eggs were obtained, but 14,500,000 of these were in bad condition when placed in the hatching apparatus, and were turned out in the harbor on the fourth day. Hatching began June 18 with a water temperature of 64½° F. From the 83,135,000 good eggs, 69,066,000 fry were produced and liberated in Vineyard Sound and Buzzards Bay from twelve to twenty-four hours after hatching. The experiment of keeping lobster eggs in process of hatching during the winter was again tried, with the following results:

When stripped.	Number of lobsters.	Number of eggs produced.	Number of fry.	Number of days hatching.
December, 1893	38	361, 000	225, 000	146
January, 1894	38	426, 000	325, 000	129
February, 1894	9	121, 800	95, 500	106

The above shows that lobster eggs can be handled successfully during the winter, if the water temperature does not fall below 29° F.

A section of the basement under the hatchery was made into a reservoir by cementing, etc. In this reservoir 7 fish cars were erected with a capacity for storing 1,000 brood fish.

There were collected during the summer a large number of sea plants, shellfish, etc., for the World's Fair at Chicago.

The temperature of the water at the station during the hatching season was as follows:

Month.	Max.	Min.	Month.	Max.	Min.
	° F.	° F.		° F.	° F.
December, 1893	48	36	April, 1894	47	39
January, 1894	37	33	May, 1894	59	48
February, 1894	34	30	June, 1894	67	58
March, 1894	41	32			

Delaware River Shad-Propagating Station (Lieut. Robert Platt, U. S. N., in charge).

On May 8 the steamer *Fish Hawk* arrived off Gloucester City, N. J., to commence the season's work. The first eggs were obtained May 9 and the last June 7, during which time 9,651,000 eggs were taken from 395 fish. The number of fry produced was 5,768,000, and the number of eggs transferred 1,500,000. All were deposited in the Delaware River. The details of deposit are as follows:

Date.	Number of fry or eggs.	Locality.
May 16, 1894	1, 699, 000	Delaware Watergap, Pa.
18, 1894	800, 000	Do.
19, 1894	500, 000	Port Jervis, N. Y.
19, 1894	142, 000	Gloucester, N. J.
22, 1894	1, 100, 000	Lambertville, N. J.
28, 1894	*a* 277, 000 709, 000	Delaware Watergap, Pa.
June 5, 1894	400, 000	Callicoon, N. Y.
8, 1894	*a* 1, 223, 000 418, 000	Delaware Watergap, Pa.

a Eggs.

The eggs were chiefly obtained, as in previous years, from Faunce's, Bennett's, and Howell's Cove fishing shores.

The water was muddy during the entire season.

The following table exhibits the take of eggs, temperatures, etc., during the season:

Date.	Fish stripped.		Number of eggs.	Noon temperatures.	
	Male.	Female.		Air.	Water.
				° F.	° F.
May 9	26	26	1,425,000	70	67
10	15	14	681,000	69	69
11	31	27	1,392,000	74	69
14	25	25	1,112,000	69	69
15	5	5	266,000	65	68
16	9	9	473,000	67	68
17	12	12	586,000	73	68
18	11	11	544,000	83	68
19	5	5	221,000	87	70
22	8	8	372,000	57	63
25	1	1	45,000	63	56
26	1	1	40,000	65	59
28	12	12	621,000	78	65
29	8	8	483,000	57	62
June 4	12	12	442,000	82	62
5	10	10	469,000	62	61
6	4	4	238,000	50	61
7	5	5	241,000	61	60
Total	200	195	9,651,000		

BATTERY ISLAND STATION, MARYLAND (W. DE C. RAVENEL, SUPERINTENDENT).

The station was opened April 1, and preparations commenced for the propagation of the shad. The collection of eggs began April 21, and continued to May 19. There were taken during that time 39,770,000 eggs, from which 22,695,000 fry were hatched, and of these 22,645,000 were distributed as follows:

Place of deposit.	Number.	Place of deposit.	Number.
North East River, Maryland	1,200,000	Susquehanna River, Pennsylvania	2,507,000
Elk River, Maryland	1,380,000	Nanticoke River, Delaware	450,000
Bush River, Maryland	630,000	Brandywine River, Delaware	1,330,000
Wicomico River, Maryland	345,000	Delaware River, Delaware	450,000
Gunpowder River, Maryland	450,000	Carp Ponds, Washington, D. C	40,000
Tuckahoe River, Maryland	450,000	Hudson River, New York	5,414,000
Chester River, Maryland	450,000	Delaware River, New York	450,000
Chesapeake Bay, Maryland	2,976,000	Connecticut River, Connecticut	1,519,000
Susquehanna River, Maryland	1,104,000	Palmer River, Rhode Island	1,500,000

During the season eggs taken, numbering 5,634,000, were shipped as follows: To the New York Commission, for the Hudson River, 2,000,000; to the Palmer River, Providence, R. I., 1,669,000; to the Connecticut River, 1,610,000, and to Chesapeake Bay (Battery Station, Maryland), 355,000.

The water was generally clear.

The temperatures of air and water at noon during the season of 1894 were as follows:

Date.	Air.	Water.	Date.	Air.	Water.
	° F.	° F.		° F.	° F.
April 6	46	45	April 30	61	61
7	47	45	May 1	68	61
8	45	46	2	71	67
9	36	44	3	68	67
10	43	45	4	67	67
11	35	41	5	67	67
12	35	38	6	70	67
13	38	39	7	68	67
14	50	42	8	60	69
15	55	48	9	66	69
16	56	49	10	67	68
17	57	53	11	68	68
18	59	54	12	67	69
19	61	54	13	70	70
20	65	57	14	66	69
21	61	57	15	62	69
22	56	57	16	67	69
23	60	56	17	64	67
24	56	56	18	74	69
25	57	56	19	74	70
26	57	56	20	66	68
27	61	59	21	62	64
28	64	60	22	58	57
29	65	62			

On May 19, the last day on which eggs were taken, a severe storm set in which lasted three days, and caused the worst freshet that has occurred on the river since 1885, the island being under water for several hours on the 21st and 22d. This made the season the shortest that has ever been known on the Susquehanna, the station having been in operation only thirty-one days. After the freshet shad were caught in considerable numbers off Spesutia Island and in the vicinity of the station; but a careful examination failed to show a ripe shad between May 24 and June 3.

On April 25 one of the spawn-takers used a striped bass for fertilizing some 60,000 shad eggs, there being no male shad on hand, and on May 3 they were all hatched. When placed alongside of other shad fry hatched at the same time they seemed slightly different in color and action, and as it is claimed that the milt will not live exposed to the air more than a few minutes, it seems probable that the fry referred to are genuine hybrids.

Experiment was made in canning roes of shad and alewives for fish food for the rearing stations, but without success, the roes not having been sufficiently cooked or steamed. It is thought that the work in this line can be made a success if arrangements are made to do it early in April, when the herring or alewife first come in and when the roes are firm.

Bryan Point Station, Maryland (S. G. Worth, Superintendent).

Until preparations for the shad season began, early in March, 1894, the property was in charge of a custodian. Mr. L. G. Harron, superintendent of the aquarium at Central Station, was sent to the station March 7, and on March 27 the launch *Blue Wing* was put in commission and assigned to the duty of carrying spawn-takers to fisheries lying between Bryan Point and Cockpit Point, at the lower entrance to Occoquan Bay.

The employees, with a few exceptions, were again housed in tents, furnished by Gen. Albert Ordway, commanding the militia of the District of Columbia, and the use of such quarters was found beneficial.

Seining operations with the Fish Commission seine began April 5.

Indurated fiber tubs with drop handles were substituted for the tin tanks formerly used for holding eggs in the boats and were found to possess many advantages. Being without joints and hoops, they do not fall to pieces or corrode, and they are good nonconductors of heat. The tubs are 17¾ inches in diameter and 8½ inches high, with tops of one-half inch white pine, to prevent splashing. Around the edge of the top is attached a rubber packing of suitable elasticity and in the center a 4-inch hole is cut to admit air.

The Fish Commission seine captured at Bryan Point 5,231 shad, of which 466 were skins, skips, or immature fish. The ripe fish yielded 4,350,000 eggs. Only a very small number of fish were hatched at the station. The total number of eggs obtained and the sources from whence derived are shown in the following statement:

Chapman Point seine	2,007,000
Stony Point seine	2,216,000
Tulip Hill seine	573,000
Tent Landing seine	235,000
Freestone Point seine	3,249,000
Bryan Point seine	4,350,000
Gill nets	19,763,000
Total	32,393,000

There were shipped to Central Station 32,254,000, which, on the day following their receipt in Washington, were measured and their number found to be 27,334,000, the loss in transportation being attributed chiefly to breakage of defective eggs. The eggs were packed in crates and delivered daily by the launch or small boat at Marshall Hall, whence they were taken in charge by Mr. F. H. Williams and carried to Washington on the Mount Vernon and Marshall Hall steamers. The season closed in early June, but shad continued to be abundant in the Potomac during June, July, and August, and some were observed in September. For the greater portion of that time eggs of apparently good quality could have been collected in large quantities.

CENTRAL STATION, WASHINGTON, D. C. (S. G. WORTH, SUPERINTENDENT).

From the beginning of the fiscal year until February 19, 1894, the superintendent performed the additional duties of acting assistant in charge of the division of fish culture during the detail of the assistant in connection with the World's Fair at Chicago. He was also a member of the examining board of the Civil Service Commission, and took the general oversight of the aquaria in the absence of the superintendent of aquaria.

The purchase and shipment of various supplies for other stations of the Commission were attended to by Mr. Worth, and numerous services were rendered for other departments of the Central office. The number of shipments of freight handled at the station was 618. The shad eggs collected at Bryan Point are hatched in Central Station, as well as eggs of trout, salmon, whitefish, pike-perch, etc., from distant stations of the Commission. This is the shipping-point also for the fish produced at the Fish Ponds in Washington, as well as for those hatched in the station.

A special carp-distribution pail, devised in October, 1893, has two small rings soldered midway between the ears of the handles. The openings in the rings and ears provide a ready means of fastening on the lids.

The cement used in repairing aquaria at the station is made according to the following formula: Putty, 4 pounds; litharge, 1 pound; red lead, 1 pound. The litharge and lead are kneaded into the putty. If the mixture should be too dry, linseed oil is added, drop by drop, until the desired consistency is secured. The cement may be darkened by asphaltum or lampblack. It requires several days to set.

For drilling glass, a file is fastened in a handle and the free end is ground on three faces with a ⅛-inch bevel to a sharp point. "Bortine" or "glass-bore" is used as a lubricant in drilling.

In February, 1894, the office of the Commission was moved to the Atlantic Coast Line Building, corner of Sixth street and Pennsylvania avenue, and the first floor of the Central Station was used for storage during the repairs to the roof and upper floors. The work was completed and the office reinstated late in June.

In February, 1894, arrangements were made to discard the open water supply tank at the west end of the third-story hall. A safety valve was first connected with the iron piping supplying the hatching tables, and was found available as a temporary expedient during the hatching of some whitefish eggs. This was soon afterwards replaced by a 3-inch Watson water-pressure regulator, which proved entirely satisfactory. The regulator may be found useful at Alpena and other stations taking water by gravity.

In the spring of 1894, Superintendent Worth prepared 173 photographic prints from negatives of fishery and fish-culture subjects made for the World's Columbian Exposition, and these were sent to Dr. Ernst Ehrenbaum, Kgl. Biologische-Anstalt, Helgoland. Of similar illustrations, 36 were prepared and forwarded to Dr. Nicolas Borodine, Uralsk, Russia. Illustrations and explanations of the methods of the Commission in shad culture were also furnished to Mr. C. B. Hudson.

On June 27 the superintendent commenced an examination of the McDonald patent fishway at the Great Falls of the Potomac River to determine its condition and the number of fish ascending. A preliminary report was made, which was approved, and formed the basis of operations and expenditures.

The application of air for oxygenizing water in which living fishes are kept has been a subject of experiment since the fall of 1888. References to this use of air will be found in the bulletin for 1890 and in the report for 1893. The first object of the experiments was to maintain fishes in salt-water aquaria without circulating the water. Rubber tubing, pricked with pinholes, to liberate air, was tried without satisfactory results. Section of dead grapevine, cornstalk pith, and twigs of various trees were substituted, with little improvement. Sponge, inserted in small openings in rubber tubes, also gave poor results.

Finally it was discovered, as detailed in the report for the preceding fiscal year, that twigs of the American linden or basswood furnish perfect liberators, and the difficult problem was solved. The liberator plugs are made from wilted or dead boughs of any size greater than $\frac{1}{4}$ inch in diameter. The bark is removed and the wood seasoned. It is then cut by a saw with very thin blade and fine teeth into sections $\frac{1}{4}$ inch to $\frac{1}{2}$ inch long. The plugs are made from $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter by forcing them through a round belt-lacing punch. The ends of the plugs may be smoothed with the finest sandpaper. The liberators continue useful from a few days to several weeks, according to the amount of grit entering the circulation. They were inserted in sections of $\frac{1}{2}$-inch rubber tubing.

In January, 1894, a Bishop & Babcock air-compressor of large size was introduced to furnish air for the aquaria in Central Station through small iron pipes. It delivers air under pressure of from 5 to 8 pounds per square inch. The water or power cylinder is $4\frac{1}{8}$ inches in diameter and $8\frac{1}{2}$ inches long; the air cylinder, $5\frac{7}{8}$ inches by $8\frac{1}{2}$ inches. Strokes per minute, $6\frac{1}{10}$, delivering 1,405.13 cubic inches of air under a pressure of 7 pounds per square inch, a rate of 364.8 liquid gallons per hour, equivalent to the flow of salt water through the aquaria. At delivery points, $\frac{1}{4}$-inch brass jet cocks were inserted into the $\frac{3}{8}$-inch conduit piping. To the jet cocks were attached sections of $\frac{1}{2}$-inch rubber tubing, and air liberators were inserted in the free ends of the tubing.

The air circulation proved so successful in the aquaria as to lead to the addition of an air pump to the steam plant on car No. 3, in August, 1893, and the result was equally good. It has been demonstrated that as many fish can be transported in the same bulk of water by air circulation as with water circulation.

In December, 1893, a practical test was made of the practicability of hatching floating eggs by means of air circulation. Cod eggs and sea water were obtained from the Gloucester, Mass., Station, and two shipments of eggs out of eleven produced fry.

The eggs were placed in universal hatching jars and the jars were embedded about two-thirds of their height in a mixture of crushed ice and salt, the upper third being free and exposed to a strong light. The water temperature was kept uniformly at 38° F. Air was introduced at the bottom of each jar through a rubber tube provided with a liberator. It was believed that the experiment would have been more satisfactory if pure sea water had been available to make a complete change of water every third day during the hatching process.

Advantages claimed for the air-circulation process are: (1) Thorough aeration, (2) active movement of the eggs, (3) light, (4) ability to keep eggs in sea water of proper density and at a uniform temperature, (5) economy of labor and apparatus, (6) increased comfort to hatchery employees, (7) economy and improved quality of water, (8) reduction of cost of pumping, (9) increased facility in removing dead eggs, (10) increased cleanliness and absence of wet floors, (11) economy of space in the hatching room, (12) improved facilities for observing the condition of eggs and fry. Hatching operations could be carried on in jars on the cars en route or on board ship.

Two lots of pike-perch eggs were received from Put-in-Bay Station May 4 and 5, 1894, with a loss of about 90 per cent. Those received May 5 were in a temperature of 62° F. They were allowed to rise to 62° and placed in water at 68°, when hatching commenced at once.

On December 28, 1893, Superintendent Seagle sent from Wytheville, Va., 10,000 rainbow-trout eggs of different ages for use by Prof. W. K. Brooks, of Johns Hopkins University, in his studies of the development of fins. The young cod hatched at Central Station were also shipped to Professor Brooks, together with three universal hatching jars, complete.

Central Station is credited with furnishing for distribution the following fry:

Species.	Place where eggs were collected.	No. of fry distributed.
Shad	Bryan Point	21,082,000
Whitefish	Put-in-Bay	3,800,000
Landlocked salmon	Green Lake	2,500
Brook trout	Northville and Green Lake	19,500
Rainbow trout	Wytheville and Neosho	22,000
Pike perch	Put-in-Bay	75,000
Total		25,001,000

Of rainbow-trout eggs produced at Wytheville and Neosho 104,537 were reshipped to applicants in Baltimore, Md., Canada, Belgium, and France, as shown in the details of distribution. Of species forwarded from the Fish Ponds, World's Fair, Green Lake, Quincy, Wytheville, Neosho, Havre de Grace, and Put-in-Bay stations, 1,236,704 individuals were received and most of them were distributed.

Aquaria, Central Station (L. G. Harron, Superintendent).

At the beginning of the fiscal year the superintendent was on detailed duty at the aquarium of the Fish Commission at the World's Columbian Exposition, and remained in that service until October 30, 1893. Preparations for restocking Central Station aquaria began November 5, and on November 12 a collecting trip was made to lower Chesapeake Bay. Fish had left the inlets and shallow bays owing to cold weather, and very few specimens could be collected.

In February, 1894, during repairs to the aquaria, the fish were transferred to the outside supply reservoir and air currents were introduced, but all of them died during spring and summer. The superintendent was detached for duty at Bryan Point until after the close of the fiscal year.

The water motor, introduced in May, 1893, to pump salt water into the storage tank, works satisfactorily and at much less cost than the gas engine previously used. A line of $\frac{3}{8}$-inch iron pipe was extended from the air compressor to establish air circulation in the aquaria.

Goldfish spawned in May and the eggs were hatched in tubs of standing water; the fry were reared in small "balanced" aquaria. Eggs of the paradise fish were hatched and the fry reared in the same way. Common darters (*Boleosoma olmstedi*) spawned in May and the eggs were eaten by the adult fish. Among the marine species some of the mummichogs (*Fundulus*) spawned in June and a number of fry were produced, but they were devoured by the adults.

Adult grayling, brought from the World's Fair November 3, 1893, to the number of 44, were kept with the loss of only 4 until February 17, 1894, when they were transferred to the Wytheville, Va., Station in excellent condition. About 50 young brook trout, reared from fry exhibited at the World's Fair, were transferred to the aquaria at Central Station November 5, 1893, and held without loss until March 5, 1894, when they were from 5 to 6½ inches in length. They were planted at Leesburg, Va. Some anemones from the Pacific Coast, exhibited four months in the aquarium at Chicago, were transferred to Washington November 5, 1893, and lived in salt water with air circulation until May, 1894, when they were killed by high temperature.

The mortality among marine species is merely nominal, and fresh-water fishes, with the exception of the *Salmonidæ*, which can not endure summer warmth, are successfully maintained.

FISH PONDS, WASHINGTON, D. C. (R. HESSEL, SUPERINTENDENT).

The following yearling fish were taken from the ponds in November, and distribution of them made through Central Station: Carp, 51,802; tench, 10,022; golden tench, 431; goldfish, 8,427; golden ides, 1,947; black bass, 12,330; shad, 1,000,000.

On the night of October 12 a strong wind blew up, which developed into a hurricane by morning, and forced the water from the bay into the Potomac. Toward evening, at high tide, the water rushed over the banks and flooded all the large ponds containing carp, black bass, and tench, and for eight hours the water was on a level with the base of the office building. The water thus became brackish, and about 1,000,000 yearling shad were swept into the Potomac somewhat earlier than originally intended.

Ides.—Early in March the old ides were transferred to the hatching ponds, where they began to spawn on April 20. Subsequently the frost killed over 20,000 eggs, and only about 40 young ides were saved.

Black bass.—Both kinds of the black bass were raised—the large-mouthed and the small-mouthed. On April 1 they were placed in their respective hatching ponds. The small-mouthed bass spawned April 23, and the large-mouthed one week later. On May 8 the first young bass of both species were seen. The large-mouthed variety soon increased to about 60,000, while the small-mouthed did not produce over 4,000 eggs. Soon after May 10, the young bass were placed in the north pond and the old ones retained in the hatching ponds. The bass were fed on live food, 500,000 tadpoles and 400,000 young carp being placed at their disposal.

With the arrival of the warm weather the natural consequences of the October flood could be seen. Grasses and other water plants, the seeds of which had been carried into the station by the high water, grew very rapidly into a dense mass of vegetation, which had to be removed over and over again to prevent their interfering with the growth of the young fish. There also appeared at the same time two kinds of *Notonecta* and *Nepa*, both insects being very injurious to young fish. Daily efforts were made to destroy them, but without success.

Notwithstanding the abundance of live food, the young large-mouthed black bass commenced to attack each other, thereby causing a decrease in the number of young fish; and how to remedy this is a problem yet to be solved.

Carp.—The leather and scale varieties were raised in the new pond, while the blue carp were placed in another pond. The carp in the new pond suffered from the insects above referred to.

Tench.—This species was hatched and raised in the south pond, and the golden tench in a smaller pond. Compared with former seasons, the young fish grew very fast.

Pike perch.—A number of transport cans full of this fish were transferred to the new south pond, but the fish all died on account of the too warm water, the pond being but one foot and a half deep.

The shad hybrids also died from the same cause.

WYTHEVILLE STATION, VIRGINIA (GEORGE A. SEAGLE, SUPERINTENDENT).

The product of this station during the season was as follows:

Species.	Eggs.	Fry.	Yearlings.
Rainbow trout	104,500	15,000	90,640
Rock bass			20,750
Black bass			40
Carp			790
Goldfish			2,649

Of the rainbow trout 250,000 eggs were collected from the brood stock at the station, 114,000 were received in January from the Neosho Station, and 10,000 from the Troutdale Fish Farm, Mammoth Spring, Ark., making in all 374,200 eggs. Of this number, 180,360 were hatched at the station, 104,500 were shipped to Central Station for foreign shipments, and 80,040 died during incubation. From the native rainbow trout 10,000 eggs were shipped to the station from Hoopa Valley, California, on March 24, and arrived at Wytheville April 2; but as all the eggs hatched en route the shipment was a total loss.

From 135 black-spotted trout at the station there were collected 12,000 eggs, but owing to the lack of milt only 500 were saved. The propagation of this species has been tried at the station the past two seasons, but without success. The sexes do not mature together, the male having passed out of season when the female comes in.

About November 5 the rainbow trout commenced to spawn and ceased about February 20. Many of the older rainbows did not spawn this season from some unknown cause. The brood stock of rainbows consists of 5,400 fish, of which 1,000 are from 6 to 12 years old; 3,200 are 2 years old, and 1,200 are 1 year old. Very few of the 2-year fish produced eggs this season. Of rainbows, there were distributed this year 90,320 yearlings, 320 adults, and 15,000 fingerlings. Fish of a summer's growth were distributed as follows: Rock bass, 20,750; black bass, 40; carp, 790; goldfish, 2,649. The goldfish commenced spawning this year March 24, and the carp April 27.

From the rainbow-trout eggs hatched at the station the past season there are on hand, in good condition, 80,000 fingerlings. The bulk of these fish are being reared in the troughs where they were hatched.

The maximum and minimum temperatures of air and water during the months of November (twenty-six days), December, January, and February (twenty days), were as follows:

	Temperature (air).		
	Max.	Min.	Mean.
	° F.	° F.	° F.
Twenty-six days in November	60	13	$40\frac{10}{39}$
December	58	12	$36\frac{16}{31}$
January	58	12	$36\frac{22}{31}$
Twenty days in February	58	12	$37\frac{29}{30}$
Water	54	53	$53\frac{65}{108}$

PUT-IN-BAY STATION, OHIO (J. J. STRANAHAN, SUPERINTENDENT).

The work of this station during the year was chiefly confined to the whitefish, pike perch, and lake herring. The egg-collecting season for whitefish and herring was one of the worst in the history of the commercial fisheries of Lake Erie. A very severe gale set in on November 12, which lasted, with the exception of November 16 and 20, to the close of the spawn-taking season, thereby greatly interfering with the collecting work.

Whitefish.—The first whitefish eggs were taken November 7, and the last November 29. The places and the number of eggs taken at each were: North Bass Island, 24,780,000; Middle Bass Island, 4,800,000;

Put-in-Bay Island, 5,190,000; Kelly Island, 2,880,000; East Sister Island, 1,260,000; Toledo, 140,000; total, 39,050,000.

Herring.—The first herring eggs were taken November 12, and the last November 26. From Put-in-Bay Island were received 31,000,000; from North Bass Island, 22,000,000; total, 53,000,000. Both kinds of eggs were, as a whole, of poor quality, owing to the difficulties under which they were obtained.

The work of penning live fish was a failure. There were penned only 82 fish, over one-half of which were males.

Only 45,000 lake trout eggs were collected during the season, and they were in such poor condition that but few of them hatched.

In the hatching, extensive and careful experiments were made with cone-shaped tubes as compared with the straight ones in general use. Eggs taken on the same day by the same person were mixed in a tub, and McDonald jars with open tops were fitted with the two styles of tubes and filled with these eggs. The percentage of loss was found to be much less with the cones than with the straight tubes. The percentage of loss after eye-specks were formed in the eggs was almost nothing with the cones, while it was considerable with the straight tubes. Like experiments were made with pike-perch eggs and with like results.

The cones were made at the station of tin, 6 inches long and 1 inch in diameter at the large end. Sections 6 inches long were cut from the lower end of the straight iron tubes, the cones centered and soldered on, after which all was coated with asphaltum.

Pike perch.—The season for collecting eggs of this species was very good, and 293,845,000 were obtained from the following grounds: North Bass Island, 80,580,000; Put-in-Bay Island, 61,030,000; Port Clinton, 100,725,000; Catawba Island, 3,400,000; East Sister Island, 21,760,000; Sandusky Bay, 26,350,000.

Of these, 248,965,000 were placed in the station, and 44,880,000 in the Sandusky station of the Ohio Fish Commission for the pike-perch season, the United States Commission having taken possession April 5.

On April 15, a series of experiments was commenced for the purpose of preventing the sticking together of adhesive eggs. Following the directions of Prof. Jacob Reighard, of Michigan, in 1 quart of dry cornstarch, dissolved in 5 gallons of water, was placed, after impregnation and 3 minutes interval, 1 gallon of pike-perch eggs. In another vessel was placed finely dissolved swamp muck in a solution of about the consistency of porridge, 2 quarts of this to 10 gallons of water, and in this were put 3 gallons of eggs. The spawn-taker making this experiment brought in 1 gallon of eggs in starch, and 2 gallons in muck. He reported that it was more work to keep the eggs free with the starch than under the former plan of constant stirring until the adhesive tendency disappears; as in the one case the eggs need attention only while being freed, while in the other they must be almost constantly stirred until the station is reached. He reported that the muck entirely prevented adhesion, and gave no trouble whatever. After arriving at the station both lots were examined and then placed under running water as usual. The current carried over nearly all of the starch and a considerable portion of the muck. About twenty-four hours after being taken the two lots were separately removed from the kegs, passed through a screen with meshes large enough to admit of the passage of a single egg, when it was found that there were practically no lumps in either case. They were then put into a screen box with mesh fine enough to hold the eggs and all the muck was washed out, there being no starch remaining. Examination was made of both lots with the microscope, which showed minute particles of muck and starch adhering thickly all over the outer membrane of the eggs, thus preventing adhesion. Both lots showed a nearly equal percentage of good eggs, the muck eggs being slightly the better. In the starch solution 11 jars of eggs were taken; in the muck, 32. The muck was prepared by taking black muck from the shores of a pond near by, thoroughly mixing to a very thin solution with water, letting the vessel set about half a minute to settle out the coarser and heavier particles, then decanting off the water, holding the fine particles in solution, which was left to settle, when the nearly clear water was poured off, the muck being then rubbed through a fine wire screen, when it was ready for use.

An experiment was also made in hatching yellow-perch eggs. The eggs (73,000) were taken, April 27, from a fish weighing 9 ounces, and were at once impregnated, the milt of two small males being used. They were put in a McDonald jar and worked with a small amount of water, being thoroughly feathered twice a day or more. Eye-specks showed on the ninth day, and the fry hatched May 12. There was not 1 per cent of eggs in all which did not hatch.

Experiments were made in feeding the pike-perch fry to prevent cannibalism. One hundred thousand fry ten days old were placed in each of three kegs, each supplied with running water; one was entirely darkened; the fry in the second were freely fed on graham flour, and the third lot were left to themselves. The kegs were set up May 14. The darkened keg was opened on the 17th and again on the 19th, and but very few "doubles" were found—not over 1 per cent. The fry were light colored, and not as vigorous as those which had been in the light. On the 21st the keg was again opened, and a large percentage of the fry being dead, the experiment was abandoned and the live ones planted. There was a perceptibly greater mortality through cannibalism in the keg wherein the fry were not fed than in the one where they were, but it was considerable in the latter, although they seemed to eat the graham flour freely and remain healthy.

These experiments show that pike-perch fry can be held for two or three weeks for the purpose of facilitating shipment by providing ample tankage facilities, feeding often, and keeping the tanks moderately dark when the fry are not feeding.

Distribution and deposits of eggs and fry were made from the station, as follows:

Whitefish eggs to Central Station, Washington, D. C., 4,000,000; to Clayton, N. Y., State Fish Commission, 6,000,000.

Pike-perch eggs to Central Station, Washington, D. C., 3,700,000; to Constantia, N. Y., Fish Commission, 5,000,000; to Sandusky hatchery, 10,000,000.

Plants of fry were made in Lake Erie as follows: Whitefish, 21,710,000; herring, 30,005,000; pike perch, 132,000,000; lake trout, 121,000; yellow perch, 70,000.

Pike-perch fry delivered to United States Fish Commission (car No. 4), 24,300,000; to Ohio Fish Commission, 18,900,000; to John Fitzgerald (Winnow Point Club) at Put-in-Bay Station, for Mud Creek Bay, Ohio, 2,500,000.

NORTHVILLE STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

During the first half of the year there were completed two large ponds fed by pipe and race from the reservoir at the station, and twelve small rearing ponds were reconstructed. Drainpipes were introduced to all the remaining ponds, making it possible to draw each pond separately into the sewer.

The following table shows the number of each kind of fish on hand at the station July 29, 1893:

Kind.	Hatching of the year.			
	1893.	1892.	1891.	1890, or previously.
Brook trout	47,500	4,000	3,000	575
Von Behr trout	24,000	2,300		900
Loch Leven trout	37,700			1,700
Black-spotted trout		1,500	940	
Lake trout	25,700			
Total	134,900	7,800	1,240	7,175

There were not as many eggs collected this year from the parent fish at this station as in prior years, owing to the small number of breeders, a large portion of the stock fish having been shipped to the aquaria at the World's Fair.

Brook trout.—From 548 old fish (277 females and 271 males) 163,820 eggs were obtained, and from 3,106 yearlings (1,901 females and 1,205 males) 250,125 eggs, an average of 132 eggs to each fish. There were retained for hatching 228,945, and 185,000 eggs were shipped as follows: Troutdale Fish Farm, Mammoth Spring, Ark., 5,000; John G. Bailey, Rogers, Ark., 5,000; secretary of Hampshire Trout Club, Northampton, Mass., 10,000; Vermont Fish Commission, 20,000; Nebraska Fish Commission, 20,000; Minnesota Fish Commission, 20,000; A. P. Muzzey, New Richmond, Wis., 5,000; consul of Switzerland, at Havre, France, 20,000; Wytheville, Va., Station, 20,000; Duluth, Minn., Station, 20,000; Neosho, Mo., Station, 20,000; Central Station, Washington, D. C., 20,000.

Of yearlings, 29,100 were sent out, mostly to parties in Michigan, Pennsylvania, and New York. Six thousand fingerlings were shipped to persons in Michigan and Indiana.

When the brook-trout fry were 2 months old they began to die, and the loss continued as long as any of the fry were on hand, or until about July 1, 1894. It is thought that this loss was caused by the fact of the parent fish being diseased, a parasite attaching itself to their gills. About the beginning of March, when the disease was discovered, the fish were apparently clean, and from fifteen to thirty minutes after being attacked they would die. From early in March until in May over 3,000 of the parent fish, mostly from those 2 years old, died.

Von Behr trout.—Between October 31 and December 23 there were taken 235,000 eggs. Of these, 135,000 were distributed as follows: Troutdale Fish Farm Company, Mammoth Spring, Ark., 5,000; E. Chazari, City of Mexico, Mexico, 20,000; R. E. Follett, fish commissioner, Sheffield, Mass., 20,000; Minnesota Fish Commission, 20,000; Vermont Fish Commission, 20,000; Wyoming Fish Commission, 15,000; Green Lake Station, 25,000; Neosho Station, 10,000.

From the 24th of January to the 29th of March 14,972 fingerlings were distributed to parties in Michigan, Indiana, Ohio, Wisconsin, Iowa, and Kentucky.

Loch Leven trout.—Of this species 205,500 eggs were taken between October 30 and December 30. From these the following distributions were made: California Fish Commission, 20,000; Minnesota Fish Commission, 20,000; Green Lake, Me., Station, 20,000; Leadville, Colo., Station, 10,000; E. Chazari, inspector-general of pisciculture, City of Mexico, Mexico, 25,000.

Yearlings distributed, 10,600; fingerlings, 24,000.

Lake trout.—Eggs numbering 2,663,000 were received at the station during the season from Alpena, Mich., and 21,099 from the World's Fair on the 1st of November. Distributions of these eggs were made between January 17 and 19, as follows: Caledonia, N. Y., hatchery, 300,000; E. A. Brackett, fish commissioner, Winchester, Mass., 100,000; S. S. Watkins, superintendent Minnesota Fish Commission, St. Paul, 100,000; A. M. Musser, Salt Lake City, Utah, 100,000; C. C. Warren, fish commissioner, Roxbury, Vt., 300,000; Nebraska State Fish Commission, 100,000; R. E. Follett, fish commissioner, Sheffield, Mass., 100,000; Green Lake, Me., Station, 50,000; Put-in-Bay, Ohio, Station, 125,000; World's Fair, 54,000. Of this latter number, 21,099 were returned to the Northville Station November 1.

The number of fingerlings distributed between June 13 and 26 was 102,000: C. N. Clark, Cape Vincent, N. Y., 30,000; Lake Huron, off Sugar Island, 40,000; Lake Huron, off Alpena, 30,000; E. C. Dayton, Kalamazoo, Mich., 2,000.

Yearlings distributed, 19,423, to parties in New York, Pennsylvania, Ohio, Michigan, Indiana, and Montana. There were deposited in Lake Huron, near Alpena, Mich., 145 fish, 1, 2, and 3 years old.

Black-spotted trout.—The number of this species on hand April 1 was 927 of those coming 3 years, and 1,400 of those coming 2 years old. The 3-year-old fish were in excellent condition, but only 62,500 eggs were taken, and for some unknown reason these did not do well, as only about 20 per cent of very weak fry were produced, and nearly all of them died before they commenced to take food readily. Toward the close of the season nearly all the 2 and 3 year old fish died. This was caused by handling them while taking spawn during the very warm weather in May, and partially by the same disease which attacked the brook trout.

Salmon.—There were received from the World's Fair 40,000 Pacific Coast salmon eggs in very good condition, from which a good percentage hatched. After the sac was absorbed they were planted near Monroe, Mich., in the Rasin River, a tributary to Lake Erie. On April 30 there reached the station from Fort Gaston, Cal., 100,000 Pacific Coast salmon eggs, but on opening the package they were found to be all rotten.

Trout were forwarded from the Northville Station to the World's Fair, as follows:

Brook, 2 and 3 years old, 100; 1 and 2 years old, 100; yearlings, 300; fingerlings, 2,000.

Von Behr, 4 years old, 50; fingerlings, 2,000.

Loch Leven, 4 years old, 50; fingerlings, 2,000.

Black-spotted, 2 years old, 50.

Grayling, wild, 189.

Trout delivered to Michigan Fish Commission: Lake, 1 year old, 25; black-spotted, 1 year old, 25; 2 years old, 25; grayling, wild, 10.

On January 16, 20,000 rainbow-trout eggs were received from the Neosho Station, in fair condition. The loss in hatching these and up to the time of the absorption of the sac was 5,000. By the end of the year 8,000 more were lost, leaving 7,000 fingerlings on hand in good condition, which are held for distribution when a year old.

The following table shows the number of eggs, fry, and fish of each species on hand at the end of the year (June 30, 1894):

Kind.	Eggs.	Fingerlings.	1 year old.
Brook trout	228,945		
Loch Leven trout			1,500
Lake trout	1,388,000		
Von Behr trout	100,000		
Rainbow trout		7,000	

Alpena Station, Michigan (F. N. Clark, Superintendent).

The operations of this station during the season were, as in previous years, devoted to the collection of whitefish and lake-trout eggs. The work of securing these commenced about November 1, and continued during the month. The fishing was confined to fewer grounds than formerly, and the severe weather during the spawning seasons of these two species of fish interfered greatly with the work.

In September spawning outfits were sent to Thunder Bay and Middle Islands, and other arrangements were made for collecting shoal-trout eggs for the United States Fish Commission exhibit at the World's Fair, but very few eggs were collected during the month.

Early in October 96,000 shoal-trout eggs were received at the station, 54,000 of which were shipped by express to the World's Fair on the 6th, and 42,000 to the Northville Station by boat to Detroit on the 11th.

Lake trout.—During the latter part of October 368,000 eggs of the lake trout were received at the station, and 160,000 of these were shipped to Northville. During November 1,316,000 eggs were received, and these, with the 208,000 on hand at the end of October, were sent to Northville, and 1,000,000 were taken direct from Charlevoix to Northville. All the lake-trout eggs sent from Alpena to Northville were from fish taken in gill nets on the Big Reef in Lake Huron, near Alpena, and from reefs in Lake Michigan near Charlevoix, Mich.

Whitefish.—The first whitefish eggs, about 1,000,000, were received on the 9th of November; 19,010,000 were received during the month. The loss on these was 230,000. There were 6,590,000 eggs received in December; there being in all at the station at the close of the month, in fair condition, 24,320,000. Of these, a loss of 820,000 took place in January, leaving 23,500,000 on hand, January 31, in first-class condition.

On the 17th of February 10,000,000 whitefish eggs were sent to Duluth Station by car No. 1, and on the 24th of the same month 200,000 were shipped to R. E. Follet, fish commissioner, Sheffield, Mass. The loss on eggs during February was 250,000; leaving 13,050,000 on hand in first-class condition. There was no loss on the eggs on hand at the station during March.

The first fish hatched on the 6th of April and the last on the 30th.

Deposits of whitefish fry were made as follows:

Date.	Points of deposit.	Number of fish.
Apr. 16	Lake Huron, near East Tawas, Mich	1,000,000
18	Whitefish Lake, near Corinne, Mich	2,000,000
24	Lake Huron, north of Thunder Bay Island	1,050,000
25	Lake Huron, near Sturgeon Point	1,000,000
26	Lake Huron, near Miller Point	1,000,000
27	Lake Huron, Detour Passage	1,500,000
May 2	Lake Michigan, near Manistique, Mich	2,000,000
7	Lake Michigan, near Charlevoix, Mich	2,000,000
11	Lake Michigan, Epaufette and Nanbinway	1,500,000
	Total	13,050,000

The maximum and minimum temperatures of the water at the station for the months given were as follows:

Month.	Max.	Min.	Month.	Max.	Min.
	°F.	°F.		°F.	°F.
November, 1893	40	33	March, 1894	37	33
December, 1893	33	33	April, 1894	48	34
January, 1894	33	32½	May, 1893, to the 19th	54	50
February, 1894	34	33			

DULUTH STATION, MINNESOTA (S. P. WIRES, SUPERINTENDENT).

Dr. R. O. Sweeny, sr., tendered his resignation as superintendent to take effect July 31, 1893. The resignation was accepted. Mr. S. P. Wires, foreman of the station, was promoted to the position of superintendent.

The work at this station was confined during the year to the propagation of the whitefish, lake trout, brook trout, and pike perch.

Whitefish.—Between the 1st and 18th of November 750,000 eggs were collected: 500,000 from Siskowit Bay, Isle Royale, Mich., and 250,000 from Willey Island, vicinity of Bayfield, Wis.; and on February 22 10,000,000 eggs were received from Alpena Station. These 11,500,000 eggs produced 10,190,000 fry, which were deposited as follows: May 2, Raspberry Bay, Wisconsin, 2,000,000; May 2, Lake Superior, vicinity of Iron River, Wisconsin, 2,000,000; May 7, points between Duluth and Iron River, 2,000,000; May 11, Lake Superior, vicinity of Bayfield, 2,000,000; May 14, Lake Superior, vicinity of Isle Royale, 500,000; May 18, Siskowit Lake, Isle Royale, 1,000,000; May 19, Lake Superior, vicinity of Fish Island, Isle Royale, 490,000; May 19, vicinity of station, 200,000.

Lake trout.—The first lake-trout eggs of the season were collected at St. Ignace Island and Kings Bay, Ontario, September 25, and the last at Bayfield, Wis., November 17. Collections were made as follows:

St. Ignace Island, Ontario	973,400
Kings Bay, Ontario	729,650
Fishermens Home, Isle Royale, Mich	163,800
Grand Portage, Minn	437,300
Fish Island and Rock Harbor, Isle Royale, Mich	295,950
Wright Island, Isle Royale, Mich	180,000
Washington Harbor, Isle Royale, Mich	270,000
Port Arthur, Ontario	199,900
Bayfield, Wis	410,000
Total	3,660,000

From these were obtained 2,540,000 fry, which were planted in Lake Superior in many localities in May and June.

Brook trout.—On January 13th, 20,000 eggs were received from the Northville Station. There were lost of these, February, 1894, 1,000, mostly fry, and in March 9,000 fry. June 25, 10,000 fry were deposited in Washington River, Isle Royale, Mich.

Pike perch.—Between April 27 and 30, 23.000,000 eggs were collected at Pike River, Minn. In May there was a loss of 15,000,000 of these eggs. The 8,000,000 fry hatched were deposited at the following points: June 3, Pike Lake, St. Louis County, Minn., 2,500,000; June 4, Lake Vermilion, vicinity of Tower, Minn., 2,500,000; June 8, Lake Superior, vicinity of Sand Bay, Wis., 3,000,000.

The average temperature of the water was as follows: October, 44°; November, 35°; January, 34°; February, 34°; March, 33°; April, 32½°; May (from 33° on May 1 to 58° May 31); June, 65°.

Quincy Station, Illinois (S. P. Bartlett, Superintendent).

As in former seasons, the work of this station was carried on from points along the Mississippi River above and below Quincy and from points on the Illinois River above and below Meredosia. The regular work of the station was delayed until the latter part of August, as the cars and equipments for the movement of the fish were used in the collection of fish for the aquarium at the World's Fair. Consequently, the collections were restricted to places not dried out by midsummer heat, or to rivers in which the water was not very low.

The fish distributed from the station were, in the main, much above the average size, and were in very good condition for transportation. They consisted principally of black bass, white bass, Warmouth bass, crappie, spotted catfish, pike, and sunfish. The following table shows the distribution work of the season:

State.	Black bass.	Crappie.	Catfish.	Warmouth bass.	Sunfish.	Yellow perch.	White bass.	Wall-eyed pike.	Pike.	Bream.	Rock bass.	Total.
Idaho	......	......	100	......	......	......	......	......	......	......	......	100
Illinois	752	1,006	2,800	150	......	......	......	......	......	......	30	4,738
Indiana	335	2,725	375	650	20	......	......	......	......	......	......	4,105
Iowa	1,212	1,075	9,642	629	100	167	......	......	......	......	......	12,825
Kansas	853	549	1,100	100	......	20	......	......	......	......	......	2,622
Kentucky	5,012	1,740	1,165	219	......	75	......	......	......	20	......	8,231
Massachusetts	190	......	......	38	......	......	......	......	......	......	......	228
Missouri	375	306	450	115	......	......	......	......	......	......	......	1,246
New York	50	50	125	......	......	......	......	......	......	......	......	225
Ohio	2,275	15	......	......	50	......	......	......	......	......	......	2,340
Oregon	50	......	......	......	......	......	......	......	......	......	......	50
Texas	422	535	265	275	......	......	......	......	......	......	......	1,497
Utah	50	......	......	......	......	......	......	......	......	......	......	50
Virginia	100	50	300	......	......	......	......	......	100	......	......	550
Washington	550	18	100	......	......	......	......	......	......	......	......	668
Wyoming	600	25	25	......	......	......	......	......	......	......	......	650
Central Station	738	448	150	152	49	......	9	61	......	......	......	1,607
Total	13,564	8,542	16,597	2,328	219	262	9	61	100	20	30	41,732

In the distribution of these fish the four cars of the Commission were employed. The whole number of miles traveled was 16,498, transportation for 11,899 miles being given free by the railroads and 4,599 miles being paid for.

The residue of the fish taken from the ponds and lakes formed by the overflows of the Mississippi and Illinois rivers—those which had not been selected for distribution—was again returned to the nearest deep water. The kinds and numbers are as follows: White perch, 18,100; buffalo, 35,000; sunfish, 25,000; bullpout, 86,000; carp, 31,000; catfish, 109,000; warmouth bass, 3,900; pike perch, 500; white bass, 3,600; black bass, 1,000; crappie, 2,000; pike, 8,900; total, 324,000.

Neosho Station, Missouri (William F. Page, Superintendent).

The operations of this station during the year were confined to the propagation of black bass, rock bass, carp, tench, golden ide, goldfish, spotted or channel catfish, brook trout, Von Behr trout, and rainbow trout.

A new railroad siding was projected to connect with the Kansas City, Pittsburg and Gulf Railroad at Neosho.

Owing to the ravages of crayfish, Mr. Page reports that the production of each pond has steadily decreased each season since its construction and no means have yet been found to destroy these pests. Another destructive agency is the boat fly (*Notonecta glauca*), by which 600 young goldfish were killed in about ten days.

Black bass.—About September 1 there were 2,000 of these fish at the station, but four months later, when distribution was about to be made, only 630 were shipped, the number being thus reduced by the fish eating each other, notwithstanding every effort was made to supply them liberally with both natural and artificial food.

On April 4, 20 old breeders were put in pond No. 10, and 23 2-year-old bass in pond No. 11, in which were 4 old breeders. April 21 these bass were found guarding newly made nests. By May 1 all the eggs in the earliest nests were hatched out, though new nests were seen up to June 10. June 1 the fish of the earliest hatch were $1\frac{1}{4}$ inches, and numbered from 8,000 to 15,000. On June 6 a heavy rainstorm destroyed most of them.

Rock bass.—Of this species 4,710 were distributed, mostly in Indian Territory, Texas, Arkansas, Missouri, Iowa, Kansas, and Nebraska.

Carp.—During the winter 2,275 yearling carp, ranging from one-quarter to one-half pound in weight, were shipped. It having been determined to discontinue the propagation of this species at this station, the breeders on hand were liberated, May 1, in Grand River, Indian Territory.

Tench.—The good results heretofore attained in the propagation of the tench were not realized this year, the total production being but 10,000, due, it is thought, to the depredations of crayfish. The number of yearling fish distributed was 9,210, to parties in Indian Territory, Texas, Missouri, and Arkansas.

Golden ides.—But 18 yearlings of this species were distributed during the season, and there is but one of two years old and one of four years on hand. These are employed as scavengers in the pond with the brood stock of rainbow trout.

Goldfish.—There were distributed 4,231 goldfish during the year. The production of this fish will hereafter be confined to a limited number of the finer specimens.

Spotted or channel catfish.—The fish of this variety which have been at the station for the past three years failed to spawn, and they all died during the winter, being attacked by fungus. There were distributed 1,059 yearlings.

Brook trout.—The 20,000 brook-trout eggs received from the Northville Station January 13, 1894, had every appearance of being in good condition when received, but twenty-four hours after unpacking 95 per cent of the eggs were dead. By February 11 all were dead. The cause of the loss is unknown.

Von Behr trout.—On January 19, 10,000 eggs were received from Northville. These produced 10,312 fry, which were placed in the outdoor pools.

Rainbow trout.—Of this variety there were distributed during the season 52,513 yearlings. This trout began to spawn December 12, and 787,339 eggs were produced, of which 604,923 (or about 75 per cent) were impregnated. Of those impregnated, 491,640 were shipped to other stations, and the remainder, 113,283, were retained for hatching and rearing. During the breeding season the loss of breeders from constant fighting incident to spawning amounted to 67 females and 103 males.

The temperatures of the waters in the various pools and ponds at the station during the year were as follows:

Location.	Max.	Min.	Location.	Max.	Min.
	°F.	°F.		°F.	°F.
Trout pools, A to F	59	56	Pond No. 7	70	59
Trout pool; new, eastern	62	56	8	72	32
Pond No. 1	68	50	9	82	32
2	69	32	10	81	32
3	80	32	11	86	32
4	82	32	12	79	32
5	75	32	13	71	32
6	87	32	15	67	60

The air temperatures during the year were:

1893.	Max.	Min.	Mean.	1894.	Max.	Min.	Mean.
	°F.	°F.	°F.		°F.	°F.	°F.
July	102	66	82.10	January	68	—20	38.50
August	100	51	80.40	February	60	— 1	35.60
September	96	42	77.40	March	80	14	54.50
October	87	28	60.70	April	90	31	64.95
November	70	10	44.70	May	92	43	72.90
December	66	11	42.60	June	103	52	84.40

Leadville Station, Colorado (H. D. Dean, Superintendent).

In April, 1894, the United States acquired from John Law, Jennie Goodell Blow, and J. B. Grant their rights in the water of Rock Creek and their lakes and other property contiguous to the Government reservation, with exception of a prior right of De May to an amount not exceeding 500 gallons per minute from May to October, and an amount of water from Rock Creek not to exceed 1,000 gallons per minute for the Law Placer. The work at this station was, as in previous years, confined to the propagation of the trouts, the varieties handled being the brook, Loch Leven, black-spotted, rainbow, Von Behr, and yellow-finned.

Brook trout.—The first eggs were taken October 16; began hatching January 1, and feeding February 14. Between November 1 and 10 there were taken at Wellington Lake 789,200 eggs. Eye-spots showed in forty-four days; fish commenced hatching January 12 and completed January 30; 60 per cent hatched. The first lot began feeding April 5, and the second March 16. Fully 75 per cent of the latter died from some unknown cause after hatching.

On November 4 there were taken at Uneva Lake 24,800 eggs from 5 females. These eggs began hatching January 29; 73 per cent hatched. They began feeding February 27, and on May 25 there were on hand 17,000 fish, or 68½ per cent. June 30, 8,500 were delivered to Searl & Lazenby, in accordance with agreement. There were taken from stock fish 448,400 eggs, 47 per cent of which hatched. The total number of eggs of this species taken was 1,262,400, of which 55½ per cent hatched. Between December 5, 1893, and June 11, 1894, there were distributed 23,000 fry and 35,900 yearlings, mostly to Colorado waters.

Black-spotted trout.—There were 74,800 eggs taken from stock fish, but they were very poor. It is thought that these fish can not be successfully kept in small ponds. From October 20 to December 6 there were 10,100 yearlings distributed to various parties for planting in Colorado waters, and 1,000 to Ernest Barthold, of Sheridan, S. Dak., for waters of that State.

Rainbow trout.—On January 18, there were received from Neosho 20,000 eggs. They were in very poor condition, however, and after hatching the fish were weak—would not take food—and on April 19 it was thought best to plant them, and 5,000 were deposited in Lower Evergreen Lake and 6,000 in Lake Creek. On November 12, 1893, 475 yearlings were furnished to W. R. Callicotte, of Denver, for his fish ponds, and December 5, 475 were given to Capt. G. L. Brown, Pine Ridge, S. Dak., which were deposited in Medicine Root Creek.

Loch Leven trout.—On January 21, there were received from Northville 11,200 eggs. After hatching, 80 per cent of them died. Between October 26 and December 18 there were distributed 19,800 yearlings in Colorado, Montana, New Mexico, South Dakota, and Wyoming.

Yellow-finned trout.—In December, the 2-year-old fish on hand began to die rapidly, and to save them the 700 that remained were planted in Lower Lake on December 13.

Von Behr trout.—In July, 450 yearlings were distributed in Colorado waters, and on December 24, 1,000 yearlings were deposited in Black Lake.

The mean air temperature for the year was 35¾°, and the mean water temperature 43⅔°. The highest air temperature was 72°, on July 2, 3, 4, 9, and on August 3. The lowest air temperature was on January 18, when it was 16° below zero.

The eggs, fry, and other stock on hand June 30, 1894, were as follows:

Species.	Eggs.	Fry or fish hatched in calendar year—		
		1894.	1892.	1891.
Brook trout		145,000	3,445	1,123
Rainbow trout		500		26
Loch Leven trout		2,000	1,580	27
Black-spotted trout	5,000	13,500		424

BAIRD STATION, CALIFORNIA (LIVINGSTON STONE, SUPERINTENDENT).

The salmon rack across McCloud River having been built (in June) earlier this season than has been customary in recent years, accounts for the fact that there were more breeding salmon corralled at the station than there were last year, and a million more eggs were taken from the summer run of fish.

The regular fishing and spawn-collecting season for the summer run began August 22, when 104,000 eggs were taken. At the end of the month 840,000 eggs were in the hatching house. The season ended September 15, with a take of 2,069,200 eggs.

Fishing for the fall run of salmon began October 21 and continued till November 28, when a violent storm, lasting nine days, with a sudden rise in the river, tore out the rack and prevented further fishing for the season. During the fall run 6,019,150 eggs were obtained, making a total of 8,088,350, which was exceeded only in 1875 and 1878.

Five hundred thousand eggs were hatched at the station, and the fry distributed along the McCloud River; the remainder (7,500,000) were sent to the California State hatching station at Sisson, where they were hatched, and the young fish deposited in the Sacramento River.

On the 1st of September 50,000 eggs were sent to the World's Fair at Chicago, and were hatched there.

The highest temperatures of the air and water at 2 p. m. at the station during the year were as follows:

1893.	Air.	Water.	1894.	Air.	Water.
	° F.	° F.		° F.	° F.
July	102	59	January	69	49
August	104	58	February	71	50
September	90	56	March	82	53
October	90	52	April	90	53
November	81	48	May	92	56
December	70	44	June	*a* 90	*a* 59

a Noon.

FORT GASTON STATION, CALIFORNIA (CAPT. WILLIAM E. DOUGHERTY, U. S. A., SUPERINTENDENT).

The station is situated on the Trinity River in the Hoopa Indian Reservation, the site being on the military reservation of Fort Gaston by permission of the War Department, afterwards confirmed by the Indian Bureau of the Interior Department. The Indian agent, Capt. W. E. Dougherty, discharges the duties of superintendent of the station.

The water supply for the hatchery is drawn from a ditch constructed by the Government for the supply of the reservation. The ponds are supplied from a small stream about one-fourth of a mile distant from the hatchery. The ponds contain steelhead salmon and eastern brook trout. Silverside salmon are caught below a rack in the Trinity, and a few quinnat salmon also are taken there.

A tributary collecting station has been established on Bair's ranch upon Redwood Creek. The substation has a small hatchery and ponds for penning salmon. Probably a smaller proportion of quinnat salmon are found in Redwood Creek than in the Trinity. The run is short and occurs in the fall.

Another hatchery site was selected by Commissioner McDonald at Korbel on Mad River, where there is a large run of quinnat salmon, and where there is less interruption from net fishing. The site is about one-half mile above Korbel, at a point where a small tributary (Clear Creek) enters the river and furnishes ample water for the hatchery. A flume 150 yards long will suffice to convey the water, and a large building, formerly used by the Korbel Lumber Company, can be utilized for a hatchery and quarters for the employees at the cost of the lumber which it contains. The salmon can be stopped by a rack opposite the station.

There were collected during the season, from November to May, about 800,000 eggs of salmon, and about 460,000 of the steelhead, 15,000 of the Von Behr, and 3,000 of the rainbow.

During the fall a disease occurred among the trout which was not checked until it had destroyed a large number of each variety and nearly exterminated the Eastern brook trout.

In August and September 5,450 yearling rainbow trout were deposited in the waters of Trinity Mountain, Humboldt County.

In March and April 10,000 rainbow-trout eggs were shipped to the Wytheville, Va., Station; 100,000 eggs of the steelhead to the Northville, Mich., Station, and 50,000 eggs of the steelhead to the California State hatchery at Sisson.

There were remaining on hand at the station and substation on the 1st of July fry, as follows: Salmon, 560,000; steelhead, 332,000; eastern brook trout, about 40; Von Behr, 15,000; rainbow, 3,000; brood stock, about 600. The salmon and steelheads, when sufficiently grown, will be planted in waters adjacent to the station.

The season was very unfavorable for taking eggs on account of the continuous high water during the winter months.

The highest temperatures of the air and water at noon at the station for the months given were as follows:

Month.	Air.	Water.	Month.	Air.	Water.
	° F.	° F.		° F.	° F.
November, 1893	56	50	March, 1894	57	48
December, 1893	61	53	April, 1894	....	....
January, 1894	54	50	May, 1894	*a* 64	*a* 58
February, 1894	59	47	June, 1894	*a* 64	*a* 60

CLACKAMAS STATION, OREGON (WALDO F. HUBBARD, SUPERINTENDENT).

The hatchery is located on the Clackamas River, 4 miles from its junction with the Willamette, about 12 miles from Portland and about 5 miles from the Willamette Falls at Oregon City. The station is reached by driving from Portland.

The salmon stripped at the station belong to the spring run of quinnat into the Columbia. They are intercepted by a rack, below which the fish are detained until they are ready to spawn. The success of the work depends upon the free passage of the salmon through the river below the rack, but this was interfered with by dams and numerous nets so that in the fall of 1893 the number of fish below the rack was very small in comparison with the number detained several years earlier.

About 4 miles below the hatchery and 1 mile from the mouth of the Clackamas is a sawmill dam about 7 feet high, with no adequate means for the ascent of the fish. The net fishing below the dam is of itself sufficient to prevent the salmon from ascending the stream and unless prohibited or greatly restricted the station may have to be abandoned.

On July 5 the building of a rack across the Clackamas River at the station for the purpose of preventing the salmon from going any farther up the stream was begun, and finished August 3. August 28 a trap for catching spawning salmon was built near the rack. Near the station is a deep pool in the river where the salmon collect until ready to spawn. Above this pool is a riffle where the rack and trap are situated, and the salmon that go there are taken in the trap. Below the pool is another riffle where some of the salmon spawn, and these are caught with a net.

On September 16 two ripe female salmon were taken, from which 7,000 eggs were obtained, and from that date to October 6 fishing was carried on daily. On account of the high water in the Clackamas during the season, the highest known for seventeen years, the work in the catching of adult fish was not as satisfactory as expected.

The whole number of eggs taken during the season was 277,000. Of these, 40,000 were sent, October 13, to the World's Fair at Chicago by one of the cars of the Commission and reached there with a loss of only 92. The eggs at the station began hatching November 1 and the fry liberated in the Clackamas December 25; between which date and January 26, 1894, 213,000 young fish were deposited in the Clackamas. About 10 per cent of the eggs at the station were lost in hatching.

On December 11, 1893, in accordance with instructions received from the Commissioner, the superintendent left the station to locate a site for a State hatchery at or near Knowles Creek, a tributary of the Siuslaw. A suitable location was found where a good supply of water can be taken by gravity into the hatching house. The building of the hatching house was let by contract, and work on it is now completed. Arrangements have been made to begin work there preparatory to taking salmon eggs the first part of July, 1894.

DISTRIBUTION.

The fiscal year opened with the car and messenger service engaged in transporting fishes and other aquarium materials to the exhibit of the Commission at the World's Fair. In connection with the distribution of food-fishes of the Mississippi Valley, this work continued until November.

Fresh-water collections were brought from Wisconsin, Michigan, Lake Erie, Illinois, and Iowa, and marine species from Massachusetts, Florida, and the State of Washington. When the aquarium at the Exposition was dismantled the fishes were taken chiefly to Northville, Mich., Spirit Lake, Iowa, Champaign, Ill., and Washington, D. C.

The distribution of food-fishes from Quincy, Ill., began in August and was finished in December. Trout and salmon were taken from Green Lake in September and October; from Wytheville, November to March; Leadville, November and December; Neosho, December to March; Northville, January to March; and the fingerlings in June. The black bass reared in the Washington ponds were distributed in December and a few carp in January. Whitefish eggs were carried from Alpena to Duluth in February. Whitefish fry hatched at Central Station were taken to Lake Ontario in March, and fry of the same fish were distributed from Alpena in April and May. Pike-perch shipments were made in May, and shad were planted in May and June.

In accomplishing the above work car No. 1 was engaged 178 days; No. 2, 200 days; Nos. 3 and 4, each, 185 days. They made 129 trips, aggregating 105,529 miles, and carried 71,440,513 fish and eggs. In addition to the car travel, 40 detached messengers, during the distribution of the year, covered 60,228 miles.

A far greater bulk of distribution is carried on also from the various stations of the Commission to neighboring waters, especially cod and lobsters from Gloucester and Woods Hole, Mass. Eggs are forwarded by express to distant stations and to State commissions and foreign countries. Carp, goldfish, etc., are shipped from various centers to points more or less remote. The total distribution, amounting to more than 450,000,000, is set forth elsewhere in this report.

CHANGES IN CARS.

An improvement in the water circulation on some of the cars was effected by substituting galvanized-iron pipes for the common pipes previously used. Steam-pipes were placed under the cars to circulate steam from the locomotive. Air-pumps were introduced and connected with the transportation tanks with good results; but the attempt to take in air through water from a small supply tank was unsatisfactory. An ice coil was laid on the bottom of the ice box in car No. 3, to reduce the temperature of the water by pumping cold air into it, but without success. Aërating syringes were furnished to the cars and messengers for use instead of dippers in carrying trout and other large fish, but they were found troublesome to keep safely in car work.

LOSSES DURING TRANSPORTATION.

The mortality among rainbow trout in transit was notably larger than with other species, and especially on journeys over thirty to thirty-five hours in length. The number lost was 13,366.

The results of work with food-fishes of the Mississippi Valley were reduced by the necessity of maintaining the aquarium at the World's Fair.

NEW WORK.

The supply of black bass for distribution was much increased by collecting them from the reservoir at Celina, Ohio.

An experiment in carrying 1,000 yearling landlocked salmon from Green Lake to Vermont proved so encouraging that a full carload of 12,000 was afterwards taken, and although 3,000 of these were lost, it was demonstrated that the fish can be transported successfully. It was previously considered impossible to do so.

DIFFICULTIES IN TRANSPORTATION.

In shipping shad eggs on the cars to the South, trouble arose from the water foaming through sudden changes of temperature, causing some of the fry to hatch prematurely. In other shipments, when the water at destination was too warm, the fish hatched out weak, and when too cold, hatching was almost entirely prevented.

The details of the distribution of fishes and the scope of the distribution service for the year are shown in the appended table, pages 62 to 76.

COLLECTING FISH IN THE LOWLANDS OF ST. FRANCIS RIVER, ARKANSAS.

At the suggestion of Superintendent W. F. Page, arrangements were made in August, 1893, to collect food-fishes from overflow pools in northeastern Arkansas, just the same species as are obtained yearly at the Quincy, Ill., station. The Commission was greatly assisted by Mr. G. H. Nettleton, president of the Kansas City, Fort Scott and Memphis Railroad, along whose line the pools are located, and also by Mr. H. W. Diggins, division superintendent of the road.

Owing probably to the extremely high temperature of the water in the pools (called "borrow pits"), the results of the experiment were poor; but large collections might have been made if the work had been begun earlier in the year. Mr. Page's report follows herewith:

REPORT ON THE COLLECTION AND MOVEMENT OF NATIVE FISHES IN NORTHEAST ARKANSAS.

The annual inundation of the Sunk Lands of the St. Francis River basin creates a great number of small ponds along the line of the Kansas City, Fort Scott and Memphis Railroad by filling the "borrow pits." The overflow usually occurs in March, a little prior to the spring spawning of the fishes. The adult fish coming in with the high water find in these borrow pits excellent conditions for spawning. They go out with the falling waters, leaving behind their young in almost countless numbers. The droughts of August and September dry these pits, killing all the young fish in them. It was hoped that very many thousands of these young bass, crappie, pickerel, and channel catfish might be seined from these pools and moved to the river currents before the droughts killed them.

Marked Tree, Ark., was selected as a base of operations because it presented the following points: (1) It is a station on the line of the Kansas City, Fort Scott and Memphis Railroad; (2) it has a night and day telegraph operator; (3) all trains stop there; (4) it has a railway water tank; (5) it has two side tracks aggregating over a mile; (6) on one side the St. Francis River is within 40 yards of the track, and on the other side Little River is as close; (7) the borrow pits extend 7 miles west of Marked Tree and about the same distance to the east. It was contemplated to seine the borrow pits, transfer the catch on hand cars to Marked Tree, and retain the fish in live-boxes until it was convenient to ship them.

The last week of July was spent in making preliminary arrangements for this work. On August 1 actual seining was commenced, with a force consisting of two seiners with one man to help in sorting and caring for the catch, two men to run the hand car, and one man at the live-boxes to equalize the difference in temperature of the water in the borrow pits and the river. The first day's seining resulted in about 4,500 fingerling crappie and bass transferred to the live boxes in apparent good order.

On the morning of August 2 an examination of the boxes showed that nearly all of the fishes caught the day before were dead. It was thought that this possibly had been produced by an overstrong current in the box, and a change in the position in the boxes was made so as to reduce the strength of the current. On this day we caught and removed to the boxes something over 5,000 fish. By evening the dying and suffering of those caught in the morning indicated clearly that the trouble was not solely due to current.

On the morning of August 3 the boxes had only about 300 fish (in bad order) to show for the 10,000 put in them in the past two days. To-day we fished the borrow pits near Oak Dornic, handling the fish in small lots and much more carefully. We secured about 5,000 fish, mostly crappie, and transferred them to the live-boxes.

August 4. This morning the condition of the boxes being unimproved, and all known methods of handling fish having been tried without avail, it was concluded to abandon for the present any attempt to store the fish. Seining was continued throughout the day, resulting in about 5,000 crappie and bass, which were planted directly in the St. Francis River. In the afternoon a telegram was sent to the Commissioner, stating that the fish alive twelve hours after capture were fungussed, and a recommendation made that the work be discontinued.

August 5. We seined the borrow pits until noon, capturing about 3,000 crappie, which we placed in the St. Francis River. At noon a telegram was received from the Commissioner, directing that the work be discontinued and that the equipment be transferred to Neosho Station.

It is the opinion that the failure to successfully handle these fish was due to the very high temperature of the water in which they were found, the water in many of the pits ranging from 95° to 98° F. The fish living in this water were so tender that the gentlest handling produced an abrasion which quickly resulted in a fungus growth. It is very doubtful if any of those planted in the St. Francis River will survive the handling.

It has been suggested that this work might successfully be prosecuted earlier in the season, before the water in the borrow pits has become so very hot as to render the fish too tender for handling. There is no doubt but that this might be done, but to a limited extent only, because the waters are already at a high temperature before they commence to fall, and until the recession occurs seining would be nearly impossible.

The inundation of the Sunk Lands usually occurs in the latter part of February or early in March. In the year 1893 it was later than for many years, not coming on until May. To this cause undoubtedly is to be ascribed the scarcity of young game fish in the borrow pits. The adults had spawned elsewhere before the overflow came in.

FISH-CULTURAL NOTES.

The correspondence of the station superintendents furnishes many valuable records of observations and experiments which are not usually embodied in their annual reports. They may very properly be presented here, grouped under the names of the species to which they relate:

Mackerel (*Scomber scombrus*).—June 21, 1894, Mr. W. P. Sauerhoff found five small mackerel at Magnolia, Mass., containing ripe eggs, and obtained 116,000, the first taken this season.

Pike perch (*Stizostedion vitreum*).—Mr. Frank N. Clark wrote from Northville, Mich., March 30, 1894:

In transferring pike-perch eggs from Detroit to the World's Fair last spring * * * the best success I obtained was in carrying the eggs in 10-gallon cans, putting from 12 to 16 quarts in a can, and frequently stirring the eggs and water to keep them from sticking together. If the eggs are to be held in jars * * * until the eyes show, I think you will meet with success in shipping them on flannel trays with a covering of damp moss on each tray, the top tray to contain nothing but fine ice, the whole to be surrounded with from 3 to 4 inches of sawdust; temperature from 55° to 60°. This is practically our mode of shipping eyed eggs during the winter.

Mr. J. J. Stranahan made the following report of an experiment with eggs and milt from dead fish:

On April 23, 1894, I took 1 quart of eggs from dead pike perch, using milt from two dead males. Eggs came freely and looked fine. Milt flowed in a fluid stream, though very slightly thickened. The eggs were set up and worked in a jar in the usual way. Frequent examinations show that all are dead, and in 150 eggs counted and examined April 30 no life could be discovered. A curious feature in this case is that 95 per cent or more of the yolks are ruptured.

Mr. Stranahan weighed and counted a series at Put-in-Bay, from which he puts the eggs at 170,000 to the quart. Mr. Bower uses the estimate of 150,000 to the quart. Mr. Stranahan says further:

Eggs from different localities differ greatly in size. It seems to me that I can clearly see with the naked eye that the eggs of the Sandusky Bay pike perch (smallish, round, less compressed than lake fish, more fusiform, deep yellow instead of nearly white as in the lake fish), are perceptibly larger than those taken in the open lake. The pike perch from the bay, I feel sure, lives there, never entering the lake. It resembles very strongly those brought to Sandusky from the Lake of the Woods and those caught in inland waters belonging to the Mississippi system; also those from Saginaw Bay.

Handling of pike-perch eggs at Put-in-Bay.—April 15, 1894, Mr. Stranahan experimented with swamp muck for separating pike-perch eggs successfully. He screened the mud through fine wire cloth so that all was finer than the eggs. A pint of thick muck solution to a 12 gallon keg was sufficient. Afterwards he used a quart of muck of the consistency of sirup to a 15-gallon keg of water. An account of his experiments was published in the Transactions of the American Fisheries Society for 1894.[1]

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[1]The handling of adhesive eggs. J. J. Stranahan, Trans. Amer. Fish. Soc. 1894, 22–25.

Pike and pike-perch hybrid (*Esox lucius and Stizostedion vitreum.*)—Superintendent J. J. Stranahan, of the Put-in-Bay, Ohio, station made the following report, dated April 26, 1894, upon an experiment with the grass pike (*Esox lucius*):

Nineteen adult fish were captured, but none of them in spawning condition. We penned the best and although most of them kept well, having been caught in the net by the teeth, the females refused to yield their eggs and were finally released. On April 22, Mr. John Dischied, of North Bass Island, noticed a grass pike from which the eggs were running freely. He took a quantity, and not having a male, impregnated them with the milt of a pike perch. * * * I made my first examination of them April 26. They have gone too far to see the segmentation under the microscope, and I am in doubt whether any are alive. There are about 9½ eggs to a linear inch, 759 to a cubic inch, measured in water, or 43,832 to the fluid quart. The eggs are of about the same specific gravity as whitefish eggs, and work readily in the McDonald hatching jar, but have very thin membranes, easily ruptured between the fingers.

Under date of April 28, 1894, Mr. Stranahan forwarded the following additional notes:

The grass-pike eggs referred to in my letter of April 26 have been examined daily and now show the fish form past doubt. I examined 140 this morning under the microscope and found 40 with the fish formed, or about 28½ per cent. These were worked from the start in a McDonald jar. Those handled in a floating box show a fraction over 20 per cent alive, which leads me to believe that with careful working muskellunge can be hatched in jars. The developing embryo is unlike any other I have observed. It covers about one-third of the circumference of the egg and has on each side of the body not far behind the head what seems to be an oil drop, nearly equal to the body in diameter. The yolk has no distinct large oil drop, but numerous small ones, pretty evenly distributed over its surface, for which reason the embryo is as likely to be in one position as another, no two apparently assuming the same position. The embryo now covers about two-fifths of the circumference of the yolk. The egg is more opaque than any other I have examined, making its investigation difficult.

On May 4, Mr. Stranahan reported that the above eggs began hatching in small numbers. There were not enough to work well in the jar, the eggs attacked by fungus being hard to separate from the live ones. All the eggs in the floating boxes died and it was estimated that only 10 per cent of those in the jar would hatch. The eyes were not discerned until May 3, and then very faintly.

Yellow perch (*Perca americana*).—About the end of April, 1894, Mr. Stranahan took the eggs from a yellow perch weighing 9 ounces. He wrote:

The eggs came freely in a continuous tube and I used two males for impregnation. After swelling the mass was 73 inches long, the tube 3 inches wide (or 6 inches if flattened out). We find 13 eggs to the linear inch, or 73,000 in all. Impregnation was almost complete. Aside from the fragment used for counting, there do not appear to be 1 per cent of dead eggs.

On March 20, 1894, the eggs from a yellow perch were taken from one of the aquaria in Central Station and placed in a McDonald jar. They developed without perceptible loss (hatching began April 12), and on April 14 about one-tenth of them were out.

Striped bass (*Roccus lineatus*).—Twenty large striped bass, three or four of them in spawning condition, were taken near Edenton, N. C., in sturgeon nets, about April 18, 1894.

Longjaw or blackfin whitefish (*Argyrosomus nigripinnis* ?).—Mr. E. A. Tulian wrote Mr. F. N. Clark from Alpena, Mich., November 30, as follows:

I telegraphed Platts yesterday to find out when the longjaw would spawn and whether we could get any quantity of the eggs. I received an answer this morning saying: "We can get plenty of longjaw spawn now; trout run over." I answered him to collect all long-jaw spawn possible, with Clifford's help, until further orders.

Mr. Clark wrote the office that the longjaw is becoming a valuable food-fish, selling in the market for the same price as the common white-fish. While it was found easy to get eggs, there were no males and the experiment failed. It is supposed the males run later, but the season could not be prolonged, for lack of funds.

Whitefish.—Mr. S. P. Wires counted a liquid quart of whitefish eggs taken in Lake Superior and found 33,600 eggs.

Mr. F. N. Clark writes from Northville, Mich., March 28, 1894:

Eggs from fish caught in gill nets in Lake Michigan, near Manistique, show a measurement of 1,115 to the ounce, or 35,680 to the quart. These eggs were taken on December 9, 10, and 11, 1893. Eggs taken November 25, from fish caught in pound nets set in Lake Huron near Miller Point, show a measurement of 1,097 to the ounce, or 35,104 to the quart. Possibly, measuring eggs almost at the period of hatching is not a fair test.

Brook trout.—In taking eggs of brook trout at Greensboro Pond, Vermont, November 15, 1893, Mr. John W. Titcomb stripped 140 males and 70 females. This large proportion of males is observed also by anglers.

Black-spotted trout.—On February 24, 1894, Mr. Seagle collected about 1,000 eggs, but could not find a male in proper condition. Last season about 50,000 eggs were lost for want of milt. On March 7 Mr. Seagle took 2,500 eggs, but found no suitable male. On March 12 he obtained 2,000 eggs and secured one male in fair spawning condition. Some eggs of the black-spotted species have been fertilized at Wytheville with milt of the rainbow.

Superintendent Clark began taking eggs of black-spotted trout at Northville, Mich., April 30, 1894, but they were not very good. The females seemed to have a quantity of water that flowed with the eggs, and Mr. Clark feared the same trouble experienced with rainbow trout, in which the eggs became glassy. The superintendent thinks by introducing water direct from a cold spring better eggs and fish would be produced.

Von Behr and Loch Leven trout.—Mr. Frank N. Clark sent by express from Northville, Mich., 20,000 Von Behr trout eggs and 20,000 of the Loch Leven trout to Mexico. Although these were 8 days in transit and were consigned to a warm climate, they were received with a loss of only 60 of the former and 72 of the latter.

Steelhead.—A case containing 100,000 eggs of steelhead (*Salmo gairdneri*) was shipped in April from Fort Gaston Station to Northville, Mich., but they were spoiled on the way because the temperature was not kept low enough.

Landlocked salmon.—On October 21, 1893, Mr. A. N. Cheney, of Glens Falls, N. Y., suggested to the Commissioner the advantages to be derived from planting landlocked salmon in Lake George, with the object of stocking that body of water as well as the larger Lake Champlain, into which it empties and in which the Commissioner desired to introduce that species. Mr. Cheney's letter pointed out the superior claims of Lake George as an experimental field, and his plan was considered worthy to be carried out.

Packing trout eggs for transportation.—Mr. W. F. Page, superintendent of the Neosho Station, is in favor of using cut sponge as a packing material, because of its cleanliness, the rapidity with which it can be worked, firmness and evenness of packing, and its economy in the long run. It can be dried out and used almost indefinitely. One pound of sponge will pack 15,000 rainbow-trout eggs. A pound of sponge, however, in Mr. Page's experience, requires the entire attention of one man for ten hours to properly pick up.

Lobster.—Capt. A. C. Adams was instructed to buy lobsters at a price not exceeding 10 cents each for large ones and 5 cents each for small ones, the lobsters to be liberated after removal of their eggs. Mr. W. P. Sauerhoff was assigned to the lobster work at Gloucester May 16, relieving Captain Adams, and on the 23d he reported 191 females which had furnished 2,473,000 eggs.

At Woods Hole Station arrangements were made in the spring of 1894 to buy egg-bearing female lobsters from lobster men at Cuttyhunk, Menemsha Bight, Nomans Land, and Woods Hole. About 3,300 pots are set in these localities. Off Nomans Land very large lobsters, from 3 to 10 pounds in weight, are taken and the largest yield 30,000 eggs. The pots are hauled twice a week and the average catch is about 2,400 pounds at a haul, two-thirds of which are egg-bearing females.

FISH ENEMIES, DISEASES, AND FATALITIES.

Otter.—February 6, 1894, Mr. E. M. Robinson at Green Lake Station, reported the capture of an otter measuring 5 feet 6 inches, in two traps. He had eaten many trout before his capture. On February 24 the capture of another otter and one mink was reported.

Larvæ of caddis and black flies.[1]—In the spring of 1894 the superin-

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[1] See also the following articles by the late Prof. C. V. Riley:

The death web of young trout. <Am. Ent. and Bot., Apr., 1870, v. 2, p. 174. Riley.

Supposed trout enemy. <Am. Ent. and Bot., Apr., 1870, v. 2, pp. 179–180. Riley.

The death web of young trout. <Amer. Ent. and Bot., May, 1870, v. 2, p. 211. Larvæ of a *Simulium*. Riley.

The death web of young trout. <Amer. Ent. and Bot., June, 1870, v. 2, pp. 227–228, figs. 143–144. Habits of *Simulium piscicidium*. Riley.

The so-called web worm of young trout. <Amer. Ent. and Bot., Dec., 1870, v. 2, pp. 366–367. Riley. Description of *Simulium piscicidium*, n. sp.

Remarks on *Simulium piscicidium*. <Trans. Acad. Sci. St. Louis, July, 1873, v. 3, p. 79 Proc. Nature and supposed ravages. Riley.

Carnivorous habits of caddis worms. <Amer. Ent., July, 1880 (v. 3), n. s., v. 1, p. 176. Riley.

tendent of the Green Lake Station reported the presence of the larvæ of two insects in the hatching troughs, and the destruction thereby of some newly-hatched landlocked salmon. Specimens were forwarded to the office of the Commission and were referred to the Department of Agriculture for identification. The following correspondence relates to the subject:

GREEN LAKE, ME., *May 7, 1894.*

I send by to-day's mail two specimens of water life which made its appearance in large numbers in our troughs just about the time the salmon were hatching or when the water reached 46° F. * * * The large specimens I would say were from five to six days old, while the small ones are not over two days old. The former are full grown. It seems they do not grow to any size, but their development is very rapid. * * * Any considerable number of them in a hatching trough in one night will spin the trough almost full of a very fine web; it is quite strong, too. They will sometimes spin a web around the neck of a fish and choke it to death; then they congregate in numbers and will eat the entire fish if left alone. They also attack the sac of the fish, and this is always fatal, as the sac soon bursts. They would not be able to harm the fish after they are ten days old, but should they come in numbers at the proper time they would destroy a good many fish if not kept out. I have no doubt this same insect will make excellent food for the fry a month later.

E. M. ROBINSON, *Superintendent.*

DEPARTMENT OF AGRICULTURE,
OFFICE OF ASSISTANT SECRETARY,
Washington, D. C., May 19, 1894.

SIR: I have the honor to acknowledge the receipt of your favor of May 12, transmitting vials containing larvæ received from the fish-cultural station at Green Lake, Me., and to report that they have been referred to the entomologist, who submits the following statement:

"The large larvæ sent by Colonel McDonald are predaceous in their habits. They belong to the species known as *Hydropsyche phalerata,* a form which is noted for the fact that it preys almost exclusively on the larvæ of the genus *Simulium,* known in different parts of the country as black flies, buffalo gnats, turkey gnats, etc. The smaller larvæ sent in a separate vial belong to the genus *Simulium;* the exact species can not be determined from the larva alone, but it is probably *decorum* or *invenustum,* and the adult is the common black fly of the Green Lake region, in all probability.

"The damage done by the larvæ of *Simulium* in fish hatcheries has been commented upon before. They feed upon aquatic vegetation in part, and in part upon minute infusoria, and the damage to the fish occurs through the spinning of their web through the water, as detailed by Mr. Robinson. The statement that the *Simulium* larvæ cluster upon the young fish after they are caught in the web, and feed upon them, may be doubted. It is very possible, however, that the *Hydropsyche* larvæ will feed upon very small fish captured in the net made by the *Simulium* larvæ. It is a very peculiar and interesting condition of affairs. The best article which has been published on the subject is entitled 'The death web of young trout,' and will be found in volume II of the American Entomologist and Botanist, pages 227–228 (June, 1870). Mr. Seth Green, the well-known pisciculturist of New York, was the first observer to call attention to this interesting habit of the *Simulium* larvæ. Mr. Robinson is perfectly correct in supposing that the young fry, when they are a little older, will feed upon the *Simulium* larvæ."

I have the honor to remain, respectfully, yours,

CHAS. W. DABNEY, Jr.,
Assistant Secretary.

Hon. M. MCDONALD,
Commissioner Fish and Fisheries, Washington, D. C.

GREEN LAKE, ME., *May 26, 1894.*

DEAR SIR: Your letter dated May 23, inclosing a copy of a report upon the larvæ sent, by the entomologist of the Agricultural Department, is at hand, and which I was glad to receive. I am not prepared to say positively whether the larvæ of the large caddis fly intentionally fed upon the fry, or whether the web spun was for the capture of the fry, but during a period of ten days they appeared in our supply and hatching troughs in large numbers, spinning them full of this fine web, which would naturally entangle a small per cent of the embryos. Clusters containing 25 or 30 of the large larvæ would be found all through the troughs, and invariably a fish would be found in the middle, in some cases almost entirely devoured; numbers would be seen moving to and fro, hither and thither; also quite a lot of them would adhere to the sides of the trough at water level. A single larva was noticed time and again to attach itself to the sac and sometimes to the head of the fish; the fish would swim around as if in severe pain for a moment or two, and would settle to the bottom dead or dying.

Of course, in one of our hatching troughs, where we were carrying from 10,000 to 12,000 fry, with as many thousand larvæ in it, it was natural to suppose that they were feeding upon them, which they surely did; it might not have been from preference but from necessity, as the troughs contained but very little else in the shape of food that could be seen with the unaided eye, though I am of opinion that they were feeding upon the sac of the embryo from preference, and I am sure that the sac of the young fry would make very delicate food. After the fish arrived at the age of 15 days, the larva was not able to entangle or capture them except in very rare cases, as the fish by this time had developed sufficient activity to free themselves. The larvæ of both the caddis and black fly have almost entirely disappeared. The fish is no longer the sufferer, but the fish-culturist, as the black fly is in all of his glory.

I am, very respectfully,

E. M. ROBINSON,
Superintendent.

DR. TARLETON H. BEAN,
Assistant in Charge Division of Fish Culture,
U. S. Fish Commission, Washington, D. C.

Fungus and parasites.—The parasite referred to in the following letter of Mr. Robinson was not identified, but similar attacks have been observed at other stations, and studies are now in progress looking toward the identification of the species and the elucidation of its life history, as well as the proper treatment of the fish affected.

GREEN LAKE, ME., *May 30, 1894.*

DEAR DR. BEAN: For the past month or twenty days the loss in our salmon fry began to be alarming, and at one time I feared the epidemic that caused so much destruction at the Craig Brook Station, and gave Mr. Atkins so much trouble, was upon us in its worst form. I first began to notice very fine fungus growth on the fins and near the gill covers; the little fish so affected would huddle together in the corners of the troughs and seemed to have no life about them, and in 24 or 36 hours would die. The next trouble discovered was a small parasite, not on any particular part of the body, but pretty generally distributed; these parasites looked to the unaided eye like very small warts, and showed white in the water. Whether the irritation of the parasite on the body of the fish causes the fungus I can't say, but am of the opinion it does.

As soon as the fungus and parasites were discovered I had salt used very freely; would have water cut off the troughs and drawn down to within 3 inches of the bottom; then made a strong brine by dissolving 1 quart of salt in a pail for each trough; this brine would be poured in, and at the same time be thoroughly mixed with the water and fish; all the little nooks and corners of the trough would be washed out, and we would keep the brine on from 3 to 5 minutes. We feel by doing this we have checked the fungus and, in part, nipped the parasite; still, the parasite can be seen on a large number of the fish yet. The only remedy we know of is to keep cleaning and salting, and I am glad to say at this writing we can see a marked improvement in the fry. We are now salting every other day, and when a trough does not improve as we think it ought, we give it a quart every day. I send you by this mail two vials with labels inside that will show the parasite and fungus on the fins of the fry. Someone has said "the price of all fish is eternal vigilance," and I will add, in this locality, a free use of salt.

Very respectfully,

E. M. Robinson,
Superintendent.

Dr. Tarleton H. Bean,
Assistant in Charge Division of Fish-Culture,
U. S. Fish Commission, Washington, D C.

Epidemic among trout.—April 21, 1894, Superintendent Clark reported an unusual loss of yearling and 2-year-old brook trout at the Northville, Mich., Station, which begun ten days before and was without visible cause. The fish were dying at the rate of from 40 to 100 a day in spite of the ample water flow and plenty of wholesome food. Trout in ponds below the dying fish did not seem to be affected, although the same water flowed through all.

Dr. R. R. Gurley was sent to Northville on April 23, and after investigation made a provisional report upon the epidemic. Arrangements were soon made also to isolate the diseased fish and to provide separate drainage for each pond. The epidemic abated considerably from the beginning of May. It involved the black-spotted as well as the brook trout.

Black bass killed by thunder.—On June 5, 1894, at the Neosho Station, Missouri, a very heavy storm of lightning and rain occurred about noon. Next morning thousands of young black bass were found dead on the bottom of a pond, mostly in water 3 feet deep. No signs of wounds or punctures were upon them and they were all in excellent condition in the morning of June 5. Some of the dead fish were examined by Dr. R. R. Gurley, assistant to the United States Fish Commission, who found no evident cause of death. He refers to an item in Rayer's Archiv de Med. Comp., Paris, 1843, pp. 253–254, in which it is stated:

In times of storm fish, and particularly carp and perch, experience a very marked effect from the electricity. The fishermen assert that after a peal of thunder, in an étang or in a lake, fish have been seen to die in a few days.

Fish struck by lightning.—The Philadelphia *Public Ledger* stated that at Allentown, September 2, 1895, during a severe thunder storm lightning struck the water of one of the fish ponds of the State Fishery which contained 5-year-old California trout. The trout measured from 18 to 22 inches in length. Between 75 and 100 of the finest trout were paralyzed and many of them had their backs broken.

Details of distribution, 1893–94.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Spotted catfish:			
Applicant in District of Columbia			10
Boise River near Boise, Idaho			100
Kishwaukee River near Belvidere, Ill			25
Fox River near St. Charles, Ill			1,916
Elgin, Ill			300
Geneva, Ill			25
Applicants in Illinois			534
Pine Lake near Laporte, Ind			150
Applicants in Indiana			225
Iowa River near Lime Spring, Iowa			100
Chester, Iowa			100
Cedar River near Osage, Iowa			100
Lime Creek near Mason City, Iowa			600
Bishop Lake near Sheldon, Iowa			300
Twin Lakes near Rockwell City, Iowa			2,800
Des Moines River near Fort Dodge, Iowa			300
Storm Lake near Storm Lake, Iowa			4,000
Maquoketa River near Manchester, Iowa			150
Otter Creek near Oelwein, Iowa			225
Upper Iowa River near Decorah, Iowa			275
Cedar River near Cedar Rapids, Iowa			292
Iowa State Fish Commission ponds, Spirit Lake, Iowa			300
Applicants in Iowa			100
Kansas			1,099
Reservoir near Middlesboro, Ky			50
Tygart Creek near Olive Hill, Ky			50
Nolin Creek near Hodgensville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Blue Spring near Cecilian, Ky			50
Mud River near Russellville, Ky			75
Pond River near Bakersport, Ky			75
Drake Creek near Hortonville, Ky			75
Tradewater River near Dawson, Ky			75
Otter Creek near Cerulean Springs, Ky			100
Muddy Fork near Kuttawa, Ky			75
Applicants in Kentucky			240
Moreau River near Jefferson City, Mo			100
Applicants in Missouri			350
Johnson Creek near county line, N. Y			50
Mohawk River near Utica, N. Y			75
Applicants in Ohio			25
Texas			265
Virginia			50
Jackson River near Cedar Creek, Va			300
Applicants in Wyoming			25
Public lake near Montborne, Wash			100
Catfish (common):			
Herrealls Branch near Neosho, Mo			1,059
Carp:			
Applicants in Alabama			575
Arkansas			611
California			18
Colorado			30
Connecticut			390
Delaware			60
District of Columbia			235
Potomac River in District of Columbia			1,757
Applicants in Florida			364
Georgia State Fish Commission			3,000
Tallulah Creek, Tallulah Falls, Ga			1,000
Applicants in Georgia			489
Idaho			60
Illinois			150
Indiana			90
Indian Territory			150
Red River near Colbert, Ind. T			390
Grand River near Shawneetown, Ind. T			35
Applicants in Iowa			340
Kansas			1,001
Kentucky			320
Louisiana			190
Maine			30
Maryland			610
Massachusetts			260
Michigan			780
Minnesota			1,000
Minnesota State Fish Commission			2,500
Applicants in Mississippi			806
Missouri			450
Montana			740
Nebraska			110

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Carp—Continued.			
Applicants in New Hampshire			160
New Jersey			280
New Mexico			484
New York			5,355
New York State Fish Commission			5,000
Applicants in North Carolina			1,218
North Dakota			186
Ohio			810
Oklahoma			510
Oregon			30
Pennsylvania			720
Rhode Island			7
South Carolina			304
South Dakota			1,910
Tennessee			1,990
Doe River near Allentown, Tenn			384
French Broad and Pigeon rivers in Jefferson County, Tenn			384
Holston River near Rutledge, Tenn			193
Strawberry, Tenn			192
Rogersville, Tenn			384
Tennessee River near Knoxville, Tenn			770
London, Tenn			384
Chucky Creek near Erwin, Tenn			192
Big Limestone Creek near Limestone, Tenn			192
Lick Creek near Mohawk, Tenn			384
Clinch River near Clinton, Tenn			386
Emory River near Harriman, Tenn			193
Obeys River near Lancing, Tenn			193
Red River near Cobert, Tex			390
Trinity River near Fort Worth, Tex			390
Applicants in Texas			1,100
Reed Creek near Wytheville, Va			1,086
Applicants in Virginia			2,535
Washington			280
West Virginia			210
Wisconsin			30
Tench:			
Applicants in Arkansas			500
Blue River near Armstrong, Ind. T			600
Applicants in Indian Territory			500
Iowa Fish Commission			50
Lime Creek near Mason City, Iowa			50
Bishop Lake near Sheldon, Iowa			40
Cedar River near Osage, Iowa			25
Applicants in Kansas			100
Appalachee River at crossing of Macon and Northern Railroad, in Georgia			2,000
Oconee River at crossing of Macon and Northern Railroad, in Georgia			2,000
Applicants in Maryland			60
Hickory Creek near Neosho, Mo			1,200
Applicants in Missouri			1,045
Applicants in New York			4,000
North Carolina			150
Ohio			200
Exalls Lake near Dallas, Tex			1,000
Canyon Lake near Cisco, Tex			1,000
Chesley tank near Cisco, Tex			300
Delmark tank near Cisco, Tex			300
Colorado River near Austin, Tex			600
San Marcos River near San Marcos, Tex			1,200
Applicants in Texas			900
Goldfish:			
Applicants in Alabama			48
Arkansas			124
Colorado			24
Connecticut			30
District of Columbia			6,771
Delaware			48
Florida			50
Florida Agricultural Department			24
Applicants in Georgia			138
Georgia Fish Commission			30
Applicants in Illinois			310
Indiana			127
Indian Territory			24
Iowa			110
Iowa Fish Commission			100
Applicants in Kansas			162
Kansas Fish Commission			30
Applicants in Kentucky			84

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Goldfish—Continued.			
Applicants in Louisiana			419
Maine			14
Maryland			360
Massachusetts			74
Michigan			60
Minnesota			10
Minnesota Fish Commission			50
Applicants in Mississippi			66
Missouri			479
Missouri Fish Commission			100
Applicants in Nebraska			6
New Jersey			120
New Mexico			12
New York			224
North Carolina			227
Ohio			466
Oklahoma			12
Pennsylvania			838
Rhode Island			12
South Carolina			117
Tennessee			198
Texas			318
Utah			6
Virginia			797
West Virginia			72
Wisconsin Fish Commission			100
Golden ide:			
Applicants in Arkansas			100
Colorado			125
District of Columbia			91
Florida			50
Georgia			50
Georgia Fish Commission			100
Applicants in Illinois			37
Indiana			25
Kansas			8
Administrator public buildings, New Orleans, La			100
Applicants in Maryland			24
Massachusetts			24
Minnesota Fish Commission			25
Missouri Fish Commission			50
Applicants in Missouri			25
New York			275
New Jersey			15
North Carolina			100
Ohio			166
Pennsylvania			115
Tennessee			100
Texas			125
Virginia			50
Golden tench:			
Applicants in District of Columbia			50
Illinois			6
Indiana			12
Iowa			2
Maryland			24
North Carolina			86
Pennsylvania			18
Tennessee			42
Virginia			20
United States of Columbia			12
Shad:			
Connecticut River near Warehouse Point, Conn		3,044,000	
Potomac River near Georgetown, D. C		469,000	
U. S. Fish Commission Fish Ponds, Washington, D. C		*a*2,109,000	
Nanticoke River near Seaford, Del		450,000	
Brandywine Creek near Wilmington, Del		1,330,000	
St. Johns River near Palatka, Fla		2,250,000	
Ogeechee River near Midville, Ga		500,000	
Ocmulgee River near Macon, Ga		500,000	
Savannah River near Augusta, Ga		1,417,000	
Chesapeake Bay near Battery Island, Md	355,000	2,976,000	
Chester River near Chestertown, Md		420,000	
Patuxent River near Laurel, Md		899,000	
Patapsco River near Relay Station, Md		476,000	
Susquehanna River near Port Deposit, Md		1,104,000	
Bush River near Bush River Station, Md		630,000	
North East River near North East, Md		1,200,000	
Wicomico River near Salisbury, Md		345,000	
Gunpowder River near Gunpowder Station, Md		450,000	

a Not to be included in summations.

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Shad—Continued.			
Elk River near Elkton, Md		1,380,000	
Potomac River near Washington Junction, Md		1,676,000	
Tuckahoe Creek near Queen Anne, Md		450,000	
Delaware River near Gloucester, N. J		142,000	
Lambertville, N. J		1,100,000	
Callicoon, N. Y		490,000	
Port Jervis, N. Y		917,000	
New York Fish Commission	2,000,000	5,414,000	
Pasquotank River near Elizabeth City, N. C		429,000	
Lumber River near Lumberton, N. C		389,000	
Neuse River near Newbern, N. C		403,000	
Yadkin River near Salisbury, N. C		419,000	
Susquehanna River near Columbia, Pa		870,000	
Susquehanna River near Fites Eddy, Pa		757,000	
Peach Bottom, Pa		850,000	
Delaware River near Delaware Water Gap, Pa	300,000	5,276,000	
Palmer River near Providence, R. I	669,000	2,350,000	
Broad River near Columbia, S. C		1,600,000	
Congaree River near Columbia, S. C		2,155,000	
Catawba River near Catawba, S. C		960,000	
Potomac River near Widewater, Va		457,000	
Chappawansic Creek near Quantico, Va		1,407,000	
Cedar River near Catletts, Va		482,000	
Mattaponi River near Milford, Va		453,000	
Stony Creek near Stony Creek, Va		433,000	
Rapidan River near Rapidan, Va		448,000	
Little River near Taylorsville, Va		451,000	
Rappahannock River near Fredericksburg, Va		475,000	
Occoquan River near Woodbridge, Va		907,000	
Meherrin River near Belfield, Va		381,000	
Tye River near Tye River Station, Va		463,000	
Rockfish River near Rockfish, Va		459,000	
Otter River near Evington, Va		447,000	
Nansemond River near Suffolk, Va		509,000	
Quinnat salmon:			
California Fish Commission	7,500,000		
McCloud River near Baird, Cal		438,500	
Raisin River in Monroe County, Mich		39,000	
Clackamas River and Clear Creek near Clackamas, Oreg		213,000	
Silver salmon:			
Mad River near Korbel, Cal		280,000	
Atlantic salmon:			
New York Fish Commission	60,000		
Pennsylvania Fish Commission	60,000		
New Hampshire Fish Commission	25,000		
Connecticut Fish Commission	25,000		
Perts Stream, tributary to Toddy Pond in Hancock County, Me			10,000
Sucker Brook, tributary to Toddy Pond in Hancock County, Me			8,000
Luke Harriman's brook, tributary to Toddy Pond in Hancock County, Me			9,200
Trundy Brook, tributary to Toddy Pond in Hancock County, Me			8,235
Conary Brook, tributary to Toddy Pond in Hancock County, Me			11,343
Hatch brook, tributary to Toddy Pond in Hancock County, Me			6,000
Saunders Cove, tributary to Toddy Pond in Hancock County, Me			5,900
Robert Gray brook, tributary to Toddy Pond in Hancock County, Me			6,191
Toddy Pond in Hancock County, Me			49,655
Meadow brook, tributary to Alamoosook Lake in Hancock County, Me			21,300
Wardwell brook, tributary to Alamoosook Lake in Hancock County, Me			14,625
Gully brook, tributary to Alamoosook Lake in Hancock County, Me			6,100
Alamoosook Lake in Hancock County, Me			32,089
Heart Pond in Hancock County, Me			9,899
Hen Brook, tributary to Narramissic River in Hancock County, Me			9,099
Dead Brook, tributary to Narramissic River in Hancock County, Me			18,662
Little Dead Brook, tributary to Narramissic River in Hancock County, Me			5,100
Green Lake in Hancock County, Me			3,908
Landlocked salmon:			
Caleb Gilman, Calais, Me	5,000		
W. T. Haynes, Oakland, Me	5,000		

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Landlocked salmon—Continued.			
W. L. Gilbert, Plymouth, Mass	1,000		
A. E. Adams, No. 115 State street, Boston, Mass	5,000		
E. R. Hewett, Ringwood, N. J	5,000		
Gardner Smaith, Ragged Lake, N. Y	5,000		
Bisby Club, White Lake Corners, N. Y	5,000		
New York Fish Commission	30,000		
Wilmurt Club, Buffalo, N. Y	5,000		
Adirondack League Club, Old Forge, N. Y	5,000		
Tuxedo Park Association, Tuxedo, N. Y	5,000		
Applicants in United States of Colombia	3,000		
Monocacy River near Frederick Junction, Md		2,500	
Applicants in Connecticut			300
Eagle Lake near Bar Harbor, Me			5,000
Fourth Pond near Bluehill, Me			1,000
Long Pond near South West Harbor, Me			5,000
Tributary of Duck Lake in Penobscot County, Me		6,000	
Whites Pond near Penobscot, Me			1,000
Big Tunk Waters near Ellsworth, Me			5,000
Donnell Pond in Hancock County, Me			10,000
Great Pond near Waterville, Me			1,000
Parlin Pond in Somerset County, Me			1,200
Beech Hill Pond in Hancock County, Me			2,500
Giles Pond in Hancock County, Me			5,000
Great Pond in Hancock County, Me			8,000
Great Pond near Waterville, Me			1,000
Funk Pond in Washington County, Me			1,489
Brewer Pond near South Brewer, Me			2,000
Blunt Pond in Hancock County, Me			2,000
Green Lake in Hancock County, Me			26,682
Toddy Pond in Hancock County, Me			6,585
Long Pond in Hancock County, Me			7,151
Flanders Pond in Hancock County, Me			2,665
Rocky Pond No. 2 in Hancock County, Me			5,000
Phillips Pond in Hancock County, Me			2,000
Branch Pond near East Dedham, Me			7,800
China Lake near Waterville, Me			1,500
Cuniculocus Pond near Egypt, Me			1,500
Hatcase Pond in Hancock County, Me			3,000
Mountany Pond in Hancock County, Me			3,000
Great Brook in Hancock County, Me			6,000
Simmons Pond near Ellsworth, Me			1,000
Fish River Lakes in Aroostook County, Me			4,986
Browns River, tributary of Lake Champlain near Waterbury, Vt			2,269
Indian Brook, tributary of Lake Champlain near Essex Junction, Vt			2,269
Winooski River, tributary of Lake Champlain near Essex Junction, Vt			4,538
Vermont Fish Commission			1,000
Steelhead trout:			
California Fish Commission	50,000		
Government of Japan	25,000		
North Fork of Mad River near Korbel, Cal		308,500	
Loch Leven trout:			
California Fish Commission	20,000		
Minnesota Fish Commission	20,000		
Government of Mexico	25,000		
Orchard Lake, Oakland County, Mich		10,000	
Zukey Lake near Hamburg Junction, Mich		10,000	
Cold Creek near Tawas City, Mich		4,000	
Upper Clear Creek near Idaho Springs, Colo			2,000
South Platte River near Dome Rock, Colo			2,500
Estabrook, Colo			500
Frying Pan Creek near Thomasville, Colo			1,500
Ruedi, Colo			1,000
Eagle River near Berry's Branch, Colo			2,000
East River near Almont, Colo			700
Los Pinos River near Osier, Colo			2,500
Lake Creek near Idaho Springs, Colo			500
Lower Evergreen Lake near Leadville, Colo			600
Arkansas River near Boulevard, Colo			500
Applicants in Colorado			200
Oak Hill Lake near Butler, Ind			800
Clear Lake near South Bend, Ind			500
Hartman Lake near South Bend, Ind			1,000
Floods Pond in Hancock County, Me			2,500
Big Tunk Pond near Ellsworth, Me			4,000
Green Lake in Hancock County, Me			11,668
Simmons Pond near Ellsworth, Me			500
Branch Pond near East Dedham, Me			2,000
Heart Pond near East Orland, Me			46
Railroad Lake near Wingleton, Mich			2,000

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Loch Leven trout—Continued.			
Beitner Creek near Traverse City, Mich			1,000
Lake Mary Rowan near Jocko, Mont			1,000
Pecos River near Glorieta, N. Mex			800
Lake in Franklin Park, Columbus, Ohio			300
Deep Lake near Mount Pocono, Pa			3,000
False Bottom Creek near Deadwood, S. Dak			900
Applicants in South Dakota			1,400
Long Lake near Rice Lake, Wis			1,000
Cedar Lake near Rice Lake, Wis			1,000
La Prele Creek near Douglas, Wyo			1,000
Rainbow trout:			
Mammoth Springs Fish Co., Mammoth Springs, Ark	12,000		
J. E. Bailey, Silver Springs, Benton County, Ark	5,000		
Johns Hopkins University, Baltimore, Md	2,500		
Missouri Fish Commission	50,000		
Minnesota Fish Commission	42,000		
Nebraska Fish Commission	23,000		
Nevada Fish Commission	40,000		
Vermont Fish Commission	30,000		
J. E. Sherlock, Salt Lake City, Utah	10,000		
F. A. Thole, New Castle, Wyo	10,500		
Wyoming Fish Commission	45,000		
W. P. Greenough, Portneuf, Quebec, Canada	10,000		
Maj. W. Turner, Bertrix, Belgium	25,000		
A. Geoffroy St. Hilaire, Paris, France	57,000		
Raveret-Wattel, Fecamp, France	10,000		
Evergreen Lake near Leadville, Colo		5,000	
Lake Creek near Leadville, Colo		6,000	
Green Lake in Hancock County, Me		500	
Kephart stream near Glyndon, Md		9,500	
Patapsco Falls near Glyndon, Md		9,500	
Local streams near Alberton, Md		5,000	
Crane Creek near Crane, Mo		2,000	
Ocona Lufty River near Cherokee, N. C		5,000	
Dry Run in Bath County, Va		4,500	
Mill Creek in Bath County, Va		4,500	
Applicants in Virginia		1,000	
East Cahaba River near Birmingham, Ala			500
Applicants in Alabama			475
Spavina Creek near Nebo, Ark			1,000
Sugar Creek near Brightwater, Ark			1,300
Clear Fork of Illinois River near Johnson, Ark			800
Main Fork of White River near Durham, Ark			600
Delaney, Ark			600
St. Paul, Ark			800
West Fork, Ark			1,000
Winslow, Ark			1,000
Frog Gabou near Mountainburg, Ark			700
Frog Bayou near Lancaster, Ark			600
Lillie, Ark			600
Feazels Pond near Nashville, Ark			500
Applicants in Arkansas			1,400
Trinity Summit Lake near Trinity Summit, Cal			5,400
Colorado Fish Commission			475
Applicants in District of Columbia			97
Georgia			200
Clear River near Warren, Ill			725
Clear Lake near South Bend, Ind			1,000
Chamberlain Lake near South Bend, Ind			500
Applicants in Indiana			200
Jackson Creek near Cresco, Iowa			700
Clear Creek near Lansing, Iowa			977
Dourman Mill, Coulie Creek near McGregor, Iowa			500
Applicants in Iowa			50
Cow Creek near Baxter Station, Kans			500
Marmonton River near Fort Scott, Kans			2,000
Little Osage River near Fulton, Kans			1,000
Marais Des Cygnes River near Boicourt, Kans			5,200
Applicants in Kansas			1,200
Blue Spring near Cecilian, Ky			200
Lander Branch near Casky, Ky			100
Sinking Creek near Saulsberry, Ky			750
Applicants in Kentucky			100
Maine Fish Commission			471
Parlin Pond in Somerset County, Me			300
Almshouse Run near Hagerstown, Md			52
Lake Roland near Lutherville, Md			312
Beaver Run near Glyndon, Md			100
Local streams near Hagerstown, Md			500
Cronwell Creek near Timonium, Md			1,000
Big Pool near Hagerstown, Md			1,000
Minnehaha Creek near Glyndon, Md			425

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rainbow trout—Continued.			
Egypt Branch near Brooklandville, Md			425
Applicants in Maryland			250
Kansas River near Kansas City, Mo			100
Indian Creek near Lanagan, Mo			2,200
Elk River near Rutledge, Mo			2,200
Shoal Creek near Neosho, Mo			350
Gasconade River near Arlington, Mo			3,420
Meramac River near Mosalle, Mo			1,500
Metcalf Spring near Steelville, Mo			500
Sugar Creek in McDonald County, Mo			1,000
Current River near Chicopee, Mo			9,300
Spring Pond near Ash Grove, Mo			100
Sylvan Lake near Ironton, Mo			500
Applicants in Missouri			400
Lake Creek near Rushville, Nebr			400
Worth Branch near Far Hills, N. J			500
Applicants in New Jersey			150
New York			300
Dods Lake near Babylon, N. Y			600
Jonathan Creek near Dellwood, N. C			800
Buck Creek near Marion, N. C			1,500
Linville River near Linville, N. C			760
Sugar Fork Run near Black Mountain, N. C			800
Long Branch near Black Mountain, N. C			300
Swananoa River near Black Mountain, N. C			500
Applicants in North Carolina			200
Ohio			300
Tributary of Gunpowder River near New Freedom, Pa			500
Deer Creek near New Freedom, Pa			500
Anderson Branch near Stewartstown, Pa			500
Loyalhanna Creek near Latrobe, Pa			500
Clover Creek near Altoona, Pa			500
Clear Creek near Johnstown, Pa			800
Trout Run near Bedford, Pa			300
Youghiogheny River near Ohiopyle, Pa			500
Elk Run near Ebensburg, Pa			800
Black Lick Creek near Ebensburg, Pa			500
Moore Run near Ebensburg, Pa			500
Long Run near Arnot, Pa			800
Bobs Run near Morris, Pa			500
Alder Run near Munsons, Pa			800
Little Montgomery Creek near Clearfield, Pa			500
Allegheny River near Coudersport, Pa			700
Freeman Run near Austin, Pa			300
Lick Run near Gaines, Pa			1,000
Cushing Creek near Coudersport, Pa			600
Local streams near Blossburg, Pa			4,000
Churchill Creek near Farmington, Pa			800
Clear Brook near Dubois, Pa			200
Falling Spring near Chambersburg, Pa			500
Trindle Run near Mechanicsburg, Pa			800
Hagerman Run near Williamsport, Pa			600
Local streams near Williamsport, Pa			1,275
Sugar Creek near Troy, Pa			800
Red Run Creek near Waynesboro, Pa			500
Glen Brook near Berwick, Pa			300
Harvey Lake near Nanticoke, Pa			500
Local streams near Stroudsburg, Pa			4,000
Pike Creek near Nanticoke, Pa			300
Roaring Brook near Scranton, Pa			600
Moss Hollow Creek near Hamilton, Pa			300
Spring River near Tobyhanna, Pa			100
Jerry Run near Lockhaven, Pa			1,000
Drury Run near Renovo, Pa			600
Deep Creek near Ashland, Pa			500
Quaker Pond near Shenandoah, Pa			200
Rock Run near St. Peters, Pa			475
Steens Run near Mortonville, Pa			425
Meadow Brook near Meadowbrook, Pa			500
Smyser Pond near York, Pa			100
Trout Run near York, Pa			500
Susquehanna River near Peach Bottom, Pa			588
Applicants in Pennsylvania			1,590
South Carolina			100
Indian Creek near Irwin, Tenn			2,900
Boon Creek near Irwin, Tenn			100
Knob Creek near Irwin, Tenn			100
Sinking Creek near Irwin, Tenn			100
Upper Doe River near Roan Mountain, Tenn			1,150
Cranberry Creek near Cranberry, Tenn			1,112
French Broad and Pigeon rivers in Jefferson County, Tenn			1,000
Doe River in Carter County, Tenn			1,000

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rainbow trout—Continued.			
Spring Branch near Kimmins, Tenn			200
New River near Helenwood, Tenn			250
Little River near Knoxville, Tenn			1,000
Pigeon River in Knox County, Tenn			500
Tellico River in Knox County, Tenn			500
Applicants in Tennessee			1,594
Texas			442
Reed Creek near Wytheville, Va			320
Tyre River near Arrington, Va			1,500
Cowpasture River near Millboro, Va			500
Augusta Springs near Augusta Springs, Va			500
Barbers Creek near Craig City, Va			500
Spring Creek near Craig City, Va			500
Cowpasture River near Hot Springs, Va			1,000
Gordon Creek in Bath County, Va			1,000
Cedar Creek in Bath County, Va			1,500
Little Healing Creek in Bath County, Va			1,500
Walkers Creek near Pearisburg, Va			500
North Fork of Tye River in Nelson County, Va			492
Campbell County, Va			500
Clinch River near Tazewell County, Va			600
Wolf Creek in Tazewell County, Va			1,000
South Fork of Powell River in Wise County, Va			1,000
Powell River and branches near Bigstone Gap, Va			500
Beaver Dam Creek in Washington County, Va			225
Laurel Run in Rockbridge County, Va			300
Rappahannock River near Fredericksburg, Va			200
Spring Creek in Washington County, Va			225
Laurel River in Washington County, Va			450
Applicants in Virginia			1,586
Mound Spring Pond near Seymour, Wis			300
Wausaukee Fish and Game Club, Amberg, Wis			2,000
Gauley River in Fayette County, W. Va			5,000
Applicants in West Virginia			895
Von Behr trout:			
Troutdale fish farm, Mammoth Spring, Ark	5,000		
Connecticut Fish Commission	20,000		
Minnesota Fish Commission	20,000		
Vermont Fish Commission	20,000		
Wyoming Fish Commission	15,000		
Government of Mexico	20,000		
North Ten Mile Creek near Frisco, Colo			450
Black Lake in Summit County, Colo			1,000
Denslow Brook in Fairfield County, Conn			310
Trail Creek near Michigan City, Ind			300
Notre Dame Lake near South Bend, Ind			200
Applicants in Indiana			500
Hoover Spring near West Union, Iowa			200
Silver Springs near Waverly, Iowa			200
Spirit Lake near Spirit Lake, Iowa			1,325
Applicants in Iowa			400
Kentucky			300
Big Tunk Pond near Ellsworth, Me			3,000
Phillips Pond near Phillips Pond Station, Me			2,000
Rocky Pond in Hancock County, Me			3,000
Branch Pond near East Dedham, Me			4,228
Green Lake in Hancock County, Me			3,000
Pattens Pond in Hancock County, Me			5,000
Rogers Pond near Topham, Me			400
Heart Pond near Orland, Me			18
Lidensparker Pond near Waldoboro, Me			1,500
Fourth Pond in Hancock County, Me			2,000
One Mile River near Attleboro, Mass			500
Great Pond near Randolph, Mass			800
Almshouse Run near Hagerstown, Md			118
Pri Pond near Lawton, Mich			300
North Branch Tobacco River near Hatton, Mich			2,000
Centennial Mill and Pokagan Creek near Lagrange, Mich			722
Big Black Creek in Muskegon County, Mich			500
Big Bear Creek in Muskegon County, Mich			400
Little Bear Creek in Muskegon County, Mich			100
Pere Marquette River in Newaygo County, Mich			1,000
Little Manistee River in Newaygo County, Mich			500
Crooked Creek near Coldwater, Mich			500
Applicants in Michigan			150
Salt Peter Creek, near Rexville, N. Y			200
Local streams in Sullivan County, N. Y			1,200
Charlotte Creek near Oneonta, N. Y			500
Tawawa Lake near Sidney, Ohio			500
Applicants in Ohio			268
Columbia Creek near Troy, Pa			300
Lackawaxen River in Wayne County, Pa			500

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Von Behr trout—Continued.			
Applicants in Pennsylvania			500
Mill Brook near South Pomfret, Vt			1,000
Big Spring near Leesburg, Va			85
Gauley River in Fayette County, W. Va			1,000
Rush River near Baldwin, Wis			300
Middle Inlet near Amberg, Wis			800
North Branch near Farmington, Wis			1,400
Main Creek near Bangor, Wis			300
Black-spotted trout:			
Frying Pan Creek in Pitkin County, Colo			1,200
Eagle County, Colo			1,300
Upper Boulder Creek near Central City, Colo			2,000
Mammoth Creek near Central City, Colo			2,000
Lake Creek near Twin Lakes, Colo			500
Spring Brook near Carbondale, Colo			500
Tomichi Creek near Sargent, Colo			1,800
Rito Alto Creek near Moffat, Colo			800
Spring Creek near Sheridan, S. Dak			900
Brook trout;			
Troutdale Fish Farm, Mammoth Spring, Ark	5,000		
John G. Bailey, Rogers, Ark	5,000		
Hampshire Trout Club, Northampton, Mass	10,000		
Minnesota Fish Commission	20,000		
Nebraska Fish Commission	20,000		
W. H. Vansickle, Bevans, N. J	10,000		
Vermont Fish Commission	20,000		
A. P. Muzz, New Richmond, Wis	5,000		
Government of Switzerland	20,000		
J. J. Armistead, Killywhan, Scotland	20,000		
Lieut. H. R. Lemly, U. S. of Colombia, South America	3,000		
Rock Creek in Lake County, Colo		3,000	
Lake Creek in Lake County, Colo		2,500	
Arkansas River near Arkansas Junction, Colo		2,500	
Upper Lake in Lake County, Colo		15,000	
Spring Brook near Laporte, Ind		2,000	
Chamberlain Lake near South Bend, Ind		1,000	
Almshouse Run near Hagerstown, Md		7,000	
Creek near Dexter, Mich		2,000	
Wells Creek near Schoolcraft, Mich		1,000	
Washington River in Houghton County, Mich		10,000	
North River near Staunton, Va		12,000	
Arkansas River near Boulevard, Colo			1,900
Los Pinos Creek near Osier, Colo			1,250
Mill Creek near Idaho Springs, Colo			2,000
Fall River near Idaho Springs, Colo			2,000
South Platte River in Park County, Colo			4,500
South Boulder Creek near Central City, Colo			2,000
Jennie Lind Creek near Central City, Colo			2,000
Lake Creek in Lake County, Colo			500
Upper Twin Lakes in Lake County, Colo			1,000
Lower Evergreen Lake in Lake County, Colo			2,000
Lake Creek in Lake County, Colo			500
Crystal River near Carbondale, Colo			500
Tomichi Creek near Sargent, Colo			400
Gunnison, Colo			2,500
East River near Almont, Colo			850
Greenhorn River near Graneros, Colo			500
Roaring Fork River in Eagle County, Colorado			1,000
Applicants in Colorado			800
Hammonasset River near Madison, Conn			700
Whitlock Brook near South Norwalk, Conn			240
Jacks Brook in Litchfield County, Conn			500
Burr Oak Creek near Osage, Iowa			200
Craig Pond near East Orland, Me			4,505
Applicants in Maryland			400
Trout Brook near North Pembroke, Mass			800
Sweetwater Creek near Stearns, Mich			500
West Branch Donnaber Creek near Wingleton, Mich			500
Poquetts Creek in Lake County, Mich			500
Avery Creek near Cherry Valley, Mich			1,000
Spring Lake near Wingleton, Mich			300
Dannanher Creek near Wingleton, Mich			500
Mill Creek in Lake County, Mich			800
Baldwin Creek near Baldwin, Mich			800
Cedar Creek near Baldwin, Mich			500
Pickerel Creek near Baldwin, Mich			800
Sweetwater Creek near Branch, Mich			500
Sanborn Creek near Nirvana, Mich			500
Branch Pere Marquette River near Nirvana, Mich			1,000
Dock and Tom Creek near Lake Station, Mich			800
Chippewa River near Chippewa, Mich			1,000
South Branch Tobacco River near Clare, Mich			2,000

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Brook trout—Continued.			
Star Lake near Wingleton, Mich			2,000
Middle Branch of Tobacco River near Farwell, Mich			800
Willow Creek near Farwell, Mich			1,000
Indian Lake near Dowagiac, Mich			300
Kesby Brook near Milford, Mich			100
Glenwood Lake near Jefferson City, Mont			500
Buffalo and Travis creeks near Helena, Mont			500
Applicants in Montana			500
Nebraska			250
Merrimac River near Hudson, N. H			400
Pecos River near Las Vegas, N. Mex			500
Tosuque River near Santa Fe, N. Mex			1,000
Musconetcong River near Trenton, N. J			900
Applicants in New Jersey			200
Crum Creek near Congers, N. Y			425
Sauquoit Creek near Waterville, N. Y			800
Bridgewater Stream near Bridgewater, N. Y			500
Beaver Meadow Creek near Cutting, N. Y			500
Little Broken Straw Creek near Clymer, N. Y			500
Unadilla River near West Winfield, N. Y			800
Little Moose Lake near Wilmurt, N. Y			1,000
Oriskany Creek near Waterville, N. Y			500
Ragged Lake near Owls Head, N. Y			990
Harvey Creek near Nanticoke, Pa			500
Roaring Brook near Scranton, Pa			500
Walker Creek near Herrick Center, Pa			200
Corey Creek near Herrick Center, Pa			200
Price Creek near Herrick Center, Pa			200
Lee Creek near Herrick Center, Pa			200
McGonegal Creek near Herrick Center, Pa			200
Patterson Creek near Herrick Center, Pa			200
Tingley Creek near Herrick Center, Pa			200
Bowell Creek near Herrick Center, Pa			200
Brookings Creek near Herrick Center, Pa			200
Barnes Creek near Herrick Center, Pa			200
Dunns Creek near Herrick Center, Pa			200
Johnson Creek near Pleasant Mount, Pa			200
Applicants in Pennsylvania			200
Battle Creek near Hermosa, Pa			500
Dotham Pond near Hartford, Vt			500
Lake Witchel near North Pomfret, Vt			600
Ottaqueechy River near Sherburne, Vt			1,000
Lakota Lake near Woodstock, Vt			500
Big Spring near Leesburg, Va			69
Eighteen Mile Creek near Pratt, Wis			800
Kinnickinnick River near River Falls, Wis			1,000
Local stream near West Salem, Wis			500
Bear Creek near Rice Lake, Wis			1,000
Shoshone Creek in Yellowstone National Park, Wyo			4,500
Yellow-finned trout:			
Lower Evergreen Lake near Leadville, Colo			700
Lake trout:			
Connecticut Fish Commission	100,000		
Massachusetts Fish Commission	100,000		
Minnesota Fish Commission	100,000		
Nebraska Fish Commission	100,000		
New York Fish Commission	300,000		
Utah Fish Commission	100,000		
Vermont Fish Commission	300,000		
Green Lake in Hancock County, Me		25,000	
Pretty Lake near Kalamazoo, Mich		2,000	
Lake Huron off North Point, Mich		29,000	
Sugar Island, Mich		38,000	
Lake Superior near Fishermans Home, Mich		100,000	
Wright Island, Mich		100,000	
Rock Harbor, Mich		100,000	
Tobin Bay, Mich		100,000	
Duncan Bay, Mich		100,000	
Washington Harbor, Mich		200,000	
Lester Park, Minn		40,000	
Two Harbors, Minn		200,000	
Beaver Bay, Minn		200,000	
Grand Marcus, Minn		200,000	
Poplar River, Minn		50,000	
Grand Portage, Minn		400,000	
Chicago Bay, Minn		100,000	
French River, Minn		20,000	
Fish Island, Minn		100,000	
Eaglenest Lake near Ely, Minn		100,000	
Burnside Lake near Ely, Minn		50,000	
Trout Lake near Tower, Minn		77,000	
Lake Ontario off Cape Vincent, N. Y		29,000	

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Lake trout—Continued.			
Lake Erie on North Bass Island Reef, Ohio		79,000	
Peach Point Reef, Ohio		42,000	
Lake Superior near Bayfield, Wis		300,000	
Hudson Lake near South Bend, Ind			1,000
Lake in Franklin Park, Columbus, Ohio			300
Lake Maxinkuckee near Marmont, Ind			3,000
Heart Pond near East Orland, Me			19
East Orland, Me			17
Lake Huron near Thunder Bay, Mich			145
off North Point, Mich			6,823
Star Lake in Saginaw, Mich			2,000
Bitter Root River near Hamilton, Mich			780
Ragged Lake near Owls Head, N. Y			1,996
Pundersons Lake near Burton, Ohio			1,810
Lake Winola near Falls, Pa			1,000
Beech Lake near Honesdale, Pa			500
Whitefish:			
Connecticut Fish Commission	200,000		
New York Fish Commission	6,000,000		
Lake Superior off Fish Island, Mich		990,000	
Siskouvit Lake, Isle Royal, Mich		1,000,000	
Lake Michigan near Naubinway, Mich		750,000	
Epoufette, Mich		750,000	
Charlevoix, Mich		2,000,000	
Manistique, Mich		2,000,000	
Lake Huron near East Tawas, Mich		1,000,000	
Detour Passage, Mich		1,500,000	
Lake Huron off Miller Point, Mich		1,000,000	
Sturgeon Point, Mich		1,000,000	
Thunder Bay Island, Mich		1,050,000	
Whitefish Lake in Mackinac County, Mich		2,000,000	
Lake Superior near Duluth, Minn		200,000	
Lake Ontario near Oswego, N. Y		1,900,000	
Sacketts Harbor, N. Y		1,900,000	
Lake Erie on North Bass Island Reef, Ohio		4,340,000	
Rattlesnake Island Reef, Ohio		4,420,000	
Ballast Island Reef, Ohio		3,900,000	
Green Island Reef, Ohio		2,600,000	
Middle Bass Island Reef, Ohio		2,500,000	
Peach Point Reef, Ohio		1,250,000	
Starve Island Reef, Ohio		700,000	
Kelly Island Reef, Ohio		1,000,000	
Mouse Island Reef, Ohio		1,000,000	
Lake Superior near Bayfield, Wis		4,000,000	
Iron River, Wis		2,000,000	
Raspberry Bay, Wis		2,000,000	
Lake Erie on North Bass Island Reef, Ohio		5,450,000	
Rattlesnake Island Reef, Ohio		7,230,000	
Green Island Reef, Ohio		1,500,000	
Middle Bass Island Reef, Ohio		1,600,000	
Peach Point Reef, Ohio		3,125,000	
Ballast Island Reef, Ohio		3,300,000	
Starve Island Reef, Ohio		2,400,000	
Kelley Reef, Ohio		3,400,000	
Mouse Island Reef, Ohio		2,000,000	
Pike perch:			
Long Lake near Albion, Ind		500,000	
High Lake near Albion, Ind		500,000	
Pretty Lake near Plymouth, Ind		1,000,000	
Maxinkuckee Lake near Marmont, Ind		2,000,000	
Twin Lakes near Plymouth, Ind		1,000,000	
Lake of the Woods near Plymouth, Ind		1,000,000	
Blue River near Milltown, Ind		200,000	
Long Lake near Lagrange, Ind		500,000	
Dallas Lake near Lagrange, Ind		500,000	
Atwood Lake near Lagrange, Ind		500,000	
Applicants in Indiana		200,000	
Salt River near Shepherdsville, Ky		1,886,000	
Green River near Bowling Green, Ky		1,667,000	
Barren River near Munfordsville, Ky		1,647,000	
Applicants in Kentucky		100,000	
Pike Lake near Duluth, Minn		2,500,000	
Lake Vermilion near Tower, Minn		2,500,000	
Harper Lake near Center Village, N. Y		500,000	
Owasco Lake near Auburn, N. Y		500,000	
Cayuga Lake near Auburn, N. Y		500,000	
New York State Fish Commission	5,000,000		
Maumee Bay near Toledo, Ohio		13,600,000	
Sandusky River near Fremont, Ohio		2,500,000	
Sandusky Bay near Sandusky, Ohio		10,800,000	
Lake Erie on Rattlesnake Island Reef, Ohio		8,400,000	
Put-in-Bay Island Reef, Ohio		15,300,000	

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Pike perch—Continued.			
Lake Erie on Port Clinton Reef, Ohio		13,200,000	
Ballast Island Reef, Ohio		21,600,000	
Middle Bass Island Reef, Ohio		26,700,000	
Peach Point Reef, Ohio		15,000,000	
North Bass Island Reef, Ohio		7,500,000	
Ohio Fish Commission		18,900,000	
Beech Lake near Honesdale, Pa		2,000,000	
Chapman Lake near Jermyn, Pa		500,000	
Heart Lake near Jermyn, Pa		500,000	
Applicants in Pennsylvania		2,500,000	
Lake Superior near Port Wing, Wis		3,000,000	
Pike:			
Jackson River near Cedar Creek, Va			100
Yellow perch:			
Lake Erie on Put-in-Bay Island Reef, Ohio		70,000	
Applicants in District of Columbia			63
Cedar River near Cedar Rapids, Iowa			167
Clark Creek near Skiddy, Kans			20
City reservoir, Winchester, Ky			15
Applicants in Kentucky			25
Pennsylvania			50
Black bass:			
Cahaba River near Selma, Ala			100
Applicants in Alabama			210
Arkansas			100
District of Columbia			357
East Lake near Atlanta, Ga			200
Applicants in Georgia			367
Fox River near St. Charles, Ill			197
Elgin, Ill			150
Geneva, Ill			50
Lake Sibley near Sibley, Ill			22
Kiswaukee River near Belvidere, Ill			50
Applicants in Illinois			333
Long Lake near Miller, Ind			95
Applicants in Indiana			210
Lime Creek near Mason City, Iowa			50
Bishop Lake near Sheldon, Iowa			50
Cedar River near Cedar Rapids, Iowa			400
Badger River near Fayette, Iowa			25
Upper Iowa River near Decorah, Iowa			87
Otter Creek near Oelwein, Iowa			100
Twin Lakes near Rockwell City, Iowa			100
Storm Lake near Storm Lake, Iowa			100
Maquoketa River near Manchester, Iowa			75
Iowa River near Lime Spring, Iowa			50
Iowa River near Chester, Iowa			25
Cedar River near Osage, Iowa			25
Iowa Fish Commission			100
Applicants in Iowa			75
Clark Creek near Skiddy, Kans			50
Lake View near Lawrence, Kans			200
Applicants in Kansas			602
Lake Reba near Richmond, Ky			100
Clark County Fishing Club, Winchester, Ky			200
Clear Creek near Shelbyville, Ky			50
City Reservoir, Winchester, Ky			50
Middleboro, Ky			50
Fleming Creek near Flemingsburg, Ky			50
Kinney Creek near Vanceburg, Ky			50
South Licking River near Cynthiana, Ky			50
Tygart Creek near Olive Hill, Ky			100
Nolin River near Hodgenville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Blue Spring near Cecilian, Ky			50
Big Clifty Creek near Clifty, Ky			75
Caney Creek near Spring Creek Station, Ky			75
Mud River near Russellville, Ky			100
Pond River near Bakersport, Ky			75
Tradewater River near Dawson, Ky			50
Lake Slough near Kuttawa, Ky			200
Little River near Cerulean Springs, Ky			75
Asylum Lake, Lakeland, Ky			200
South Park Lake near South Park, Ky			50
Harrods Creek, Ky			200
Rolling Fork, branch of Salt River, Ky			450
Green River near Hustonville, Ky			300
Dix River near Danville, Ky			340
Knob Lick Creek near Junction City, Ky			150
Crystal Lake near Covington, Ky			75
Applicants in Kentucky			1,852

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Black bass—Continued.			
Bayou Robert near Moreland, La			230
Applicants in Louisiana			30
St. Catherine Lake near Mount Hope, Md			30
Patapsco River near Glenn Falls, Md			100
Patuxent River near Laurel, Md			100
Applicants in Maryland			100
Dodgewell Pond near Attleboro, Mass			30
Hebron Pond near Attleboro, Mass			30
Applicants in Massachusetts			130
Magruder Lake near Canton, Miss			100
Applicants in Mississippi			220
Lake View near Nevada, Mo			30
Moreau Creek near Jefferson City, Mo			300
Applicants in Missouri			245
Ireland Mill Pond near Bridgeton, N. J			100
Crosswicks Creek near Crosswick, N. J			100
Applicants in New Jersey			460
Johnson Creek near County Line, N. Y			50
Lake Wiley near Charlotte, N. C			100
Broad River in Rutherford County, N. C			100
Pig Run near Rocky Mount, N. C			100
Union Mill Pond near Mebane, N. C			100
Pond on Sandy Creek near Henderson, N. C			100
Ten Mile Pond near Flat Rock, N. C			50
Yadkin River near Patterson, N. C			100
Applicants in North Carolina			590
Stone Lake near North Bend, Ohio			125
City reservoir near Bellevue, Ohio			100
Middle Fork of Little Beaver River near New Lisbon, Ohio			100
Bass Lake near Chardon, Ohio			100
Tinkers Creek near Bedford, Ohio			75
Cuyahoga River near Shalersville, Ohio			75
Lake tributary to Cuyahoga River near Shalersville, Ohio			75
Wills Creek near Coshocton, Ohio			100
Xenia Water Company Reservoir, Xenia, Ohio			100
Applicants in Ohio			1,425
Oregon			50
Beaver River near Beaver Falls, Pa			200
Local creek near Bedford, Pa			100
Sinnemahoming Creek near Winterburn, Pa			300
Lake near Yardley, Pa			50
Applicants in Pennsylvania			130
Seneca River near Seneca, S. C			100
Broad River near Alston, S. C			30
Ocall River near Parksville, Tenn			100
Lake Wildwood near Cleveland, Tenn			100
Clinch River near Clinton, Tenn			386
Emory River near Harriman, Tenn			200
Obed River near Lancing, Tenn			100
New River and tributaries near Helenwood, Tenn			400
Pigeon River near Knoxville, Tenn			100
Duck River near Wartrace, Tenn			50
Applicants in Tennessee			170
Moutney Lake near Gainesville, Tex			15
Chesley Tank near Cisco, Tex			50
Palo Dowra Creek near Amarillo, Tex			50
Tulia Creek near Amarillo, Tex			50
Running Water Creek near Amarillo, Tex			30
Austin Rod and Gun Club, Austin, Tex			100
Applicants in Texas			587
Clinch River near Tazewell, Va			200
Rivanna River near Proffit, Va			200
Falling River and Seneca Creek near Lynchburg, Va			100
Jackson River near Cedar Creek, Va			100
Cowpasture River near Millboro, Va			100
Rappahannock River near Fredericksburg, Va			199
South Anne River near Ashland, Va			100
Applicants in Virginia			480
Shepherd Lake near Cheney, Wash			50
Clear Lake near Cheney, Wash			50
Lake near Hamilton, Wash			150
Lake Padden near Fairhaven, Wash			125
Applicants in Washington			175
Cheat River near Morgantown, W. Va			149
Gauley River near Camden on Gauley, W. Va			1,000
Applicants in West Virginia			50
Gibbon River in Yellowstone National Park, Wyo			250
Rock bass:			
Oxford Lake near Anniston, Ala			100
Applicants in Alabama			150
Arkansas			1,100

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rock bass—Continued.			
Applicants in Delaware			500
Georgia			725
Georgia Fish Commission			600
Applicants in Illinois			30
Indian Territory			1,000
Kansas			800
Lake Reba near Richmond, Ky			500
Patuxent River near Laurel, Md			1,000
Applicants in Maryland			200
Missouri			640
Mississippi			600
Nebraska			300
North Carolina			2,975
Oklahoma			100
Pennsylvania			400
Allegheny River near Warren, Pa			500
Susquehanna River near Williamsport, Pa			1,000
Sinnemahoming River near Clearfield, Pa			300
Applicants in South Carolina			900
Tarra Blanco Creek near Amarillo, Tex			200
Applicants in Texas			600
State Capitol Ponds, Nashville, Tenn			200
Applicants in Virginia			2,661
Cove Creek near Wytheville, Va			300
Applicants in Tennessee			600
Warmouth bass:			
Applicants in Illinois			100
Fox River near St. Charles, Ill			50
Pine Lake near Laporte, Ind			525
Long Lake near Miller, Ind			75
Applicants in Indiana			50
Cedar River near Cedar Rapids, Iowa			50
Upper Iowa River near Decorah, Iowa			104
Otter Creek near Oelwein, Iowa			150
Twin Lakes near Rockwell City, Iowa			100
Storm Lake near Storm Lake, Iowa			150
Maquoketa River near Manchester, Iowa			75
Lake View near Lawrence, Kans			100
Mud River near Russellville, Ky			75
Lake Dlough near Kuttawa, Ky			60
Applicants in Kentucky			75
Patuxent River near Laurel, Md			90
Applicants in Massachusetts			38
Ohio			50
Texas			235
Crappie:			
Fox River near St. Charles, Ill			217
Elgin, Ill			145
Geneva, Ill			40
Lake Sibley near Sibley, Ill			81
Kishwaukee River near Belvidere, Ill			40
Applicants in Illinois			483
Pine Lake near Laporte, Ind			2,350
Applicants in Indiana			375
Storm Lake near Storm Lake, Iowa			150
Otter Creek near Oelwein, Iowa			175
Badger River near Fayette, Iowa			50
Upper Iowa River near Decorah, Iowa			275
Cedar River near Cedar Rapids, Iowa			400
Iowa River near Chester, Iowa			25
Lyons Creek near Junction City, Kans			25
Applicants in Kansas			474
Nolin River near Hodgenville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Big Clifty Creek near Clifty, Ky			75
Caney Creek near Spring Creek Station, Ky			75
Mud River near Russellville, Ky			100
Pond River near Bakersport, Ky			75
Drake Creek near Hortonville, Ky			75
Tradewater River near Dawson, Ky			50
Lake Dlough near Kuttawa, Ky			250
Muddy Fork near Kuttawa, Ky			75
Little River near Cerulean Springs, Ky			75
Otter Creek near Cerulean Springs, Ky			100
Reservoir near Winchester, Ky			15
Middleboro, Ky			25
Kinney Creek, near Vanceburg, Ky			25
South Licking near River Cynthiana, Ky			25
Applicants in Kentucky			400
Lake View near Nevada, Mo			6
Applicants in Missouri			300

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Crappie—Continued.			
Applicants in New York			100
Johnson Creek near county line, N. Y			50
Applicants in Ohio			40
Codorus Creek near Brodbecks, Pa			17
French Creek near Phœnixville, Pa			50
Moutney Lake near Gainesville, Tex			20
Applicants in Texas			515
Jackson River near Cedar Creek, Va			50
Sunfish:			
Lime Creek near Mason City, Iowa			50
Bishop Lake, Sheldon, Iowa			50
Pine Lake near Laporte, Ind			20
Applicants in Ohio			50
Cod:			
Vineyard Sound off the Massachusetts coast		1,254,000	
Massachusetts Bay off Gloucester Harbor, Mass		21,617,000	
Haddock:			
Massachusetts Bay off Gloucester Harbor, Mass		19,500	
Flatfish:			
Vineyard Sound off the Massachusetts coast		1,795,000	
Lobster:			
Vineyard Sound off the Massachusetts coast		69,066,000	
Massachusetts Bay off Gloucester Harbor, Mass		9,332,000	
Total	24,123,000	424,320,500	1,867,043

Résumé by States and Territories of the distribution and assignment of fish and fish eggs.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Alabama	Carp			575
	Goldfish			48
	Rainbow trout			975
	Black bass			340
	Rock bass			250
Arkansas	Carp			611
	Tench			500
	Goldfish			124
	Golden ide			100
	Rainbow trout	17,000		10,900
	Von Behr trout	5,000		
	Brook trout	10,000		
	Black bass			100
	Rock bass			1,100
California	Carp			18
	Quinnat salmon	7,500,000	438,500	
	Silver salmon		280,000	
	Steelhead trout	50,000	308,500	
	Loch Leven trout	20,000		
	Rainbow trout			5,400
Colorado	Carp			30
	Goldfish			24
	Golden ide			125
	Loch Leven trout			14,500
	Rainbow trout		11,000	475
	Von Behr trout			1,450
	Black-spotted trout			10,100
	Yellow-finned trout			700
	Brook trout		23,000	26,200
Connecticut	Carp			390
	Goldfish			30
	Shad		3,044,000	
	Atlantic salmon	25,000		
	Landlocked salmon			300
	Von Behr trout	20,000		310
	Brook trout			1,440
	Lake trout	100,000		
	Whitefish	200,000		
Delaware	Carp			60
	Goldfish			48
	Shad		1,780,000	
	Rock bass			500
District of Columbia	Spotted catfish			10
	Carp			1,992
	Goldfish			6,771

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
District of Columbia	Golden ide			91
	Golden tench			50
	Shad		469,000	1,000,000
	Rainbow trout			97
	Yellow perch			63
	Black bass			357
Florida	Carp			364
	Goldfish			74
	Golden ide			50
	Shad		2,250,000	
Georgia	Carp			4,489
	Tench			4,000
	Goldfish			168
	Golden ide			150
	Shad		2,417,000	
	Rainbow trout			200
	Black bass			567
	Rock bass			1,325
Idaho	Spotted catfish			100
	Carp			60
Illinois	Spotted catfish			2,800
	Carp			150
	Goldfish			310
	Golden ide			37
	Golden tench			6
	Rainbow trout			725
	Black bass			802
	Rock bass			30
	Warmouth bass			150
	Crappie			1,006
Indiana	Spotted catfish			375
	Carp			90
	Goldfish			127
	Golden tench			12
	Golden ide			25
	Loch Leven trout			2,300
	Rainbow trout			1,700
	Von Behr trout			1,000
	Brook trout		3,000	
	Lake trout			4,000
	Pike perch		7,900,000	
	Black bass			335
	Warmouth bass			650
	Crappie			2,725
	Sunfish			20
Indian Territory	Carp			575
	Tench			1,100
	Goldfish			24
	Rock bass			1,000
Iowa	Spotted catfish			9,642
	Carp			340
	Tench			165
	Goldfish			210
	Golden tench			2
	Rainbow trout			2,227
	Von Behr trout			2,125
	Brook trout			200
	Yellow perch			167
	Black bass			1,262
	Warmouth bass			629
	Crappie			1,075
	Sunfish			100
Kansas	Spotted catfish			1,099
	Carp			1,001
	Tench			100
	Goldfish			192
	Golden ide			8
	Rainbow trout			9,900
	Yellow perch			20
	Black bass			852
	Rock bass			800
	Warmouth bass			100
	Crappie			499
Kentucky	Spotted catfish			1,190
	Carp			320
	Goldfish			84
	Rainbow trout			1,150
	Von Behr trout			300
	Pike perch		6,200,000	
	Yellow perch			40
	Black bass			5,342
	Rock bass			500

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Kentucky	Warmouth bass			219
	Crappie			1,765
Louisiana	Carp			190
	Goldfish			419
	Golden ide			100
	Black bass			260
Maine	Carp			30
	Goldfish			14
	Atlantic salmon			235,306
	Landlocked salmon	10,000	6,000	130,058
	Loch Leven trout			20,714
	Rainbow trout		500	771
	Von Behr trout			24,146
	Brook trout			4,505
	Lake trout		25,000	36
Maryland	Carp			610
	Tench			60
	Goldfish			360
	Golden ide			24
	Golden tench			24
	Shad	355,000	12,006,000	
	Landlocked salmon		2,500	
	Rainbow trout	2,500	21,000	4,064
	Von Behr trout			118
	Brook trout		7,000	400
	Black bass			330
	Rock bass			1,200
	Warmouth bass			90
Massachusetts	Carp			260
	Goldfish			74
	Golden ide			24
	Landlocked salmon	6,000		
	Von Behr trout			1,300
	Brook trout	10,000		800
	Lake trout	100,000		
	Black bass			190
	Warmouth bass			38
	Cod		25,871,000	
	Haddock		19,500	
	Flatfish		1,795,000	
	Lobster		78,398,000	
Michigan	Carp			780
	Goldfish			60
	Quinnat salmon		39,000	
	Loch Leven trout		24,000	3,000
	Von Behr trout			6,172
	Brook trout		13,000	16,200
	Lake trout		769,500	8,968
	Whitefish		15,040,000	
Minnesota	Carp			3,500
	Goldfish			60
	Golden ide			25
	Loch Leven trout	20,000		
	Rainbow trout	42,000		
	Von Behr trout	20,000		
	Brook trout	20,000		
	Lake trout	100,000	1,537,000	
	Whitefish		200,000	
	Pike perch		5,000,000	
Mississippi	Carp			806
	Goldfish			66
	Black bass			320
	Rock bass			600
Missouri	Spotted catfish			450
	Catfish (common)			1,059
	Carp			450
	Tench			2,245
	Goldfish			579
	Golden ide			75
	Rainbow trout	50,000	2,000	21,570
	Black bass			575
	Rock bass			640
	Crappie			306
Montana	Carp			740
	Loch Leven trout			1,000
	Brook trout			1,500
	Lake trout			780
Nebraska	Carp			110
	Goldfish			6
	Rainbow trout	23,000		400
	Brook trout	20,000		205
	Lake trout	100,000		

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Nebraska	Rock bass			300
New Hampshire	Carp			160
	Atlantic salmon	25,000		
	Brook trout			400
New Jersey	Carp			280
	Goldfish			120
	Golden ide			15
	Shad		1,242,000	
	Landlocked salmon	5,000		
	Rainbow trout			650
	Brook trout	10,000		1,100
	Black bass			660
New Mexico	Carp			484
	Goldfish			12
	Loch Leven trout			800
	Brook trout			1,500
Nevada	Rainbow trout	40,000		
New York	Spotted catfish			125
	Carp			10,355
	Tench			4,000
	Goldfish			224
	Golden ide			275
	Shad	2,000,000	6,731,000	
	Atlantic salmon	60,000		
	Landlocked salmon	55,000		
	Rainbow trout			900
	Von Behr trout			1,900
	Brook trout			6,015
	Lake trout	300,000	29,000	1,996
	Whitefish	6,000,000	3,800,000	
	Pike perch	5,000,000	1,500,000	
	Black bass			50
	Crappie			150
North Carolina	Carp			1,218
	Tench			150
	Goldfish			227
	Golden ide			100
	Golden tench			86
	Shad		1,640,000	
	Rainbow trout		5,000	4,860
	Rock bass			2,975
	Black bass			1,240
North Dakota	Carp			186
Ohio	Spotted catfish			25
	Carp			810
	Tench			200
	Goldfish			466
	Golden ide			166
	Loch Leven trout			300
	Rainbow trout			300
	Von Behr trout			768
	Lake trout		121,000	2,110
	Whitefish		21,710,000	
	Lake herring		30,005,000	
	Pike perch		153,500,000	
	Yellow perch		70,000	
	Black bass			2,275
	Warmouth bass			50
	Crappie			40
	Sunfish			50
Oklahoma Territory	Carp			510
	Goldfish			12
	Rock bass			100
Oregon	Carp			30
	Quinnat salmon		213,000	
	Black bass			50
Pennsylvania	Carp			720
	Goldfish			838
	Golden ide			115
	Golden tench			18
	Shad	300,000	7,753,000	
	Atlantic salmon	60,000		
	Loch Leven trout			3,000
	Rainbow trout			33,153
	Von Behr trout			1,300
	Brook trout			4,100
	Lake trout			1,500
	Pike perch		5,500,000	
	Yellow perch			50
	Black bass			780
	Rock bass			2,200
	Crappie			67

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Rhode Island	Carp			7
	Goldfish			12
	Shad	669,000	2,350,000	
South Carolina	Carp			304
	Goldfish			117
	Shad		4,055,000	
	Rainbow trout			100
	Black bass			130
	Rock bass			900
South Dakota	Carp			1,910
	Loch Leven trout			2,300
	Black-spotted trout			900
Tennessee	Carp			6,221
	Goldfish			198
	Golden ide			100
	Golden tench			42
	Rainbow trout			11,506
	Black bass			1,606
	Rock bass			800
Texas	Spotted catfish			265
	Carp			1,880
	Tench			5,300
	Goldfish			318
	Golden ide			125
	Rainbow trout			442
	Black bass			882
	Rock bass			800
	Warmouth bass			235
	Crappie			535
Utah	Goldfish			6
	Rainbow trout	10,000		
	Lake trout	100,000		
Vermont	Landlocked salmon			10,076
	Rainbow trout	30,000		
	Von Behr trout	20,000		1,000
	Brook trout	20,000		2,600
	Lake trout	300,000		
Virginia	Spotted catfish			350
	Carp			3,621
	Goldfish			797
	Golden ide			50
	Golden tench			20
	Shad		7,772,000	
	Rainbow trout		10,000	16,398
	Von Behr trout			85
	Brook trout		12,000	69
	Pike			100
	Black bass			1,479
	Rock bass			2,961
	Crappie			50
Washington	Spotted catfish			100
	Carp			280
	Black bass			550
West Virginia	Carp			210
	Goldfish			72
	Rainbow trout			5,895
	Von Behr trout			1,000
	Black bass			1,199
Wisconsin	Carp			30
	Goldfish			100
	Loch Leven trout			2,000
	Rainbow trout			2,300
	Von Behr trout			2,800
	Brook trout	5,000		3,300
	Lake trout		300,000	
	Whitefish		8,000,000	
	Pike perch		3,000,000	
Wyoming	Spotted catfish			25
	Loch Leven trout			1,000
	Rainbow trout	55,500		
	Von Behr trout	15,000		
	Brook trout			4,500
	Black bass			250
Foreign countries	Golden tench			12
	Landlocked salmon	3,000		
	Steelhead trout	25,000		
	Loch Leven trout	25,000		
	Rainbow trout	102,000		
	Von Behr trout	20,000		
	Brook trout	43,000		

REPORT UPON THE INQUIRY RESPECTING FOOD-FISHES AND THE FISHING-GROUNDS.

By Richard Rathbun, *Assistant in Charge.*

FUR-SEAL INVESTIGATIONS.

In accordance with a provision of the sundry civil appropriation bill approved March 3, 1893, it was made incumbent upon the Fish Commissioner to continue, under the direction of the Secretary of the Treasury, the annual investigations relative to the conditions of seal life on the Pribilof Islands, which had then been carried on during three seasons; and the Commissioner was also charged with the conduct of further observations respecting the life-history and pelagic habits of the fur-seals. The first of the present series of inquiries on the Pribilof Islands was made during the summer of 1890 by Mr. Henry W. Elliott, a special agent of the Treasury Department, appointed under an act of Congress dated April 5 of that year, which provided for a thorough examination into the status of the fur-seal industry on the seal islands of Alaska, so as to make known its relative condition then as compared with 1872. A novel and important feature of Mr. Elliott's work was the construction of a series of maps showing the precise outlines of each of the breeding and hauling grounds. In 1891, and again in 1892, in connection with the preparation of the case of the United States for the Paris tribunal of arbitration, Mr. J. Stanley-Brown, also acting as a special Treasury agent, conducted corresponding observations, including the delineation of rookery areas occupied by seals, for the convenience of which purpose a set of base maps was prepared and lithographed. An innovation on the part of Mr. Stanley-Brown was the photographing of characteristic parts of each of the rookeries, in order to illustrate graphically the distribution and abundance of the seals upon them.

The summer of 1892 was the last preceding the meeting of the Paris tribunal, and the object in still further continuing the examinations was to provide for maintaining a record of all subsequent changes in the condition of the rookeries, especially under the operations of the Paris award, which had not, however, at that date been concluded. It was, therefore, made a part of the mission of the steamer *Albatross* to repeat the observations of Messrs. Elliott and Stanley-Brown, the naturalist of the steamer, Mr. C. H. Townsend, who had had considerable previous experience with the matter, being specially charged with the conduct of this work. He was stationed at the islands from July 11 to August 18, 1893, and was assisted in the photographic work by

Mr. N. B. Miller. The delineation of the rookeries and the taking of the photographs were all accomplished during the period when seal life was most abundantly represented on the islands—that is to say, when the rookeries had reached their maximum development for the season and before the females had begun their search for food. The views, 46 in number, were taken from the same positions as in 1892, and, so far as the weather permitted, at corresponding dates. The observations related mainly to the abundance of seals as compared with the previous season, the number of bachelor seals available for killing, the effects of long-distance drives and of culling, and the results to be expected from a continuance of pelagic sealing. In accordance with the law, the report of Mr. Townsend was transmitted to the Secretary of the Treasury.

The experience of the *Albatross* in previous years, as well as in 1893, has demonstrated that the pelagic habits of the seals can not be satisfactorily studied by means of so large a vessel, if by a steamer at all, about the only opportunities afforded for examining specimens being on the few occasions when a sealing schooner is boarded. To obviate this difficulty during the season of 1894, arrangements were made before the close of the fiscal year to have Mr. A. B. Alexander accompany one of the vessels actually engaged in pelagic sealing during the open period in the Bering Sea—that is to say, after August 1. The importance of such an undertaking will consist in the advantages to be gained from expert evidence in respect to several of the questions which have given rise to controversy, such as the proportions of each sex found at a distance from the islands, the breeding condition of the females there taken, the feeding habits of the seals, the character of their food, etc.

OPERATIONS OF THE STEAMER ALBATROSS IN THE NORTH PACIFIC OCEAN AND BERING SEA.

During the summer of 1893 the steamer *Albatross*, Commander Z. L. Tanner, U. S. N., commanding, was attached to the sealing patrol fleet operating in the North Pacific Ocean and Bering Sea under the orders of the Secretary of the Navy. Her instructions also provided for the customary fishery investigations and for those relating to the pelagic habits of the fur-seal, as directed by Congress, which were to be carried on to the extent permitted by the requirements of this special detail. Through the cooperation of the senior naval officer in charge, a considerable amount of time was allotted to these inquiries, but they were necessarily restricted to that part of Bering Sea within the limits of possible pelagic sealing.

Leaving Port Townsend, Wash., on May 24, 1893, the *Albatross* followed along the course taken by the seal herds and the sealing fleet as far as Unalaska, whence she proceeded by way of Bering Sea and Amukta Pass to Adak Island, of the Aleutian chain, arriving at the latter place on July 1, the beginning of the fiscal year. The object of visiting Adak Island was to learn if one of its harbors, the Bay of Waterfalls, was being used as a rendezvous by pelagic sealers and although no vessels were found there at the time, there were indications that it had been so utilized earlier in the season. After making an examination of the harbor, a line of soundings was carried southeasterly to latitude 50° 03′ N., longitude 174° 30′ W., in order to ascertain if the deep submarine trough occurring to the eastward and running approximately parallel with the trend of the Alaska Peninsula and Aleutian Islands extended to this point. A maximum depth of 4,002 fathoms was found in latitude 50° 28′ N., longitude 175° 10′ W., and only 2,802 fathoms at the end of the line, the depression being again crossed in 3,794 fathoms on the way back to Amukta Pass, thus demonstrating the existence of the trough in this vicinity. The beam trawl was used in Amukta Pass, whence a line of soundings was run to the Pribilof Islands, which were reached on July 10. Mr. C. H. Townsend, accompanied by Mr. N. B. Miller, was at once landed to begin upon the work of delineating and photographing the rookeries, as elsewhere explained, this task not being finally completed until August 18.

Until near the end of July the movements of the *Albatross* were governed chiefly by patrol duty and by the necessity of rendering incidental assistance in connection with the party on the islands, but some fishery and hydrographic inquiries were conducted, more especially to the northwestward of the Pribilofs. Before the close of the month, however, the investigations were taken up on a more comprehensive basis, and they were continued systematically until September 3, although patrol service remained a necessary adjunct of the work. The plan as carried out provided for regular series of observing stations along 13 lines equally distant from one another and radiating from a common center located midway between St. Paul and St. George islands. The length of each of these lines or radii was 225 miles, the area covered being, therefore, circular in shape and 450 miles in diameter; it extended a considerable distance beyond the border of the shallow platform to the south, east, and southeast of the islands, but the bulk of the work was done inside of the 100-fathom curve, which practically marks the outer limit of profitable fishing-grounds.

The inquiries comprised the customary examinations respecting the depth and temperature of the water; the character, condition, and richness of the bottom; the food-fishes of the region, their distribution, abundance, size, quality, etc., and the additional ones relating to the fur-seal. It was found to be impossible, however, to obtain satisfactory results in respect to the pelagic habits of the seal, which, quickly alarmed at the approach of any object, is especially distrustful of a steamer under way, and the most that could be accomplished was to record the positions of those noticed from the deck. Under the circumstances, therefore, it was not considered expedient for the ship to deviate from the regular courses laid out in connection with the fishery work, and the number of seals observed was undoubtedly much smaller than would have been the case had they been hunted for persistently. Seals were seen along 11 of the 13 radiating lines, the most distant positions being from 180 to 200 miles from the Pribilof Islands in northeasterly, northwesterly, southwesterly, and southerly directions. With respect to their feeding-grounds in August, Commander Tanner makes the following remarks:

The 100-fathom curve from the one hundred and seventieth to the one hundred and seventy-fourth meridian is a favorite feeding-ground, where scattered seals were frequently observed from the decks of the vessel, a sure indication that it would have been a prolific hunting-ground had we hove to and sent out boats. Next to this region, the largest numbers were observed near the northern extremity of radial No. V, and it soon became evident that the August feeding-grounds were to the westward of the meridian of the Pribilof Islands. Earlier in the season they would doubtless have been found in greater numbers east of that meridian, where their food, composed largely of codfish, would still abound in the shoaler waters of eastern Bering Sea.

The restriction of the fishery work to a period of scarcely more than a month's duration made it necessary to so hasten its progress that the fishing trials could not, in most cases, be conducted with sufficient thoroughness to satisfactorily demonstrate the productiveness of the different grounds examined. Notwithstanding this fact, however, the results obtained have enabled Commander Tanner to reach certain conclusions which it is important to note in this connection. So far as known at present, Baird Bank and Slime Bank, in Bristol Bay, described in previous reports, afford the only profitable cod fishing in Bering Sea on a commercial basis, although this species has also been taken to a slight extent on the Kulukak Ground and is sufficiently abundant along the shores of the Aleutian Islands to supply the local demand. With respect to other parts of the sea, Commander Tanner makes the following statement:

Banks have been reported in various parts of Bering Sea, but we have no data at present that would justify a fisherman in visiting them as a commercial venture. A vessel can anchor anywhere inside of the 100-fathom line and by persistent fishing take enough to "fill the decks," to use a common expression, where a mess for all hands has been caught. The same may be done in calm, smooth weather, when the ship is lying dead in the water, yet the locality might be worthless commercially; and, in fact, such is the case over the greater portion of Bering Sea. The search for cod in paying quantities would be confined to spots where the bottom is free from mud, and a glance at the chart will show the prescribed areas where success would be probable.

First, a stretch of 60 miles or more will be observed ESE. (mag.) of St. George Island, in from 70 to 80 fathoms, coarse sand and gravel, and fine dark sand, near the 100-fathom curve. Another spot having favorable indications lies about 50 miles NE. by N. (mag.) from the island, in 40 fathoms, gray sand and rocky, and fine gray sand. A region of considerable area, having promising features, lies from 180 to 200 miles NE. (mag.) of St. Paul Island in from 20 to 30 fathoms, fine gray sand and shells. A spot about 42 miles N. by W. ½ W. (mag.) from northeast point of St. Paul Island has been reported as a bank, and has favorable indications, in about 40 fathoms, sand and gravel. There are other places between the above spot and Nunivak where a certain degree of success might be expected, although our examination did not develop a particularly rich fauna. There is also a region near the 100-fathom curve, in from 70 to 90 fathoms, fine gray sand and rocky bottom, lying from W. by S. to SW. by W. (mag.) of St. Paul Island, which promises well, although the depth is greater than fishermen are in the habit of resorting to in this region.

The report of the fishery expert, Mr. A. B. Alexander, gives the experience of this vessel in fishing with hand lines from the rail, but in considering the results it must be remembered that the vessel was always under way, frequently drifting rapidly before boisterous winds and heavy seas. The duration of trials never exceeded 20 minutes, and other work was frequently carried on when line fishing was impracticable; hence some of the most favorable localities escaped a fair trial with hook and line.

It is reasonable to suppose that the presence of cod varies with the seasons in the shoal waters of Bering Sea, as in other localities, and that they will be found in greater depths as summer approaches. The *Albatross* has never taken halibut in any considerable quantities in Bering Sea, and none of large size. The conditions under which trial lines have been used were particularly unfavorable for the capture of this slow-biting fish. Trawl lines set on favorable bottom near the 100-fathom line would be an interesting experiment, from which good results might be expected to follow.

Incidental to the specific objects of the cruise in Bering Sea, attention was also given, as heretofore, whenever the opportunity offered, to the requirements of navigation, in the direction of perfecting the information relative to harbors, coast lines, the passes between the islands, etc. In view of the dangers attending navigation in this region and the limited surveys hitherto made there, this work can not fail to be of great practical benefit, especially considering the number of vessels which now assemble in Bering Sea every season in connection with the fur-seal fishery. With respect to the principal harbor, located at the entrance to the sea, Commander Tanner summarizes his results as follows:

Great difficulty has frequently been experienced in making Unalaska in thick weather in the absence of soundings, and we have from time to time run lines from the 100-fathom curve to Unalaska Bay, which were supplemented after our departure from Unalaska by a line from Priest Rock, off Kalekhta Point, to the north head of Akutan, and thence to Akun, the route usually followed by steamers between Unimak Pass and Unalaska. These soundings, with others we have made in the vicinity of the Fox Islands, will, when plotted on a chart of large scale, greatly assist the navigator, inasmuch as it will make the lead available.

The work in Bering Sea terminated early in September, and on the 9th of that month the *Albatross* left Unalaska bound south. In accordance with the directions of the senior naval officer, a course was first laid along the south side of the Alaska Peninsula as far as Kadiak for the purpose of intercepting, if possible, certain vessels for violation of the hunting regulations. From off Cape Greville, Kadiak, soundings were made to the vicinity of Cape Edgecumbe, Baranof Island, with the object of investigating the circumstances connected with a reported discoloration of the water in the neighborhood of latitude 57° 16′ N., longitude 143° 11′ W., but only deep water and normal conditions were discovered along all parts of the line. Sitka was reached September 17, Port Townsend on the 24th, and the Mare Island navy-yard on the 30th. The control of the movements of the ship by the Navy Department was relinquished on October 16, but the work of repairing and refitting detained her at the navy-yard until the end of the calendar year.

As the appropriation would not permit continuous operations during the winter, the *Albatross* was ordered to San Diego, where a survey of the bay was considered desirable, and where the health of the crew could best be assured. She reached that locality on January 4, 1894, and remained there until March 27, the examination of the bay being conducted by Mr. N. B. Miller, under the direction of Commander Tanner, and relating to its general fishery resources and its advantages for oyster cultivation. Returning to the Mare Island navy-yard the last of March, Mr. Townsend and Mr. Alexander were dispatched to the Puget Sound region to make inquiries respecting the character and conditions of the sea and salmon fisheries adjacent to the international boundary line in the interest of the joint investigation elsewhere described. On April 11 the ship was again placed under the orders of the Secretary of the Navy for detail to sealing patrol service during the season of 1895, and on April 19 she reached Port Townsend, the first rendezvous of the fleet. Nearly a month was spent in this region, such time as could be spared being given to cooperating with Messrs. Townsend and Alexander in the local inquiries above referred to.

Commander Tanner relinquished his command on May 1, being succeeded by Lieut. Commander F. J. Drake, U. S. N., and on May 17 the *Albatross* proceeded north in company with the flagship, the U. S. S. *Mohican*. The course was first to Unalaska, and thence to Attu Island, at the western end of the Aleutian chain, where Lieutenant Jacobs, United States Revenue Marine, was landed. Returning eastward, an outlook was maintained for the purpose of intercepting any sealing schooners which might approach from the westward with the intention of entering Bering Sea. Stops were made at the islands of Agattu, Kyska, and Atka, and the fishing-grounds in their vicinity were hastily examined. The latter part of June was occupied in patrol duty and in conducting observations relative to the distribution and pelagic habits of the fur-seal to the eastward and the southeastward of the Pribilof Islands, fishing trials being also made in the same connection. The instructions for 1895 contemplated the same combination of fishery and sealing work that had been carried on the previous season.

During the year the *Albatross* had been at sea 138 days, and had steamed 17,269 miles. The number of fishing and dredging stations occupied was 223, and of hydrographic stations 259. The civilian scientific staff consisted of Mr. C. H. Townsend, naturalist; Mr. A. B. Alexander, fishery expert; and Mr. N. B. Miller, laboratory assistant. Mention should also be made of Mr. H. C. Fassett, the captain's clerk, for his efficient services in preparing the charts illustrating the results of the investigations.

The retirement from active service with the Fish Commission, near the close of the fiscal year, of Commander Z. L. Tanner, U. S. N., has been the cause of deep regret, to which the writer ventures to give expression in this connection. Illness, following an attack of grip, made it imprudent for him to risk the exposure or assume the arduous duties attendant upon a northern cruise during the summer of 1894, and hence the action taken, at his own request. Commander Tanner was first assigned to duty with the Fish Commission as in charge of the temporary dredging steamer *Speedwell* in 1879, which led to his being selected by Professor Baird to supervise the planning and construction, first, of the steamer *Fish Hawk*, and, later, of the steamer *Albatross*, each of which he commanded in succession. The exceptional advantages afforded by these two vessels for marine investigations have, through his energetic and appreciative cooperation, been utilized to the greatest possible extent, the appliances for research have been developed and perfected to a degree not elsewhere approached, and the results accomplished in the lines both of fishery and of deep-sea exploration have greatly surpassed those by any other nation. After an experience of nine years on the Atlantic coast, during which his work extended from Newfoundland to South America, he was especially qualified to enter the comparatively unknown region of the North Pacific Ocean and Bering Sea, with which his name will ever remain associated as the earliest practical exponent of its fishing-grounds and fishery resources. Commander Tanner has in course of preparation an important paper descriptive of the methods of investigation employed on board the *Albatross* and of the history of their development.

JOINT INVESTIGATION OF FISHERIES IN WATERS CONTIGUOUS TO CANADA AND THE UNITED STATES.

On December 6, 1892, an agreement was entered into between Great Britain and the United States for the investigation, by a joint commission of two experts, of the fisheries prosecuted in the territorial and contiguous waters of Canada and the United States, with the object of determining the regulations, practices, and restrictions proper to be adopted in concert for their preservation. The provisions of this agreement, the subjects and territory comprised within the scope of the inquiry, and the work accomplished to the end of the fiscal year 1892–93 were explained in the last annual report. At the close of that year the two representatives, Dr. William Wakeham on the part of Great Britain and Mr. Richard Rathbun on the part of the United States, were at Eastport, Me., having made a rapid reconnoissance of the mackerel fishery northward from New York City. Mr. R. Venning, of the department of marine and fisheries of Canada, accompanied Dr. Wakeham until July 8, and Dr. Hugh M. Smith, of the United States Fish Commission, acted in conjunction with Mr. Rathbun until July 21.

During a large part of July the Commission was engaged in investigating the mackerel in the Gulf of St. Lawrence, having the use for that purpose of the Canadian fishery cruiser *Acadia*, Capt. O. G. V. Spain commanding, by which means all the principal fishing centers were visited in rapid succession, the movements and spawning habits of the fish being studied, and many fishermen interrogated respecting the abundance of the species and condition of the fishery. Returning again to Eastport, Me., a temporary laboratory was established there to provide the means for studying the marine and especially the herring fisheries of Passamaquoddy Bay and adjacent waters. The *Fish Hawk* was detailed to the region to assist in the work, which was carried on by Mr. H. F. Moore, of the University of Pennsylvania, and Mr. W. C. Kendall and Mr. B. L. Hardin, of the Fish Commission. This party continued its inquiries into November, making observations also respecting the fresh-water fishes in the upper St. Croix River.

By the end of July the members of the Commission had begun the examination of the St. Croix and St. John river basins, which are contiguous to Maine on the one side and to New Brunswick and Quebec on the other. Attention was first paid to the St. Croix River, including the main stream and its two branch systems, together with the interesting chain of lakes which constitute the most conspicuous features of the latter. An important part of this investigation was the survey, by the steamer *Fish Hawk*, under Lieut. Robert Platt, U. S. N., of the extensive beds of sawdust which encumber the upper tidal channel of the river from near the "Ledge" to the Calais–St. Stephen bridge.

The St. John River was next taken up, and all important places along its course were visited from the Bay of Fundy at its mouth to the St. Francis River in the upper part of the main valley. Examinations were also made of the Aroostook and Meduxnikeag rivers, the two most important western tributaries of the lower basin lying chiefly in the State of Maine and formerly resorted to by many salmon. This species is the principal one of international concern in both the St. John and St. Croix rivers, in which its numbers have been greatly reduced through the building of dams and the polluting and obstructing influences of factory refuse, although excessive fishing may also have been partly responsible for this result.

After completing the work on the Maine border Dr. Wakeham and Mr. Rathbun proceeded to the upper part of the St. Lawrence River, where they began the examination of the basin of the Great Lakes, their investigations extending westward along the northern sides of Lake Ontario and Lake Erie as far as the Detroit River, where the season's field work was completed about the middle of October.

During November sessions of the Commission were held at Gloucester, Mass., Portland and Eastport, Me., where the testimony of many mackerel and other fishermen was obtained and recorded stenographically. Dr. Hugh M. Smith was present at Gloucester and took part in the examinations.

In the spring of 1894 arrangements were completed for a thorough study, during the succeeding summer and fall, of the natural history of the fishes and the methods and statistics of the fisheries throughout the boundary waters of the chain of the Great Lakes and adjacent regions. The statistical inquiries were to be under the direction of Dr. Hugh M. Smith, the natural-history topics and the relations of the fishes to the different methods of capture employed being assigned to several parties, as follows: Lakes Ontario, Champlain, and Memphremagog, and the upper St. Lawrence River to B. W. Evermann and R. R. Gurley, of the Fish Commission, Barton A. Bean, of the National Museum, and R. H. Hinckley, of Bowdoin College; Lake Erie and Lake

St. Clair to H. F. Moore, B. L. Hardin, and Cloud. Rutter; Lake Huron to J. T. Scovell and D. C. Ridgely, of Indiana; Lake Superior and Lake of the Woods to A. J. Woolman, of Duluth, Minn. Work was begun on Lakes Ontario, Erie, and Huron early in June, Mr. Rathbun also spending some time with the party on Lake Erie during that month, and taking the field for the season just before the close of the fiscal year.

OYSTER INQUIRIES.

MOBILE BAY AND MISSISSIPPI SOUND, ALABAMA.

During February and March, 1894, a survey of the oyster beds of Mobile Bay and Mississippi Sound, Alabama, was made by Mr. Homer P. Ritter, assistant, United States Coast and Geodetic Survey, who had been specially detailed for that purpose, and who was assisted by Mr. W. F. Hill, of the Fish Commission, and Mate James A. Smith, U. S. N., of the steamer *Fish Hawk*. A small steamer, suitably equipped, belonging at Mobile, was employed for the use of the party. The limited time available for the inquiry prevented its being made as exhaustive as will eventually be desirable, but the work was executed in a methodical and thoroughly reliable manner, and, within the limits of the bay, is supposed to have been sufficiently comprehensive in scope to meet the present requirements of oyster fishermen of the region.

The principal object of the investigation, as stated in the instructions, was to determine the positions, outlines, characteristics, and richness of the different oyster beds, and the location and extent of all areas of bottom which appear to be suitable for oyster-planting, either in their natural condition or after preparation. During the period when the survey was in progress extensive freshets prevailed in the neighboring region, causing the bay to become nearly filled with fresh water, which extended far out into Mississippi Sound. The densities were therefore again observed by Mr. Ritter in the following December, when more normal conditions were found to exist. In his report,[1] which is accompanied by a large chart, showing graphically the results accomplished, Mr. Ritter states:

> The investigations were confined principally to the waters of Mobile Bay and the eastern end of Mississippi Sound. The location and extent of the natural oyster beds are shown, as is also the density of the water in the different parts of the bay, showing what it was during a heavy freshet and also after the succeeding protracted drought. The depth of water and nature of the bottom are also indicated wherever examined. * * * From the most reliable information we could gather, and which is borne out by our investigations, the northern limit for oyster growth in Mobile Bay is a line extending from Fowl River on the west to Great Point Clear on the east. The location of the oyster beds as shown on the chart indicates that in the bay the greater part of the natural oyster beds lies between the 6-foot and 12-foot curves. From all the information we could obtain the local impression seems to be that few if any oyster beds exist beyond the 12-foot curve.

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[1] Report on a Reconnoissance of the Oyster Beds of Mobile Bay and Mississippi Sound, Alabama, by Homer P. Ritter, assistant, U. S. Coast and Geodetic Survey, Bull. U. S. Fish Com., xv, for 1895, pp. 325-339, pls. 56-63.

The total acreage of the reefs surveyed on the east side of the bay was less than 500 acres, but the oysters are generally large and of fine quality. The known reefs are few, of small size, and considerably depleted, owing doubtless to excessive fishing. Oyster planting is carried on to quite an extent in the southeastern part of this side of the bay, especially in and around the mouth of Bon Secours River and in Oyster Bay. The natural oyster-grounds are more extensive on the west side of the bay, the beds are larger, and at present are in a more flourishing condition. They seem to lie more in the pathway of the fresh waters coming from the large tributaries at the head of the bay, which may produce a more abundant supply of food, although at times these fresh waters may be a source of danger if too long continued. The total area of natural reefs surveyed on this side of the bay was 2,245 acres.

Only a few days could be given to the examination of Mississippi Sound, which for a distance of 15 miles east and west belongs within the State of Alabama, and detailed observations were, therefore, impossible. This territory merits further attention at an early date, its advantages for oyster cultivation suggesting the utility of a careful investigation. The water area embraced within the State, north of a line extending due west from the western end of Grant Pass, is roughly estimated at 35,000 acres, two-thirds of which has less than 6 feet of depth, and the remaining one-third averaging less than 9 feet. That much of that area may be considered suitable for oyster cultivation is borne out by the circumstances that oysters are growing in all parts of it. There may also be added to it no less than 10,000 acres of marsh, which if the occasion should demand might with a comparatively slight outlay for dredging be changed into canals or basins for oyster purposes. Little is known of the southern part of the sound, in which the water is of greater depth.

BEAUFORT, N. C.

During the late spring and early summer of 1894 observations and experiments relating to the oyster were carried on at Beaufort, N. C., by Mr. C. P. Sigerfoos, of Johns Hopkins University, under the immediate direction of Dr. W. K. Brooks. The plan contemplated the utilization of a tract of tide-water marsh land on the Government reservation at Fort Macon, by the damming of one of the creeks flowing through it, in order to control the supply of water as desired and to test its nutrient value to the oyster. Unfortunately these arrangements could not be perfected, owing to the lateness of the season when the work began, but other experiments respecting the feeding of the species were conducted on a smaller scale and with significant results.

Although a complete report upon the investigation has not yet been submitted, it may be said that noteworthy progress was made in the attempt to rear oysters from the egg, a subject to which Dr. Brooks has given much attention, but not to the extent of entirely overcoming the difficulties previously existing in that respect. In connection with all former experiments it had been impossible to discover any food suited to the larval oysters, or any means of renewing the water without losing the latter, owing to their small size, and they soon ceased to grow, dying of starvation. Mr. Sigerfoos was successful in devising a partially satisfactory method for replenishing the water and in finding that the young will feed voraciously upon a certain kind of alga after it has been finely powdered in a mortar. Under this treatment they grew rapidly for some time and large quantities were carried in good health past the stage where the former experiments met with failure, but after a while the remains of the powdered algæ, which were so minute that no way of getting rid of them could be found, caused the water to become vitiated with the inevitable result of destroying the larvæ. It is intended to continue these studies at a future time. A good series of the young attached oysters of all stages from one hour up to maturity were obtained and preserved for examination.

Mr. Sigerfoos also began upon a study of the shipworm (which is quite abundant in this region) from both a scientific and practical standpoint, securing material for a complete life-history of three species. It is expected that important results will be obtained, suggestive of more effective methods of protecting submerged timber against its inroads than are now recognized. A full report upon the subject is in course of preparation; a short preliminary paper on the development of the several forms observed has been published.[1]

INQUIRIES RESPECTING THE MACKEREL, MENHADEN, ETC.

MACKEREL.

The investigations respecting the habits and abundance of the mackerel and the fisheries to which this important species gives rise were continued again this year upon the same general plan as in 1893, but on a more elaborate scale and during a greater part of the season. The schooner *Grampus* and steamer *Fish Hawk* were both utilized in connection with this inquiry, and several land parties were employed to study the subject from the standpoint of the inshore fisheries along the entire coast covered by the range of the species. The information sought to be obtained from this series of observations was desired for the use of the Joint International Commission, as elsewhere explained, and the practical importance to the American fishermen of reaching a more complete and definite understanding of all the circumstances connected with the natural history of the mackerel, in relation to the several methods employed for their capture, has long been acknowledged.

Until this work was started by the Fish Commission a few years ago, most of the facts at hand were such as had been obtained incidentally, and it is only within a year or two that the matter has been taken hold of in the systematic and comprehensive manner which it deserves. The

[1] The Pholadidæ; note on the early stages of development. By C. P. Sigerfoos, Johns Hopkins University Circulars, XIV, No. 119, June, 1895, pp. 78, 79.

mackerel fishery has long been the subject of a vigorous controversy, both domestic and international. Each year the same phases are repeated; the fish first appear off our coast above Cape Hatteras, whence they spread rather rapidly toward the north and east as far as Labrador, giving rise to one of the most active and persistent fisheries of the world. Their abundance, within the scope of observation of the fishermen, varies from year to year, and at times the fluctuations are very great, periods of plenty of greater or less duration being followed by others of scant supply, bringing consternation to those whose fortunes are mainly linked with this species.

The improvement of methods for the capture of mackerel has kept pace with the steady development in other lines of industry until it would appear as though the limit of perfection had practically been reached. One of the most important questions of the day is whether, as some affirm, the modern devices are proving too destructive and are causing a depletion, in view of the lessened catch during several years past. To those who are at all acquainted with the history and character of the mackerel fishery, it will be evident that this question can not be answered offhand, and that the published observations respecting the natural history of the mackerel do not meet the requirements of a thorough consideration of the matter. To supply this desideratum so far as possible, has been the object of the inquiries now in progress.

These inquiries have been directed so as to cover at least the more essential features in the history of the mackerel during that part of each season when their presence along the coast becomes apparent through their surface distribution, the only period when they can be fished for. It has been attempted to trace their movements and all the principal circumstances connected therewith from the time of their first appearance in the spring until cold weather causes their return to winter quarters; to learn the extent and relations of the schools, the conditions which accelerate or retard their progress, and the factors which influence their swimming at different depths, whereby the great body of the fish may travel long distances unobserved; to settle definitely their spawning-places and seasons and their habits in that connection; to ascertain the effect upon the schools of the different fishing methods apart from the simple question of the quantity of fish so captured; and from the data thus secured, as well as from statistics of the catch, to determine, so far as possible, if the stock is being decimated and the causes which may be directly responsible therefor.

The schooner *Grampus* started south from Gloucester, Mass., on April 7, to repeat the customary examinations on the southern grounds during the early spring season, but heavy gales retarded her movements in the beginning, as well as interfered with the operations of the fishing vessels. Lewes, Del., was made the headquarters from April 20 to May 10, but the *Grampus* remained constantly with or in the neighborhood of the fleet, as the best means of keeping track of the schools of fish, making a careful series of physical observations at hourly intervals, towing for mackerel food, and recording all facts obtainable from the fishing captains or by personal observations respecting the positions of the schools each day, their extent, movements, depth, the abundance, size, and condition of the fish, etc. From the extreme south the *Grampus* followed the main body of the fish to the region off New York, and thence proceeded eastward over Georges Bank to Cape Sable and the Nova Scotia coast. Here the mackerel were studied during their progress to the Gulf of St. Lawrence as far as Cape North, stops being made at Shelburne, Liverpool, Beaver Harbor, and North Sidney, in search of such information as could be gained from the local fisheries in the neighborhood of those places.

On June 13, the main part of the down run of mackerel having ended and the spring season closed on the cape shore, the *Grampus* left North Sidney and returned to Gloucester, first passing around the north side of Cape Breton and through the Gut of Canso, in quest of further data. Gloucester was reached on June 25, and the remainder of the month was spent in preparations for a summer cruise on the mackerel grounds in the Gulf of Maine. This work was in charge of Mr. E. E. Hahn, master of the *Grampus*, with Mr. W. C. Kendall as naturalist.

Mr. B. L. Hardin was stationed again this year at Fulton Market, New York City, from April 21 to the last of May, his observations being mainly supplemental to those conducted on board the schooner *Grampus* and directed chiefly toward completing the records bearing upon the early offshore fishery. Every fare landed by the purse-seiners from the southern grounds, as well as all specimens received from the shore fisheries tributary to New York, were inspected by Mr. Hardin, and everything that could be learned relating to their capture and conditions was fully noted. Convenient office and laboratory accommodations were supplied gratuitously by Hon. E. G. Blackford, through whom and the other prominent fish-dealers of the city, Mr. Hardin was afforded the fullest opportunity for the successful prosecution of his inquiries.

Mr. H. F. Moore, of the University of Pennsylvania, was detailed to the study of the shore fisheries from their southern limit at Virginia Beach, Va., to Rhode Island. His work was begun at the south at the commencement of the season, and was carried northward, all of the principal fishing centers being visited, the fishermen interrogated, specimens examined wherever possible, and blanks left to be filled in with daily records of the catch. In this manner a very complete account was secured of the shore relations of the mackerel during the period of their early movements, a subject which had not hitherto been given much attention.

Dr. W. E. Wolhaupter was given the section of coast from Rhode Island to the outer side of Cape Cod, including the important spawning and hooking grounds between Block Island and Nomans Land, and the extensive trap-net fisheries of Vineyard and Nantucket sounds.

The steamer *Fish Hawk* also assisted in the work here during a part of June. The region between Cape Cod and the Bay of Fundy, including the coast waters of Massachusetts, New Hampshire, and Maine, and the Gulf of Maine, was assigned to Capt. A. C. Adams, formerly in command of the schooner *Grampus*, and having a long experience in connection with the mackerel fishery. His inquiries were started at Provincetown on Cape Cod, about the middle of May, and were thence extended along the shores of Massachusetts Bay, Cape Ann, and the coast farther north to Portland, where he was joined by the steamer *Fish Hawk* and Dr. Wolhaupter in the latter part of June. By the close of the year the examination had been carried as far east as Boothbay Harbor.

MENHADEN.

From the 1st of March to early in May, 1894, the steamer *Fish Hawk*, Lieut. Robert Platt, U. S. N., commanding, was stationed in the lower Chesapeake Bay investigating the spawning and other habits of the menhaden and making observations respecting the natural history of the other economic fishes of the region, and the fisheries to which they give rise. Mr. W. C. Kendall was on duty as naturalist during the first part of the season, being succeeded later by Dr. W. E. Wolhaupter. The collecting work was carried on by means of seines, fyke nets, gill nets, and the beam trawl, and specimens were obtained from the fishermen wherever possible. In this manner much important information was secured relative to the life-history, distribution, seasons, food, spawning characteristics, etc., of several species. Physical observations relating more especially to the temperature and density of the water were also conducted at frequent intervals during the entire cruise.

The fact seems to have been quite conclusively established, through recent observations, that the menhaden resort to shallow, protected coastal waters, such as bays, inlets, and the lower parts of rivers and creeks, for spawning purposes, and that the young remain for a considerable length of time in the same or similar situations, but persistent investigations have failed to discover the mature fish in the act of breeding. A few specimens have been secured from time to time containing ripe eggs or ripe milt, but ripe individuals of both sexes have never yet been taken together, thus precluding the fertilization and hatching of the spawn artificially, whereby the conditions necessary to that process could positively be ascertained. The *Fish Hawk* was again unsuccessful in regard to the matter this spring, but many interesting observations on the young of different stages and on the adult fish were obtained, and from the evidence supplied by the fishermen and by the condition of the fish it was concluded that the spawning period in the Chesapeake Bay region occurs probably in February or March, or during parts of both of those months.

Mr. Vinal N. Edwards, of the Woods Hole Station, also gave much time during the spring of 1894 to the study of the menhaden question in the region about Buzzards Bay, where that species is known to spawn abundantly, and where Mr. Edwards has conducted extensive inquiries on the subject during several years past.

TILEFISH.

During a part of July and August, 1893, the schooner *Grampus* was employed, under the immediate direction of the Commissioner, in making fishing trials along the margin of the Gulf Stream slope off the coast of southern New England, New York, and New Jersey, for the purpose of determining the present range and abundance of the tilefish, in continuance of the examinations conducted during the past few years, as described in previous reports. A number of specimens, weighing from 7 to 20 pounds apiece, were obtained, and the reestablishment of the species seems to be assured, although it does not appear as yet to have been restored to its old-time abundance.

TEMPERATURE OBSERVATIONS.

The Fish Commission has continued to receive, through the courtesy of the Light-House Board and the Southern Pacific Company, the daily records of water-temperature observations taken at many seacoast and inland stations, as follows:

Temperature stations on the Atlantic Coast.

Stations of the Light-House Board:

- Coast of Maine: Petit Manan Island, Mount Desert Rock, Matinicus Rock, Seguin Island, Boon Island.
- Coast of Massachusetts: Race Point, Pollock Rip light-ship, Great Round Shoal light-ship, Nantucket New South Shoal light-ship, Cross Rip light-ship, Vineyard Sound light-ship.
- Coast of Rhode Island: Brenton Reef light-ship, Block Island southeast light.
- Long Island Sound: Bartlett Reef light-ship, Stratford Shoal light-ship.
- Coast of New Jersey: Absecon Inlet, Five Fathom Bank light-ship.
- Delaware Bay: Fourteen Foot Bank light-ship.
- Coast of Virginia: Winter Quarter Shoal light-ship.
- Chesapeake Bay: Windmill Point, Stingray Point, York Spit.
- Coast of North Carolina: Cape Lookout, Frying Pan Shoal light-ship.
- Coast of South Carolina: Rattlesnake Shoal light-ship, Martins Industry Shoal light-ship.
- Coast of Florida: Fowey Rocks, Carysfort Reef, Dry Tortugas.

Temperature stations on the Pacific Slope.

Stations of the Southern Pacific Company:

- Sacramento River at Tehama and Yolo bridges and Kings Landing, California.
- Feather River at Feather River Bridge, California.
- American River at American River Bridge, California.
- Mokelumne River at Lodi, Cal.
- Tuolumne River at Modesto, Cal.
- San Joaquin River at the upper and lower railroad crossings.
- King River at Kingsburg, Cal.
- Colorado River at Yuma, Ariz.

WOODS HOLE LABORATORY.

The Woods Hole laboratory of the Commission was kept open, as usual, during the summer of 1893. A few investigators arrived there in June, but the largest attendance was during July and August. The laboratory was in charge of Mr. J. Percy Moore, instructor in biology in the University of Pennsylvania. The Commissioner was also present during the most of the season, aiding and advising in the direction of the work, and conducting experiments relative to fish-cultural subjects.

The others in attendance were as follows: Prof. Francis H. Herrick, of Adelbert College; Dr. William Patten, of Dartmouth College; Dr. Bashford Dean, of Columbia University; Dr. John A. Ryder and Mr. H. F. Moore, of the University of Pennsylvania; Dr. E. A. Andrews and Dr. George P. Dreyer, of Johns Hopkins University; Dr. H. V. Wilson, of the University of North Carolina; Dr. Charles B. Davenport, Mr. H. V. Neal, and Mr. Conkling, of Harvard University; Mr. James I. Peck, of Williams College; Prof. D. S. Kellicott, of the University of Ohio; Prof. R. C. Schiedt, of Franklin and Marshall College; Mr. John Y. Graham, of Princeton College; Mr. B. L. Hardin, of the Fish Commission; Miss Elizabeth Cooke, of the University of Chicago; Miss Ida Hyde, of Bryn Mawr College, and Miss M. H. Carter, of Boston.

Of these, Mr. J. Percy Moore, Professor Herrick, Mr. Peck, Dr. Dean, Mr. H. F. Moore, and Mr. Hardin were engaged upon investigations in the interest of the Fish Commission. The remainder were accorded the privilege of the laboratory for carrying on such special biological researches as they desired to undertake on their own account, in accordance with the custom which has prevailed since the establishment of the station by Professor Baird. The presence of such independent workers involves no extra expense upon the Government, and is fully justified both by the private subscriptions from scientific sources which rendered possible the purchase of the land on which the station is located, and by the benefits indirectly derived by the fishing industries from the results of all such inquiries.

The time of Mr. J. Percy Moore was given mainly to the study of the embryology and food of some of the more important market fishes. The station was not opened until after the close of the spawning season of both the menhaden and mackerel in this region, an examination of fresh specimens showing that the season had ended with the former about the middle of June, and with the latter perhaps a week later. From the study of alcohol specimens of menhaden, preserved from day to day by Mr. Edwards during the earlier part of the run, Mr. Moore is led to believe that in the case of that species the greatest spawning activity in the vicinity of Woods Hole occurs between May 15 and June 15, this conclusion agreeing essentially with the results of previous observations by Mr. Edwards on the spawning conditions of the living fish. Inquiries were also made relative to the spawning of other species, to the age or size at which the menhaden, mackerel, and scup first begin to spawn, and to the anatomy of the adult menhaden, of which a number of drawings were made.

The fishes whose food was studied were the mackerel, cod, haddock, hake, scup, sea bass, weakfish, bluefish, and tilefish. Over 1,000 stomachs of the common mackerel (*Scomber scombrus*), besides a small number of the chub mackerel (*Scomber colias*), were examined. The majority were taken in the neighborhood of Woods Hole the latter part of June and during July and August, when the food was found to consist almost exclusively of surface amphipods, copepods, squids, and sand eels (*Ammodytes*), one or other of these forms or groups preponderating according to locality or time. The stomachs of over 200 individuals brought by the schooner *Grampus* from the coast of Nova Scotia, where they had been captured during the spawning season, furnished interesting results in respect to their habits at such times, as their contents consisted chiefly of bottom living animals, many of which were also discovered in the stomachs of cod and haddock taken in the same localities. Although copepods and appendicularia were abundant at the surface at the same time, as proved by the results of surface towings, these forms were detected in only two of the stomachs.

Mr. H. F. Moore and Mr. Hardin assisted in the study of the mackerel, but they remained at the station only a short time, being ordered to other parts of the coast on Fish Commission work.

Professor Herrick continued his researches on the natural history of the lobster, a work begun in 1889, in preparation for the writing of a complete monograph of the species, to include a discussion of all subjects relative to its structural features, life-history, habits, etc., which are important for consideration in connection with its protection and increase by legislative action and by propagation. The drawings for the report, which are being prepared by Professor Herrick himself, are not only noteworthy for their accurate representation of structural details, but they also exhibit a degree of finish and beauty of execution that will make them a popular object lesson in natural-history illustration.

During this season Professor Herrick also visited the principal lobster-fishing centers along the coast of Maine and Massachusetts for the purpose of extending the scope of his observations and of obtaining materials for study from additional localities. With the assistance of Mr. V. N. Edwards, inquiries were also continued at Woods Hole during the winter of 1893–94 and the following spring to determine the entire range of the breeding period of the lobster—that is to say, the time during which the extrusion of the eggs takes place—as well as other important questions respecting its winter habits. A number of lobster traps were kept set continuously, their contents being removed every day and each lobster subjected to a detailed examination, all of the points on which information was desired being carefully noted and recorded.

The studies of Dr. Peck related chiefly to the food and feeding habits of the menhaden, which resort in considerable numbers to the region adjacent to Woods Hole, and his report[1] upon the work accomplished must be given a place in the front rank of biologic-economic contributions, both for the thoroughness with which the subject was treated and the uniqueness of the results. But few specimens of menhaden could be obtained at that season in the open waters, and the majority of those examined were from the smaller bays, brackish-water estuaries, and shallow lagoons. The material secured from those sources was quite sufficient to demonstrate the general character of the food, as well as some of its details, and to illustrate the mechanism by which it is taken. The food of the menhaden consists of the unicellular organisms, both vegetable and animal, which swarm in all surface waters, together with the smaller crustaceans and other free-swimming forms which congregate there.

The presence in a region of the brackish, even almost fresh, waters of broad shallow estuaries and inlets, connecting with the sea only by narrow channels, is very important as affecting the kind and abundance of the various microscopic organisms used by this fish as food. The streams tributary to them also bring down a wealth of fresh-water microorganisms of the most important nature, and salt-water forms are carried in with each tide, giving a new intensity to the struggle. These minute organisms furnish directly the food of the menhaden, not only within the limits of the brackish-water inlets and estuaries where the spawn is left to develop, but also wherever the fish is found in the more open coast waters. The whole food supply of this species is obtained by filtering out from the surface stratum of water the organic life there suspended. The observations of Dr. Peck related to the younger as well as to the adult stages of the fish. After discussing the different groups of organisms which were discovered among its food, he adds:

> Such being, then, the primitive character of the food supply of the menhaden, its economic relations are very important; it arrives first hand at a food supply which is the most stable, the most abundant and widely distributed of all foods, and yet so unavailable to the majority of other species. The wide distribution and vast extent of the schools of this fish testify to this fact, for no matter how many are aggregated together in a given area the food supply is adequate. At the same time the menhaden comes into no competition with the other food-fishes. * * * Not only, therefore, do the menhaden not compete with other fishes for food, but they themselves form an important factor in the food of other fishes, as has been so often observed in the bluefish, bonito, and squeteague; making available through their own life-history favorable conditions upon which the other economic fishes are borne and satisfied, bringing to them directly an elaboration of this primitive food supply here considered.

[1] On the Food of the Menhaden, by James I. Peck, Ph. D., Bull. U. S. Fish Com., XIII, for 1893, pp. 113–126, pls. 1–8.

Dr. Dean, who had carried on successful experiments during the spring respecting the artificial hatching of the sea sturgeon (*Acipenser sturio*) on the Delaware River, continued at Woods Hole the detailed study of the material collected and preserved at that time.

The subjects pursued by the independent investigators were mainly as follows: Dr. Andrews, the anatomy of certain annelids; Dr. Patten, the structure, physiology, and development of the horseshoe-crab; Dr. Schiedt, the anatomy and physiology of the oyster, an interesting conclusion based upon some of his experiments being that the presence of great quantities of minute algæ in the water is unfavorable to the life of oysters, the gills and palpi becoming so clogged as to interfere with the freedom of ciliary action, causing the animals practically to starve because of a superabundance of food; Professor Kellicott, the marine rotifera and infusoria; Dr. Ryder, the habits and life-history of a fresh-water polyp and the bathymetric relations and distribution of the foraminifera; Miss Carter, the micro-organisms affecting the alimentary canal of the mackerel and other fishes, a new field of study of probably great economic importance as well as scientific interest; Miss Hyde, the physiology and mechanism of the respiratory movements of the horseshoe-crab, and the ontogeny of several forms of jelly-fishes; Miss Cooke, the physical factors in the modification of the form and life phenomena of the lower animals; Mr. Graham, the development of the sea bass.

The season's work will result in the preparation for publication of at least 23 papers, all of scientific value and several of great economic importance.

Mr. Vinal N. Edwards, who has been attached to the station at Woods Hole since 1871, has continued his regular natural-history observations throughout the year, keeping a daily record respecting the presence, movements, etc., of the different fishes occurring in the region. In this connection the catches made by the local fishermen are closely examined and seines and other nets are constantly employed by him for this special purpose. Mr. Edwards has also conducted important investigations relative to the mackerel, menhaden, and lobster, as described elsewhere.

The season of 1894 was opened on June 4 by the arrival of Mr. J. Percy Moore, who was again designated to take charge of the laboratory, with instructions to begin upon a special study of the embryology and spawning habits of the common mackerel. Investigations relative to the natural history of the mackerel in connection with the fishery for that species off the southern coast of New England by Dr. Wolhaupter and Mr. Edwards were already in progress at this place, as elsewhere explained. Before the end of June the following additional investigators had also arrived: Mr. W. E. Castle, of Harvard University; Mr. Ulric Dahlgren, of Princeton College; and Mr. N. R. Harrington, of Williams College.

INVESTIGATIONS OF INTERIOR WATERS.

COLUMBIA RIVER BASIN.

The last annual report contains an account of investigations made during the fall of 1892, in accordance with two provisions of the act of Congress approved August 5, 1892, relative to (1) the character and extent of the obstructions to the ascent of salmon in the Clarke Fork of the Columbia River, and (2) the advisability of establishing a hatching station for salmon in the eastern part of the State of Washington. As this work was not completed at that time, it was taken up again during the summer of 1893 by Prof. B. W. Evermann, assisted by Drs. C. H. Gilbert, O. P. Jenkins, and W. W. Thoburn, of Stanford University, and by Mr. C. Rutter, of Long Pine, Nebr.

The primary objects of this inquiry were (1) to ascertain the location and character of all obstructions, natural and artificial, which seriously interfere with the movements of salmon and other important fishes in the principal streams of the Columbia River Basin; (2) to determine the past and present distribution of salmon throughout the basin, as indicating, in a measure, the extent of their depletion; (3) to locate definitely the spawning-grounds of the salmon and ascertain to what extent the species enters the different streams for spawning purposes; (4) to examine all available sites, especially in the State of Washington, with respect to their adaptation for salmon-hatching operations; and (5) to make a general study of the fish fauna of the basin.

In view of the wide extent of the Columbia drainage and the perplexing nature of many of the problems presented by the salmon question in that region, it was found to be impossible to cover the ground in one season as thoroughly as is desirable, or to arrive at more than tentative conclusions respecting the special points on which information is most urgently required. The waters examined were the Snake River at many points and 11 of its tributaries; the Pend d'Oreille River or Clarke Fork, from Albany Falls, Idaho, to the international boundary; the Upper Columbia at Kettle Falls, and the Colville and Spokane rivers; and the Lower Columbia River in numerous localities from Pasco, Wash., to its mouth.

The results of this investigation were embodied in a report to Congress by the Commissioner of Fisheries, under date of May 31, 1894, the same being supplemented by a detailed description by Professors Gilbert and Evermann, of the work accomplished during the seasons of 1892 and 1893.[1] According to the Commissioner:

The area of distribution [of the salmon in the Columbia River Basin] is approximately 90,000 square miles. This immense tract is drained by innumerable streams of clear, cold water, into which the salmon enter for the purpose of spawning and

[1] The Salmon Fisheries of the Columbia River Basin, by Marshall McDonald, United States Commissioner of Fish and Fisheries; including a report upon investigations in the Columbia River Basin, with descriptions of four new species of fishes by Charles H. Gilbert and Barton W. Evermann. First issued August 27, 1894, as Senate Mis. Doc. No. 200, Fifty-third Congress, second session, and reprinted in Bull. U. S. Fish Com., XIV, for 1894, pp. 153-207, pls. 13-25.

up which they ascend till their progress is stopped by falls or other obstructions which they can not surmount. These waters furnish the feeding-grounds of the young salmon during their early life, which is spent in the fresh waters. Their migration seaward does not begin until they are at least a year old and have attained a length of from 8 to 10 inches. These streams are the nurseries of the great salmon fisheries of the Lower Columbia. From each goes out every year a colony more or less numerous, to swell the aggregate of young salmon necessary to repair the waste by natural casualty and by capture. The area of natural distribution has not as yet been very materially abridged. Certain streams, such as the Bruneau and the Boise, have been obstructed by dams near their mouths, but the vast extent of waters still accessible to salmon and affording suitable breeding and feeding grounds indicates that we must look to other causes to explain any ascertained deterioration in the salmon fisheries of the Columbia.

The investigations made by Professor Evermann and the parties under his direction establish conclusively the fact that there has been a very great reduction in the number of salmon frequenting the headwaters of the Columbia River and its tributaries. This decrease is more notable in the main river. * * * There is no reason to doubt—indeed, the fact is beyond question—that the number of salmon now reaching the headwaters of streams in the Columbia River Basin is insignificant in comparison with the number which some years ago annually visited and spawned in these waters. It is further apparent that this decrease is not to be attributed either to the contraction of the area accessible to them or to changed conditions in the waters which would deter the salmon from entering them. We must look to the great commercial fisheries prosecuted in the lower river for an explanation of this decrease, which portends inevitable disaster to these fisheries if the conditions which have brought it about are permitted to continue.

The principal recommendations of the Commissioner are as follows:

The initial step in attempting the restoration of the salmon fishery is to restrict and regulate the net fishing. The restriction that may be put in force with the least hardship to the fishermen is the shortening of the season of net fishing. The use of pounds, gill nets, traps, and seines in the lower river, from the Cascades to the mouth, should be limited strictly to the months of May, June, and July. The wheels should not be permitted to take salmon prior to the middle of May, so as to permit the salmon which have entered the river in April the opportunity to pass up to the headwaters. A further close season for wheels should be established from the 1st of August to the 10th of September, so as to provide for the uninterrupted spawning of the August run of salmon. There does not at present appear sufficient reason to prohibit the wheel fishing during the balance of September and during the month of October. Protection for the salmon which have thus been enabled to reach their spawning-grounds should be afforded by a close season during the months of September and October, covering the streams in Washington, Oregon, and Idaho, to which the salmon resort for breeding.

Should the policy above outlined be adopted by these States and the requisite measures to carry it into effect be enacted and enforced, it will be possible for the United States Fish Commission and the State commissions to greatly enlarge their fish-cultural operations and to prosecute them under much more satisfactory and economical conditions than at present. Until the States interested adopt measures to restrain net fishing, so as to permit a portion at least of the salmon entering the river to pass up to their spawning-grounds, it is not deemed wise or expedient to attempt to increase or extend the work of artificial propagation of the salmon.

The report of Gilbert and Evermann discusses the conditions found at each of the localities visited, the physical and natural-history features, the impediments to the movements of salmon, of which the principal ones are illustrated, and the advantages for fish-cultural operations presented by the waters in different parts of the basin. While good sites for a hatching station occur in the Upper Columbia and on the Snake River and other tributaries, the investigations failed to show that spawning fish could be obtained in sufficient numbers in the neighborhood of any of those visited to make them suitable for that purpose. Their conclusions are as follows:

In summing up the facts brought out by these investigations it may be said, first, that the absence of salmon from the Pend Oreille River is not necessarily due to the presence of falls in that stream, but to other causes, chief among which is the excessive catching of salmon in the Lower Columbia; second, that while it is true that the salmon are shut out by falls and dams from a large area, especially in the Upper Snake River basin, and that these limitations are increasing as the streams become useful for irrigation and mining purposes, it is nevertheless certain that the decrease in the salmon has been even greater, and that the accessible waters suitable for spawning purposes are still more than ample to meet present needs; and, third, that the desirability of establishing another salmon hatchery at some point in the Columbia basin will depend largely upon the nature of the fishery legislation in the States of Washington, Oregon, and Idaho.

It must be understood, however, that our knowledge regarding the present abundance of salmon, their relative abundance as compared with former years, and the location and extent of their spawning-grounds, is of the most general kind. While valuable so far as it goes, the information which we now possess upon these important questions is chiefly useful in indicating the nature of the investigations which must be carried on for several seasons before a thorough understanding of the salmon question can be reached.

The study of the Columbia River was again taken up early in the season of 1894, by Professor Gilbert, who proceeded to Astoria on March 20. Three weeks were spent in the field at that time, chiefly at Astoria and on the fishing-grounds in the lower part of the river, in making observations on the runs of both the quinnat and blueback salmon, but the river was also ascended as far as Lewiston, Idaho, with stops at The Dalles, Riparia, and Starbuck. The work was resumed June 1 by Professor Gilbert, with three assistants from Stanford University, and its scope was extended to include a reconnoissance of the Klamath, Rogue, and Umpqua rivers, for the purpose of determining the relation of their faunas to that of the Sacramento on the south and the Willamette on the north. This inquiry was still in progress at the end of the fiscal year.

IOWA, NEBRASKA, SOUTH DAKOTA, AND WYOMING.

The acts of Congress approved July 28 and August 5, 1892, directed that investigations be conducted respecting the advisability of establishing fish-hatching stations at suitable places in one or more of the States above named. This work was commenced in the fall of 1892 and was completed during the summer and fall of 1893, having been under the immediate direction of Prof. B. W. Evermann. The inquiries were twofold in nature, relating (1) to the physical and natural-history characteristics of the waters of the region, in order to determine their conditions as to the existing fish supply, as well as their suitability for stocking with species not indigenous to them and their requirements in that respect, and (2) to the advantages presented by different localities for fish-cultural operations.

A previous acquaintance with the general hydrographic features of the four States made it possible to restrict the investigations mainly to certain areas in each, outside of which it was evident that little information could be gained that would be of material advantage in reaching the desired results. Most attention was therefore given to the northeastern part of Iowa, the northern and central parts of Nebraska, the southeastern part of South Dakota, and the eastern part of Wyoming, including the Black Hills region in the two States last mentioned.

According to Professor Evermann's report,[1] there is no State west of the Mississippi which has a greater number of excellent fish streams than Iowa. Upon the first settlement of the country these numerous streams teemed with many of the most valuable river fishes, including both species of black bass, the wall-eyed pike, pickerel, white bass, fresh-water drum, channel cat, mud cat, and several species of suckers and sunfishes; while trout were abundant in the clear, cold streams in the northeast part of the State. Many of the streams are still well supplied with these species, and under proper regulations the rivers and lakes of Iowa can be made to yield annually an enormous amount of valuable and nutritious food-supply to the people of that State.

While the Platte and some other rivers of Nebraska are shallow and filled with shifting sands, there are many deep and important streams in which valued food and game fishes abound. The collections made show that this State is not inferior to neighboring States in the variety and abundance of its fish life. Among the food-fishes of most importance are the channel cat, mud cat, buffalo, several species of suckers, sturgeon, the large-mouthed black bass, the wall-eyed pike, and the sauger. In the small lakes in the northern part of the State and in some of the streams the large-mouthed black bass is abundant, and in some of the colder streams, particularly at Long Pine and Bazile Mills, trout were quite plentiful, the plants having been made by the Nebraska Fish Commission.

South Dakota does not differ greatly from Nebraska in its streams and the fishes which they contain. The larger streams in the eastern part of the State and the numerous lakes in the eastern and northeastern portions are well supplied with valuable food-fishes and the amount taken annually from these waters is of no small importance to the people of that State. The half of the State lying west of the Missouri River is but poorly supplied with permanent streams, and many of these are more or less alkaline, and in consequence not inhabited by many species of food-fishes. The numerous species of spiny-rayed fishes, among which are found nearly all of the better game fishes of the Mississippi Valley, are scarcely represented at all in the waters of this State west of the Missouri. The few species there which possess any food value are three species of catfish, a few suckers, and one or

[1] The Fishes of the Missouri River Basin, by Barton W. Evermann, ichthyologist of the U. S. Fish Commission, and Ulysses O. Cox, professor of biology in the Mankato, Minn., State Normal School. Report U. S. Fish Com. 1894, pp. 325–429.

two of the larger species of minnows. This is particularly true of the southwestern part of the State, in which occur the Mauvaises Terres or Bad Lands. The only region in the western half of the State which has really excellent streams is the Black Hills.

The Black Hills constitute a mountain island, with heavy pine forests and clear, cold streams, surrounded on all sides by plains with alkali soil, shallow, uncertain streams, and limited vegetation. All the streams of the Black Hills, unless contaminated by mining operations, are clear, pure, and cold, and well suited to trout, though trout do not occur in any of them naturally.

The streams of Wyoming belong to two very different types. Those of the northwestern and western parts of the State are, in many cases, excellent trout streams. The eastern and southern portions are not well supplied with permanent streams. Many of them dry up into isolated pools during the summer, and all are more or less alkaline. There are no trout in these streams, and other food-fishes are few in species and individuals. The only species in eastern Wyoming that are of any importance as food-fishes are three species of suckers, three of catfish, a few minnows, and the wall-eyed pike, which, however, is of rare occurrence. In Green River, in the southwestern part of the State, are found the large Cyprinoids, characteristic of the Colorado River Basin, and which are of some commercial importance.

The total number of fishes now known from the Missouri River Basin is 140; of these, 42 may be regarded as food-fishes of more or less importance. Some of these are game fishes, but it is the pond and river species whose cultivation will result in the greatest good to the Missouri River States.

The investigations bearing directly upon the selection of hatchery sites included the examination of more than 100 springs, at each of which the temperature, character, and volume of water were determined and the surrounding topographic features were considered with special reference to fish-cultural needs, such as the location of buildings, laying out of ponds, the supplying of water by gravity, railroad facilities, etc. In his report to Congress, transmitted on January 24, 1894,[1] the Commissioner recommended the establishment of only one station to supply the needs of Iowa, South Dakota, and Nebraska, the same to be devoted to the rearing of those species which are indigenous to the waters of the region, with some attention paid to trout, the cultivation of which should be a minor feature in the development of the station. Manchester, Iowa, was subsequently selected for the site as furnishing the best combination of facilities for that purpose. It was furthermore suggested that the station under construction at Bozeman, Mont., would be able to supply the requirements of the State of Wyoming.

Professor Evermann was assisted in this investigation by Prof. U. O. Cox, Mr. Cloudsley Rutter, and Prof. R. G. Gillum.

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[1] Senate Mis. Doc. No. 53, Fifty-third Congress, second session.

TENNESSEE.

In compliance with act of Congress approved August 5, 1892, providing "for investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Tennessee," the necessary inquiries to that end were conducted in September and October, 1893. The observations were limited to the eastern part of the State, as it was known that the conditions required for such a station as was contemplated were most likely to be found there. Many of the streams of that region are suitable for trout, but the majority are better adapted to the various species of pond and river fishes, and eastern Tennessee is especially noteworthy for its numerous large springs. More than 30 of the latter, together with their surroundings, chiefly in the vicinity of Greeneville, Cumberland Gap, Knoxville, Marysville, Athens, Cleveland, and Chattanooga, were examined with reference to their suitability for the purpose in question.

A careful study was also made of a number of streams in the same region with respect to their character and volume, the physical features of the adjacent country, and the abundance and distribution of their fishes, special attention being paid to the food and game species, of which there are a large number of varieties. The principal game fishes are the small-mouthed black bass, the "jack salmon" (*Stizostedion vitreum*), and the speckled trout, the first two occurring in the larger streams, the last in the small, colder ones that flow down the mountain slopes on the eastern boundary.

Only four of the springs examined were found to approximate the requirements of the proposed hatching station, two of these being in the neighborhood of Cleveland, one near Greeneville and one near Athens, the last offering the greatest natural advantages, but being somewhat distant from a railroad station and source of general supplies. A report upon the question of site was transmitted to Congress in January, 1894, and was printed as Senate Miscellaneous Document No. 52, of the Fifty-third Congress, second session. In this the Commissioner reserved his opinion respecting the choice of a location until additional inquiries could be made, but recommended action favorable to the establishment of a station. A general report upon the results of the investigation is in course of preparation. The examinations were conducted by Professor Evermann, assisted by Dr. R. R. Gurley, and by Dr. J. T. Scovell, of Terre Haute, Ind.

OHIO, INDIANA, AND MICHIGAN.

During July and August, 1893, a detailed examination of the Maumee River basin, including its principal lakes and tributary streams, was made for this Commission by Prof. Philip H. Kirsch, fish commissioner of the State of Indiana, assisted by Mr. W. S. Blatchley, of Terre Haute, Ind., and Mr. Charles Beeson, of the Indiana University. This basin covers a considerable area in the northwestern part of Ohio, and also extends over portions of Hillsdale and Lenawee counties, Mich., and of Steuben, Dekalb, Allen, and Adams counties, Ind., embracing in all a territory of about 7,500 square miles. The main river, formed by the confluence of the St. Joseph and St. Mary rivers, at Fort Wayne, Ind., flows in a general northeasterly direction a distance of 96 miles to Toledo, where it empties through Maumee Bay into Lake Erie, of which it is the most important side tributary. The water is rather clear in the main stream and its larger affluents, but more or less turbid in the smaller branches, owing to their clay channels; in all of the lakes visited it was remarkably clear and pure. Examinations were made in the Maumee River proper, in the neighborhood of Fort Wayne, Ind., and of Antwerp, Cecil, Defiance, Grand Rapids, Waterville, and Toledo, Ohio.

The other waters studied were the St. Joseph River and seven of its tributaries, including Fish Lake and Cedar Lake; St. Marys River, Gordon Creek, Lost Creek, Tiffin River, and Devils Lake; Auglaize River and four of its tributaries, and Beaver Creek.

This water system was found to be exceedingly rich in variety of fishes, the total number of species observed having been 87, more than is known from any other river basin of the same size. The list includes 8 species of catfishes, 9 of suckers, 25 of minnows (*Cyprinidæ*), 9 of sunfishes and basses, and 16 of perches. Over 30 species are of value for food, the most important of these being the two species of black bass, the grass pike, and the wall-eyed pike. Crayfishes and mussels are rather common in all parts of the basin; snails are plentiful, and shrimps were obtained in several streams.[1]

INDIAN TERRITORY.

In May, 1894, Prof. S. E. Meek, of the Arkansas Industrial University, began an investigation of certain streams in the southeastern part of Indian Territory, along the line of the St. Louis and San Francisco Railroad between Fort Smith, Arkansas, and Arthur, Texas, this work being continued into the next fiscal year. Two of the most important rivers of that region are the Poteau and the Kimishi, both rising in the Ozark Mountains between the Arkansas and Red rivers, the former flowing north into the Arkansas, the latter south into the Red River. In the upper two-thirds of their courses they drain a mountainous sandstone region, their currents being swift and the bottom generally rocky. The Poteau River, below the town of the same name, occupies a deep and rather broad channel, with an occasional rocky shoal, the current being sluggish and causing it to partake somewhat of the nature of a lake. Examinations were made near the mouth of the river and in the vicinity of Poteau. The fishes of the Kimishi River were

[1] Report upon investigations in the Maumee River basin during the summer of 1893, by Philip H. Kirsch, commissioner of fisheries for the State of Indiana. Bull. U. S. Fish Com., XIV, 1894, pp. 315–337.

studied in the neighborhood of Kimishi and Goodland. Collections were also obtained from the Red River at Arthur, Tex.

These waters were found to be very rich in fish life, both as to species and individuals, the total number of species observed being 58, including the following important food varieties: Channel cat or white cat (*Ictalurus punctatus*), blue cat (*Leptops olivaris*), little green pickerel (*Lucius vermiculatus*), crappie (*Pomoxis annularis*), several species of sunfish, large-mouthed black bass (*Micropterus salmoides*), sauger (*Stizostedion canadense*), and fresh-water drum (*Aplodinotus grunniens*).[1]

MINNESOTA.

In the spring of 1894, the services of Prof. U. O. Cox, of Mankato, Minn., were secured to make a study of the small lakes in the neighborhood of Worthington, Nobles County, with special reference to the habits of the buffalo-fish which had been reported as running in exceedingly large numbers into the sloughs and other shallow waters about those lakes during their spawning season of 1893. The run did not occur, however, as anticipated, but observations were made on the fishes generally of the region, and a report upon the subject is in course of preparation.

THE GREAT LAKES.

Lake Erie.—During the summer of 1893, investigations were conducted along the south shore of Lake Erie, from Port Clinton, Ohio, eastward to and including Niagara River as far as the falls, by Mr. A. J. Woolman, of the Duluth High School, assisted by Mr. D. C. Ridgley, of Delphi, Ind., and Mr. E. M. Hasbrouck, of Washington, D. C. This work was carried on primarily for the purpose of securing information desired by the Joint International Commission, elsewhere referred to, and comprised the collecting of data relative to the commercial fisheries at the principal fishing centers, as well as the customary observations respecting the natural history of the fishes occurring along the lake shore and in the more important streams tributary thereto.

These inquiries were preliminary to more extensive investigations planned for the season of 1894, and which were taken up early in June by Mr. H. F. Moore, Mr. B. L. Hardin, and Mr. Rutter. During the balance of the fiscal year this party was engaged in a study of the fishes and the market fisheries in the region about Kelley Island and the Bass Islands, making personal examinations and also securing testimony from the fishermen concerning the methods, history, and conditions of their industry.

Lake Huron.—Corresponding inquiries on this lake were also begun in June, 1894, by Dr. J. T. Scovell, assisted by Mr. D. C. Ridgley. The work was commenced at the lower end of the lake and was carried thence northward.

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[1] A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894, by Seth Eugene Meek, Ph. D., associate professor of biology and geology in the Arkansas Industrial University. Bull. U. S. Fish Com., XV, 1895, pp. 341–349.

Lake Ontario and St. Lawrence River.—Coincident with the inquiries on Lake Erie and Lake Huron during the summer of 1894, investigations of a similar character were begun about the middle of June with respect to Lake Ontario and the upper or boundary part of the St. Lawrence River, by Professor Evermann, assisted by Mr. Barton A. Bean, of the United States National Museum.

During the same month Professor Evermann also made an examination of several springs located near together in the vicinity of Sterlingville, N. Y., which had been recommended as suited to the needs of the proposed hatching station recently authorized by Congress for the State of New York. The volume of water supplied, its character, temperature, etc., were determined, and observations were made relative to the adjacent stream known as Black Creek; but the distance of this place from Lake Ontario was found to be a serious objection to its selection for the purpose in view, especially as it was intended to utilize the station chiefly for the propagation of lake fishes.

POLLUTIONS IN THE WABASH RIVER, INDIANA AND ILLINOIS.

In view of complaints made by the fishermen and other residents along the Wabash River at and below Terre Haute, Ind., the House of Representatives, by resolution dated April 30, 1894, requested the Fish Commission to investigate and report the extent of damage done to the food-fishes in the Wabash River by reason of the discharge into said river of the overflow and waste products of the oil wells located in the city of Terre Haute, and what steps, if any, are necessary to prevent further destruction of the fishes in that river by the polluting agencies referred to. The examinations required to ascertain the correctness of the statements relative to the conditions said to prevail in the region in question, the injury done to the fishes thereby, and the character and origin of the polluting influences, were made during the middle of May, by Prof. S. A. Forbes, director of the Illinois State Laboratory of Natural History, and indicated a state of affairs sufficiently serious to suggest and invite remedy.

Subsequently, the services of Mr. Arthur N. Talbot, professor of municipal and sanitary engineering in the University of Illinois, were secured to determine the amount of waste matter, deleterious to fishes, discharged into the river at Terre Haute, and the measures best adapted to disposing of it. The results of his observations were satisfactory in demonstrating that the waste products could readily be prevented from reaching the river without imposing any unreasonable or excessive charges upon the industrial enterprises which are responsible for their production. The reports of Professor Forbes and Professor Talbot were submitted to the House of Representatives on July 13, 1894.[1]

[1] House of Representatives Miscellaneous Document No. 196, Fifty-third Congress, second session.

Omitting the detailed statements based upon the testimony which he obtained, the report of Professor Forbes is as follows:

I have the honor to report, concerning the alleged injury to fishes in the Wabash River by overflow and waste from oil wells at Terre Haute, that in accordance with your instructions I went, May 15, to Marshall, in Clarke County, Ill., near the Wabash, spent May 16 and 17 along that river in and near the towns of Darwin, Old York, and Hutsonville, returned to Marshall on the evening of the 17th, and went thence to Terre Haute, where I remained until the forenoon of May 19, at which time other engagements compelled my return to Champaign.

I made personal observations of the condition of the river with reference to the contamination of its waters by coal oil or its waste products, and collected a mass of evidence concerning the pollution of the river at different times and under different circumstances, and likewise concerning the effect upon the fish. The time at my disposal was too short to permit a complete investigation, and I shall be obliged, consequently, to limit myself to a preliminary report.

As a general result of this investigation, I reached the conclusion that there can be no doubt of a considerable pollution of the river at Terre Haute by the oil wells and gas works connected with it, having the effect to injure fish for a distance of at least 40 miles down the river, and the consequent effect to diminish, and in some places practically suspend, the fishing industry, and to decrease or stop the sale of fish.

There are at Terre Haute three separate sources of pollution—the oil wells, the fuel-gas works, and the illuminating-gas works. In the absence of the general manager of the oil wells, who was out of the city during my visit, I was not able to get personal knowledge of the nature and amount of the objectionable materials which the waters of the Wabash may receive from these wells. I learned, however, from other reputable citizens—especially from the officers of the gas companies, so related to the oil business as to be thoroughly intelligent with reference to it—that there are three of these wells in the city now in operation. Their entire product, I am told, is used at the fuel-gas works, for the manufacture of gas distributed to the city, and at the works of a tool company, where the oil is used as a fuel.

The oil, after being pumped into large tanks, is steamed some time for the purpose of causing a separation of the water and other impurities, which settle to the bottom of the tank. This "B. S.," so called, is then drawn off into the sewers, and reaches the river by way of the main city sewer, a 5-foot brick sewer opening into the river at the foot of Eagle street. The present product of these wells, and the exact nature and amount of this contamination, I was not able to ascertain at the time. I was informed, however, by men who should be acquainted with the facts, that it is much greater than that from the gas works, and that occasional overflows of the wells have occurred, the oil then, of course, escaping into the river. Since my return to Champaign I have received a letter, in reply to inquiries addressed to Mr. S. M. Reynolds, the general manager of the Guarantee Oil and Gas Company, controlling these wells, in which he informs me that the entire product of the three wells is about 45 barrels per day, of which "not one-thousandth of 1 per cent finds its way into the waters of the Wabash." Further investigation will evidently be needed on this point. I may add that Mr. Reynolds volunteers the fullest information with regard to the situation and every opportunity to inspect the works personally.

The second source of contamination is the waste from the fuel-gas works, an establishment situated two blocks from the river and emptying the washings of the gas and other waste directly into the main brick sewer above described. I was shown this sewer connection, and saw also the liquid waste escaping. It is received in a large open tank, the surface of which is covered with a coating of slushy tar, while the water runs off, carrying an iridescent oily or tarry material in suspension. The stream of water, running at the time rapidly through the trough, was perhaps 8 or 9 inches across by an inch in depth. It is possible that there are other sewer connections at this establishment or additional waste not seen by me. At the mouth of this sewer, which was nearly submerged by the water at the time of my visit, I found a continuous outpouring of oily and tarry materials into the river, which formed, at a distance of 50 feet below, a practically continuous film alongshore about 10 feet wide, with irregular patches extending farther out.

The wind at the time of my visit was blowing across the river from the west, with the effect to hold this floating film against the eastern bank. In an eddy just below the projecting mouth of the sewer was a triangular patch of black tar about half an inch thick and some 3 feet on each side. The amount of tar in the water here is shown by its accumulation in a thick layer at the water's edge, on the sides of barges, etc. A belt of this hard oil tar, three-fourths of an inch thick at its lower edge, had formed on the hull of a cabin boat, according to the owner's statement, within a month since it was cleaned away.

The third source of contamination is the illuminating-gas works, situated on the bank of the river at the foot of Swan street. In these gas works, according to the statement made to me independently by the superintendent of the works and by a workman whom I encountered there, the material principally used in making the gas is what is known as "naphtha oil," brought by rail from Whiting, Ind. From these gas works, I was told, only the washings of the gas escape into the river. These are received in an open iron tank, the overflow from which, as it runs rapidly down the bank, forms a rivulet about a foot wide and an inch deep. At this point a film similar to that from the fuel works was formed on the surface of the water, apparently containing, however, less tarry material. The current inshore is here slower than above, and the film was continuous for about 20 feet out from the bank at a distance of 50 feet below the point of entrance.

As we rowed across the river, about a quarter of a mile below these lowest gas works, small patches of this oily surface coating could be recognized halfway across the river, and the odor was strong for a considerable distance out. On the opposite side of the river there was neither appearance nor smell of this contamination of the surface. It would appear from information collected concerning the oil wells that this waste which I saw was derived entirely from the gas works, that from the wells coming off in quantities and at intervals only, as the tanks are emptied.

Going above the Eagle-street sewer, all appearance of pollution from these sources disappeared within a few rods, and, thence, as far upward as I went, I saw no signs of it on the water, and could get none of the charcteristic odor from the driftwood or other water-soaked débris alongshore. The city waterworks are, in fact, situated on the river bank within the city limits above the mouth of this sewer, taking the water through an iron pipe which extends about a third of the way across the river; and here, as I was told by workmen in charge, no trouble is ever experienced with oil or tar or any similar substance. From this I judge that the fish occasionally taken above the town, which taste of oil, have recently come up from below, and that all important contamination of the river by these oil wastes is to be looked for at Terre Haute itself.

The time of my visit was said to be an unfavorable one for an estimate of the amount of pollution apparent at the towns below, since, although the river had begun to rise, it was coming up but slowly and was still below the medium stage. High-water mark is 28 feet, and the river stood at 8¾ by the gauge on the wagon bridge at Terre Haute. I was also repeatedly informed that the damage is much the worst in the spring, when the ice breaks up with the spring rise of the stream.

I saw, however, some slight but unmistakable evidence of present contamination as far down as Darwin, 23¾ miles below; and again, less evident, but still recognizable, at Old York and Hutsonville, the latter 48 miles by river from Terre Haute. At the place first mentioned I saw on the still water, at the mouth of a small creek opening into the river, a continuous film of an oily appearance, measuring probably 2 square rods, with flakes or patches of a thicker, blackish, tarry film, from mere specks to half an inch or more across. This was pointed out to me as the characteristic evidence of pollution, and had, in fact, the same general appearance as the film above described at Terre Haute. The peculiar odor of this tarry material was easily obtained, in almost any eddy along the bank where fine drift had accumulated, by raking up a little of this from the bottom, and the same odor could occasionally be got from the bank by standing at the edge of such an eddy when the wind was blowing across it. It was universally said, however, by those with whom I talked, that at this time of year, and especially under conditions existing, these appearances were at their minimum.

I systematically questioned over 20 men at Terre Haute, Marshall, Darwin, Old York, and Hutsonville, examining them separately, and making full notes of their statements at the time. Although it was not possible for me to take sworn evidence, a comparison of these various statements with each other leaves no doubt of the substantial accuracy of most of them. They include reports from fishermen, business men, fish-dealers, and those who have bought and cooked damaged fish, as well as statements from the Fuel Gas Company, superintendent of the Gaslight Company, the city engineer of Terre Haute, and other prominent citizens. I may summarize the statements with respect to injuries to fish by saying that this whole mass of evidence, together with an indefinite amount of general conversation by others, was to the effect that the fishing industry along Wabash River has been practically destroyed at Terre Haute itself, and badly injured for at least 50 miles down the stream—beyond which my visit did not extend—by the presence in the water of oily and tarry waste, traceable to the oil wells and gas works, one or both, at Terre Haute.

Although three experienced fishermen gave some evidence that fish were killed in winter under the ice by accumulations of this waste, I was not fully satisfied that this was true. There can be no doubt at all, however, that they are largely rendered inedible, catfish and buffalo most frequently, but no species escaping wholly. The game fishes, the sheepshead, and the so-called pike perch are seemingly least liable to the injury. It is a curious fact, repeatedly stated to me, that the whole body of a fish may not be impregnated, but that the parts about the fins are most likely to be affected. The fact that catfishes are so much more susceptible in this particular than other species is explained by the fishermen, in part, by their naked skins. There is considerable reason to believe that fish which would otherwise pass upstream are kept below by this pollution, and as it unquestionably extends everywhere during seasons of overflow, it may easily have a serious effect upon the eggs and young. The contamination is, indeed, the most marked during the first two months of the season after the breaking of the ice, a time when fishing operations are most active, and coincident likewise, in part, with the spawning seasons of some important species. There is no doubt that the heavier portions of this waste settle in still water, and thus permeate the mud and drift accumulations on the bottom in a way to make it possible that they may have an injurious effect on the invertebrate animal life of the river, on which fish largely depend for food. Its accumulation in and beneath the ice in winter, testified to by several of my witnesses, should be taken into account in considering the importance of its effects.

It seems to me quite impossible to make a definite intelligent estimate of the ratio of damage or the amount of loss which this contamination of the river has caused. It has unquestionably compelled a considerable number of men to abandon fishing, and has reduced the income of others endeavoring to make a living by that business. Statistical information is, however, quite beyond my present reach, and I am equally unable to make any definite recommendations as to remedial measures. This last is evidently a question for an engineer rather than for a zoologist.

Respecting the fuel gas company, I beg to say that the president of the company, Mr. H. P. Townley, gave me every desired opportunity to examine their works, and assured me that they would be glad to do anything that we might indicate to correct any trouble due to their waste. The superintendent of the gaslight company, Mr. M. N. Diall, was also communicative, but seemed to attach but little importance to the waste from their works.

I trust that the foregoing will serve your purpose as a preliminary report and as a guide to further investigation if such is desired.

I send you herewith a copy of my notes of statements made by the various persons whom I examined systematically, together with bottles of the waste from the two gas works at Terre Haute and a small package of the tarry deposit from a barge in the river there. This barge had been cleaned off within a month, and a deposit of the thickness sent you had collected there since that time.

Following is the report of Professor Talbot:

In accordance with your instructions to make an investigation with respect to the amount of waste matter deleterious to fishes which empties into the Wabash River from the oil wells and gas works at Terre Haute, Ind., and to report upon the same with recommendations relative to the proper disposition of said refuse, I have the honor to report that I spent July 5 and 6 in Terre Haute, returning July 7, and that the amount and condition of the wastes at the oil wells, the fuel gas works, and the gaslight works are as follows:

1. *Oil wells.*—Only three wells produce oil. These are controlled by the Guarantee Oil and Gas Company. The oil is pumped into wooden tanks, where the process of steaming and subsidence separates the oil from the water and its impurities. The water is of limestone origin, and its impurities are much the same as those from the artesian wells in the locality. As much of these impurities as may properly be discharged into the sewer either settle in the river or at once mingle and diffuse with the water within a short distance of the mouth of the sewer, it is probable that their effect upon the fishes is comparatively small and not worth considering. It is the escaping oil and tarry matter which is to be avoided.

The product of two of the wells contains but little water. The third, however, discharges twenty times as much water as oil. At the time of my visit this third well, located near the Phœnix Foundry, was undergoing repairs, and the overflowing water and oil were flowing through an open ditch to the sewer, no effort being made to prevent the waste. While the flow of water may have been augmented somewhat by the increased amount of ground water due to the change of casing, the flow was probably less than during the process of pumping. I made weir measurements of the discharge, and calculate that the flow was at the rate of 0.0189 cubic feet per second, equal to about 12,200 gallons per 24 hours, or, say, 240 barrels in 24 hours. Of this I estimate that about 5 per cent is oil, perhaps 12 barrels per 24 hours.

Mr. Reynolds, the general manager of the Guarantee Oil and Gas Company, stated that this is the first time that repairs of this kind have been made to this well, and intimated that this is a very infrequent occurrence, adding that considerations of economy prevent the waste of oil.

The other wells were being pumped and the whole product was received in the tanks. There was visible evidence that there had been waste into the sewer, and testimony taken shows that not infrequently there is leakage and waste of a few barrels of oil, which is allowed to flow into the sewer. It was even stated that at times when it was inconvenient to tank the oil the whole flow of the wells passed into the sewer.

Of the amount of oil which escapes with the "B. S." at the time of the discharge of that waste I have no means of ascertaining. Judging from the means of separation and the care taken in the operation, there is considerably more than is necessary. The amount of this oil reaching the sewer probably would not usually be more than a barrel a day. There must, however, be times when the waste is considerably greater than this.

2. *Fuel-gas works.*—The second source of pollution is the works of the Citizens' Gas and Fuel Company, which uses oil in the manufacture of its gas. The overflow from the tar barrel and the washings from the "scrubber" are caught in a tank, from which, after the tar and oil are roughly separated by subsidence, the waste flows into the sewer. Owing to inadequate facilities for subsidence and to careless-

ness in operating, the quality of this waste is inexcusably bad, a large amount of oil and tar escaping with it.

By weir measurements the amount of waste discharged from the subsidence tank and escaping into the sewers was at the rate of 0.173 cubic feet per second, equal to 112,000 gallons per 24 hours, or about 2,150 barrels. It was impracticable to determine the amount of oil and tar contained in this, but the samples show that it must be at the rate of several barrels per day.

While these works are not now running during the night, it is probable that, except in the summer months, the total discharge for 24 hours is greater than indicated above.

3. Illuminating-gas works.—The discharge of waste from the works of the Terre Haute Gaslight Company is from a pipe on the bank of the river near the works. It is of much cleaner quality than the preceding. The discharge was at the rate of 43,000 gallons per 24 hours. Of this the oil did not amount to more than a few gallons a day. From what could be seen, I judge that little pollution comes from this source.

The discharge from the oil wells and the fuel gas works is into the city sewer, known as the canal sewer, which empties into the Wabash River at the foot of Eagle street. Samples taken from the sewer at three different points show a strong indication of oil, and even near the outlet, where sewage discharges down an incline with a velocity of 10 feet per second, at the rate of 2,000,000 gallons per day, the oil quickly comes to the top and floats along down the bank. The very marked coating of oil on the walls of the sewer shows that the discharge of oil must have continued for a considerable time and that it has been at different stages of the river.

It may be said that the total amount of oil discharged into the river is not large when compared with the oil received by other streams, and that the waste is not relatively as large as that from some oil wells and refineries. However, the refusal of the oil to diffuse with the water makes its presence, even when intermittent, very perceptible, and the results are far different than would be the case with diffusing liquids.

It is fortunate that this very principle of nondiffusion makes the separation of this refuse from the ordinary washings very easy, and hence the method of avoiding its discharge into the river is simple and inexpensive. The only process needed is that of separation by subsidence, carrying out more thoroughly and completely the method now used at both the oil wells and the fuel gas works.

The situation is such that no pumping or extra labor is necessary beyond the watching, the proper drawing off of oil and waste, and the occasional cleaning of the tanks. Contrary to what might be expected, there will be no necessity for expensive processes such as are used in sewage purification works.

The recommendations I would make relative to the disposition of the refuse are that the oil and tarry waste be not allowed to reach the sewer or the river, and that this waste be separated from the unobjectionable waste water by the process of subsidence in tanks. The difference in specific gravity is so marked that the separation of the water will not be difficult.

At the oil wells a tank at least 12 feet deep and 16 feet in diameter should be sunk in the ground to such a depth as to catch all overflow from the wells and all leakage from tanks and pipes and waste from loading. The inlet should be so made that the inflow will not agitate the liquid in the tank. A perforated partition will direct the proper distribution of the liquid. The outlet pipe should project well into the tank 3 or 4 feet above the bottom of the tank and be so perforated as to obtain an even draft from the liquid without causing any perceptible current in the tank. It should then be carried to the level of the inlet and connected with the discharge pipe. By this process the water will be carried away and the oil and heavier matter held in the tank. Care must be taken to draw off the oil and waste at the top as fast as it accumulates and to clean the bottom as often as necessary.

In drawing off the "B. S." from the steaming tank, sufficient time for the discharge must be given, that the flow through the separation tank will be slow. Negligence in this matter and any overcharging of the tank will result in inefficiency. A second and smaller tank may be used if it is necessary to continue operations when this tank is being cleaned.

At the fuel-gas works a separation or subsidence tank, in addition to the one now in use, is very desirable. This may be similar to the one described for the oil wells. The depth should be 12 feet and the diameter 16 feet. It should be designed so that the inflow will be evenly and smoothly distributed, with partitions arranged so as to prevent currents, and with the outlet pipe placed 5 feet above the bottom and extending two-thirds the way across the tank and so perforated as to permit an even flow. The outlet pipe will discharge near the level of the inflow, and all the ordinary water and washings will flow off by gravity. The oil waste at the top and the tarry waste at the bottom may be emptied when necessary.

Some repairs and modifications of the tank now in use are desirable, and proper attention to its cleaning and operation will be necessary.

The expense of following out the recommendations made will not be great. Wooden tanks, partitions, and drains are suitable for the purpose. The waste products obtained will be of some commercial value, and at least will not be difficult to dispose of. The location is such that the tanks may receive and discharge the liquid without pumping.

To summarize my report, I may repeat:

(1) That oil waste escapes from the oil wells and from the fuel-gas works into the Wabash River in noticeable quantities, although the total amount is not large.

(2) That this waste may readily be separated from the waste water by inexpensive subsidence tanks.

I ship by American Express to-day a sample taken from the flow from the well of the Phœnix foundry; a sample of sewage from the canal sewer on Ninth street, near Sycamore, which receives the waste from the oil wells; a sample of sewage from the mouth of the sewer at the foot of Eagle street; a sample of the waste which passes into the sewer from the works of the Citizens' Fuel and Gas Company, and also a sample of the waste from the works of the Terre Haute Gaslight Company.

DISEASES OF FISHES.

Dr. R. R. Gurley continued during the year his researches respecting the parasites and diseases of fishes. His paper on the Myxosporidia or protozoan parasites, which are the cause of considerable mortality among fishes, was finished early in the year, although assigned a place in the annual report for 1891–92, the publication of which was at that time not completed. Several cases of disease and mortality among the eggs and young fish at some of the hatching stations were made the subject of investigations, the most important being furnished by the station at Northville, Mich., where, during the spring of 1894, a very high death rate occurred among the yearling and two-year-old brook trout stored in the ponds at that place. Dr. Gurley was sent to the station and remained there several weeks, but despite the comprehensive scope of his inquiries the true cause of the difficulty failed to be discovered, or, at least, no effective remedy was found. The diseased fishes were infested to a greater or less extent with well-known parasites of two or more varieties, but it could not positively be said that they were the chief instrument of death, even if they were concerned in it at all.

REPORT OF THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

By Hugh M. Smith, *Assistant in Charge.*

The report of the division of statistics and methods of the fisheries for the fiscal year 1894 comprises an outline of the general statistical field investigations conducted by the regular corps of agents; an account of inquiries regarding special fisheries or in special regions; a notice of the published reports emanating from the division; suggestions for the work of the division, and notes on a number of miscellaneous matters connected with the division work.

The regular personnel of this division in 1894 consisted of 7 clerical assistants, 4 field agents, and 2 local agents. Two clerks and 1 local agent were at times assigned to duty as field agents. Mr. A. B. Alexander, fishery expert on the Fish Commission steamer *Albatross*, was temporarily detached from the vessel and given shore duty in this division. In a special inquiry several temporary field assistants were also employed for a short period. The appropriation for the field and other expenses was $5,400, of which $3,296 was expended in field inquiries and $541 for salaries of temporary employees, incidentals, etc., the unexpended balance being $1,563.

GENERAL FIELD INVESTIGATIONS.

THE MACKEREL FISHERY.

In the report of the division for 1893 announcement was made of the inauguration of a study of the New England mackerel fishery in May, 1893, in conjunction with a canvass of other fisheries of that region. Mention was also made of inquiries in the Middle Atlantic States regarding the catch of mackerel in pound nets. The work in New England was brought to a close by October, and resulted in the collection of more detailed statistical information for the mackerel fishery than the Commission had previously obtained. A synopsis of the scope of the statistical inquiries was given in last year's report.

In addition to the four regular field agents, the division had the services of Mr. E. F. Locke, who was detailed from the division of fish-culture, and Mr. F. F. Dimick, local agent at Boston. The territory covered by the field force in the investigation was as follows: Mr. Ansley Hall canvassed the whole of Rhode Island and New Hampshire and that part of the Massachusetts coast lying between Newburyport and Barnstable, with the exception of Gloucester and vicinity; Mr. C. H. Stevenson, the whole of Connecticut and part of Maine coast between Round Pond, in Lincoln County, and Castine, including the islands in Penobscot Bay; Mr. W. A. Wilcox, part of Massachusetts south of Barnstable, including the Cape Cod peninsula and the islands off the southern coast; Mr. E. F. Locke, Gloucester, Rockport, and vicinity, Massachusetts, and the coast of Maine from Sullivan to Bluehill, including Mount Desert Island and other smaller islands adjacent thereto; Mr. F. F. Dimick, the eastern Maine coast from Gouldsboro to Lubec, inclusive; Mr. E. E. Race, the western part of Maine, from the State line to Round Pond and the region between Castine and Bluehill.

The number of persons engaged in the mackerel fishery of the New England States in 1892, the last of the three years covered by the agents' inquiries, was 5,893. Of this number, 2,406 were vessel fishermen, and 3,487 were shore or boat fishermen. These figures include all persons who fished especially for mackerel during any part of the year or in whose apparatus mackerel constituted a conspicuous part of the catch. Detailed information for each State is contained in the following table, in which data for the years 1890 and 1891 are added for comparison:

Table showing by States the number of persons engaged in the New England mackerel fishery in 1890, 1891, and 1892.

States	Vessel fishermen.			Shore or boat fishermen.			Total.		
	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.
Maine	374	482	418	2,429	2,603	2,387	2,803	3,085	2,805
New Hampshire	32	25	25	23	16	20	55	41	45
Massachusetts	1,440	1,722	1,876	948	969	1,006	2,388	2,691	2,882
Rhode Island	58	60	71	72	72	74	130	132	145
Connecticut	....	17	16	....	....	....	....	17	16
Total	1,904	2,306	2,406	3,472	3,660	3,487	5,376	5,966	5,893

The value of the fishing property connected with the mackerel fishery of the New England States in 1892 was $1,414,422. The vessels employed numbered 207, and were valued with their outfit at $789,358. The number of boats used in the shore fisheries was 2,906, with a value of $196,997. The apparatus consisted of 244 purse and other seines, valued at $127,775; 7,321 gill nets, worth $62,450; 361 pound nets and trap nets, having a value of $236,736; and 7,789 lines, with a value of $1,106. In the table which follows figures for each State are given, showing the details of the investment in the mackerel fishery in 1890, 1891, and 1892.

Table showing by States the vessels, boats, and apparatus employed in the New England mackerel fishery in 1890, 1891, and 1892.

Items.	Maine.		New Hampshire.		Massachusetts.	
	No.	Value.	No.	Value.	No.	Value.
1890.						
Vessels	28	$88,700	3	$3,700	153	$306,205
Outfit		38,900		1,950		97,641
Tonnage	1,608		90		6,305	
Boats	1,972	105,219	43	1,620	778	79,622
Apparatus, vessel fisheries:						
Seines	37	20,900	4	1,600	142	70,365
Gill nets	179	1,134	20	300	402	4,235
Lines					1,383	193
Apparatus, boat fisheries:						
Seines	5	300			2	900
Gill nets	3,800	27,811	75	1,125	3,174	32,099
Pound nets and weirs	108	40,705			175	183,825
Lines	4,584	570	20	2	1,651	212
Total		324,239		10,297		775,297
1891.						
Vessels	35	111,975	2	3,000	164	423,794
Outfit		48,000		1,285		125,819
Tonnage	2,079		75		7,728	
Boats	2,156	112,287	36	1,525	799	80,992
Apparatus, vessel fisheries:						
Seines	49	25,050	4	1,500	181	92,320
Gill nets	149	894			386	3,700
Lines					1,094	156
Apparatus, boat fisheries:						
Seines	5	350			3	1,050
Gill nets	4,031	30,817	75	1,125	2,822	27,980
Pound nets and weirs	159	59,165			192	190,950
Lines	5,020	752	6	1	1,888	226
Total		389,290		8,436		946,987
1892.						
Vessels	32	92,450	2	3,000	164	489,719
Outfit		41,210		1,385		137,972
Tonnage	1,758		75		8,657	
Boats	2,005	109,576	34	1,580	830	80,041
Apparatus, vessel fisheries:						
Seines	44	21,750	4	1,500	184	102,450
Gill nets	181	1,086			431	4,335
Lines					972	152
Apparatus, boat fisheries:						
Seines	6	375	1	100	3	900
Gill nets	3,882	28,354	75	1,125	2,752	27,550
Pound nets and weirs	154	52,026			207	184,710
Lines	4,224	542			2,259	273
Total		347,369		8,690		1,028,102

Items.	Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value.	No.	Value.
1890.						
Vessels	15	$13,100			201	$411,705
Outfit		1,236				139,727
Tonnage	158				8,161	
Boats	36	5,300			2,829	191,761
Apparatus, vessel fisheries:						
Seines					183	92,865
Gill nets					601	5,669
Lines	136	85			1,519	278
Apparatus, boat fisheries:						
Seines					7	1,200
Gill nets					7,049	61,035
Pound nets and weirs					283	224,530
Lines	144	29			6,399	813
Total		19,750				1,129,583
1891.						
Vessels	16	14,100	1	$3,000	218	555,869
Outfit		1,336		1,300		177,740
Tonnage	173		71		10,126	
Boats	36	5,300			3,027	200,104

Table showing by States the vessels, boats, and apparatus employed in the New England mackerel fishery in 1890, 1891, and 1892—Continued.

Items.	Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value.	No.	Value.
1891—continued.						
Apparatus, vessel fisheries:						
Seines			2	$700	236	$119,570
Gill nets					535	4,594
Lines	152	$86			1,246	242
Apparatus, boat fisheries:						
Seines					8	1,400
Gill nets					6,928	59,922
Pound nets and weirs					351	250,115
Lines	144	29			7,058	1,008
Total		20,851		5,000		1,370,564
1892.						
Vessels	18	17,700	1	3,000	207	605,869
Outfit		1,622		1,300		183,489
Tonnage	203		71		10,764	
Boats	37	5,800			2,906	196,997
Apparatus, vessel fisheries:						
Seines			2	700	234	126,400
Gill nets					612	5,421
Lines	186	109			1,158	261
Apparatus, boat fisheries:						
Seines					10	1,375
Gill nets					6,709	57,029
Pound nets and weirs					361	236,736
Lines	148	30			6,631	845
Total		25,261		5,000		1,414,422

The quantity of mackerel taken by New England fishermen in 1892 was 21,494,913 pounds, for which the fishermen received $1,062,460. The fish sold fresh amounted to 7,411,113 pounds, valued at $450,974; the remainder of the catch was pickled, making 9,389,200 pounds (or 46,946 barrels) of salt fish, with a market value of $611,486. The results of the fishery in each State, together with comparative figures for the two preceding years, are shown in the following table:

Table showing by States the quantity and value of the New England mackerel catch in 1890, 1891, and 1892.

States.	Total quantity as taken from the water (pounds).	Quantity sold fresh.		Quantity sold salted.	
		Pounds.	Value.	Pounds.	Value.
1890—Maine	3,514,217	2,166,017	$127,766	898,800	$70,569
New Hampshire	107,800	74,800	6,140	22,000	1,578
Massachusetts	6,984,095	2,393,495	163,606	3,060,400	221,075
Rhode Island	339,175	88,375	7,652	167,200	13,509
Connecticut					
Total	10,945,287	4,722,687	305,164	4,148,400	306,731
1891—Maine	6,987,045	3,837,345	194,724	2,099,800	139,264
New Hampshire	68,460	10,560	522	38,600	2,187
Massachusetts	11,939,074	3,898,174	242,123	5,360,600	303,351
Rhode Island	274,475	93,275	8,176	120,800	9,583
Connecticut	93,300			62,200	3,408
Total	19,362,354	7,839,354	445,545	7,682,000	457,793
1892—Maine	5,072,433	2,521,233	133,781	1,700,800	113,685
New Hampshire	59,000	15,500	1,420	29,000	2,525
Massachusetts	16,037,805	4,762,905	305,839	7,516,600	484,657
Rhode Island	226,975	111,475	9,934	77,000	5,802
Connecticut	98,700			65,800	4,817
Total	21,494,913	7,411,113	450,974	9,389,200	611,486

In the previous report mention was made of the intention of the office to obtain statistics showing, for the fresh and salt fish, respectively, the quantities and values of the mackerel of each size and grade recognized in commerce. No attempts had previously been made to secure complete information on this phase of the subject, the only data published bearing on it being the report of the inspection of salt mackerel in some of the New England States. By those who have favored the restriction of the mackerel fishery, much stress has been laid on the diminishing size of the mackerel caught, the point sought to be made being that the fishery is prosecuted so assiduously that the fish fail to attain maturity before they are caught. While the results of the efforts to secure complete figures on this point were not entirely satisfactory, owing to the general absence of records showing the sizes of the fish sold in a fresh condition, the information obtained is as accurate as the circumstances permit and undoubtedly differs but little from the actual results of the fishery.

The sizes of fresh mackerel recognized in the trade are extra large, large, medium, small, and tinkers; the grades of salt mackerel are No. 1 extra, No. 1, No. 2, No. 3 large, No. 3, No. 4. Several special grades are also recognized. These sizes and grades may be defined as follows, the measurements being made from tip of nose to fork of tail:

Sizes and grades of fresh and salt mackerel recognized in the trade.

Fresh mackerel.	Designation.	Salt mackerel.	Designation.
Over 15 inches long	Extra large.	Best quality, over 15 inches long.	No. 1, large.
Over 13 inches and under 15 inches long.	Large.	Best quality, not less than 13 inches long.	No. 1.
Over 11 inches and under 13 inches long.	Medium.	Best quality, 11 inches long and under 13 inches.	No. 2.
Over 10 inches and under 11 inches long.	Small.	Second quality, not less than 13 inches.	No. 3, large.
Under 10 inches long	Tinkers.	Second quality, at least 10 and under 13 inches in length.	No. 3.
		All under 10 inches in length.	No. 4.

The data obtained in the recent canvass, combined with those secured in the previous investigation of this region, permit a comparison of the mackerel catch for a continuous period of six years ending in 1892. The figures are very instructive, in view of the importance of the fishery and the special attention it has of late received on account of the serious decline dating from 1886. When the yield of mackerel in 1880 is contrasted with that in each of the recent years, as is done in the following table, the full extent of the decrease is exhibited.

It appears from the table that in 1880 the quantity of mackerel sold fresh by the New England fishermen was 21,742,763 pounds, valued at $374,329, and the quantity salted was 50,226,800 pounds (or 251,134 barrels), valued at $1,442,917. During the six-year period covered by the figures presented, the fishery reached its lowest point in 1889, when the yield of fresh mackerel was only 3,074,441 pounds, worth $256,550, and of salt fish 5,286,967 pounds (or 26,435 barrels), having a value of $474,874; while the fishery was at its maximum in 1887, in which year 7,356,046 pounds of fresh fish, valued at $373,070, were sold, and 18,716,580 pounds (or 93,583 barrels) of salt fish, worth $1,064,124, were packed.

The decrease in the mackerel catch, as compared with 1880, has been largely compensated for by the increase in the price. Thus, while the yield of fresh mackerel in 1892 was but little more than a third that in 1880, the value of the catch was one-fourth greater; and while the output of salt mackerel in 1892 was less than one-fifth that in 1880, the value of the salt fish was only about one-half less.

Comparative table showing the quantities and values of fresh and salt mackerel taken by New England fishermen in 1880, 1887, 1888, 1889, 1890, 1891, and 1892.

Year.	Maine.				New Hampshire.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880	4,352,455	$135,249	18,228,000	$524,055	368,000	a$10,580	1,470,000	$41,160
1887	1,011,814	54,809	3,023,000	159,784	144,377	8,849	49,600	2,728
1888	573,509	40,703	1,121,000	73,900	56,616	4,118	43,400	3,348
1889	417,441	36,074	562,100	51,904	21,860	2,010	24,600	2,359
1890	2,166,017	127,766	898,800	70,569	74,800	6,140	22,000	1,578
1891	3,837,345	194,724	2,099,800	159,264	10,560	522	38,600	2,187
1892	2,521,233	133,781	1,700,800	113,685	15,500	1,420	29,000	2,525

Year.	Massachusetts.				Rhode Island.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880	16,896,308	$224,720	29,684,200	$853,420	89,000	a$2,670	....	....
1887	5,890,092	287,657	15,084,500	870,025	268,063	18,545	500,200	$28,541
1888	4,755,925	268,800	8,920,050	659,520	237,100	20,007	303,800	23,624
1889	2,305,028	190,074	4,382,167	394,517	296,612	25,081	302,000	24,555
1890	2,393,495	163,606	3,060,400	221,075	88,375	7,652	167,200	13,509
1891	3,898,174	242,123	5,360,600	303,351	93,275	8,176	120,800	9,583
1892	4,762,905	305,839	7,516,600	484,657	111,475	9,934	77,000	5,802

Year.	Connecticut.				Total.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880	37,000	a$1,110	844,600	$24,282	21,742,763	$374,329	50,226,800	$1,442,917
1887	41,700	3,210	59,280	3,046	7,356,016	373,070	18,716,580	1,064,124
1888	28,160	2,276	24,500	2,100	5,651,310	335,904	10,412,750	762,492
1889	33,500	3,311	16,100	1,539	3,074,441	256,550	5,286,967	474,874
1890	....	....	....	....	4,722,687	305,164	4,148,400	306,731
1891	....	....	62,200	3,408	7,839,354	445,545	7,682,000	457,793
1892	....	....	65,800	4,817	7,411,113	450,974	9,389,200	611,486

a Approximate.

A feature of some interest disclosed by the foregoing figures is the relative proportion of mackerel sold fresh and salted in the years mentioned as compared with the conditions in 1880. The percentage of mackerel leaving the hands of the fishermen in a fresh condition in recent years was greater than in 1880, and the tendency toward the disposal of the fish in a fresh state appears to be increasing yearly. Thus, the percentage (by weight) of the total catch sold fresh was 28 in 1887, 35 in 1888, 37 in 1889, 53 in 1890, 51 in 1891, and 44 in 1892, while in 1880 it was only 30.

A consideration of the quantities of mackerel taken with each kind of apparatus shows the preponderating importance of the purse seine as a means of capture. Of the 47,946 barrels of salt mackerel landed in 1892, 42,650 barrels were caught with seines, and of the 7,411,113 pounds of fresh fish taken in the same year, 1,202,686 pounds were secured in seines. The largest quantities of the mackerel sold fresh are, however, obtained in pound nets, the catch in 1892 being 3,915,037 pounds.

In the following table detailed figures are given showing by States, for the years 1890, 1891, and 1892, the quantity and value of salt and fresh mackerel taken with the different appliances.

Table showing by apparatus with which taken the quantity and value of the New England mackerel catch in 1890, 1891, and 1892.

Apparatus.	Maine.		New Hampshire.		Massachusetts.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1890.						
Salt fish:						
Seines ....barrels..	3,993	$64,311	80	$1,103	13,560	$192,825
Gill nets.......do....	104	1,583	30	475	386	6,331
Pound nets.......do....	231	2,340	....	....	29	415
Lines.......do....	166	2,335	....	....	1,327	21,504
Total	4,494	70,569	110	1,578	15,302	221,075
Fresh fish:						
Seines ....pounds..	19,350	1,068	28,800	2,790	618,480	36,901
Gill nets.......do....	815,148	48,572	28,000	1,950	499,007	40,586
Pound nets.......do....	874,764	46,582	....	....	1,133,438	74,588
Lines.......do...	456,755	31,544	18,000	1,400	142,570	11,531
Total	2,166,017	127,766	74,800	6,140	2,393,495	163,606
1891.						
Salt fish:						
Seines ....barrels..	8,647	113,825	193	2,187	25,456	283,143
Gill nets.......do....	312	3,924	....	....	525	7,504
Pound nets.......do....	1,233	17,288	....	....	83	1,788
Lines.......do....	307	4,227	....	....	739	10,916
Total	10,499	139,264	193	2,187	26,803	303,351
Fresh fish:						
Seines.......pounds..	13,916	825	5,760	232	679,380	41,355
Gill nets.......do....	1,049,485	56,281	3,000	210	521,807	42,526
Pound nets.......do....	1,882,381	77,060	....	....	2,495,675	142,329
Lines.......do....	891,563	60,558	1,800	80	201,312	15,913
Total	3,837,345	194,724	10,560	522	3,898,174	242,123
1892.						
Salt fish:						
Seines ....barrels..	7,539	102,546	145	2,525	34,637	440,016
Gill nets.......do....	225	3,125	....	....	935	14,030
Pound nets.......do....	137	1,499	....	....	1,107	17,560
Lines.......do....	603	6,515	....	....	904	13,051
Total	8,504	113,685	145	2,525	37,583	484,657
Fresh fish:						
Seines.......pounds..	83,751	4,843	13,500	1,280	1,105,435	73,644
Gill nets.......do....	806,510	45,703	2,000	140	607,787	47,449
Pound nets.......do....	1,174,328	56,348	....	....	2,740,709	159,832
Lines.......do....	456,644	26,887	....	....	308,974	24,914
Total	2,521,233	133,781	15,500	1,420	4,762,905	305,839

Table showing by apparatus with which taken the quantity and value of the New England mackerel catch in 1890, 1891, and 1892—Continued.

Apparatus.	Rhode Island.		Connecticut.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1890.						
Salt fish:						
Seines ....barrels..					17, 643	$258, 239
Gill nets ....do....					520	8, 389
Pound nets ....do....					260	2, 755
Lines ....do....	836	$13, 509			2, 329	37, 348
Total	836	13, 509			20, 742	306, 731
Fresh fish:						
Seines ....pounds..					666, 630	40, 759
Gill nets ....do....					1, 342, 155	91, 108
Pound nets ....do....					2, 008, 202	121, 170
Lines ....do....	88, 375	7, 652			705, 700	52, 127
Total	88, 375	7, 652			4, 722, 687	305, 164
1891.						
Salt fish:						
Seines ....barrels..			311	$3, 408	34, 607	402, 563
Gill nets ....do....					837	11, 428
Pound nets ....do....					1, 316	19, 076
Lines ....do....	604	9, 583			1, 650	24, 726
Total	604	9, 583	311	3, 408	38, 410	457, 793
Fresh fish:						
Seines ....pounds..					699, 056	42, 412
Gill nets ....do....					1, 574, 292	99, 017
Pound nets ....do....					4, 378, 056	219, 389
Lines ....do....	93, 275	8, 176			1, 187, 950	84, 727
Total	93, 275	8, 176			7, 839, 354	445, 545
1892.						
Salt fish:						
Seines ....barrels..			329	4, 817	42, 650	549, 904
Gill nets ....do....					1, 160	17, 155
Pound nets ....do....					1, 244	19, 059
Lines ....do....	385	5, 802			1, 892	25, 368
Total	385	5, 802	329	4, 817	46, 946	611, 486
Fresh fish:						
Seines ....pounds..					1, 202, 686	79, 767
Gill nets ....do....					1, 416, 297	93, 292
Pound nets ....do....					3, 915, 037	216, 180
Lines ....do....	111, 475	9, 934			877, 093	61, 735
Total	111, 475	9, 934			7, 411, 113	450, 974

THE NEW ENGLAND STATES.

In connection with the canvass of the mackerel fishery in the New England States, an investigation of certain other important fisheries of the region was undertaken, as mentioned in the last report of the division. Circumstances prevented a general canvass of the New England fisheries, and it was necessary to restrict the inquiries to those subjects having special interest. The branches considered were the fisheries for shad, alewives, herring, menhaden, salmon, smelt, lobsters, whales, oysters, clams, and scallops; the canning of sardines and lobsters; and the manufacture of menhaden oil and fertilizer. Complete data were obtained for all of these, the statistics relating to the calendar year 1892, and the descriptive matter indicating the principal changes in methods of fishing, abundance of fish and other products, and the general condition of the industry since the period covered by the last field inquiries. Some brief descriptive notes on each of the foregoing branches will be presented, supplemented by general statistics.

The shad fishery.—While the shad is found along the entire New England coast, it is only in Maine and Connecticut that regular fishing for this fish is carried on; in all of the other States except New Hampshire, however, considerable quantities of shad are taken incidentally and add to the income of the fishermen. In Maine the shad ranks next to the smelt in value among the river fishes, and in Connecticut it is the most important anadromous species.

The principal part of the shad catch in Maine is taken in the Kennebec River and Casco Bay. In Connecticut, the Connecticut and Housatonic rivers yield most of the supply. The bulk of the shad credited to Massachusetts is obtained in pound nets in Barnstable County; larger or smaller quantities are, however, taken each year by mackerel vessels using purse seines. The shad caught in Rhode Island are mostly secured in pound nets set in Narragansett Bay.

The number of persons using apparatus set primarily for shad in the New England States in 1892 was 570; of these, 454 were in Maine and 116 in Connecticut; 177 fishermen used gill nets, 358 pound nets or weirs, and 35 seines; in Maine the gill-net fishermen numbered 96 and the pound-net fishermen 358. Shad fishing in Connecticut was carried on by 35 seine fishermen and 81 gill-net fishermen.

The apparatus employed especially for shad in Maine consisted of 365 gill nets, valued at $3,425, and 156 pound nets, valued at $13,280. In Connecticut, the shad apparatus comprised 12 seines, worth $675, and 46 gill nets, having a value of $2,312. The boats used in connection with the foregoing apparatus numbered 55, and were valued at $2,095.

The catch of shad in apparatus set especially for that fish was 939,110 pounds, valued at $34,948, of which quantity 850,150 pounds, worth $27,192, were taken in Maine, and 88,960 pounds, worth $7,756, in Connecticut. The yield of the different kinds of apparatus in each State was as follows: Pound nets, 669,450 pounds, $19,590 (all in Maine); seines, 17,252 pounds, $1,704 (all in Connecticut); gill nets, 180,700 pounds, $7,602, in Maine; 71,708 pounds, $6,052, in Connecticut. The catch of the regular shad fishermen was greatly augmented by the take of persons using apparatus set primarily for other fish. Thus, in Maine, pound nets took 17,420 pounds, valued at $789, and gill nets 1,400 pounds, $70; in Massachusetts, pound nets caught 48,382 pounds, $2,409; purse seines (operated from mackerel vessels) 79,300 pounds, $1,986; haul seines, 6,827 pounds, $410; in Rhode Island, pound nets secured 24,350 pounds, $776; in Connecticut, pound nets yielded 21,602 pounds, $1,679.

Considered in the aggregate, the New England shad fishery has declined since 1880. An analysis of the statistics shows that in Maine the catch has decidedly increased and that in Connecticut the decrease has been noticeable. In New Hampshire and Rhode Island there has also been a marked decline, while in Massachusetts the output in 1892 was about the same as in 1880. The total catch of shad in the New England States in 1880 was 2,117,392 pounds, having a value of $88,730. Of this quantity, 580,319 pounds were taken in Maine, 6,417 pounds in New Hampshire, 164,524 pounds in Massachusetts, 48,100 pounds in Rhode Island, and 1,318,032 pounds in Connecticut. The difference between the output in 1880 and 1892 was 979,001 pounds, valued at $45,663. In Maine the increase, amounting to 288,651 pounds, or about 50 per cent, was chiefly in the Kennebec River, and in Connecticut the decreased output, 1,207,470 pounds, or 92 per cent, was mostly in the Connecticut River.

The failure of the shad fishery of Connecticut River is one of the most noteworthy changes in the condition of the New England river fisheries in recent years. During the first half of the present century this was, next to the Potomac, doubtless the principal shad stream in the United States. The decline in the fishery dates from and may be definitely traced to the erection of a dam at Hadley Falls, Massachusetts, in 1848. A steady annual decrease in the catch was thereafter reported up to 1868, but as late as 1867 the output of the river was 628,500 shad. In 1869 and 1870 the effects of artificial propagation, first undertaken in 1867, were manifested and large numbers of people who had abandoned the fishery resumed operations; these carried on their business without regard for restrictions, and the supply again became exhausted and has since shown an almost unbroken annual decrease for twenty years, the decline being facilitated by overfishing, the interception of larger numbers of fish at or near the mouth of the river by means of nets, the pollution of the water by sewage and factory refuse, and the construction of jetties at the mouth of the river by which the migrating fish have been diverted to other streams.

The following table, compiled from the reports of the Connecticut and Massachusetts Fish Commissions, shows the number of shad taken in the Connecticut River in each of those States in a series of years. The figures for Massachusetts are fully as suggestive as those for Connecticut. The relatively large catch shown for that State in 1881 was due to a reduction from 5 inches to 2 inches in the size of the mesh permitted to be used in nets; this resulted in a greatly increased yield, consisting chiefly of small fish, and was immediately followed by an inordinately small catch.

Statement of the number of shad taken in the Connecticut River during a series of years.

Years.	Connecticut.	Massachusetts.	Total.	Years.	Connecticut.	Massachusetts.	Total.
1867	526,500	102,000	628,500	1884	150,045	1,593	151,638
1876	....	12,792	12,792	1885	190,300	1,718	192,018
1877	....	6,503	6,503	1886	117,950	577	118,527
1878	....	17,790	17,790	1887	80,350	850	81,200
1879	436,981	13,409	450,390	1888	68,450	824	69,274
1880	269,918	7,727	277,645	1889	42,325	796	43,121
1881	351,678	38,382	390,060	1890	34,318	58	34,376
1882	272,903	2,270	275,673	1891	20,503	....	20,503
1883	177,308	3,591	180,899	1892	18,376	....	18,376

The alewife fishery.—Among the river fishes of the New England States the alewives rank next to the smelt in importance, although in all the New England States except Maine and New Hampshire the alewife catch exceeds in value that of the smelt. The fishery is most extensive in Massachusetts, where nearly half the quantity and more than half the value of the yield are obtained. In Maine and Rhode Island the fishery is of similar extent, the former State having a somewhat larger catch and the latter a greater value.

Most of the alewife fishing is done in the rivers or the waters adjoining the river mouths. In Maine the principal alewife grounds are the Machias, Penobscot, Damariscotta, Kennebec, and Sheepscot rivers. In New Hampshire fishing is done in the Piscataqua River. The fishery in Massachusetts is most extensive in Cape Cod Bay, on Marthas Vineyard, and in the Bass, Essex, Rowley, Aganan, Taunton, Mattapoisett, and Acushnet rivers. The catch in Rhode Island is made in Narragansett Bay, and in Connecticut the Connecticut River is the only important fishing-ground.

In 1892 the number of persons in New England engaging in the capture of alewives was 571. Of these, 318 were in Massachusetts and 179 in Maine. The apparatus employed consisted of 112 seines, 203 gill nets, 60 pound nets and weirs, and 151 dip nets. These, with the 258 boats used, had a value of $17,686. The total catch of alewives amounted to 7,847,928 pounds, with a value of $100,364, of which 1,313,977 pounds, valued at $19,826, were incidentally taken in apparatus set primarily for other fish—salmon weirs in Maine and pound nets employed in general shore fishing in Massachusetts, Rhode Island, and Connecticut. The output in Massachusetts was over 3,650,000 pounds, for which the fishermen received $58,516. The principal part of the catch in Maine and New Hampshire was taken in weirs, in Massachusetts and Rhode Island seines took the largest quantities, while in Connecticut the most prominent apparatus was the gill net, which also took considerable quantities in Maine. More than one-third the aggregate yield was caught with seines, and almost as much with pound nets and weirs.

The herring fishery.—The taking of the sea herring is one of the most important fisheries of New England, because of its actual value and of the extensive industries dependent on it. The value of the herring fishery is exceeded only by that of such prominent fisheries as the whale, cod, mackerel, haddock, halibut, oyster, clam, and lobster; and, if the closely related business of canning and smoking herring is considered, the herring becomes more important than any other New England fishery product except cod.

The herring is taken chiefly in Maine and Massachusetts, although its range embraces the entire New England coast. By far the largest fishery is in Maine, where there are more herring fishermen, more capital invested in the fishery, and more fish taken than in all the other States combined. In Massachusetts, however, the fishery is important.

The bulk of the catch in Maine is consumed in the preparation of sardines and in smoking; while in Massachusetts more herring are used for bait in the line fisheries than for any other purpose.

In 1892 the number of persons engaged in fishing for herring in this region was 1,995; of these, 1,409 were in Maine. The capital invested in vessels, boats, and apparatus that were used in the capture of herring was $364,840; of this sum, $197,420 is to be credited to Maine, and $164,687 to Massachusetts. The aggregate catch of herring was 53,064,929 pounds of fresh fish; this was valued at $386,871 as it left the hands of the fishermen in a fresh, pickled, or smoked state.

Weirs, pound nets, gill nets, and seines take large quantities of herring, but brush weirs secure the major part of the catch. In Maine, these latter are to be credited with fully three-fourths of the herring yield, and in the entire region they took nearly three-fifths of the aggregate catch. Gill nets rank next to weirs and pounds in the quantity of their yield; they are especially important in Maine, where about seven-ninths of the herring thus secured are obtained. Seines take less than half the fish caught with gill nets, and are more prominent in Massachusetts than in Maine. On parts of the Massachusetts coast, the use of dip nets and torches in the capture of herring is rather a prominent feature of the fisheries, but in other States this primitive method is now of no importance.

Comparing the results of the herring fishery with previous years for which complete data are available, it appears that in 1892 the total output was nearly double that in 1880, and was considerably larger than in 1887, 1888, or 1889. In Maine the catch in 1892 was nearly twice that in 1880, and in Massachusetts the increase was comparatively almost as large. The yield in both Maine and Massachusetts in 1892 was larger than in any other year for which data are available. The following table shows, by States, the quantity and value of herring caught in each of the years named, the weights representing the fish as taken from the water:

Table showing for a series of years the catch of herring in the New England States.

States.	1880.		1887.		1888.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	21, 455, 192	$122, 596	32, 134, 005	$200, 615	39, 018, 007	$239, 949
New Hampshire	108, 750	932	225, 500	1, 793	358, 200	3, 060
Massachusetts	7, 794, 780	62, 998	8, 711, 650	74, 290	10, 846, 770	96, 776
Total	29, 358, 722	186, 526	41, 071, 155	276, 698	50, 222, 977	339, 785

States.	1889.		1892.	
	Pounds.	Value.	Pounds.	Value.
Maine	30, 056, 999	$239, 571	40, 814, 164	$274, 397
New Hampshire	19, 800	195	146, 600	1, 615
Massachusetts	10, 434, 103	90, 762	12, 103, 465	110, 829
Total	40, 510, 902	330, 528	53, 064, 229	386, 841

NOTE.—In Rhode Island in 1892, 700 pounds of herring were caught, having a value of $30.

In addition to the herring smoked at the sardine canneries in Maine, large quantities are so prepared by the fishermen of the eastern part of the State. In 1892, 10,495,143 pounds of fresh herring taken in American waters, chiefly with brush weirs, were consumed in the preparation of 5,997,225 pounds of smoked fish. These were placed on the market in 1,060,320 boxes, each holding about 5 pounds, and 27,825 boxes holding about 25 pounds each, the value of the smoked fish being $136,297. By far the largest quantities of herring are smoked by the fishermen of Eastport and Lubec, who also obtain many herring for smoking from weirs set in Canadian waters. The business is also important in the towns of Jonesport, Trescott, Cutler, Addison, and Machiasport. Between 1889, when the Fish Commission conducted an investigation of the Maine fisheries, and 1892, the year covered by the last canvass, this branch experienced a large increase, as shown by the following figures:

Comparative statement of the quantities of herring smoked by Maine fishermen in 1889 and 1892.

Items.	1889.	1892.	Increase in 1892.	Percentage of increase.
Fresh herring utilized ....pounds..	5,761,000	13,301,395	7,540,395	131
Herring smoked:				
Regular size ....boxes..	626,400	1,460,320	833,920	133
Value........	$98,031	$162,156	$64,125	65
Bloaters ....boxes..	6,400	34,825	28,425	444
Value........	$5,008	$23,741	$18,733	374
Total quantity as smoked........pounds..	3,292,000	8,172,225	4,880,225	150
Total value........	$103,039	$185,897	$82,858	80

The present extent of the smoked-herring business as compared with the conditions ten years ago is one of the most noteworthy features of the Maine fisheries. This branch has steadily increased since the abrogation of the Washington treaty in 1885. It is not possible to present satisfactory comparative figures showing separately the fish smoked by fishermen and canners and the quantity coming from American and Canadian waters, but accurate statistics may be given showing for the years 1880, 1887, 1888, 1889, and 1892 the total extent of the smoked-herring business. This branch was somewhat less extensive in 1887 than in 1880, but since 1887 the business has steadily increased, and in 1892 had more than double the importance it had twelve years before.

Comparative summary of the smoked-herring business of Maine in 1880, 1887, 1888, 1889, and 1892.

Year.	Fresh herring utilized (pounds).	Herring smoked.					
		Regular size.		Bloaters.		Equivalent number of pounds as smoked.	Total value of smoked fish.
		Boxes.	Value.	Boxes.	Value.		
1880........	6,138,942	318,915	$63,783	51,700	$36,190	4,434,111	$99,973
1887........	5,984,098	588,297	88,506	19,120	11,982	3,419,485	100,488
1888........	7,630,761	755,077	124,705	23,402	15,449	4,360,435	140,154
1889........	8,908,243	919,880	143,961	19,641	15,369	5,090,425	159,330
1892........	17,765,466	1,781,214	198,670	49,825	33,366	10,151,695	232,036

The salmon fishery.—The taking of salmon is one of the most interesting of the New England river fisheries, although its economic importance is slight as compared with many other fisheries of that region. While straggling salmon are found in a number of the rivers, it is only in the Penobscot that the yield is sufficiently large to warrant notice, less than one-tenth the total annual output coming from other streams. Special fishing for salmon is prosecuted only in the St. Croix, Denny, and Penobscot rivers, the fish obtained in other waters being only an incidental element in the catch of nets set for shad, alewives, and other fish.

In 1892, the number of persons fishing specially for salmon in the Maine rivers was 198, of whom 174 were in the Penobscot. Of these, 29 used gill nets, 159 pound nets or weirs, and 10 lines. There were 20 gill nets employed, valued at $615; the pound nets and weirs were 211 in number, worth $14,450. The boats and shore and other property connected with the fishery had a value of $5,339. The aggregate catch was 98,322 pounds, for which the fishermen received $20,332. The quantity taken in the Penobscot River was 92,282 pounds (equivalent to 6,789 fish), valued at $19,124. The output of the St. Croix, Denny, and Kennebec rivers, respectively, was 2,560 pounds, with a value of $512; 1,200 pounds, $216; and 2,080 pounds, $460. In addition to the salmon catch shown, a few fish were taken in the Merrimac River and at several points on the Massachusetts coast. These, however, were generally released, in conformity with law. The gill-net catch amounted to only 3,650 pounds, valued at $745; that of lines was 560 pounds, with a value of $112, while the yield in pound nets was 94,112 pounds, worth $19,475. In Connecticut less than 200 pounds of salmon were taken in pound and gill nets set for shad, alewives, and other fish.

A small decrease (12,916 pounds, valued at $1,685) occurred in the New England salmon catch in 1892, as compared with 1880, although a comparison with intermediate years for which statistics are available shows a more pronounced decline. Thus, in 1887, the total yield was 186,067 pounds, valued at $36,736; in 1888, 205,679 pounds, valued at $41,635; and in 1889, 153,159 pounds, valued at $34,406, these figures being obtained in the official investigations of this division.

The principal decline in the New England salmon fishery considerably antedated 1880, however, and was coincident with the erection of dams or other barriers to the passage of fish. As early as the beginning of the century the rivers of Maine began to experience a decline, and one by one the numerous streams to which the salmon had been accustomed to resort ceased to support the fish, until only the Penobscot remains. Prior to 1798, salmon were very abundant in the Connecticut River; in that year a 16-foot dam was placed entirely across the river about 100 miles above its mouth, and from that time the fish began to decrease. By 1810 the salmon had almost disappeared, and during the succeeding sixty years the fish was practically unknown in this river.

There seems little reason to doubt that the preservation of the salmon run in the Penobscot River has been due entirely to artificial propagation, which began about 1871 and has continued to the present time.

The known results of the attempts to acclimatize salmon in new streams warrants the belief that but for cultivation salmon would have long since been exterminated on the east coast of the United States. The plants of salmon fry in New England waters by the national and State fish commissions aggregated about 20,000,000 to 1892.

The suggestive history of salmon propagation in the Connecticut may here be outlined. The first planting of fry in this river, consisting of 2,000, was made in 1869. A second lot of 30,000 was planted in 1870. In 1873 150,000 were planted in the tributaries of the river, and in 1874 another lot of 1,189,000 was introduced. In 1875 the plantings consisted of 500,000, and in 1876 300,000. Results were soon seen. In 1872 a 7¾-pound female, a 10-pound female, and a 1-pound grilse, apparently the results of the plantings in 1869, were taken. In 1874 and 1875 smolts were observed in large numbers in this stream, and several were caught in the Farmington River, the principal tributary of the Connecticut. At least three or four salmon were caught in 1876, while in 1877 the catch amounted to about a dozen. The best results, however, were observed in 1878, four years after the largest deposits had been made. During that season the catch amounted to probably 500 marketable fish, the average weight of which was reported as about 12 pounds, some of them weighing 20 pounds. The catch in 1879 is reported as having been somewhat less than in 1878, but the average weight was greater, most of those taken exceeding 18 pounds. Because of certain difficulties, relatively few fry have been planted in the Connecticut River since 1879, and since that year the catch has been very small, only a few stragglers being reported each year. In 1882 four were reported, two of which weighed 23 and 25 pounds, respectively, the other two about 15 pounds each. In 1884 two were captured. In 1887 the catch was unusually large, about twenty being reported. In 1892 three, weighing 35 pounds, were caught in gill nets set below Chester, in the township of Saybrook, and six others, weighing 78 pounds, were taken in pound nets on either side of the mouth of the river.

The smelt fishery.—While the catching of smelt is not of great importance in comparison with other branches of the New England fisheries, this fishery has some interesting features and in parts of Maine is of considerable extent. The fish enter the fresh waters of all the coast States of the region, but only in Maine are they sufficiently abundant to constitute a prominent river fish; there they are more valuable than salmon, shad, alewives, or any other anadromous species.

Smelt fishing is carried on along the entire coast of Maine, but is most extensive in the Machias, Westongus, Penobscot, Bagaduce, Damariscotta, Sheepscot, Kennebec, and Saco rivers, in Penobscot Bay, Muscongus Sound, Casco Bay, and in small streams in York County. In Massachusetts regular smelt fishing is confined to the Merrimac River. The smelt catch in Rhode Island is obtained in the Paweatuck River. The Thames and Mystic rivers are the principal smelt streams in Connecticut.

The smelt fishery in 1892 gave employment to over 2,000 persons, of whom more than 1,900 were in Maine. These used, as apparatus of capture, 161 seines, 305 bag nets, 62 traps and weirs, and 3,858 lines, which, with 408 boats, had a value of $32,406, of which over $29,000 represented the investment in Maine. The quantity of smelts taken was 1,697,768 pounds, for which the fishermen received $123,963, the catch in Maine being 1,616,758 pounds, valued at $115,913. The product of the fishery in 1892 was greater than in any other year for which data are available. Thus, in 1880, the New England catch was 966,641 pounds, worth $51,313; in 1887, 1,316,350 pounds, $96,467; in 1888, 1,397,450 pounds, $103,584; in 1889, 1,209,385 pounds, $84,912. More than half the aggregate catch in 1892 was obtained with seines, after which, in point of output, came lines and bag nets.

The increase in recent years over 1880 has been chiefly due to the employment of more fishermen and the use of more apparatus. Thus, in Maine the smelt fishermen in 1880 numbered only 992 against 1,913 in 1892, and the number of smelt seines (the most prominent apparatus now used) increased from 4 to 152.

The lobster fishery.—This fishery has of late attracted much attention on account of the serious decrease in the output in the principal lobster-producing States, and special attention was given to it in the field inquiries. The lobster is generally distributed in the coastal waters of the New England States, and in each its capture constitutes an important industry. It is more valuable in Maine than in all the other States combined, and is the principal fishery product of the State.

This fishery in 1892 gave employment to 3,673 persons directly engaged in fishing. Of these, 2,628 were in Maine, 26 in New Hampshire, 616 in Massachusetts, 145 in Rhode Island, and 258 in Connecticut. The vessels employed in catching lobsters numbered 55, and were valued, with their outfit, at $63,590. They were provided with 6,457 pots, having a value of $11,124, and carried 151 fishermen. Seven of the vessels belonged in Maine, 2 in Massachusetts, 12 in Rhode Island, and 34 in Connecticut. The number of boats used was 3,925, valued at $323,290; 2,888 were in Maine, 29 in New Hampshire, 739 in Massachusetts, 86 in Rhode Island, and 183 in Connecticut. The pots or traps employed in the boat fishery numbered 190,617, valued at $206,118, of which 152,121 are to be credited to Maine, 1,393 to New Hampshire, 25,872 to Massachusetts, 5,121 to Rhode Island, and 6,110 to Connecticut. The live-cars and other accessory property connected with this fishery had a value of $55,709, of which $30,746 belonged in Maine and $18,573 in Massachusetts. The quantity and value of the lobster catch in 1892 were as follows: Maine, 17,642,677 pounds, $663,043; New Hampshire, 196,350 pounds, $11,790; Massachusetts, 3,182,270 pounds, $205,638; Rhode Island, 774,100 pounds, $53,762; Connecticut, 1,614,530 pounds, $101,358; a total of 23,409,927 pounds and $1,035,591.

A comparison of the extent of the New England lobster fishery in 1880 and 1892 shows that in the aggregate there has been an advance in practically every item. In 1880 the number of lobster fishermen was 2,759, divided as follows among the States: Maine 1,843, New Hampshire 44, Massachusetts 595, Rhode Island 129, Connecticut 148. The increase in 1892 was therefore 914, or 33 per cent; the largest advances were in Maine and Connecticut.

The increase in the investment has been very marked in every State; it rose from $263,963 in 1880 to $659,831 in 1892, the gain being 150 per cent. The number of boats and vessels used advanced from 2,438, valued at $150,537, in 1880, to 3,980, worth $386,880, in 1892; in Maine the increase in this item was from 1,797 to 2,895, and in Massachusetts from 446 to 741. The lobster pots or traps employed in 1880 numbered 140,083, valued at $217,242, the increase in 1892 being 43,009, or 31 per cent.

The output of the New England lobster fishery in 1880 was 19,946,733 pounds, valued at $477,484; the catch in 1892 was 3,463,194 pounds larger and $558,107 more valuable, an increase of 17 per cent in quantity and 117 per cent in value.

The increased valuation per pound in 1892 as compared with 1880 indicates the condition of the fishery and suggests the actual decline which is not disclosed by the bare figures for the catch. The following table, showing the percentage of increase or decrease in the quantity and value of the yield in the two years named, strikingly illustrates this point. In Maine, while the output increased 23.95 per cent, the value of the catch to the fishermen increased 146.72 per cent. In Massachusetts there was a decrease in the quantity of 26.26 per cent, but an increase in the value of 23.42 per cent. Similar noteworthy differences appear for the other States.

Comparison of the New England lobster catch in 1880 and 1892.

States.	1880.		1892.		Increase (+) or decrease (—).		Percentage of increase or decrease.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	14,234,182	$268,739	17,642,677	$663,043	+3,408,495	+$391,304	+ 23.95	+146.72
New Hampshire	250,000	7,500	196,350	11,790	— 53,650	+ 4,290	— 21.46	+ 55.73
Massachusetts	4,315,416	158,229	3,182,270	205,638	—1,133,146	+ 47,409	— 26.26	+ 23.42
Rhode Island	423,250	15,871	774,100	53,762	+ 350,850	+ 37,891	+ 82.89	+238.74
Connecticut	723,885	27,145	1,614,530	101,358	+ 890,645	+ 74,213	+123.04	+273.39
Total	19,946,733	477,484	23,409,927	1,035,591	+3,463,194	+ 558,107	+ 17.36	+116.88

An additional evidence of the decline in this fishery is the diminished average catch per man. In 1880 the Maine lobster fishermen took, on an average, during the season 7,723 pounds of lobsters; in 1892 they caught 6,713 pounds. The change in this State has been especially marked since 1889, in which year the average catch per man was 12,019 pounds. The average yield in Massachusetts was 7,253 pounds in 1880 and 5,165 pounds in 1892. In Rhode Island there has been an advance in this respect from an average of 3,281 pounds per man in 1880 to 5,338 pounds in 1892. A similar increase has occurred in Connecticut, the average being 4,884 pounds in 1880 and 6,258 pounds in 1892. It will be seen, however, that the increase has been due to the use of larger numbers of traps per man. Considering the entire region, the average catch per man was 7,229 pounds in 1880 and 6,374 pounds in 1892.

Further indication of a diminished supply of lobsters is seen in the smaller average catch per trap. In 1880 the average quantity of lobsters taken in the New England States was 142 pounds per trap; in 1889 it was 180 pounds, and in 1892 it was 119 pounds. The figures for Maine are 136 pounds per trap in 1880 and 115 pounds in 1892. In 1889, when the lobster fishery reached its height, it was 195 pounds, against 193 in 1888 and 200 in 1887. In Massachusetts the average catch per pot declined from 149 pounds in 1880 to 121 pounds in 1892. The decrease was most marked in Rhode Island and Connecticut. In the former the average was 194 pounds in 1880 and 122 pounds in 1892, while in Connecticut the average for 1880 was 349 pounds and for 1892 only 149 pounds.

The following comparative table shows the New England lobster catch in the five years for which figures are available, and gives a clear idea of the fluctuations which have characterized the fishery in each State:

States.	1880.		1887.		1888.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	14,234,182	$268,739	22,916,642	$512,044	21,694,731	$515,880
New Hampshire	250,000	7,500	142,824	6,268	136,350	6,256
Massachusetts	4,315,416	158,229	3,511,075	156,204	3,743,475	172,936
Rhode Island	423,250	15,871	570,039	27,128	588,500	28,047
Connecticut	723,885	27,145	1,487,020	82,594	1,477,226	85,723
Total	19,946,733	477,484	28,627,600	784,238	27,640,282	808,842

States.	1889.		1892.	
	Pounds.	Value.	Pounds.	Value.
Maine	25,001,351	$574,165	17,642,677	$663,043
New Hampshire	137,175	6,415	196,350	11,790
Massachusetts	3,353,787	148,492	3,182,270	205,638
Rhode Island	456,000	21,565	774,100	53,762
Connecticut	1,501,290	83,099	1,614,530	101,358
Total	30,449,603	833,736	23,409,927	1,035,591

The whale fishery.—The whale fishery continues to be one of the most important branches of the New England fisheries, although its importance is much less than formerly, owing to the scarcity of whales, the withdrawal of vessels from the business, and the transfer of interests to the Pacific Coast, where the conditions for carrying on the fishery are better. New Bedford, which in 1880 had 123 vessels engaged in whaling, in 1892 had a fleet of only 41 vessels, 17 of which made their headquarters at San Francisco. The other 11 vessels, comprising the New England whaling fleet in the latter year, hailed from Provincetown, Boston, Edgartown, and New London. The value of the vessels and their outfits was $700,700, and the tonnage of the fleet was 9,537.60 net. The crews numbered 1,409. The following table shows the rigs represented and the grounds resorted to by the vessels of each port.

The yield of the whale fishery consisted of 211,235 gallons of whale oil valued at $88,712, 440,159 gallons of sperm oil valued at $294,931, 120,150 pounds of bone valued at $585,347 and 20 pounds of ambergris valued at $5,277. The aggregate value of the fishery products was $974,267, of which $656,072 represented the results of the fishery carried on by New Bedford vessels rendezvousing at San Francisco and fishing in the North Pacific and Arctic oceans; their catch was made up of whale oil worth $67,778, sperm oil worth $37,044, and whalebone worth $551,250. The aggregate gross stocks of the vessels fishing from the different ports are shown in the summary.

Summary of the New England whaling fleet in 1892.

Hailing ports.	Number of vessels of each rig.						Number of vessels on each fishing-ground.					Gross value of catch.
	Steamers.	Barks.	Ships.	Brigs.	Schooners.	Total.	North Pacific and Arctic oceans.	Atlantic Ocean.	Okhotsk Sea.	Hudson Bay.	Total.	
New Bedford:												
At New Bedford	....	11	1	....	12	24	......	23	....	1	24	$226,360
At San Francisco	2	14	....	1	....	17	14	1	2	....	17	656,072
Provincetown	....	....	....	1	7	8	......	8	....	....	8	80,140
Edgartown	....	....	....	....	1	1	......	1	....	....	1	6,332
Boston	....	....	....	1	....	1	......	1	....	....	1	4,040
New London	....	....	....	....	1	1	......	1	....	....	1	1,323
Total	2	25	1	3	21	52	14	35	2	1	52	974,267

The oyster fishery.—With the exception of the cod, the oyster was the most valuable product of the New England fisheries in 1892. Although absent from the waters of Maine and New Hampshire, and taken in only limited quantities in Massachusetts, the extent of the fishery in Rhode Island and Connecticut is sufficient to give the oyster a position in advance of such important products as haddock, halibut, herring, mackerel, lobsters, and whales.

The New England oyster industry in 1892 gave direct employment to 1,741 persons, of whom 1,152 were fishermen and 589 were shoresmen, 714 of the former and 561 of the latter being in Connecticut. The aggregate investment in the industry was $471,931, exclusive of the oyster-grounds. Of this amount over $400,000 is to be credited to Connecticut. $370,000 represented vessels and their outfit, $89,000 boats, and $12,000 dredges and tongs. The yield of the oyster fishery consisted of 1,175,182 bushels of market oysters, valued at $1,201,782; 1,004,245 bushels of seed oysters, valued at $567,347; and 230,661 bushels of shells, used for planting purposes, valued at $8,263.

The most interesting and suggestive feature of the oyster industry of this section is the complete dependence for the supply on grounds under private ownership or control. During the period between 1880 and 1892 great changes occurred in the methods of the oyster fishery. In 1880 the exhaustion of the natural oyster-grounds had resulted in a decrease in the fishery, the average size of the oysters was smaller than before, and a still further decline in the industry was unavoidable under the conditions prevailing. The output of the fishery in that year was only 435,650 bushels, a quantity insignificant when compared with the yield which subsequent experience has shown to be possible in these waters. The most noteworthy change in the condition of the industry occurred in Connecticut, which has been the scene of the most extensive and remunerative oyster-culture in the world. The entire history of the oyster industry in that State, as well as in the other States of the section, has demonstrated the futility of depending on natural oyster-grounds for the supply and the possibility of bringing barren areas of sea bottom, hitherto regarded as useless, under profitable cultivation. The Connecticut system has attracted much attention and has been adopted by other States. For a detailed account of the methods and conditions which have contributed to the development of the oyster industry of Connecticut, recourse should be had to the State reports and to papers[1] published by this Commission.

In addition to the value of fishing property (vessels, boats, apparatus) employed in the Connecticut oyster fishery, there are very important investments represented by the private oyster-grounds, the crop on the beds, and the shore property and cash capital required by the large operators for the proper conduct of the business. In 1892 the market value of the oyster-grounds was $1,283,650; the oysters planted on the grounds had an estimated value of $2,118,600; the value of the wharfs, buildings, etc., connected with the industry was $361,270, and the cash capital was $370,000.

According to the official State records, the available area for oyster fishing and planting in Connecticut is 93,601 acres. The division of this area into private and public grounds is shown in the following table, in which the areas over which the State and towns respectively exercise jurisdiction are separately indicated:

Grounds.	Public.	Private.
	Acres.	*Acres.*
State	5,809	67,905
Town	13,482	6,405
Total	19,291	74,310

The public beds in 1892 yielded less than a bushel of market oysters and less than 11 bushels of seed oysters to the acre. The private beds, on the other hand, produced on an average 13 bushels of market oysters and 10 bushels of seed oysters per acre, if the entire grounds be considered, but if, as is proper, only the part actually utilized in 1892 be regarded (about 18,225 acres), then the average production per acre was 53 bushels of market oysters and 41 bushels of seed oysters. The average value per acre of the oysters taken from the public or natural beds was under $4, while the yield of the cultivated grounds had an average value of about $75 per acre.

[1] See especially "Notes on the oyster industry of Connecticut," by J. W. Collins (Bulletin U. S. Fish Commission 1889), and "The methods of deep-water oyster culture," by Henry C. Rowe (Bulletin U. S. Fish Commission 1893).

Following is a table showing the quantity and value of the market and seed oysters taken from public and private grounds in 1892:

Grounds.	Bushels.	Value.
Private grounds:		
Market oysters	972,074	$878,560
Seed oysters	752,460	474,340
Total	1,724,534	1,352,900
Public grounds:		
Market oysters	13,720	10,125
Seed oysters	201,920	63,224
Total	215,640	73,349
Grand total	1,940,174	1,426,249

The business of planting seed oysters and of placing various kinds of shells on the oyster-grounds for the purpose of furnishing a suitable place for the attachment of the oyster spat is very extensive. The use of crushed stone and gravel for the latter purpose is also resorted to in some parts of the State. The quantity and value of the seed, shells, and stone deposited on the grounds in 1892 are given in the following table; 106,500 bushels of the seed sown, valued at $62,260, represented small oysters brought from the South.

Items.	Quantity.	Value.
Seed oysters .... bushels	288,700	$122,670
Shells .... do	1,666,450	125,416
Crushed stone and gravel .... tons	26,745	21,435
Total	....	269,521

The most northern locality on the New England coast where any form of oyster-culture is practiced is in the mouth of Parker River, at Newburyport, Mass., where 12 acres are under cultivation. In 1892 1,500 bushels of oysters, costing $1 per bushel, were planted. When taken up they amounted to 1,800 bushels, which were sold at retail in Newburyport for $2,700. Mr. Hall, field agent, reports as follows on the oyster business at this place:

This is not a natural oyster region. The business is very small, and there is no prospect that it will ever increase. The oysters are planted in April and taken up during the following summer and fall. The bottom is hard mud. Sea cabbage (an alga) grows on portions of the beds. The oystermen believe it is beneficial to the oysters. The seed oysters, which come from Barnstable Bay, are large when planted. After lying on the beds one season they open 1 gallon to the bushel. No seed oysters are produced on the beds, and those brought from Barnstable Bay cost too much to render competition practicable on the part of the producers at Newburyport, as market oysters can be obtained in Boston from Virginia, Maryland, Rhode Island, and elsewhere more cheaply than they can be raised at Newburyport.

On the southern part of the Massachusetts coast, the principal places where the oyster fishery is carried on are Barnstable Bay and Wellfleet Bay, on the northern side of the Cape Cod Peninsula; Oyster Pond and Oyster Pond River, at Chatham, on the east side of the cape; Cotuit Harbor and Lewis Bay, arms of Vineyard Sound, which washes the southern shores of the peninsula; Red Brook Harbor, Bourne Neck, Buttermilk Bay, Onset Bay, Wareham River, Sippican Harbor, and Westport River, all tributaries of Buzzards Bay; and Taunton River, which enters Narragansett Bay. The oysters in these localities are taken from natural grounds having an area of about 1,100 acres and from cultivated beds with an area of about 3,125 acres. The principal natural grounds are in Taunton River and the most extensive cultivated beds are in Onset Bay and Wareham River.

The inquiries of the office showed that about 1,500 acres in Onset Bay and its arms and 800 acres in Wareham River were utilized for oyster-culture by 47 planters. Some of the planters do only a small business, while others are quite extensively engaged. Some years the set is very good, that in 1893 being the best in many years. It is reported that fully half the yearly output represents native growth. In 1892, 7,041 bushels of market oysters, valued at $14,082, were taken; 10,600 bushels of seed oysters from Connecticut and Rhode Island and 10,000 bushels of shells, costing $7,160, were planted on the grounds in the same year. The seed from Rhode Island remains planted one year and is then returned to Providence River to mature. This is done chiefly to escape the ravages of starfish in Rhode Island waters while the oysters are young, starfish being uncommon in Onset Bay and Wareham River and doing no damage. The borer, however, is quite destructive, and the periwinkle is also injurious.

Mr. W. A. Wilcox, field agent, has submitted the following notes on the oyster industry of Taunton River:

Taunton River has more acres in natural oyster beds than any other ground in the State. The natural oyster beds are estimated to cover 1,000 acres of ground; they extend on either side of the river in an almost continuous bed from the mouth at Fall River up as far as Dighton. The oyster beds are owned by the towns bordering on the river, the town right extending from the shore to the middle of the stream. Each town leases its oyster privileges to one person, who has the exclusive right to take oysters from grounds within the respective towns between September 1 and June 1. The leases are sold at public or private sale, and are good for one year or a term of years. During 1892 the town licenses for that year were as follows: Fall River, $152; Somerset, $710; Dighton, $275; Berkeley, $1,500; Freestone, $1,000 (two leases). The town of Freestone sells one privilege for Taunton River and one for Asonet River. The latter is a small stream tributary to Taunton River; natural oyster beds are found from its mouth for a distance of 2½ miles upstream.

In past years the Taunton River oysters were highly esteemed and considered equal to any in the State, but since about 1883, when extensive copper works were established at Taunton, the oysters, from some unknown cause, have taken on a greenish-yellow color and an astringent coppery flavor. As a consequence, they are not now considered wholesome and are not placed on the market or used locally, and the beds are now only valuable for the seed oysters produced. Of late years about 25,000 bushels of seed oysters have been taken annually from Taunton and Asonet rivers and transplanted in Providence River, where they lose their undesirable color and flavor, becoming equal to any oysters taken from Providence River, which is noted for its fine stock. The seed are taken up during April and May, when about 50 rowboats, with one man each, are at work on the beds. The men tong the oysters, taking on an average about 25 bushels daily, for which service they receive 10 to 20 cents a bushel.

Of late years oysters are reported to be growing scarce, which is not surprising, as there has been no good set for a number of years, and the beds are allowed no chance to recuperate.

The oyster output of Rhode Island is at present obtained almost wholly from private cultivated grounds. These have an area of about 700 acres. In 1892 there were taken from these beds 156,080 bushels of marketable oysters, valued at $239,941. As the oysters remain on the beds for about three years, on an average, and as about one-third of the ground gives up these oysters annually, it appears that the average production of marketable oysters to the acre is 670 bushels, valued at $1,020. The natural oyster beds of the State have become practically unproductive of marketable oysters. In 1892 only 2,000 bushels, valued at $2,075, were taken off the natural grounds. In addition to these, 14,865 bushels of small oysters, worth $5,783, were obtained, which were used for planting purposes.

A striking illustration of the utility of a rational system of water culture applied to mollusks is seen by comparing the oyster with other shellfish the beds of which are not subject to private ownership except on an exceedingly small scale. The susceptibility of the soft clam, the quahog, and the scallop to cultivation is perhaps as pronounced as that of the oyster, and the comparison is therefore fair. While the average quantities of soft clams, of quahogs, and of scallops taken for market in the New England States in 1892 were, respectively, 227 bushels, 154 bushels, and 176 bushels per man, the average quantity of oysters was 1,892 bushels per man. The incomes of the fishermen from the sale of these products indicate a similar disparity, being $125 per man for soft clams, $168 per man for quahogs, $141 per man for scallops, and $1,536 per man for oysters.

The clam fishery.—Clams are among the most valuable fishery resources of the New England States, and their collection constitutes one of the most extensive and important branches of the fisheries. Throughout this region the soft clam or long clam (*Mya arenaria*) is found abundantly; but it is only along the southern part of the coast that the quahog or round clam (*Mercenaria mercenaria*) occurs. The former is the more abundant and important species, considering the yield in the aggregate; it is especially prominent in Maine and Massachusetts. The quahog is most important in southern Massachusetts.

The number of persons engaged in clamming is larger than in any other fishery under consideration, with the exception of the lobster. Over 3,300 persons in 1892 took clams for a livelihood during some part of the year. In Maine there were more than 1,900 clam fishermen and in Massachusetts over 800. Owing to the inexpensive outfit required for clamming and the comparative ease with which the clams are taken, this fishery is of great assistance to the poorer classes in the fishing communities; and it is a saying along parts of the Maine coast that "the clam beds keep many people off the town." The semiprofessional nature of the fishery in Maine may be judged from the circumstance that the average value of the clams taken in 1892 was only $80 per man.

The New England clam catch in 1892 was 759,402 bushels, valued at $462,889. The yield of soft clams was 667,509 bushels, valued at $362,477, and that of quahogs 91,893 bushels, with a market value of $100,412. The production of each species by States is given in the following table:

Production of soft clams and quahogs.	States.	Bushels.	Value.
Soft clams	Maine	416,806	$157,431
	New Hampshire	1,050	975
	Massachusetts	191,923	133,529
	Rhode Island	33,950	45,222
	Connecticut	23,780	25,320
	Total	667,509	362,477
Quahogs	Maine	....	....
	New Hampshire	....	....
	Massachusetts	54,823	61,801
	Rhode Island	19,950	20,275
	Connecticut	17,120	18,336
	Total	91,893	100,412
Total	Maine	416,806	157,431
	New Hampshire	1,050	975
	Massachusetts	246,746	195,330
	Rhode Island	53,900	65,497
	Connecticut	40,900	43,656
	Total	759,402	462,889

In Maine a large part of the clams taken are salted, to be used as bait in the line fisheries for cod and other ground fish. The salted clams are placed in barrels holding about 12 bushels of shucked clams. In 1892, 75,269 bushels were thus utilized in the preparation of 5,938 barrels of clam bait, for which the fishermen received $27,044. Notwithstanding the increase in the clam production in 1892 as compared with 1880, the quantity of clams salted for bait was much greater in 1880, being 178,164 bushels, from which were prepared 12,726 barrels of pickled clams, valued at $63,630.

Between 1880 and 1892 the output of soft clams fluctuated considerably; in Maine, Massachusetts, and Rhode Island, the yield in 1889 was larger than in any other year for which complete data are available, the aggregate catch being double that in 1880. The season of 1892 was unusually poor in both Maine and Massachusetts; the catch was but little more than in 1880, and the total production of the region was hardly 100,000 bushels more than in 1880. The years 1887 and 1888 also had a larger output than 1880 and 1892.

The yield of quahogs in 1892 was perhaps the largest known up to that time. Massachusetts experienced a noteworthy advance, which counterbalanced the decline in Rhode Island and Connecticut. The abundance of this mollusk, however, seems to have been singularly uniform, as judged by the aggregate catch, the smallest production, in 1889, being only 25 per cent less than the largest in 1892.

Following is a comparative exhibition of the results of the clam fishery in each State during all the years for which figures are at hand:

Comparative statement of the yield of clams in the New England States during a series of years.

	Soft clams.		Quahogs.		Total.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Maine:						
1880	318,383	$101,808			318,383	$101,808
1887	608,780	228,490			608,780	228,490
1888	600,675	227,665			600,675	227,665
1889	595,105	200,761			595,105	200,761
1892	416,806	157,431			416,806	157,431
New Hampshire:						
1880	17,960	8,980			17,960	8,980
1887	280	140			280	140
1888	300	150			300	150
1889	300	150			300	150
1892	1,050	975			1,050	975
Massachusetts:						
1880	158,626	76,195	11,050	$5,525	169,676	81,720
1887	230,659	121,202	35,540	21,363	266,199	142,565
1888	243,777	127,838	26,165	14,822	269,942	142,660
1889	240,831	137,711	16,913	12,549	257,744	150,260
1892	191,923	133,529	54,823	61.801	246,746	195,330
Rhode Island:						
1880	53,960	48,564	42,000	35,000	95,960	83,564
1887	25,825	25,030	19,215	15,699	45,040	40,729
1888	30,825	30,030	33,029	28,075	63,854	58,105
1889	33,375	32,475	29,650	25,600	63,025	58,075
1892	33,950	45,222	19,950	20,275	53,900	65,497
Connecticut:						
1880	75,000	38,000	49,250	29,475	124,250	67,475
1887	26,735	25,370	18,887	18,677	45,622	44,047
1888	26,575	24,270	18,907	18,729	45,482	42,999
1889	26,360	24,900	21,362	21,114	47,722	46,014
1892	23,780	25,320	17,120	18,336	40,900	43,656
Total:						
1880	623,929	273,547	102,300	70,000	726,229	343,547
1887	892,279	400,232	73,642	55,739	965,921	455,971
1888	902,152	409,953	78,101	61,626	980,253	471,579
1889	895,971	395,997	67,925	59,263	963,896	455,260
1892	667,509	362,477	91,893	100,412	759,402	462,889

The question of artificially raising clams has received but little consideration; the following note of Mr. Ansley Hall, field agent, on the inception of clam-culture at Essex, Mass., will therefore prove of interest:

I found quite an interesting feature in connection with the clam fisheries at Essex, Mass., in the shape of clam-culture. In 1888 an act was passed by the legislature authorizing the selectmen of the town to stake off in lots of 1 acre or less each of the flats along the Essex River and let them to persons desiring to plant clams, for a rental of $2 per acre or lot for five years and an additional fee of 50 cents. Thus far 37½ acres have been taken up and seeded with clams. Small clams are dug on the natural beds and planted on these hitherto unproductive flats. Mr. J. Bennett Fuller states that about 500 bushels are required to plant an acre properly. During the first two years (1889 and 1890) the people were slow to avail themselves of the privilege of planting, for fear that after they had spent their time and labor they would not be able to secure protection from trespassers. But in 1891 and 1892 lots were obtained and planted. The principal difficulty encountered has been the loss of the clams by the sand washing over them, the bottom in some localities being soft and shifting. In 1892 there were 25 acres that were quite productive, about one-third of the entire catch of the section being obtained from them. The catch from these lots is not definitely known, but is estimated at about 2,500 barrels.

The cultivated clams possess some advantage over the natural growth from the fact that they are more uniform in size and are as large as the best of the natural clams. They bring $1.75 per barrel, while the natural clams sell for $1.50 per barrel. This is the price received by the catchers. One acre of these clams is considered to be worth $1,000 if well seeded and favorably located so as not to be in danger of being submerged with sand. This valuation would be too high for an average, since all the acres are not equally well seeded and located. The clammers are generally impressed that the industry can be extensively and profitably developed, and their only fear is that they will not be able to secure lots permanently. The greater part of the land available for this purpose is covered by the deeds of people owning farms along the river and the consent of the land-owners has to be obtained before lots can be taken up. It seems probable, however, that the business will continue to progress unless checked by complications that may arise relative to the occupancy of the grounds.

The scallop fishery.—The taking of scallops is recognized as a commercial fishery only in Maine, Massachusetts, and Rhode Island. In the first-named State, where the fishery is of least importance, the scallop taken differs from that obtained in the other States and is known as the giant scallop or smooth scallop (*Pecten magellanicus*). It attains a very large size, but is found only in circumscribed limits and is not especially abundant in the accessible localities. The common scallop (*Pecten irradians*) ranges from southern Massachusetts to Connecticut, and is very abundant in parts of Massachusetts and Rhode Island.

The principal grounds resorted to by the Maine scallop fishermen in 1892 were the eastern side of Mount Desert Island, the region between Deer Isle and Castine, and the Sheepscot River. In Massachusetts the scallop-grounds are in Nantucket Sound and Buzzards Bay. Scallops are generally distributed in the waters of Rhode Island, the largest catch, however, being obtained in Greenwich Bay, a tributary of Narragansett Bay, in Kent County.

In 1892 the scallop fishery was engaged in by 55 vessel fishermen, 838 boat fishermen, and 80 shoresmen, 973 persons in all. Of the fishermen, 142 were in Maine, 509 in Massachusetts, and 242 in Rhode Island. The aggregate investment in the industry was $102,397, of which $11,535 represented the value of 24 vessels, $81,970 the value of 626 boats, and $8,892 the value of the apparatus used. Of the aggregate sum $63,592 was invested in Massachusetts. The quantity of scallops taken for market in Maine was 19,374 bushels, having a value of $9,455; in Massachusetts, 84,154 bushels, valued at $75,637, and in Rhode Island, 52,690 bushels, valued at $38,998. In Connecticut, where there is no regular scallop fishery, 440 bushels of scallops, worth $330, were taken by clam fishermen.

The New England scallop output in 1892 was 231 per cent larger and the value of the catch was 905 per cent greater than in 1880. The very interesting and unusual feature shown by the statistics of a greatly augmented yield, attended by an even greater increase in the selling price, is to be accounted for by the fact that the mollusks have steadily risen in popular favor as a food product. In 1880 the yield of scallops in Massachusetts was only 7,568 bushels, having a value of $3,514, and in Rhode Island was 35,600 bushels, valued at $8,900. No fishery was at that time prosecuted in Maine. The output of giant scallops in this State has decreased since 1887, the first year for which statistics were obtained. Thus, in that year 35,204 bushels were taken, valued at $13,994; in 1888, 29,578 bushels, worth $11,278, and in 1889, when the fishery probably reached its height, 45,368 bushels, valued at $18,647.

The menhaden industry.—In 1892 seven menhaden factories were in operation in the New England States; four of these were in Connecticut, two in Rhode Island, and one in Massachusetts. In previous years several firms were engaged in the menhaden industry in Maine. The business was much less extensive than during a number of previous years. The details of this branch are brought out in the following table, which shows an investment of over $588,000 in factories, vessels, etc., a catch of 21,450,500 pounds of menhaden (equivalent to about 35,750,835 fish), and resulting manufactured products with a value of $134,144. In Rhode Island the 1,120,400 pounds of other fish besides menhaden reported as being utilized in the industry consisted chiefly of sea-robins and sculpins.

Table showing by States the extent of the menhaden industry in the New England States in 1892.

Items.	Massachusetts.	Rhode Island.	Connecticut.	Total.
Number of factories in operation	1	2	4	7
Value of factories	$8,000	$215,500	$66,800	$282,300
Amount of cash capital	$1,000	$42,000	$22,500	$65,500
Number of shoresmen employed	6	70	70	146
Number of fishermen employed	22	161	86	269
Number of steam vessels employed	1	8	4	13
Net tonnage	69.46	627.32	343.72	696.78
Value	$12,000	$126,000	$49,000	$187,000
Value of outfit and apparatus	$2,493	$34,731	$16,100	$53,324
Pounds of menhaden handled	60,000	10,355,600	11,034,900	21,450,500
Value to fishermen	$300	$38,904	$34,087	$73,291
Pounds of other fish handled	....	1,120,400	....	1,120,400
Value to fishermen	....	$1,400	....	$1,400
Number of gallons of oil made	1,100	136,540	175,006	312,646
Value as sold	$394	$37,001	$49,826	$87,221
Number of tons of scrap prepared	12	1,758	1,635	3,405
Value as sold	$144	$21,919	$24,860	$46,923

The canning industry.—The business of canning herring, mackerel, lobsters, and clams is very extensive in Maine, where it supports important fisheries. The canning of herring as sardines is the most prominent branch of this nature, and the extent of the herring fishery is in a large part due to the canneries. Fifty-eight separate establishments were operated in 1892; of these, 37 canned only sardines; 3, sardines and lobsters; 2, sardines, plain herring, lobsters, and clams; 2, sardines, lobsters, and clams; 1, lobsters only; 5, clams only; 2, herring and clams; 2, sardines and clams; 2, lobsters and clams, and 2, lobsters, clams, and herring. In Massachusetts, where the conditions appear favorable for fish canning, only 5 such establishments were in operation. At these mackerel and herring were canned.

The value of the property devoted to the canning industry in Maine in 1892 was $439,210; an additional cash capital of $549,700 was required to conduct the business. The cannery employees numbered 5,020. Over 63,000,000 pounds of raw products, for which the fishermen received $399,749, were consumed in canning. The value of the prepared products was $2,486,247.

In Maine most of the canneries are located in the eastern part of the State, in Washington County, where there were 39 in 1892. The prominent centers of the canning industry in that county are Eastport and Lubec; the former has for many years been the chief sardine center of the country, and in 1892 had 15 canneries, most of them of large size, while Lubec had 13 such establishments in 1892, and in 1893 had an increase which gave it a greater number than Eastport. The other places in this county in which canneries were located are Robbinston 2, Perry 1, West Pembroke 1, Cutler 1, Machiasport 1, Jonesboro 1, Jonesport 2, Millbridge 2. In Hancock County there were 9 canning houses, situated as follows: Prospect Harbor 1, Greens Landing 2, Oceanville 1, Brooklin 1, Hancock 1, Southwest Harbor 1, Bass Harbor 1, West Tremont 1. Knox County had 1 cannery at St. George. The 4 canneries in Lincoln County were at Pemaquid, South Bristol, Boothbay Harbor, and Round Pond. In Cumberland County were 5 canneries, as follows: Portland 2, Pine Point 2, West Scarboro 1.

The 50 establishments in Maine engaged in the preparation of sardines and plain canned herring utilized over 57,000,000 pounds of fresh herring, for which the fishermen were paid $253,848. A conspicuous part of the raw material consumed by the factories in Eastport and Lubec came from Canadian waters and is not shown in the figures for the herring fishery elsewhere given. From the foregoing there were prepared 568,853 cases (equivalent to 48,460,110 cans) of sardines, 14,883 cases (or 548,496 cans) of plain herring, 828 barrels of Russian sardines, 2,048 barrels of pickled herring, and 335,894 boxes of smoked fish, the whole having a value of $2,081,994. The most important of the numerous grades of canned herring are the small fish packed in oil in quarter-pound cans and generally known to the trade as "quarter oils." Of these, 396,428 cases of 100 cans each were prepared, for which $1,455,245 was received, an average price of $3.67 per case, or 3⅝ cents per can. Next in point of importance are the sardines in mustard in three-quarter pound cans. Of these, 149,020 cases of 50 cans each were canned, the market value of which was $435,863, or $2.92 per case. Other rather important grades of sardines are "half-oils," "three-quarter spices," and "quarter-mustards."

The 11 lobster canneries operated in Maine in 1892 were located in four counties, 5 being in Washington, 3 in Lincoln, 2 in Hancock, and 1 in Knox. The quantity of fresh lobsters utilized was 5,326,322 pounds, for which the canneries paid $78,720; from these, 25,732 cases of 1-pound and 2-pound cans were prepared, for which the canneries received $195,953.

At many of the sardine canneries in Washington County, Me., the smoking of herring constitutes an important branch. The herring so utilized are mostly surplus fish or fish too large for canning. The business is most extensive in Eastport and Lubec, a large part of the fish coming from Canadian waters, as is the case with the sardine fish. The quantity of herring utilized for smoking at the sardine canneries was about 3,465,000 pounds. The prepared product consisted of 320,894 regular-sized boxes and 15,000 boxes of bloaters, the weight of the smoked fish being 1,979,470 pounds, and the value $46.139.

The canning of soft clams, in the form of clam chowder, plain clams, and clam juice, is carried on at 17 establishments on the Maine coast—1 in Washington County, 6 in Hancock County, 4 in Lincoln County, 5 in Cumberland County, and 1 in Knox County.

In the following table the details of the canning industry of Maine are given:

Table showing the extent of the canning industry of Maine in 1892.

Items.	No.	Value.
Establishments	58	$388, 200
Cash capital		549, 700
Employees	5, 020	
Vessels and boats	106	51, 010
Total		988, 910
Raw products utilized.		
Herring ... pounds	57, 061, 320	253, 848
Mackerel ... do	51, 760	1, 339
Lobsters ... do	5, 326, 322	78, 720
Clams ... bushels	195, 914	65, 842
Total		399, 749
Manufactured products.		
Sardines, in oil:		
Quarters ... cases	396, 428	1, 455, 245
Halves ... do	6, 614	31, 870
Sardines, in mustard:		
Quarters ... do	5, 031	21, 582
Three-quarters ... do	149, 020	435, 863
Sardines, in spices:		
Quarters ... do	543	2, 145
Three-quarters ... do	5, 705	18, 011
Two pound ... do	730	1, 643
Three pound ... do	1, 042	3, 126
Odd sizes ... do	2, 000	7, 500
"Brook trout" (herring):		
One pound ... cases	278	1, 090
Two pound ... do	1, 462	4, 286
Mackerel:		
One pound ... do	708	3, 040

Items.	No.	Value.
Manufactured products—continued.		
Plain herring:		
One pound ... cases	7, 971	$22, 894
Two pound ... do	6, 912	17, 268
Pickled herring ... barrels	2, 048	9, 179
Russian sardines ... do	828	4, 153
Smoked herring:		
Regulars ... boxes	320, 894	36, 514
Bloaters ... do	15, 000	9, 625
Lobsters:		
One pound ... cases	25, 603	195, 114
Two pound ... do	129	839
Clams:		
One pound ... do	34, 146	108, 933
Two pound ... do	23, 313	49, 658
Clam chowder:		
One pound ... do	675	2. 294
Three pound ... do	6, 341	19, 631
Clam juice ... do	1, 151	4, 604
Total		2, 466, 107
Secondary products.		
Oil ... gallons	14, 140	3, 160
Pomace ... tons	1, 506	14, 632
Refuse		2, 348
Total		20, 140
Total of manufactured and secondary products		2, 486, 247

Statistical recapitulation.—In the following series of tables the extent of the foregoing fisheries is shown by States. The statements relate (1) to the number of persons engaged in each branch, (2) to the vessels, boats, and apparatus employed in each fishery, and (3) to the quantity and value of the catch in each form of apparatus. In the tables of persons engaged and of boats, vessels, and apparatus used, the full extent of each branch is shown, regardless of the duplications of persons and appliances employed in two or more fisheries.

In a statistical paper printed in the Bulletin of the Fish Commission for 1893, use was made of the advance returns for the New England fisheries, the data desired for the paper in question being hastily compiled from field agents' notes. In the final compilation of the figures certain revisions were necessary, which make the information heretofore published differ in some particulars from the actual results of the field investigation as correctly given in the present report.

Table showing the number of persons engaged in certain fisheries of the New England States in 1892.

Fisheries.	Maine.	New Hampshire.	Massachusetts.	Rhode Island.	Connecticut.	Total.
Alewife	179	9	318	51	14	571
Herring	1,409	17	569			1,995
Menhaden				161	217	378
Salmon	198					198
Shad	454				116	570
Smelt	1,913	47	25	13	19	2,017
Lobster	2,628	26	616	145	258	3,673
Clam	1,940	14	843	228	339	3,364
Oyster			251	187	714	1,152
Scallop	142		509	242		893
Whale			1,396		13	1,409

Table showing by States the vessels, boats, and apparatus employed in the capture of certain products of the fisheries of the New England States in 1892.

Fisheries and apparatus.	Maine.		New Hampshire.		Massachusetts.		Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Alewife:												
Boats	115	$3,605	7	$110	100	$1,730	29	$580	7	$155	258	$6,180
Pound nets, trap nets, and weirs	38	2,630	6	300	5	86	11	660			60	3,676
Seines			1	150	91	4,470	20	720			112	5,340
Gill nets	178	950							25	1,250	203	2,200
Dip nets	75	150			76	140					151	290
Total		7,335		560		6,426		1,960		1,405		17,686
Herring:												
Vessels	32	27,450			11	4,802					43	32,252
Tonnage	673.39				112.78						786.17	
Outfit		5,650				951						6,601
Boats	1,169	57,907	37	1,536	404	30,054					1,610	89,497
Pound nets, trap nets, and weirs	213	64,616			97	118,745					310	183,361
Seines	20	6,125			8	2,150					28	8,275
Gill nets	4,380	35,671	84	1,197	707	7,773					5,171	44,641
Dip nets	1	1			57	212					58	213
Total		197,420		2,733		164,687						364,840
Menhaden:												
Vessels							8	126,000	6	67,500	14	193,500
Tonnage							627.32		483.14		1,110.46	
Outfit								19,331		13,900		33,231
Boats									88	8,295	88	8,295
Pound nets, trap nets, and weirs									75	22,470	75	22,470
Seines							15	13,400	13	9,640	28	23,040
Total								158,731		121,805		280,536
Salmon:												
Boats	210	4,272									210	4,272
Pound nets, trap nets, and weirs	211	14,445									211	14,445
Gill nets	20	615									20	615
Lines		8										8
Total		19,340										19,340

Table showing by States the vessels, boats, and apparatus employed in the capture of certain products of the fisheries of the New England States in 1892—Continued.

Fisheries and apparatus.	Maine.		New Hampshire.		Massachusetts.		Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Shad:												
Boats	297	$6,640							55	$2,095	352	$8,735
Pound nets, trap nets, and weirs	156	13,280									156	13,280
Seines									12	675	12	675
Gill nets	365	3,425							46	2,312	411	5,737
Total		23,345								5,082		28,427
Smelt:												
Boats	390	9,895					6	$175	12	195	408	10,265
Pound nets, trap nets, and weirs	50	1,680					12	1,350			62	3,030
Seines	152	7,970					1	175	8	560	161	8,705
Bag nets	255	9,810	50	$200							305	10,010
Lines		383		5		$8						396
Total		29,738		205		8		1,700		755		32,406
Lobster:												
Vessels	7	6,070			2	1,350	12	7,000	34	31,400	55	45,820
Tonnage	77.11				17.77		84.43		322.17		501.48	
Outfit		980				360		1,565		14,865		17,770
Boats	2,888	242,629	29	594	739	47,162	86	15,320	183	17,585	3,[illegible]5	323,290
Pots	153,043	143,709	1,393	2,786	26,192	38,479	6,341	10,090	10,105	22,178	197,074	217,242
Total		393,388		3,380		87,351		33,975		86,028		604,122
Clam:												
Vessels					1	1,000	2	1,100			3	2,100
Tonnage					7.89		16.48				24.37	
Outfit						20		265				285
Boats	1,548	27,506	14	180	663	16,000	183	4,860	172	5,290	2,580	53,836
Hoes, rakes, etc		1,894		11		2,605		833		463		5,806
Total		29,400		191		19,625		7,058		5,753		62,027
Oyster:												
Vessels					1	2,000	6	18,100	123	304,140	130	324,240
Tonnage					17.87		79.90		2,488.44		2,586.21	
Outfit						2,100		3,322		40,540		45,962
Boats					369	22,440	189	14,431	543	52,413	1,101	89,284
Dredges					158	912	62	2,415	240	3,198	460	6,525
Tongs					275	1,457	294	2,214	509	2,249	1,078	5,920
Total						28,909		40,482		402,540		471,931
Scallop:												
Vessels	2	400			19	8,800	3	1,400			24	10,600
Tonnage	33.60				130.27		17.58				181.45	
Outfit		170				700		65				935
Boats	64	3,610			322	49,370	240	28,990			626	81,970
Dredges and rakes	105	504			1,236	4,722	874	3,666			2,215	8,892
Total		4,684				63,592		34,121				102,397
Whale:												
Vessels					51	364,600			1	4,000	52	368,600
Tonnage					9,410.27				127.33		9,537.60	
Outfit and apparatus						329,100				3,000		332,100
Total						693,700				7,000		700,700

Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892.

Species and apparatus.	Maine.		New Hampshire.		Massachusetts.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alewives:						
Pound nets, trap nets, and weirs............pounds..	1,411,350	$13,302	45,000	$690	720,025	$10,850
Gill nets..............do....	583,150	3,877	....	....	....	....
Seines.................do....	....	....	5,000	80	1,853,200	32,812
Dip nets...............do....	282,000	1,875	....	....	1,077,650	14,854
Total	2,276,500	19,054	50,000	770	3,650,875	58,516
Herring:						
Pound nets, trap nets, and weirs............pounds..	32,072,214	224,250	....	....	6,247,315	60,164
Gill nets..............do....	6,905,700	42,396	140,000	1,500	1,915,900	14,639
Seines.................do....	1,832,250	7,738	6,600	115	2,323,600	20,593
Dip nets...............do....	4,000	13	....	....	1,616,650	15,433
Total	40,814,164	274,397	146,600	1,615	12,103,465	110,829
Menhaden:						
Pound nets, trap nets, and weirs............pounds..	....	....	....	....	185,010	3,036
Gill nets..............do....	83,140	532	4,000	40	....	....
Seines.................do....	....	....	....	....	65,000	722
Total	83,140	532	4,000	40	250,010	3,758
Salmon:						
Pound nets, trap nets, and weirs............pounds..	94,112	19,475	....	....	....	....
Gill nets..............do....	3,650	745	....	....	....	....
Lines..................do....	560	112	....	....	....	....
Total	98,322	20,332	....	....	....	....
Shad:						
Pound nets, trap nets, and weirs............pounds..	686,870	20,379	....	....	48,382	2,409
Gill nets..............do....	182,100	7,672	....	....	....	....
Seines.................do....	....	....	....	....	86.127	2,396
Total	868,970	28,051	....	....	134,509	4,805
Smelt:						
Pound nets, trap nets, and weirs............pounds..	72,870	6,215	....	....	....	....
Seines.................do....	839,478	54,363	....	....	....	....
Bag nets...............do....	301,050	25,159	16,500	1,650	....	....
Lines..................do....	403,360	30,176	14,500	1,450	3,000	600
Total	1,616,758	115,913	31,000	3,100	3,000	600
Lobsters:						
Pots................pounds..	17,642,677	663,043	196,350	11,790	3,182,270	205,638
Clams:						
Rakes, hoes, etc...bushels..	416,806	157,431	1,050	975	246,746	195,330
Oysters, market:						
Dredges and tongs....do....	....	....	....	....	29,807	59,638
Oysters, seed:						
Dredges and tongs....do....	....	....	....	....	35,000	24,000
Total	....	....	....	....	64,807	83,638
Scallops:						
Dredges and rakes..bushels..	19,374	9,455	....	....	84,154	75,637
Whale:						
Oil, whale.........gallons..	....	....	....	....	208,085	87,389
Oil, sperm............do....	....	....	....	....	440,159	294,931
Bone...............pounds..	....	....	....	....	120,150	585,347
Ambergris..........do....	....	....	....	....	20	5,277
Total	....	....	....	....	....	972.944
Total value special fisheries	....	1,288,208	....	18,290	....	1,711,695

Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892—Continued.

Species and apparatus.	Rhode Island.		Connecticut.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alewives:						
Pound nets, trap nets, and weirs............pounds..	487,468	$8,126	79,360	$683	2,743,203	$33,651
Gill nets..............do....	....	....	601,600	3,125	1,184,750	7,002
Seines................do....	702,125	10,090	....	....	2,560,325	42,982
Dip nets..............do....	....	....	....	....	1,359,650	16,729
Total	1,189,593	18,216	680,960	3,808	7,847,928	100,364
Herring:						
Pound nets, trap nets, and weirs............pounds..	700	30	....	....	38,320,229	284,444
Gill nets..............do....	....	....	....	....	8,961,600	58,535
Seines................do	....	....	....	....	4,162,450	28,446
Dip nets..............do....	....	....	....	....	1,620,650	15,446
Total	700	30	....	....	53,064,929	386,871
Menhaden:						
Pound nets, trap nets, and weirs............pounds..	34,000	57	2,515,200	7,332	2,734,210	10,425
Gill nets..............do....	....	....	....	....	87,140	572
Seines................do....	10,726,600	40,725	20,432,280	63,548	31,223,880	104,995
Total	10,760,600	40,782	22,947,480	70,880	34,045,230	115,992
Salmon:						
Pound nets, trap nets, and weirs............pounds..	....	....	78	45	94,190	19,520
Gill nets..............do....	....	....	35	24	3,685	769
Lines.................do....	....	....	....	....	560	112
Total	....	....	113	69	98,435	20,401
Shad:						
Pound nets, trap nets, and weirs............pounds..	24,350	776	21,602	1,679	781,204	25,243
Gill nets..............do....	....	....	71,708	6,052	253,808	13,724
Seines................do....	....	....	17,252	1,704	103,379	4,100
Total	24,350	776	110,562	9,435	1,138,391	43,067
Smelt:						
Pound nets, trap nets, and weirs............pounds..	18,740	1,720	....	....	91,610	7,935
Seines................do....	19,460	1,840	8,810	790	867,748	56,993
Bag nets..............do....	....	....	....	....	317,550	26,809
Lines.................do....	....	....	....	....	420,860	32,226
Total	38,200	3,560	8,810	790	1,697,768	123,963
Lobsters:						
Pots...............pounds..	774,100	53,762	1,614,530	101,358	23,409,927	1,035,591
Clams:						
Rakes, hoes, etc...bushels..	53,900	65,497	40,900	43,656	759,402	462,889
Oysters, market:						
Dredges and tongs....do....	159,581	253,459	985,794	888,685	1,175,182	1,201,782
Oysters, seed:						
Dredges and tongs....do....	14,865	5,783	954,380	537,564	1,004,245	567,347
Oyster shells:						
Dredges and tongs....do....	40,661	2,033	190,000	6,230	230,661	8,263
Total	215,107	261,275	2,130,174	1,432,479	2,410,088	1,777,392
Scallops:						
Dredges and rakes.bushels..	52,690	38,998	440	330	156,613	124,420
Whale:						
Oil, whale ....gallons..	....	....	3,150	1,323	211,235	88,712
Oil, sperm............do....	....	....	....	....	440,159	294,931
Bone .. ..pounds..	....	....	....	....	120,150	585,347
Ambergris ....do....	....	....	....	....	20	5,277
Total	....	....	....	1,323	....	974,267
Total value special fisheries................	....	482,896	....	1,664,128	....	5,165,217

THE GREAT LAKES.

In connection with the consideration of the fish and fisheries of the basin of the Great Lakes by the international commission appointed by the United States and Canada to investigate the fisheries of the contiguous waters of the two countries, a canvass of the commercial fisheries of the United States waters of these lakes was begun by this division in May, 1894, and by the close of the fiscal year had progressed satisfactorily. The inquiry related to the statistics and methods of the industry, the abundance of the economic fishes, and the changes occurring since the last investigation. The United States Fish Commission conducted a complete canvass of the Great Lakes in 1891, the results of which are published in the annual report for 1892; but recent marked and rapid changes in certain important phases of the industry made another inquiry at this time desirable in order to arrive at a proper knowledge of the extent and methods of the fisheries.

SPECIAL INQUIRIES.

PACIFIC COAST FISHERIES.

In November, 1893, Mr. A. B. Alexander, fishery expert on the *Albatross*, was detached from that vessel and assigned to temporary field duty in this division. He was ordered to make a study of those fishes which have been artificially introduced into the waters of the Pacific States and become the object of fisheries. Supplementary instructions were subsequently issued covering a canvass of the whale fishery and salmon-canning industry. Mr. Alexander had previously been engaged in similar inquiries for this division, and his familiarity with the fisheries of the region made his services valuable. The inquiry began November 7, and was continued until about February 10. Work was begun in the vicinity of San Francisco, extended as far south as Monterey Bay, and later carried on at Portland, Astoria, and other places on the northern part of the west coast.

The fishes to which attention was specially directed were shad, striped bass, black bass, catfish, eel, and carp. The inquiry was addressed to the methods, apparatus, history, and statistics of the fisheries, to the wholesale trade, and to such phases of the natural history as may have a bearing on the practical aspects of the subject. Statistical data relating to the calendar year 1893 were obtained. The data collected for the whale fishery consisted of the statistics for the year 1893 for the San Francisco fleet and for the New Bedford vessels rendezvousing at the former port. The salmon investigation covered all phases of the packing industry in California, Oregon, Washington, and Alaska. While it was not feasible to visit all streams on which salmon canneries were located, nor to personally study the salmon-packing in Alaska, complete information was obtainable for the more remotely located canneries at the headquarters of the firms located in San Francisco and Portland.

The notes submitted by Mr. Alexander on the shad and striped bass are reserved for incorporation in a special report now in course of preparation, in which the entire subject of fish acclimatization in the Pacific States is considered. His statistics of the whale fishery and salmon-canning industry have been embodied in a general report on the fisheries of the Pacific States, prepared by Mr. W. A. Wilcox. An outline of the results of his work is here given.

The shad is increasing in numbers yearly, and is now one of the cheapest fish on the coast. Comparatively few years ago only the wealthy could afford to buy shad; now it is within the reach of everyone. Only a small part of the supply is taken, and few fish are obtained in nets set especially for them. With proper apparatus, the catch could doubtless be increased to ten times more than it is at present.

During the year 1893 the fish was very numerous in the Sacramento and San Joaquin rivers and in the San Francisco Bay region, which is the center of its abundance, and was very low in price. About the middle of November it was selling at 2 cents a pound in the city markets, and about the first of the month the fish sold as low as 4 and 5 cents apiece. Mr. Alexander found the crab fishermen were using shad for bait, a circumstance forcibly illustrating the fish's abundance and cheapness.

In Monterey Bay, the southern limit of distribution of the fish, it is more abundant on the north side, near Soquel and Santa Cruz, than on the south side, in the vicinity of Monterey. Only six shad were taken at Monterey in 1893, while on the other side of the bay the catch was much larger, although small as compared with that in other waters.

In the Columbia River the shad is very rapidly increasing in numbers. Each season shows a decided increase over the preceding one. The physical conditions appear to be quite as favorable to the shad as those found in the Sacramento and San Joaquin rivers. Only an inconspicuous part of the run is taken, and the entire quantity marketed is obtained incidentally in traps and seines operated for salmon.

The striped bass, like the shad, has steadily increased in numbers, and like the shad it attains its greatest abundance in San Francisco Bay and its tributaries. In the lower courses of the Sacramento and San Joaquin rivers it is very numerous and it may there be taken at all seasons. It is, however, much less numerous than the shad and holds a higher place in popular estimation as a food-fish. At the present rate of increase, it would appear that in a few years the supply will so far exceed the demand that the price of the fish will be reduced almost to that of the shad.

Monterey Bay marks the southern limit of the range of the striped bass as it does of the shad. The bass is so uncommon in the bay that it may almost be regarded as a straggler. At Monterey only two or three have ever been taken. At Santa Cruz only one was taken in 1893; this weighed 15 pounds. At Capitola bass were first taken in 1893; 25, weighing 260 pounds, were obtained in a drag seine.

This fish has not as yet distributed itself along the more northern parts of the Pacific Coast. It is not known from the Columbia River, and there are no records of its capture at any place in either Oregon or Washington.

An interesting fact disclosed by Mr. Alexander's inquiries is that the striped bass feed largely on carp, which are very numerous in the rivers frequented by the bass, and are by many persons considered of little value. If further inquiries show that carp constitute an important part of the food supply of the bass, they will doubtless rise in popular favor. On November 22, of 9 bass opened in the San Francisco markets 6 contained carp, and Mr. Alexander is convinced that 7 bass in every 10 will be found to contain carp.

Black bass are well distributed in numerous rivers, lakes, and reservoirs in California, but are not taken in commercial fishing. The fish have readily become accustomed to their new environments and are rapidly increasing.

Carp and catfish are very abundant in the Sacramento and San Joaquin and Columbia rivers, and are also found in other waters of the west coast. They do not rank high as food-fish, but considerable quantities are taken and sold in the San Francisco, Sacramento, and Portland markets. The catfish have failed to attain the average size reached by the fish in their natural habitat, but the carp are as large as those found anywhere in the country.

Diligent inquiry was made by Mr. Alexander as to the possible existence of lobsters on the Pacific Coast as a result of the attempts to acclimatize them made by the United States Commission of Fish and Fisheries. Several reports of the capture of the eastern lobster had from time to time been circulated since the experimental plans were made, and in the summer of 1893 accounts of the taking of other reputed lobsters in the vicinity of Monterey were published. Mr. Alexander reported as follows on this subject:

Reports are frequently circulated that lobsters have been taken by the fishermen of Monterey, but each time the investigation which has followed has proved the story false. Those not familiar with the lobster easily mistake the fresh-water crayfish for that animal. During the past season a report was circulated through the press of this coast that several small Eastern lobsters had been caught at Monterey, and to add strength to the story it was stated that samples had been sent to the Fish Commission for identification, and word had been sent back that the samples received were the genuine Eastern lobster. Such reports are very misleading, and have caused considerable inquiry to be made concerning the lobsters planted on the coast in 1888.

The writer has had occasion to interview the fishermen of Monterey several times during the past four years, but has never been able to find a man who was certain he had caught a lobster. Prof. Charles H. Gilbert saw the specimens that were taken this summer, and states that they were fresh-water crayfish.

That several of the lobsters planted at Monterey have been caught, there is little doubt. Captain Nichols, of the United States Navy, says that several years ago he ate a lobster which was purchased at a market in Oakland; being an Eastern man, and having taken an interest in the fisheries all his life, it is to be presumed that he is correct in what he says. The white fishermen say they have never been guilty of saving what they supposed to be lobsters, but are of the opinion that the Chinese have caught and sold many specimens, but of this there is no direct proof. From what can be learned it would seem that the lobsters planted here were either caught before they had time to increase, or the character of the bottom and general surroundings was not suited to them for propagating.

No traces of the lobsters planted off Trinidad, Cal., have ever been found. The fishermen of that locality have made diligent search for them with such appliances as they had, but to no purpose. Captain Nichols, in charge of the Light-House Board of California, has had lobster pots made and set on and near the spots where they were planted. This kind of apparatus has also met with negative results.

In view of the fact that nearly five years have passed since the planting was made, it is very probable that the water and general surroundings of this locality are not conducive to their growth. A few lobsters planted off the coast washed by so vast an ocean as the Pacific can not be considered a fair test; 302 lobsters, the number planted, would naturally in a few days become more or less scattered, and the sexes widely separated and perhaps never get together again.

It is frequently stated that a lobster ought to live in a water where crayfish are found. This can hardly be expected, for crayfish are never found as far north as Monterey Bay, which proves conclusively that they require warmer water than a lobster, and in all probability they would not live off the New England coast.

The geographical position, temperature of water, and general character of the bottom in many parts of Alaska are, in the opinion of the writer, much better suited to the requirements of the lobster than that part of the coast lying below or south of Cape Flattery. The whole archipelago of southeastern Alaska contains many places where the lobster would be more likely to live and multiply than any other place on the Pacific Coast.

The temperature and other environments of this region correspond more closely to the home of the lobster on the Atlantic Coast. It is quite evident that lobsters require a change in temperature of water far greater than they would find off the Pacific Coast below 50° N. latitude, from the fact that they are only found in latitudes where the water undergoes such a change.

The coast of southeastern Alaska is cut up into hundreds of islands both large and small, forming numerous bays, channels, and estuaries very similar to the coast of Maine and some parts of Nova Scotia and Newfoundland. From Massachusetts to the Gulf of St. Lawrence is where the lobster abounds in greatest numbers, and in this region the water in summer is comparatively warm and in winter extremely cold, elements perfectly congenial to this crustacean. In Alaska the water annually undergoes, to a much less degree, the change which takes place in the latitudes above mentioned. All things considered, no great mistake would be made in planting lobsters in the waters of southeastern Alaska. The harbor of Sitka would be an excellent place to try the experiment; also at Hooniah. There are many localities equally as good above Prince of Wales Island, viz: Howkan, Nichols Bay, and Shakan; or at Loring, Revillagigedo Island, and several more points farther up the Behm Canal.

The canvass of the whale fishery carried on from San Francisco by San Francisco and New Bedford vessels disclosed a fleet of 49 vessels in 1893. In comparatively recent years San Francisco has attained leading importance as a whaling center. The scarcity of whales in the Atlantic Ocean and the relative abundance of the valuable bowhead whales in the North Pacific and Arctic oceans have led to the transfer of a number of New Bedford vessels, which, with the local fleet, have made San Francisco the principal rendezvous for whaling vessels in the United States.

The fleet consisted of 35 vessels belonging in San Francisco and 14 others owned in New Bedford. The tonnage of the combined fleet was 13,910 net tons, and the value was $1,702,360. Thirteen of the vessels were propelled by steam. Detailed figures showing the number and tonnage of vessels of each rig, etc., are given in the following table:

Vessels.	San Francisco fleet.		New Bedford fleet.		Total.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Steam barks	9	3,188.66	2	763.73	11	3,952.39
Steam brigs	1	164.78			1	164.78
Steam barkentine	1	281.42			1	281.42
Barks	a 15	4,573.25	10	3,358.57	25	7,931.82
Brigs	4	779.87	1		5	779.87
Ship			1	328.55	1	328.55
Schooners	b 5	471.57			5	471.57
Total	35	9,459.55	14	4,450.85	49	13,910.40
Value		$656,000		$241,000		897,000
Value of outfit		595,360		210,000		805,360

a Includes one vessel of 307.24 tons burned at sea while bound for the Arctic Ocean.
b Includes one vessel of 141.25 tons engaged in trading for bone and ivory with the natives in the Arctic Ocean.

The persons employed on the whaling vessels with headquarters at San Francisco numbered 1,767; 1,214 of these were on the local fleet and 553 on the New Bedford vessels. The 13 steamers carried 520 persons, an average of 40 to a vessel, while the 36 sailing vessels had 1,247 men, an average of about 35, as shown in the following table:

Rigs.	San Francisco fleet.	New Bedford fleet.	Total.
Steam barks	373	86	459
Steam brigs	24		24
Steam barkentine	37		37
Barks	590	402	992
Brigs	108	27	135
Ship		38	38
Schooners	82		82
Total	1,214	553	1,767

In 1893 337 whales were taken by the San Francisco whaling fleet; of these, 288 were obtained by San Francisco vessels and 49 by New Bedford vessels. The catch comprised 278 bowhead whales, 45 sperm whales, 13 right whales, and 1 humpback whale; these yielded 225,951 gallons of oil and 417,266 pounds of bone ,worth $1,136,657. Figures showing the results of the fishery by San Francisco and New Bedford vessels are separately given in the following statement:

Table showing the number of whales taken and products obtained by the fleet rendezvousing at San Francisco in 1893.

Whales taken.	San Francisco vessels.	New Bedford vessels.	Total.	Products.	San Francisco vessels.	New Bedford vessels.	Total.
Sperm	40	5	45	Sperm oil..galls..	31,400	5,700	37,100
Right	5	8	13	Whale oil....do...	117,441	71,410	188,851
Bowhead	243	35	278	Whalebone..lbs..	368,966	48,300	417,266
Humpback		1	1	Ivory........do...			
Total	288	49	337	Value	$956,249	$180,408	$1,136,657

NOTE.—In addition to the products given, 1,350 pounds of bone and 2,000 pounds of ivory, valued at $3,700, were landed by a vessel that traded with the natives.

The classification of the whaling fleet by fishing-grounds and the number of whales of each species taken on the different grounds are given in the following table. The importance of the North Pacific and Arctic oceans will be readily seen from the figures presented. More than nine-tenths (293) of the whales captured were taken on those grounds, and of these fully 280 were obtained in the Arctic Ocean.

Table showing by fishing-grounds the number of whales taken by the vessels rendezvousing at San Francisco in 1893.

Fishing-grounds.	San Francisco fleet.						New Bedford fleet.						Total.					
	No. of vessels.	Number of whales.					No. of vessels.	Number of whales.					No. of vessels.	Number of whales.				
		Sperm.	Right.	Bowhead.	Humpback.	Total.		Sperm.	Right.	Bowhead.	Humpback.	Total.		Sperm.	Right.	Bowhead.	Humpback.	Total.
North Pacific and Arctic oceans	a33	....	5	243	....	248	13	4	5	35	1	45	46	4	10	278	1	293
Okhotsk Sea	1	3	....	....	....	3	1	1	3	....	....	4	2	4	3	....	....	7
South Pacific and Indian oceans	1	37	....	....	....	37	....	....	....	....	....	....	1	37	....	....	....	37
Total	35	40	5	243	....	288	14	5	8	35	1	49	49	45	13	278	1	337

a Includes one vessel burned on the way to the fishing-grounds and one vessel engaged in trading for bone and ivory.

The season in the Arctic was remarkably successful. One vessel took 48 bowhead whales; these yielded 72,000 pounds of bone, valued at $180,000. Five other vessels secured, respectively, 45, 38, 30, 26, and 20 whales and stocked over $100,000 each ($163,750 to $104,298).

The practice of remaining in the Arctic during the winter in order to be early on the grounds is becoming more prevalent, and 7 steamers and 3 sailing vessels wintered near the mouth of the Mackenzie River in 1893.

In May, 1894, the writer made a brief visit to the Pacific Coast for the purpose of studying the apparatus and methods of the fisheries. He was instructed by the Commissioner to make observations on the condition of the salmon industry, the sturgeon fishery, and other prominent branches, and to give special attention to those fishes which have been artificially introduced into the waters of the Pacific States, namely, the shad, the striped bass, the catfish, and the carp.

The inquiry began in San Francisco, Cal., May 24 and was terminated at Portland, Oreg., June 25. The short time available restricted the inquiry to the fisheries of greatest extent and interest and to the localities affording the best opportunities to see the greatest variety of fishery products and methods. The results of the inquiry will be incorporated in a special report and need only be outlined at this time.

The time spent in San Francisco and vicinity was chiefly devoted to the consideration of the market fishery for salt-water products; to the salmon, shad, striped bass, sturgeon, and other fisheries in the lower courses of the Sacramento and San Joaquin rivers and in San Francisco, San Pablo, and Suisun bays, and to the San Francisco fish trade. Some valuable data relating to the acclimatized fishes were obtained from the records of the wholesale dealers. Through the courtesy of the California Fish Commission several days were passed in the Sacramento-San Joaquin delta, where are located the principal spawning-grounds of the shad and striped bass and important fishing-grounds for them, salmon, and other species.

A short visit was made to San Pedro, in Los Angeles County, for the purpose of investigating the sardine fishing and canning at that place. While the sardine (*Clupea sagax*) is found along the whole length of the west coast, it appears that it is only in the southern part of its range that it occurs in sufficient abundance and with enough regularity to permit the prosecution of a successful business. A sardine cannery was established at San Pedro in 1893. This is the only cannery of the kind now on the Pacific Coast, although for a number of years prior thereto sardine canning had been done at San Francisco. Sardines of suitable size are quite abundant, and the prospects seem very favorable. In connection with the capture and utilization of sardines, a scombroid fish (*Trachurus picturatus*), locally called Spanish mackerel, is taken and canned.

At Astoria and Portland attention was given to the important fisheries for salmon and sturgeon and to the canning industry. The prevalence of unprecedentedly high water prevented a visit to the interesting wheel and other fisheries of the Upper Columbia River. Some very suggestive detailed statistics regarding the present and past condition of the salmon industry were secured at Astoria. A canvass among canners and others interested in the fishing industry and deeply concerned in the preservation of the salmon showed that while all looked to extensive artificial propagation as affording the most certain relief, practically all favored the establishing of a close time throughout April or August, or both.

INQUIRY REGARDING WHITING.

In the summer of 1893 an inquiry regarding the edible qualities of the whiting (*Merlucius bilinearis*) was made. This fish is a member of the cod family, and occurs in great abundance on the New England coast. It reaches an average length of about 20 inches. It is known as whiting, silver hake, and Old England hake. Attention has from time to time been drawn to the probable economic value of the fish, in the publications of the Commission. In a report on the fisheries of the New England States, printed in the Fish Commission Bulletin for 1890, the following reference to this fish was made:

Although the whiting, as it comes from the water, is one of the best flavored and most nutritious of our food-fishes, the difficulty of keeping it fresh and in good condition when iced has militated against its utilization to a large extent for market purposes. Often great quantities are taken in pound nets and floating traps, but generally these fish have to be turned out of the nets, only to reenter perhaps on the next tide. Some effort has been made to market at least a portion of the catch, and it is to be hoped that a method will be discovered for utilizing quantities of this species. In view of its abundance and cheapness it seems pertinent to suggest the possibility of its profitable utilization by canning or smoking. Its delicate flavor should make it an excellent article of food when canned, or, if lightly salted and prepared like kippered herring and finnan haddies, a demand might be created which would consume great quantities of what is now essentially a waste product.

While small quantities are utilized in a fresh condition or for salting, in most places the whiting is regarded as having no market value, and fully nine-tenths of the quantities taken are discarded. It is especially abundant in the region of Cape Cod, Massachusetts, where it is taken in large numbers each year in pound nets set for mackerel and other fish. When this section was visited June 1-12, 1893, there was an exceedingly large body of whiting in Cape Cod Bay and the pound nets were filled with them; one net at Provincetown on June 9 contained 300 barrels, and some nets had been dismantled so that the trouble of having to turn the fish out might be obviated.

The abundance of the whiting at that time and its nonutilization prompted an inquiry into its possible food value and economic importance. According to the statements of the weir fishermen, there are often 400 to 500 barrels of whiting in some nets at one time, and in a single week as many as 2,000 barrels will be taken. Many of the fish must be caught a number of times, for as long as the school remains they continue to enter the traps. An estimated annual catch of 100,000 barrels would probably be below the actual figures.

The run of whiting in Cape Cod Bay usually begins in the latter part of May and continues about two weeks. The fish are in a spawning condition at this time. There is also another well-marked run in the fall. Scattering fish are taken throughout the pound-net season. The fish thus obtained are usually from 18 to 24 inches long and weigh about 2 pounds, although many smaller fish are taken.

It may be said that practically no use is made in the Cape Cod region of the whiting in a fresh state. A few are at times shipped to New York where they bring the same price as haddock, and to Boston where there is little market for them; small numbers are used for lobster bait. The opinion is unanimous as to the excellent food qualities of the whiting in a perfectly fresh condition. The flesh is very sweet and palatable, and the fish is generally regarded as equal to cod, haddock, and hake, and, by some, preferred to those fish. The fish is by some persons considered too soft to bear shipment well, with the present methods of preservation; others, however, say that when properly iced it keeps as well as any other fish. Objection is made to its use fresh as bait in the line fisheries on account of its softness.

In this region the whiting is generally regarded as a nuisance. Its advent interferes with the run of better fish, such as mackerel and herring, and no large catches of the latter are made while the whiting remain. A great many are killed in emptying the nets, and the dead bodies often thickly cover the shores and bottom. They are also destructive to the nets, owing to slime which accumulates on the twine when large numbers of fish are crowded into the pounds.

Small quantities of salted whiting have been prepared for sale at Provincetown and other places on Cape Cod, although most of the fish thus preserved have been for home consumption. Mr. Henry T. Lewis, of Provincetown, pickled 80 barrels of whiting in 1892 and sent them to Cayenne, South America, on a whaler, where they sold for $7 per barrel. In 1893 it was his intention to prepare several hundred barrels for the West Indian or South American trade.

When split and pickled the fish keep well, retain a good color, and will bear shipment to the tropics. When dry-cured, however, they become very hard, turn yellowish, owing to the oil they contain, and lose their market value.

Mr. Morgan, of South Truro, a fish-canner of much experience, states that the experiments made in canning whiting have shown that the fish is not well suited to that method of preservation; the flesh is flaky and breaks up in the canning process.

The possibility of utilizing whiting for salting was suggested, and it seemed probable that in Central and South America a market might be created for this cheap fish. It was, therefore, determined to secure an expression of opinion from a number of dealers and to have some samples of salted whiting prepared for a distribution with a view to test their edible qualities. Mr. W. A. Wilcox, agent of the Commission, who was then in the Cape Cod region, was instructed to make arrangements for the preparation of the fish, and Capt. Atkins Hughes, of North Truro, was engaged to select and cure them. It was intended to have them prepared in a number of different ways—as pickled, kench-cured, and smoked—but it was found feasible to have only the pickled fish prepared. Through some misunderstanding, the fish intended for pickling were not eviscerated and split in the best manner, and the samples presented a less inviting appearance than might otherwise have been the case. Several hundred pounds were distributed in Gloucester and Boston by agents of the office, and at the same time the following letter, in which the objects of the inquiry were explained, was addressed to the principal firms by the Commissioner:

The United States Fish Commission is desirous of securing an expression of your opinion as to the economic value of the fish known on the New England coast as the whiting, silver hake, or Old England hake. As you are doubtless aware, it occurs abundantly on our shores, and is taken in large quantities in traps and pound nets. Owing to real or supposed difficulties in shipping it to market in a fresh condition and the low price which it commands, only small quantities are utilized for food purposes, and in many places it is regarded as a nuisance. It has occurred to me that the financial condition of many of our fishermen might be materially improved if means could be devised to utilize the whiting, either in a fresh or prepared state; and it is with a view to secure the benefit of your experience and advice in this matter that this communication is addressed to you.

I am aware that efforts have long ago been made to introduce this fish into commerce and give it a permanent place in our fish trade; that prior to the expiration of the reciprocity treaty there was a limited trade in salt whiting with the British Provinces, and that small consignments of this fish have in recent years been sent to Brazil, the West Indies, and other places; but there has probably never been a better opportunity to make profitable use of this waste product than is now afforded by the reciprocity relations established between the United States and various other countries.

The Commission has recently had prepared at North Truro, Mass., a quantity of pickled whiting with a view to submit them to the principal dealers in Boston, Gloucester, and elsewhere and have their edible and commercial qualities determined. It is the intention to continue the inquiries and to ascertain the value of the fish for smoking, canning, etc. Within a short time an assistant of this office will wait upon you and present to you samples of the fish. Permit me to ask that you will kindly examine them and favor me with a written statement of your views.

The principal points on which your opinion is desired are the following:

(1) The commercial importance of whiting prepared like the samples.

(2) The food value of the whiting in a dry-salted and pickled state as compared with (1) cod, (2) hake, and (3) haddock.

(3) The commercial value of dry-salted and pickled whiting in the United States and Canada, and the possibility of renewing a market for it in the latter country.

(4) The commercial value of dry-salted and pickled whiting in the West Indies, Brazil, and other South American countries, and the possibility of establishing with them a remunerative trade.

(5) The food and economic value of smoked whiting; its comparison with smoked herring.

(6) The feasibility of preparing boneless whiting to supply a demand for cheap boneless fish.

Of the large number of responses received and variety of opinions expressed, the following, chiefly from leading firms of Boston and Gloucester, will be sufficient to illustrate the different views entertained regarding the special points referred to in the circular letter:

[Leonard A. Treat, wholesale fish-dealer, Boston.]

The rank of whiting, either in a dry-salted or pickled state, as compared with cod, hake, and haddock, would be about fourth. There would be no difficulty in renewing a market in Canada for whiting, and also for hake, haddock, and cod, if it were not for the tremendous duty on all our goods going into Canada. Give us reciprocity with Canada and there will be no question about a market for whiting and a great many other of our fish products. Smoked whiting would take its place in economic and food value alongside of smoked haddock and hake; it would be better than hake, perhaps not quite as popular as haddock. It is entirely feasible to market boneless whiting. It has been done and is being done whenever the whiting is put on the market at a lower price than hake. If whiting can be cured and marketed at a competing price with hake, it will find a place at once in the various markets of this country. As the years would roll around it would become more and more popular as its value became known, and ultimately would, in our opinion, rank fully up with cusk and haddock, if not equal to medium cod. This fish has but to be known to be appreciated. What might be done with the fish abroad is, in our opinion, an unknown quantity, a mere conjecture, as the value of our reciprocity relations with the various countries to the south of us has not been of such magnitude as to give it a passing notice. The truth of the matter is that it costs us so much to produce our goods here in this country, as compared with Canada, that notwithstanding the apparent advantage of our reciprocity relations with Brazil, etc., Canada and Newfoundland still hold the trade. Reciprocity in fish has not, so far as we know, materialized to the financial benefit of our salt-fish trade.

[Frederick F. Dimick, secretary Boston Fish Bureau.]

I have had a few of the silver hake which you sent me cooked and placed on my table. I found them very good eating, tasting very much like salt codfish. They were prepared for the table in the same way salt codfish usually are. There is a taste to them, however, that one who eats much codfish easily discovers, but I confess that I could hardly tell the difference.

[John Pew & Son, outfitters and wholesale fish-dealers, Gloucester.]

We have carefully considered your inquiry in regard to the whiting, or Old England hake, as we call them. They are quite common in the market as cheap fresh fish, but without any demand otherwise. In regard to their value for general trade as cured fish, we have doubts of their being handled with any success in any direction. They are of a long, slender, soft nature, very expensive to handle as far as labor is concerned. Fresh, they equal the hake in most ways of cooking and to some minds are as desirable as the haddock or cusk, but do not compare with the cod. Dried, and salted especially, they would be so thin and unattractive that they could not be sold for a price that they really would cost after the labor and expenses were put upon them. Efforts have been made years ago to handle them in different directions, but without success. The common hake, which is of a better substance, being harder, are much preferred to the whiting in quality and are much cheaper to handle. The common hake has a large liver, valuable sound, and considerable pea [spawn], all of which are of commercial worth. The cost of the common hake dressed and salted, after crediting the value of livers, etc., is much less than the whiting. We would answer your specific inquiries, therefore, as follows:

The commercial importance of the whiting as prepared in your sample, namely, in pickle, would be very small, indeed, and it is doubtful if any considerable market could be obtained for them. We do not think a market could be found in either the United States or Canada at a remunerative price. The whiting being of such a soft nature we think it would be impossible to process them in any way, either by smoking or canning, as it would leave a soft substance of very small value, for which it would be hard to secure a market. They are not very fat and would not smoke, as do the herring, and keep for transportation, though lightly smoked for immediate consumption they are very good, but even then without much commercial value. We have made no attempts at skinning or boning them, but think as the skin is quite tough and the flesh very soft the flesh would be torn and its worth proved very slight.

[Oscar Andrews, with Benjamin Low, wholesale salt-fish dealer, Gloucester.]

You have asked my opinion as to the introduction of whiting to the trade of this country for export. I was one of the partners of the house of Andrews & Co., who were in the shipping business in this city from 1878 until 1888. We did quite a business in Canada from 1881 until the expiration of the treaty in 1885. In 1882 we introduced the whiting to that trade and sold several hundred barrels pickled. They seemed to give perfect satisfaction in every case. At any rate, the parties who first took hold of them ordered again and again. We prepared them in exactly the same way as codfish, splitting and salting them in precisely the same way. The second year we split them on the backs, as we do mackerel, and it made trouble for the reason that they hurt near the bone. This was our own fault; we should have let good enough alone. We did not try to introduce these fish to the trade of the United States in 1882, as Canada took all that we prepared, and we could really have sold many more than we did there if we had salted more down while the school was on our coast. I think there is a party in this city who has been canning them for several years. There are no better eating fish than whiting. Every person who has ever eaten one of them broiled will agree with me on this point. They would make a very nice smoked fish, and would really be far superior to finnan haddie, but unfortunately they are a summer fish and would soon spoil if shipped any distance. As dried fish they would be a failure, for, owing to having a little fat in the flesh, they rust very quickly. I should say on the whole that whiting shipped fresh, packed in ice, canned, or packed in barrels or small packages as pickled fish, would prove to be of great commercial importance.

[Lyon, Dupuy & Co., wholesale salt-fish dealers, Boston].

In regard to the value of whiting, we would say that our business with fish being confined entirely to the export trade to the West Indies, we can best give you our idea of the whiting as regards its value for shipping to such tropical and semi-tropical countries. The fish fit to ship to such countries must be able to withstand a certain amount of hot weather, and we consider the whiting as being too soft to successfully do this, and much inferior to codfish in this respect. We consider that codfish would be so much preferred that no difference in price would cause whiting to be used in our trade. The meat of the whiting is so soft, watery, and tender that the skin can not be removed, and they are therefore useless as boneless fish. On account of these qualities people do not like the fish and will not buy them and dealers will not handle them. Therefore, their food value as compared with cod, haddock, etc., is not so great, especially as the latter are caught in sufficient quantities.

[Capt. Atkins Hughes, weir fisherman, North Truro, Mass.]

As a food-fish, fresh, there is no ground fish that is better, in my opinion. As the weir men give them to anyone who comes for them, there are a good many eaten in this place and Provincetown. At some places on the Massachusetts coast, the fish-dealers protested so much against this practice of the weir men, on the ground that it injured their business, that the fishermen had to abandon their generosity. I mention this to show that the whiting are good fish and would be more generally used if the common people could get them. Their keeping qualities fresh are as good as any fish we ship away in ice. In 1893 not more than 200 or 300 barrels of whiting were utilized in the Cape Cod region, about 100 barrels being salted at Provincetown and the remainder shipped to the New York market. A good many whiting are now taken to Boston and sold to peddlers, but the regular dealers do not handle them.

[James G. Tarr & Bro., wholesale fish-dealers, Gloucester.]

We are able to state from practical experience that the whiting is only fit for use fresh or pickled for immediate consumption. We split and salted 3,000 pounds in 1891, carried them in salt pickle three months, and found upon examination they had shrunk in weight nearly one-half, and were turned a yellowish straw color on their faces. We soaked, dried, and smoked the lot, and when cured they were worthless, being like cardboard, dry and shriveled up, worthless for food. In cans they do a little better, but there is so much water in the fish that contents of cans get mushy, and we do not consider it profitable to use them.

[H. E. Woodward & Co., wholesale fish-dealers, Boston.]

The silver hake or whiting in our judgment can only be used when split and salted exactly as hake are. In that state could be exported same as hake, and might also be dressed for cheap boneless fish. We think of no other way of utilizing it.

THE FRESH-WATER PEARL FISHERIES.

In December, 1893, negotiations were opened with Mr. George F. Kunz, the well-known gem expert, with a view to have him make a thorough investigation of the fresh-water pearl fisheries of the United States and prepare a report on the subject for the Commission.

While the taking of fresh-water pearls is not a branch of the fisheries which possesses great importance because of the number of persons finding employment or the capital invested therein, the industry possesses much interest and the value of the output is in the aggregate large. The absence of even an approximately complete account of the extent, methods, and other features of this fishery, and the opportunity of having the subject investigated by one so well informed as Mr. Kunz and at a purely nominal expense, were taken into consideration.

Mr. Kunz was already in possession of a large amount of important unpublished material which he had been gathering for many years. This was freely placed at the disposal of the Commission and served as a valuable basis for the future inquiries. Mr. Kunz also had access to the extensive records of Messrs. Tiffany & Co., the well-known New York jewelers, with whom he is associated.

In order to bring the matter up to date and secure uniformity in the information obtained, a circular form was prepared for Mr. Kunz's use, and sent out by him to all persons who had within recent years engaged in the pearl fishery or in buying and selling the pearls. The topics sought to be brought out by the schedule were as follows:

The pearl-bearing mussels:
- Nature of stream in which found; kind of bottom; character of water.
- Geological character of the district as to rock, soil, etc.
- General abundance of mussels.
- Size, shape, and position of the mussel beds.
- Local names of mussels.
- Habits of mussels.
- Enemies and fatalities to which mussels are exposed; nature and extent of destruction by muskrats, hogs, freshets, etc.
- Size, shape, and color of mussels.
- Species of mussels in which pearls are most common.
- Proportion of mussels in which pearls occur.
- Sizes, or other peculiarities, of shells in which pearls are found.

The pearls:
- Nature and origin of pearls.
- Position in mussel.
- Size, shape, and color of pearls.
- Relative value of pearls in different sizes, shapes, and colors.
- Markets for pearls.
- Prices for pearls.

The fishery:
- Method of taking the mussels.
- Description of apparatus used in taking mussels and in opening the shells.
- Methods of extracting the pearls.
- Treatment of pearls when found.
- Utilization of mussels after extraction of pearls or after opening.
- Principal occupations of mussel fishermen.
- Statistics of fishery in 1893: Fishermen, boats, apparatus, pearls.
- Statistics, complete or partial, for previous years.
- Period when pearl fishing was of greatest importance in district.
- History of origin and growth of fishery.
- Exhaustion of mussel beds; causes, rapidity.
- Do exhausted beds become replenished, and in what time?
- Is State protection of beds desirable or necessary?

The inquiries were begun in February, 1894, and by the close of the fiscal year, when they were still in progress, much interesting and useful data had been secured. The completion of the inquiry is expected during the next fiscal year.

THE MENHADEN FISHERY.

In the report of the division for 1892 reference was made to the desirability of undertaking a special inquiry regarding one of the controversial points that had arisen in the menhaden fishery, namely, the extent to which other fish besides menhaden are taken in the seines, The plan proposed contemplated the assignment of agents to menhaden vessels fishing from various points on the coast, and the recording of the detailed results of each seine-haul during the season.

By the opening of the fishing season, in May, 1894, arrangements had been perfected for conducting an inquiry in accordance with the plan suggested in the report cited. The limited force available for this work, owing to the prosecution of extensive field inquiries in the Great Lakes, necessitated a curtailment of the original plan to the extent of making continuous observations on only two menhaden vessels. A number of menhaden firms consented to the use of their vessels, when the purposes of the investigation were made known. The offers accepted were those of Messrs. Luce Brothers, of Niantic, Conn., and Mr. A. J. Morse, of Hoffman's Wharf, Va., the former tendering the use of the steamer *Arizona*, of 103 tons; the latter the steamer *J. W. Hawkins*, of 125 tons. Mr. C. E. Latimer, a former employee of the Commission, was appointed to duty on the *Arizona*, and Mr. E. F. Locke, field agent, was assigned to the *J. W. Hawkins*. Owing to sickness, Mr. Latimer's services were discontinued shortly after he entered on the work, and Mr. W. P. Hay, teacher of zoology in the Washington High School, took his place.

Up to the end of the fiscal year the inquiry had progressed satisfactorily, and the indications were that by the close of the season more detailed and reliable information than had ever before been collected on this subject would be in the possession of the Commission.

SALMON IN COAST WATERS AND AT SEA.

A paper entitled "Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States" was issued in pamphlet form in May, 1894. The purpose of the article was to record some of the results of salmon culture, as evidenced by the capture of salmon in places remote from the rivers in which fry had been deposited; to solicit information from offshore and coast fishermen concerning the taking of salmon in their nets, and "to bring to their attention the opportunity they will thus have of increasing the knowledge of the movements of the salmon, of aiding in the determination of the results of fish cultural operations, and of ultimately, if not immediately, benefiting themselves by supplying information that will conduce to the most effective application of artificial methods."

An edition of 500 copies of the article was printed. The paper was sent to persons engaged in the mackerel, menhaden, and other ocean fisheries, and to the operators of pound nets, traps, and other shore apparatus in the New England and Middle States, accompanied by a circular letter from the Commissioner directing attention to that part of the paper in which information was solicited.

Already numerous replies have been received recording the occurrence of salmon on various parts of the coast, and it is expected that in the next two or three years much valuable material will be obtained in this way.

INQUIRIES AT BOSTON AND GLOUCESTER, MASS.

The nature of the services performed by the local agents of the Commission at Boston and Gloucester has been fully explained and the importance of these inquiries has been referred to in previous reports of the division. At nominal salaries, Mr. F. F. Dimick, at Boston, and Capt. S. J. Martin, at Gloucester, have continued to render efficient service and to procure accurate data showing the operations of a large part of the New England fishing fleet.

The following table, based on Mr. Dimick's returns, shows that in the calendar year 1893 67,595,289 pounds of fish, having a value to the fishermen of $1,595,902, were landed at Boston by American fishing vessels, in addition to which considerable quantities of lobsters, clams, and other products were received. More than half the aggregate weight of the fish landed represented haddock; of this species, over 31,229,000 pounds, valued at $658,000, were brought in. Of cod, the next important fish, over 16,000,000 pounds, worth $451,000, were taken. The receipts of hake were 11,590,000 pounds, having a value of over $133,000. Georges Bank was the principal fishing-ground resorted to by vessels landing their fares at Boston; this famous bank yielded over 17,000,000 pounds of the fish shown in the table. The South Channel grounds are credited with over 13,600,000 pounds. Other important banks were Cashes, Jeffreys Ledge, Middle, La Have, and Western. Detailed figures for the different species and grounds are given in the table.

Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels.

Fishing-grounds.	No. of trips from each ground.	Cod.		Cusk.		Haddock.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:							
La Have Bank	101	1,368,000	$36,989	539,500	$7,658	1,125,700	$22,550
Western Bank	68	823,300	21,194	195,000	3,233	212,400	3,819
Cape Shore	47	507,500	14,820	163,700	2,448	341,400	8,818
Gulf of St. Lawrence	2	....	....	....	....	....	....
West of 66° W. longitude:							
Browns Bank	46	543,000	13,198	150,500	2,225	904,000	14,511
Georges Bank	547	4,221,700	122,145	598,200	8,615	10,524,300	230,647
Cashes Bank	189	1,117,600	31,639	1,524,400	22,533	1,283,600	24,616
Clark Bank	6	52,000	1,285	10,000	200	72,000	1,735
Fippenies Bank	14	48,400	1,663	23,500	299	82,000	1,718
Tillies Bank	7	12,500	399	....	....	35,000	800
Ipswich Bay	72	222,800	6,633	1,000	13	286,500	7,184
Jeffreys Ledge	492	773,900	22,460	212,750	2,958	2,390,300	52,626
Middle Bank	548	764,600	22,703	149,100	1,903	2,554,850	58,897
Off Highland Light	215	653,800	17,048	118,000	1,605	1,258,800	25,555
Off Chatham	81	172,000	4,690	6,000	113	707,700	14,158
South Channel	538	3,278,900	87,807	393,300	6,159	7,308,700	145,263
Nantucket Shoals	74	683,000	20,296	3,400	43	461,900	7,579
Shore, general	779	841,290	26,240	149,300	2,398	1,680,200	37,732
Total	3,826	16,075,290	451,209	4,237,650	62,403	31,229,350	658,208

Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels—Continued.

Fishing-grounds.	Hake.		Halibut.		Pollock.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:						
La Have Bank	780,000	$8,539	151,100	$14,808	128,800	$1,791
Western Bank	301,500	3,315	747,500	75,065	30,500	481
Cape Shore	230,100	2,856	30,650	2,489	30,800	521
West of 66° W. longitude:						
Browns Bank	107,000	1,153	71,600	8,411	13,600	287
Georges Bank	1,272,100	14,845	202,910	20,593	64,100	978
Cashes Bank	2,302,400	27,890	13,040	1,309	47,000	690
Clark Bank	39,500	555	3,500	270		
Fippenies Bank	67,000	860	6,500	598	3,800	54
Tillies Bank	17,500	168			1,000	15
Ipswich Bay	21,700	247	400	40	1,000	10
Jeffreys Ledge	1,449,100	15,531	3,200	304	231,650	2,948
Middle Bank	1,142,000	13,491	6,435	593	65,950	900
Off Highland Light	566,900	6,627	11,385	1,151	20,900	283
Off Chatham	94,900	931	2,182	218	4,200	56
South Channel	2,464,700	27,782	113,450	11,995	84,900	1,065
Nantucket Shoals	38,700	482	400	57	22,500	349
Shore, general	695,300	8,599	10,200	1,111	138,500	1,635
Total	11,590,400	133,871	1,374,452	139,012	889,200	12,063

Fishing-grounds.	Mackerel.				Other fish.		Total.	
	Fresh.		Salted.					
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank							4,093,100	$92,335
Western Bank					225	$14	2,310,425	107,121
Cape Shore			316,400	$17,207			1,620,550	49,159
Gulf of St. Lawrence			65,000	4,788			65,000	4,788
West of 66° W. longitude:								
Browns Bank					3,000	135	1,783,700	39,920
Georges Bank					156,825	10,275	17,040,135	408,098
Cashes Bank	10,500	$635					6,298,540	109,312
Clark Bank							177,000	4,045
Fippenies Bank							231,200	5,192
Tillies Bank							66,000	1,382
Ipswich Bay							533,400	14,127
Jeffreys Ledge					5,105	305	5,066,005	97,132
Middle Bank					9,725	367	4,692,660	98,854
Off Highland Light					4,000	142	2,633,785	52,411
Off Chatham	22,700	1,636			64,450	1,076	1,074,132	22,878
South Channel					16,100	768	13,660,050	280,839
Nantucket Shoals							1,209,900	28,806
Shore, general	470,100	36,981	696,100	47,371	358,717	17,436	5,039,707	179,503
Total	503,300	39,252	1,077,500	69,366	618,147	30,518	67,595,289	1,595,902

The receipts of fish at Gloucester in 1893, landed from American fishing vessels, consisted of 29,478,000 pounds of fresh and 45,322,000 pounds of salt fish, valued at $2,503,000. Over 38,500,000 pounds, or more than half the total receipts, consisted of fresh and salt cod, the salt cod amounting to about 34,000,000 pounds. The value of the cod at first hands was $1,145,000. The next important fish was halibut, of which 8,418,000 pounds, worth $656,000, were landed. Hake were taken in about the same quantities as halibut, but their value was much less; 8,400,000 pounds, valued at $59,000, are shown in the statistics. Of mackerel, 7,715,420 pounds, with a value of $503,887, were received. The most prominent fishing-grounds visited by the Gloucester vessels are the Grand Banks; here over 19,000,000 pounds of fish, having a value of $572,000, were caught. Georges Bank yielded more than 14,100,000 pounds, valued at $492,000. The details are shown in the following table, compiled from statistics furnished during the year by Capt. S. J. Martin.

Summary by fishing-grounds of certain fishery products landed at Gloucester, Mass., in 1893, by American fishing vessels.

Fishing-grounds.	No. of trips from each ground.	Cod.				Cusk.			
		Fresh.		Salted.		Fresh.		Salted.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:									
La Have Bank	92	431,000	$8,367	571,770	$20,522	350,000	$5,004		
Western Bank	73	30,000	550	493,200	14,510	12,000	198		
Quereau Bank	163	2,000	80	433,260	11,778			7,000	$158
Misaine Bank	1			32,000	1,040				
St. Peters Bank	7			26,000	734				
Green Bank	2								
Grand Bank	148			18,021,275	491,934				
Canso Bank	9			864,940	24,209				
Cape Shore	100			1,083,350	35,097	45,000	720	31,600	576
Gulf of St. Lawrence	35			909,330	26,405				
Iceland and Greenland	11			156,000	4,935				
Off Newfoundland	4			15,000	475				
Total	645	463,000	8,997	22,606,125	631,639	407,000	5,922	38,600	734
West of 66° W. longitude:									
Browns Bank	25	234,000	4,488	181,800	5,418	112,500	1,618	4,000	70
German Bank	1								
Georges Bank	672	1,090,360	24,484	10,213,472	372,924	369,600	5,567	82,000	1,892
Clarks Bank	1	3,000	60			35,000	578		
Cashes Bank	287	1,612,200	30,583			3,653,900	56,083		
Fippenies Bank	1					2,000	27		
Middle Bank	23	8,950	207			47,500	723		
Platts Bank	3			30,000	810			21,000	448
Jeffreys Ledge	43	40,900	924			94,000	1,460		
Off Chatham	9	4,000	72						
South Channel	18	36,000	580			119,000	1,789		
Nantucket Shoals	45			1,270,000	40,209	24,000	360		
Shore, general	1,415	686,007	21,350	72,000	2,056	7,620	96	28,000	630
Total	2,543	3,715,417	82,748	11,767,272	421,417	4,465,120	68,301	135,000	3,040
Grand total	3,118	4,178,417	91,745	34,373,397	1,053,056	4,872,120	74,223	173,600	3,774

Fishing-grounds.	Haddock.				Hake.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank	271,000	$2,586			655,000	$4,563		
Western Bank					40,000	310		
Cape Shore	5,000	45	13,000	$163			33,300	$367
Iceland and Greenland							14,500	182
Total	276,000	2,631	13,000	163	695,000	4,873	47,500	549
West of 66° W. longitude:								
Browns Bank	247,000	2,218			88,000	612	3,000	38
German Bank					30,000	255		
Georges Bank	1,235,500	12,395	9,000	100	403,680	3,001	2,000	20
Clarks Bank					5,000	35		
Cashes Bank	633,350	5,851			6,216,500	42,254		
Fippenies Bank					8,000	68		
Middle Bank	10,700	237			113,000	844		
Platts Bank			8,000	101			33,000	388
Jeffreys Ledge	12,000	552			187,000	1,597		
Off Chatham	18,000	162			4,000	20		
South Channel	61,000	526			204,500	1,495		
Nantucket Shoals	8,000	72			18,000	98		
Shore, general	133,880	2,098	14,000	186	190,520	1,280	152,500	1,745
Total	2,359,430	24,111	31,000	387	7,468,200	51,559	190,500	2,191
Grand total	2,635,430	26,742	44,000	550	8,163,200	56,432	238,000	2,740

Summary by fishing-grounds of certain fishery products landed at Gloucester—Continued.

Fishing-grounds.	Halibut.				Mackerel.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank	705,935	$56,197						
Western Bank	1,251,844	95,008	2,700	$162				
Quereau Bank	2,532,720	222,060	2,000	100				
Misaine	63,000	2,655						
St. Peters Bank	197,980	14,131						
Green Bank	48,400	4,542						
Grand Bank	874,225	72,132	145,680	8,525				
Canso Bank			2,540	152				
Cape Shore	11,000	822	2,880	173			2,823,000	$153,825
Gulf of St. Lawrence							750,400	53,108
Iceland and Greenland			1,673,200	98,078				
Off Newfoundland	122,250	7,257						
Total	5,807,354	474,804	1,829,000	107,190			3,573,400	206,933
West of 66° W. longitude:								
Browns Bank	8,900	548						
Georges Bank	753,025	72,218						
Cashes Bank	12,600	783						
Middle Bank	3,520	340					91,200	7,402
Jeffreys Ledge	160	16						
Off Chatham							44,000	2,445
Nantucket Shoals	3,900	347						
Shore, general					48,420	$3,205	3,958,400	283,902
Total	782,105	74,252			48,420	3,205	4,093,600	293,749
Grand total	6,589,459	549,056	1,829,000	107,190	48,420	3,205	7,667,000	500,682

Fishing-grounds.	Pollock.				Other fish.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank					3,600	$360		
Iceland and Greenland							2,200	$132
Total					3,600	360	2,200	132
West of 66° W. longitude:								
Browns Bank	3,000	$21						
Georges Bank			3,000	$30	1,000	120		
Jeffreys Ledge	161,300	1,222						
Off Chatham			158,000	2,688				
South Channel	2,000	15						
Shore, general	2,398,126	17,593			422,490	2,975	834,400	9,394
Total	2,564,426	18,851	161,000	2,718	423,490	3,095	834,400	9,394
Grand total	2,564,426	18,851	161,000	2,718	427,090	3,455	836,600	9,526

Summary by fishing-grounds of certain fishery products landed at Gloucester—Continued.

Fishing-grounds.	All fish.					
	Fresh.		Salted.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:						
La Have Bank	2,416,535	$77,077	571,770	$20,522	2,988,305	$97,599
Western Bank	1,333,844	96,066	495,900	14,672	1,829,744	110,738
Quereau Bank	2,534,720	222,140	442,260	12,036	2,976,980	234,176
Misaine Bank	63,000	2,655	32,000	1,040	95,000	3,695
St. Peters Bank	197,980	14,131	26,000	734	223,980	14,865
Green Bank	48,400	4,542	....	....	48,400	4,542
Grand Bank	874,225	72,132	18,166,955	500,459	19,041,180	572,591
Canso Bank	....	....	867,480	24,361	867,480	24,361
Cape Shore	61,000	1,587	3,986,830	190,201	4,047,830	191,788
Gulf of St. Lawrence	....	....	1,659,730	79,513	1,659,730	79,513
Iceland and Greenland	....	....	1,845,900	103,327	1,845,900	103,327
Off Newfoundland	122,250	7,257	15,000	475	137,250	7,732
Total	7,651,954	497,587	28,109,825	947,340	35,761,779	1,444,927
West of 66° W. longitude:						
Browns Bank	693,400	9,505	188,800	5,526	882,200	15,031
German Bank	30,000	255	....	....	30,000	255
Georges Bank	3,853,165	117,785	10,309,472	374,966	14,162,637	492,751
Clarks Bank	43,000	673	....	....	43,000	673
Cashes Bank	12,128,550	135,554	....	....	12,128,550	135,554
Fippenies Bank	10,000	95	....	....	10,000	95
Middle Bank	183,670	2,351	91,200	7,402	274,870	9,753
Platts Bank	....	....	92,000	1,747	92,000	1,747
Jeffreys Ledge	495,360	5,771	....	....	495,360	5,771
Off Chatham	26,000	254	202,000	5,133	228,000	5,387
South Channel	422,500	4,405	....	....	422,500	4,405
Nantucket Shoals	53,900	877	1,270,000	40,209	1,323,900	41,086
Shore, general	3,887,063	48,597	5,059,300	297,913	8,946,363	346,510
Total	21,826,608	326,122	17,212,772	732,896	39,039,380	1,059,018
Grand total	29,478,562	823,709	45,322,597	1,680,236	74,801,159	2,503,945

It is intended to prepare in a short time a special discussion on the condition of the vessel fisheries of Massachusetts based on reports of the local agents at Boston and Gloucester. Material is at hand showing, for a series of years (1889 to 1894), the yield of different kinds of fish on each of the important banks resorted to by the vessels landing their fares in those cities, which, as has previously been stated, receive fully seven-eighths of the offshore vessel catch of New England.

REPORTS, SPECIAL PAPERS, ETC.

The published reports relating to commercial fisheries, issued from this division during the year, dealt chiefly with special subjects connected with the fisheries. A number of general reports, however, dealing with the fisheries of important geographical sections, were in course of preparation or of printing, and will be shortly published.

Among special data prepared by the division for use outside of the regular reports were statistical tables showing the extent of the fisheries of Maryland, for the Maryland Fish Commission, and printed in its report for 1893; information regarding the American mackerel fishery, for the Scotch Fishery Board, through the British embassy; a large series of detailed tables relating to the salmon industry of the Columbia River, for the use of the United States Fish Commissioner in a report to Congress on the condition of the industry.

A list of the articles issued, with a brief notice of their character, is as follows:

Report on the coast fisheries of Texas. (Report, 1889-1891, pp. 373-420, pls. 12-27.)

This report is based on field inquiries conducted in 1891, and is supplementary to the notice of the Texas fisheries contained in the report on the fisheries of the Gulf States, published in the Bulletin for 1891. The principal fisheries of the coast are first fully discussed, and then the fisheries are reviewed by geographical divisions. The paper is accompanied by 15 plates of the principal food-fishes of the coast waters of the State.

The oyster industry of Maryland. (Bulletin, 1892, pp. 203-297, pls. LVI-LXXI.)

The economic aspects of the oyster interests of the State having the most valuable oyster industry are considered in this paper. A history of the Maryland oyster-fishery from the earliest times is given, with an account of the legislation enacted for its regulation, the oyster-grounds, the methods pursued in oystering, oyster-culture, the oyster-police and the oyster-revenue services, the transporting, packing, and marketing trades, and detailed statistics of the industry. Fifteen plates showing fishing vessels, boats, appliances, and methods, and a colored chart indicating the position of the oyster beds, accompany the report.

The use of the proof sheets of this report was tendered the Maryland Bureau of Industrial Statistics, and the entire paper was printed in the report of that bureau for 1893.

The fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. (Bulletin, 1892, pp. 299-355, pls. LXXII-XCI.)

This article embodies the results of an original study of this group of fishing apparatus which had been in progress for several years. The fyke is one of the most generally used nets in the United States, and is also found in nearly every other country having important commercial fisheries. The paper defines the fyke net, gives the names by which it is known, explains the principle of its action, classifies and describes the different types, contains a geographical and statistical review of the fyke-net fisheries of the United States, and concludes with notes on the fyke net in other countries. In the fyke-net fisheries of the coast and lake States, 2,300 persons are shown to have been engaged, 25,700 nets used, and over 12,000,000 pounds of fish taken, the value of the catch being over $300,000. Illustrations of 40 types of fyke nets employed in the United States and other countries are given.

Economic and natural-history notes on fishes of the northern coast of New Jersey. (Bulletin, 1892, pp. 365-380.)

The commercial fisheries of the northern part of the New Jersey coast are of great importance, and angling from the shore and from boats is also very extensively carried on during the summer months.

The paper represents the personal observations of the writer during parts of four years, and is chiefly based on a study of the pound-net fisheries. Pound nets of this section are more prominent than any other nets, and are the principal objects of the opposition to net fishing which exists on this coast. The article consists of a general review of the history and extent of the pound-net fishery, and of notes on the abundance, movements, and commercial value of the principal food-fishes of the region. About 50 species are separately mentioned, and for all the most important ones detailed figures are given showing the monthly catch in 1891 and 1892 at a pound-net fishery in Monmouth County.

Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States. (Bulletin, 1894, pp. 95–99, pls. 3 and 4.)

Some instances of the occurrence of Atlantic salmon off the coasts of Maine, Massachusetts, New Jersey, and Delaware are given in this paper. The taking of salmon at places remote from the mouths of rivers and off States having no salmon streams is of considerable interest to naturalists and fish-culturists, in view of the information afforded as to the oceanic migrations of this fish and owing to the efforts being made to introduce it into new waters. Reference is elsewhere made to this paper and to a special inquiry of which it served as a basis.

MISCELLANEOUS MATTERS, NOTES ON FISHERIES, ETC.

FISHERIES EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Opportunity was afforded the writer to inspect the exhibits of foreign countries in the fisheries section of the World's Columbian Exposition. A special study of the apparatus there displayed was made. Some of the notes and sketches taken were incorporated in the paper elsewhere referred to on the fyke nets and fyke-net fisheries of the United States and other countries. The foreign fishery exhibits which were especially noteworthy for their completeness or for special features were those of Canada, Norway, Russia, New South Wales, and Japan. These contained many objects offering valuable suggestions to the fishery interests of the United States as to apparatus, methods, preparation, and utilization of products, etc. The descriptive catalogues and reports issued by the Governments of Japan and New South Wales relating to the fishery exhibits and to the fisheries and fishery resources of those countries deserve mention.

Among the States whose official exhibits were worthy of special note were North Carolina, Wisconsin, Pennsylvania, California, Oregon, and Washington. Some of the foremost fishing States were, unfortunately, either entirely unrepresented in the fisheries building or were represented only by a few individual dealers or manufacturers.

THE WORLD'S FISHERY CONGRESS.

This congress, one of a series of international gatherings under the auspices of the World's Columbian Exposition, convened at Chicago October 16–19, 1893. As chairman of the section devoted to the consideration of the commercial fisheries, the writer entered into correspondence with persons in this country and abroad with a view to secure their cooperation and attendance. He also delivered an address on the condition of the American fisheries at the opening of the section, presented papers on the southern spring mackerel fishery and the statistics of the United States fisheries; compiled a report on the fisheries of Japan, based on the official catalogue of the Japanese exhibit, and abstracted and arranged a paper on improvements suggested for the British fisheries.

Following is a list of papers relating to the economic aspects of the fisheries which are printed as a part of the proceedings of the congress as contained in the Bulletin of the Fish Commission for 1893:

Fish nets: Some account of their construction and the application of their various forms in the American fisheries. By C. H. Augur.
The sea and coast fisheries. By Daniel T. Church.
Notes on the Irish mackerel fisheries. By W. S. Green.
The fisheries of Canada. By L. Z. Joncas.
The fishing industry of Lake Erie, past and present. By C. M. Keyes.
The exhibit of pearls at the World's Columbian Exposition. By George F. Kunz.
Foul fish and filth fevers. By J. Lawrence-Hamilton.
Reforms and improvements suggested for the fisheries of Great Britain and Ireland. By J. Lawrence-Hamilton. (Abstracted and arranged by Hugh M. Smith.)
Fishing in British Guiana. By J. J. Quelch.
Remarks on the maintenance and improvement of the American fisheries. By Hugh M. Smith.
Statistics of the fisheries of the United States. By Hugh M. Smith.
The fisheries of Japan. Compiled by Hugh M. Smith.
Our ocean fisheries, and the effect of legislation upon the fisheries. By J. M. K. Southwick.
The decrease of fish in American waters, and some of the causes. By A. M. Spangler.
The past and future of the fur-seal. By J. Stanley-Brown.
Notes on the fisheries and fishery industries of Puget Sound. By James G. Swan.
The fisheries of the Virginia coast. By J. T. Wilkins.

INTERNATIONAL FISHERY COMMISSION.

In July, 1893, the writer accompanied Mr. Richard Rathbun, the United States representative on the International Fishery Commission, to points in New Brunswick, Nova Scotia, and Quebec. In addition to the special inquiries of the commission, an opportunity was afforded by personal observation to acquire a knowledge of the methods of taking and curing fish at some of the most important fishing stations in the provinces named. In November the writer accompanied the commission to Gloucester, where several weeks were spent in interviewing the mackerel fishermen.

MARKET VALUE OF THE CARP.

Notwithstanding the carp has for many years been abundantly distributed over a large part of the United States, and extensively cultivated for home consumption, it is only recently that the fish has had sufficient abundance in public waters to warrant the prosecution of a special fishery or to give the fish a conspicuous position in the fish markets of the country. Of late, however, large quantities of carp have been taken for market in Lake Erie and other lakes and rivers of the interior States, and the fish is now regularly exposed for sale and usually cited in the market quotations in all the large cities. The decrease in the output of whitefish and lake herring in Lake Erie and elsewhere has also had much to do with the rise of the carp as a commercial fish.

Of the many States in which the carp is now taken for home supply and for market there are few in which the introduction of the fish has been more successful or in which it has attained greater commercial importance than in Illinois. The stocking of the streams and ponds of that State was accomplished some years ago by the United States Fish Commission in cooperation with the State commission of Illinois. The fish has rapidly propagated and distributed itself, and is now a very important factor in the supply of fish food in the region, the increase of the fish in the Illinois River being especially noteworthy. The State fish commissioners in their report for 1890 refer to this fish as follows:

> The success attending the introduction of carp-culture in Illinois can not be estimated in dollars and cents, and has never been fairly placed before the people. Adverse criticism has, in many instances, had the effect of creating an undue prejudice against the fish. Lack of care and ignorance as to the methods of culture have done much more to cause the impression that carp are not profitable to raise. Still, the facts are that a very large number of those who prepared ponds for their reception, and gave them ordinary care, are successfully producing a profitable supply of fish every year as food, and good food, at a comparatively trifling expense. In addition to this, evidences are numerous to show that our streams are full of these fish, and they are entering into the supply of food at almost every point where fish are taken for market. Hundreds of very large carp have been taken this season from the pools along the Illinois River, and the fishermen report very large catches from the river itself very often. These are the product of the planting by the commission of carp furnished by the United States Fish Commission, in the public waters of the State, a report of which plant, with list of streams planted, was published in a former report.

The information at hand indicates that the Illinois River is perhaps as well stocked with carp as any other stream in the United States. Numerous instances might be cited of the wonderful multiplication of the fish in the waters of the State, but a single reference to this river will be sufficient to show the abundance of the fish and its commercial importance. In August, 1893, Dr. S. P. Bartlett, field superintendent of the United States Fish Commission, brought to the attention of the office the following information:

At Meredosia, Ill., in Morgan County, a shallow lagoon 6 miles long and three-quarters of a mile wide at the average stage of the water communicates with the Illinois River. This lagoon is known as Meredosia Bay. In this bay, on August 9, a fisherman using a 900-yard seine caught 25,000 pounds of carp averaging 7 pounds apiece. Some of the fish weighed 20 pounds. On August 17 the same fisherman secured 12,000 pounds of carp in the same place. The fisherman received from 7 to 10 cents per pound for the fish that weighed 7 pounds or over and 3 to 5 cents per pound for those under that size. He had an offer from New York dealers for all the carp he could catch at the rate of 3½ cents per pound in rough state.

The statistical inquiries of the Commission in the Great Lakes in 1894 disclosed a very large catch of carp in Lake Erie in the previous year. In nearly every county bordering on the lake relatively large quantities of carp were taken and sold, the aggregate catch being 627,000 pounds, valued at $16,245. The principal part of the yield was obtained in the shallow water of the western end of the lake, Erie, Ottawa, and Lucas counties, in Ohio, having the largest catch. In Michigan, 41,900 pounds were taken; in Ohio, 581,360 pounds, and in Pennsylvania and New York, 3,740 pounds.

TWO VOYAGES TO REMOTE FISHING-GROUNDS.

In the report of this division for 1891 mention was made of the trip of a Gloucester vessel to Africa for mackerel. The continued scarcity of mackerel in the western part of the Atlantic Ocean prompted another experimental voyage of a Gloucester schooner to the coast of the Old World. On June 22, 1893, the *Nannie C. Bohlin*, of 124 tons, after baiting with menhaden, sailed from Newport for Stavenger, Norway, fitted with seines and lines suitable for taking the large mackerel which are found on that coast. The vessel arrived at her destination July 13, to find that the season had not yet opened. In a few days, however, the vessel sailed for the fishing-grounds, which consist of two banks lying between 120 and 160 miles off the coast. Some fish were secured with the seine at the start, but later the more primitive method of drailing was resorted to. The largest haul of the seine was reported to be only 6 barrels. Unfortunately for the success of this venture, the weather was unfavorable for fishing during most of the season, and only a few fish were observed schooling, and the vessel was forced to return home with only 59 barrels of mackerel. This small fare was, however, larger than the average catch of the fleet on the United States coast.

As exemplifying the sailing qualities of the new class of New England fishing schooners, it may be mentioned that this vessel accomplished the trip from Norway to Massachusetts—a distance of 4,400 miles—in 22 days, during a third of which time head winds were encountered. It will be recalled that the famous racing yacht *Valkyrie* required 30 days to make a passage that was 800 miles shorter. The *Bohlin* is the same vessel whose seaworthiness was specially referred to in the report of this division for 1891. A mackerel voyage to Norway made by the Gloucester schooner *Notice* in 1877 was likewise unsuccessful.

The halibut fishing schooner *Carrie W. Babson*, 86 tons, of Gloucester, in 1893 visited a region but rarely sought by United States fishing vessels. The schooner sailed May 29 for Labrador and Baffin Bay. In Davis Strait so much ice was met with that the fishing-grounds off the northern part of Labrador could not be tested, and the vessel sailed for the west coast of Greenland, which was safely reached after the experience of much difficulty in crossing Davis Strait. On the shore of Greenland a comparatively good fishing season was passed, and the vessel returned to Gloucester on October 5 with about 80,000 pounds of fletched halibut, 21 barrels of fins, and 11 barrels of salmon and salmon trout. The captain of the vessel thinks this region offers advantages for profitable fisheries, and intends to resume his explorations of the coast of Greenland and the region north of Hudson Strait.

BOSTON FISH BUREAU.

This is an association of persons engaged in the fish trade, chiefly in Boston, Gloucester, and New York. In its aims and organization it occupies a unique position in the United States fishing industry. It is primarily intended to furnish its members with reliable, prompt, and private information regarding the catch, the receipts, and the general condition of the fish trade, but the entire fishery interests of the section are indirectly benefited, and it is, in fact, a fisheries intelligence bureau. The Commission has for many years received the confidential daily reports of the bureau. These contain much valuable information as to the movements of the fishing fleet, the abundance of fish, the condition of the different branches of the industry, the state of the markets, prices of fish, etc., and are very useful to the division. The annual reports of the bureau, compiled by the secretary, Mr. Frederick F. Dimick, while applying primarily to the New England vessel fisheries, also contain much information on important fisheries of other sections of the United States, as well as of foreign countries. The statistical and descriptive data with which these reports are filled make them extremely valuable for reference.

PROPOSED WORK OF THE DIVISION.

FISHERIES OF THE MINOR INTERIOR WATERS.

The investigation of the fresh-water fisheries of the rivers and lakes of the interior States, recommended in a previous report of the division, can probably be undertaken during the next fiscal year. The recent completion of statistical inquiries in all the coastal sections and in the basin of the Great Lakes makes the canvass of these minor waters opportune and desirable. It is anticipated that the extent of these fisheries will in the aggregate be enormous, and that some very interesting methods and apparatus will be found, of which little is now known outside of circumscribed limits. It will be the purpose of the division to pursue these inquiries as means and time will permit, until the fresh-water fisheries of each State and Territory shall have been covered. The small force of agents available for the field work will hardly be able to canvass the entire country in less than two seasons.

PREPARATION OF FISHERY PRODUCTS.

The Commission receives numerous inquiries as to the methods employed in smoking, salting, canning, and otherwise preparing or preserving fishery products for market. Especially in those sections in which the fisheries are undergoing rapid development is there great demand for information of this character. While the Commission has from time to time published much bearing on this subject, the material is scattered through a number of volumes and is not available for distribution. Even in the comprehensive quarto series of reports issued by the Commission this matter was not especially considered.

It is therefore proposed that, at as early a time as practicable, this division make a special investigation of this subject to serve as the basis for a comprehensive, practical report, which shall contain descriptions of the various processes of preserving fish and other economic water animals in the United States. To these may be properly added accounts of the methods adopted in other countries.

UTILIZATION OF WASTE PRODUCTS.

A topic of no little consequence to the commercial fishermen is the proper utilization of their catch and of the by-products resulting from the cleaning, curing, or canning of the catch. In nearly every important branch of the fisheries there is more or less waste of products having value as food, fertilizer, oil, etc. One of the most conspicuous cases in which a disregard for the value of refuse products results in a great loss to the fishing interests is that of the salmon-canning industry of the Pacific Coast. In this branch probably 20,000,000 pounds of salmon heads, tails, trimmings, and viscera are annually thrown away, which could, at a very slight cost, be converted into a high-class fertilizer, and would probably yield considerable quantities of a valuable oil. Numerous instances of this kind might be cited. In a previous discussion of this subject[1] the following statements were made:

> The increased attention paid to the utilization of refuse products of fish in some parts of the United States, especially New England, where not many years ago they were generally thrown away, marks an advance in our industrial life. Every waste product of fish and other aquatic animals resulting from their cleaning, curing, and canning has a commercial value in a crude state or after further manipulation, but in most regions no regard is paid to anything but the actual flesh, and many thousands of dollars are thus annually lost to a class that is least able to afford it. As one instance of the loss our fishing interests are yearly incurring, mention may be made of the economic value of the roe of fishes as an article of food. Practically, the eggs of only two species of fishes—the sturgeon and mullet—are utilized in this country, but there is hardly a fish whose roe is not suitable to be made into a valuable caviar, which could meet with ready sale abroad as well as at home, and would be an important addition to our fishery output, in that it would represent the expenditure of little time and money and the sacrifice of no additional fish. In the utilization and appreciation of our resources we can emulate the Chinese to decided advantage.

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[1] Remarks on the maintenance and improvement of the American fisheries. Bulletin United States Fish Commission, 1893.

It is suggested that as soon as convenient, in connection with the other investigation previously referred to, a systematic inquiry be made in all the important fishing regions with a view to determine the extent to which waste products are utilized, the methods employed in so doing, the value of the secondary products, and to ascertain what other waste material not now employed might be rendered of value to the fishermen. Much information bearing on this subject is already in the possession of the office, but it is only in a special investigation that the matter can be thoroughly considered. The issuance of a report, in which the value of the various secondary fishery products is pointed out and the methods of preparing them for market shown, would be of great benefit to a large part of the fishing population. Dr. J. Lawrence-Hamilton, in a paper[1] presented to the World's Fishery Congress, at Chicago, in 1893, estimated that upwards of £2,000,000 ($10,000,000) annually is lost to the fishermen of the United Kingdon owing to failure to work up the waste fishery products; and it is known that in the United States an immense loss results from this cause which could be easily averted.

FISHERIES INTELLIGENCE BUREAU.

The success which has attended the establishment of a fisheries intelligence service in Canada suggests the advisability of having a similar bureau in the United States. There seems no reason to doubt that great advantage would thus accrue to the coast fishing interests, and that such a service would be almost unanimously welcomed by fishermen, dealers, outfitters, and others.

The idea of a fisheries intelligence office seems to have first taken practical shape in Norway, where the service has attained great perfection and is recognized as being of inestimable benefit to the fisheries. The intelligence bureau of the Canadian fisheries department is organized on the plan of the Norwegian service, and is likewise regarded by the fishermen as an extremely valuable aid in their work.

The following brief outline of the organization and functions of the Canadian bureau is sufficient to show the scope and importance of the work:

The headquarters of this service is at Halifax, Nova Scotia. About 40 observers in the principal fishing centers of the maritime provinces communicate with the main office by means of a telegraphic cipher-code. The information conveyed consists chiefly of news concerning the weather; the movements of the fishing fleet; the presence, movements, and abundance of fish; the presence and abundance of bait, and other data intended to facilitate the operations of the fishermen. From Halifax the reports are sent out by telegraph to newspapers in the fishing towns, and to local agents, by whom they are posted in con-

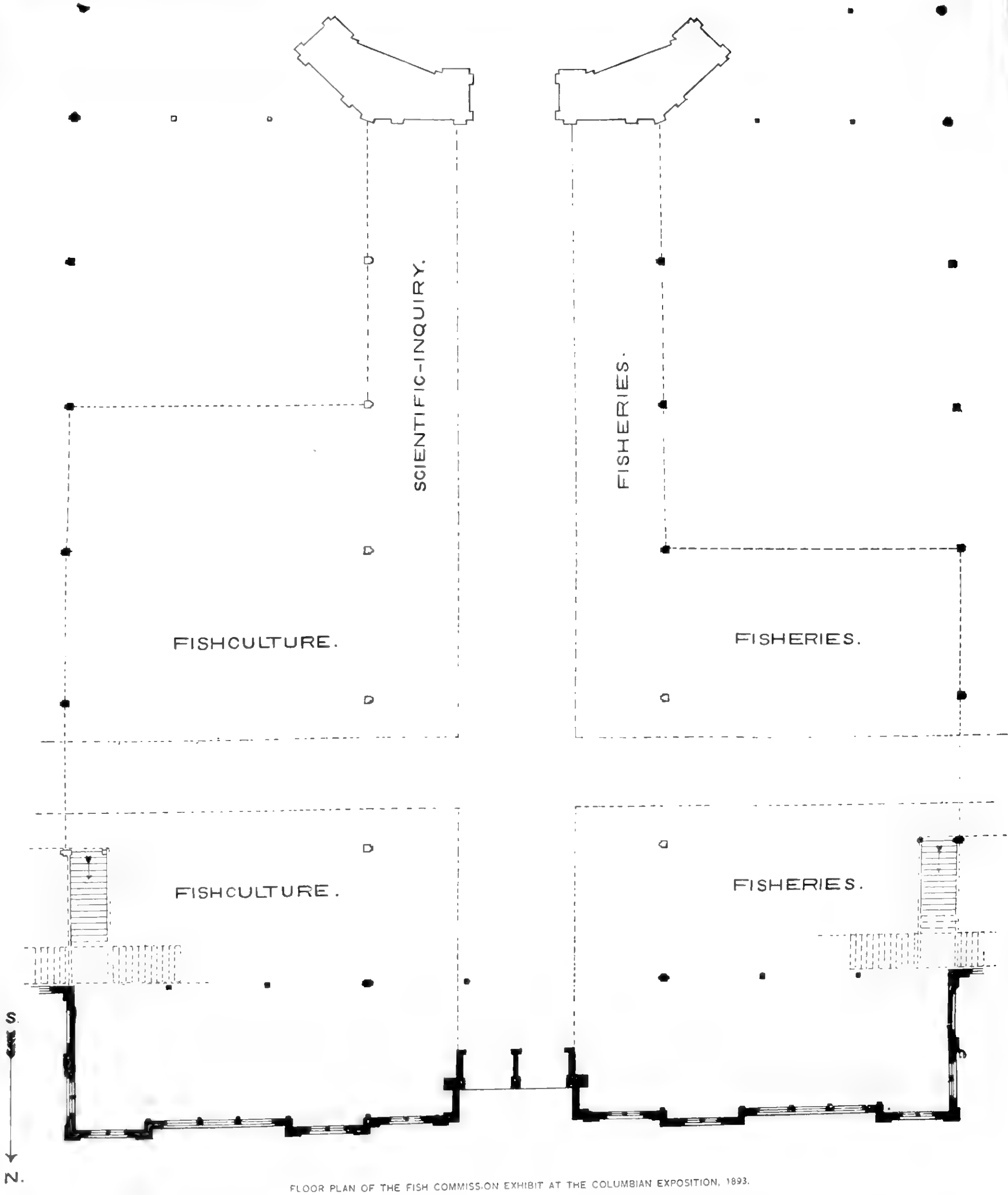
[1]Reforms and improvements suggested for the fisheries of Great Britain and Ireland. Bulletin United States Fish Commission, 1893.

spicuous places, as weather reports are displayed in the United States. The entire service is maintained at an annual expense of $2,500, most of which sum represents telegrams. The observers are usually light-house keepers, customs officers, weather officials, and other employees of the Government, who are paid very small salaries—$15 to $25 annually—in addition to their regular compensation. In some places fishermen, telegraph operators, and other private persons are connected with the service, who receive more pay.

During a visit of the writer to a number of the New England and Canadian fishing centers in 1893 the importance of this subject was brought to his attention in many ways, and the desirability of instituting a bureau on the east coast of the United States, under the supervision of the Commission, was forcibly suggested to him. Fishermen, fish-dealers, and vessel-owners in Gloucester, Boston, and other fishing ports, who voluntarily mentioned the matter or to whose attention it was brought, spoke confidently of the value which such a bureau would have in certain important fisheries; and it would appear that the whale, mackerel, cod, herring, menhaden, halibut, haddock, and, probably, all other ocean fisheries would be greatly benefited.

The New England and Middle States would chiefly profit by the founding of such a service, although the vessel fishermen of the entire coast would receive valuable information. To properly equip the bureau, there should be at least 50 agents located at suitable coast points in each State, probably as far south as North Carolina, and the employment of a number of observers in the Canadian provinces in regions frequented by the United States fishermen would also be necessary. By relying chiefly on the services of light-house keepers, life-saving men, local fishermen, and others, to whom a nominal salary would be acceptable for the slight aid rendered in addition to their regular duties, the annual cost of the service would probably be under $5,000. There are times each year when the daily saving to the fleet in time and fish, through the information furnished by such a bureau, would much more than counterbalance the entire expense of the service.

PLATE 1.



FLOOR PLAN OF THE FISH COMMISSION EXHIBIT AT THE COLUMBIAN EXPOSITION, 1893.

1.—REPORT OF THE REPRESENTATIVE OF THE UNITED STATES FISH COMMISSION AT THE WORLD'S COLUMBIAN EXPOSITION.

SKETCH OF THE EXHIBIT.

The Commissioner of Fish and Fisheries was directed by the act of Congress approved April 25, 1890, to join with the several Executive Departments in the preparation of an exhibit illustrating the functions of the Government at the World's Columbian Exposition. The representation of the Departments was intrusted to one member from each of them, and one from the Smithsonian Institution and National Museum, as well as one from the Fish Commission; these representatives to constitute a board of management and control. The representative of the Fish Commission, nominated by the Commissioner August 18, 1890, was Capt. J. W. Collins, assistant in charge of the division of fisheries. Captain Collins tendered his resignation as representative December 27, 1892, and Commissioner McDonald then designated Dr. Tarleton H. Bean, assistant in charge of the division of fish-culture, to succeed him.

No active work was undertaken until April 1, 1891, upon which date certain employees of the Commission were detailed for special duty in connection with the preparation of the exhibit, and such additional assistants as were required were employed.

The building No. 210 Tenth street NW., Washington, D. C., was leased for the use of the Fish Commission exhibit May 1, 1891. On August 13, 1891, the equipment of the building was reported complete, and W. P. Sauerhoff was detailed to work, under Mr. Ravenel's direction, upon the preparation of fish-cultural apparatus. The building was given up March 15, 1893, after the exhibit had been shipped to Chicago.

The general plan and scope of the exhibit were outlined by Captain Collins, and, with the approval of the Commissioner, active measures were soon after begun, with the assistance of E. C. Bryan, chief special agent in charge of administration and fisheries; W. deC. Ravenel, special agent in charge of fish-culture; William P. Seal, in charge of construction of aquarium, and Dr. J. A. Henshall, in charge of the angling exhibit.

Mr. Seal resigned his position as special agent in charge of the aquarium December 31, 1892, and on the following day, upon the designation by the Commissioner of Fish and Fisheries, Prof. S. A. Forbes, director of the State Laboratory of Natural History at Champaign, Ill., was appointed to take charge of the aquarial exhibit. He was assisted by

Mr. L. G. Harron, who had supervision of the salt-water section, and Mr. Alexander Jones, who superintended the fresh-water division.

Mr. Bryan severed his connection with the exhibit on January 10, 1893, and was replaced by Mr. Ravenel.

Dr. J. A. Henshall resigned his position as special agent in charge of the angling exhibit January 16, 1893, and the work to which he had been assigned was performed by the representative, Dr. Bean.

The preparation of the fisheries section included the construction of a series of boat and vessel models, together with sail and builders' plans of fishing vessels, the collection of fishes and other marine animals, and the preparation of casts of gelatin and papier mâché, the mounting of skins of seals, sea lions, and other objects of the fisheries, the collection of nets and other apparatus, fishermen's clothing, photographs and other illustrations of the fisheries and fishery industries of the United States, and the securing of a typical series of fishing and angling appliances from manufacturing firms.

The series of vessel models, built under the personal supervision of Capt. J. W. Collins, was illustrative of modern vessels engaged in the fisheries of New England, Chesapeake Bay, Gulf of Mexico, and the Pacific and Arctic oceans. It embraced also types of historical interest as showing the development of fishing craft, with suggestions for important improvements in vessel construction.

The boat models included types of those in common use in Chesapeake Bay and the North Carolina sounds, the Gulf of Mexico, the Great Lakes, and those used by natives of Alaska. These latter were accompanied by the netting and fishing appliances, clothing, and other equipment of the people.

The fish casts were made chiefly from specimens of important food and economic species which were obtained at Gloucester, Boston, and Woods Hole, Mass.; New York; Norfolk and Cape Charles City, Va.; Washington, D. C.; Tampa, Key West, and Cedar Keys, Fla.; Sandusky, Ohio; Quincy and Meredosia, Ill., and San Francisco, Cal.

Reference is made elsewhere to persons who, through their interest in the undertaking, forwarded many rare fishes. Numerous specimens were secured through dealers, and important collections were made by employees of the Commission; as, for example, Mr. V. N. Edwards, in Woods Hole, Mass.; Dr. J. A. Henshall, in Florida; Dr. S. P. Bartlett, in Illinois; Mate James A. Smith, U. S. N., in North Carolina; F. N. Clark, in Michigan; W. F. Page, in Missouri; Charles G. Atkins, in Maine; Rudolph Hessel, in Washington, D. C.; George A. Seagle, in Virginia; Capt. W. E. Dougherty, in California, and A. B. Alexander, in California and elsewhere on the Pacific Coast.

Lieut. Robert Platt, U. S. N., took an active part in the collection of marine animals with the steamer *Fish Hawk*, and sent details of men to help in the preparation and return of the exhibit.

The following superintendents of stations were present during the whole or part of the Exposition period in connection with the aquarial

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FISH-CULTURAL SECTION [illegible] MODELS OF [illegible] STAT[illegible]
TRANSPORTATION [illegible]

and fish-cultural exhibits: Dr. S. P. Bartlett, Frank N. Clark, H. D. Dean, J. J. Stranahan, as was also Mr. J. F. Ellis, superintendent of the car and messenger service, who gave personal direction to matters of transportation for the aquarium and fish-hatchery.

A large series of photographs, already in the possession of the Fish Commission and the National Museum, was transferred to the exhibit, and many new illustrations showing recent changes in the methods and development of the fisheries were secured by detailing employees for work in suitable regions. These details included S. G. Worth for duty in the New England States and in the South; Messrs. C. H. Townsend, A. B. Alexander, and W. A. Wilcox on the Pacific Coast; Dr. H. M. Smith, C. H. Stevenson, and Ansley Hall at various field stations. This work, in most cases, was performed in addition to regular duties. Dr. Smith also prepared the statistical charts showing the extent of the fisheries of the United States.

The exhibit of the division of inquiry respecting food-fishes was prepared under the direction of Mr. Richard Rathbun, assistant in charge of the division. In that section were to be found illustrations of the marine laboratory and fish-cultural station at Woods Hole, models and illustrations of the vessels of the Commission, specimens of the seines, trawls, nets, dredges, and other collecting apparatus, together with wire rope used in dredging operations and the other accessories for scraping the ocean bottom.

The apparatus used in sorting and preserving collections was also exhibited. There was a model of the sounding machine used in deep-sea work, with examples of the various thermometers used in physical observations. The results of scientific explorations of the Commission appear in the form of charts and models of the areas over which the vessels made their investigations.

In the cases preserved in alcohol or in a dry state were many curious inhabitants of the deep sea as well as the surface waters—the crinoids, corals, crabs, sea-pens, starfish, sea-urchins, the various invertebrate animals that form the food of fishes, foraminifera, sponges, worms, and mollusks. In the latter class extensive series of oysters were displayed to show the rate of growth on different kinds of bottoms, the method of attachment of the spat, the injuries produced by starfish, drills, and other enemies of the oyster.

The dredging apparatus included appliances for collecting in depths greater than 3 miles, and was therefore of especial interest to the public. This division was further enriched by a collection of about 150 flexible casts of fishes painted from the fresh or living specimens in faithful imitation of nature.

In the installation of the exhibit of the scientific section, as well as in its return to Washington, valuable assistance was rendered by Mr. C. H. Townsend, naturalist of the *Albatross*.

The preparation of the exhibit of the fish-cultural section was directly in charge of Mr. W. deC. Ravenel, upon plans prepared with the assistance and approval of the Commissioner. In that section the apparatus of modern fish-culture was shown by means of models and full-sized specimens as far as possible in operation, and an historical series showing the development of modern appliances, as well as their geographical variation. This included apparatus for collecting and carrying eggs and for transporting spawning fish, hatching apparatus, rearing apparatus, models and pictures of hatching and rearing establishments, and collections showing the methods and results of fish-culture.

Eggs in various stages of development were shown preserved in brine or alcohol, and fish reared at the various stations were illustrated by means of painted casts and alcoholic specimens. The food and the enemies of fish were exhibited in various ways. There was also a collection of fish-cultural literature.

PRACTICAL FISH-CULTURE.

To illustrate practically the fish-cultural work of the Commission, a number of modern forms of trout and salmon troughs, shad and whitefish tables, and cod boxes were erected in the exhibit, and operations conducted during the entire Fair with real and artificial eggs. The apparatus was as follows: Two hatching tables, 8 feet long, 3 feet wide, and 3 feet high, equipped with McDonald jars for hatching eggs of shad, whitefish, and pike perch; four representative salmon and trout troughs, 8 feet long, 12 inches wide, and 8 inches deep, one for hatching trout eggs on gravel, one on trays, the Clark-Williamson combination, one of the Atkins pattern, such as is used in hatching the Atlantic and landlocked salmon in Maine, and the other with a Stone salmon basket, commonly used on the Pacific Coast. A set of McDonald cod boxes and Chester jars was also provided for illustrating work with cod and other floating eggs. As it was not possible to obtain live eggs throughout the season, it was necessary to provide a substitute, so that there should be no cessation in our work. Through the ingenuity of Mr. S. G. Worth, superintendent of Central station, artificial eggs were made of resin for illustrating the methods employed in hatching the floating and semi-buoyant varieties.

Salmon and trout eggs preserved in brine were used in the troughs. These eggs were the dead ones picked out of the hatching troughs at the different stations of the Commission during the previous winter, and answered the purpose well. Credit is due Mr. J. J. Stranahan for this idea. The artificial eggs having been found to be of greater specific gravity than fresh water, and it having been demonstrated that eggs kept in brine would soon decay in fresh water, it was necessary to equip this composite hatchery so that either fresh or salt water could be used in each form of apparatus. The fresh water was furnished by the Exposition Company and was pumped from Lake Michigan. This was found to be fairly good for hatching operations, and ranged in temperature from 42° F. in May to 74° in August, and down again to 47° in October.

The salt water was a saturated solution, and was manufactured from time to time as needed. This water was circulated by means of two pumps driven by water pressure, the pumps lifting the water from the storage tanks below the floor, into which the troughs and other forms of apparatus emptied, into the tanks overhead, from which the water was furnished by gravity to the hatching apparatus.

Eggs of various kinds were hatched during the months of May, June, parts of July and September, and all of October. At the opening of the exhibition, May 1, there were in the hatchery 800,000 shad eggs, 3,000,000 pike-perch, and 84,000 yellow-perch, and by the end of June 16,550,000 pike-perch eggs, 700,000 yellow-perch, 800,000 shad, and 154,000 eggs of the common sucker had been received and cared for and 6,900,000 fry hatched. Of these 3,700,000 pike-perch fry, 700,000 yellow-perch, and 100,000 suckers were planted in Lake Michigan near Jackson Park.

The shad eggs were all lost on account of the extremely low temperature of the water (average 42° F.), though some of them showed signs of life as late as May 13.

On June 29, 20,000 black-spotted trout eggs were received from Leadville and placed on the wire trays and in the gravel trough. The temperature of the water at that time was 64°, and the eggs commenced hatching two days after they arrived. By July 9 they were all hatched, with a loss of about 8,000. The fry commenced feeding on July 14, and were carried with fair success in our troughs, notwithstanding the high temperature of the water, until, owing to an accident to the machinery, the Exposition Company was compelled to shut off the water, which killed most of the fry on hand.

Arrangements had been made for obtaining the supply of quinnat-salmon eggs from California, and on September 23 a package containing 50,000 was received in good condition. These were placed in the Stone salmon baskets and Atkins trough, and were all hatched by October 7, with a loss of about 29,000. The fry were successfully carried in our rearing troughs until the close of the Exposition, when 19,000, the balance on hand, were shipped by one of the Fish Commission cars to Northville, Mich. A consignment of 54,000 lake-trout eggs, from Alpena, was received on October 9, and another of 40,000 quinnat-salmon eggs was received on the 19th of the same month from Clackamas. This latter package arrived in first-class condition. These eggs were placed in the hatching troughs, where they remained until the close of the Exposition, when they were shipped to Mr. Frank N. Clark at the Northville station. In addition to the hatching operations, several thousand trout furnished from the Northville station were cared for in our rearing troughs during the summer in the Government building.

THE AQUARIUM.

The east wing of the Fisheries building was fitted up by the Columbian Exposition Company for the aquarial exhibit of the Fish Commission.

The engineering duties in the preparation of this exhibit at first devolved upon W. B. Bayley, U. S. N., and afterwards upon I. S. K. Reeves, U. S. N. The Commissioner personally assisted in the installation of the live-fish exhibit, having previously determined by experiment the principles of successful management.

In the course of these experiments sea-anemones were kept alive in an aquarium fitted up with air circulation and with water half artificial, the aeration having been effected by means of a succession of fine jets lowered to the bottom of the tank.

A full report upon this part of the exhibit was published in the Bulletin of the Commission for 1893, pages 143 to 190. It will be necessary only to give here a brief sketch of its main features.

The aquarium was a circular structure of 125 feet in diameter, forming the east annex of the Fisheries building. Upon the completion of the annex it was turned over to the Fish Commission for the purpose of making its aquarial display. Tanks of various sizes, made of cement, slate, glass, and iron, filled all the available exhibition space of the building. Some of them were large enough to accommodate the largest fish that could be transported alive. For example, one tank in the fresh-water series was about 50 feet in length. Nearly one-third of the tank capacity was devoted to the exhibition of salt-water animals and plants. The water was brought from the ocean at Morehead City, N. C., and was stored in a reservoir under the Fisheries building. This reservoir was 46$\frac{3}{4}$ feet long, 18$\frac{2}{3}$ feet wide, and 8$\frac{1}{2}$ feet deep. From this reservoir water was pumped into a pressure tank 30 feet in diameter and 5 feet deep, located at the top of the Fisheries building. From this height it was conveyed into the aquarium tanks, after leaving which it passed through a sand and gravel filter back again into the reservoir.

Rubber pumps for the circulation of the salt water were located under the Fisheries building and were operated by electricity. All the pipes and connections with which the salt water came in contact were made of hard rubber or were lined with that material. About 60,000 gallons were required for the supply of the tanks.

The fresh water was obtained from the city waterworks, and was filtered before entering the aquaria. On some occasions during the Exposition as much as 750,000 gallons of fresh water passed through the tanks in twenty-four hours.

The salt water was constantly aerated by means of two hydraulic pumps which delivered the air into a galvanized air cylinder at a pressure of about 7 pounds per square inch. From this cylinder the air was conducted to the backs of the salt-water aquaria by iron pipes, and each aquarium received its supply of air by rubber tubing, into which were inserted plugs of basswood, through which the air was forced.

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FISH-CULTURAL SECTION. SHAD AND WHITEFISH HATCHING TABLES AND TROUT AND SALMON TROUGHS LOOKING FROM SOUTH ENTRANCE [illegible] WITH OTHER FORMS OF FISH-CULTURAL APPARATUS IN THE BACKGROUND.

Marine fishes and plants were obtained at various localities along the east and west coasts and the Gulf of Mexico. The fresh-water supplies were drawn chiefly from the Potomac, Mississippi, and Great Lake basins, as also from the hatching establishments of the Commission. A principal object of the exhibit was to show the important food and game fishes of typical localities, as well as numerous species which were notable on account of their colors, their forms, and their singular habits. The kinds of fishes and other forms of animal life shown were as follows:

Species.	Number.	Species.	Number.	Species.	Number.
Paddle-fish	23	Viviparous perch	8	Pike perch	300
Bullhead catfish	83	Ling	1	Yellow perch	282
Spotted catfish	2,724	Dogfish	24	White perch	196
Carp	211	Toadfish	10	Sea bass	17
Tench	36	Alewives	9	Black bass	1,944
Golden tench	20	Angel-fish	3	Warmouth bass	384
Golden ide	150	Stingray	2	Rock bass	47
Goldfish	350	Remora	6	Calico bass	33
Redhorse	50	Sea-raven	53	White bass	83
Fresh-water drum	23	Burrfish	64	Striped bass	35
Gizzard shad	24	Shark	1	Crappie	500
Brook sucker	201	Sand shark	4	Sunfish	695
Shiner	20	Sea-urchin	1	Red snapper	7
Stickleback	25	Starfish	185	Scup	112
Garfish	11	Alligator	1	Cod	3
Minnows	3,965	Sea eel	7	Tautog	70
Quinnat salmon	9	Lamper eel	3	Flounder	25
Grayling	204	Crayfish	500	Pompano	46
Loch Leven trout	2,049	Blue crab	53	Tomcod	32
Rainbow trout	26	Spider crab	21	Cunner	25
Von Behr trout	2,068	Hermit crab	52	Kingfish	83
Black-spotted trout	50	King crab	5	Mussels	250
Brook trout	2,607	Lady crab	6	Turtles	3
Lake trout	54	Whitefish	48	Clams (barrels)	2
Saibling	10	Lake herring	99	Lizard	3
Hogchoker	46	Muskellunge	3	Sea anemone	37
Scallop	8	Pike	103	Sea moss (tanks)	2
Skate	36	Pickerel	73	Red sponge (tank)	1

Water for the aquarium.—It was at first proposed to use the constituents of salt water and make from them the amount necessary for supplying the marine aquarium at the World's Fair by the addition of fresh water. Bitter water, salt, and lime were purchased in New Bedford, Mass., and shipped to the Fisheries building. The lime residuum from salt-water evaporation, upon analysis by the chemist of the Agricultural Department, was pronounced almost pure calcium sulphate. One hundred and fifty sacks of natural sea salt, 3 bushels of lime residuum, and 40 barrels of bitter water were obtained for the purpose. Before this was finally used the Commissioner instituted a series of experiments in his office at Washington and found that bitter water offers no advantage, and it was feared that some deleterious effect would result from its use. The original plan was abandoned, and it was determined to transport natural sea water from a point on the Atlantic coast.

Transportation of marine animals.—It was found very difficult to ship large skates in water tanks; therefore the superintendent of the Woods Hole station was instructed to experiment in keeping such animals in clean sea weed, cotton fabric, or burlaps, providing for a free circulation of air. They were inclosed in crates and were sprinkled once an hour by hand with salt water. In order to keep down the temperature of the salt water the Commissioner advised that direct connection be made to permit circulation of the water to the aquaria and back from the reservoir without pumping it up into the tank on the top of the Fisheries building.

Food for aquarium animals.—The principal articles of food used in the aquarium were beef liver and beefsteak. It was sometimes difficult to obtain these, and parties were sent to the lagoons to seine for small minnows, which were fed to the fish as a substitute for other meats. Clams and mussels were forwarded from various parts of the east coast, and small fresh-water crustaceans were obtained by tow nets and other apparatus in the fresh waters in the vicinity of Chicago to feed the paddle-fish.

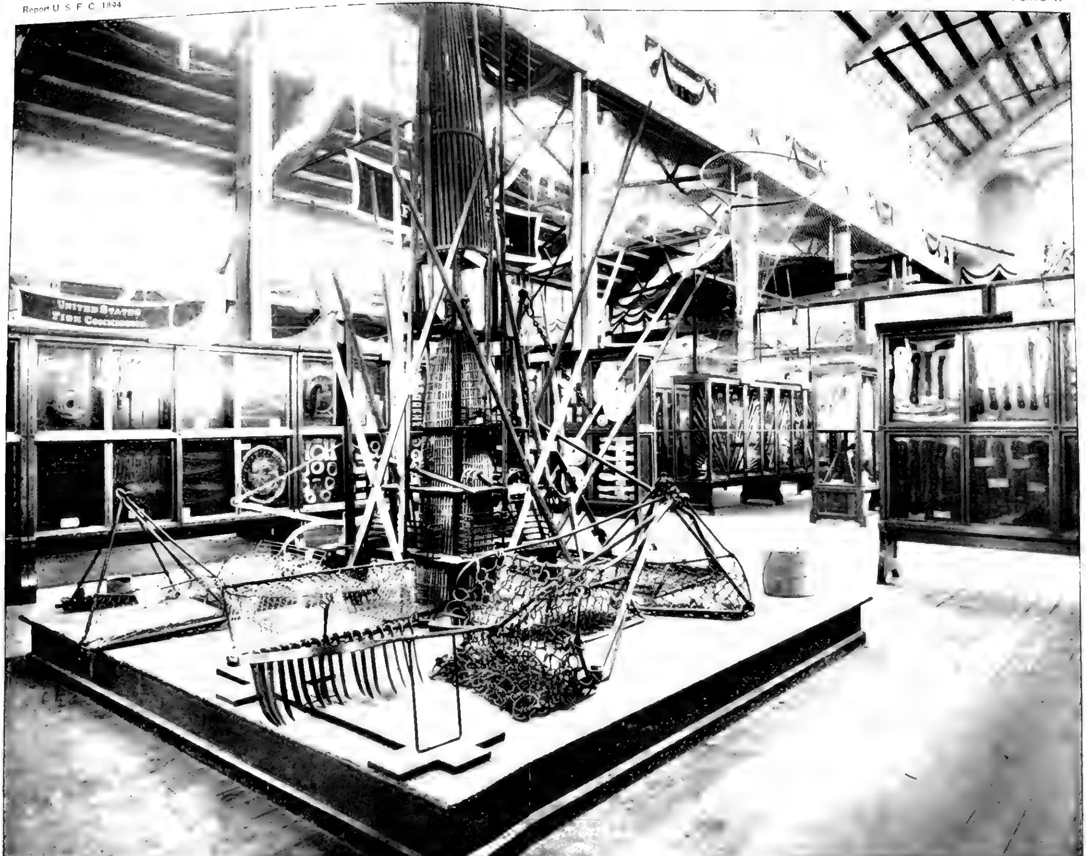
WORLD'S FISHERIES CONGRESS.

One of the natural outgrowths of the Fish Commission exhibit in Chicago was the relation in which the Commission stood to the World's Congress Auxiliary, organized under the direction of a committee of the Columbian Exposition, of which C. C. Bonney was general chairman.

The Commissioner of Fisheries called a preliminary meeting in Chicago April 25, 1893, associating with himself Dr. G. Brown Goode, Prof. S. A. Forbes, and Dr. T. H. Bean, for the purpose of organizing a Fisheries Congress. With these gentlemen were united Mr. E. G. Blackford, of New York; N. K. Fairbank and A. Booth, of Chicago; and R. E. Earll, of Washington. After the preliminary meeting Chairman Bonney officially appointed the committee just named, and the work of organization was immediately entered upon. Men of prominence in the fisheries, fish-culture, and scientific investigation in various parts of the world were designated to form an advisory council, and invitations were sent out requesting attendance at the sessions of the congress and asking for contributions. The responses to this call were numerous, and the communications brought together were of a very important character, embracing papers upon fishery laws and regulations, science in relation to the fisheries and fish-culture, methods employed in the capture and utilization of fishery products in all parts of the world, together with statistics of fisheries and essays upon fish-cultural topics.

Associated with the general committee was a committee of State commissioners of fisheries, through whom it was arranged to hold meetings of those commissioners during the time occupied by the meetings of the Fisheries Congress. Mr. E. A. Brackett, of Winchester, Mass., was the chairman of the committee of organization.

The formal sessions of the Fisheries Congress opened in a hall in the Memorial Art Palace, Chicago, on October 16, at which time Hon. Marshall McDonald delivered the opening address as chairman of the



A [illegible] PART OF FISHERIES SECTION.

On the platform are various types of dredges and rakes used in the oyster, clam, and other molluscan fisheries. In the central tier are wicker and slat traps [illegible] [illegible] traps, nets, lines, and various forms of tackle employed in the [illegible] fishery.

congress. Dr. G. Brown Goode, Hon. E. G. Blackford, and Dr. Hugh M. Smith acted as chairmen of the principal sections of the congress. The meetings were brought to a close on October 19 by a fish banquet in the hall of the New York State building, in Jackson Park, in which the members of the Fisheries Congress, the conference of State commissioners of fish and game, and their invited guests participated. Hon. T. W. Palmer presided and delivered the opening address. Other speakers of the evening were Hon. Carter H. Harrison, mayor of Chicago; Messrs. Andrews, Bowman, and Breslin, of New York; Commissioner McDonald, J. J. Quelch, commissioner of British Guiana, and John Foord, secretary of the New York World's Fair Commission.

The papers prepared for the World's Fisheries Congress have been published, and form volume XIII of the Bulletin of the U. S. Fish Commission.

A complete descriptive catalogue of the Fish Commission exhibit was prepared, but the plan and scope of the several sections will be sufficiently shown by means of the following synopsis:

CATALOGUE OF THE EXHIBIT.

Scientific Inquiry Section.

1. **Laboratories for Marine Exploration.**

   Illustrations of Zoological Stations: (1) Laboratory at Woods Hole, Mass., 1875. (2) Laboratory at Woods Hole, Mass.

2. **Exploring Vessels.**

   Models: (1) Steamer Albatross. (2) Steamer Fish Hawk. (3) Schooner Grampus.
   Illustrations: (1) Steamer Albatross. (2) Steamer Fish Hawk. (3) Schooner Grampus.

3. **Collecting Apparatus.**

   Nets: (1) Seines. (2) Beam trawls. (3) Towing nets.
   Dredges: (1) Naturalist's deep-sea dredge. (2) Naturalist's boat dredge. (3) Benedict rake dredge. (4) Oyster dredge.
   Tangles.

4. **Accessories for Dredging and Trawling.**

   Dredge rope (steel-wire dredge rope; splices in dredge rope). Iron dredge block. Sigsbee accumulator. Weights for beam trawl.

5. **Apparatus for Assorting Collections.**

   Rocker sieves. Table sieves. Hand sieves.

6. **Apparatus for Preserving Collections:** *Tanks.*

7. **Apparatus for Deep-Sea Sounding:**

   Sigsbee sounding machine (model).

8. **Apparatus for Physical Observations.**

   Thermometers: Deck thermometer. Professor Baird's protected thermometer. Miller-Casella deep-sea thermometer. Negretti & Zambra thermometer.
   Thermometer cases and accessories: Wooden cases. Brass cases. Reading lens.
   Salinometers: Hilgard salinometer.

9. Results of Explorations.

Charts and models.

Collections:

1. Marine animals in alcohol:
   - (*a*) Deep-sea animals: Crinoids, corals, crabs, sea-pens, starfish, sea-urchins, etc.
   - (*b*) Surface animals: Entomostraca, etc., forming food of fish.
   - (*c*) Shallow-water animals: Mollusks, crustaceans, etc.
2. Marine animals: Foraminifera. Sponges. Corals. Mollusks, etc.
3. Microscopic slides: Of fish eggs, fish embryos, fish food, and Foraminifera.

FISH-CULTURAL SECTION.

10. Transportation Apparatus.

Apparatus for collecting and carrying eggs:

Models and specimens: Wroten bucket. Wroten bucket improved. Collins's can. McDonald's egg reel. McDonald's crate. McDonald's crate for egg reel. Atkins's egg box. Green's egg box. Clark's egg case. Clark's whitefish crate. Clark's foreign-egg case. Mather transportation box. Taylor's egg-transportation can. Trout boxes used in 1872.

11. Apparatus for Transporting Fry.

Models and full-sized apparatus:

(*a*) Models: Car No. 1. Clark's transportation can.

(*b*) Specimens: Stone's transportation can. Automatic transportation can. Mulertt's transportation can. McDonald's trout can. Zolinsky's carboy. Mortimer's sole aquarium. Carp transportation pail. Carp transportation kettle. Wood-bound can, full size. Messenger's complete outfit. Bucksport transportation can. Ferguson's transportation can. Fish Commission transportation can. Stranahan transportation keg. Box for native food-fishes.

(*c*) Accessories: Siphon strainer. Monroe Green's aerator and cooler. Siphon tube, bag, and cage. Dip nets of various sizes. Water bucket.

12. Apparatus for Carrying Spawning Fish.

Models and specimens:

(*a*) Models: Group of salmon dory cars.

(*b*) Specimens: Maitland's salmon car. Seal's transportation tub.

13. Hatching Apparatus.

Models and specimens:

(*a*) For floating eggs: Chester wave box. Chester semi-rotating hatcher. Chester cod box. Cone with automatic siphon. Stand of cones with automatic siphon. McDonald's cod hatcher. Cod box. McDonald's cod box. McDonald's improved cod box. McDonald's mackerel tubs. McDonald's hatching bucket. Ferguson's submerged bucket.

(*b*) For semi-buoyant eggs: Wroten's bucket. Green's shad box. Brackett's shad box. Wright's submerged box. Ferguson's submerged bucket. Mather's shad can. Bell-Mather shad cone. Ferguson's improved cone. Models of cones and buckets. McDonald's Y-shaped box. Bower's V-shaped box. Chase's whitefish jar. McDonald's jar, old style. McDonald's universal hatching jar. Clark's jar. Apparatus used on cars. De Lawder-Wroten shad hatcher.

(*c*) For heavy eggs: Garlick's hatching box. Stone's charred trough. Coste's hatching grills. Williamson's hatching trough. Stone's salmon basket. Bucksport hatching trough. Brackett's hatching trough. Holton's hatching box. Clark's hatching trough. Hatching trough with glass strip trays. Mather's hatching trays. Atkins's hatching crate.

14. **Rearing Apparatus.**

Clark's trout-rearing troughs: Whitefish tanks. Shad tanks.

(*a*) Accessories: Ainsworth's spawning race. Mather's spawning cone. Spawning pans. Spawning buckets. Page's egg scale. Egg funnels for whitefish and shad. Series of nets from Central station, Washington, D. C. Series of nets from Northville station, Mich. Series of nets from Battery station, Md. Nippers, brass and wood. Dippers. Strainer dippers. Hume's spawning box. Rubber boots. Oil clothing. Pan for washing eggs. Salmon dip net. Tray for washing eggs. Siphon bags. Siphon cages. Siphon tubes. Aquaria.

(*b*) Accessories to pond culture: Seines. Dip nets. Farm profit boiler. Meat chopper. Gun. Garden rake.

15. **Hatching and Rearing Establishments.**

Charts:

(*a*) Chart giving names and location of stations and output of each station for fiscal year 1891–92.

(*b*) Chart showing work of the Commission from 1872 to 1892.

Models of hatching establishments:

(*a*) Hatching houses: Put-in-Bay hatchery. Leadville hatchery. Havre de Grace hatchery. Gloucester, Mass., hatchery.

(*b*) Floating hatchery. Hatching barge.

Illustrations of hatching stations (showing buildings, exterior and interior, methods employed in collecting, hatching, rearing, and distributing fish fry and eggs):

(*a*) Green Lake. Grand Lake stream. Bucksport and Craig Brook, Me. Gloucester cod station and Woods Hole, Mass. Central station and Fish Commission fish ponds, Washington, D. C. Battery station, Havre de Grace, Md. Bryan Point shad station, Md. Wytheville station, Va. Duluth station, Minn. Alpena and Northville stations, Mich. Put-in-Bay station, Ohio. The Quincy (Ill.) station. Neosho station, Mo. Leadville station, Colo. Fort Gaston, McCloud, and Baird stations, Cal. Clackamas, Oreg.

(*b*) Floating stations: Hatching barge. Steamer Fish Hawk.

16. **Methods and Results of Fish Culture.**

Lay figures: Group illustrating shad fishing and spawning. Group illustrating cod fishing and spawning.

Chart showing the effect of fish-culture on the shad fishery.

Painted casts of fishes reared by the Fish Commission:

(*a*) Brook trout, 1, 2, 3, and 4 years old. Von Behr trout, 1, 2, 3, and 5 years old. Loch Leven trout, 1, 2, 3, and 6 years old. Lake trout, 1 and 2 years old. Landlocked salmon, 1 year old. Rainbow trout, 1 and 2 years old. Whitefish, 5 years old. Carp, tench, goldfish, black bass, etc.

(*b*) Alcoholic and brine specimens: Eggs in different stages. Fry, yearlings and adults.

Protection of Fish (assistance in ascending streams):

Duncannon fishway. Shaw's spiral fishway. Swazey's oblique fishway, old style. Swazey's oblique fishway, new style. Worrall's expanding sluice fishway. Worrall's chute fishway. Brewer's single-groove fishway. Brewer's double-groove fishway. Steck's fishway. Smith's inclined-plane return fishway. Lawrence fishway. Holyoke fishway. Everleth's self-adjusting fishway. Pike's spiral fishway. Atkins's spiral fishway. Bangor fishway. McDonald fishway, old style. McDonald fishway, section 6, Great Falls, Potomac River.

Illustrations: Photographs: McDonald's fishway, Fredericksburg, Va.

Fisheries Section.

17. Objects of the Fisheries.

Mammals:

1. Sirenians: Manatee (cast).
2. Cetaceans:
   (*a*) Dolphins: Common dolphin (cast). Bottle-nose dolphin (cast). Blackfish (cast). Grampus (cast). Harbor porpoise (casts).
   (*b*) Sperm whales: Pygmy sperm whale (cast).
3. Carnivores:
   (*a*) Earless seals: Harbor seal (mounted group).
   (*b*) Eared seals: Northern fur seal (mounted group). Steller's sea lion (mounted group).

Birds: Fish-eating birds, 80 skins.

Reptiles and Batrachians:

1. Alligators: Florida alligator (mounted skin).
2. Turtles and tortoises: Loggerhead turtle (cast). Hawk's-bill turtle (mounted shell). Green turtle (cast). Soft-shell turtle (cast). Snapping turtle (cast). Spotted turtle (cast).
3. Snakes: Water snake (cast).
4. Frogs: Bullfrog (cast). Green frog (cast). Pickerel frog (cast).

Fish: Casts of 150 species of marine and fresh-water food-fishes. Color drawings of fishes. Maps showing the distribution of halibut, cod, mackerel, and other kinds. Living marine and fresh-water fish in aquarium.

Invertebrates: Living sea-anemones, starfish, crabs, lobsters, mollusks, algæ, etc., in aquarium.

18. Fishery Apparatus.

Vessels: (1) Models of sloops, ketches, schooners, steamers. (2) Pictures of vessels. (3) Vessel fittings. (4) Instruments of navigation (logs, compasses, clocks, etc.). Fishermen's clothing, etc.

Boats: (1) Models. (2) Full-sized boats. (3) Pictures.

Canoes: (1) Bark. (2) Skin. (3) Wood.

Nets: Pounds. Weirs. Pots. Seines. Cast nets. Dip nets. Trawls. Dredges.

Lines: Trawl lines. Hand lines. Accessories (rods, reels, floats and sinkers, gaff hooks, creels, bait boxes, fly books, etc.).

Appliances for seizing: Rakes. Tongs. Hooks for sponge. Accessories (water glass).

Appliances for striking: Spears. Lances. Bows (and arrows). Guns.

Lures: Artificial flies; artificial minnows, frogs, etc.

Charts of fishing grounds.

19. Illustrations of Fisheries.

Fishermen: Professional; anglers; lay figures.

Fishermen's dwellings. Fishing towns.

Special fisheries: Mammals; reptiles; fishes; mollusks; crustaceans; sponges.

20. Statistics of Fisheries.

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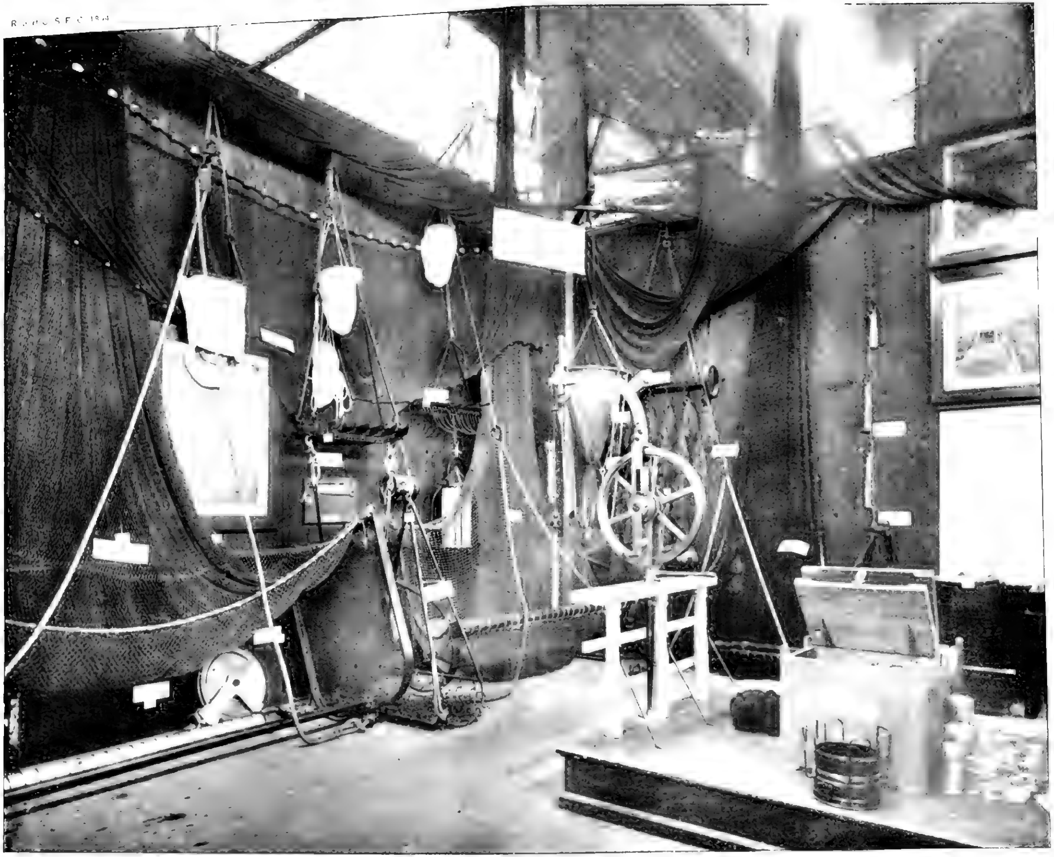

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INSTALLATION OF THE EXHIBIT.

The delivery of boxes in the Government building began early in December, 1892, the freight having been consigned to Capt. J. F. Aytoun, local agent of the board of management and control at Chicago. All of the materials were on the space by April 15. A temporary office was constructed on the ground floor in January, 1893, for use during installation, and permanent offices were completed on the gallery in April. Late in February, 1893, Mr. W. P. Sauerhoff was sent to Chicago to commence unpacking and setting up cases, and about the end of March the active work of installation was begun, under the supervision of Dr. Bean and Mr. Ravenel.

The installation was seriously hindered by unfavorable weather, but was finished by the end of April, both in the Government building and in the aquarium in the Fisheries building. The hatching apparatus and pumps in the fish-cultural section were working satisfactorily, and supplies of eggs had been obtained, so that the entire exhibit was ready for the inspection of visitors upon the opening day.

The exhibit was located in the northern portion of the Government building, between the Agricultural Department on the east and the Interior Department on the west. Its space was 150 feet from east to west, by 95 feet in depth along the western border, and 120 feet in depth along the eastern line.

This space was continued backward along the west side of the main north and south aisle by a strip 15 feet wide and 75 feet long, and on the east side of the same aisle by a strip of the same width 50 feet in length, the narrow strips extending to the rotunda.

The western portion of this space was devoted entirely to the fisheries exhibit; the eastern portion to the divisions of fish-culture and scientific inquiry.

The general arrangement is shown by the accompanying floor plan, and the details of the exhibits may be seen from the illustrations which form part of this report.

The superficial area, including the aisles, amounted to 16,000 square feet, while the aquarial exhibit in the east annex of the Fisheries building had an area of nearly 10,000 square feet.

FOREIGN VISITORS TO THE EXHIBIT.

The exhibit attracted the attention of a great many visitors from foreign countries who were interested in the apparatus and methods employed by the National Fish Commission. The following are among those who called during the Exposition and to whom the operations of the Commission were explained in greater or less detail. Many of the persons named made reports to their Governments upon the subject, embracing in them an account of the exhibit of the Commission:

Dr. Henri de Varigny, in behalf of the minister of public instruction and fine arts, and delegate of the minister of commerce, Paris, France.
Mr. A. Caméré, chief engineer of bridges and roads, Paris.
Mr. Pung Kwang Yu, first secretary of the Chinese legation and commissioner to the World's Columbian Exposition.
Dr. Nicolas Borodine, St. Petersburg and Uralsk, Russia.
Dr. Einar Lönnberg, delegate of the royal Swedish board of agriculture, Stockholm.
Mr. Paul Hillman, agricultural student, Rustorf, Germany.
Dr. Gaston Bodart, assistant I. R. Austrian commissioner.
Mr. E. A. C. Landmark, government inspector of fresh-water fisheries for Norway, Christiania.
Mr. Ivan Janschul, professor of political economy in the University of Moscow, Russia.
Hon. L. O. Smith, ex-member of the Swedish Senate, Stockholm.
Mr. Frederico Atristain, Mexican commissioner to the Columbian Exposition.
Mr. Carlos Young, Montevideo, Uruguay.
Mr. A. Hinkelmann, director of fisheries, Kiel, Germany.
Mr. Nobuakira Yamataka, imperial Japanese commissioner.
Mr. Tamotsu Murata, member of the House of Peers, chief counsel of the Society of Fisheries, Japan.
Mr. K. Tawara, secretary Imperial Japanese Commission.
Mr. Y. Yambe, secretary Imperial Japanese Commission.
Mr. Sakaye Sawatari, commissioner of Japanese Fisheries Society.
Mr. N. Yanagimoto, Okinawa, Japan.
Mr. T. Kondo, Osaka, Japan.
Mr. L. Z. Joncas, M. P., Quebec, Canada.
Dr. Ernst Ehrenbaum, Royal Biological Station, Helgoland.
Mr. Fernando Ferrari Perez, general secretary Mexican World's Fair Commission.
Dr. Emile Poussié, delegate of the Agricultural Society of Melun, France.
Comte de Balincourt, lieutenant, French Navy.
Mr. Albert Gomez Ruano, special commissioner of education from Uruguay.
Mr. Henri Giudicelli, commissioner of fine arts for France.
Constantine de Rakouza Soustcheffsky, commissioner-general for Russia to the Columbian Exposition.
Dr. Oscar Nordqvist, inspector of fisheries of Finland, Helsingfors.
Mr. J. J. Armistead, proprietor of Solway fisheries, Dumfries, Scotland.

COURTESIES RENDERED TO THE U. S. FISH COMMISSION.

From the U. S. National Museum were obtained numerous objects illustrating fish, fisheries, and fish-culture, some of which were on exhibition in the fisheries section of the Museum, and others stored among the duplicate collections. The officers of the Museum cooperated most heartily with the Commission in bringing together a valuable and comprehensive exhibit.

To Dr. Goode personally the Commission is indebted for the loan of a series of chromolithographs which form part of the illustrations of Game Fishes of the United States, for which he wrote the text, which was published by Charles Scribner & Sons in 1880. He lent, also, a number of fish-cultural books to make the series exhibited more nearly complete.

Through the courtesy of Hon. W. M. Meredith, Chief of the Bureau of Engraving and Printing, Washington, a supply of macerated greenback pulp was obtained for the purpose of making casts of fishes.

The Department of Agriculture assisted the Commission in its investigation of a fish disease, which proved very destructive during the progress of the Exposition, by the detail of Dr. Charles W. Stiles, who made a study of the parasite and prepared a report upon its life-history and the methods of its destruction.

Through the intervention of the late Hon. F. B. Stockbridge the Commissioner obtained permission from Mr. Howard Page, 26 Broadway, New York City, to use a sufficient number of tank cars belonging to the Standard Oil Company to convey salt water from the North Carolina coast to Jackson Park, Chicago, to be used in maintaining marine animals and plants in the aquarium. Free transportation for the salt water was obtained from Richmond, Va., to Chicago through the liberality of Mr. M. E. Ingalls, president of the Chesapeake and Ohio and the Cleveland, Cincinnati, Chicago and St. Louis railroads.

One of the cars of the Commission was sent from Chicago to Wisconsin for living specimens of muskellunge, black bass, and other fishes, in which undertaking Mr. C. L. Ryder, agent of the Milwaukee, Lake Shore and Western Railroad at Milwaukee, furnished free transportation for the car and its attendants. He also provided the service of Mr. J. B. Carlin, one of the conductors on the road, who was thoroughly familiar with the region to be visited, as a guide and helper for the trip, and he proved of great assistance on that occasion and subsequently.

In the selection of available localities for collecting marine materials along the southern coast, the advice of Dr. W. K. Brooks, of Johns Hopkins University, Baltimore, was profitably followed by the Commission.

In the collection of live fish and other objects in North Carolina, the agent of the Commission was assisted by Mr. George N. Ives and Mr. William Arendell, of Morehead City, and Mr. W. S. Chadwick, of Newbern.

Mr. T. J. Griggs, fish commissioner of Iowa, cooperated with Dr. Bartlett in securing specimens of black bass and other fish at Muscatine Slough during the entire course of the Exposition, as well as in their transportation to the aquarium.

To Mr. R. Ulrich, superintendent of the landscape gardening department of the Columbian Exposition, the Commission is indebted for flowering plants by means of which its space in the Government building was beautified.

A very useful device for recording the pressure of the water in the main supplying the Government building was furnished by Bristol's Manufacturing Company, of Waterbury, Conn. A pressure gauge was set up in proximity to the water motors, enabling us to show upon dials a constant record of the pressure. Thus, when it fell below a point to which the pumps were adjusted, it was easy to ascertain where the fault lay and to give the proper notice to the Exposition authorities.

On July 25, 1893, the water was turned off at one of the pumping stations at Jackson Park to make repairs, but fortunately no loss occurred in the aquarium. Men were up all night for the purpose of making water connections with hose borrowed from the fire department

Thanks are due to Marshal Murphy, chief of the fire department, for permission to connect hose with the plug outside of the aquarium building, in the event of its becoming necessary to shut off the water again for repairs or any other purpose.

During the progress of the Exposition the Imperial Japanese Commission, through Commissioner C. Matsudaira, signified its intention to present the fisheries exhibit of Japan to the U. S. Fish Commission at the close of the Exposition. After consultation with the Commissioner of Fish and Fisheries the gift was accepted, and a few articles desired by the Japanese Commission were promised them in exchange for their valuable collection, which filled 46 cases. These articles were deposited in the Fisheries section of the United States National Museum upon their arrival in Washington.

Mr. Kokichi Mikimoto, of Miyeken, Japan, on behalf of the Japanese Central Association, also presented numerous specimens showing the growth of the pearl oyster for seven years.

Acknowledgments are due to the following persons for gifts of model of vessels and boats used in the fisheries: Gillman Hodgkins, Lamoine, Me.; Louis King, Lamoine, Me.; Newell B. Coolidge, Lamoine, Me.: Coolidge & Bros., Lamoine, Me.; Robert Dority, Sargentville, Me.; D. D. Hodgkins, Lamoine, Me.; J. Brown, Lubec, Me.; Board of Trade, New Bedford, Mass.; L. D. Ashby, Noank, Conn.; E. J. Tull, Pocomoke City, Md.; H. Brusstar & Bro., Newport News, Va.; W. W. Sweat, Tampa, Fla.

From Mr. A. R. Crittenden, Middletown, Conn., was obtained an old-time quadrant used by a fishing captain until about 1840.

A model of a fish car or live box, used by fishermen of Cape Fear, N. C., and made in the shape of a boat, was presented by Lieut. Robert Platt, U. S. N.

Mr. J. M. K. Southwick, Newport, R. I., presented to the Commission a model of fish marketman's car, used by fishermen of southern New England for keeping live fish and lobsters.

Mr. Charles L. Marsh, Solomons, Calvert County, Md., presented for exhibition a pair of his patented deep-water oyster tongs, with photographs illustrating their use.

Capt. E. P. Herendeen, while at Point Barrow, Alaska, obtained specimens of the whalebone gill nets used by the Eskimo in fishing, and an ancient fishing spear from the Mackenzie River basin, through a native of Herschel Island.

Mr. F. E. Brown and Capt. E. Pierce, of New Bedford, Mass., lent a unique collection of whaling apparatus, including many articles of historic value as well as the principal implements now used by whalers.

Mr. John A. Sawyer sent from the same place a darting gun harpoon which had been strangely bent in the body of a whale.

The American Needle and Fish Hook Company, New Haven, Conn., furnished a large series of hooks manufactured on automatic machinery.

The T. J. Buell Company, Whitehall, N. Y., lent spoons, minnow gangs, leaders, and lures for fishing.

Charles Kerrison, jr., Charleston, S. C., sent a case of hooks with barbs shaped like the point of an arrow.

Edward Pitcher, Brooklyn, N. Y., furnished a large series of hooks, squids, swivels, sinkers, and other angling appliances.

Mr. G. M. Skinner, of Clayton, N. Y., furnished a series of his fluted spoon baits.

Messrs. Welch & Graves, Natural Bridge, N. Y., forwarded a specimen of trolling apparatus consisting of a glass tube in which a live minnow can be used as a lure without injury.

J. & S. Allen, Walpole, Mass., lent a series of silk and linen fishing lines.

G. H. Mansfield & Co., Canton, Mass., provided a series of enameled waterproof braided fishing lines.

A very large collection of rods, made at their several factories, were furnished by the Montague Rod Company, of Montague City, Mass. This series included split bamboo, lancewood, and various other styles.

Messrs. Abbey & Imbrie, New York City, lent for exhibition many of the finest types of rods used by anglers, including the celebrated Queen's Jubilee gold-mounted and jeweled fly rod, which was valued at $2,000, and was accompanied by an engraved gold reel. This handsome collection also contained lines of high grade and a variety of high class reels for salmon, tarpon, bass, and trout fishing; also fly books and boxes and a steel tarpon gaff.

The Andrew B. Hendryx Company, of New Haven, Conn., lent 211 reels, representing all grades of their workmanship, and mounted and labeled them in handsome cases at their own expense. This exhibit was so arranged as to show all parts of the reel from the outside, as well as the separate pieces used in reel construction.

Mr. Charles F. Orvis, of Manchester, Vt., provided the exhibit with four of his patent perforated reels, designed for drying the rod without removing it from the reel. The collection of flies manufactured by Mr. Orvis and arranged with angling scenes by Mrs. Mary Orvis Marbury, contained 428 flies for trout, salmon, black bass, etc., and 157 photographs representing angling in nearly all parts of the United States and Canada.

D. W. C. Farrington, Lowell, Mass., exhibited a beautiful series of flies and bugs made by himself for his own use, together with a mounted half skin of a brook trout around which the flies were arranged.

T. W. Rudolph, Chicago, Ill., furnished his ventilated tackle box, his minnow trap, floating minnow bucket, and floating live net, and these were afterwards presented to the Commission for its permanent exhibit in Washington.

G. L. Bailey, Portland, Me., furnished his patent landing-net frame with patent ring.

A figure representing a modern angler was clothed and fitted out by A. G. Spalding & Bros., of Chicago, with a Kosmic rod, reel, line, net, and the angler's suit.

R. D. Hume, of Gold Beach, Oreg., presented for exhibition a spawning box for holding salmon when taking eggs or milt, such as he uses on Rogue River, Oregon.

The Colorado Fish Commission, through Mr. O. G. French, secretary of the Colorado World's Fair Commission, lent a trout transportation can, a spawning can, a zinc hatching tray, and a pair of nippers.

Mr. Henry W. Elliott, 317 Detroit street, Cleveland, Ohio, lent his valuable series of water-colored paintings, illustrating the fur-seal and other related fisheries of Bering Sea.

Permission was obtained from Harper & Bros., Scribner & Co., the Outing Magazine Company, the Cosmopolitan Magazine Company, the Century Magazine Company, and Frank Leslie's Publishing Monthly Magazine Company to borrow illustrations from their respective magazines for the use of the Fish Commission exhibit.

In the preparation of the illustrations of Alaskan fisheries, Mr. Ivan Petroff's sketches were utilized, and he also superintended the construction of certain models showing native fishing methods.

Mr. Alexander Agassiz, Cambridge, Mass., furnished plans and photographs of the Zoological Laboratory at Newport, R. I., besides memoirs by himself, Garman, Hillman, De Pourtales, and Whitman.

Hon. J. J. Grinlinton, commissioner for Ceylon, presented copies of the Handbook and Catalogue of the Ceylon Courts.

Hon. Arthur Renwick, executive commissioner for New South Wales, furnished numerous copies of a catalogue of Australian mammals and of a work on edible crustaceans and fishes, which were intended partly for the library of the Commission and partly for distribution from its office.

Acknowledgments are due to Capt. William T. Lee, of Gloucester, Mass., and Capt. William M. Ellis, for specimens of rare and curious fishes obtained by them on La Have Bank.

Also to F. F. Dimick, Boston, Mass., for a curious flounder, and to Capt. Alfred Bradford, of Gloucester, for a collection of flounders taken with the beam trawl.

Miss E. E. Davidson, Jamaica Plains, Mass., lent two cases of stuffed European fishes prepared in accordance with the process of her father, Dr. Davidson.

E. A. Holmes, Eastport, Me., sent a living albino lobster.

COURTESIES RENDERED BY THE FISH COMMISSION.

On October 31, 1893, after the close of the Exposition, all of the aquarium fishes and other animals and plants not otherwise assigned by the Commissioner, such as brood fishes to be returned to the stations from which they were shipped and a small part of the marine species for the aquarium at the office in Washington, were transferred to Prof. S. A. Forbes for the State Laboratory of Natural History at Champaign, Ill. It was the intention to give this material to the South Park commissioners, of Chicago, but after operating the establishment for a few days these commissioners found themselves unable to maintain it and it was turned over to Professor Forbes for the State of Illinois.

On February 21, 1894, permission was given to James R. Barrie, of New York City, to have two photographic prints made from each negative belonging to the U. S. Fish Commission exhibit, Mr. Barrie desiring to use these prints in the illustration of a sumptuous work on the World's Fair.

Mr. J. H. Crockwell, agent of Halligan's Illustrated World's Magazine, was given permission to make photographs of the Fish Commission exhibit for reproduction in his magazine.

FINANCIAL STATEMENT.

The total allotment to the United States Fish Commission of the funds appropriated by Congress for the preparation, maintenance, and return of the Government exhibit, after deducting 5 per cent for common expenses of the board of management, was $89,205. This sum was increased by resolution of the board in May, 1893, by granting permission to use a further sum of $4,000, or so much thereof as might be necessary, for carrying out the plan of the Fish Commission exhibit as formulated by the Commission and approved by the board of management. Of that sum, however, only $584.60 was required. The total expenses of the exhibit to September 30, 1894, amounted to $89,789.60.

The various items for which the above expenditure was incurred are as follows:

1. Salaries	$41,215.35
2. Travel	3,327.80
3. Subsistence	6,631.16
4. Office equipment	5,081.62
5. Transportation and freight	3,998.37
6. Scientific inquiry	376.40
7. Fish-culture	1,612.04
8. Fishery exhibit	9,956.46
9. Installation and maintenance	2,537.62
10. Exhibition furniture	8,012.10
11. General equipment	331.23
12. Labels	654.10
13. Packing and repacking	1,838.13
14. Aquarium, equipment	1,877.55
15. Aquarium, temporary labor	595.88
16. Aquarium, collection and food for fishes	1,713.79
Total	89,789.60

Salaries, $41,215.35, may be subdivided as follows:

1. Administration and office force	$15, 951. 79
2. Installation, maintenance, and return	7, 054. 06
3. Fish-cultural section	5, 130. 25
4. Fisheries section	5, 890. 41
5. Aquarium	7, 188. 84
Total	41, 215. 35

The amount expended for subsistence may be classified as follows:

1. Preparatory work	$358. 45
2. Installation and maintenance	3, 400. 97
3. Aquarium	2, 871. 74
Total	6, 631. 16

RETURN AND DISPOSITION OF THE EXHIBITS.

The extensive collection of fishery objects presented to the U. S. Fish Commission by the Imperial Japanese Commission at the close of the Exposition was deposited in the U. S. National Museum.

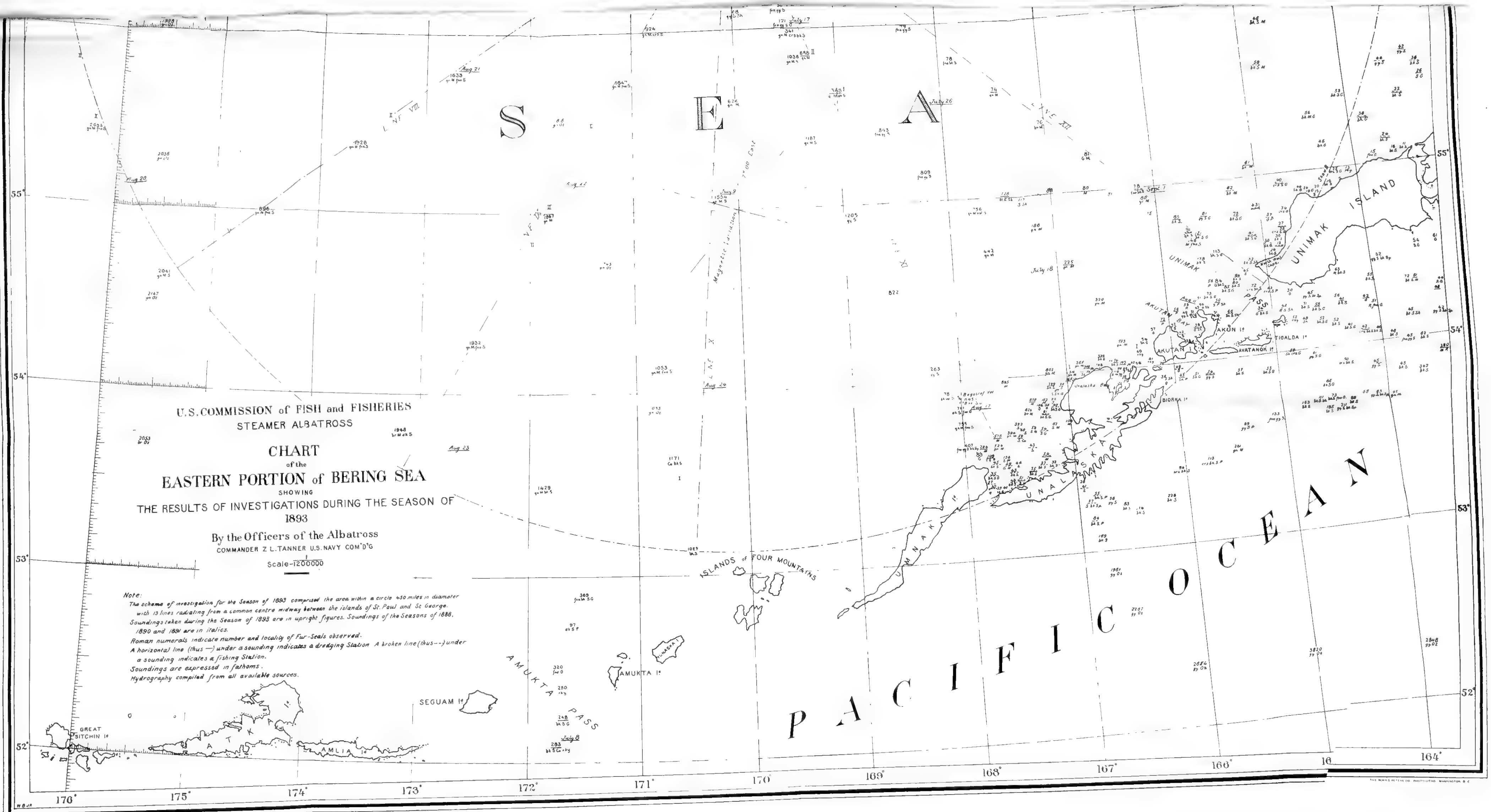
The large case made for the boat and vessel models of the exhibit was also turned over to the Museum and adapted for use in the section of naval architecture.

All the vessel and boat models, canoes, fishing apparatus, clothing, marine animals, fishery products, fishery illustrations, etc., not needed by the Commission were deposited upon their return to Washington in the fisheries section of the National Museum. Articles and materials belonging to the exhibit such as could be utilized in the work of the Commission were transferred to its central office after their return to Washington, in accordance with the instructions of the Treasury Department.

Respectfully submitted.

TARLETON H. BEAN,
Representative.


ST MATTHEW Id
NUNIVAK Id
NELSON Id
COOK STRAIT
KUSKOKWIM BAY
BERING



Copied from a chart drawn by
Harry Clifford Fassett Capts Clerk

2.—REPORT UPON THE OPERATIONS OF THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS FOR THE YEAR ENDING JUNE 30, 1894.

OPERATIONS FROM JULY 1, 1893, TO MAY 1, 1894.

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

The *Albatross* was in latitude 51° 39′ N., longitude 172° 22′ W., at midnight June 30, 1893, en route from Unalaska to the Bay of Waterfalls, Adak Island, Aleutian Chain, where she arrived at 7.30 p. m. July 1.

We visited the bay under orders of the senior officer, commanding the United States naval force in Bering Sea, to ascertain if it was being used as a rendezvous by the sealing fleet. Its location on the Pacific side of the island, remote from the usual cruising grounds of the patrol fleet, its accessibility, ample supply of pure, fresh water from mountain streams, and driftwood conveniently strewn along the beaches made it the most desirable port for that purpose west of Sand Point (Humboldt Harbor), in the Shumagin group. There were no vessels in the bay at the time of our arrival, but recent beach fires, trampled grass, etc., plainly indicated the presence of visitors at no distant date. We subsequently boarded three schooners off the coast, all bound into the bay for water, and as they were among the last of the western-bound fleet it is highly probable that the harbor was visited by sealers earlier in the season.

The Bay of Waterfalls takes its name from a number of mountain streams which fall into it from the surrounding heights. It is 4 miles wide at the entrance, and penetrates the island in a northerly direction about 8 miles. Chapel Cove lies on the east side, 2 miles from the entrance. It was examined by the officers of this vessel, and found to afford fairly good anchorage for vessels of all classes in the outer bay in about 20 fathoms, while the inner cove furnishes almost perfect protection to small craft, such as hunters and sealers. Water could be procured early in the season, but the streams were dry at the time of our visit.

Cataract Bight was examined also. It lies on the east side of the bay, about 4 miles from the entrance, and affords good anchorage—the best in the Bay of Waterfalls—in from 15 to 20 fathoms. There is quite a large stream falling into the head of the bight, affording the most convenient watering-place in the vicinity. Anchorage may be found at the head of the bay, and water procured from any of the numerous streams. The beaches were lined with driftwood.

We remained at anchor until the morning of July 5, under bright, clear skies and pleasant weather during the daytime, but the nights were misty, and an impenetrable wall of fog surrounded the island without a break, totally obscuring everything seaward.

Adak Island, like most of the Aleutian Chain, is mountainous and wholly devoid of timber; even the stunted growth of alder and willow found on some of the islands is lacking, at least in the region contiguous to the Bay of Waterfalls. The valleys and foothills are covered with a rank growth of grass and wild flowers, which extend high up the mountain sides wherever there is a handful of soil, mosses occurring on the barren heights.

The naturalists examined the region with the assistance of volunteers from the officers and crew, trawl-lines were set without result, and the seine was used wherever suitable beaches could be found, but the waters of the bay were nearly barren of fish, except in the immediate vicinity of fresh-water streams, where trout were plentiful and taken in large numbers. A few cod, chicken halibut, flounders, and a single Atka mackerel were caught by persistent fishing with hook and line from the ship's rail, and large numbers of fine trout were taken from the streams and lakes by fly fishermen. Land birds were extremely scarce, particularly ptarmigan, which are so plentiful on some of the other islands. The only apparent cause is lack of food in winter when the ground is covered with snow, for here the fresh buds of alder and willow which supply their wants in more favored localities are entirely lacking. The scarcity can hardly be attributed to foxes, for there were few, if any, on that part of the island visited by the collectors.

Remnants of a copper-fastened boat were found on the shore of a large lake lying about 2 miles northeast of the bay.

The fog broke at intervals on the morning of July 5, and at 8.40 a. m. we got under way and patrolled off the heads, boarding two sealers, taking several soundings, and finally anchoring in Chapel Cove for the night. A haul of the seine brought in a number of trout and young cod.

We were under way again at 2.30 a. m., on the 6th, and availed ourselves of the opportunity to further develop the great submarine trough lying south of the Aleutian Chain. Commencing a line of soundings near the entrance of the Bay of Waterfalls, it was carried in a southeasterly direction to 50° 03′ N., 174° 30′ W., in 2,802 fathoms, the maximum depth of 4,002 fathoms having been found in latitude 50° 28′ N., longitude 175° 10′ W. From the former position the line was extended in a northeasterly direction, recrossing the depression in 3,794 fathoms.

Two hauls of the beam-trawl were made in Amukta Pass on the 8th in 283 and 248 fathoms, respectively, the former proving quite rich in branching coral, sponges, hydroids, etc., while the latter was almost barren of life, the net being loaded with volcanic sand and gravel, very light and apparently subject to frequent shifting from the effect of currents.

Soundings were continued to the island of St. George, which we passed at 10 p. m. July 9, during a southerly gale with rain, fog, and short, chopping swell, peculiar to Bering Sea. Low speed during the remainder of the night brought us to St. Paul at 6.38 on the morning of the 10th. A landing was effected a few hours later at East Anchorage, and Mr. C. H. Townsend went to confer with the chief Treasury agent, Mr. J. B. Crowley, regarding a photographic survey of the seal rookeries on St. Paul and St. George.

While at the Bay of Waterfalls Mr. Townsend suggested planting a quantity of trout in the lakes of St. Paul Island, which heretofore have been entirely without edible fish, and, with this object in view, a number of fine adult specimens were taken and transported to the islands, where 20 were deposited in good condition in two of the most promising lakes.

Having secured the cooperation of the chief Treasury agent and procured from him necessary instructions to his subordinates on St. George, we steamed over to the latter island and landed Messrs. C. H. Townsend and N. B. Miller with apparatus for the prosecution of their photographic work and the platting of the outlines of the fur-seal rookeries in accordance with the plan previously inaugurated by Mr. J. Stanley-Brown.

While at St. Paul Island Mr. Adams, Treasury agent, visited the ship and reported that a schooner had been seen off Northeast Point on the 4th, sealing, and a brig had five boats out for seals on the 7th. As none of the patrol fleet was at the islands at the time, we proceeded to the locality mentioned, and, early on the morning of the 12th, boarded two whaling barks which were on a favorite cruising-ground, north and east of St. Paul; one of them reported a whaling schooner cruising in the vicinity, but we did not meet her. The east and north shores were examined during the morning, but we saw no vessels.

It was arranged before leaving St. George that we should return on the 15th to transfer Messrs. Townsend and Miller to St. Paul, hence our operations in the meantime were prosecuted with this end in view.

A line of soundings commencing north of St. Paul on the parallel of 57° 18′ N. was carried due west to the meridian of 173° 53′ W., in 150 fathoms. Beam-trawl and hand-lines were used frequently, special care having been given to serial temperature observations. Depths varied but little from 60 fathoms, with bottom of green mud, until, in 172° 43′ W., specimens of branching coral were brought up, and in 173° 18′ W., rocky bottom was first struck and carried to the next station, about 5 miles. The 100-fathom curve was then followed in a southerly and easterly direction, with frequent sounding, dredging, and temperature stations to the parallel of 56° 30′ N., thence due east to the vicinity of St. George, where we arrived at 8.40 a. m. July 14.

The results of fishing trials will be found in the report of the fishery expert; the contents of trawl, intermediate tow net, soundings, temperatures, etc., are tabulated for the sake of brevity, and will be referred to only incidentally in this report. Strict attention was given to the study of the pelagic life and aquatic habits of the fur seal in so far as it could be done without serious interference with the work of deep-sea exploration. The numbers of seals seen, with dates, localities, etc., have been tabulated, and are shown in roman numerals on the appended chart. Fishing stations are indicated by a broken line (......) and dredging stations by a horizontal line (———) drawn under soundings on the same chart.

Messrs. Townsend and Miller came on board at 11.30 a. m. on the 15th, having completed the primary photographic survey of the rookeries, and we were under way fifteen minutes later for St. Paul, arriving at 5.10 p. m. The flagship *Mohican* anchored near us two hours later. Arrangements having been completed, Messrs. Townsend and Miller were landed at 3.30 p. m. July 16, with photographic apparatus and other equipment, for the prosecution of their work on the rookeries.

Treasury Agent J. B. Crowley, having requested transportation to St. George, we left our anchorage at 4.30 p. m. and landed him at his destination five hours later. At daylight next morning we examined the north and west shores of the island, in compliance with verbal instructions of the senior officer; then started a line of investigations in a southerly and easterly direction, intending to extend it to Cape Makushin, but a gale sprung up during the night, forcing us to discontinue it and make the best of our way to Unalaska, where we arrived at 5.50 p. m. July 18. Several of the Arctic whaling fleet—transports, and other vessels—were found at anchor in the harbor.

Our movements to this time were governed, first by patrol duty, and later in attendance upon Mr. Townsend in his special work on the seal islands; but subsequently we were practically free to prosecute the work of the Fish Commission, and preparations were made accordingly.

Unexpected losses of dredging gear on the preliminary trips forced us to the conclusion that the older portion of the steel-wire rope had reached its limit of usefulness, and as it would be in constant use the remainder of the season we carefully overhauled the whole 3,600 fathoms on the reeling engine, and finally condemned 750 fathoms, replacing it by 1,000 fathoms of new rope. The deep-sea sounding reel having shown signs of distress after the 4,002-fathom sounding made early in the month, the wire was run off and a careful examination made, which showed it to be in good order in every respect, except that the flange of the drum opposite the friction groove was distorted by the great pressure of wire, giving it an irregular, wavy appearance. Fortunately, the metal was not fractured; so, after overhauling the wire, it was replaced, and the reel continued to do good service, although it would not be reliable in heavy work.

The plan for carrying out the explorations contemplated in the instructions of the Commissioner for the season of 1893 may be stated in a general way as follows: Taking into consideration the probable delays incident to the peculiar climatic conditions of Bering Sea, and the time consumed in coaling, it was considered probable that we would have but 30 working days to cover the broad area under investigation, and the scheme finally adopted was based on the amount of work we could do within that limit of time.

The initial point, latitude 56° 51′ 30″ N., longitude 170° W., lies midway between the islands of St. Paul and St. George, and from this point as a center a circle was described 450 miles in diameter, and 13 radii were drawn to the circumference, at angles of about 28°. They were numbered from right to left for convenience of reference, No. 1 ending in latitude 57° 46′ 20″ N., the total length of lines aggregating about 3,700 miles.

We sailed at 5 p. m. July 25, towed the whaling bark *Stamboul* out of the harbor, then steamed direct to St. George with mail for the island, but rough weather prevented a landing, so we ran on to St. Paul and delivered it to the *Mohican*. A quantity of trout, starry flounders, and clams, brought from Unalaska to stock the waters of St. Paul, were landed and properly distributed immediately after our arrival.

Having communicated with Mr. Townsend and ascertained that his work was progressing satisfactorily, we got under way at 10.20 a. m. July 28, and commenced explorations in accordance with the plan before described. Line I was first developed until its intersection with a previous line from Cape Newenham, and was completed on the evening of the 29th, when we started for the eastern extremity of line II. A gale sprang up, however, which caused a dangerous sea and forced us to haul off to the northward and westward until we deepened our water and the swell became more regular. We reached the line on the morning of the 30th, and continued work during the day and following night under great difficulties and no little discomfort from a heavy, vicious sea; it moderated, however, during the morning of the 31st and the work progressed more rapidly. We reached the vicinity of St. Paul about noon. Mr. N. B. Miller returned on board during the afternoon, and took charge of the scientific department, which had been ably conducted by Passed Assistant Surgeon T. A. Berryhill, U. S. Navy, during the absence of the naturalists.

Leaving the anchorage at 3.40 a. m. August 1, we commenced the development of line III, which ran in a northerly direction; made the island of Nunivak at 10 a. m. on the 2d, passing about 15 miles to the westward of it in from 14 to 19 fathoms, and reached the northern extremity of the line, in latitude 60° 28′ N., longitude 168° 08′ W., at 4.33 p. m. Then, turning sharply to the westward, investigations were extended toward the most northern station of radial line IV, which was occupied at 6.40 a. m. August 3. It is 11 miles ENE. (mag.) from Cape Upright, St. Matthew Island, and, the weather being clear at the time, the headland was plainly visible; Pinnacle Rock and Hall Island could be seen also.

Extending the line in the direction of the initial point, excellent progress was made, the weather being exceptionally favorable; made the high land of St. Paul at 4 p. m. August 4, and at 7.44 anchored for the night off the north shore of the island in 9 fathoms. We were under way at 2.45 a. m. next morning, and commenced the development of line V, which was completed on the 6th, in latitude 59° 54′ N., longitude 174° 17′ W. A marked feature of this line was the uniformity in depth of water, 10 fathoms being the maximum variation, while for over 100 miles it did not exceed 2 fathoms.

We reached line VI at 5 a. m. August 7, in 58° 10′ N. and 176° 40′ W., the depth having increased from 71 to 1,744 fathoms in 35 miles. No attempt was made at dredging or trawling in such great depths, from a lack of time, investigations being confined to sounding, temperatures, and seal observations until we were within the 100-fathom curve. An increasing breeze from the northward and westward gave us a leading wind, with which excellent time was made between stations, but a heavy sea interrupted our work to some extent. The line was completed about noon August 8, and we came to an hour later at East Anchorage, St. Paul, to communicate with Mr. Townsend and insure his transportation to St. George at the proper time for a second series of rookery views at that place.

This matter having been satisfactorily arranged, we left the island at 1.15 a. m. August 9, and commenced the development of line XIII, which ran in an easterly direction. Fog prevailed during the morning, but commenced breaking away at 8 a. m., and it finally proved one of the most pleasant days of the season. The line was developed rapidly under favorable conditions of weather, and the last station, which lies in latitude 56° 10′ N., longitude 163° 25′ W., near the northern limits of Slime Bank, was occupied at 9.46 a. m. August 10. The snow-covered peaks of Pavlof and Shishaldin were seen at daylight, and a little later Aghileen Pinnacles and Amak Island came into view, the weather still remaining remarkably clear.

As soon as the line was completed we started for Unalaska for coal, but early in the afternoon the wind increased rapidly from the southwest, and the evidences of approaching bad weather were so apparent that we ran into Shaw Bay and passed a quiet night, although it was blowing a strong gale at midnight, with furious squalls. This bay is easy of approach, has no outlying dangers, water shoals gradually from 20 fathoms, and it affords good protection with winds from southwest to southeast. It was still blowing a fresh gale at 5.20 next morning when we got under way, but by hugging the land we kept in comparatively smooth water until we reached the vicinity of the Northwest Cape of Unimak, when the wind died out and fog set in which lasted with occasional intervals until our arrival at Dutch Harbor at 5.35 p. m.

We commenced coaling at 10 a. m. August 14, and finished at 11.12 a. m. on the 16th. Ten minutes later we cast off from the wharf, hoisted boats, and proceeded to sea, anxious, if possible, to make up for a part at least of our unexpected detention in port. It was our intention to resume work at the southern extremity of radial line XI, near Chernofski; and, starting out with light winds and pleasant weather, we anticipated a speedy and interesting trip while skirting the northern shores of Unalaska; but off Cape Cheerful a dense fog rolled down from the heights of Makushin and shut out everything a ship's length from us; a breeze sprang up a few minutes later, light at first and variable in direction, but increasing rapidly, until within a short time we were driving into the teeth of a southwest gale—a typical illustration of the rapid atmospheric changes experienced in Bering Sea. The conditions were so unfavorable for the prosecution of our work that we ran into Chernofski for the night, anchoring at 8.30.

Chernofski Bay is the most secure harbor near the western extremity of Unalaska, if not in the whole of Bering Sea. The inner basin is perfectly landlocked, and being surrounded by low land or moderate elevations it is not subject to the much-dreaded "woollies," as the furious mountain-bred squalls of northern regions are called. The *Albatross* visited the harbor in August, 1890, and by careful observations with artificial horizon determined the position of the southwest point of the entrance to the inner basin to be in latitude 53° 23′ 06.5″ N., longitude 167° 30′ 33.8″ W., the Greek church in the village bearing N. 5° 30′ W., true, 0.64 mile. The longitude depends upon that of the point opposite the wharf in Iliuliuk Harbor, being in 166° 31′ 44.2″ W., as shown on Coast Survey chart No. 821. Information concerning the observations above mentioned will be found in my report for the fiscal year ending June 30, 1891.

The wind subsided during the night, and at 6.30 the following morning we left the harbor and commenced work on line XI, making corrections in the coast line of the northeastern extremity of Umnak Island in passing. A line of soundings was run from the latter point to Bogoslof over the line where a reef was shown on the older charts, and which looked so formidable that for many years vessels avoided the passage. Seven hundred fathoms was the least water found, and we saw no indications of foul ground, yet a subsequent experience while passing the volcano in a gale readily accounted for the natural belief in its existence. We were running before a heavy, regular sea until abreast of Bogoslof, when suddenly it lost all semblance of regularity as far as the eye could reach in the direction of Umnak, high combers running apparently in every direction in a remarkable manner, giving the impression of breakers, and had we not recently sounded over the region we also would have looked with suspicion upon it and perpetuated its bad name. The phenomenon was doubtless caused by a strong current setting against the wind.

Bogoslof Volcano was in active eruption, as usual. We made a partial examination of it in 1890, which was verified and extended during our late visit. The latitude of the cone of Old Bogoslof was, by good observations, sea horizon, found to be 53° 54′ N.

Having developed line XI to the vicinity of St. George, we called at that island in the afternoon of the 18th to communicate with Mr. Townsend, and upon his reporting the completion of the special work to which he had been assigned on the islands, he was taken on board and resumed his duties in charge of the scientific department.

We were detained about an hour at St. George, then took up the development of line VII, and carried it to its western extremity in latitude 56° 21′ N., longitude 176° 45′ W., where the depth of water reached 2,049 fathoms. The station was occupied at 2.11 a.m. August 20; then, changing direction to the southward, we reached the terminus of radial VIII at 4.21 the same day, in latitude 54° 38′ N., longitude 175° 25′ W., with a depth of 2,041 fathoms. We followed line VIII to the 100-fathom curve, then took up radial IX, and developed it to latitude 53° 48′ N., longitude 173° 11′ W., in 1,948 fathoms.

Indications of bad weather were unmistakable on the morning of the 22d; a brisk breeze from the southward and eastward sprung up during the afternoon, and at midnight it was blowing a fresh gale from E. by S., with rapidly falling barometer. At 11.50 p. m. stopped the engines, set fore storm staysail, and hove to with wind on port quarter. The gale having moderated to a strong breeze, we started ahead at 7.30 a. m. August 23, and reached the outer extreme of line X at 10.25 p. m., in 1,027 fathoms, latitude 53° 09′ N., longitude 170° 31′ W. The wind backed to the northward during the day, and at 10 p. m. was blowing a moderate gale from northwest, with rough cross sea, yet work was continued under low speed and at the expense of great wear and tear until 6.30 p. m. August 24, when the line was practically completed.

Radial line XII and a considerable area about the Pribilofs still remained unexplored, and we were anxious to finish it before going into port, but the gale was still blowing, with no immediate prospect of improvement, and as our fuel was nearly exhausted we concluded to return to Unalaska and procure a fresh supply. We passed Bogoslof at 5.45 a. m. and anchored in Dutch Harbor at 11 a. m. The flagship *Mohican*, *Ranger*, *Rush*, and H. B. M. S. *Champion* were found in port.

At the request of Captain Ludlow I called on the chief engineer of this vessel, A. M. Hunt, passed assistant engineer, U. S. N., for a report on the comparative merits of the best varieties of steaming coal used during the season, and received the following reply:

On May 31 we coaled ship at Union Bay with coal fresh from the Comox mines. It was washed coal, very clean, and free from slack, and probably of the finest quality that the mines furnish. It proved very satisfactory in every respect. It is a little slower in igniting than the Wellington or Nanaimo coals, and gives a good body of clear fire, with very light smoke as compared with other coast coals. Such clinker as forms breaks away from the bars readily, and does not form so close a blanket as to deaden the fires by preventing the passage of air through them. The soot formed does not adhere to the tubes, is granular rather than flaky, and is easily blown out with the steam tube sweeper. There was no difficulty in burning as many pounds of it per square foot of grate surface as of any other coal we have used.

The only coals with which I am able to make a comparison are the Welch Brymbo coal we received at the Mare Island Navy-Yard in May, 1893, and Wellington coal received from the North American Commercial Company at Dutch Harbor during July and August, 1893. The Brymbo coal was taken from a pile that had been exposed for about a year, but was in fairly good condition. The Wellington coal was fresh from the mines and of good quality. The figures are from data taken from the steam log of this vessel and can not be considered as more than approximate, owing to the difficulty of getting runs with the different coals under the same conditions.

	Percentage of ash.
Comox	$13\frac{1}{2}$
Brymbo	$10\frac{1}{2}$
Wellington	15

The distance that can be steamed at economical speed by this vessel with equal amounts of coal is as follows: With Comox, about 6 per cent more than with Wellington and 3 per cent less than with Brymbo. From my experience with the Comox coal I do not hesitate to pronounce it superior for our purposes to any coast coal on the market.

Getting under way at 4.55 a. m. August 31, we examined the area embraced between Akutan and Akun islands, commonly called Akutan Bay, and looked into Akutan Harbor and other coves to ascertain whether any of the small sealers had taken refuge there. The beam trawl and hand-lines were used at several stations to determine the character of bottom and its fauna, thinking we might possibly find codfish or halibut. On the contrary, the bottom was composed largely of glacial mud and almost barren of life.

Arriving off the north head of Akun at 1.50 p. m., a vessel was reported from the masthead, standing to the southward through Unimak Pass. Gave chase, and at 3.50 boarded the American schooner *Lettitia*, from Sulima River for San Francisco with a cargo of salt salmon. As soon as the boarding officer returned, we steamed to the southward and westward, and at 6.30 p. m. anchored in Akun Cove for the night.

Getting under way at 4.15 the following morning, September 1, we took up radial line XII, the last of the series, in latitude 54° 36′ N., longitude 165° 27′ W., depth 113 fathoms, and developed it to the initial point. A northeasterly wind sprang up soon after we reached the line, and increased in force during the day until it became exceedingly difficult to carry on the work; yet we persevered until the evening of the 2d, and succeeded in covering a large portion of the unexplored ground in the region of the Pribilofs.

When in the vicinity of Otter Island a heavy break was seen over a reef which extends at least half a mile off its western extremity, as shown on canceled Coast Survey chart No. 886, but not charted on later issues. The charts of the Pribilof Islands have "breakers" marked about 2 miles N. by E. (magnetic) from Otter Island, directly between it and St. Paul, and while the existence of concealed dangers in the assigned position has been generally doubted, the spot has been given a wide berth in clear weather, and has proved the source of much anxiety to navigators during the almost constant summer fogs. The absence of breakers with the heavy swell then rolling in seemed to confirm their nonexistence, but to settle the question beyond doubt we steamed to the spot and sounded in 26 fathoms, sand and stones, then dragged the beam-trawl nearly half a mile in the direction of St. Paul without changing the character of bottom or shoaling the water. Strong currents and tide rips are not infrequent near the islands, and under favoring conditions overfalls might occur bearing the general appearance of breakers.

An anchorage was found for the night in Village Cove, St. Paul Island.

A moderate to strong northeast wind was blowing on the morning of September 3, the weather overcast with drizzling rain and heavy sea, conditions most unfavorable for our work. As there was no immediate prospect of improvement, and we could not afford delay, we got under way at 5.20 a. m., and occupied the last few stations required to complete our scheme of exploration; then, at 3.15 p. m., started for Unalaska. The run was made under steam and sail with fresh, following wind, and at 12.55 p. m. September 4 we arrived at Dutch Harbor.

Our season's work in Bering Sea was completed under difficulties and at considerable expense of wear and tear. Our instructions contemplated a line of soundings and observation of seal life between the Pribilofs and the Commander Islands, providing it was found practicable, after the completion of the more important work in southeastern Bering Sea; and we looked forward to it as a satisfactory winding up of the season's exploration until the rapid succession of September gales put a stop to further operations.

Voluminous reports relative to patrol duty were made periodically to the senior officer commanding United States naval force in Bering Sea, and incidents connected with that service have been mentioned only where they have a bearing on the narrative of exploration.

The general results in the several branches under investigation during the season may be summarized as follows:

Seal life.—The observation of seal life was conducted with the greatest care, but was subordinate to other duties in so far that we did not deviate from our course or delay operations for that special purpose. The small numbers observed may seem strange in view of the fact that many thousands were constantly afloat; yet it is not really so, for they have become wary since they have been hunted so persistently by pelagic sealers. I have been told by sealers that it was the exception when large numbers were seen from the deck, and that some of the best catches are made on days when there are none sighted from the vessel. It is a common saying that you will not see a moving seal if he sees you first, and this is largely true, although occasionally curiosity induces them to approach a vessel, especially if she is lying to. A larger number will be seen from a sailing vessel than from a steamer moving through the water at the same speed, the vibrations of the propeller being distinguished at a greater distance than the wash of the water about the hull of the former.

To find seals it is necessary to hunt them as other game is hunted, and as we were constantly moving in the prosecution of other work, it is safe to assume that we passed in the immediate vicinity of large numbers which were not seen, and that where we saw one there were others near by.

Very few were seen within 10 miles of the Pribilofs, except close to land in the vicinity of the rookeries and on the direct route between the islands. Even there an average of only four were observed each trip, yet many thousands are constantly traversing the region day and night through the entire season; in fact, the waters surrounding the islands are, of all areas in Bering Sea, the most frequently traveled by the feeding portion of the herd.

Seals were seen in varying numbers on 11 of the 13 radii, exclusive of those encountered near the rookeries.

On line I, 200 miles NE. by E. (mag.) of St. Paul Island.
On line III, 40 to 70 miles N. by E. (mag.) of St. Paul Island.
On line IV, 25 miles N. by W. (mag.) of St. Paul Island.
On line V, 40 to 200 miles NW. by W. (mag.) of St. Paul Island.
On line VI, 50 to 110 miles west (mag.) of St. Paul Island.
On line VII, 120 miles WSW. (mag.) of St. George Island.
On line VIII, 140 to 200 miles SW. (mag.) of St. George Island.
On line IX, 85 to 130 miles SSW. (mag.) of St. George Island.
On line X, 25 to 180 miles S. ½ E. (mag.) of St. George Island.
On line XI, 40 to 60 miles SE. by S. (mag.) of St. George Island.
On line XIII, 12 miles north (mag.) of St. George Island.

The 100-fathom curve from the 170th to the 174th meridian is a favorite feeding-ground, where scattered seals were frequently observed from the decks of the vessel, a sure indication that it would have been a prolific hunting-ground had we hove to and sent out boats. Next to this region, the largest numbers were observed near the northern extremity of radial No. V, and it soon became evident that the August feeding-grounds were to the westward of the meridian of the Pribilof Islands. Earlier in the season they would doubtless have been found in greater numbers east of that meridian, where their food, composed largely of codfish, would still abound in the shoaler waters of eastern Bering Sea.

Soundings.—Depths inside of the 100-fathom curve were found to be remarkably regular, shoaling gradually where land was approached. Off the Kuskokwim, and thence to Nunivak, shoal water extends farther from land than in any portion of Bering Sea, while off the Aleutian Archipelago deep water frequently approaches very near to the coast line.

Depths of 2,000 fathoms or more are found in central Bering Sea, the eastern part having less than 100 fathoms. The western section is still unexplored. The 100-fathom curve lies on the summit of a steep, irregular bank, extending from the vicinity of the Northwest Cape of Unimak in a WNW. (mag.) direction to the meridian of St. George, approaching within 18 miles of the island; thence, about W. by S. (mag.), for 140 miles to the meridian of 173° 25′ W., where it turns abruptly to NW. by N. (mag.) for 140 miles, then WSW. (mag.) along the southeasterly coast of Kamchatka, where an immense area over 200 miles in width at its eastern extremity remains unexplored.

Character of bottom.—Black sand and gravel occur on Baird and Slime banks, in Bristol Bay; also in Unimak Pass and off the north shore of Unalaska Island. Spots of black and gray sand occur north of the Pribilofs, but a large proportion of the vast area within the 100-fathom curve is dominated by green mud, having usually a proportion of fine sand, although this is not invariably the case.

In the deeper waters, even to depths exceeding 2,000 fathoms, green mud occupies a prominent place, with a small percentage of fine, gray sand, which during the season of 1890 we mistook for foraminifera. Clay occurred once only in Bering Sea, in latitude 55° 38′ N., longitude 170° 39′ W., at 1,171 fathoms. Rocky bottom was found occasionally near the 100-fathom line west of the Pribilofs.

Water Temperatures.—The surface temperature of the Pacific Ocean, south of the Aleutian Islands, during July and August, was from 48° to 50° F., while in Unimak and Amukta passes it was but 40°. Marked variations of temperatures have been noted in Bering Sea and commented upon by navigators, some of whom have ascribed the phenomenon to mysterious agencies. It can readily be accounted for, however, from natural causes. Inside of the 100-fathom line the surface temperatures were from 44° to 46°, while at the bottom they ranged from 35° to 40°, and between Nunivak and St. Matthew were as low as 31°. The temperatures at the surface fell with shoaling water, approximating to that of the bottom as the depths decreased, until in some instances both were the same. A fall of 3° to 4° was noted in approaching the Pribilof Islands.

Outside of the 100-fathom curve, and particularly between the seal islands and Amukta Pass, the surface temperature was about 47°, or 4° higher than inside of the curve and 3° lower than the Pacific outside of the pass. This condition is owing to natural causes also, as the weight of current is from the warmer waters of the Pacific through the archipelago into the colder region of Bering Sea.

The mean surface temperature in the harbor of Unalaska during July, August, and the first week of September was 50°.

Serial temperatures observed showed frequent mingling of warmer and colder waters.

Currents.—Regular tides were found inside of the 100-fathom curve, the flood strongest and setting to the northward, the ebb running in the opposite direction. They were greatly affected by winds and the proximity of land, and around the Pribilof group they were particularly strong and erratic. Outside of the 100-fathom curve there was a general northerly set, light, however, and greatly affected by prevailing winds.

Intermediate tow-net.—This apparatus was used frequently with good results between 25 and 250 fathoms.

Codfish.—The only known cod fishing-grounds of commercial value in Bering Sea are Baird and Slime banks, in Bristol Bay. They are taken in other places, such as the Hospital Bank, an unimportant locality on the Kulukak ground, where fishing vessels from Baird Bank sometimes seek shelter during northerly and northeasterly storms; also along the shores of the Aleutian Islands, where a sufficient quantity are secured for local consumption. Banks have been reported in various parts of Bering Sea, but we have no data at present that would justify a fisherman in visiting them as a commercial venture.

A vessel can anchor anywhere inside of the 100-fathom line and by persistent fishing take enough to "fill the decks," to use a common expression, where a mess for all hands has been caught. The same may be done in calm, smooth weather, when the ship is lying dead in the water, yet the locality might be worthless commercially; and, in fact, such is the case over the greater portion of Bering Sea.

The search for cod in paying quantities would be confined to spots where the bottom is free from mud, and a glance at the chart will show the prescribed areas where success would be probable.

First, a stretch of 60 miles or more will be observed ESE. (mag.) of St. George Island, in from 70 to 80 fathoms, coarse sand and gravel, and fine dark sand near the 100-fathom curve. Another spot having favorable indications lies about 50 miles NE. by N. (mag.) from the island, in 40 fathoms, gray sand and rocky, and fine gray sand. A region of considerable area, having promising features, lies from 180 to 200 miles NE. (mag.) of St. Paul Island in from 20 to 30 fathoms, fine gray sand and shells. A spot about 42 miles N. by W. ½ W. (mag.) from northeast point of St. Paul Island has been reported as a bank, and has favorable indications, in about 40 fathoms, sand and gravel. There are other places between the above spot and Nunivak where a certain degree of success might be expected, although our examination did not develop a particularly rich fauna.

There is also a region near the 100-fathom curve, in from 70 to 90 fathoms, fine gray sand and rocky bottom, lying from W. by S. to SW. by W. (mag) of St. Paul Island, which promises well, although the depth is greater than fishermen are in the habit of resorting to in this region.

The report of the fishery expert, Mr. A. B. Alexander, gives the experience of this vessel in fishing with hand-lines from the rail, but in considering the results it must be remembered that the vessel was always under way, frequently drifting rapidly before boisterous winds and heavy seas. The duration of trials never exceeded twenty minutes, and other work was frequently carried on when line fishing was impracticable; hence some of the most favorable localities escaped a fair trial with hook and line.

It is reasonable to suppose that the presence of cod varies with the seasons in the shoal waters of Bering Sea as in other localities, and that they will be found in greater depths as summer approaches.

Halibut.—The *Albatross* has never taken halibut in any considerable quantities in Bering Sea, and none of large size. The conditions under which trial lines have been used are particularly unfavorable for the capture of this slow-biting fish. Trawl lines set on favorable bottom near the 100-fathom line would be an interesting experiment, from which good results might be expected to follow.

Fishing trials.—It may be asked why we did not make more extended fishing experiments at the various stations. There are several reasons, among them the necessity of completing the lines as quickly as practicable in that region of fogs, to prevent the vessel from drifting out of her course, it being desirable to locate the stations as accurately as possible as bases for future exploration. Another and vital reason was the lack of time.

Occupation of a station.—The following details are given as an evidence of the time and labor required for the full occupation of a station:

When the vessel is under sail and steam, as often happens, the former is clewed up, and furled, if necessary, before the station is reached. Having arrived on the desired spot, a sounding is made, say, in 60 fathoms, surface and bottom temperatures being taken; time, 3 minutes. Serial temperatures are then observed in 5, 10, 20, 30, 40, and 50 fathoms; time, 10 minutes. As many fishing lines as the watch on deck can attend are put over for 15 minutes, followed by the beam-trawl with a scope of 150 fathoms on the dredge rope; time, 6 minutes. The trawl is then dragged 15 minutes, and hoisted aboard in 10 minutes, the haul having occupied 31 minutes. The surface tow-net was in operation while the trawl was on the bottom. The intermediate tow-net follows the beam-trawl, and is lowered to 50 fathoms in about 4 minutes, towed 10 minutes, messenger sent down to close the lower net; time, 3 minutes, and it is then hoisted on board in about 3 minutes, the haul having occupied 20 minutes. Thus 1 hour and 19 minutes are required for the full occupation of a station in 60 fathoms, under favorable conditions. A detention of 2 minutes would be about the average if we were simply running a line of soundings in the same depth.

It would require 3 hours at least to set a trawl line in addition to the operations detailed, and satisfactory trials with hand lines can only be made from boats. Further investigations in this direction are desirable, but they should be taken up when the vessel is not required to maintain her position on a line, and can afford to wait for favorable weather, as she will frequently find it necessary to do in Bering Sea.

On September 8, at 6 p. m., we left Dutch Harbor under the following orders from Commander Nicoll Ludlow, United States Navy, commanding the United States naval force in Bering Sea:

> You will proceed to sea as soon as ready, and so far as possible complete your work in and about Bering Sea in connection with your investigations, under the instructions of the United States Commissioner of Fish and Fisheries, and your patrol work which is carried on at the same time. You will return to Dutch Harbor by the 10th of September, fill up with coal, and return to San Francisco via Sitka. Should the weather and other circumstances permit, you will take the route to the north of the Sannak, on your way to the eastward, and keep a sharp lookout en route for the British steamer *Warlock*, the British schooner *Diana*, and the American

schooner *Czarina*. The latter vessel is liable to seizure for receiving cargo from the schooner *C. G. White* at Caton Harbor. The other two vessels are liable to seizure—the *Warlock* if found otter hunting, as it is suspected she is, or loitering in our harbors if not in distress, as she cleared for Petropaulovski August 2 from Sand Point, and the *Diana* (late *Sea Lion*) for escaping after seizure at Sand Point September 28, 1892. The schooner *Emma*, with Hansen, the rookery raider, on board, is probably in or about the Sannak otter hunting. She was enrolled at Juneau and licensed for coasting trade only, and if hunting is being run without proper clearance.

This order is inserted to show that while we were accorded every practicable facility for the prosecution of our special work, it did not relieve us from patrol and other duties required of the vessels composing the Bering Sea fleet.

The navigation of Bering Sea is complicated during the summer season by almost constant fogs. It is difficult at all times in the vicinity of land, from lack of soundings and accurate surveys, and it has been our custom to do what we could for the improvement of charts by taking soundings, correcting coast lines, and giving reliable astronomical positions when it could be done without materially interfering with our legitimate work. Great difficulty has frequently been experienced in making Unalaska in thick weather in the absence of soundings, and we have from time to time run lines from the 100-fathom curve to Unalaska Bay, which were supplemented after our departure from Unalaska by a line from Priest Rock, off Kalekhta Point, to the north head of Akutan, and thence to Akun, the route usually followed by steamers between Unimak Pass and Unalaska. These soundings, with others we have made in the vicinity of the Fox Islands, will, when plotted on a chart of large scale, greatly assist the navigator, inasmuch as it will make the lead available.

We anchored in the south arm of Akun Cove at 1.27 p. m. September 8, for the double purpose of giving the naturalists an opportunity of exploring the region and to make an early start next morning for the inner passage to the eastward. Akun Cove affords convenient and safe anchorage with all winds except from SE. to NE. It has three arms, two of which, the middle and southern, have been surveyed. It has no permanent settlement, but during the fishing season temporary camps are formed by natives who resort to the place for the purpose of taking salmon. The fishing was closed during the season of 1893, however, from natural causes.

At the head of the cove, and separated from it by a narrow shingle beach, lies a beautiful lake of considerable size, which usually finds an outlet to the sea through a small creek; but the storms of the previous winter threw up stones and gravel until the mouth was completely blocked, thus effectually excluding the fish from their usual spawning grounds. Yet thousands of fine red salmon were seen patrolling the shores, vainly searching for an entrance to the lake, and the beach was lined with the carcasses of the many victims to the vital instinct of reproduction. When the tide was low, fresh water from the lake percolated through the obstruction at the mouth of the creek, forming a small rivulet up which spirited dashes were frequently made by the more vigorous males, until, becoming exhausted, they rolled and floundered back into the waters of the bay.

At 1 o'clock next morning, September 9, we left our snug anchorage in a drizzling rain and fog, but it lighted up at intervals, giving us momentary sight of islands and headlands by which the course was checked, and during the forenoon occasional views of the snow-covered heights of Unimak were obtained.

At 5.10 a. m. Seal Cape, or Cape Khituk of the older charts, was abeam about $1\frac{1}{2}$ miles distant, and, the fog having partially lifted, we could see the graceful slopes of Progromnia sweeping down from the lower snow line to the shores. The cape is a vertical rocky cliff 150 feet high, with grassy slopes on either hand, through which flow numerous mountain streams that finally fall into the sea from cascades, or over small shingle beaches; about a mile to the eastward rises a steep hill, 500 feet in height, with its sides extending to the water's edge.

The charts show an island off Seal Cape, but it does not exist. The cape itself seems to be detached when seen from a distance, but a nearer view shows it to be connected with the main island. Promontory Cape has a small off-lying rocky islet, and the error may have occurred from the latter cape being mistaken for the former.

The snow-covered peak of Shishaldin, 9,000 feet in height, is beautifully symmetrical when seen in a northerly direction, and while it was obscured most of the morning, we were able to get a good bearing of the summit, which seemed to verify the position assigned it on the older charts, where it was placed in latitude 54° 45′ N., longitude 163° 59′ W. Two elevations rising above the snow line lie to the eastward of Shishaldin; the first is exceedingly rugged in outline, and has a double peak which is approximately in latitude 54° 45′ 30″ N., longitude 163° 44′ W.; the second peak, having a dome-shaped summit, is in 54° 45′ 30″ N. and 163° 34′ W. The relative positions were determined by cross bearings and a run of 15 miles, based on Cape Lazaref, being in latitude 54° 34′ N. and longitude 163° 34′ W. The elevated region west of Shishaldin was enveloped in clouds and fog.

Cape Lazaref is a bold rocky point, or, rather, three rocky points, all lying within a mile and a half, with small sand beaches intervening, and has a rocky ledge partly above water extending off in a southeast direction about a mile.

Cape Pankof has three rugged rocky points, and a reef partially above water extends about a quarter of a mile E. by S. from the middle one.

Having passed the latter cape, we laid a course for Umga Island, intending to verify its position by the run and bearings, but before reaching it the fog shut down and we saw nothing more until next morning, having anchored for the night to the westward of Deer Island. We were about 2 miles from Umga when it was shut out, and saw distinctly that there was but one island instead of two, as shown on some charts; it was about 150 feet in height. The summit was in line with Cape Pankof at NE. by N. (mag.), as shown on United States Fish Commission charts and on Coast Survey chart No. 8800.

It is to be regretted that we were unable to examine the region more thoroughly, for the various charts show greater discrepancies than in any other locality on the Pacific side of the peninsula.

The fog partially lifted at daylight next morning, and at 5.35 we got under way and steamed to the eastward through the channel between North Cape and Deer Island. The *Rush* being observed at anchor near the head of King Cove, we steamed in and boarded her to ascertain if we could be of assistance; also to get the latest information concerning the vessels supposed to be still out sea-otter hunting. The commanding officer reported all well and that the last otter hunter had left the Sannaks. Having obtained the desired intelligence, we left the commodious and convenient bay without anchoring, and at 8.35 a. m. came to in Bailey Harbor, where the naturalists spent the day in exploring the region with fairly good results.

Bailey Harbor has an inner and an outer bay, divided by a broad shingle spit, extending from the western shore nearly two-thirds across. The only directions required to enter the outer harbor are to favor the eastern shore in order to give the flats on the opposite side a wide berth, as they cover at high water. The inner bay is entirely landlocked, and affords a secure harbor in from 5 to 8 fathoms near its center. To enter, favor the east side as before, and take a mid-channel course through the narrow passage, carrying about 9 fathoms. In the absence of surveys, it would be prudent to anchor off the inner side of the shingle spit. The head of the bay and western shore are lined with huge bowlders.

Leaving Bailey Harbor at 4.42 p. m. the same day (September 10), we anchored at 6.05 off Belkofsky, a village having a population of 160, and, next to Unalaska, the largest native settlement west of Kadiak. Its principal industry is sea-otter hunting. We called to learn from Captain Lenard himself the particulars concerning the rock bearing his name, which is shown on the charts to the southward of the Sannaks, in about latitude 54° N. We did not meet him, however, as he had removed to another locality.

Belkofsky Bay is open from SW. to SE., and is not safe with strong winds between those points. The best anchorage for a stranger is in 10 fathoms, with the church bearing WNW. (mag.). It is claimed by some that better holding-ground may be found farther to the eastward, which may be true. The western part of the bay is strewn with bowlders, which endanger a vessel's ground tackle and should be avoided.

A reef, partially bare at low water, extends from the Inner Iliasik to the mainland, and rising from it, about 60 yards from the latter shore, is a pinnacle rock, which is conspicuous. The only break in the reef occurs just outside of this rock, where there is a narrow channel having 2 fathoms at high water. It is used only by the smallest class of vessels.

We were detained by fog until 7 o'clock on the morning of the 11th, when a strong southeasterly wind drove it away sufficiently to allow us to proceed. Passing between Inner and Outer Iliasik islands, we favored the latter to avoid a reef that makes out about 100 yards from the former, then took a mid-channel course between Goloi and the mainland. The north end of Goloi Island and Moss Cape terminate in low shingle points, and the northern extremity of Dolgoi in a series of wedge-shaped bluffs, having their vertical thick ends outward.

Seal Cape, which forms the east side of Coal Bay, terminates in a flat-topped mound about 100 feet high, with low land between it and the mainland. A conical rock opened out from the cape at about WSW. (mag.), and this was the only rock we observed disconnected from the shore line.

The shores of Beaver Bay were partially obscured by mist, but high land was observed to extend from the eastern extremity of Seal Cape to the vicinity of the entrance to Otter Bay, and thence to within 4 or 5 miles of Cape Aliaksin.

There were no apparent outlying dangers in Unga Strait, and the chart was found to be unusually accurate, cross bearings of principal points plotting within reasonable limits.

At 3 p. m. we anchored in a cove on the west side of Portage Bay, which we have called "Albatross Anchorage." The naturalists and parties of volunteer collectors went out immediately after our arrival, and continued their explorations until the moment of departure.

Albatross Anchorage is a small cove lying on the west side of Portage Bay, near its head, between Three Finger Point and Peninsula Bluff. We anchored between the above points, where we were protected from the swell caused by a heavy southerly wind, and riding to a long scope of chain we found ample swinging room with 3½ fathoms at low water. Small vessels may go farther in and secure better protection by keeping well over on the southern side to avoid a ledge which uncovers at half tide. Large vessels would anchor in the open bay to the eastward of Three Finger Point or Peninsula Bluff. To enter Portage Bay take a mid-channel course. A spit making out about 300 yards from Reef Point was the only outlying danger observed.

A reconnoissance of Albatross Anchorage and adjacent portion of Portage Bay was made by the officers of this vessel. The position of the north extremity of Three Finger Point, by observations with artificial horizon, was found to be latitude 53° 34′ 40″ N., longitude 160° 38′ 16″ W., H. W. F. & C., 0^h 13^m, approximate; rise and fall, about 8 feet. The names of points correspond with those of our chart of the anchorage.

Getting under way at 1.50 p. m., September 12, we steamed through Gorman Straits, and thence for the south coast of Kadiak.

The existence of Scotland Rock in the position assigned it on the charts has been questioned, and while we can not confirm its existence or location with certainty, we saw a small conical rock about 10 feet in height, a little open of the west tangent of Karpa Island when the latter bore NW. ½ N. (mag.) 11 miles distant.

The Semidi Islands were sighted at daylight on the morning of September 13, and half an hour later Chirikof became visible. The accuracy of the delineation of this island on the charts has been doubted by so many navigators that we took the opportunity to verify it by steaming along its south and east shores and taking angles on prominent points until we satisfied ourselves that it was laid down practically correct. The diverse opinions regarding the platting of this island may be accounted for from the fact that passing vessels lay a course to clear its southern extremity, which is high, and this carries them so far from the long, low northern extension that they do not see it even in clear weather.

The Trinity Islands were sighted at 3 p. m., and at 8 a. m. the following morning, September 14, we took a departure from Ugak Island and steamed offshore to intersect a rhumb line from Cape Greville to Cape Edgecumbe, for the purpose of running a line of soundings between those points, this course having been decided upon after a conference with Captain Ludlow and at his request, which was based upon the following experience of the U. S. S. *Mohican* while en route from Sitka to Kadiak:

At meridian, June 21, 1893, she was in latitude 57° 16′ N., longitude 143° 11′ W., with clear, pleasant weather, and after running 10.4 miles WSW. ½ W. (mag.) was found to be in discolored water, with quantities of seaweed and floating kelp; and although 160 miles from the coast, appearances were so suspicious that they commenced sounding, but found no bottom at 100 fathoms. Similar reports have been made of discolored water, drifting kelp, etc., in various localities of the Gulf of Alaska by sealers, whalers, and others, casting suspicion over the region, which could be removed only by sounding; and as the *Albatross* was the only vessel in the fleet having the necessary appliances, the senior officer considered it advisable for us to make the examination.

The first sounding of the series was made at 5.55 p. m., September 14, in 838 fathoms, rocky bottom, latitude 57° 24′ N., longitude 149° 33′ W., and the maximum depth, 2,741 fathoms, was found in latitude 57° 14′ N., longitude 148° 06′ W., in the great submarine depression lying south of the Aleutian Chain and the Peninsula of Alaska. A depth of 2,099 fathoms was found in 57° 20′ N., 143° 26′ W., where the *Mohican* encountered discolored water. The line developed a great basin with no indications of shoaling water except at the terminals.

In reporting the operations of the *Albatross* it is the intention to confine ourselves generally to a simple statement of facts; yet it may not be out of place in this instance to call attention to similar phenomena in other seas as a possible explanation of the appearance of discolored water in various parts of the Gulf of Alaska.

On the Atlantic and Gulf coasts of the United States patches of discolored water have frequently been encountered many miles at sea off the mouths of the great rivers. Discolored water and soundings of 52, 64, and 66 fathoms were reported between 5° 00′ N. and 5° 12′ N. and longitude 46° 43′ W. off the Amazon River, yet a cast of the lead in 5° 01′ N., 46° 44′ W., developed a depth of 1,876 fathoms. In the China Sea, off the great rivers, patches of discolored water are of frequent occurrence, and I have a vivid recollection of the anxiety their unexpected appearance caused me during my early cruising in those waters.

The Gulf of Alaska receives the drainage of the greatest glacial system in the United States, if not in the world; its waters reach the sea icy cold and ladened with mud, heavier than the warmer waters of the gulf, hence they find their way seaward in the great system of ocean circulation as submarine currents, until by gradual precipitation of glacial mud and increase of temperature the relative specific gravity is reversed and they appear on the surface in patches of discolored water.

Strong westerly winds and rough seas were encountered on the 15th, which interfered somewhat with the work of sounding, but moderate to smooth weather followed until our arrival in Sitka at 1.30 p. m. September 17. Leaving Sitka at 2.30 p. m. September 18, we entered Goletas Channel at 2.30 a. m. on the 21st, after a smooth and uneventful run; reached Seymour Narrows at 5.30 p. m., two hours after high water, and encountered an adverse current of about 9 knots per hour, with the swirls and whirlpools incident to the narrow and intricate pass. Its full strength was not felt until we reached the southern entrance, and being under one boiler and not particularly good fires we were barely able to hold our own for the few minutes required to raise sufficient steam to send us through. We anchored for the night near Oyster Bay, reached Union Bay at 9.30 the following morning, took on board 145 tons of Comox coal, and at 8.35 a. m. September 23 left for Port Townsend, arriving at 12.54 a. m. on the 24th.

We were detained at the latter port until 8.36 a. m. on the 26th, when we left for San Francisco, arriving at 12.15 a. m. September 30, and at Mare Island at 2.15 p. m.

Ensign Houston Eldredge, United States Navy, reported for duty October 17; Ensign E. A. Anderson, United States Navy, was detached on the 19th, and Ensign H. B. Wilson, United States Navy, on the 20th.

Passed Assistant Surgeon E. S. Bogert, jr., United States Navy, was ordered to take charge of the medical department of this vessel, in addition to his duties on board the *Boston*, on October 30, and having been finally detached from that vessel, he reported for duty November 4, relieving Passed Assistant Surgeon T. A. Berryhill, United States Navy, who was detached October 31. Passed Assistant Engineer A. M. Hunt, United States Navy, was detached on the 8th, Passed Assistant Engineer Howard Gage, United States Navy, being ordered to take charge of the engineer's department in addition to his duties on board the U. S. S. *Monterey*, to which vessel he was attached.

We are greatly indebted to Mr. Hunt for intelligent and faithful service during the time he was attached to the *Albatross*. He superintended the installation of new boilers, the general and thorough overhauling of machinery, and designed new propellers, which have given great satisfaction. He took an active interest in the work of the vessel, and was always ready to forward it in every possible way.

W. R. Rush, lieutenant junior grade, reported for duty November 6, and on the same day Mr. A. B. Alexander was ordered to special duty in connection with statistical investigations concerning the acclimated fishes of the Pacific Coast.

I was sent to the United States naval hospital at Mare Island on November 10 for treatment, having been taken with grippe October 17; I finally returned to the vessel December 9.

Ensign Philip Williams, United States Navy, reported for duty November 15, and on the following day Ensign C. F. Hughes, United States Navy, was detached.

Lieut. W. R. Rush, United States Navy, was detached December 15.

Passed Assistant Engineer Howard Gage, United States Navy, reported for duty in charge of the machinery on the 23d, having been detached from the *Monterey*.

The vessel was ready for sea on December 31, and sailed for San Diego January 2, 1894, arriving on the evening of the 4th, after a boisterous trip.

About the 1st of March, 1894, numerous articles appeared in the newspapers concerning an unprecedented destruction of fish life along the southern California coast, and particularly in the vicinity of Santa Monica and Redondo Beach. Thinking the matter worthy of attention, I directed Mr. N. B. Miller to take passage on board the steamship *Santa Rosa* on March 3, prepared to make an exhaustive investigation and preserve a sufficient number of specimens for future examination. He returned on the 6th and submitted the following report:

On the 25th of February an article appeared in the San Francisco *Examiner*, stating that all sorts of rumors were afloat to account for the great numbers of dead fish that had been coming ashore during the previous week, and that the line of fish extended from Santa Barbara to San Diego.

I commenced an investigation by going on board the different vessels as they arrived at this port from either the north or south. The schooner *Jessie D.* arrived on February 28 from Cerros Island. Captain Hardwick reported that between Point San Tomas and San Diego he passed through large numbers of fish swimming near the surface, and apparently going south; the greatest numbers of fish were seen at night, and he was unable to recognize any but barracuda; he thinks, however, there were other fish among them. The schooner *Excelsior* arrived the same day from San Pedro, and reported that no dead fish were to be seen on the surface of the water between that port and San Diego, but great numbers were observed on the beaches at Santa Monica, Redondo, and Newport. Captain Alexander, of the steamer *Santa Rosa*, reported the same facts, and suggested Redondo as the best place to make an investigation. The fishermen of San Diego have found no dead fish either at Point Loma or on the beach in False Bay.

In obedience to your order of March 3, I took passage on the steamer *Santa Rosa* the same day, arriving in Redondo Sunday morning, March 4. I commenced as soon as possible to get at the facts by personal observation, and obtained also the ideas of fishermen as to the cause of the destruction of such great numbers of fish. Some of the fishermen at first thought that giant powder had been used, as there had been heard a number of loud explosions offshore a short time before the dead fish were seen on the surface; others claimed to have seen the water spout up into the air. After an investigation it was found that none of the fishermen were out at the time, as the water was then too rough for fishing with safety.

The first appearance of these fish was on the 24th of February, and for the first two or three days very few were seen, but on the 28th thousands of fish appeared on the surface of the water, both dead and alive; the live ones appeared to be unable to keep below the surface, or were trying to avoid deep water; those that got too near the shore in shallow water were thrown upon the beach. Most of the dead ones were carried out to sea by currents, and were probably eaten by gulls, as not a gull has been seen along the shore since the first fish made their appearance.

I examined the beach for several miles at Redondo, and found barracuda, flatfish, sardines, whitefish, red rockfish, anchovies, sea bass, and yellow-fins; the most numerous of the large fish were barracuda and flatfish. In the distance of half a mile I counted 168 flatfish and 225 barracuda, and in the same distance were a thousand or more sardines and other small species. I secured a number of specimens of sardines, anchovies, and red rockfish alive as they were thrown upon the beach by the surf. At this date, March 4, very few fish of any kind were to be seen on the surface, and no dead ones. I also succeeded in getting some fine specimens of barracuda and flatfish alive.

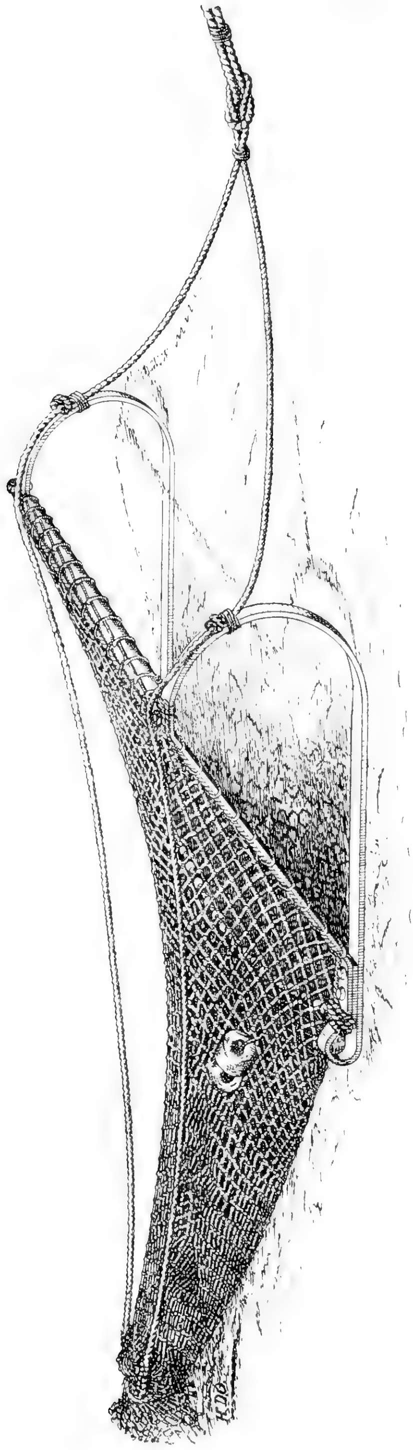
I examined very carefully a large number of fish, both living and dead; in every case the stomach of the fish was empty, and those that were thrown upon the beach dead had their gall bladders ruptured. The gills of the live ones were natural in color, but had patches of yellow slime attached to them which had a strong odor of petroleum. These fish are being used for food on the steamers and at the hotels, and also shipped to Los Angeles for the market, but no bad effects have as yet been reported from eating them.

Of course, such an unusual occurrence caused great excitement among the fishermen. Mr. E. P. Maxey, of Redondo, states that he was born on the coast of southern California and has been a fisherman most of his life, and that nothing of the kind has ever happened before.

It is an established fact that there are oil springs all along the southern California coast, in from 2 to 700 feet of water, and from 1 to 10 miles from shore; and, as new springs have occurred in localities where they have never before been seen, and at the same time that the fish first appeared on the surface, the only explanation probable is that some seismic disturbance has taken place in the ocean not far from the mainland which has caused new springs to burst forth, throwing out an unusual amount of oil and gas, and that one or more of these springs have appeared on the banks or feeding grounds of the fish. The fish in the immediate neighborhood of these springs were probably killed by the explosion; those farther away were doubtless stunned or affected by the escaping oil and gas, which caused them to come to the surface, and from the effects of which it took them several days to recover.

On March 5 I visited Santa Monica, but found very few fish on the beach, and none floating on the surface. On the return trip to San Diego I kept a careful lookout for floating fish, but saw none.

A scientific examination of San Diego Bay was commenced by Mr. Miller on the 23d of February and completed March 25. The beaches were examined with a seine; then the boat dredge and oyster tongs



BOAT BEAM TRAWL.

were brought into requisition, followed finally by a boat beam trawl which was devised for and first used on this work. The results of the investigation will be found in the records submitted by Mr. Miller, copies of which are hereto appended.

The boat beam trawl was found so eminently successful that it seems to be worthy of special notice. It may be described as follows (see Pl. I):

Beam: Iron pipe; length, 3 feet 6 inches; diameter, outside, 1¼ inches.

Runners: Size of iron, 1½ by ¼ inch, flat bar; length, 2 feet 7 inches; height, 1 foot 1 inch.

Net: Length, 7 feet; mesh, 2 inches; jacket, ½-inch mesh; jacket length, 2½ feet.

The bridles, of 9-thread manila, were seized to the front of runner with three turns of seine twine and the ends lashed in with the tail lashing, the intention being that the bridle stops shall part in case of fouling the bottom and allow the net to come up tail first.

We left the harbor of San Diego at 4 p. m., March 27, and reached Mare Island at 10.50 a. m. on the 30th, after a smooth, foggy trip. The *Albatross* was docked from March 31 to April 5. Messrs. C. H. Townsend and A. B. Alexander left for the Puget Sound region by rail on the 8th, to prosecute Fish Commission work in advance of the arrival of the *Albatross.*

On April 11, by direction of the Commissioner of Fish and Fisheries, I reported by telegram to the Secretary of the Navy for assignment to duty in connection with patrol service in Bering Sea during the approaching season, and on the 13th I received instructions from the latter to proceed with the *Albatross*, when ready for service, to Port Townsend, Wash., and there to report to Commander Clark, U. S. N., in command of the Bering Sea squadron. Leaving Mare Island navy-yard on the 14th, Port Townsend was reached on the 19th.

Ensign W. R. Shoemaker, U. S. N., reported for duty on the 29th, and Lieut. Commander F. J. Drake, U. S. N., detailed as my relief, visited the ship.

On April 30, with the permission of the senior officer, got under way at 9 a. m. and steamed out into the Straits of Fuca for the purpose of showing to Lieut. Commander Drake the various apparatus and methods employed in the process of submarine exploration. Returning, we anchored in Port Townsend again at 5 p. m.

At 1 p. m., May 1, I was relieved of the command of the *Albatross* by Lieut. Commander F. J. Drake, U. S. N., who assumed command. I signed the log book, and took receipts from Captain Drake for the vessel's outfit, stores, and equipment, forwarding the latter at once to the Fish Commission. I left the ship at 6 p. m. en route for my home.

OPERATIONS FROM MAY 1 TO JUNE 30, 1894.

By Lieutenant-Commander F. J. DRAKE, U. S. N., Commanding.

On April 19, 1894, while on duty at the navy-yard, Norfolk, Va., I received orders from the Secretary of the Navy to proceed to Port Townsend, Wash., and take command of the United States Fish Commission steamer *Albatross*, relieving Commander Z. L. Tanner, United States Navy.

I reported to the Commissioner of Fish and Fisheries at Washington, D. C., on the 21st of April, left Washington on the 22d for Port Townsend, and arrived on the 28th, when I reported on board the U. S. S. *Mohican* to Commander C. E. Clark, United States Navy, commander in chief of the United States naval force in Bering Sea.

On Tuesday, May 1, at 1 p. m., a thorough inspection of the vessel was made by Commander Tanner and myself, previous to the transfer of command. All hands were then mustered aft. The usual reading of orders being concluded, Commander Z. L. Tanner turned over the ship and her crew to Lieut. Commander F. J. Drake, who assumed command.

The *Albatross* being reported ready for sea, received instructions the same evening, May 1, to hold in readiness to proceed to Unalaska as the pioneer ship of the Bering Sea fleet.

On the 3d I sent on board the *Mohican*, flagship of the Bering Sea squadron, eleven blue prints of the chart of the eastern portion of Bering Sea, showing the work of the *Albatross* in that region. The blue prints were accompanied by a letter of instructions, giving information for additional safety in navigating those waters; this letter was also—and primarily—a request that the commander in chief issue orders to the commanding officers of the several vessels of the squadron relative to observations with regard to fur-seal life which might be made by them while engaged in patrol duty, besides furnishing each vessel with one of the blue prints. It was further requested that all data so collected be turned in to the commander in chief at the end of the season, to be collated on board the *Albatross* as a part of the information sought on that subject for the Fish Commission.

On May 5, with the permission of the commander in chief, got under way at 10.45 a. m. and stood out of Port Townsend to convey Messrs. Townsend and Alexander to Stuart, Waldron, and Lucia islands in order that they might obtain certain information from the fishermen of that region relative to the waters adjacent to the international boundary line.

At Reid Harbor, Stuart Island, but little industry in fishing was found, except for open market. A seining party in charge of Mr. Alexander made a haul at the head of the harbor with fair results. The fishermen say that a very good trade is carried on in salmon during July and August, when they pass up Haro Strait to the westward of San Juan Island.

At Waldron Island Messrs. Townsend and Alexander visited the fishing hamlets on both sides of Sandy Point, on the west end of the island, half a dozen fishermen being interrogated. Two hauls of the seine on the beach at Cowlitz Bay and fishing trials with hand lines resulted but indifferently. Lay at anchor for the night in Cowlitz Bay, Waldron Island, and at daybreak on the 6th steamed over to Lucia Island, arriving at 7.40 a. m. Here some valuable information was obtained and photographs secured of types of fishing vessels and boats. Seining and fishing parties were sent out, and a rich and varied collection was obtained. Returning, we left Lucia Island at 11.20 for Port Townsend, where we arrived at 6 the same afternoon.

On the 10th Messrs. Townsend and Alexander left the ship to continue their work in Puget Sound and among the boundary islands.

May 16 final orders for sailing were received. Next morning at early daylight the entire fleet got under way, the *Yorktown*, *Adams*, *Alert*, and *Corwin* going out by way of the Straits of Fuca to their respective patrol stations. The *Albatross* followed the flagship *Mohican* through Haro Straits, Active Pass, and Strait of Georgia to Tribune Bay (south side of Hornby Island, British Columbia), where we anchored for the night, having made a run of 129 miles from Port Townsend.

At 9 a. m. on the 18th got under way with the *Mohican*, and stood up the Strait of Georgia and through Discovery Passage for Seymour Narrows, which we passed through at 6 p. m. at high-water slack. Continued on up Johnstone Strait to Alert Bay, Cormorant Island, where we anchored at 2 o'clock the next morning. Captain Lennan, who had been sent on board the flagship at Port Townsend to act as their pilot during the run up the inside passage, returned on board shortly after anchoring.

We were under way again at 4.10 a. m. May 19, and stood out through Goletas Channel and Queen Charlotte Sound to sea, thence shaping course for Unalaska in obedience to sealed orders to "proceed there with all dispatch, coal, and sail for Attu Island for the purpose of landing Lieutenant Jacobs, U. S. R. M., and his assistant, then to return to Unalaska; on the way back, however, to endeavor to be off the principal passages between the western groups of islands during the daytime, if possible, so as to intercept any sealers which may come from the westward with the intention of entering Bering Sea."

May 20 proved to be a pleasant day, with moderate long swell from the southwest and light head winds. A succession of thick fogs were encountered until the forenoon of the 25th, when the barometer fell rapidly and it came on to blow a gale from the northeast. At 7 p. m., having arrived off Unimak Pass, the weather being thick and the horizon so obscured that objects could not be distinguished over a quarter of a mile, hove to for the night. At 4 a.m. May 26 filled away under steam and sail on course for Unimak Pass and arrived at Dutch Harbor at 2.24 p.m. the same day.

The season was very backward at Unalaska, signs of approaching spring not then having made their appearance. The snow line was but little above the water's edge, and no grass was visible. During our stay in port it snowed part of the time each day. The anglers who tried the streams for trout reported that they had not yet commenced to bite.

Left Dutch Harbor the morning of May 31, with overcast sky and peaks of mountains enveloped in clouds. Shaped course for Attu Island, with vessel under full steam power. During the passage over the weather was pleasant, with occasional passing showers. A smooth sea with light westerly swell favored a quick passage, which was made without delay in 78 hours, arriving in Chichagof Harbor on June 4. Lieutenant Jacobs was landed the same day.

Hunting, seining, and collecting parties were dispatched on shore to gather such specimens as would best illustrate the commercial value of this island. As far as any trade is concerned, the few inhabitants of the village at the head of Chichagof Harbor, numbering 23 men, 48 women, and about 30 children, have apparently relapsed into a state of apathy from which only the advent of the company's steamer with supplies or the arrival of a vessel like the *Albatross* will arouse them. Game of any description is scarce at this season of the year, and only a few minor fox skins and straw baskets were offered in trade for plug tobacco, which evidently was in great demand. Seven frame houses, a thatched church built from driftwood, and a dozen or more mud huts constitute the village. I found that for three months—March, April, and May—these people had been subsisting on fish, all other provisions having been consumed. In consequence of their dilapidated condition and want of necessary supplies, I had issued from the paymaster's department, 10 pounds of tea, 50 pounds of sugar, and 105 pounds of sea biscuit, which was served out in equal shares to each family. These articles I deemed sufficient to sustain them until the arrival of the Alaska Commercial Company's supply steamer, which was not expected for some time.

Three hauls of the seine on the beach near one of the fresh-water streams on the south side of the bay yielded 300 salmon, 500 flounders, and 100 rock trout, with other minor species. Several Atka mackerel were caught from the ship's side. The natives here report that cod banks exist off the entrance to this harbor, where they make good catches in 50 to 60 fathoms, with sand and broken-shell bottom. Atka mackerel are also caught inshore on the south side of the harbor entrance in 20 to 30 fathoms, rocky bottom, and close to the ledges of outlying islets which form a barrier to the approach to the shore in this locality.

Tuesday morning, the 5th of June, got under way and steamed over to Agattu Island, about 30 miles SSE. (mag.) from Attu, to an entirely new field of investigation. Stood in and anchored in a broad, open bay on the eastern end of the island in 16 fathoms, sand and gravel. Sent seining, hunting, and fishing parties ashore in charge of Messrs. Townsend and Miller, and made fishing trials over the side, catching many cod and a few mackerel.

Little hydrographic work has been done around this island and, from the soundings taken when running in, this end appears to have a gradually sloping platform extending off 6 miles or more, which I should have developed, instead of making a reconnaissance, which was done by the officers on the afternoon of the 5th, had time permitted. At 6 miles it shows an average depth of 35 fathoms, gray sand and broken shells, which may extend well to the eastward and be a future field of examination. I have named this place McDonald Bay, in honor of the United States Commissioner of Fish and Fisheries.

On the morning of the 6th sent seining and fishing parties on shore with Mr. Townsend; weather thick, and blowing fresh from the southward. Ran a line of soundings out 6 miles over the platform to the eastward of Agattu; found the bottom irregular and studded with rocky patches, changing the soundings abruptly 8 to 10 fathoms. Therefore I deferred dredging in consequence of the probable loss of any apparatus sent to the bottom, and accordingly shaped a course due east (mag.) for the island of Kiska, on the Bering Sea side of this chain of islands. The conditions of weather were such as to make it impossible, with our limited time, to investigate more fully the banks to the eastward of Attu. This will have to remain for future work. The seining and fishing parties sent out at Agattu had negative results; but better conditions were looked for near Kiska, on the northeast side of the island.

With a strong westerly wind, the weather remained thick and foggy. This, in connection with the variable currents near these islands, would make the location of any platform suitable for dredging more or less doubtful. Had the weather remained pleasant for one or two days, I should have been able to have accomplished some good results, which would probably have been of interest to the Fish Commission. With unlimited time at this season of the year, I can readily see that a thorough examination of the platforms along these islands and in the several passes would undoubtedly open up a new field which would be productive of good results.

June 7, at 2 p. m., ran in and anchored in Kiska Harbor, on the east side of Kiska Island. Sent seining, fishing, and hunting parties on shore. Some salmon and trout were caught in a lake at the head of the bay. A few ptarmigan, ducks, and geese were secured by the hunters. Very little game appears to occur in this vicinity. The weather changed rapidly during the night to a stiff SE. blow, with rain, which drove in a dense fog, shutting out the land. On the 8th it was foggy and rainy, with the wind moderating. Got under way and steamed off the NE. entrance to Kiska Harbor, and made a successful haul of the dredge in 35 fathoms, sandy bottom. A few specimens of fish, shells, sponges, etc., were obtained. Compelled to suspend operations for the day on account of heavy fog, we returned to anchorage in Kiska Bay. We were under way again at 9 a. m. June 9, and stood out of Kiska in a dense fog. Put over the dredge in 55 fathoms and made a successful haul. Several varieties of sponges, corals, a few fish, serpent starfish, etc., were obtained. Fishing trials from the ship and boats did not prove to be successful in the vicinity of this bay and entrance to harbor.

Shaped course for Atka, passing to the northward of Chugal and Khwostof islands. Arrived at Nazan Bay, Atka Island, the forenoon of June 10. Sent out seining, fishing, and hunting parties; very few fish were caught by any of the parties. From questioning the natives who fish around the islands, both at Attu and Atka, it appears that the Atka mackerel are caught on rocky ledges covered with kelp at Attu, near the entrance on the south shore of Chichagof Harbor, in 6 to 10 fathoms of water. It also appears from the statements made by the Aleuts that the Atka mackerel is fished principally on the side of ledges and islands where the tide runs strongest. Both spear and line are used.

Left Atka at 6 p. m. June 10 for Unalaska, passing to northward of intervening islands, and arrived in Dutch Harbor at 2 a. m. on the 12th.

During the forenoon of the 12th a whaleboat arrived in the harbor containing nine survivors of the whaling bark *James Allen*, which had been wrecked on the Agladak Reefs, east end of Amlia Island. The boat contained Captain Huntley and eight men, who had managed to reach this port in 32 days by coasting along the chain of islands. The bark was wrecked on the 11th of May, about 2.30 a. m., in attempting to pass into Bering Sea by the Seguam Pass. As the boat entered the harbor it was met by the steam launch of the *Bear*, then returning from Iliuliuk. From an interview held on board the *Bear* with the survivors, at which I was present, it was learned that the crew numbered fifty, all told. Five boats were lowered, and four got away from the wreck, the fifth boat being stove alongside. Several were drowned. One boat found its way to the Alaska Commercial Companys' station at Nazan Bay, Atka Island, on the 24th of May. The nine survivors in the boat were transferred on the 2d of June by the company's steamer *Dora* to the U. S. S. *Petrel*, and eventually were landed at Dutch Harbor. The captain's boat and one other, No. 3, kept together, and landed on the 12th of May on the north side of Amlia Island near the scene of the wreck. The fourth boat, containing the first and second mates and a crew of men, parted company with the others May 11, and was last seen well to windward under sail. This boat was the only one which managed to leave the wreck with an outfit of oars, spars, sails, compass, and charts.

No provisions were saved from the wreck or taken in the boats; hence, the only food obtained consisted of mussels, seaweed, and such fish as they could devise means to catch. The captain's boat and No. 3 coasted along the chain of islands, making a landing each night except two, when they were compelled to run before a westerly gale. No. 3 boat capsized off the Islands of Four Mountains; four men were drowned, and the remainder taken in the captain's boat, making a total of 23 men. One died the next day and was buried at sea. With 22 men he landed on the north shore, west end of Umnak Island, at an old deserted settlement, where huts were found which afforded shelter. Several days were passed here in resting and repairing the remaining boat. Captain Huntley then decided to take 8 of the strongest men and push on to Unalaska for relief and rescue of those left behind. He made the passage from Umnak to Dutch Harbor in ten days, with crew and boat.

It was decided by Captain Healy and myself that he should go immediately to the rescue of the men left on Umnak Island, as he had finished coaling, and that I should follow as soon as coaled and make a careful search of the shore lines of the islands from Dutch Harbor to Nazan Bay, and especially along the north shore of Amlia, as Captain Huntley, of the wrecked bark, believed that No. 4 boat had landed on the north side of Amlia Island, and in so doing had probably stove their boat, and consequently were unable to get away.

The *Albatross* sailed on the 13th, at noon, but encountered a gale and rough sea off Cape Makushin, which prevented a successful search of the shore line being made; hence, returned to our anchorage for the night. Got under way at 5.30 a. m., June 14, and continued search along the north shore of Unalaska, working westward; anchored at night in Chernofski Harbor, west end of Unalaska Island. Left at 5.30 on the morning of the 15th and continued the search along the north shore of Umnak Island. At noon stood off shore on account of a gale, heavy sea, and thick weather, which shut in the land at a distance of a mile, preventing further search. Stood to the westward along the chain of islands and anchored in Nazan Bay at 5 a. m., the 17th, in order to ascertain if any additional information had been obtained of No. 4 boat. It was learned, however, that nothing had been heard of the missing boat; hence, the *Albatross* left Nazan Bay at 7 a. m. and made a careful search of the shore line of Amlia and Seguam islands. A heavy fog and westerly wind then setting in, prevented the further search of Amukta and the Islands of Four Mountains. The *Albatross* was accordingly headed for Unalaska, as it was concluded that nothing more could be accomplished toward finding the missing boats, under the uncertain conditions of weather then existing. The circumstances also prevented utilizing any of this search to the advantage of the Fish Commission, which is to be regretted. Arrived at Dutch Harbor the evening of the 18th.

Sailed from Dutch Harbor at 8 p. m., June 21, for the Pribilofs. Arrived at St. George Island and anchored off the village at 8 p. m., June 22. Weather cloudy, rainy, and foggy, with fresh ENE. wind. For several days previous to the arrival of the *Albatross* communication with the shore from the north anchorage had been interrupted by heavy weather. At midnight got under way for St. Paul, where the *Albatross* arrived at 5 a. m., June 23. The Treasury agents reported that the seals were late this season in arriving, especially the cows.

At St. Paul orders were received for the *Albatross* to "cruise for ten days between a line drawn from St. Paul to Cape Newenham, and another from St. Paul to Akutan Island; then return to Unalaska. To go as far to the eastward as judgment seems best." One killing of 1,200 seals had taken place from the Reef Point rookery a few days previous to our arrival; another occurred on the 23d at Zapadnie rookery, of 1,000 seals. Fresh salmon were found in the seals' stomachs at the last killing.

Information was received from otter hunters at Unalaska the day of our departure that the majority of seals were entering Bering Sea through False Pass, or Isanotski Strait, between Unimak Island and Alaska Peninsula. It was therefore concluded that some information might be brought to light relative to the migratory habits of the seal by making an examination at this period of that portion of Bering Sea included between a line drawn from Amak Island W. by N. (mag.) to a point 20 miles NE. of St. Paul, and another line from Cape Lapin, west end of Shaw Bay, W. ½ N. (mag.) to a point 20 miles SW. of St. George Island.

Accordingly, the *Albatross* sailed from St. Paul at 7 p. m., June 23, to cruise in search of pelagic sealers and investigate the supposed channel of migration, as outlined above. A part of the 24th and 25th was spent in examining this locality. A haul of beam trawl, also surface net, was made at a distance of 1¾ miles from and across the mouth of False Pass; the usual temperatures and a specimen of bottom water were taken. The trawl was drawn for thirty minutes, the haul being successful. The principal specimens consisted of flounders, alligator-fish, starfish, hermit crabs, and sponges; bottom composed of black volcanic sand. On consultation with the naturalists it was decided that fishing trials under these conditions would not be productive of any additional information in this locality. Up to this time no seals nor sealers had been seen, although favorable sealing weather; a very marked contrast to conditions supposed to exist, from all accounts.

The run was then made to Port Moller, where we arrived June 27 at 7 a. m. Neither seals nor sealers were seen in this locality; we therefore continued on to Port Haiden, which was reached that afternoon. The weather being unsettled, accompanied by thick fog and mist, together with the late hour of the day, I did not consider it advisable to examine this locality or employ the time allotted to cruising in making a reconnoissance of this port. Hence, a course was laid for Cape Newenham with the intention of reaching the fishing grounds in that locality, situated at the northern limit of our patrol work.

After running 50 miles from Port Haiden light field ice was encountered at midnight of the 27th in latitude 57° 34′ N., longitude 160° 10′ W. At 1 a. m. it had become so thick and floating patches of such dimensions that further continuance of the same course, WNW. (mag.), would have been dangerous to the propellers; hence the *Albatross* was put about and by careful management pushed through the ice till open water was reached at 3 a. m., having been 3 hours in the ice field. The fog was thick when the ice was encountered, and the temperature fell to 32° F., with intense humidity, which increased the chilling effect of the atmosphere, causing everything about the ship to be covered with heavy moisture, and consequently in a dripping state. A moderate breeze was blowing at the time from the southward and westward. As we emerged from the ice, a shift of wind lifted the fog, when a view of the ice field demonstrated that it was closed to the WNW. with southern limit extending a SW. by S. and an E. direction from our position as far as the distant horizon. The dimensions of several of the cakes when alongside of the *Albatross* were found to be about 3 feet out of water and from 200 to 300 feet in length, varying in width from 50 to 75 feet. It was composed principally of old shore ice and some snow ice, which had undoubtedly found its way to this part of Bristol Bay from the numerous inlets and rivers at its head. Evidently this is characteristic of a late season at the head of the bay, which will undoubtedly have its effect upon the appearance of the salmon in the Nushagak River, owing to the low temperature of the water. This will probably delay the cannery industry of this region and give their yield a late market for this season's work.

The course having been changed to SW. by S. (mag.), skirting the ice limit, the weather changed somewhat, making a fair day for this region, much above the average. In the 42 days subsequent to our departure from Queen Charlotte Sound only 5 days of partial sunshine have been experienced. The remaining days were enveloped in fog, mist, rain, and several summer gales of slight duration.

A few scattered fishing trials, with hand lines, of 30 minutes' duration each, with 13 to 15 lines down, were made, commencing in latitude 57° 58′ N., longitude 166° 04′ W., on a line drawn between St. Paul and Cape Newenham, and 134 miles from St. Paul. The line extended NE. by N. (mag.) 95 miles toward Cape Newenham, then SE. by S. (mag.) for a distance of 90 miles, and finished on a line WSW. (mag.) in latitude 56° 58′ N., longitude 163° 45′ W. Scattering specimens only of codfish and two or three flounders were taken. The bottom at the various stations was composed largely of fine gray sand; the depth varied from 21 to 44 fathoms, the bottom temperature from 32° to 35° F. Soundings were continued at intervals in this region for the purpose of filling in between the radial lines run by the *Albatross* on July 29 and 30 and August 10, 1893.

The position at noon June 30 was latitude 56° 59′ N., longitude 163° 02′ W.

The end of the fiscal year finds the *Albatross* engaged in patrol work connected with the Bering Sea squadron and making occasional soundings for hydrographic information. The confidential orders under which the vessel is performing patrol duty prevent legitimate work in the interest of the Fish Commission. Observations in this section in the study of seal life and the collection of data relative thereto, as well as the further development of the fishery resources of this region, can not be executed by the ship and her staff with any degree of satisfaction where sudden and frequent changes of base are ordered in the patrol work assigned, which is entirely foreign to the method and manner of investigation necessary in the study of the seal and its habits.

The following is a brief summary of the movements and operations of the *Albatross* during the year:

	No.		No.
Days steaming and under way	138	Hauls of intermediate tow-net, Tanner	13
Nautical miles run by log	17,269.1	surface tow-net	40
Ports and anchorages made	61	Fishing trials, hand-line	79
Hauls of beam-trawl	102	Bottom temperatures taken	236
rake-dredge	5	Serial temperatures taken, sets	95
dredge	12	Water densities taken	230
mud bag	23		
tangles	2		

The following is the list of officers and assistants June 30, 1894: Lieut. Commander F. J. Drake, United States Navy, commanding; Lieut. A. F. Fechteler, United States Navy, executive officer and navigator; Ensign Houston Eldredge, United States Navy; Ensign W. R. Shoemaker, United States Navy; Ensign C. M. Fahs, United States Navy; Ensign Philip Williams, United States Navy; Passed Assistant Surgeon E. S. Bogert, jr., United States Navy; Assistant Paymaster Eugene D. Ryan, United States Navy; Passed Assistant Engineer Howard Gage, United States Navy. Captain's clerk, Harry Clifford Fassett. C. H. Townsend, resident naturalist; A. B. Alexander, fishery expert; N. B. Miller, general assistant; Capt. James E. Lennan, seal hunter.

REPORT OF A. B. ALEXANDER, FISHERY EXPERT.

[Abstract.]

INSHORE INVESTIGATIONS.

On May 30, 1893, the *Albatross* stopped at Comox, Vancouver Island, while en route for Bering Sea, for the purpose of coaling. During the detention at this port the drag seine was hauled to some extent, but the shores generally about here are unsuited to the use of such nets, being rocky in most places. No fishes of economic importance were secured, but clams were found to be abundant. The latter constitute one of the principal articles of food utilized by the small tribe of Indians, numbering about 100 persons, which camps in this locality during the summer months for the purpose of laying in a supply of salmon for winter use. These fish are either smoked or dried. For smoking they are hung on lines or poles near the roof of the huts or houses, where the smoke circulates freely among them; in drying, they are thrown upon the rocks or sand and left until sufficiently cured to permit of their being packed and shipped to the winter settlement of the tribe near the town of Union, 13 miles from the coast.

Hunting is the only winter occupation of these Indians. I saw no nets of any kind at the fishing settlement, and, from such information as was obtainable, I judge that all the salmon taken here are caught by trolling. Although plentiful enough to supply the wants of the local white and Indian population, salmon are not sufficiently abundant in this locality to induce the establishment of a cannery for their preparation.

Our next stopping-place was at Pender Island, British Columbia, 77 miles north of Comox, where we anchored for the night. Several hauls of a drag seine were made upon a fine beach near at hand, but without success, the strong current which sweeps by the island possibly accounting for the absence of fish.

St. Paul, Kadiak, was reached on June 7, and shortly after anchoring a seining party proceeded to a beach about 1½ miles east of the town, where a considerable number of flounders, sculpins, and salmon trout were captured in the net. The next morning a second visit was made to the same place with the object of laying in a stock of the trout, but only a single individual was secured. A few cod taken in the seine were small and sickly in appearance, but others procured by hand lines from the ship's deck were more thrifty-looking. We also noticed several native women and boys using hand lines from the beach and taking cod of the same character as those secured in our seine, but the white inhabitants always fish for cod and other bottom species a mile or two from the islands, where the condition of the fish is excellent.

In Humboldt Harbor, Popof Island, of the Shumagin group, 150 flounders and a few small salmon were seined at the mouth of a small creek. Two halibut, weighing 5 pounds each, were the total result of a day's fishing with hand lines at the same place. A week later (June 16) repeated hauls were made with the drag seine in Humboldt Harbor, but all kinds of fish except flounders were as scarce as they had been on the previous trial. A few cod and halibut were taken from the ship with hand lines. They were in fine condition, but too small for market.

Seining was subsequently carried on at Northeast Harbor, Sandy Cove, and Yukon Harbor, of the Shumagin group, the two former being on Little Koniushi Island, the latter on Big Koniushi Island. Cod were plentiful at Sandy Cove, 50 being secured in a short space of time. Their range in weight was from 4 to 16½ pounds, the average weight being 7½ pounds. At Northeast and Yukon harbors only a few flounders were obtained, the beaches being composed of large stones and affording few places where the seine could be hauled.

Mist Harbor, Nagai Island, is one of the finest harbors in the Shumagin group for the establishment of a fishing station for cod, being entirely landlocked and of sufficient size to accommodate a large fleet of fishing vessels. The water is everywhere deep, over 20 fathoms occurring within an eighth of a mile of the shore at the entrance, and it is also very clear, the bottom being visible to a considerable depth. The fishing trials were, however, poorly rewarded, and the shores near the water's edge were observed to be almost entirely barren of animal life. The drag seine was employed in all parts of the harbor. One salmon was seen to jump at the mouth of a small mountain stream, but repeated hauls failed to secure us a single specimen. Later in the season the salmon probably strike in here in considerable numbers. Late in the day, by the use of a couple of hand lines off a rocky point not far from the ship's anchorage, I succeeded in catching a couple of cod weighing 3 pounds each, and it is possible that this species may enter the harbor abundantly at some other season.

The following morning a visit was paid to a small lake on the island about a mile from the entrance to the harbor, where over 20 small trout and a large quantity of sticklebacks were obtained by seining.

Sanborn Harbor, on the west side of Nagai Island, is well sheltered and offers many advantages for a fishing station. The drag seine was hauled there in many places and there were secured large numbers of two species of flounders, 6 adult salmon, besides many young salmon about 2 inches long, 8 salmon trout, and a dozen sculpins.

Collections were also made in a small lake adjacent to the harbor, which at one time was connected with the sea, but now has its outlet entirely cut off by a dam of rocks and wood built by fishermen. Its water, formerly salt or brackish, has become perfectly fresh, but in addition to several hundred small trout our seining catch consisted of a large number of starry flounders and a few tomcod. Neither the condition nor quality of the flounders appeared to have suffered from their presence in the fresh water, and they were eaten on board the ship.

Four visits were paid to Unalaska during the season, and more or less collecting was done at each. On June 28 the drag seine was hauled several times along the beach or spit which forms Dutch Harbor, but only 2 flounders and 4 sea trout were thus obtained. This beach has never afforded good results in previous trials; in most places it makes off very abruptly, and the bottom is nearly devoid of such life as attracts flounders and other food-fishes. Clams are fairly abundant, and at low tide the crews of whalers, men-of-war, and other vessels may frequently be seen collecting them.

On July 18 a party from the *Albatross*, in company with one from the whaling bark *Stamboul*, made a seining trip to Glacier Bay, about 7½ miles from Dutch Harbor, for the purpose of obtaining a supply of salmon. A whaleboat belonging to the latter ship was used for the trip, and three hauls of the large seine sufficed to fill it comfortably full with dressed fish. The next day a sufficient quantity was taken in the same place to supply the wants of four other whalers anchored in the harbor.

Before leaving Unalaska on this trip three-fourths of a barrel of clams, 80 starry flounders, and several hundred small trout were secured for transplanting to St. Paul Island, the fishes being intended for the lakes on that island and the clams for the muddy flats of a lagoon a short distance from the settlement. Starry flounders had always been quite abundant at Unalaska, but on this occasion we were unable to obtain more than 2 individuals after repeated hauls of the seine in several parts of the harbor. A visit was then paid to a fresh-water lake at Summer Bay, at the southern entrance to Unalaska Harbor, for the purpose of procuring the trout, but to our surprise many starry flounders were taken with them in the seine. The sea water does not approach nearer than one-third of a mile from the mouth of the lake, and no salt water ever enters it, but a rapid stream flows from the lake to the sea. The natives set nets for salmon across the stream during July and a part of August. It would, therefore, appear that the flounders must ascend the stream to the lake.

During the second week in August salmon and herring were the only fishes obtained by us in Unalaska Harbor, and neither of these species was then abundant. Herring strike this part of the island every season, generally by the 1st of August. They are then found close inshore in considerable numbers, but the writer has never seen them schooling, nor has he been able to learn that they do so. It is probable that they spawn in the spring about the same time that they do in southeastern Alaska.

Between the 4th and the 8th of September seine hauls were made in Summer Bay, but without success. Trout were numerous in the adjacent lake, and many were captured both by seining and by hook and line. Young salmon were also abundant.

Four days in the first part of July were spent at the Bay of Waterfalls. Adak Island. Salt-water fishes were not abundant, but trout were numerous in the lakes and in the streams flowing from them. A few flounders and sculpins were the only species taken in the seine the first day. The following day a 40-foot seine was hauled in two of the lakes near the shore, resulting in the capture of trout and sticklebacks only. Quite a number of young salmon were caught at the mouth of a small stream which rushes down the side of a steep hill, but no salmon were found elsewhere in the bay, possibly due to the fact that on this side of the island there are no streams large enough for the ascent of these fishes.

The water at the mouth of the harbor is very deep. A cod trawl, baited with salt salmon, was set in 40 fathoms near the eastern side of the entrance, and was allowed to remain down seven hours. At the end of that time the catch consisted of 1 halibut weighing 10 pounds, 3 skates, 4 sculpins, and 3 starfish, this result not indicating a rich fishing bottom in that locality. One Atka mackerel, the only specimen secured here, was taken on a hand line from the ship's rail. It is possible that this species becomes abundant about the island at the proper season, especially in view of its proximity to Atka Island, where they occur in immense numbers.

On July 5 the ship anchored in Chapel Cove, a short distance from the previous locality. At this place the shore is mostly rocky, and only a few beaches were found where the seine could be employed. Two sea trout, and a quantity of young cod, from 2 to 3½ inches long, were the only fish secured by this means, and nothing was obtained by the use of hand lines from the ship.

OFFSHORE INVESTIGATIONS, BERING SEA.

The first fishing trial with hand lines in the open waters of Bering Sea was made at dredging station[1] No. 3484, latitude 57° 18′ N., longitude 171° 54′ W., 60 fathoms, where 5 cod were taken on muddy bottom. They ranged in weight from 13 to 22 pounds, and were in good condition, showing no signs of disease, as frequently happens among the cod caught on the inshore grounds. At station No. 3485, latitude 57° 18′ N., longitude 172° 34′ W., 62 fathoms, one cod weighing 12 pounds and one large flounder (*Atheresthes stomias*) were obtained by the same means. At the latter station the beam trawl brought up a large quantity of Alaskan pollock.

No trials with hand lines were made on either the 13th or 14th, but at station No. 3489, latitude 57° N., longitude 173° 44′ W., 184 fathoms, a small cod was captured in the beam trawl. A cod trawl was baited on the morning of the 13th, but no suitable bottom being found during these two days, it was finally set on the 15th off the village at St. George Island, but nothing was taken.

[1] There are two series of stations made by the *Albatross*, namely, dredging station and sounding station. The former are simply designated as "station," the latter as "hyd. station."

On July 17 seven hauls were made with the beam trawl in depths of 41 to 688 fathoms. At the first station, No. 3496, latitude 56° 32′ N., longitude 169° 45′ W., 41 fathoms, the catch consisted of sponges, small pieces of coral, a few shrimps, 7 sculpins, and 2 flounders, but nothing was secured on the hand lines, which were kept down twenty minutes. At stations Nos. 3497 and 3498, 86 and 142 fathoms, the same character of bottom was found to exist. At station No. 3500, latitude 56° 02′ N., longitude 169° 30′ W., 121 fathoms, the beam trawl gave indications of a rich bottom, the catch including sponges, hermit crabs, 3 sculpins, 12 red rockfish, 4 flounders, 1 cod, and several species of small fishes. Two subsequent hauls, made later in the day, were in too deep water for the capture of edible fishes.

Leaving St. Paul Island in the morning of July 28, fishing trials were made as follows during the day: Hand lines were used for ten minutes at station No. 3503, latitude 57° 06′ 15″ N., longitude 170° 11′ W., 17 fathoms, mud and fine sand, without taking any fishes. The same results were obtained at hyd. station No 3307, latitude 57° 03′ N., longitude 169° 54′ W., 35 fathoms, fine sand; and at station No. 3504, latitude 56° 57′ N., longitude 169° 27′ W., 34 fathoms, fine sand. The beam trawl used at the latter station brought up a large variety of animal life, but the only edible fishes were 4 flounders. The hand lines were again unsuccessful at hydrographic station No. 3308, latitude 57° 03′ N., longitude 168° 52′ W., 43 fathoms, sand and shells; and at station No. 3505, latitude 57° 09′ N., longitude 168° 17′ W., 44 fathoms, fine sand.

The only cod taken during the day was a single specimen captured in the beam trawl at the last mentioned station. This failure to take any cod with the hand lines during the day was doubtless due to the rapid drifting of the ship, caused by the prevalence of a strong breeze. The bottom over which we passed is considered good fishing ground early in the spring and late in the fall, previous to the appearance of the seals and after their departure. It has been the general experience of fishermen to find cod scarce about the Pribilof Islands during the summer months. In November and until the ice prevents making trips to the west grounds, the natives of both St. George and St. Paul have no difficulty in catching all the cod required for their use.

On July 29 six trials with hand lines were made, resulting in the capture of 47 cod and 1 flounder. The best fishing for the day was obtained at hyd. station No. 3312, latitude 57° 38′ N., longitude 165° 20′ W., 35 fathoms, where 17 cod were taken. Their average weight was 7½ pounds and their average length 26⅓ inches. The next best results were secured at station No. 3507, latitude 57° 43′ N., longitude 164° 42′ W., 31 fathoms, 14 cod being caught in a drift of only twelve minutes. They averaged 8¼ pounds in weight and 26¾ inches in length. The beam trawl at this station brought up mollusks, crabs, starfish, flounders, etc. These trials indicated a rich bottom and a good fishing ground, the depth of water also being convenient for fishing operations. Ten cod were subsequently obtained at station No. 3508, latitude 58° 33′ N., longitude 164° 49′ W., 23 fathoms, the beam trawl hauled at the same place yielding mollusks, crabs, shrimps, starfish, and small fishes.

On July 31 two hand-line trials were made, but without success. One was at hydrographic station No. 3322, latitude 57° 10′ N., longitude 169° 05′ W., 42 fathoms; the other at station No. 3509, latitude 57° N., longitude 169° 43′ W., 35 fathoms. The failure to take cod at these two places occasioned no surprise, as they were too close to the Pribilof Island to make it probable that cod were at all abundant there.

A line of fishing and dredging stations was commenced on August 1, in 27 fathoms, 5 miles NE. ½ E. of Walrus Island, of the Pribilof group, being carried thence north (magnetic). At the first station the beam trawl brought up large quantities of the common sand-dollar (flat sea-urchin), many mollusks, and a few small crabs, but nothing was taken on the hand lines, five of which were kept down fifteen minutes. Four more stations were made during the day, 20 miles apart, but at none of them did the trial with hand lines prove successful. At most of these positions, moreover, the beam trawl showed little evidence of a rich bottom, such as would be expected to attract fishes, although it is reported that cod have been found abundant in a part of the region crossed by the line of investigations. At station No. 3513, latitude 58° 27′ N., longitude 169° 01′ W., 35 fathoms, 2 large flounders, a number of Alaskan pollock, and a bushel of crabs were captured in the beam trawl.

On August 2 five fishing and dredging stations were made and six cod were obtained, one having come up in the beam trawl. The first trial, at which one cod was secured on the hand lines, was in 13 fathoms, Northwest Cape of Nunivak Island, bearing NNE. ½ E., 19 miles distant. The next successful trial as regards the capture of cod was at station No. 3517, 24 fathoms, Northwest Cape bearing E. ¼ N., 51 miles distant. Four specimens were taken here. In this locality it is possible that a vessel anchoring for a short time would be able to toll a school of cod by the bait which naturally falls from the hooks. During the night the ship worked in the direction of St. Matthew Island.

Early the following morning, August 3, hand-line fishing was begun at hydrographic station No. 3348, latitude 60° 24′ N., longitude 170° 48′ W., 35 fathoms, and was continued later at a second station 21 miles NE. by E. ½ E. of Pinnacle Island. At both of those positions and at most of the sounding stations made in the vicinity of St. Matthew Island the bottom was found to consist of mud, and no fishes were captured on the hooks. Cod are known to occur in that locality, however, and halibut may also frequent the same waters, but it is not probable that either of these species is sufficiently abundant there to afford a profitable fishery. From the station last mentioned fishing trials and dredge hauls were made at intervals of 20 miles in a SSE. course in depths of

29 to 41 fathoms, the bottom continuing to consist largely of mud until we approached the Island of St. Paul, when more or less sand and pebbles were found. The only fish taken on the hand lines were three Alaskan pollock, a species frequently found on muddy bottom.

On the morning of August 5 a line of observations was commenced off St. Paul Island, extending in a NW. ½ W. direction from that island, the stations, as in previous days, being mostly 20 miles apart. Trials with hand lines were made at six different positions, beginning at hydrographic station No. 3353, latitude 57° 24′ N., longitude 170° 24′ W., and ending at station No. 3529, latitude 58° 36′ N., longitude 172° 24′ W. No fish were taken near the Pribilof Islands. The first cod, a single specimen, was caught at station No. 3527, latitude 57° 48′ N., longitude 171° 21′ W., 52 fathoms. The best fishing for the day was obtained at station No. 3528, latitude 58° 19′ N., longitude 172° 02′ W., 55 fathoms, the catch consisting of 4 cod, averaging 13¾ pounds in weight and 29¼ inches in length. The bottom of both of those stations was composed of mud, and the indications were not favorable to good fishing. During the day over 70 fur seals were seen, the first observed this season at a distance from the Pribilof Islands.

On the following day (August 6) hand lines were tried at four positions and cod were taken at two of them, only one at each, in depths of 57 and 59 fathoms, muddy bottom (hydrographic station No. 3357, latitude 59° 24′ N., longitude 173° 31′ W.; station No. 3531, latitude 59° 55′ N., longitude 174° 17′ W.). On August 7 the ship ran back to St. Paul Island on a S. by E. course from hydrographic station No. 3362, latitude 57° 41′ N., longitude 174° 05′ W., 77 fathoms, frequent trials being made for bottom fish, but without success.

During August 9 a course was run E. ½ S. from St. Paul Island, 10 cod being taken on the hand lines at six stations, the small number secured in this direction being explained by the fact that we were cruising over a common feeding ground of the fur seals.

Amak Island was sighted the next morning. Hand lines were put over at two stations, seventeen minutes being given to each trial, and the result at each being five cod. The sea was smooth and a light breeze blowing. This was in the region where cod are known to be plentiful, and had the forenoon been entirely given over to fishing a catch of 100 or more fish might have been expected. I have heard that the vessels which resorted to the cod banks of Bristol Bay in 1892 obtained better fares than ever before. The fish were also much larger and in better condition.

From Amak Island the ship proceeded to Shaw Bay, Unimak Island, and thence to Dutch Harbor and Chernofski Harbor, Unalaska. On August 17 hand lines were tried for nineteen minutes a short distance off the mouth of the latter harbor, in 43 fathoms, Western Head bearing S. ⅜ W. The weather was calm, the sea smooth, and the ship lay nearly stationary, but only one cod was captured. The bait used was recently salted salmon. Three years before we had found cod plentiful on these same grounds, and their scarcity at this trial is not to be taken as an indication that they are absent from the region, the state of the tide and other conditions being sufficient to account for their biting at one time of day and not at another, as happens on other fishing-grounds.

As explained in a previous report, the fishing-ground off Chernofski extends only a short distance from the shore, the continental platform in this region being comparatively narrow. A run of 20 miles NNW. from the above position carried the ship into a depth of 407 fathoms. Hydrographic work was carried on during the remainder of the day in the direction of St. George Island, which we reached in the afternoon of the 18th. Two hauls of the beam trawl were made the same day between that island and St. Paul Island, in depths of 41 and 43 fathoms, only a small amount of material being obtained, and the hand lines employed in the same places failing to secure a single fish. The last station was 16 miles off the western end of St. George Island, which bore SE. $\frac{1}{8}$ E. From that position the hydrographic work was carried WSW. to a distance of about 225 miles from the island, mostly through deep water in which no fishing trials could be made.

On August 31 five trials with hand lines were made in Akutan Bay, formed by Akun and Akutan islands, the total catch amounting to 7 cod. The depth of water ranged from 36 to 51 fathoms. The beam trawl was also hauled twice in the same bay, bringing up 11 large and 24 small flounders and a number of sculpins, crabs, and shrimps. The indications point to a fair feeding-ground for fishes, and it is reasonable to suppose that the cod resort to this bay for spawning in the fall and winter months. Should that prove to be the case Akutan Bay would be a favorable locality at that season for small-boat fishing.

In the evening the ship anchored in Akun Cove, on the NE. side of Akun Island. At the head of this cove there is a small lake which is separated from the salt water by a narrow spit composed of pebbles, stones, and sand. Three good-sized trout, several small ones, and a number of young salmon were caught in this lake by means of a 120-foot drag seine.

During September 1 a line of soundings was carried from Akun Island on a WNW. $\frac{1}{4}$ W. course, the depths ranging from 74 to 96 fathoms. The beam trawl was used at four stations, but as the bottom seemed everywhere unfavorable to the occurrence of cod the hand lines were not put over.

On the following day dredging was carried on between St. George and St. Paul islands, and an attempt was also made to fish with hand lines, but the wind was fresh and the ship drifted too rapidly for the leads to be kept on the bottom. The inquiries made about these islands by the *Albatross* indicate that good fishing is confined to more or less scattered areas of bottom, the total extent of which is small, and a run of only a few miles would carry the ship from a favorable locality to one that seemed entirely barren. The best places are known to the inhabitants of the islands, who are able to locate them by bearings from the shore;

but the natives do not exert themselves specially to lay in a supply of either cod or halibut, their wants being so well provided for by the Government. The village of St. Paul secures its cod and halibut from two small fishing-grounds, one of which lies off the eastern end of Otter Island, the other about 1½ miles from the settlement.

The last trial with hand lines in Bering Sea was made at station No. 3558 (latitude 56° 58′ N., longitude 170° 09′ W.), 25 fathoms. Five cod and 3 sculpins were taken there in the course of fifteen minutes, the former averaging 12 pounds in weight. The total number of trials with hand lines in the sea during the summer had been 70, the total catch by that means amounting to 116 cod.

On September 8 the *Albatross* again anchored in Akun Bay. The charts locate a fishing village in this bay, but we found there only a single small building, which is occupied by fishermen during the salmon season. The salmon (red salmon) which run here are much superior to those about Unalaska Island, and every year parties come over from the latter island in order to obtain a supply. In one haul of the seine on the beach we succeeded in capturing all the salmon we could take care of, and all of the boats belonging to the ship could readily have been loaded.

Just back of the beach here there is a lake about 1½ miles long by ½ mile wide. We launched our dory into this lake and made about a dozen seine hauls, securing a quantity of trout and young salmon. We were puzzled at first to account for the presence of the salmon in the lake, but on a closer examination we found that there had been an outlet which the sea had closed up, the fresh water at the time of our visit forcing its way under the beach through gravel and stones. At the places where the fresh water was oozing through many salmon were endeavoring to effect an entrance into the lake. So active were they in their efforts that several had managed to work some 10 or 15 feet up the steep beach into a little pool about 6 inches deep.

Arriving back on board the ship at dark, we found that the crew had caught several cod with hand lines, and a halibut weighing 17 pounds.

From Akun Island the *Albatross* proceeded to Deer Island, located between the Sannak islands and the mainland, a night anchorage being made off the southern and western end of the island. Hand lines were thrown over there and in the course of 1½ hours 27 cod and 6 halibut were captured. The former averaged 6⅓, the latter 6½ pounds in weight. In most parts of this region cod are plentiful, and it is not necessary to go far from the harbors to find good fishing. Halibut do not seem to be so abundant, however, although they are at least sufficiently common to supply all local demands.

A day was spent in collecting in Bailey Harbor, which is located a short distance to the westward of Belkofski, a native village containing about 200 inhabitants. Salmon, several species of flounder, (chiefly the starry flounder), and young cod were taken abundantly with the drag seine in all parts of the harbor. Dog and humpback salmon were seen jumping in every direction and dead individuals lined the shores on both sides. In a small stream fed by water oozing out of wet moss the writer counted 336 dead salmon and about the same number of living ones, but the latter looked as though they would not survive much longer, as they were covered with scars and bruises.

The stream was about 4 feet wide, in no place over 1 foot deep, and generally much less. Tall, thick grass obscured the course of most of the stream, and it could only be followed by forcing one's way through the rank growth. In so doing, one's foot would constantly come in contact with salmon, which would jump and rush upstream, making a great splashing as they went. Several attempts were made to drive a number downstream, but they were all unsuccessful. In many places the bottom of the stream was thickly covered with salmon eggs, the most of which were dead. The dead salmon filled the air with a sickening odor. As there is no large stream entering Bailey Harbor, the small ones become overcrowded with salmon, and thousands are obliged to remain in the bay without the chance of reaching fresh water.

Bailey Harbor would apparently be a desirable locality for a fishing settlement. It is well protected from the wind in most directions, but a heavy gale from the south would cause a heavy swell to enter, and yet a lee could be found by shifting from one side of the harbor to the other, as the occasion might require. Small boats could run into the inner harbor and find shelter from all kinds of weather. Fish are abundant and easily taken.

A run of 80 miles east brought us to Portage Bay, where we found shore collecting very poor as compared with Bailey Harbor. The water is very shallow and but few places exist which are favorable for seining. Only one large salmon and about a dozen small ones were taken. Flounders and sculpins are also scarce. Our seine catch consisted mainly of young cod, and 12 cod were caught on hand lines. Many dead salmon were lying on the beaches and some were floating on the waters of the bay. A mountain stream flows into the head of the bay, but as the tide was low at the time of our visit there, we made no attempt to seine at its mouth. Taken as a whole, Portage Bay does not seem to offer as many inducements for fishing as Bailey Harbor. The work in Portage Bay completed our fishery investigations for the season of 1893.

On June 19, 1894, I joined the ship at Unalaska, and on the evening of the 21st we sailed for the Pribilof Islands, where we arrived the following day. A drag seine was hauled in the lake on St. Paul Island, where a number of trout were planted last season. The seine reached nearly across the lake, and was hauled from one end of it to the other, with the object of determining whether the fish had survived the winter. Nothing was found to indicate that any of them were alive. The seine touched bottom, and had there been fish in this small body of water, it is very probable that a few would have been captured. The people living on the Island of St. Paul say that the past winter was very severe, more so than for many years, and that the lake was frozen to the bottom. If this be true, the trout planted were undoubtedly killed by the ice.

The first ocean investigation was made with the beam trawl on June 26, off the northern entrance to Isanotski Strait, generally known as False Pass. The bottom here is composed of volcanic sand, and has very little on it to support a large amount of life. The principal part of the catch consisted of starfishes; the economic species were flounders and one small cod; the cod, however, was dead and considerably bruised, as if it had been washed about violently by the sea.

The first trial for bottom fish was made on June 29 at hydrographic station 3492, latitude 57° 59′ N., longitude 166° 04′ W., in 32 fathoms of water. Fifteen hand lines baited with salt salmon were put over, and fishing carried on for thirty minutes. The result of this trial was two cod. Another trial was made the same day at hydrographic station 3493, in latitude 58° 06′ N., longitude 165° 22′ W., 26 fathoms of water. The same time was given here as at the previous station. Four cod and two flounders were caught; the last-named species were taken on very small hooks, none being caught on the regular cod gear.

On the 30th three fishing trials were made, the first at hydrographic station 3495, in 27 fathoms, latitude 57° 28′ N., longitude 163° 14′ W. Nothing was taken here. At the next station, which was in latitude 56° 59′ N., longitude 163° 02′ W., in 34 fathoms of water, one cod, weighing 6¾ pounds, was taken. Later in the day we hove to and put over 13 hand lines, in 37 fathoms, for thirty minutes. The result of this investigation was the same as at the first station.

The result of the fishing trials made in this region was far different from what was anticipated; fairly good fishing was looked for. The ground lying between the Pribilof Islands and Cape Newenham has never been considered by fishermen to be as prolific as the banks farther south, yet at times cod may be expected in considerable numbers. The almost negative result of the above trials could not have been due to any fault of the bait, for it was such as we have always used, salt salmon, and of good quality. It seems reasonable to suppose that the low temperature of the water at the bottom where these fishing trials were carried on accounts for the scarcity of fish. A comparison of the bottom temperatures found this season with those of past years shows a difference of from 4° to 8°. The bottom temperature of water at the fishing stations thus far this season has varied from 32° to 35° F. A difference of a few degrees may prevent cod from migrating to favorite grounds. In past years it has been found that cod exist in greatest numbers in water ranging from 38° to 43°. The cause for the extra cold temperature of the water this season is no doubt due to a very late summer and considerable quantities of field ice.

THE BLISH DISTANCE-FINDER.

By Commander Z. L. TANNER, U. S. Navy.

This simple and admirable little instrument was devised by John B. Blish, lieutenant, United States Navy. It has been used to advantage on board this vessel for about two years, and we have found it particularly valuable at night and in stormy weather.

With the course and distance and two bearings of a point of land, without computation or reference to books or charts, the instrument will give the distance of the point at the time of the first and second bearings, the distance to be run from second bearing to bring it abeam; also the distance at which it will be passed if the course is maintained. Repeated observations will show whether the vessel is actually making her course.

Referring to the sketch, Fig. I is a plan view, full size, and Fig. II a sectional view.

Scales of degrees and points are marked on the arc, and there is a scale of equal parts on CD, CE, and CF, which may be used as miles or fractions of a mile. A and B are silk threads pivoted at C and drawn under an elastic band which rests snugly in a groove surrounding the instrument, as shown in Fig. II. The band permits free movement of the arms, yet holds them in place when set. The vessel is supposed to be heading at all times from C to E, hence all bearings are plotted from E.

To use the distance finder, take a bearing of a point, note the number of degrees or points it bears from the ship's head, note the reading of the log, and set the arm A, counting the degrees from E; steer the same course until the bearing is sufficiently changed to make a good angle, then take another bearing, note distance run between first and second bearings, and set arm B on the number of degrees or points the object bears from the ship's head, counting from E as before. Then find the distance by log, GH, parallel with CE and between the arms A and B.

To find the distance of the point when the first bearing was taken, measure the interval CG on the scale CE or CD.

To find the distance of the point when the second bearing was taken, measure CH on CE or CD.

To find the distance to be run from the second bearing to bring the point abeam, read the interval HI on CE.

To find the distance the point will be when abeam, read CI on the scale CD, which is equal to the interval between CE and GHI, and may be read anywhere between those lines.

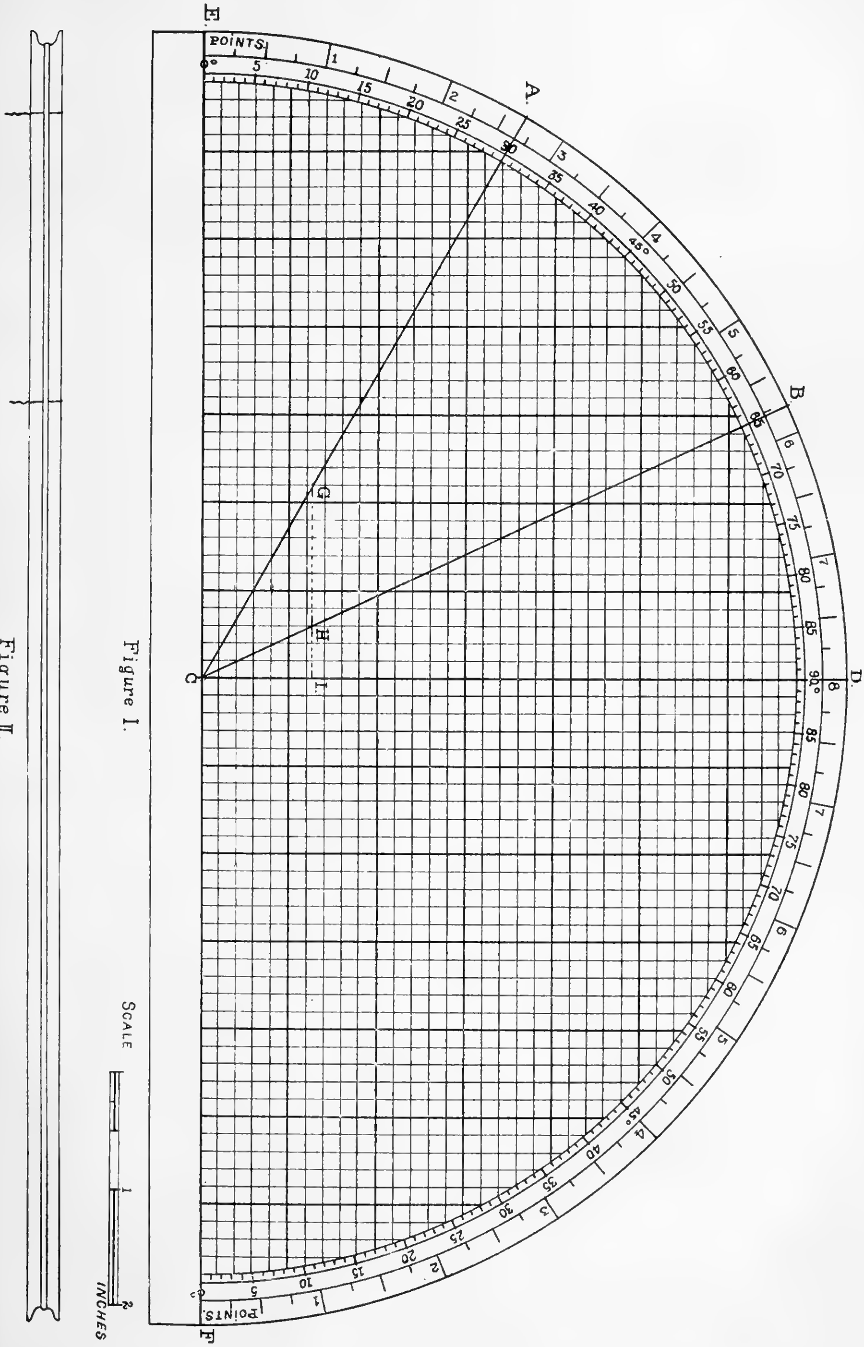


Figure I.

Figure II.

THE BLISH DISTANCE FINDER.

If the point is to be passed at a distance of 5 miles or less, it may be found convenient to have the lines on the scale represent half miles instead of miles. In reading the scale, fractions of a mile are estimated to tenths to correspond with the divisions of the patent log.

EXAMPLE.

First bearing, 30° from ship's head (or E).

Second bearing, 65° from ship's head (or E).

Distance by log between first and second bearings, 8 miles. Set arm A on 30° for first bearing, and arm B on 65° for the second bearing.

Then, 8 miles, the distance run, equals GH between the arms A and B.

CG measured on CE or CD equals 12.6 miles, distance of point at first bearing.

CH measured on CE or CD equals 7 miles, distance of the point at second bearing.

HI measured on CE or CD equals 3 miles, distance to be run from second bearing to bring the point abeam.

CI measured on CD equals 6.3 miles, distance the point will be from the vessel when it is abeam.

The distances CI and HI are those mostly used in practice, but if the distances CG or CH are required, grasp the arm A at G, or arm B at H, and swing them to CE or CD and read off the distance from the scale.

The distance finder in use on board the *Albatross* was improvised by Ensign Henry B. Wilson, United States Navy. The scales were marked in India ink on Irish linen writing paper, which was then glued to a wooden frame, and finally given several coats of shellac varnish. Sewing silk was used for the arms, which were held in place by an ordinary elastic band resting in the groove, and a small nail constituted the pivot.

It will be observed that the left quadrant of the semicircle is used in the description and the example; the right one may be used in like manner by assuming that the ship's head is at F. The instrument is used as though the vessel was at C, steering to E, on the line CE, but in reality she was at G when the first bearing was taken, at H at the time of the second bearing, steering for I, on the line GHI, and the pivot C is the point on which both bearings were taken.

The distance finder and Table 5A of the new Bowditch Navigator are constructed on the same principle.

TABLES.

Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894.

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperature. Air.	Temperature. Surface.	Temperature. Bottom.	Instrument used.	Weight of sinker.
	1893.		° ′ ″	° ′ ″	Fms.		° F.	° F.	° F.		Lbs.
3240	Apr. 26	10.00 a. m.	36 48 15	121 59 05	266	None obtained.	58	54	.....	Sigsbee..	35
3241	Apr. 27	8.33 a. m.	37 29 00	123 01 20	301	stf. gy. M......	54	53	.....	...do	35
3242	June 5	1.15 p. m.	57 40 00	143 18 00	2,064	gy. oz	48	47	35.0	...do	60
3243	June 6	9.01 p. m.	57 44 00	150 45 00	59	gy. S. Sh.......	46	45	.....	Tanner ..	25
3244	June 8	7.00 p. m.	56 48 00	152 30 00	87	stf. M	47	45	.....	...do	25
3245	June 15	6.10 p. m.	54 42 00	160 47 00	60	bl. M	47	44	.....	...do	25
3246	June 17	8.10 a. m.	54 56 15	159 01 00	48	gy. S. P........	46	43	.....	...do	25
3247	...do...	8.28 a. m.	54 56 30	159 05 20	41	gy. S. rky	46	43	.....	...do	25
3248	...do...	8.45 a. m.	54 56 45	159 09 00	36	gy. S	46	43	.....	...do	25
3249	...do...	9.01 a. m.	54 57 45	159 11 00	38	gy. S	46	43	.....	...do	25
3250	...do...	9.16 a. m.	54 58 45	159 13 45	33	S. brk. Sh......	46	43	.....	...do	25
3251	...do...	9.52 a. m.	55 01 30	159 16 30	27	gy. S	46	43	.....	...do	25
3252	...do...	10.14 a. m.	55 02 15	159 19 00	17	fne. gy. S	46	43	.....	...do	25
3253	June 27	6.58 a. m.	54 04 00	162 55 00	48	S. G	48	46	.....	...do	25
3254	July 1	12.03 p. m.	51 32 00	175 52 00	697	bk. S	43	48	36.6	Sigsbee..	35
3255	...do...	4.24 p. m.	51 35 40	176 41 00	62	crs. gy. S. Sh...	47	48	.....	Tanner ..	25
3256	...do...	5.51 p. m.	51 35 40	176 46 15	46	crs. gy. S	48	48	.....	...do	25
3257	July 5	9.47 a. m.	51 33 30	176 50 00	57	Sh.............	50	47	.....	...do	25
3258	...do...	10.06 a. m.	51 32 00	176 49 00	78	gy. S. Sh.......	50	47	.....	...do	25
3259	...do...	11.23 a. m.	51 28 00	176 49 00	172	gy. S. P........	50	47	39.4	Sigsbee..	35
3260	...do...	12.02 p. m.	51 24 00	176 50 00	428	gy. S. Sh.......	52	44	38.6	...do	35
3261	July 6	8.53 a. m.	51 19 00	176 39 00	1,622	bk. S. brk. Sh ..	48	44	38.5	...do	35
3262	...do...	11.03 a. m.	51 11 00	176 25 00	2,350	gy. oz. fne. S ...	52	44	36.9	...do	60
3263	...do...	2.12 p. m.	51 00 00	176 04 00	2,039	gy. M. S	52	44	37.3	...do	60
3264	...do...	6.27 p. m.	50 41 00	175 30 00	3,323	gy. M. S	49	48	39.6	...do	60
3265	...do...	10.24 p. m.	50 28 00	175 10 00	4,002	br. oz..........	50	49	34.6	...do	60
3266	July 7	2.44 a. m.	50 16 00	174 51 00	3,191	None obtained.	50	48	.....	...do	60
3267	...do...	6.22 a. m.	50 03 00	174 30 00	2,802	gy. oz	50	49	35.0	...do	60
3268	...do...	12.23 p. m.	50 31 00	173 54 00	3,667	hard	53	49	.....	...do	60
3269	...do...	10.05 p. m.	50 57 00	173 06 00	3,794	br. oz. S	49	48	.....	...do	60
3270	July 8	3.47 a. m.	51 23 00	172 18 00	2,320	br. oz. S	50	49	.....	...do	60
3271	...do...	9.02 a. m.	51 50 00	171 38 00	1,330	fne. bk. S	49	48	.....	...do	60
3272	...do...	3.39 p. m.	52 24 00	171 40 00	250	rky	48	44	.....	Tanner ..	25
3273	...do...	4.55 p. m.	52 31 00	171 42 00	320	fne. G	47	41	.....	...do	25
3274	...do...	6.44 p. m.	52 44 00	171 35 00	97	dk. S. P........	46	41	.....	Sigsbee..	35
3275	...do...	7.53 p. m.	52 54 00	171 29 00	369	fne. bk. S. G ...	45	40	.....	...do	35
3276	July 9	11.06 a. m.	55 04 00	170 11 00	1,554	gn. M. S	49	46	.....	...do	35
3277	...do...	2.57 p. m.	55 36 00	170 02 00	1,626	gn. M..........	48	47	.....	...do	35
3278	...do...	6.48 p. m.	56 06 00	169 58 00	68	gy. S. Sh.......	48	47	.....	...do	35
3279	...do...	7.53 p. m.	56 16 00	169 57 00	72	gy. S. bk. Sp. ..	48	47	.....	Tanner ..	35
3280	...do...	9.46 p. m.	56 35 00	169 55 00	52	S. rky	48	47	.....	.. do	35
3281	July 12	4.20 a. m.	57 18 00	169 38 00	35	gy. S. Sh.......	42	42	.....	...do	25
3282	...do...	7.01 p. m.	57 18 00	172 20 00	62	gn. M	43	44	38.0	...do	25
3283	...do...	7.37 p. m.	57 18 00	172 27 00	62	gn. M. S	43	44	36.6	...do	25
3284	...do...	9.53 p. m.	57 18 00	172 43 00	62	Co.............	42	44	38.0	...do	25
3285	...do...	10.35 p. m.	57 18 00	172 51 00	64	gn. M	43	44	37.0	...do	25
3286	...do...	11.38 p. m.	57 18 00	173 00 00	65	gn. M	43	44	37.0	...do	25
3287	July 13	12.22 a. m.	57 18 00	173 09 00	66	gn. M	42	44	37.0	...do	25
3288	...do...	1.09 a. m.	57 18 00	173 18 00	67	rky............	42	44	37.0	...do	25
3289	...do...	1.50 a. m.	57 19 00	173 27 00	69	rky............	42	43	37.8	...do	25
3290	...do...	2.30 a. m.	57 19 00	173 36 00	71	gn. M	42	43	38.0	...do	25
3291	...do...	3.12 a. m.	57 19 00	173 45 00	82	rky............	42	42	37.8	...do	25
3292	...do...	6.14 a. m.	57 16 00	173 46 00	78	gn. M. fne. S ...	43	43	37.9	...do	25
3293	...do...	7.02 a. m.	57 11 00	173 42 00	77	gy. S...........	43	43	37.7	...do	25
3294	...do...	8.47 a. m.	57 06 00	173 42 00	81	gy. S...........	43	43	38.0	...do	25
3295	...do...	12.37 p. m.	56 51 00	173 37 00	516	gn. M. S	47	45	37.0	Sigsbee..	35
3296	...do...	4.41 p. m.	56 42 00	173 18 00	80	fne. gy. S. rky..	46	46	37.7	...do	35
3297	...do...	5.30 p. m.	56 37 00	173 21 00	80	fne.gy.S.bk.Sp.	46	46	37.7	...do	35
3298	...do...	6.14 p. m.	56 32 00	173 24 00	797	yl. M G	46	46	36.2	...do	35
3299	...do...	7.25 p. m.	56 29 00	173 19 00	1,188	None obtained.	47	46	35.5	...do	35
3300	...do...	10.18 p. m.	56 30 00	172 56 00	74	gy. S...........	46	45	38.0	...do	35
3301	July 14	2.21 a. m.	56 30 00	172 25 00	100	fne.gy.S.bk.Sp.	46	44	38.0	Tanner ..	25
3302	July 17	11.10 a. m.	56 07 00	169 33 00	260	fne. gy. S	49	46	38.3	Sigsbee..	35
3303	...do...	10.47 p. m.	55 24 00	168 34 00	843	fne. gy. S	48	45	.....	...do	35
3304	July 18	2.41 a. m.	55 09 00	168 11 00	809	fne. gy. S	51	45	.....	...do	35
3305	...do...	5.28 a. m.	54 56 00	167 44 00	756	gn. M. vol. S ...	50	46	.....	...do	35
3306	...do...	8.42 a. m.	54 42 00	167 39 00	442	gn. M	50	48	.....	...do	35
3307	July 28	12.28 p. m.	57 03 00	169 54 00	35	fne. gy. S	50	44	41.9	Tanner ..	25
3308	...do...	5.19 p. m.	57 03 00	168 52 00	43	gy. S. Sh.......	50	45	37.6	...do	25
3309	...do...	10.56 p. m.	57 15 00	167 42 00	41	fne. gy. S	45	43	36.0	...do	25
3310	July 29	1.29 a. m.	57 21 00	167 05 00	33	fne. bk. S	45	42	35.0	...do	25
3311	...do...	4.04 a. m.	57 27 00	166 30 00	38	fne. S. bk. M ...	45	42	34.8	...do	25

Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894—Continued.

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperature. Air.	Temperature. Surface.	Temperature. Bottom.	Instrument used.	Weight of sinker.
	1893.		° ′ ″	° ′ ″	Fms.		° F.	° F.	° F.		Lbs.
3312	July 29	9.46 a. m.	57 38 00	165 20 00	35	fne. S. dk. M	45	42	35.5	Tanner	25
3313	...do...	5.14 p. m.	58 13 00	164 47 00	26	fne. gy. S	44	42	41.4	...do	25
3314	...do...	11.22 p. m.	58 42 00	165 30 00	22	gy. S	43	41	41.8	...do	25
3315	July 30	2.04 a. m.	58 51 00	166 11 00	21	fne. gy. S	42	41	41.0	...do	25
3316	...do...	5.00 a. m.	58 36 00	166 38 00	25	fne. gy. S	42	41	40.1	...do	25
3317	...do...	8.31 a. m.	58 22 00	167 04 00	29	crs. gy. S	44	42	37.0	...do	25
3318	...do...	1.16 p. m.	58 07 00	167 29 00	36	gn. M. fne. S	45	42	35.5	...do	25
3319	...do...	5.50 p. m.	57 52 00	167 54 00	38	dk. M. fne. S	46	43	37.5	...do	25
3320	...do...	10.27 p. m.	57 38 00	168 19 00	36	fne. gy. S	46	43	36.1	...do	25
3321	July 31	3.22 a. m.	57 24 00	168 42 00	41	gy. S. rky	46	44	36.8	...do	25
3322	...do...	6.49 a. m.	57 10 00	169 05 00	42	fne. gy. S. bk. Sp	46	44	37.3	...do	25
3323	Aug. 1	4.44 p. m.	58 08 30	169 14 00	38	dk. M. fne. S	47	45	31.8	...do	25
3324	...do...	10.44 p. m.	58 45 30	168 48 00	30	fne. gy. S. M	44	43	33.9	...do	25
3325	Aug. 2	1.16 a. m.	59 04 00	168 34 00	24	fne. gy. S. bk. Sp	43	42	39.8	...do	25
3326	...do...	7.36 a. m.	59 41 00	168 06 00	22	fne. gy. S. Sh	42	41	41.1	...do	25
3327	...do...	10.07 a. m.	59 55 00	167 55 00	14	gy. S	42	42	.....	Bassnett tube.	25
3328	...do...	10.22 a. m.	59 56 00	167 54 00	16	gy. S. Sh	42	42	.....	...do	25
3329	...do...	10.37 a. m.	59 58 00	167 53 00	14	fne. gy. S	42	42	.....	...do	25
3330	...do...	11.35 a. m.	60 00 00	167 53 00	14	fne. gy. S	42	42	.....	...do	25
3331	...do...	11.50 a. m.	60 01 30	167 54 00	14	fne. gy. S	42	42	.....	...do	25
3332	...do...	12.05 p. m.	60 03 00	167 55 00	14	fne. gy. S	42	42	.....	...do	25
3333	...do...	12.20 p. m.	60 05 00	167 56 00	15	fne. gy. S	42	42	.....	...do	25
3334	...do...	12.35 p. m.	60 06 30	167 57 00	16	fne. gy. S	42	42	.....	...do	25
3335	...do...	12.50 p. m.	60 08 00	167 58 00	15	fne. gy. S	42	42	.....	...do	25
3336	...do...	1.05 p. m.	60 09 30	167 59 00	15	fne. gy. S. bk. Sh	42	42	.....	...do	25
3337	...do...	1.20 p. m.	60 11 00	168 00 00	16	fne. gy. S	42	42	.....	...do	25
3338	...do...	1.35 p. m.	60 13 00	168 01 00	16	fne. gy. S. bk. Sh	42	42	.....	...do	25
3339	...do...	1.50 p. m.	60 14 30	168 02 00	16	fne. gy. S	42	42	.....	...do	25
3340	...do...	2.05 p. m.	60 16 00	168 03 00	16	fne. gy. S	42	43	.....	...do	25
3341	...do...	2.20 p. m.	60 17 30	168 04 00	16	fne. gy. S	43	43	.....	...do	25
3342	...do...	2.35 p. m.	60 19 00	168 05 00	16	fne. gy. S	43	43	.....	...do	25
3343	...do...	2.50 p. m.	60 21 00	168 05 00	17	fne. gy. S. bk. Sh	43	43	.....	...do	25
3344	...do...	3.05 p. m.	60 22 00	168 06 00	16	fne. gy. S	43	43	.....	...do	25
3345	...do...	3.20 p. m.	60 24 00	168 07 00	19	fne. gy. S. bk. Sh	43	43	.....	...do	25
3346	...do...	3.35 p. m.	60 26 00	168 08 00	19	fne. gy. S	43	43	.....	...do	25
3347	...do...	11.45 p. m.	60 26 00	169 54 00	27	gn. M. fne. S	41	41	35.3	Tanner	25
3348	Aug. 3	3.10 a. m.	60 24 00	170 48 00	35	bk. M	42	42	32.0	...do	25
3349	...do...	1.15 p. m.	59 47 00	171 08 00	38	dk. M	43	43	31.8	...do	25
3350	...do...	11.01 p. m.	58 52 00	170 38 00	40	bk. M	45	44	30.8	...do	25
3351	Aug. 4	2.39 a. m.	58 33 00	170 28 00	42	None obtained	46	43	.....	...do	25
3352	...do...	6.11 a. m.	58 15 00	170 18 00	40	gn. M. fne. S	46	44	35.4	...do	25
3353	Aug. 5	4.15 a. m.	57 24 00	170 24 00	37	fne. gy. S. Sh	47	43	40.3	...do	25
3354	...do...	1.53 p. m.	58 04 00	171 41 00	55	gn. M	48	45	37.4	...do	25
3355	...do...	11.29 p. m.	58 52 00	172 45 00	57	gn. M	46	44	35.3	...do	25
3356	Aug. 6	2.04 a. m.	59 09 00	173 09 00	57	gn. M	45	43	34.2	...do	25
3357	...do...	4.42 a. m.	59 24 00	173 31 00	57	gn. M	45	43	35.7	...do	25
3358	...do...	3.46 p. m.	59 33 00	175 00 00	70	gn. M	51	46	36.7	...do	25
3359	Aug. 7	12.02 a. m.	58 43 00	176 10 00	71	gn. M	44	44	.....	Sigsbee	35
3360	...do...	5.02 a. m.	58 11 00	176 38 00	1,744	gn. M. fne. S	45	44	35.5	...do	35
3361	...do...	10.16 a. m.	58 01 00	175 41 00	1,367	gn. M. fne. S	48	46	35.2	...do	35
3362	...do...	5.10 p. m.	57 41 00	174 05 00	77	gn. M	49	47	38.0	...do	35
3363	...do...	11.12 p. m.	57 25 00	172 50 00	69	dk. gn. M. fne. S	47	45	37.8	Tanner	25
3364	Aug. 8	4.13 a. m.	57 08 00	171 38 00	60	gn. M	47	45	37.8	...do	25
3365	Aug. 9	4.21 a. m.	56 49 00	169 42 00	37	fne. S. Sh	46	44	40.9	...do	25
3366	...do...	1.09 p. m.	56 37 00	167 55 00	59	gn. M. S	49	46	38.0	...do	25
3367	...do...	6.39 p. m.	56 31 00	166 43 00	55	dk. gn. M. fne. S.	48	46	37.5	...do	25
3368	Aug. 10	12.18 a. m.	56 23 00	165 28 00	48	gn. M. fne. S	48	45	36.5	...do	25
3369	...do...	2.47 a. m.	56 18 00	164 48 00	49	fne. gy. S	48	45	36.4	...do	25
3370	...do...	7.10 p. m.	54 53 15	164 25 40	20	dk. gy. S. Lava.	53	47	.....	Bassnett tube.	25
3371	...do...	7.20 p. m.	54 52 00	164 26 20	17	dk. gy. S. Lava.	53	47	.....	...do	25
3372	...do...	7.25 p. m.	54 51 30	164 26 40	15	dk. gy. S	53	47	.....	...do	25
3373	...do...	7.30 p. m.	54 51 00	164 27 00	14	dk. gy. S	53	47	.....	...do	25
3374	...do...	7.35 p. m.	54 50 30	164 27 20	9	dk. gy. S	53	47	.....	...do	25
3375	Aug. 17	7.13 a. m.	53 25 00	167 33 00	43	bk. S	47	46	41.8	Tanner	25
3376	...do...	9.21 a. m.	53 35 00	167 53 00	89	G	47	44	40.3	Sigsbee	35
3377	...do...	9.53 a. m.	53 38 00	167 59 00	407	fne. gy. S. bk. Sp	48	44	37.9	...do	35
3378	...do...	11.08 a. m.	53 45 00	168 01 30	755	gn. M. fne. S	48	44	36.2	...do	35
3379	...do...	12.10 p. m.	53 52 00	168 01 30	717	dk. S. fne. G	48	47	36.5	...do	35
3380	...do...	1.20 p. m.	53 56 00	168 07 00	781	bk. vol. S	48	47	36.6	...do	35
3381	...do...	2.57 p. m.	54 04 00	168 14 00	1,263	gy. S	49	48	35.8	...do	35
3382	...do...	7.05 p. m.	54 30 00	168 35 00	822	hard	49	47	36.4	...do	35
3383	...do...	11.16 p. m.	54 56 00	168 56 00	1,205	gy. S	48	46	35.9	...do	35
3384	Aug. 18	3.20 a. m.	55 22 00	169 17 00	1,187	gn. M. S	48	47	35.9	...do	60
3385	...do...	7.20 a. m.	55 50 00	169 24 00	1,036	gn. M. S	48	47	36.0	...do	35
3386	...do...	9.01 a. m.	55 59 00	169 27 00	341	gn. M. crs. bk. S	49	47	38.3	...do	35
3387	...do...	10.25 a. m.	56 09 00	169 29 00	292	dk. M	49	48	38.7	Tanner	25

Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperature.			Instrument used.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1893.		° ′ ″	° ′ ″	Fms.		° F.	° F.	° F.		Lbs.
3388	Aug. 18	11.50 a. m.	56 19 00	169 32 00	74	gy. S. G	49	48	.....	Tanner	25
3389	...do	10.18 p. m.	56 47 00	170 34 00	57	dk. M	46	43	.....	...do	25
3390	Aug. 19	12.39 a. m.	56 45 00	171 10 00	63	fne.gy.S.bk.Sp	46	45	.....	...do	25
3391	...do	2.56 a. m.	56 42 00	171 45 00	65	fne.gy.S.bk.Sp	46	45	.....	...do	25
3392	...do	5.19 a. m.	56 39 00	172 21 00	76	gy. S. M	47	45	38.9	...do	25
3393	...do	8.02 a. m.	56 36 00	172 56 00	346	gn. M	46	46	38.1	...do	25
3394	...do	10.47 a. m.	56 32 00	173 32 00	1,631	bl. M. fne. S. G	47	46	35.4	Sigsbee	35
3395	...do	3.02 p. m.	56 29 00	174 26 00	1,787	crs. bk. S	48	47	35.4	...do	35
3396	...do	8.11 p. m.	56 25 00	175 35 00	2,000	gn. M. fne. S. bk. Sp.	47	47	35.4	...do	60
3397	Aug. 20	2.11 a. m.	56 21 00	176 45 00	2,049	gn. M	48	47	35.0	...do	60
3398	...do	9.45 a. m.	55 25 00	176 13 00	2,055	gn. M. fne. S	48	47	35.1	...do	60
3399	...do	4.21 p. m.	54 38 00	175 27 00	2,041	gn. M. S	56	49	35.1	...do	60
3400	...do	11.18 p. m.	55 00 00	174 32 00	1,996	gn. M. fne. S	48	47	35.3	...do	60
3401	Aug. 21	4.48 a. m.	55 23 00	173 38 00	1,928	gn. M. fne. S	48	47	35.5	...do	60
3402	...do	10.04 a. m.	55 46 00	172 44 00	1,833	gn. M. fne. S	51	48	35.1	...do	60
3403	...do	10.52 p. m.	56 26 00	171 04 00	171	gn. M. fne. S	50	46	.....	Tanner	35
3404	Aug. 22	1.07 a. m.	56 18 00	170 34 00	69	gn. M. fne. S	49	46	39.0	...do	25
3405	...do	4.09 a. m.	56 01 00	170 50 00	924	gn. M. crs. S	48	47	36.0	Sigsbee	35
3406	...do	7.16 a. m.	55 43 00	171 07 00	1,647	gn. M. fne. S	49	48	35.4	...do	60
3407	...do	1.46 p. m.	54 59 00	171 49 00	1,867	gn. M	49	48	35.1	...do	60
3408	...do	8.03 p. m.	54 17 00	172 30 00	1,932	gn. M. fne. S	48	47	35.0	...do	60
3409	Aug. 23	9.25 a. m.	53 48 00	173 11 00	1,948	br. M. dk. S	50	48	35.1	...do	60
3410	...do	4.25 p. m.	53 29 00	171 51 00	1,429	gn. M. bk. S	50	48	35.2	...do	60
3411	...do	10.25 p. m.	53 09 00	170 31 00	1,027	bk. S	50	48	35.8	...do	60
3412	Aug. 24	9.00 a. m.	53 38 00	170 39 00	1,171	bk. S. C	48	47	.....	...do	60
3413	...do	5.43 p. m.	54 08 00	170 47 00	1,053	gn. M. fne. S	49	48	.....	...do	60
3414	Aug. 31	9.01 a. m.	54 13 00	165 58 00	42	dk. gy. S	51	46	44.6	Tanner	25
3415	...do	9.48 a. m.	54 10 00	165 54 00	42	dk. gy. S	51	46	45.0	...do	25
3416	...do	10.46 a. m.	54 07 00	165 51 00	38	bk. M. fne. S	54	47	45.0	...do	25
3417	...do	1.56 p. m.	54 18 00	165 41 00	45	G. brk. Sh	51	46	45.9	...do	25
3418	...do	3.49 p. m.	54 26 00	165 28 00	84	G. crs. bk. S	50	46	41.5	...do	25
3419	...do	5.52 p. m.	54 14 00	165 33 00	23	fne. gy. S	55	47	.....	Bassnett tube.	25
3420	...do	5.57 p. m.	54 13 45	165 33 30	23	fne. gy. S	55	47	.....	...do	25
3421	...do	6.03 p. m.	54 13 30	165 34 00	28	fne. gy. S	55	47	.....	...do	25
3422	...do	6.09 p. m.	54 13 15	165 34 30	25	fne.gy.S.bk.Sp	55	47	.....	...do	25
3423	...do	6.15 p. m.	54 13 00	165 35 00	26	fne. gy. S. Sh	55	47	.....	...do	25
3424	Sept. 1	7.54 a. m.	54 36 00	165 27 00	113	bk. S. G	50	46	39.0	Tanner	25
3425	...do	2.17 p. m.	55 12 00	166 36 00	81	G. M	53	49	39.9	...do	25
3426	...do	9.28 p. m.	55 47 00	167 53 00	78	fne. bk. S	49	47	38.8	...do	25
3427	...do	11.30 p. m.	55 59 00	168 19 00	79	fne. gy. S	49	46	39.0	...do	25
3428	Sept. 2	1.37 a. m.	56 11 00	168 45 00	97	fne. dk. S	48	46	39.0	...do	25
3429	...do	5.03 a. m.	56 22 00	169 09 00	77	crs. S. G	49	47	40.0	...do	25
3429a	...do	9.33 a. m.	56 28 00	170 04 00	61	gn. M. fne. S	49	47	39.3	...do	25
3430	...do	2.36 p. m.	56 55 00	170 18 00	47	gn. M. fne. S	49	46	40.6	...do	25
3431	Sept. 3	11.48 a. m.	56 48 00	169 26 00	43	gn. M	47	45	39.0	...do	25
3432	Sept. 8	7.28 a. m.	54 01 30	166 23 00	42	bk. S. G	51	47	44.7	...do	25
3433	...do	7.54 a. m.	54 05 00	166 18 00	49	rky	52	47	43.2	...do	25
3434	...do	8.39 a. m.	54 09 00	166 15 00	54	G. brk. Sh	52	45	42.5	...do	25
3435	...do	9.14 a. m.	54 12 00	166 09 00	57	dk. G	51	45	42.1	...do	25
3436	...do	10.46 a. m.	54 16 40	165 50 00	49	dk. gy. S	51	45	44.0	...do	25
3437	...do	12.00 m.	54 18 00	165 40 00	50	gy. S. brk. Sh	57	46	43.0	...do	25
3438	...do	12.27 p. m.	54 15 30	165 32 00	51	crs. dk. S. brk. Sh.	57	46	42.9	...do	25
3439	Sept. 9	7.56 a. m.	54 27 00	163 55 00	52	fne. gy. S. bk. Sp.	52	48	46.5	...do	25
3440	...do	10.02 a. m.	54 32 00	163 31 00	54	bk. S. G	55	48	44.0	...do	25
3441	...do	10.54 a. m.	54 33 00	163 19 00	61	bk. G	55	48	42.8	...do	25
3442	...do	12.50 p. m.	54 39 00	163 05 00	35	fne. G. brk. Sh	53	47	45.6	...do	25
3443	...do	1.11 p. m.	54 40 00	163 03 00	37	G. brk. Sh	53	47	.....	...do	25
3444	...do	1.47 p. m.	54 44 00	162 56 00	41	rky	53	47	.....	Bassnett tube.	25
3445	...do	2.10 p. m.	54 46 00	162 52 00	30	crs. dk. S	51	48	.....	...do	25
3446	...do	2.40 p. m.	54 48 00	162 50 00	33	bk. S	51	48	.....	...do	25
3447	...do	3.19 p. m.	54 51 00	162 43 00	23	rky	51	49	.....	...do	25
3448	...do	3.35 p. m.	54 52 00	162 41 00	15	brk. Sh	51	49	.....	...do	25
3449	...do	3.47 p. m.	54 53 00	162 39 00	18	G. brk. Sh	51	49	.....	...do	25
3450	...do	3.58 p. m.	54 53 30	162 38 00	15	G. brk. Sh	51	49	.....	...do	25
3451	...do	4.08 p. m.	54 54 00	162 37 00	10	bk. S. brk. Sh	51	49	.....	...do	25
3452	Sept. 11	8.43 a. m.	55 12 30	161 53 00	22	bk. S. R	52	48	.....	...do	25
3453	...do	10.43 a. m.	55 18 00	161 18 00	32	dk. S	53	49	.....	...do	25
3454	...do	11.41 a. m.	55 19 00	161 03 00	28	crs. S. G. brk. Sh.	52	49	.....	...do	25
3455	...do	12.43 p. m.	55 23 30	160 54 00	31	gy. S. bk. Sp	52	49	.....	...do	25
3456	...do	12.58 p. m.	55 24 30	160 49 30	32	bk. S	52	49	.....	...do	25
3457	...do	1.19 p. m.	55 25 00	160 45 00	42	fne. bk. S	53	49	.....	...do	25

Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894—Continued.

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperature. Air.	Temperature. Surface.	Temperature. Bottom.	Instrument used.	Weight of sinker.
	1893.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
3458	Sept. 11	1.30 p. m.	55 26 00	160 41 00	36	brk. Sh	53	49	.....	Bassnett tube.	25
3459	...do...	1.44 p. m.	55 28 00	160 37 00	21	brk. Sh	53	49	.....		25
3460	...do...	1.50 p. m.	55 29 00	160 35 00	19	G. brk. Sh	52	48	.....	...do.....	25
3461	...do...	2.01 p. m.	55 30 00	160 34 30	13	bk. S. Sh	52	48	.....	...do.....	25
3462	...do...	2.08 p. m.	55 31 00	160 35 00	27	fne. bk. S. Sh	52	48	.....	...do.....	25
3463	...do...	2.14 p. m.	55 32 00	160 35 00	31	fne. bk. S	52	48	.....	...do.....	25
3464	...do...	2.21 p. m.	55 33 00	160 35 00	38	bk. S	52	48	.....	...do.....	25
3465	...do...	2.28 p. m.	55 34 00	160 35 00	38	gy. S. Sh	52	48	.....	...do.....	25
3466	...do...	2.35 p. m.	55 35 00	160 35 00	42	bk. S	52	49	.....	...do.....	25
3467	...do...	2.40 p. m.	55 35 30	160 35 00	31	bk. S. Sh	52	49	.....	...do.....	25
3468	...do...	2.43 p. m.	55 36 00	160 35 00	26	bk. S	52	49	.....	...do.....	25
3469	Sept. 14	8.09 a. m.	57 14 00	151 52 00	46	gy. S. brk. Sh	48	47	.....	Tanner	25
3470	...do...	5.56 p. m.	57 24 00	149 33 00	938	rky	48	47	36.1	Sigsbee	35
3471	...do...	8.06 p. m.	57 21 00	149 11 00	1,427	bl. M. S	49	47	35.1	...do.....	60
3472	...do...	10.52 p. m.	57 18 00	148 38 00	1,961	br. M. fne. S	50	48	35.1	...do.....	60
3473	Sept. 15	1.53 a. m.	57 14 00	148 06 00	2,741	br. M	50	47	35.0	...do.....	60
3474	...do...	5.39 a. m.	57 08 00	147 22 00	2,587	br. M	53	51	35.0	...do.....	60
3475	...do...	9.20 a. m.	57 11 00	146 41 00	2,320	gy. Oz	57	51	35.0	...do.....	60
3476	...do...	1.10 p. m.	57 15 00	145 52 00	2,150	gy. Oz	56	51	34.6	...do.....	60
3477	...do...	4.50 p. m.	57 18 00	145 05 00	2,149	gy. Oz	59	52	35.1	...do.....	60
3478	...do...	8.44 p. m.	57 20 00	144 17 00	2,119	gy. Oz	53	51	35.1	...do.....	60
3479	Sept. 16	12.26 a. m.	57 20 00	143 27 00	2,099	gy. Oz	53	51	35.1	...do.....	60
3480	...do...	4.35 a. m.	57 17 00	142 28 00	2,034	gy. Oz	53	51	35.1	...do.....	60
3481	...do...	8.40 a. m.	57 12 00	141 31 00	1,946	lt. br. Oz	55	52	35.1	...do.....	60
3482	...do...	1.02 p. m.	57 09 30	140 37 00	1,826	lt. br. Oz	58	54	35.1	...do.....	60
3483	...do...	5.05 p. m.	57 09 00	139 38 00	1,868	br. Oz	59	55	35.0	...do.....	60
3484	...do...	9.12 p. m.	57 07 00	138 40 00	1,724	br. and gy. Oz	54	53	35.1	...do.....	60
3485	Sept. 17	1.25 a. m.	57 04 00	137 43 00	1,553	gy. Oz	53	51	35.1	...do.....	60
3486	...do...	5.28 a. m.	57 01 00	136 46 00	1,270	br. M	53	52	35.1	...do.....	60
3487	...do...	7.44 a. m.	57 00 00	136 12 30	756	gn. M. S	55	53	38.9	...do.....	35
3488	...do...	9.43 a. m.	56 58 40	135 47 30	55	rky	55	54	45.0	Tanner	25

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. E.	Depth.	Character of bottom.	Temperature. Air.	Temperature. Surface.	Temperature. Bottom.	Remarks.
	1894.		° ′ ″	° ′ ″	*Fms.*					
Hy. 3490	June 6	9.00 p. m.	52 46 30	175 27 00	2,237	No specimen	44	40	.....	
Hy. 3491	June 7	5.06 a. m.	52 41 30	176 24 00	2,107	br. M. fne. S.	40	39	3.50	
Dr. 3598	June 8	3.18 p. m.	52 01 00	177 34 00	34	bk. G	43	40	.....	Beam-trawl.
Dr. 3599	June 9	10.49 a. m.	52 05 00	177 40 00	55	rky. fne. S. Sh	43	42	.....	Do.
				West.						
Dr. 3600	June 26	3.41 p. m.	55 06 00	163 28 00	9	fne. dk. vol. S	43	41	40.0	Beam-trawl.
Hy. 3492	June 29	1.08 p. m.	57 59 00	166 04 00	32	gy. S	44	38	33.0	Fished.
Hy. 3493	...do...	4.16 p. m.	58 06 00	165 22 00	26	fne. gy. S	45	38	35.7	Do.
Hy. 3494	...do...	11.55 p. m.	58 24 00	163 38 00	21	fne. gy. S	40	37	34.5	
Hy. 3495	June 30	7.36 a. m.	57 28 00	163 14 00	27	fne. gy. S	38	38	34.0	Do.
Hy. 3496	...do...	12.03 p. m.	56 59 00	163 02 00	34	fne. gy. S	42	40	32.0	Do.
Hy. 3497	...do...	3.24 p. m.	56 59 00	163 48 00	37	fne. gy. S	42	40	34.3	Do.
Hy. 3498	...do...	9.34 p. m.	56 58 00	165 15 00	44	gn. M	41	38	34.0	

Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross.

Serial No.	Date.	Time.	Position. Lat. N.	Position. Long. W.	Temperatures. Air.	Temperatures. Surface.	Temperatures. Bottom.	Depth.	Character of bottom.	Wind. Direction.	Wind. Force.	Drift. Direction.	Drift. Distance.	Instrument used, etc.
	1893.		° ′ ″	° ′ ″	° F.	° F.	° F.	Fms.					Miles.	
3477	Apr. 26	9.20 a. m.	36 50 00	121 59 45	54	51	46.5	80	rky	North	1			L. B. T.
3478	...do	11.24 a. m.	36 44 45	120 57 00	56	53		68	gy. S. M.	SW	2			L. B. T., surface tow net.
3479	Apr. 27	6.55 a. m.	37 28 00	123 00 00	52	50		276	gn. M. fne. S.	WNW	3			L. B. T.
3480	July 8	11.02 a. m.	52 06 00	171 45 00	50	47		283	bk. S. Co. rky	West	2			L. B. T.
3481	...do	1.29 p. m.	52 15 00	171 40 00	51	48		248	bk. S. G.	West	2			L. B. T. and swabs.
3482	July 12	9.05 a. m.	57 18 00	170 42 00	43	42	38.9	42	gn. M. fne. S.	SW	3	WSW. $\frac{1}{2}$ W	0.7	S. B. T. and swabs.
3483	...do	12.32 p. m.	57 18 00	171 18 00	44	42	36.8	56	gn. M.	SW	3	S. by E.	0.5	Do.
3484	...do	4.11 p. m.	57 18 00	171 54 00	43	44	37.4	60	bu. M.	SW. by W.	3	SW. $\frac{1}{2}$ W.	1.0	L. B. T. and mud bag.
3485	...do	8.13 p. m.	57 18 00	172 34 00	42	44	37.1	62	gn. M.	SW. by W.	2	S. by W. $\frac{1}{4}$ W.	0.7	L. B. T.
3486	July 13	3.51 a. m.	57 19 00	173 53 00	43	43	38	150	gn. M. fne. S.	SW	1	ESE. $\frac{1}{2}$ E.	1.0	L. B. T. and mud bag.
3487	...do	7.24 a. m.	57 10 00	173 45 00	43	43	37.6	81	gn. M. fne. S.	SE.	1			Do.
3488	...do	9.14 a. m.	57 05 00	173 47 00	45	45	37.3	106	gn. M. gy. S.	SE.	1	E. $\frac{1}{2}$ N.	1.2	Do.
3489	...do	10.22 a. m.	57 00 00	173 14 00	47	46	38.5	184	gn. M. gy. S.	SE.	1	E. $\frac{1}{4}$ S.	1.2	Do.
3490	...do	3.09 p. m.	56 47 00	173 14 00	46	46	38	78	gn. M. fne. S.	E. by N.	3	NE. by E.	1.3	Do.
3491	July 14	4.05 a. m.	56 32 00	172 28 00	45	44		103	gn. M. fne. gy. S.	ENE	3.5	NE	2.5	Do.
3492	...do	8.12 a. m.	56 32 00	171 50 00	46	45	37.8	70	gn. M. fne. S.	NNE	5	NE. by E.	0.8	Do.
3493	...do	11.12 a. m.	56 33 00	171 20 00	47	46	38.5	67	gn. M. fne. S.	NNE	4	E. by S.	0.3	Do.
3494	...do	2.56 p. m.	56 34 00	170 34 00	50	46	38.5	65	gn. M. fne. S.	North	3	ENE	1.2	L. B. T.
3495	...do	5.55 p. m.	56 37 00	170 01 00	46	45	38.5	56	gn. M. fne. S.	North	2	NE. by E.	1.2	L. B. T.
3496	July 17	5.45 a. m.	56 32 00	169 45 00	48	42	39.9	41	gy. S. St. gn. M.	SW	3	SE. by E.	0.1	L. B. T. and mud bag.
3497	...do	8.09 a. m.	56 18 00	169 38 00	48	42	38.7	86	gy. S. bk. Sp.	SW	3	SE. by S.	1.2	Do.
3498	...do	9.10 a. m.	56 13 00	169 36 00	48	45	38.6	142	fne. gy. S. G.	SW	3	SE. by E.	0.8	Do.
3499	...do	9.51 a. m.	56 12 00	169 35 00	49	46	38.5	162	fne. gy. S. G.	SW	3	SE. by S.	0.4	L. B. T.
3500	...do	11.53 a. m.	56 02 00	169 30 00	49	46	38.6	121	fne. gy. S. G.	South	3	SE. by S.	0.7	L. B. T., surface tow net.
3501	...do	2.16 p. m.	55 51 00	169 18 00	50	47	36.9	688	gn. M.	South	3	SE. $\frac{3}{8}$ E.	4.0	Do.
3502	...do	6.55 p. m.	55 38 00	169 00 00	49	46		368	gn. M. dk. S.	SSW	3	SE. $\frac{3}{8}$ E.	0.5	Do.
3503	July 28	10.44 a. m.	57 06 15	170 11 00	54	43	37.9	17	gn. M. fne. S.	NW	3	NE. by E. $\frac{1}{2}$ E.	0.3	S. B. T.
3504	...do	2.23 p. m.	56 57 00	169 27 00	54	45	37.8	34	fne. gy. S. bk. Sp.	WNW	2	NE. by E	0.2	L. B. T.
3505	...do	7.55 p. m.	57 09 00	168 17 00	46	44	38.1	44	fne. gy. S.	WNW	4	E. by N.	0.5	L. B. T.
3506	July 29	6.39 a. m.	57 33 00	165 55 00	43	42	32	36	gy. S. M.	NE	2	NNW. $\frac{1}{2}$ W	0.8	L. B. T.
3507	...do	1.00 p. m.	57 43 00	164 42 00	50	43	37.5	31	fne. gy. S.	NNW	2	NNW. $\frac{1}{8}$ W	0.8	L. B. T., surface tow net.
3508	...do	7.33 p. m.	58 33 00	164 49 00	43	41	42	23	fne. gy. S. Sh.	NW	2	W. $\frac{1}{2}$ S	1.0	Do.
3509	July 31	11.09 a. m.	57 00 00	169 43 00	46	43	40.8	35	fne. gy. S. Sh.	SE.	1	W. $\frac{1}{2}$ S	0.3	R. D.
3510	Aug. 1	6.14 a. m.	57 12 30	169 51 00	47	43	40.1	27	Sh. bk. S.	NE	4	NNW	1.7	L. B. T.
3511	...do	10.10 a. m.	57 32 00	169 38 00	48	44	37.2	39	fne. S. dk. M.	N. by E.	4	NW. by W	0.6	L. B. T.
3512	...do	1.34 p. m.	57 49 30	169 27 00	49	45	36.6	38	fne. S. gn. M.	NW	3	NE	0.5	R. D.
3513	...do	7.43 p. m.	58 27 00	169 01 00	46	43		35	fne. S. gn. M.	NNW	4	North	0.7	L. B. T. and mud bag.
3514	Aug. 2	4.05 a. m.	59 22 00	168 21 00	40	40	40.8	21	fne. gy. S.	NW. by W.	4	North	0.6	L. B. T.
3515	...do	10.43 a. m.	59 59 00	167 53 00	42	42	41.8	13	fne. gy. S.	NNW	4	North	0.6	L. B. T. and mud bag.
3516	...do	3.57 p. m.	60 28 00	168 08 00	43	44	43.2	17	fne. gy. S.	NW	3	WSW. $\frac{3}{4}$ W	0.2	L. B. T.
3517	...do	8.01 p. m.	60 27 00	169 04 00	41	41	40.3	24	fne. gy. S.	West	4	WSW. $\frac{3}{4}$ W	1.0	L. B. T., surface tow net.
3518	Aug. 3	6.40 a. m.	60 22 00	171 42 00	41	42	33.9	36	gn. M.	West	3	SSE. $\frac{1}{2}$ E.	1.0	Do.

3519	...do	10.03 a. m.	60 06 00	171 25 00	43	42	31.1	37	bk. M. fne. S	SSE	2	ESE	0.5	Do.
3520	...do	4.10 p. m.	59 28 00	170 57 00	43	43	32.2	38	gn. M. fne. S	SE........	3	E. by S	0.7	L. B. T. and mud bag, surface tow net.
3521	...do	7.35 p. m.	59 09 00	170 48 00	43	43	31.9	40	gn. M. fne. S	SE........	5	ESE............	0.5	L. B. T., surface tow net.
3522	Aug. 4	9.24 a. m.	57 58 00	170 09 00	46	44	35.7	41	crs. gy. S. G	SW	4	SSE	1.0	L. B. T. and mud bag, surface tow net.
3523	...do	1.18 p. m.	57 39 00	170 02 00	47	45	38	39	gn. M. fne. S	SSW	3	SSE	0.7	L. B. T., surface tow net.
3524	...do	4.08 p. m.	57 24 00	169 56 00	46	45	40.3	36	gy. S. P	SSW	4	SSE	1.3	Do.
3525	...do	5.40 p. m.	57 21 00	170 05 00	46	45	41.6	29	bk. S. Sh	SSE	4	SE. ½ E.........	0.7	R. D.
3526	Aug. 5	7.24 a. m.	57 31 00	170 57 00	47	44	38.9	49	dk. M. fne. S	SSW	3	NW. by W........	0.8	R. D.
3527	...do	10.35 a. m.	57 48 00	171 21 00	48	44	38	52	gn. M	SSW	4	NW. by W......	0.8	L. B. T., surface tow net.
3528	...do	5.03 p. m.	58 19 30	172 02 00	47	45	35.9	55	dk. gn. M. fne. S.	SW........	3	NW. by W.......	0.7	L. B. T.
3529	...do	8.18 p. m.	58 36 00	172 24 00	46	45	36.1	56	gn. M	SW........	3	WNW. ¼ W.....	0.7	L. B. T.
3530	Aug. 6	7.33 a. m.	59 39 00	173 53 00	45	44	34.9	59	dk. gn. M. fne. S.	Calm	0	W. ½ N	0.5	L. B. T., surface tow net.
3531	...do	11.00 a. m.	59 55 00	174 17 00	47	46	35.1	59	gn. M	SE.........	1	W. ½ S	1.0	Do.
3532	...do	7.40 p. m.	59 12 00	175 39 00	48	44	34.8	77	dk. gn. M. fne. S.	N. by E...	3	SE...............	1.2	Do.
3533	Aug. 7	7.42 p. m.	57 34 00	173 33 00	47	46	39.2	70	gy. S. bk. Sp.....	NW. by N.	4	NE	0.7	L. B. T.
3534	Aug. 8	5.56 a. m.	57 03 00	171 19 00	47	45	38.1	59	gn. M	NNW	5	NE. by E........	0.9	L. B. T.
3535	...do	8.56 a. m.	57 02 00	170 46 00	48	45	39	52	gn. M. fne. S	NNW	5	NNE	0.8	L. B. T.
3536	...do	10.18 a. m.	57 05 00	170 35 00	48	45	42.4	40	gn. M. fne. S	NNW	5	NNE	0.5	L. B. T.
3537	Aug. 9	6.55 a. m.	54 45 00	169 06 00	45	43	38	49	fne. gy. S.........	SW........	2	E. ½ N.	1.0	L. B. T., surface tow net.
3538	...do	10.13 a. m.	56 41 00	168 29 00	48	46	38	59	gn. M. S..........	West	2	E. ½ N...........	0.8	Do.
3539	...do	3.49 p. m.	56 34 00	167 19 00	49	45	38.9	57	gn. M. S..........	SW	3	E. ½ S	0.5	L. B. T. and mud bag, surface tow net.
3540	...do	9.12 p. m.	56 27 00	166 08 00	47	45	36	51	gn. M. fne. S	SSW.......	3	East	0.6	L. B. T., surface tow net.
3541	Aug. 10	5.19 a. m.	56 14 00	164 08 00	48	46	36.1	49	bk. M. fne. S	SSE	3	E. ½ N...........	0.5	L. B. T. and mud bag, surface tow net.
3542	...do	8.43 a. m.	56 10 00	163 26 00	49	47	39.2	49	dk. M. fne. S	SE.........	3	SE. by E. ½ E....	0.7	L. B. T., surface tow net.
3543	Aug. 18	4.17 p. m.	56 41 00	169 39 00	48	44	42.7	43	bk. S. Sh	WNW......	2	East	1.0	Do.
3544	...do	7.20 p. m.	56 50 00	169 59 00	47	44	41.1	41	fne. gy. S. Sh	NW. by N.	2	WSW	0.5	Do.
3545	Aug. 21	5.07 p. m.	56 15 00	171 33 00	52	48	36	1,020	gn. M. fne. S. C..	West	5	NNE. ⅞ E.......	0.7	Agassiz dredge, surface tow net.
3546	Aug. 31	11.24 a. m.	54 12 00	165• 42 00	54	47	45.6	36	G. bk. S	South.....	2.4	NW	1.0	L. B. T. and mud bag.
3547	...do	12.38 p. m.	54 16 00	165 45 00	54	47	45	51	fne. bk. S........	South.....	2.3	NNE. ¼ E.......	0.7	L. B. T., surface tow net.
3548	Sept. 1	9.03 a. m.	54 44 00	165 42 00	52	47	39.5	91	bk. S............	East	3	W. ½ S	1.5	Do.
3549	...do	11.54 a. m.	55 00 00	166 10 00	53	49	40.1	78	fne. bk. S........	E. by S....	5	WNW	2.0	Do.
3550	...do	4.26 p. m.	55 24 00	167 02 00	51	48	39	76	br. M	NE	5	NNW. ½ W......	0.8	Do.
3551	...do	6.56 p. m.	55 36 00	167 28 00	49	47	39.1	74	gn. M	NE	3	N. by W. ½ W...	1.2	Do.
3552	Sept. 2	6.35 a. m.	56 28 00	169 28 00	50	47	39.8	54	bk. S. rky	North.....	4	NNW. ½ W......	0.5	L. B. T.
3553	...do	7.58 a. m.	56 28 00	169 46 00	48	48	39.5	51	fne. gy. S. M	NNE	3	NNW. ½ W......	0.8	L. B. T., surface tow net.
3554	...do	10.33 a. m.	56 34 00	170 19 00	48	47	39.5	62	gn. M	NE. by N..	4	N. by W. ½ W...	0.7	Do.
3555	...do	12.41 p. m.	56 45 00	170 18 00	47	46	40.2	57	gn. M	NE. by N..	4	N. by W. ½ W...	1.0	Do.
3556	...do	3.21 p. m.	56 57 30	170 33 00	49	46	41	49	gn. M. fne. S	NE	4	NW. by W......	1.5	Do.
3557	...do	4.49 p. m.	57 04 00	170 24 00	48	45	45	26	S. bk. Sp	NE	4	NW	1.0	L. B. T.
3558	Sept. 3	7.04 a. m.	56 58 00	170 09 00	46	45	42.9	25	S. dk. Sp. rky ...	NNE	4	SE. by E. ½ E....	1.0	L. B. T.
3559	...do	9.17 a. m.	56 56 00	169 52 00	47	46	42.5	39	gy. S. brk. Sh ...	NE. by E..	4	East	0.8	L. B. T. and mud bag, surface tow net.
3560	...do	1.10 p. m.	56 40 00	169 20 00	47	45	40.7	43	fne. gy. S. bk. Sp.	NNE	3	E. ½ N...........	0.7	L. B. T.
3561	...do	2.51 p. m.	56 31 00	169 17 00	48	45	40.7	48	gy. S. bk. Sp	NE	3	ESE............	0.8	L. B. T.

Record of boat dredging and trawling stations of the U. S. Fish Commission steamer Albatross.

Serial No.	Date.	Time.	Position, San Diego Bay, California.	Temperatures. Air.	Temperatures. Surface.	Temperatures. Bottom.	Depth.	Character of bottom.	Drift. Direction.	Drift. Distance.	Instrument used, etc.
	1894.			° F.	° F.	° F.	*Fms.*			*Mile.*	
3562	Mar. 19	9.25 a. m.	Coronado Wharf, SW., $\frac{7}{10}$ mile	62	58	......	7	S. bk. Sh	....	0.3	Boat dredge.
3563	...do	10.25 a. m.	Beacon No. 8, W. $\frac{3}{10}$ mile	64	56	......	$6\frac{1}{2}$	fne. S. bk. Sh	....	0.3	Do.
3564	...do	10.50 a. m.	Beacon No. 8, NW. by W. $\frac{1}{2}$ W., $\frac{6}{10}$ mile	66	58	......	5	fne. S. M. bk. Sh.	....	0.3	Do.
3565	...do	11.28 a. m.	Beacon No. 8, NW. by W. $\frac{1}{2}$ W., 1 mile	64	58	......	$4\frac{1}{2}$	fne. S. M. bk. Sh.	....	0.3	Do.
3566	...do	11.56 a. m.	Beacon No. 9, ESE., $\frac{4}{10}$ mile	60	58	......	3	fne. S. bk. Sh	....	0.3	Do.
3567	Mar. 21	9.37 a. m.	Beacon No. 10, SE. $\frac{1}{2}$ S., $\frac{2}{10}$ mile	57	57	......	3	fne. S. bk. Sh	....	0.3	Do.
3568	...do	9.52 a. m.	End National City Wharf, N. by E. $\frac{1}{4}$ E., 200 yards	57	57	......	4	hrd. bk. Sh	....	0.3	Do.
3569	...do	10.06 a. m.	End National City Wharf, NNW., $\frac{6}{10}$ mile	59	57	......	6	fne. S. bk. Sh	....	0.3	Do.
3570	...do	10.24 a. m.	End National City Wharf, N. by W. $\frac{1}{2}$ W., $1\frac{2}{10}$ miles	60	57	......	2	fne. S. oyster Sh.	....	0.3	Do.
3571	...do	11.05 a. m.	End National City Wharf, N. by W. $\frac{1}{2}$ W., $1\frac{7}{10}$ miles	60	57	......	2	hrd	....	0.3	Do.
3572	...do	11.18 a. m.	End National City Wharf, N. by W. $\frac{3}{4}$ W., $2\frac{1}{10}$ miles	58	56	......	2	M. fne. S	....	0.3	Do.
3573	...do	11.44 a. m.	End National City Wharf, N. by W. $\frac{1}{2}$ W., $2\frac{6}{10}$ miles	58	56	......	$1\frac{1}{2}$	M. S	....	0.3	Boat beam-trawl.
3574	...do	2.45 p. m.	Beacon No. 7, NW. by N., $\frac{4}{10}$ mile	64	57	......	$5\frac{3}{4}$	fne. S	....	0.3	Do.
3575	...do	3.12 p. m.	Beacon No. 7, E. $\frac{1}{4}$ N., $\frac{5}{10}$ mile	64	57	......	$6\frac{3}{4}$	fne. S	....	0.3	Do.
3576	...do	3.32 p. m.	Beacon No. 5, W., $\frac{5}{10}$ mile	64	58	......	5	fne. S. bk. Sh	....	0.3	Do.
3577	...do	4.03 p. m.	Beacon No. 5, NNW., $\frac{2}{10}$ mile	65	57	......	6	fne. S. bk. Sh	....	0.3	Do.
3578	...do	4.45 p. m.	Beacon No. 4, ESE., 300 yds	59	56	......	6	fne. S. bk. Sh	....	0.3	Do.
3579	Mar. 22	9.53 a. m.	Beacon No. 3, NNW. $\frac{1}{4}$ W., $\frac{2}{10}$ mile	57	53	......	9	hrd	....	0.2	Do.
3580	...do	10.13 a. m.	Ballast Point Light House, SSE., $\frac{6}{10}$ mile	57	53	......	7	hrd	....	0.1	Do.
3581	...do	10.29 a. m.	Ballast Point Light House, WSW. $\frac{1}{2}$ W., 300 yards	56	53	......	12	fne. S. R	....	0.2	Do.
3582	...do	10.55 a. m.	Point Loma Light House, SW. by W. $\frac{1}{2}$ W., $\frac{8}{10}$ mile	59	54	......	$6\frac{3}{4}$	fne. S. R	....	0.2	Do.
3583	...do	11.10 a. m.	Point Loma Light House, W. $\frac{1}{2}$ S., $\frac{6}{10}$ mile	59	53	......	4	fne. S. R	....	0.2	Do.
3584	...do	11.25 a. m.	Bell Buoy, W. $\frac{1}{2}$ S., 125 yds	58	54	......	8	fne. S. R	....	0.3	Do.
3585	Mar. 24	1.30 p. m.	Beacon No. 8, WNW., $\frac{7}{10}$ mile	63	57	......	4	fne. gy. S	....	0.3	Do.
3586	...do	1.50 p. m.	Beacon No. 9, ESE., $\frac{9}{10}$ mile	63	57	......	4	fne. gy. S	....	0.4	Do.
3587	...do	2.30 p. m.	Beacon No. 9, ENE. $\frac{1}{4}$ E., 300 yds	64	57	......	3	fne. gy. S	....	0.2	Do.
3588	...do	3.05 p. m.	Beacon No. 10, WNW., $\frac{3}{10}$ mile	64	57	......	$2\frac{1}{2}$	R. oyster Sh	....	0.3	Do.
3589	...do	3.25 p. m.	End National City Wharf, N. by W. $\frac{1}{2}$ W., $\frac{8}{10}$ mile	64	57	......	3	R. oyster Sh	....	0.3	Do.
3590	...do	3.50 p. m.	End National City Wharf, N. by W. $\frac{1}{2}$ W., $1\frac{4}{10}$ miles	65	57	......	$3\frac{1}{2}$	R. bk. Sh	....	0.3	Do.
3591	...do	4.25 p. m.	Beacon No. 8, SW. $\frac{3}{4}$ S., $\frac{2}{10}$ mile	64	57	......	$4\frac{1}{2}$	R. bk. Sh	....	0.4	Do.

NOTE.—All bearings are magnetic. Chart used, C. S. No. 5106.

Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross.

Serial No.	Date.	Time.	Position.		Temperatures.			Depth.	Character of bottom.	Wind.		Drift.		Instrument used, etc.
			Lat. N.	Long. W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.	
	1894.		° ′ ″	° ′ ″	° F.	° F.	° F.	*Fms.*					*Miles.*	
3592	Apr. 30	9.50 a. m.	48 10 00	122 45 30	48	46	......	27	R. S	SSE	2	W. by N	0.3	S. B. T.
3593	...do	10.29 a. m.	48 11 30	122 48 00	48	46	46	37	Rky	SSE	2	WNW	0.3	Ship's dredge.
3594	...do	10.47 a. m.	48 12 00	122 50 00	50	46	46	36	S. P	SSE	2	West	0.4	Tangles.
3595	...do	11.56 a. m.	48 13 00	122 59 30	51	46	45	49	Rky. G. S	ENE	3	South	3.0	Tangles.
3596	...do	1.08 p. m.	48 14 30	122 58 00	53	46	44	81	bu. M.	West	1	SW. ½ S.	0.8	L. B. T.
3597	...do	2.08 p. m.	48 15 00	123 00 00	53	46	45	67	crs. bk. S	West	2	SW. ½ W.	1.0	L. B. T.
				E.										
3598	June 8	3.24 p. m.	52 01 00	177 34 00	43	40	......	34	bk. G	SE. by E.	2	SE.	2.0	L. B. T.
3599	June 9	10.52 a. m.	52 05 00	177 40 00	43	42	......	55	rky. fne. S. Sh.	Calm	0	NE. ½ N.	0.3	L. B. T.
				W.										
3600	June 26	3.37 p. m.	55 06 00	163 28 00	43	41	40	9	fne. dk. vol. S.	SW	4	SW	1.0	L. B. T. and surface tow net.

Record of intermediate tow-net stations of the U. S. Fish Commission steamer Albatross.

[Condition of sea, smooth.]

Serial No.	Date.	Time.	Position. Latitude N.	Position. Longitude W.	Temperatures. Air.	Temperatures. Surface.	Temperatures. Bottom.	Depth (in fathoms).	Wind. Direction.	Wind. Force.	Drift. Direction.	Drift. Distance.	Appearance of sky.	Remarks.
	1893.		° ′ ″	° ′ ″	° F.	° F.	° F.							
31	Apr. 26	10.11 a. m.	36 48 15	121 59 05	58	54	....	5 to surface	N	1			Clear	Entire net open.
32	Apr. 27	8.30 a. m.	37 29 00	123 01 20	54	53	41.7	100 to surface	WNW	3			do	All specimens from upper net.
33	Aug. 3	6.40 a. m.	60 22 00	171 42 00	41	42	33.9	25 to surface	W	3			Cloudy	
33	do	6.40 a. m.	60 22 00	171 42 00	41	42	33.9	25 fathoms*	W	3			do	Specimens from both nets.
34	do	10.03 a. m.	60 06 00	171 25 00	43	42	31.1	25 to surface	SSE	2			do	
34	do	10.03 a. m.	60 06 00	171 25 00	43	42	31.1	25 fathoms*	SSE	2			do	Do.
35	Aug. 4	9.24 a. m.	57 58 00	170 09 00	46	44	35.7	30 to surface	SW	4			do	
35	do	9.24 a. m.	57 58 00	170 09 00	46	44	35.7	30 fathoms*	SW	4			do	Do.
36	Aug. 6	7.33 a. m.	59 39 00	173 53 00	45	44	34.9	43 to surface	Calm	0			do	
36	do	7.33 a. m.	59 39 00	173 53 00	45	44	34.9	43 fathoms*	Calm	0			do	All specimens from upper net.
37	do	11.00 a. m.	59 55 00	174 17 00	47	46	35.1	44 to surface	SE	1			do	
37	do	11.00 a. m.	59 55 00	174 17 00	47	46	35.1	44 fathoms*	SE	1			do	Specimens from both nets.
38	Aug. 9	6.55 a. m.	54 45 00	169 06 00	45	43	38	40 to surface	SW	2			do	
38	do	6.55 a. m.	54 45 00	169 06 00	45	43	38	40 fathoms*	SW	2			do	Do.
39	Aug. 10	8.43 a. m.	56 10 00	163 26 00	49	47	39.2	30 to surface	SE	3			do	
39	do	8.43 a. m.	56 10 00	163 26 00	49	47	39.2	30 fathoms*	SE	3			do	Do.
40	Aug. 18	4.17 p. m.	56 41 00	169 39 00	48	44	42.7	30 to surface	WNW	2			Overcast.	
40	do	4.17 p. m.	56 41 00	169 39 00	48	44	42.7	30 fathoms*	WNW	2			do	Do.
41	Aug. 20	4.03 p. m.	54 38 00	175 27 00	56	49	35.1	125 to surface	NNE	3			do	
41	do	4.03 p. m.	54 38 00	175 27 00	56	49	35.1	125 fathoms*	NNE	3			do	Do.
42	Aug. 21	9.48 a. m.	55 46 00	172 44 00	51	48	35.1	250 to surface	W	5			do	
42	do	9.48 a. m.	55 46 00	172 44 00	51	48	35.1	250 fathoms*	W	5			do	Do.
43	Aug. 22	1.29 p. m.	54 59 00	171 49 00	49	48	35.1	100 to surface	SE. by S	2			Cloudy	
43	do	1.29 p. m.	54 59 00	171 49 00	49	48	35.1	100 fathoms*	SE. by S	2			do	Do.
44	Sept. 1	9.03 a. m.	54 44 00	165 42 00	52	47	39.5	50 to surface	E	3			do	
44	do	9.03 a. m.	54 44 00	165 42 00	52	47	39.5	50 fathoms*	E	3			do	Do.
	1894.													
45	Apr. 30	1.08 p. m.	48 14 30	122 58 00	53	46	44	4 to surface	W	1	SW. ½ S	0.2	Clear	Do.

* Lower net closed at this depth by messenger.

Record of fishing stations of the U. S. Fish Commission steamer Albatross.

Station No.	Date.	Time.	Position. Latitude N.	Position. Longitude W.	Depth (in fathoms).	Character of bottom.	Bait used.	Number of lines used.	Length of trial.	Fish taken.	Average weight.	Average length.
	1893.		° ′ ″	° ′ ″					*Minutes.*		*Pounds.*	*Inches.*
3482	July 12	9.05 a. m.	57 18 00	170 42 00	42	gy. M. fne. S	Salt salmon	4	10	None		
3483	...do	12.32 p. m.	57 18 00	171 18 00	56	gy. M	...do	6	15	...do		
3484	...do	4.11 p. m.	57 18 00	171 54 00	60	blue M	...do	6	20	5 cod	16	$32\frac{3}{5}$
3485	...do	8.13 p. m.	57 18 00	172 34 00	62	gy. M	...do	8	20	1 cod *	12	31
3496	July 17	5.45 a. m.	56 32 00	169 45 00	41	gy. M	...do	4	15	None		
3500	...do	11.53 a. m.	56 02 00	169 30 00	121	fne. gy. S				1 cod	8	28
3503	July 28	10.44 a. m.	57 06 15	170 11 00	17	fne. bk. S	Salt salmon	6	10	None		
3307	...do	12.27 p. m.	57 03 00	169 54 00	35	fne. gy. S	...do	7	20	...do		
3504	...do	2.23 p. m.	56 57 00	169 27 00	34	fne. gy. S	...do	8	14	...do		
3308	...do	5.18 p. m.	57 03 00	168 52 00	43	gy. S. Sh	...do	7	14	...do		
3505	...do	7.55 p. m.	57 09 00	168 17 00	44	fne. gy. S	...do	8	15	2 cod †	$2\frac{2}{3}$	$16\frac{1}{2}$
3311	July 29	4.00 a. m.	57 27 00	166 30 00	38	fne. gy. S. M	...do	5	15	1 cod	8	27
3506	...do	6.39 a. m.	57 33 00	165 55 00	36	gy. S. and M	...do	8	15	2 cod	$7\frac{3}{4}$	$25\frac{3}{4}$
3312	...do	9.46 a. m.	57 38 00	165 20 00	35	fne. dk. S. and M	...do	8	23	17 cod	$7\frac{1}{2}$	$26\frac{1}{3}$
3507	July 29	1.00 p. m.	57 43 00	164 42 00	31	fne. gy. S	...do	9	12	14 cod	$8\frac{1}{4}$	$26\frac{2}{3}$
3313	...do	5.14 p. m.	58 13 00	164 47 00	26	fne. gy. S	...do	8	15	3 cod ‡	$7\frac{1}{3}$	$26\frac{2}{3}$
3508	...do	7.33 p. m.	58 33 00	164 49 00	23	fne. gy. S. and Sh	...do	9	30	10 cod	$8\frac{3}{4}$	$27\frac{1}{4}$
3312	July 31	6.48 a. m.	57 10 00	169 05 00	42	fne. gy. S. bk. Sp	...do	7	14	None		
3509	...do	11.09 a. m.	57 10 00	169 43 00	35	fne. gy. S	...do	7	15	...do		
3510	Aug. 1	6.14 a. m.	Walrus Island, SW. ½ W., distance 5 miles.		27	bk. Sh. and S	...do	5	15	...do		
3511	...do	10.10 a. m.	57 32 00	169 38 00	39	fne. P. bk. M	...do	9	15	...do		
3512	...do	1.34 p. m.	57 49 30	169 27 00	38	fne. gy. S. gn. M	...do	11	15	...do		
3323	...do	4.43 p. m.	58 08 30	169 14 00	38	fne. gy. S. bk. M	...do	10	15	...do		
3513	...do	7.45 p. m.	58 27 00	169 01 00	35	fne. S. gy. M	...do	10	10	...do		
3514	Aug. 2	4.10 a. m.	59 22 00	168 21 00	21	fne. gy. S	...do	6	15	...do		
3326	...do	7.38 a. m.	59 41 00	168 06 00	22	fne. gy. S. Sh	...do	6	10	...do		
3515	...do	10.45 a. m.	NW. Cape Nunivak Island, bearing NNE. ½ E. 19 miles.		13	fne. gy. S	...do	9	15	1 cod	$11\frac{1}{2}$	29
3516	...do	3.57 p. m.	NW. Cape ESE. distance 27 miles.		17	fne. gy. S	...do	10	15	None		
3517	...do	8.03 p. m.	NW. Cape E. ¼ N. 51 miles.		24	fne. gy. S	...do	8	23	5 cod §	$8\frac{3}{5}$	$27\frac{1}{5}$
3348	Aug. 3	3.09 a. m.	60 24 00	170 48 00	35	bk. M	...do	6	15	None		
3518	...do	6.40 a. m.	Pinnacle Island, bearing SW. by W. ½ W., distance 21 miles.		36	gn. M	...do	8	17	...do		
3519	...do	10.22 a. m.	60 06 00	171 25 00	37	bk. M. fne. S	...do	8	10	...do		
3349	...do	1.14 p. m.	59 46 00	171 08 00	38	sft. dk. M	...do	10	15	...do		
3520	...do	4.10 p. m.	59 28 00	170 57 00	38	gy. M. fne. S	...do	9	15	...do		
3521	...do	7.36 p. m.	59 09 00	170 48 00	40	gy. M	...do	10	14	...do		
3352	Aug. 4	6.11 a. m.	58 15 00	170 18 00	40	gy. M. fne. S	Salt salmon, shells	5	15	...do		
3522	...do	9.24 a. m.	57 58 00	170 09 00	41	dk. gy. S. and G	...do	9	15	...do		

* And 1 *Atheresthes* flounder. † Taken in beam-trawl. ‡ And 1 flounder. § One taken in trawl.

Record of fishing stations of the U. S. Fish Commission steamer Albatross—Continued.

Station No.	Date.	Time.	Position. Latitude N.	Position. Longitude W.	Depth (in fathoms).	Character of bottom.	Bait used.	Number of lines used.	Length of trial.	Fish taken.	Average weight.	Average length.
	1893.		° ′ ″	° ′ ″					*Minutes.*		*Pounds.*	*Inches.*
3523	Aug. 4	1.20 p. m.	57 39 00	170 02 00	39	gy. M. fne. S.	Salt salmon, shells	7	19	None		
3524	...do	4.08 p. m.	57 24 00	169 56 00	36	gy. S. P.	...do	7	15	...do		
3525	...do	5.40 p. m.	57 21 00	170 05 00	29	bk. S. brk. Sh	...do	6	13	...do		
3353	Aug. 5	4.15 a. m.	57 24 00	170 24 00	37	fne. gy. S. and Sh.	...do	4	15	...do		
3526	...do	7.25 a. m.	57 31 00	170 57 00	49	dk. M. fne. S.	...do	5	15	...do		
3527	...do	10.36 a. m.	57 48 00	171 21 00	52	gy. M	...do	6	15	1 cod	11	29
3354	...do	1.52 p. m.	58 04 00	171 41 00	55	gy. M	...do	8	25	2 cod	$7\frac{1}{2}$	26
3528	...do	5.02 p. m.	58 19 30	172 02 00	55	dk. gy. M. fne. S.	...do	5	26	4 cod	$13\frac{3}{4}$	$29\frac{1}{4}$
3529	...do	8.19 p. m.	58 36 00	172 24 00	56	gn. M	...do	6	15	1 cod	8	27
3357	Aug. 6	4.45 a. m.	59 24 00	173 31 00	57	gn. M	...do	5	20	...do	11	29
3530	...do	7.33 a. m.	59 39 00	173 53 00	59	dk. gy. M. fne. S.	...do	6	15	None		
3531	...do	11.02 a. m.	59 55 00	174 17 00	59	gy. M	Salt shells, cod	9	25	12 cod	$11\frac{1}{6}$	30
3358	Aug. 8	3.46 a. m.	59 33 00	175 00 00	70	gy. M	Salt salmon	10	17	None		
3364	...do	4.13 a. m.	57 08 00	171 38 00	60	gy. M	...do	4	15	...do		
3535	...do	8.35 a. m.	57 02 00	170 46 00	52	dk. gn. M. fne. S.	...do	5	15	...do		
3536	...do	10.19 a. m.	57 05 00	170 35 00	40	fne. S. dk. M	...do	5	15	...do		
3365	Aug. 9	4.20 a. m.	56 49 00	169 42 00	37	fne. sh. S	...do	4	15	...do		
3537	...do	6.55 a. m.	54 45 00	169 06 00	49	fne. gy. S.	...do	6	15	...do		
3538	...do	10.15 a. m.	56 41 00	168 29 00	59	gn. M. S.	Salmon shells	7	18	3 cod	$13\frac{1}{3}$	$30\frac{2}{3}$
3366	...do	1.10 p. m.	56 37 00	167 55 00	59	gn. M. S.	Salt salmon, shells	8	21	5 cod	11	30
3539	...do	3.50 p. m.	56 34 00	167 19 00	57	gn. M. S.	...do	8	17	2 cod	$8\frac{1}{2}$	$25\frac{1}{2}$
3367	...do	6.40 p. m.	56 31 00	166 43 00	55	dk. M. fne. S	...do	6	7	None		
3541	Aug. 10	5.20 a. m.	56 14 00	164 08 00	49	bk. M. fne. S	...do	5	17	5 cod	$11\frac{1}{5}$	30
3542	...do	8.45 a. m.	56 10 00	163 26 00	49	dk. M. fne. S	...do	9	17	...do	11	29
3375	Aug. 17	7.14 a. m.	Chernofski, bearing SE. $\frac{5}{8}$ E. Western Head, S. $\frac{3}{8}$ W.		43	bk. S.	Salt salmon	8	19	1 cod	11	29
3543	Aug. 18	4.18 p. m.	St. George Island, S. by S. $\frac{3}{4}$ S., distance $5\frac{1}{2}$ miles.		43	bk. S. brk. Sh	...do	7	15	None		
3544	...do	7.20 p. m.	Western end St. George, SE. $\frac{1}{2}$ E., 16 miles.		41	fne. gy. S. Sh	...do	7	14	...do		
3414	Aug. 31	9.05 a. m.	54 13 00	165 58 00	42	bk. gy. S. M	...do	9	15	Astherestes, flounder.		
3415	...do	9.48 a. m.	54 10 00	165 54 00	42	dk. gy. S	...do	9	11	None		
3416	...do	10.47 a. m.	54 07 00	165 51 00	38	bk. M. fne. S	...do	9	16	2 cod	$8\frac{1}{2}$	27
3546	...do	11.26 a. m.	54 12 00	165 42 00	36	G. bk. Sh	...do	8	16	5 cod	$10\frac{2}{5}$	30
3547	...do	12.39 p. m.	54 16 00	165 45 00	51	fne bk. S	...do	3	15	None		
3558	Sept. 3	7.04 a. m.	56 58 00	170 09 00	25	S. and dk. Sp.	...do	7	15	5 cod*	12	29
	Sept. 9	5.30 p. m.	Deer Island, bearing about SW., distance 3 miles.		12		...do	6	90	27 cod †	$6\frac{1}{3}$	25
	Sept. 11		Portage Bay		6	dk. M., G. and S	Salmon-fed sculpin	2	6	12 cod	$9\frac{1}{3}$	$29\frac{3}{4}$

* And 3 sculpin.

† And 6 halibut.

Record of fishing stations of the U. S. Fish Commission steamer Albatross—Continued.

Serial No.	Date.	Time of day.	Position.				Character of bottom.	Depth.	Temperature.			Bait used.	No. of lines.	Length of trial.	Food-fishes taken.	Cod.				Average of cod.	
			Lat. N.		Long. W.				Air.	Surface.	Bottom.					Sexes.		Weight.	Length.	Weight.	Length.
	1894.		°	′	°	′		Fms.						Min.		♂	♀	Lbs.	In.	Lbs.	In.
Hy. 3492	June 29	1.00 p. m.	57	59	166	04	gy. S.	32	44	38	33	Salt salmon	15	30	2 cod	1	....	11	30	....	....
																	1	9	29	10	29½
Hy. 3493	...do	4.17 p. m.	58	06	165	22	fne. gy. S.	26	45	38	35.7	...do	15	30	4 cod, 2 flounders	1	....	5	25	....	....
																1	....	5	28	....	....
																1	....	4	22	....	....
																1	....	4	25	4½	25
Hy. 3495	June 30	7.36 a. m.	57	28	163	14	fne. gy. S.	27	38	38	34	...do	13	30	Nothing	....	....	....	....	....	....
Hy. 3496	...do	12.03 p. m.	56	59	163	02	fne. gy. S.	34	42	40	32	...do	14	30	1 cod	1	....	6¾	28	6¾	28
Hy. 3497	...do	3.24 p. m.	56	59	163	48	fne. gy. S.	37	42	40	34.3	...do	13	30	Nothing	....	....	....	....	....	....

Record of serial temperatures.

No. of station.	Date.	Time of day.	Depth.	Position. Lat. N.	Position. Long. W.	Air	Surface.	Bottom.	5 fms.	10 fms.	15 fms.	20 fms.	25 fms.	30 fms.	40 fms.	50 fms.	60 fms.	70 fms.	80 fms.	90 fms.	100 fms.	200 fms.	300 fms.	400 fms.	500 fms.
	1893.		*Fms.*	° ′ ″	° ′ ″	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Dr. 3482	July 12	9.10 a. m.	42	57 18 00	170 42 00	43	42	38.9	42.1	40.1		39.8		38.1											
Dr. 3483	...do....	12.40 p. m.	56	57 18 00	171 18 00	44	42	36.8	44.1	43.6		38.2		37.7	36.8	36.7									
Dr. 3484	...do....	4.20 p. m.	60	57 18 00	171 54 00	43	44	37.4	44.8	46.8		47.8		47.5	44.6	45.9									
Dr. 3485	...do....	8.20 p. m.	62	57 18 00	172 34 00	42	44	37.1	45.0	44.8		38.6		39.0	36.1	36.1						*110.*	*120.*	*130.*	*140.*
Dr. 3486	July 13	4.00 a. m.	150	57 19 00	173 53 00	43	43	38.0	45.8	45.6		40.8		39.1	39.0	37.8	37.6	37.1	36.9	36.8	37.0	37.0	37.3	37.5	38.0
Hy. 3301	July 14	2.30 a. m.	100	56 30 00	172 25 00	46	44	38.0	45.5	45.2		41.7		41.5	41.0	38.6	39.1	38.0	37.9	37.8					
Dr. 3494	...do....	3.00 p. m.	65	56 34 00	170 34 00	50	46	38.5	44.6	44.2		39.6		37.9	38.0	37.7	37.8					*200.*	*300.*	*400.*	*500.*
Hy. 3303	July 17	11.00 p. m.	843	55 24 00	168 34 00	48	45		47.0	42.0			39.9			38.1					38.8	38.3	38.4	38.0	38.5
Hy. 3306	July 18	9.00 a. m.	442	54 42 00	167 39 00	50	48		46.8	45.6			42.4			38.9					38.6	38.2	38.1	38.1	
Dr. 3503	July 28	10.50 a. m.	17	57 06 15	170 11 00	54	43	37.9	41.5	42.3															
Dr. 3504	...do....	2.30 p. m.	34	56 57 00	169 27 00	51	45	37.8	43.5	36.6		36.4													
Hy. 3308	...do....	5.30 p. m.	43	57 03 00	168 52 00	50	45	37.6	45.1	45.6															
Dr. 3505	...do....	8.00 p. m.	44	57 09 00	168 17 00	46	44	38.1	45.1	45.0															
Hy. 3309	...do....	11.00 p. m.	41	57 15 00	167 42 00	45	43	36.0	42.0	41.9		31.8		38.5											
Hy. 3310	July 29	1.30 a. m.	33	57 21 00	167 05 00	45	42	35.0	41.9	42.2															
Hy. 3311	...do....	4.10 a. m.	38	57 27 00	166 30 00	45	42	34.8	42.8	42.7															
Dr. 3506	...do....	6.50 a. m.	36	57 33 00	165 55 00	43	42	32.0	42.3	42.7		39.2		33.5											
Hy. 3312	...do....	9.50 a. m.	35	57 38 00	165 20 00	45	42	35.5	41.5	41.2	37.5														
Dr. 3507	...do....	1.10 p. m.	31	57 43 00	164 42 00	50	43	37.5	41.0	41.0															
Hy. 3313	...do....	5.20 p. m.	26	58 13 00	164 47 00	44	42	41.4	41.2	40.7		40.3													
Dr. 3508	...do....	8.00 p. m.	23	58 33 00	164 49 00	43	41	42.0	41.7	42.6															
Hy. 3314	...do....	11.30 p. m.	22	58 42 00	165 30 00	43	41	41.8	42.0	41.5															
Hy. 3315	July 30	2.10 a. m.	21	58 51 00	166 11 00	42	41	41.0	41.0	42.0															
Hy. 3316	...do....	5.10 a. m.	25	58 36 00	166 38 00	42	41	40.1	40.2	40.3															
Hy. 3317	...do....	8.40 a. m.	29	58 22 00	167 04 00	44	42	37.0	41.2	39.9															
Hy. 3319	...do....	6.00 p. m.	38	57 52 00	167 54 00	46	43	37.5	43.0	42.8															
Hy. 3320	...do....	10.30 p. m.	36	57 38 00	168 19 00	46	43	36.1	44.0	43.8															
Hy. 3321	July 31	3.30 a. m.	41	57 24 00	168 42 00	46	44	36.8	43.2	43.3															
Hy. 3322	...do....	6.50 a. m.	42	57 10 00	169 05 00	46	44	37.3	43.1	42.8															
Dr. 3509	...do....	11.10 a. m.	35	57 00 00	169 43 00	46	43	40.8	42.0	41.6															
Dr. 3510	Aug. 1	6.20 a. m.	27	57 12 30	169 51 00	47	43	40.1	43.5	43.1															
Dr. 3511	...do....	10.20 a. m.	39	57 32 00	169 38 00	48	44	37.2	43.9	43.9		43.2		36.2											
Dr. 3512	...do....	1.40 p. m.	38	57 49 30	169 27 00	49	45	36.6	44.0	43.6															
Hy. 3323	Aug. 1	4.50 p. m.	38	58 08 30	169 14 00	47	45	31.8	43.9	42.8															
Dr. 3513	...do....	7.50 p. m.	35	58 27 00	169 01 00	46	43		42.1	41.6		30.9		31.0											
Dr. 3514	Aug. 2	4.10 a. m.	21	59 22 00	168 21 00	40	40	40.8	40.6	40.8															
Hy. 3326	...do....	7.40 a. m.	22	59 41 00	168 06 00	42	41	41.1	41.1	41.1															
Dr. 3515	...do....	10.50 a. m.	13	59 59 00	167 53 00	42	42	41.8	42.0	41.8															
Dr. 3516	...do....	4.00 p. m.	17	60 28 00	168 08 00	43	44	43.2	42.3	43.2															
Dr. 3517	...do....	8.10 p. m.	24	60 27 00	169 04 00	41	41	40.3	41.8	41.0															
Hy. 3347	...do....	11.50 p. m.	27	60 26 00	169 54 00	41	41	35.3	41.3	41.1															
Hy. 3348	Aug. 3	3.20 a. m.	35	60 24 00	170 48 00	42	42	32.0	42.0	41.8		31.0													

Dr. 3518	...do....	6.50 a.m.	36	60 22 00	171 42 00	41	42	33.9	41.7	41.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3519	...do....	10.10 a.m.	37	60 06 00	171 25 00	43	42	31.1	42.0	40.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3349	...do....	1.20 p.m.	38	59 47 00	171 08 00	43	43	31.8	43.0	42.5	.....	29.8	.....	29.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3520	...do....	4.20 p.m.	38	59 28 00	170 57 00	43	43	32.2	42.6	39.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3521	...do....	7.40 p.m.	40	59 09 00	170 48 00	43	43	31.9	43.0	42.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3350	...do....	11.10 p.m.	40	58 52 00	170 38 00	45	44	30.8	43.2	42.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3352	Aug. 4	6.20 a.m.	40	58 15 00	170 18 00	46	44	35.4	43.1	41.1	.....	40.0	.....	32.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3522	...do....	9.30 a.m.	41	57 58 00	170 09 00	46	44	35.7	44.0	44.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3523	...do....	1.20 p.m.	39	57 39 00	170 02 00	47	45	38.0	44.5	44.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3524	...do....	4.10 p.m.	36	57 24 00	169 56 00	46	45	40.3	44.0	43.5	.....	42.3	.....	37.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3525	...do....	5.50 p.m.	29	57 21 00	170 05 00	46	45	41.6	43.0	41.9	.....	41.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3353	Aug. 5	4.20 a.m.	37	57 24 00	170 24 00	47	43	40.3	43.3	42.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3526	...do....	7.30 a.m.	49	57 31 00	170 57 00	47	44	38.9	44.2	43.9	.....	43.1	.....	39.1	37.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3527	...do....	10.40 a.m.	52	57 48 00	171 21 00	48	44	38.0	45.0	45.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3354	...do....	2.00 p.m.	55	58 04 00	171 41 00	48	45	37.4	44.8	44.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3528	...do....	5.10 p.m.	55	58 19 30	172 02 00	47	45	35.9	45.6	45.2	.....	44.5	.....	43.0	35.5	35.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3529	...do....	8.20 p.m.	56	58 36 00	172 24 00	46	45	36.1	45.2	44.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3355	...do....	11.30 p.m.	57	58 52 00	172 45 00	46	44	35.3	45.2	44.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3356	Aug. 6	2.10 a.m.	57	59 09 00	173 09 00	45	43	34.2	43.3	43.2	.....	39.0	.....	34.9	33.2	33.7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3357	...do....	4.50 a.m.	57	59 24 00	173 31 00	45	43	35.7	44.7	41.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3530	...do....	7.40 a.m.	59	59 39 00	173 53 00	45	44	34.9	44.3	43.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3531	...do....	11.10 a.m.	59	59 55 00	174 17 00	47	46	35.1	43.5	43.4	.....	33.6	.....	34.0	33.6	33.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3358	...do....	3.50 p.m.	70	59 33 00	175 00 00	51	46	36.7	44.8	44.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3532	...do....	7.50 p.m.	77	59 12 00	175 39 00	48	44	34.8	44.6	42.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3359	Aug. 7	12.10 a.m.	71	58 43 00	176 10 00	44	44	.....	45.1	45.0	.....	45.0	.....	44.2	34.9	37.1	36.8	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3360	...do....	5.20 a.m.	1,744	58 11 00	176 38 00	45	44	35.5	35.9	35.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3361	...do....	10.30 a.m.	1,367	58 01 00	175 41 00	48	46	35.2	46.7	45.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3362	...do....	5.20 p.m.	77	57 41 00	174 05 00	49	47	38.0	46.0	45.5	.....	40.1	.....	39.0	38.0	38.1	38.1	38.0	.....	.....	.....	.....	.....	.....	.....
Dr. 3533	...do....	7.50 p.m.	70	57 34 00	173 33 00	47	46	39.2	45.9	45.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3363	...do....	11.20 p.m.	69	57 25 00	172 50 00	47	45	37.8	46.1	45.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3364	Aug. 8	4.20 a.m.	60	57 08 00	171 38 00	47	45	37.8	44.4	45.0	.....	45.1	.....	39.6	38.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3534	...do....	6.00 a.m.	59	57 03 00	171 19 00	47	45	38.1	45.3	46.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3535	...do....	9.00 a.m.	52	57 02 00	170 46 00	48	45	39.0	43.4	43.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 2536	...do....	10.20 a.m.	40	57 05 00	170 35 00	48	45	42.4	43.4	42.5	.....	42.2	.....	41.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3365	Aug. 9	4.30 a.m.	37	56 49 00	169 42 00	46	44	40.9	44.1	41.0	.....	40.0	.....	39.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3537	...do....	7.00 a.m.	49	54 45 00	169 06 00	45	43	38.0	45.6	45.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3538	...do....	10.20 a.m.	59	56 41 00	168 29 00	48	46	58.0	45.5	46.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3366	...do....	1.20 p.m.	59	56 37 00	167 55 00	49	46	38.0	45.9	45.4	.....	38.8	.....	36.5	37.2	37.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3539	...do....	4.00 p.m.	57	56 34 00	167 19 00	49	45	38.9	46.2	46.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3367	...do....	6.40 p.m.	55	56 31 00	166 43 00	48	46	37.5	46.5	46.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3540	...do....	9.20 p.m.	51	56 27 00	166 08 00	47	45	36.0	46.4	46.0	.....	34.1	.....	34.1	34.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3541	Aug. 10	5.20 a.m.	49	56 14 00	164 08 00	48	46	36.1	46.9	47.2	.....	35.4	.....	34.9	35.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3542	...do....	8.50 a.m.	49	56 10 00	163 26 00	49	47	39.2	47.0	47.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3385	Aug. 18	7.40 a.m.	1,036	55 50 00	169 24 00	48	47	36.0	47.7	48.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3543	...do....	4.20 p.m.	43	56 41 00	169 39 00	48	44	42.7	42.0	41.9	.....	41.3	.....	41.0	41.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dr. 3544	...do....	7.30 p.m.	41	56 50 00	169 59 00	47	44	41.1	44.6	43.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hy. 3392	Aug. 19	5.30 a.m.	76	56 39 00	172 21 00	47	45	38.9	46.0	46.0	46.6	42.4	.....	39.1	38.4	38.0	38.4	.....	.....	.....	.....	.....	.....	.....	.....

Record of serial temperatures—Continued.

No. of station.	Date.	Time of day.	Depth.	Position. Lat. N.	Position. Long. W.	Air.	Surface.	Bottom.	5 fms.	10 fms.	15 fms.	20 fms.	25 fms.	30 fms.	40 fms.	50 fms.	60 fms.	100 fms.	200 fms.	300 fms.	400 fms.	500 fms.	600 fms.	700 fms.	800 fms.	900 fms.	1,000 fms.
	1893.		*Fms.*	° ′ ″	° ′ ″	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Hy. 3399	Aug. 20	4.50 p. m.	2,041	54 38 00	175 27 00	56	49	35.1	47.8	47.0	....	....	47.0	....	....	37.0	....	36.3	39.0	44.1	38.2	37.4	37.9	36.9	36.3	....	35.7
Hy. 3402	Aug. 21	10.30 a. m.	1,833	55 46 00	172 44 00	51	48	35.1	....	....	....	....	39.4	....	....	38.3	....	37.0	39.0	38.1	38.2	37.8	38.0	37.2	36.4	36.2	38.9
Dr. 3558	Sept. 3	7.10 a. m.	25	56 58 00	170 09 00	46	45	42.0	45.3	45.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dr. 3559	...do....	9.20 a. m.	39	56 56 00	169 52 00	47	46	42.5	45.0	45.0	....	41.1	....	41.0	....	....	....	....	....	....	....	....	....	....	....	....	....
Hy. 3431	...do....	12.00 m.	43	56 48 00	169 26 00	47	45	39.0	46.0	45.3	....	42.6	....	37.0	....	....	....	....	....	....	....	....	....	....	....	....	....
	1894.																										
Dr. 3600	June 26	3.45 p. m.	9	55 06 00	163 28 00	43	41	40.0	40.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

Record of ocean temperatures and specific gravities.

[All specimens were taken at about 1 foot below the surface, by means of a specimen bottle.]

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 60° F.	Specific gravity reduced to 15° C.
1893.			° ′ ″	° ′ ″		°	°	°			
July 1	12 m		51 32 00	175 52 00	Surface	48	43	63	1.0248	1.025211	1.024391
2	12 m	Adak Island			do	49	60	63	1.0246	1.025011	1.024191
5	12 m		51 23 00	176 49 00	do	42	52	63	1.0248	1.025211	1.024391
6	12 m		51 09 00	176 19 00	do	44	52	63	1.0244	1.024811	1.023991
7	12 m		50 31 00	174 02 00	do	50	52	63	1.0244	1.024811	1.023991
8	12 m		52 06 00	171 45 00	do	48	50	63	1.0244	1.024811	1.023991
9	12 m		55 06 00	170 10 00	do	46	49	63	1.0246	1.025011	1.024191
Aug. 1	12 m		57 39 00	169 33 00	do	44	49	65	1.0236	1.024290	1.023470
1	6 p.m.		58 15 00	169 05 00	do	44	46	65	1.0234	1.024090	1.023270
1	12 p.m.		58 52 00	168 45 00	do	42	43	65	1.0234	1.024090	1.023270
2	6 a.m.		59 29 00	168 09 00	do	41	41	65	1.0234	1.024090	1.023270
2	12 m		60 03 00	167 55 00	do	42	42	65	1.0232	1.023890	1.023070
2	6 p.m.		60 28 00	168 17 00	do	44	43	65	1.0230	1.023690	1.022870
2	12 p.m.		60 25 00	170 10 00	do	41	41	65	1.0230	1.023690	1.022870
3	6 a.m.		60 19 00	171 41 00	do	42	41	65	1.0230	1.023690	1.022870
3	12 m		59 58 00	171 17 00	do	43	43	65	1.0230	1.023690	1.022870
3	6 p.m.		59 25 00	170 50 00	do	43	42	65	1.0230	1.023690	1.022870
3	12 p.m.		58 44 00	170 35 00	do	43	45	65	1.0230	1.023690	1.022870
4	6 a.m.		58 20 00	170 10 00	do	44	46	65	1.0230	1.023690	1.022870
4	12 m		57 48 00	170 04 00	do	45	46	65	1.0234	1.024090	1.023270
4	6 p.m.		57 23 00	169 55 00	do	45	46	65	1.0234	1.024090	1.023270
5	12 m		57 53 00	171 28 00	do	45	50	65	1.0236	1.024290	1.023470
5	6 p.m.		58 28 00	172 06 00	do	45	47	65	1.0238	1.024490	1.023670
5	12 p.m.		58 53 00	172 40 00	do	44	46	65	1.0232	1.023890	1.023070
6	6 a.m.		59 25 00	173 30 00	do	44	44	65	1.0232	1.023890	1.023070
6	12 m		59 54 00	174 18 00	do	46	48	65	1.0232	1.023890	1.023070
6	6 p.m.		59 25 00	175 20 00	do	45	50	65	1.0230	1.023690	1.022870
6	12 p.m.		58 46 00	176 12 00	do	44	44	65	1.0236	1.024290	1.023470
7	6 a.m.		58 10 00	173 30 00	do	44	46	65	1.0240	1.024690	1.023870
7	12 m		57 57 00	175 19 00	do	46	48	65	1.0240	1.024690	1.023870
7	6 p.m.		57 43 00	173 52 00	do	47	48	65	1.0242	1.024890	1.024070
7	12 p.m.		57 22 00	172 26 00	do	45	47	65	1.0238	1.024490	1.023670
8	6 a.m.		57 10 00	170 55 00	do	45	47	65	1.0234	1.024090	1.023270
8	12 m	St. Paul Island			do	44	48	65	1.0232	1.023890	1.023070
9	12 m		56 39 00	168 13 00	do	46	48	65	1.0230	1.023690	1.022870
9	6 p.m.		56 33 00	166 50 00	do	46	48	65	1.0230	1.023690	1.022870
9	12 p.m.		56 22 00	165 20 00	do	45	48	65	1.0232	1.023890	1.023070
10	6 a.m.		56 12 00	163 48 00	do	47	49	65	1.0234	1.024090	1.023670
10	12 m		55 56 00	163 38 00	do	48	51	62	1.0240	1.024270	1.023450
11	12 m		54 20 00	165 42 00	do	48	52	62	1.0244	1.024670	1.023850
17	12 m		53 51 00	168 00 00	do	47	48	62	1.0248	1.025070	1.024250
17	6 p.m.		54 28 00	168 10 00	do	47	49	62	1.0246	1.024870	1.024050
17	12 p.m.		55 07 00	169 03 00	do	46	48	62	1.0242	1.024470	1.023650
18	6 a.m.		55 42 00	169 10 00	do	47	48	62	1.0243	1.024570	1.023750
18	12 m		56 19 00	169 32 00	do	48	49	62	1.0244	1.024670	1.023850
18	6 p.m.		56 45 00	169 40 00	do	44	47	62	1.0244	1.024670	1.023850
18	12 p.m.		56 48 00	169 59 00	do	43	46	62	1.0242	1.024470	1.023650
19	6 a.m.		56 40 00	172 30 00	do	45	46	62	1.0242	1.024470	1.023650
19	12 m		56 31 00	173 45 00	do	47	48	62	1.0240	1.024270	1.023450
19	6 p.m.		56 27 00	175 27 00	do	45	46	62	1.0244	1.024670	1.023850
19	12 p.m.		56 22 00	176 48 00	do	47	47	62	1.0246	1.024870	1.024050
20	6 a.m.		55 38 00	176 20 00	do	47	48	62	1.0246	1.024870	1.024050
20	12 m		55 08 00	175 56 00	do	48	51	62	1.0246	1.024870	1.024050
20	6 p.m.		54 40 00	175 30 00	do	48	49	62	1.0244	1.024670	1.023850
20	12 p.m.		54 58 00	174 31 00	do	47	48	62	1.0244	1.024670	1.023850
21	6 a.m.		55 17 00	173 33 00	do	47	49	63	1.0244	1.024811	1.023991
21	12 m		55 47 00	172 41 00	do	49	51	63	1.0242	1.024611	1.023791
21	6 p.m.		56 08 00	171 45 00	do	48	51	63	1.0244	1.024811	1.023991
21	12 p.m.		56 18 00	170 35 00	do	46	49	63	1.0244	1.024811	1.023991
22	6 a.m.		55 44 00	171 10 00	do	47	48	63	1.0246	1.025011	1.024191
22	12 m		55 09 00	171 39 00	do	48	49	63	1.0244	1.024811	1.023991
22	6 p.m.		54 46 00	171 53 00	do	48	49	63	1.0244	1.024811	1.023991
22	12 p.m.		54 25 00	172 12 00	do	47	48	63	1.0244	1.024811	1.023991
23	6 a.m.		54 08 00	172 23 00	do	47	49	63	1.0243	1.024711	1.023891
23	12 m		53 42 00	172 44 00	do	48	50	63	1.0244	1.024811	1.023991
23	6 p.m.		53 45 00	172 06 00	do	48	49	63	1.0242	1.024611	1.023791

Record of ocean temperatures and specific gravities—Continued.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 60° F.	Specific gravity reduced to 15° C.
1893.			° ′ ″	° ′ ″		°	°	°			
Aug. 23	12 p. m.	....	53 46 00	171 35 00	Surface	47	49	63	1.0244	1.024811	1.023991
24	6 a. m.	....	53 47 00	171 07 00	...do....	47	48	63	1.0244	1.024811	1.023991
24	12 m....	....	53 48 00	170 42 00	...do....	47	49	63	1.0243	1.024711	1.023891
24	6 p. m.	....	53 52 00	169 38 00	...do....	48	49	63	1.0244	1.024811	1.023991
24	12 p. m.	....	53 55 00	168 40 00	...do....	47	49	63	1.0244	1.024811	1.023991
25	6 a. m.	....	54 06 00	167 32 00	...do....	45	46	63	1.0242	1.024611	1.023791
25	12 m....	....	54 00 00	166 34 00	...do....	45	48	63	1.0244	1.024811	1.923991
31	12 m....	Akutan Bay..........			...do....	47	54	63	1.0243	1.024711	1.023891
31	6 p. m.	Akun Cove..........			...do....	47	55	63	1.0244	1.024811	1.023991
Sept. 1	12 m....	....	55 00 00	166 10 00	...do....	49	53	63	1.0242	1.024611	1.023791
1	6 p. m.	....	55 20 00	167 18 00	...do....	48	50	63	1.0238	1.024211	1.023391
2	12 m....	....	56 40 00	170 18 00	...do....	46	47	63	1.0238	1.024211	1.023391
2	12 p. m.	SW. Bay, St. Paul Island......			...do....	44	46	63	1.0238	1.024211	1.023391
3	6 a. m.	Off Otter Island..........			...do....	45	46	63	1.0238	1.024211	1.023391
3	12 m....	....	56 48 00	169 26 00	...do....	45	47	63	1.0236	1.024011	1.023191
3	6 p. m.	....	56 10 00	168 40 00	...do....	46	47	63	1.0238	1.024211	1.023391
3	12 p. m.	....	55 38 00	167 45 00	...do....	45	46	63	1.0240	1.024411	1.023591
4	6 a. m.	....	54 45 00	167 12 00	...do....	47	49	63	1.0240	1.024411	1.023591
4	12 m....	....	54 00 00	166 33 00	...do....	46	50	63	1.0240	1.024411	1.023591
5	12 m....	Dutch Harbor..........			...do....	47	53	63	1.0238	1.024211	1.023391
8	12 m....	....	54 18 00	165 39 00	...do....	46	57	63	1.0242	1.024611	1.023791
9	12 m....	....	54 37 00	163 16 00	...do....	47	53	63	1.0238	1.024211	1.023391
9	6 p. m.	Off Deer Island..........			...do....	49	51	63	1.0232	1.023611	1.022791
10	12 m....	Bailey Harbor..........			...do....	50	52	63	1.0180	1.018411	1.017591
11	12 m....	....	55 20 00	161 01 00	...do....	49	52	63	1.0230	1.023411	1.022591
11	8 p. m.	Portage Bay..........			...do....	50	51	63	1.0216	1.022011	1.021191
12	6 p. m.	Unga Strait..........			...do....	50	51	63	1.0230	1.023411	1.022591
13	12 m....	....	55 37 00	155 38 00	...do....	49	52	63	1.0238	1.024211	1.023391
13	6 p. m.	....	56 04 00	154 45 00	...do....	49	50	63	1.0240	1.024411	1.023591
13	12 p. m.	....	56 30 00	153 43 00	...do....	47	48	63	1.0240	1.024411	1.023591
14	6 a. m.	....	56 55 00	152 37 00	...do....	47	48	63	1.0240	1.024411	1.023591
14	12 m....	....	57 20 00	150 57 00	...do....	46	47	63	1.0242	1.024611	1.023791
14	6 p. m.	....	57 18 00	150 12 00	...do....	47	48	63	1.0242	1.024611	1.023791
14	12 p. m.	....	57 16 00	148 40 00	...do....	47	49	63	1.0240	1.024411	1.023591
15	6 a. m.	....	57 16 30	147 10 00	...do....	51	53	63	1.0242	1.024611	1.023791
15	12 m....	....	57 15 00	146 05 00	...do....	51	56	63	1.0242	1.024611	1.023791
15	6 p. m.	....	57 10 00	144 42 00	...do....	51	55	63	1.0242	1.024611	1.023791
15	12 p. m.	....	57 08 00	143 18 00	...do....	51	53	63	1.0240	1.024411	1.023591
16	6 a. m.	....	57 07 00	142 10 00	...do....	51	53	63	1.0242	1.024611	1.023791
16	12 m....	....	57 11 00	140 49 00	...do....	54	58	63	1.0240	1.024411	1.023591
16	6 p. m.	....	57 08 00	139 05 00	...do....	54	57	63	1.0240	1.024411	1.023591
16	12 p. m.	....	57 02 00	137 20 00	...do....	52	54	63	1.0240	1.024411	1.023591
17	6 a. m.	Sitka Sound..........			...do....	52	54	63	1.0240	1.024411	1.023591
18	12 m....	Sitka Harbor..........			...do....	52	64	69	1.0186	1.019887	1.019067
19	12 m....	....	54 18 00	133 55 00	...do....	53	57	69	1.0234	1.024687	1.023867
19	6 p. m.	....	53 42 00	133 22 00	...do....	55	67	69	1.0236	1.024887	1.024067
19	12 p. m.	....	52 58 00	132 40 00	...do....	53	57	69	1.0236	1.024887	1.024067
20	6 a. m.	....	52 16 00	131 58 00	...do....	53	56	69	1.0236	1.024887	1.024067
20	12 m....	....	51 37 00	131 03 00	...do....	55	60	69	1.0232	1.024487	1.023667
20	6 p. m.	....	51 28 00	130 12 00	...do....	54	60	69	1.0232	1.024487	1.023667
20	12 p. m.	....	51 15 00	129 15 00	...do....	53	55	69	1.0230	1.024287	1.023467
21	6 a. m.	....	51 03 00	128 11 00	...do....	48	48	69	1.0228	1.024087	1.023267
21	12 m....	Johnston Strait..........			...do....	50	50	69	1.0218	1.023087	1.022267
21	6 p. m.	Seymour Narrows..........			...do....	50	55	69	1.0212	1.022487	1.021667
21	12 p. m.	Oyster Bay, B. C..........			...do....	51	50	69	1.0192	1.020487	1.019667
22	6 a. m.	Bayne Sound..........			...do....	54	53	69	1.0192	1.020487	1.019667
23	12 m....	Gulf of Georgia..........			...do....	56	61	69	1.0190	1.020287	1.019467
23	6 p. m.	Active Pass..........			...do....	58	62	69	1.0102	1.011487	1.010667
26	12 m....	Off Race Rocks..........			...do....	52	54	69	1.0224	1.023687	1.022867
27	12 m....	....	46 04 00	124 58 00	...do....	56	59	69	1.0186	1.019887	1.019067
28	12 m....	....	42 39 00	124 39 00	...do....	52	57	69	1.0240	1.025287	1.024467
29	12 m....	....	39 11 00	124 03 00	...do....	53	56	69	1.0240	1.025287	1.024467

Record of temperatures and specific gravities.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 15°C.
1894.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
May 19	12 m		50 57 00	128 47 00	Surface	47	51	64	1.0232	1.022928
19	6 p. m.		51 15 00	129 55 00	...do	49	51	63	1.0236	1.023228
19	12 p. m.		51 30 00	130 42 00	...do	47	48	62	1.0242	1.023650
20	6 a. m.		51 40 00	131 40 00	...do	48	52	62	1.0244	1.023850
20	12 m		51 54 00	133 39 00	...do	49	50	62	1.0244	1.023850
20	6 p. m.		52 15 00	134 50 00	...do	49	52	62	1.0244	1.023850
20	12 p. m.		52 32 00	136 00 00	...do	47	51	62	1.0244	1.023850
21	6 a. m.		52 46 00	137 05 00	...do	46	48	62	1.0245	1.023950
21	12 m		53 07 00	138 24 00	...do	44	48	62	1.0245	1.023950
21	6 p. m.		53 15 00	139 45 00	...do	44	49	62	1.0246	1.024050
21	12 p. m.		53 20 00	141 06 00	...do	43	46	62	1.0246	1.024050
22	6 a. m.		53 28 00	143 40 00	...do	44	46	62	1.0244	1.023850
22	12 m		53 37 00	144 10 00	...do	42	48	62	1.0244	1.023850
22	6 p. m.		53 43 00	145 30 00	...do	42	48	62	1.0244	1.023850
22	12 p. m.		53 50 00	147 00 00	...do	40	44	62	1.0244	1.023850
23	6 a. m.		53 56 00	148 25 00	...do	39	42	62	1.0244	1.023850
23	12 m		54 07 00	149 59 00	...do	38	42	62	1.0246	1.024050
23	6 p. m.		54 16 00	151 55 00	...do	38	42	62	1.0246	1.024050
23	12 p. m.		54 20 00	153 20 00	...do	38	42	62	1.0246	1.024050
24	6 a. m.		54 28 00	155 05 00	...do	38	40	62	1.0246	1.024050
24	12 m		54 30 00	156 49 00	...do	38	41	62	1.0246	1.021050
24	6 p. m.		54 32 00	157 55 00	...do	39	43	62	1.0246	1.024050
24	12 p. m.		54 35 00	159 10 00	...do	38	41	62	1.0244	1.023850
25	6 a. m.		54 18 00	160 25 00	...do	38	40	62	1.0244	1.023850
25	12 m		53 57 00	161 48 00	...do	38	43	62	1.0242	1.023650
25	6 p. m.		53 48 00	163 10 00	...do	37	38	62	1.0242	1.023650
26	6 a. m.	Unimak Pass			...do	36	37	62	1.0236	1.023050
26	3 p. m.	Dutch Harbor			...do	39	40	62	1.0236	1.023050
31	12 m		54 03 00	167 54 00	...do	38	40	62	1.0242	1.023650
June 1	12 m		53 44 00	174 24 00	...do	39	40	62	1.0244	1.023850
3	12 m	East	53 20 00	178 45 00	...do	41	48	62	1.0244	1.023850
5	8 a. m.	Attu Island			...do	41	44	58	1.0252	1.024140
5	6 p. m.	Aggattu Island			...do	40	44	58	1.0252	1.024140
8	12 m	Kyska Island			...do	40	44	58	1.0252	1.021140
9	12 m	East	52 07 00	177 43 00	...do	40	42	58	1.0253	1.024240
9	6 p. m.	...do	52 15 00	179 10 00	...do	40	42	58	1.0253	1.024240
9	12 p. m.	West	52 20 00	179 35 00	...do	39	41	58	1.0254	1.024340
10	6 a. m.		52 23 00	178 20 00	...do	40	43	58	1.0254	1.024340
10	12 m	Atka Island			...do	41	44	58	1.0254	1.024340
11	12 m		53 20 00	169 38 00	...do	39	41	58	1.0252	1.024140
14	6 p. m.	Chernofski Harbor			...do	39	43	58	1.0210	1.019940
15	12 m		53 27 00	168 14 00	...do	38	41	58	1.0252	1.024140
16	12 m		52 57 00	171 55 00	...do	39	41	58	1.0254	1.024340
17	9 a. m.	Amlia Island			...do	39	40	58	1.0254	1.024340
22	8 p. m.	St. George Island			...dd	37	39	58	1.0216	1.023540
23	12 m	St. Paul Island			...do	38	44	58	1.0244	1.023340
24	12 m		57 34 00	167 58 00	...do	36	39	58	1.0244	1.023340
24	6 p. m.		56 48 00	167 50 00	...do	38	41	58	1.0244	1.023340
24	12 p. m.		56 10 00	167 40 00	...do	38	39	58	1.0242	1.023140
25	6 a.		55 50 00	167 00 00	...do	39	40	58	1.0242	1.023140
25	12 m m.		56 12 00	165 45 00	...do	39	41	58	1.0240	1.022940
25	6 p. m.		56 05 00	164 40 00	...do	38	40	58	1.0240	1.022940
25	12 p. m.		55 45 00	163 50 00	...do	38	40	58	1.0240	1.022940
26	6 a. m.		55 30 00	164 18 00	...do	38	41	58	1.0240	1.022940
26	12 m		55 33 00	163 23 00	...do	40	41	58	1.0240	1.022940
26	4 p. m.		55 08 00	163 30 00	...do	40	43	58	1.0240	1.022940
26	4 p. m.		55 08 00	163 30 00	Bottom, 9 fms.	40	43	58	1.0240	1.022940
26	12 p. m.		56 10 00	162 03 00	Surface	38	41	58	1.0240	1.022940
27	6 a. m.		56 17 00	160 50 00	...do	37	40	58	1.0240	1.022940
27	12 m		56 31 00	159 48 00	...do	40	43	58	1.0242	1.023140
27	6 p. m.		56 54 00	158 45 00	...do	39	41	58	1.0242	1.023140
27	12 p. m.		57 20 00	159 55 00	...do	35	37	58	1.0242	1.023140
28	6 a. m.		57 05 00	159 40 00	...do	35	36	58	1.0242	1.023140
28	12 m		56 38 00	160 35 00	...do	36	37	58	1.0242	1.023140
28	6 p. m.		56 55 00	161 45 00	...do	40	39	58	1.0242	1.023140
28	12 p. m.		57 18 00	163 20 00	...do	37	38	58	1.0240	1.022940
29	6 a. m.		57 33 00	164 50 00	...do	38	38	58	1.0240	1.022940
29	12 m		57 56 00	166 16 00	...do	38	39	58	1.0238	1.022740
29	6 p. m.		58 15 00	164 45 00	...do	38	43	58	1.0238	1.022740
29	12 p. m.		58 18 00	163 35 00	...do	37	40	58	1.0238	1.022740
30	6 a. m.		57 40 00	163 25 00	...do	38	37	58	1.0236	1.022540
30	12 m		56 59 00	163 02 00	...do	40	42	58	1.0234	1.022340
30	6 p. m.		56 58 00	164 20 00	...do	40	43	58	1.0234	1.022340
30	12 p. m.		56 55 00	165 40 00	...do	38	38	58	1.0236	1.022540

Record of animal life, driftwood, kelp,

FROM DUTCH HARBOR, UNALASKA ISLAND, FOR

Date.	Meridian positions. Latitude north.	Meridian positions. Longitude west.	Mean temperatures. Air.	Mean temperatures. Water surface.	Seals	Whales.	Little auks.	Cormorants.	Ducks.
1893.	° ′ ″	° ′ ″	°	°					
July 1	51 32 00	175 52 00	44	44	....	....	....	....	....
2	Bay of Waterfalls, Adak Island.		52	47	....	....	....	....	....

FROM BAY OF WATERFALLS, ADAK ISLAND,

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals	Whales.	Little auks.	Cormorants.	Ducks.
July 5	51 23 00	176 49 00	49	45	....	....	....	....	Few ......
6	51 09 00	176 19 00	50	47	....	....	....	....	....
7	50 31 00	174 02 00	51	49	....	Two	....	....	....
8	52 06 00	171 45 00	47	44	....	Many *killers.*	....	....	....
9	55 06 00	170 10 00	47	45	Three .	Two	....	....	....
10	St. Paul Island, Pribilofs.		45	41	Many..	....	Great many.	....	....

FROM ST. PAUL ISLAND, ON CRUISE IN BERING

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals	Whales.	Little auks.	Cormorants.	Ducks.
July 11	St. George Island, Pribilofs.		45	41	Many..	....	Great many.	....	....
12	57 17 00	171 10 00	43	43	Nine...	One......	....	....	....
13	56 56 00	173 40 00	44	44	Fifteen	Fourteen .	....	....	....
14	56 34 00	171 18 00	47	45	Twenty	....	Several ...	....	....
15	St. George Island, Pribilofs.		46	42	Many..	One......	Great many.	....	....

FROM ST. GEORGE ISLAND TO DUTCH HARBOR,

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals	Whales.	Little auks.	Cormorants.	Ducks.
July 16	East anchorage, St. Paul Island, Pribilofs.		45	42	Many..	....	Great many.	....	....
17	56 02 00	169 30 00	49	44	Six	One......	Great many.	....	....
18	54 34 00	167 14 00	55	48	One....	One......	....	....	....
19	Dutch Harbor, Unalaska Island.		56	49	....	....	....	....	....

FROM DUTCH HARBOR, UNALASKA

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals	Whales.	Little auks.	Cormorants.	Ducks.
July 26	55 33 00	168 05 00	47	44	One....	....	....	....	....
27	East anchorage, St. Paul Island, Pribilofs.		46	43	Many..	....	Great many.	Few	....
28	57 05 00	170 04 00	49	43	Two ...	....	Great many.	....	....
29	57 41 00	164 58 00	46	42	Two ...	....	....	....	....
30	58 12 00	167 29 00	44	42	One....	....	....	....	....
31	57 01 00	169 44 00	50	44	Three..	....	Great many.	....	....
Aug. 1	57 39 00	169 33 00	46	43	One....	One......	....	Two	....
2	60 03 00	167 55 00	41	42	....	....	....	....	....
3	59 58 00	171 17 00	43	42	....	....	....	....	One......
4	57 48 00	170 04 00	45	43	One....	....	Many.....	Few	....
5	57 53 00	171 28 00	48	41	Three..	....	....	....	....
6	59 54 00	174 18 00	48	44	Sixteen	....	....	....	....
7	57 57 00	175 19 00	47	45	One....	....	....	....	....

etc., observed from deck of Albatross at sea.

BAY OF WATERFALLS, ADAK ISLAND, ALASKA.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
One	Many	Many		Many			Much	Many white gonies.
						Much		Driftwood on the beaches.

TO ST. PAUL, PRIBILOF ISLANDS, BERING SEA.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
		Few		Several				
	Several			Many				
	Several			Few				
	Few		Few	Few			Much	
Several	Three (white).	Great many.	Several	Great many.	Few		Much	
Many		Great many.		Great many.				Many seals close to rookeries.

SEA, AND TO ST. GEORGE ISLAND, PRIBILOFS.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Many		Great many.	Several	Many	Few			Many seals close to rookeries.
Several	Few	Many	Many	Many				
Several	Several	Many	Several	Many	Several			
Several	Few	Great many.	Several	Many	Several			
Many		Great many.	Many	Many	Few			Flock of Aleutian sandpipers.

UNALASKA ISLAND, VIA ST. PAUL ISLAND.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Many		Great many.	Few	Many	Many			Many seals near rookeries.
Many		Great many.	Many	Great many.	Many			
Many		Many	Many	Few	Many		Little	

ISLAND, ON CRUISE IN BERING SEA.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Few	One	Many	Few	Few				
		Great many.	Many	Many	Many			Many seals near rookeries. Few snipe.
Few		Great many.	Few	Several				
Few		Several	Few					Large flock of whale birds.
Several		Many	Several	Several				
Many		Great many.	Many	Many				
Many		Great many.	Many	Many				
Several	One	Several	Several					One snipe near Nunivak Island.
Several		Many	Many	Several				Few snipe near St. Matthew Island.
Many		Many	Many	Many	Several			
Many		Many	Many	Few				Observed many varieties of petrels.
Few		Many	Several					
Many		Many	Several	Many	Few			

Record of animal life, driftwood, kelp, etc.,

FROM DUTCH HARBOR, UNALASKA ISLAND,

Date.	Meridian positions.		Mean temperatures.		Seals.	Whales.	Little auks.	Cormorants.	Ducks.
	Latitude north.	Longitude west.	Air.	Water surface.					
1893.	° ′ ″	° ′ ″	°	°					
Aug. 8	57 07 00	170 22 00	46	44	Five...	Many.....	Many.....	Few	Few ......
9	56 39 00	168 13 00	47	44	....	....	....	....	....
10	55 56 00	163 38 00	51	46	....	One........	....	....	....
11	54 20 00	165 42 00	53	47	One....	Great many.	....	Few	....
12	Dutch Harbor, Unalaska Island.		55	50	....	....	....	....	....
16	53 58 00	166 33 00	51	46	....	Many *killers.*	....	Several ...	Few ......
17	53 51 00	168 00 00	48	46	....	....	....	Few	Few ......
18	56 19 00	169 32 00	47	45	....	....	....	....	....
19	56 31 00	173 45 00	47	46	Two ...	....	....	....	Several ...
20	55 08 00	175 56 00	52	48	Three..	....	....	....	....
21	55 47 00	172 41 00	50	47	Eight..	Many.....	....	....	....
22	55 09 00	171 39 00	49	47	Seven..	Many.....	....	....	....
23	53 42 00	172 44 00	49	47	....	....	....	....	....
24	54 02 00	170 23 00	48	47	One....	....	....	....	....
25	54 00 00	166 34 00	48	45	One....	....	....	....	....
26	Dutch Harbor, Unalaska Island.		49	46	....	....	....	....	....
31	54 13 00	165 42 00	52	46	....	Many.....	Many.....	Several ...	Few ......
Sept. 1	55 00 00	166 10 00	51	47	....	Several ...	....	....	....
2	56 40 00	170 18 00	48	46	Many..	Three.....	....	....	....
3	56 48 00	169 26 00	47	45	Many..	....	....	....	....
4	54 00 00	166 33 00	48	46	....	....	....	....	....
5	Dutch Harbor, Unalaska Island.		50	45	....	....	....	....	....

observed from deck of Albatross at sea—Continued.

ON CRUISE IN BERING SEA—Continued.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Many...	....	Great many.	Several.	Many...	Many...	....	....	Many seals near St. Paul Island.
Few	....	Many...	Many...	Many...	Few	....	....	One goose.
Few	One.....	Few	Few	Few	....	....	....	One white gony.
Many...	Few	Few	Many...	Few	Many...	....	Much..	Saw one seal off Akutan Pass. Large school of whales feeding off Unimak Pass, accompanied by large flocks of whale birds.
Few	....	....	....	....	....	....	....	
Many...	Several.	Several.	Few	Many...	Few	....	Much..	Few Aleutian sandpipers.
Many...	Few	Great many.	Several.	Many...	....	....	Much..	Many phalaropes.
....	....	....	....	....	....	....	....	
Many...	....	Few	Few	Few	....	....	....	
Few	Several.	Several.	Many...	Several.	....	Little...	Much..	Several pieces of driftwood seen in morning watch; 2 snipe seen in forenoon.
Many...	One.....	....	Several species; many.	....	....	....	....	Many phalaropes.
Many...	Few	Few	Many...	Few	....	....	....	
....	....	....	Several.	Few	....	....	....	Swallow flew on board.
....	Few	....	Many...	Few	....	....	Much..	One white gony.
....	....	Few	Few	Few	....	....	Much..	
Few	....	....	....	....	....	....	....	
Many...	Many...	Many...	Many...	Many...	Many...	....	Much..	Several porpoises in Unimak Pass. Several hawks and white gonies. Many whales, accompanied by large flocks of birds, in Unimak Pass.
Several.	Few	Few	Few	Few	....	....	Much..	Land hawk rested in rigging.
Many...	....	Many...	Many...	Many...	Several.	....	....	Many seals seen near Pribilofs. Many phalaropes.
Few	Few	Few	Few	Few	....	....	....	Many seals near St. Paul Island. Few phalaropes.
Few	Few	Few	Few	Few	....	....	Little..	
Few	....	....	....	....	....	....	....	

Record of animal life, driftwood, kelp, etc.,

FROM DUTCH HARBOR, UNALASKA

Date.	Meridian positions.		Mean temperatures.		Seals.	Whales.	Little auks.	Cormorants.	Ducks.
	Latitude north.	Longitude west.	Air.	Water surface.					
1893.	° ′ ″	° ′ ″	°	°					
Sept. 8	54 18 00	165 39 00	53	46		One			Few
9	54 37 00	163 16 00	51	47				Few	
10	Bailey Harbor, Alaska Peninsula		54	51		Four		Many	
11	55 20 00	161 01 00	51	48		Two			
12	Portage Bay, Alaska Peninsula.		50	50				Many	Several
13	55 37 00	155 38 00	50	48		Several			
14	57 20 00	150 57 00	48	47		Several			
15	57 15 00	146 05 00	55	50					
16	57 11 00	140 49 00	56	53					
Sept. 17	Sitka Harbor, SE. Alaska.		53	52		Two			

FROM SITKA, SOUTHEAST ALASKA, TO

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals.	Whales.	Little auks.	Cormorants.	Ducks.
Sept. 18	Sitka Harbor, SE. Alaska.		56	51					
19	54 18 00	133 55 00	60	53		Two			
20	51 37 00	131 03 00	59	55		Many			Many
21	50 29 00	126 15 00	54	49					Many
22	Union Bay, Baynes Sound, British Columbia.		54	54					
23	49 23 00	124 18 00	61	54					
24	Port Townsend, Wash.		61	51					

FROM PORT TOWNSEND, WASH., TO

Date.	Latitude north.	Longitude west.	Air.	Water surface.	Seals.	Whales.	Little auks.	Cormorants.	Ducks.
Sept. 26	48 10 00	123 20 00	54	51					
27	46 04 00	124 58 21	57	55		Many			
28	42 39 00	124 39 30	56	54		One			
29	39 11 00	124 03 00	61	53					
30	Raccoon Straits, San Francisco Bay.		64	58					
Oct. 1	Navy-Yard, Mare Island, Cal.		68	62					

observed from deck of Albatross at sea—Continued.

ISLAND, TO SITKA, SOUTHEAST ALASKA.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Few		Several	Many	Several			Much	Small school of porpoises in Akun Cove; also few snipe and geese.
Many	Several	Many	Many	Many			Much	One white gony.
Many			Many	Few	Many			
Several			Several		Few			
Many					Many			Few geese at Portage Bay.
Several	Few		Many					Large flock of whale birds in company with school of whales.
Few			Many			Some	Much	
		Few	Several					
	Few		Several					
	Few			Few				

PORT TOWNSEND, WASH.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
Several	Few					Little	Little	Several geese in Sitka Harbor.
Several	Several			Many	Few	Little	Much	
Several	Many	One		Many		Little	Much	Land hawk perched in rigging.
Many	Several					Much	Little	Porpoise in Seymour Narrows.
Many	Many					Much		
Several	Many					Much	Much	

NAVY-YARD, MARE ISLAND, CAL.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Driftwood.	Kelp.	Remarks.
	Few					Some	Little	
	Many	Several	Many			Large log.	Little	
	Few	Few		Few				Several blackfish and sharks.
	Few	Few		Few				
	Few							

Record of animal life, driftwood,

FROM PORT TOWNSEND, WASH., TO DUTCH

Date.	Meridian position. Lat. N.	Meridian position. Long. W.	Mean temperatures. Air D. B.	Mean temperatures. Sea surf.	Seals.	Whales.	Auks.	Cormorants.	Ducks.
1894.	° ′ ″	° ′ ″							
May 17	48 55 00	123 20 00	53	50				Few	
18	49 44 30	124 48 00	57	53				Several	Several
19	50 57 00	128 47 00	50	47				Several	Several
20	51 54 00	133 39 00	50	48		Four			
21	53 07 00	138 24 00	48	45		One			
22	53 37 00	144 10 00	46	41					
23	54 07 00	149 59 00	41	39					
24	54 30 00	156 49 00	41	38	One	One			
25	53 57 00	161 48 00	40	37		Large sch'l	Many		
26	54 08 00	166 11 00	38	37		Several	Many	Few	
27	Dutch Harbor.		40	38					

FROM DUTCH HARBOR, UNALASKA, TO CHICHAGOF HARBOR,

Date.	Lat. N.	Long. W.	Air D. B.	Sea surf.	Seals.	Whales.	Auks.	Cormorants.	Ducks.
May 31	54 03 00	167 54 00	39	37					Several
June 1	53 44 00	174 24 00 East.	40	38					
2, 3	53 20 00	178 45 00	44	39					
4	Chichagof Harbor, Attu Island.		42	42				Several	Many
5	52 37 00	173 45 00	41	39			Many	Several	Many
6	52 39 00	173 44 00	43	39			Many	Several	Many
7	52 19 00	177 30 00	41	39		Many finbacks.			Few
8	Kiska Harbor, Kiska Island.		42	40				Few	Few
9	52 07 00	177 43 00 West.	42	39				Few	
9	52 25 00	177 15 00	42	40		Many	Many	Few	
10	Nazan Bay, Atka Island.		43	40		One	Many	Few	Few
11	53 20 00	169 38 00	41	39		Two	Many		
12	Dutch Harbor.		47	40					

FROM DUTCH HARBOR, UNALASKA, TO NAZAN BAY,

Date.	Lat. N.	Long. W.	Air D. B.	Sea surf.	Seals.	Whales.	Auks.	Cormorants.	Ducks.
June 13	53 57 00	166 31 00	50	41					
14	53 55 00	167 05 00	42	39		Two		Few	
15	53 27 00	168 14 00	41	39			Many		
16	52 59 00	171 55 00	40	39		Many			
17	52 11 00	173 03 00	41	39		Many	Many	Few	Several
18	54 10 00	167 56 00	44	41					
19	Dutch Harbor.		47	43					

FROM DUTCH HARBOR, UNALASKA, ON CRUISE IN EASTERN

Date.	Lat. N.	Long. W.	Air D. B.	Sea surf.	Seals.	Whales.	Auks.	Cormorants.	Ducks.
June 22	55 40 00	168 35 00	40	38			Grt. many		
23	Village Cove, St. Paul Island.		41	37			Grt. many		
24	57 34 00	167 58 00	39	37			Many		
25	56 12 00	165 45 00	40	38		Two			
26	55 33 00	163 23 00	41	39				Few	
27	56 31 00	159 48 00	40	38					Grt. many
28	56 38 00	160 39 00	37	37	Two	Several			
29	57 56 00	166 16 00	41	37	Two	Five			
30	56 59 00	163 02 00	40	39					

kelp, etc., observed at sea—Continued.

HARBOR, UNALASKA ISLAND, ALASKA.

Gulls.	Gonies.	Guillemots.	Petrels.	Puffins.	Terns.	Drift-wood.	Kelp.	Remarks.
Few					Many	Much	Much	
Few					Many	Much	Much	
Many			Few		Many	Much	Much	
Many			Many	Many	Many			Immense flocks of sea fowl following whales and feeding on surface life.
Few			Few					Four hawks.
	Few		Few					
	Several		Several	One				
Few	Several	Several	Several	Few				
Several	Several	Many	Many	Several				
Many	Few	Many	Many	Many	Few		Little	
Few								

ATTU ISLAND, AND RETURN TO DUTCH HARBOR.

Many		Many	Many	Many			Little	Few porpoises.
Many		Many	Many	Few	Few			
Several	1 white	Many	Many	Many				Several species of petrels.
Many	Several	Many	Many	Many			Much	Many jägers; many geese.
Many		Many	Few	Many			Much	Several jägers; many geese.
Many		Many	Few	Many			Much	Do.
Many		Several	Several	Many			Much	Few snipe.
Few							Little	
Several	1 white	Several	Several				Little	
Few	Few	Many	Many	Many			Much	Immense flocks of sea fowl following large school of whales, feeding on surface.
Several			Many	Many			Much	Many geese.
Few	Few	Many	Many	Many			Much	
Several		Several		Few			Little	

ATKA ISLAND, AND RETURN TO DUTCH HARBOR.

Few	Few	Many	Several				Little	
Few		Many	Several	Several				
Few	2 white	Many	Many	Many			Much	Several porpoises.
Few	2 white	Many	Several	Several				
Several	1 white	Many		Many			Much	
	2 white	Many	Several	Several			Little	
Several							Little	

PORTION OF BERING SEA, AND RETURN TO DUTCH HARBOR.

Many	Several	Grt.many	Many		Several		Some	
Many		Grt.many	Many	Many	Several		Little	
Several		Many	Many	Many	Several			
		Several	Several					Several species of petrels.
		Many						
Many	Many	Grt.many	Many		Many			Great many geese.
Few		Several	Few		Few			Much floating ice.
		Several						
One		Few		Few				

Meteorological and cruising record, and seal data.

Date.	Meridian position. Lat. N.	Meridian position. Long. W.	Distance run per log.	Barometer. Max.	Barometer. Min.	Temperature. Air. Dry bulb. Max.	Dry bulb. Min.	Wet bulb. Max.	Wet bulb. Min.	Water at surface. Max.	Water at surface. Min.	State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents.	Force in knots per hour.	Number of hours sealing weather.	Number of fur seals seen.
1893.	° ′ ″	° ′ ″	Knots.																
July 1	51 32 00	175 52 00	261.0	30.08	29.96	48	41	47	40	49	40	Overcast and foggy; thick.	NW., 2	None	Smooth	N. 3° W.	0.5	15	0
2	Bay of Waterfalls, Adak Island.		59.8	29.98	29.78	60	44	58	43	49	45	Clear and pleasant	NE., hauling to NW., 2 to 3.	None					0
3	do			30.02	29.84	53	45	52	44	47	44	Foggy and misty; clearing at times.	NNW., 5; N., 3; W., 2	Light					0
4	do			30.23	30.03	52	46	50	45	48	44	Overcast and foggy; clear at times.	NW., 2, hauling to SSE., 2.	None					0
5	51 23 00	176 49 00	19.1	30.29	30.22	52	46	51	45	47	44	Thick and foggy; misty at times.	SE. and NNE., 2	Light mist.	Smooth			9	0
6	51 09 00	176 19 00	79.4	30.26	29.97	52	48	51	47	50	44	Cloudy and misty	E'd, 3 to 5	Moderate mist.	Smooth to moderate.	N. 52° W.	0.15	10	0
7	50 31 00	174 02 00	144.6	30.12	29.97	53	49	52	48	50	48	Cloudy; misty at times.	NNE., 4-2	Light mist.	Moderating.	S. 80° W.	1.0	12	0
8	52 06 00	171 45 00	139.1	30.11	30.06	50	45	49	44	49	40	Foggy, misty, and rainy; wet.	NNW. to W. to NW., 2	Moderate.	Smooth	S. 54° W.	0.3	17	0
9	55 06 00	170 10 00	199.7	30.08	29.71	49	45	48	44	48	42	Misty, drizzly, and stormy.	NW. to W., 2-4; WSW., 4-8.	Moderate.	Moderate to rough.	S. 83° E.	0.4	8	3
10	St. Paul Island, Pribilofs.		137.5	29.88	29.70	46	44	45	43	43	40	Stormy to thick, misty and rainy.	SSW., 9; SW., 3	Moderate.	Rough to moderating.			0	Many.
11	St. George Island, Pribilofs.		43.2	30.12	29.88	48	42	47	41	43	40	Wet and disagreeable, rainy and foggy.	SSW., 3	Moderate.	Gentle to smooth.	West	0.5	18	Many.
12	57 17 00	171 10 00	107.7	30.22	30.12	44	42	43	41	44	42	Overcast and cloudy to foggy.	S'd and W'd, 4-3	None	Gentle to smooth.	S. 81° W.	0.25	20	9
13	56 56 00	173 40 00	123.0	30.18	29.86	47	42	46	41	46	43	Overcast, misty, and rainy.	SE., 1; E'd, 4	Moderate.	Smooth to moderate.	N. 62° E.	0.2	14	15
14	56 34 00	171 18 00	120.5	30.30	29.82	50	44	49	43	46	44	Rainy and overcast to cloudy.	ENE., 5; NNE., 4; N., 3	Light	Moderate to smooth.	N. 83° W.	0.7	0	20
15	St. George Island, Pribilofs.		61.9	30.40	30.31	50	43	47	42	44	40	Fair and pleasant	N'd and W'd to S'd and W'd., 3-2.	None	Smooth			20	Many.
16	East anchorage, St. Paul Island.		38.7	30.38	30.20	47	44	47	43	44	41	Fair and pleasant to overcast and rainy.	WSW., 3; SSW., 2	Moderate.	Smooth			16	Many.

	17	56 02 00	169 30 00	87.7	30.25	30.20	52	46	50	45	47	42	Overcast and foggy	SW., 3; squalls (9 to 11 p.m.), 6.	None	Smooth to increasing.	......	......	16	6
	18	54 34 00	167 14 00	130.4	30.18	30.01	60	50	58	49	50	47	Cloudy and boisterous to overcast and rainy.	S'd, 6	Moderate.	Moderate to rough; choppy.	N. 11° E	0.9	0	1
	19	Dutch Harbor, Unalaska Island.		51.2	30.10	29.90	63	59	61	47	51	48	Fair and pleasant	SE., 3; S. by W., 4; squalls, 6.	None	Smooth	......	......	......	......
	20	....do		......	30.12	30.08	56	49	54	47	51	47	....do	S. by W., 3; (mid. and p. m. watches) squalls, 6.	None	......	......	......	......	......
	21	....do		......	30.14	30.08	57	50	56	49	52	48	....do	SSW., 2; SW., 1	None	......	......	......	......	......
	22	....do		......	30.13	30.07	54	50	52	49	51	49	Cloudy; partially clear in forenoon.	S., 1; NW. and N., 1	None	......	......	......	......	......
	23	....do		......	30.16	30.06	58	49	57	48	52	49	Foggy to fair and pleasant.	Variable, 1; calm; SSE., 3	None	......	......	......	......	......
	24	....do		......	30.05	29.88	70	57	69	55	53	52	Cloudy and rainy	Calm; S'd, 1; calm	Moderate.	......	......	......	......	......
	25	....do		......	29.96	29.84	68	47	66	45	54	43	Fair and pleasant; windy.	S., 4; squalls, 6; SW., 6	None	Moderate	......	......	0	0
	26	55 33 00	168 05 00	125.6	30.09	29.80	48	46	47	45	46	43	Overcast and stormy; heavy rain middle and first watches.	S'd. and W'd, 7–4	Moderate.	Rough to moderate.	S. 79° E	0.7	0	1
	27	East anchorage, St. Paul Island.		130.2	29.86	29.66	48	45	47	44	44	42	Overcast and foggy; drizzly at times.	SW., 4 till noon; NW., 5–7.	Light	Moderate	......	......	0	Many.
	28	57 05 00	170 04 00	9.1	29.99	29.86	54	44	53	43	45	42	Fair and pleasant	NW. and WNW., 3	None	Smooth	None	......	10	3
	29	57 41 00	164 58 00	171.3	30.00	29.76	50	43	49	41	43	41	Overcast and misty to fair and pleasant.	NW., 3; NNW., 3; SE., 3	Light mist.	Smooth	N. 13° E	0.2	16	2
	30	58 12 00	167 29 00	160.0	29.71	29.24	46	42	45	41	43	41	Overcast and stormy; driving mist.	E'd, 9; SE., 6	Heavy mist.	Rough	......	......	0	1
	*31	57 01 00	169 44 00	112.8	29.57	29.21	56	45	55	44	46	42	Misty and rainy; thick.	S'd and E'd, 4–3	Moderate.	Rough to moderating.	S. 56° E	0.7	0	3
Aug.	1	57 39 00	169 33 00	61.2	30.00	29.58	49	43	47	42	45	42	Fair generally; foggy 4 to 9 p.m.	NE'd, 4–6; N'd to NW., 3–4.	None	Moderate	South	0.04	8	1
	2	60 03 00	167 55 00	155.5	30.02	29.98	43	40	42	39	44	40	Overcast and misty	NW. to W	Moderate mist.	Moderate	S. 65° E	0.4	4	0
	3	59 58 00	171 17 00	157.9	30.05	29.85	45	41	44	40	44	41	Overcast to rainy	W. 3; S'd and E'd, 2–4	Moderate.	Smooth	S. 47° W	0.6	14	0
	4	57 48 00	170 04 00	146.0	29.80	29.66	47	44	46	43	45	42	Overcast and rainy	SE., 4–6; SW'd, 4; SE., 4	Moderate.	Moderate	N. 48° E	0.6	4	1
	5	57 53 00	171 28 00	96.1	29.66	29.50	50	46	49	45	45	43	Overcast, foggy, and misty.	SW., 3	Light mist.	Smooth; swell S'd and W'd.	None	0.08	6	Many.
	6	59 54 00	174 18 00	154.9	29.49	29.34	52	44	50	43	46	43	....do	Variable, 1; N'd, 3	Light mist.	Smooth	N. 70° E	0.4	16	16
	7	57 57 00	175 19 00	179.6	29.64	29.44	51	44	49	43	47	44	Cloudy, but pleasant	N'd, 4–5	None	Moderate; long swell	N. 60° W	0.3	13	1
	8	57 07 00	170 22 00	182.2	29.76	29.63	48	44	46	43	45	43	Fair and pleasant to overcast and cloudy.	NNW. to WNW., 5–3	None	Moderate to rough.	West	0.5	0	5

*Distance steamed during month, 2,513.5 knots; days under way and steaming, 23.

Meteorological and cruising record, and seal data—Continued.

Date.	Meridian position.		Distance run per log.	Barometer.		Temperature.						State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents.	Force in knots per hour.	Number of hours sealing weather.	Number of fur seals seen.
						Air.				Water at surface.									
						Dry bulb.		Wet bulb.											
	Lat. N.	Long. W.		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.								
1893.	° ′ ″	° ′ ″	*Knots.*																
Aug. 9	56 39 00	168 13 00	80.9	30.05	29.78	49	45	47	44	46	43	Fair and pleasant	SW., 2–3	None	Smooth	East	0.03	16	0
10	55 56 00	163 38 00	181.0	30.09	29.74	55	48	53	47	48	45	....do	SE., 3; SSE., 10	None	Smooth to moderate.	N. 1° W	0.3	14	0
11	54 20 00	165 42 00	126.2	29.81	29.68	57	49	55	48	49	46	Overcast, foggy, and drizzly.	SE'd, 10–5: N., 1	Light	Moderate to smooth.	None	0.0	6	1
12	Dutch Harbor, Unalaska Island.		50.0	29.84	29.37	61	49	60	48	53	48	Overcast and cloudy; fair midday.	Variable, 1; SE., 4 (squalls, 6).	None	......	......	......	......	......
13	....do		......	29.60	29.30	56	50	54	49	50	48	Clear and pleasant	S'd, 3	None	......	......	......	......	......
14	....do		......	29.86	29.62	57	51	54	48	50	47	....do	S'd, 3; squalls, 6	None	......	......	......	......	......
15	....do		......	29.87	29.60	62	54	59	52	50	48	Fair and pleasant	SE, 3	None	......	......	......	......	......
16	53 58 00	166 33 00	5.9	29.79	29.63	57	45	55	44	49	44	Fair to overcast and boisterous.	S'd, 2; SW., 6; S'd, 2	Light	Rough to moderate.	......	......	0	0
17	53 51 00	168 00 09	105.1	29.76	29.70	49	47	48	46	48	44	Overcast and misty; fair at midday.	Variable, 1; W'd, 2 and 3	Light mist.	Smooth; swell S'd and W'd.	No account	......	13	0
18	56 19 00	169 32 00	166.8	29.72	29.61	49	46	48	45	48	43	....do	N'd and W'd, 3	Moderate mist.	Smooth; swell N'd and W'd.	S. 28° W	0.5	16	Many.
19	56 31 00	173 45 00	168.1	29.82	29.66	48	46	47	45	47	45	Overcast and cloudy, but pleasant.	WNW., 4	None	Moderate	S. 24° E	0.4	12	2
20	55 08 00	175 56 00	175.1	29.81	29.69	56	48	55	47	50	46	Drizzly to fair and pleasant.	N'd, 3	Light drizzle	Smooth	S. 9° W	0.2	16	3
21	55 47 00	172 41 00	156.5	29.80	29.74	52	48	51	47	49	46	Clear and pleasant; sunny.	N'd and W'd, 4; W., 5	None	Swell from N'd; gentle.	S. 38° W	0.3	8	8
22	55 09 00	171 39 00	164.2	29.81	29.12	50	48	49	47	49	46	Fair to stormy	SW., 3; E'd, 9	Light	Smooth to rough.	S. 17° E	0.1	14	7
23	53 42 00	172 44 00	124.7	29.03	28.81	50	48	49	47	48	46	Stormy; driving mists.	ENE., 10; N'd, 5; NW'd, 9	Much mist.	Rough	No account	......		0
24	54 02 00	170 23 00	139.3	29.66	29.02	49	48	48	47	48	46	Stormy and squally; misty.	W'd, 8–9	Much mist.	Rough	No account	......	0	1
25	54 00 00	166 34 00	179.2	29.84	29.66	51	46	50	45	47	44	Overcast and boisterous; rainy.	W'd, 7–6, S'd, 3; N., 1	Moderate.	Rough	S. 38° W	0.4	0	1
26	Dutch Harbor, Unalaska Island.		8.5	29.93	29.74	52	47	50	46	47	45	Overcast and cloudy; rainy at midday.	W., 4–3	Light	......	......	......	......	......

27	....do..........		....	29.97	29.80	52	45	50	44	47	45	Fair and pleasant; showery at midday.	S., 2; NNE., 1	Light					
28	....do..........		....	29.87	29.75	53	45	51	44	49	44	Cloudy, but pleasant	Variable, 1	None					
29	....do..........		....	30.11	29.86	51	45	50	44	47	45	Fair to overcast and cloudy.	Calm; S'd, 2; E., 1; calm.	None					
30	....do..........		....	30.30	30.12	55	46	53	45	49	45	Fair and pleasant	Calm; N., 2	None					
*31	54 13 00	165 42 00	45.5	30.28	30.22	55	49	53	48	47	45	Fair and pleasant; cloudy after sunset.	S., 2–3	Light	Smooth	No account		12	0
Sept. 1	55 00 00	166 10 00	104.6	30.21	29.66	54	48	52	47	49	45	Misty; fair middle of day.	E., 4; NNE., 5	Much mist.	Moderate	N. 53° W.	0.3	0	0
2	56 40 00	170 18 00	191.8	29.77	29.64	50	46	48	45	48	44	Cloudy, but pleasant	N., 5; NNE., 3	None	Moderate	S. 05° E.	0.4	0	Many.
3	56 48 00	169 26 00	75.0	29.77	29.68	49	45	48	44	46	44	Drizzly and rainy; disagreeable.	NE'd, 4–5	Moderate.	Moderate	No account		8	Many.
4	54 00 00	166 33 00	216.5	30.40	29.73	50	47	49	46	47	45	Overcast to cloudy, but pleasant.	N'd, 4; WNW., 2	None	Moderate	N. 64° W.	0.5	0	0
5	Dutch Harbor, Unalaska Islands.		8.0	30.47	30.42	53	47	51	46	47	44	Fair and pleasant	SW., 2 to 3; squalls, 5	None					
6	....do..........		....	30.46	30.18	55	48	53	47	48	46	....do....	SW., 2; NE., 3	None					
7	....do..........		....	30.13	29.92	61	51	59	49	49	46	Cloudy and blustery	SW., 4; squalls, 5 and 6	Light					
8	54 18 00	165 39 00	48.0	30.24	30.08	57	50	55	48	47	45	Fair to overcast and rainy.	WSW., 6; SSW., 3	Moderate.	Moderate	No account		0	0
9	54 37 00	163 16 00	101.7	30.06	29.90	54	48	52	46	49	45	Rainy and foggy to fair to foggy.	WSW. to SE., 2	Light	Smooth	No account		12	0
10	Bailey's Harbor, Alaska Peninsula.		61.9	29.92	29.82	58	51	57	50	55	47	Foggy to fair to overcast.	SSW., 2–1	None	Smooth	No account		4	0
11	55 20 00	161 01 00	52.6	29.80	29.64	53	50	52	48	50	47	Drizzly, foggy, and overcast.	SE., 2; SSE. to S., 4–3	Light	Moderate	No account		0	0
12	Portage Bay, Alaska Peninsula.		26.0	29.88	29.68	53	48	51	46	51	49	Fair and pleasant	S. to SSW., 3; W., 4	None	Smooth	No account		4	0
13	55 37 00	155 38 00	193.9	30.07	29.90	53	48	50	47	49	47	....do....	N'd, 4–2	None	Long swell S'd and E'd.	Tidal	0.16	12	0
14	57 20 00	150 57 00	206.0	30.24	30.02	50	47	49	46	48	46	Rainy and misty	N'd, 2–4	Moderate.	Moderate	West	0.3	0	0
15	57 15 00	146 05 00	178.4	30.45	30.26	61	50	60	49	54	47	Clear and pleasant	N'd and W'd, 5	None	Rough to moderate.	S. 46° W.	1.2	0	0
16	57 11 00	140 49 00	171.0	30.41	30.17	60	53	58	51	55	51	....do....	WNW., 4; W., 3	None	Moderating.	N. 48° E.	0.1	6	0
17	Sitka, S. E. Alaska		174.0	30.15	29.98	59	48	57	47	55	50	....do....	N'd and W'd, 3; SW., 2	None	Smooth	N. 70° E.	0.3	6	0
18	....do..........		3.6	30.24	30.10	65	48	63	47	54	49	....do....	N., 2; N'd and W'd, 4	None	Smooth	No account		3	0
19	54 18 00	133 55 00	187.5	30.10	29.92	67	54	64	53	55	52	....do....	WNW., 4	None	Moderate	Tidal	0.15	0	0
20	51 37 00	131 03 00	210.8	30.03	29.95	62	56	58	54	57	53	....do....	N'd, 4	None	Moderating.	N. 36° E.	0.2	10	0
21	50 29 00	126 15 00	207.1	36.20	30.04	63	45	61	44	53	46	....do....	S'd and E'd, 1; calm	None	Smooth	No account		0	0
22	Union Bay, Baynes Sound, B. C.		124.9	30.25	30.20	60	49	59	48	58	50	....do....	Calm generally	None	Smooth	No account			
23	49 23 00	124 18 00	27.8	30.25	30.16	71	53	68	52	59	50	....do....	Calm generally	None	Smooth	No account			
24	Port Townsend, Wash.		102.8	30.24	30.10	72	50	70	49	53	49	....do....	W'd, 1–2	None					

*Distance steamed during month, 3,010.4 knots; days under way and steaming, 24.

Meteorological and cruising record, and seal data—Continued.

Date.	Meridian position. Lat. N.	Meridian position. Long. W.	Distance run per log.	Barometer. Max.	Barometer. Min.	Temperature. Air. Dry bulb. Max.	Dry bulb. Min.	Wet bulb. Max.	Wet bulb. Min.	Water at surface. Max.	Water at surface. Min.	State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents.	Force in knots per hour.	Number of hours sealing weather.	Number of fur seals seen.
1893.	° ′ ″	° ′ ″	*Knots.*																
Sept. 25	Port Townsend Wash.		......	30.19	30.06	76	52	73	51	54	50	Clear and pleasant	W'd, 2	None..	....	....	......	....	......
26	48 10 00	123 20 00	27.0	30.29	30.20	55	53	54	51	52	50	Foggy to fair and pleasant.	Calm; SW., 2; WSW., 3.	None..	Smooth ...	No account	......	0	0
27	46 04 00	124 58 21	210.0	30.26	30.18	59	55	58	54	59	52	Fair and pleasant generally.	S'd, 2–1	Light.	Smooth ...	None	0.0	13	0
28	42 39 00	124 39 30	211.0	30.19	29.99	59	54	57	53	57	52	Fair to overcast and rainy.	S'd, 2–1	Light.	Smooth ...	N. 56° E ..	0.5	12	0
29	39 11 00	124 03 00	208.6	30.12	29.95	68	54	65	52	55	51	Overcast and rainy to fair.	NW., 4–5	Light.	Moderate.	S. 76° W ..	0.2	0	0
*30	Raccoon Straits, Bay of San Francisco.		123.7	30.08	29.97	76	53	72	51	64	52	Clear and pleasant	NW., 4–2	None..	Smooth ...	No account	......	0	0
Oct. 1	Navy-yard, Mare Island, Cal.		16.7	30.18	30.00	77	60	69	58	65	59	....do	NW., 2; SW., 2	None..	....	....	......	....	......
2	....do		......	30.22	30.05	77	60	72	58	66	60	....do	Calm; SSW., 2	None..	....	....	......	....	......
3	....do		......	30.15	30.01	78	55	74	54	65	59	....do	W., 2	None..	....	....	......	....	......
4	....do		......	30.10	30.00	80	59	77	58	64	60	....do	WSW., 2	None..	....	....	......	....	......
5	....do		......	30.13	29.99	80	55	79	54	66	55	....do	Calm; S'd and W'd, 1–2..	None..	....	....	......	....	......
6	....do		......	30.14	30.04	76	58	74	57	66	59	....do	W. and WSW., 1	None..	....	....	......	....	......
7	....do		......	30.21	30.08	73	58	70	55	66	59	....do	S'd and W'd, 2–1	None..	....	....	......	....	......
8	....do		......	30.11	29.98	72	60	69	59	65	60	....do	WSW., 1–2	None..	....	....	......	....	......
9	....do		......	30.20	29.93	69	56	66	55	65	59	Drizzling to clear and pleasant.	S., 2, to W., 3	Light.	....	....	......	....	......
10	....do		......	30.30	30.19	70	53	67	52	66	59	Clear and pleasant	W., 1, to SW., 2	None..	....	....	......	....	......
11	....do		......	30.36	30.20	68	54	65	52	63	59	....do	Calm; SW., 2	None.	....	....	......	....	......
12	....do		......	30.29	30.01	79	55	76	53	66	58	....do	Calm generally; SW., 1..	None..	....	....	......	....	......
13	....do		......	30.07	29.88	80	55	76	55	66	59	....do	Calm; SW., 1 (8 a. m., 5 p. m.); calm.	None..	....	....	......	....	......
14	....do		......	30.02	29.94	71	53	68	56	63	59	....do	Calm; SW., 2	None..	....	....	......	....	......
15	....do		......	30.22	30.00	64	56	60	54	63	59	Fair generally; sun-showers middle of day.	SW., 2	Light.	....	....	......	....	......
16	....do		......	30.30	30.15	67	50	61	48	62	58	Clear and pleasant	Calm; WSW. and SW., 2–3.	None..	....	....	......	....	......

*17	....do		30.22	30.04	69	47	65	46	62	57	....do	WSW., 2	None					
18	....do		30.12	29.98	67	48	65	47	62	58	Clear generally; fog 5 to 8 a. m.	Calm; WSW., 2	None					
19	....do		30.11	30.02	64	54	60	53	60	55	Clear and pleasant	WSW., 2	None					
20	....do		30.24	30.10	66	52	62	50	61	55	....do	WSW. and SW., 2	None					
21	....do		30.24	29.95	66	53	64	51	62	57	....do	W., 1, to WSW., 2	None					
22	....do		30.00	29.80	65	53	63	51	61	58	....do	SW., 1 (occasionally)	None					
23	....do		30.11	30.02	71	55	69	53	61	59	Fair and pleasant	Calm; W'ly, 1 (7 a. m., 3 p. m); calm.	None					
24	....do		30.26	30.10	67	57	64	56	61	59	Cloudy and drizzly to fair.	SW. and SSW., 1	Light					
25	....do		30.38	30.26	66	54	63	53	60	58	Fair and pleasant	SW., 1-2	None					
26	....do		30.22	30.14	67	52	64	52	60	54	Overcast and foggy to fair.	S'd and W'd, 1-2	None					
27	....do		30.19	30.01	75	52	70	52	60	57	Foggy to clear and pleasant.	Calm generally; E'ly, 1	None					
28	....do		30.20	30.08	61	53	59	52	60	57	Fair and pleasant; cloudy.	S'd and Wd, 1-2	None					
29	....do		30.25	30.18	65	55	62	54	60	57	....do	SW., 2	None					
30	....do		30.24	30.12	64	54	63	54	60	57	Rainy to fair and pleasant.	SW., 2	Light					
†31	....do		30.16	30.08	63	50	61	48	60	56	Fair and pleasant; cloudy.	Calm; SW., 1-2	None					
Nov. 1	....do		30.20	30.10	65	55	64	53	60	57	Fair and pleasant	Calm; SW., 2 (2 to 7 p. m); calm.	None					
2	....do		30.28	30.19	63	47	59	46	58	55	Fair to clear and pleasant.	Calm; W., 2	None					
3	....do		30.37	30.19	62	47	60	44	59	56	Fair generally; mist 8 to 10 a. m.	W., 2; calm; SW., 2	Light mist					
4	....do		30.24	30.01	65	52	62	51	60	55	Foggy and misty to fair.	S'd and W'd., 1-2	Light mist.					
5	....do		30.08	30.02	60	54	58	53	59	56	Cloudy to overcast and rainy.	Calm; WSW. to SSW., 2-3.	Light					
6	....do		30.32	30.04	64	56	62	54	59	57	Overcast and rainy to clearing.	SW., 2	Moderate.					
7	....do		30.41	30.27	61	51	59	49	58	55	Foggy to clear and pleasant.	Calm generally; SW'ly, 1	None					
8	....do		30.42	30.28	61	49	58	48	58	54	Foggy to fair and pleasant.	Calm; SW., 1	None					
9	....do		30.31	30.22	63	53	61	53	59	55	Cloudy to overcast, then clearing.	SW., 2; calm	None					
10	....do		30.35	30.19	65	51	62	50	53	55	Fair generally; mist 4 to 6 a. m.	SW., 2	Light mist.					
11	....do		30.37	30.22	70	55	64	54	59	55	Clear and pleasant	W., 2 to SE., 2	None					
12	....do		30.44	30.29	69	44	65	47	58	54	....do	Calm; NE'd, 2 (9 a. m., 5 p. m.); calm.	None					
13	....do		30.35	30.20	67	49	65	48	60	54	....do	Calm; variable 1 (10 a. m., 3 p. m.); calm.	None					
14	....do		30.38	30.22	71	52	66	51	58	55	....do	E. 1-3; ENE., 3; calm	None					
15	....do		30.34	30.13	69	48	64	47	58	54	....do	Calm generally; E., 1	None					

*Distance steamed during month, 3,454.2 knots; days under way and steaming, 27. †Distance steamed during month, 16.7 knots; days underway and steaming, 1.

Meteorological and cruising record, and seal data—Continued.

Date.	Meridian position. Lat. N.	Meridian position. Long. W.	Distance run per log.	Barometer. Max.	Barometer. Min.	Temperature. Air. Dry bulb. Max.	Temperature. Air. Dry bulb. Min.	Temperature. Air. Wet bulb. Max.	Temperature. Air. Wet bulb. Min.	Temperature. Water at surface. Max.	Temperature. Water at surface. Min.	State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents.	Force in knots per hour.	Number of hours sealing weather.	Number of fur seals seen.
1893.	° ′ ″	° ′ ″	Knots.																
Nov. 16	Navy-yard, Mare Island, Cal.			30.17	29.95	57	48	56	47	57	54	Fair generally; foggy and misty 6 a. m. to 12 m.	W., 1; SW., 2	Light mist.					
17	do			30.17	30.00	56	47	54	46	55	51	Clear, but squally	N'd and W'd, 3–6	None					
18	do			30.14	29.99	65	49	61	47	55	53	Clear and pleasant	Calm generally; variable, 1.	None					
19	do			30.32	30.15	58	47	55	45	54	50	do	Calm; E., 3 (5 a. m., 5 p. m.); calm.	None					
20	do			30.34	30.24	58	40	56	39	54	49	Fair; cooler	Calm; SW., 1	None					
21	do			30.25	30.12	56	49	55	48	53	50	Overcast and threatening to fair.	Calm; S'd and W'd (8 a. m., 6 p. m.); calm.	None					
22	do			30.26	30.16	62	49	60	48	54	51	Cloudy and cool to overcast and drizzly.	SW., 2–1	Light					
23	do			30.25	30.11	63	54	60	53	55	53	Fair to misty and drizzly.	Calm; SW. to SE., 2	Light					
24	do			30.08	29.90	61	54	60	53	54	53	Overcast and rainy to cloudy.	Calm; SE. and S., 3–2	Moderate.					
25	do			30.22	30.06	58	52	57	51	54	52	Cloudy and unsettled; showery.	WSW., 1; SSW., 2	Light					
26	do			30.22	30.12	61	51	59	50	56	51	Overcast and stormy; rainy.	ESE., 1; SE., 2–3	Heavy					
27	do			30.25	30.17	61	52	59	51	55	52	Overcast, drizzly, and rainy.	ESE., 1; S'd and W'd, 2–3.	Moderate.					
28	do			30.34	30.21	64	52	62	50	55	52	Cloudy to fair; drizzle 4 to 5 a. m.	Calm; SE., 3–2; calm	Light					
29	do			30.38	30.29	60	54	59	53	55	52	Overcast and rainy	Calm; SE., 2	Moderate.					
30	do			30.34	30.29	61	57	60	56	56	52	Overcast, misty, and rainy.	SSW., 1	Moderate.					
Dec. 1	do			30.41	30.33	64	54	62	53	56	52	Cloudy and unsettled; showery in forenoon.	Calm; SW., 1	Light					
2	do			30.41	30.31	67	52	65	50	56	51	Foggy to fair and pleasant.	Calm; NW. to E., 2	None					
3	do			30.51	30.40	64	51	62	50	55	51	Clear and pleasant	E., 3; NE. to S., 2; calm	None					

4	.....do		30.48	30.33	63	51	60	50	55	51	Fair to clear and pleasant.	Calm; ENE., 2–1; calm.	None.					
5	.....do		30.40	30.26	66	50	64	49	56	50	Clear and pleasant	Calm; E. and ENE., 2.	None.					
6	.....do		30.44	30.32	67	49	61	48	54	51	.....do	NE., 3 (squalls, 5); ENE., 3	None.					
7	.....do		30.26	30.18	68	50	66	49	54	50	.....do	Calm generally; SW. by 1	None.					
8	.....do		30.29	30.17	70	56	67	55	62	51	.....do	E., 1–2; calm at times	None.					
9	.....do		30.27	30.11	65	54	63	53	55	52	.....do	E., 2; calm	None.					
10	.....do		30.16	30.03	61	50	59	49	55	51	.....do	Calm; E., 2	None.					
11	.....do		30.19	30.08	57	46	55	45	53	50	Fair and pleasant; fog 4 to 8 a. m.	Calm generally; W., 1.	None.					
12	.....do		30.13	30.04	56	48	55	47	54	50	Overcast and cloudy; rain 10 to 11 p. m.	Calm generally; SW., 1.	Light.					
13	.....do		30.16	30.08	58	51	57	50	Dry dock.		Cloudy; frequent rain showers.	Calm; S'd and W'd, 2.	Moderate.					
14	.....do		30.45	30.11	59	46	57	45	..do..		Overcast and rainy to fair.	SW., 2–3	Moderate.					
15	.....do		30.57	30.47	58	42	57	41	..do..		Clear and pleasant	SW., 1; E., 2	None.					
16	.....do		30.55	30.43	61	44	59	42	..do..		.....do	E'd, 2–3	None.					
17	.....do		30.46	30.28	59	49	58	48	..do..		Fair to overcast and rainy.	E'd, 2; calm	Light.					
18	.....do		30.32	30.22	61	50	59	49	..do..		Rainy to clearing	Calm; SW'ly 1; calm.	Light.					
19	.....do		30.27	30.19	54	50	53	49	..do..		Fair and pleasant to overcast.	Calm; N'd and W'd, 1	None.					
20	.....do		30.26	30.18	55	52	53	51	..do..		Overcast and threatening.	NW., 1; NE., 2	None.					
21	.....do		30.20	30.10	58	53	56	52	..do..		Overcast, rainy, and drizzly.	E'd, 1; calm	Moderate.					
22	.....do		30.20	30.06	57	47	56	46	..do..		Overcast and drizzly to clearing.	Calm; WSW., 3	Light.					
23	.....do		30.18	30.00	52	44	52	42	51	46	Fair to overcast and rainy.	SW., 1–2; S'd and E'd, 2.	Light.					
24	.....do		30.21	29.93	53	46	52	45	51	46	Rainy and drizzly to clearing.	S'd and W'd, 2	Light.					
25	.....do		30.30	30.09	46	44	45	43	49	45	Cloudy to overcast and disagreeable.	NE., 2–3	None.					
26	.....do		30.02	29.78	50	46	48	44	49	45	Overcast and drizzly.	NNE., 3; ESE., 2; NE., 2.	Light.					
27	.....do		30.49	29.94	51	44	49	43	48	44	Fair generally; showers 1 to 2 p. m.	Calm; E'd, 1–2	Light.					
28	.....do		30.53	30.43	49	41	48	39	47	43	Foggy and disagreeable.	Calm	None.					
29	.....do		30.50	30.33	46	35	45	34	46	40	Cold and disagreeable; heavy fog.	Calm generally; variable, 1.	None.					
30	.....do		30.44	30.38	44	37	43	36	46	42	Cloudy and cold; disagreeable.	N'd, 2–3	None.					
31	.....do		30.39	30.18	44	42	43	41	46	44	.....do	ENE., 2–3	None.					

Meteorological and cruising record, and seal data—Continued.

Date.	Meridian position.		Distance run per log.	Barometer.		Temperature.						State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents.		Number of hours sealing weather.	Number of fur seals seen.
						Air.				Water at surface.									
						Dry bulb.		Wet bulb.											
	Lat. N.	Long. W.		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.					Setting to the (true).	Force in knots per day.		
1894.	° ′ ″	° ′ ″	Knots.																
May 1	Port Townsend, Wash.		24.8	30.53	30.44	51	42	50	40	47	45	Cloudy to clear and pleasant; showery 6 to 8 a.m.	SW., 2; NE., 2; W'd, 2	Light	Smooth	No account	....	....	....
2	....do		......	30.52	30.36	55	43	53	42	47	45	Cloudy, but pleasant generally.	SW., 2; NE., 2; W., 3	Light	....	....	....	....	....
3	....do		......	30.36	30.02	53	46	52	44	47	45	Overcast, drizzly, and rainy.	W., 4; S'd and E'd, 3; calm.	Heavy	....	....	....	....	....
4	....do		......	30.10	29.93	51	47	50	46	47	46	Overcast and rainy; disagreeable.	Variable, 1; S'd and W'd, 2–3.	Moderate	....	....	....	....	....
5	48 13 00	122 51 00	9.8	30.15	30.03	55	45	52	44	48	46	Overcast, gloomy, and unsettled.	E., 3; NW., 1–3; S'd, 3	Light mist.	Smooth	No account	....	....	....
6	48 43 00	122 57 30	56.7	30.34	30.16	59	45	57	43	48	45	Fair, but cool	S'd and W'd, 4–3	None	Smooth	No account	....	....	....
7	Port Townsend, Wash.		55.1	30.26	30.01	54	45	52	44	48	46	Overcast and rainy to clearing.	Variable, 1; SE., 3–4; NW., 3; SW., 4–6.	Moderate	....	....	....	....	....
8	48 40 00	122 33 00	52.7	30.49	30.26	54	45	52	43	52	46	Clear and pleasant	WSW., 6; SW., 2; S'd, 2	None	Smooth	No account	....	....	....
9	Port Townsend, Wash.		49.9	30.58	30.28	54	45	52	43	52	46	Fair and pleasant	S'd and W'd, 2; N'd, 2; SW., 2; calm.	None	....	....	....	....	....
10	....do		......	30.24	30.04	54	43	52	42	47	45	....do	E'ly, 1; W., 2–4	None	....	....	....	....	....
11	....do		......	30.21	30.12	58	45	57	44	51	46	Overcast to fair and pleasant.	N'd and W'd, 1	None	....	....	....	....	....
12	....do		......	30.20	30.11	50	44	48	43	48	45	Fair to overcast and drizzly.	Calm; W., 1–3	Light	....	....	....	....	....
13	....do		......	30.16	29.99	52	45	50	43	48	45	Cloudy, but pleasant; showers 4 to 6 a.m.	S'd and W'd, 2	Light	....	....	....	....	....
14	....do		......	29.97	29.89	53	44	50	42	47	45	Overcast and cloudy	SW., 2; W., 4–3; WSW., 2–3.	None	....	....	....	....	....
15	....do		......	30.19	29.90	50	45	48	44	47	46	Overcast and disagreeable; rainy.	WSW., 2; SE., 28; calm	Heavy	....	....	....	....	....
16	....do		......	30.30	30.20	57	46	55	45	48	46	Overcast and cloudy	S'd and E'd, 2–1; calm	Light drizzle.	....	....	....	....	....
17	48 55 00	123 20 00	66.8	30.30	30.17	58	48	57	46	54	46	Clear and pleasant	W'ly, 1; calm	None	Smooth	No account	....	....	....
18	49 44 30	124 48 00	83.1	30.16	29.86	64	50	61	49	57	49	Clear and pleasant generally.	Calm; W., 2; calm; W., 2	None	Smooth	No account	....	....	....
19	50 57 00	128 47 00	176.7	30.02	29.88	53	48	52	47	49	46	Fair and pleasant generally; showery 7 to 8 a.m.	SW., 3–2	Light	Smooth	No account	....	....	....

	20	51 54 00	133 39 00	197.2	30.04	30.00	53	48	52	47	50	47	Fair and pleasant	SW., 2-1	None	Smooth	S. 42° E.	2.7	16	0
	21	53 07 00	138 24 00	209.8	30.13	29.99	51	46	50	45	48	43	Foggy to overcast and cloudy.	SSW., 2; E'd, 2	None	Smooth	N. 75° E.	23.5	16	0
	22	53 37 00	144 10 00	217.5	30.16	30.01	48	44	47	42	43	40	Overcast and foggy	N'd and E'd, 3; E'd, 4	None	Smooth	No account	......	16	0
	23	54 07 00	149 59 00	230.2	30.08	29.93	43	40	42	39	40	38	Foggy and misty	S'd and E'd, 4	Light	Smooth	S. 85° E.	21.2	16	0
	24	54 30 00	156 49 00	241.4	30.06	29.81	44	39	43	38	39	38	Foggy and thick	SE., by E., 4; E., 2	None	Smooth sea, swell from E'd.	No account	......	0	1
	25	53 57 00	161 48 00	206.0	29.77	29.19	43	37	42	36	39	36	Gloomy, threatening, and stormy.	E., 4, to NE., 9	Moderate	Moderate to rough.	East	20.6	0	0
	26	54 08 00	166 11 00	167.5	29.16	29.10	40	37	39	36	39	36	Stormy, overcast, and gloomy.	NE., 9; NNW., 3; NE., 2-1.	Moderate	Rough to smooth.	No account	......	5	0
	27	Dutch Harbor, Unalaska Island.		22.5	29.29	29.16	41	39	40	37	39	37	Overcast and stormy; snowing at times.	S'd and W'd, 1-3; squalls, 6.	Moderate	......	......	......	...	...
	28	....do....		......	29.69	29.29	41	38	40	37	38	37	Overcast and boisterous; snow, rain, and sleet at times.	W., 2; squalls, 6	Moderate	......	......	......	...	...
	29	....do....		......	29.78	29.70	51	38	50	37	39	37	Cloudy, but pleasant, to overcast.	S'd and W'd, 1-2	None	......	......	......	...	...
	30	....do....		......	29.73	29.67	41	38	40	37	39	37	Overcast and gloomy; snow in a.m.; rain in p.m.	NE., to NNW., 1	Moderate	......	......	......	...	...
	*31	54 03 00	167 54 00	65.3	29.88	29.72	40	38	39	37	38	37	Overcast and drizzly	S'd, 1; W., 2-3	Moderate	Smooth	No account	......	13	0
June	1	53 44 00	174 24 00	259.7	30.06	29.90	42	38	40	37	41	36	Rainy and misty to cloudy, but pleasant.	W'd, 4; S'd, 4; SSE., 4	Light	Smooth	East	28.8	18	0
	2, 3	53 20 00	*East.* 178 45 00	272.6	30.01	29.83	49	39	48	38	41	38	Cloudy, but generally pleasant.	SSE., 3; variable, 1; NW., 3.	Light	Smooth	N. 77° E.	26.6	18	0
	4	Chichagof Harbor, Attu Island.		229.6	30.12	29.92	46	39	45	38	46	38	Fair and pleasant	NW., 3; N'd, 1; calm	None	Smooth	S. 78° E.	22 hrs. 20.3.	8	0
	5	52 37 00	173 45 00	31.9	30.14	30.09	46	37	45	36	41	38	Fair to overcast, thick, and stormy.	Calm; S'd and W'd, 2-5	Moderate	Smooth	No account	......	5	0
	6	52 39 00	173 44 00	55.1	30.14	30.04	45	41	43	40	40	39	Rainy, misty, and boisterous.	S'd and W'd, 7-3	Heavy	Rough	No account	......	0	0
	7	52 19 00	177 30 00	164.5	30.14	29.91	44	39	43	39	40	39	Overcast and gloomy	SW., 3; SE., 3-5	Light	Moderate to smooth.	None	0	12	0
	8	Kiska Harbor, Kiska Island.		28.0	29.85	29.60	44	41	43	40	41	39	Stormy, thick, and rainy.	S'd and E'd, 5; squally, 8; S'd and E'd, 2.	Moderate	Smooth to moderate.	No account	......	4	0
	9	52 07 00	177 43 00	23.3	29.62	29.58	43	41	42	40	40	39	Thick, foggy, and rainy	SE., 1; E'd, 3	Moderate	Moderate to rough.	No account	......	2	0
	9	52 25 00	*West.* 177 15 00	189.1	29.58	29.41	43	41	42	40	41	39	Thick, foggy, and drizzly.	E'd, 2; N'd and E'd, 2-3	Moderate	Moderate to smooth.	S. 36° E.	7.4	10	0
	10	Nazan Bay, Atka Island.		161.5	29.52	29.38	44	42	43	41	41	40	Stormy, thick, and rainy.	S'd and W'd, 4-7; S'd and W'd, 4.	Moderate	Smooth to moderate.	No account	......	0	0
	11	53 20 00	169 38 00	183.5	29.81	29.52	42	41	41	40	40	39	Overcast and cloudy; misty at times.	S'd and W'd, 5	Light	Moderate	South	7.1	0	0
	12	Dutch Harbor, Unalaska Island.		133.5	29.85	29.52	54	41	53	40	42	39	Cloudy to misty, stormy and rainy.	SW., 3-1; S'd and E'd, 2-4; squalls, 7.	Moderate	Smooth	No account	......	0	0
	13	53 57 00	166 31 00	4.7	29.55	29.38	57	43	55	42	44	39	Stormy, partly clear, to overcast and misty.	SE., 4; squalls, 6; S., 8; S., 4.	Light	Rough	No account	......	0	0
	14	53 55 00	167 05 00	110.3	29.91	29.56	44	41	43	40	40	39	Stormy, misty, and rainy.	S., 3-7; SSW., 5	Moderate	Rough	No account	......	0	0

*2,133 knots per log; 18 days under way.

Meteorological and cruising record, and seal data—Continued.

Date.	Meridian position. Lat. N.	Meridian position. Long. W.	Distance run per log.	Barometer. Max.	Barometer. Min.	Temperature. Air. Dry bulb. Max.	Dry bulb. Min.	Wet bulb. Max.	Wet bulb. Min.	Water at surface. Max.	Water at surface. Min.	State of the weather.	Force and direction of winds.	Rainfall.	State of sea.	Currents. Setting to the (true).	Currents. Force in knots per day.	Number of hours sealing weather.	Number of fur seals seen.
1894.	° ′ ″	° ′ ″	*Knots.*																
June 15	53 27 00	168 14 00	85.0	30.01	29.94	43	40	42	39	40	38	Stormy, misty, and thick.	SSW., 4-8; S., 6; S'd and W'd, 6-5.	Moderate	Rough	No account	....	0	0
16	52 59 00	171 55 00	188.7	30.18	29.98	42	39	41	38	39	39	Overcast and misty; boisterous.	SW., 6-2..................	Moderate	Rough to moderate.	N. 56° E...	14.5	0	0
17	52 11 00	173 03 00	171.8	30.16	29.94	43	40	42	39	40	39	Overcast to foggy and misty.	SW., 3; S. to SSE., 3-4...	Light mist.	Smooth...	No account	....	12	0
18	54 10 00	167 56 00	231.3	29.93	29.68	47	41	46	40	44	39	Foggy and rainy, thick and disagreeable.	S., 4; SW., 4; S., 2-3.....	Moderate	Smooth...	S. 17° E...	19 hrs. 8.0	15	0
19	Dutch Harbor, Unalaska Island.		60.6	29.76	29.60	50	45	49	43	44	43	Rainy to cloudy and pleasant.	S'd and W'd., 3; squalls, 5-6.	Light...	....	....	....	....	....
20	....do....	....	....	29.78	29.70	52	43	50	43	45	42	Cloudy, but pleasant ..	S'd, 3-5; NE., 3; NNW., 3; ESE., 3-5.	None....	....	....	....	....	....
21	....do....	....	....	30.11	29.80	56	41	55	40	44	40	Fair and pleasant; foggy outside.	S'd, 4; squalls, 6; S., 4; variable, 2.	None....	Smooth...	....	....	....	....
22	55 40 00	168 35 00	134.7	30.10	29.94	41	39	40	38	40	36	Misty, drizzly, and foggy; thick.	Variable, 1; NNE., 4-6; ENE., 4-6.	Moderate	Smooth to choppy.	S. 13° W ..	15 hrs. 5.0	8	0
23	Village Cove, St. Paul Island.		129.0	29.99	29.90	44	39	43	38	39	36	Misty and foggy; thick	SE., 2-4..................	Light mist.	Smooth ..	No account	....	0	0
24	57 34 00	167 58 00	127.6	29.97	29.76	41	38	40	37	38	36	Misty, drizzly, and foggy; thick.	SE. and SSE., 3; SW., 3-4.	Moderate	Smooth...	N. 39° W..	17 hrs. 5.1	14	0
25	56 12 00	165 45 00	185.4	30.00	29.91	41	39	40	39	39	38	Foggy, misty, and rainy; thick.	SW., 4; SSE., 4; S., 4....	Moderate	Smooth sea; SW. swell.	No account	....	16	0
26	55 33 00	163 23 00	184.0	30.03	29.91	43	40	42	39	40	38	.....do................	S., 4; S'd and W'd, 4.....	Moderate	Smooth to moderate.	N. 14° E...	48 hrs. 12.3	12	0
27	56 31 00	159 48 00	202.9	30.17	30.04	43	37	43	36	41	35	Foggy and misty; thick	W., 3; WSW., 4; W., 3; SW., 4.	Light...	Smooth...	No account	....	14	0
28	56 38 00	160 39 00	194.4	30.10	29.96	39	35	38	34	41	34	Foggy to fair to foggy and misty.	SSW., 2; W'd, 1.........	Light...	Smooth...	No account	....	16	2
29	57 56 00	166 16 00	198.2	30.07	29.91	45	38	44	37	38	37	Misty and foggy to fair.	W'd., 2-3.................	Light...	Smooth...	N. 22° E...	8.6	14	2
*30	56 59 00	163 02 00	177.1	30.15	29.93	46	35	45	34	41	37	Foggy to fair and pleasant.	SW., 2; calm; SE., 2; NW., 3.	None....	Smooth...	N. 56° E...	5.3	18	0

*4,117.9 knots steamed per log; 28 days under way.

3.—DESCRIPTION OF A CLOSING TOW-NET, FOR SUBMARINE USE AT ALL DEPTHS.

By C. H. Townsend,
Assistant, United States Fish Commission.

Recent experiments with closing tow-nets in submarine explorations have yielded so much accurate information concerning the vertical range of pelagic life that the construction of the Tanner intermediate tow-net in 1891[1] may be said to have inaugurated a new era in the study of the pelagic fauna, characterized by exact knowledge of the depth of the forms collected.

The vertical distribution of the pelagic life gathered with the open tow-nets of the *Challenger* expedition has necessarily been conjectural, the nets employed having been dragged open at all depths. Since then European investigators have employed several devices for closing submarine tow-nets, but direct evidence as to their reliability, so far as the writer is aware, seems to be lacking.

Open tow-nets of different forms have long been employed by the United States Fish Commission, while a closing collector, although of very limited capacity (the Sigsbee gravitating trap), has done service on the Coast Survey steamer *Blake;* but it was not until 1891 that a closing tow-net of large size was brought into use. The Tanner tow-net, closing tightly at any depth desired, has proved its efficiency during recent explorations conducted by the Fish Commission and by Mr. Alexander Agassiz, but its large size and somewhat complicated construction have prevented its use except by steam power from large vessels.

While towing a light surface-net behind one of the small boats of the *Albatross* in an Alaskan harbor in the summer of 1894, the idea of a very simple closing-net presented itself, which was at once experimented upon and gave satisfactory results. I at first used it in moderate depths only, but subsequently, having made one of heavier form than at first employed, the principle was found applicable to deep-sea work as well as near the surface.

[1]Tanner, Rept. U. S. Fish Com. 1889-91, pp. 259-260. Bull. U. S. Fish Com. 1894, pp. 143-151.

This form of towing-net is, on account of its lightness and simplicity, convenient for use by hand from all kinds of small sailing craft and open boats. It can be rolled into a small package with all its attachments and carried readily in one hand. With a light tow-line passed through a pulley slung from one of the boat davits of the Fish Commission steamer *Albatross*, it has been hauled in from depths of 20 and 30 fathoms by one man with very little exertion, and has not failed to work in a single instance.

In the summer of 1895 this net, constructed in larger and heavier form, with a net ring 3 feet in diameter, was used successfully on board the *Albatross* during fishery investigations in Bering Sea, at depths varying from 20 to 200 fathoms.

Following is a description of a closing-net of medium size constructed for use on the Fish Commission schooner *Grampus* (pl. 9, figs. 1 and 2): It consists of a tow-net with a folding-ring suspended by rope slings from a tripping-arm attached to the tow-line, and is operated at will by a messenger. The ring to which the net is attached is hinged to fold, for the purpose of closing the net, and is supported by two sets of slings of nearly equal length, one set attached near the hinges, supporting the net in an open position, the other attached at right angles to the hinges, supporting it in a closed position.

Closing is effected by means of a tripping-arm, from which the slings are suspended, and which, being tripped by a messenger, shifts the weight from the opening to the closing slings with the result of closing the net. The tow-line is attached to the lower end of the tripping-arm, the upper end of which is hooked to a ring on the tow-line. The opening slings are secured near the upper end of the arm, the closing slings to the lower end. A light messenger (pl. 9, fig. 3) sliding down the tow-line detaches the messenger-ring from the upper hook of the tripping-arm, shifting the weight from the opening to the closing slings. A spring catch in the upper hook of the tripping-arm keeps the messenger-ring from slipping out of place until struck by the messenger, while a heavy ring-shaped weight, released by the tripping of the arm, slips from the lower hook of the arm down the closing slings and keeps the jaws from opening after they have been closed by the messenger. The accompanying figures, showing the net in both open and closed positions, illustrate its workings clearly.

The tripping arm is merely a piece of half-inch brass, ordinarily about 2 feet in length and of the shape shown in the cut. The ring is 2 feet in diameter, made of $\frac{3}{4}$ by $\frac{1}{4}$ inch brass, and is essentially the same as that employed by Agassiz for use with his modified Chun-Petersen machine.[1] The messenger is a 2-pound bronze casting, in two parts, to lash around the towline. A small lead sinker is lashed to the bottom of the net, of sufficient weight to carry it down clear of the ring, as it is, of course, lowered vertically and the vessel from which it is operated

[1] Agassiz, Bull. Mus. Comp. Zool. 1892–93, vol. XXIII, p. 45, etc.

 PLATE 9.

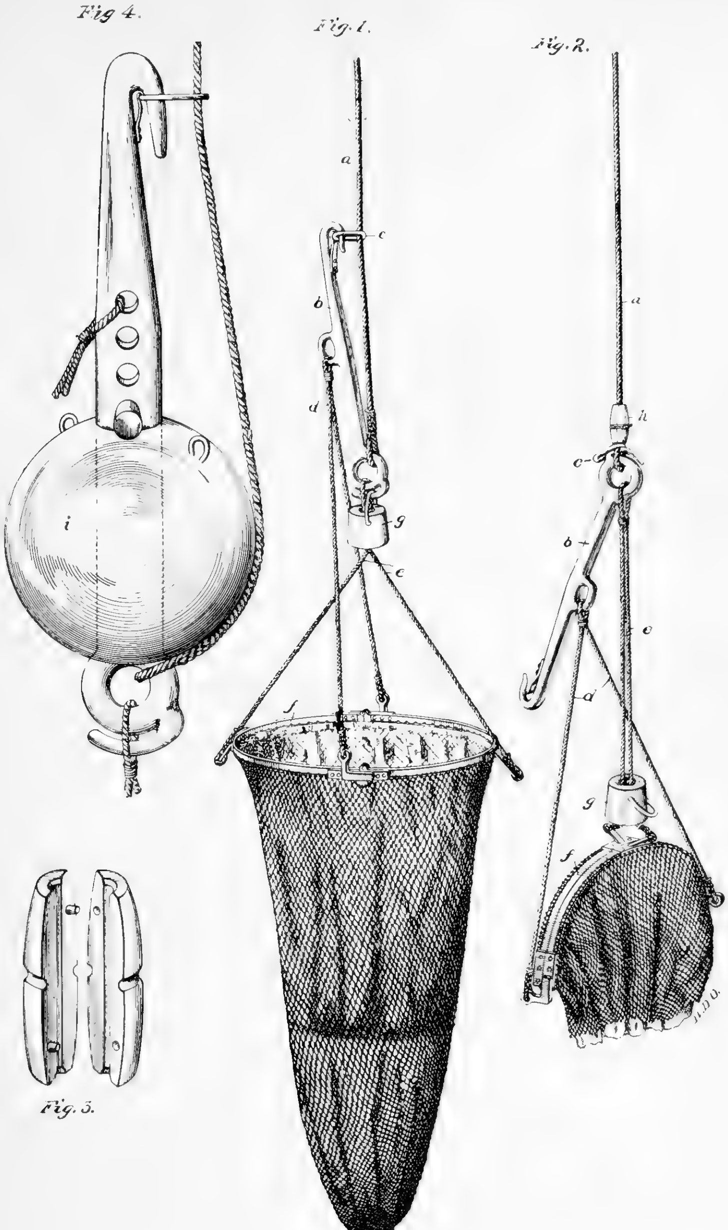


FIG. 1. Showing net in position for lowering and towing.
- *a.* Tow line.
- *b.* Tripping arm.
- *c.* Tripping ring.
- *d.* Opening slings.
- *e.* Closing slings.
- *f.* Folding net ring.
- *g.* Closing weight.
- *h.* Closing messenger. (See also Fig. 3.)

FIG. 2. Showing net closed for heaving in.

FIG. 3. Closing messenger.

FIG. 4. Showing heavy tripping arm used on steamer Albatross, with 60-pound sounding shot attached as sinker for proper strain on wire tow line in deep-sea work.
- *i.* Common sounding shot—60 pounds.

brought to a full stop. The net is light and of small mesh, preferably half inch. It is lined with bobbinet or mosquito netting, with a delicate inner lining of silk bolting-cloth, the last being the real collector, to which the outer nets act as supports.

In this combination of three nets all are of full width to the bottom, where they are closed by a lashing, the inner nets being secured rather slack, in order to avoid strain upon them in towing. As used on board the *Albatross*, by steam power at all depths, the net and its appliances have been constructed somewhat heavier and stronger. Additional weight is secured by passing the tripping-arm through a 60-pound shot, of the ordinary pattern used for sounding, the shot being secured by a bolt to prevent its slipping when the arm is capsized. (See pl. 9, fig. 4.)

A deep-sea tow-net, closed, with the folded jaws protecting its mouth, offers little resistance to the water, and can be heaved in rapidly without the danger of being torn away from an open and widespread net-ring, while the friction upon the contained organisms is reduced to the minimum.

The time gained in deep-sea work, with a folding-ring net which will permit of the steam winch reeling in at full speed, and the small stowage space required on shipboard for a net of this pattern, are matters of considerable importance. The readiness with which this net can be carried on deck by one man and attached to the wire dredge rope without complicated adjusting is perhaps the most important point of all in its favor, while its cost is less than that of any intermediate net hitherto employed.

This device has also been constructed in very light form, with a net ring 18 inches in diameter, for use in lakes or at very moderate depths, the heavier outside net being done away with, leaving merely the mosquito netting with its lining of silk bolting-cloth.

In this form it will be useful in gathering the minute life, crustacea, etc., of the Great Lakes, a knowledge of which is essential in its bearing upon the food of young whitefish and other important fishes now being propagated artificially.

The folding-ring tow-net is also available for use as an ordinary surface tow-net, without the employment of the messenger and the lead sinker.

The collections made by the *Albatross* during the past summer with the intermediate net were from depths of 20 to 200 fathoms, the net being lowered in one instance to 575 fathoms, when it accidentally touched bottom. The forms obtained consisted principally of minute crustacea, medusæ, annelids, and fishes, which have not yet been studied; but the ordinary surface tow-net having been used at the same stations as the intermediate net, the contents of the two nets were usually found to differ somewhat in character and quantity. As a rule, the surface net contained a slightly greater quantity of material than the intermediate net, but at some stations the reverse was the case, while the intermediate net sometimes brought up forms not taken at all in the surface net. The towings, 18 in all, were made along the border of the submarine bank south of the Pribilof Islands during the month of August, from lat. 54° to 56° N. and long. 167° to 172° W. Soundings were from 75 fathoms, on the bank, to 1,901 fathoms beyond it. There can be no doubt that there is an abundance of pelagic life at 200 fathoms in this part of Bering Sea.

After some experience with the single tripping-arm described in the preceding pages, I designed a machine for *opening as well as closing* the jaws of the tow-net, which worked satisfactorily (plate 10). It is a combination of two tripping arms, for operating which two messengers are employed on the same tow-line, the second striking a separate detacher from the first. A rough experimental machine, constructed on board the *Albatross*, was used successfully in port, but did not have strength to withstand the strain of towing at sea. Experiments indicate, however, that a properly constructed machine of the same pattern would accomplish the desired result. Its use in place of the single tripping-arm permits of the folding-ring tow-net being lowered in a closed position, the closing-slings being attached to the right arm, the opening-slings to the left. The arms are bolted to a bar of brass about 2 feet long, suspended from the towline, and in position for use are hooked upright to detachers released by messengers. The first messenger tripping the right arm, the jaws of the net fall apart for towing. The second messenger, in turn, tripping the left arm, the weight is thrown back on the slings of the right arm, closing the jaws. A ring-shaped weight around the right slings, and suspended from a hook on the left arm, holds the jaws together for lowering. It is released upon the tripping of the left arm, and slips again to its position upon the right slings, holding the jaws together for heaving in.

The net being closed tightly in going down, it is not necessary to stop the vessel and lower it vertically.

PLATE 10.

Fig. 1.

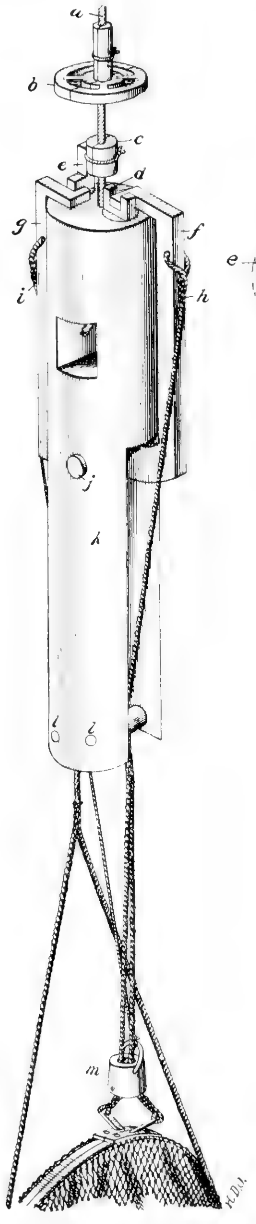


Fig. 2.

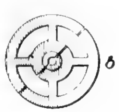


Fig. 3.

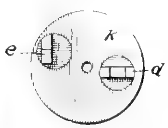


Fig. 4.

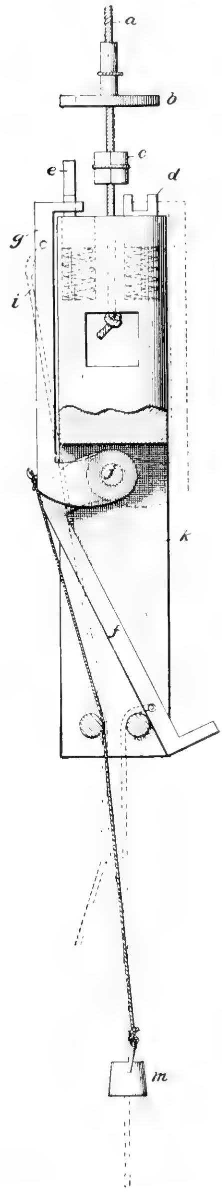


FIG. 1. Showing net in position for lowering.
- *a*. Wire tow line.
- *b*. Second messenger—to close.
- *c*. First messenger—to open
- *d*. Plunger securing right arm.
- *e*. Plunger securing left arm.
- *f*. Right arm.
- *g*. Left arm.
- *h*. Closing slings.
- *i*. Opening slings.
- *j*. Bolt securing tripping arms.

FIG. 1. Showing net, etc.—Continued.
- *k*. Body of machine (2 feet 3 inches long).
- *l*. Bolts holding net lines on center of gravity.
- *m*. Closing weight.

FIG. 2. End view of second messenger

FIG. 3. End of machine, showing position of plungers.

FIG. 4. Showing right arm tripped, springs to plungers, and knot securing tow line.

4.—THE WHITEFISHES OF NORTH AMERICA.

By Barton W. Evermann and Hugh M. Smith.

GENERAL REMARKS.

The whitefishes constitute one of the most interesting and important groups of food-fishes inhabiting the fresh waters of the Northern Hemisphere. In North America they are especially numerous as to species and individuals in the States forming the northern boundary of the United States, in the British possessions, and in Alaska, where there is scarcely a lake or river of importance in which the whitefishes are not represented by one or more species.

The distribution of these fishes, their geographical and individual variations, and their habits are perhaps as little known as are those of any group of fresh-water food-fishes of North America. Only two or three of the numerous whitefishes have been studied with even approximate completeness, and there is much yet to be learned regarding even the best-known species.

The close relationships of many of the whitefishes make a careful study of actual specimens the most essential step toward a fuller knowledge of these fishes. To the scarcity of specimens in collections, and, in the case of most species, the absence of complete series of examples representing different sexes, ages, conditions, seasons, etc., may be largely attributed the general deficiency of recorded information regarding the species of this group.

The United States Fish Commission has recently come into possession of a large amount of new material relating to the whitefishes of the Great Lakes basin and the specimens and data are available for a preliminary study of the group. It is not intended, however, to present a complete account of these fishes, since much more information will be required before such an effort will be warranted. In the present paper we have endeavored to give careful detailed descriptions of all the species of this group found in North America, together with what is now known of the geographic distribution of each. We consider most in detail those species found in the Great Lakes basin, but for purposes of comparison, and that the paper may be as complete as is now possible, we have included all the species of North America.

During 1893 and 1894 Mr. Richard Rathbun, of the United States Fish Commission, as the representative of the United States Government upon the International Fisheries Commission, conducted extensive inquiries and made large collections of the fishes found in the Great Lakes region of the United States. Among these collections were large series of the various species of whitefishes which constitute the principal material upon which this paper is based.

In order to determine the geographical distribution of each species of whitefish in the Great Lakes basin, we have studied not only these collections, but also those contained in the National Museum, and have examined and made notes upon multitudes of specimens in the field and at the various fish markets and fish companies' houses. In this paper are presented the results of these studies and the conclusions reached.

The following persons connected with the Fish Commission collected specimens of whitefishes from the localities named: Mr. Richard Rathbun, Lake of the Woods, Lake Superior, and Lake Huron; Mr. A. J. Woolman and Mr. U. O. Cox, Lake of the Woods and Lake Superior; Dr. J. T. Scovell and Mr. D. C. Ridgley, Lake Huron; Mr. Cloudsley Rutter, Lake Erie; Dr. R. R. Gurley, Lake Ontario; Prof. Barton W. Evermann and Mr. Barton A. Bean, Lakes Ontario, Champlain, and Memphremagog; Mr. Charles H. Stevenson and Mr. Ansley Hall, Lake Michigan; Mr. W. A. Wilcox, Lake Huron.

For other valuable specimens of whitefishes the Commission is indebted to Mr. Charles H. Strowger, of Nine Mile Point, N. Y., who forwarded us many specimens from Lake Ontario. Mr. Strowger has devoted many years to the study of the fishes of Lake Ontario, and has furnished us with a large amount of interesting information regarding the habits and abundance of the species found near Nine Mile Point. Hon. L. D. Miles, of Newport, Vt., has kindly sent us specimens from Lake Memphremagog. Mr. Woolman also forwarded market specimens of whitefishes from Lake Winnipeg and from small lakes in northern Minnesota.

The descriptions given in this paper of Alaskan species are based partly on the hitherto published descriptions and partly upon a reexamination of the specimens now in the National Museum. All the other descriptions have been drawn up from fresh specimens, in most cases numerous individuals of each species having been examined, including large series from the Great Lakes and considerable material from Lakes Champlain and Memphremagog and Lake of the Woods. We have also had a number of fresh specimens of the sisco of Lake Tippecanoe (for which we are indebted to Prof. P. H. Kirsch), and of Williamson's and Coulter's whitefishes.

Desiring to make this paper as useful as possible to the fishermen and others who make no claim to technical knowledge, we have avoided the use of uncommon technical terms whenever it seemed expedient and have made the descriptions fuller and more explicit than would be otherwise required. To prevent the descriptions from being needlessly long, we have used the usual abbreviations and abridged phrases well understood by students of fishes; and that these may be understood by all, we give on plate 11 an explanation of such terms as may not be at once intelligible to the lay reader.

We present illustrations of all the American whitefishes, in the thought that they will prove of assistance to fishermen and others in identifying the different species. All of these except two have appeared in the publications of the Fish Commission or elsewhere. The drawings of the blackfin and the kieye were made by Mr. A. H. Baldwin for this report. The desirability of bringing together in one publication illustrations of all the species of the group will be at once apparent to everyone.

THE COMMERCIAL IMPORTANCE OF THE WHITEFISHES.

The whitefishes are found in great abundance in the northern parts of North America, Europe, and Asia, and, viewed economically, are the most important fresh-water fishes of the grand divisions named, affording a larger food supply and supporting more extensive fisheries than any other group of fishes of the interior waters.

All of the whitefishes are of sufficient size to have food and commercial value, and in all settled communities they are utilized to a greater or less extent for local consumption or export, or both. The common whitefish and the lake herring are, however, so much more important than all other species combined that they alone are sufficient to give to this group the economic prominence which it has attained. In certain waters the menominee, the blackfin, the longjaw, the tullibee, and other whitefishes are of considerable importance.

In the United States the fishery for the various species of whitefishes is of great extent and importance, the value of the yield ranking among that of such well-known fisheries as the halibut, lobster, menhaden, haddock, bluefish, squeteague, alewife, sponge, fur seal, and lake trout, and, at the present time, exceeding the fisheries named, while the number of persons engaged in the fishery and the capital invested therein are very large. If to the value of the whitefish fisheries of the United States is added that of the fisheries in the Canadian provinces of Ontario, Quebec, Manitoba, and the Northwest Territory, the aggregate is enormous.

While economic fishing of greater or less extent is carried on for whitefishes in the Lake of the Woods, the Great Lakes, and numerous lakes in the more northern parts of the United States and in Canada, the fisheries in the Great Lakes far outrank those in other sections.

For detailed accounts of the whitefish fisheries in the United States waters of the Great Lakes, reference is made to the several reports issued by the United States Commission of Fish and Fisheries, in which the methods and apparatus are described and full statistical data are given. Detailed statistical and descriptive matter relating to the whitefish fisheries of Canada will be found in the annual reports of the Department of Marine and Fisheries.

The body of water supporting the most extensive whitefish fisheries in the United States is Lake Michigan. Up to a comparatively recent year Lake Erie took precedence, but the serious decline in that lake has brought Lake Michigan to the front. Lake Erie ranks second, followed by lakes Huron, Superior, Ontario, and St. Clair, in the order named.

The aggregate quantity of whitefishes taken for market in the United States and Canada is now more than 76,000,000 pounds annually, with a value of over $2,400,000. These figures are based on the known yield in the Great Lakes and the British North American provinces in 1893 as given in the official reports, and in other parts of the United States in 1894. If to this catch is added the large quantities consumed locally by Indians, Eskimos, and others in Arctic America, Alaska, and the Western States, the total annual output of whitefishes in North America probably amounts to not less than 83,000,000 pounds, having a value of $2,800,000.

THE GENERA AND SPECIES OF AMERICAN WHITEFISHES.

The range of variation among the individuals of each of the species of this group is very much greater than has usually been supposed. An examination of a large series of almost any one of the species shows astonishing differences, even among individuals taken in the same net and at the same time. Aside from the usual variations due to differences in age, sex, and season, there are other variations which manifestly bear no relation to those causes, and which are also independent of geographic influences. Among these are variations in the size of the mouth, the length and relative width of maxillary and mandible, the prominence of the lower jaw, and, most unexpected of all, a very considerable variation in the number and length of the gillrakers. The range in the number of scales in a longitudinal series is also very great. An examination of the tables of comparative measurements, which we give in connection with our discussion of the different species, will make plain the details of these diverse and extensive variations.

The most important characters which are used to separate the different species of whitefishes are the following: Size and shape of the mouth, size of the mandible, maxillary, and eye; relative length of the head and snout; size and position of the different fins; the teeth; the number and length of the gillrakers; the number and character of scales; the color; and the general form of the head and body.

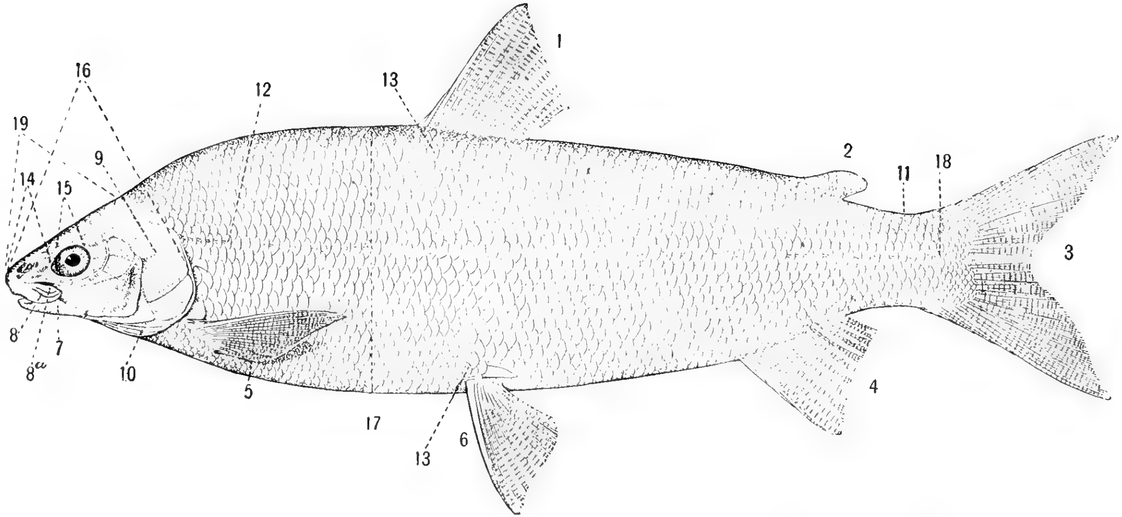
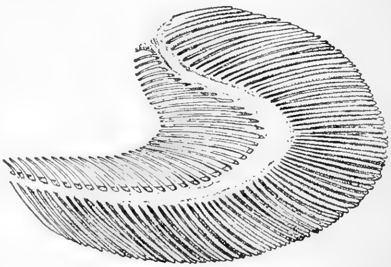


FIGURE OF A WHITEFISH SHOWING THE LOCATION OF PARTS USUALLY REFERRED TO IN DESCRIPTIONS.

1. Dorsal fin.
2. Adipose fin.
3. Caudal fin.
4. Anal fin.
5. Pectoral fin.
6. Ventral fin.
7. Lower jaw, or mandible.
8. Upper jaw, or maxillary.
8a. Supplemental maxillary.
9. Opercle.
10. Branchiostegals.
11. Caudal peduncle.
12. Lateral line.
13. Series of crosswise scales usually counted.
14. Snout.
15. Eye.
16. Head.
17. Depth.
18. Base of caudal.
19. Distance from snout to nape or occiput.

The measurements given in the descriptions in this paper are proportional. "Head 4" means that the length of the head is contained 4 times in the length of the fish, measured from the tip of the snout to the base of the tail or caudal fin. "Depth 5" means the greatest depth of the body is contained 5 times in the same length. The lengths of the eye, snout, maxillary, and mandible are compared with the length of the head; thus "eye 5" means the diameter of the eye (not the orbit) is contained 5 times in the length of the head. The snout is measured from its tip to the anterior rim of the orbit. The maxillary is the long, usually somewhat ovate, bone on side of upper jaw; the mandible is the bone forming the side of the lower jaw. The length of the maxillary and mandible is important.

The gillrakers of the first gill-arch afford one of the best characters for distinguishing the species of this group. The accompanying figure shows the first gill-arch of the bloater or longjaw. From this it may be seen that there are, in this case, 15 gillrakers on the upper or short limb of the arch, and 31 on the long limb; the length of the longest is contained $1\frac{1}{5}$ times in the diameter of the eye. These three facts are ordinarily stated thus: Gillrakers 15+31, the longest $1\frac{1}{5}$ in eye.



Gill-arch of the Longjaw.

The number of scales is also important. "Scales 8–77–7" means that there are 7 rows of scales in a vertical series between the base of the dorsal fin and the lateral line, or 8 including the scale in the lateral line; that there are 77 scales in a longitudinal series counted along the side from the gill-opening to the base of the caudal fin, and that there are 7 scales between the lateral line and the base of the ventral fin. The lateral line is the series of modified scales along the middle of the side.

The total number of species and subspecies of whitefishes recognized by us as at present known from the waters of America is 20, at least 10 of which are known to inhabit the basin of the Great Lakes. The whitefishes and lake herrings are now regarded by most students of American fishes as belonging to one or the other of two rather closely related genera, *Argyrosomus* and *Coregonus*, which may be distinguished as follows:

a. Mouth rather small, maxillary short and broad; mandible short; lower jaw usually included and overhung by the more or less projecting snout; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on the first arch few and short, usually fewer than 30... COREGONUS.

aa. Mouth rather large, maxillary long and narrow; mandible long; lower jaw usually more or less projecting beyond the upper; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on the first arch long and numerous, usually more than 35................ ARGYROSOMUS.

The following analytical key will enable one to identify with reasonable certainty the various species of whitefishes of America:

I. **Coregonus**, *the True Whitefishes:*

a. Cleft of mouth short, maxillary and mandible short; lower jaw not projecting beyond the upper; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on first gill-arch fewer than 30.

b. Gillrakers very short, thickish, about 12 to 16 on the lower limb of the arch; maxillary short and broad, not reaching eye; mouth very small.

c. Maxillary 3½ to 4 in head; gillrakers short and thick, 5 to 9+11 to 15; body oblong, the back not elevated.

d. Scales 60 to 64 in lateral line; snout blunt and decurved.......... *coulterii*, 1.

dd. Scales smaller, 72 to 90 in lateral line.

e. Supplemental maxillary bone rather narrow; scales 83 to 90.

f. Head moderate, blunt, 4 to 5 in body without caudal; tip of snout below level of eye; gillrakers 7 to 9+14 or 15, very short; lower fins pale.......................... *williamsoni*, 2.

ff. Head very short, blunt, 5⅗ in body; gillrakers short but slender, about 7+14; fins all blackish.................. *kennicotti*, 3.

ee. Supplemental maxillary bone very broad, semicircular in shape; scales 72 to 80.............................. *richardsoni*, 4.

cc. Maxillary shorter, 4⅘ to 5½ in head; gillrakers shorter, about 6+11; body long, slender, not compressed........ *quadrilateralis*, 5.

bb. Gillrakers more numerous, longer and more slender, 17 to 20 on lower limb of the arch; maxillary longer, about 4 in head, about reaching pupil; mouth larger; preorbital long and narrow.

g. Tongue toothless, or nearly so; back decidedly elevated; head very low and short, especially in old examples.

h. Back elevated, but not greatly compressed; supplemental maxillary bone nearly twice as long as deep; head usually 5 to 5½ in length of body.................. *clupeiformis*, 6.

hh. Back elevated and greatly compressed; supplemental maxillary bone more than two-thirds as deep as long; head about 5 in length................................ *nelsonii*, 7.

gg. Tongue with 3 series of small teeth (not always evident); body elongate, compressed; lower jaw slightly included; head larger; gillrakers 10+15 to 17, about 2 in eye.................................. *labradoricus*, 8.

II. **Argyrosomus**, *the Lake Herrings:*

aa. Cleft of mouth long, maxillary and mandible long, the former usually extending beyond vertical of pupil; lower jaw long and usually projecting beyond the sharp snout; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on first gill-arch numerous—more than 35.

i. Body elongate, herring-shaped; scales small, uniform in shape and size, the free edges convex.

j. Lower fins pale or merely tipped with dusky; scales punctate with dark specks.

k. Eye large, not much, if any, shorter than snout, its length 3½ to 4½ in that of head.

l. Head long and sharp, 4 in length of body; body very slender, the depth 5 to 6 in the length; maxillary 3 in head .... *osmeriformis*, 9.

ll. Head long, $4\frac{1}{2}$ to 5 in length of body; body deeper and head less pointed; pectorals short, reaching about half way to ventrals.

m. Maxillary $3\frac{1}{4}$ to $3\frac{3}{5}$ in head; lower jaw projecting beyond upper; gillrakers long and numerous, usually about 47 on first gill-arch .... *artedi*, 10.

mm. Maxillary longer, $2\frac{3}{5}$ to 3 in head; lower jaw scarcely or not at all projecting; gillrakers fewer, usually not more than 39 or 40 on first gill-arch .... *hoyi*, 11.

lll. Head shorter, about 5 in length of body; pectorals long, reaching more than half way to ventrals; maxillary $3\frac{1}{3}$ in head .... *pusillus*, 12.

kk. Eye small, shorter than snout, about 5 times in length of head.

n. Head short, about 5 in length of body.

o. Body rather slender, the depth about equal to length of head .... *lucidus*, 13.

oo. Body deeper, the depth in adult greater than length of head .... *laurettæ*, 14.

nn. Head long, 4 to $4\frac{1}{2}$ in length of body; lower jaw strong; maxillary very long, $2\frac{1}{2}$ in head; mandible also very long, usually reaching posterior edge of orbit, at least half as long as head ..... *prognathus*, 15.

jj. Lower fins all blue-black; body stout; mouth large; gillrakers numerous, usually at least 50 on the first gill-arch .... *nigripinnis*, 16.

ii. Body short, deep, and compressed, the curve of the back similar to that of the belly; scales large, larger forward and closely imbricated, the free margin often concave or notched .... *tullibee*, 17.

DESCRIPTIVE LIST OF AMERICAN SPECIES OF WHITEFISHES.

In nomenclature and in sequence of species we follow Jordan & Evermann's Fishes of North and Middle America.[1] In the matter of synonymy, preceding the description of each species, we give reference only to the publications in which the various species were described as new. From the synonymy it may be seen that twenty-nine nominal species and subspecies of American whitefishes have been described, but these are now believed to represent only twenty really different forms. The species which have each been described as new more than once are the following: *Coregonus williamsoni*, twice; *C. quadrilateralis*, twice; *C. clupeiformis*, five times; *C. labradoricus*, three times, and *Argyrosomus artedi*, twice.

In connection with each reference we have given the locality from which the type specimens of the supposed new species were obtained. The types of only eight of these nominal species are in the collection of the United States National Museum. We give in parentheses the numbers which they bear on the Museum records.

1. **Coregonus coulterii** Eigenmann & Eigenmann.

COULTER'S WHITEFISH.

Coregonus coulterii Eigenmann & Eigenmann, American Naturalist, November, 1892, 961, Kicking Horse River at Field, British Columbia, one of the head streams of the Columbia River. (Type, No. 44875.)

Description.—Head, $4\frac{1}{2}$ to 5; depth, $4\frac{1}{2}$ to $5\frac{1}{2}$; eye, $3\frac{1}{3}$ to $3\frac{3}{5}$; snout, $4\frac{3}{5}$ to 5; maxillary, $3\frac{3}{5}$ to 4; mandible, $2\frac{3}{5}$ to 3. D. 9 or 10; A. 10 or 11. Scales, 8–60 to 64–6. Gillrakers, 5+11. Body rather slender, compressed, back not much elevated; head short; snout short, bluntly decurved; mouth small, nearly horizontal, the upper lip on a level with the lower line of orbit; maxillary short, broadly ovate behind, barely reaching vertical of pupil; lower jaw short, included, the mandible scarcely reaching vertical of posterior edge of pupil. Distance from tip of snout to occiput $1\frac{3}{5}$ in distance from occiput to origin of dorsal fin. Caudal peduncle long, slender, and compressed. Fins moderate; origin of dorsal much nearer snout than base of caudal, its height $1\frac{2}{5}$ in head and about equal to length of pectoral or longest anal ray. Gillrakers very short, fewer than in *C. williamsoni*. Scales large, firm. Color, pale bluish or lead-color above, becoming silvery on sides and white below; fins all plain. Size small, the specimens examined by us being 5 inches or under in total length.

This species is most closely related to *C. williamsoni*, from which it seems to differ in the larger scales and fewer gillrakers. Specimens of *williamsoni* the size of the types of *coulterii* nearly always show the parr

[1] Fishes of North and Middle America, Bull. 47, United States National Museum, part I, pp. 461–473, 1896.

marks usually seen in the young of most *Salmonidæ*, but our specimens of *coulterii*, all of which are young fish, show no traces of parr marks.

This species was described from the Kicking Horse River at Field, British Columbia, where more than a hundred specimens were obtained by Dr. Eigenmann, in 1892, at an elevation of 4,050 feet. One specimen was also secured by him from Kicking Horse River at Golden, British Columbia. It has not been obtained by any other collector. It does not appear to attain any considerable size or to be of any commercial importance. The largest specimens yet collected do not exceed 8 inches in length. The following table gives comparative measurements of seven individuals examined by us:

Table of comparative measurements of specimens of Coulter's whitefish (C. coulterii).

[The numbers by which specimens are designated in this and all other tables of this paper are those which the specimens bear in the Fish Commission collections.]

No.	Locality.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.
		Inches.									
189	Kicking Horse River, Field, British Columbia.	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{3}$	$3\frac{1}{2}$	5	$3\frac{3}{4}$	3	10	11	7-60-6
190	.....do	4	$4\frac{1}{2}$	$5\frac{1}{3}$	$3\frac{1}{2}$	$4\frac{3}{5}$	$3\frac{3}{4}$	$2\frac{3}{5}$	9	10	8-60-6
191	.....do	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{3}$	$4\frac{3}{5}$	4	$2\frac{3}{4}$	9	10	8-62-6
192	.....do	$4\frac{5}{16}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	5	$3\frac{4}{5}$	$2\frac{3}{5}$	10	11	8-63-6
193	.....do	$3\frac{3}{4}$	$4\frac{3}{5}$	$5\frac{1}{4}$	$3\frac{2}{5}$	$4\frac{3}{5}$	4	$2\frac{3}{5}$	10	11	8-64-6
194	.....do	$4\frac{1}{4}$	$4\frac{1}{2}$	$5\frac{1}{3}$	$3\frac{3}{5}$	$4\frac{3}{4}$	$3\frac{3}{5}$	$2\frac{3}{5}$	10	11	8-61-6
195	.....do	$3\frac{3}{8}$	$4\frac{1}{2}$	$5\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{3}{5}$	$3\frac{4}{5}$	$2\frac{3}{4}$	10	10	8-60-6

2. Coregonus williamsoni Girard.

ROCKY MOUNTAIN WHITEFISH; MOUNTAIN HERRING.

Coregonus williamsoni Girard, Proc. Ac. Nat. Sci. Phila. 1856, 136, Des Chutes River, Oregon.

Coregonus couesii Milner, Rept. U. S. Fish Comm. 1872–73 (1874), 88, Chief Mountain Lake, Montana. (Type, No. 14146.)

Description.—Head, $4\frac{1}{2}$ to 5; depth, 4 to 5; eye, 4 to 5 (much larger in young); snout, about 4; maxillary, 4; mandible, $2\frac{3}{4}$. D. 11 to 14; A. 11 to 13. Scales, 9 or 10–78 to 87–8; gillrakers, 7 to 9+14 or 15, very short. Body moderately long, back gently elevated, the curve from middle of head to dorsal fin quite evenly convex. Head short, conic; snout gently decurved, pointed; mouth small, maxillary short and broad, scarcely reaching pupil, its direction nearly horizontal in the closed mouth; lower jaw included, the mandible short. Mouth very low; entirely below level of eye. Distance from tip of snout to occiput $1\frac{3}{4}$ in distance from occiput to origin of dorsal fin. Caudal peduncle rather stout; its least depth about $2\frac{3}{4}$ in head. Fins moderate; base of dorsal equal to height of fin, $1\frac{2}{5}$ in head; origin of dorsal usually equally distant between tip of snout and posterior edge of adipose fin; adipose fin unusually large; anal base $1\frac{1}{2}$ in height of fin or about 2 in head; pectoral rather short, $1\frac{1}{5}$ in head; ventral still shorter, $1\frac{3}{5}$ in head; caudal well forked, the lobes about equal to length of head.

Gillrakers few and short, the number usually not exceeding 25 and the length of the longest about 4 times in diameter of eye.

Color bluish above; sides silvery; under parts white; fins all plain, except in breeding males, when they are tipped with black; adipose fin and caudal frequently steel-blue in breeding males. The scales of the male at the breeding season are covered with tubercles, which have been described by Mr. Barton A. Bean as follows:

The tubercles on the scales at this time are very prominent, situated on the middle of the scales, milk-white in color, and forming horizontal lines along the body from head to tail. About 16 of these lines can be counted between the back and the ventral edge of the body. The tubercles show on the abdomen, but the color of that portion of the body and of the tubercles being similar they are indistinct. (Bull. U. S. Fish Comm. 1894, p. 55.)

The following table gives comparative measurements of 37 specimens of *Coregonus williamsoni.*

Table of comparative measurements of specimens of Rocky Mountain whitefish (Coregonus williamsoni).

No.	Locality.	Sex.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.											
186	Shushwap Lake, Sicamous, British Columbia	....	....	$4\frac{4}{5}$	$4\frac{3}{4}$	$4\frac{3}{5}$	4	4	$2\frac{4}{5}$	12	11	9-84-8	7+15; 8+14	4
187	.....do	....	$3\frac{3}{4}$	$4\frac{1}{2}$	5	$3\frac{1}{3}$	$4\frac{1}{2}$	....	....	12	12	10-87-8	....	....
188	.....do	....	$4\frac{1}{8}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	5	....	....	12	12	10-87-8	....	....
31	Little Spokane River	....	$14\frac{1}{2}$	$4\frac{2}{3}$	$4\frac{2}{3}$	5	$3\frac{1}{2}$	4	$2\frac{3}{4}$	12	12	10-87-8	9+15; 8+15	4
....	.....do	♂	11	5	4	$4\frac{1}{3}$	3	....	....	14	13	9-83-8	? +12; ?+12	....
....	.....do	♂	$12\frac{1}{2}$	5	4	....	....	....	....	13	13	....	....	....
95	Outlet Alturas Lake, Idaho	♀	....	5	4	5	$3\frac{1}{3}$	....	....	10	10	10-85-8	8+14; 8+13	....
96	.....do	♀	....	5	$4\frac{1}{4}$	$4\frac{1}{4}$	$3\frac{1}{2}$	....	....	12	10	10-78-8	7+12; 6+11	....
97	Junction of Salmon River and Alturas Creek, Idaho	♀	....	$5\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$	....	....	12	10	10-86-8	10+15; 8+13	....
98	.....do	....	....	5	$4\frac{1}{3}$	$4\frac{1}{2}$	$3\frac{2}{3}$	....	....	12	11	10-89-8	8+13; 8+12	....
103	Outlet Alturas Lake, Idaho	....	....	$4\frac{3}{4}$	5	$4\frac{1}{2}$	4	....	....	11	10	10-85-8	6+12; 8+11	....
127	Alturas Lake, Idaho	....	....	$4\frac{2}{3}$	$5\frac{1}{4}$	4	4	....	....	12	11	10-90-8	9+13; 9+13	....
128	.....do	....	....	$4\frac{3}{4}$	$5\frac{1}{2}$	4	4	....	....	12	11	10-86-8	8+10; 9+15	....
129	.....do	....	....	5	5	4	$3\frac{1}{2}$	....	....	12	11	10-78-8	10+14; 9+13	....
130	.....do	....	....	$4\frac{1}{2}$	5	$3\frac{1}{2}$	$3\frac{2}{3}$	....	....	12	11	10-78-8	8+13; 8+12	....
131	.....do	....	....	$4\frac{1}{2}$	$5\frac{1}{3}$	4	$3\frac{3}{4}$	....	....	13	12	10-84-8	8+10; 8+11	....
132	.....do	....	....	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$	4	....	....	12	11	10-87-8	8+12; 8+11	....
133	.....do	....	....	$4\frac{3}{4}$	5	4	4	....	....	11	10	10-92-8	9+12; 7+15	....
134	.....do	....	....	$4\frac{1}{3}$	$4\frac{1}{3}$	4	4	....	....	12	12	10-85-8	8+14; 10+15	....
135	.....do	....	....	$4\frac{3}{4}$	$5\frac{1}{2}$	4	$3\frac{1}{3}$	....	....	11	10	10-82-8	9+14; 8+14	....
136	.....do	....	....	$4\frac{3}{4}$	5	$4\frac{1}{3}$	4	....	....	12	10	10-82-8	9+15; 8+15	....
137	.....do	....	....	$4\frac{1}{4}$	5	$3\frac{1}{2}$	$3\frac{1}{2}$	....	....	11	10	9-82-8	7+13; 7+13	....
153	Payette River, a few miles below Payette Lake, Idaho	....	....	5	$4\frac{1}{4}$	4	4	....	....	12	11	10-80-8	8+11; 8+12	....
154	.....do	....	....	5	$4\frac{3}{5}$	4	4	....	....	11	11	10-79-8	7+12; 8+14	
155	.....do	....	....	5	$4\frac{1}{2}$	$4\frac{1}{3}$	$4\frac{1}{3}$	....	....	12	11	10-88-8	8+13; 8+12	....
156	.....do	....	....	$5\frac{1}{4}$	$4\frac{2}{3}$	4	$3\frac{2}{3}$	....	....	13	11	10-83-8	9+12; 10+12	....
157	.....do	....	....	$4\frac{3}{4}$	$4\frac{1}{2}$	$4\frac{1}{3}$	$3\frac{2}{3}$	....	....	12	12	10-81-8	9+12; 9+12	....
158	.....do	....	....	$5\frac{1}{4}$	$4\frac{2}{5}$	$4\frac{1}{2}$	4	....	....	12	11	9-84-7	8+12; 7+12	....
159	.....do	....	....	5	$4\frac{3}{5}$	$4\frac{1}{4}$	4	....	....	12	11	9-89-8	8+14; 9+15	....
160	.....do	....	....	5	$4\frac{1}{2}$	$4\frac{3}{5}$	$3\frac{2}{3}$	....	....	10	9	9-83-8	9+12; 8+14	....
161	.....do	♂	....	5	$4\frac{2}{5}$	5	$3\frac{1}{2}$	....	....	13	12	9-81-7	8+13; 8+14	....
162	.....do	....	....	5	5	$4\frac{2}{5}$	$3\frac{3}{5}$	....	....	12	11	9-85-7	9+14; 8+13	....
182	.....do	....	....	$4\frac{4}{5}$	$4\frac{2}{3}$	$4\frac{2}{3}$	$4\frac{1}{4}$	....	....	11	11	9-84-7	7+14; 6+13	....
183	.....do	....	....	5	$4\frac{1}{2}$	$4\frac{2}{3}$	4	....	....	12	11	9-85-7	7+12; 7+14	....
184	.....do	....	....	5	$4\frac{1}{3}$	4	$3\frac{4}{5}$	....	....	12	11	9-82-8	8+12; 8+12	....
....	Snake River at Upper Salmon Falls, Idaho	....	....	$4\frac{3}{5}$	5	$3\frac{1}{2}$	4	....	....	12	11	9-80-8	7+12; 7+13	....
....	.....do	....	....	$4\frac{1}{2}$	$4\frac{1}{4}$	$3\frac{1}{3}$	$4\frac{1}{2}$	....	....	12	11	9-82-7	8+13; 7+12	....

Distribution.—The Rocky Mountain whitefish is of wide distribution. It is found throughout the Rocky Mountain region from central Colorado and Utah northward through Wyoming, Idaho, western Montana, at least as far as the headwaters of the Columbia, and thence westward throughout the Columbia Basin. The most eastern locality from which it has been reported is Chief Mountain Lake, at the head of the Saskatchewan River, on the northern boundary of Montana. It was described from that lake in 1874 by Milner as *Coregonus couesii*. It is found only in the clearer, colder streams and lakes.

One of the authors of this paper has collected or observed this fish at the following places: Provo River, Provo, Utah; Jordan River, near Salt Lake City; Swan River, below Swan Lake, Montana; Jocko River, Ravalli, Mont.; Big Blackfoot River, Bonner, Mont.; Little Blackfoot River, Elliston, Mont.; Cottonwood Creek, Deer Lodge, Mont.; Snake River, President's Camp, Wyoming; Little Spokane River at Dart's Mill, Washington; Snake River at Upper Salmon Falls and Weiser, Idaho; Little Weiser River in Indian Valley, Idaho; and in the upper Salmon River Valley in Idaho in Alturas, Pettit, and Redfish lakes and their outlets. We have also examined specimens collected in 1892 by Messrs. A. J. Woolman and B. A. Bean in Flathead Lake, Montana; Post Creek, St. Ignatius Mission, Montana; Clark Fork, Thompson Falls, Montana, and Spokane and Little Spokane rivers, near Spokane, Wash.; also specimens collected in 1893 by Doctors Gilbert and Jenkins in Payette River, Payette, Idaho; Clearwater River, Lewiston, Idaho; Columbia River, Umatilla, Oreg.; Natches River, North Yakima, Wash., and Newaukum River, Chehalis, Wash.; also many specimens collected by Mr. T. M. Williams at Payette Lake, Idaho. Besides these we have examined specimens in the National Museum from Washington (Major Bendire); Provo, Utah (Dr. Yarrow); Portland, Oreg. (United States Fish Commission); Lake Tahoe (Dr. J. G. Cooper); Mill Creek and Garrison Creek at Walla Walla (Major Bendire); Montana (W. C. Harris); Clark Fork (W. C. Harris); Lake Cœur d'Alene (Bendire); White River, Meeker, Colo. (Jas. L. Foley); Utah Lake (Jordan), and Lake Tahoe (H. W. Henshaw).

This fish attains a length of a foot or more and a weight of 4 pounds, the average weight of adults being about 1 pound. Though not of much commercial importance as yet, it is eagerly sought after by the inhabitants of the region in which it is found and is held in high esteem as a pan-fish. At some seasons it readily takes the hook, especially when baited with salmon or trout spawn.

This whitefish spawns in late fall or early winter, at which time it runs up into the smaller streams. At the mountain lakes in Idaho, where it is an abundant fish, the spawning time appears to be in October or November. Then they ascend the inlets of the lakes in great numbers and spawn upon the same beds which are used by the redfish in August and September. During the summer the young are found in abundance in the lakes.

2a. Coregonus williamsoni cismontanus Jordan.

WHITEFISH OF THE UPPER MISSOURI BASIN.

Coregonus williamsoni cismontanus Jordan, Bull. U. S. Fish Comm., IX, 1889, 49, pl. 9, figs. 8, 9, Horsethief Springs Creek, a tributary of Madison River, Montana.

In the headwaters of the Missouri River is found a scarcely tangible variety of Williamson's whitefish which has received the above name. It is distinguished from *C. williamsoni* by the more slender body and somewhat lower fins. Head, 5; depth, 5 to $5\frac{1}{2}$; pectoral, $1\frac{1}{2}$ in head; ventral, $1\frac{1}{5}$; longest dorsal ray, $1\frac{1}{2}$. Scales in lateral line, 80 to 90.

A specimen 9 inches long, from Big Goose Creek, Sheridan, Wyo., gives the following measurements: Head, $4\frac{3}{5}$; depth, $4\frac{1}{2}$; eye, 5; snout, $3\frac{4}{5}$; maxillary, $4\frac{1}{3}$; mandible, $2\frac{4}{5}$. Scales, 9–86–8. Length of pectoral, $1\frac{1}{4}$ in head; ventral, $1\frac{1}{2}$; anal, $1\frac{1}{2}$.

Differences between this and typical *williamsoni* are not marked, and the variety should probably not be recognized as having any real existence.

This whitefish has been collected by us in the following Missouri Basin localities: Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Gibbon and Firehole rivers, Yellowstone Park; and Big Goose Creek, Sheridan, Wyo. It has been obtained by Dr. Jordan from Madison River below the falls, and from Horsethief Springs Creek, Montana. The National Museum contains specimens from Gallatin River, Montana (W. C. Harris); Gallatin and Madison rivers (J. E. Curtis), and Montana (E. Wernigk).

From these records it would seem that the center of abundance of this variety of whitefish is in the three forks (Jefferson, Madison, and Gallatin) which unite to form the Missouri northwest of the Yellowstone Park. The most eastern locality from which it is yet known is Sheridan, Wyo., where numerous young individuals were collected in July, 1893, by Prof. U. O. Cox, for the United States Fish Commission. These specimens were obtained in Big Goose Creek, which is tributary to Tongue River. Though the streams in the Black Hills to the east of Tongue River are clear and cold and well adapted to the habits of this fish, somewhat extended investigations in that region in 1892 and again in 1893 failed to discover any whitefish there.

3. Coregonus kennicotti Milner.

KENNICOTT'S WHITEFISH; BROAD WHITEFISH; MUKSUN.

Coregonus kennicotti Milner, in Jordan & Gilbert, Synopsis, 298, 1883, Fort Good Hope, British America. (Type, No. 8971.)

Head, $5\frac{2}{3}$; depth, $4\frac{2}{3}$; eye, $5\frac{1}{2}$; snout about 4; maxillary, 4. D. 11; A. 14. Scales, 10–87 to 90–10. Gillrakers, 6 or 7 + 14, short and slender, $1\frac{1}{4}$ in eye. Head very blunt, premaxillaries wide and vertically placed; mouth inferior, the high, blunt snout but little projecting; maxillary reaching slightly beyond the vertical at front of the eye, broadly ovate; preorbital narrow, its greatest width 5 times in its length and $3\frac{1}{3}$ in eye; width of supraorbital bone $2\frac{1}{2}$ in its length. Distance from snout to nape one-third distance from nape to front of dorsal; front of dorsal nearer tip of snout than base of caudal by a distance equal to length of snout and eye. Adipose fin large. Scales small, adherent, very regularly imbricated. Color probably very dark in life; in spirits, fins all blackish, with a bluish tinge (Gilbert). Large, reaching a length of 2 feet.

Dr. Bean says:

This is the *muksun* of the Russians, a name transferred from a Siberian species of similar appearance. The broad whitefish reaches the weight of 30 pounds, ranking next in size to the *inconnu* only. It is a food-fish of great excellence. Dall states that it is abundant in both winter and summer, spawning in September in the small streams falling into the Yukon.

The type of this species came from Fort Good Hope, British America. Murdock reports it from the Meade and Kuahroo rivers, Alaska; Townsend found it in the Kuwuk River, Dall and Turner in the Yukon; and it was recently obtained by Miss Elizabeth Taylor in Great Bear Lake. All the Alaskan references to *C. clupeiformis* probably belong to this species, or to *C. richardsonii*, if the latter be distinct from *C. kennicotti.*

4. **Coregonus richardsonii** Günther.

RICHARDSON'S WHITEFISH.

Coregonus richardsonii Günther, Cat., VI, 185, 1866, exact locality unknown.

Very similar to the common whitefish, also to the broad whitefish, with which it may prove identical. Scales 10–72 to 80–12; B. 9; D. 13; A. 13. Snout of moderate length, the lower jaw included; eye shorter than snout; maxillary reaching anterior edge of eye, 4 in head; supplemental bone short, broad, and semicircular; mandible shorter than least depth of tail. Pectoral longer than head without snout.

This species was described in 1866, the type locality being unknown, but it was somewhere in British America. It is a species of doubtful validity. Only the types are known. Dr. G. A. Boulenger has kindly sent us the following note regarding the types of this species which are in the British Museum:

I have examined the types (dry) of *Coregonus richardsonii.* There are about 20 gillrakers on the lower part of the anterior arch, the longest half the diameter of the eye. The maxillary extends to below anterior border of eye, and its length is 4 times in length of head, as stated by Günther, therefore a little shorter than in *C. clupeiformis.* Tongue with 4 series of teeth, as in *C. labradoricus.* It seems to agree best with *C. nelsoni* (description), but has fewer scales in lateral line. In short, I can not identify *C. richardsonii* with any of the forms known to me.

5. **Coregonus quadrilateralis** Richardson.

MENOMINEE WHITEFISH; FROSTFISH; SHADWAITER; PILOTFISH; CHIVEY; ROUND WHITEFISH; CHATEAUGAY SHAD; BLACKBACK.

Coregonus quadrilateralis Richardson, Franklin's Journ., 1823, 714, Fort Enterprise, British America.

Coregonus novæ-angliæ Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, N. H.

Description.—Head, $5\frac{1}{4}$ to $5\frac{1}{2}$; depth, $4\frac{2}{3}$ to $5\frac{1}{2}$; eye, 5 to $5\frac{3}{5}$; snout, $4\frac{1}{2}$ to 5; maxillary, $4\frac{4}{5}$ to $5\frac{1}{2}$; mandible, 3 to $3\frac{1}{5}$; D. 11 or 12; A. 11 or 12. Scales, 9 or 10–86 to 92–7 or 8. Gillrakers, 5 to 8+9 to 12, usually about 6+11, very short, the longest about 4 in eye.

Body long, slender, and round, not much elevated nor compressed, the back broad, and the body more nearly round than in any other whitefish. Head rather small and pointed; snout short, bluntly decurved, projecting somewhat beyond the included lower jaw; maxillary short and broad, scarcely reaching eye, the supplemental bone very narrow; mandible very short, barely reaching posterior line of pupil; mouth small, entirely below level of orbit. Top of head not arched, cranial ridges prominent. Distance from snout to occiput $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; origin of dorsal notably in front of insertion of ventrals, equidistant from tip of snout and posterior edge of adipose fin; caudal peduncle long, $1\frac{4}{5}$ in head, somewhat compressed. Base of dorsal fin short, $1\frac{1}{5}$ in longest ray or $1\frac{4}{5}$ in head; anal base short, $1\frac{2}{5}$ in longest anal ray or $2\frac{3}{5}$ in head; pectoral, $1\frac{2}{5}$ in head; ventral, $1\frac{3}{5}$; adipose fin small. Color silvery white, dusky on back and upper part of sides; under parts white; fins all pale except dorsal and caudal, which are more or less dark on tips.

The following table exhibits the variations in proportion of parts in the specimens examined critically by us:

Table of comparative measurements of specimens of the Menominee whitefish (Coregonus quadrilateralis).

Number.	Locality.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.	*Oz.*											
76	Lake Michigan.	♂ nearly ripe.	$14\frac{1}{4}$	12+	$5\frac{1}{4}$	$4\frac{2}{3}$	$5\frac{1}{3}$	$4\frac{1}{2}$	$4\frac{4}{5}$	$3\frac{1}{5}$	11	11	9–86–8	8+12; 8+12	Very short.
77	.....do..........	....	$14\frac{1}{4}$	14—	$5\frac{1}{4}$	$4\frac{3}{4}$	$5\frac{3}{5}$	$4\frac{3}{4}$	5	$3\frac{1}{5}$	11	11	9–92–7	6+11; 6+11	Very short.
78	.....do..........	....	$14\frac{1}{4}$	14-	$5\frac{1}{2}$	$4\frac{2}{3}$	$5\frac{1}{3}$	$4\frac{2}{3}$	$5\frac{1}{2}$	$2\frac{4}{5}$	12	11	9–86–7	7+12; 7+10	......
224	Lake Superior..	....	....	....	$5\frac{1}{2}$	$4\frac{4}{5}$	5	5	5+	3	12	11	10–88–8	5+10; 5+11	4
226	Southampton, Ontario.	....	....	....	$5\frac{2}{5}$	$5\frac{2}{5}$	5	5	....	....	....	....	10–92–8	7+11; 7+11	4
229	Lake Superior..	....	....	....	$5\frac{2}{5}$	$5\frac{1}{2}$	$4\frac{3}{5}$	$4\frac{2}{5}$	5	3	12	12	10–88–8	5+10; 5+10	4
132	Clear Water Pond, Industry, Maine.	....	....	....	....	....	5	$4\frac{2}{3}$	$4\frac{3}{5}$	3+	11	11	9–86–7	5+11; 6+9	$3\frac{1}{2}$
278	Lake Superior..	....	15	....	$5\frac{1}{3}$	$5\frac{1}{2}$	$4\frac{4}{5}$	$4\frac{1}{5}$	5	$2\frac{4}{5}$	11	10	9–86–7	....	......
286	.....do..........	....	14	....	5	5	5	$4\frac{1}{3}$	5	3	11	10	8–81–7	5+12+5+11	4
287	.....do..........	....	16	....	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{3}$	$4\frac{1}{3}$	$5\frac{1}{4}$	3	12	11	9–90–8	7+10; 7+10	$4\frac{1}{3}$
288	.....do..........	....	17	....	5	5	$5\frac{1}{3}$	$4\frac{1}{3}$	5	3	12	....	9–85–7	6+10; 5+10	$3\frac{4}{5}$

Distribution.—The Menominee is found in the lakes of New England, westward through the Adirondacks and the Great Lakes, thence northward into Alaska. In addition to the localities represented in the foregoing table, we have examined specimens in the National Museum from the following localities: Squattock, New Brunswick (Philip Cox); Farmington, Me. (Frank N. Whittier); Lake Winnipiseogee, New Hampshire (R. Appleton, Dr. W. W. Fletcher); "New Hampshire" (E. B. Hodge); "Adirondacks" (Verplank Colvin); White Lake, Oneida County, N. Y. (W. T. Loomis); Big Moose Lake, New York (Fred Mather); Northville, Mich. (F. N. Clark); Sault Ste. Marie (J. W. Milner), and Madaline Island, Lake Superior (Milner).

It has also been recorded from the following localities: Fort Enterprise, British America (type locality, Richardson); Lake Superior (Agassiz); Saumuss Lake and Fraser River, British Columbia (Günther; probably *C. williamsoni*); Lake Erie (Jordan); Lake Michigan (Jordan; Hoy); island of Kadiak, Alaska (Bean); Mackinaw Straits (Bean); Yukon River, at Fort Yukon (Turner); Nulato, Alaska (Bean); Kuskokwim River, Alaska (Bean); Putnam or Kuwuk River, Alaska (Bean); Slave Lake (Bean); Adirondack lakes, Meacham Lake, Chateaugay Lake, Lake Champlain, Big Moose Lake, the Fulton Chain, and Clear Pond (Fred Mather).

From the above it will be seen that this is one of the most—perhaps the most—widely distributed of the American whitefishes.

The Menominee attains a length of 12 to 15 inches and a weight of 2 pounds; the average weight of the fish taken for market, however, is under 1 pound.

6. **Coregonus clupeiformis** (Mitchill).

COMMON WHITEFISH; OTSEGO BASS; HUMPBACK WHITEFISH; BOWBACK WHITEFISH; HIGHBACK WHITEFISH.

Salmo clupeiformis Mitchill, Amer. Month. Mag., II, 1818, 321, Sault Ste. Marie.
Coregonus albus Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie to Arctic Sea.
Coregonus otsego DeWitt Clinton, Med. and Phil. Register, III, 188, about 1824, Otsego Lake.
Coregonus sapidissimus Agassiz, Lake Superior, 344, 1850, Lake Superior.
Coregonus latior Agassiz, Lake Superior, 348, 1850, Lake Superior.

Description.—Head, $4\frac{3}{5}$ to $5\frac{1}{2}$; depth, $3\frac{5}{6}$ to $4\frac{1}{2}$; eye, about 5; snout, 4 to $4\frac{1}{2}$; maxillary, $3\frac{4}{5}$ to $4\frac{2}{5}$; mandible, $2\frac{1}{3}$ to 3. D. 11, occasionally 10; A. 11, sometimes 12. Scales 11–82 to 92–8. Gillrakers usually about 10 or 11+17 or 18, the longest about 2 in eye. Vertebræ 56. Body rather long and compressed, the back arched in front, especially so in the adult, the outline nearly straight posteriorly; ventral outline somewhat convex in front; bases of dorsal and anal fins not very oblique; back narrow; head small and short; snout short and rather blunt; mouth small, nearly horizontal; maxillary short, broadly ovate, its tip reaching about to vertical of front edge of pupil, its width about one-half its length; mandible short, reaching about to posterior edge of eye; upper lip on a level with lower line of eye; lower jaw always included and the blunt snout projecting. Distance from tip of snout to nape $3\frac{1}{4}$ to 4 in distance from snout to origin of dorsal fin. Gillrakers not numerous, the number on the short arm of the arch varying from 7 to 11, on the long arm from 17 to 19; the total number, however, is usually 27 to 29; they are short and rather stout, the longest being contained from $1\frac{3}{5}$ to $2\frac{1}{3}$ times in eye. Fins moderate, the longest rays in pectoral, ventral, and dorsal about equaling length of head. Color, satiny-white all over, back with a faint olive-green shade; fins all white, except the caudal, which is usually slightly dark-edged.

The principal variations in the characters of this well-known fish are shown in the following table of detailed measurements:

Table of comparative measurements of specimens of common whitefish (C. clupeiformis).

No.	Lakes where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.												
74	Michigan	♂	$11\frac{5}{8}$	7 oz.	$5\frac{1}{6}$	$4\frac{1}{3}$	$4\frac{1}{3}$	4	4	$2\frac{1}{3}$	11	11	10-80-?	10+19; 9+17	....
121	Erie	♂ spent.	$20\frac{3}{8}$	$3\frac{1}{4}$ lbs.	$5\frac{2}{5}$	$3\frac{5}{6}$	5	4	$4\frac{1}{4}$	3	10	11	10-84-8	10+18; 10+18	$1\frac{3}{5}$
122	do	♀ spent.	$20\frac{1}{8}$	$3\frac{3}{8}$ lbs.	$5\frac{1}{2}$	$3\frac{3}{4}$	$5\frac{1}{2}$	4	$3\frac{3}{4}$	$2\frac{4}{5}$	11	11	10-85-8	9+18; 8+17	....
123	do	♀ spent.	21	$3\frac{3}{4}$ lbs.	$5\frac{1}{2}$	$3\frac{4}{5}$	$5\frac{1}{2}$	4	4	$2\frac{4}{5}$	11	11	10-83-8	10+18; 10+19	$1\frac{3}{4}$
124	do	♂ partly spent.	$22\frac{1}{2}$	$4\frac{3}{4}$ lbs.	$5\frac{1}{4}$	$3\frac{3}{5}$	$5\frac{5}{6}$	4	4	3	10	12	10-82-8	11+19	....
225	Superior	....	.....	......	5	$4\frac{4}{5}$	5+	4	$3\frac{4}{5}$	3—	10	11	10-92-8	10+18; 10+17	2
227	do	....	.....	......	5	$4\frac{1}{2}$	5	$4\frac{4}{5}$	$4\frac{2}{5}$	$2\frac{4}{5}$	11	11	10-82-9	10+17; 10+18	....
230	do	....	.....	......	$4\frac{3}{5}$	5	$4\frac{3}{4}$	$4\frac{2}{3}$	4+	$2\frac{3}{5}$	11	11	9-85-8	7+18; 7+18	2+
231	do	....	.....	......	$4\frac{5}{6}$	$4\frac{1}{2}$	$4\frac{2}{5}$	$4\frac{2}{3}$	$4\frac{2}{5}$	3—	11	12	11-87-9	10+17; 10+17	2
277	Erie	....	13	......	$5\frac{1}{3}$	4	$4\frac{3}{4}$	$4\frac{3}{4}$	4	$2\frac{3}{4}$	11	12	9-75-8	9+18; 10+18	$2\frac{1}{3}$
384	Winnipeg	....	$15\frac{1}{2}$	......	5	$3\frac{2}{3}$	$5\frac{1}{2}$	4	4+	3—	11	12	10-81-8	....	....

Among the numerous specimens of whitefish which we have examined, we have one which is of unusual interest. This is specimen No. 243, obtained by Mr. Cloud. Rutter from the Droziski Fish Company, at Dunkirk, N. Y., September 17, 1894. It is a fine example, 19 inches in total length. In external appearance it might very well pass for a true whitefish, but careful measurements and examination of its gillrakers show it to differ very materially from typical *C. clupeiformis*. It may be described as follows:

Head, 5; depth, $3\frac{1}{2}$; eye, $5\frac{1}{2}$; snout, 5; maxillary, 4; mandible, $2\frac{3}{5}$. D. 10; A. 11. Scales, 10-72-8. Gillrakers, 12+26 on one side and 13+24 on the other, the longest $1\frac{3}{5}$ in diameter of eye. Body stout and deep, compressed; head larger than in the typical whitefish, the mouth larger, maxillary longer and stouter, reaching to front of pupil; mandible longer, reaching posterior edge of eye; snout more pointed, less decurved, the lower jaw slightly projecting. Distance from tip of snout to nape $3\frac{1}{2}$ in distance from snout to origin of dorsal fin. Caudal peduncle short and deep. From typical *C. clupeiformis* this specimen differs chiefly in the more numerous gillrakers, the somewhat heavier head, the larger mouth, longer maxillary, longer mandible, sharper snout, slightly projecting lower jaw, and the larger scales. In all of these respects the variations from *clupeiformis* are corresponding approximations to the characters possessed by the lake herring.

While we are not at all inclined to admit the occurrence in nature of hybrids among fishes, we are disposed to regard this specimen as a hybrid between the true whitefish (*C. clupeiformis*) and the lake herring (*A. artedi*). We are informed by Dr. Bean, until recently in charge of the Fish-cultural Division of the United States Fish Commission, that it has been a common practice among fish-culturists at the stations about the Great Lakes to fertilize the eggs of the true whitefish (*C. clupeiformis*) with the milt from the lake herring (*A. artedi*), and that this hybridizing has been carried on more or less for several years.[1] Plants of these hybrids have been made in various places, but chiefly in Lake Erie; and it is not at all unlikely that this specimen and all those which the Lake Erie fisherman occasionally get and which they call "mongrel whitefish" are really hybrids between the true whitefish and the lake herring. The number of such hybrids can not be great, however. During the entire season's work of the various Fish Commission parties on the different Great Lakes, only the one specimen which we have described was obtained. Mr. Rutter informs us that the fisherman say they occasionally get a "mongrel whitefish," but this, and possibly one other, are the only ones he saw.

Distribution and abundance.—The common whitefish is one of the most abundant species of whitefishes. It is found throughout the Great Lakes region from Lake Champlain to Lake Superior and Lake Winnipeg. We have examined specimens from Lake Champlain, Otsego Lake, each of the Great Lakes, and from Lake Winnipeg. We have seen no specimens from Lake Memphremagog or elsewhere east of Lake Champlain. Of the three species known to occur in Lake Champlain this is the rarest. The form described from Otsego Lake, N. Y., is a landlocked variety, scarcely worthy of recognition; the National Museum contains three specimens from this lake. In lakes Erie, Huron, Michigan, and Superior the whitefish is abundant, but is now most so in Lake Michigan. It occurs in diminished numbers west and north of Lake Superior, but we have few authentic records to establish the fact. It is reported commercially from Lake of the Woods, Lake Winnipeg, and the northwest Territories, but all the specimens of so-called whitefish which we have seen from the first-named lake belong to a very different species—the Musquaw River whitefish (*C. labra-*

[1] This is done, however, only as a last resort, when eggs of the whitefish can be saved which would otherwise be lost on account of an insufficient number of spawning male whitefish on hand at the collecting station.

doricus). The only specimen of the true whitefish which we have seen from any locality west of Lake Superior is an example obtained by Mr. Woolman in the Duluth market, and which is alleged to have come from Lake Winnipeg. All the records of the occurrence of this species west of Lake Superior need verification.

Names, size, habits, etc.—This fish is generally known as the whitefish throughout the United States and Canada. The landlocked race found in Otsego Lake, N. Y., has been designated by the singularly inappropriate and misleading name of "Otsego bass." Several local names have been applied to the fish in Lake Superior, in allusion to the nuchal hump which characterizes the breeding males. Mr. Woolman found that among the fisherman of the north shore of Lake Superior the names "highback whitefish" and "buffalo-back whitefish" were applied to this fish; the name "bowback" or "bowback whitefish" was heard by Mr. Wilcox in the eastern part of the same lake.

This fish attains a larger size than any other whitefish of North America. Examples weighing as much as 23 pounds, and possibly more, have been taken in the upper lakes. Lake Superior has the reputation of producing the largest fish. In all the lakes, however, fish weighing 10 to 14 pounds are taken. The average size of those obtained in the United States fisheries of the Great Lakes is probably under 4 pounds, the fish taken in gill nets being somewhat larger than those secured in traps.

The habits and movements of this fish are better understood than are those of any other American whitefish. It is chiefly to the late Prof. J. W. Milner that we are indebted for our knowledge concerning this fish in the Great Lakes. The results of his researches were originally published in the Report of the United States Commission of Fish and Fisheries for 1872–73, and have since been extensively copied; we refer to Milner's report for information on this subject.

The whitefish reaches maturity at the age of three or four years, and deposits from 10,000 to 75,000 eggs, the number depending on the size of the fish. The spawning capacity can be approximately gauged by allowing about 10,000 eggs for each pound of body weight. The spawning time is in the late fall, chiefly in the month of November. During the summer they retire to the deeper portions of the lakes, but as the time for spawning approaches they come into shoal water about the islands and in the bays and coves. In Lake Ontario they first appear on their spawning-grounds late in October and the season extends into December. The principal spawning-grounds are in Chaumont Bay, Three-mile Bay, and on the gravelly bars about the head of Fox Island and across to Point Peninsula. The bottom selected seems to be of gravel or of the peculiar rock known as "finger rock" or "honeycomb," at a depth of 20 to 30 feet. In Lake Erie the principal spawning-grounds are among the islands in the western end of the lake.

The whitefish makes regular migrations analogous to the movements of anadromous fishes in the coast rivers. These occur chiefly about the spawning season and are impelled by the reproductive instinct. There are also more or less regular movements at other times, but these are not well understood.

The whitefish rarely takes the hook. Its small mouth necessitates the ingestion of minute food, and examination of the stomach contents has shown that it subsists chiefly on crustaceans, mollusks, and insect larvæ.

Dr. S. A. Forbes, of Illinois University, has made a careful study of the first food of the common whitefish in Lake Michigan, and has reached the following conclusion:

> 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 *Diaptomus 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 *Limniaclanus*. (Bull. Ill. State Lab. Nat. Hist., vol. I, No. 6, p. 108, 1883.)

The common whitefish is generally regarded as one of the best food-fishes of North America. In the regions in which it is taken it is usually held in higher esteem than any other fish. Being a soft fish, it spoils rapidly, and in the condition in which it usually reaches the consumer its edible qualities have greatly deteriorated.

7. **Coregonus nelsonii** Bean.

HUMPBACK WHITEFISH.

Coregonus nelsonii Bean, Proc. U. S. Nat. Mus. 1884, 48, Nulato, Alaska. (Type, No. 29903.)

Head, 5; depth, 4; maxillary, 4; D. 12; A. 12. Scales, 10–88–8 (or 10 counting to middle line of belly). Gillrakers about 26 in number, the longest about 2 in eye. Body heavy forward; back greatly arched and compressed. Head small, snout rather pointed. Mouth small, the maxillary reaching front of eye. Distance from snout to nape about $2\frac{1}{3}$ in distance from nape to origin of dorsal, the latter a little nearer posterior base of adipose fin than tip of snout. Base of dorsal fin, $1\frac{2}{5}$ in longest ray or $1\frac{1}{2}$ in head.

This species is allied to *C. clupeiformis* and *C. labradoricus*, from which it may be distinguished by the greatly arched and compressed back.

It was described by Dr. Bean in 1884 from specimens collected by Mr. E. W. Nelson, at Nulato, Alaska; Mr. Townsend reports it from the Kuwuk River. It is known only from Alaska, from Bristol Bay northward.

Of this species Dr. Bean says:

This whitefish has long been known from Alaska, but it has been confounded with a Siberian species, *C. syrok,* from which it is really very different. The Russian name is *korabati;* the Tinneh tribes of the Yukon call it *kolokuh.* Dr. Dall speaks of it as a common species. He says it is rather bony, and inferior in flavor, and that it is generally used for dog feed except in times of scarcity.

8. **Coregonus labradoricus** Richardson.

LABRADOR WHITEFISH; MUSQUAW RIVER WHITEFISH; SAULT WHITEFISH; WHITING; LAKE CHAMPLAIN; SHAD OR SHADWAITER; WHITEFISH; GIZZARD-FISH; ATTIHAWMEG; POISSON POINTU.

Coregonus labradoricus Richardson, Fauna Bor.-Amer., III, 206, 1836, Musquaw River, Labrador.

?? *Coregonus angusticeps,* Cuvier & Valenciennes, His. Nat. Poiss., XXI, 534, 1848, Saskatchewan River; description brief and erroneous.

Coregonus neohantoniensis Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, New Hampshire.

Description.—Head, $4\frac{3}{5}$ to 5; depth, $3\frac{1}{4}$ to $3\frac{3}{4}$; eye, $5\frac{1}{4}$; snout, $4\frac{1}{2}$ to 5. D. 11 or 12; A. 11. Scales, 10–72 to 87–9. Maxillary, $3\frac{3}{4}$ to 4; mandible, $2\frac{3}{5}$. Gillrakers, 9 or 10+15 to 17=25 or 26, the longest about 2 in eye.

Body long ovate, compressed, the dorsal and ventral outlines about equally arched. Head small, slender, and pointed; snout blunt, truncate, jaws subequal; maxillary rather long, reaching to vertical of anterior line of eye; the supplemental bone more than half length of maxillary, its width $2\frac{1}{5}$ in its length; mandible long, reaching vertical of posterior edge of pupil. Eye moderate, shorter than snout, lower edge of pupil in a line with middle of upper jaw. Distance from snout to occiput $3\frac{1}{2}$ in distance from snout to origin of dorsal fin, which is slightly nearer snout than base of caudal. Caudal peduncle short and deep, its least depth $2\frac{1}{6}$ in head. Fins rather large; height of dorsal and length of pectoral about equal to length of head; base of dorsal fin not much oblique, short, $1\frac{1}{3}$ in height of fin; base of anal fin very oblique, about equal to height of fin or $1\frac{1}{2}$ in longest dorsal ray; adipose fin small, over posterior third of anal; ventrals shorter than pectorals, $1\frac{1}{5}$ in head, their insertion under middle of dorsal fin. Tongue with very weak teeth. Gillrakers short and few, usually not more than 25. Scales thin and loosely imbricated; lateral line nearly straight, along axis of body. Color usually quite dark on back and sides, becoming gradually paler below; under parts pale without dark punctulations; fins all more or less black-tipped, caudal darkest. Length about 2 feet.

Specimens from Lake of the Woods are darker and much deeper in body than those from lakes Champlain and Memphremagog. There is also much variation in the length of the maxillary and in the number of scales in the lateral line. In specimen No. 63, from Lake of the Woods, and upon which our general description is chiefly based, the maxillary scarcely reaches the eye, and is contained $3\frac{3}{5}$ times in the head; the scales are unusually large, there being but 68 in the course of the lateral line; and the body is very deep, the form being much like that of the common whitefish. No. 120, from Lake Memphremagog, has the usual more elongate form of the species, the maxillary is shorter and the scales are much smaller, there being 87 in the course of the lateral line. The examples from Lake Champlain are deeper and paler than those from Lake Memphremagog.

These variations in proportions are exhibited in the following table:

Table of comparative measurements of specimens of Labrador whitefish (*C. labradoricus*).

No.	Locality.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
													Number.	In eye.
		Ins.	*Lbs.*											
63	Lake of the Woods....	21	$2\frac{1}{2}$	5	3	5+	5	$3\frac{3}{5}$	$2\frac{2}{5}$	12	11	10-68-9	10+15; 10+15	2+
65	.....do	20	.....	$5\frac{1}{5}$	$3\frac{1}{4}$	$5\frac{3}{4}$	5	$3\frac{3}{4}$	$2\frac{3}{5}$	12	11	10-80-9	9+16;	$1\frac{1}{2}$
67	Lake Champlain	15	$1\frac{1}{4}$	$4\frac{5}{6}$	$3\frac{1}{2}$	$4\frac{3}{5}$	$4\frac{3}{5}$	4	....	11	11	10-72-9	9+17; 9+17	2+
68	.....do	20	$2\frac{1}{4}$	5+	$3\frac{3}{4}$	5	5	$3\frac{3}{4}$	....	12	11	10-71-8	9+16; 9+16	2+
120	Lake Memphremagog.	18	.....	$4\frac{2}{3}$	4—	5+	$4\frac{1}{2}$	4+	$2\frac{2}{3}$	10	10	10-87-8	9+16; 9+16	2
279	Basswood Lake, Minn	$18\frac{1}{2}$	.....	$4\frac{3}{4}$	$3\frac{1}{2}$	5	5	4	$2\frac{3}{4}$	11	11	9-80-8	....	....
382	Ely, Minn	$15\frac{1}{2}$	.....	$4\frac{1}{2}$	$3\frac{3}{5}$	$5\frac{1}{2}$	$4\frac{3}{4}$	4	$2\frac{3}{4}$	12	13	10-84-8	....	....

Distribution and abundance.—This species was originally described from the Musquaw River, Labrador, in 1836. In 1851 it was redescribed as new by Prescott, under the name of *Coregonus neohantoniensis*, from Lake Winnipiseogee, New Hampshire. The specimen described in 1848 from the Saskatchewan River as *Coregonus angusticeps* by Cuvier & Valenciennes is probably identical with the Musquaw River species. It is now known from the Lake of the Woods eastward through the Great Lakes, the Adirondacks, the lakes of Vermont, New Hampshire, and Maine, and northeast through New Brunswick into Labrador. It doubtless inhabits most of the eastern Canadian lakes. We have examined specimens from the following places: Lake of the Woods; Lake Superior; Basswood Lake and Ely, Minn.; Hudson Bay; Ecorse, Mich.; Gross Water and Mississquoi bays, Lake Champlain; Cooperstown, N. Y.; Lake Memphremagog; Lake Winnipiseogee; Moosehead Lake and Grand Lake Stream, Me.; Fredericton and St. Johns River, New Brunswick; Labrador.

This species does not appear to be common in any of the Great Lakes; indeed, we have no authentic record of its ever having been taken in Lake Ontario or Lake Erie, while the few definite records for Lake Huron and Lake Michigan would indicate that it is a rare fish in those two lakes. Lake Superior seems to be the only one of the Great Lakes in which it is at all common. This is no doubt due to the fact that the waters of Lake Superior are colder than those of the other Great Lakes, thus approaching in that regard the character of the more northern lakes of Canada, where this whitefish appears to reach its greatest abundance and largest size.

As early as 1852, Mr. M. H. Perley gave the following very interesting account[1] of this species:

This fish, the celebrated *attihawmeg* of the great northern lakes, so frequently described by Arctic voyagers as the most delicious of all purely fresh-water fishes, is found in considerable numbers in Lake Temiscouata, where many are taken every autumn by the French Canadians, who come over from the St. Lawrence to fish for them, and call them *poisson pointu*. The English lumbermen call them "gizzard fish." They are taken occasionally along the Madawaska River, and the writer has caught them with rod and line below the falls of that river, at its confluence with the St. John, in the early part of summer. At these falls the inhabitants take about 40 barrels every autumn, which are cured in pickle for winter use. The whitefish abounds in all the Eagle lakes, at the head of Fish River, a tributary of the Upper St. John, and in the St. Francis lakes, at the stream's head. In these lakes it is caught abundantly every autumn, by torchlight, with dip nets. It has not been observed in any of the lakes or rivers which discharge into the Gulf of St. Lawrence, nor yet in any of the waters of Nova Scotia.

Some years since this fish was abundant in the Grand Lake, where the writer, in the month of May, saw great numbers taken out of gill nets set for gaspereau, and thrown away by the fishermen as worthless. At the same time the writer caught a number of them with rod and line in one of those small pieces of water connected with the Grand Lake, usually called "keyholes." It is occasionally taken in the Saint John throughout its whole extent. In the harbor of Saint John, in spring, it has been often caught in the seines and weirs with the gaspereau and salted with that fish because its value was not known.

It is probable that the similar fish found in the lower part of the Saint John have strayed from the great lakes at the sources of its upper tributaries and have been swept over the Grand Falls by some extraordinary flood. Once over those falls there is no possibility of return. The whitefish seen by the writer have seldom exceeded 1½ pounds in weight, but they are taken in Lake Temiscouata of the weight of 3 pounds and even more. It is an inhabitant of all the interior lakes of America, from Lake Erie to the Arctic Sea. Several Indian tribes mainly subsist upon it, and it forms the principal food at many of the fur posts for eight or nine months of the year, the supply of other articles of diet being scanty and casual. Its usual weight in the northern regions is from 2 to 3 pounds, but it has been taken in the clear, deep, and cold waters of Lake Huron of the weight of 13 pounds. The largest seen in the vicinity of Hudson Bay weighed between 4 and 5 pounds, and measured 20 inches in length and 4 in depth. One of 7 pounds' weight, caught in Lake Huron, was 27 inches long. Very recently the writer had an opportunity of seeing some fresh specimens of the whitefish of Lake Erie,[2] and was satisfied of their identity with the "gizzard-fish" of the Saint John and Lake Temiscouata.

During the summer the whitefish is not seen in Lake Temiscouata, and it is then supposed to retire to the depths of that unusually deep and cold lake. In October it draws near the shores, and ascends the Tuladi River for the purpose of spawning. It ascends the river during the night, and, having deposited its spawn, returns as quickly as possible to the lake. It is when this fish draws near the shore, prior to spawning, that the fishery is carried on, chiefly at a little bay in Lake Temiscouata,

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[1] Descriptive Catalogue of the Fishes of New Brunswick and Nova Scotia, by M. H. Perley. Fredericton, 1852. This account of the *attihawmeg*, published in 1852 by Mr. Perley, was appropriated by Charles Lanman and republished verbatim as original matter in the United States Fish Commission Report for 1872–73. In this report Mr. Lanman prints three articles dealing with nine species of fishes, copying the entire amount of his articles from Perley without credit. James F. Knight, in 1866, in a descriptive catalogue of the fishes of Nova Scotia, made a similar use of much of the interesting portions of Mr. Perley's paper.

[2] The "whitefish" which Mr. Perley saw from Lake Erie were probably *C. clupeiformis*, rather than *C. labradoricus*, as he thought.

into which the Tuladi discharges its waters. At the same time the great gray trout (*Salmo ferox*)[1] follows the whitefish to the shore and preys upon it. While the nets are set for whitefish, the fishers, with torch and spear, attack and capture the *Salmo ferox*, frequently of large size; and hence this latter fish has acquired the name of *tuladi*, from the river to which it is attracted by its favorite prey.

The whitefish feeds largely on fresh-water shellfish; its stomach, in consequence, acquires an extraordinary thickness and resembles the gizzard of a fowl, hence its popular name of "gizzard-fish." The stomach, when cleaned and boiled, is a favorite morsel with the Canadian *voyageurs*.

9. **Argyrosomus osmeriformis** (H. M. Smith).

SMELT OF THE NEW YORK LAKES.

Coregonus osmeriformis Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, pl. 1, 2, Seneca Lake and Skaneateles Lake, New York. (Types, Nos. 32162 and 32165.)

Head, 4; depth, 5 to 6; eye, 4. D. 9; A. 13; scales, 9–83–10. Body elongate, slender, back not elevated. Head rather large, its width equal to half its length. Length of top of head $2\frac{1}{4}$ in distance from occiput to dorsal; greatest depth considerably less than length of head. Eye large, equal to snout. Gillrakers very long and slender, as long as eye, 20 + 35. Dorsal fin rather high, its height equal to four-fifths depth of body and $1\frac{1}{2}$ times length of base of fin; its origin nearer base of caudal than snout; its free margin nearly vertical, straight. Longest anal ray, four-fifths length of base of fin. Ventral long, equal to height of dorsal, its length equal to three-fourths of distance from ventral origin to vent; ventral origin midway between base of caudal and pupil. Adipose dorsal long and slender, of same width throughout, its width one-third its length. Mouth large, lower jaw projecting; snout straight; maxillary contained 3 times in length of head; its posterior edge extending to line drawn vertically through anterior margin of pupil; mandible one-half length of head, its angle under pupil. Teeth present on the tongue. Color above, grayish silvery; sides, bright silvery; below, white; tips of dorsal and caudal, dark. Length, 10 inches.

This fish has been recorded from Seneca and Skaneateles lakes, New York, where it is known as smelt. It doubtless inhabits most of the deep-water lakes of the northern part of the State. Nothing is known of its habits, and its small size renders it of little value as food.

10. **Argyrosomus artedi** (Le Sueur).

HERRING; LAKE HERRING; CISCO; MICHIGAN HERRING; BLUEBACK HERRING; GRAYBACK HERRING; GREENBACK HERRING; SHORE HERRING.

Coregonus artedi Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie; Niagara River.

Salmo (Coregonus) harengus, Richardson, Fauna Bor.-Amer., III, 210, 1836, Lake Huron.

Description.—Head, 4 to 5; depth, 4 to $4\frac{2}{3}$; eye, 4 to 5; snout, 4 to 5. Dorsal 9 to 11, usually 10; anal 10 to 13, usually 11 or 12. Maxillary, 3 to $3\frac{3}{5}$ in head; mandible, 2 to $2\frac{1}{2}$, usually over 2. Scales, 8 to 10–62 to

[1] The fish referred to is the lake trout, *Cristivomer namaycush*.

87–7 or 8, the most frequent number being 9–81–8. Vertebræ, 57. Gill-rakers varying from 45 to 58 (15 to 19+30 to 38), long and slender, about $1\frac{1}{5}$ in eye.

Body long, slender, and somewhat compressed; dorsal and ventral outlines but little arched; head pointed; mouth large, jaws subequal or lower jaw somewhat projecting; maxillary long, usually reaching to vertical of pupil, its width $2\frac{1}{2}$ times in its length; supplemental maxillary bone broad, about half length of maxillary; mandible long, but not often reaching vertical of posterior border of orbit; middle of upper jaw on level with lower edge of orbit. Caudal peduncle slender, not much compressed, its least depth equal to distance from tip of snout to middle of eye. Distance from tip of snout to occiput $2\frac{1}{2}$ times in distance from occiput to origin of dorsal fin, which is somewhat nearer snout than base of caudal fin. Dorsal fin small, length of base about $2\frac{1}{5}$ in head, longest ray $1\frac{3}{5}$ in head; base of anal fin about equal to that of dorsal, its longest ray about $2\frac{1}{2}$ in head; pectoral $1\frac{3}{5}$ in head. Color in life: Back dull bluish-green, this color extending down the sides nearly to the lateral line; lower part of sides silvery, under parts white or silvery; dorsal fin usually blackish or bluish-black on distal third, sometimes plain, membrane often punctate with dark; caudal bluish-black at tip; anal and ventrals pure white; pectorals white, edged with dark above. Sometimes the anal has a few black specks at base and on anterior part. The snout is also often more or less dark.

It will be noticed from the numerous comparative measurements and actual counts of fin rays, scales, and gillrakers, as exhibited in the accompanying table, that the amount of variation among individuals of this species is astonishingly great. The greatest range of variation is found in the scales. While the number in the transverse series is pretty constant, the variation being only through 4 (i. e., from 15 to 18), there is no such constancy in the number in the longitudinal series. Omitting from consideration in this connection all specimens in which mutilation of any kind renders the accurate counting of the scales uncertain, we find an extreme variation of 31 in the number of scales in the lateral line. The minimum number found by us is 62 in specimen No. 56, from Lake Ontario. The maximum number is 92 in specimen No. 142, from Lake Erie. These are the extreme variations in the scales, and are exceptional. The number does not usually run lower than 74 nor higher than 83.

The variation in the gillrakers is very great. The least number found was 43 and the greatest 58. The average for 101 examples counted, excluding mutilated ones, was 47. The length of the longest gillraker varies somewhat, from 1 to $1\frac{1}{2}$ times in the diameter of the eye, the average for over 100 examples being about $1\frac{1}{4}$. The gillrakers are, however, always long and slender, and average more in number than in any other species of *Argyrosomus* except *nigripinnis* and *tullibee.*

Table of comparative measurements of specimens of lake herring (Argyrosomus artedi).

Number.	Lakes where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.	*Oz.*											
10	Ontario		$14\frac{1}{2}$	12	$4\frac{3}{4}$	$3\frac{3}{4}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{1}{3}$	$2\frac{1}{5}$	10	12	9-75-7	*14+29; 17+30	$1\frac{1}{2}$
54	do				$5\frac{1}{2}$		$4\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{3}{5}$	$2\frac{2}{5}$	10	11	8-71-8	Dressed fish.	
55	do				$4\frac{4}{5}$		$4\frac{1}{5}$	$4\frac{4}{5}$	$3\frac{1}{6}$	2	11	12	9-78-8	do	
56	do				$3\frac{4}{5}$	$4\frac{1}{2}$	$4\frac{1}{4}$	$4\frac{4}{5}$	3+	2—		11	9-62-7	16+31; 15+30*	1
69	Michigan	♀ ripe	$12\frac{3}{4}$	10—	$5\frac{1}{6}$	$4\frac{1}{2}$	4	4	$3\frac{1}{3}$	$2\frac{1}{5}$	10	10	10-83-8	17+30; 16+30	
70	do	do	$13\frac{5}{8}$	12—	$4\frac{1}{2}$	$4\frac{2}{5}$	$4\frac{1}{2}$	$4\frac{1}{3}$	$3\frac{1}{2}$	$2\frac{1}{6}$	10	11	9-82-8		
80	do	do	$13\frac{1}{8}$	11+	$4\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{2}{5}$	$2\frac{1}{5}$	10	11	9-82-8	19+39; 18+38	$1\frac{1}{5}$
83	do	do	$13\frac{3}{4}$	12—	5	$4\frac{1}{4}$	$4\frac{4}{5}$	5	$3\frac{1}{3}$	$2\frac{1}{7}$	11	12	9-81-8	16+32; 16+32	$1\frac{1}{3}$
85	do	♀	$14\frac{1}{4}$	13+	5	$4\frac{1}{6}$	$4\frac{3}{5}$	$4\frac{4}{5}$	$3\frac{3}{5}$	2+	10	11	9-87-8	17+34; 17+34	$1\frac{1}{4}$
90	Huron	♀	$11\frac{1}{2}$		5	$4\frac{1}{3}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{3}{5}$	$2\frac{1}{8}$	10	12	8-82-8	15+33; 16+33	$1\frac{1}{5}$
91	do	♀	$12\frac{1}{2}$		$4\frac{4}{5}$	$4\frac{3}{5}$	$4\frac{1}{2}$	5	$3\frac{3}{4}$	$2\frac{1}{8}$	10	12	9-83-8	*14+32; 18+33	$1\frac{1}{5}$
92	do	♀	12		$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{5}$	5	$3\frac{2}{5}$	$2\frac{1}{5}$	9	12	8-79-8	17+33; 17+32	$1\frac{1}{5}$
93	do	♂	12		5	$4\frac{1}{2}$	$4\frac{1}{3}$	$4\frac{3}{4}$	$3\frac{1}{5}$	$2\frac{1}{8}$	10	11	9-76-8	17+30; 16+29	$1\frac{2}{5}$
94	do	♂			$4\frac{3}{5}$		$4\frac{1}{3}$	$4\frac{3}{5}$	$3\frac{3}{5}$	$2\frac{1}{6}$				17+34; 17+32	$1\frac{3}{5}$
125	Erie	♀ spent.	$13\frac{3}{4}$	12—	5	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{4}$	$2\frac{1}{3}$	11	12	9-81-8	16+30; 15+30	
126	do	♂ spent.	$13\frac{3}{8}$	13	$4\frac{4}{5}$	4	$4\frac{1}{5}$	$4\frac{3}{5}$	3	$2\frac{2}{3}$	11	13	9-72-7	17+30; 12+30*	
127	do	♀ spent.	$13\frac{1}{4}$	11+	$4\frac{4}{5}$	$4\frac{3}{5}$	$4\frac{2}{5}$	$4\frac{1}{2}$	$3\frac{1}{6}$	$2\frac{1}{4}$	10	10		16+31; 13+31*	$1\frac{1}{5}$
128	do	♂ partly spent.	$14\frac{1}{2}$	14	5	$4\frac{2}{5}$	5	5	3	$2\frac{1}{5}$	11	10	9-81-8	16+29; 16+30	$1\frac{1}{5}$
129	do	♀ spent.	$14\frac{1}{4}$	13—	5	4	$4\frac{2}{5}$	$4\frac{4}{5}$	3	2	10	11	9-74-7	17+33; 16+31	$1\frac{1}{5}$
133	Huron				$4\frac{1}{2}$	4	5	5	$3\frac{3}{5}$	2+	11	11	9-70-8	*16+30; 15+30	1
134	Erie				$4\frac{1}{3}$	$3\frac{5}{6}$	5	5	$3\frac{2}{3}$	$2\frac{1}{5}$	11	11	8-76-7	16+32; 16+32	1
140	do				$4\frac{1}{2}$		$4\frac{3}{5}$	5	3	2+		11	9-74-8	*11+30; 10+16*	
141	do				$4\frac{1}{5}$	$4\frac{1}{5}$	$4\frac{1}{3}$	5	3+	2+	10	12	9-67-8*	17+27; 17+30	$1\frac{1}{4}$
142	do				$4\frac{1}{4}$	4	$4\frac{3}{5}$	5	$3\frac{2}{3}$	$2\frac{1}{5}$	11	13	9-92-8	16+31; 16+31	1
144	do													16+27; 16+29	
145	do													16+26; 16+28	
146	do						$4\frac{1}{2}$		$3\frac{1}{2}$	2+				16+27; 16+30	$1\frac{1}{4}$
147	do						4+		$3\frac{1}{2}$	2+				18+31; 18+31	$1\frac{1}{3}$
148	do													16+30; 16+30*	
149	do													16+30; 16+28*	
150	do						5		$3\frac{3}{5}$	2+				17+32; 17+31	$1\frac{1}{5}$
151	do						$4\frac{1}{2}$		$3\frac{3}{5}$	$2\frac{1}{4}$				15+31; 17+31	$1\frac{1}{5}$
152	do						$4\frac{1}{4}$		$3\frac{1}{2}$	$2\frac{1}{4}$				18+32; 16+32	1
153	do						4+		$3\frac{1}{2}$	2+				17+30; 17+30	$1\frac{1}{5}$
154	do						$4\frac{1}{3}$		$3\frac{1}{3}$	2+				17+30; 16+31	$1\frac{1}{3}$
155	do						$4\frac{1}{2}$		$3\frac{1}{2}$	$2\frac{1}{5}$				17+31; 17+31	$1\frac{1}{2}$
156	do						4		$3\frac{1}{2}$	$2\frac{1}{4}$				18+30; 18+29*	$1\frac{1}{4}$
157	do						4		$3\frac{1}{2}$	2+				16+30; 16+28*	
160	do													15+31; 16+30	
161	do													16+30; 17+30	
164	do													14+28; 14+29	
166	do													*15+30; 15+31	
167	do													16+28; 16+28	
168	do													17+32; 17+32	
169	do						5		4	$2\frac{1}{4}$				17+31; 17+31	$1\frac{1}{4}$
170	do													*14+26; 14+24*	
171	do													18+30; 17+30	
172	do													16+28; 16+26*	
173	do						$4\frac{1}{2}$		$3\frac{1}{2}$	2+				16+30; 15+31	$1\frac{1}{3}$
174	do													*16+30; 13+32*	
175	do						4		$3\frac{1}{2}$	$2\frac{1}{4}$				16+32; 16+28	$1\frac{1}{3}$
176	do						$4\frac{1}{4}$		$3\frac{2}{3}$	$2\frac{1}{5}$				17+31; 18+32	$1\frac{1}{3}$
177	do													16+30; 16+28*	
178	do													16+28; 17+28	
179	do						4+		$3\frac{2}{3}$	$2\frac{1}{4}$				16+30; 17+31	$1\frac{1}{3}$
180	do						$4\frac{3}{4}$		$3\frac{2}{3}$	$2\frac{1}{4}$				17+31; 16+31	$1\frac{1}{4}$
181	do						$4\frac{1}{2}$		$3\frac{1}{3}$	$2\frac{1}{5}$				17+32; 17+32	$1\frac{1}{5}$
182	do						$4\frac{1}{4}$		$3\frac{1}{4}$	$2\frac{1}{5}$				17+29; 16+30	$1\frac{1}{3}$
183	do						5		$3\frac{4}{5}$	$2\frac{1}{2}$				17+31; 16+31	
184	do				$4\frac{1}{3}$	4+	$4\frac{1}{2}$	5	$3\frac{2}{5}$	2+	10	12	8-72-7	17+31; 17+31	1+
185	do				$4\frac{3}{5}$	$5\frac{1}{3}$	$4\frac{3}{4}$	$4\frac{3}{4}$	3	2+	10	10	8-80-7	15+28; 15+29	1
280	Superior		15		$4\frac{3}{5}$	$4\frac{4}{5}$	$5\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{2}{3}$	$2\frac{1}{5}$	9	11	9-85-8	*13+27; 16+28	1
298	do				$4\frac{1}{2}$	5	4	5	3	2	10	12			
299	do				$4\frac{3}{5}$		4	$4\frac{3}{5}$	3	2	10	13			
303	do		$7\frac{1}{8}$		$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{3}{5}$	4+	$2\frac{4}{5}$	2	10	11	8-76-7	17+29; 16+32	$1\frac{1}{6}$
314	Ontario	♂	$10\frac{1}{2}$		$4\frac{3}{5}$	4	$4\frac{1}{5}$	$4\frac{3}{5}$	$3\frac{1}{2}$	$2\frac{1}{4}$	11	11	8-75-7	16+31; 16+31	$1\frac{1}{5}$
315	do	♂	$12\frac{1}{2}$		$4\frac{3}{5}$	$3\frac{3}{5}$	$4\frac{3}{4}$	$4\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{5}$	11	11	8-80-7	16+30; 16+30	$1\frac{3}{5}$
316	do	♀	$12\frac{1}{2}$		$4\frac{2}{5}$	$4\frac{2}{5}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{6}$	12	12	8-79-7	18+32; 18+33	1
317	do	♂	$10\frac{1}{2}$		$4\frac{1}{2}$	$4\frac{1}{5}$	$4\frac{1}{4}$	$4\frac{3}{4}$	$3\frac{1}{5}$	$2\frac{1}{5}$	11	12	8-76-7	17+33; 17+30	$1\frac{1}{5}$
318	do	♂	$11\frac{1}{2}$		$4\frac{3}{5}$	$3\frac{4}{5}$	$4\frac{4}{5}$	$4\frac{4}{5}$	$3\frac{3}{5}$	$2\frac{1}{6}$	11	12	8-70-7	17+32; 17+31	$1\frac{1}{4}$

* Gill mutilated; number uncertain.

Abundance, distribution, etc.—In all the Great Lakes the lake herring, or cisco, is more abundant than any other whitefish. It is taken in enormous quantities each year, and in most of the lakes is the object of a special fishery. Considering the entire basin, the quantity of lake herring taken is greater than that of all other whitefishes combined, but in value of catch and in food value it does not equal the common whitefish.

We have critically examined specimens from lakes Ontario, Erie, Huron, Superior, and Michigan. We have also examined all the specimens of this species now in the National Museum, which represent the following localities: Lake Champlain (Professor Baird); Missisquoi Bay, Lake Champlain (R. W. Marfel); Lake Champlain, Vergennes, Vt. (M. E. Hall); Labrador (L. M. Turner); Nelson River, Hudson Bay (Dr. Robert Bell); Hudson Bay (Walter Haydon); Lake Ontario (W. H. Thompson); lakes Erie, Huron, and Michigan; Moose Factory, British America (C. Drexler). The specimens from Labrador and Hudson Bay region may represent a slight variety worthy of recognition.

Mr. John W. Titcomb says this species is quite common in several of the small lakes of Vermont, particularly Bomoseen Lake in Rutland County. In October and November, they appear in large schools close to the rocky shores of the lake for the purpose of spawning.

This species is abundant in Lake Ontario; its most important spawning-grounds are in the east end of the lake, in Chaumont Bay, Three-mile Bay, and about Grenadier, Stony, and Fox islands. Farther west spawning-grounds are found along the shores and bays, more especially in Great Sodus Bay. On the Canadian side important grounds seem to be in the Bay of Quinte. The spawning-beds are usually in shallow water on hard bottom, though mud bottom is frequently used. In the American portions of Lake Ontario the spawning takes place almost entirely in the month of November. The ciscoes of Lake Ontario run from less than a pound to 1½ pounds, though it is said they are sometimes taken weighing 2½ or even 4 pounds.

In Lake Erie this species exists in greater abundance than elsewhere. Its spawning seasons and habits are not known to differ materially from those of the Lake Ontario fish.

Common names.—This species is known by many names. The most widely used are lake herring and cisco, either of which is, in most places, distinctive. In Lake Ontario it is commonly called the cisco. The etymology of the word is in dispute. One assigned derivation is from a fish-peddler named Cisco, who, about 1830, took the fish through the northern part of the State and sold it to farmers as "Cisco's herring." "Sisco" is only a recent variation in the orthography. Other names used by the fishermen of this lake are herring, blueback or greenback, blueback herring or greenback herring, and grayback or grayback herring. The name most widely used, however, is cisco. These different names are the fishermen's way of distinguishing individual variations in color, sex, age, or time of run. Usually the fishermen claim that the graybacks run in the spring and that the spring or early summer is their spawning time. The greenbacks and bluebacks run in the late fall and they are a better fish than the graybacks. It is not unlikely that all the fish found spawning in early summer are bloaters (*A. prognathus*). In lakes Erie, St. Clair, Huron, and Superior the fish is generally known as herring and lake herring, which are the names in use in Canada. In Lake Michigan the names herring, Michigan herring, blueback herring, and shore herring are in use. The name herring is in places shared by another species (*A. hoyi*). A trade name for large herring in Lake Erie is ciscoette or siscowet.

10a. Argyrosomus artedi sisco Jordan.

SISCO OF LAKE TIPPECANOE.

Argyrosomus sisco Jordan, Amer. Nat., IX, 1875, 136, Lake Tippecanoe, Warsaw, Ind.

Head, $3\frac{3}{4}$ to $4\frac{3}{5}$; depth, 4 to 5; eye, 4 to 5; snout, about 5; maxillary, $3\frac{3}{5}$; mandible, $2\frac{1}{3}$. Scales, 9–74 to 89–8. Gillrakers, 15+28 to 31 (43 to 46), long and slender, 1 to $1\frac{1}{5}$ in eye. This species is not essentially different in form from that of the lake herring, but is smaller and much superior as food. It reaches a length of about 14 inches. It is known only from Geneva, La Belle, and Oconomowoc lakes in Wisconsin, and Tippecanoe, Crooked, Shriner, and Cedar lakes in northeastern Indiana. It lives in deep water except in December, when it comes into shallow water and ascends brooks to spawn. According to Professor Kirsch it spawns from about the 25th of November to the 25th of December in Shriner Lake and the other Indiana lakes.

The following table gives detailed measurements of four specimens from Crooked Lake, Whitley County, Indiana, which were obtained by Prof. P. H. Kirsch, the Indiana State fish commissioner.

Table of comparative measurements of specimens of sisco of Lake Tippecanoe (Argyrosomus artedi sisco).

No.	Locality.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
											Number.	In eye.
136	Crooked Lake, Indiana	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{4}$	6	$3\frac{1}{2}$	$2\frac{1}{4}$	10	11	9–85–8	15+31; 15+30	1+
137	do	$4\frac{2}{5}$	5	4	5	$3\frac{3}{5}$	$2\frac{1}{4}$	10	11	9–89–8	15+29; 14+28	$1\frac{1}{5}$
138	do	$4\frac{3}{5}$	4+	5+	$4\frac{1}{2}$	$3\frac{3}{5}$	$2\frac{1}{3}$	10	11	9–74–8	15+29; 15+30	$1\frac{1}{5}$
139	do	$3\frac{3}{4}$	4–	5–	5+	$3\frac{3}{5}$	$2\frac{1}{3}$	10	11	9–77–8	15+29; 15+30	1

11. Argyrosomus hoyi Gill.

MOON-EYE; MOON-EYE CISCO; CISCO; KIEYE; CHUB.

Argyrosomus hoyi (Gill MS.) Jordan, American Naturalist, IX, March, 1875, 135, Lake Michigan, near Racine, Wis.

Description.—Head, $4\frac{1}{2}$; depth, $4\frac{1}{2}$; eye, $4\frac{1}{5}$ to $4\frac{2}{3}$; snout, $3\frac{2}{5}$ to $3\frac{5}{6}$; maxillary, $2\frac{3}{5}$ to 3 in head, reaching to vertical of middle of pupil. D. 10; A. 11 or 12; scales, 8 or 9–73 to 80–7. Gillrakers, 14+25 or 26, slender, about 2 in eye. Vertebræ, 56; branchiostegals, 8 or 9. Body rather elongate, compressed, the back somewhat elevated. Mouth rather large, subterminal, the lower jaw shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate, somewhat as in a true *Coregonus*; mandible nearly reaching posterior edge of eye, $2\frac{1}{6}$ in head. Head rather long, slender, and pointed. Supraorbital and preorbital long and narrow. Distance from tip of snout to occiput, $2\frac{1}{5}$ to $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; fins low; free margin of dorsal very oblique, the length of the anterior rays $1\frac{3}{5}$ in head, that of the last ray less than half length of the first; longest anal ray, $2\frac{3}{5}$ in head and more than twice as long as the last ray. Pseudobranchiæ very large; tongue with traces of teeth.

Color light iridescent blue on back, scales with a few fine dark punctulations reaching about two scales below lateral line; sides and under parts rich silvery, brighter than in any other of our *Coregoninæ*, much as in *Hiodon* and *Albula;* top of head light olivaceous; cheeks silvery; dorsal, caudal, and pectorals with some dark on their margins; anal and ventrals white, with some dark dustings; the male, perhaps, a little richer, more iridescent blue on back, and with the scales a little thicker and less closely imbricated. Length, 13 inches. Deep waters of Lake Michigan; the smallest and handsomest of our *Coregoninæ*.

The only specimens known until recently were the two sent to Dr. Gill and the one to Dr. Jordan by Dr. Hoy; but during recent investigations by the Fish Commission this species was found to be one of the principal fishes caught in the gill nets in the western part of Lake Michigan. It is a true *Argyrosomus*, though approaching *Coregonus*.

Table of comparative measurements of Hoy's whitefish (Argyrosomus hoyi).

No.	Lake where taken.	When taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
				In.	*Oz.*											
57	Michigan.	Nov. 6	♀ ripe....	$13\frac{1}{2}$	10+	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{2}{5}$	3	$2\frac{1}{6}$	10	12	8-80-7	14+26; 14+26	2
58	.....do	Nov. 6	♂ ripe....	12	8+	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{2}{3}$	$3\frac{4}{5}$	$2\frac{4}{5}$	$2\frac{1}{5}$	10	11	*8-73-7	14+25; 14+25	$1\frac{1}{2}$
59	.....do	Nov. 6	♀ ripe....	13	9+	$4\frac{2}{3}$	$4\frac{1}{5}$	$4\frac{1}{5}$	$3\frac{4}{5}$	$2\frac{4}{5}$	$2\frac{1}{6}$	10	11	8-78-7	14+25; 14+25	$1\frac{1}{2}$
60	.....do	Nov. 6	♀ ripe....	12	9—	$4\frac{1}{2}$	$4\frac{1}{5}$	$4\frac{2}{3}$	$3\frac{4}{5}$	$2\frac{3}{8}$	$2\frac{1}{5}$	10	12	8-78-7	14+25; 14+25	$1\frac{1}{2}$
61	.....do	Nov. 6	♂ not ripe	12	8—	$4\frac{3}{5}$	$4\frac{2}{5}$	$4\frac{3}{5}$	$3\frac{3}{5}$	$2\frac{3}{5}$	$2\frac{1}{6}$	9	11	9-76-7	14+26; 14+24	$1\frac{1}{2}$
62	.....do	Nov. 6	♀ partly spent.	12	8—	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{5}{6}$	$2\frac{7}{8}$	$2\frac{1}{3}$	10	12	9-73-7	12+25; 12+25	$1\frac{2}{3}$
71	.....do	Nov. 12	♂ ripe....	$12\frac{3}{8}$	8	$4\frac{3}{5}$	$4\frac{3}{5}$	$4\frac{1}{4}$	$3\frac{3}{4}$	$2\frac{5}{6}$	$2\frac{1}{6}$	9	11	9-83-8	14+28; 14+27	$1\frac{1}{3}$
72	.....do	Nov. 12	♂ ripe....	$12\frac{7}{8}$	8+	$4\frac{5}{6}$	$4\frac{1}{2}$	4	$3\frac{1}{2}$	$2\frac{7}{8}$	2	9	9	9-81-8	13+26; 13+26	$1\frac{1}{3}$
75	.....do	Nov. 12	♂ ripe....	$12\frac{1}{4}$	7+	$4\frac{7}{8}$	$4\frac{1}{2}$	4	4	$2\frac{3}{4}$	$2\frac{1}{8}$	9	11	9-83-8	13+26; 13+24	$1\frac{1}{8}$
107	.....do	Nov. 19	♀ spent..	$13\frac{1}{4}$	13—	$4\frac{1}{4}$	...	$4\frac{3}{5}$	4	3	2	10	12	....	....	....

* Thicker and less closely imbricated than in No. 57.

Among the collections recently made there are 8 specimens of *Argyrosomus* (5 from Lake Michigan and 3 from Lake Superior) which we refer to *A. hoyi* for the present, though they differ from typical *hoyi* in some respects. The most important of these is the number of gillrakers. In the numerous specimens of *hoyi* examined the average number of gillrakers was found to be 39, while the average for the 8 specimens here considered is but 31½. If we consider only these averages the difference is great, but the range of variation in each is so great as to render this contrast less striking. An examination of the table under *hoyi* shows the range to be from 37 to 42, and the following table shows the range in these 8 specimens to be from 29 to 34. The difference of 3, however, between the minimum for *hoyi* and the maximum for these peculiar specimens is important, and would, under ordinary circumstances, lead us to regard these 8 specimens as belonging to another and apparently undescribed species.

These specimens also resemble *A. prognathus* in general appearance, and a comparison with that species is equally interesting. The chief differences from *A. prognathus*, which can be represented numerically, are the fewer gillrakers, the longer mandible, and shorter maxillary. The average number of gillrakers in *A. prognathus* is, as shown by our material, about 39. These averages are sufficiently wide apart to justify separating the two forms specifically; and we would not hesitate to do so were it not for the fact that the recognized extremes of variation in this particular in *A. prognathus* are very great, the minimum number recognized by us in that species being as low as 32 (in specimens Nos. 23 and 25). But the other characters shown by these two specimens are not appreciably different from typical *prognathus*. They have the projecting lower jaw, the long mandible and maxillary, and the general form of muzzle of that species.

In the 8 specimens under consideration, not only are the gillrakers very few, but the mandible and maxillary are rather shorter, and the general form of the snout is different. The lower jaw projects but slightly or not at all, and the maxillary is narrower. Nos. 108 to 112 were obtained in deep water off Sheboygan, Wis., with Hoy's whitefish, from which they were not distinguished by the fishermen, all being known to them as "kieye" or "chub." While these fish were confounded with *A. hoyi* by the fishermen, they appear more different from that species than they do from *A. prognathus*, the gillrakers in *A. hoyi* being even more numerous than in *prognathus*. Externally they very closely resemble *hoyi*, while in number of gillrakers they seem more closely related to the longjaw. If further investigation should show these differences to be as great and valuable as they now appear, these specimens should be regarded as a distinct species. For the present, however, we suspend judgment and await additional evidence.

The following table shows the comparative measurements of these 8 specimens:

No.	Lake where taken.	When taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
				In.	*Oz.*											
108	Michigan...	Nov. 18	♀ partly spent.	$13\frac{1}{2}$	14	$4\frac{2}{5}$	4	$4\frac{3}{4}$	$4\frac{1}{2}$	3+	2—	10	13	9-81-8	11+21; 11+19	$1\frac{1}{3}$
109	.....do......	Nov. 18	♂	$13\frac{3}{8}$	14+	4	$3\frac{3}{4}$	5	$4\frac{1}{3}$	$3\frac{1}{4}$	2	...	...	9-87-8	11+18; 10+19	$1\frac{1}{5}$
110	.....do......	Nov. 18	♀	$13\frac{1}{4}$	13—	$4\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{2}{3}$	$4\frac{1}{2}$	3	2+	10	11	9-77-8	12+21; 11+21	$1\frac{1}{5}$
111	.....do......	Nov. 18	♀ spent.	13	11+	$4\frac{1}{3}$	$4\frac{1}{3}$	5	$4\frac{1}{2}$	3	2+	10	11	9-86-8	10+20; 10+20	$1\frac{1}{5}$
112	.....do......	Nov. 18	♂ spent.	$12\frac{1}{4}$	9+	$4\frac{2}{5}$	$4\frac{2}{5}$	$4\frac{2}{5}$	$4\frac{1}{2}$	$3\frac{1}{4}$	$2\frac{1}{5}$	9	12	8-85-7	10+19; 10+19	$1\frac{1}{5}$
282	Superior....	July 28	....	$10\frac{1}{2}$	....	$4\frac{1}{3}$	4	$4\frac{1}{4}$	$4\frac{1}{3}$	3	$2\frac{1}{4}$	10	11	8-74-7	13+21; 12+21	$1\frac{1}{4}$
283	.....do......	July 28	....	11	....	$4\frac{1}{3}$	$4\frac{1}{5}$	$4\frac{3}{4}$	$4\frac{1}{4}$	3	$2\frac{1}{4}$	11	10	8-75-7	11+22; 12+21	$1\frac{2}{5}$
284	.....do......	July 29	....	11	....	$4\frac{1}{5}$	$4\frac{1}{5}$	$4\frac{1}{3}$	$4\frac{1}{3}$	3	$2\frac{1}{5}$	10	11	8-74-7	11+22; 13+21	$1\frac{1}{2}$

Spawning habits and food value.—Very little is known about the spawning habits of Hoy's whitefish. All the Lake Michigan specimens examined by us were taken between the 5th and 20th of November, and they were all ripe or nearly so, or partially spent. The spawning time is therefore evidently late in the fall, and probably in deeper water than is resorted to by the herring and other species. The probability that the long-jaw spawns much earlier is an interesting and important fact, and is additional evidence of the distinctness of these species.

In the original references to this fish in the writings of Milner and Hoy, it is stated that it has no food value, on account of its small size, but that it constitutes a prominent part of the food of the salmon trout. From the time of its discovery, in 1871, to a comparatively recent date, this fish attracted no attention and was not known to possess economic value. The extension of the operations of the gill-net fishermen of Lake Michigan into the deepest parts of the lake brought the fish into notice, and for fully six years or longer it has had a gradually increasing importance. The relative scarcity of the common whitefish in the fisheries of the western side of the lake has resulted in the utilization of Hoy's whitefish, notwithstanding its small size.

12. **Argyrosomus pusillus** (Bean).

SMALL WHITEFISH; LEAST WHITEFISH.

Coregonus pusillus Bean, Proc. U. S. Nat. Mus. 1888, 526, Kuwuk River, Alaska. (Type, No. 38366.)

Head, 5; depth, 5; eye, $4\frac{3}{4}$; D. 10; A. 12; V. 11; scales, 10–91–9; mandible, $2\frac{1}{3}$; maxillary, $3\frac{1}{3}$; gillrakers very long and slender, numerous, 49 in all. Body rather elongate, compressed. Mouth as in *A. artedi*, the lower jaw projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, not quite reaching middle of the very large eye; preorbital extremely narrow. Teeth none, or reduced to slight asperities on the tongue. Dorsal much higher than long, its last rays rapidly shortened, the first ray twice length of base of fin; insertion of dorsal midway between snout and middle of adipose fin. Caudal large, well forked; anal small; ventrals inserted under middle of dorsal, very long, five-sixths length of head and equal to pectorals. Steel blue above, with many dark points; belly white; dorsal and caudal blackish; pectorals and ventrals tipped with black.

This is one of the smallest of the American whitefishes, rarely reaching a foot in length or a half pound in weight. It has the reputation of being more bony than any other whitefish. It is little utilized for food in Alaska, but is used chiefly by native traveling parties and as food for dogs. It extends over a very large portion of Alaska and is very abundant. So far as our information goes, it is found in all parts of Alaska except the southeastern portion. The types were obtained in the Kuwuk River by the well-known collector, Charles H. Townsend.

13. **Argyrosomus lucidus** (Richardson).

GREAT BEAR LAKE HERRING.

Salmo (Coregonus) lucidus Richardson, Fauna Boreali-Americana, III, 207, 1836, Great Bear Lake.

Head small, 5 to $5\frac{1}{3}$; depth, $4\frac{1}{3}$ to $4\frac{3}{5}$; eye, 5. D. 11 or 12 developed rays; A. 11 or 12. Scales, 85 to 87, 11 or 12 in an oblique series downward and forward from front of dorsal to lateral line. Eye slightly less than length of snout, $1\frac{1}{2}$ times in interorbital width. Body slender, elongate, the curve of back and belly about equal, the greatest depth exceeding length of head. The snout narrow, almost vertically truncate when mouth is closed, the lower jaw fitting within the upper, but the mouth not inferior. Distance from snout to nape $2\frac{3}{5}$ to 3 in distance between nape and front of dorsal. The head is much smaller in one of our specimens than in the other. Mouth oblique, with rather slender maxillary, which extends to vertical midway between front and middle of pupil, its length from tip to articulation equaling distance from end of snout to front of pupil, and contained $3\frac{2}{3}$ to $3\frac{4}{5}$ in length of head. Supplemental maxillary bone probably broader than in *artedi*, from three-fifths to two-thirds greatest width of maxillary. Suborbital bone large, its width $2\frac{1}{2}$ to $2\frac{2}{3}$ in its length. Gillrakers very long and slender, the longest slightly more than two-thirds length of eye, 16 + 28 in number in each specimen. Front of dorsal slightly nearer tip of snout than base of upper rudimentary dorsal rays. The fins are mutilated, so that their length can not be given. Adipose fin large, inserted vertically above last anal rays, its height from tip to posterior end of base equaling vertical diameter of eye. Color, silvery.

This description is based on 2 specimens recently obtained in Great Bear Lake by Miss Elizabeth Taylor and donated by her to the museum of Leland Stanford Junior University. These specimens are each 16 inches long and are the only ones received by any museum since Richardson's time. These are described in detail by Dr. Gilbert in the Bulletin of the U. S. Fish Commission for 1894.

14. Argyrosomus laurettæ (Bean).

LAURETTA WHITEFISH.

Coregonus laurettæ Bean, Proc. U. S. Nat. Mus. 1881, 156, Point Barrow. (Types Nos. 27695 and 27915.)

Head, 5; depth, 4; eye, $4\frac{1}{2}$ to 5. D. 12; A. 11; V. 12; scales, 10–84 to 95–10, 84 to 87 in specimens examined by us. Body robust, the back elevated; head small and slender, the small eye not longer than snout. Distance from nape to front of snout $2\frac{1}{2}$ times distance of nape from dorsal. Maxillary about reaching middle of eye, $3\frac{1}{2}$ in head, its supplemental bone half its length. Lower jaw very slightly longer than upper; mandible, $2\frac{1}{3}$ in head; lingual teeth present. Gillrakers long and numerous, 10+25; ventral scale not half length of fin; pectorals short, not reaching half way to ventrals. Scales smaller than in *A. artedi*, 16 cross series under base of dorsal. Alaska, from Yukon River northward to Point Barrow; generally common. Apparently very close to *A. lucidus*, but differing in longer base of dorsal.

15. Argyrosomus prognathus (H. M. Smith).

BLOAT; BLOATER; BLOATER WHITEFISH; LONGJAW; SILVER WHITEFISH.

Coregonus prognathus Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, 4, pl. 1, fig. 3, Lake Ontario, at Wilson, New York. (Type, No. 45568.)

Description: Head, $4\frac{1}{3}$; depth, $3\frac{1}{2}$ to 4; eye, 5. D. 9 or 10; A. 10 to 12. Eye rather small; $1\frac{1}{3}$ in snout, $1\frac{1}{2}$ in interorbital space. Scales, 9–75–8. Body oblong, much compressed; back elevated, tapering rather sharply toward the narrow caudal peduncle, the adult fish having a slight nuchal hump, as in *C. clupeiformis*. Mouth large and strong; snout straight, its tip on level with lower edge of pupil. Top of head $2\frac{1}{5}$ in distance from occiput to front of dorsal. Maxillary reaching to opposite pupil, $2\frac{1}{2}$ in head; length, $3\frac{1}{2}$ times its greatest width; mandible projecting beyond upper jaw when mouth is closed, very long, reaching to or beyond posterior edge of eye, $1\frac{3}{4}$ to $1\frac{7}{8}$ in head. Head of medium size, rather short and deep, pointed; cranial ridges prominent.

Dorsal rather high, the longest ray one-third longer than base of fin and contained $1\frac{2}{3}$ times in greatest body depth and $1\frac{1}{3}$ times in head; free margin slightly concave; origin nearer end of snout than base of caudal. Longest anal ray equal to base of fin or two-thirds height of dorsal. Vertebræ, 55. Gillrakers slender, about 15 + 28, about length of eye. Adipose fin the length of eye, its width half its length. Narrowest part of caudal peduncle contained nearly 4 times in greatest body depth. Ventral as long as dorsal is high, its origin midway between end of snout and fork of tail. Pectoral as long as ventral. Lateral line straight except at origin, where it presents a rather marked curve. Sides of body uniformly bright silvery, with pronounced bluish reflection in life; the back dusky, the under parts pure white without silvery color; above lateral line, the upper and lower edges of scales finely punctulated, central part unmarked, producing light longitudinal stripes extending whole length of body; fins flesh color or pinkish in life, the dorsal and caudal usually showing dusky edges; postorbital area with a bright golden reflection. Iris golden, pupil black.

The extreme variations in some of the characters of this species are remarkable, their nature and importance being apparent only upon examination of a large series of specimens. We have counted the scales and gillrakers and made comparative measurements of a great many examples, and present in the appended table the figures obtained from such a study of nearly one hundred specimens. Figures obtained from specimens examined in the field and not preserved are not included in this table. A study of the table will show that the relative length of head and depth of body are fairly constant; the same is true of the eye and snout, and the number of fin rays; the maxillary and mandible are a little more variable, while the variations in the scales and the gillrakers are unexpectedly great. Using the averages obtained from the table and putting in parentheses the extremes of variation, this species would be described as follows:

Head, $4\frac{1}{6}$ ($3\frac{1}{2}$ to $4\frac{3}{4}$); depth, $4\frac{1}{3}$ ($3\frac{1}{2}$ to $5\frac{1}{4}$); eye, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 6); snout, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 5); maxillary, 3 ($2\frac{2}{5}$ to $3\frac{1}{3}$); mandible, 2 ($1\frac{4}{5}$ to $2\frac{1}{4}$); dorsal, 10 (9 to 12); anal, 11 (10 to 15); scales, 8 (7 to 9)–75 (65 to 86)–7 (6 to 9); gillrakers, 14 (10 to 17) + 25 (21 to 32).

Table of comparative measurements of specimens of longjaw whitefish (Argyrosomus prognathus).

No.	Lake where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			Ins.	*Oz.*											
1	Ontario	....	$8\frac{1}{2}$	4	$4\frac{1}{5}$	$3\frac{2}{3}$	4	4	$2\frac{3}{4}$	$1\frac{4}{5}$	10	10	9-83-9	*14+28; 15+29	......
2	.....do......	....	8	3	4—	$3\frac{4}{5}$	$3\frac{3}{4}$	$3\frac{3}{4}$	$2\frac{3}{4}$	$1\frac{4}{5}$	11	12	9-71-8	*14+24; 15+29	......
3	.....do......	....	7	2	$3\frac{3}{4}$	4	$3\frac{3}{4}$	4	$2\frac{3}{5}$	2	10	12	9-79-8	*12+31; 15+31	......
4	.....do......	♀	11	8	$4\frac{1}{5}$	$3\frac{2}{3}$	$4\frac{1}{2}$	4	3	2	10	11	9-75-8	*13+30; 16+31	$1\frac{1}{3}$
5	.....do......	....	12	8	4	$3\frac{2}{3}$	5	4	3	2	9	12	9-74-8	*11+24; 14+25	$1\frac{2}{3}$
6	.....do......	....	13	9	4	4	$5\frac{1}{5}$	$3\frac{2}{3}$	3	$1\frac{7}{8}$	10	12	8-74-8	*12+26; 12+27*	1
7	.....do......	....	$11\frac{1}{2}$	8	4	$3\frac{1}{2}$	5	$4\frac{1}{4}$	3	$2\frac{1}{5}$	10	10	8-66-7	*13+22; 10+21*	$1\frac{1}{4}$
8	.....do......	....	14	16	$4\frac{1}{4}$	4	$5\frac{1}{4}$	4	3	2	10	11	8-65-8	*14+26; 14+27	1
9	.....do......	....	$8\frac{1}{4}$	2	$3\frac{3}{4}$	$4\frac{1}{3}$	4	$4\frac{1}{2}$	3+	2	9	11	9-70-7	*15+26; 16+30	1
10	.....do......	....	$14\frac{1}{2}$	12	$4\frac{3}{4}$	$3\frac{3}{4}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{1}{3}$	$2\frac{1}{5}$	10	12	9-75-7	*14+29; 17+30	$1\frac{1}{2}$
11	Huron	....	$9\frac{1}{4}$	3	4+	$4\frac{1}{3}$	4	4	3+	2	11	11	9-74-7	*10+18; 12+22	2
12	.....do......	....	11	5	$4\frac{1}{2}$	4+	$4\frac{1}{3}$	$4\frac{1}{3}$	$3\frac{1}{5}$	$2\frac{1}{5}$	10	12	8-79-7	*14+23; 13+26	......
13	.....do......	....	$9\frac{1}{2}$	4	4	4	$4\frac{1}{2}$	$4\frac{1}{3}$	$3\frac{1}{5}$	2	9	12	8-75-8	*10+17; 10+17*	$1\frac{1}{5}$
14	.....do......	....	7	2—	$4\frac{1}{4}$	4	$3\frac{1}{2}$	$4\frac{3}{5}$	3+	2+	10	11	8-66-8	14+26; 14+27	......
15	.....do......	....	7	2—	4	4	$3\frac{3}{5}$	4	3	2	9	12	8-70-7	15+27;	......
16	.....do......	....	$8\frac{1}{2}$	2	$4\frac{1}{6}$	$4\frac{1}{6}$	$4\frac{1}{5}$	$4\frac{1}{5}$	3	2	10	12	9-70-7	14+27; 14+27	......
17	.....do......	....	$8\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	4	$4\frac{1}{3}$	3	2+	11	11	9-75-7	14+23; 13+23	......
18	.....do......	....	$8\frac{1}{2}$	2	$4\frac{1}{5}$	$4\frac{1}{5}$	4	$4\frac{1}{3}$	$3\frac{1}{5}$	2	10	11	8-75-7	*12+23; 13+21	$1\frac{3}{5}$
19	.....do......	....	$8\frac{1}{2}$	....	$4\frac{1}{2}$	$4\frac{1}{4}$	$3\frac{3}{4}$	$4\frac{3}{4}$	$2\frac{1}{5}$	2	9	12	8-77-8	*13+23; 11+23	$1\frac{3}{5}$
20	.....do......	....	$8\frac{3}{4}$	....	$4\frac{1}{4}$	$4\frac{1}{2}$	4	$4\frac{1}{2}$	$2\frac{1}{5}$	2	10	12	8-73-8	12+23; 13+23	$1\frac{3}{5}$
21	.....do......	....	$7\frac{3}{4}$	....	$4\frac{1}{5}$	$4\frac{1}{2}$	$3\frac{5}{6}$	4	3	2	9	11	7-73-8	14+27; 14+27	$1\frac{3}{5}$
22	.....do......	....	7	....	$4\frac{1}{2}$	$4\frac{1}{2}$	4	$4\frac{1}{2}$	3	2	9	12	9-78-8	12+22; 12+23	$1\frac{3}{5}$
23	.....do......	....	$7\frac{1}{2}$	....	$4\frac{1}{4}$	$4\frac{1}{4}$	4	4	3	2—	10	12	8-79-7	11+21; 11+21	$1\frac{1}{2}$
24	.....do......	....	8	....	$4\frac{1}{6}$	$4\frac{1}{2}$	$3\frac{3}{4}$	4+	3	2	9	11	9-73-8	11+22; 11+22	2
25	.....do......	....	$8\frac{1}{4}$	....	$4\frac{1}{5}$	$4\frac{1}{2}$	$3\frac{1}{5}$	$4\frac{1}{2}$	3	2	9	11	8-73-8	12+22; 12+21	$1\frac{1}{3}$
26	.....do......	....	$6\frac{1}{4}$	....	$4\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{3}{5}$	4	$2\frac{1}{5}$	2	10	11	7-70-6	13+26; 13+19*	$1\frac{1}{2}$
27	.....do......	....	$5\frac{1}{2}$	....	$4\frac{2}{5}$	$4\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{3}$	3	$1\frac{5}{6}$	10	11	8-71-7	14+26; 15+26	$1\frac{3}{5}$
28	.....do......	....	$5\frac{1}{2}$	....	$4\frac{1}{4}$	$4\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{1}{5}$	$1\frac{5}{6}$	10	11	8-70-7	13+25; 12+27	$1\frac{4}{5}$
29	.....do......	....	$7\frac{1}{2}$	....	$4\frac{1}{4}$	$4\frac{1}{5}$	4	$4\frac{1}{4}$	$2\frac{5}{6}$	2—	10	12	8-70-7	13+27; 14+27	$1\frac{1}{3}$
30	.....do......	....	$7\frac{1}{2}$	....	$4\frac{1}{2}$	$4\frac{3}{4}$	4—	$4\frac{1}{2}$	3	2	9	12	7-78-8	13+24; 13+24	$1\frac{1}{2}$
31	.....do......	....	$9\frac{1}{4}$	....	$4\frac{3}{4}$	$4\frac{3}{4}$	4	$4\frac{1}{2}$	$3\frac{1}{3}$	$2\frac{1}{5}$	12	12	7-74-7	*9+30; 6+33*	$1\frac{3}{5}$
32	Michigan ...	....	8	....	$4\frac{1}{4}$	$4\frac{3}{4}$	4	$4\frac{1}{4}$	3	2	10	12	7-70-7	12+22; 13+23	2—

* Gill mutilated; number uncertain.

Table of comparative measurements of specimens of longjaw whitefish (*Arggrosomus prognathus*)—Continued.

No.	Lake where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			Ins.	Oz.											
33	Michigan....	....	$7\frac{1}{4}$	....	4	$4\frac{1}{5}$	4	$4\frac{1}{3}$	3	2	10	12	7-72-7	15+29; 16+28	$1\frac{3}{5}$
34	.....do......	....	$8\frac{1}{2}$	....	4	4	$3\frac{5}{6}$	$4\frac{1}{5}$	3	$2\frac{1}{6}$	10	11	7-78-7	12+24; 12+24	$1\frac{1}{2}$
35	.....do......	....	$8\frac{1}{2}$	....	$4\frac{3}{4}$	$4\frac{2}{5}$	4	$4\frac{1}{4}$	$2\frac{1}{5}$	2—	10	12	7-73-7	*14+26; 14+27*	$1\frac{1}{2}$
36	.....do......	....	$8\frac{1}{2}$	....	$4\frac{1}{2}$	$4\frac{3}{5}$	4	$4\frac{1}{4}$	3	$2\frac{1}{5}$	10	12	8-70-7	13+22; 13+22	$1\frac{1}{5}$
37	.....do......	....	$8\frac{1}{2}$	....	$4\frac{1}{2}$	$4\frac{1}{2}$	4—	$4\frac{1}{4}$	$3\frac{1}{3}$	$2\frac{1}{5}$	9	12	8-72-7	12+23; 12+24	$1\frac{2}{5}$
38	.....do......	....	8	....	$4\frac{1}{2}$	$4\frac{3}{4}$	4—	$4\frac{3}{5}$	3	2	10	11	7-70-7	12+22; 12+22	$1\frac{1}{2}$
39	.....do......	....	7	....	$4\frac{1}{4}$	$4\frac{1}{3}$	$3\frac{3}{4}$	4	3	$2\frac{1}{5}$	9	12	8-70-7	13+24; 13+24	$1\frac{3}{5}$
40	.....do......	....	8	....	$4\frac{1}{6}$	$4\frac{1}{2}$	4	4	3	2+	9	12	7-73-7	12+24; 12+24	$1\frac{3}{5}$
41	.....do......	....	$7\frac{3}{4}$	....	$4\frac{1}{5}$	$4\frac{1}{5}$	4	$4\frac{1}{5}$	$2\frac{4}{5}$	2	10	11	7-74-7	14+27; 14+26	$1\frac{2}{5}$
42	.....do......	....	8	....	$4\frac{1}{5}$	$4\frac{1}{2}$	$3\frac{4}{5}$	4	3	$2\frac{1}{5}$	10	12	8-74-7	13+23; 12+23	$1\frac{2}{5}$
43	.....do......	....	$8\frac{1}{4}$	....	$4\frac{1}{4}$	$4\frac{1}{2}$	4	4	3	2	10	12	7-70-7	10+23; 11+23	$1\frac{1}{2}$
44	.....do......	....	8	....	$4\frac{1}{4}$	$4\frac{1}{4}$	4	$4\frac{1}{6}$	$2\frac{5}{8}$	2	9	11	7-71-7	15+29; 15+29	$1\frac{1}{3}$
45	.....do......	....	10	....	$4\frac{1}{5}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	3—	$1\frac{5}{6}$	11	11	8-76-7	11+23; 11+23	$1\frac{1}{2}$
46	.....do......	....	9	....	4	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{5}$	3	2—	10	12	8-76-7	12+24; 13+24	2
47	.....do......	....	$7\frac{1}{2}$	....	4	$4\frac{1}{2}$	4	$4\frac{1}{2}$	3	2	11	12	8-70-7	13+28; 14+28	$1\frac{2}{5}$
48	.....do......	....	$7\frac{3}{4}$	....	$4\frac{1}{5}$	5	4—	4+	3	$2\frac{1}{6}$	10	11	8-77-7	12+22; 11+23	$1\frac{4}{5}$
49	Huron	....	....	....	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{4}{5}$	$4\frac{1}{5}$	$3\frac{1}{4}$	$2\frac{1}{4}$	10	11	9-80-8	13+26; 13+24	1+
50	.....do......	....	....	....	4	....	5	4	$2\frac{1}{5}$	$2\frac{1}{4}$	10	11	8-72-8	13+25; 12+24	1
51	Ontario	....	....	....	$4\frac{1}{4}$	4+	$5\frac{1}{4}$	$4\frac{1}{2}$	3	2	11	12	9-76-7	14+32; 14+29*	1
52	.....do......	....	....	....	$4\frac{1}{5}$	....	5	4	$2\frac{3}{5}$	$1\frac{7}{8}$	11	12	8-75-7	15+25; 14+27	1
53	.....do......	....	....	....	$4\frac{1}{4}$	....	$5\frac{1}{2}$	$4\frac{1}{5}$	3	2	10	12	8-71-7	13+25; 13+24	1
79	Michigan ...	♀ ripe	$12\frac{3}{8}$	10—	$4\frac{1}{6}$	4+	5	$4\frac{1}{5}$	3	2	10	11	9-80-8	13+24; 12+22	$1\frac{2}{5}$
82	.....do......	♀	$15\frac{3}{8}$	16+	$4\frac{1}{2}$	$4\frac{1}{6}$	....	4	3+	2	10	12	8-77-8	13+23; 13+25	$1\frac{1}{8}$
88	.....do......	♂	$12\frac{3}{4}$	11+	$4\frac{1}{2}$	4	$4\frac{1}{2}$	4	3	2	10	11	8-72-7	13+27; 13+27	$1\frac{1}{5}$
113	Superior	....	16	....	$4\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{2}{3}$	$4\frac{2}{3}$	3+	2—	11	12	9-88-7	Eviscerated	......
114	...do......	....	16	....	4	$4\frac{3}{5}$	$5\frac{1}{2}$	4	3+	2—	10	11	9-77-7	Eviscerated	......
135	Ontario	....	....	....	$3\frac{7}{8}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{5}$	$2\frac{4}{5}$	$1\frac{4}{5}$	10	11	8-67-8	17+28; 16+30	1
200	Superior	....	....	....	$4\frac{1}{5}$	$4\frac{3}{5}$	$5\frac{3}{4}$	$4\frac{1}{2}$	3+	2+	10	12	8-74-7	15+27; 15+27	$1\frac{1}{3}$
201	.....do......	....	....	....	4	$4\frac{1}{2}$	$5\frac{3}{5}$	$4\frac{3}{5}$	3	2	11	12	8-82-7	14+27; 14+27	......
202	.....do......	....	....	....	$4\frac{1}{5}$	$4\frac{1}{2}$	$5\frac{3}{5}$	$4\frac{1}{2}$	3	2	11	12	9-86-7	13+26; 14+25	......
203	.....do......	....	....	....	$4\frac{1}{5}$	$4\frac{1}{2}$	5	$4\frac{3}{8}$	3	2	11	11	8-86-7	15+24; 14+25	......
204	.....do......	....	....	....	4	$4\frac{1}{4}$	5	$4\frac{1}{2}$	$2\frac{3}{4}$	2—	11	11	8-76-7	15+25; 14+25	$1\frac{1}{5}$
205	.....do......	....	....	....	4+	$4\frac{2}{3}$	$4\frac{4}{5}$	4	$3\frac{1}{5}$	2+	11	11	8-76-7	15+28; 15+29	$1\frac{1}{4}$
206	.....do......	....	....	....	4	$4\frac{1}{3}$	$4\frac{3}{5}$	4—	$2\frac{4}{5}$	2+	11	11	9-73-7	16+27; 14+27	$1\frac{2}{5}$
207	.....do......	....	....	....	$4\frac{2}{5}$	$4\frac{1}{4}$	$5\frac{1}{4}$	$4\frac{1}{2}$	3	2+	11	13	8-80-7	15+26; 14+27	$1\frac{1}{4}$
208	.....do......	....	....	....	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{4}{5}$	2—	10	11	8-77-7	13+26; 13+26	$1\frac{1}{2}$
209	.....do......	....	....	....	4	$4\frac{1}{2}$	$4\frac{1}{4}$	$4\frac{1}{4}$	3	2	11	11	8-73-7	13+25; 10+23*	......
210	.....do......	....	....	....	$4\frac{2}{5}$	4	$3\frac{1}{2}$	$4\frac{3}{5}$	3	2—	10	11	8-74-7	15+28; 15+30	$1\frac{1}{2}$
211	.....do......	....	....	....	$4\frac{2}{5}$	$4\frac{3}{5}$	4+	$4\frac{4}{5}$	$2\frac{4}{5}$	2+	12	15	9-78-8	13+24; 13+24	$1\frac{1}{2}$
212	.....do......	....	....	....	4+	$4\frac{3}{5}$	5—	4+	$2\frac{1}{5}$	2	12	13	9-79-8	14+27; 14+26	$1\frac{1}{3}$
213	.....do......	....	....	....	$4\frac{1}{4}$	$4\frac{1}{2}$	4+	$4\frac{1}{3}$	3—	2+	10	11	8-70-7	15+30; 14+29	1+
214	.....do......	....	....	....	4+	$4\frac{1}{3}$	4	$4\frac{1}{2}$	$2\frac{4}{5}$	2	11	11	8-74-7	13+26; 14+26	$1\frac{1}{2}$
215	.....do......	....	....	....	4	$4\frac{1}{2}$	$3\frac{4}{5}$	$4\frac{4}{5}$	3	2	11	11	8-77-7	*13+27; 15+28	$1\frac{1}{4}$
216	.....do......	....	....	....	$4\frac{1}{4}$	$5\frac{1}{4}$	$3\frac{4}{5}$	5—	3+	$2\frac{1}{6}$	11	11	8-80-7	13+23; 14+23	$1\frac{3}{5}$
217	.....do......	....	....	....	$4\frac{1}{5}$	$4\frac{1}{5}$	4—	$4\frac{3}{5}$	3	2	11	10	8-76-7	15+28; 15+28	......
218	.....do......	....	....	....	4+	$4\frac{3}{5}$	4	5	3+	2	11	11	8-78-7	14+29; 14+29	$1\frac{1}{3}$
219	.....do......	....	....	....	$3\frac{1}{2}$	$3\frac{4}{5}$	$3\frac{4}{5}$	5—	3+	2	10	10	8-73...	14+26; 14+26	$1\frac{1}{2}$
220	.....do......	....	....	....	4	$4\frac{1}{4}$	4+	$4\frac{5}{6}$	3+	2—	10	10	9-67-7	15+29; 15+29	$1\frac{1}{5}$
221	.....do......	....	....	....	$3\frac{7}{8}$	$4\frac{3}{5}$	4	$4\frac{1}{2}$	3	2	11	13	8-78-7	15+25; 15+25	$1\frac{1}{2}$
222	.....do......	....	....	....	$3\frac{4}{5}$	$4\frac{1}{5}$	$3\frac{2}{5}$	5	3—	2	10	11	8-76-7	15+27; 15+26	$1\frac{2}{5}$
223	.....do......	....	....	....	$3\frac{5}{6}$	$4\frac{2}{3}$	4+	$4\frac{1}{2}$	3	2	9	12	9-67-8	15+26; 14+25	2
228	.....do......	....	....	....	$4\frac{1}{3}$	$5\frac{1}{5}$	5—	4+	3—	2+	11	13	8-79-7	12+26; 13+26	......
281	.....do......	....	16	....	4	$3\frac{5}{6}$	6	$4\frac{1}{5}$	3	$1\frac{5}{6}$	10	11	8-82-8	*14+21; 14+26	1
285	.....do......	....	11	....	$4\frac{1}{5}$	$4\frac{1}{5}$	$4\frac{1}{5}$	$4\frac{1}{2}$	3	2	10	11	8-82-7	13+21; 13+21	......
275	.....do......	....	14	....	4+	4+	$5\frac{2}{5}$	$3\frac{3}{4}$	$2\frac{5}{6}$	$1\frac{8}{9}$	11	11	8-79-8	15+28; 15+28	$\frac{4}{5}$
276	.....do......	....	15	....	$4\frac{1}{2}$	4	$5\frac{1}{8}$	4	$3\frac{1}{3}$	$2\frac{1}{4}$	11	12	8-75-7	16+27; ..+27	$\frac{4}{5}$
300	.....do......	....	$8\frac{1}{4}$	....	4	$4\frac{3}{5}$	4	$4\frac{1}{2}$	3	2	9	10	9-75-8	14+29; 15+29	$1\frac{2}{5}$
301	.....do......	....	$8\frac{5}{8}$	....	$4\frac{1}{4}$	5	$4\frac{1}{4}$	$4\frac{1}{2}$	3	2	10	10	8-79-7	12+24; 12+23	$1\frac{2}{5}$
302	.....do......	....	$8\frac{1}{8}$	....	4	$4\frac{1}{2}$	4	$4\frac{2}{5}$	$2\frac{2}{3}$	2	9	12	8-75-7	11+25; 14+26	$1\frac{1}{8}$
310	Ontario	♂	$12\frac{1}{2}$	....	4	4	5	4	3	2	10	10	8-72-7	14+25; 13+25	$1\frac{1}{6}$
311	.....do......	♂	14	....	4	4	$5\frac{1}{2}$	4	$2\frac{4}{5}$	2—	10	10	9-77-7	14+28; 14+28	$\frac{5}{6}$
312	.....do......	♀	13	....	4	$3\frac{4}{5}$	5	4	$2\frac{7}{8}$	2	10	11	8-71-7	13+23; 13+22	$1\frac{2}{5}$
313	.....do......	♀	$11\frac{1}{2}$	....	4	$3\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{1}{2}$	3	2	9	11	9-66-8	*11+20; 13+21	$1\frac{1}{3}$

* Gill mutilated; number uncertain.

Food value.—The longjaw is a fish of some commercial importance in lakes Superior, Michigan, Huron, and Ontario. It is most valuable in Lake Michigan, although a few years ago the largest catch was taken in Lake Ontario. Its edible qualities are relatively high. The flesh is firm and of very good flavor, and by many people the difference between the longjaw and the common whitefish in this respect is considered to be only slight. It is most highly esteemed on Lake Ontario, where it often brings the same price as the common species; elsewhere it yields the fisherman several cents a pound less than *C. clupeiformis*. Mr. Charles H. Strowger, an experienced fisherman and careful observer, residing on the shores of Lake Ontario, gives the following estimate of the food value of this fish:

When properly cared for on being caught, this is a delicious fish. When salted it keeps well, and does not lose its freshness when cooked. A great deal of prejudice against the longjaw is entertained because of the soft and damaged condition in which the fish is usually sold to the consumers. It is a fish that ought to be iced as soon as it is taken from the water and left cold until used, as it easily softens and on cooking becomes too greasy for ordinary human palates to enjoy. When fresh caught it is equal, in my judgment, to any fish for delicacy of flavor. It is a splendid fish for baking when of full size, but small-sized fish are always of less value and should not be caught.

Spawning.—Very little is certainly known regarding the spawning habits of the longjaw. Examples taken by Mr. Charles H. Strowger in Lake Ontario, May 17, 1892, had immature spawn except in one fish, in which the eggs were fully ripe. Specimens sent us from the same lake in April, by Mr. John S. Wilson, contained very immature spawn; while other specimens forwarded by Mr. George M. Schwartz of Rochester, on June 13, 1892, had fully matured spawn. Mr. Strowger's observations lead him to believe that this species has a prolonged spawning period, extending perhaps over the entire year. Specimens examined by us on Grenadier Island June 28, 1894, were ripe, and others examined at various times in June and July were nearly or wholly ripe. From these facts it is certain that many of this species spawn in Lake Ontario in the summer. Some of the specimens obtained by Dr. Scovell in Lake Huron in July were also ripe, while others were not. The probabilities are that Mr. Strowger's view is right, and that while the summer is the principal spawning time, the season is prolonged until late in the fall. Little is known of the location of the spawning-beds, but all the evidence indicates that they are in relatively deep water.

16. **Argyrosomus nigripinnis** Gill.

BLACKFIN; BLACKFIN WHITEFISH; BLUEFIN; BLUEFIN WHITEFISH.

Argyrosomus nigripinnis (Gill MS.) Milner, Rept. U. S. Fish Comm. 1872–73 (1874), 87, Lake Michigan, off Racine, Wis.

Description.—Head, $4\frac{1}{3}$ to $4\frac{3}{5}$; depth, 4 to $4\frac{1}{2}$; eye, $4\frac{1}{3}$ to $4\frac{5}{6}$; snout, 4 to 5; mandible, 2 to $2\frac{1}{8}$; maxillary, 3 to $3\frac{2}{5}$. D. 10 or 11 (rarely 9); A. 11 or 12. Scales, 8 or 9–75 to 81–7 or 8. Vertebræ, 58; gillrakers usually $17+33=50$, long and slender, about $1\frac{1}{5}$ in eye.

Body moderately stout, ventral outline more curved than the dorsal. Head large, pointed; mouth large; maxillary long and narrow, reaching middle of pupil, the supplemental maxillary long, narrowed above; mandible very long, usually reaching vertical of posterior rim of orbit; lower jaw usually projecting. Distance from snout to occiput about

2 in distance from occiput to origin of dorsal fin. Caudal peduncle rather slender, its least depth $2\frac{3}{5}$ in head. Fins all long; in No. 100, a female, they measure as follows: Pectoral $1\frac{1}{3}$ in head, reaching just half way to base of ventrals; ventrals a little shorter, $1\frac{1}{2}$ in head; dorsal high, its longest ray equal to length of pectoral; base of dorsal fin short, $1\frac{1}{5}$ in height of fin; base of anal fin about equal to that of dorsal, longest ray 2 in head; caudal fin widely forked, the lobes $2\frac{3}{5}$ times length of middle rays.

The fins of No. 96, a male, measure as follows: Pectoral, $1\frac{1}{3}$ in head, reaching slightly more than half way to base of ventral; ventrals scarcely shorter than the pectorals and just equaling length of longest dorsal ray; length of dorsal base, $1\frac{2}{5}$ in height of fin; anal base shorter than that of dorsal, about $1\frac{1}{5}$ in longest anal ray.

Color in life: Dull bluish-green above; sides silvery, with minute black specks; white below; tip of nose and mandible black; fins all rich blue-black; pale at base. In some specimens, usually females, the fins are less black, the ventrals and anal sometimes showing scarcely any black. The dorsal, caudal, and usually the pectorals, however, are always more or less black.

The specimens of this species which we have examined are from 13 to 16 inches in length and weighed, when fresh, from two-thirds of a pound to $1\frac{1}{2}$ pounds.

Table of comparative measurements of specimens of blackfin whitefish (Argyrosomus nigripinnis).

No.	Lake where taken.	Date when taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
				In.	Oz.											
81	Michigan	Nov. 12	♂ ripe ..	$13\frac{1}{8}$	10—	$4\frac{1}{2}$	$4\frac{1}{3}$	$4\frac{1}{3}$	4	$3\frac{1}{8}$	2	10	11	9-81-8	18+33; 18+33	1
84	..... do	Nov. 12	♂	$12\frac{3}{4}$	10—	$4\frac{3}{5}$	$4\frac{1}{2}$	$4\frac{1}{2}$	5	$3\frac{1}{4}$	2+	10	12	9-76-7	17+32; 16+30	$1\frac{1}{5}$
86	..... do	Nov. 12	♂	$13\frac{1}{4}$	11—	$4\frac{1}{2}$	$4\frac{1}{3}$	$4\frac{2}{3}$	$4\frac{1}{2}$	$3\frac{1}{5}$	2+	11	12	8-76-7	17+33; 17+32	$1\frac{1}{5}$
87	..... do	Nov. 12	♂ ripe ..	13	11+	$4\frac{1}{2}$	4+	$4\frac{1}{3}$	$4\frac{3}{5}$	3+	2+	10	12	8-77-7	17+33; 18+35	$1\frac{1}{3}$
89	..... do	Nov. 12	....	$15\frac{1}{2}$	19—	$4\frac{1}{2}$	4	$4\frac{3}{4}$	$4\frac{1}{4}$	3	2	10	11	8-77-7	.... ? +31	$1\frac{1}{5}$
95	..... do	Nov. 18	♂ ripe ..	$15\frac{3}{8}$	20—	$4\frac{2}{3}$	$4\frac{1}{5}$	$4\frac{4}{5}$	$4\frac{4}{5}$	$3\frac{1}{5}$	$2\frac{1}{8}$	10	11	9-78-7	16+31; 17+31	$1\frac{1}{8}$
96	..... do	Nov. 18	♂ spent	$16\frac{1}{8}$	21—	$4\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{5}{6}$	$4\frac{5}{6}$	$3\frac{1}{4}$	$2\frac{1}{8}$	10	11	9-75-8	18+32; 19+34	$1\frac{1}{4}$
97	..... do	Nov. 18	♂ nearly ripe.	$16\frac{1}{8}$	23—	$4\frac{2}{3}$	$4\frac{1}{3}$	$4\frac{2}{3}$	$4\frac{2}{3}$	$3\frac{1}{8}$	2+	10	11	8-77-8	16+32; 17+32	$1\frac{1}{3}$
98	..... do	Nov. 18	♀ nearly ripe.	$14\frac{1}{2}$	18—	$4\frac{2}{5}$	4	$4\frac{3}{4}$	5	3+	2+	11	12	9-75-8	17+34; 18+31	1
99	..... do	Nov. 18	♂ ripe.	$15\frac{1}{8}$	22	$4\frac{1}{3}$	4	$4\frac{1}{4}$	$4\frac{1}{3}$	3	2	10	12	9-80-8	17+31; 17+31	$1\frac{1}{5}$
100	..... do	Nov. 18	♀ spent.	$14\frac{7}{8}$	21—	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{1}{6}$	2	10	11	9-76-7	17+32; 17+33	1
101	..... do	Nov. 18	♀ spent.	$14\frac{1}{4}$	15	$4\frac{1}{2}$	$4\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{1}{2}$	$3\frac{1}{8}$	2	10	11	9-75-7	19+34; 19+34	$1\frac{1}{5}$
102	..... do	Nov. 18	♀ spent.	$14\frac{7}{8}$	14—	$4\frac{2}{5}$	$4\frac{2}{5}$	$4\frac{1}{2}$	$4\frac{1}{2}$	3	2	9	11	8-78-7	18+32; 17+32	$1\frac{1}{5}$
103	..... do	Nov. 18	♀ spent.	$14\frac{7}{8}$	17+	$4\frac{2}{3}$	$4\frac{1}{5}$	$4\frac{2}{3}$	$4\frac{2}{3}$	3	2+	10	12	8-76-7	17+33; 17+33	$1\frac{1}{8}$
104	..... do	Nov. 18	♂ spent.	$14\frac{1}{4}$	15+	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{4}$	5	$3\frac{1}{5}$	2+	11	11	8-76-7	17+32; 17+32	$1\frac{1}{5}$
105	..... do	Nov. 18	♂ spent.	$14\frac{1}{4}$	13+	$4\frac{2}{3}$	$4\frac{2}{3}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{1}{8}$	2+	10	11	8-75-7	18+33; 18+35	$1\frac{1}{3}$
106	..... do	Nov. 18	♀ spent.	$14\frac{1}{4}$	15—	$4\frac{3}{5}$	...	$4\frac{3}{5}$	$4\frac{1}{2}$	$3\frac{2}{5}$	$2\frac{1}{8}$	10	12	......	....	...
43099	Miltona	....	....	$15\frac{1}{2}$	....	4	4	$4\frac{1}{6}$	...	$3\frac{5}{6}$	...	10	...	9-73-7	—— 18+30	$1\frac{2}{5}$
43100	..... do	....	....	16	....	4	4	$4\frac{1}{5}$	...	$3\frac{1}{2}$	...	10	12	9-77-8	—— 17+31	$1\frac{1}{2}$

Range, habits, etc.—The blackfin or bluefin whitefish was first brought to public notice at the same time that *Argyrosomus hoyi* was discovered. It was first collected in Lake Michigan, in deep water off Racine, Wis., and first described by Mr. J. W. Milner in the Report of the Commissioner of Fish and Fisheries for 1872–73. It is not known from any of the Great Lakes except Michigan. All of the specimens of the so-called bluefin or blackfin of Lake Superior which we have seen are the longjaw (*A. prognathus*).

The only specimens of the blackfin not from Lake Michigan which we have seen, and, indeed, the only ones existing in collections, are two fine examples (Nos. 43099 and 43100, U. S. Nat. Museum) obtained by James R. B. Van Cleave in Miltona Lake, Minnesota, where the fish is reported to be abundant, and two others (Nos. 22117, U. S. Nat. Museum), secured in one of the lakes at Madison, Wis. The Miltona Lake specimens have been described by Dr. Bean (Forest and Stream, June 2, 1894), and we agree with him in regarding them as not different from the Lake Michigan blackfin. The Madison specimens also agree very well with those from Lake Michigan.

The blackfin is probably the most abundant fish of commercial importance in the deeper waters of Lake Michigan. It is found in schools, like other members of the group, and is, at times, at least, associated with lake trout (*Cristivomer namaycush*), longjaws (*A. prognathus*), chubs (*A. hoyi*), and common whitefish (*C. clupeiformis*).

Up to a comparatively recent date very little was recorded about this fish. Specimens were scarce in collections, and in the National Museum at Washington there were only the four specimens mentioned. The absence of recorded data regarding the fish and its scarcity in collections have certainly been due to no lack of abundance of the fish, but rather to the neglect of collectors. As late as 1886, Dr. Goode, in his standard work on American Game and Food Fishes, stated that "at times it comes in considerable numbers to the Chicago market, but it is in general a rare species."

The first detailed reference to the commercial value of this fish and the most complete account of its habits and distribution in Lake Michigan were contained in a report on the Great Lakes for 1885, issued by the United States Fish Commission, based on inquiries made under the direction of Mr. R. Edward Earll.

Spawning habits.—The spawning season of the blackfin is the same as that of the common whitefish and the lake herring. The somewhat limited observations thus far made, and the specimens available for examination, indicate a spawning period in November and December. At that time the fish are reported to gather on stony bottom for the purpose of depositing their eggs, while at other seasons they are said to prefer clay bottom. The specimens from Lake Michigan examined by us were received fresh November 15 and 21. They were taken in gill nets off Sheboygan on or about November 12 and 18, and examination showed them to be ripe or nearly ripe with spawn; indeed, some were partially spent.

The blackfin is found in the deep water at all seasons, although during part of the year it frequents relatively shallow water. About the first part of November the fish begins to withdraw from the deepest water of the lake and may be taken at depths of 60 to 80 fathoms. The number of fish in water of that depth increases with the advance of winter, and when fishing is brought to a close by the formation of ice the fish are at the height of their abundance. When the ice breaks up between February and April the fish begin to move into deeper water, and by May fishing is done in water 100 or 110 fathoms deep. During the warmer months this is about the minimum depth at which the blackfins are regularly found.

A favorite resort for the blackfin is Mud Hole, a large depression in the bottom of the lake, located about 20 miles east of Sheboygan; it is 7 or 8 miles square and about 90 fathoms deep. Another ground that is frequented by large bodies of blackfins is Grand Traverse Bay, on the east side of Lake Michigan.

17. Argyrosomus tullibee (Richardson).

TULLIBEE; MONGREL WHITEFISH.

Salmo (Coregonus) tullibee Richardson, Fauna Bor.-Amer., III, 201, 1836, Cumberland House, Pine Island Lake.

Description.—Head, 4 to $4\frac{1}{2}$; depth, 3 to $3\frac{3}{5}$; eye, 4 to 5; snout, about 5. Dorsal fin with about 11 developed rays, the number varying from 10 to 12; anal, 11 or 12. Maxillary, $3\frac{1}{2}$ in head; mandible, 2 to $2\frac{1}{4}$; scales, 9–68 to 71–8; gillrakers, 16 to 18+30 to 34; 1–$1\frac{1}{2}$ in eye.

Body short and deep, compressed, the dorsal and ventral outlines similarly curved. Head small, conic and compressed; mouth large, lower jaw projecting; middle of upper lip on a level with middle of pupil, maxillary long, moderately broad, reaching anterior edge of pupil, the width about one-third its length; supplemental maxillary bone well developed, nearly half length of maxillary, its width $2\frac{3}{4}$ times in its length; mandible long, reaching posterior edge of pupil. Distance from tip of snout to occiput half that from occiput to origin of dorsal fin, which is midway between tip of snout and base of caudal fin. Caudal peduncle short, compressed and deep, its least depth about $2\frac{1}{4}$ in head. Fins rather large; height of dorsal, $1\frac{1}{5}$ in head; base of fin, $1\frac{2}{5}$ in longest ray; anal base very oblique, equal to length of longest ray, which is about equal to base of dorsal fin; pectorals and ventrals long, almost equal to height of dorsal. Scales firm, considerably enlarged anteriorly; free margin of scales less convex than in other species, often emarginate, especially on anterior part of body; lateral line straight and in a line with upper rim of orbit. Tongue with a patch of fine teeth near the tip. Gillrakers numerous, long and slender, the number varying from 47 to 52. Color iridescent bluish above, sides and under parts silvery; older individuals darker above and with more golden reflection on sides; fins all more or less evidently black-tipped; upper edge of pectoral margined with black.

Table of comparative measurements of specimens of tullibee (Argyrosomus tullibee).

Number.	Where taken.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
												Number.	In eye.
		In.											
115	Lake of the Woods........	12	4¼	3½	4	5	3⅖	2¼	11	12	....	18+33; 18+34	1⅓
116	.....do....................	8	4⅓	3½	4	5	3½	2⅕	12	13	9-71-8	16+34; 18+33	1⅖
117	.....do....................	8	4	3⅗	4—	5	3½	2+	12	12	9-70-8	17+30; 17+31	1¼
118	.....do....................	7¾	4	3+	4	5	3½	2+	10	11	9-71-8	16+33; 16+32	1⅖
119	.....do....................	6¼	4	3⅗	4—	5	3¼	2⅕	11	12	9-70-8	17+32; 17+31	1⅔
64	.....do....................	14	4⅓	3—	4⅔	4⅔	3⅔	2+	12	12	9-68-8	....	....
66	.....do....................	16½	4⅖	3	5+	5	3⅔	2⅕	11	11	9-68-8	16+31; 16+32	1

This species was originally described in 1836 by Richardson, from Pine Island Lake, at Cumberland House, British America. Since then it has been recorded from the following places: Albany River district, Hudson Bay (Richardson, 1836); Lake Superior (Agassiz, 1850); Albany River, Günther, 1866; Lake Superior (Jordan, 1878); Lake Erie (Jordan, 1878 and 1882); Lake Michigan (Jordan & Evermann, 1886); lower end of Lake Erie (Forest and Stream, 1890); Qu'Appelle River (Forest and Stream, 1892); and North Minnesota (Blackford, U. S. N. M.). It is also known from Lake of the Woods, Lake Winnipeg, and Manitoba.

The tullibee attains a length of 18 to 20 inches and a weight of 3½ pounds. Its food value is high, but its commercial importance is as yet very limited. In none of the Great Lakes is the fish at all common, but in the Lake of the Woods it is quite abundant and considerable quantities are taken and shipped to Sandusky. In the provinces of Assiniboia and Manitoba the fish is taken in large numbers for local consumption, with gill nets and in traps made of brush and stones.

But little is definitely known of the spawning habits of the tullibee. Mr. F. C. Gilchrist, of Fort Qu'Appelle, writing in Forest and Stream concerning this fish, as observed by him in the lakes of the Western Territories of Canada, says:

> In September they will again be found gradually nearing the shoal water, feeding heavily, and plump with fat and the now swelling ovaries. Later on they appear to eat little or nothing and devote all their time to playing until about the 25th of October, when they have settled down to the business of propagation, which they have finished by November 10. They prefer shallow water close to shore with clean sand to spawn on, and during the day they may be seen in pairs and small schools, poking along the shores, but at night they come in thousands and keep up a constant loud splashing and fluttering, very strange and weird on a calm night. Two years ago I carefully counted the ova from a ripe fish 2½ pounds in weight, and found there were 23,700, closely resembling whitefish eggs in appearance, but somewhat smaller. After spawning the fish are very thin, lank, dull in color, and quite unfit for human food.

In a recent article entitled "Whitefish culture in New York," published in the New York Fishing Gazette, Dr. Bean records the taking of a specimen of tullibee in Lake Onondaga, New York, where the species is abundant but has apparently not been previously recognized. The fish was a male, 18½ inches long, and was obtained in November by

Mr. James Annin, jr., State superintendent of fish-culture, who furnished the following notes on the tullibee in this lake:

> In regard to the spawning habits of the Onondaga Lake whitefish, they are spawning at present at Onondaga Lake. They generally commence running up onto the shoals about November 15, and the season extends into December. They come up to the banks or gravelly shoals and spawn in from 3 to 6 and 7 feet of water. They have never been caught with hook in this lake, and an old fisherman told me that he had tried almost every kind of bait, and had used the very finest gut and the smallest hooks baited with *Gammarus* (fresh-water shrimp) and other kinds of natural food—that is, he supposed the food was natural to them. At the same time he claims he could see them in large schools lying in the water 8 or 10 feet from the surface.

17a. Argyrosomus tullibee bisselli (Bollman).

BISSELL'S TULLIBEE.

Coregonus tullibee bisselli Bollman, Bull. U. S. Fish Comm., VIII, 1888, 223, Rawson and Howard lakes, Michigan. (Type, No. 40619.)

Similar to *A. tullibee*, but with maxillary reaching to middle of eye, and with 80 to 82 scales in lateral line. End of supplemental maxillary bone rounded. Lower jaw projecting when closed. Supraorbital bone elongate pear-shaped. Head, $4\frac{1}{3}$ to $4\frac{1}{2}$; depth, $3\frac{1}{2}$; eye, $4\frac{1}{2}$ to $4\frac{2}{3}$. Scales anteriorly scarcely larger than those on caudal peduncle. This variety of *tullibee* is known from small lakes in southern Michigan and bears the same relation to the typical *tullibee* that *A. artedi sisco* does to the lake herring. Nothing has been recorded concerning its size, abundance, and habits.

COMMON NAMES OF THE WHITEFISHES.

A great deal of misapprehension exists among fishermen, dealers, and others regarding the identity of even the common species of whitefishes, and a large variety of common names is employed to designate the different fishes in the same and different localities. During the recent investigations of the fish and fisheries of the Great Lakes by the United States Fish Commission, a special effort was made to learn the common names by which each of the whitefishes is known to the fishermen about the different lakes. It became apparent very soon, not only that the same species is known by a great variety of names in the different parts of its range, but that in a number of places a single species is known by several common names; and, what is still more confusing, the same common name is, in different localities, applied to two or more entirely different species.

As illustrating the improper use of common names we may take the name "whitefish" or "common whitefish." In Lake Champlain "whitefish" is one of the common names applied to either *Coregonus clupeiformis* or *C. labradoricus*. In all of the Great Lakes it is correctly applied to *C. clupeiformis*, though occasionally about Lake Huron and

Lake Superior it is used for *C. labradoricus*, while in the Lake of the Woods "whitefish" may mean either *Argyrosomus tullibee* or *C. labradoricus*, or possibly *C. clupeiformis*. Again, the "cisco" of Lake Ontario is *A. artedi*, which is the "herring" of Lake Erie, or the "shore herring" or "greenback herring" of Lake Michigan. At Whitefish Bay, Lake Superior, the name "cisco" is sometimes applied to *C. quadrilateralis*. At some places in Lake Superior "cisco" means *A. prognathus*, and in Lake Michigan it may refer to *A. hoyi*. The name "herring" or "lake herring" is generally applied to *A. artedi*, but in Lake Michigan *A. hoyi* is known by the same designation. Such names as "shad," "chub," "pilot-fish," and "shiner," when given to species of whitefish, afford no clue to the identity of the fish and illustrate the confused popular nomenclature.

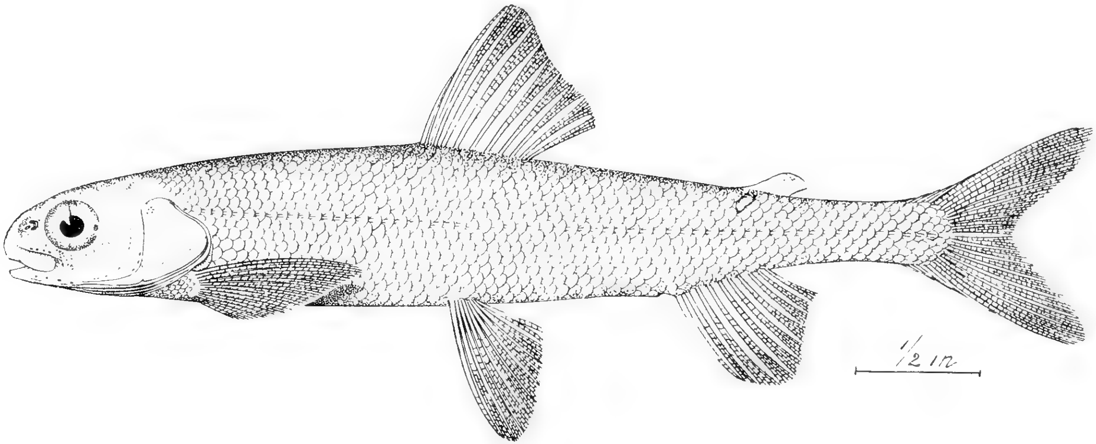
In order to facilitate to some extent the identification of the various whitefishes by persons not conversant with the subject, the common names in use have been brought together in the following list. In the first column we give the common or local name; in the second, the place where used, and in the third the scientific name. The absence of an assigned locality indicates either that the common name is not used among the fishing population (as, for instance, Nelson's whitefish), or that the common name is in more or less general use.

Classified list of the common names applied by fishermen and others to the different species of whitefish.

Common name.	Where used.	Scientific name.
Attihawmeg	Northern lakes	Coregonus labradoricus.
Blackfin, or blackfin whitefish	Lake Michigan	Argyrosomus nigripinnis.
Blackback	do	C. quadrilateralis.
Bloat	Lake Huron; Lake Ontario	A. prognathus.
Bloater, or bloater whitefish	Lake Ontario; Lake Superior	Do.
Blueback, or blueback herring	Lake Ontario; Lake Michigan	A. artedi.
Bluefin, bluefin whitefish	Lake Michigan	A. nigripinnis.
Bowback, or bowback whitefish	Lake Superior	C. clupeiformis.
Broad whitefish		C. kennicotti.
Buffalo-back whitefish	Lake Superior	C. clupeiformis.
Chateaugay shad	Chateaugay Lake	C. quadrilateralis.
Chivey	Maine	Do.
Chub	Lake Michigan	A. hoyi.
Cisco (or Sisco)	Lake Ontario; Lake Erie	A. artedi.
Do	Lake Michigan	A. hoyi.
Do	Lake Superior; Lake Ontario	A. prognathus.
Do	Lake Superior	C. quadrilateralis.
Do	Lake Tippecanoe	A. artedi sisco.
Ciscoette	Lake Erie (trade name for large herring).	A. artedi.
Do	Lake Ontario (trade name)	A. prognathus.
Common whitefish		C. clupeiformis.
Coulter's whitefish		C. coulterii.
Cross whitefish	Lake Ontario	A. prognathus.
Deep-water herring	Lake Michigan	A. hoyi.
Deep-water whitefish	Lake Superior	A. prognathus.
Fresh-water herring	Payette Lake, Idaho	C. williamsoni.
Frostfish	Adirondack Mountains; Lake Champlain.	C. quadrilateralis.
Gizzard-fish	St. John's River, N. B.	C. labradoricus.
Grayback, or grayback herring	Lake Ontario	A. artedi.
Greenback, or greenback herring	Lake Ontario; Lake Michigan	Do.
Herring		Do.
Do	Idaho	C. williamsoni.
Do	Great Bear Lake	A. lucidus.
Do	Lake Michigan	A. hoyi.

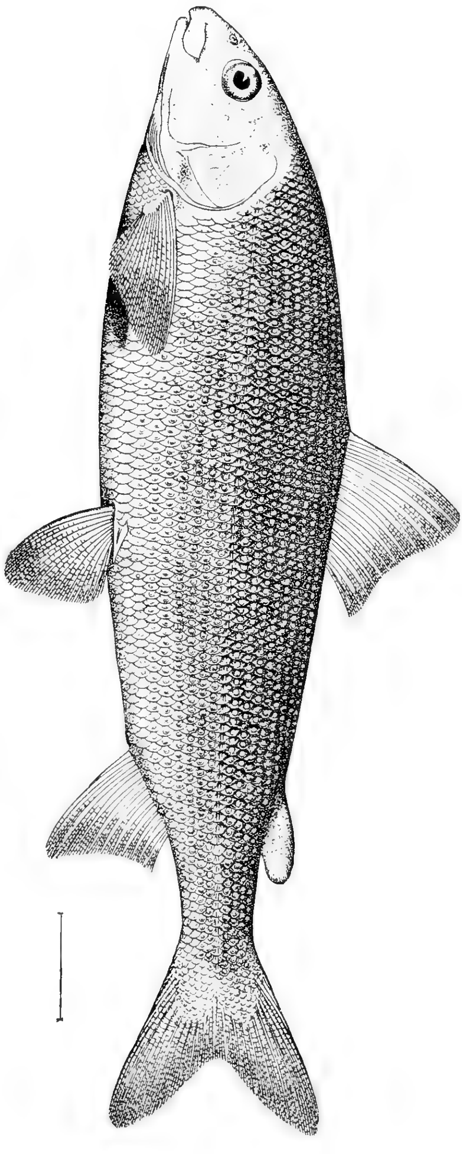
Classified list of the common names applied by fishermen and others to the different species of whitefish—Continued.

Common name.	Where used.	Scientific name.
Highback whitefish	Lake Superior	C. clupeiformis.
Hoy's whitefish		A. hoyi.
Humpback whitefish		C. nelsonii.
Do	Lake Superior	C. clupeiformis.
Hybrid whitefish	Lake Superior; Lake of the Woods	C. labradoricus.
Kiyi or kieye	Lake Michigan	A. hoyi.
Kennicott's whitefish		C. kennicotti.
Labrador whitefish		C. labradoricus.
Lake herring		A. artedi.
Lake whiting		C. labradoricus.
Lauretta whitefish		A. laurettæ.
Least whitefish		A. pusillus.
Little whitefish	Lake Superior	A. prognathus.
Longjaw, or longjaw whitefish	Lake Ontario; Lake Huron; Lake Michigan; Lake Superior.	Do.
Longjaw	Lake Superior; Lake of the Woods	C. labradoricus.
Menominee, or Menominee whitefish	Lake Superior; Lake Michigan	C. quadrilateralis.
Michigan herring	Lake Michigan	A. artedi.
Mongrel whitefish		A. tullibee.
Do	Lake Superior; Lake of the Woods	C. labradoricus.
Mooneye	Lake Michigan	A. hoyi.
Mooneye cisco	do	Do.
Mountain herring	Utah; Idaho	C. williamsoni.
Musquaw River whitefish		C. labradoricus.
Nelson's whitefish		C. nelsonii.
Onondaga Lake whitefish	Onondaga Lake, N. Y	A. tullibee.
Ontario whitefish	Lake Ontario	A. prognathus.
Otsego bass	Otsego Lake; New York	C. clupeiformis.
Pilot-fish	Lake Champlain	C. quadrilateralis.
Poisson pointu	French Canadians	C. labradoricus.
Richardson's whitefish		C. richardsonii.
Rocky Mountain whitefish		C. williamsoni.
Round whitefish		C. quadrilateralis.
Sault whitefish		C. labradoricus.
Shad	Lake Champlain	C. quadrilateralis.
Do	Lake Champlain; Lake Memphremagog.	C. labradoricus.
Shadwaiter	Lake Winnipiseogee	C. quadrilateralis.
Do	Lake Champlain; Lake Memphremagog.	C. labradoricus.
Shiner	Lake Michigan	A. hoyi.
Shore herring	do	A. artedi.
Silver whitefish	Lake Ontario	A. prognathus.
Sisco (see Cisco)	Lake Tippecanoe	A. artedi sisco.
Siscowet	Lake Erie (trade name for large herring).	A. artedi.
Do	Lake Ontario (trade name)	A. prognathus.
Small whitefish		A. pusillus.
Smelt	New York lakes	A. osmeriformis.
Tullibee	Lake Superior; Lake of the Woods; Lake Winnepeg, Assinniboia.	A. tullibee.
Whitefish	Idaho	C. williamsoni.
Do	Lake of the Woods	A. tullibee.
Do		C. clupeiformis.
Do	Lake of the Woods; Grand lakes, Maine; Lake Champlain.	C. labradoricus.
Do	Maine; New Hampshire	Do.



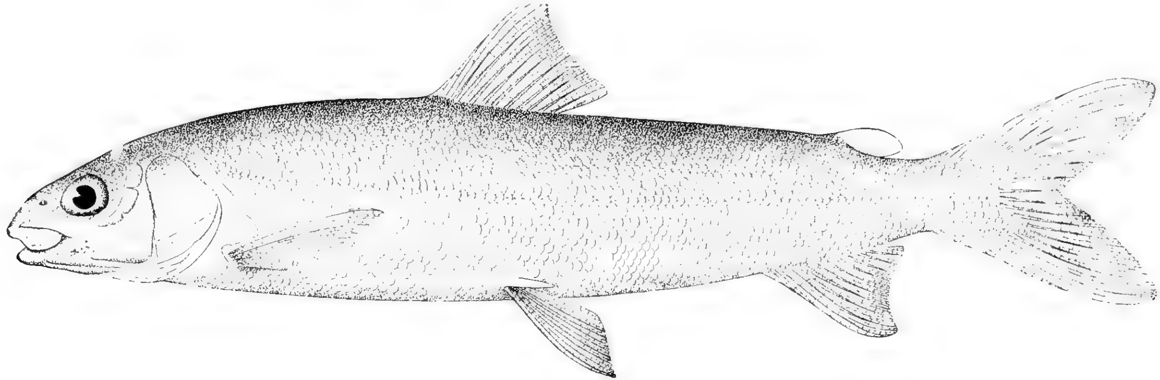
COREGONUS COULTERII Eigenmann & Eigenmann. *Coulter's Whitefish.*

From a specimen, 4½ inches long, one of the types, collected in Kicking Horse River, at Field, British Columbia.



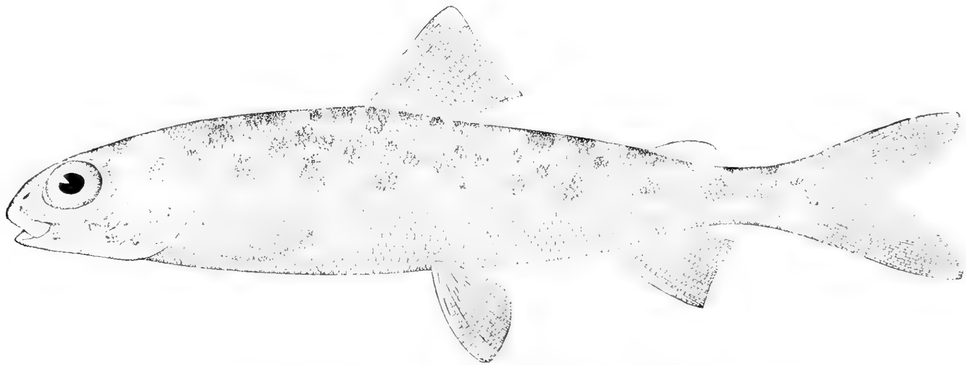
COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

From a breeding male, 11 inches long, collected in Little Spokane River, Washington.



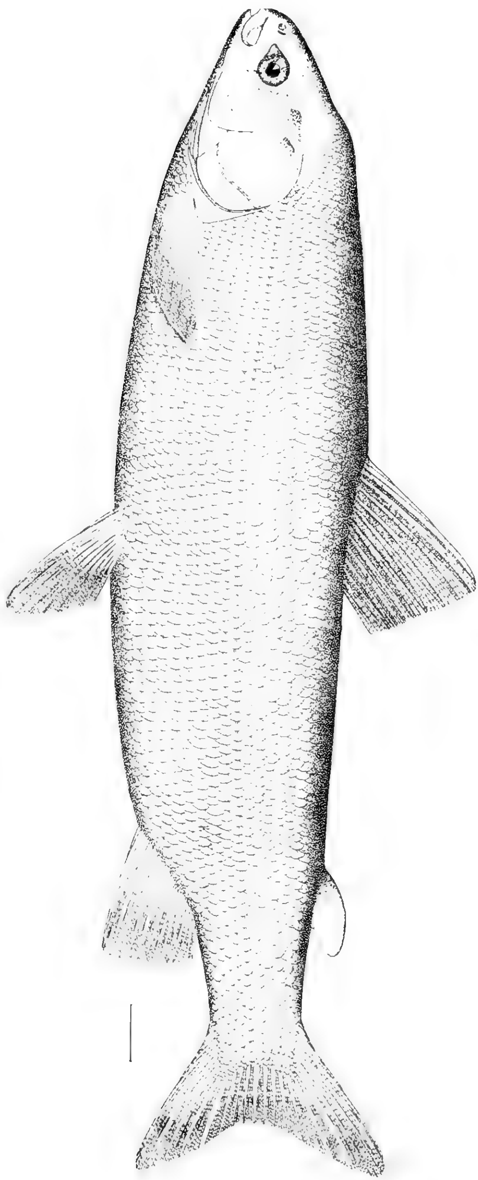
COREGONUS WILLIAMSONI CISMONTANUS Jordan. *Mountain Whitefish.*

From a specimen, about 11 inches long, collected in Horsethief Springs Creek, Montana.



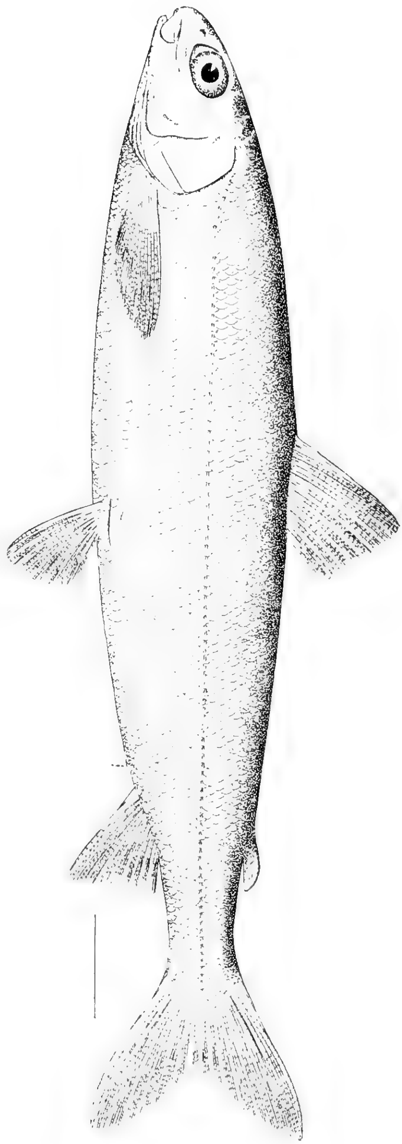
COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

From a young specimen, 3 inches long, showing parr-marks, collected in Little Blackfoot River, Elliston, Montana.



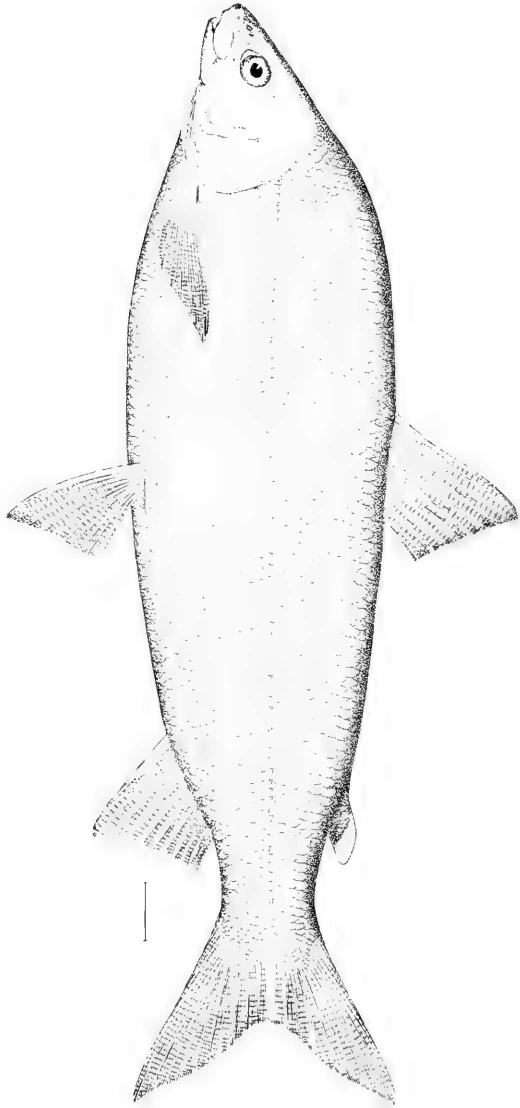
COREGONUS KENNICOTTI Milner. *Kennicott's Whitefish.*

From a specimen, 20 inches long, collected in Meade River, Alaska.



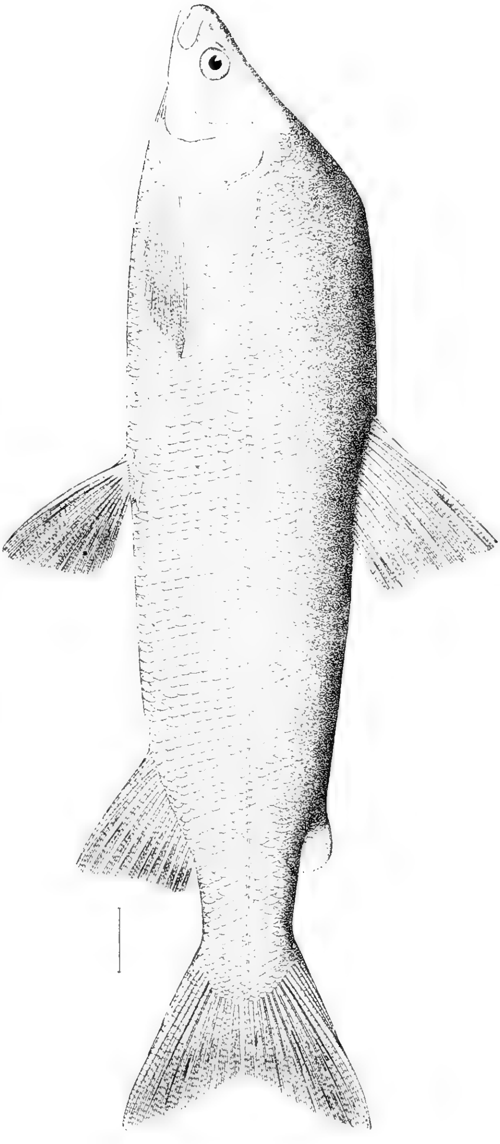
COREGONUS QUADRILATERALIS Richardson. *Round Whitefish.*

From a specimen, 11 inches long, collected in Lake Winnipiseogee, New Hampshire.



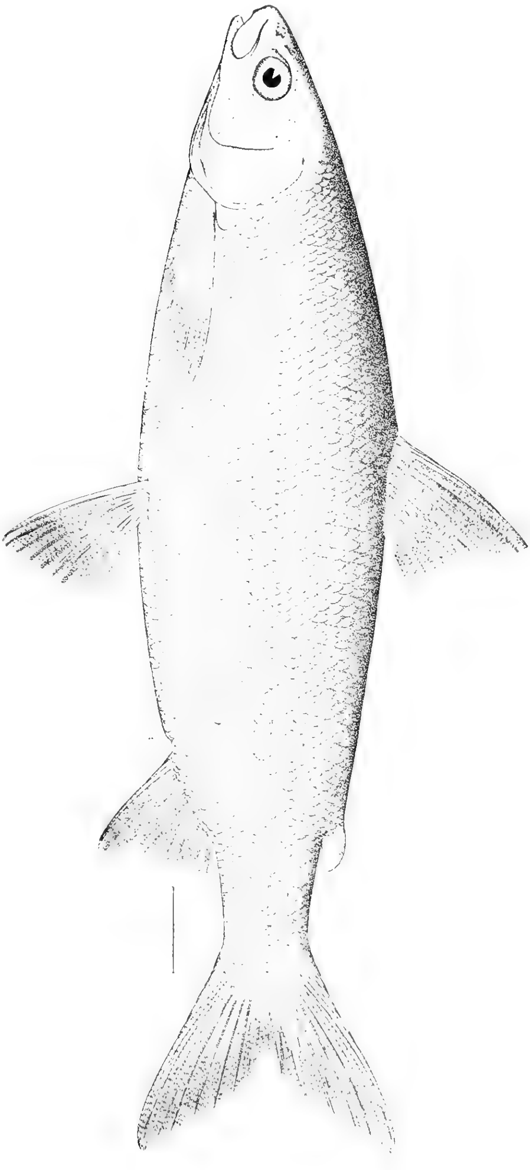
COREGONUS CLUPEIFORMIS (Mitchill). *Common Whitefish.*

From a specimen, 19 inches long, collected in Detroit River, near Ecorse, Michigan.



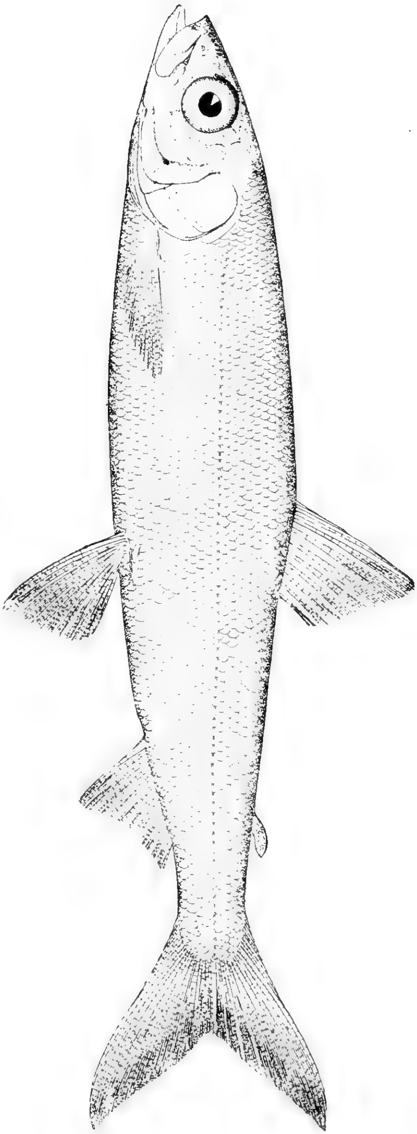
COREGONUS NELSONII Bean. *Nelson's Whitefish.*

From the type, a specimen 18 inches long, collected at Nulato, Alaska.



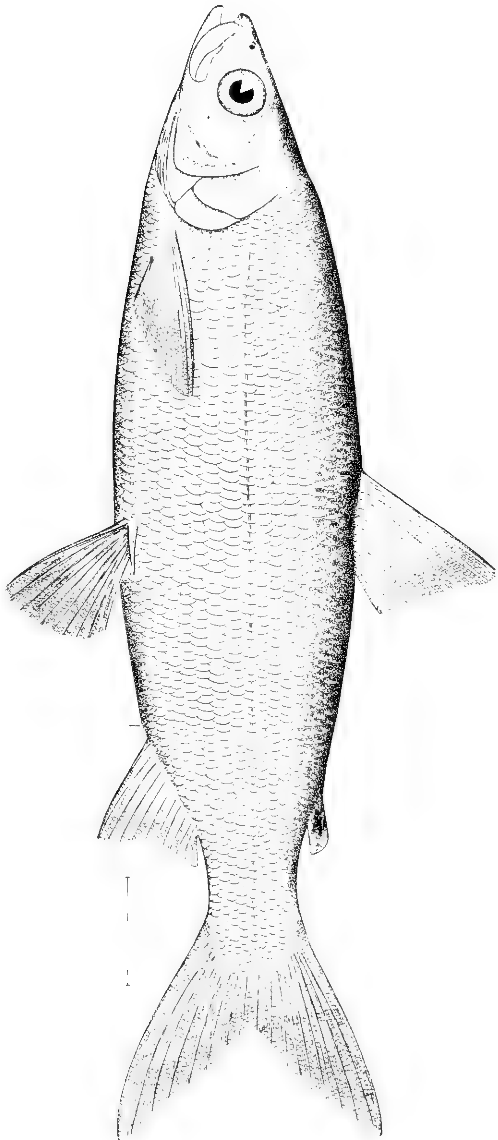
CORAGONUS LABRADORICUS Richardson. *Labrador Whitefish.*

From a specimen, 13½ inches long, collected in Grand Lake Stream, Maine.



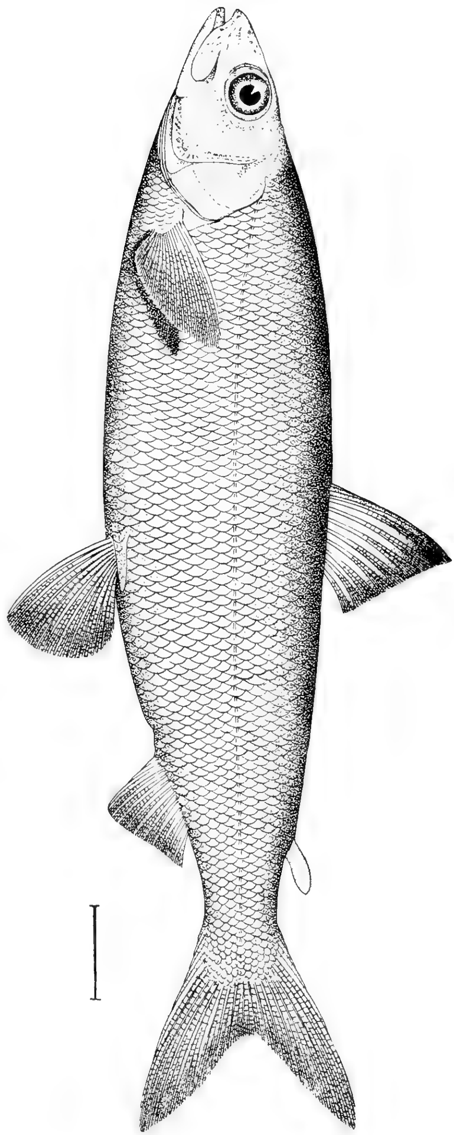
ARGYROSOMUS OSMERIFORMIS (H. M. Smith) *Smelt.*

From the type, a specimen 10 inches long, taken in Seneca Lake, New York.



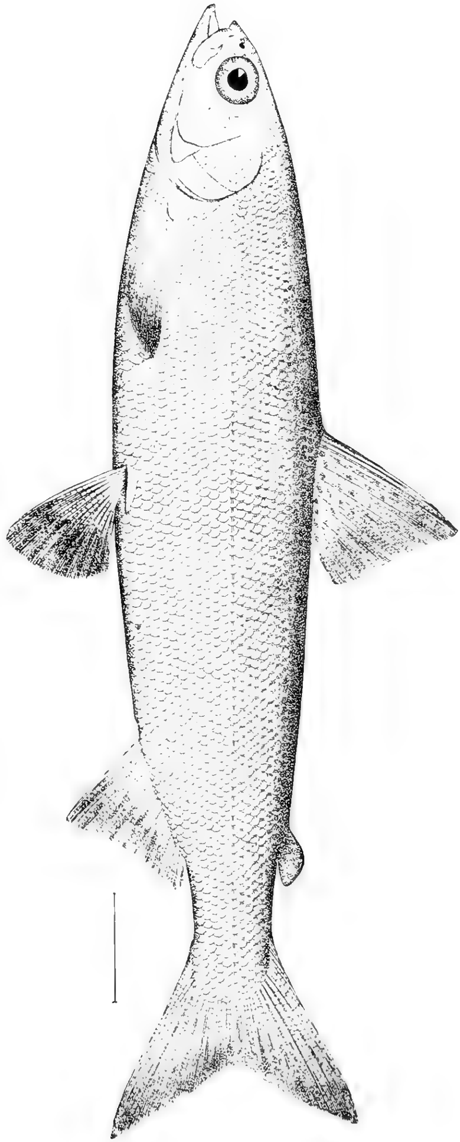
ARGYROSOMUS ARTEDI (Le Sueur). *Lake Herring.*

From a specimen, 11 inches long, collected in Lake Superior, near Bayfield, Wisconsin.

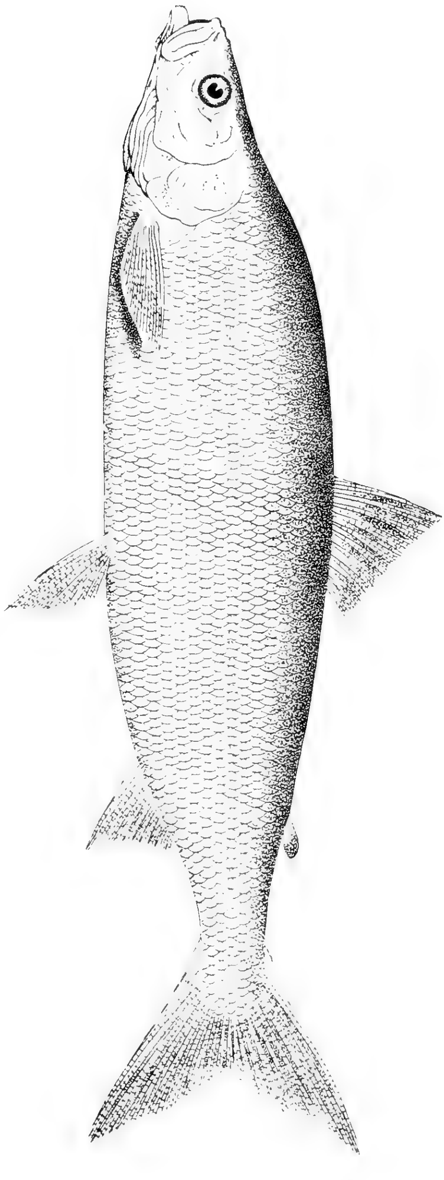


ARGYROSOMUS HOYI Gill. *Hoy's Whitefish; Kiyi.*

From a nearly ripe male, 12 inches long, collected in deep water in Lake Michigan, off Kenosha, Wisconsin.

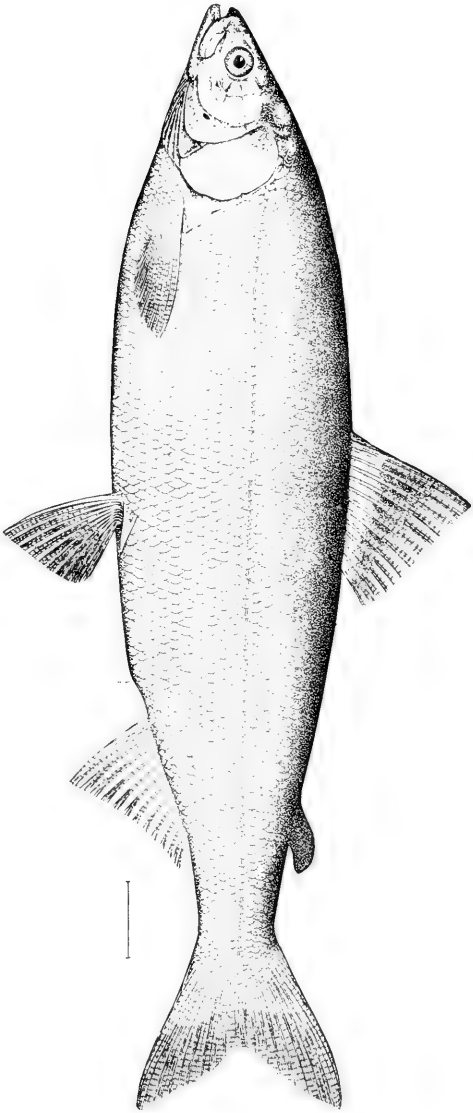


ARGYROSOMUS PUSILLUS (Bean). *Least Whitefish.*
From a specimen, 10 inches long, collected in northern Alaska.

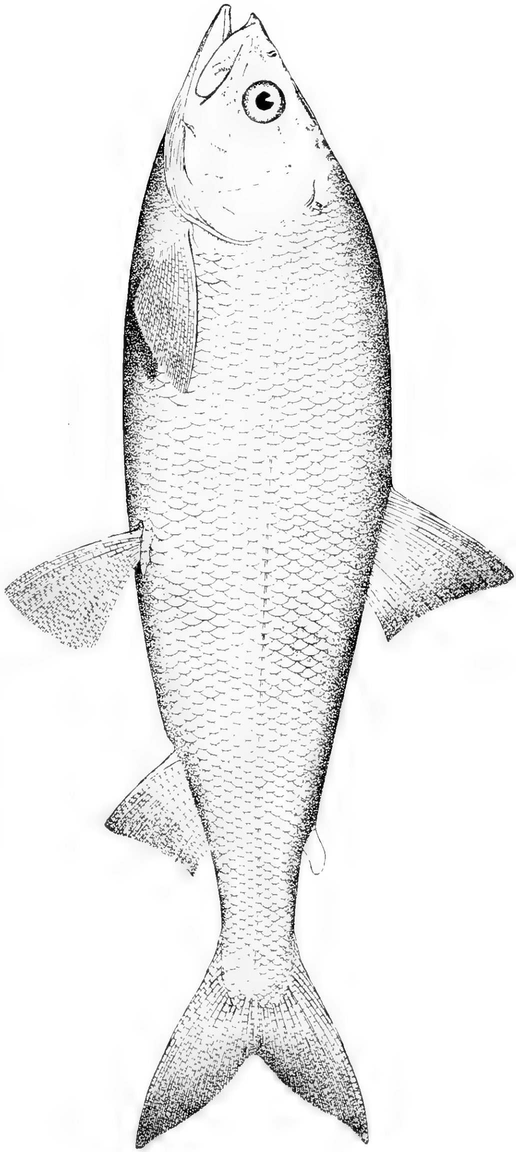


ARGYROSOMUS LUCIDUS (Richardson). *Great Bear Lake Herring.*

Adapted from Richardson's figure of the type, collected in Great Bear Lake.

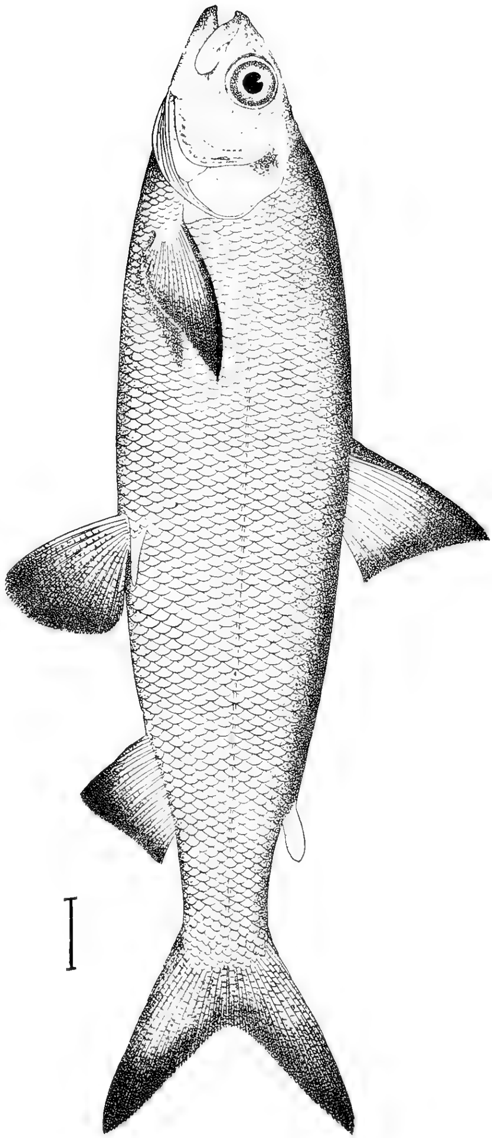


ARGYROSOMUS LAURETTÆ (Bean). *Lauretta Whitefish.*
From the type, a specimen 15 inches long, collected at Point Barrow, Alaska.



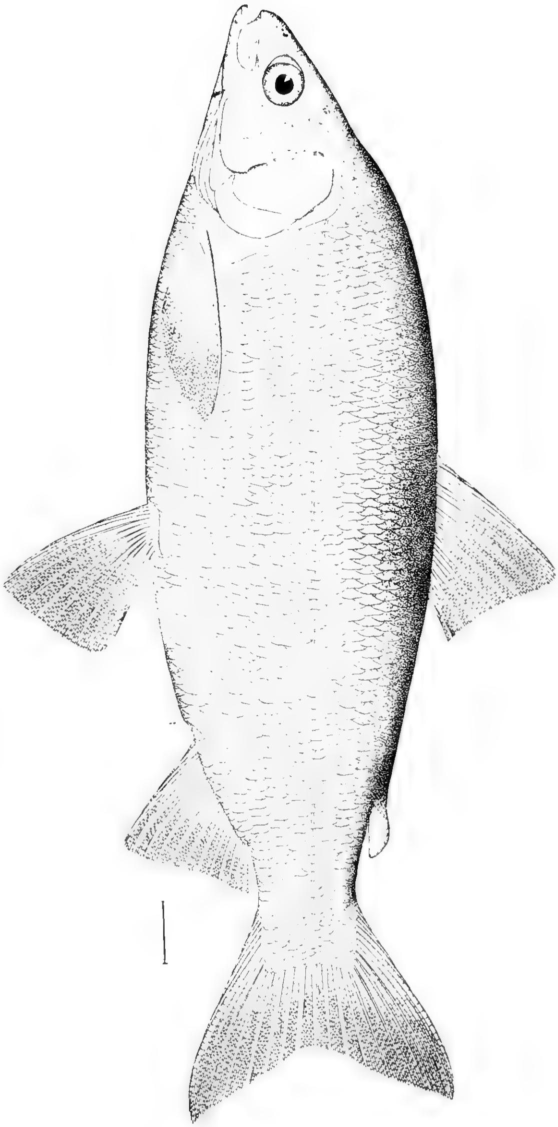
ARGYROSOMUS PROGNATHUS (H. M. Smith). *Longjaw Whitefish.*

From the type, a specimen 15 inches long, taken in Lake Ontario in 40 fathoms of water, off Wilson, New York.



ARGYROSOMUS NIGRIPINNIS Gill. *Blackfin.*

From a nearly ripe male, 16⅓ inches long, caught in Lake Michigan in 90 fathoms of water, off Sheboygan, Wisconsin.



ARGYROSOMUS TULLIBEE (Richardson). *Tullibee.*

From a specimen 18 inches long, probably from Minnesota.

5.—A REPORT UPON THE FISHES OF THE MISSOURI RIVER BASIN.

By Barton W. Evermann and Ulysses O. Cox.

INTRODUCTION.

The investigations upon which this report is primarily based were provided for by two items in the sundry civil bill approved August 5, 1892. First, "for investigation and report respecting the advisability of establishing fish-hatching stations at suitable points in the States of South Dakota, Iowa, and Nebraska, $1,000, or as much thereof as may be necessary"; and second, "for investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in Wyoming, $400."

The conditions which determine the desirability of locating one or more fish-hatcheries in these States made it expedient to conduct each investigation as being a part of one general inquiry. It was wholly impracticable to separate them or to consider their results as pertaining alone to Wyoming on the one hand, or to Iowa, South Dakota, and Nebraska, on the other. They were, therefore, conducted with reference to the general fish-cultural needs of the entire group of north-central States west of the Mississippi River.

It became apparent, early in the consideration of the matter, that the greatest need of this region, so far as fish-culture is concerned, is a station for the hatching and rearing of the various pond and river fishes. With the exception of a few streams in northeastern Iowa, two or three small creeks in northern Nebraska, and the Black Hills streams in South Dakota, the waters of these three States are not adapted to trout. The streams of Wyoming which are suitable for trout are, with few unimportant exceptions, confined to that portion west of the Powder River and north of the Sweetwater. This is a region which can probably be best reached and stocked with trout from the station now being established at Bozeman, Montana.

It therefore appears that if but one station is established for these States it should be chiefly devoted to the hatching and rearing of the species of fishes which are indigenous to the waters of this region, and that the best location, geographically, would be somewhere in South Dakota, Nebraska, or Iowa. If it should be regarded as desirable to establish at any time a second station in these States it might very well be a trout station, and should be located in or near the Black Hills. If but one station is established it should be a composite station, or one which, though chiefly devoted to pond and river fishes, could also engage in trout culture to some extent.

SUMMARY OF REPORT.

These investigations were begun in the fall of 1892 (October 6 to November 2), but owing to cold weather the work was suspended the first week in November, and was not taken up again until June, 1893. The work done in 1892 was carried on by Professor Evermann, assisted by Mr. Lewis M. McCormick, formerly of Oberlin College, now of the Glen Island Museum, New York.

ITINERARY, 1892.

Oct. 6. Began work at Deadwood, S. Dak.
7. Drove to Spearfish and examined Spearfish Creek and numerous springs in vicinity.
8. Drove from Spearfish to Beulah, Wyo.; examined Cook's Pond, Chicken and Crow creeks, Cox and Montana lakes, and Sand and Redwater creeks.
9. Returned to Deadwood.
10. Went to Lead City and examined Whitewood Creek and Gold Run.
11. Went to Belle Fourche, examined the waters in that vicinity, and seined Belle Fourche River.
12. Seined Redwater and Middle creeks and returned to Deadwood.
13. Went to Crystal Cave, S. Dak.
14. Examined Elk Creek, then went to Rapid City, S. Dak.
15. Examined Rapid Creek, Cleghorn's and Miller's springs, and went to Hot Springs.
16. At Hot Springs.
17. Drove to Cheyenne Falls.
18. Examined Fall River and various springs about Hot Springs and went to Edgemont.
19. Examined Cottonwood Creek and Cheyenne River.

Oct. 20. Went to Newcastle, Wyo., and examined Salt and Beaver creeks.
21. Went to Ardmore, S. Dak., where we seined Hat Creek; took night train for Ravenna, Nebr.
22. Seined Mud Creek and South Loup River at Ravenna.
23. Took train for Lincoln.
24. Spent at Lincoln and vicinity.
25. Went to South Bend and examined Nebraska fish-hatchery there. Returned to Lincoln in the evening.
26. Went to Crete and examined Blue River. Took night train for Albia, Iowa.
27. Went to Lovilla, Iowa, where we examined Bluff Creek.
28. Went to Ames, Iowa.
29. Examined springs and streams near Ames.
30. At Ames. Went to Cedar Rapids, Iowa, at night.
31. Examined springs in the vicinity of Cedar Rapids.

Nov. 1. Went to Spirit Lake, Iowa.
2. Cold weather having set in, we decided to close the work here, and returned to Washington.

The work was resumed June 16, 1893, and carried on for several weeks, under the immediate direction of Professor Evermann, who was assisted by Prof. U. O. Cox, teacher of biology in the State Normal School at Mankato, Minn., Mr. Cloudsley Rutter, then of Long Pine, Nebr., now a student at Stanford University, and Prof. Robert G. Gillum, professor of chemistry and physics in the Indiana State Normal School. During the time that Professor Evermann was unable to remain with the party Mr. Cox was placed in charge.

The examination and determination of the physical and biological features of the streams of these States was made an important part of these investigations, and it was this phase of the work to which Mr. Cox and his assistants chiefly directed their attention. The work in Iowa was done by Professor Evermann alone, and was in most part devoted to the examination of springs and the smaller streams.

ITINERARY, 1893.

June 16. Messrs. Cox and Rutter began the work at Mitchell, S. Dak.

17. Examined the Dakota River, Rock Creek, and Firesteel Creek, near Mitchell.

18. Made collections in Enemy Creek, near Mitchell.

19 to 21. Spent in making further investigations on Dakota River and Rock Creek.

22. Professor Evermann joined the party. Went to Chamberlain, S. Dak.

23. Drove north of Chamberlain and examined Crow and Smith creeks.

24. Drove 15 miles southwest of Chamberlain and examined White River.

25. Sunday. Spent the day at Chamberlain.

26. Went from Chamberlain to Scotland, S. Dak., where we examined Prairie Creek; went to Springfield, S. Dak., in the evening.

27. Drove northwest of Springfield and examined Emanuel and Choteau creeks; then to Running Water, S. Dak., where we crossed the Missouri River and went to Niobrara, Nebr.

28. Went 3 miles west of Niobrara to Ponca Creek; examined it and Niobrara River, then drove east to Bazile Creek, which we examined; went to Verdigris, Nebr., in the evening.

29. Examined the Verdigris River and a small creek near Verdigris, and in the afternoon went to Creighton, Nebr., where we examined a large pond.

30. Drove to Bazile Mills, where we examined Spring Creek; then took train to Norfolk Junction, and fished Elkhorn River and Norfolk Creek.

July 1. Messrs. Cox and Rutter went to Ewing, Nebr., where they examined the Elkhorn River and other waters in that vicinity. In the evening they went to Long Pine, Nebr. Prof. Evermann examined springs near Council Bluffs, Iowa.

3 and 4. Messrs. Cox and Rutter examined streams about Long Pine, and were rejoined on the 4th by Messrs. Evermann and Gillum.

5 and 6. Examined various streams and springs about Long Pine.

7. Professor Evermann left the party here and went to Lake Erie; the others drove south of Long Pine and examined Lake George and Carp Lake, returning to Long Pine on evening of the 8th.

9. Went from Long Pine to Valentine, Nebr.

10. Fished the Niobrara River, Minnechaduza Creek, and another small creek near Valentine. Left in the evening for Chadron, Nebr.

11. Examined White River, Chadron Creek, and Lone Tree Creek near Chadron.

12. Went by rail to Casper, Wyo.

13. Examined the North Platte and a small creek at Casper.

14. Went from Casper to Glenrock, Wyo., and examined Deer Creek and North Platte River.

15. Went to Douglas, Wyo., and examined the North Platte at that place.

16. Sunday, spent at Douglas.

17. Went to Crawford, Nebr.

18. Went to Sheridan, Wyo.

19. Examined Big Goose Creek at Sheridan, and left in the afternoon for a three days' wagon trip to the mountains.

ITINERARY, 1893—Continued.

July 20. Investigated Tongue River.
21. Investigated Big Goose Creek.
22. Went to Little Goose Creek and returned to Sheridan.
23. Sunday, spent at Sheridan.
24. Left for Arvada, Wyo., Mr. Rutter stopping at Clermont to fish Clear Creek; fished Powder River at Arvada.
25. Went to Newcastle, Wyo.
26. Examined Salt and Beaver creeks near Newcastle, and went to Edgemont, S. Dak., in the evening.
27. Fished Cheyenne River and went to Hot Springs, S. Dak., where Prof. Evermann rejoined the party.
28. Examined Fall and Cheyenne rivers. Messrs. Evermann and Rutter left the party here and went to Cheyenne, Wyo., then to Idaho to take up work in Columbia River basin. Messrs. Cox and Gillum went to Buffalo Gap, S. Dak.
29. Fished Beaver Creek at Buffalo Gap and returned to Hot Springs at night.
30. Sunday, spent at Hot Springs.
31. Went from Hot Springs to Custer, S. Dak., and examined French Creek.

Aug. 1. Went to Hill City, S. Dak., and examined a small stream there.
2. Went from Hill City to Deadwood, S. Dak.
3. Went by stage to Spearfish, S. Dak., where examined Spearfish Creek.
4. Drove northwest of Spearfish and examined Cox, Hopkins, and Montana lakes and Redwater Creek.
5. Returned to Deadwood.
6. Went to Crawford, Nebr.
7. Fished White River and then went to Marsland, Nebr.
8. Examined the Niobrara River at Marsland, and then went to Dunning, Nebr.
9. Examined Dismal River and the North Loup, and then went to Ravenna, Nebr.
10. Examined Mud Creek and the South Loup at Ravenna.
11. Went to Grand Island, where we fished the Platte River.
12. Went to York, Nebr., and fished Lincoln and Beaver creeks.
13. Sunday, spent at York.
14. Went to Seward, Nebr., and examined Lincoln Creek and Blue River.
15. Went from Seward to Lincoln, Nebr., where the work was brought to a close, and Mr. Cox and Mr. Gillum returned home.

Professor Evermann's examinations for the selection of a hatchery site in Iowa were made on the following dates: July 17, at Manchester; July 18, at Waterloo; July 19, at Marshalltown; July 20, at Cedar Rapids; July 21, at Ames; July 22, at Des Moines; October 23 and 24, at Spirit Lake; October 25, at Decorah; October 26, at McGregor; October 27, at Jesup.

As already stated, these investigations were not limited to the examination of proposed hatchery sites, but included an examination and study of the physical and biological features of the waters of the region, with especial reference to the species of fish and other animal life they already contain, and their suitability for stocking with other species of food-fishes not indigenous to them.

A report has already been made to the Commissioner, in which were given the details of the investigations bearing directly upon the selection of a hatchery site. In this particular work more than 100 springs were examined, their temperatures taken, their volume measured or approximately estimated, and the topographic features surrounding each noted and recorded.

After a careful consideration of the advantages and disadvantages of each place, the Commissioner selected a site on Spring Branch, near Manchester, Iowa, and the station is now under construction there.

In the present paper are given the results of the examination of the various streams visited in South Dakota, Nebraska, and Wyoming, together with our report upon the large collections of fishes obtained.

ACKNOWLEDGMENTS.

During the progress of our work in 1892, and again in 1893, numerous courtesies of one kind or another were shown us by various gentlemen who are interested in the work of the Commission, and we desire here to express our thanks to all these gentlemen for their many kindnesses. Especial mention should be made of Hon. George W. Holdredge, general manager of the Burlington and Missouri River Railroad; Hon. C. J. Ives, president of the Burlington, Cedar Rapids and Northern Railroad, and Hon. Roswell Miller, president of the Chicago, Milwaukee and St. Paul Railroad, all of whom took an active interest in our work and furnished facilities in the way of transportation which enabled us to greatly extend the field of our investigations.

Capt. Frank A. Whittemore, of Long Pine; Mr. Fred Ingalls and Mr. and Mrs. Blodgett, of Brown County, Nebr.; Dr. John Dixon and Messrs. John Harlow and John Johnson, of Spearfish; Mr. J. R. Brennan, of Rapid City; Major Wolcott, of Glenrock, Wyo.; Hon. Joseph M. Carey, Hon. Henry A. Coffeen, and Mr. Charles L. Decker, of Wyoming, all rendered us valuable assistance in various ways.

The following gentlemen in Iowa showed us many courtesies: Col. B. F. Shaw, ex-State fish commissioner, Cedar Rapids; Mr. T. J. Griggs, of Spirit Lake, then State fish commissioner; William Mynster, esq., Council Bluffs; Mr. J. A. Laird, Jesup; Mr. J. H. Larson, McGregor; Mr. Frank S. Landers, Decorah; Mr. A. M. Sherwood, Manchester; Mr. O. L. F. Browne, Des Moines; Prof. Herbert Osborn, Ames, and E. T. Cowin, esq., Waterloo.

THE MISSOURI RIVER BASIN.

The Missouri is the longest river in North America. Its headwaters are among the Rocky Mountains of Montana, Wyoming, and Colorado. At numerous places its sources are but a few miles from those of the Saskatchewan, the Columbia, and the Colorado. In northwestern Montana are the sources of Milk River, which are said to be connected directly with those of the Saskatchewan, while only a few miles to the westward the drainage is into Flathead River and thence into the Columbia. In southwestern Montana the headwaters of the Big Hole, Beaverhead, Red Rock, and Madison, on one hand, closely approach those of the Bitter Root, Salmon, and Snake on the other. In northwestern Wyoming, just south of the Yellowstone National Park, the headwaters of the Columbia and Missouri actually unite in Two-Ocean Pass, forming a continuous waterway from the mouth of the Columbia to that of the Mississippi.

In Wyoming the Sweetwater, a tributary of the North Platte, and in Colorado the South Platte, rise within a few miles of streams which are tributary to the Colorado of the West.

The headwaters of these various tributary streams are 8,000 to 14,000 feet above sea level. Gallatin, Mont., where the Jefferson, Madison, and Gallatin rivers unite to form the Missouri proper, is 4,132 feet in altitude; the sources of the Madison River are over 8,300 feet above the sea, while Two-Ocean Pass is about 8,200 feet.

The mouth of the Missouri River is about 400 feet above sea level; the total fall of this river is therefore over 7,000 feet, or 3,732 feet between Gallatin and the Mississippi. The length of the Missouri proper is given as 3,000 miles; add to this the length of Madison River and we have 3,230 miles, which may properly be regarded as the total length of the Missouri. Among the important tributaries may be named Milk River; Jefferson Fork, 140 miles; Gallatin Fork, 170 miles; Yellowstone River, 1,100 miles; Platte River, 1,250 miles (including the North Platte); and the Kansas River, 900 miles (including the Smoky Hill Fork). The area drained by this great river is given as 518,000 square miles. This includes the entire State of Nebraska, all of South Dakota except a few square miles in the northeast corner, nearly all of Montana, North Dakota, and Wyoming, about half of Kansas, more than half of Missouri, and large parts of Iowa and Colorado.

In the mountains at the headwaters of the various tributary streams there is an abundance of rainfall in summer and snow in winter. As a rule, the mountains were naturally heavily timbered, and the moisture was therefore conserved and fed out slowly during the season of drought. This is still true in general, but the reckless destruction of the forests in many places is having its effect upon the streams.

After leaving the mountains the tributaries of the Missouri, with scarcely an exception, enter a broad plain almost entirely devoid of trees except along the water-courses. This plain extends over eastern Montana, the two Dakotas, eastern Wyoming, Nebraska, Kansas, and Iowa. The western portion is barren, in some places even desolate. This is particularly true of the Bad Lands, or Mauvaises Terres, of South Dakota, and parts of North Dakota, Montana, Wyoming, and Nebraska. These are Miocene beds of great thickness. The White River Tertiary beds of parts of Wyoming, Nebraska, and South Dakota are several hundred feet thick, full of alkali, and in most places easily eroded.

The eastern part of South Dakota, nearly all of Nebraska and Kansas, and those parts of Colorado and Iowa in the Missouri basin constitute a more or less gently undulating prairie country, becoming dry, almost arid to the westward, but receiving an abundance of moisture and being very rich and productive in the eastern parts. In the State of Missouri there is more timber and plenty of moisture. The Missouri basin as a whole, however, is a country whose soils erode with unusual ease, and after getting out of the mountains and upon the plains few of the streams are ever really clear. The Missouri River always carries vast amounts of solid matter in suspension, and justly deserves the name "Big Muddy." The channels of the Missouri and all the larger tributaries are constantly changing and shifting the beds of the streams. All this, of course, has its effect upon the fishes.

Classified list of streams examined in the Missouri River Basin in 1892 and 1893.

Missouri River at Chamberlain and Running Water, S. D.
  Yellowstone River:
    Tongue River at Sheridan, Wyo.
      South Fork of Tongue River at Sheridan.
      Big Goose Creek at Sheridan.
        Wolf Creek at Sheridan.
      Little Goose Creek at Sheridan.
    Powder River at Arvada, Wyo.
      Clear Creek at Clermont, Wyo.
  Big Cheyenne:
    North Fork or Belle Fourche at Belle Fourche, S. D.
      Redwater Creek at Spearfish, S. D.
        Montana Lake at Spearfish, S. D.
        Cox Lake at Spearfish, S. D.
        Spearfish Creek at Spearfish, S. D.
        Crow Creek near Spearfish.
        Chicken Creek near Spearfish.
        Sand Creek near Beulah, Wyo.
      Whitewood Creek at Deadwood.
      Rapid Creek at Rapid City, S. D.
    South Fork at Hot Springs and Edgemont, S. D.
      Fall River at Hot Springs, S. D.
      Beaver Creek at New Castle, Wyo.
        Salt Creek at New Castle, Wyo.
      Hat Creek at Ardmore, S. D.
      Beaver Creek at Buffalo Gap, S. D.
      French Creek at Custer, S. D.
      Spring Creek at Hill City, S. D.
  Crow Creek at Chamberlain, S. D.
      Smith Creek at Chamberlain, S. D.
  White River at Chadron and Crawford, Neb., and Chamberlain, S. D.
      Chadron Creek at Chadron, Nebr.
      Lone Tree Creek at Chadron, Nebr.
  Choteau Creek at Springfield, S. D.
  Ponca Creek at Niobrara, Nebr.
  Niobrara River at Marsland, Valentine, Long Pine, and Niobrara.
      Schlegel Creek at Valentine, Nebr.
      Minnechaduza Creek at Valentine.

Missouri River—Continued.
  Niobrara River—Continued.
      Long Pine Creek at Long Pine.
        Bone Creek at Long Pine, Nebr.
        Ponds along creek at Long Pine.
      Verdigris River and a small creek at Verdigris, Nebr.
  Emanuel Creek at Springfield, S. D.
  Bazile Creek at Niobrara, Nebr.
    Ponds at Creighton, Nebr.
    Spring Creek at Bazile Mills, Nebr.
  James or Dakota River at Mitchell, S. D.
    Rock, Firesteel, and Enemy creeks at Mitchell, S. D.
    Prairie Creek at Scotland, S. D.
  Platte River at Grand Island and South Bend, Nebr.
    North Fork of Platte River at Casper, Glenrock and Douglas, Wyo.
      Garden Creek at Casper, Wyo.
      Deer Creek at Glenrock, Wyo.
        Little Deer Creek at Glenrock.
    Wood River at Grand Island, Nebr.
    Loup River at Grand Island, Nebr.
      Middle Loup and Dismal rivers at Dunning, Nebr.
      South Loup River and Mud Creek at Ravenna, Nebr.
      Calamus River:
      Isolated lakes near Long Pine.
      Carp Lake and Lake George near Long Pine, Nebr.
    Elkhorn River at Ewing and Norfolk, Nebr.
      Bayous, south fork of Elkhorn, and pond, at Ewing, Nebr.
      Ponds and Norfolk Creek at Norfolk, Nebr.
  Kansas River:
    Big Blue River at Seward and Crete, Nebr.
      Lincoln Creek at York and Seward.
      Beaver Creek at York, Nebr.

The Missouri River itself was examined at Chamberlain, S. Dak., where the stream is divided into two channels by an island, the west channel being 1,200 feet wide and the east 1,436 feet. At the time of the visit the water was higher than usual, "the June rise," as the people call it, and the current was swift, in some places averaging 3 feet per second. Owing to the high water it was impossible to do successful seining, although we attempted it at the north end of the island. As is usually the case with this river, the water was exceedingly muddy. At places the recently deposited silt was so deep that it was dangerous to attempt to wade in the water over it. Where the water had receded enough to allow a light crust to form on top of the mud it was possible to stand and shake the whole mass for a distance of 10 feet or more in all directions. The Missouri was also examined at Running Water, opposite Niobrara, but no specimens were obtained.

The larger and more important river fishes, such as sturgeon, cat, and buffalo are said to be abundant in this portion of the river and to furnish a considerable food supply.

Tongue River rises in the Big Horn Mountains west of Sheridan, Wyo., flows northeast, and empties into the Yellowstone River in southeastern Montana. We examined the Tongue River at the mouth of the canyon where it leaves the mountains. At this place it is a very swiftly flowing stream, current 3½ feet per second, discharging about 127,200 gallons of water a minute. The bed of the stream is everywhere strewn with bowlders, which made it next to impossible to seine in it. Considerable pine timber is found along the banks, which are composed in most part of granite, enough having been disintegrated and collected in places to allow the growth of a scanty vegetation. The source of the water supply is the melting snow on the mountains, and since there is barely any limestone with which it can come in contact the water is very pure and soft. The temperature of the water in the canyon was 54°, air 90°. While our fishing was done under many unfavorable circumstances, we secured one fine specimen of mountain trout (*Salmo mykiss lewisii*) 20 inches long, a black-nosed dace (*Rhinichthys cataractæ dulcis*), and from a fisherman a specimen of whitefish (*Coregonus williamsoni cismontanus*). The whitefish is said to be quite common there. Many persons were seen along the river fishing for trout. Taking everything into consideration, it would certainly be hard to find a more ideal trout stream. Small parties have reported as many as 800 fish taken with hook and line in a few days. There is so much fishing done now in that region that most residents are of the opinion that if something is not done to stock the stream its fame as a fishing resort will soon be lost.

South Fork of Tongue River.—Not far from where the Tongue River leaves the canyon it is joined by a small stream from the south called the south fork of Tongue River. We fished it a few miles from its mouth on Mr. Dinwiddie's ranch. At this place it averaged 8 inches deep and 5 to 20 feet wide, with a current of 2 feet per second. The water was clear and pure and the bottom was covered with gravel and bowlders. We seined it very carefully and secured several specimens of *Pantosteus jordani*, several mountain trout, and a number of dace. The water was not cold, being 70°. The banks were lined with box-elders and a few low shrubs.

Big Goose Creek, a stream similar to Tongue River and one of its tributaries, flows from the mountains about 12 miles south of Tongue River. Big Goose Creek is a stream nearly as large as Tongue River, has a swift current, bottom covered with bowlders, and water clear and very pure. All the streams in this region have irrigation ditches connected with them, consequently the volume is much reduced outside the canyon. Goose Creek was fished in two places, at Beck's ranch about 3 miles from the mouth of the canyon, and at Sheridan. At the former place we took several mountain trout, one dace, and a sucker. At Sheridan we found the temperature of the water 62°, current 2 feet per second, stream 35 feet wide and ranging 2 to 5 feet deep. The bottom was gravelly, but in many places there were bowlders in addition. At this place we took one species of sucker and two species of minnows.

On Mr. Decker's ranch, about 10 miles northwest of Sheridan, we examined a small brook which was fed partially by springs. The largest spring we found discharged about 945 gallons per minute, and when this amount of water was flowing the temperature was 65°. The spring did not originate in any one place, but the water seemed to seep from the banks along the spring brook. We did not take any fish from either of these streams.

Little Goose Creek flows from the mountains some 7 or 8 miles south of Big Goose and is very much smaller than the latter. We did not fish in it, but found it a characteristic mountain stream similar to the other except in size. At the town of Bighorn we visited an artificial fish pond whose outlet is Little Goose Creek. The pond was fed by a spring whose temperature was 51°. The temperature of the water at the surface in the pond was 72°. At one edge of the pond there were considerable algæ and a very great amount of white water-crowfoot (*Batrachium trichophyllum*). The owner of the pond was trying to cultivate trout, but had not been successful. From appearances it is possible that black bass would do much better than trout. From the overflow stream we took two species of minnows and one species of sucker.

The streams about Sheridan are the finest of any that we visited in Wyoming, and were the most numerous for the region over which they were distributed. They are nearly all fed by melting snow, and since the snow does not entirely leave during the year, they never go dry. They are all filled with bowlders and the currents of all were swift. Big Goose and Tongue rivers are the longest, and have probably the most picturesque canyons.

Powder River was fished at Arvada, a watering station on the Burlington and Missouri road. The bed of the river at this place was 250 feet wide, but the water, simply running in a few shallow channels, did not fill it. At no place was the water more than 2½ feet deep. It was milky in color and strongly alkaline. The current was about 2 feet per second. We took five species of minnows, two species of suckers, and one catfish (*Noturus flavus*). The channel cat was reported by fishermen. The temperature of the water was 75°, air 90°. The country is very poor, there being but little vegetation except buffalo grass and sage brush. A few cottonwood trees grow on the river banks.

Clear Creek, a tributary of the Powder River, rises in the Bighorn Mountains and flows northeast until it joins the river about 15 miles south of the northern boundary line of the State. Mr. Rutter, of our party, examined this at the small station of Clermont. The depth of the water varied from 4 inches to 6 feet, and the width from 15 to 40 feet, with a very sluggish current. Temperature of water, 67.5°; air, 72°. A spring near by registered 54.5°. The bottom was covered with sand, pebbles, and large rocks, and the water was clear. There was very little woody vegetation along the banks. The following fishes were taken: Redhorse sucker (*Moxostoma aureolum*), 5¼ inches long; *Pantosteus jordani*, 12½ inches long; wall-eyed pike (*Stizostedion vitreum*); catfish (*Ictalurus punctatus*); also a number of minnows.

Belle Fourche River was examined at the little town of Belle Fourche, where it is a stream of some size, except during dry weather. The water is fairly pure, and a good many fishes, chiefly suckers, minnows, and catfishes, are found here. We also examined the Redwater Creek and a small creek called Middle Creek at this place.

Redwater Creek was examined 14 miles northwest of Spearfish, where it is a stream 30 feet wide, 2 feet deep, and discharged, when we were there, about 27,000 gallons of water per minute. The water was clear at this time, but ordinarily it contains red clay in suspension, and this gives the name to the stream. We fished it carefully, and took *Notropis blennius*, *Rhinichthys cataractæ dulcis*, *Pantosteus jordani*, *Catostomus commersonii*, *Platygobio gracilis*, and *Semotilus atromaculatus*. Near this stream is Cox Lake, which contains 4 acres or more, and whose depth we could not measure on account of not having a boat. The shores were grown up with *Chara*, which had become so incrusted with calcareous deposits that it would hold a person's weight, but when you ventured too far you would break through and sink to your waist. The outlet to the lake was in the same condition, and this hindered us very much in seining. We secured from the lake, however, two species of fish, *Rhinichthys cataractæ dulcis* and *Leuciscus neogæus*, the latter being very abundant. The outlet of this lake, measured just below the lake, October 8, was 14 feet wide, 16 inches deep, and flowed 2 feet per second. The temperature of the water was 58°.

About 3 miles west of Cox Lake is Montana Lake, which contains 5 acres or more, with shores filled with *Chara* similar to Cox Lake, but, in addition, other vegetation. We found it impossible to seine, but by getting into an old boat we dipped out a few examples of *Leuciscus neogæus*. This fish swarmed by thousands around the mouth of a little spring that helped to feed the lake. We saw no other fish, but were told that suckers had been taken from it. The owner was contemplating stocking it with carp. The lake has an outlet, but at the time of our visit there was no overflow water.

Spearfish Creek.—This is by far the most picturesque of all the streams of the Black Hills seen by us. It has its source on the limestone divide between Crook Tower and Custer Peak, and after cutting a rough and interesting canyon through a belt of quartzite, shale, and igneous rocks, enters the limestone formation encircling the Hills, and unites its waters with those of Redwater Creek not far from Belle Fourche. We examined Spearfish Creek at the town of Spearfish, where it was 30 feet wide, 1 foot or more deep, and with a swift current. The temperature was 68° in one place and 70° in another, August 3. On October 7, at 11 a. m., it was 45° when the air was 64°. The bottom was gravelly and there was considerable vegetation along the banks. From it we took *Salvelinus fontinalis* (planted), *Pantosteus jordani*, and *Rhinichthys cataractæ dulcis*. The stream is a very fine one, indeed. The bulk of its water comes fresh from the hills, but even at Spearfish there are some fine springs. One in particular had a temperature of 52° and discharged 2,250 gallons per minute. The gentleman who owned it had a number of brook trout in a small pool formed by the spring. The bottom is in most places moderately coarse gravel of sandstone, chert, and quartz. There is but little vegetation except in the deeper holes, where there is some *Chara* and where the bottom is of stiff white clay. The banks are from 1 to 5 feet high in the little valley. The immediate banks are in most places pretty well covered with a growth of cottonwood, ash, elm, oak, etc. Further back and on the hills were a few pines.

About 12 miles above the town of Spearfish are Spearfish Falls, where the stream descends several feet in a series of very beautiful cascades. Below these falls 5 or 6 miles are two considerable and picturesque rapids; the more important one, known as Dickson Rapids, is about 2,200 feet long and falls 96 feet in that distance. Just above the town are several important springs. One of these, which may be designated as the upper spring, flows about 375 gallons per minute and has a temperature of 49° to 50°. The outlet of this spring soon receives the water from a number of smaller springs and the total flow amounts to about 1,100 gallons. Above the mill some distance from the town is Kroll's Spring, which has a temperature of 47° and flows about 500 gallons. A little further up is the Randall Spring, with a temperature of 47° and flowing about 800 gallons per minute. If fish-cultural work should ever be undertaken at any place in the Black Hills, the most satisfactory natural conditions could probably be found here.

Crow Creek.—This was visited at Gammon's ranch, not far from Beulah. It is a small, sluggish stream, excessively full of suckers and minnows.

Whitewood Creek, at Deadwood, is ruined by the tailings from the numerous stamp mills. No fish are now found in it, but in pools along the creek we found many young suckers.

Chicken Creek is a small stream rising north of Crow Peak and after flowing north about 4 miles empties into Redwater Creek near Gammon's ranch. It is a small stream that has cut out a narrow channel 6 to 10 feet deep in the loose soil through which it flows. The bottom is very muddy in most places. Average width near Gammon's ranch 2 feet, depth 10 inches, current 1⅓ feet per second, temperature, October 8, 57°.

Sand Creek rises about 8 miles southwest of Beulah, Wyo., and flows northeast, joining the Redwater a few rods below Beulah. The bed of this creek is of coarse gravel, the banks are 1 to 15 feet high and are composed chiefly of very red clay. Along the banks are a few willows and cottonwoods. Near Beulah the stream measured 17 feet wide, 14 inches deep, and flowed nearly 4 feet per second. The temperature at 3.30 p. m., October 8, was 55°. No vegetation was seen in the stream except in the quiet water above a dam.

The *South Fork* of the *Cheyenne River* rises in east-central Wyoming, flows east through southwestern South Dakota until it joins the North Fork, or Belle Fourche, then northeast and joins the Missouri. This river was examined at Cheyenne Falls, October 17, 1892, and again July 28, 1893; and at Edgemont, October 19, 1892, and again July 27, 1893. Measured at the ford, just below the mouth of Fall River, October 17, Cheyenne River was 100 feet wide, 2 feet deep, and flowed 3⅓ feet per second. There had been recent rains and there was a much larger volume of water than usual. At Cheyenne Falls the river forms two separate falls, the upper and the lower, the distance between them being about 250 feet. These falls are formed by ledges extending obliquely across the river, and the vertical descent in each is about 10 feet. At the time of our visit, in October, considerable water was flowing over, on account of recent rains. The ledges are quite irregular and the water pours over at several disconnected places. The temperature October 17 was 47° at noon, when the air was 58°. On July 28 the water temperature was 75°. The water was very muddy and strongly alkaline. All the fishes obtained were so bleached as to be almost colorless. The characteristic fishes of this place were found to be *Noturus flavus*, *Moxostoma*, *Hybognathus*, and *Platygobio*.

At Edgemont, on October 19, this river was less than 20 feet wide and 5 inches deep, with a current of 1 foot per second. At 9 a. m., when the air was 49°, the water was 39°. The channel of the stream here, as elsewhere, is much wider than the stream itself. The bed is of sand and yellowish or whitish clay, and is constantly shifting. The changes that had taken place since 1892 were very noticeable. The banks of Cheyenne River are usually of pale-colored clay and are ordinarily but a few feet high. The flood-plain is here from a few rods to a mile in width. The region through which the stream flows is a prairie country with soil so charged with alkali as to be, in many places, almost without vegetation; indeed, a considerable portion of the Mauvaises Terres or Bad Lands lies in the drainage basin of the Cheyenne. This soil erodes with great ease, and, as a consequence, the water of the river is never clear. The only trees seen along the Cheyenne were a few cottonwoods. At Edgemont a small stream known as Cottonwood Creek flows into the Cheyenne. This is a muddy creek with only a few species of fishes, chief among which are *Platygobio gracilis*, *Hybognathus nuchale evansi*, and *Catostomus griseus*. The temperature of the water was 46° at noon, October 19, when the air was 59°.

Fall River.—This is a considerable stream, formed just above the town of Hot Springs by the union of Warm Creek and Cold Creek, the first of these deriving its water from numerous warm or hot springs. The larger warm springs at the town pour their waters into the creek there and the water is quite warm for some distance below. On October 18, when the air was 50° at noon, the water was 65° at a point 2 miles below the town. At the town the temperature of the water in the creek was 80°. This water is strongly impregnated with lime, and as a result the *Chara* which fills the stream grows very rank and forms thick deposits along the banks and in the bed of the stream. In places it has become quite hard, but upon attempting to walk over it one will frequently break through the crust and sink into the soft mud beneath. Besides the *Chara*, there are several species of algæ growing luxuriantly, and in this mass of vegetation the smaller crustaceans and other minute forms of animal life abound. The only species of fish which we found living in this warm water was the western dace (*Rhinichthys cataractæ dulcis*).

Hat Creek.—This stream was examined October 21 at Ardmore, S. Dak., about 1½ miles from the Nebraska line. It is a small alkali stream about 10 feet wide, 6 inches in average depth, and flowing about a foot in 2 seconds. At the time examined it was flowing more water and was muddier than usual, owing to recent rains. The bed is in most places of very soft mud; the banks are rather high and of blue or white adobe clay, which is sticky in the extreme when wet. There are occasional deeper holes in the stream, where the characteristic fishes of the region are found in considerable numbers. This stream is subject to sudden floods and dries up to mere isolated pools in the summer and early fall. The headwaters of the stream are said not to dry up so much as does the lower course. The country is prairie, easily eroded, and the water is always muddy or milky in appearance. At 5 p. m., when the temperature of the air was 52°, that of the water was 46°. The principal fishes found here were the flatheaded minnow and the silvery minnow (*Hybognathus nuchale evansi*), both of which were abundant. There were also a few western dace and suckers.

Beaver Creek rises in the western part of the Black Hills, flows south and empties into the South Fork of the Cheyenne River. We examined it near the L. A. K. ranch, 5 miles from Newcastle, Wyo., October 20, and again on July 26, about 6 miles east of Newcastle. At the first place we found it to be a clear, cold, swift creek about 7 feet wide, 1½ feet deep, with a 4-foot current, and a temperature at 10 a. m. of 43°, when the air was 51°. The bottom was of large gravel in most places, mud-coated rocks with much *Chara*, and other aquatic vegetation in other places where the water was less swift. The banks were usually of mud, 1 to 5 feet high, and were covered with a good growth of willows, box-elders, buffalo berry, and cottonwood. The hills near by were covered with pines. No fish were seen here. At the place where it was visited July 26 it was about 10 feet wide and 2 feet deep, with a current flowing 2½ feet per second. The temperature of the water at this time was 58°, while that in some of the springs was 54°. One set of springs on Mr. Hanson's ranch near by discharges about 700 gallons per minute, while another furnishes about 300 gallons per minute.

We saw a number of fine brook trout and rainbow trout in the irrigating ditches on Mr. Hanson's ranch. These all seemed to be doing well, but Mr. Hanson did not think that they increased in numbers very rapidly. The water was thoroughly saturated with gypsum. From the brook we took one species of sucker and two species of minnows.

Salt Creek is a very small western tributary of Beaver Creek. We saw it east of Newcastle, Wyo., where it contained very little running water and no fish. The water was strongly saturated with common salt. On October 20, this creek was about 7 feet wide, 3 inches deep, and flowed about 9 inches per second. The temperature was 45° at 11 a. m., when the air was 52°.

Beaver Creek.—At Buffalo Gap, a small station on the Elkhorn Road east of Hot Springs, we examined a little stream called Beaver Creek. In places it was 10 feet wide and 3 feet deep, while at others it was narrowed down to a small, shallow ripple. The water contained much vegetation, principally algæ and *Chara*. The latter was incrusted with calcareous deposits from the water. We found suckers very abundant and took two species (*Pantosteus jordani* and *Catostomus commersonii*), besides three species of minnows and one species of catfish (*Noturus flavus*).

French Creek is a small stream which rises in the central part of the Black Hills and flows east to the south fork of the Cheyenne. We examined it at Custer, S. Dak. There is no creek worth mentioning, and at the time of our visit it consisted of a few stagnant pools. We took *Semotilus atromaculatus*, *Rhinichthys cataractæ dulcis*, *Pimephales promelas*, *Pantosteus jordani*, and *Catostomus commersonii*, all thickly covered with trematodes. Some of the fish were about dead from the effects of these parasites. Near Custer there is an interesting artificial lake, but it contained no fish.

Spring Creek, a western tributary of the Cheyenne, was examined at Hill City, S. Dak. It was not over 10 feet wide and contained very little running water. From it we took *Pantosteus jordani*, *Catostomus commersonii*, *Rhinichthys cataractæ dulcis*, and *Semotilus atromaculatus*.

Crow Creek rises northeast of Chamberlain, S. Dak., and, flowing west, empties into the Missouri some 16 miles south of the above-named town. The stream ranges from 15 to 20 feet wide, and from 6 inches to 3 feet deep. The current was moderate and the banks of the stream were covered with trees and shrubs. The quiet water contained some plant life, but much of it was free from this, and the creek bed was covered with gravel and bowlders. From the creek we took three species of suckers, a wall-eyed pike, a mooneye, a few darters, and several species of minnows. The next day after we were there a fisherman caught an 18-inch gar in the same creek, which we examined.

Smith Creek flows into Crow Creek near where we fished the latter. It is a small stream, with very little running water, but a few pools range from 2 to 4 feet deep and from 8 to 30 feet wide. These pools contain stagnant water, great mats of aquatic vegetation, and the bottom is covered with soft mud ranging in depth from 1 to 2 feet. Much marsh gas bubbled up through the water when the mud was disturbed. In some places a few trees and shrubs lined the banks.

It is worthy of notice that all these streams, as was the case with those at Mitchell and Scotland, are made up of more or less disconnected pools.

White River rises in the northwestern county of Nebraska, flows through southwestern South Dakota, and empties into the Missouri River near Chamberlain, S. Dak. In its entire course this river flows through a dry, barren, and worthless country, some of it—the Bad Lands—being among the most desolate regions found in the United States. The soil and the water are of such a nature as will support but few forms of plant life and the condition of the water limits the forms of animal life. The so-called alkali is found in the water, even up to the very head of the river, in small quantities. We examined White River at Crawford and Chadron, Nebr., and at Chamberlain, S. Dak. At Crawford the stream was 15 feet wide, 1½ feet deep, and discharged 9,450 gallons per minute. The water was clear, and in places there was considerable plant life. The banks had at this place a few bushes. We fished it here and took at least four species of fishes. At Chadron the stream was about the same size as at Crawford, and flowed through a similar country, but the water was more milky in color, which is a characteristic of the water of this region. There was no visible vegetation in the water here, but the banks supported a few small trees and shrubs. The fishes were not numerous, and all were white in color, bleached by the action of the alkaline water. Near Chamberlain, at the mouth of the river, the stream was 273 feet wide, averaged 10 inches deep, and discharged 153,500 gallons per minute. The banks supported but little vegetation, consisting of a few bushes; the bottom was gravelly in places, of quicksand in others, and in still others it was covered with a layer of fine mud. This fine mud was so near the same specific gravity as the water that where undisturbed it was held in suspension in great quantities. Water that appeared to be 6 inches deep was found to be 12, the lower part being completely filled with the fine mud particles. In the mouth of this river we found such species as *Leptops olivaris* and *Polyodon spathula*, which had run in from the Missouri. We were told that spoonbill cat as long as 5 feet and buffalo weighing 30 pounds or more are often caught here.

Chadron Creek is a small stream, some 15 miles long, which empties into White River 3 miles west of Chadron, Nebr. We fished it not far from the mouth, where it was 4 to 6 feet wide and 2 to 3 feet deep, with a very sluggish current. There was no vegetation along the banks except grass.

Lone Tree Creek, 20 miles in length, flows from the northwest and empties into White River, near the mouth of Chadron Creek. Near its mouth, where we examined it, the stream was 40 to 50 feet wide and from 4 to 8 feet deep. The banks below the surface of the water were almost perpendicular, and the water so deep that we could do but little seining. The water was muddy and the current very sluggish. While the creek seemed to discharge but little water, the portion examined was a continuous pool. The banks were bare, with the exception of a very few small shrubs and some grass.

Choteau Creek is a small creek flowing into the Missouri from the north, 15 miles west of Springfield, S. Dak. At the place examined it was 50 feet wide and ranged from 1 to 8 feet deep, but averaging about 3 feet. The bottom was covered with soft, black mud, 15 inches deep in places, which gave forth large quantities of marsh gas when stirred. The bank on one side was well wooded, some of the trees being quite large. The trees and shrubs noted were ash, cottonwood, box-elder, oak, elm, willow, sumac, and plum. The temperature of the water at noon June 27 was 73°.

Much algæ, *Potamogeton*, and other aquatic plant life were found in the water. We fished the stream in several places and took as many as 10 different species of fishes. Among the valuable fishes were the wall-eyed pike, bullhead, channel cat, black sucker, redhorse sucker, and buffalo. Several other species of less importance were taken.

Ponca Creek rises in the southern part of Tripp County, S. Dak., flows a little southeast, and empties into the Missouri River in the northwestern part of Knox County, Nebr. It is more than 100 miles long, flows through a prairie country, and at its mouth is 41 feet wide, 4 to 8 feet deep, with a sluggish current and, at the time examined, muddy water. The sluggish current, depth of the water, and its muddiness were in part due to backwater from the Missouri River. Only two species of fish were taken, *Hiodon alosoides* and *Hybognathus nuchale evansi*. Temperature of water 72°, air 70°. The banks of the stream were heavily wooded.

Niobrara River.—The Niobrara River rises in eastern Wyoming, flows east through northern Nebraska, and empties into the Missouri River at the northeastern boundary of Nebraska. At Marsland, the farthest western station made on it by us, the stream was 20 feet wide and 6 inches deep. The bottom was sandy, as is the case with the bottom at every station made. In some places this sand is very loose quicksand. The whole course of the river is through a dry, sandy country, known as the sand-hill region of Nebraska.

At Valentine, Nebr., the stream was 150 feet wide, 1 to 4 feet deep, and with a very swift current, 2½ feet per second, at least. We found it very difficult to seine, on account of the velocity of the current.

The temperature July 10 was 81½°. There was much quicksand in the bottom. The region at Valentine is a typical sand-hill country. Very little vegetation other than grass and small shrubs was found along the banks of the river. The water was clear and free from vegetation. Only a few cyprinoids were found here.

We fished the Niobrara again 15 miles north of Long Pine, Nebr., and found still more quicksand than at either Marsland or Valentine. The bed of the stream here was 800 feet wide. The current averaged about 3 feet per second, and the stream ranged in depth from 1 to 6 feet. The velocity and the quicksand bottom made it impossible to fish in some places. The banks of the river at this place are quite heavily timbered for a few rods on each side. The temperature of the water was 80°. Only minnows and a few suckers were found.

At Niobrara the Niobrara River is 1,000 feet wide, the water running in many small channels over the sandy bottom at the time examined, and averaging 10 inches in depth. The same characteristics that have been given above apply to the river here. A narrow timbered strip lines its banks, but the water is free from vegetation and is clear wherever running. A few rods from the river we fished a small pond and secured a few species of minnows. The pond was simply an old bend in the river that had been cut off by a change in the direction of the current. Some of the trees and shrubs of this region are cottonwood, elm, ash, cedar, two species of oak, wild cherry, willow, box-elder, grapevine, sumac, rose, poison ivy, *Euonymus*, prickly ash, elder, lead plant, and basswood.

Schlegel Creek is the tributary farthest up the Niobrara River which we examined. It is a small creek, 15 feet wide and 2 feet deep, which flows from the south and empties into the river about 4½ miles south of Valentine. Near the mouth the banks are broken and hilly and are covered with shrubs. The stream itself was dammed in many places by snags, which made seining very difficult. The bed of the creek was sandy. Fishermen reported that trout had been taken in this brook, and that it had been stocked up toward its head, where there are several springs. The temperature of the water was 71°.

Minnechaduza Creek flows from the west and empties into the north side of the Niobrara River at Valentine. It is a fine stream, averaging 20 feet wide, 1 foot deep, and having a velocity of 3 feet per second. The bottom is covered with rocks and gravel, and several springs flow into it in the vicinity of Valentine. The banks are lined with various kinds of trees and shrubs, and the water was free from vegetable life of any importance. There are several fine small springs near Valentine. We took sunfish from this creek, the farthest west they have been recorded along the Niobrara River. Below the milldam, at Valentine, in Minnechaduza Creek there was a great abundance of fish, principally minnows, all trying, no doubt, to go upstream. The temperature of the water below the dam was 76°. A little spring running into the creek at this place had a temperature of 54°.

Long Pine Creek, which is something more than 20 miles in length, rises in the east-central part of Brown County, Nebr., and flows directly north, emptying into the Niobrara River. This stream is a characteristic spring creek. Near the town of Long Pine there are many fine springs, some of them discharging large quantities of water. The bed is sandy and the water clear and almost entirely free from lime and other impurities. Seven miles south of Long Pine, near the head of the creek, the stream was 15 feet wide and 1 to 3 feet deep, with a swift current. Temperature 65° At various places between the head of this creek and the town of Long Pine are numerous springs; indeed, the creek is fed almost entirely by springs. About 4 miles above the town is a spring creek about 2 feet wide and 5 inches deep, possessing a 2-foot current and a temperature of 53° to 55°. This was the temperature of all the springs along this creek except those at the extreme head. In them the water was more stagnant and warmer by several degrees. The temperature of the main stream was found to range from 61° to 75° near noon, July 5.

We secured some sunfish, a few sticklebacks, and some minnows. We fished the creek 10 miles north of Long Pine, where we found it 35 to 40 feet wide, 2 to 4 feet deep, and a current averaging 3 feet per second. We attempted to fish below a dam, but found it difficult on account of the swift current and the numerous snags. The banks along this portion of the creek were covered with small trees, principally ash. The temperature of the water was 79°. Half a mile above the dam Bone Creek enters Long Pine Creek from the west. It is small, 10 feet wide, 8 inches deep, and has a rather swift current. Its bottom is sandy and the water clear, with a temperature of 79°.

Between the mouth of Bone Creek and the dam in Long Pine Creek there are some ponds that have been made by a change of channel of Long Pine Creek. When we visited them there was no connection between them and the creek, and since Long Pine Creek depends upon springs and does not have high water, the ponds have not been connected with the stream for some time. The water in the ponds was almost completely filled with aquatic vegetation, ranged from 2 to 4 feet in depth, and had a temperature of 77°. From these ponds we took sunfish (*Apomotis cyanellus*), darters, and minnows.

Of the many streams of Nebraska which we have examined, Long Pine Creek is by far the most beautiful and best adapted to trout. In volume of water, clearness, purity, and low temperature, it surpasses any other stream in the State, of which we know. Natural food of the trout is found in abundance; besides insect larvæ, the smaller crustaceans and mollusks abound, and several species of minnows are abundant as to individuals and doubtless furnish excellent food to better fishes.

The numerous beautiful groves of hardwood trees and shrubs covering the little park-like tracts of bottom land found along the stream, or scattered over the hillsides and in the narrow flanking canyons, make this region one of surprising beauty and picturesqueness. The trout that were planted in this creek a few years ago have done unusually well, and now Long Pine Creek affords excellent fishing to the anglers of Nebraska and neighboring States.

Verdigris River rises in the northwest corner of Antelope County, Nebr., flows northeast and then north, and empties into the Niobrara River about 5 miles from its mouth. We examined it at the town of Verdigris, where the stream below the mill-dam was 58 feet wide and 1 foot deep, with a current of 2½ feet per second. The temperature of the air was 77° and that of the water 67°. The bottom was covered with rather large rocks and the water was clear.

The small unnamed creek which emptied into Verdigris River at Verdigris had a very little muddy water standing in pools and consequently very few fish were found in it.

Emanuel Creek was fished 3 miles northwest of Springfield, S. Dak. It is quite a small stream, a tributary of the Missouri, with very muddy water which was not more than 3 feet deep at any place, and ranged from 4 to 30 feet wide. There were some bushes on the banks, principally ash, and a great amount of algæ in the bed of the stream.

Bazile or Creighton Creek is small, rises in northern Nebraska, flows north, and empties into the Missouri about 5 miles east of the town of Niobrara. The current is swift, flowing a stream 30 to 40 feet wide and 18 inches deep over a fine gravelly bottom. Shrubs and small trees, principally ash, are found along the banks. As many as 8 species of fishes were taken, but none in great abundance. A pond which has connection with Bazile Creek was fished at Creighton, Nebr. This pond is at the edge of the town and contains 10 or 15 acres. On one side there were a few shrubs, but, for the most part, the banks were grassy. The water was deep except at the edges and here it was almost completely filled with the algæ and other aquatic vegetation. In some places it was almost impossible to land the seine on account of this mass of plant life. Twelve species of fish, at least, were taken here, among them *Notropis topeka*, *Notropis cayuga*, *Apomotis cyanellus*, *Etheostoma iowæ*, and *Fundulus sciadicus*.

Spring Creek, a very small tributary of Bazile Creek, was fished at Bazile Mills. This brook was interesting on account of the fact that the water was cold, 54° at 8 a. m., when the air was 68°, and that trout had been planted there and were doing well. The only fish taken were the trout and *Catostomus commersonii.* The water is clear and pure; the bottom is of sand and gravel. Though this stream is scarcely more than a mile long, it is so well suited to trout that it affords excellent trout fishing and large catches are made in it every season.

Dakota or *James River* rises near the central part of North Dakota and flows a little southeast until it empties into the Missouri River on the southeastern boundary of South Dakota. The country through which it flows is comparatively level prairie, hence the course of the river, while in general straight, has very many crooks and bends which make it many times longer than it would otherwise be. The current is sluggish and as a result the water becomes somewhat stagnant in summer and contains much aquatic vegetation and lower forms of aquatic life peculiar to such conditions. On account of the loose prairie soil through which the river flows, the water is muddy, even when only slightly disturbed.

The tributaries to the Dakota River are small and short, consequently the region drained, while long from north to south, is not wide.

We examined the Dakota River at Mitchell, S. Dak., about 80 miles from its mouth, where we found it 110 feet wide and averaging 6¼ feet in depth, with a current having a velocity of 1 foot per second, thus discharging about 300,000 gallons per minute. Owing to rains in the Dakota Valley a few days previous to our examination, the water was probably 1 foot higher than usual at this time of year, June 19. The temperature at this time was 74°. The nature of the stream shows at once its suitability for suckers, catfish, sunfish, and yellow perch, which is further proved by our taking numerous specimens of each, either in the river itself or from the mouths of creeks which empty into the river. The banks of the stream are covered with low shrubs and a few trees, principally ash.

Rock Creek flows from the northeast and enters the Dakota River near Mitchell. It averages 30 feet wide and 2½ feet deep, although it is very irregular, being made up apparently of a series of holes connected by a small stream of running water, probably formed partly by erosion and partly by glacial action. The same may be said of Enemy and Firesteel creeks. We examined Rock Creek near its mouth, where the banks are covered with small bushes, principally ash and willow, and took specimens of pike (*Lucius lucius*), yellow perch, sunfish, catfish, darters, and a few minnows. The water was clear, and contained so much algæ that seining was difficult in places. Much of the bottom was covered with bowlders. Crawfish, frogs, and toads were abundant.

Firesteel Creek flows from the northwest and empties into the Dakota River about 2 miles below the mouth of Rock Creek. It is, like that creek, tortuous and sluggish, and is about 30 feet wide, 4 feet deep, and has a current of ½ foot per second. The temperature was 79°. The bottom was covered with mud, the water contained much algæ and other aquatic vegetation, and about the same species of fish were taken here as in Rock Creek.

Enemy Creek, which empties into the Dakota River 6 miles southeast of Mitchell, is a small stream made up of connected pools and just enough running water through the narrow connecting channels to allow small fish to pass from one pool to another. The bottom in that part examined was gravelly, and the water did not contain as much plant life as was found in the others. We did not find as great a variety of fishes here as in the other streams, the principal species being suckers, yellow perch, sunfish, and catfish.

Prairie Creek, a western tributary of the Dakota River, was examined about 4 miles east of Scotland, S. Dak. The creek was nearly dry, with the exception of a few small pools, but these were deep and contained so much plant life that seining was difficult. No trees or shrubs were found on the banks. The country about Scotland is of the same general character as that around Mitchell. The aquatic animals that we found, other than fish, were crawfish, clams, and frogs.

Platte River.—The North Fork of the Platte River rises in western Wyoming, and flows a little southeast through Wyoming and Nebraska until it joins the South Fork in the southwestern part of the latter State. Platte River proper, formed by the joining of the two forks, flows east through Nebraska and empties into Missouri River. The point nearest its head, at which the North Fork was examined, was Casper, Wyo. The stream at this place varied from 150 to 200 feet in width, has a very swift current, and was in some places from 6 to 7 feet deep. The temperature was 66½°, and the water was clear. Along the banks were a few scattered cottonwood, willow, and box-elder trees.

We next examined the North Platte at Glenrock, Wyo., where we found the temperature, current, size, and general appearance about the same as at Casper.

At Douglas, Wyo., we found the North Platte the same swift, sandy stream, and not any larger than before, owing to the dry region through which it flows.

Our next station was on the Platte River proper, at Grand Island. At the time of our visit, August 11, the water was very low and ran in several small and shallow channels, the depth at no place being more than 2½ feet, consequently only very small fish could live in it. The temperature of the water was 79°. Several minnows were taken, as well as young wall-eyed pike, yellow catfish, a buffalo, a moon-eye, and a sturgeon.

On October 23, 1892, we examined the Platte at South Bend, Nebr., but made no collections except specimens of *Etheostoma iowæ* from the State fish-hatchery waters near South Bend, where this small darter is very abundant.

Garden Creek, a little mountain stream discharging 250 gallons of water per minute at the mouth of the canyon, is the tributary farthest up the North Platte that we examined. In fact, it is a tributary only during high water, for during the dry season all the water is used in irrigation and not a drop of it reaches the river. At the mouth of the canyon is a pretty little fall, 70 feet in height. Only two species of fish were found, *Semotilus* and *Rhinichthys*. Trout would probably live in this stream, since the temperature in the canyon was 53½°.

Deer Creek rises in the Laramie Mountains and flows northeast into the North Platte at Glenrock, Wyo. It is a small stream, not over 15 feet in width at its mouth at the time examined, but this was during the dry season and much of the water was used above for irrigating purposes. The stream did not average more than 6 inches deep at the mouth; the water was clear, and the temperature 61½°.

Little Deer Creek, a tributary of Deer Creek, flows out of a canyon in the Laramie Mountains on the ranch of Major Wolcott, about 7 miles south of Glenrock. It is a very pretty little mountain stream, discharging about 1,600 gallons of water per minute at the mouth of the canyon and registering a temperature of 50°.

Wood River flows first in a southeasterly direction, until it gets within 4 or 5 miles of the Platte, when it takes a northwesterly course, following alongside the latter river until it joins it about 10 miles east of Grand Island. We fished it at Grand Island, where it was not more than 15 feet wide, the water muddy, and standing principally in holes. The banks were lined with small trees. The fishes taken were *Hybognathus nuchale evansi*, *Notropis lutrensis*, *Notropis blennius*, *Catostomus commersonii*, and *Carpiodes carpio.*

Middle Loup River rises in Cherry County, in northwestern Nebraska, and joins the South Loup about the center of the State. We examined it at Dunning, where it was 200 to 250 feet wide, averaged 6 inches deep, and had a current of 2 feet per second, thus discharging 112,500 gallons per minute. The bottom was sandy and the water clear, with a temperature of 65°. From it we took *Platygobio gracilis*, *Hybopsis æstivalis*, *Rhinichthys cataractæ dulcis*, *Notropis lutrensis*, *Noturus flavus*, *Hybognathus nuchale evansi*, *Fundulus sciadicus*, *Notropis blennius*, and *Carpiodes carpio.* The country about Dunning is prairie with but a few small bushes along the banks of the river.

Dismal River, a tributary which joins the Middle Loup at Dunning, was also examined. It is 100 feet wide, averages 10 inches deep, and has a current of 2 feet per second, thus discharging 75,000 gallons per minute. Like the Loup River, the water was clear and the bottom sandy. In two or three shallow ponds near by, containing much *Lemna* and other aquatic vegetation, we found the green sunfish (*Apomotis cyanellus*). This was the farthest west in central Nebraska that we took sunfish. From the ponds and river we took, also, *Pimephales promelas*, *Notropis lutrensis*, *Catostomus commersonii*, and *Fundulus sciadicus.* The temperature of the water was 66°.

South Loup and the mouth of *Mud Creek* were examined, October 22 and August 10, at Ravenna, where they join. The South Loup River here is 150 feet wide, but the water at the times of our visits was very shallow and flowed in several channels over the sandy bottom. Mud Creek is a very sluggish stream, being 40 to 60 feet wide and from 2 to

8 feet deep. The bottom is covered with a thick deposit of black mud, and at the edge of the water there was considerable vegetation. The temperature October 22 was 46° when the air was 62°. Owing to a milldam in the stream at the town, the fish from the river have free access to only about a mile of Mud Creek. The water was considerably colder than that in Loup River, and this, with the great amount of food matter and the quietness and depth of the water, accounted for the abundance of fishes found in it. No doubt many of them had been driven in here on account of low water in Loup River.

We examined Mud Creek from the railroad bridge down to its mouth, a distance of nearly a mile, and then seined the river at several places near the mouth of Mud Creek. The abundance of fishes here, both as to species and individuals, was unusually great. We obtained not fewer than 15 species, among which were the following:

Moxostoma aureolum.	Carpiodes velifer.	Platygobio gracilis.
Notropis jejunus.	Notropis lutrensis.	Stizostedion vitreum.
Hiodon alosoides.	Fundulus sciadicus.	Hybognathus nuchale evansi.
Apomotis cyanellus.	Hybopsis æstivalis.	Micropterus salmoides (planted).
Ictalurus punctatus.	Hybopsis storerianus.	Pimephales promelas.

The black bass had been planted and seemed to be doing well. We saw two which a fisherman had taken, that were each 12 inches long. There is certainly much need of a fishway in Mud Creek, so that fish may pass to the water above the dam. The banks of both streams are well covered with trees. In Mud Creek 2 species of turtles were seen, *Chelydra serpentina* and *Aspidonectes spinifer*.

Lakes Carp and George.—Seventeen miles south and a little west of Long Pine, Nebr., lie two isolated lakes of considerable size, and a few small ones. There is no record of any outlet for these lakes, but the slope is toward the south, and since there is but one neighboring river, the Calamus, in this direction, it is likely that these lakes were once drained by that stream.

Carp Lake contains about 160 acres and ranges in depth from 3 to 7 feet. There is open water in the center, but the edges of the lake are grown up with various species of aquatic plants. We seined the lake on the south side and secured a large number of *Ameiurus melas* and *Apomotis cyanellus*. At one haul we took 65 specimens of *Ameiurus*, 4 of them ranging from 11 to 13 inches in length. No other species of fish were seen, and Mr. Blodgett, who lives near the lake, said that no native fish had ever been taken there. The catfish and sunfish he planted in the lake himself. In 1887 he planted 2,000 young carp, but never saw any afterwards. In 1888 he planted 512 sunfish and 6 bullheads, and it was from these that the fish we caught had grown. We also tried catching sunfish with a hook and were very successful. Those we caught were not very large, but Mr. Blodgett said he had caught some that measured 8 inches in length.

Lake George lies about 3 miles southeast of Carp Lake, covers 200 acres, and is from 3 to 7 feet deep. It has more open water than Carp

Lake and not so much vegetation around the shores. We made several hauls in it and secured nothing but *Apomotis cyanellus*, all young, many of them but one-half inch long. Eight carp were planted in this lake at the same time the 2,000 were put in Carp Lake, but they have never been seen since. A few sunfish and a few bullheads were planted in this lake at the time those were put in Carp Lake. Both lakes abound in fish food, and the conditions are very favorable for the black bass. The water in both lakes is quite pure and the temperature at the time of our visit was 70°.

A little lake of about 20 acres, north of Carp Lake, was visited, but no fish were found. The water was not more than 1 foot deep and was very warm. In one haul of the seine we took a large number of tadpoles and about 150 larval salamanders.

In addition to the lakes mentioned, there are other small ponds and marshes throughout the region, but all are shallow and contain no fish.

Elkhorn River rises in the central part of Rock County, in northern Nebraska, flows southeast and finally south, and empties into Platte River about 30 miles above its mouth. We examined it at Ewing and at Norfolk, Nebr. At Ewing the stream was about 100 feet wide and 6 inches to 5 feet deep, averaging 18 inches, and the current was moderate. The bottom was sandy in most places, but occasionally there was a bunch of aquatic vegetation, in which we found sunfish (*Apomotis cyanellus*) and black bass (*Micropterus salmoides*). We also took two species of suckers, a catfish, two darters, and several species of minnows. Near the river are some old bayous that are probably connected with the river during high water, but at the time of our visit were isolated. These contain thousands of young black bass, most of them about one-fourth inch long.

Elkhorn River, 2 miles southeast of Norfolk Junction, is 150 feet wide, averages 2 feet in depth, and has a swift current. The bottom is sandy and trees line the south bank. Among the fish taken here were the pickerel (*Lucius lucius*), large-mouthed black bass, redhorse sucker, a darter, and a number of minnows.

Near the river are some bayous that furnish excellent fishing for the people of Norfolk, the principal fish being black bass and sunfish. There are two of these bayous located in a nicely wooded grove. The water was quiet and in the shallow places completely matted with aquatic vegetation. From the banks the sunfish could be seen quietly swimming around looking for food, while farther along, perhaps, numerous fish were jumping out of the water to catch the unwary insects that had ventured too near the surface. Many frogs were seen along the banks and the aquatic vegetation was well loaded with numerous forms of animal life. One noticeable fact was the scarcity of minnows, yet this is not remarkable when we consider the abundance of bass.

South Fork of Elkhorn River.—The tributary of Elkhorn River nearest its head, which we examined, was the south fork of the Elkhorn at Ewing, Nebr. The stream was 30 feet wide, 1 foot deep, current swift, and water with a temperature of 79½°. The bottom was sandy, the water clear, and there were no trees on the banks, only a few willows. We secured two species of minnows, one darter, and one sucker. From a small pond near by we took a few catfish (*Ameiurus melas*).

Norfolk Creek flows into Elkhorn River about 3 miles southeast of Norfolk Junction, and near its mouth averages 35 feet wide and 1¾ feet deep, but a few holes were as much as 6 feet. The current was rather sluggish and the water somewhat muddy. The banks were well wooded in places with cottonwood, box-elder, willow, and ash. From this stream we secured at least five species of minnows, two species of darters, one species of black bass, two species of catfish, and a red-horse sucker.

Big Blue River rises in southeastern Nebraska, flows south, and empties into the Kansas River. We fished the Big Blue at Seward, Nebr., where it was 30 feet wide, 2 to 4 feet deep, and very muddy. From it we secured *Lepomis humilis*, *Ameiurus melas*, *Notropis lutrensis*, and *Pimephales promelas*. This stream was also examined at Crete in 1892, and by Mr. Rutter at Crete in 1891.

Lincoln Creek, a tributary of the Big Blue River, was 10 feet wide, 10 inches deep, had a current of 1 foot per second at York, was very muddy, and registered a temperature of 68°. From it we took the following species: *Noturus flavus*, *Pimephales promelas*, *Ameiurus melas*, *Notropis lutrensis*, and *Notropis blennius*.

At Seward, Nebr., Lincoln Creek was 40 to 50 feet wide, 4 to 6 feet deep, and very muddy. We found but one species of fish here, *Notropis lutrensis*. The place fished was just above a dam, consequently the water was much deeper than at other places.

Beaver Creek, a tributary of the Big Blue River, was fished at York, Nebr. We found it a little larger than Lincoln Creek at the same place, but the same kind of a stream, and with a temperature of 71°. We took from it *Ameiurus melas*, *Noturus flavus*, *Notropis lutrensis*, *Pimephales promelas*, *Notropis blennius*, and *Semotilus atromaculatus*.

HISTORICAL AND BIBLIOGRAPHICAL.

In the following pages we give the bibliography of the ichthyology of the Missouri River basin. We have meant to include all faunal lists and such other papers as throw light upon the geographic distribution of the species of fishes in the drainage basin of that river. The titles are arranged in chronologic order, thus enabling one to see at a glance the progress of ichthyological investigations in that region. Following the title of each paper will be found a brief statement of the character of the paper, and then a summary of its contents, including (1) the page upon which the species is mentioned, (2) the name under which recorded, (3) our identification of the nominal species, (4) the locality from which the specimens were obtained, and (5) the name of the collector. Whenever the character of the paper permits it, the summary is given in briefer form.

The first printed references to fishes of the Missouri River basin that have come under our notice are those by Lewis and Clark in the journal of their famous expedition to the mouth of the Columbia River in 1803–1806. The original edition of the history of this expedition was published in 1814.

In 1893 appeared the elegant and splendidly annotated new edition by Dr. Elliott Coues. In this edition all the fishes mentioned in the original journals and note books of the expedition are identified when the reference is sufficiently full.

The fishes mentioned are, as would be expected, those which they were able to catch for food, and we find the following noted with sufficient detail to render identification possible: *Ictalurus punctatus*, *Leptops olivaris* or *Ameiurus lacustris*, *Stizostedion canadense boreum*, *Moxostoma aureolum*, *Pantosteus jordani*, and *Salmo mykiss lewisi*.

The following are the more important notes on the fishes seen. The references are to the new edition of Lewis and Clark, in four volumes, by Dr. Elliott Coues (New York, 1893):

Vol. I, p. 54: "White catfish [*Ictalurus punctatus*], the eyes of which were small, and its tail resembling that of a dolphin"; Missouri River near mouth of Papillion Creek, near present site of Omaha.

Vol. I, p. 76: "August 16. * * * A party had gone out yesterday to the Maha Creek [and] a second went to-day. They made a kind of drag with small willows and bark, and swept the creek. The first company brought 318 fish, the second upward of 800, consisting of pike [probably *Lucius lucius*], bass [*Micropterus salmoides?*], fish resembling salmon trout, red-horse [*Moxostoma aureolum*], buffalo fish [*Ictiobus sp.?*], rock-fish, one flat-back, perch, catfish, a small species of perch called on the Ohio silver-fish, a shrimp of the same size, shape, and flavor of those about New Orleans and the lower part of the Mississippi. We also found very fat mussels." Few, if any, of these are certainly identifiable. This locality is in the present Dakota County, Nebraska, a little south of Dakota City. They called the place "Fishing Camp."

Vol. I, p. 88: "Some large catfish, nine that would together weigh 300 pounds." Nine miles below mouth of Bow Creek, Cedar County, Nebraska. These may have been *Leptops olivaris* or *Ameiurus lacustris*.

Vol. I, p. 320: "We have caught very few fish on this side of the Mandans, and these were the white catfish of two to five pounds"; Missouri River near mouth of Beauchamp Creek, Mont., longitude about 108° W.

Vol. II, p. 363: "The white cat [-fish] continues as high as Marias River, but they are scarce in this part of the Missouri, nor have we caught any of them since leaving the Mandans which weighed more than six pounds."

Vol. II, p. 364: "I amused myself catching those white [cat-] fish yesterday. I caught upward of a dozen in a few minutes; they bite most freely at the melt of a deer which Goodrich brought with him for the purpose of fishing." (Lewis.) This locality was near the mouth of Marias River, longitude about 110° 30′ W.

Vol. II, p. 367: "Both kinds of white fish" [*I. punctatus* and *Stizostedion canadense boreum*]. Falls of Missouri.

Vol. III, p. 1159: "Some catfish and soft-shelled turtles were procured"; near mouth of Tongue River.

Vol. II, p. 362: "June 11. One of the men caught several dozen fish of two species. The first is about nine inches long, of a white color, round in shape; the mouth is beset both above and below with a rim of fine, sharp teeth, the eye moderately large, the pupil dark, the iris narrow, and of a yellowish brown. In form and size it resembles the white chub of the Potomac, though its head is proportionally smaller. These readily bite at meat or grasshoppers; the flesh, though soft and of a fine white color, is not highly flavored. The second species is precisely of the form and about the size of the fish known by the name of hickory-shad or old-wife, though it differs from it in having the outer edge of both the upper and lower jaw set with a rim of teeth, and the tongue and palate also defended by long, sharp teeth bending inward; the eye is very large, the iris wide, and of a silvery color. These do not inhabit muddy water, and the flavor is much superior to that of the former species. Of the first kind we have seen a few before we reached Marias River; but had found none of the last before we caught them in the Missouri above its junction with that river." This locality was near the mouth of Marias River. The first species is *Stizostedion canadense boreum*, and the other either *Hiodon alosoides* or *Hiodon tergisus*.

Vol. II, p. 367: "June 13. In the afternoon they caught in the falls some of both kinds of the white fish, and half a dozen trout from 16 to 23 inches long, precisely resembling in form and in the position of the fins the mountain or speckled trout of the United States, except that the specks of the former are of a deep black while those of the latter are of a red or gold color. They have long, sharp teeth on the palate and tongue, and generally a small speck of red on each side behind the front ventral fins; the flesh is of a pale yellowish red, or when in good order of a rose-colored red." This locality is the lower or Crooked Falls of the Missouri, below the present town of Great Falls, Montana. The two kinds of "white fish" were probably *Ictalurus punctatus* and *Hiodon alosoides*, and the trout, of course, was *Salmo mykiss lewisi*.

Vol. II, p. 373: The next day and at the same place they "obtained a number of fine trout and several small catfish, weighing about four pounds and differing from the white catfish lower down the Missouri." These were probably not different from the other white catfish.

Vol. II, p. 431: "July 20. Since the river has become shallow we have caught a number of trout and a fish white on the belly and sides, but of a bluish cast on the back, with a long, pointed mouth opening somewhat like that of a shad." This was in the Missouri nearly due east of Helena. The fish were *Salmo mykiss lewisi* and probably *Hiodon alosoides*.

Vol. II, p. 458: "August 3. The only fish observed in this part of the river were the trout and a species of white fish with a remarkably long, small mouth, which one of our men recognized as the fish called in the Eastern States the 'bottlenose.'" This was in Jefferson Fork of the Missouri, near the mouth of Whitetail Deer Creek, south of Helena. The trout was *Salmo mykiss lewisi*; the "bottlenose" is not identifiable; it may have been *Coregonus williamsoni cismontanus* or *Pantosteus jordani*.

Vol. II, p. 495: "August 13. Some very fine trout [*Salmo mykiss lewisi*] were caught, as also for several days past." This was in Beaverhead River near the mouth of Grasshopper Creek, south of Dillon, Mont.

Vol. III, p. 1138: "July 16. One of the men caught a fish which they had not seen before. It was eight inches long, and resembled a trout in form, but its mouth was like that of a sturgeon, and it had a red streak passing on each side from the gills to the tail." This locality was in the Yellowstone River near the mouth of Little Timber Creek, some 30 miles below Livingston, Mont. The fish was undoubtedly a sucker, and almost certainly the species named *Pantosteus jordani* 87 years afterward. There is, of course, a possibility of its having been *Catostomus catostomus*.

The papers whose titles follow are each more or less faunal in character and each contains references to fishes from definite Missouri Basin localities.

1854. Louis Agassiz. Notice of a collection of fishes from the southern bend of the Tennessee River, in the State of Alabama. <Amer. Journ. Science and Arts, 2d series, vol. XVII, No. 50, March, 1854, 297–308, and No. 51, May, 1854, 353–365.

In a footnote on page 304 of this paper Professor Agassiz described as new two darters collected in the Osage River, Missouri, by Mr. George Stolley. These are *Pœcilichthys spectabilis* (=*Etheostoma cœruleum spectabile*) and *Pœcilichthys punctulatus* (=*Etheostoma punctulatum*).

1856. Charles Girard. Researches upon the cyprinoid fishes inhabiting the fresh waters of the United States west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution. <Proc. Ac. Nat. Sci. Phila. 1856, 165–218.

This is the first of the several papers based wholly or partly upon the collections made by the naturalists connected with the Pacific Railroad Survey parties which traversed portions of the Missouri Basin. The localities from which the specimens of these collections came are seldom given with any definiteness, as will appear from an examination of the following table. In this table, and in all others of like character in the present paper, the names of new species are printed in italics.

Page.	Nominal species.	Identification.	Locality.	Collector.
170	Carpiodes *damalis*	Carpiodes velifer	Milk River	Suckley.
172	Ptychostomus *haydeni*	Minytrema melanops	Missouri River at Fort Pierre.	Evans and Hayden.
			Yellowstone River.	Do.
174	Catostomus (Acomus) *lactarius*.	Catostomus griseus	Milk River	Suckley.
174	Catostomus (Acomus) *griseus*.	do	Sweetwater River	Bowman.
175	Catostomus *sucklii*	Catostomus commersonii	Milk River	Suckley.
180	Pimephales *fasciatus*	Pimephales promelas	Yellowstone River.	Hayden.
182	Hybognathus *argyritis*	Hybognathus argyrite	Milk River	Suckley.
182	Hybognathus *evansi*	Hybognathus nuchale evansi.	Fort Pierre, Nebr	Evans.
185	Argyreus *dulcis*	Rhinichthys cataractæ dulcis.	Sweetwater River	Bowman.
188	Pogonichthys *communis*	Platygobio gracilis	Fort Pierre, Nebr	Evans.
			Fort Union	Denig.
			Above Fort Union.	Suckley.
			Milk River	Do.
			Yellowstone River.	Hayden.
			Sweetwater River	Bowman.
188	Gobio *gelidus*	Hybopsis gelidus	Milk River	Suckley.
189	Leucosomus *dissimilis*	Couesius dissimilis	Milk and Little Muddy rivers.	Do.
190	Nocomis *nebracensis*	Hybopsis kentuckiensis	Sweetwater River	Bowma.
196	Plagyrus *bowmani*	Notropis cornutus	do	Do.
204	Semotilus *macrocephalus*	Semotilus atromaculatus.	Fort Pierre, Nebr	Evans.
204	Semotilus *speciosus*	do	Sweetwater River	Bowman.

1858. CHARLES GIRARD. The fishes [of the Pacific Railroad Surveys]; Pacific Railroad Report, vol. x, 1–400, numerous plates, 1858; vol. VI, part IV, No. 1, 9–34, 11 plates.

The reports of the Pacific Railroad Survey credit but 23 nominal species to the Missouri Basin.

Page.	Nominal species.	Identification.	Locality.	Collector.
17	Calliurus longulus	Apomotis cyanellus	Platte River	Captain Pope.
32	Stizostedion boreus	Stizostedion canadense boreum.	Fort Sarpy, Nebr	Dr. Hayden.
			Milk River, Mont	Dr. Suckley.
			Fort Union, Mont	Dr. Hayden.
98	Amblodon grunniens	Aplodinotus grunniens	Milk River, Mont	Dr. Suckley.
212	Pimelodus *olivaceus*	Ictalurus punctatus	Fort Pierre, Nebr	Dr. Evans.
			Milk River, Mont	Dr. Suckley.
			Yellowstone River, Nebr.	Mr. Walker, Dr. Hayden.
219	Carpiodes damalis	Carpiodes velifer	Milk River	Dr. Suckley.
			Fort Pierre, Nebr	Dr. Evans.
221, 21	Ptychostomus haydeni	Minytrema melanops	Yellowstone River	Dr. Hayden.
			Missouri River at Fort Pierre, Nebr.	Dr. Evans.
222, 22	Acomus griseus	Catostomus griseus	Sweetwater River	J. S. Bowman.
223	Acomus lactarius	do	Milk River	Dr. Suckley.
226	Catostomus sucklii	Catostomus commersonii	do	Do.
234	Pimephales fasciatus	Pimephales promelas	Yellowstone River	Dr. Hayden.
			Milk River	Dr. Suckley.
236, 22	Hybognathus argyritis	Hybognathus argyrite	do	Do.
237	Hybognathus evansi	Hybognathus nuchale evansi.	Fort Pierre, Nebr	Dr. Evans.
			Sweetwater River	J. S. Bowman.
243	Argyreus dulcis	Rhinichthys cataractæ dulcis.	do	Do.
248	Pogonichthys communis	Platygobio gracilis	Milk River	Dr. Suckley.
			Sweetwater River	J. S. Bowman.
			Missouri River at Fort Union.	E. J. Denig.
			Milk River above Fort Union.	Dr. Suckley.
			Fort Pierre, Nebr	Dr. Evans.
			Yellowstone River	Dr. Hayden.
249	Gobio gelidus	Hybopsis gelidus	Milk River	Dr. Suckley
251	Leucosomus dissimilis	Couesius dissimilis	do	Do.
			Little Muddy River	Do.
253	Leucosomus macrocephalus.	Semotilus atromaculatus	Fort Pierre, Nebr	Dr. Evans.
254, 23	Nocomus nebrascensis	Hybopsis kentuckiensis	Sweetwater River	J. S. Bowman.
264	Plagyrus bowmani	Notropis cornutus	do	Do.
284, 25	Semotilus speciosus	Semotilus atromaculatus	Tributary of Platte River, Nebr.	Do.
320	Salar lewisi	Salmo mykiss lewisi	Falls of Missouri River.	Dr. Suckley.
357, 59	Scaphirhynchus platirhynchus.	Scaphirhynchus platorhynchus.	Missouri River	Dr. Shumard.
358	Polyodon folium	Polyodon spathula	Fort Pierre, Nebr	Dr. Evans.

1859. CHARLES GIRARD. Ichthyological Notices. <Proc. Ac. Nat. Sci. Phila. 1859, 100–104.

In these "notices" Dr. Girard described as new two species of darters from the Missouri Basin, viz: In Notice XXXVII, p. 103, *Boleichthys exilis*, obtained by Dr. George Suckley in the Little Muddy River, and in Notice XL, p. 104, *Boleichthys warreni* (=*Boleichthys exilis*), obtained by Dr. F. V. Hayden in the Cannon Ball River September, 1856. The Cannon Ball flows into the Missouri just below Bismarck, N. Dak., in long. 100° 30′, lat. 46° 30′. The stream called Little Muddy River is probably near Bismarck.

1860. CHARLES C. ABBOTT. Descriptions of two new species of *Pimelodus* from Kansas. <Proc. Ac. Nat. Sci. Phila. 1860, 568-569.

In this paper are given descriptions of the two nominal species, *Pimelodus hammondii* (=*Ictalurus punctatus*) and *Pimelodus notatus* (=*Ictalurus punctatus*). The types of each were collected at Fort Riley, Kans., by Dr. W. A. Hammond, presumably from the Kansas River.

1860. DR. GEORGE SUCKLEY. Report upon the fishes collected on the [Pacific Railroad] Survey; chapter 1, Report upon the *Salmonidæ;* chapter 2, Report upon the fishes exclusive of the *Salmonidæ.* Pacific Railroad Report, vol. XII, part III, No. 5, pp. 307-368, with 21 plates, 1860; and in Natural History of Washington Territory, same pagination, plates, and date.

All of the dozen Missouri Basin fishes mentioned in this paper were collected by Dr. Suckley.

Page.	Nominal species.	Identification.	Locality.
348	(Salmo) Salar lewisi	Salmo mykiss lewisi	Falls of Missouri River.
351	Stizostedion boreus	Stizostedion canadense boreum	Milk River.
355	Amblodon grunniens	Aplodinotus grunniens	Do.
359	Pimelodus olivaceus	Ictalurus punctatus	Do.
360	Carpiodes damalis	Carpiodes velifer	Do.
360	Acomus lactarius	Catostomus griseus	Do.
360	Catostomus sucklii	Catostomus commersonii	Upper Missouri and its tributaries.
360	Pimephales fasciatus	Pimephales promelas	Milk River.
361	Hybognathus argyritis	Hybognathus argyrite	Do.
361	Pogonichthys communis	Platygobio gracilis	Do.
361	Gobio gelidus	Hybopsis gelidus	Do.
364	Hyodon tergisus	Hiodon tergisus	West of Fort Union.

1862. THEODORE GILL. Observations on the genus *Cottus*, and descriptions of two new species (abridged from the forthcoming report of Capt. J. H. Simpson.) <Proc. Bost. Soc. Nat. Hist., VIII, 1862, 40-42.

In this paper, page 40, is given the original description of *Potamocottus punctulatus* (=*Cottus bairdi punctulatus*), the type a single specimen obtained by Dr. George Suckley in 1859, "between Bridger's Pass and Fort Bridger." This is probably in the Missouri Basin.

1862a. THEODORE GILL. Descriptions of new species of *Pimelodinæ* (abridged from the forthcoming report of Capt. J. H. Simpson). <Proc. Bost Soc Nat. Hist., VIII, 1862, 42-46.

In this paper Dr. Gill described as new 3 species of catfishes, viz. *Ictalurus simpsonii* (=*I. punctatus*), from the "Big Sandy River of Kansas" (probably the Kansas River); *Amiurus obesus* (=*Ameiurus melas*), "supposed to be from Nebraska" (collected by Mr. McCarthy); and *Noturus occidentalis* (=*N. flavus*) from Platte River. The first and third were collected by Dr. Suckley.

1863. F. W. PUTNAM. List of the fishes sent by the Museum to different institutions in exchange for other specimens, with annotations. <Bull. Mus. Comp. Zool., vol. I, No. 1, 2–16, 1863.

In this paper are described 2 species supposed to be new. The types of each were collected by Mr. Stolley in the Osage River, Missouri. They are *Alburnus lineolatus* Agassiz MS., 1854, and *Alburnus zonatus* Agassiz MS., 1854 (=*Notropis zonatus*). The first of these is unidentifiable; it may be *Notropis scylla*.

1864. THEODORE GILL. A new species of *Percopsis* (*Percopsis hammondii*) from Kansas. <Proc. Ac. Nat. Sci. Phila. 1864, 151.

In this note Dr. Gill describes *Percopsis hammondii* (=*Percopsis guttatus*), the specimen said to have been obtained in Kansas by Dr. W. A. Hammond.

1864. E. D. COPE. On a blind Silurid from Pennsylvania. <Proc. Ac. Nat. Sci. Phila. 1864, 231–233.

In the paper bearing this inadequate title Professor Cope describes not only the blind catfish from Pennsylvania and a new darter from New Jersey, but a new darter (as *Pœcilichthys mesæus* = *Boleosoma nigrum*) from Platte River, near Fort Kearney, Nebr. The type was collected by Dr. Hammond.

1864a. EDWARD D. COPE. Partial catalogue of the cold-blooded Vertebrata of Michigan. Part I. <Proc. Ac. Nat. Sci. Phila. 1864, 276–285.

In this paper Professor Cope records 5 species of fishes from the Missouri Basin, 4 of which he describes as new. All were collected by Dr. W. A. Hammond.

Page.	Species.	Present identification.	Locality.
277	Pogonichthys (Platygobio) *gulonellus*.	Platygobio gracilis	Near Bridger Pass.
278	Rhinichthys *maxillosus*	Rhinichthys cataractæ dulcis	Kansas.
282	Alburnus *oligaspis*	Notropis dilectus	Do
283	Hybognathus evansi	Hybognathus nuchale evansi	Upper Platte River.
284	Campostoma *hippops*	Campostoma anomalum	Platte River at Fort Kearney, Kans.

1865. EDWARD D. COPE. Partial catalogue of the cold-blooded Vertebrata of Michigan. Part II. <Proc. Ac. Nat. Sci. Phila. 1865, 78–88.

In this paper Professor Cope incorporates a "Note on fishes brought from the Platte [Kansas] River, near Fort Riley, by Dr. W. A. Hammond." Twenty-four species are mentioned, three of which (*Gasterosteus micropus*, *Fundulus sciadicus*, and *Lepidosteus otarius*) are described as new. The localities assigned to some of these species seem to be erroneous. *Gila affinis* certainly did not come from any Missouri Basin locality, and the trout mentioned as *Trutta lewisi* probably came from some point in the headwaters of the South Platte rather than from Fort Riley. Fort Riley was on the Kansas River, in what is now Davis County, Kans., near the present town of Junction City. It is very doubtful if trout ever occurred so far east in Kansas.

Page.	Nominal species.	Identification.
85	Bryttus longulus	Apomotis cyanellus.
85	Stizostedium americanum	Stizostedion canadense.
85	Pœcilichthys mesæus	Boleosoma nigrum.
81	Gasterosteus *micropus*	Eucalia inconstans.
85	Trutta lewisi	Salmo mykiss stomias.
85	Hyodon tergisus	Hiodon tergisus.
85	Percopsis hammondii	Percopsis guttatus.
78	Fundulus *sciadicus*	Fundulus sciadicus.
85	Carpiodes damalis	Carpiodes velifer.
85	Catostomus chloropterum	Catostomus commersonii.
85	Campostoma hippops	Campostoma anomalum.
85	Hybognathus evansi	Hybognathus nuchale evansi.
85	Pimephales promelas	Pimephales promelas.
85	Alburnus oligaspis	Notropis dilectus.
85	Gila affinis	Gila robusta (locality erroneous).
85	Semotilus corporalis	Semotilus atromaculatus.
85	Semotilus pallidus	Do.
85	Platygobio gulonellus	Platygobio gracilis.
85	Ceratichthys cyclotis	Hybopsis kentuckiensis.
85	Rhinichthys maxillosus	Rhinichthys cataractæ dulcis.
85	Ictalurus cærulescens	Ictalurus punctatus.
86	Ictalurus notatus	Do.
86	Amia calva	Amia calva.
86	Lepidosteus *otarius*	Lepisosteus osseus.

1870. EDWARD D. COPE. A partial synopsis of the fishes of the fresh waters of North Carolina. <Proc. Amer. Philos. Soc. 1869–70 (June 7, 1870), 448–495.

In this paper, page 482, *Carpiodes grayi* (=*Carpiodes velifer*) is described as new. The definite locality is not known, but Prof. Cope says "it is probably from one of the Western States."

1870. AUG. DUMÉRIL. Histoire naturelle des poissons, ou ichthyologie générale, vol. II, 1870.

In this work the common sturgeon of the Great Lakes and the Mississippi Valley is described as new no fewer than sixteen times. The types of three of these nominal species are reputed to have come from the Missouri Basin. They are the following: *Acipenser* (*Huso*) *copei*, Upper Missouri; *Acipenser* (*Huso*) *rauchii*, Osage River, Missouri, and *Acipenser* (*Huso*) *anasimos*, Missouri River, near St. Louis.

1871. EDWARD D. COPE. Recent reptiles and fishes. Report on the reptiles and fishes obtained by the naturalists of the expedition. <Preliminary Report U. S. Geological Survey of Wyoming and portions of contiguous territory, being a second annual report of progress, 432–442, 1870 (1871).

This paper is a report upon the fishes collected by the naturalists of the Hayden Survey during the season of 1870. Most of the specimens were probably collected by C. P. Carrington, zoologist, and Henry D. Schmidt, naturalist, of the expedition. Some were obtained by Dr. W. A. Hammond, and others by Dr. William Stimpson.

Page.	Nominal species.	Present name.	Locality.
433	Salmo (Salar) *stomias*	Salmo mykiss stomias	Platte [Kansas] River near Fort Riley.
434	Catostomus sucklii	Catostomus commersonii	Platte River.
434	Catostomus griseum	Catostomus griseus	Horse Creek, Red Cloud Creek, Platte River.
437	Ptychostomus *bucco*	Moxostoma bucco	St. Joseph, Mo.
437	Campostoma anomalum	Campostoma anomalum	Probably headwaters of Platte River.
437	Coliscus *parietalis*	Pimephales promelas	Missouri River near St. Joseph.
437	Hybopsis *missuriensis*	Notropis blennius	Near St. Joseph, Mo.
438	Hybopsis *scylla*	Notropis scylla	Red Cloud Creek.
438	Photogenis *piptolepis*	Notropis piptolepis	North Platte River and Red Cloud Creek.
439	Hypsilepis cornutus	Notropis cornutus	Red Cloud Creek.
439	Cyprinella *billingsiana*	Notropis lutrensis	St. Joseph, Mo.
439	Moniana *jugalis*	do	Do.
440	Alburnellus *percobromus*	Notropis rubrifrons	Do.
440	Sarcidium *scopiferum*	Phenacobius scopifer	Missouri River near St. Joseph, Mo.
442	Rhinichthys maxillosus	Rhinichthys cataractæ dulcis.	Red Cloud Creek and Platte River.
442	Noturus flavus	Noturus flavus	Platte River.

1872. EDWARD D. COPE. Report on the recent reptiles and fishes of the survey, collected by Campbell Carrington and C. M. Dawes. <Preliminary Report U. S. Geological Survey of Montana and portions of adjacent territory, being a fifth annual report of progress, 467–476, 1872.

Only three or four species from the Missouri Basin are mentioned in this paper.

Page.	Nominal species.	Present name.	Locality.
469	Thymallus tricolor	Thymallus signifer ontariensis.	Yellow Creek and the Gallatin Fork of the Missouri in Montana; headwaters of Yellowstone.
471	Salmo *pleuriticus*	Salmo mykiss stomias and Salmo mykiss lewisi.	Platte River and Yellowstone River; Yellow Creek and Gallatin Fork of Missouri, Montana; Yellowstone Lake.
476	Uranidea punctulata.	Cottus bairdi punctulatus.	Gallatin Fork of the Missouri River.

1874. EDWARD D. COPE. On the *Plagopterinæ* and the ichthyology of Utah. <Proc. Amer. Philos. Soc. Phila. 1874, 129–139, 1–11 of reprint.

In this paper one species is recorded from the Missouri Basin, viz: *Fundulus floripinnis*, which is described as new (as *Haplochilus floripinnis*, on page 10 of reprint). The specimens were obtained by Mr. J. M. Keasbey from the South Platte River near Denver.

1874. GEORGE SUCKLEY. On the North American species of salmon and trout. <Report U. S. Fish Comm. 1872–73 (1874), 91–160.

This paper was written by Dr. Suckley in 1861, but was not printed and published until 1874. Only one species is mentioned from the Missouri Basin, viz: *Salmo mykiss lewisi* (as *Salmo lewisi*), on page 139, from headwaters of the Missouri (Dr. Suckley; Dr. Cooper); southern tributaries of the Yellowstone; Black Hills, Nebr. (Dr. Hayden); on page 140, "Falls of the Missouri in Nebraska" (Dr. Cooper); "Great Falls of the Missouri" (the types; Dr. Suckley).

1874. JAMES W. MILNER. Notes on the grayling of North America. <Report U. S. Fish Comm. 1872–73 (1874), 729–742.

In this paper, p. 741, Professor Milner describes the grayling of the headwaters of the Missouri as a new species, to which he gives the name *Thymallus montanus*. The type came from Camp Baker, Montana.

1876. E. D. COPE and H. C. YARROW. Report upon the collections of fishes made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, and 1874. <U. S. Geographical Surveys west of the one hundredth meridian, in charge of First Lieut. G. M. Wheeler, Corps of Engineers, U. S. Army, vol. V, Zoology, Fishes, 635–703, pls. XXVI–XXXII, 1875 (1876).

The only species mentioned in this report from the Missouri Basin is *Fundulus floripinnis* (as *Haplochilus floripinnis*, p. 695, pl. XXVIII, figs. 4, 4*a*, 4*b*), from Denver, Colo.

1876. THEODORE GILL. Report on [the] ichthyology [of Captain Simpson's explorations across the Great Basin of the Territory of Utah in 1859]. Appendix L, 385–431, pls. I–IX, 1876.

In this report the following species are mentioned as having been obtained from Missouri Basin localities:

Page.	Nominal species.	Present name.	Locality.
408	Platygobio communis	Platygobio gracilis	Platte Valley.*
417	Ictalurus simpsoni	Ictalurus punctatus	Big Sandy River of Kansas.
420	Amiurus obesus	Ameiurus melas	Probably Nebraska.
423	Noturus occidentalis	Noturus flavus	Platte River.

*The specimens of this species which Dr. Gill records from "Green River, Utah," almost certainly came from some point in the Missouri Basin. It is not known to occur in the Green River Basin. This is not the Big Sandy Fork of Green River, but probably the Platte, or possibly the Arkansas.

1878. DAVID STARR JORDAN. Report on the collection of fishes made by Dr. Elliott Coues, U. S. A., in Dakota and Montana during the seasons of 1873 and 1874. <Bull. U. S. Geol. and Geog. Surv. Terr., IV, 1878.

The fishes reported upon in this paper were collected by Dr. Elliott Coues, naturalist of the United States Northern Boundary Survey. The localities are not, in most cases, stated with such definiteness as is desirable. The following 9 species are reported from the Missouri Basin:

Page.	Nominal species.	Present name.	Locality.
777	Scaphyrynchus platyrhynchus.	Scaphirhynchus platorynchus	Fort Buford, N. Dak.
777, 778	Ichthælurus punctatus	Ictalurus punctatus	Big Muddy River.
777, 792	Hyodon chrysopsis	Hiodon alosoides	Quaking Ash River.
777	Catostomus teres	Catostomus commersonii	Five Forks of Milk River; headwaters of Milk River.
777, 780	Pantosteus virescens	Pantosteus jordani	Sweet Grass Hills.
777, 797	Salmo clarki	Salmo mykiss lewisi	St. Marys River.
777	Polyodon folium (?)	Polyodon spathula	Do.
778, 798	Esox lucius	Lucius lucius	Do.
791	Cliola chlora	Notropis scylla	Upper Missouri.

1879. E. D. COPE. A contribution to the zoology of Montana. <American Naturalist, XIII, July, 1879, 432–441.

In the summer and autumn of 1876 Professor Cope made an expedition into Montana and South Dakota, the special object of which was the investigation of the beds of the Judith River lignite formation and the extraction of their fossils. Some attention was given to the present fauna of the region, and this paper contains his notes on the fishes and other animals observed. The fishes mentioned were seen chiefly in the vicinity of Fort Benton, on the Missouri River, in longitude 110° 40′ west, latitude 47° 50′ north, and near the mouth of Battle Creek, which empties into the Missouri a short distance north of the mouth of the Moreau River, South Dakota, longitude 100° 30′ west, latitude 45° 25′ north. The streams from which fishes are recorded in this paper are: Missouri River at Fort Benton and near mouth of Battle Creek; lower portion of Battle Creek, South Dakota; Judith River, Montana, and headwaters of the Upper Missouri.

Page.	Nominal species.	Present name.	Locality.
439 440	Lucioperca borea	Stizostedion canadense boreum.	Missouri River at Fort Benton and elsewhere, abundant.
440	Lota maculosa	Lota lota maculosa	Battle Creek.
440	Ichthælurus punctatus	Ictalurus punctatus	Pools left by river near Battle Creek.
440	Semotilus corporalis	Semotilus atromaculatus	Battle Creek.
440	Pogonichthys communis	Platygobio gracilis	Fort Benton, Judith River.
440	Rhinichthys maxillosus	Rhinichthys cataractæ dulcis.	Battle Creek.
440	Phoxinus *milnerianus*	Leuciscus milnerianus	Battle Creek, probably.
440	Chrosomus sp. (?)	Chrosomus dakotensis?	Battle Creek.
440	Hybognathus evansi	Hybognathus nuchale evansi.	Do.
440	Hyborhynchus nigellus	Pimephales promelas	Do.
441	Hyodon tergisus	Hiodon tergisus	Judith River and river pools near Battle Creek.
441	Coregonus williamsonii	Coregonus williamsoni cismontanus.	Heads of tributaries of the Upper Missouri.
441	Lepidosteus productus	Lepisosteus platostomus	River pools near Battle Creek.
441	Lepidosteus otarius	Lepisosteus osseus	Do.
441	Scaphirhynchops platyrhynchus.	Scaphirhynchus platorynchus.	Missouri River at Fort Benton.

1881. SAMUEL GARMAN. New and little-known reptiles and fishes in the Museum collections. Bull. Mus. Comp. Zool., VIII, No. 3, 85–93, February, 1881.

This paper contains a single reference to the Missouri Basin. On page 88 *Fundulus lineatus* is described as new (as *Zygonectes lineatus*), and "northeastern Wyoming" is given as the type locality.

1881a. SAMUEL GARMAN. North American fresh-water fishes (1). Science Observer, vol. III, No. 8, 1881, 57–63.

In this paper is given a synopsis of the species of *Rhinichthys*. The western dace (*Rhinichthys cataractæ dulcis*) is recorded from Missouri Basin localities as follows: Northeast Wyoming and Montana (as *R. ocella* sp. nov.); Cheyenne, Wyo. (as *R. dulcis*); and from Kansas (as *R. maxillosus*).

1883. DAVID S. JORDAN and CHARLES H. GILBERT. Synopsis of the fishes of North America. Bull. U. S. Nat. Mus., 16, 1882 (1883).

In the Synopsis are several references to Missouri Basin localities, none of them, however, being original references.

1884. SETH E. MEEK. Description of a new species of *Hybopsis* (*Hybopsis montanus*).

This species was described from three specimens (No. 36882, U. S. N. M.) collected by Dr. F. V. Hayden. The exact locality is not known, but it is presumably somewhere in the Upper Missouri region.

1884. DAVID S. JORDAN. Descriptions of four new species of *Pœcilichthys* in the United States National Museum. <Proc. U. S. Nat. Mus., VII, 1884, 477–480.

On page 479 of this paper *Pœcilichthys beani* (=*Boleosoma nigrum*) is described as new. The type (No. 35754, U. S. N. M.) came from Tabo Creek, Lafayette County, Mo.

1884. CHARLES H. GILBERT. Notes on the fishes of Kansas. <Bulletin Washburn Laboratory of Natural History, vol. I, No. 1, 10–16, September, 1884.

In 1883 the Washburn College laboratory of natural history (Topeka, Kans.) began a biological survey of the State of Kansas, under Prof. Francis W. Cragin, director, at that time professor of natural history in Washburn College. The fishes, which were collected chiefly by Professor Cragin and his students and by Dr. Watson, of Ellis, Kans., were studied by Dr. Gilbert. This paper and three others published in 1885, 1886, and 1889, respectively, contain the results of his examination of the different collections.

Page.	Nominal species.	Identification.	Locality.
10	Amiurus melas	Ameiurus melas	Kansas River, Topeka.
10	Ictiobus carpio	Carpiodes carpio	Manhattan, Riley County, Ward Creek.
10	Catostomus teres	Catostomus commersonii	Shunganunga Creek and Kansas River, Topeka.
11	Campostoma anomalum	Campostoma anomalum	Alma, Wabaunsee County; Kansas River, Topeka; Ellis, Ellis County.
11	Hybognathus nuchalis	Hybognathus nuchale	Ward Creek, Menoken; Kansas River, Topeka.
11	Pimephales confertus	Pimephales promelas	Ellis, Ellis County.
12	Pimephales notatus	Pimephales notatus	Ward Creek.
12	Cliola straminea	Notropis blennius	Do.
13	Cliola (Hybopsis) *topeka*	Notropis topeka	Shunganunga Creek, Topeka.
13	Cliola (?) gibbosa	Notropis lutrensis	Ward Creek.
14	Minnilus cornutus	Notropis cornutus	Ellis, Ellis County.
14	Minnilus (Lythrurus) *nigripinnis*.	Notropis umbratilis umbratilis.	Shunganunga Creek, Topeka.
14	Phenacobius mirabilis	Phenacobius mirabilis	Ward Creek.
15	Semotilus corporalis	Semotilus atromaculatus	Shunganunga Creek, Topeka.
15	Fundulus zebrinus	Fundulus zebrinus	Ellis, Ellis County.
16	Lepomis humilis	Lepomis humilis	Ward and Shunganunga creeks, Topeka.
16	Pœcilichthys cœruleus	Etheostoma lepidum	Ellis, Ellis County.

1885. CHARLES H. GILBERT. Description of three new fishes from Kansas. <Proc. U. S. Nat. Mus., VII, 1884 (January 19, 1885), 512–514.

Two of these three species are from Missouri Basin localities, viz: *Cliola* (*Hybopsis*) *topeka* (=*Notropis topeka*) from Shunganunga Creek, Topeka (type, No. 36609, U. S. N. M., coll. Prof. F. W. Cragin), and *Minnilus* (*Lythrurus*) *nigripinnis* (=*Notropis umbratilis umbratilis*), also from Shunganunga Creek, Topeka (type, No. 36613, coll. Prof. Cragin). The first publication of these names was really in the preceding paper.

1885. DAVID STARR JORDAN and SETH E. MEEK. List of fishes collected in Iowa and Missouri in August, 1884, with descriptions of three new species. <Proc. U. S. Nat. Mus. 1885, 1–17.

The explorations upon which this paper was based were carried on during August, 1884, under the auspices of the United States National Museum and the United States Fish Commission. The field work was under the direction of Dr. Jordan, assisted by Mr. Meek.

Collections were made in the Missouri Basin at the following places:

(*a*) At Bedford, Taylor County, Iowa, from the east fork of Hundred and Two River, and at Marysville, Nodaway County, Mo., from Hundred and Two River.

(*b*) At St. Joseph, Mo., from Missouri River on the Kansas shore opposite the city.

(*c*) About 6 miles east of Lexington, Lafayette County, Mo., from Tabo Creek, a small tributary of the Missouri.

(*d*) At Brownsville, Saline County, Mo., from Blackwater Creek, and near Sedalia, Pettis County, Mo., from Flat Creek. Both of these creeks are small tributaries of La Mine River, which flows into the Missouri northeast of Sedalia.

(*e*) At Clinton, Henry County, Mo., from Grand River, and at Calhoun, in the same county, from Tabo Creek, a small tributary of Grand River. Grand River flows into the Osage River at Warsaw, a few miles southeast of Clinton, and the latter stream unites with the Missouri just below Jefferson City.

Nineteen species were obtained from Hundred and Two River:

Noturus flavus.
Ameiurus melas.
Ictalurus punctatus.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Hybognathus nuchale.
Pimephales promelas.
Pimephales notatus.
Notropis blennius (as N. deliciosus).
Notropis topeka (only at Bedford, from an abandoned stone quarry).
Notropis lutrensis.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Phenacobius mirabilis.
Hybopsis kentuckiensis (as H. biguttatus).
Semotilus atromaculatus.
Lepomis humilis.
Apomotis cyanellus (as Lepomis cyanellus).
Boleosoma nigrum (as Boleosoma olmstedi maculatum).

From the Missouri River, opposite St. Joseph, the following 22 species were collected:

Lepisosteus osseus.
Leptops olivaris.
Ameiurus melas.
Ameiurus natalis.
Ictalurus punctatus.
Ictalurus furcatus.
Ictiobus cyprinella.
Ictiobus urus.
Ictiobus bubalus.
Ictiobus carpio.
Hybognathus nuchale.
Notropis blennius (as N. deliciosus).
Platygobio gracilis.
Hybopsis meeki (as H. gelidus).
Dorosoma cepedianum.
Hiodon alosoides.
Micropterus salmoides.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Pomoxis annularis.
Stizostedion canadense.
Aplodinotus grunniens.

From Tabo Creek, near Lexington, 9 species were obtained, viz:

Ameiurus melas.
Ictalurus punctatus.
Notropis blennius (as N. deliciosus).
Notropis lutrensis.
Phenacobius mirabilis.
Semotilus atromaculatus.
Hiodon alosoides.
Dorosoma cepedianum.
Apomotis cyanellus (as Lepomis cyanellus).

From the tributaries (Blackwater and Flat creeks) of La Mine River 24 species were obtained, viz:

Noturus flavus.
Ameiurus melas.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. macrolepidotum duquesnii).
Campostoma anomalum.
Pimephales notatus.
Notropis blennius (as N. deliciosus).
Notropis lutrensis.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Notropis rubrifrons.
Abramis crysoleucas (as Notemigonus americanus chrysoleucus; from Blackwater Creek only).
Phenacobius mirabilis.
Hybopsis kentuckiensis (as H. biguttatus).
Semotilus atromaculatus.
Labidesthes sicculus.
Micropterus salmoides.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Pomoxis annularis.
Boleosoma nigrum (as Boleosoma olmstedi maculatum).
Etheostoma cœruleum spectabile (as E. variatum spectabile).
Aplodinotus grunniens.

From the tributaries (Grand River and Tabo Creek) of Osage River the following 27 species were secured:

Lepisosteus osseus.
Noturus flavus.
Ameiurus melas.
Leptops olivaris.
Ictalurus punctatus.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Campostoma anomalum.
Pimephales notatus.
Cliola vigilax.
Notropis blennius (as N. deliciosus).
Notropis gilberti.
Notropis dilectus.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Notropis lutrensis.
Phenacobius mirabilis.
Hybopsis storerianus.
Semotilus atromaculatus.
Micropterus salmoides.
Dorosoma cepedianum.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Hadropterus phoxocephalus.
Boleosoma nigrum (as B. olmstedi maculatum).
Etheostoma cœruleum spectabile (as E. variatum spectabile).
Aplodinotus grunniens.

1885a. CHARLES H. GILBERT. Second series of notes on the fishes of Kansas. <Bull. Washburn Lab. Nat. Hist., vol. 1, No. 3, 97–99.

This is the second of the four papers of Dr. Gilbert based upon the collections made by Prof. F. W. Cragin in connection with the biological survey of Kansas conducted by the Washburn College laboratory of natural history.

Specimens were obtained from the following streams:

(*a*) Ward Creek, Shunganunga Creek, and Kansas River, in Shawnee County, near Topeka; collectors, Messrs. Ralph McCampbell and Dana McVicar. Menoken, Shawnee County; collector, Mr. L. T. Matthews.
(*b*) Manhattan, Riley County; collector, Prof. E. A. Popenoe.
(*c*) Mill Creek, at Alma, Wabaunsee County; collectors, Professor Cragin and Mr. Jerry Fields.
(*d*) Ellis, Ellis County; collector, Dr. L. Watson.

Page.	Nominal species.	Identification.	Locality.
97	Ictalurus punctatus	Ictalurus punctatus	Ward Creek.
97	Amiurus melas	Ameiurus melas	Shunganunga and Ward creeks.
97	Ictiobus carpio	Carpiodes carpio	Manhattan and Ward Creek.
98	Catostomus teres	Catostomus commersonii	Shunganunga Creek and Kansas River.
98	Moxostoma macrolepidotum	Moxostoma aureolum	Shunganunga Creek.
98	Campostoma anomalum	Campostoma anomalum.	Shunganunga Creek, Kansas River, Ellis, and Mill Creek.
98	Hybognathus nuchalis	Hybognathus nuchale	Ward Creek, Menoken, and Kansas River.
98	Pimephales promelas	Pimephales promelas	Shunganunga Creek, Kansas River, Ward and Mill creeks and Ellis.
98	Pimephales notatus	Pimephales notatus	Shunganunga and Ward creeks.
98	Notropis topeka	Notropis topeka	Shunganunga Creek and Ellis.
98	Notropis lutrensis	Notropis lutrensis	Ward and Shunganunga creeks.
98	Notropis megalops	Notropis cornutus	Ellis; Shunganunga, Ward, and Mill creeks.
98	Notropis nigripinnis	Notropis umbratilis umbratilis.	Shunganunga Creek.
98	Phenacobius mirabilis	Phenacobius mirabilis	Shunganunga and Ward creeks.
98	Hybopsis biguttatus	Hybopsis kentuckiensis	Mill Creek.
99	Semotilus atromaculatus	Semotilus atromaculatus	Mill and Shunganunga creeks.
99	Fundulus zebrinus	Fundulus zebrinus	Ellis.
99	Lepomis humilis	Lepomis humilis	Ellis; Ward and Shunganunga creeks.
99	Lepomis cyanellus	Apomotis cyanellus	Ward and Shunganunga creeks.
99	Etheostoma variatum	Etheostoma cœruleum spectabile.	Ellis.

1885. F. W. CRAGIN. Note on the chestnut lamprey. <Bull. Washburn Lab. Nat. Hist., vol. 1, No. 3, 99–100.

In this note Professor Cragin records the occurrence of the chestnut lamprey (*Ichthyomyzon castaneus*) in Mill Creek, Shawnee County, Kans.

1885a. F. W. CRAGIN. Preliminary list of Kansas fishes. <Bull. Wash. Coll. Lab. Nat. Hist., vol. 1, No. 3, 105–111.

This is a list of 91 nominal species thought to inhabit the waters of Kansas. Of this number 69 are credited to that portion of the State lying in the Missouri basin. These are given in the following tabular list:

Page.	Nominal species.	Identification.	Locality.
106	Ammocœtes niger	Lampetra wilderi	Kansas River at Lawrence (Snow).
106	Petromyzon argenteus	Ichthyomyzon concolor	Osage River (Prof. Wheeler).
106	Petromyzon castaneus	Ichthyomyzon castaneus	Mill Creek, Wabaunsee County (Cragin).
106	Polyodon spathula	Polyodon spathula	Kansas River at Lawrence (Snow).
106	Acipenser rubicundus	Acipenser rubicundus	Do.
106	Scaphirrhynchops platyrrhynchus.	Scaphirhynchus platorynchus.	Kansas River at Topeka (Cragin) and Lawrence (Snow).
106	Lepidosteus osseus	Lepisosteus osseus	Kansas River (Cragin) and Osage River (Wheeler).
106	Lepidosteus platystomus	Lepisosteus platostomus	Kansas River at Topeka (Cragin), and Osage River (Wheeler).
106	Litholepis tristœchus	Lepisosteus osseus(?)	Kansas River at Junction City (Cragin).
107	Leptops olivaris	Leptops olivaris	Kansas River (Cragin), Lawrence (Snow), and Osage River (Wheeler).
107	Amiurus nebulosus	Ameiurus nebulosus	Topeka (Cragin), Lawrence (Snow), and Ottawa (Wheeler).

Page.	Nominal species.	Identification.	Locality.
107	Amiurus natalis	Ameiurus natalis	Kansas River (Snow).
107	Ictalurus albidus	Ictalurus punctatus (?)	Osage River (Wheeler).
107	Ictalurus lacustris	Ictalurus furcatus (?)	Kansas River (Snow) and Osage River (Wheeler).
107	Ictalurus punctatus	Ictalurus punctatus	Kansas River, Silver Lake, Ward Creek, and Mill Creek (Cragin); Manhattan (Prof. Popenoe); Blue River (Graham).
107	Ictalurus furcatus	Ictalurus furcatus	Kansas River (Snow).
107	Ictiobus cyprinella	Ictiobus cyprinella	Soldier Creek in Shawnee County (Cragin); Osage River (Wheeler).
107	Ictiobus urus	Ictiobus urus	Silver Lake and Soldier Creek in Shawnee County (Cragin).
107	Ictiobus bubalus	Ictiobus bubalus	Kansas River (Snow).
107	Ictiobus carpio	Carpiodes carpio	Silver Lake and Ward Creek in Shawnee County (Cragin); Fort Riley (Cope).
107	Ictiobus bison	Carpiodes velifer	Ottawa (Wheeler).
107	Ictiobus velifer	do	Eureka Lake (Graham).
107	Cycleptus elongatus	Cycleptus elongatus.	Kansas River between Manhattan and Topeka (Cragin).
107	Catostomus teres	Catostomus commersonii	Shunganunga Creek and Kansas River (Cragin); Wild Cat Creek (Graham); Osage River (Wheeler); Fort Riley (Abbott).
108	Catostomus nigricans	Catostomus nigricans	Osage River (Wheeler).
108	Erimyzon sucetta	Erimyzon sucetta	Kansas River (Snow).
108	Minytrema melanops	Minytrema melanops	Osage River (Wheeler); Mill Creek (Cragin).
108	Moxostoma macrolepidotum.	Moxostoma aureolum	Soldier Creek, Shunganunga Creek and Silver Lake (Cragin); Osage River (Wheeler); Blue River (Graham).
108	Moxostoma aureolum	do	Kansas River (Snow).
108	Campostoma anomalum	Campostoma anomalum	Kansas River, Shunganunga Creek, Mill Creek, and Ellis (Cragin); Wild Cat Creek (Graham).
108	Hybognathus nuchalis	Hybognathus nuchale	Kansas River and Ward Creek (Cragin); Fort Riley (Cope).
108	Pimephales promelas	Pimephales promelas	Kansas River at Topeka and small streams in Shawnee, Wabaunsee, and Ellis counties (Cragin).
108	Pimephales notatus	Pimephales notatus	Shunganunga and Ward creeks (Cragin).
108	Notropis hudsonius	Notropis hudsonius	Wild Cat Creek (Graham).
108	Notropis topeka	Notropis topeka	Shunganunga Creek and Ellis (Cragin).
108	Notropis lutrensis	Notropis lutrensis	Shunganunga and Ward creeks (Cragin).
108	Notropis billingsiana	do	Missouri River at St. Joseph (Cope).
108	Notropis megalops	Notropis cornutus	Shawnee, Wabaunsee, and Ellis counties (Cragin).
109	Notropis atripinnis	Notropis umbratilis umbratilis.	Shunganunga Creek (Cragin).
109	Notropis percobromus	Notropis rubrifrons	St. Joseph, Mo. (Cope).
109	Phenacobius mirabilis	Phenacobius mirabilis	Shunganunga and Ward creeks (Cragin).
109	Rhinichthys maxillosus	Rhinichthys cataractæ dulcis.	Fort Riley (Cope).
109	Hybopsis biguttatus	Hybopsis kentuckiensis	Mill Creek (Cragin); Fort Riley (Cope).
109	Platygobio gracilis	Platygobio gracilis	Fort Riley (Cope).

Page.	Nominal species.	Identification.	Locality.
109	Semotilus atromaculatus	Semotilus atromaculatus	Shunganunga and Mill creeks (Cragin); Fort Riley (Cope).
109	Hyodon tergisus	Hiodon tergisus	Kansas River at Topeka (Cragin).
109	Hyodon alveoides	Hiodon alosoides	Silver Lake (Cragin).
109	Dorosoma cepedianum	Dorosoma cepedianum	Shunganunga and Ward creeks (Cragin).
109	Salmo purpuratus stomias	Salmo mykiss stomias	Kansas River (Cope).
109	Percopsis hammondi	Percopsis guttatus	Kansas (Gill).
110	Fundulus zebrinus	Fundulus zebrinus	Ellis (Cragin).
110	Anguilla rostrata	Anguilla chrysypa	Kansas River at Lawrence (Snow) and at Topeka (Cragin).
110	Pomoxys annularis	Pomoxis annularis	Soldier Creek (Cragin).
110	Pomoxys sparoides	Pomoxis sparoides	Osage River (Wheeler).
110	Ambloplites rupestris	Ambloplites rupestris	Kansas River (Snow).
110	Lepomis cyanellus	Apomotis cyanellus	Shunganunga and Ward creeks (Cragin).
110	Lepomis humilis	Lepomis humilis	Shunganunga and Ward creeks and Ellis (Cragin).
110	Lepomis gibbosus	Eupomotis gibbosus	Osage River at Ottawa (Wheeler).
110	Micropterus salmoides	Micropterus salmoides	Soldier Creek (Cragin).
110	Ammocrypta pellucida	Ammocrypta pellucida	Kansas River (Snow).
110	Boleosoma nigrum	Boleosoma nigrum	Near Fort Riley (Cope).
110	Diplesion blennioides	Diplesion blennioides	Wild Cat Creek (Graham).
111	Etheostoma variatum	Etheostoma cœruleum spectabile.	Ellis (Cragin).
111	Stizostedion vitreum	Stizostedion vitreum	Soldier Creek (Cragin).
111	Stizostedion canadense	Stizostedion canadense boreum.	Mill Creek (Graham).
111	Roccus chrysops	Roccus chrysops	Do.
111	Roccus interruptus	Morone interrupta	Kansas River (Snow).
111	Aplodinotus grunniens	Aplodinotus grunniens	Kansas River (Cragin).
111	Lota maculosa	Lota lota maculosa	Missouri River at Wyandotte (Snow; Bean).

1885. I. D. GRAHAM. Preliminary list of Kansas fishes. <Trans. Kans. Ac. Sci., vol. IX, 1883-84 (1885), 69-78.

This paper seems to be merely a compilation and contains no definite original locality references. Several of the references need verification

Page.	Nominal species.	Identification.	Locality.*
70	Ammocœtes niger	Lampetra wilderi	Wild Cat Creek near Manhattan.
70	Petromyzon argenteus	Ichthyomyzon concolor	Cottonwood River.
70	Polyodon spathula	Polyodon spathula	Kansas River, Manhattan.
70	Scaphirrhynchops platyrrhynchus.	Scaphirhynchus platorynchus.	Kansas, common over the State.
70	Acipenser rubicundus	Acipenser rubicundus	Kansas River.
70	Lepidosteus osseus	Lepisosteus osseus	Common in all streams in Kansas.
71	Lepidosteus platystomus	Lepisosteus platostomus	Kansas River.
71	Amia calva	Amia calva	Branches of Missouri River, Osage River, etc.
71	Noturus miurus	Schilbeodes miurus	Branches of Missouri River.
71	Noturus exilis	Schilbeodes exilis	Osage River, etc.
71	Leptops olivaris	Leptops olivaris	Kansas River.
71	Amiurus melas	Ameiurus melas	Common over the State.
71	Amiurus natalis	Ameiurus natalis	Kansas River.
71	Amiurus nebulosus	Ameiurus nebulosus	Plentiful.
71	Ictalurus punctatus	Ictalurus punctatus	Quite common.
71	Ictalurus furcatus	Ictalurus furcatus	Large streams.
71	Ictiobus carpio	Carpiodes carpio	Kansas River.
72	Ictiobus velifer	Carpiodes velifer	Do.
72	Ictiobus velifer bison	do	Do.
72	Ictiobus urus	Ictiobus urus	Kansas River and branches of the Missouri.

*Some of the locality references given in this column seem somewhat vague, but we have used the phraseology of Mr. Graham.

Page.	Nominal species.	Identification.	Locality.
72	Ictiobus bubalus	Ictiobus bubalus	Plentiful over State.
72	Ictiobus cyprinella	Ictiobus cyprinella	Eastern Kansas.
72	Cycleptus elongatus	Cycleptus elongatus	Kansas River.
72	Catostomus teres	Catostomus commersonii	Common over State.
72	Catostomus nigricans	Catostomus nigricans	Kansas River.
72	Moxostoma macrolepidotum.	Moxostoma aureolum	Plentiful.
72	Campostoma anomalum	Campostoma anomalum	Common in small streams.
72	Chrosomus erythrogaster	Chrosomus erythrogaster	Marais des Cygnes.
72	Hybognathus placita	Hybognathus nuchale evansi.	Kansas River and other branches of the Missouri.
73	Pimephales promelas	Pimephales promelas	Kansas River.
73	Notropis hudsonius	Notropis hudsonius	Kansas River branches.
73	Notropis billingsiana	Notropis lutrensis	Kansas River and Missouri River at St. Joseph.
73	Notropis lutrensis	do	Very abundant.
73	Notropis lineolatus	Notropis scylla	Marais des Cygnes.
73	Notropis deliciosa	Notropis blennius	Kansas River branches.
73	Notropis topeka	Notropis topeka	Missouri River, St. Joseph.
73	Notropis rubifrons	Notropis rubifrons	Kansas and Missouri rivers.
74	Phenacobius mirabilis	Phenacobius mirabilis	Common throughout the State.
74	Hybopsis biguttatus	Hybopsis kentuckiensis	Very common.
74	Hybopsis gelidus	? Hybopsis meeki	Branches of Missouri River.
74	Hybopsis storerianus	Hybopsis storerianus	Osage River and branches.
74	Platygobio gracilis	Platygobio gracilis	Kansas River.
74	Gila affinis	Gila robusta	Kansas River (erroneous).
74	Notemigonus chrysoleucus.	Abramis crysoleucas	Eastern Kansas.
74	Hyodon alosoides	Hiodon alosoides	Kansas, Marais des Cygnes, and Missouri rivers.
74	Hyodon tergisus	Hiodon tergisus	Common.
75	Dorosoma cepedianum	Dorosoma cepedianum	Very common.
75	Fundulus zebrinus	Fundulus zebrinus	Kansas River and branches.
75	Fundulus diaphanus	Fundulus diaphanus	Kansas River.
75	Anguilla rostrata	Anguilla chrysypa	Believed to be common throughout the State.
75	Pomoxys annularis	Pomoxis annularis	Kansas River at Lawrence.
75	Chænobryttus gulosus	Chænobryttus gulosus	Kansas River.
75	Lepomis cyanellus	Apomotis cyanellus	Common.
75	Lepomis humilis	Lepomis humilis	Locally abundant.
76	Micropterus salmoides	Micropterus salmoides	Kansas River at Lawrence.
76	Micropterus dolomieu	Micropterus dolomieu	Marais des Cygnes.
76	Percina caprodes	Percina caprodes	Eastern Kansas.
76	Boleosoma olmstedi maculatum.	Boleosoma nigrum	Kansas River.
76	Diplesion blennioides	Diplesion blennioides	Wild Cat Creek, Manhattan.
76	Hadropterus phoxocephalus.	Hadropterus phoxocephalus.	Marais des Cygnes.
76	Etheostoma variatum	Etheostoma cœruleum	Kansas River.
76	Etheostoma fusiforme	Boleichthys fusiformis	Marais des Cygnes.
77	Stizostedion vitreum	Stizostedion vitreum	Kansas River.
77	Stizostedion canadense	Stizostedion canadense	Kansas River and Mill Creek.
77	Roccus chrysops	Roccus chrysops	Kansas River.
77	Aplodonatus (Aplodinotus) grunniens	Aplodinotus grunniens	Do.
77	Clupea chrysochloris	Pomolobus chrysochloris	Abundant in large streams.

1886. CHARLES H. GILBERT. Third series of notes on Kansas fishes. <Bull. Washburn Laboratory of Natural History, vol. 1, No. 7, 207–211.

This is the third series of notes upon the collections made by the Washburn College Laboratory biological survey of Kansas. The Missouri Basin specimens reported upon in this paper came from the following places:

(*a*) Mission Creek, Shawnee County; collectors, Messrs. H. J. Adams and Ralph McCampbell.

(*b*) Snokomo Creek, Wabaunsee County; collector, Mr. Aaron Myers.

(*c*) Missouri River, Leavenworth; collectors, Professors Cragin and Kelly, and Messrs. Poston, Lange, and Johnston.

(*d*) Shunganunga Creek, Shawnee County; collectors, Professor Cragin and Mr. Myers.

(*e*) Blacksmith Creek, Shawnee County; collectors, Messrs. Adams and McCampbell.

(*f*) Spring near Maple Hill, Wabaunsee County.

Page.	Nominal species.	Identification.	Locality.
207	Noturus flavus	Noturus flavus	Mission Creek, Snokomo Creek, Leavenworth.
207	Amiurus natalis	Ameiurus natalis	Shunganunga, Blacksmith, and Mission creeks.
207	Ictalurus furcatus	Ictalurus furcatus	Leavenworth.
208	Notropis rubrifrons	Notropis rubrifrons	Blacksmith and Snokomo creeks.
209	Hybopsis gelidus	Hybopsis meeki	Leavenworth.
209	Hadropterus aspro	Hadropterus aspro	Snokomo Creek.
209	Percina caprodes	Percina caprodes	Do.
209	Etheostoma cœruleum lepidum.	Etheostoma lepidum	Shunganunga Creek and Maple Hill.
210	Boleosoma olmstedi maculatum.	Boleosoma nigrum	Shunganunga, Blacksmith, and Snokomo creeks.
210	Lota lota maculosa	Lota lota maculosa	Leavenworth.
210	Amiurus melas	Ameiurus melas	Blacksmith Creek.
210	Ictalurus punctatus	Ictalurus punctatus	Blacksmith and Mission creeks.
210	Catostomus teres	Catostomus commersonii	Blacksmith Creek.
210	Campostoma anomalum	Campostoma anomalum	Do.
210	Pimephales promelas	Pimephales promelas	Do.
210	Notropis topeka	Notropis topeka	Do.
210	Notropis lutrensis	Notropis lutrensis	Do.
210	Notropis megalops	Notropis cornutus	Do.
210	Hybopsis biguttatus	Hybopsis kentuckiensis	Mission and Blacksmith creeks.
211	Semotilus atromaculatus	Semotilus atromaculatus	Do.
211	Lepomis cyanellus	Apomotis cyanellus	Blacksmith Creek.
211	Lepomis humilis	Lepomis humilis	Do.

1887. R. ELLSWORTH CALL. Memoranda on a collection of fishes from the Ozark region of Missouri. <Proc. Davenport Ac. Nat. Sci., vol. v, 1887, 73–80.

The collections upon which this paper was based were made by Professor Call in June and July, 1886. The majority of the specimens came from the west fork of Black River and its smaller tributaries in Reynolds County, and from Jacks Fork and its tributaries in Shannon County. These streams are in southeastern Missouri and drain southward by way of the Black River, being no part of the Missouri system. A small collection was made in Texas County, in Piney River, a tributary of the Gasconade, which flows northeastward into the Missouri. In October and November of the same year Professor Call made some collections in Bear and Hickson creeks, near Columbia, Boone County, which lies on the north side of the Missouri. In this paper 11 species are credited to Piney River, viz:

Ictalurus punctatus.
Catostomus nigricans (as Hypentelium nigricans).
Campostoma anomalum.
Hybognathus nubilum (as Dionda nubila).
Hybognathus nuchale.
Notropis blennius (as N. deliciosus).
Notropis whipplii (as N. notatus).
Notropis zonatus.
Notropis cornutus (as N. megalops).
Micropterus dolomieu.
Cottus bairdi (as Uranidea richardsoni).

In the same paper 5 species are reported from Hickson Creek, near Columbia, Boone County, viz:

Catostomus commersonii (as C. teres).
Schilbeodes exilis (as Noturus exilis).
Campostoma anomalum.
Apomotis cyanellus (as Lepomis cyanellus).
Moxostoma aureolum (as M. macrolepidotum.)

From Bear Creek, near Columbia, Boone County, the 10 following species are recorded:

Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Boleosoma nigrum (as B. olmstedi ozarcanum).
Campostoma anomalum.
Pimephales notatus.
Pimephales promelas.
Notropis blennius (as N. deliciosus missuriensis).
Semotilus atromaculatus.
Phenacobius scopifer (as P. mirabilis scopifer).
Pomoxis annularis.

1887. O. P. HAY. A contribution to the knowledge of the fishes of Kansas. <Proc. U. S. Nat. Mus. 1887, 242–253.

The fishes on which this paper was based were collected in July, 1885. by Prof. Hay, assisted by Prof. M. J. Thompson, of Bethany College. Collections were made from the following streams:

(*a*) Republican River, Concordia, Cloud County, Kans.
(*b*) Small tributary of Solomon River, Beloit, Mitchell County, Kans.
(*c*) North fork of Solomon River, Kirwin, Phillips County, Kans.
(*d*) North fork of Solomon River, Lenora, Norton County, Kans.
(*e*) Saline River, north of Wakeeney, Trego County, Kans.
(*f*) Smoky Hill River, Wallace, Wallace County, Kans.

The following species were obtained:

Page.	Nominal species.	Identification.	Locality.
242	Hyodon alosoides	Hiodon alosoides	Republican River.
242	Notropis lutrensis	Notropis lutrensis	Do.
242	Ictiobus velifer	Carpiodes velifer	Do.
242	Ictalurus punctatus	Ictalurus punctatus	Do.
242	Ameiurus melas	Ameiurus melas	Do.
243	Boleosoma olmstedi	Boleosoma nigrum	Solomon River at Beloit.
243	Lepomis humilis	Lepomis humilis	Do.
243	Lepomis cyanellus	Apomotis cyanellus	Do.
243	Semotilus atromaculatus	Semotilus atromaculatus	Do.
243	Phenacobius mirabilis	Phenacobius mirabilis	Do.
243	Notropis megalops	Notropis cornutus	Do.
243	Notropis lutrensis	Notropis lutrensis	Do.
244	Notropis macrostoma	do	Do.
245	Notropis *æneolus*	Notropis topeka	Do.
246	Notropis deliciosus	Notropis blennius	Do.
246	Notropis topeka	Notropis topeka	Do.
246	Pimephales notatus	Pimephales notatus	Do.
247	Pimephales promelas confertus.	Pimephales promelas	Do.

Page.	Nominal species.	Identification.	Locality.
247	Campostoma anomalum	Campostoma anomalum	Solomon River at Beloit.
247	Moxostoma macrolepidotum.	Moxostoma aureolum	Do.
247	Catostomus teres	Catostomus commersonii	Do.
247	Ictiobus velifer	Carpiodes velifer	Do.
247	Ictalurus punctatus	Ictalurus punctatus	Do.
247	Amiurus melas	Ameiurus melas	Do.
247	Lepidosteus osseus	Lepisosteus osseus	Do.
247	Lepomis humilis	Lepomis humilis	North fork of Solomon River at Kirwin.
247	Semotilus atromaculatus	Semotilus atromaculatus	Do.
247	Notropis megalops	Notropis cornutus	Do.
247	Notropis deliciosus	Notropis blennius	Do.
248	Notropis lutrensis	Notropis lutrensis	Do.
248	Notropis æneolus	Notropis topeka	Do.
248	Pimephales promelas confertus.	Pimephales promelas	Do.
248	Pimephales notatus	Pimephales notatus	Do.
248	Amiurus melas	Ameiurus melas	Do.
248	Etheostoma lepidum	Etheostoma lepidum	North fork of Solomon River at Lenora.
249	Boleosoma olmstedi	Boleosoma nigrum	Do.
249	Lepomis cyanellus	Apomotis cyanellus	Do.
249	Fundulus zebrinus	Fundulus zebrinus	Do.
249	Squalius elongatus	Leuciscus elongatus	Do.
249	Semotilus atromaculatus	Semotilus atromaculatus	Do.
249	Phenacobius mirabilis	Phenacobius mirabilis	Do.
249	Notropis megalops	Notropis cornutus	Do.
249	Notropis umbratilis	Notropis umbratilis	Do.
249	Notropis deliciosus	Notropis blennius	Do.
249	Notropis lutrensis	Notropis lutrensis	Do.
249	Pimephales promelas confertus.	Pimephales promelas	Do.
249	Pimephales notatus	Pimephales notatus	Do.
249	Chrosomus erythrogaster	Chrosomus erythrogaster	Do.
250	Campostoma anomalum	Campostoma anomalum	Do.
250	Catostomus teres	Catostomus commersonii	Do.
250	Noturus flavus	Noturus flavus	Do.
250	Etheostoma lepidum	Etheostoma lepidum	Saline River near Wakeeney.
250	Boleosoma olmstedi	Boleosoma nigrum	Do.
250	Lepomis humilis	Lepomis humilis	Do.
250	Lepomis cyanellus	Apomotis cyanellus	Do.
250	Fundulus zebrinus	Fundulus zebrinus	Do.
250	Hyodon alosoides	Hiodon alosoides	Do.
250	Semotilus atromaculatus	Semotilus atromaculatus	Do.
250	Hybopsis biguttatus	Hybopsis kentuckiensis	Do.
250	Hybopsis storerianus	Hybopsis storerianus	Do.
250	Phenacobius mirabilis	Phenacobius mirabilis	Do.
250	Notropis megalops	Notropis cornutus	Do.
250	Notropis deliciosus	Notropis blennius	Do.
250	Notropis lutrensis	Notropis lutrensis	Do.
251	Notropis æneolus	Notropis topeka	Do.
251	Pimephales promelas confertus.	Pimephales promelas	Do.
251	Pimephales notatus	Pimephales notatus	Do.
251	Hybognathus nuchalis	Hybognathus nuchale	Do.
251	Campostoma anomalum	Campostoma anomalum	Do.
251	Catostomus teres	Catostomus commersonii	Do.
251	Ictiobus velifer	Carpiodes velifer	Do.
251	Ictalurus punctatus	Ictalurus punctatus	Do.
251	Amiurus melas	Ameiurus melas	Do.
252	Etheostoma lepidum	Etheostoma lepidum	Smoky Hill River at Wallace.
252	Lepomis humilis	Lepomis humilis	Do.
252	Lepomis cyanellus	Apomotis cyanellus	Do.
252	Fundulus zebrinus	Fundulus zebrinus	Do.
252	Semotilus atromaculatus	Semotilus atromaculatus	Do.
252	Hybopsis biguttatus	Hybopsis kentuckiensis	Do.
252	Phenacobius mirabilis	Phenacobius mirabilis	Do.
252	Notropis megalops	Notropis cornutus	Do.
252	Notropis deliciosus	Notropis blennius	Do.
252	Notropis lutrensis	Notropis lutrensis	Do.
252	Notropis æneolus	Notropis topeka	Do.
252	Notropis *germanus*	Notropis heterodon	Do.
253	Pimephales promelas confertus.	Pimephales promelas	Do.
253	Hybognathus nuchalis	Hybognathus nuchale	Do.
253	Campostoma anomalum	Campostoma anomalum	Do.
253	Catostomus teres	Catostomus commersonii	Do.
253	Amiurus melas	Ameiurus melas	Do.
253	Noturus flavus	Noturus flavus	Do.

1889. CHARLES H. GILBERT. Fourth series of notes on the fishes of Kansas. <Bull. Washburn Laboratory of Natural History, vol. II, No. 9, 38–43, January, 1889.

These collections also were made by Professor Cragin and his students (James L. Poston and Dana McVicar) during the summer of 1887 for the Washburn College Laboratory of Natural History. The Missouri Basin localities are the following:

(*a*) Republican River, near Wano, Cheyenne County.
(*b*) Sappa Creek, a tributary of Republican River, Oberlin, Decatur County.
(*c*) North fork of Solomon River, Logan, Phillips County.
(*d*) North fork of Solomon River, Harlan, Smith County.
(*e*) Middle Beaver Creek, a tributary of North fork of Solomon River, Smith County.
(*f*) A spring branch of Spring Creek, near Smith Center, Smith County.
(*g*) Osage River, La Cygne, Linn County.

Localities *a* to *f* are in the northwestern part of the State, while *g* is near the middle of the eastern boundary.

Page.	Nominal species.	Identification.	Locality.
38	Amiurus melas	Ameiurus melas	Sappa Creek.
38	Notropis deliciosus lineolatus.	Notropis blennius	Republican River; Logan and Harlan; Ward Creek, Shawnee County.
39	Notropis topeka	Notropis topeka	Sappa Creek.
39	Notropis lutrensis	Notropis lutrensis	Do.
39	Notropis jejunus	Notropis jejunus	Do.
39	Phenacobius mirabilis	Phenacobius mirabilis	Do.
39	Semotilus atromaculatus	Semotilus atromaculatus	Republican River.
39	Fundulus zebrinus	Fundulus zebrinus	Do.
39	Lepomis humilis	Lepomis humilis	Sappa Creek.
39	Etheostoma olmstedi maculatum.	Boleosoma nigrum	Do.
40	Amiurus melas	Ameiurus melas	Logan and Harlan; Middle Beaver Creek.
40	Ictalurus punctatus	Ictalurus punctatus	Harlan.
40	Noturus flavus	Noturus flavus	Logan and Harlan.
40	Catostomus teres	Catostomus commersonii	Middle Beaver Creek and Logan.
40	Campostoma anomalum	Campostoma anomalum	Middle Beaver Creek and spring branch of Spring Creek.
40	Hybognathus nuchalis	Hybognathus nuchale	Logan.
40	Pimephales promelas	Pimephales promelas	Middle Beaver Creek and Logan.
40	Notropis deliciosus lineolatus.	Notropis blennius	Middle Beaver and Spring creeks and Logan.
40	Notropis lutrensis	Notropis lutrensis	Do.
40	Notropis megalops	Notropis cornutus	Logan.
40	Phenacobius mirabilis	Phenacobius mirabilis	Do.
40	Semotilus atromaculatus	Semotilus atromaculatus	Middle Beaver and Spring Creeks.
40	Fundulus zebrinus	Fundulus zebrinus	Logan and in a spring branch of Sand Creek 5 miles southwest of Logan.
40	Lepomis humilis	Lepomis humilis	Smith County. ?
40	Ictalurus punctatus	Ictalurus punctatus	Osage River at La Cygne, Linn County, Kans.
40	Noturus flavus	Noturus flavus	Do.
40	Notropis deliciosus	Notropis blennius	Do.
40	Notropis lutrensis	Notropis lutrensis	Do.
40	Notropis rubrifrons	Notropis rubrifrons	Do.
40	Phenacobius mirabilis	Phenacobius mirabilis	Do.
40	Hybopsis biguttatus	Hybopsis kentuckiensis	Do.
40	Dorosoma cepedianum	Dorosoma cepedianum	Do.
40	Lepomis humilis	Lepomis humilis	Do.
40	Lepomis cyanellus	Apomotis cyanellus	Do.
40	Etheostoma phoxocephalus	Hadropterus phoxocephalus	Do.

1891. DAVID STARR JORDAN. Report of explorations in Colorado and Utah during the summer of 1889, with an account of the fishes found in each of the river basins examined. <Bull. U. S. Fish Comm., IX, 1889 (May 29, 1891), 1-40, plates 1-5.

During July and August, 1889, these collections were made under the direction of the United States Fish Commission. In making them Dr. Jordan was assisted by Messrs. Barton W. Evermann, Bert Fesler, and Bradley M. Davis. Specimens from the Missouri Basin were obtained at the following places:

(*a*) South Platte River near Denver.
(*b*) South Platte River at Hartsel Hot Springs.
(*c*) Bear Creek near Morrison, Jefferson County, Colo. This creek is a small tributary of South Platte. The specimens from this place were obtained by Messrs. Fesler and Davis.
(*d*) Middle Boulder Creek near Boulder, Boulder County, Colo. This is also a tributary of the South Platte. The collecting here was done by Messrs. Jordan and Evermann.

The following species were obtained:

Page.	Nominal species.	Identification.	Locality.
7	Catostomus teres sucklii	Catostomus commersonii	Denver.
7	Catostomus griseus	Catostomus griseus	Denver, Hartsel Hot Springs, Morrison, and Boulder.
8	Hybognathus nuchalis (? var. placita).	Hybognathus nuchale evansi.	Denver.
8	Notropis scylla	Notropis scylla	Do.
8	Notropis gilberti	Notropis gilberti	Do.
8	Notropis megalops	Notropis cornutus	Do.
8	Notropis lutrensis	Notropis lutrensis	Do.
8	Semotilus atromaculatus	Semotilus atromaculatus	Do.
8	Rhinichthys dulcis	Rhinichthys cataractæ dulcis.	Denver, Hartsel Hot Springs, and Morrison.
8	Zygonectes floripinnis	Fundulus floripinnis	Denver.
8	Etheostoma nigrum	Boleosoma nigrum	Do.
8	Salmo mykiss stomias	Salmo mykiss stomias	Morrison.

1891a. DAVID STARR JORDAN. A reconnoissance of the streams and lakes of the Yellowstone National Park, Wyoming, in the interest of the United States Fish Commission. <Bull. U. S. Fish Comm., IX, 1889 (July 11, 1891), 41-63, plates 7-22, and map.

The investigations upon which this paper was based were made under the direction of the United States Fish Commissioner in October, 1889, by Dr. Jordan, assisted by Dr. C. H. Gilbert. The following streams in the Missouri Basin were examined:

(*a*) Yellowstone and Gardiner rivers near Mammoth Hot Springs, and Yellowstone River at Livingston, Mont.
(*b*) Madison River, Yellowstone Park.
(*c*) Horsethief Springs, Gallatin County, Mont.
(*d*) Gallatin River west of Yellowstone Park.
(*e*) Riddle Lake and Solution Creek, Yellowstone Park.
(*f*) Canyon Creek, Yellowstone Park.

The following species were found in the Missouri Basin:

Page.	Nominal species.	Identification.	Locality.
46	Catostomus griseus	Catostomus griseus	Yellowstone and Gardiner rivers.
48	Rhinichthys dulcis	Rhinichthys cataractæ dulcis.	Gardiner River.
49	Coregonus williamsoni *cismontanus.*	Coregonus williamsoni cismontanus.	Madison, Yellowstone, and Gardiner rivers, and Horsethief Springs.
49	Thymallus signifer ontariensis.	Thymallus signifer ontariensis.	Madison River, Horsethief Springs, and Gallatin River.
50	Salmo mykiss	Salmo mykiss lewisi	Livingston, Gardiner River below the falls, Solution Creek, Riddle Lake, Canyon Creek, and Madison River.
53	Cottus bairdi punctulatus	Cottus bairdi punctulatus	Gibbon and Madison rivers, and Canyon Creek.

1891. SETH EUGENE MEEK. Report of explorations made in Missouri and Arkansas during 1889, with an account of the fishes observed in each of the river basins examined. <Bull. U. S. Fish Comm., IX, 1889 (1891), 113–141.

The collections reported upon in this paper were made between July 17 and August 21, 1889, for the United States Fish Commission, by Professor Meek, assisted by Messrs. Frank M. Drew and Louis J. Rettger. Collections were made in Missouri in the Missouri Basin at the following places: Gasconade River at Arlington, Phelps County, and at a point 5 miles above Arlington; Little Piney River, an eastern tributary of the Gasconade at Arlington, and also at Newburg, Phelps County; Osage Fork of Gasconade River, 6 miles southeast of Marsh, field, Webster County; Lock Fork of Gasconade River, Mansfield-Wright County; Big Piney River, a southern tributary of the Gasconade, near Cabool, Texas County; Jones Creek, a small western tributary of the Gasconade, near Dixon, Pulaski County; Marais River, near Dixon; Niangua River, near Marshfield; and Sac River, near Springfield, Greene County. The last three streams mentioned are tributaries of Osage River, the most important southern tributary of the Missouri in Missouri.

The following 16 species were obtained from the Gasconade River at or near Arlington:

Leptops olivaris.
Ictalurus punctatus.
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Notropis shumardi (as N. boops).
Notropis zonatus.
Hybopsis kentuckiensis.
Hybopsis dissimilis.
Semotilus atromaculatus.
Fundulus catenatus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus dolomieu.
Diplesion blennioides (as Etheostoma blennioides).
Cottogaster uranidea (as Etheostoma uranidea).
Etheostoma cœruleum spectabile.

From Little Piney River at Arlington and Newburg 25 species were obtained, as follows:

Schilbeodes exilis (as Noturus exilis).
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Hybognathus nubilum.
Pimephales notatus.
Notropis shumardi (as N. boops).
Notropis lutrensis.
Notropis whipplii.
Notropis zonatus.
Hybopsis kentuckiensis.
Hybopsis dissimilis.
Semotilus atromaculatus.
Dorosoma cepedianum.
Fundulus catenatus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus dolomieu.
Micropterus salmoides.
Diplesion blennioides (as Etheostoma blennioides).
Cottogaster uranidea (as Etheostoma uranidea).
Hadropterus aspro (as Etheostoma aspro).
Hypohomus cymatotænia (as Etheostoma cymatotænia).
Etheostoma flabellare.
Etheostoma cœruleum spectabile.
Cottus bairdi.

From Osage Fork of the Gasconade the following 27 species were taken:

Ameiurus nebulosus.
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Pimephales notatus
Notropis cayuga.
Notropis whipplii.
Notropis umbratilis cyanocephalus.
Notropis zonatus.
Notropis rubrifrons.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Fundulus macdonaldi (as Zygonectes macdonaldi).
Labidesthes sicculus.
Lepomis macrochirus.
Lepomis pallidus.
Lepomis megalotis.
Micropterus dolomieu.
Micropterus salmoides.
Percina caprodes (as Etheostoma caprodes).
Diplesion blennioides (as Etheostoma blennioides).
Hypohomus cymatotaenia (as Etheostoma cymatotaenia).
Etheostoma flabellare.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Cottus bairdi.

The following 20 species were found in Lock Fork of the Gasconade:

Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Hybognathus nubilum.
Pimephales notatus.
Notropis cayuga.
Notropis umbratilis cyanocephalus.
Notropis zonatus.
Notropis cornutus (as N. megalops).
Notropis rubrifrons.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Lepomis macrochirus.
Micropterus salmoides.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Boleosoma nigrum (as Etheostoma nigrum).
Diplesion blennioides (as Etheostoma blennioides).
Percina caprodes (as Etheostoma caprodes).
Cottus bairdi.

The collection from Big Piney River contained 16 species, as follows:

Ameiurus melas.
Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Chrosomus erythrogaster.
Pimephales notatus.
Notropis cayuga.
Notropis zonatus.
Notropis cornutus (as N. megalops).
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Labidesthes sicculus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus salmoides.
Etheostoma cœruleum spectabile.

From Jones Creek, near Dixon, the following 17 species were taken:

Schilbeodes exilis (as Noturus exilis).
Catostomus nigricans.
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Notropis shumardi (as N. boops).
Notropis zonatus.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Fundulus catenatus.
Fundulus macdonaldi (as Zygonectes macdonaldi, types).
Etheostoma flabellare.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Microperca punctulata (as Etheostoma microperca).
Apomotis cyanellus (as Lepomis cyanellus).
Cottus bairdi.

The following 10 species were found in each of the three tributaries of the Osage River—the Marais, the Niangua, and the Sac:

Catostomus nigricans.
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Pimephales notatus.
Notropis zonatus.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Etheostoma cœruleum spectabile.
Cottus bairdi.

The following 7 species were found in both the Marais and Niangua, but not in the Sac:

Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. macrolepidotum duquesnei).
Campostoma anomalum.
Labidesthes sicculus.
Apomotis cyanellus (as Lepomis cyanellus).
Boleosoma nigrum (as Etheostoma nigrum).
Etheostoma flabellare.

The following 2 species were found in the Marais and Sac, but not in the Niangua:

Diplesion blennioides (as Etheostoma blennioides).
Notropis umbratilis.

In the Niangua were found 4 species not found in either of the two other streams, viz:

Schilbeodes exilis (as Noturus exilis).
Notropis cayuga.
Etheostoma punctulatum.
Etheostoma nianguæ.

The Marais contained 7 species not found in either of the other streams, viz:

Ameiurus melas.
Ictiobus cyprinella.
Ictiobus bubalus.
Abramis crysoleucas (as Notemigonus chrysoleucus).
Notropis lutrensis.
Lepomis humilis.
Micropterus dolomieu.
Hypohomus cymatotænia (as Etheostoma cymatotænia).

In the Sac River only 2 species were found which were not obtained from the Marais or the Niangua, viz:

Notropis blennius (as N. deliciosus).
Notropis rubrifrons.

1892. SETH EUGENE MEEK. Report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891. <Bull. U. S. Fish Comm., x, 1890 (1892), 217–248.

The Missouri Basin localities mentioned in this paper are as follows:

(*a*) Missouri River at Sioux City, Woodbury County, Iowa.
(*b*) Big Sioux River at Sioux City and at Sioux Falls, Minnehaha County, S. Dak.
(*c*) Silver Lake, Dickinson County, Iowa, at the head of the north fork of Little Sioux River.
(*d*) East Fork of Soldier River at Charter Oak, Crawford County, Iowa.
(*e*) Boyer River at Arion, Crawford County, Iowa.

All of these localities (except Sioux Falls) are in the northwestern part of Iowa, in which region all the streams flow southwestward, in courses nearly parallel to the Missouri. In this report upon the fishes of Iowa, Prof. Meek records the following species from that portion of the State lying in the Missouri River basin:

Page.	Species.	Locality.
245	Polyodon spathula	Missouri River, Harrison County, Iowa.
245	Scaphirhynchus platorynchus	Missouri River.
245, 246	Ictalurus punctatus	Missouri River; Big Sioux River at Sioux City.
245, 246	Noturus flavus	Missouri River; Big Sioux River at Sioux Falls and Sioux City.
246	Schilbeodes gyrinus	Big Sioux River.
247, 248	Ameiurus melas	Silver Lake; Soldier River at Charter Oak; Boyer River at Arion.
245, 246	Carpiodes velifer	Missouri River; Big Sioux River at Sioux City.
246, 248	Catostomus commersonii	Big Sioux River at Sioux City; Boyer River at Arion.
246	Moxostoma aureolum (as duquesnei).	Big Sioux River at Sioux Falls and Sioux City.
245, 246, 247	Hybognathus nuchale	Missouri River; Big Sioux River at Sioux City; Soldier River at Charter Oak.
246, 247	Pimephales notatus	Big Sioux River at Sioux City and Sioux Falls; Silver Lake.
247, 248	Pimephales promelas	Silver Lake; Soldier River at Charter Oak; Boyer River at Arion.
245, 246	Notropis dilectus	Missouri River; Big Sioux River at Sioux Falls.
246	Notropis cayuga	Big Sioux River at Sioux City.
246, 248	Notropis blennius	Big Sioux River; Boyer River.
246, 248	Notropis topeka	Big Sioux River at Sioux City; Boyer River.
246	Notropis heterodon	Silver Lake.
246	Notropis hudsonius	Big Sioux River at Sioux City.
246	Notropis whipplii	Do.
246	Notropis atherinoides	Do.
246, 247, 248	Notropis cornutus (as megalops).	Big Sioux River; Silver Lake; Boyer River.
247, 248	Notropis gilberti	Soldier River; Boyer River.
248	Notropis lutrensis	Boyer River.
245	Hybopsis meeki (as gelidus)	Missouri River.
246	Hybopsis kentuckiensis	Big Sioux River at Sioux Falls.
245	Platygobio gracilis	Missouri River.
246, 247	Abramis crysoleucas	Big Sioux River at Sioux Falls; Silver Lake.
247, 248	Semotilus atromaculatus	Soldier River; Boyer River.
248	Phenacobius mirabilis	Boyer River.
245, 246	Dorosoma cepedianum	Missouri River; Big Sioux River at Sioux City.
245, 246	Hiodon alosoides	Do.
246, 247	Fundulus zebrinus	Big Sioux River at Sioux City; Silver Lake.
246, 248	Percopsis guttatus	Big Sioux River at Sioux City; Boyer River.
248	Lucius lucius	Boyer River.
246	Ambloplites rupestris	Big Sioux River at Sioux City and Sioux Falls.
246, 247, 248	Apomotis cyanellus	Big Sioux River at Sioux City and Sioux Falls; Soldier River; Boyer River.
246, 248	Lepomis humilis	Big Sioux River at Sioux City and Sioux Falls; Boyer River.
247	Lepomis megalotis	Silver Lake.
246, 248	Boleosoma nigrum	Big Sioux River at Sioux City and Sioux Falls; Boyer River.
246	Etheostoma zonale	Big Sioux River at Sioux City.
246	Hadropterus aspro	Big Sioux River.
247	Etheostoma iowæ	Silver Lake.
246, 247	Perca flavescens	Big Sioux River at Sioux City and Sioux Falls; Silver Lake.
246	Stizostedion vitreum	Big Sioux River.
246	Stizostedion canadense	Do.
246, 247	Roccus chrysops	Big Sioux River; Silver Lake.
246	Aplodinotus grunniens	Big Sioux River at Sioux City.

1892. BARTON W. EVERMANN. A reconnaissance of the streams and lakes of western Montana and northwestern Wyoming, in Report of the Commissioner of Fish and Fisheries respecting the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States. Senate Mis. Doc. 65, Fifty-second Congress, first session, 1–90, plates 1–36, May 25, 1892.

These investigations were carried on during July and August, 1891, by Professor Evermann, assisted by Prof. O. P. Jenkins, of Stanford University, and Mr. B. Clapham, of Monroeville, Ind.

The Missouri Basin localities from which specimens were obtained are the following:

(*a*) Red Rock River, near Red Rock, Beaverhead County, Mont.
(*b*) Beaverhead River, near Dillon, Beaverhead County, Mont.
(*c*) Junction of Firehole and Gibbon rivers, Yellowstone Park.
(*d*) Horsethief Springs, Gallatin County, Mont.
(*e*) Atlantic Creek, in and below Two-Ocean Pass, Wyoming.
(*f*) Mouth of Upper Yellowstone River, Yellowstone Park.
(*g*) Meadow Creek at its mouth on east side of Yellowstone Lake.
(*h*) East Fork of Gardiner River, below the falls, Yellowstone Park.
(*i*) McClellan Creek, near Helena, Mont.
(*j*) Canyon Creek, Yellowstone Park.

From these localities only 7 species were obtained, viz:

Page.	Species.	Identification.	Locality.
41	Catostomus discobolus	Pantosteus jordani	Red Rock and Beaverhead rivers.
42	Rhinichthys dulcis	Rhinichthys cataractæ dulcis.	Beaverhead River, Red Rock River, and junction of Firehole and Gibbon rivers.
47	Coregonus williamsoni	Coregonus williamsoni cismontanus.	Do.
47	Thymallus signifer	Thymallus signifer montanus.	Red Rock and Beaverhead rivers; junction of Firehole and Gibbon Rivers; Horsethief Springs.
48	Salmo mykiss	Salmo mykiss lewisi	Atlantic Creek in Two-Ocean Pass and one mile above its mouth; mouth of Upper Yellowstone River; Meadow Creek; east fork of Gardiner River; McClellan Creek.
51	Cottus bairdi punctulatus	Cottus bairdi punctulatus	Beaverhead and Red Rock rivers; Canyon Creek and junction of Firehole and Gibbon rivers.
52	Lota lota maculosa	Lota lota maculosa	Red Rock River.

1892a. BARTON W. EVERMANN. Report on the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States. <Bull. U. S. Fish Comm., XI, 1891 (1892), 1–90, plates 1–36.

This is the Fish Commission edition of the above report, and contains no additional species.

1893 BARTON W. EVERMANN. Description of a new sucker, *Pantosteus jordani*, from the Upper Missouri Basin. <Bull. U. S. Fish Comm., XII, 1892 (January 27, 1893), 51–56, with figure.

This paper contains the original description of *Pantosteus jordani*. The type locality and all others from which specimens were obtained are given under this species in the general list and need not be repeated.

1893a. BARTON W. EVERMANN. The ichthyologic features of the Black Hills. <Proc. Indiana Ac. Sci. 1892 (1893), 73–78.

This was a preliminary paper upon the work done in the Black Hills and gives the Black Hills localities for the 15 species collected there in October, 1892, by Evermann and McCormick. All these localities are clearly given in the present report, and need not be repeated here.

1894. CARL H. EIGENMANN. Results of explorations in western Canada and the northwestern United States. <Bull. U. S. Fish Comm., XIV, 1894 (July 7), 101–132, plates 5–8.

During these explorations (summer of 1892) Dr. Eigenmann made two stations in the Missouri River basin—at Craig, Mont. (long. 112° W., lat. 47° N.), where collections were made from Missouri River, and at Poplar, Mont. (long. 105° W., lat. 48° N.), where Poplar River was examined. The following species are recorded by Dr. Eigenmann:

Page.	Species.	Locality.
107	Noturus flavus	Missouri River at Craig, Mont.
107	Carpiodes velifer	Poplar River at Poplar, Mont.
108	Catostomus griseus	Missouri River at Craig.
108	Catostomus commersonii	Poplar River at Poplar.
108	Moxostoma aureolum	Poplar River.
108	Hybognathus nuchale evansi (as placita)	Do.
110	Notropis atherinoides	Do.
111	Rhinichthys cataractæ dulcis	Poplar River; Missouri River.
111	Couesius dissimilis	Poplar River.
111	Platygobio gracilis	Missouri River; Poplar River
114	Hiodon alosoides	Poplar River at Poplar.
115	Coregonus williamsoni	Missouri River at Craig.
115	Thymallus signifer ontariensis	Do.
116	Eucalia inconstans	Poplar River at Poplar.
118	Stizostedion canadense boreum (as griseum)	Do.
118	Cottus bairdi punctulatus	Missouri River at Craig.
118	Lota lota maculosa	Do.

1894. SETH EUGENE MEEK. Notes on the fishes of western Iowa and eastern Nebraska. <Bull. U. S. Fish Comm., XIV, 1894, 133–138.

The localities from which were obtained the specimens mentioned in this paper are the following:

(*a*) Spirit Lake, Dickinson County, Iowa.
(*b*) East and West Okoboji lakes, Dickinson County, Iowa.
(*c*) Little Sioux River, the outlet of Spirit and the Okoboji lakes, was examined at Cherokee, Cherokee County, Iowa.
(*d*) Floyd River was examined at Lemars, Plymouth County, and Sioux City, Woodbury County, Iowa.

Collections were made from these Iowa localities by Professor Meek in 1890. A few specimens from Spirit and East Okoboji lakes obtained by Professor Evermann, October 31, 1892, are also included.

(*e*) Platte River at Fremont, Dodge County, Nebr.
(*f*) Elkhorn River near Fremont, Nebr.
(*g*) Salt Creek near Lincoln, Nebr.
(*h*) Blue River at Crete, Saline County, Nebr.

The specimens from these four places were obtained in the summer of 1891 by Professor Meek and Prof. P. B. Burnett, then of Cotner College, now of Nebraska State University.

(*i*) Nebraska State fish commission ponds in Sarpy County, near the mouth of Platte River.

The few specimens recorded by Professor Meek from this locality were obtained by Messrs. Evermann and McCormick, October 25, 1892.

In this paper Dr. Meek records the following species from Missouri Basin localities:

Page.	Species.	Locality.
135	Lepisosteus osseus	Spirit Lake, Iowa.
135	Schilbeodes gyrinus	Platte River at Fremont; Floyd River at Lemars and Sioux City.
135	Noturus flavus	Salt Creek near Lincoln.
135	Ameiurus melas	Platte and Elkhorn Rivers at Fremont; Salt Creek near Lincoln; Floyd River at Lemars; Spirit Lake.
135	Ictalurus punctatus	Blue River at Crete; Platte and Elkhorn rivers at Fremont; Salt Creek near Lincoln.
135	Ictiobus cyprinella	Elkhorn River at Fremont.
135	Ictiobus bubalus	Floyd River at Sioux City; East Okoboji Lake.
135	Carpiodes velifer	Blue, Platte, Elkhorn, and Floyd rivers.
135	Catostomus commersonii	Floyd River at Lemars and Sioux City.
136	Moxostoma aureolum	Floyd and Blue rivers.
136	Placopharynx duquesnei	Floyd River.
136	Campostoma anomalum	Floyd River at Sioux City.
136	Hybognathus nuchale	Platte, Elkhorn, and Floyd rivers; Salt Creek.
136	Pimephales promelas	Blue, Platte, Elkhorn, and Floyd rivers; Salt Creek.
136	Pimephales notatus	Blue, Elkhorn, and Floyd rivers.
136	Notropis cayuga	Floyd River.
136	Notropis blennius	Platte, Elkhorn, Blue, and Floyd rivers; Salt Creek.
136	Notropis gilberti	Floyd River.
136	Notropis topeka	Blue and Floyd rivers; Salt Creek.
136	Notropis hudsonius	Floyd River; Spirit Lake, and East and West Okoboji lakes.
136	Notropis lutrensis	Blue, Platte, Elkhorn, and Floyd rivers; Salt Creek.
136	Notropis cornutus	Floyd and Elkhorn rivers.
136	Notropis jejunus	Platte and Elkhorn rivers.
136	Notropis dilectus	Floyd and Elkhorn rivers.
136	Phenacobius mirabilis	Blue River.
137	Hybopsis kentuckiensis	Elkhorn River.
137	Hybopsis storerianus	Floyd and Elkhorn rivers.
137	Hybopsis hyostomus	Blue, Platte, and Elkhorn rivers.
137	Platygobio gracilis	Platte River.
137	Semotilus atromaculatus	Floyd River.
137	Abramis crysoleucas	Platte and Floyd rivers; Spirit Lake.
137	Hiodon alosoides	Floyd and Platte rivers.
137	Dorosoma cepedianum	Floyd and Elkhorn rivers.
137	Percopsis guttatus	Floyd River; East Okoboji Lake.
137	Fundulus zebrinus	East Okoboji Lake.
137	Fundulus sciadicus	Floyd, Platte, and Elkhorn rivers.
137	Lucius lucius	Floyd River; East Okoboji, West Okoboji, and Spirit lakes.
137	Pomoxis sparoides	East Okoboji Lake.
137	Ambloplites rupestris	Floyd River.
137	Apomotis cyanellus	Platte River at South Bend and Fremont; Elkhorn and Floyd rivers.
137	Lepomis humilis	Platte River at South Bend and Fremont; Elkhorn, Blue, and Floyd rivers; Salt Creek.
137	Lepomis pallidus	Spirit Lake.
137	Eupomotis gibbosus	Do.
138	Micropterus salmoides	Floyd, Platte, and Elkhorn rivers; Spirit Lake.
138	Micropterus dolomieu	Spirit Lake.
138	Boleosoma nigrum	Floyd and Elkhorn rivers; Spirit and East Okoboji lakes.
138	Hadropterus aspro	Floyd River.
138	Etheostoma iowæ	Platte and Elkhorn rivers at Fremont; State fish commission ponds at South Bend; Floyd River at Lemars and Sioux City; Spirit Lake.
138	Perca flavescens	East Okoboji and Spirit lakes.
138	Stizostedion vitreum	West Okoboji and Spirit lakes.
138	Stizostedion canadense	Floyd and Platte rivers; Spirit Lake.
138	Aplodinotus grunniens	Elkhorn River.

1896. ALBERT J. WOOLMAN. A report upon ichthyological investigations in western Minnesota and eastern North Dakota. < Report U. S. Fish Comm., 1893 (1896), 343–373.

During the months of July and August, 1892, Mr. Woolman made extensive collections of fishes in western Minnesota and eastern North Dakota, in the interests of the United States Fish Commission. He was assisted by Mr. Ulysses O. Cox, instructor in biology in the State Normal School, Mankato, Minn. The work was confined chiefly to the basins of the Minnesota River and the Red River of the North, but some work was done in the Dakota or James River, which is a tributary of the Missouri.

Collections were made in this river basin at the following places:

(*a*) Dakota River at Lamoure, about 100 miles southwest from Fargo.
(*b*) Dakota River at Jamestown, about 55 miles northeast from Lamoure.
(*c*) Pipestem Creek near Jamestown.

The total number of species obtained at these stations was 20. The following is the list:

Page.	Name under which recorded.	Name adopted.	Locality.
359	Ameiurus nebulosus	Ameiurus nebulosus	Lamoure; Jamestown.
359	Ameiurus natalis	Ameiurus natalis	Lamoure.
359	Ameiurus melas	Ameiurus melas	Dakota River; Pipestem Creek.
359	Catostomus teres	Catostomus commersonii	Lamoure; Jamestown.
359	Moxostoma macrolepidotum duquesnei.	Moxostoma aureolum	Jamestown.
359	Campostoma anomalum	Campostoma anomalum	Do.
359	Pimephales notatus	Pimephales notatus	Lamoure; Jamestown.
359	Pimephales promelas	Pimephales promelas	Lamoure.
360	Hybognathus nuchalis	Hybognathus nuchale	Jamestown.
360	Notropis megalops	Notropis cornutus	Lamoure; Jamestown.
360	Notropis deliciosus	Notropis blennius	Do.
360	Notropis cayuga	Notropis cayuga	Jamestown, in the river.
360	Hybopsis kentuckiensis	Hybopsis kentuckiensis	James River; Pipestem Creek.
360	Semotilus atromaculatus	Semotilus atromaculatus	Do.
360	Rhinichthys atronasus	Rhinichthys atronasus	Lamoure; Jamestown.
360	Lucius lucius	Lucius lucius	Jamestown.
360	Etheostoma nigrum	Boleosoma nigrum	Do.
360	Etheostoma aspro	Hadropterus aspro	Do.
360	Etheostoma iowæ	Etheostoma iowæ	Do.
360	Perca flavescens	Perca flavescens	Do.

CHARACTER OF THE FISH FAUNA OF THE MISSOURI RIVER BASIN.

The total number of species and subspecies of fishes at present known from the Missouri Basin is 143. These are distributed among 24 families and 68 genera, as may be seen from the table on pages 426–428. This table also shows the distribution of the species among the 9 different States of the Missouri Basin. It will be seen that the great majority of the species do not extend westward beyond the eastern counties of Kansas, Nebraska, and South Dakota. Only 55 of the 143 species are known from North Dakota, Montana, Wyoming, and Colorado, and but 10 of these are limited to those 4 States. On the other hand Missouri and the small part of Iowa drained by the Missouri furnish 94 species, or, if we include the narrow-timbered and abundantly-watered strip of eastern Kansas, Nebraska, and South Dakota, we have about 100 species occurring in this eastern or lower belt of the Missouri Basin.

The middle belt, or that portion lying between the one hundredth and the one hundred and fifth meridians, has such characteristic species as *Platygobio gracilis*, *Hybopsis gelidus*, *Rhinichthys cataractæ dulcis*, *Hybognathus nuchale evansi*, and the like. Few if any of these are confined to this belt, but they probably all extend more or less into the lower and upper belts.

The upper belt comprises the elevated mountain region where the water is comparatively clear and cold. The characteristic species here are the trout, whitefish, grayling, two or three species of suckers (*P. jordani*, *C. catostomus*, and *C. griseus*), and the western blob. These are all practically limited to this belt.

In the lower belt is found the limit in the westward extension of spiny-rayed fishes. West of the ninety-sixth meridian, which is approximately the eastern boundary of Nebraska and the Dakotas, not over a dozen species of spiny-rayed fishes are known to occur. This fact becomes interesting when we recall that a single small creek in Indiana (Bean Blossom Creek, Monroe County) is known to contain not fewer than 18 species of spiny-rayed fishes, and from the streams of Indiana alone we know at least 51 species of that group, nearly as many as the total number of species found in the entire fish fauna of the Missouri Basin west of the ninety-eighth meridian.

In the Missouri itself and in its larger tributaries are found such large river species as *Polyodon spathula*, *Scaphirhynchus platorynchus*, *Leptops olivaris*, *Ictalurus punctatus*, species of *Ictiobus*, and the like; but in the smaller streams *Catostomus*, *Hybognathus*, and *Notropis* are the principal genera represented. *Micropterus*, *Perca*, *Lepomis*, and *Etheostoma* are not rare on the eastern edge of this region, but they become more and more rare as we go westward and very soon disappear altogether. *Perca* has not been found west of Dakota River (98° 30′ W.);

Micropterus has not been found west of Ravenna, Nebr. (98° 30′ W.), and it is not likely that it occurs naturally even that far west.

Of the four darters whose range extends farthest west in this basin, *Boleosoma nigrum* reaches only to Dakota River, *Hadropterus aspro* to Ewing, Nebr. (98° 20′ W.), and to Jamestown, N. Dak. (98° 30′ W.). *Etheostoma iowæ* extends still farther west, it having been found by us at Valentine, Nebr. (100° 30′ W.), while *Boleichthys exilis*, a somewhat doubtful species, was found by Dr. Suckley even a little farther west in North Dakota.

THE ICHTHYOLOGIC PECULIARITIES OF THE BLACK HILLS.

The fish fauna of that portion of the Missouri system lying in and about the Black Hills is peculiarly restricted in its character, and presents a number of interesting problems in geographic distribution. The physical conditions of the region are briefly these:

(1) An isolated, mountainous region, approximately 75 by 100 miles in extent, covered with heavy pine forests and drained by more than a dozen good-sized creeks, whose waters are naturally cold, clear, and pure, and all flowing east, northeast, or southeast to the north or south fork of the Cheyenne.

(2) Surrounding this region on all sides is a broad plain 100 to 200 miles wide, in which the soil is full of alkali, where the rainfall is not great, where there are no forests, and where even herbaceous vegetation is very scant, where the soil is eroded with great ease, the streams are shallow, their beds constantly shifting, the water warm in the summer time and always strongly alkaline and full of solid matter in suspension. To the east and northeast, country of this character extends from the base of the Hills to the Missouri River at least, a distance of not less than 150 to 200 miles. To the southward is a broad strip almost equally uninviting, while on the west, extending from the base of the Hills to the Powder River, the country is barren in the main and the streams are of the same general character. Among the low hills on the east of the Powder River Valley are the headwaters of two streams; one of these is the Belle Fourche or north fork of the Cheyenne, which flows to the northeast and sweeps around the north base of the Black Hills; the other is the south fork of the Cheyenne, which, flowing east and south, hugs the south base of the Hills a little less closely, and then turning northeast unites with the north fork 30 or 40 miles east of the Hills, thereby forming the Big Cheyenne, which, after a course of more than 100 miles in a northeasterly direction, flows into the Missouri. Into one or the other of these two forks flow all the streams of the Hills.

Most of these streams were examined by us and collections made from them at many different places. Only 15 species of fishes were secured, and no other species has ever been reported from any definite locality of this region. The 15 species known from the Black Hills represent but 4 families, viz: 2 catfishes, 4 suckers, 8 cyprinoids, and one member of the codfish family. Eight of the 15 species belong to one family, the *Cyprinidæ*. Not a single species of spiny-rayed fish has ever been found in any of the streams in or about the Hills and it is not probable that any will be found there. Many of the streams in or near the Hills would apparently furnish congenial homes for sunfishes, bass, and even several of the different species of darters. That these are not there must be due to the nature of the lower courses of the streams draining the Hills, and that of the Cheyenne to which they are all tributary. The Cheyenne is ordinarily a shallow stream whose waters are always more or less alkaline and filled with solid matter in suspension from the extremely easily eroded country through which it flows; and fishes would not ascend such streams from choice.

The lower courses of the streams flowing from the Hills are through the same Cretaceous beds and partake of the same character. Only those species with which the struggle has become most severe will be driven to seek protection and food in the muddy, alkaline streams, and they alone would eventually find their way into purer, clearer waters above. This, of course, means the soft-rayed, non-rapacious fishes, the suckers and minnows and other mud-loving forms.

The spiny-rayed species are aggressive, extending their attacks to all weaker forms about them, while the soft-rayed species are defensive and seek protection in retreat. A spiny-rayed fish has no occasion to ascend into the muddy, alkaline, and uncongenial portions of these streams; the only thing which would cause him to do so would be a quest for food, but he finds it easier and more agreeable to get food of sufficient quantity and quality where he is.

Not so with the soft-rayed fish; he must not only search for suitable food but he must also see that his enemy, the spiny-rayed fish, does not catch him. The attacks of his enemies were probably the first cause impelling him to take refuge in the turbid water. Finding suitable and sufficient food in this new environment, and total relief from the persecutions of his old enemies, he finds the struggle for existence easy, the surroundings in time become bearable and perhaps agreeable, and he moves about at will through all parts of the muddy stream and even into the headwaters where, still finding an abundant food supply and none of his old enemies, he is content to make his home.

Before mining began in the Hills in 1875 and 1876, nearly every stream possessed all the natural conditions necessary to make it an excellent trout stream. The waters were clear and cold, not subject to contamination from any source, and suitable food, such as insects and insect larvæ, and the smaller crustacea and mollusca, was undoubtedly found then, as now, in abundance. With the exception of a few streams which are now ruined by mining operations, the creeks of this region are yet excellent for trout.

The explanation of their absence is practically the same as that which accounts for the absence of spiny-rayed fishes. Land barriers have evidently proved competent to prevent trout getting in from the headwaters of the trout streams to the westward, and the mud and alkali which they encountered in the lower portion of the Yellowstone, the Missouri, and the Big Cheyenne have as certainly proved an impassable barrier from that direction. Among the many regions of the United States which possess the necessary natural conditions for trout, the Black Hills district is the only one of any considerable area, if we except portions of the Yellowstone National Park, in which one or more specimens of *Salmonidæ* are not or have not been indigenous. The absence of trout and all other species of fish from the various lakes and streams of Yellowstone National Park (i. e., Lewis and Shoshone lakes, Gibbon, Firehole, and Little Firehole rivers, and Indian, Glen, Nez Perce, and Sentinel creeks) is undoubtedly accounted for by the presence of impassable falls where these waters leave the great rhyolite sheet which covers the park, as shown by the investigations made by Dr. Jordan in 1889. The presence of trout in Yellowstone Lake and tributary streams, notwithstanding the fact that the outlet of Yellowstone Lake (Yellowstone River) has two enormous falls which wholly prevent the ascent of fish, is quite evidently due to the most interesting and curious fact that there is a continuous waterway furnishing easy passage for trout from the upper tributaries of Snake River by way of Two-Ocean Pass into the Upper Yellowstone River. That Yellowstone Lake could have been, and almost certainly was, stocked in this way from the Columbia Basin was demonstrated by the investigations which were made by Professor Evermann during a visit to Two-Ocean Pass in August, 1891.[1]

The presence of trout in the upper tributaries of the Colorado, Rio Grande, Arkansas, and South Platte, whose lower courses are, in some cases at least, not unlike those of the Cheyenne and Missouri, is a matter whose explanation is not without some difficulties. The relationships of the various species or subspecies of *Salmo* found in those different basins are very close and indicate a common origin at no remote date. It is certain that they are all descended from a form which came up from the Pacific Coast and that the headwaters of the Columbia, Colorado, Rio Grande, Arkansas, and South Platte have been connected in some way at some time or other, thus permitting the trout to spread into these various basins.[2]

That there are no trout in the Cheyenne Basin would seem to indicate that the streams of this system became separated and differentiated as a distinct drainage system earlier than did those of the South Platte, Arkansas, Rio Grande, Colorado, and Columbia; or else that they are

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[1] See Bull. U. S. Fish Comm., XI, 1891, 24–28; also, Popular Science Monthly for June, 1895.

[2] For an interesting discussion of the origin of the varieties of *Salmo* of our western waters see "How the trout came to California," by Dr. Jordan, in Recreation, for October, 1894.

streams of more recent origin and have never been connected at any time with any of the streams containing trout. Such a history as this for the Cheyenne, together with the shallow, muddy, alkaline character of its lower portion, seems to be a reasonable explanation of the absence of trout from the Black Hills.[1]

The effect of the peculiar alkaline water of the Cheyenne and the lower courses of the streams flowing from the Black Hills has been to reduce the fishes to a nearly uniform pale, faded, or bleached appearance. Except those found above the alkali water, they are apparently almost wholly without pigment cells of any kind. Perhaps the most extreme case of bleaching is that of the flat-headed minnow, *Platygobio gracilis*, which, of all American fishes, seems to be the one most perfectly adapted to these alkali streams.

ANNOTATED LIST OF THE FISHES FOUND IN THE MISSOURI RIVER BASIN.

In this list we give under each species all the localities in this basin from which it has been recorded. The references are arranged in chronological order, and the localities are given in the terms of the original record, except when a modification of the wording seemed desirable for sake of clearness. When in the original reference the fish was designated by some name different from the one by which it is now recognized, the name employed in the original reference is given in parenthesis. The name of the authority and the date of each reference are also given in parenthesis, thus enabling the reference to be connected with the appropriate title in the bibliography given on pages 350–379.

The nomenclature and sequence of species adopted in this paper agree essentially with the forthcoming "Fishes of North and Middle America," by Jordan & Evermann.

1. **Ichthyomyzon concolor** (Kirtland). *Silver Lamprey.* One small specimen, 4½ inches long, from Crow Creek, Chamberlain, South Dakota. This is the most western point from which this species has been reported. It has also been recorded from Kansas by Professor Snow, and from Cottonwood Creek, Kans. (as *Petromyzon argenteus*, Graham, 1885); Osage River (Cragin, 1885*a*).

2. **Ichthyomyzon castaneus** Girard. *Chestnut-colored Lamprey.* The only reference to the occurrence of this lamprey in the Missouri Basin is by Prof. F. W. Cragin (1885), who obtained four specimens at the mouth of Mill Creek, Shawnee County, Kans. These specimens were found attached to buffalo-fish.

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[1] In his paper "On the North American species of salmon and trout," printed in the U. S. Fish Commission Report for 1872–73, Dr. Suckley, in giving the habitat of *Salmo lewisi*, credits it to the "Black Hills, Nebraska (Dr. Hayden)." We have been unable to verify this reference, and believe it to be erroneous. It is possible the specimen came from the headwaters of the North Platte, in what is now known as the Laramie Range. In that case the trout was *Salmo mykiss stomias.*

3. **Lampetra wilderi** Gage. *Brook Lamprey.* Wild Cat Creek, near Manhattan (as *Ammocœtus niger*, Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*).

4. **Polyodon spathula** (Walbaum). *Spoonbill Cat; Paddle-fish.* Fort Pierre, Nebr. (as *P. folium*, Girard, 1858); St. Mary River (Jordan, 1878); Kansas River (Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*); Missouri River, Harrison County, Iowa (Meek, 1891).

A large male fish of this species was caught in White River, at the ford 12 miles from Chamberlain, S. Dak., June 24. Total length, 4 feet 5 inches; length to base of caudal fin, 3 feet 10 inches; tip of paddle to edge of gill flap, 2 feet 7 inches; to origin of dorsal fin, 2 feet 10½ inches; stretch of caudal fin, 1 foot; weight, 18 pounds.

The water was not over 18 inches deep where this fish was caught. This species has not hitherto been reported from any point so far west, but it is probably not uncommon in the Missouri and its large tributaries even farther west than this place. Mr. Walker, who lives near the mouth of White River, says the spoonbill cat is occasionally seen there in the spring, and that one was taken near this same place, about the 1st of June of this year, which was about 5 feet long.

While this curious and interesting fish is probably common in all the larger streams and bayous of the Mississippi Valley, especially in the lowland waters, it is very rarely caught or seen. During several years collecting in the Mississippi Valley, we have taken not more than 6 or 8 examples, all of which were rather large, the smallest being at least 15 inches long. Special search for the young has been made by us in the ponds and bayous along the lower Wabash River, but without finding any. Prof. Harrison Garman, who has made a careful study of the fauna of the waters of the Mississippi bottoms near Quincy, Ill., took but a single example, which was about 14 inches long. "The adults," he says, "are common in the Mississippi River, where they were occasionally seen leaping about the water."

5. **Acipenser rubicundus** Le Sueur. *Red Sturgeon; Common Sturgeon.* Upper Missouri River (as *Acipenser copei* type, Duméril, 1870); Osage River (as *Acipenser rauchi* type, Duméril, 1870); and Missouri River (as *Acipenser anasimos* type, Duméril, 1870); Kansas River (Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*).

Not seen by us, but Mr. Walker informs us that sturgeon are often taken in White and Missouri rivers, near Chamberlain, in the spring, and we have learned from others that this species is of considerable importance as a food-fish in this portion of the Missouri River. In the vicinity of Yankton considerable numbers were formerly caught, but the fish is less abundant during the last few years.

6. **Scaphirhynchus platorynchus** (Rafinesque). *Shovel-nose Sturgeon.* Missouri River (Girard, 1858); Missouri River, at Fort Buford, N. Dak. (Jordan, 1878); Missouri River, at Fort Benton (Cope, 1879); "Common over the State of Kansas" (Graham, 1885); Kansas River at Lawrence and Topeka (Cragin, 1885*a*); Missouri River, Iowa (Meek, 1892).

Specimens of this species were obtained from North Platte River at Casper and Douglas. The single specimen in the collection from Casper is 18 inches long. At Douglas numerous specimens were taken, the largest being about 2 feet long. Armed plates before the dorsal, 16; lateral plates, 42. A very small specimen from North Platte, at Grand Island, measures 4¾ inches in total length. Smaller individuals than this are not often taken in miscellaneous collecting. While at Creighton we were told of the capture of a shovel-nosed sturgeon 2 feet long in Bazile Creek, 15 miles from that place, a few weeks before our visit.

7. **Lepisosteus osseus** (Linnæus). *Long-nosed Gar.* Kansas River near Fort Riley (as *L. otarius* type, Cope, 1865); pools of the Missouri near mouth of Battle Creek, S. Dak. (as *L. otarius*, Cope, 1879); Osage River and tributaries and Missouri River at St. Joseph (Jordan & Meek, 1885); common in all streams of Kansas (Graham, 1885); Kansas and Osage rivers (Cragin, 1885*a*); Solomon River at Beloit (Hay, 1887); Spirit Lake (Meek, 1894). It was reported to us as being seen frequently in the Missouri at Niobrara and Chamberlain, and in the White River near the latter place. We examined one large example, 2½ feet long, which was taken in Crow Creek, near Chamberlain, while we were there. The distance from the tip of the bill to the eye was 6½ inches, or about one-fifth total length. There were no dark spots except on the caudal and one on the dorsal fin.

8. **Lepisosteus platostomus** Rafinesque. *Short-nosed Gar.* Pools of the Missouri River near Battle Creek, S. Dak. (as *Lepidosteus productus*, Cope, 1879); Kansas River (Graham, 1885); Kansas River at Topeka and Osage River (Cragin, 1885*a*). Not seen by us.

9. **Amia calva** Linnæus. *Mudfish; Dogfish.* Not seen by us. The only record for the upper Missouri is that of Cope in 1865, who reports it from "Platte [Kansas] River, Fort Riley." It is also recorded from the branches of Missouri River, Osage River, etc. (Graham, 1885). This species doubtless occurs in all the bayous along the lower Missouri.

10. **Ictalurus furcatus** (Le Sueur). *Chuckle-head Cat.* Missouri River, Leavenworth, Kans. (Gilbert, 1885); Missouri River, St. Joseph (Jordan & Meek, 1885); "Large streams" [in Kansas] (Graham, 1885); Kansas River and Osage River (Cragin, 1885*a*).

11. **Ictalurus punctatus** (Rafinesque). *Channel Cat; Blue Cat.* Fort Pierre, Nebr.; Milk and Yellowstone rivers; and Nebraska (as *Pimelodus olivaceus* types, Girard, 1858); Fort Riley, Kans. (as *Pimelodus hammondii* and *Pimelodus notatus* types, Abbott, 1860); Milk River (as *Pimelodus olivaceus*, Suckley, 1860); "Big Sandy River of Kansas" [Platte River] (as *Ictalurus simpsonii* type, Gill, 1862 and 1876); Kansas River near Fort Riley (as *I. cœruleus* and *I. notatus*, Cope, 1865); Big Muddy River (Jordan, 1878); Missouri River pools near mouth of Battle Creek, S. Dak. (Cope, 1879); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River at St. Joseph; Tabo Creek at Lexington, Mo.; Grand and Osage rivers at Clinton, Mo. (Jordan & Meek, 1885); "quite common" [in Kansas] (Graham, 1885); Ward Creek, Shawnee County, Kans. (Gilbert, 1885); Kansas River, Silver Lake, Ward Creek, Mill Creek, Manhattan, Blue River, and Osage River (Cragin, 1885*a*); Blacksmith and Mission creeks, Shawnee County, Kans. (Gilbert, 1886); Republican River at Concordia, Saline River at Wakeeney, and Solomon River at Beloit (Hay, 1887); Piney River, Texas County, Mo. (Call, 1887); Osage River at La Cygne, Kans.; Solomon River at Harlan, Kans. (Gilbert, 1889); Gasconade River, Mo. (Meek, 1891); Missouri River at St. Joseph and Big Sioux River at Sioux City (Meek, 1892).

Obtained by us at the following localities: White River at Chamberlain; Choteau Creek at Springfield; Bazile Creek at Niobrara; South Loup River and Mud Creek at Ravenna, and Clear Creek at Clermont, Wyo. It was also obtained by Professor Meek in Blue River at Crete, Salt Creek at Lincoln, and at Fremont in the Elkhorn and Platte rivers (Meek, 1894). In most of the streams where we found this fish at all it was rather abundant, but not many specimens were saved. It was especially abundant in White River near Chamberlain and in the channel of South Loup River. Most of the individuals seen were young fish. The largest were a 15-inch specimen at Ravenna and one 16 inches long at Clermont. One of the best and most valuable food-fishes of the lower and middle Missouri Basin.

12. Ameiurus natalis (Le Sueur). *Yellow Cat.* Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River (Graham, 1885); Kansas River (Cragin, 1885*a*); Shunganunga Creek, Topeka, and Blacksmith and Mission creeks, Shawnee County, Kans. (Gilbert, 1886); Dakota River at Lamoure (Woolman, 1896).

13. Ameiurus nebulosus (Le Sueur). *Common Bullhead.* "Plentiful" [in Kansas] (Graham, 1885); Topeka, Lawrence, and Ottawa (Cragin, 1885*a*); Osage Fork of Gasconade River, Mo. (Meek, 1891); Dakota River at Lamoure and Jamestown, N. Dak. (Woolman, 1896).

14. Ameiurus melas (Rafinesque). *Black Bullhead.* Nebraska (as *A. obesus* type, Gill, 1862 and 1876); Kansas River at Topeka (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River at St. Joseph; Tabo Creek, Lexington, Mo.; La Mine River and tributaries at Sedalia, Mo; Osage River at Clinton, Mo.; Grand River and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); "common over the State" [of Kansas] (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Smoky Hill River at Wallace, Republican River at Concordia, Solomon River at Beloit, Saline River at Wakeeney, north fork of Solomon River at Kirwin (Hay, 1887); Sappa Creek at Oberlin, Middle Beaver Creek, Smith County, Kans., Solomon River at Logan and Harlan, Kans. (Gilbert, 1889); Big Piney River near Cabool and Marais River at Dixon, Mo. (Meek, 1891); Silver Lake, Iowa; Soldier River at Charter Oak, and Boyer River at Arion, Iowa (Meek, 1892); Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Floyd River at Lemars, and Spirit Lake (Meek, 1894); Dakota River and Pipestem Creek at Jamestown, N. Dak. (Woolman, 1896).

Found by us at the following places: Blue River, Seward; Ingalls Lake, Long Pine; Bazile Creek, Niobrara; Long Pine Creek, Long Pine; pond at Creighton; pond at Norfolk Junction; pond at Ewing; canal at Niobrara; Lincoln and Beaver creeks, York; Carp Lake near Long Pine; Big Blue River at Seward; Lone Tree Creek, Chadron; Rock and Enemy creeks, Mitchell; Firesteel, Choteau, and Emanuel creeks, Springfield; Crow Creek, Chamberlain; and Prairie Creek, Scotland. The western limit in the range of this species seems to be near the western boundaries of Kansas and Nebraska, and is marked by the western limit of the small prairie lakes and stagnant ponds. It was not found in any of the alkaline streams, nor in any of the clear, cold streams of the Black Hills; but in the ponds in eastern Nebraska and South Dakota it was very abundant, particularly at Scotland, Mitchell, Chamberlain, Creighton, and Long Pine. It grows to a size which makes it of considerable value in those States as a pan fish.

15. Leptops olivaris (Rafinesque). *Mud Cat.* Osage River, Mo., and Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River (Graham, 1885); Topeka, Lawrence, and Ottawa (Cragin, 1885*a*); Gasconade River, Mo. (Meek, 1891). A single specimen of this species was caught with the seine in the White River near Chamberlain. It was a female measuring 3 feet 6 inches in total length, and weighing 32 pounds. The following additional measurements were taken: Tip of nose to origin of dorsal fin, 15 inches; to adipose fin, 28 inches; distance over head between pectorals, 15¼ inches; distance between posterior nostrils, 3½ inches; distance between eyes, 6½ inches; length of maxillary barbel, 7¼ inches. This fish was very sluggish, and made no effort to escape until we began lifting it out of the water, when it became greatly excited and hard to handle. The mud cat probably occurs in all the larger streams of the Missouri Basin, but we have not seen any record of its occurrence west of Omaha, except the general statement of Graham cited above.

16. Noturus flavus Rafinesque. *Stone Cat; Yellow Cat.* Platte River (as *Noturus occidentalis* type, Gill, 1862 and 1876); Platte River (Cope, 1871); Osage River., Mo., La Mine River, Mo., and Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Osage River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Mission Creek, Shawnee County, Kans. (Gilbert, 1886); Smoky Hill River, Wallace, Kans., and North Fork of Solomon River, Lenora, Kans. (Hay, 1887); Mission Creek, Shawnee County, Kans.; Snokomo Creek, Wabaunsee County, Kans., and Missouri River, Leavenworth, Kans. (Gilbert, 1886); Solomon River at Harlan and Logan, Kans., and Osage River at La Cygne, Kans. (Gilbert, 1889); Missouri River, St. Joseph; Big Sioux River, Sioux Falls, S. Dak., and Sioux City, Iowa (Meek, 1892); Missouri River, Craig, Mo. (Eigenmann, 1894); Salt Creek, Lincoln, Nebr. (Meek, 1894). It was found by us at the following places: Emanuel Creek, Springfield; Norfolk Creek, Norfolk Junction; Elkhorn River, Ewing; Beaver Creek, York; Lincoln Creek, York; Platte River, Grand Island; Middle Loup River, Dunning; Chadron Creek, Chadron; White River, Chadron; Cheyenne Falls; Belle Fourche River, Belle Fourche; Beaver Creek, Buffalo Gap; Platte River, Douglas; Beaver Creek near Newcastle; Powder River, Arvada; Big Goose Creek, Sheridan, and Salt Creek, Lincoln. Quite abundant in the south fork of the Cheyenne at Cheyenne Falls, where numerous specimens, 5 to 10 inches long, were taken. It is said to be a common fish in the Cheyenne and is of some importance as a food-fish. The specimens from Cheyenne Falls are all extremely pale.

17. Schilbeodes gyrinus (Mitchill). Big Sioux River, Sioux Falls, S. Dak. (Meek, 1892); Platte River, Fremont, Nebr.; Floyd River, Lemars and Sioux City, Iowa (Meek, 1894); Choteau Creek, Springfield; Prairie Creek, Scotland; Enemy, Firesteel, and Rock creeks, Mitchell; Norfolk Creek, Norfolk Junction.

This small catfish appears to be not uncommon about Mitchell and Scotland, but we did not find it elsewhere except at Norfolk Junction, where a single specimen was obtained. The largest specimens secured by us are 4 inches long, and are very plump. The head is very broad and heavy. The interorbital region is concave, especially posteriorly, the postocular region being quite fleshy and prominently rounded. The pectoral spine is equal to one-third of the distance from the tip of the snout to the origin of dorsal fin. Most of these specimens are very dark, but the dark lateral lines show plainly on all. These lines are three in number, one following the axis of the body from just back of the pectoral to the middle of the base of the caudal fin, another above from the dorsal fin to the caudal; the median line of the back also is dark.

18. Schilbeodes exilis (Nelson). Osage River, etc. (Graham, 1885); Jones Creek, Dixon, Mo., and Little Piney River, Cabool, Mo. (Meek, 1891).

19. Schilbeodes miurus (Jordan). Branches of Missouri River (Graham, 1885).

20. Ictiobus cyprinella (Cuvier & Valenciennes). *Common Buffalo-fish.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); eastern Kansas (Graham, 1885); Soldier Creek and Osage River (Cragin, 1885*a*); Marais River, Dixon, Mo. (Meek, 1891); Elkhorn River, Fremont, Nebr. (Meek, 1894). Small specimens were obtained in Platte River at Grand Island, in the Elkhorn at Ewing, and in the Middle Loup River at Dunning. The confusion which exists among the species of *Ictiobus* and *Carpiodes* is very great and it is doubtful if any of the descriptions given in the books is correct. The species as now understood are certainly hard to distinguish, and the confusion can only be removed by an exhaustive study of a very large amount of material.

21. Ictiobus urus (Agassiz). *Mongrel Buffalo.* Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River and branches of the Missouri (Graham, 1885); Silver Lake and Soldier Creek (Cragin, 1885*a*).

22. Ictiobus bubalus (Rafinesque). *Small-mouth Buffalo.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); plentiful over Kansas (Graham, 1885); Kansas River (Cragin, 1885*a*); Marais River, Dixon, Mo. (Meek, 1891); Floyd River, Sioux City, Iowa, and East Okoboji Lake, Iowa (Meek, 1894). Found by us only in Crow Creek near Chamberlain, S. Dak. The two small specimens in the collection give the following measurements: Head 4; depth $2\frac{3}{4}$ and 3; eye 4; snout 4; scales 7–37–5 and 7–38–5. D. 23 and 26; A. 8. The number of dorsal rays is fewer than the usual number for this species, and the axis of the body is scarcely below the lateral line. These are the only dark-colored specimens of buffalo-fish that we secured, and they are paler than more eastern examples.

Either this or the following species is said to be very abundant in Okoboji Lake and the other lakes of northwestern Iowa and southern Minnesota. We were unable to secure specimens, and can not be sure which species it is. Some species of buffalo-fish, probably this one, is said to be excessively abundant in most of the small lakes of South Dakota, where it is of much importance as an article of food.

23. Carpiodes carpio (Rafinesque). *Carp Sucker.* Osage River, Mo. (as *Carpiodes bison* type, Agassiz, 1855); Manhattan, Kans., and Ward Creek, Shawnee County, Kans. (Gilbert, 1884); Silver Lake, Ward Creek, and Fort Riley (Cragin, 1885*a*); Belle Fourche River, Belle Fourche, S. Dak. (Evermann, 1893); Niobrara River north of Long Pine; Mud Creek at Ravenna; Wood Creek at Grand Island; Middle Loup River at Dunning and Emanuel Creek near Springfield. Only young specimens were obtained. These seemed to differ from typical *carpio* in being more slender and in having fewer rays in dorsal fin. The depth is 3 to $3\frac{2}{5}$ and the dorsal 25.

24. Carpiodes velifer (Rafinesque). *Quillback.* Milk River (as *Carpiodes damalis* type, Girard, 1856); Fort Pierre (Girard, 1858); Milk River (as *Carpiodes damalis*, Suckley, 1860); Kansas River near Fort Riley (as *Carpiodes damalis*, Cope, 1865); "Probably from one of the Western States" (as *Carpiodes grayi* type, Cope, 1870); Hundred and Two River, Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, and Flat Creek, near Sedalia, Mo.; Osage River, Clinton, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Ictiobus velifer*, Jordan & Meek, 1885); Kansas River (as *Ictiobus velifer* and *Ictiobus velifer bison*, Graham, 1885); Ottawa and Eureka Lake (Cragin, 1885*a*); Republican River, Concordia, Kans.; Solomon River, Beloit, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Missouri River, Iowa; Big Sioux River, Sioux City, Iowa (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Blue River, Crete, Nebr.; Platte and Elkhorn rivers, Fremont, Nebr., and Floyd River, Sioux City, Iowa (Meek, 1894). Found by us in the South Loup at Ravenna, which is the most western point from which this species has been reported.

25. Cycleptus elongatus (Le Sueur). *Gourd-seed Sucker; Missouri Sucker; Black Sucker.* Kansas River (Graham, 1885; Cragin, 1885*a*). This interesting sucker does not seem to have been taken often in the Missouri Basin, and how it came by the name "Missouri sucker" is not apparent.

26. Pantosteus jordani Evermann.

Pantosteus virescens Jordan, Bull. 4, vol. IV., U. S. Geol. and Geogr. Survey of Territories, 780, 1878, Sweet Grass Hills, Montana (specimens collected by Dr. Elliott Coues).

Catostomus discobolus Evermann, Bull. U. S. Fish Comm., XI, 1892, pl. XVIII, fig. 1, 41, Red Rock and Beaverhead rivers, Mont.

Pantosteus jordani Evermann, Bull. U. S. Fish Comm., XII, 1892, January 27, 1893, art. 2, 51–56, Red Rock and Beaverhead rivers, Mont., and various Black Hills localities, types; Gilbert & Evermann, Bull. U. S. Fish Comm., XIV, 1894, 189, various places in the Columbia River basin.

Pantosteus columbianus Eigenmann & Eigenmann, American Naturalist, February 4, 1893, 151, Boise River, Caldwell, Idaho; types.

In the third paper referred to above will be found the description of this species, together with a discussion of the relationships of the various known species of *Pantosteus* and the closely related species of *Catostomus*. In the paper is also given the complete synonymy of each species of *Pantosteus*. In October, 1892, numerous specimens of this species were obtained as follows: Whitewood Creek, Deadwood; Spearfish Creek, Spearfish; Chicken Creek near Spearfish; Crow Creek, Gammon's Ranch; Belle Fourche River, Belle Fourche; Rapid Creek, Rapid, and Hat Creek, Ardmore.

All the specimens found in Whitewood and Spearfish creeks were young individuals. In all the other streams named, good-sized specimens were found, the largest and finest one being about 7 inches in length and from Rapid Creek. During the investigation in South Dakota, Nebraska, and Wyoming, carried on in 1893, it was found in the following places: Chadron Creek, Chadron; Cheyenne River, Edgemont; Cheyenne River near Hot Springs; Beaver Creek, Buffalo Gap; Spearfish Creek, Spearfish; Redwater Creek near Spearfish; creek at Hill City; French Creek, Custer; Beaver Creek, Newcastle; Powder River, Arvada; Clear Creek at Clermont; south fork of Tongue River, Sheridan; Big Goose Creek, Sheridan. This small sucker is abundant in most of the smaller, clearer streams in and about the Black Hills. It seems most abundant in the streams tributary to the Cheyenne. South of the Cheyenne it was found in only one place, this being at Chadron in the basin of White River, which, however, is separated from the south fork of Cheyenne River by a distance of less than 20 miles. This is the most eastern and southern point from which it has yet been obtained. The only other place outside of the Cheyenne basin where we found it was in the streams about Sheridan. It probably does not occur in the North or South Platte, but will doubtless be found to inhabit all suitable streams of the upper Missouri Basin.

The recent finding of this fish at many places in the Columbia Basin shows it to be a species of wide distribution, and, as is usually the case with such species, it is subject to great variations in some of its characters. This is true particularly as regards the squamation. The specimens from Spearfish and Hill City are noticed to have very small scales, the number in the course of the lateral line ranging from 94 to 108 in the several specimens counted; the usual number seems to be 17–104–13. Those from Sheridan, Chadron, and Hot Springs have larger scales, the number in the lateral line running from 77 to 89 in numerous examples counted. From Big Goose Creek the usual formula was found to be 14–80–11 or 12. In the Newcastle specimens the scales are a little smaller, the number being about 88 or 89, thus approximating the fine-scaled Hill City form. There is not much variation among the individuals from any one place. The fine-scaled specimens were found in very cold water, and it may be that they represent a slight geographic variety inhabiting the smaller and colder mountain streams of the Black Hills. The Hill City specimens have the mouth unusually broad and 3 or 4 rows of papillæ upon the upper lip. The Chadron specimens have the mouth narrower and more numerous papillæ upon the upper lip. The color is somewhat darker. This species evidently does not reach a large size. We have examined about 500 specimens, and the largest individual measures less than 10 inches in the total length.

27. Catostomus griseus (Girard). *Milk River Sucker.* Sweetwater River (as *Catostomus (Acomus) griseus* type, Girard, 1856 and 1858); Milk River (as *Catostomus (Acomus) lactarius* type, Girard, 1856 and 1858); Milk River, Mont. (as *Catostomus retropinnis* type, Jordan, 1878); Horse Creek, Red Cloud Creek, and Platte River (as *C. griseum*, Cope, 1871); South Platte River, Denver and Hartsel Hot Springs, Colo.; Bear Creek, Morrison, Colo.; Middle Boulder Creek, Boulder, Colo. (Jordan, 1891); Yellowstone and Gardiner rivers (Jordan, 1891*a*); Missouri River, Craig, Mont. (Eigenmann, 1894). Two specimens were taken from the North Platte River at Douglas, Wyo. They give the following measurements:

Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
Inches.							
7	$4\frac{1}{5}$	$4\frac{3}{5}$	5	$2\frac{1}{4}$	10	7	15–88–10
5	$3\frac{7}{8}$	$4\frac{5}{6}$	5	$2\frac{1}{4}$	10	7	15–95–10

Compared with specimens of *C. commersonii sucklii* of the same size, the following differences are noted: Body rather heavier or stouter; caudal peduncle shorter and deeper, the least depth being $2\frac{1}{4}$ in head, while in *C. commersonii sucklii* it is more than 3; the top of the head is less arched and the snout more prominent; the mouth is a little narrower and the lobes of the lower lip are longer; the scales are very small, particularly on the anterior part of the body; the color is much paler, the three dark spots usually present on younger specimens of var. *sucklii* not being present on *griseus* at all. Compared with smaller specimens of *C. catostomus*, the distinguishing characters are found to be very slight. In *C. griseus* the top of the head is flatter and the snout is less decurved; the upper lip is larger and more pendant, and has more papillæ; the lobes of the lower lip are rather longer, and the cartilaginous sheath is less developed; the dorsal fin is smaller, it having but 10 rays.

28. Catostomus catostomus (Forster). *Long-nosed Sucker.* This sucker was obtained at the following places: North Platte River; Deer Creek, Glenrock; Clear Creek, Clermont; Powder River, Arvada; Big Goose Creek, Sheridan, and south fork of Tongue River, Sheridan. It was not found anywhere in Nebraska or South Dakota, and probably does not occur in the Missouri Basin east of Wyoming. It was obtained in 1892 by Dr. Eigenmann in the Red River of the North at Winnipeg, Swift Current Creek, and Bow, Elbow, Vermillion, and Saskatchewan rivers, all in the Saskatchewan Basin. The important characters of the larger specimens collected by us are given in the following table:

Locality.	Total length in inches.	Head in length.	Depth in length.	Eye in head.	Eye in snout	Dorsal.	Anal.	Rows of papillæ on upper lip.	Scales.
Arvada, Wyo	11	$4\frac{1}{2}$	6	6	3	10	7	3	17– 95–13
Sheridan, Wyo	8	$4\frac{3}{4}$	$5\frac{1}{4}$	6	$2\frac{1}{4}$	10	7	4	15–105–12
Clermont, Wyo	$7\frac{1}{2}$	$4\frac{1}{8}$	$5\frac{2}{5}$	6	$2\frac{4}{5}$	10	7	3	17–102–12
Do	$7\frac{1}{2}$	$4\frac{1}{8}$	5	6	$2\frac{3}{4}$	10	7	2	16– 96–13
Douglas, Wyo	7	$4\frac{1}{5}$	5	$5\frac{3}{4}$	$2\frac{1}{2}$	10	7	3	15– 89–12
Sheridan, Wyo	11	$4\frac{2}{5}$	$4\frac{3}{5}$	$6\frac{3}{4}$	$3\frac{1}{4}$	10	7	3	17–100–13
Do	....	....	....	$6\frac{1}{2}$	$3\frac{1}{4}$	10	7	4	14–100–16
Do	....	....	....	$6\frac{1}{4}$	$3\frac{1}{8}$	10	7	4	17–100–13

The Sheridan specimens are badly decayed and accurate measurements can not be taken. In all of these specimens the scales are considerably smaller than the examples of *C. griseus* from Douglas, the top of the head is more curved, and the snout less prominent. The upper lip is incised nearly to the base, there being but a single row of papillæ across the base.

29. Catostomus commersonii (Lacépède). *Common White Sucker.* Milk River (as *Catostomus sucklii* type, Girard, 1856 and 1858); upper Missouri and tributaries (as *Catostomus sucklii*, Suckley, 1860); Kansas (as *Catostomus chloropteron* type, Abbott, 1860); Kansas River near Fort Riley (as *Catostomus chloropteron*, Cope, 1865); Platte River (as *C. sucklii*, Cope, 1871); Five Forks and headwaters of Milk River (as *C. teres*, Jordan, 1878); Shunganunga Creek and Kansas River, Topeka (as *C. teres*, Gilbert, 1884); Hundred and Two River, Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; and Flat Creek, Sedalia, Mo.; Osage River, Clinton, Mo.; Grand River, Clinton, Mo., and Tabo Creek, Calhoun, Mo. (as *C. teres*, Jordan & Meek, 1885); common over the State [of Kansas] (as *C. teres*, Graham, 1885); Shunganunga Creek and Kansas River, Topeka (as *C. teres*, Gilbert, 1885); Shunganunga and Wild Cat creeks, and Kansas and Osage rivers (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (as *C. teres*, Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); north fork of Solomon River, Logan, Kans.; Middle Beaver Creek, Smith County, Kans. (as *C. teres*, Gilbert, 1889); Big Piney River, Cabool, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo. (as *C. teres*, Meek, 1891); South Platte River, Denver (as *C. teres sucklii*, Jordan, 1891); Big Sioux River, Sioux City, Iowa; Boyer River, Arion, Iowa (Meek, 1892); Middle, Crow, Chicken, Cottonwood, and Hat creeks, S. Dak., and Belle Fourche River, Belle Fourche, S. Dak. (Evermann, 1893); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River at Lemars and Sioux City, Iowa (Meek, 1894); Dakota River at La Moure and Jamestown (Woolman, 1896).

This is apparently the most abundant sucker in the region covered by these investigations, as may be seen from the following list of localities from which we obtained it: Enemy Creek, Mitchell; Dakota River, Mitchell; Firesteel Creek, Mitchell; Rock Creek, Mitchell; Crow Creek, Chamberlain; Prairie Creek, Scotland; Emanuel Creek, Springfield; Choteau Creek, Springfield; canal at Niobrara; Bazile Creek, Niobrara; Verdigris Creek, Verdigris; pond at Creighton; Spring Creek at Bazile Mills; Elkhorn River at Ewing; Long Pine Creek, Long Pine; Niobrara River, Marsland; Chadron Creek, Chadron; Lone Tree Creek, Chadron; Wood Creek, Grand Island; Dismal River, Dunning; Deer Creek, Glenrock; North Platte River, Glenrock; North Platte River, Douglas; French Creek, Custer; small creek at Hill City; Beaver Creek, Buffalo Gap; Cheyenne River, Hot Springs; Cheyenne River, Edgemont; Redwater Creek, Spearfish; Beaver Creek, Newcastle; Clear Creek, Clermont; Powder River, Arvada; south fork of Tongue River, Sheridan; Big Goose Creek, Sheridan. In October, 1892, it was found at the following places: Middle Creek and Belle Fourche River at Belle Fourche; Crow Creek at Gammon's ranch, near Spearfish; Chicken Creek, near Spearfish; Rapid Creek, Rapid City, S. Dak.; Cottonwood Creek, Edgemont, and Hat Creek, Ardmore, S. Dak.

We have spent a good deal of time in studying this large amount of material and have found it extremely difficult to reach any satisfactory conclusion regarding the status of this and the other species of *Catostominæ* of the Missouri Basin. Among the individuals which we refer to this species there is great variation, particularly in the size and arrangement of the scales, the number of dorsal fin rays, and in the mouth. Such of these variations as can be well presented in tabular form are given in the following table. The localities are arranged approximately, beginning with those farthest east and ending with those farthest west at which this species was found:

Locality.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Rows of papillæ on upper lip.
Mitchell, S. Dak	4	4¾	5	2¼	11	7	10-64-8, crowded anteriorly	3
Do	3⅘	4⅓	4½	1¾	11	7	10-60-7, crowded anteriorly	3
Do	3¾	4⅕	4⅗	2	11	7	10-59-7, crowded anteriorly	3
Do	3⅘	5	5	2⅕	13	7	9-60-8, somewhat crowded	3
Ewing, Nebr	4	4½	5	2½	12	7	10-58-9	3
Do	4⅓	5	5½	2⅕	11	7	10-62-8	3
Bazile Mills, Nebr	4⅕	6	5	2¼	11	7	10-62-9, crowded anteriorly	......
Niobrara, Nebr	3⅘	5	4½	2	11	7	9-60-8, crowded anteriorly	3
Do	4¼	5	5	2½	11	7	10-62-8, crowded anteriorly	......
Scotland, S. Dak	4	5	5⅓	2⅓	11	7	9-61-7, not much crowded	4
Chamberlain, S. Dak	4	5¼	5⅓	2¼	11	7	9-59-7, crowded anteriorly	......
Creighton, Nebr	4	4½	4⅓	2	11	7	10-60-8, crowded anteriorly	3
Long Pine, Nebr	4	5½	6	2⅕	10	7	10-63-7, crowded anteriorly	......
Do	4	4⅖	4¾	2⅕	10	7	10-62-9, not much crowded	3
Do	4	5	4	1⅗	11	7	9-60-8, not much crowded	3
Do	4	5½	4¾	2⅕	10	7	10-60-8, not much crowded	3
Dunning, Nebr	4	4⅔	4½	2	11	7	9-59-8	3
Grand Island, Nebr	4	4⅗	4⅚	2⅕	10	7	9-62-7, scarcely reduced anteriorly.	3
Chadron, Nebr	4	4⅗	5½	2⅓	11	7	10-60-8, not much crowded	4
Do	4⅙	5	5	2	12	7	10-63-9, not much crowded	3
Do	......	......	......	......	......	......	10-60-7	......
Cheyenne Falls, S. Dak	3¾	5	5	2¼	11	7	9-56-7	2 or 3
Do	3¾	4⅔	4¾	2½	9	7	9-56-7	2 or 3
Custer, S. Dak	3¾	4¾	5	2⅓	11	7	11-63-9, somewhat crowded	3
Do	3¾	4½	4¾	2	11	7	10-62-8	3
Do	3⅕	5	4¼	2	12	7	10-64-9	4
Hill City, S. Dak	3⅕	4½	5⅕	2⅓	11	7	10-62-7, rather crowded	3
Redwater Creek, S. Dak	4	4⅓	5	2⅕	10	7	9-60-7, not much crowded	3
Do	3⅚	4⅗	4¾	2⅕	10	7	9-58-7, not much crowded	4
Do	4	4⅔	5	2¼	11	7	10-62-7, not much crowded	3
Do	4	5	5	2⅕	11	7	9-58-8, not much crowded	3
Glenrock, Wyo	3¾	5	4½	2½	11	7	58-19, no lateral line	2 or 3
Do	3¾	4⅖	4¾	2⅓	10	7	9-60-8	3
Do	3¾	4⅓	4¾	2⅕	10	7	10-61-8, somewhat crowded	3
Do	......	......	......	......	11	....	10-58-7	......
Douglas, Wyo	3⅗	5	5	2⅗	11	7	9-61-7, somewhat crowded	3
Newcastle, Wyo	4	5	4¾	2½	10	7	9-54-6, somewhat crowded	3
Do	3¾	5½	4¾	2½	10	7	9-54-6, somewhat crowded	3
Do	......	......	......	......	11	7	9-58-6, somewhat crowded	3
Marsland, Nebr	4	4½	5	2	11	7	10-61-9, not much crowded	3
Buffalo Gap, S. Dak	......	......	......	......	12	....	9-64-8	4
Do	......	......	......	......	11	....	9-59-8	......
Arvada, Wyo	3⅕	4⅖	5½	2⅗	11	....	9-59-7, not much crowded	4
Do	3⅘	4½	5½	2⅓	11	7	9-58-8, crowded, but regular	4 or 5
Do	3¾	5	5	2¼	11	7	10-57-6, crowded, but reguar	4 or 5
Clermont, Wyo	3⅘	4	5¾	2⅕	13	7	11-61-9, much crowded and irregular.	2
Do	3¾	4¾	6	2⅒	11	7	10-56-7, crowded and irregular	2
Do	3¾	5	4⅗	2¼	11	7	10-60-8, crowded, but regular	3
Sheridan, Wyo	3⅗	5	5	2½	12	7	9-59-7, not much crowded	3

An inspection of this table shows that the variation in the length of head is from 3⅗ to 4¼, and in depth from 4 to 6; the usual length of head and depth of body is about 4 and 5, respectively. These variations, however, are not unusual, and need give us no trouble. The same may be said of the eye and snout; these differences are no greater than can be accounted for as due to differences in age. The range of the dorsal fin rays is through 5, i. e., from 9 to 13, the usual number being 10 or 11. This is a larger range than has hitherto been noticed in this species and is, of course, independent of age. The variation in the scales is rather remarkable, the number in a transverse series ranging from 15 to 20, and those in the course of the lateral line from 54 to 64, the most usual formula being 9 or 10-59 to 61-7 or 8. The scale formula for *Catostomus commersonii* has usually been given as 10-64 to 70-9. In the original description of *Catostomus sucklii* the dorsal rays are given as 14 (including rudimentary ones), but Girard does not give the number of scales, merely remarking that "the scales are large and but little smaller anteriorly than posteriorly." The two figures which he gives in the Pacific Railroad report show the scales as 10-64-8 and 9-55-9, the latter being a young specimen. The specimens in our collection which we have examined from Mitchell, Bazile Mills, Niobrara, Chamberlain, Long Pine, and Clermont, have the scales decidedly crowded and irregular on the anterior part of the body; this is especially so in the two large specimens from Clermont. Those from Chadron, Custer, Hill City, Redwater Creek, Douglas, and Newcastle are not much crowded, but they are irregular in arrangement.

Five of the eight small specimens from Glenrock are peculiar in that there is no trace of the lateral line. In the three others the lateral line is normally developed. The number of rows of papillæ upon the upper lip varies from 2 to 5, the usual number being 3 or 4. These differences do not possess any geographic significance; specimens from the same stream or from the same sub-basin show both extremes of variation in this regard. Nor have we been able to discover that these variations in lip characters are coordinated with any other characters. Upon comparing these Missouri specimens with others from Ohio and Pennsylvania, it appears that in the western specimens the scales average somewhat larger and the papillæ on the upper lip are arranged in more rows. The eye is somewhat smaller in the western specimens. The two forms may be diagnosed as follows:

a. Scales small, 60 to 70 in lateral line, much crowded anteriorly; eye less than 5 in head; upper lip with 2 or 3 rows of papillæ .... *commersonii.*
aa. Scales large, 54 to 64 in lateral line, less crowded anteriorly; eye smaller, usually more than 5 in head; upper lip with 3 or 4 rows of papillæ .... *sucklii.*

We doubt, however, if *sucklii* should be recognized even as a subspecies, and for the present we combine the two.

In nearly all the young western specimens the dark spot at base of caudal fin is quite distinct; there is often a similar dark spot above the ventral and one just above the middle of the pectoral. All these disappear with age.

30. Catostomus nigricans Le Sueur. *Hog Sucker; Stone-lugger.* Kansas River (Graham, 1885); Osage River (Cragin, 1885*a*); Little Piney River, Osage Fork, Lock Fork, and Jones Creek, Mo.; Marais, Niangua, and Sac rivers, at Dixon, Marshfield, and Springfield, Mo. (Meek, 1891). This common eastern species seems not to occur in Nebraska, South Dakota, or Wyoming, but reaches its western limit in the lower Missouri Basin.

31. Erimyzon sucetta oblongus (Mitchill). *Chub Sucker.* Professor Snow reports this fish from the Kansas River at Lawrence (Cragin, 1885*a*).

32. Minytrema melanops (Rafinesque). *Spotted Sucker; Striped Sucker.* Missouri River at Fort Pierre and Yellowstone River (as *Ptychostomus haydeni* type, Girard, 1856 and 1858); Osage River and Mill Creek (Cragin, 1885*a*). The fact that this species has not been taken west of Missouri by any recent collector makes its occurrence in the upper Missouri region questionable.

33. Moxostoma bucco (Cope). St. Joseph, Mo. (as *Ptychostomus bucco* type, Cope, 1871). Only the type known; a doubtful species.

34. Moxostoma aureolum (Le Sueur). *Common Redhorse.* Blackwater Creek at Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (as *Moxostoma macrolepidotum duquesnei*, Jordan & Meek, 1885); plentiful in Kansas (Graham, 1885); Soldier and Shunganunga creeks, Silver Lake, Osage River, Blue River, and Kansas River (Cragin, 1885*a*); La Mine River, Mo. (Jordan & Meek, 1885); Shunganunga Creek, Topeka (as *M. macrolepidotum*, Gilbert, 1885); Solomon River, Beloit, Kans. (Hay, 1887); Osage River, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Big Piney River, Cabool, Mo.; Little Piney River, Newburg, and Arlington, Mo.; Gasconade River, Arlington, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield (as *M. macrolepidotum duquesnei*, Meek, 1891); Big Sioux River at Sioux Falls and Sioux City (Meek, 1892); Belle Fourche River, Belle Fourche, S. Dak.; Redwater Creek, Belle Fourche, S. Dak.; and south fork of Cheyenne River, Cheyenne Falls, S. Dak.

(Evermann, 1893); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River, Lemars, Iowa, and Blue River, Crete, Nebr. (as *M. macrolepidotum duquesnei*, Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Many good-sized examples were obtained in 1892 at Belle Fourche from the Redwater and the Belle Fourche. The collection of 1893 contains specimens from the following places: Dakota River, Mitchell; Emanuel Creek, Springfield; Choteau Creek, Springfield; Crow Creek, Chamberlain; canal at Niobrara; Verdigris Creek, Verdigris; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; South Loup River, Ravenna; Long Pine Creek, Long Pine; Niobrara River, Long Pine; North Platte River, Douglas; North Platte River, Casper; Deer Creek, Glenrock; Clear Creek, Clermont. There is but little variation among the specimens from different localities, either in number of fin rays, size of scales, or proportion of parts. The scales are, in many specimens counted, 6 or 7–42 to 45–4 or 5. D. 12 or 13; head $4\frac{1}{2}$ to $4\frac{3}{4}$; depth $3\frac{4}{5}$ to 4. In large specimens the upper caudal lobe is the longer. This species is of sufficient size and abundance to make it of considerable value as a food fish in this region.

35. **Placopharynx duquesnii** (Le Sueur). *Big-jawed Sucker.* Floyd River at Sioux City and Lemars, Iowa (as *P. carinatus*, Meek, 1894).

36. **Campostoma anomalum** (Rafinesque). *Stone-roller.* Platte River at Fort Kearney (as *C. hippops* type, Cope, 1864 and 1865); Alma, Wabaunsee County, Kans.; Kansas River, Topeka; Ellis, Ellis County, Kans. (Gilbert, 1884); Blackwater Creek, Brownsville, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); common in small streams in Kansas (Graham, 1885); Shunganunga Creek and Kansas River at Topeka; Ward Creek, Shawnee County, Kans.; Alma and Ellis, Kans. (Gilbert, 1885); Kansas River, Shunganunga, Mill, and Wild Cat creeks, and Ellis (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Middle Beaver Creek and Spring branch of Spring Creek, Smith County, Kans. (Gilbert, 1889); Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Floyd River, Sioux City, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Obtained by us as follows: Floyd River, Sioux City; Emanuel Creek, Springfield; Enemy Creek, Mitchell; Prairie Creek, Scotland; Firesteel Creek, Mitchell; Crow Creek, Chamberlain; Wood Creek, Grand Island; Chadron Creek, Chadron; Deer Creek, Glenrock. Not found in any of the streams in or about the Black Hills; nor was it found in any of the streams that are strongly alkaline in character. The largest specimens are those from Chadron, some of which are about 5 inches long. No differences between these and eastern specimens are apparent. Head $4\frac{1}{5}$; depth $4\frac{1}{5}$; eye $5\frac{1}{4}$; snout $2\frac{1}{2}$; D. 8; A. 7; scales 8–52–7. The black band in the dorsal and anal fins distinct in males; those from Glenrock paler. Glenrock, Wyo., is the most western point from which this fish is known.

37. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Dace.* Marais des Cygnes, Kans. (Graham, 1885); north fork of Solomon River, Lenora, Kans. (Hay, 1887); Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

38. **Chrosomus dakotensis** sp. nov. Type locality: Crow Creek, Chamberlain, S. Dak., where 11 specimens were collected June 22, 1893. (**Type, No. 45680, U. S. Nat. Mus.**)

Closely related to *Chrosomus erythrogaster*. Head $3\frac{3}{5}$; depth $4\frac{1}{2}$; eye $3\frac{1}{2}$; snout $4\frac{1}{2}$; D. 8; A. 8; scales about 80, 24 in cross series. Teeth 4-4, hooked, and with a slight grinding surface. Body moderately stout, head heavy, caudal peduncle shorter than in related species. Eye moderate, interorbital width 3 in head; mouth small and oblique, maxillary short, not nearly reaching vertical at front of eye, its length $1\frac{1}{3}$ in eye; lower jaw projecting. Fins moderate; height of dorsal $1\frac{1}{2}$ in head, its origin behind the base of the ventrals a distance greater than length of snout; anal similar to dorsal; pectorals short, $1\frac{1}{2}$ in head; ventrals very short, not reaching anal. Color as in *C. erythrogaster*, except that the back is darker and the upper dark line is continuous and not broken up into spots; the lower black line is also more distinct. Besides the 11 specimens obtained in Crow Creek we have two from a pond at Niobrara and one from Minnechaduza Creek at Valentine, Nebr. The specimens from Battle Creek, S. Dak., referred by Professor Cope (1879) to *Chrosomus* sp., probably belong to this species.

39. Hybognathus nuchale Agassiz. Ward Creek, Menoken, Kans., and Kansas River, Topeka (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River, Ward Creek, and Fort Riley (Cragin, 1885*a*); Piney Creek, Texas County, Mo. (Call, 1887); Smoky Hill River, Wallace, Kans. (Hay, 1887); north fork of Solomon River, Logan, Kans. (Gilbert, 1889); Missouri River, Iowa; Big Sioux River, Sioux City, Iowa; Soldier River, Charter Oak, Iowa (Meek, 1892); Platte and Elkhorn rivers, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

40. Hybognathus nuchale evansi (Girard). Missouri River at Fort Pierre, Nebr. (as *H. evansi* type, Girard, 1856); Fort Pierre and Sweetwater River (Girard, 1858); upper Platte River (Cope, 1864*a*); Kansas River near Fort Riley (Cope, 1865); Battle Creek, S. Dak. (Cope, 1879); Kansas River and other branches of the Missouri (as *H. placita*, Graham, 1885); South Platte River, Denver (as *H. nuchalis placita*, Jordan, 1891); Cottonwood, Hat, and Middle creeks, and south fork of Cheyenne and Belle Fourche rivers, Black Hills (as *H. nuchalis placita*, Evermann, 1893); Poplar River, Poplar, Mont. (as *H. placita*, Eigenmann, 1894).

Our collections contain specimens from the following localities: Ponca Creek near Niobrara; Bazile Creek, Niobrara; Platte River, Grand Island; Wood Creek, Grand Island; Middle Loup River, Dunning; Niobrara River north of Long Pine; South Loup River, Ravenna; Mud Creek, Ravenna; Platte River, Fremont; White River, Chadron; Lone Tree Creek, Chadron; Choteau Creek, Springfield; Cheyenne River near Hot Springs; Hat Creek, Ardmore; Cottonwood Creek, Edgemont; Crow Creek, Chamberlain; Emanuel Creek, Springfield; Belle Fourche River, Belle Fourche; Cheyenne River, Edgemont; White River, Chamberlain; Middle Creek, Belle Fourche; Powder River, Arvada; Beaver Creek, Newcastle; Platte River, Douglas; Platte River, Casper.

The following notes are from a specimen 5 inches long, from Belle Fourche River: Head 5; depth $4\frac{1}{5}$; eye 5; snout $3\frac{1}{3}$; D. I, 8; A. I, 9; scales 6-40-7, 18 before dorsal; mouth small, slightly oblique, lower jaw included; maxillary short, not reaching eye. Origin of dorsal a little in front of ventral, and nearer snout than base of caudal; height of dorsal nearly equal to length of head; interorbital width equal to length of snout to middle of pupil. In a specimen from Ravenna the scales count 6-43-5, 16 before the dorsal. There is considerable variation in the snout, it being much more blunt in some than in others, those from Ardmore being especially blunt. This minnow seems to be peculiarly liable to be affected by parasites, a considerable percentage of the specimens from Belle Fourche, Ravenna, and Cheyenne Falls showing psorosperms embedded among the scales over different parts of the body. Girard's types of *H. evansi* came from Fort Pierre, Nebr., and if identical with *placitus* the name *evansi* has precedence, and the form may stand as *Hybognathus nuchale evansi* Girard.

41. Hybognathus argyrite Girard. Milk River (as *H. argyritis* type, Girard, 1856 and 1858, and Suckley, 1860). This is a doubtful species, probably identical with *H. evansi*.

42. Hybognathus nubilum (Forbes). Piney Creek, Texas County, Mo. (Call, 1887); Jones Creek and Marais River, Dixon, Mo.; Little Piney River at Arlington and Newburg, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891). Obtained by us at the following places: Floyd River, Sioux City; Bazile Creek, Niobrara; Verdigris Creek, Verdigris; Elkhorn River, Norfolk Junction; Norfolk Creek, Norfolk; pond at Long Pine; Ponca Creek, Niobrara; canal at Niobrara; pond at Creighton; Niobrara River north of Long Pine; Emanuel Creek, Springfield; Choteau Creek, Springfield; Crow Creek, Chamberlain; White River, Chamberlain; Platte River, Casper; Powder River, Arvada.

A very large series of specimens of *Hybognathus* was collected, but we find it extremely difficult to decide just how many and what species are represented. For the present it seems best to recognize *nubila, argyrite nuchalis*, and var. *evansi*. The range of variation in each is great. *H. nubila* is the more common form in eastern Nebraska and southwestern South Dakota, and is distinguished by the much larger eye (less than 4 in head), the larger mouth, more pointed snout, and the plumbeous lateral stripe; ordinarily this lateral stripe is quite distinct and characteristic. This species is found chiefly in the clearer, colder streams. Typical *nuchale* was found in Salt Creek at Havelock, and Fremont, Nebr., and by Dr. Gilbert at several places in Kansas. It is not unlikely that some of the specimens from middle Nebraska, that we have identified with *evansi*, are really *nuchale*. The two forms are very close and can be distinguished with difficulty. We identify with *evansi* that form with a small eye ($4\frac{1}{2}$ to $5\frac{1}{2}$ in head), short, blunt snout, small mouth, and very pale coloration; it is perhaps more slender, also. The specimens of *H. nuchale* have a somewhat larger eye (about 4 in head), rather larger, sharper snout, and slightly darker coloration, in these respects approaching *nubilum*.

43. Pimephales promelas Rafinesque. *Fat-head; Black-head Minnow.* Yellowstone River (as *P. fasciatus* type, Girard, 1856); Yellowstone River and Milk River (as *P. fasciatus*, Girard, 1858); Milk River (as *P. fasciatus*, Suckley, 1860); Kansas River near Fort Riley (Cope, 1865); Missouri River near St. Joseph (as *Coliscus parietalis* type, Cope, 1871); Battle Creek, S. Dak. (as *Hyborhynchus nigellus*, Cope, 1879); Ward Creek, Menoken, Kans.; Shunganunga Creek and Kansas River, Topeka; Ellis, Kans. (as *P. confertus*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885); Kansas River at Topeka, and small streams in Shawnee, Wabaunsee, and Ellis Counties, Kans. (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1885); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *P. promelas confertus*, Hay, 1887); north fork of Solomon River at Logan, Kans., and Middle Beaver Creek, Smith County, Kans. (Gilbert, 1889); Silver Lake, Iowa; Soldier River, Charter Oak, Iowa; Boyer River, Arion, Iowa (Meek, 1892); Blue River, Crete, Nebr.; Platte and Elkhorn rivers, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Lamoure (Woolman, 1896); Dover, S. Dak. (Butler, 1896).

Numerous specimens obtained by us at the following places: Enemy Creek, Mitchell; Rock Creek, Mitchell; Dakota River, Mitchell; Choteau Creek, Springfield; Emanuel Creek, Springfield; Prairie Creek, Scotland; Crow Creek, Chamberlain; Rapid Creek, Rapid City; Hat Creek, Ardmore; Cottonwood Creek, Edgemont; Middle Creek, Belle Fourche; French Creek at Custer; Bazile Creek, Niobrara; pond at Niobrara; pond at Creighton; Elkhorn River, Fremont; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; Spring Creek, Bazile Mills; Salt Creek, Havelock; Mud Creek, Ravenna; Long Pine Creek and ponds, Long Pine; Bone Creek, Long Pine; Ingalls Lake, Long Pine; Chadron Creek, Chadron; South Loup River, Ravenna; Dismal River, Dunning; Platte River, Fremont; Beaver Creek, York; Niobrara River, Marsland; Blue River, Seward; Lincoln and Beaver creeks, York; Minnechaduza Creek, Valentine; Clear Creek, Clermont.

In all the warmer, sluggish creeks with muddy bottom, and in all the warmer ponds and stagnant pools of the prairie region from Illinois to Wyoming, this, the fat-head or black-head minnow, is one of the most abundant species. During the dry season many of the small streams are reduced to isolated pools, mere mudholes, which are kept stirred up and rendered filthy by the cattle which visit them to slake their thirst. In these pools, however shallow and filthy they might be, we never failed to find this hardy, little fish. There is no doubt that all the nominal species cited in the above synonymy belong to a single species. There is considerable variation in the development of the lateral line, the position of the dorsal, the shape of the head, and the color; all of these, except the variation in the lateral line, are accessory sexual characters. In breeding males the head is short, the snout very blunt, and the origin of dorsal fin nearer tip of snout than base of caudal; the males are very dark, sometimes the upper parts and entire head being blue-black, while the females are much paler. The females are more elongate, head larger, snout less blunt, and correlated with this is the more posterior portion of the dorsal. Among two dozen examples studied, all the females have the dorsal midway between the snout and base of caudal, while in all the males the dorsal was nearer snout than base of caudal. The lateral line is usually better developed on the females than on the males.

On a number of male examples we find from 9 to 28 pores and these are often scattered (*parictalis.*) In several females we find the number of pores varying from 20 to 46, or complete. A female $2\frac{7}{8}$ inches long, from Ingalls Lake, is described as follows: Head $3\frac{4}{5}$; depth $3\frac{4}{5}$; eye 4; snout $4\frac{3}{4}$; D. I, 8; A. 7; scales 9–47–3, lateral line developed on 9 scales on one side and 2 on the other. Body short and stout; snout blunt; caudal peduncle compressed, deep, its least depth 2 in head. Origin of dorsal nearer snout than base of anal, directly opposite ventrals. Entire head, except preopercle and free edge of opercle, and upper parts blue-black, middle of side with a broad plumbeous band; lower parts pale; fins all more or less thickly dusted with fine dark spots; a long dark blotch on anterior rays of dorsal; snout with about 25 large tubercles, about 7 on tip of lower jaw. A female about 3 inches long from Lincoln Creek has the following characters: Head $4\frac{1}{5}$; depth $4\frac{4}{5}$; eye $4\frac{3}{4}$; snout $3\frac{3}{4}$; D. I, 8; A. 7; scales 9–46–4, the lateral line nearly complete, 2 or 3 isolated scales without pores. Body more slender; snout and head less blunt; caudal peduncle more slender, its least depth more than 2 in head. Color pale; back and upper part of sides dusted with fine dark specks; plumbeous lateral band faint; under parts pale; few fine punctulations on fins; dorsal with a long black blotch on anterior rays.

The specimens from Hat Creek, $1\frac{1}{2}$ to 2 inches long, present the following characters: Head $3\frac{3}{4}$, = depth; eye $3\frac{1}{2}$, = snout; dorsal I, 8; anal I, 7; scales 10–55–5; lateral line decurved and incomplete; scales small and crowded anteriorly, about 30 before the dorsal; origin of dorsal in front of ventrals, nearer snout than caudal. Snout blunt, mouth terminal, small, oblique; head broad, interorbital width $2\frac{1}{2}$ in length of head. Teeth 4–4, with rather broad grinding surface. Intestine more than twice the length of body; peritoneum black. Color very pale; upper part of body with numerous very small dark specks, a few narrow, indistinct lines on anterior half, running from median line upward and backward; a dark line from occiput to origin of dorsal; a rather distinct plumbeous band along lateral line; base of caudal dark. The specimens from Middle and Beaver creeks are considerably paler, the lateral plumbeous band being evident on caudal peduncle.

44. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Ward Creek, Menoken, Kans. (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo., and Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Shunganunga and Ward creeks, Topeka (Gilbert, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Big Piney River, Cabool, Mo.; Little Piney River, Arlington and Newburg, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls; Silver Lake, Iowa (Meek, 1892); Blue River, Crete, Nebr.; Elkhorn River, Fremont, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

45. **Semotilus atromaculatus** (Mitchill). *Creek Chub.* Fort Pierre, Nebr. (as *S. macrocephalus* type, Girard, 1856 and 1858); Sweetwater River (as *S. speciosus* type, Girard, 1856); tributary of Platte River (as *S. speciosus*, Girard, 1858); Kansas River near Fort Riley (as *S. hammondii* type, Abbott, 1860); Platte River (Cope, 1865); Kansas River near Fort Riley (as *S. corporalis* and *S. pallidus*, Cope, 1865); Red Cloud Creek (Cope, 1870); Battle Creek, S. Dak. (as *S. corporalis*, Cope, 1879); Shunganunga Creek, Topeka (as *S. corporalis*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo. (Jordan & Meek, 1885); Mill Creek, Wabaunsee County, Kans. (Gilbert, 1885); Shunganunga and Mill Creeks and Fort Riley, Kans. (Cragin, 1885*a*); Mission and Blacksmith creeks, Shawnee County, Kans. (Gilbert, 1886); Bear Creek, Boone County, Mo. (Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Republican River, Wano, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans. (Gilbert, 1889); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891*a*); Soldier River at Charter Oak and Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Sioux City (Meek, 1894); Dakota River and Pipestem Creek at Jamestown (Woolman, 1896).

Obtained by us at the following places: Floyd River, Sioux City; Bazile Creek, Niobrara; Norfolk Creek, Norfolk Junction; Verdigris Creek, Verdigris; Long Pine Creek, Long Pine; Bone Creek, Long Pine; Minnechaduza Creek, Valentine; Chadron Creek, Chadron; Lone Tree Creek, Chadron; White River, Crawford; Beaver Creek at York; Emanuel Creek, Springfield; Crow Creek, Chamberlain; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid

City; Redwater Creek, Spearfish; Spring Creek, Hill City; Crow Creek, Gammon's ranch; Chicken Creek, Spearfish; Belle Fourche River, Belle Fourche; French Creek at Custer; Deer Creek, Glenrock; Big Goose Creek, Sheridan. At most of these places it was quite abundant, especially in the clear and moderately cold streams with gravelly bottoms. The largest specimens obtained are from the Belle Fourche and from Rapid Creek, some of which are over 8 inches in total length. Head $3\frac{3}{5}$; depth $4\frac{1}{3}$; eye $7\frac{1}{2}$; snout 3; D. 8; A. 8; scales 11–56 to 59–6. These western specimens do not differ appreciably from eastern specimens of this species.

46. **Leuciscus elongatus** (Kirtland). North fork of Solomon River, Lenora, Kans. (as *Squalius elongatus*, Hay, 1887). This reference to the occurrence of this fish in the Missouri Basin needs verification.

47. **Leuciscus neogæus** (Cope). Fifteen specimens from Cox Lake and 10 from Montana Lake. These examples vary in length from 2 to $3\frac{1}{2}$ inches, the average being about $2\frac{3}{4}$ inches. Head $3\frac{1}{5}$ to 4; depth 4 to 5; eye $3\frac{1}{2}$ to 4; D. I, 8; A. I, 8; scales about 80, 20 to 26 in transverse series, very small, embedded and hard to count. Body stout, not compressed; head very broad and heavy; snout moderate, oblique, the maxillary reaching orbit. Color dark olive above, sides paler, under parts straw color, median line of back black; middle of side with a narrow plumbeous band, ending in a small black caudal spot. The band greenish posteriorly.

48. **Leuciscus milnerianus** (Cope). Probably Battle Creek, S. Dak. (as *Phoxinus milnerianus* type, Cope, 1879). A species of doubtful validity.

49. **Abramis crysoleucas** (Mitchill). *Golden Shiner; Roach.* Blackwater Creek, Brownsville, Saline, County, Mo.; Flat Creek, Sedalia, Mo. (as *Notemigonus americanus chrysoleucus*, Jordan & Meek, 1885); eastern Kansas (as *Notemigonus chrysoleucus*, Graham, 1885); Marais River, Dixon, Mo. (Meek, 1891); Big Sioux River at Sioux Falls and Silver Lake, Iowa (Meek, 1892); Platte River at Fremont; Floyd River at Sioux City, and Spirit Lake (Meek, 1894). Not obtained by us except in ponds near Long Pine Creek, 10 miles north of Long Pine, where it was common, and in bayous of Elkhorn River near Ewing.

50. **Cliola vigilax** (Baird & Girard). Grand River at Clinton, Mo., and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); Norfolk Creek, Norfolk Junction; Floyd River, Sioux City; Elkhorn River at Fremont, Norfolk Junction, and Ewing. This species was, contrary to what we had expected, found to be rather uncommon in this region. Eastern Nebraska seems to be the limit of its range northwestward. The largest specimens are $2\frac{3}{4}$ inches in total length. A typical example from Ewing shows the following characters: Head $4\frac{1}{4}$; depth $4\frac{1}{4}$; eye 4; snout 4; D. I, 8; A. I, 7; scales 7–46–3, 21 before dorsal; lateral line complete, decurved. Body rather slender; snout, blunt; top of head, flat; back, little arched; caudal peduncle, long; mouth small, subinferior, nearly horizontal, maxillary barely reaching eye; color, pale; back and upper parts of sides with small black specks on borders of the scales forming cross-hatching on back; lower parts pale; black caudal spot, not large; fins all plain, except a dark spot on front of dorsal. On some specimens the caudal and dorsal spots were quite indistinct.

51. **Cliola smithii** sp. nov. Type locality: Prairie Creek near Scotland, S. Dak., where 5 specimens were obtained June 26, 1893 (collectors, Evermann, Cox, and Rutter). Associate type localities: Pond near Niobrara, Nebr., 1 specimen, June 28, 1893 (collectors, Evermann, Cox, and Rutter); Dismal River, Dunning, Nebr., August 9, 1 specimen (collectors, Cox and Gillum). (Type, No. 45681, U. S. Nat. Mus. Co-type, No. 3136, L. S. Jr. Univ. Mus.)

Head 4; depth $3\frac{3}{5}$; eye 4; snout 4; interorbital width 3; D. I, 8; A. 7; scales 9–47–6, 27 before the dorsal. Teeth 4–4, not hooked, grinding surface slightly developed. Intestine not long. Body short and stout, compressed;

head moderate; mouth small, terminal, slightly oblique; maxillary not reaching eye; preorbital broad. Back considerably arched, caudal peduncle deep, its least depth 2 in head. Origin of dorsal fin over ventrals, nearer snout than base of caudal. Color, above densely covered with fine, black specks, giving a general blue-black appearance; sides with a broad plumbeous band two-thirds as broad as eye, darkest and best defined on caudal peduncle; sides below this band with a few scattered specks anteriorly; lower part of caudal peduncle pale; top and upper parts of sides of head bluish-black; dorsal, anal, and pectorals with a few dark specks; other fins plain. Length, $2\frac{1}{2}$ inches.

Named for Dr. Hugh M. Smith, chief of the Statistical Division of the United States Fish Commission.

52. Notropis cayuga Meek. Big Piney River, Cabool, Mo.; Osage River and Lock Fork, Mansfield, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891); Big Sioux River, Sioux City, Iowa (Meek, 1892); Floyd River, Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896); Floyd River, Sioux City; Dakota River and Enemy, Firesteel and Rock creeks, Mitchell; Prairie Creek, Scotland; Choteau and Emanuel creeks, Springfield; pond at Niobrara; Bazile Creek, Niobrara; pond at Verdigris; pond at Creighton; Norfolk Creek, Norfolk Junction; Elkhorn River at Ewing; creek at Ewing; ponds and creeks, Long Pine; Minnechaduza Creek, Valentine; Chadron Creek, Chadron; Mud Creek, Ravenna.

From the above it will be seen that this small minnow is one of the most abundant species in eastern South Dakota and Nebraska. The most westerly point at which we obtained it is Chadron, Nebr., and as but a single specimen was found there, its occurrence at that place is probably exceptional. At Valentine, about 130 miles east of Chadron, it was found in considerable numbers, and eastward from Valentine it was abundant in all suitable places.

This is preeminently a species of the pools, ponds, and small lakes. While we might not find it, even with careful seining, in the clear running streams, we seldom failed to take it in abundance in any overflown pond or small lake that we found along the streams. It was very abundant in the ponds at Creighton and Long Pine. Choteau Creek, in which it was also abundant, is a slow, sluggish creek, much like a pond in many respects. In such waters as these, when the bottom was of mud, or mud and coarse gravel, and where there was considerable vegetation, *Potamogeton*, *Chara*, and various species of *Algæ*, would we find *Notropis cayuga* in greatest numbers. The last week of June seems to be its spawning season in this region; many of the specimens taken at Creighton, June 29, were full of ripe spawn.

Considerable variation in the intensity of the coloration is shown by these collections, the specimens from the cooler, clearer ponds being much darker than those from warmer streams.

The following description is drawn up from a typical specimen, $2\frac{1}{2}$ inches long, from Prairie Creek: No. 1745. Head $3\frac{5}{6}$; depth $4\frac{3}{4}$; eye $3\frac{1}{5}$; snout 4; D. I, 8; A. 8; scales 6–35–3, 15 before dorsal; lateral line incomplete, irregularly broken. Body slender, head moderate, back little arched, peduncle long and slender, mouth moderate, somewhat oblique, terminal; maxillary not reaching eye; eye large. Origin of dorsal slightly behind ventrals, midway between snout and base of caudal; pectorals short; $1\frac{1}{2}$ in head, not reaching ventrals; ventrals shorter than pectorals, reaching vent; caudal deeply forked. Color of back dark, covered with fine brownish points, thickest on edges of scales, forming cross-hatching on entire length of back; middle of sides with a broad dark band from base of caudal fin along course of lateral line across opercle, and meeting its fellow around snout, not on lower lip; under parts pale, except a dark line from anus along base of anal fin and under side of caudal peduncle and on to caudal fin; fins all more or less dusted with fine dark points. The only species with which this fish is likely to be confused are the closely related species *N. heterodon* and *N. anogenus*.

These three species bear a very close superficial resemblance to each other. They were first critically compared and their differential characters pointed out by Dr. Meek in his Fishes of the Cayuga Lake Basin. The following key will enable one to distinguish them:

a. Black of nose not extending to lower lip; snout blunt, mouth small, subinferior, little oblique .... *cayuga*.

aa. Black of nose upon lower lip as well as upon upper.

b. Snout sharp; mouth large, oblique, the lower jaw scarcely included . *heterodon*.

bb. Snout more blunt; mouth very small, very oblique .... *anogenus*.

A comparison of our specimens of *cayuga* with others from northern Indiana shows no marked differences.

53. Notropis heterodon (Cope). Smoky Hill River, Wallace, Kans. (as *N. germanus* type, Hay, 1887); Silver Lake, Iowa (Meek, 1892).

54. Notropis blennius (Girard). Missouri River at St. Joseph (as *Hybopsis missuriensis* type, Cope, 1874); Ward Creek, Shawnee County, Kans. (as *Cliola straminea*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River, St. Joseph; Tabo Creek, Lexington, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *N. deliciosus*, Jordan & Meek, 1885); Kansas River branches (as *N. deliciosa*, Graham, 1885); Piney River, Texas County, Mo. (as *N. deliciosus*, Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *N. deliciosus*, Hay, 1887); Republican River, Wano, Kans.; Sappa Creek, Oberlin Kans.; Logan, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans.; Osage River, La Cygne, Kans. (as *N. deliciosus lineolatus*, Gilbert, 1889); Sac River, Springfield, Mo. (as *N. deliciosus*, Meek, 1891); Big Sioux River at Sioux Falls and Sioux City; Boyer River at Arion, Iowa (as *N. deliciosus*, Meek, 1892); Platte and Elkhorn rivers at Fremont; Blue River at Crete; Salt Creek at Lincoln; and Floyd River at Sioux City and Lemars (Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

Found by us at the following places: Floyd River, Sioux City; Verdigris Creek, Verdigris; Norfolk Creek, Norfolk Junction; Salt Creek, Havelock; Chadron Creek, Chadron; Mud Creek, Ravenna; Schlegel Creek, Valentine; Minnechaduza Creek, Valentine; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; Bazile Creek, Niobrara; Long Pine Creek, Long Pine; White River, Chadron; canal at Niobrara; Niobrara River, Valentine; Niobrara River, north of Long Pine; Wood Creek, Grand Island; South Loup River, Ravenna; Lincoln Creek, York; Dismal River, Dunning; Middle Loup River, Dunning; Beaver Creek, York; Ingalls Lake, Long Pine; Platte River, Grand Island; White River, Crawford; Niobrara River, Marsland; Belle Fourche River, Belle Fourche; Middle Creek, Belle Fourche; Cheyenne River, Hot Springs; Cottonwood Creek, Edgemont; Hat Creek, Ardmore; Rapid Creek, Rapid City; Beaver Creek, Buffalo Gap; Dakota River, Mitchell; Crow Creek, Chamberlain; Redwater Creek, Spearfish; Deer Creek, Glenrock; Platte River, Glenrock; Garden Creek, Casper; Platte River, Douglas.

This is one of the most abundant and widely distributed of the *Cyprinidæ*, it being found from the Great Lakes to Virginia, and westward to Wyoming and south to Texas. It is subject to great variation, and many nominal species have been based upon the differences in eye, snout, or scales presented by specimens from different parts of its range. None of these is, however, worthy of specific recognition, though several of the more pronounced forms may be recognized as subspecies.

The very large series of specimens and the numerous localities represented in the present collection show most perplexing variations even in this basin. As a rule the individuals from any particular stream can be told from those from any other stream. The differences lie chiefly in the relative bluntness of the snout, the stoutness of the body, size of eye, size and arrangement of the scales, and in the color. A typical specimen from Glenrock, Wyo., has the head 4; depth 4; eye $3\frac{1}{2}$; snout $4\frac{1}{2}$; D. I, 8; A. 7; scales 6-34-3. One from Floyd River, Sioux City, has the eye somewhat larger ($3\frac{1}{4}$), and the snout shorter and more blunt (4). One from Rapid City, head $4\frac{1}{5}$; depth $4\frac{1}{3}$; eye $3\frac{2}{3}$; snout 4; scales 6-35-3. All the specimens from this place have short, blunt heads and rather large eyes. One from Belle Fourche agrees with the Rapid City specimens except that the scales are rather smaller, 7-36-4. The lot from Fremont has larger scales (6-33-3), sharper snout, and more distinct plumbeous lateral band than those from farther west. The number of scales before the dorsal varies from 14 to 20, the usual number being 15 or 16. This does not seem to be correlated with any other variable character. The teeth, in numerous examples examined, were 4-4, hooked, and with slight grinding surface on two or three teeth.

55. Notropis scylla (Cope). Osage River, Mo. (as ? *Alburnus lineolatus* type, Agassiz, 1863); Red Cloud Creek, tributary of Platte River (as *Hybopsis scylla* type, Cope, 1871); upper Missouri region (as *Cliola chlora* type, Jordan, 1878); Marais des Cygnes (as *N. lineolatus*, Graham, 1885); South Platte River, Denver (Jordan, 1891*a*). If all of these references really belong to one species, it would stand as *Notropis lineolatus* (Agassiz).

56. Notropis topeka (Gilbert).

Cliola (*Hybopsis*) *topeka* Gilbert, Bull. Washburn Lab. Nat. Hist., vol. 1, No. 1. 13, September, 1884. Type locality: Shunganunga Creek, Topeka, Kans,

Notropis æneolus Hay, Proc. U. S. Nat. Mus. 1887, 245. Type locality: Saline River, Wakeeney, Kans.

Hundred and Two River, Bedford, Iowa (Jordan & Meek, 1885); Shunganunga Creek and Ellis, Kans. (Cragin, 1885*a*); Smoky Hill River, Wallace, Kans.; north fork of Solomon River, Kirwin, Kans.; Solomon River, Beloit, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans. (Gilbert, 1889); Boyer River at Arion, Iowa; Big Sioux River, Sioux City, Iowa (Meek, 1892); Floyd River at Sioux City and Lemars, Iowa; Salt Creek, Lincoln, Nebr.; and Blue River at Crete, Nebr. (Meek, 1894); Firesteel and Enemy, Rock creeks, Mitchell; Prairie Creek, Scotland; pond at Creighton.

The localities in which we found this pretty little fish are, as may be noticed, all close together. In Kansas it was found by Drs. Gilbert and Hay considerably farther west. All the waters in which we took it were pond-like, isolated portions of streams which dry up in parts of their course during dry weather. These ponds are partly supplied from small springs, the water is usually rather clear and cool, and there is an abundance of water vegetation. The bottom is mostly soft mud.

Male: Head $3\frac{5}{6}$; depth $3\frac{1}{3}$; eye $4\frac{1}{5}$; snout $3\frac{1}{2}$; interorbital width $2\frac{3}{4}$; D. I, 8; A. I, 7; scales 6-35-4, about 12 scales before the dorsal; lateral line more or less broken, slightly decurved; body short, compressed, and deep; head rather small, snout blunt; mouth somewhat oblique, subterminal, lower jaw included; maxillary not reaching eye; back somewhat elevated; caudal peduncle deep, 2 in head; fins moderate; dorsal inserted opposite ventrals, its height $1\frac{1}{3}$ in head; pectorals short, $1\frac{1}{2}$ in head. Color greenish above, orange below; scales above lateral line dark-edged; a rather distinct plumbeous lateral band; fins all rich red in life. Snout, top of head, and back as far as dorsal fin thickly covered with strong tubercles; scattered tubercles on sides; scales on ventral surface in front of ventral fins greatly thickened.

Female: Head a little shorter, fins not so red, and no tubercles.

Of the 31 specimens from Creighton, all but 8 are females, most of which are nearly ripe with spawn. All but 8 of those from Prairie Creek are nearly ripe females; while all of those from Firesteel Creek are males.

57. **Notropis gilberti** Jordan & Meek.

Notropis gilberti Jordan & Meek, Proc. U. S. Nat. Mus. 1885, 4. Type locality: Valley Creek, Ottumwa, Iowa.

Grand River, Clinton, and Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); South Platte River at Denver (Jordan, 1891*a*); Boyer River, Arion, Iowa; Soldier River, Charter Oak, Iowa (Meek, 1892); Verdigris Creek, Verdigris; canal at Niobrara; creek at Norfolk Junction; creek at Ewing; Bone Creek, Long Pine. This little fish seems to be quite rare. We found it in but five places and secured but 18 specimens. It appears to prefer the small streams or rivulets with sandy bottom and some current.

58. **Notropis piptolepis** (Cope). Red Cloud Creek, a tributary of the North Platte (as *Photogenis piptolepis* type, Cope, 1871). Not obtained by any other collector.

59. **Notropis shumardi** (Girard). Jones Creek, Dixon, Mo.; Little Piney River at Newburg and Arlington, Mo.; Gasconade River, Arlington, Mo. (as *N. boops*, Meek, 1891).

60. **Notropis hudsonius** (Clinton). "Kansas River branches" (Graham, 1885); Wild Cat Creek, Kans. (Cragin, 1885*a*); Big Sioux River at Sioux City (Meek, 1892); Floyd River at Sioux City; Spirit, East Okoboji, and West Okoboji lakes (Meek, 1894). This species was obtained by us at Mitchell, S. Dak., in Rock and Firesteel creeks, and in the Dakota River, where 45 specimens were collected. In the Dakota River, just below the milldam, we found it in abundance; none of the specimens, however, was over 3 inches in length. In Spirit Lake and the other lakes about it this is the most abundant minnow, and the principal live bait used by the anglers who frequent these lakes. From all other *Cyprinidæ* of the Missouri River this species may be known by the large black spot at the base of the tail, and the broad silver band on the side. The teeth of this species have usually been given as 1, 4–4, 0 or 1. As early as 1886 it was shown by Evermann & Bollman* that they are often 1, 4–4, 2, or even 2, 4–4, 2. An examination of numerous specimens in the present collection shows the same range in variation, even in examples from the same locality. The form described in 1893 from Winnipeg as *Notropis scopiferus*, by Eigenmann & Eigenmann, seems to be this species, with the teeth 2, 4–4, 2.

61. **Notropis lutrensis** (Baird & Girard). Big Creek, Hays City, Kans. (Evermann, collector, 1879); St. Joseph, Mo. (as *Cyprinella billingsiana* type and as *Moniana jugalis* type, Cope, 1871); Ward Creek, Shawnee County, Kans. (as *Cliola* (?) *gibbosa*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River and Missouri River at St. Joseph (as *N. billingsiana*, Graham, 1885); "very abundant in Kansas" (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Missouri River at St. Joseph, and Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Republican River, Concordia, Kans.; Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; Logan, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans.; Osage River, La Cygne, Kans. (Gilbert, 1889); Little Piney River at Arlington and Newburg, Mo.; Marais River, Dixon, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891*a*); Boyer River at Arion, Iowa (Meek,

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* Notes on a collection of fishes from the Monongahela River, by Barton W. Evermann and Charles H. Bollman. Proc. N. Y. Ac. Sci. 1886, 335–340.

1892); Blue River at Crete; Elkhorn and Platte rivers at Fremont; Salt Creek at Lincoln; Floyd River at Sioux City and Lemars (Meek, 1894); canal at Niobrara; Elkhorn River, Norfolk Junction and Ewing; Verdigris Creek, Verdigris; Bazile Creek, Niobrara; Niobrara River at Long Pine and Valentine; Long Pine Creek at Long Pine; Beaver Creek at York; Lincoln Creek at York and Seward; creek at Ewing; Blue River, Crete; Salt Creek, Havelock; Mud Creek, Ravenna; South Loup River, Ravenna; Middle Loup River, Dunning; Blue River, Seward; Wood Creek, Grand Island; Dismal River at Dunning; Platte River, Grand Island; Dakota River at Mitchell; Enemy and Rock creeks at Mitchell; Crow Creek, Chamberlain; Emanuel and Choteau creeks, Springfield; North Platte River, Douglas.

As will appear from the localities given above, this is an abundant and generally distributed fish in Nebraska and South Dakota. It has been found by Professor Meek as far east as Des Moines, and by Mr. A. J. Woolman as far south as Chihuahua. It was found by us in nearly all the streams which we examined in eastern South Dakota and in Nebraska. In northwestern Nebraska and in the region in and about the Black Hills we did not find it; and Douglas, Wyo., is the only place in that State where we met with it. The most western place in Nebraska at which it was obtained is Ravenna. The longest specimens we have are $3\frac{1}{4}$ inches long. A fine male from Platte River, Grand Island, is described as follows: Head 4; depth 3; eye $4\frac{1}{2}$; snout $3\frac{1}{2}$; interorbital width $2\frac{3}{4}$; D. I, 8; A. I, 9; scales 7-36-3, 16 before dorsal. Body short and deep, greatly compressed; back elevated and keel-like before dorsal; head pointed, mouth moderate, terminal, oblique; maxillary scarcely reaching the eye. Dorsal high, its longest rays $1\frac{1}{5}$ in head; anal lower, $1\frac{2}{3}$ in head; pectorals and ventrals short, about $1\frac{2}{3}$ in head; caudal deeply forked, the lobes $1\frac{1}{5}$ in head. Color steel-blue above, belly and all fins, except dorsal, blood-red; dorsal pale; postocular and subocular region red; a violet and crimson crescent behind opercle, changing to dull bluish in alcohol; nose, top of head, nuchal region, and sides along base of anal fin, profusely tuberculate; middle of side under dorsal fin with a patch of tubercles. In other specimens the caudal peduncle is thickly covered with strong tubercles. Very small individuals, not over $1\frac{3}{4}$ inches long, are strongly tuberculate and brightly colored, and have evidently reached the breeding age. The females average slightly smaller than the males and are not brightly colored.

62. **Notropis macrostomus** (Girard). Solomon River, Beloit, Kans. (Hay, 1887); Solomon River at Beloit and Saline River at Wakeeney, Kans. (as *N. umbrifer* type, Hay, 1887). Not seen by us.

63. **Notropis notatus** (Girard). Osage River, Mo. (as *Alburnus notatus* type, Agassiz, 1863); Piney River, Texas County, Mo. (Call, 1887).

64. **Notropis whipplii** (Girard). *Silver-fin; Satin-fin.* Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo. (Meek, 1891); Big Sioux River at Sioux City (Meek, 1892).

65. **Notropis cornutus** (Mitchill). *Common Shiner.* Sweetwater River (as *Plargyrus bowmani* type, Girard, 1856 and 1858); Red Cloud Creek (as *Hypsilepis cornutus*, Cope, 1871); Ellis, Ellis County, Kans. (as *Minnilus cornutus*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *N. megalops*, Jordan & Meek, 1885); Shunganunga and Ward creeks, Shawnee County, Kans.; Ellis, Kans.; Mill Creek, Alma, Kans. (as *N. megalops*, Gilbert, 1885); Shawnee, Wabaunsee, and Ellis counties, Kans. (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (as *N. megalops*, Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora,

Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *N. megalops*, Hay, 1887); Big Piney River, Cabool, Mo.; Lock Fork at Mansfield, Mo. (as *N. megalops*, Meek, 1891); South Platte River, Denver (as *N. megalops*, Jordan, 1891*a*); Big Sioux River at Sioux City; Boyer River at Arion, Iowa; and Silver Lake, Iowa (as *N. megalops*, Meek, 1892); Floyd River at Lemars and Sioux City; Elkhorn River at Fremont and Salt Creek at Lincoln (as *N. megalops*, Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

Obtained by us at the following places: Floyd River, Sioux City; Elkhorn River at Fremont, Norfolk Junction, and Ewing; creek at Ewing; Verdigris Creek, Verdigris; Norfolk Creek, Norfolk Junction; Rock Creek, Mitchell; Enemy Creek, Mitchell; Firesteel Creek, Mitchell; Prairie Creek, Scotland; Choteau Creek, Springfield; Emanuel Creek, Springfield; Deer Creek, Glenrock.

The shiner is abundant in the northeastern corner of Nebraska and the adjacent parts of Iowa and South Dakota. It is not uncommon in eastern Kansas, but appears to be rare in western Nebraska and in Wyoming. The only Wyoming localities from which it has been reported are Glenrock and the Sweetwater. We did not find it about the Black Hills. All the specimens obtained by us are small, the largest being but $4\frac{1}{4}$ inches long, from Scotland, S. Dak. Head $3\frac{4}{5}$; depth $3\frac{3}{4}$; eye $3\frac{2}{3}$; snout $3\frac{2}{3}$; D. I, 8; A. I, 8; scales 7–36–4, about 26 before dorsal. Body stout, compressed, head moderate; mouth moderate, terminal, oblique, the maxillary not quite reaching vertical at front of eye; caudal peduncle compressed and deep, least depth $2\frac{1}{2}$ in head. Origin of dorsal opposite ventrals; scales closely imbricated and thin, deeper than long, especially in front; lateral line somewhat decurved. Sides silvery, with bluish reflections; back darker; cheek silvery, with fine dark punctulations on opercles; under parts pale; fins all pale, except dorsal and caudal, which have some fine dark specks. Not differing greatly from eastern specimens. A voracious minnow, taking the hook eagerly when better fish are wanted, but not without its value as an addition to the small boy's string.

66. Notropis zonatus (Agassiz). Osage River, Mo. (as *Alburnus zonatus*, Putnam, 1863); Ozark region of Missouri (Call, 1887); Big Piney River, Cabool, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

67. Notropis jejunus (Forbes). Sappa Creek, Oberlin, Kans. (Gilbert, 1889); Platte and Elkhorn rivers at Fremont (Meek, 1894).

Found by us at the following places: Platte River, Grand Island; Wood River, Grand Island; South Loup River, Ravenna; Middle Loup River, Dunning; Dismal River, Dunning; North Platte River, Douglas.

This interesting species was found only in a few places. We found it in none of the small sluggish creeks which we examined and it seemed to frequent only the open channels of the large, clear streams with considerable current and sandy bottom. It is not found in deep water, nor in water that is very cold; nor on gravel or rocky bottom; nor in pools or streams without some current. The specimens from Dunning and Grand Island are particularly fine, the longest measuring $3\frac{1}{2}$ inches. Head 4 to $4\frac{1}{3}$; depth $3\frac{5}{6}$ to 4; eye $3\frac{1}{2}$; D. I, 8; A. I, 7; scales 6–35 or 36–3. Teeth 2, 4–4, 2, hooked, and without grinding surface. Body rather heavy, compressed; head heavy; mouth large, terminal, oblique; maxillary reaching eye; caudal peduncle deep. Dorsal in front of ventrals; equidistant between snout and base of caudal fin. Scales large, thin, about 15 before the dorsal; lateral line somewhat decurved. Color, median line of back with a narrow but distinct dark line from head to caudal fin; upper part of side pale straw-color, but dusted with numerous dark spots; middle of side with a broad plumbeous band, broader than eye, chiefly above lateral line; the upper edge of this band distinctly defined, the lower less distinct; lower sides and under parts pale; top of head dark, rest of head pale; cheeks and opercles silvery; fins all pale, dorsal and caudal with some dark specks.

68. Notropis atherinoides Rafinesque. Big Sioux River at Sioux City (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894).

69. Notropis dilectus (Girard). Kansas (as *Alburnus oligaspis* type, Cope, 1861*a*); Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Missouri River at Sioux City and Big Sioux River at Sioux Falls (Meek, 1892); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894); Elkhorn River, Norfolk Junction; Bazile Creek, Niobrara; Platte River, Grand Island; South Loup River, Ravenna; Dakota River, Mitchell. This species, like *N. jejunus*, is found usually in the clear, shallow streams on sandy bottom, but where the water is only moderately cold. It does not seem to be widely or generally distributed in the Missouri Basin. Many of the specimens obtained by us are unusually large, particularly those from Fremont and Ravenna, the largest measuring $3\frac{1}{2}$ inches in total length. Head $4\frac{2}{5}$; depth 5; eye $3\frac{1}{5}$; snout 4; D. I, 8; A. I, 13; scales 6–40–3, 20 before the dorsal, closely imbricated and deeper than long; lateral line decurved. Body long and slender, compressed; head moderate, snout pointed; mouth large, oblique, terminal; maxillary reaching vertical of front of eye; eye large, equal to interorbital width; caudal peduncle long; its least depth $2\frac{1}{2}$ in head. Origin of dorsal fin much behind insertion of ventrals nearer base of caudal than tip of snout. Color pale, upper parts dusted over with fine brown punctulations, thickest on edges of scales, thus resulting in faint cross-hatching; median line of back dark, darkest on caudal peduncle; middle of side with a broad silvery band, plumbeous above; under parts pale straw-color; head dusted above and on lips and chin; cheeks and opercles bright silvery; fins all pale except dorsal and anal, which have some fine dark specks. This trim minnow resembles *N. jejunus* in general appearance, but can be readily distinguished from all other species of *Notropis* found in the Missouri Basin by its large anal fin and the posterior position of the dorsal.

70. Notropis rubrifrons (Cope). St. Joseph, Mo. (as *Alburnellus percobromus* type, Cope, 1871); Blackwater River, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Kansas and Missouri rivers (Graham, 1885); Osage River, La Cygne, Kans. (Gilbert, 1889); Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Little Piney River at Arlington and Newburg, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

71. Notropis umbratilis umbratilis (Girard). *Redfin.* Shunganunga Creek, Topeka (as *Minnilus* (*Lythrurus*) *nigripinnis* type, Gilbert, 1884); Shunganunga Creek (Cragin, 1885*a*); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Shunganunga Creek, Topeka (as *N. nigripinnis*, Gilbert, 1885); north fork of Solomon River, Lenora, Kans. (Hay, 1887); Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

72. Phenacobius mirabilis (Girard). Ward Creek, Shawnee County, Kans. (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo. (Jordan & Meek, 1885); common throughout Kansas (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Shunganunga and Ward creeks (Cragin, 1885*a*); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; Logan, Kans.; Osage River, La Cygne, Kans. (Gilbert, 1889); Boyer River at Arion, Iowa (Meek, 1892); Blue River at Crete (Meek, 1894).

This does not appear to be an abundant fish in the Missouri Basin, but it is rather widely distributed. It was found by us only in Crow Creek near Chamberlain, S. Dak., and at Ravenna, Nebr., in Mud Creek. Head $4\frac{1}{2}$; depth $4\frac{3}{4}$; eye $4\frac{3}{4}$; snout $2\frac{3}{4}$; interorbital width $3\frac{1}{3}$. D. I, 8; A. I, 7; scales 6–48–4, about 17 before the dorsal. Largest example about 3 inches long.

73. Phenacobius scopifer (Cope). Missouri River near St. Joseph, Mo. (as *Sarcidium scopifer* type, Cope, 1871); Bear Creek, Boone County, Mo. (Call, 1887). This species may not be distinct from the preceding.

74. Rhinichthys cataractæ dulcis (Girard). *Western Dace.* Sweetwater River (as *Argyreus dulcis* type, Girard, 1856 and 1858); Kansas (as *R. maxillosus* type, Cope, 1864*a*); Kansas River near Fort Riley (as *R. maxillosus*, Cope, 1865); Red Cloud Creek and Platte River (as *R. maxillosus*, Cope, 1871); Battle Creek, S. Dak. (as *R. maxillosus*, Cope, 1879); northeastern Wyoming and Montana (as *R. ocella* type, Garman, 1881); Cheyenne, Wyo. (as *R. dulcis*, Garman, 1881); Kansas (as *R. maxillosus*, Garman, 1881); South Platte River at Denver and Hartsel Hot Springs, and Middle Boulder Creek, Boulder, Colo. (Jordan, 1891); Gardiner River (Jordan, 1891*a*); Beaverhead River at Dillon, Mont.; Red Rock River at Red Rock, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Poplar River at Poplar and Missouri River at Craig, Mont. (Eigenmann, 1894).

This species has been described as new three times from the Missouri Basin, as indicated above. The present collection contains about 500 specimens from 34 different localities, as follows: Creek at Verdigris; Minnechaduza Creek, Valentine; Niobrara River, Marsland; Bone Creek near Long Pine; Long Pine Creek, Long Pine; Middle Loup River, Dunning; White River at Chadron; Lone Tree Creek at Chadron; White River, Crawford; Chadron Creek, Chadron; Cheyenne River, Cheyenne Falls; Cheyenne River, Edgemont; Cottonwood Creek, Edgemont; Chicken Creek, Gammon's Ranch; Spearfish Creek, Spearfish; Redwater Creek, Beulah; Cox Lake near Beulah; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid City; Fall River, Hot Springs; Whitewood Creek, Deadwood; Crow Creek, Gammon's Ranch; creek at Hill City; creek at Custer; Crow Creek, Chamberlain; Choteau Creek, Springfield; Big Goose Creek, Sheridan; Powder River, Arvada; south fork of Tongue River, Sheridan; Platte River, Glenrock; Garden Creek, Casper; Platte River, Casper; Deer Creek, Glenrock; Beaver Creek, Newcastle; overflow pond at Sheridan; Platte River, Douglas.

The variations shown by this large amount of material are very great, but the differences found among the individuals from one locality are often as great as are found among specimens from different localities. In mature individuals the origin of the dorsal is nearer base of caudal than tip of snout; or in about half of the specimens examined it is about midway between nostril and base of caudal, while in the others it is nearer nostril. The length of the snout varies from $1\frac{1}{2}$ to 2 times the diameter of the eye, and the extent to which it projects beyond the mouth is subject to variation. The thickness of the lips, the size of the barbel, the angle made by the two sides of the lower jaw, the number of scales, and the color are all subject to considerable variation. The specimens from Cheyenne Falls and other alkaline streams are very pale, while those from purer waters are usually dark. In the warm water from Hot Springs at Hot Springs, S. Dak., this was the only species found, it occurring there in great abundance. We examined this stream at many different places and found this fish everywhere abundant, not only in the more open, swifter current, but in the more quiet nooks among the dense growth of *Chara* and about the outlets of springs whose water was very warm. This is a very interesting and remarkable fact, and was not what we expected. *Rhinichthys* is a group of fishes whose species seem to prefer cold water. If in any given region we wished to find *Rhinichthys* we looked for it in the coldest parts of the smaller streams, but here we found it in the warmest parts of a very warm stream.

75. **Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* This species has been reported from the Dakota River at Jamestown and La Moure, N. Dak., by Woolman (1896).

76. **Hybopsis æstivalis** (Girard). This species was found by us at Dunning, Nebr., in Middle Loup River, and at Ravenna, Nebr., in the South Loup River and Mud Creek, from which places 44 specimens were obtained. The largest of these are $2\frac{1}{2}$ inches in total length. This species is readily distinguished from *H. gelidus* by its much shorter, blunter snout, and larger eye; the color is also different, both lobes of the caudal being pale and the fine dark dustings are more evident on both back and sides,

77. **Hybopsis hyostomus** (Gilbert). Blue River at Crete; Platte and Elkhorn rivers at Fremont (Meek, 1894).

78. **Hybopsis gelidus** (Girard). Milk River (as *Gobio gelidus* type, Girard, 1856 and 1858, and Suckley, 1860). Obtained by us at the following places: Powder River, Arvada; North Platte River, Douglas; North Platte River, Grand Island; Bazile Creek, Niobrara; White River, Chamberlain. Upon comparing these specimens with those collected at St. Joseph, Mo., in 1884, by Drs. Jordan and Meek, and which were identified by them as *H. gelidus,* we found important differences and were disposed to regard our specimens as being an undescribed species. But a reexamination of Girard's original description showed that our specimens were the true *H. gelidus*, and that the St. Joseph specimens had been erroneously referred to that species. These have since been described by Jordan and Evermann[1] under the name *Hybopsis meeki.*

The considerable number of excellent specimens which we have enables us to give a more detailed description of *H. gelidus* than has hitherto been published. Head 4; depth 5; eye $6\frac{1}{4}$; snout $2\frac{2}{5}$; D. 8; A. 9; scales 6–44–4. Body slender, not much compressed, back little arched, head long and slender; mouth inferior, horizontal, broad, overhung by the very long pointed snout, which is considerably decurved; barbel short, $1\frac{2}{3}$ in head; eyes very small, high up, midway of head; interorbital width equal to width of mouth, origin of dorsal a little nearer snout than base of caudal, directly over base of ventrals; free edge of dorsal fin slightly concave, the anterior ray but little produced, its length $1\frac{2}{5}$ in head; free edge of anal little concave, length of first rays $1\frac{3}{5}$ in head; pectorals much shorter than in *H. meeki,* $1\frac{1}{2}$ in head, the first rays not produced or filamentous and not reaching ventrals; ventrals barely reaching vent, $1\frac{2}{3}$ in head; caudal very long and deeply forked, the lobes as long as head, the lower slightly the longer. Lateral line complete, straight; teeth, 4–4, strongly hooked. Color, sides silvery, pale below; scales of back each with a group of fine dark specks on posterior border, these extending almost to lateral line; rest of back and upper part of sides sparsely dusted over with minute brownish specks; fins all pale except the caudal, the lower lobe of which is dark, with a narrow white border below; upper lobe slightly dark at base. From *Hybopsis meeki,* which it most closely resembles, this species may be distinguished by the much longer and more pointed snout, the smaller eye, the much shorter pectoral fins, and the darker coloration of the back.

[1] Fishes of North and Middle America, Part I, 317, 1896.

79. **Hybopsis meeki** Jordan & Evermann.

Ceratichthys gelidus Jordan & Gilbert, Synopsis, 216, 1883; in part.

Hybopsis gelidus Jordan & Meek, Proc. U. S. Nat. Mus. 1885, 10; branches of Missouri River, Graham, 1885; Missouri River at Sioux City, Meek, 1892.

Hybopsis meeki Jordan & Evermann, Fishes North and Middle America, Part 1, 317, 1896. Type locality: Missouri River, St. Joseph, Mo.

Head 4; depth 5½; D. 8; A. 8; lateral line 44. Body very slender, not elevated. Snout long, thick, blunt, overhanging the rather large mouth. Barbel as long as eye. Head slender and elongate. Eye small, rather high, 4½ in head. Mouth small, subterminal, the maxillary not extending to the eye. Fins all large; pectoral as long as head; caudal deeply forked. Lateral line decurved, scales rather large. Coloration silvery, unspotted; a dusky lateral streak ending in a blackish spot at base of caudal; lower lobe of caudal abruptly black, edged below with white. Male with the nuptial tubercles excessively developed, covering most of body. Length, 2 inches. Missouri River at St. Joseph in river channel. A curious little fish, hitherto confounded with *H. gelidus*. (Named for Dr. Seth Eugene Meek.)

80. **Hybopsis montanus** Meek. Upper Missouri region (type, Meek, 1884). The exact locality from which these specimens came is not known. They are three in number (Nos. 36882, U. S. Nat. Mus.) and are said to have been collected by Dr. F. V. Hayden.

81. **Hybopsis dissimilis** (Kirtland). Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891).

82. **Hybopsis storerianus** (Kirtland). Grand River at Clinton, Mo., and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); Osage River and branches (Graham, 1885); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894); Mud Creek, Ravenna; Elkhorn River, Norfolk Junction; Platte River, Grand Island; Wood Creek, Grand Island. Very abundant at Ravenna, where 35 large specimens, 5 to 6 inches long, were obtained.

83. **Hybopsis kentuckiensis** (Rafinesque). *River Chub.* Sweetwater River (as *Nocomis nebracensis* type, Girard, 1856 and 1858); Kansas River near Fort Riley (as *Ceratichthys cyclotis*, Cope, 1865); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (as *H. biguttatus*, Jordan & Meek, 1885); Mill Creek and Fort Riley, Kans. (Cragin, 1885*a*); very common in Kansas (as *H. biguttatus*, Graham, 1885); Mill Creek, Alma, Kans. (as *H. biguttatus*, Gilbert, 1885); Mission and Blacksmith creeks, Shawnee County, Kans. (as *H. biguttatus*, Gilbert, 1887); Smoky Hill River, Wallace, Kans. (as *H. biguttatus*, Hay, 1887); Osage River, La Cygne, Kans. (as *H. biguttatus*, Gilbert, 1889); Big Piney River, Cabool, Mo.; Little Piney River at Arlington and Newburg, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage River, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Big Sioux River at Sioux Falls (Meek, 1892); Elkhorn River at Fremont (Meek, 1894); Dakota River and Pipestem Creek at Jamestown (Woolman, 1896).

84. **Couesius dissimilis** (Girard). Milk and Little Muddy rivers (as *Leucosomus dissimilis* type, Girard, 1856 and 1858); Poplar River, Poplar, Mont. (Eigenmann, 1894). Numerous specimens of this species were obtained by us as follows: Minnechaduza Creek, Valentine; Schlegel Creek, Valentine; Crow Creek, Chamberlain; Long Pine Creek, Long Pine; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid City; creek at Hill City; creek at Custer; Big Goose Creek, Sheridan; south fork of Tongue River, Sheridan.

All of the streams in which it was found are clear and cold, and it probably does not occur in any of the warmer alkaline streams in the eastern and central part of the region examined. It appears to be common, however, in certain Wyoming streams. The finest, largest, individuals obtained are those from Rapid Creek and Tongue River, the largest of these measuring about 6 inches in total length. Head $4\frac{1}{3}$ to $4\frac{1}{2}$; depth 4 to 5; eye 4 to 5; snout 3 to 4; D., 8; A., 8. There is considerable variation in the scales, the extremes being 12-72-8 and 12-64-8, the usual number, however, being 12-68-8. Occasionally there are 11 to 13 scales above (and including) the lateral line.

In the fifth edition of Jordan's Manual of Vertebrates, *Couesius dissimilis* is distinguished from *C. plumbeus* as having fewer scales in the lateral line, the number given for *dissimilis* being 60 and for *plumbeus* 68. This is evidently a mistake. Specimens in the National Museum of what have been called *plumbeus*, from Lake Superior and the Adirondacks, have 70 to 75 scales in the lateral line. This is not sufficiently different from western specimens to be of any specific value. While we can not see how these species can be distinguished by the scales, we think we have discovered a character which will serve to distinguish them, viz: The differences in the dorsal and anal fins, which may be stated thus:

a. Height of dorsal fin 1 to $1\frac{1}{3}$ in head, free margin of fin concave, the anterior rays produced and extending beyond the others when the fin is depressed. Length of longest anal ray $1\frac{1}{4}$ to $1\frac{1}{2}$ in head, the free margin of the fin more or less concave, the anterior rays somewhat produced, and when deflexed extending slightly beyond other rays .... *plumbeus.*

aa. Height of dorsal $1\frac{1}{3}$ to $1\frac{1}{2}$ in head; free margin of fin nearly straight, the anterior rays little if at all produced, and when depressed barely reaching beyond end of other rays. Length of longest anal ray $1\frac{2}{3}$ in head, free margin of fin straight, anterior rays not produced and not extending beyond end of others when depressed .... *dissimilis.*

These differences are well marked between the specimens of *dissimilis* examined and all specimens of *plumbeus* from the upper Great Lakes region. A specimen (U. S. N. M., No. 34388) collected in the Adirondacks by Mr. Fred Mather, seems to belong to *Couesius plumbeus*, though it does not wholly agree with those from Lake Superior. The height of the dorsal fin is $1\frac{1}{5}$ in head, the anterior rays are somewhat produced and extend some beyond the other rays when the fin is depressed; the free margin is but slightly concave. The longest anal rays are contained $1\frac{2}{3}$ times in length of head, the anterior rays are but little produced and do not reach beyond the others when deflexed; the free margin of the anal fin is nearly straight. The origin of the dorsal fin is midway between middle of pupil and base of caudal. This posterior position of the dorsal is a character, however, not possessed by the other specimens of *C. plumbeus* examined. This species differs from *C. greeni* of the Columbia and Frazer River basins in the smaller scales and in having the scales more crowded on the anterior part of the body. There is considerable variation in the squamation of this species, however. Examination of ten examples from Sheridan gives the following results:

Number of rows of scales between front of dorsal fin and lateral line.	Number of scales in lateral line.	Number of rows of scales between lateral line and base of ventrals.	Number of scales in front of dorsal fin.
11	60	8	32
12	63	10	40
12	63	8	40
12	66	8	35
12	63	9	40
11	60	9	36
11	60	9	35
12	65	9	36
15	70	9	40
12	60	9	40

The type of *C. dissimilis* has the head $3\frac{5}{6}$; depth $4\frac{3}{4}$; eye 4; snout $3\frac{2}{3}$; interorbital 3; scales 12–66–9, 38 before dorsal. Of 21 specimens of *Couesius* from Rapid Creek all but one are infested more or less with a parasitic trematode embedded under the scales and showing as small black spots. All of those from Hill City and many from Custer and Sheridan are similarly affected.

85. **Platygobio gracilis** (Richardson). *Flat-headed Chub.* Fort Pierre, Fort Union, above Fort Union, Milk River, Yellowstone River, and Sweetwater River (as *Pogonichthys communis* type, Girard, 1856 and 1858); Milk River (as *Pogonichthys communis,* Suckley, 1860); near Bridger Pass (as *Pogonichthys* (*Platygobio*) *gulonellus* type, Cope, 1864*a*); Kansas River near Fort Riley (as *P. gulonellus,* Cope, 1865); Platte Valley (as *P. communis,* Gill, 1876); Fort Benton and Judith River (as *Pogonichthys communis,* Cope, 1879); Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885); Missouri River at Sioux Falls (Meek, 1892); Poplar River at Poplar, and Missouri River at Craig, Mont. (Eigenmann, 1894); Platte River at Fremont (Meek, 1894).

This abundant minnow was found by us at the following places: White River near Chamberlain; Redwater Creek near Spearfish; canal at Niobrara; Bone Creek and Niobrara River near Long Pine; Middle Loup River at Dunning; Chadron Creek, Lone Tree Creek, and White River near Chadron; Platte River at Grand Island; Niobrara River near Valentine; Mud Creek and South Loup River at Ravenna; Clear Creek, Clermont; North Platte River at Glenrock, Casper, and Douglas; Cheyenne River at Edgemont and Cheyenne Falls; Powder River at Arvada; Deer Creek at Glenrock.

The flat-headed chub is preeminently the characteristic fish of the shallow alkaline streams of the middle Missouri Basin, and shows better than any other the peculiar bleaching effect of the alkaline waters of that region. The fishes are all reduced to a nearly uniform pale or faded appearance. Except those found in the headwaters above the alkali, they are almost wholly without pigment cells of any kind. Perhaps the most extreme case of bleaching is that of *P. gracilis,* which, of all American fishes, seems to be the one most perfectly adapted to life in these alkaline streams.

86. **Anguilla chrysypa** Rafinesque. *Common Eel.* "Believed to be common throughout the State" of Kansas (as *A. rostrata,* Graham, 1885); Kansas River at Lawrence and Topeka (Cragin, 1885*a*). The eel probably occurs abundantly in the lower portion of the Missouri Basin, but no definite records are known.

87. **Hiodon alosoides** (Rafinesque). *Toothed Herring.* Quaking Asp River (as *Hyodon chrysopsis,* Jordan, 1878); Missouri River, St. Joseph, Mo.; Tabo Creek, Lexington, Mo. (Jordan & Meek, 1885); Silver Lake (Cragin, 1885*a*); Republican River, Concordia, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Missouri and Big Sioux rivers, Sioux City (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River at Sioux City, and Platte River at Fremont (Meek, 1894).

Young examples of this species were obtained as follows: Crow Creek, Chamberlain; Choteau Creek, Springfield; Bazile Creek and Ponca Creek, Niobrara; Loup River, Ravenna; White River, Chadron; Wood and Platte rivers, Grand Island; Platte River, Casper; and Clear Creek, Clermont. The largest specimens obtained do not exceed 6 inches in length. Though it was not secured in many of the streams examined by us, this species is no doubt generally distributed throughout the lower and middle Missouri River basin in all suitable waters. It is a fish of the open stream, being found where there is some current and where the depth is not great. It reaches a length of a foot or more, and is a handsome fish possessing some game qualities, though not of much food value. At Hot Springs we were told that this fish is found at Cheyenne Falls in considerable numbers in the spring, that it is locally known as the "whitefish," and that it affords some sport for the local anglers.

88. Hiodon tergisus Le Sueur. *Moon-eye.* West of Fort Union (as *Hyodon tergisus*, Suckley, 1860); Kansas River near Fort Riley (as *Hyodon tergisus*, Cope, 1865); Judith River and river pools near Battle Creek, S. Dak. (as *Hyodon tergisus*, Cope, 1879); "common in Kansas" (Graham, 1885); Kansas River at Topeka (Cragin, 1885*a*).

89. Dorosoma cepedianum (Le Sueur). *Hickory Shad; Mud Shad.* Missouri River, St. Joseph, Mo.; Tabo Creek, Lexington, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); "very common" in Kansas (Graham, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Osage River, La Cygne, Kans. (Gilbert, 1889); Little Piney River at Newburg and Arlington, Mo. (Meek, 1891); Missouri River and Big Sioux River at Sioux City (Meek, 1892); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894).

90. Pomolobus chrysochloris Rafinesque. *Skipjack; Blue Herring.* "Abundant in large streams" in Kansas (Graham, 1885).

91. Coregonus williamsoni cismontanus Jordan. *Rocky Mountain Whitefish.* Headwaters of the tributaries of the upper Missouri as (*C. williamsonii*, Cope, 1879); Madison, Yellowstone, and Gardiner rivers, and Horsethief Creek, Mont., types, Jordan, 1891*b*); Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

Whitefish were found only in Tongue River and Big Goose Creek near Sheridan, 13 small specimens being secured. In Tongue River they are said to be quite common. This variety of Williamson's whitefish is found in most of the cold streams of the upper Missouri Basin, particularly in the streams about the Yellowstone Park. The differences which are assigned as distinguishing the Missouri River whitefish from Williamson's are scarcely perceptible, if at all. The body is said to be somewhat more slender and the fins lower. All the young examples in the present collections show the parr marks very distinctly.

92. Salmo mykiss lewisi (Girard). *Cut-throat Trout; Yellowstone Trout.* Falls of Missouri River (as *Salar lewisi* type, Girard, 1858); Falls of Missouri River (as *Salmo* (*Salar*) *lewisi*, Suckley, 1860); Yellowstone River, Yellow Creek, Gallatin Fork, and Yellowstone Lake (as *Salmo pleuriticus* type, Cope, 1872); St. Mary River (as *S. clarki*, Jordan, 1878); Yellowstone River at Livingston, Mont.; Gardiner River below the Falls; Solution Creek, Riddle Lake; Canyon Creek and Madison River, Yellowstone National Park (Jordan, 1891*b*); Atlantic Creek in Two-Ocean Pass and below the pass; upper Yellowstone River; Meadow Creek in Yellowstone Park; east fork of Gardiner River, and McClellan Creek, Helena, Mont. (Evermann, 1892).

Two specimens of the black-speckled trout are in the collection from south fork of Tongue River and two from Big Goose Creek near Sheridan. Numerous other examples were caught with hook from these streams. In these and in nearly all the streams in this part of Wyoming trout are abundant and afford excellent sport to the angler. Small parties often report catches of 400 to 600 as the result of two or three days' fishing. Upon comparing the specimens from Sheridan with others of the same size from Big Wood River at Galena, Idaho, the following differences are noted: The Sheridan specimens have the eye a little larger, the snout a little shorter, the maxillary notably longer and heavier, and the fins all much larger; the height of the dorsal is less than 2 in head and that of the anal is $1\frac{3}{4}$ in head. In the Idaho specimens the dorsal and anal are at least a fourth lower; the pectorals and ventrals are also correspondingly shorter. The Sheridan specimens have smaller scales and differ somewhat in coloration. In both, the back is profusely spotted throughout the entire length, but in the Sheridan specimens there are but few spots below the lateral line, while those from Idaho are almost as thickly spotted below the lateral line as on the back; in the Sheridan specimens the head has scarcely any spots; in the other, the head is well spotted; there is also a marked difference in the size of the spots, those on the Idaho specimens being much the larger. Contrasting these differences in tabular form we have the following:

Characters contrasted.	Specimen (male) 10 inches long, Sheridan, Wyo.	Specimen (male) $9\frac{1}{2}$ inches long, Galena, Idaho.
Eye	$4\frac{4}{5}$ in head	$5\frac{1}{6}$ in head.
Snout	$5\frac{3}{4}$ in head	$4\frac{2}{3}$ in head.
Maxillary	Long and broad, upper edge convex.	Shorter and narrower, the two sides nearly parallel.
Dorsal fin	Large, its height less than 2 in head	Small, its height $2\frac{1}{4}$ in head.
Anal fin	Large, $1\frac{3}{4}$ in head	Smaller, $2\frac{1}{4}$ in head.
Pectoral fins	Long, $1\frac{2}{3}$ in head	Shorter, 2 in head.
Ventral fins	Long, 2 in head	Shorter, $2\frac{1}{4}$ in head.
Scales	Small	Somewhat larger.
Coloration	Back and sides above lateral line profusely spotted, the spots small. Sides below lateral line with few spots. Head almost plain with only 2 or 3 spots behind eye. Red on throat in life.	Not materially different, except that the spots are smaller and less thickly placed on antedorsal region. Almost as numerous as above. Top of head and postorbital area with numerous spots; 2 or 3 spots on snout. No red on throat in life.

These differences are very marked, and would certainly be of sufficient importance to justify the specific separation of the two if found to hold good throughout the range of each. But various more or less intermediate characters are shown in specimens from other localities, and it is probably best, for the present at least, to regard these forms as subspecies of typical *mykiss*; in which case the form found throughout the upper Missouri Basin and in the Snake River above Shoshone Falls will stand as *Salmo mykiss lewisi* (Girard), and the common form of the Snake River basin below Shoshone Falls, as *Salmo mykiss gibbsii* (Suckley). The eastern limit in Wyoming in the range of the black-speckled trout is only approximately known. We know that trout are abundant in Yellowstone Lake[1] and in the streams in and about the park, from which they are not barred by waterfalls; they are also in the Yellowstone River and its upper tributaries. It is undoubtedly in the Clark Fork of the Yellowstone and Big Horn River, though no specimens have been received from those streams. We know it is an abundant fish in the Tongue River basin, and it is probably found in the headwaters of Powder River, though we have no definite record of the fact. It is not found in any of the streams in or about the Black Hills, as we have already stated in this paper. At present the most eastern point from which specimens have been obtained, of which we have definite record, is Sheridan, Wyo., from south fork of Tongue River, and Big Goose Creek. Further investigations in Wyoming are very much to be desired, especially in the region drained by the Clark Fork of the Yellowstone, the Big Horn, Powder River, the North Platte, and the Sweetwater.

93. **Salmo mykiss stomias** (Cope). *Platte River Trout.* Kansas River near Fort Riley,[2] Kans. (as *Trutta lewisi*, Cope, 1865); Platte [Kansas] River near Fort Riley, Kans. (as *Salmo* (*Salar*) *stomias* type, Cope, 1871); Platte [Kansas] River (in part as *S. pleuriticus* type, Cope, 1872); Bear Creek, Morrison, Colo. (Jordan, 1891).

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[1] In Ludlow's Report of a Reconnaissance from Carroll, Mont. Ter., on the Upper Missouri, to the Yellowstone National Park and return, made in the summer of 1875 (War Dept., 1876), we find the following interesting note (p. 20) concerning the trout of this lake: "There seem to be two varieties of trout here, the bulky ones of the Yellowstone, with bright yellow bellies and stripings of red, and a smaller kind, more silvery in appearance and exhibiting much greater activity and game qualities. These latter seemed to come generally from the [Tower] creek."

[2] Locality probably erroneous. The specimens more likely came from some point near the headwaters of the South Platte, where variety *stomias* is found.

[Introduced species.] **Salvelinus fontinalis** (Mitchill). *Eastern Brook Trout.* This species has been planted in a number of the streams of Nebraska, South Dakota, and Wyoming. Specimens were obtained by us in Spearfish Creek at Spearfish, Spring Creek at Bazile Mills, Long Pine Creek at Long Pine, Beaver Creek near Newcastle, and Big Goose Creek near Sheridan. In Spring Creek we found the brook trout abundant and doing well. At three hauls with a short seine we caught at least 15 trout (which were returned to the streams), mostly yearlings, though one was nearly a foot long. Mr. George Brooks, of Bazile Mills, informs us that recently a trout weighing 2 pounds 9 ounces was caught in this little stream. The plant was made here by the Nebraska fish commission some six or seven years ago, and has proved very successful. The stream is so small, however, that the trout will not, as a rule, attain a large size, and, unless fishing is carefully regulated, the stream will become fished out.

Long Pine Creek is a very good trout stream and we saw a number of very fine trout there. This creek has become noted throughout Nebraska and affords more and better trout fishing then any other stream in the State. The creek is a large one, the water is excellent, and there is an abundant food supply, consequently the trout grow to a large size and are of superior flavor. Spearfish Creek is apparently the best trout stream in the Black Hills, surpassing in length and volume of water any of the other streams suitable for trout in that region. Sufficient plants of trout have been made in the vicinity of Spearfish to demonstrate the excellent character of the water. These fish appear to be doing remarkably well, and the stream is able to support a much larger supply than it now contains. Beaver Creek, near Newcastle, is another excellent trout stream in which eastern brook trout and rainbow trout have been planted. There are, of course, numerous other streams in the Black Hills well suited to trout, but, so far as we were able to learn, no plantings of importance have been made in them.

94. **Thymallus ontariensis montanus** (Milner). *Montana Grayling.* Yellow Creek and Gallatin River and headwaters of Yellowstone River (as *Thymallus tricolor*, Cope, 1872); tributary of Missouri River at Camp Baker, Mont. (as *T. montanus* type, Milner, 1874); Madison River, Gallatin River, and Horsethief Creek, Mont. (as *T. signifer ontariensis*, Jordan, 1891*a*); Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

95. **Lucius lucius** (Linnæus). *Pike; Northern Pickerel.* St. Mary River (as *Esox lucius*, Jordan, 1878); Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Lemars and Sioux City; East Okoboji, West Okoboji, and Spirit lakes (Meek, 1894); Dakota River at Jamestown (Woolman, 1896). This species was found in Elkhorn River near Norfolk, and in Rock Creek near Mitchell, where a single specimen a foot in length was secured. We were surprised not to find pickerel in any of the other waters examined, as the sluggish grassy streams and the small lakes would seem to be well suited to it. Further collecting will probably show it to be more common in eastern Nebraska and South Dakota than now appears.

96. **Fundulus diaphanus** (Le Sueur). Kansas River (Graham, 1885).

97. **Fundulus zebrinus** Jordan & Gilbert. Kansas River and branches (Graham, 1885); Ellis, Kans. (Cragin, 1885*a*); Ellis, Ellis County, Kans. (Gilbert, 1885); north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Republican River, Wano, Kans.; Logan, Kans. (Gilbert, 1889); Big Sioux River at Sioux City; Silver Lake, Iowa (Meek, 1892); East Okoboji Lake (Meek, 1894).

98. **Fundulus catenatus** (Storer). Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891).

99. Fundulus lineatus (Garman). Northeastern Wyoming (as *Zygonectes lineatus* type, Garman, 1881).

100. Fundulus macdonaldi (Meek). Jones Creek, Dixon, Mo.; Osage River, Marshfield, Mo. (as *Zygonectes macdonaldi* types, Meek, 1891).

101. Fundulus floripinnis (Cope). South Platte River near Denver (*Haplochilus floripinnis* type, Cope, 1874); Denver, Colo. (as *Haplochilus floripinnis*, Cope & Yarrow, 1876); South Platte River at Denver (as *Zygonectes floripinnis*, Jordan, 1891).

102. Fundulus sciadicus Cope. "Nebraska or Platte River" (type, Cope, 1865); Floyd River at Lemars; Platte and Elkhorn rivers at Fremont (Meek, 1894). Numerous specimens of this species were obtained. It was found at the following places: Ponds at Niobrara, Creighton, and Long Pine; Creighton Creek, Niobrara; Long Pine Creek, Long Pine; Dismal and Middle Loup rivers, Dunning; Loup River, Ravenna; Prairie Creek, Scotland, and Rock Creek, Mitchell. Specimens have recently been sent to the Commission from Dover, McCook County, S. Dak., by Mr. Fred. S. Butler. The center of abundance for this region seems to be in northeastern Nebraska and southeastern South Dakota, the largest number of specimens having been obtained about Scotland, Niobrara, and Long Pine. It was also common at Dunning, and probably occurs in all suitable waters of Nebraska and South Dakota. It seems to prefer the small grassy ponds and lakes, but it also finds a congenial home in the sluggish grassy creeks so common in this region. In the small, isolated pools along the creeks among the *Chara*, *Potamogeton*, and *Myriophyllum*, in which they abound, these little "top minnows" could usually be found in large numbers swimming about at the surface. Usually the vegetation was so abundant that it was difficult to secure any of these fish with the seine. A dip net or a very short seine generally gave the best results. The largest specimens secured are $2\frac{3}{4}$ inches long, and may be described as follows: Head $3\frac{3}{5}$; depth 4; eye 4; snout $3\frac{1}{2}$; interorbital width $1\frac{1}{2}$ times eye. D. 10; A. 12; scales 35–10. Body short and stout; head flat, snout pointed, the lower jaw slightly projecting; caudal peduncle compressed and deep, its least depth nearly equal to snout and eye. Teeth in each jaw in about 3 series, those of the outer enlarged and somewhat curved inward. Fins all small; the pectorals about as long as depth of caudal peduncle; ventrals much shorter; origin of dorsal behind that of anal and nearer tip of caudal than to occiput. Color in life, rosy olivaceous, profusely covered with fine brownish punctulations; middle line of back darker; in spirits, uniform olivaceous or brownish, paler below; dark line on back evident.

103. Eucalia inconstans (Kirtland). *Brook Stickleback.* Poplar River, Poplar, Mont. (Eigenmann, 1894). The brook stickleback was found only in Crow Creek, near Chamberlain, and in the ponds and creek at Long Pine. Mr. Fred S. Butler, of Dover, S. Dak., has kindly sent us specimens from that place. Over 50 specimens were secured, all but 4 of them from Long Pine. In the small grassy ponds at the head of Long Pine Creek it is very abundant. The largest specimens are 2 inches in total length. Head $3\frac{1}{2}$; depth $3\frac{4}{5}$; eye $3\frac{3}{4}$; snout $3\frac{1}{2}$. D. IV or V–I, 10 or 11; A. I, 9 or 10. In 31 examples counted the dorsal was IV–I, 10 in 12; IV–I, 9 in 2; IV–I, 11 in 1; V–I, 10 in 10; V–I, 9 in 4, and V–I, 11 in 2. In the same examples the anal was I, 9 in 16 and I, 10 in the remaining 15. Body smooth throughout. Ventrals very short, wide apart, innominate bone covered by the skin about $1\frac{1}{3}$ times length of ventrals. Color, dark brown above, pale below.

104. Percopsis guttatus Agassiz. *Trout Perch.* Kansas (as *P. hammondii* type, Gill, 1864); Kansas River near Fort Riley (as *P. hammondi*, Cope, 1865); Big Sioux River at Sioux City; Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Lemars, and East Okoboji Lake (Meek, 1894).

105. Labidesthes sicculus (Cope). Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891).

106. Pomoxis annularis Rafinesque. *Crappie.* Missouri River, St. Joseph, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Kansas River at Lawrence (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Bear Creek, Boone County, Mo. (Call, 1887). Both species of *Pomoxis* are being extensively introduced into the waters of Kansas, Nebraska, and South Dakota, and it is not easy to determine definitely the natural western limit of either. It will be very close to the truth, however, if we put it in the eastern part of Nebraska and the Dakotas on the border of the alkali region.

107. Pomoxis sparoides (Lacépède). *Calico Bass.* Osage River, Kans. (Cragin, 1885*a*); East Okoboji Lake (Meek, 1894).

108. Ambloplites rupestris (Rafinesque). *Red-eye; Goggle-eye.* Kansas River at Lawrence (Cragin, 1885*a*); Big Sioux River at Sioux City and Sioux Falls (Meek, 1892); Floyd River at Sioux City (Meek, 1894). The western limit of this species is apparently about the same as that of the two species of *Pomoxis*. All three species could doubtless be introduced successfully into many of the small lakes in Nebraska and the Dakotas.

109. Chænobryttus gulosus (Cuvier & Valenciennes). *Warmouth.* Kansas River (Graham, 1885). This species ought to be found in the lakes of Iowa and those of the Dakotas, but no specimens have been reported from any point in the Missouri Basin, except those recorded from Kansas River by Professor Graham.

110. Apomotis cyanellus (Rafinesque). *Green Sunfish.* Kansas River near Fort Riley (as *Bryttus longulus*, Cope, 1865); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek at Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); "common" in Kansas (Graham, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Ward and Shunganunga creeks, Shawnee County, Kans. (Gilbert, 1885); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Osage River, La Cygne, Kans. (Gilbert, 1889); Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls; Soldier River at Charter Oak, and Boyer River at Arion, Iowa (Meek, 1892); Platte River at South Bend and Fremont (Meek, 1894).

This common sunfish was obtained in the following places: Rock, Enemy, and Firesteel creeks and Dakota River, Mitchell; Emanuel and Choteau creeks, Springfield; Prairie Creek, Scotland; Creighton Creek, Niobrara; ponds at Verdigris, Creighton, Norfolk Junction, Long Pine, and Dunning; Minnechaduza Creek, Valentine; Lake George, Carp Lake, and Ingalls Lake near Long Pine; Elkhorn River at Norfolk Junction and Ewing; South Loup River at Ravenna; and Bone Creek near Long Pine.

The collections contain 146 specimens from these localities. The species is most abundant in southeastern South Dakota, as is shown by the numerous specimens from the vicinity of Mitchell. It is also quite abundant in suitable places in eastern Nebraska, but is not common westward. About Long Pine, in Brown County, we found it to be rather common, and 9 specimens were obtained still farther west from Minnechaduza Creek near

Valentine, in Cherry County, and 9 specimens are in the collection from the ponds along Dismal River near Dunning, in Blaine County. Very suitable ponds near Chamberlain did not contain this or any other species of sunfish, though some 60 miles east of the place where we found it in Minnechaduza Creek. It seems probable that the western limit in Nebraska, of this sunfish, is not far from the one hundredth meridian, and that in the Dakotas it is some miles farther east. This western limit seems coincident with the disappearance of the small lakes and ponds of pure water and the appearance of the shallow, uncertain, alkaline streams so characteristic of western Nebraska and South Dakota. There is a number of suitable ponds and lakes farther west, particularly about the Black Hills, where sunfish would probably do well, but that they are not there is apparently due to the fact that the alkaline streams to the eastward have served as a barrier. This sunfish attains a considerable size in this region, especially in the lakes, and is of no little importance as a pan fish. Our specimens from Mitchell, Verdigris, and the Brown County lakes are particularly large and fine. In life the colors are very brilliant; dark greenish above and on sides, with bright blue lines on cheek; belly and posterior portion of body orange; soft part of opercular flap lemon; ventrals orange with white border; anal black at base, rays orange toward tips, outer edge orange and white; caudal lobes with some deep orange.

111. Lepomis megalotis (Rafinesque). *Long-eared Sunfish.* Osage Fork, Marshfield, Mo. (Meek, 1891); Silver Lake, Iowa (Meek, 1892).

112. Lepomis humilis (Girard). *Red-spotted Sunfish.* Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); "locally abundant" in Kansas (Graham, 1885); Ellis, Kans.; Ward and Shunganunga creeks, Shawnee County, Kans. (Gilbert, 1885, and Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Bear Creek, Boone County, Mo. (Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; La Cygne, Kans.; Solomon River, Wano, Kans. (Gilbert, 1889); Marais River, Dixon, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls, and Boyer River at Arion, Iowa (Meek, 1892); Platte River at South Bend and Fremont; Elkhorn River at Fremont; Blue River at Crete; Salt Creek at Lincoln; Floyd River at Lemars and Sioux City (Meek, 1894); and Dover, S. Dak. (Butler, 1896).

This sunfish was obtained at the following places: Rock and Firesteel creeks and Dakota River, Mitchell; Prairie Creek, Scotland; pond at Norfolk Junction, and Blue River at Stewart. A total of 88 specimens are in the collection, all but 30 being from the streams about Mitchell. While this species is abundant about Mitchell it does not appear to be so elsewhere. The most westerly point at which we found it in Nebraska is Norfolk Junction. Evidently its range does not extend so far to the westward as does that of *A. cyanellus.* The life colors are very bright; belly, spots on sides and three or four rows on cheek rich orange; ventrals, anal, and tip of dorsal, orange; iris red. This sunfish does not reach so large a size as *A. cyanellus,* but it is, nevertheless, of considerable value as a pan fish.

113. Lepomis macrochirus Rafinesque. Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891).

114. Lepomis pallidus (Mitchill). *Blue-gill Sunfish.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Little Piney River at Newburg and Arlington, Mo.; Big Piney River, Cabool, Mo.; Gasconade River, Arlington, Mo.; Osage Fork, Marshfield, Mo. (Meek, 1891); Spirit Lake (Meek, 1894).

115. Eupomotis gibbosus (Linnæus). *Common Sunfish; Pond Sunfish.* Osage River at Ottawa, Kans. (Cragin, 1885*a*); Spirit Lake (Meek, 1894).

116. Micropterus dolomieu Lacépède. *Small-mouthed Black Bass.* Marais des Cygnes (Graham, 1885); Ozark region of Missouri (Call, 1887); Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo. (Meek, 1891); Spirit Lake (Meek, 1894).

117. Micropterus salmoides (Lacépède). *Large-mouthed Black Bass.* Missouri River, St. Joseph, Mo.; Blackwater, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River at Lawrence (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891); Floyd River at Lemars and Sioux City; Platte and Elkhorn rivers at Fremont; Spirit Lake (Meek, 1894).

This was not found at any point in South Dakota, and in Nebraska it was found only at Norfolk Junction, Ewing, and Ravenna. Only young individuals were seen. Whether the black bass is native in any of these streams is not absolutely certain. It has been planted extensively by the Nebraska fish commission and it is not unlikely that it has been introduced into these streams. At any rate the eastern parts of Nebraska and the Dakotas quite certainly mark the western limit of the natural habitat of the large-mouthed black bass. The numerous small lakes of these States seem to be well suited to it and it will no doubt prove profitable to keep them well stocked not only with the large-mouthed black bass, but with the rock bass, warmouth, ring perch, and the various species of sunfish. East of the Black Hills some of the tributaries of the Cheyenne are also well suited to the needs of these species and they could be very properly stocked.

118. Stizostedion vitreum (Mitchill). *Wall-eyed Pike.* Kansas River (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Big Sioux River (Meek, 1892); West Okoboji and Spirit lakes (Meek, 1894). Found by us only in Crow Creek near Chamberlain, in Rock Creek at Mitchell, Choteau Creek near Springfield, South Loup River at Ravenna, Long Pine Creek at Long Pine, and Clear Creek at Clermont. In all these places it is probably abundant, though we secured only a few small specimens. Large ones were seen in Choteau and Long Pine creeks, and we were informed that the wall-eyed pike is found in most of the larger creeks and rivers of eastern Nebraska and the Dakotas, and that it is the principal game fish. The larger lakes and the larger, more open streams of this region are fairly well adapted to the requirements of this fish; the waters are not unsuitable and an ample supply of desirable food is found in the various smaller fishes which, though not very great as to number of species, are abundant as regards individuals. The same is true of the next species, the sauger. We are of the opinion that these waters are capable of supporting a much larger supply of these species than now exists in them; judicious plantings of fry in the more suitable streams would, in a few years, result in a large increase in the abundance of this valuable food-fish and the angler would find the region an attractive one. Each of the 10 specimens examined possessed but 3 pyloric cœca.

119. Stizostedion canadense boreum (Girard). *Sand Pike; Gray Pike; Sauger.* Milk River (as *S. boreus*, Suckley, 1860); Kansas River near Fort Riley (as *Stizostedium americanum*, Cope, 1865); Missouri River at Fort Benton and elsewhere (as *Lucioperca borea*, Cope, 1879); Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Kansas River and Mill Creek, Kans. (Graham, 1885); Big Sioux River (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Spirit Lake, Floyd River at Lemars and Sioux City, and Platte River at Fremont (Meek, 1894).

Found by us at the following places: Choteau Creek near Springfield; White River near Chamberlain; and North Platte River at Grand Island, Glenrock, and Casper. Only 7 specimens were secured, all of them being small. The sauger is probably equally abundant with the wall-eyed pike in this region, but its habitat seems to extend farther west. Though not attaining as large size as the wall-eyed pike, the sauger reaches a length of a foot or more and possesses game qualities which render it a fish of no little importance in the Missouri Basin. The number of pyloric cœca in six of the seven specimens examined was 4, in the other there were 5. It is not always easy to distinguish the young of these species by external characters, but the number and relative lengths of the pyloric cœca seem to constitute reliable differences.

120. Perca flavescens (Mitchill). *Yellow Perch; Ring Perch.* Big Sioux River at Sioux City and Sioux Falls, and Silver Lake, Iowa (Meek, 1892); East Okoboji and Spirit lakes (Meek, 1894); Dakota River at Jamestown (Woolman, 1896). This perch was found only in the streams about Mitchell, nine specimens being obtained from Enemy, Rock, and Firesteel creeks and Dakota River. This is the most western point from which it has been reported, and is probably near the western boundary of its habitat.

121. Percina caprodes (Rafinesque). *Log Perch; Hog-nosed Darter.* Eastern Kansas (Graham, 1885); Snokomo Creek, Wabaunsee County, Kans. (Gilbert, 1886); Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891).

122. Hadropterus phoxocephalus (Nelson). Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Hadropterus phoxocephalus*, Jordan & Meek, 1885); Marais des Cygnes (Graham, 1885); Osage River, La Cygne, Kans. (Gilbert, 1889).

123. Hadropterus aspro (Cope & Jordan). Snokomo Creek, Wabaunsee County, Kans. (Gilbert, 1886); Gasconade and Little Piney rivers, Arlington, Mo. (Meek, 1891); Big Sioux River (Meek, 1892); Floyd River at Sioux City (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

The black-sided darter is rare in these States. We found it only in Norfolk Creek at Norfolk Junction and Elkhorn River at Ewing, at which places 20 specimens were obtained. All are young fish except 4 from Norfolk Creek. Head $3\frac{2}{3}$; depth 5; eye $4\frac{1}{5}$; snout $4\frac{1}{5}$. Dorsal XII to XIV-14; anal II, 7. Scales 8 or 9–59 to 61–10. Body rather long and slender; head long, snout long and pointed, not much decurved, the upper lip on level with orbit; premaxillaries not protractile; maxillary reaching vertical of pupil; lower jaw slightly included; interorbital width narrow, $1\frac{1}{5}$ in eye; gill membranes scarcely united; fins large; longest dorsal spines about $2\frac{1}{2}$ in head; soft dorsal higher, its rays less than 2 in head; dorsal fins close together; origin of spinous dorsal midway between tip of snout and origin of soft dorsal; anal large, as high as soft dorsal; pectoral long, $1\frac{1}{6}$ in head, nearly reaching tip of ventrals. Breast and nape naked; cheeks with a few small scales; opercles with larger and more numerous scales; ventral line of scales somewhat enlarged; lateral line complete. Colors in alcohol not essentially different from more eastern specimens; back with about 9 large irregular black or brownish-black blotches, surrounded by paler vermiculations; side with about 6 or 7 large dark or black blotches which are more or less confluent; under parts pale, without dark markings; upper parts of opercle and cheek dark; a dark line downward and another forward from the eye; base of spinous dorsal pale, then a broad dark band more or less made up of oblong spots on the membranes becoming gradually paler toward top of fin; soft dorsal and anal barred with brownish; other fins all plain; young with a small black spot at base of caudal. Length of longest specimen, 3 inches.

124. Hypohomus cymatotænia (Gilbert & Meek). Osage Fork, Marshfield, Mo.; Little Piney River, Arlington, Mo.; Marais River, Dixon, Mo. (Meek, 1891).

125. **Hypohomus nianguæ** (Gilbert & Meek). Niangua River, Marshfield, Mo. (Meek, 1891).

126. **Cottogaster uranidea** (Jordan & Gilbert). Little Piney River and Gasconade River, Arlington, Mo. (Meek, 1891).

127. **Diplesion blennioides** (Rafinesque). Wild Cat Creek, Manhattan, Kans. (Graham, 1885); Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Little Piney River at Newburg and Arlington, Mo.; Gasconade River, Arlington, Mo.; Marais River, Dixon, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

128. **Boleosoma nigrum** Rafinesque. *Johnny Darter.* Platte River near Fort Kearney, Nebr. (as *Pœcilichthys mesœus* type, Cope, 1864 and 1865; this second reference is by error made to Fort Riley, Kans.); Tabo Creek, Lafayette County, Mo. (as *Pœcilichthys beani* type, Jordan, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Boleosoma olmstedi maculatum*, Jordan & Meek, 1885); Kansas River (as *B. olmstedi maculatum*, Graham, 1885); Shunganunga Creek and Blacksmith Creek, Shawnee County, Kans. (as *B. olmstedi maculatum*, Gilbert, 1886); Big Creek, Texas County, Mo., and Bear Creek, Boone County, Mo. (as *B. olmstedi ozarcanum*, Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans. (as *B. olmstedi*, Hay, 1887); Sappa Creek, Oberlin, Kans. (as *Etheostoma olmstedi maculatum*, Gilbert, 1889); Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891); Big Sioux River at Sioux City and Sioux Falls; Silver Lake, Iowa, and Boyer River at Arion, Iowa (Meek, 1892); Platte and Elkhorn rivers at Fremont; State fish commission ponds at South Bend, Nebr.; Spirit and East Okoboji lakes; Floyd River at Lemars and Sioux City; Elkhorn River at Fremont (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Much less common than *E. iowæ*. We found it only at the following places: Enemy and Rock creeks, Mitchell; Norfolk Creek, Norfolk Junction, and Elkhorn River, Ewing. The total number of specimens obtained is 66, the majority being from Norfolk Junction and Ewing. They do not differ appreciably from more eastern examples, as the following description of specimens from Rock Creek shows: Head $3\frac{4}{5}$; depth $6\frac{1}{2}$; eye 4; snout 4. D. VIII or IX-11 to 13; A. I, 7 or 8. Scales 6-46 to 50-6 or 7. Body slender, fusiform; head short; snout blunt and decurved, the upper lip below level of lower edge of orbit; maxillaries protractile; gill membranes scarcely connected. Eyes high up, the interorbital width narrow, $1\frac{1}{2}$ in eye. Cheeks and breast naked; opercles with a few scales; nape mostly scaled; lateral line nearly straight and usually complete, an occasional scale, especially in posterior portion, without pore; ventral line with ordinary scales. Opercular spine well developed; no black humeral scale. Colors as in typical *nigrum*.

129. **Etheostoma zonale** (Cope). Big Sioux River at Sioux City (Meek, 1892).

130. **Etheostoma iowæ** Jordan & Meek. This is by far the most abundant and widely distributed darter in this region. It was found by us in the following localities: Crow Creek, Chamberlain; Enemy and Rock creeks, Mitchell; Emanuel and Choteau creeks, Springfield; Prairie Creek, Scotland; Creighton Creek, Niobrara; pond at Creighton; Minnechaduza Creek, Valentine; pond at Verdigris; Elkhorn River, Norfolk Junction; ponds at Long Pine, and in the State fish commission ponds at South Bend. At most of these places we found it to be abundant, the collections containing not fewer than 350 excellent specimens. It is also an abundant species in the Dakota River at Jamestown (Woolman, 1896). This species is preeminently an inhabitant of small lakes, ponds, isolated overflow pools along river courses, and of the slug-

gish, grassy creeks of the prairie region. Wherever we found a small pond or slowly flowing stream with plenty of aquatic vegetation and a more or less muddy bottom, there we found this little darter in large numbers. Similar ponds or streams in Texas yield *Boleichthys fusiformis*, while in such places in the lower Wabash Basin we find *Etheostoma chlorosoma*.

The following description is based primarily upon the specimens from Creighton: Head $3\frac{4}{5}$; depth $5\frac{1}{3}$; eye 5; snout $4\frac{3}{4}$. D. VIII to X–9 to 11; A. II, 7; scales 6–53–7, the lateral line arched anteriorly, incomplete, developed on about 30 scales. Body rather long and slender, resembling *E. fusiforme*, anterior part of back elevated, the caudal peduncle long; head moderate, snout rather short, blunt and decurved; mouth small, nearly horizontal, the lower jaw included; maxillary reaching pupil; premaxillaries not protractile; gill membranes scarcely connected. Vertical fins high in male, lower in female; pectoral about as long as head; dorsals usually well separated; anal smaller than soft dorsal, the first spine the stronger. Scales strongly ctenoid; opercle usually pretty well scaled and some scales on cheek; there is, however, much variation in these characters; ventral line with ordinary scales; nape scaled, breast naked. Colors in life: male with 10 or 11 brick-red vertical bars, the first under the pectoral; these bars are somewhat irregular in position and extent, but they do not meet under the belly nor do they usually reach above the lateral line; interspaces between the red bars two or three times as wide and pale greenish; head and back rusty or grayish; a dark line downward from the eye and another forward to tip of snout; opercle and region in front of pectoral silvery; basal half or two-fifths of spinous dorsal dark green, above this a broad, bright-red band, then a narrow, pale-blue line, narrowly bordered above by paler; soft dorsal mottled with light rusty; caudal with about five ashy crossbars; pectorals and anal nearly plain; ventrals plain; female without any bright colors, the general color rusty greenish, the dorsals and caudal mottled or barred with olivaceous.

In alcohol these specimens show the following colors: Body light coffee-color, small brown spots arranged in somewhat obscure longitudinal series, plainest on back and caudal peduncle; side with about 10 or 11 irregular, dark cross blotches; back with 6 or 7 dark cross blotches; under parts pale; head dusted with dark; a dark line downward from the eye, another forward on upper jaw, meeting its fellow on snout. In the male, the spinous dorsal has at the base a broad brown band two-fifths height of fin, this followed by a pale strip of equal width, then a narrow dark strip, and the fin finally pale along the margin; in the female these stripes are broken up into dots; soft dorsal, caudal, anal, and pectorals barred or vermiculated with light brown; ventrals pale. The variations in the squamation and in the fin formulas are very great, and must be carefully considered in determining the relationships of this and kindred species.

First, as to the squamation. Twenty-one examples were carefully examined, and the number of scales in the lateral line varied from 50 to 58, there being 50 scales in 1, 51 in 2, 52 in 2, 53 in 5, 54 in 3, 55 in 3, and 58 in 5. The number of developed pores in the lateral line ranges from 17 to 31. The number of scales in a transverse series varies from 10 to 15, counting from front of soft dorsal to middle line of belly. Usually the cheeks and opercles are fairly well scaled; in some cases they are densely scaled, while in others there are but few scales on the opercle, and still fewer or even none on the cheek. These specimens, with imperfect squamation of cheeks and opercles, are the form described under the name *Etheostoma quappelle*, by Eigenmann & Eigenmann.

The formula for the dorsal fins was found to be VIII–9 in 5; VIII–10 in 1, IX–9 in 1, IX–10 in 3, IX–11 in 2, IX–12 in 1, X–10 in 4, X–11 in 2, and XI–11 in 1. In 25 specimens which we collected at South Bend and which we examined for Professor Meek, the formula was IX–10 in 9, X–11 in 5, X–10 in 4, IX–11 in 4, IX–9 in 2, and XI–10 in 1. In the single specimen upon which *E. quappelle* was based it is IX–9. The anal fin is usually II, 7, though occasionally it is II, 6, or II, 8. The specimens from Crow Creek near Chamberlain, 39 in number, differ somewhat from Creighton specimens in having the scales smaller, usually 55 to 58 in lateral line, fewer pores developed, and the cheeks and opercles more nearly naked. The largest specimens in our collections are from Creighton, Mitchell, and Niobrara and are 2¾ inches long.

131. Etheostoma cœruleum spectabile (Agassiz). Ellis, Ellis County, Kans. (as *Pœcilichthys cœruleus*, Gilbert, 1884); Kansas River (as *E. variatum*, Graham, 1885); Ellis, Kans. (as *E. variatum*, Gilbert, 1885 and Cragin, 1885*a*); Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Etheostoma variatum spectabile*, Jordan & Meek, 1885); Bigler, Texas County, Mo. (Call, 1887); Little Piney River at Newburg and Arlington, Mo.; Big Piney River, Cabool, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Jones Creek and Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891). Whether all these references belong properly to the variety *spectabile* is doubtful; some of them may have been based upon typical *cœruleum* specimens. In the Ozark region of Missouri it is probable that only *spectabile* occurs.

132. Etheostoma lepidum (Baird & Girard). Shunganunga Creek, Topeka; spring near Maple Hill, Wabaunsee County, Kans.; Ellis, Kans. (Gilbert, 1886); north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887).

133. Etheostoma punctulatum (Agassiz). Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork and Niangua River, Mansfield, Mo. (Meek, 1891).

134. Etheostoma flabellare Rafinesque. *Fan-tailed Darter.* Jones Creek and Marais River, Dixon, Mo.; Little Piney River, Mo.; Osage Fork, Marshfield, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891).

135. Boleichthys fusiformis (Girard). Marais des Cygnes (as *Etheostoma fusiforme*, Graham, 1885).

136. Boleichthys exilis Girard. Little Muddy River (as *Boleichthys exilis* type, Girard, 1859); Cannon Ball River (as *B. warreni* type, Girard, 1859).

137. Microperca punctulata Putnam. Jones Creek, Dixon, Mo. (Meek, 1891).

138. Roccus chrysops (Rafinesque). *White Perch.* Kansas River and Mill Creek, Kans. (Graham, 1885); Big Sioux River and Silver Lake, Iowa (Meek, 1892).

139. Morone interrupta Gill. *Yellow Bass.* The only record of the occurrence of this fish in the Missouri Basin is that given by Cragin (1885*a*), who reports it from the Kansas River (presumably at Lawrence) on the authority of Prof. Frank H. Snow, of the Kansas State University.

140. Aplodinotus grunniens Rafinesque. *Fresh-water Drum.* Milk River (as *Amblodon grunniens*, Suckley, 1860); Missouri River, St. Joseph, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885, and Cragin, 1885*a*); Big Sioux River at Sioux City (Meek, 1892); Elkhorn River at Fremont (Meek, 1894).

141. Cottus bairdi Girard. *Blob*; *Molly-crawl-abottom.* "All streams of the Ozark region" (as *Uranidea richardsoni*, Call, 1887); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Jones Creek and Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

142. Cottus bairdi punctulatus (Gill). *Rocky Mountain Blob.* Between Bridger Pass and Fort Bridger (as *Potamocottus punctulatus* type, Gill, 1862); Gallatin Fork of the Missouri River (as *Uranidea punctulata*, Cope, 1872); Gibbon and Madison rivers and Canyon Creek, Yellowstone National Park (Jordan, 1891*a*); Beaverhead River, Dillon, Mont.; Red Rock River, Red Rock, Mont.; Canyon Creek, Yellowstone Park; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

143. Lota lota maculosa (Le Sueur). *Ling*; *Lawyer.* Battle Creek, S. Dak. (as *L. maculosa*, Cope, 1879); Missouri River at Wyandotte, Kans. (Cragin, 1885*a*); Missouri River at Leavenworth (Gilbert, 1887); Red Rock River, Red Rock, Mont. (Evermann, 1892); Cheyenne River at Cheyenne Falls, S. Dak. (Evermann, 1893); Missouri River, Craig, Mont. (Eigenmann, 1894). One specimen of the ling, 13 inches long, was taken in the south fork of the Cheyenne at Cheyenne Falls, S. Dak. Like all the fishes found in Cheyenne River this is greatly bleached and is much paler than specimens from the Great Lakes.

NOMINAL SPECIES DESCRIBED FROM MISSOURI BASIN LOCALITIES.

The total number of nominal species and subspecies which have been described from Missouri Basin localities is 74, representing 52 species as now recognized, and all but 28 of these 52 species had been previously described from localities not in the Missouri Basin.

Nominal species	Date.	Identification.	Type locality.
Acipenser copei Duméril	1870	Acipenser rubicundus	Upper Missouri.
Acipenser rauchi Duméril	1870	do	Osage River, Missouri.
Acipenser anasimos Duméril	1870	do	Missouri River.
Lepidosteus otarius Cope	1865	Lepisosteus osseus	Kansas River near Fort Riley, Kans.
Pimelodus olivaceus Girard	1858	Ictalurus punctatus	Fort Pierre, Milk and Yellowstone rivers, and Nebraska.
Pimelodus hammondii Abbott	1860	do	Fort Riley, Kans.
Pimelodus notatus Abbott	1860	do	Do.
Ictalurus simpsonii Gill	1862	do	Big Sandy River of Kansas (Platte River).
Amiurus obesus Gill	1862	Ameiurus melas	Nebraska.
Noturus occidentalis Gill	1862	Noturus flavus	Platte River.
Carpiodes bison Agassiz	1855	Carpiodes carpio	Osage River, Missouri.
Carpiodes damalis Girard	1856	Carpiodes velifer	Milk River.
Carpiodes grayi Cope	1870	do	"Probably from one of the Western States."
Pantosteus jordani Evermann	1893	Pantosteus jordani	Red Rock and Beaverhead rivers, Montana.
Catostomus (Acomus) griseus Girard.	1856	Catostomus griseus	Milk River.
Catostomus (Acomus) lactarius Girard.	1856	do	Do.
Catostomus retropinnis Jordan	1878	do	Milk River, Montana.
Catostomus sucklii Girard	1856	Catostomus commersonii	Upper Missouri River and tributaries.
Catostomus chloropteron Abbott	1860	do	Kansas.
Ptychostomus haydeni Girard	1856	Minytrema melanops	Missouri River at Fort Pierre and Yellowstone River.
Ptychostomus bucco Cope	1871	Moxostoma bucco	St. Joseph, Mo.
Campostoma hippops Cope	1864	Campostoma anomalum	Platte River at Fort Kearney.
Chrosomus dakotensis Evermann & Cox.	1896	Chrosomus dakotensis	Crow Creek, Chamberlain, S. Dak.
Hybognathus evansi Girard	1856	Hybognathus nuchale evansi.	Missouri River at Fort Pierre.
Hybognathus argyritus Girard	1856	Hybognathus argyrite	Milk River.
Pimephales fasciatus Girard	1856	Pimephales promelas	Yellowstone River.
Coliscus parietalis Cope	1871	do	Missouri River at St. Joseph, Mo.
Semotilus macrocephalus Girard	1836	Semotilus atromaculatus	Fort Pierre.
Semotilus speciosus Girard	1856	do	Sweetwater River.
Semotilus hammondii Abbott	1856	do	Kansas River near Fort Riley.
Phoxinus milnerianus Cope	1879	Leuciscus milnerianus	Probably Battle Creek, S. Dak.
Cliola smithii Evermann & Cox.	1896	Cliola smithii	Prairie Creek, Scotland, S. Dak.

Nominal species.	Date.	Identification.	Type locality.
Notropis germanus Hay	1887	Notropis heterodon	Smoky Hill River, Wallace, Kans.
Hybopsis missuriensis Cope	1874	Notropis blennius	Missouri River at St. Joseph.
Alburnus lineolatus Agassiz	1863	Not identifiable; may be Notropis scylla.	Osage River, Missouri.
Hybopsis scylla Cope	1871	Notropis scylla	Red Cloud Creek, a tributary of North Platte River.
Cliola chloria Jordan	1878	do	Upper Missouri region.
Cliola (Hybopsis) topeka Gilbert.	1884	Notropis topeka	Shunganunga Creek, Topeka, Kans.
Notropis æneolus Hay	1887	do	Saline River, Wakeeney, Kans.
Photogenis piptolepis Cope	1871	Notropis piptolepis	Red Cloud Creek, a tributary of North Platte River.
Cyprinella billingsiana Cope	1871	Notropis lutrensis	St. Joseph, Mo.
Moniana jugalis Cope	1871	do	Do.
Notropis umbrifer Hay	1887	Notropis macrostomus	Solomon River, Beloit, Kans.
Alburnus notatus Agassiz	1863	Notropis notatus	Osage River, Missouri.
Plargyrus bowmani Girard	1856	Notropis cornutus	Sweetwater River.
Alburnus oligaspis Cope	1864	Notropis dilectus	Kansas.
Alburnellus percobromus Cope	1871	Notropis rubrifrons	St. Joseph, Mo.
Minnilus (Lythrurus) nigripinnis Gilbert.	1884	Notropis umbratilis umbratilis.	Shunganunga Creek, Topeka.
Sarcidium scopifer Cope	1871	Phenacobius scopifer	Missouri River, St. Joseph, Mo.
Argyreus dulcis Girard	1856	Rhinichthys cataractæ dulcis.	Sweetwater River.
Rhinichthys maxillosus Cope	1864	do	Kansas.
Rhinichthys ocella Garman	1881	do	Northeastern Wyoming and Montana.
Gobio gelidus Girard	1856	Hybopsis gelidus	Milk River.
Hybopsis meeki Jordan & Evermann.	1896	Hybopsis meeki	Missouri River at St. Joseph.
Hybopsis montanus Meek	1884	Hybopsis montanus	Upper Missouri region.
Nocomis nebracensis Girard	1856	Hybopsis kentuckiensis	Sweetwater River.
Leucosomus dissimilis Girard	1856	Couesius dissimilis	Milk and Little Muddy rivers.
Pogonichthys communis Girard.	1856	Platygobio gracilis	Fort Pierre; Fort Union; above Fort Union; Milk River; Yellowstone River; Sweetwater River.
Pogonichthys (Platygobio) gulonellus Cope.	1865	do	Near Bridger Pass.
Coregonus williamsoni cismontanus Jordan.	1891	Coregonus williamsoni cismontanus.	Madison, Yellowstone, and Gardiner rivers, and Horsethief Springs, Montana.
Salar lewisi Girard	1858	Salmo mykiss lewisi	Falls of Missouri River.
Salmo pleuriticus Cope	1872	do	Yellowstone River; Yellowstone Creek, Gallatin Fork, and Yellowstone Lake.
Salmo (Salar) stomias Cope	1871	Salmo mykiss stomias	Kansas River near Fort Riley.
Thymallus montanus Milner	1874	Thymallus ontariensis montanus.	Tributary of Missouri River at Camp Baker, Montana.
Zygonectes lineatus Garman	1881	Fundulus lineatus	Northeastern Wyoming.
Zygonectes macdonaldi Meek	1891	Fundulus macdonaldi	Jones Creek, Dixon, Mo.; Osage River, Mansfield, Mo.
Fundulus floripinnis Cope	1874	Fundulus floripinnis	South Platte River at Denver.
Fundulus sciadicus Cope	1865	Fundulus sciadicus	"Nebraska or Platte River."
Percopsis hammondii Gill	1864	Percopsis guttatus	Kansas.
Pœcilichthys mesæus Cope	1864	Boleosoma nigrum	Platte River near Fort Kearney, Nebr.
Pœcilichthys beani Jordan	1884	do	Tabo Creek, Lafayette County, Mo.
Boleichthys exilis Girard	1859	Boleichthys exilis	Little Muddy River.
Boleichthys warreni Girard	1859	do	Cannon Ball River.
Potamocottus punctulatus Gill.	1862	Cottus bairdi punctulatus.	Between Bridger Pass and Fort Bridger.

DISTRIBUTION OF SPECIES BY STATES.

The following table shows the distribution by States of the fishes of the Missouri Basin:

No.	Families and species.	Missouri.	Iowa.	Kansas.	Nebraska.	South Dakota.	North Dakota.	Montana.	Wyoming.	Colorado.
	PETROMYZONIDÆ.									
1	Ichthyomyzon concolor	......	......	×	......	×	......	......	......	......
2	Ichthyomyzon castaneus	......	......	×	......	......	......	......	......	......
3	Lampetra wilderi	......	......	×	......	......	......	......	......	......
	POLYODONTIDÆ.									
4	Polyodon spathula	......	×	×	×	......	......	×	......	......
	ACIPENSERIDÆ.									
5	Acipenser rubicundus	×	×	×	×	×	......	......	......	......
6	Scaphirhynchus platorynchus	×	×	×	×	......	×	×	×	......
	LEPISOSTEIDÆ.									
7	Lepisosteus osseus	×	×	×	......	×	......	......	......	......
8	Lepisosteus platostomus	......	......	×	......	×	......	......	......	......
	AMIIDÆ.									
9	Amia calva	......	......	×	......	......	......	......	......	......
	SILURIDÆ.									
10	Ictalurus furcatus	×	......	×	......	......	......	......	......	......
11	Ictalurus punctatus	×	×	×	×	×	......	×	×	......
12	Ameiurus natalis	×	......	×	......	......	×	......	......	......
13	Ameiurus nebulosus	×	......	×	......	......	×	......	......	......
14	Ameiurus melas	×	×	×	×	×	×	......	......	......
15	Leptops olivaris	×	......	×	......	×	......	......	......	......
16	Noturus flavus	×	×	×	×	×	......	×	×	......
17	Schilbeodes gyrinus	......	×	......	×	×	......	......	......	......
18	Schilbeodes exilis	×	......	×	......	......	......	......	......	......
19	Schilbeodes miurus	......	......	×	......	......	......	......	......	......
	CATOSTOMIDÆ.									
20	Ictiobus cyprinella	×	......	×	×	......	......	......	......	......
21	Ictiobus urus	×	......	×	......	......	......	......	......	......
22	Ictiobus bubalus	×	×	×	......	×	......	......	......	......
23	Carpiodes carpio	×	......	×	×	×	......	......	......	......
24	Carpiodes velifer	×	×	×	×	......	......	×	......	......
25	Cycleptus elongatus	......	......	×	......	......	......	......	......	......
26	Pantosteus jordani	......	......	......	×	×	......	×	×	......
27	Catostomus griseus	......	......	......	×	......	......	×	×	×
28	Catostomus catostomus	......	......	......	......	......	......	......	×	......
29	Catostomus commersonii	×	×	×	×	×	×	×	×	......
30	Catostomus nigricans	×	......	×	......	......	......	......	......	......
31	Erimyzon sucetta oblongus	......	......	×	......	......	......	......	......	......
32	Minytrema melanops	......	......	×	×	......	......	×	......	......
33	Moxostoma bucco	×	......	......	......	......	......	......	......	......
34	Moxostoma aureolum	×	×	×	×	×	×	×	×	......
35	Placopharynx duquesnii	......	×	......	......	......	......	......	......	......
	CYPRINIDÆ.									
36	Campostoma anomalum	×	×	×	×	×	×	......	×	......
37	Chrosomus erythrogaster	×	......	×	......	......	......	......	......	......
38	Chrosomus dakotensis	......	......	......	×	×	......	......	......	......
39	Hybognathus nuchale	×	×	×	×	......	×	......	......	......
40	Hybognathus nuchale evansi	......	......	×	×	×	......	×	×	......
41	Hybognathus argyrite	......	......	......	......	......	......	×	......	......
42	Hybognathus nubilum	×	×	......	×	×	......	......	×	......
43	Pimephales promelas	×	×	×	×	×	×	×	......	......
44	Pimephales notatus	×	×	×	×	......	×	......	......	......
45	Semotilus atromaculatus	×	×	×	×	×	×	......	×	......
46	Leuciscus elongatus	......	......	×	......	......	......	......	......	......
47	Leuciscus neogæus	......	......	......	......	×	......	......	......	......
48	Leuciscus milnerianus	......	......	......	......	×	......	......	......	......

Distribution of the Fishes of the Missouri Basin—Continued.

No.	Families and species.	Missouri.	Iowa.	Kansas.	Nebraska.	South Dakota.	North Dakota.	Montana.	Wyoming.	Colorado.
	CYPRINIDÆ—continued.									
49	Abramis crysoleucas	×	×	×	×	......	......	......	......	......
50	Cliola vigilax	×	×	......	×	......	......	......	......	......
51	Cliola smithii	......	......	......	×	×	......	......	......	......
52	Notropis cayuga	×	×	......	×	×	×	......	......	......
53	Notropis heterodon	......	×	×	......	......	......	......	......	......
54	Notropis blennius	×	×	×	×	×	×	......	×	......
55	Notropis scylla	×	......	×	×	......	......	×	......	......
56	Notropis topeka	......	×	×	×	×	......	......	......	......
57	Notropis gilberti	×	×	......	×	......	......	......	......	×
58	Notropis piptolepis	......	......	......	×	......	......	......	......	......
59	Notropis shumardi	×	......	......	......	......	......	......	......	......
60	Notropis hudsonius	......	×	×	......	×	......	......	......	......
61	Notropis lutrensis	×	×	×	×	×	......	......	×	×
62	Notropis macrostomus	......	......	×	......	......	......	......	......	......
63	Notropis notatus	×	......	......	......	......	......	......	......	......
64	Notropis whipplii	×	×	......	......	......	......	......	......	......
65	Notropis cornutus	×	×	×	×	×	×	......	×	×
66	Notropis zonatus	×	......	......	......	......	......	......	......	......
67	Notropis jejunus	......	......	×	×	......	......	......	×	......
68	Notropis atherinoides	......	×	......	......	......	......	×	......	......
69	Notropis dilectus	×	×	×	×	×	......	......	......	......
70	Notropis rubrifrons	×	......	×	......	......	......	......	......	......
71	Notropis umbratilis umbratilis	×	×	×	......	......	......	......	......	......
72	Phenacobius mirabilis	×	×	×	×	×	......	......	......	......
73	Phenacobius scopifer	×	......	......	......	......	......	......	......	......
74	Rhinichthys cataractæ dulcis	......	......	×	×	×	×	×	×	×
75	Rhinichthys atronasus	......	......	......	......	×	......	......	......	......
76	Hybopsis æstivalis	......	......	......	×	......	......	......	......	......
77	Hybopsis hyostomus	......	......	......	×	......	......	......	......	......
78	Hybopsis gelidus	......	......	......	×	×	......	×	×	......
79	Hybopsis meeki	×	×	......	......	......	......	......	......	......
80	Hybopsis montanus	......	......	......	......	......	......	×	......	......
81	Hybopsis dissimilis	×	......	......	......	......	......	......	......	......
82	Hybopsis storerianus	×	......	×	×	......	......	......	......	......
83	Hybopsis kentuckiensis	×	×	×	×	......	×	......	×	......
84	Couesius dissimilis	......	......	......	×	×	......	×	×	......
85	Platygobio gracilis	×	......	×	×	×	×	×	×	......
	ANGUILLIDÆ.									
86	Anguilla chrysypa	......	......	×	......	......	......	......	......	......
	HIODONTIDÆ.									
87	Hiodon alosoides	×	×	×	×	×	......	×	×	......
88	Hiodon tergisus	......	......	×	......	×	......	......	......	......
	CLUPEIDÆ.									
89	Dorosoma cepedianum	×	×	×	×	......	......	......	......	......
90	Pomolobus chrysochloris	......	......	×	......	......	......	......	......	......
	SALMONIDÆ.									
91	Coregonus williamsoni cismontanus	......	......	......	......	......	......	×	×	......
92	Salmo mykiss lewisi	......	......	......	......	......	......	×	×	......
93	Salmo mykiss stomias	......	......	×?	......	......	......	......	......	×
	THYMALLIDÆ.									
94	Thymallus ontariensis montanus	......	......	......	......	......	......	×	......	......
	LUCIIDÆ.									
95	Lucius lucius	......	×	......	×	......	×	×	......	......
	PŒCILIIDÆ.									
96	Fundulus diaphanus	......	......	×	......	......	......	......	......	......
97	Fundulus zebrinus	......	×	×	......	......	......	......	......	......
98	Fundulus catenatus	×	......	......	......	......	......	......	......	......
99	Fundulus lineatus	......	......	......	......	......	......	......	×	......
100	Fundulus macdonaldi	×	......	......	......	......	......	......	......	......
101	Fundulus floripinnis	......	......	......	......	......	......	......	......	×
102	Fundulus sciadicus	......	×	......	×	×	......	......	......	......

Distribution of the Fishes of the Missouri Basin—Continued.

No.	Families and species.	Missouri.	Iowa.	Kansas.	Nebraska.	South Dakota.	North Dakota.	Montana.	Wyoming.	Colorado.
	GASTEROSTEIDÆ.									
103	Eucalia inconstans				×	×		×		
	PERCOPSIDÆ.									
104	Percopsis guttatus		×	×						
	ATHERINIDÆ.									
105	Labidesthes sicculus	×								
	CENTRARCHIDÆ.									
106	Pomoxis annularis	×		×						
107	Pomoxis sparoides		×	×						
108	Ambloplites rupestris		×	×		×				
109	Chænobryttus gulosus			×						
110	Apomotis cyanellus	×	×	×	×	×				
111	Lepomis megalotis	×	×							
112	Lepomis humilis	×	×	×	×	×				
113	Lepomis macrochirus	×								
114	Lepomis pallidus	×	×							
115	Eupomotis gibbosus		×							
116	Micropterus dolomieu	×	×	×						
117	Micropterus salmoides	×	×	×	×					
	PERCIDÆ.									
118	Stizostedion vitreum		×	×	×	×				
119	Stizostedion canadense boreum	×	×	×	×	×		×		
120	Perca flavescens		×			×	×			
121	Percina caprodes	×		×						
122	Hadropterus phoxocephalus	×		×						
123	Hadropterus aspro	×	×	×	×		×			
124	Hypohomus cymatotænia	×								
125	Hypohomus nianguæ	×								
126	Cottogaster uranidea	×								
127	Diplesion blennioides	×		×						
128	Boleosoma nigrum	×	×	×	×	×	×			×
129	Etheostoma zonale		×							
130	Etheostoma iowæ				×	×	×			
131	Etheostoma cœruleum spectabile	×		×						
132	Etheostoma lepidum			×						
133	Etheostoma punctulatum	×								
134	Etheostoma flabellare	×								
135	Boleichthys fusiformis			×						
136	Boleichthys exilis						×			
137	Microperca punctulata	×								
	SERRANIDÆ.									
138	Roccus chrysops		×	×						
139	Morone interrupta			×						
	SCIÆNIDÆ.									
140	Aplodinotus grunniens	×	×	×	×			×		
	COTTIDÆ.									
141	Cottus bairdi	×								
142	Cottus bairdi punctulatus							×	×	
	GADIDÆ.									
143	Lota lota maculosa			×		×		×		
	Total	77	59	86	59	49	23	30	26	8

RECOMMENDATIONS REGARDING THE FOOD-FISHES OF THE MISSOURI BASIN.

Of the 143 species of fishes known from the Missouri Basin at least 42 may be regarded as food-fishes of more or less importance. They are the following:

Common Sturgeon.	Common Redhorse.	Warmouth Bass.
Chuckle-head Cat.	Big-jawed Sucker.	Green Sunfish.
Channel Cat.	Creek Chub.	Long-eared Sunfish.
Common Bullhead.	River Chub.	Red-spotted Sunfish.
Black Bullhead.	Toothed Herring.	Blue-gill.
Mud Cat.	Moon-eye.	Common Sunfish.
Yellow Cat.	Rocky Mountain Whitefish.	Large-mouth Black Bass.
Common Buffalo-fish.	Yellowstone Trout.	Small-mouth Black Bass.
Small-mouth Buffalo.	Platte River Trout.	Wall-eyed Pike.
Carp Sucker.	Montana Grayling.	Sauger.
Gourd-seed Sucker.	Northern Pickerel.	Yellow Perch.
Milk River Sucker.	Crappie.	White Perch.
Long-nosed Sucker.	Calico Bass.	Freshwater Drum.
Common White Sucker.	Rock Bass	Ling.

To these may be added the following species which have been introduced into the waters of the Yellowstone National Park by the United States Fish Commission:

Rainbow Trout.	Von Behr Trout.	Eastern Brook Trout.

These three species and perhaps others, including the carp, have been introduced by several of the State fish commissions and by the United States Fish Commission in various places in these States.

The trout, whitefish, and grayling are, of course, primarily game fishes, and are of interest chiefly to the angler. Their abundance in the upper waters of this basin attracts annually a large number of anglers to that region. The supply, though yet large, is diminishing. There is no reason, however, why the supply of these species can not be greatly increased in the waters in which they are already found and plants may very properly be made in a number of suitable streams in which they are not indigenous; but the pond and river fishes are the species whose cultivation will result in the greatest good to the Missouri River States.

The six species of catfishes named above are all well suited to the lower and middle portions of the Missouri Basin. The same is true of the suckers and the spiny-rayed fishes. Nearly all of these species are found in abundance in the ponds and bayous along the Mississippi in Illinois, where the Commission has for several years been collecting them for distribution to various suitable waters.

No better work can be done than to make liberal shipments of buffalo, suckers, catfish, bullheads, black bass, sunfish, crappies, etc., to the suitable waters in western Iowa, Kansas, Nebraska, South Dakota, and Wyoming. The suckers, buffalo, and large catfish should be put in the streams; the bullheads, sunfishes, bass, crappies, etc., will do well in the numerous ponds and small lakes.

6.—A REVIEW OF THE FOREIGN FISHERY-TRADE OF THE UNITED STATES.

By Charles H. Stevenson.

SYNOPSIS.

INTRODUCTION.

Importance of the foreign trade.—There are few things of greater or more lasting benefit to the fishermen of the United States than the extension of the markets for their products. It is the demand for the produce of the fisheries that places a value upon them, and the variation of this demand is the principal regulator of prices. In the case of some items—certain smoked and canned fish and oils, for instance—the foreign demand is of as much importance as the home market, and the increase or decrease of that demand is of great consequence to fishermen and preparators of those products. In considering the methods of benefiting the fishing interests of this country it is important, therefore, that due attention be paid to increasing the trade in those products that are at present consumed largely in foreign countries.

There is also the possibility of an increase in foreign trade through the preparation of other fishery products in ways suited to foreign markets, by means of which many resources of this country, at present unrecognized or neglected, could be utilized and made to yield additional income to the fishermen. The development of this trade is retarded by the fact that few dealers or preparators of fishery products have opportunities of becoming acquainted with the foreign markets, the kind of articles that may be disposed of, and the methods of preparation suited to the foreign demands. The building up of trade in those countries is accompanied with many difficulties. Preparators and producers must cater to the foreign markets with energy equal to that exercised in the domestic trade, and should possess accurate knowledge of the present condition and requirements of the trade with those countries.

At one time a very large portion of the exports of this country consisted of dried codfish. In 1774 the value of exported cod was upward of $1,000,000, representing one-sixth of the whole export trade of the United States, for the aggregate value of the exports was then but $6,165,413. In 1804 the value of the exports of the United States was $41,467,477, of which cod represented $2,400,000, the proportion being as 17.2 to 1. In 1857, however, the total domestic exports of the United States were valued at $338,985,065, of which the value of cod was only $570,348, the proportion being as 594 to 1. The decrease in the value of exported codfish since 1804 was $1,829,652, while the increase in the value of the other exports was $297,517,588.

Since 1857 considerable foreign trade has been developed in pickled and canned fish and miscellaneous fishery products; so that, while in 1894 the exports of cod were but $704,652, the aggregate value of the fishery exports was $4,258,306, out of a total export trade of $869,204,937, the proportion being as 1 to 204.

The principal fishery exports at the present time are canned salmon, dried cod, fresh and canned oysters, whalebone, spermaceti, smoked and pickled herring, pickled mackerel, and whale and fish oils.

The total value of domestic fishery products exported from 1790 to 1894, inclusive, approximates $331,000,000, of which $115,956,126 represents the exports during the last twenty years.

The possibilities for increasing our exports are apparent from an examination of the following summary compiled from the "British Statistical Abstract for the Principal and Other Foreign Countries," and from other trade reports, showing the total imports of fishery products into several of the principal foreign countries and the imports from the United States. While the value of this summary is necessarily limited by the lack of returns for many countries, especially for those in South America and the West Indies, and by the limited classification in most of the countries here named, yet it clearly indicates the small share that this country has in supplying the foreign fishery markets.

Statement of the imports of fishery products into several of the principal foreign countries and the imports from the United States during the year 1893.

Designation.	Total imports.		Imports from United States.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
China (including Hongkong):				
Beche-de-mer	5,535,333	$1,046,682	....	....
Seaweed and agar-agar	60,582,000	887,642	....	....
All other fishery products	44,600,533	3,092,334	....	*$178,807
Total China	110,717,866	5,026,658	....	178,807
Denmark:				
Fresh fish	12,382,071	843,128	....	....
Preserved or salted fish	27,618,099	497,480	....	*365
Total Denmark	40,000,170	1,340,608	....	365
France:				
Fresh fish	16,744,607	1,666,622	....	....
Salted, dried, or smoked fish	103,117,129	5,680,487	....	....
Sardines and other prepared fish	8,399,362	964,834	154,039	26,971
Oysters, fresh and canned	....	12,100	....	534
Lobsters and other crustacea, fresh	3,067,963	537,165	....	....
Lobsters, canned or prepared	3,257,568	627,399	1,957,275	376,966
Mussels and other shellfish	15,633,808	273,730	....	....
Fish bladders, sounds, and roe	9,852,243	259,366	178,246	4,691
Marine oils	12,211,154	1,206,868	376,788	17,832
Spermaceti	21,612	6,621	12,339	3,781
Sponges	1,364,656	1,854,891	153,524	201,602
Whalebone	477,062	1,461,741	106,784	327,192
Coral, pearls, etc	....	948,083	....	....
Total France	....	15,499,907	....	959,569
German Empire:				
Herring	281,357,000	6,744,968	....	....
Italy:				
Fish of all sorts	101,167,894	5,795,790	....	*2,299
Portugal:				
Cod	43,126,385	1,789,560	*4,100	*204
Russia:				
Fish, salted or dried	287,607,104	4,901,484	....	....
Spain:				
Cod and stock fish, salted	97,811,488	4,795,278	....	....
Sweden:				
Fish, fresh, salted, etc	96,554,990	2,130,064	....	*154
United Kingdom:				
Fresh fish	134,153,488	2,429,766	41,664	7,413
Salted or prepared fish	115,400,320	9,095,814	13,896,736	1,468,912
Shellfish, all sorts	36,715,616	1,354,453	17,542,784	522,862
Isinglass	900,144	444,701	....	....
Marine oils	32,237,120	2,014,604	3,568,320	150,890
Marine shells	....	2,210,893	....	*51,028
Sponges	1,325,133	893,465	135,562	64,320
Whalebone	352,016	637,024	*3,002	*9,091
Total United Kingdom	....	19,080,720	....	2,274,516
Grand total	....	67,105,037	....	3,415,914

*From Report on Commerce and Navigation for year ending June 30, 1894.

It is important that attention be paid not only to the foreign markets, but also to the preparation of articles to take the place of foreign products in our domestic trade. The list of fishery imports contains a large number of articles for the production of which the United States has abundant resources, and the trade is enjoyed by foreign countries because of greater care or peculiar methods in preparation.

As the fisheries formed one of the principal sources of wealth of the early settlers of this country, it is not strange that for many years little necessity should have existed for the importation of fishery products. But as the wealth of the people increased and the trade facilities were enlarged, the demand for foreign preparations gradually extended. About the beginning of the present century these importations were confined almost exclusively to dried cod and pickled herring from the British Provinces in North America. But the demands of the domestic markets have so increased that, notwithstanding the remarkable resources of the United States and the extensive development and energetic prosecution of the fisheries, the foreign preparations during recent years have unduly competed with the domestic products. During the fiscal year ending June 30, 1894, for instance, the value of the fishery imports for consumption was $6,276,903, while the domestic exports were worth but $4,258,306, an excess in favor of the former of $2,018,597. In 1893 the excess of imports over exports was $2,166,811, in 1892 it was $1,283,859, and in 1891 only $769,458. In 1890 the exports exceeded the imports by $1,646,825, and in 1889 by $1,698,994. It thus appears that during the last six years there has been a constant increase in the dependence of the United States on foreign countries for fishery products.

As a suggestion of the practicability of increasing the fishery exports of the United States, in addition to more actively competing with foreign fishery products in the domestic markets, this paper is presented, comprising a general review of the principal features of the trade.

Sources of information.—The data on which this report is based have been obtained from various sources. The figures showing the value of the fishery imports and exports since 1820 have been compiled from the custom-house returns as published by the United States Treasury Department in the Annual Report on Commerce and Navigation. The United States statutes have furnished the rates of duty exacted on the products imported into this country. The present rates of duty imposed on fishery products imported into foreign countries have been compiled from the International Customs Journal, published by the International Customs Tariff Bureau, Brussels, Belgium, and from the publications of the Bureau of American Republics.

The writer acknowledges with much pleasure the suggestions received from Dr. Hugh M. Smith in the preparation of this paper, and the assistance rendered by Mr. John N. Cobb and other employees of the division of fisheries in comparing and verifying the tables.

I.—THE BALANCE OF TRADE.

Annual trade since 1820.—The extent of the foreign fishery-trade of the United States is exhibited in Table 1, showing for a series of 74 years, ending June 30, 1894, the value of the fishery products imported for consumption, the domestic exports, and the balance of trade each year. For the years prior to 1869 it is impracticable to show with exactness the imports for consumption during each year. Hence the difference between the total imports and the foreign exports is accepted as a true statement of the imports for consumption. For convenience of comparison the imports of fishery products and the foreign exports are set forth in the first and second columns, respectively.

The general statement of "imports" embraces all entries of imported articles made at the custom-houses either for immediate consumption or for warehouse. Of the warehouse entries, portions may be subsequently exported, and are then classed as foreign exports.

The statement of "imports for consumption" includes the entries of all articles for immediate consumption and the withdrawals from warehouse for consumption in this country.

The general statement of "imports" and the statement of "imports for consumption" for any period always differ to the extent that the quantity and value of entries for warehouse for the period differ from the quantity and value of withdrawals from warehouse for consumption; and this for a series of years differs little from the extent of the foreign exports.

The term "imported for consumption" is a technical designation, and does not necessarily imply that the goods were actually consumed, but simply that they were delivered into the custody of the importer, and that the duties have been paid.[1]

Whenever used in this report, unless otherwise stated, the term "exports" comprises only domestic exports, and does not include foreign merchandise transshipped in bond through this country.

From 1821 to 1894, inclusive, the total imports for consumption aggregated $152,735,501, and the domestic exports $274,096,530, an excess over the imports for consumption of $121,361,029. The total imports of fishery products during this period were valued at $167,422,617, and the foreign exports at $14,339,675.

These figures include not only the articles most generally classed as products of the fisheries, such as all fresh, dried, pickled, and canned fish and shellfish, marine oils, spermaceti, fish sounds and whalebone, but also shells of marine mollusks, sponges, corals, seaweeds, ambergris, ambergris oil, etc.

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[1] Commerce and Navigation of the United States, 1894, p. IX.

1. *Statement of the foreign fishery-trade of the United States during each year from 1821 to 1894, inclusive.*

Year ending—	Imports.	Foreign exports.	Imports for consumption.	Domestic exports.	Excess of imports for consumption over domestic exports.	Excess of domestic exports over imports for consumption.
Sept. 30, 1821	$13,186	$3,080	$10,106	$1,499,188		$1,489,082
1822	19,255	1,463	17,792	1,389,579		1,371,787
1823	31,914	260	31,654	1,658,224		1,626,570
1824	43,411	4,761	38,650	1,610,990		1,572,340
1825	29,500	383	29,117	1,595,065		1,565,948
1826	18,841	590	18,251	1,473,388		1,455,137
1827	24,971	1,704	23,267	1,575,332		1,552,065
1828	10,469	400	10,069	1,693,980		1,683,911
1829	16,182		16,182	1,817,100		1,800,918
1830	27,624	3,774	23,850	1,725,270		1,701,420
1831	49,421	276	49,145	1,889,472		1,840,327
1832	28,584	972	27,612	2,558,538		2,530,926
1833	45,649	4,552	41,097	2,402,469		2,361,372
1834	42,955	1,800	41,155	2,071,493		2,030,338
1835	88,279	21,576	66,703	2,174,524		2,107,821
1836	115,894	65,379	50,515	2,666,058		2,615,543
1837	98,044	9,260	88,784	2,711,452		2,622,668
1838	96,571	800	95,771	3,175,576		3,079,805
1839	342,755	9,034	333,721	1,917,969		1,584,248
1840	275,352	7,062	268,290	3,199,170		2,930,880
1841	225,036	15,188	209,848	2,846,851		2,637,003
1842	128,533	7,476	121,057	2,823,010		2,701,953
June 30, 1843	91,871	1,643	90,228	2,112,548		2,022,320
1844	264,227	3,164	261,063	3,350,501		3,089,438
1845	290,165	321	289,844	4,507,124		4,217,256
1846	288,834	213	288,621	3,453,398		3,164,777
1847	481,607	100,028	381,579	3,468,033		3,086,454
1848	832,508	246,865	585,643	1,980,963		1,395,319
1849	645,917	135,706	510,211	2,547,654		2,037,443
1850	561,125	143,948	417,177	2,824,818		2,407,641
1851	782,751	173,359	609,392	3,294,691		2,685,299
1852	622,734	208,004	414,730	2,282,442		1,867,612
1853	1,142,541	363,859	778,682	3,279,413		2,500,731
1854	1,177,677	381,724	795,953	3,044,301		2,248,348
1855	1,055,113	354,080	701,033	3,516,894		2,815,861
1856	2,269,184	279,278	1,989,906	3,356,797		1,366,891
1857	2,143,135	262,965	1,880,170	3,739,644		1,859,474
1858	2,289,678	230,580	2,059,098	3,550,295		1,491,197
1859	2,646,358	199,716	2,446,642	4,462,974		2,016,332
1860	2,724,824	242,421	2,482,403	4,156,480		1,674,077
1861	2,211,265	184,798	2,026,467	4,451,515		2,425,048
1862	1,328,525	56,076	1,272,449	3,987,298		2,714,849
1863	1,464,372	131,260	1,333,112	5,056,006		3,722,894
1864	2,078,991	138,804	1,940,187	4,306,303		2,366,116
1865	2,583,860	144,150	2,439,710	4,795,619		2,355,909
1866	4,375,109	129,019	4,246,090	3,562,519	$683,571	
1867	2,330,077	429,951	1,900,126	3,663,634		1,763,508
1868	1,658,766	353,890	1,304,876	3,717,248		2,412,372
1869	2,790,357	312,498	2,411,309	3,001,720		590,411
1870	3,070,407	315,844	2,685,523	2,870,517		184,994
1871	2,897,293	376,018	2,461,276	2,994,037		532,761
1872	2,754,277	347,136	2,433,970	3,443,171		1,009,201
1873	3,726,183	544,690	3,176,280	3,320,406		144,126
1874	3,874,239	206,800	3,666,301	3,566,743	99,558	
1875	3,704,028	217,456	3,597,688	4,844,847		1,247,139
1876	3,255,831	153,492	3,177,309	5,806,445		2,629,136
1877	2,935,269	235,781	2,796,990	5,734,675		2,937,685
1878	3,788,836	237,034	3,592,079	6,436,248		2,844,169
1879	3,839,368	298,759	3,546,276	6,281,288		2,735,012
1880	4,374,973	244,242	4,115,454	5,248,131		1,132,677
1881	4,995,860	210,166	4,759,133	5,554,834		795,701
1882	5,142,311	361,480	4,771,871	6,213,358		1,441,487
1883	6,050,780	356,213	5,647,650	6,279,720		632,070
1884	6,713,176	447,815	6,361,715	5,664,885	696,830	
1885	5,900,429	328,514	5,647,123	6,018,745		371,622
1886	4,604,843	376,675	4,084,719	5,264,646		1,179,927
1887	5,162,125	455,115	4,732,719	5,154,180		421,361
1888	5,808,813	514,350	5,183,610	5,518,552		334,942
1889	5,790,558	326,679	5,364,345	7,063,339		1,698,994
1890	6,355,955	552,195	5,811,560	7,458,385		1,646,825
1891	7,511,608	435,063	6,980,035	6,210,577	769,458	
1892	7,107,456	391,699	6,687,446	5,403,587	1,283,859	
1893	8,227,195	416,941	7,708,189	5,541,378	2,166,811	
1894	6,926,807	621,408	6,276,903	4,258,306	2,018,597	
Total	167,422,617	14,339,675	152,735,501	274,096,530		121,361,029

It appears from the preceding summary that prior to 1839 the imports of fishery products were of small extent, averaging less than $50,000 annually. A considerable increase then followed, but until 1891 the domestic exports each year greatly exceeded the imports for consumption with only three exceptions. The exceptions were in 1866, 1874, and 1884, and were caused by unusual trade conditions, resulting from the beginning and ending of free-trade relations with the British Provinces. The imports for consumption have so increased that since 1891 they have greatly exceeded the domestic exports.

Trade in each class of fishery products.—Table 2 shows for each kind of product (1) the imports for consumption, (2) the domestic exports, (3) the total trade, (4) the percentage of the total trade, and (5 and 6) the balance of trade during the year ending June 30, 1894. The individual items most prominent in the statement of total trade are pickled mackerel, 10.81 per cent; marine shells, 10.55 per cent; canned salmon, 9.75 per cent; pickled herring, 9.15 per cent; dried cod, 8.61 per cent, and sardines, 8.55 per cent. It appears that the trade in pickled or brine-salted fish represents 22.76 per cent of the total trade; canned goods, 20.65 per cent, and dried and fresh fish, 11.12 and 5.81 per cent, respectively. The fresh fish entering into the foreign trade are nearly all imported, the exports, which amount to about 8 per cent of the imports, consisting of haddock and other fish shipped to Montreal, Quebec, and other places in Canada. Of dried fish, the exports exceed the imports by about 200 per cent; in the pickled-fish trade the imports are about eight times as valuable as the exports; but the trade in canned goods is almost equally divided between imports and exports, with an excess slightly in favor of the latter.

2. *Classified statement of the extent and relation of the foreign fishery-trade of the United States during the year ending June 30, 1894.*

Designation.	Imports for consumption.	Domestic exports.	Total trade.	Percentage of total trade.	Excess of imports for consumption over exports.	Excess of exports over imports for consumption.
Fresh fish:						
Salmon	$156,163	....	$156,163	1.48	$156,163	....
Herring—						
Bait	2,829	....	2,829	.03	2,829	....
Food	3,090	....	3,090	.03	3,090	....
Other fresh fish	401,309	$48,820	450,129	4.27	352,489	....
Total fresh	563,391	48,820	612,211	5.81	514,571	....
Dried, smoked, or cured fish:						
Cod, haddock, hake, etc	202,725	704,652	907,377	8.61	....	$501,927
Herring	23,570	123,882	147,452	1.40	....	100,312
Others	66,406	50,966	117,372	1.11	15,440	....
Total dried, etc	292,701	879,500	1,172,201	11.12	15,440	602,239
Pickled or brine-salted fish:						
Herring	950,268	13,457	963,725	9.15	936,811	....
Mackerel	1,095,702	43,082	1,138,784	10.81	1,052,620	....
Salmon	84,442	58,659	143,101	1.36	25,783	....
Others	16,368	135,859	152,227	1.44	....	119,491
Total brine-salted	2,146,780	251,057	2,397,837	22.76	2,015,214	119,491

2. *Classified statement of the extent and relation of the foreign fishery-trade of the United States during the year ending June 30, 1894*—Continued.

Designation.	Imports for consumption.	Domestic exports.	Total trade.	Percentage of total trade.	Excess of imports for consumption over exports.	Excess of exports over imports for consumption.
Canned fish:						
Salmon	$620	$1,026,215	$1,026,835	9.75		$1,025,595
Sardines	900,780		900,780	8.55	$900,780	
Others	103,901	143,402	247,303	2.35		39,501
Total canned	1,005,301	1,169,617	2,174,918	20.65	900,780	1,065,096
Shellfish, etc.:						
Lobsters (fresh), shrimp and turtle	199,199	249,721	448,920	4.26		50,522
Lobsters, canned	574,710		574,710	5.45	574,710	
Oysters, fresh and canned		688,653	688,653	6.54		688,653
All other fish and shellfish		204,833	204,833	1.94		204,833
Total shellfish, etc	773,909	1,143,207	1,917,116	18.19	574,710	944,008
Miscellaneous products:						
Ambergris	5,112		5,112	.05	5,112	
Coral	1,911		1,911	.02	1,911	
Isinglass or fish glue	5,934		5,934	.06	5,934	
Oils, marine	184,510	140,851	325,361	3.09	43,659	
Seaweeds	4,174		4,174	.04	4,174	
Shells	1,037,152	74,328	1,111,480	10.55	962,824	
Skins, fish and shark	5	993	998	.01		988
Sounds, fish	36,375		36,375	.35	36,375	
Spermaceti		99,467	99,467	.94		99,467
Sponges	217,456	8,497	225,953	2.14	208,959	
Whalebone	2,192	441,969	444,161	4.22		439,777
Total miscellaneous	1,494,821	766,105	2,260,926	21.47	1,268,948	540,232
Grand total	6,276,903	4,258,306	10,535,209	100.00	2,018,597	

The trade with each country.—The extent of trade with each country appears in Table 3, showing the value of fishery products imported from and exported to, and the balance of trade with each foreign country during the year ending June 30, 1894. In this table omission is made of ambergris, coral, cuttle-fish bone, seaweed and skins, the customs returns not being in sufficient detail to permit a statement of the trade in these articles with each country. As the customs returns do not show the imports for consumption from each country, it is necessary in this compilation to use the extent of the imports, although the former would furnish a better basis for comparison.

3. *Statement of the fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each foreign country during the year ending June 30, 1894.*

Countries.	Imports.	Domestic exports.	Excess of imports over exports.	Excess of exports over imports.
Europe:				
Austria-Hungary	$168,391		$168,391	
Azores, and Madeira Islands	79	$2,679		$2,600
Belgium	22,436	5,483	16,953	
Denmark	1,298	1,017	281	
France	1,029,242	198,968	830,274	
Germany	90,865	438,333		347,468
Greece	11,867		11,867	
Italy	30,355	5,044	25,311	
Netherlands	502,755	58,845	443,910	
Portugal	47,478	10	47,468	
Russia		1,280		1,280
Spain	1,168	2,111		943
Sweden and Norway	627,390	552	626,838	

3. *Statement of the fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each foreign country during the year ending June 30, 1894*—Continued.

Countries.	Imports.	Domestic exports.	Excess of imports over exports.	Excess of exports over imports.
Europe—Continued.				
Switzerland	$3,223		$3,223	
United Kingdom—				
England	782,628	$1,304,493		$521,865
Ireland	111,477		111,477	
Scotland	256,185	70,143	186,042	
Total Europe	3,686,837	2,088,958		
North America:				
Canada—				
Nova Scotia and New Brunswick	2,058,543	18,222	2,040,321	
Quebec and Ontario	173,339	234,097		60,758
British Columbia	107,125	17,407	89,718	
Newfoundland and Labrador	136,305	343	135,962	
Miquelon, Langley, etc	117,255	175	117,080	
Mexico	33,947	49,336		15,389
Central America—				
Costa Rica	1,214	20,263		19,049
Guatemala		8,442		8,442
Honduras	268	2,234		1,966
Nicaragua	1,714	9,081		7,367
San Salvador		2,226		2,226
British Honduras	82	6,636		6,554
Bermuda	60	6,433		6,373
West Indies—				
British	146,135	103,584	42,551	
Danish	4,716	1,892	2,824	
Dutch	85	10,440		10,355
French	100	5,945		5,845
Haiti	1,712	652,723		651,011
Santo Domingo	2,328	82,599		80,271
Spanish—				
Cuba	42,466	117,752		75,286
Puerto Rico	411	6,353		5,942
Total North America	2,827,805	1,356,183		
South America:				
Argentina		15,700		15,700
Brazil	1,285	61,383		60,098
Chili		16,057		16,057
Colombia	44,918	27,631	17,287	
Ecuador		6,578		6,578
Guianas—				
British		30,867		30,867
Dutch		29,499		29,499
French		8,460		8,460
Peru		5,101		5,101
Uruguay		3,887		3,887
Venezuela	5,994	36,071		30,077
Total South America	52,197	241,234		
Asia and Oceanica:				
China	38,156	3,064	35,092	
East Indies, British	6,136	5,800	336	
Dutch	167		167	
Hongkong	11,231	175,743		164,512
Japan	28,794	1,230	27,564	
Russia	396		396	
Turkey	6,001		6,001	
British Australasia	3,311	235,086		231,775
French Oceanica	224,757	11,431	213,326	
Philippine Islands	479		479	
Hawaiian Islands	39	105,101		105,062
Total Asia and Oceanica	319,467	537,455		
Africa:				
British Africa		24,220		24,220
Canary Islands		314		314
French Africa	355		355	
Liberia		2,095		2,095
Total Africa	355	26,629		
All other islands and ports	1,746	7,847		2,617
Grand total	6,888,407	4,258,306		

The most extensive fishery trade is carried on with the Dominion of Canada, the aggregate value of the imports from and exports to those provinces in 1894 being $2,608,733, nearly all of which represents imports. Ranking next in extent of fishery-trade are England, France, Haiti, Sweden and Norway, Netherlands, and Germany, respectively. The following summary shows the extent of the trade in 1894 with those countries with which it generally exceeds $100,000:

4. *Statement of the total fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each principal foreign country during the year ending June 30, 1894.*

Designation.	Imports.	Domestic exports.	Total.	Percentage of total.
Canada	$2,339,007	$269,726	$2,608,733	23.39
England	782,628	1,304,493	2,087,121	18.72
France	1,029,242	198,968	1,228,210	11.02
Haiti	1,712	652,723	654,435	5.87
Sweden and Norway	627,390	552	627,942	5.63
Netherlands	502,755	58,845	561,600	5.04
Germany	90,865	438,333	529,198	4.74
Scotland	256,185	70,143	326,328	2.93
British West Indies	146,135	103,584	249,719	2.24
French Oceanica	224,757	11,431	236,188	2.13
British Australasia	3,311	235,086	238,397	2.14
Hongkong	11,231	175,743	186,974	1.68
Newfoundland	136,305	343	136,648	1.22
Austria-Hungary	168,391	....	168,391	1.51
Cuba	42,466	117,752	160,218	1.44
Miquelon, Langley, etc	117,255	175	117,430	1.05
Ireland	111,477	....	111,477	1.00
Hawaiian Islands	39	105,101	105,140	.94
All others	297,256	515,308	812,564	7.31
Total	6,888,407	4,258,306	11,146,713	100.00

II.—THE IMPORT TRADE.

Imports from 1821 to 1853.—As fish were among the principal food resources of the United States during its early history, it is not remarkable that the imports of fishery products were of small extent. With the increase of the fisheries of the British North American Provinces, the marketing of the products of those fisheries was gradually extended in this country. Those products were largely pickled mackerel, salmon, herring, shad, etc., dried cod, and fish oil. The total imports increased in value from $13,186 in 1821 to $1,142,541 in 1853. From 1821 to 1853 inclusive, the total value of fishery products imported aggregated $7,776,706, of which $7,330,268 worth, or 94 per cent, were received from the British Provinces. During this period, however, the exports of foreign fishery-products amounted to $1,536,900, leaving $6,239,806 as the value imported for consumption in this country.

Table 5, modified from a compilation[1] of the Bureau of Statistics, United States Treasury Department, shows in classified form the annual imports of fishery products during each year from 1821 to 1853, inclusive, and a separate statement of the value of the annual imports from the British North American Provinces and from all other countries.

5. *Classified statement of the imports of fishery products into the United States during each year from 1821 to 1853, inclusive.*

Year ending—	Dried or smoked fish.		Brine-salted or pickled fish.					
			Salmon.		Mackerel.		Herring and shad.	
	Quintals.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Sept. 30, 1821	346	....	1,048	....	7	....	(a)	(a)
1822	712	....	1,244	....	387	....	(a)	(a)
1823	2,969	....	1,507	....	67	....	(a)	(a)
1824	1,144	....	4,574	....	790	....	(a)	(a)
1825	1,628	....	1,540	....	242	....	(a)	(a)
1826	757	....	1,013	....	87	....	(a)	(a)
1827	685	....	1,540	....	39	....	(a)	(a)
1828	434	....	730	....	38	....	(a)	(a)
1829	492	....	699	....	95	....	(a)	(a)
1830	351	....	1,621	....	391	....	(a)	(a)
1831	1,363	....	2,315	....	4,552	....	(a)	(a)
1832	1,359	....	2,104	....	32	....	(a)	(a)
1833	6,068	....	1,652	....	20	....	(a)	(a)
1834	824	$7,795	2,009	$22,616	223	$691	(a)	(a)
1835	1,379	13,425	2,546	28,606	8,153	29,316	(a)	(a)
1836	1,872	12,178	2,976	35,884	6,037	36,470	(a)	(a)
1837	2,043	13,528	3,543	50,035	1,256	9,089	(a)	(a)
1838	2,015	14,111	3,790	58,791	182	1,595	(a)	(a)
1839	4,295	24,303	5,338	73,768	7,046	60,374	(a)	(a)
1840	4,061	19,355	4,860	78,232	11,823	114,590	(a)	(a)
1841	2,433	19,262	4,951	72,317	10,887	116,459	(a)	(a)
1842	1,265	5,186	4,693	54,679	8,194	58,812	(a)	(a)
June 30, 1843	188	1,411	2,640	26,993	12,334	57,457	c 399	c $2,048
1844	360	3,067	(a)	(a)	(a)	(a)	(a)	(a)
1845	1,297	9,646	(a)	(a)	(a)	(a)	(a)	(a)
1846	875	9,319	(a)	(a)	(a)	(a)	(a)	(a)
1847	8,274	25,711	(a)	(a)	(a)	(a)	(a)	(a)
1848	51,826	127,799	7,633	80,944	122,594	535,128	(a)	(a)

[1] Quarterly report of the Chief of the Bureau of Statistics, Treasury Department, for the three months ending December 31, 1886, p. 406.
a Included with "All other fish."
c Exclusive of 1844–1847.

5. *Classified statement of the imports of fishery products into the United States during each year from 1821 to 1853, inclusive*—Continued.

Year ending—	Dried or smoked fish.		Brine-salted or pickled fish.					
			Salmon.		Mackerel.		Herring and shad.	
	Quintals.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
June 30, 1849...	22,520	$43,709	8,244	$81,200	138,505	$465,286	13,961	$29,761
1850...	25,115	45,961	8,721	85,447	75,491	335,736	10,868	37,037
1851...	14,705	27,769	7,964	85,705	102,638	549,525	21,714	54,449
1852...	49,299	55,171	7,947	96,526	78,334	327,613	26,696	73,584
1853...	97,507	214,016	7,235	94,341	54,411	329,233	66,584	159,027
Total....	310,461	*b* 692,722	*c* 106,677	*d* 1,026,084	*c* 644,855	*d* 3,027,374	*e* 140,222	*e* 355,906

Year ending—	All other fish.		Whale and fish oil.		Total values.	Imported from—	
	Barrels.	Values.	Gallons.	Values.		British North American provinces.	All other countries.
Sept. 30, 1821....	116	....	418	....	*h* $13,186	$12,223	$963
1822....	95	....	1,194	....	*h* 19,255	18,831	424
1823....	268	....	2,231	....	*h* 31,914	30,466	1,448
1824....	651	....	786	....	*h* 43,411	42,968	443
1825....	778	....	200	....	*h* 29,500	29,337	163
1826....	242	....	194	....	*h* 18,841	18,649	192
1827....	101	....	238	....	*h* 24,971	24,537	434
1828....	187	....	4,009	....	*h* 10,469	9,944	525
1829....	138	....	1,372	....	*h* 16,182	15,343	839
1830....	715	....	96	....	*h* 27,624	27,001	623
1831....	454	....	456	....	*h* 49,421	47,686	1,735
1832....	264	....	421	....	*h* 28,584	28,318	266
1833....	840	....	6,571	....	*h* 45,649	42,714	2,935
1834....	1,515	$11,838	34	$15	42,955	35,562	7,393
1835....	3,144	15,435	4,088	1,497	88,279	82,172	6,107
1836....	5,094	30,774	1,421	588	115,894	90,611	25,283
1837....	3,111	24,828	767	564	98,044	84,081	13,963
1838....	3,521	21,775	781	299	96,571	90,364	6,207
1839....	14,489	71,489	400,151	112,821	342,755	219,934	122,821
1840....	8,810	48,979	37,236	14,196	275,352	257,881	17,471
1841....	2,175	14,149	6,705	2,849	225,036	215,029	10,007
1842....	1,791	8,754	3,573	1,102	128,533	122,767	5,766
June 30, 1843....	1,391	3,704	771	258	91,871	89,183	2,688
1844....	43,542	261,013	297	147	264,227	261,349	2,878
1845....	30,506	280,519	(*g*)	(*g*)	290,165	283,178	6,987
1846....	31,402	279,515	(*g*)	(*g*)	288,834	284,584	4,250
1847....	91,113	452,357	11,706	3,539	481,607	470,107	11,500
1848....	23,344	71,774	84,077	16,863	832,508	816,687	15,821
1849....	5,363	13,097	39,669	12,864	645,917	615,554	30,363
1850....	13,300	38,451	44,765	18,493	561,125	522,942	38,183
1851....	21,016	64,022	3,220	1,281	782,751	765,489	17,262
1852....	20,083	65,993	8,803	3,847	622,734	603,534	19,200
1853....	31,153	90,143	541,332	255,781	1,142,541	1,071,243	71,298
Total.....	360,712	*f* 1,868,609	1,207,582	*f* 447,004	7,776,706	7,330,268	446,438

b Exclusive of 1821–1833.
c Exclusive of 1844–1847.
d Exclusive of 1821–1833 and 1844–1847.
e Exclusive of 1821–1842 and 1844–1848.
f Exclusive of 1821–1833.
g Not known.
h Exclusive of whale and fish oil, the value of which is unknown.

Imports from 1854 to 1868.—The annual imports during each year from 1854 to 1868, inclusive, are shown in Table 6. From September 11, 1854, to March 17, 1866, fishery products from the British North American Provinces were admitted into this country free of duty. As the classification of the receipts from the Provinces differed somewhat from the classification of other receipts, a separate statement is made of the imports not under reciprocity and those under reciprocity treaty. This compilation, like Table 5, shows the extent of the imports, and it should be considered with Table 1 to learn the value of the imports for consumption.

6. *Classified statement of the imports of fishery products into the United States during each year from 1854 to 1868, inclusive.*

Year ending June 30—	Imports not under reciprocity treaty.							
	Fish, dried or smoked.		Pickled or brine-salted fish.					
			Salmon.		Mackerel.		Herring.	
	Quintals.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
1854	76, 074	$181, 469	6, 810	$94, 335	62, 499	$477, 131	61, 485	$158, 348
1855	111, 913	265, 934	6, 316	85, 796	80, 990	432, 431	*a* 46, 902	129, 938
1856	65, 968	158, 233	685	3, 106	81	138	*a* 3, 587	22, 808
1857	43, 994	96, 607	700	3, 949	20	144	*a* 8, 831	49, 213
1858	41, 151	111, 709	337	2, 446	45	369	3, 892	18, 905
1859	40, 450	107, 615	1, 127	6, 763	5, 067	6, 661	7, 756	39, 001
1860	66, 417	149, 217	4	111	58	258	5, 489	38, 308
1861	53, 448	120, 462	132	1, 110	110	695	5, 053	28, 367
1862	(*b*)	(*b*)	58	460			*c* 2, 595	22, 400
1863	(*b*)	(*b*)	88	419			*c* 3, 332	29, 037
1864	(*b*)	(*b*)	72	956			*c* 4, 342	34, 569
1865	(*b*)	(*b*)	13	188	10	152	4, 107	38, 394
1866	(*b*)	(*b*)	786	4, 317	5, 312	48, 121	8, 842	81, 761
1867	(*b*)	(*b*)	6, 670	129, 051	77, 503	675, 986	102, 929	396, 948
1868	(*b*)	(*b*)	6, 546	90, 287	41, 656	364, 439	62, 659	291, 435
Total	*d* 499, 415	*d* 1, 191, 246	30, 344	423, 294	273, 351	2, 006, 525	331, 801	1, 379, 432

Year ending June 30—	Imports not under reciprocity treaty—Continued.					
	Sardines in oil.	All other fish.		Whale and fish oil.		Total.
	Values.	Barrels.	Values.	Gallons.	Values.	Values.
1854	(*e*)	41, 652	$149, 824	243, 334	$116, 570	$1, 177, 677
1855	(*e*)	26, 050	86, 231	103, 844	36, 650	1, 036, 980
1856	(*e*)	454	2, 658	18, 430	8, 044	194, 987
1857	(*e*)	706	4, 633	36, 558	17, 693	172, 239
1858	$274, 137	980	5, 209	37, 437	18, 627	431, 402
1859	251, 278	1, 763	8, 673	7, 220	3, 504	423, 495
1860	299, 679	757	4, 990	185, 903	41, 903	534, 466
		Pounds.				
1861	226, 624	194, 850	6, 533	73, 325	29, 662	413, 453
1862	186, 417	1, 152, 934	26, 747	26, 933	14, 428	250, 452
1863	383, 223	3, 071, 842	77, 343	42, 808	17, 184	507, 206
1864	504, 079	1, 702, 166	45, 262	34, 097	16, 970	601, 836
1865	304, 713	743, 173	20, 602	11, 397	6, 427	370, 476
1866	937, 920	5, 539, 948	133, 842	178, 496	117, 409	1, 323, 370
1867	478, 619	14, 318, 175	466, 289	300, 152	183, 184	2, 330, 077
1868	471, 707	13, 347, 948	372, 389	125, 906	68, 509	1, 658, 766
Total	4, 318, 396		1, 411, 225	1, 425, 840	696, 764	11, 426, 882

Year ending June 30—	Imports under reciprocity treaty with British North American provinces.								All imports.
	Fish, dried or smoked.		Fish, pickled or brine-salted.		All other fish.	Whale and fish oil.		Total.	
	Pounds.	Values.	Barrels.	Values.	Values.	Gallons.	Values.	Values.	Values.
1854									$1, 177, 677
1855	256, 892	$6, 211	1, 038	$5, 582	$5, 408	1, 458	$932	$18, 133	1, 055, 113
1856	19, 569, 744	528, 788	240, 585	1, 336, 268	29, 795	249, 189	179, 346	2, 074, 197	2, 269, 184
1857	13, 289, 717	470, 416	226, 064	1, 162, 933	62, 365	364, 888	275, 182	1, 970, 896	2, 143, 135
1858	10, 446, 069	341, 855	235, 096	1, 172, 916	182, 898	269, 059	160, 607	1, 858, 276	2, 289, 678
1859	15, 244, 423	422, 505	278, 774	1, 328, 969	156, 559	558, 350	314, 830	2, 222, 863	2, 646, 358
1860	8, 847, 099	313, 491	301, 917	1, 389, 852	256, 417	428, 660	230, 598	2, 190, 358	2, 724, 824
1861	13, 577, 887	415, 201	202, 976	945, 603	305, 192	245, 236	131, 816	1, 797, 812	2, 211, 265
1862	5, 646, 947	143, 602	179, 076	678, 093	192, 272	110, 665	64, 106	1, 078, 073	1, 328, 525
1863	12, 257, 352	253, 925	94, 220	384, 011	198, 613	206, 124	120, 617	957, 166	1, 464, 372
1864	17, 894, 506	290, 647	152, 327	781, 090	331, 348	90, 570	74, 070	1, 477, 155	2, 078, 991
1865	15, 010, 007	288, 501	240, 412	1, 510, 257	391, 088	37, 766	23, 538	2, 213, 384	2, 583, 860
1866	(*e*)	383, 561	(*e*)	1, 527, 352	799, 213	(*e*)	341, 613	3, 051, 739	4, 375, 109
1867									2, 330, 077
1868									1, 658, 766
Total	*f* 132,040,643	3, 858, 703	*f* 2,152,485	12, 222, 926	2, 911, 168	*f* 2,561,965	1, 917, 255	20, 910, 052	32, 336, 934

a Including shad.
b Included with "All other fish."
c Including mackerel.
d Exclusive of 1862–1868.
e Not known.
f Exclusive of 1866.

Imports from 1869 to 1894.—Table 7 shows in classified form the values of all fishery products imported for consumption during each year from 1869 to 1894, inclusive. This statement covers the period in which the imports have made the greatest increase, the value during the last four years of this series being 176 per cent greater than during the first four years. This increase has occurred in nearly all articles, but it is most pronounced in case of brine-salted or pickled fish, shellfish, miscellaneous canned fish, and miscellaneous fishery products.

7. *Classified statement of the imports for consumption of fishery products into the United States during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Fresh or frozen.	Dried or smoked.	Brine-salted.	Canned fish and shell-fish.	
				Sardines.	Others.
1869	Unknown.	$287,934	$908,039	$640,159	$33,218
1870	....do	263,982	896,976	980,989	33,990
1871	....do	249,691	863,803	912,555	40,784
1872	$242,675	130,039	696,942	683,095	71,470
1873	279,320	190,693	980,726	986,769	84,308
1874	297,532	247,046	1,360,316	886,677	260,016
1875	346,315	347,296	1,228,135	610,705	416,264
1876	274,091	292,925	1,293,221	587,880	124,300
1877	315,858	321,240	926,406	722,997	42,491
1878	342,729	409,066	1,489,003	681,673	40,916
1879	283,734	454,338	1,187,207	833,302	68,887
1880	321,161	519,030	1,114,267	1,115,662	101,381
1881	376,722	795,853	1,301,135	956,022	176,349
1882	474,529	913,441	1,210,711	796,279	356,626
1883	572,533	1,290,527	1,548,009	773,629	371,684
1884	708,170	1,279,025	2,044,845	976,754	283,082
1885	736,765	1,242,800	1,694,214	677,068	419,619
1886	668,887	524,548	906,833	762,879	324,099
1887	754,209	511,991	1,398,223	817,675	357,364
1888	867,490	581,439	1,469,971	940,036	486,995
1889	928,344	609,396	1,476,888	806,097	614,023
1890	879,205	535,374	1,988,307	764,506	632,128
1891	652,271	434,822	2,410,868	1,000,843	1,044,615
1892	510,870	364,933	2,114,247	1,175,892	629,270
1893	535,104	401,299	2,196,226	1,258,158	696,258
1894	563,391	292,701	2,146,780	900,780	679,231
Total	11,931,905	13,491,429	36,852,298	22,249,081	8,389,368

Year ending June 30—	Shellfish and turtles.	Fish sounds, isinglass, etc.	Marine oils.	Miscellaneous products.	Total values.
1869	....	$8,719	$426,874	$106,366	$2,411,309
1870	$3,808	8,089	369,167	128,522	2,685,523
1871	4,260	6,542	204,228	179,413	2,461,276
1872	8,984	28,437	158,504	413,824	2,433,970
1873	10,920	123,750	119,788	400,006	3,176,280
1874	60,152	96,244	163,046	295,272	3,666,301
1875	129,382	52,401	185,404	281,786	3,597,688
1876	13,356	42,322	151,249	397,965	3,177,309
1877	15,175	32,236	119,340	301,247	2,796,990
1878	12,071	104,552	211,847	300,222	3,592,079
1879	4,835	202,765	125,547	385,661	3,546,276
1880	15,859	198,025	223,139	506,930	4,115,454
1881	15,243	243,239	361,956	532,614	4,759,133
1882	31,642	169,148	270,250	549,245	4,771,871
1883	39,516	189,575	280,575	581,602	5,647,650
1884	30,472	129,224	373,773	536,370	6,361,715
1885	55,469	166,305	209,845	445,038	5,647,123
1886	64,632	181,784	88,811	562,246	4,084,719
1887	76,452	185,662	85,839	545,304	4,732,719
1888	105,161	176,843	92,515	463,160	5,183,610
1889	123,093	112,302	105,938	588,264	5,364,345
1890	125,831	63,186	95,947	727,076	5,811,560
1891	180,783	112,106	113,775	1,029,952	6,980,035
1892	207,221	76,093	151,000	1,457,920	6,687,446
1893	255,780	74,198	285,593	2,005,573	7,708,189
1894	199,199	42,309	184,510	1,268,002	6,276,903
Total	1,789,296	2,826,056	5,158,460	14,989,580	117,677,473

A series of tables is next presented, showing in detail the quantities and values of the various kinds of fishery products included in each classification noted in the preceding table.

The fresh fish consist principally of various sea fish received from Nova Scotia, fish caught on the north side of the Great Lakes, and of salmon. The extent of these imports increased almost constantly until 1891, when a duty of one-fourth of a cent per pound was imposed on herring and three-fourths of a cent on salmon and all other fresh fish, all being admitted free of duty previous to that time. While this duty had little effect on the receipts of salmon and other valuable species, yet it diminished very considerably the imports of cheaper fish, such as hake, herring, etc. The average value of all fresh fish received in 1889 was only $1.92 per 100 pounds; in 1894 it was $4.87 per 100 pounds, the increase being due almost entirely to an elimination of the cheap grades. The customs returns do not present a very extensive classification of the fresh fish imported, but such returns as are available are given in Table 8.

8. *Statement of the fresh fish imported for consumption into the United States during each year from 1872 to 1894, inclusive.*

Year ending June 30—	Mackerel.		Salmon.		Trout.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
1884	(a)	(a)	1,015,923	$120,318	(a)	(a)
1885	(a)	(a)	1,336,541	152,822	(a)	(a)
1886	(a)	(a)	1,303,704	144,719	(a)	(a)
1887	(a)	(a)	1,583,464	119,361	(a)	(a)
1888	1,418,330	$76,514	768,727	77,726	2,156,307	$67,907
1889	546,547	27,640	1,011,456	104,875	3,229,531	104,992
1890	783,079	44,596	873,014	91,022	3,192,469	105,804
1891	736,779	22,166	844,940	80,649	(a)	(a)
1892	(a)	(a)	1,242,760	105,565	(a)	(a)
1893	(a)	(a)	1,238,605	116,124	(a)	(a)
1894	(a)	(a)	1,891,742	156,163	(a)	(a)

Year ending June 30—	Whitefish.		All others.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
1872	....	....	....	....	7,647,482	$242,675
1873	....	....	....	....	8,386,624	279,320
1874	....	....	....	....	9,332,878	297,532
1875	....	....	....	....	14,887,205	346,315
1876	....	....	....	....	12,327,015	274,091
1877	....	....	....	....	13,453,033	315,858
1878	....	....	....	....	9,914,296	342,729
1879	....	....	....	....	7,949,063	283,734
1880	....	....	....	....	10,780,051	321,161
1881	....	....	....	....	13,066,101	376,722
1882	....	....	....	....	15,321,009	474,529
1883	....	....	....	....	15,860,390	572,533
1884	(a)	(a)	18,910,363	$587,852	19,926,286	708,170
1885	(a)	(a)	18,315,020	583,943	19,651,561	736,765
1886	(a)	(a)	19,702,995	524,168	21,006,699	668,887
1887	(a)	(a)	26,911,790	634,848	28,495,254	754,209
1888	2,879,054	$105,675	26,165,772	539,668	33,388,190	867,490
1889	3,048,791	106,221	40,557,570	584,616	48,393,895	928,344
1890	2,648,678	86,103	33,373,961	551,680	40,871,201	879,205
1891	(a)	(a)	22,030,351	549,456	23,612,070	652,271
1892	(a)	(a)	9,370,965	405,305	10,613,725	510,870
1893	(a)	(a)	10,867,641	418,980	12,106,246	535,104
1894	(a)	(a)	9,681,799	407,228	11,573,541	563,391

a Classed with "All others."

Table 9 shows the quantities and values of dried cod, smoked herring, and other dried or smoked fish imported for consumption. A duty of one-half cent per pound was imposed on these imports prior to 1891, and since then it has been three-fourths of a cent per pound, the effect of this increase being apparent in the diminished receipts in 1891 and the following years. The large and abrupt decrease in imports in 1886 was due to the termination of the Washington treaty, which admitted free of duty fish from the British North American Provinces. The slight difference in the imports of dried or smoked fish during the first and the last year here reported is somewhat noticeable.

9. *Statement of the dry-salted and smoked fish imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Cod, haddock, hake, etc.		Herring.		Others.		Total.	
	Pounds.	Values.	Pounds.*	Values.	Pounds.	Values.	Pounds.	Values.
1869	(a)	(a)	(a)	(a)	8, 943, 318	$287, 934	8, 943, 318	$287, 934
1870	(a)	(a)	(a)	(a)	7, 209, 130	263, 982	7, 209, 130	263, 982
1871	(a)	(a)	(a)	(a)	6, 762, 520	249, 691	6, 762, 520	249, 691
1872	(a)	(a)	(a)	(a)	3, 558, 990	130, 039	3, 558, 990	130, 039
1873	(a)	(a)	(a)	(a)	5, 128, 404	190, 693	5, 128, 404	190, 693
1874	(a)	(a)	1, 029, 095	$34, 670	7, 227, 130	212, 376	8, 256, 225	247, 046
1875	(a)	(a)	1, 547, 245	63, 223	8, 284, 969	284, 073	9, 832, 214	347, 296
1876	(a)	(a)	1, 535, 950	57, 560	6, 728, 177	235, 365	8, 264, 127	292, 925
1877	(a)	(a)	1, 582, 853	39, 459	6, 389, 522	281, 781	7, 972, 375	321, 240
1878	(a)	(a)	2, 109, 150	52, 715	11, 088, 603	356, 351	13, 197, 753	409, 066
1879	(a)	(a)	1, 912, 355	46, 975	12, 336, 836	407, 363	14, 249, 191	454, 338
1880	(a)	(a)	2, 543, 075	69, 986	15, 074, 528	449, 044	17, 617, 603	519, 030
1881	(a)	(a)	3, 384, 215	92, 604	23, 670, 336	703, 249	27, 054, 551	795, 853
1882	(a)	(a)	5, 441, 805	134, 378	24, 190, 551	779, 063	29, 632, 356	913, 441
1883	(a)	(a)	3, 283, 890	120, 014	27, 427, 083	1, 170, 513	30, 710, 973	1, 290, 527
1884	26, 828, 085	$993, 489	8, 330, 641	137, 975	3, 904, 676	147, 561	39, 063, 402	1, 279, 025
1885	32, 326, 686	943, 116	10, 441, 355	129, 034	4, 843, 457	170, 650	47, 611, 498	1, 242, 800
1886	10, 998, 072	286, 505	4, 246, 970	64, 457	5, 402, 340	173, 586	20, 647, 382	524, 548
1887	8, 997, 750	264, 260	5, 533, 802	86, 390	5, 252, 836	161, 341	19, 784, 388	511, 991
1888	10, 446, 892	316, 259	3, 994, 101	86, 607	4, 759, 754	178, 573	19, 200, 747	581, 439
1889	9, 752, 941	317, 687	4, 226, 839	122, 027	5, 040, 840	169, 682	19, 020, 620	609, 396
1890	8, 303, 585	247, 327	4, 824, 261	99, 362	5, 525, 606	188, 685	18, 653, 452	535, 374
1891	6, 845, 576	254, 074	3, 723, 654	91, 032	2, 152, 448	89, 716	12, 721, 678	434, 822
1892	5, 804, 548	229, 255	2, 294, 159	52, 442	1, 839, 126	83, 236	9, 941, 833	364, 933
1893	7, 433, 163	291, 531	1, 710, 634	33, 815	1, 792, 958	75, 953	10, 936, 755	401, 299
1894	5, 468, 750	202, 725	852, 480	23, 570	1, 728, 111	66, 406	8, 049, 341	292, 701
Total	b133,206,048	b4,346,228	c74,548,529	c1,638,295	216,262,249	7,506,906	424,020,826	13,491,429

* From 1874 to 1883, inclusive, the weight is estimated at 5 pounds per box.
a Included with "Others."
b Exclusive of 1869-1883.
c Exclusive of 1869-1873.

Brine-salted fish constitute the most important class of fishery products imported into this country. Herring and mackerel are the most important species, the others being salmon, cod, etc. Of the 5,054,554 barrels of brine-salted fish imported for consumption during the twenty-six years ending in 1894, as shown in Table 10, 56 per cent were herring, 37 per cent mackerel, and 3 per cent salmon. However, the herring only slightly exceeded the mackerel in total value, the imports of the former being worth $16,978,802, and of the latter $16,401,462. The imports of pickled fish vary somewhat from year to year, yet the general increase is quite noticeable.

The rate of duty on herring and mackerel during the period herein reported has been uniformly $1 and $2 per barrel, respectively. On salmon, previous to 1884, the duty was $3 per barrel, and since then only $2 per barrel. The rate of duty on other pickled fish was $1.50 previous to 1884 and $2 per barrel since then. These tariff rates, however, did not relate to the imports from the British North American Provinces during the operation of the Washington treaty.

10. *Statement of the brine-salted or pickled fish imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Herring.		Mackerel.		Salmon.		Others.*a*		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
1869......	91, 568	$425, 213	27, 481	$306, 696	8, 455	$110, 591	9, 732	$65, 539	137, 236	$908, 039
1870......	87, 284	398, 596	28, 480	291, 528	10, 620	137, 055	9, 961	69, 797	136, 345	896, 976
1871......	62, 022	356, 760	28, 479	309, 074	9, 356	145, 264	7, 003	52, 705	106, 860	863, 803
1872......	62, 475	332, 707	39, 572	247, 701	5, 344	80, 171	7, 455	36, 363	114, 846	696, 942
1873......	63, 498	352, 235	70, 651	523, 577	4, 579	73, 231	4, 555	31, 683	143, 283	980, 726
1874......	82, 739	433, 999	90, 874	806, 089	4, 875	65, 626	9, 770	54, 602	188, 258	1, 360, 316
1875......	98, 191	516, 973	78, 132	587, 349	4, 812	62, 940	9, 393	60, 873	190, 528	1, 228, 135
1876......	107, 319	493, 162	76, 599	695, 917	4, 200	49, 970	8, 852	54, 172	196, 970	1, 293, 221
1877......	76, 699	397, 522	44, 178	373, 897	5, 438	61, 733	16, 390	93, 254	142, 705	926, 406
1878......	95, 308	431, 832	102, 001	907, 081	8, 596	109, 309	5, 403	40, 781	211, 308	1, 489, 003
1879......	77, 037	383, 494	101, 453	650, 067	9, 586	108, 363	7, 175	45, 283	195, 251	1, 187, 207
1880......	74, 559	445, 620	112, 398	492, 934	8, 258	118, 259	11, 944	57, 454	207, 159	1, 114, 267
1881......	93, 987	519, 342	120, 361	615, 162	5, 848	91, 382	15, 838	75, 249	236, 034	1, 301, 135
1882......	114, 300	649, 900	57, 862	394, 323	4, 751	86, 478	12, 802	80, 010	189, 715	1, 210, 711
1883......	150, 440	914, 433	52, 073	427, 476	4, 725	93, 639	17, 537	112, 461	224, 775	1, 548, 009
1884......	165, 019	976, 816	88, 231	873, 680	6, 447	100, 946	16, 205	93, 403	275, 902	2, 044, 845
1885......	183, 818	858, 249	92, 147	702, 030	5, 621	73, 000	12, 984	60, 935	294, 570	1, 694, 214
1886......	92, 660	617, 035	31, 848	222, 716	4, 398	46, 073	2, 930	21, 009	131, 836	906, 833
1887......	107, 189	748, 321	64, 925	563, 855	4, 588	67, 092	2, 841	18, 955	179, 543	1, 398, 223
1888......	126, 104	826, 251	56, 646	548, 073	4, 673	68, 916	3, 853	26, 731	191, 276	1, 469, 971
1889......	112, 453	796, 651	42, 394	574, 722	4, 963	77, 070	3, 437	28, 445	163, 247	1, 476, 888
1890......	123, 831	880, 238	71, 038	1, 011, 921	3, 989	68, 102	3, 550	28, 046	202, 408	1, 988, 307
1891......	128, 363	954, 697	113, 276	1, 356, 113	*b* 4, 836	79, 959	2, 796	20, 099	249, 271	2, 410, 868
1892......	150, 603	1, 167, 376	88, 209	863, 191	*b* 4, 397	60, 918	3, 622	22, 762	246, 831	2, 114, 247
1893......	163, 050	1, 151, 112	84, 217	960, 588	*b* 4, 546	63, 722	2, 747	20, 804	254, 560	2, 196, 226
1894......	141, 476	950, 268	94, 836	1, 095, 702	*b* 5, 508	84, 442	2, 017	16, 368	243, 837	2, 146, 780
Total..	2, 831, 992	16, 978, 802	1, 858, 361	16, 401, 462	153, 409	2, 184, 251	210, 792	1, 287, 783	5, 054, 554	36, 852, 298

a For quantities and values of pickled cod among "Others," see p. 476.
b On basis of 200 pounds to the barrel, see p. 510.

The quantity of each form of sardines imported is shown in Table 49, on page 504.

The "other canned fish and shellfish" comprises all in oil exclusive of sardines, and fish and shellfish canned without oil, the latter including canned lobsters, herring, mackerel, salmon, eels, etc. A classification of these imports more in detail than previously given appears in the following table. Since 1869 a duty of 30 per cent ad valorem has been imposed on fish prepared in oil. On those canned without oil a duty of 35 per cent ad valorem was imposed previous to 1884; from 1884 to 1891 the rate has been 25 per cent, and since then 30 per cent.

11. *Statement of the canned fish and shellfish, exclusive of sardines, imported for consumption into the United States from 1869 to 1894, inclusive.*

Year ending June 30—	In oil, etc., exclusive of sardines.	Plain canned, or without oil.					Total.
		Lobsters.	Salmon.	Herring.	Mackerel.	All other.	
1869	$30,861	(a)	(a)	(a)	(a)	$2,457	$33,318
1870	30,465	(a)	(a)	(a)	(a)	3,525	33,990
1871	34,173	(a)	(a)	(a)	(a)	6,611	40,784
1872	40,041	(a)	(a)	(a)	(a)	31,429	71,470
1873	27,175	(a)	(a)	(a)	(a)	57,133	84,308
1874	15,811	(a)	(a)	(a)	(a)	244,205	260,016
1875	27,117	(a)	(a)	(a)	(a)	389,147	416,264
1876	27,490	(a)	(a)	(a)	(a)	96,810	124,300
1877	15,996	(a)	(a)	(a)	(a)	26,495	42,491
1878	15,849	(a)	(a)	(a)	(a)	25,067	40,916
1879	13,835	(a)	(a)	(a)	(a)	55,052	68,887
1880	14,647	(a)	(a)	(a)	(a)	86,734	101,381
1881	21,056	(a)	(a)	(a)	(a)	155,293	176,349
1882	31,362	(a)	(a)	(a)	(a)	325,264	356,626
1883	24,272	(a)	(a)	(a)	(a)	347,412	371,684
1884	35,914	$193,587	$285	(a)	(a)	53,296	283,082
1885	22,387	357,730	9	(a)	(a)	39,493	419,619
1886	19,982	252,054	3,503	(a)	(a)	48,560	324,099
1887	17,528	267,901	719	(a)	(a)	71,216	357,364
1888	25,097	412,863	1,102	$3,022	$5,536	39,375	486,995
1889	27,614	522,547	2,193	3,503	1,894	56,272	614,023
1890	27,725	568,150	479	2,894	3,445	29,435	632,128
1891	b 64,769	966,008	388	6,514	6,936	(c)	1,044,615
1892	b 51,380	561,778	88	10,712	5,312	(c)	629,270
1893	b 71,167	609,741	56	14,286	1,008	(c)	696,258
1894	b 88,877	574,710	620	13,106	1,918	(c)	679,231

a Included with "All other, plain canned."
b Includes "All other, plain canned,"
c Included with "In oil, etc."

"Shellfish and turtles" consists principally of fresh lobsters received from Nova Scotia. It also includes fresh and prepared shrimp, crawfish, and other shellfish and turtles. All of these products are admitted free of duty. It is impossible to give a classification of the separate articles, other than is afforded by Table 64, on page 522, showing the countries from which they were received during a series of recent years.

The quantity and value of each variety of fish sounds and isinglass imported for consumption are shown in Table 77, and similar data for marine oils are given in Table 67.

The miscellaneous fishery products comprise ambergris, ambergris oil, coral, seaweed, shells of marine mollusks and crustaceans, skins of various fishes, spermaceti in the form of candles, sponges, and whalebone. The value of the imports of these separate articles is shown in Table 12, but a more extensive account of the varieties, quantities, and values is given in other tables of this report.

12. *Statement of the values of miscellaneous fishery products imported for consumption during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Ambergris.	Ambergris oil.	Coral, crude and manufactured.	Dulse, or sea weed.	Shells, rough and manufactured.	Skins, fish and shark.	Spermaceti candles.	Sponges.	Whalebone, uncut and manufactured.	Total.
1869	....	....	$22,417	$3,504	$1,826	....	$2,545	$74,731	$1,343	$106,366
1870	....	....	18,975	2,890	8,441	....	3,932	93,952	332	128,522
1871	....	....	37,877	1,094	22,244	....	4,762	113,127	309	179,413
1872	$1,328	....	59,681	....	188,283	....	8,029	153,443	3,060	413,824
1873	1,110	$31	64,035	....	136,138	....	3,666	189,986	5,040	400,006
1874	4,046	322	28,680	....	129,887	....	4,789	121,798	5,750	295,272
1875	5,217	....	34,845	....	125,649	....	1,963	110,440	3,672	281,786
1876	1,700	706	33,668	1,611	257,241	....	3,969	87,621	11,449	397,965
1877	694	745	29,368	859	172,251	....	6,302	88,798	2,230	301,247
1878	93	185	13,919	....	187,507	....	6,991	90,127	1,400	300,222
1879	3,215	....	11,474	....	231,743	....	4,618	130,515	4,096	385,661
1880	....	2,962	5,554	45	294,730	....	6,422	183,690	13,527	506,930
1881	55	2,462	2,591	1,577	288,154	$75	2,794	229,292	5,614	532,614
1882	5,408	....	2,143	....	239,231	37	5,974	293,621	2,831	549,245
1883	2,715	390	1,983	....	296,254	23	5,088	270,462	4,687	581,602
1884	4,015	92	158	979	258,639	173	....	241,874	30,440	536,370
1885	5,685	....	659	5,058	164,080	325	....	235,519	33,712	445,038
1886	1,673	175	218	2,651	245,848	35	....	296,963	14,683	562,246
1887	2,649	542	307	2,646	228,799	146	....	302,510	7,705	545,304
1888	6,774	....	594	5,199	178,839	1,395	....	268,651	1,708	463,160
1889	5,852	....	461	4,707	279,763	527	....	277,373	19,581	588,264
1890	1,454	2,920	531	4,699	340,654	605	....	352,885	23,328	727,076
1891	3,731	1,509	213	1,931	638,576	604	....	381,879	1,509	1,029,952
1892	1,288	427	1,378	3,150	1,116,536	320	....	331,241	3,580	1,457,920
1893	6,667	....	1,265	5,867	1,621,681	63	....	365,249	4,781	2,005,573
1894	5,112	....	1,911	4,174	1,037,152	5	....	217,456	2,192	1,268,002
Total	70,481	13,468	374,905	52,641	8,690,146	4,333	71,844	5,503,203	208,559	14,989,580

The quantities and values of fishery products imported for consumption in 1894 are presented in greater detail in the following compilation, showing (1) the items of fishery products imported, (2) the units of quantity used, (3) the quantities and (4) values imported, (5) average values per unit of quantity, (6) the rates of duty exacted, (7) the amount of duties collected, and (8) the average ad valorem rates of duty:

13. *Detailed statement of the fishery products imported for consumption during the year ending June 30, 1894.*

Items.	Units of quantity.	Quantities.	Values.	Average values per unit of quantity.	Rates of duty.	Amount of duty.	Average ad valorem rates of duty.
Fish:							
Fresh—							
Herring—							*P. ct.*
Food	Pounds	211,991	$3,090	$0.014	¼ c. per lb	$530	17.11
Bait	do	391,892	2,829	.007	Free	....	Free.
Salmon	do	1,891,742	156,163	.083	¾ c. per lb	14,188	9.09
Other fresh fish	do	9,077,916	401,309	.044	do	68,084	16.97
Total fresh	do	11,573,541	563,391	....	....	82,802	....
Dried or smoked—							
Cod, haddock, etc	do	5,468,750	202,725	.037	¾ c. per lb	41,016	20.23
Herring	do	852,480	23,570	.028	do	6,394	27.13
Other dried or smoked fish	do	1,728,111	66,406	.038	do	12,961	19.52
Total dried or smoked	do	8,049,341	292,701	....	....	60,371	....
Pickled or brine-salted—							
Cod, haddock, etc	Barrels	20	112	5.60	$2 per bbl	41	36.25
Herring	do	141,476	950,268	6.73	$1 per bbl	141,476	14.89
Mackerel	do	94,836	1,095,702	11.55	$2 per bbl	189,672	17.31
Salmon	Pounds	1,101,502	84,442	.077	1 c. per lb	11,015	13.04
Other pickled fish	Barrels	1,996	16,256	8.14	$2 per bbl	3,993	24.56
Total pickled	....	....	2,146,780	....	....	346,197	....

13. *Detailed statement of the fishery products imported for consumption during the year ended June 30, 1894*—Continued.

Items.	Units of quantity.	Quantities.	Values.	Average values per unit of quantity.	Rates of duty.	Amount of duty.	Average ad valorem rates of duty.
Fish—Continued.							
Canned—							*P. ct.*
Herring			$13,106		30 per cent.	$3,932	30
Mackerel			1,918		do	575	30
Salmon			620		do	186	30
Other canned fish			88,877		do	26,663	30
Total canned			104,521			31,356	
Sardines—							
Whole boxes *a*	Boxes	9,985	2,793	$0.279	10 c. per box	998	35.75
Half boxes	do	471,995	91,254	.193	5 c. per box	23,600	25.86
Quarter boxes	do	9,365,021	766,637	.082	2½ c. per box	234,126	30.54
Other form			40,096		40 per cent.	16,038	40
Total sardines			900,780			274,762	
Crustaceans, etc.:							
Lobsters, canned	Pounds	4,071,397	574,710	.141	Free		Free.
Lobsters, fresh, and shrimp and turtles.			199,199		Free		Free.
Total crustaceans, etc.			773,909				
Oils, marine:							
Cod-liver	Gallons	209,865	99,318	.48	15 c. per gall	31,480	31.70
Fish	do	344,134	74,362	.22	8 c. per gall	27,531	37.02
Seal	do	7,869	2,956	.37	do	630	21.29
Whale	do	27,110	7,874	.29	do	2,169	27.54
Total oil	do	588,978	184,510			61,810	
Miscellaneous products:							
Ambergris	Pounds	37	5,112	138.162	Free		Free.
Coral—							
Uncut			153		Free		Free.
Manufactured			1,758		25 per cent.	439	25
Isinglass or fish glue, valued at—							
Above 7 cts. per lb	Pounds	560	36	.064	1½ c. per lb.	8	23.33
From 7 to 30 cts. per lb.	do	1,975	233	.118	25 per cent.	58	25
Above 30 cts. per lb	do	2,817	5,665	2.011	30 per cent.	1,670	30
Seaweed, preparations (n. e. s.).			4,174		20 per cent.	835	20
Shells—							
Not ground or cut (n.e.s.)			643,251		Free		Free.
Mother-of-pearl—							
Not cut			2,507		Free		Free.
Manufactures of			378,381		40 per cent.	151,353	40
Cuttlefish bone	Pounds	149,708	13,013	.087	Free		Free.
Skins, fish and shark			5		Free		Free.
Sounds or bladders	Pounds	199,571	36,375	.182			Free.
Sponges			217,456		20 per cent.	43,491	20
Whalebone—							
Not manufactured	Pounds	640	669	1.045	Free		Free.
Manufactures of			1,523		30 per cent.	457	30
Total miscellaneous			1,310,311			198,311	
Grand total			6,276,903			1,055,609	16.82

a Dimensions of whole boxes, 5 by 4 by 3½ inches; half boxes, 5 by 4 by 1⅝ inches; quarter boxes 4¾ by 3½ by 1¼ inches.

Character of imports from each country.—In considering the total fishery-trade with each country it is necessary to omit ambergris, coral, seaweeds, and skins, as the customs returns are not in sufficient detail to permit a statement of the trade in those articles with each foreign country. The total value of fishery imports, omitting the above-enumerated articles, averages about $6,000,000 annually, principally from Nova Scotia, France, England, Norway and Sweden, Netherlands, and Scotland. The value of the fishery products imported during the year ending June 30, 1894, was $6,888,407, of which Nova Scotia and New Brunswick sent $2,058,543, France $1,029,242, England $782,628, Norway and Sweden $627,390, and Netherlands $502,755.

The Nova Scotia fishery products imported into the United States are principally canned and fresh lobsters, pickled mackerel, and dried cod. The imports from France consist almost entirely of sardines. Norway and Sweden send principally pickled mackerel, pickled herring, and cod oil. Over 99 per cent of the imports from the Netherlands represents pickled herring. The imports of fishery products from the West Indies, Mexico, and the Central and South American Republics are small, their total value in 1894 being as follows: West Indies, $197,953; Mexico, $33,947; Central America, $3,278, and South America, $52,197; a total of $287,375, consisting largely of marine shells, sponges, shrimp, and fish sounds. This added to the $2,475,312, the value of fish received from Canada and Newfoundland, $117,255 from Miquelon, and $60 from Bermuda, makes a total of $2,880,002 received from the American continent. The receipts from Europe amounted to $3,686,837, consisting principally of sardines, pickled herring, mackerel, marine shells, and sponges. The imports of shells, shrimp, dried fish, oil, etc., from Asia and Oceanica aggregated $319,467, leaving $2,101 as the receipts from African and other ports.

The following compilation shows the quantities and values of each fishery product imported into the United States during the year ending June 30, 1894. The totals necessarily differ from the statements of the imports for consumption, as explained on page 438.

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894.*

Countries from which imported.	Fresh or frozen.					Dried, smoked, or cured.			
	Salmon.		Bait.		Others.	Cod, haddock, hake, pollock, etc.		Herring.	
	Lbs.	Values.	Lbs.	Values.	Values.	Lbs.	Values.	Lbs.	Values.
Europe:									
Azores, and Madeira Islands	....	....	......	.....	....	250	$13	....	......
France	....	....	......	.....	....	414,655	20,405	....	......
Germany	....	....	......	.....	....	20,654	1,040	1,090	$35
Italy	....	....	......	.....	$2	1,561	63	....	......
Netherlands	....	....	......	.....	....	....	......	7,227	341
Sweden and Norway	....	....	......	.....	....	402,424	20,016	220,373	6,961
United Kingdom—									
England	....	....	......	.....	280	3,200	173	110,314	4,864
Scotland	....	....	......	.....	....	1,000	49	10,296	752
Total Europe	....	....	......	.....	282	843,744	41,759	349,300	12,953
North America:									
Canada—									
Nova Scotia, New Brunswick, etc	1,242,640	$115,971	19,900	$269	278,876	8,154,544	299,255	2,875,648	63,939
Quebec, Ontario, etc	645,824	39,996	1,665	50	113,159	8,080	293	1,800	160
British Columbia	3,872	219	......	.....	10,250	515	27	....	......
Newfoundland and Labrador	....	....	371,992	2,560	250	1,216,394	52,764	1,000	16
Miquelon, Langley, etc	....	....	......	.....	....	3,105,371	110,936	....	......
Central America—									
Nicaragua	....	....	......	.....	....	1,874	66	....	......
Mexico	....	....	......	.....	576	....	......	....	......
West Indies—									
Cuba	....	....	......	.....	....	66,515	3,906	....	......
Total North America	1,892,336	156,186	393,557	2,879	403,111	12,553,293	467,247	2,878,448	64,115

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894*—Continued.

Countries from which imported.	Fresh or frozen.					Dried, smoked, or cured.			
	Salmon.		Bait.		Others.	Cod, haddock, hake, pollock, etc.		Herring.	
	Lbs.	Values.	Lbs.	Values.	Values.	Lbs.	Values.	Lbs.	Values.
Asia:									
China					$30			60	$11
Hongkong					39	7,383	$249		
Japan						1,773	50		
Total Asia					69	9,156	299	60	11
Grand total	1,892,336	$156,186	393,557	$2,879	403,462	13,406,193	509,305	3,227,808	77,079

Countries from which imported.	Pickled or brine-salted.						Sardines.	All other fish.
	Herring.		Mackerel.		Salmon.			
	Barrels.	Values.	Barrels.	Values.	Lbs.	Values.	Values.	Values.
Europe:								
Austria-Hungary							$22	
Azores, and Madeira Islands								$66
Belgium							21,808	421
Denmark	24	$70						37
France			3	$24			841,377	15,791
Germany	4,409	31,138					1,903	14,894
Italy	7	66	19	192	11	$1	9,497	8,220
Netherlands	46,992	498,095	2	19				751
Portugal							47,474	4
Spain							1,022	146
Sweden and Norway	38,753	151,993	16,777	280,381			30,427	44,485
United Kingdom—								
England	1,178	6,600	27,078	323,954			21,026	23,521
Ireland	40	276	11,001	111,201				
Scotland	31,128	200,524	3,975	38,345			59	15,198
Total Europe	122,531	888,762	58,855	754,116	11	1	974,615	123,534
North America:								
Dominion of Canada—								
Nova Scotia and New Brunswick	16,773	47,856	39,328	378,472	536,520	36,182		78,287
Quebec, Ontario, etc	224	857	91	888	2,658	217	767	11,145
British Columbia					149,410	17,592		78,883
Newfoundland	5,320	21,249	4	33	405,407	30,396		14,077
Miquelon, Langley, etc	1,034	3,487						
Central America—								
Honduras							91	
Nicaragua	1	9						34
Mexico							35	1,835
West Indies—								
Cuba	1	11					1,340	736
Total North America	23,353	73,469	39,423	379,393	1,093,995	84,387	2,233	184,997
South America:								
Colombia								96
Asia:								
China								24,164
Hongkong	4	4			1,200	29		6,969
Japan								186
Russia	15	76			11,875	298		22
Total Asia	19	80			13,075	327		31,341
Africa, French							104	151
All other islands and ports								17
Grand total	145,903	962,311	98,278	1,133,509	1,107,081	84,715	976,952	340,136

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894*—Continued.

Countries from which imported.	Lobsters, canned.		Lobsters, fresh, and shrimp and turtles.	Fish sounds.		Fish and whale oil.		Shells and manufactures of shells.	Sponges.	Total.
	Lbs.	Values.	Values.	Lbs.	Values.	Gallons.	Values.	Values.	Values.	Values.
Europe:										
Austria-Hungary								$160, 639	$7, 730	$168, 391
Azores, and Madeira Islands										79
Belgium						450	$194	13		22, 436
Denmark				11, 527	$1, 191					1, 298
France			$144					148, 612	2, 889	1, 029, 242
Germany	140	$22		173	14	24, 113	11, 045	29, 767	1, 007	90, 865
Greece									11, 867	11, 867
Italy				219	10			11, 394	910	30, 355
Netherlands								3, 284	265	502, 755
Portugal										47, 478
Spain										1, 168
Sweden and Norway				214	38	196, 202	93, 089			627, 390
Switzerland								3, 223		3, 223
United Kingdom—										
England			51	55, 896	17, 464	11, 203	5, 523	320, 399	58, 773	782, 628
Ireland										111, 477
Scotland						3, 356	1, 258			256, 185
Total	140	22	195	68, 029	18, 717	235, 324	111, 109	677, 331	83, 441	3, 686, 837
North America:										
Canada—										
Nova Scotia and New Brunswick	3, 862, 162	543, 830	180, 177	87, 601	10, 306	104, 436	25, 073	50		2, 058, 543
Quebec, Ontario	35, 560	5, 122	429	45	23	542	233			173, 339
British Columbia						629	154			107, 125
Newfoundland and Labrador	720	75				55, 353	14, 885			136, 305
Miquelon, Langley						12, 417	2, 832			117, 255
Mexico			2, 825	530	104			28, 572		33, 947
Central America—										
Costa Rica								1, 214		1, 214
Honduras								172	5	268
Nicaragua								1, 605		1, 714
British Honduras									82	82
Bermuda								60		60
West Indies—										
British			2, 217					3, 769	140, 149	146, 135
Danish								4, 716		4, 716
Dutch			85							85
French								100		100
Spanish, Cuba			850	1, 664	82				35, 541	42, 466
Puerto Rico								411		411
Haiti								1, 712		1, 712
Santo Domingo								2, 328		2, 328
Total	3, 898, 442	549, 027	186, 583	89, 840	10, 515	173, 377	43, 177	44, 709	175, 777	2, 827, 805
South America:										
Brazil				9, 664	1, 266			19		1, 285
Colombia								44, 822		44, 918
Venezuela			75	33, 437	5, 912	10	7			5, 994
Total			75	43, 101	7, 178	10	7	44, 841		52, 197
Asia and Oceanica:										
China			13, 325			4, 668	607	19		38, 156
East Indies, British								6, 136		6, 136
Dutch								167		167
Hongkong			3, 483					458		11, 231
Japan			370			156, 456	24, 656	3, 384	148	28, 794
Russia										396
Turkey								5, 921	80	6, 001
British Australasia								3, 311		3, 311
French Oceanica								224, 757		224, 757
Philippine Islands								479		479
Hawaiian Islands								39		39
Total			17, 178			161, 124	25, 263	244, 671	228	319, 467
Africa, French								100		355
All other islands and ports								1, 729		1, 746
Grand total	3, 898, 582	549, 049	204, 031	200, 970	36, 410	569, 835	179, 556	1, 013, 381	259, 446	6, 888, 407

Import duties from 1789 to 1894.—Excepting a period of 23 years of reciprocity treaties (from September 11, 1854, to March 17, 1866, and from July 1, 1873, to June 30, 1885), when free trade in fishery products existed between the United States and the British North American Provinces, the principal products of the American fisheries have been protected by moderately heavy duties imposed on foreign importations.

The first customs act of the United States Congress (1st Cong., 1st sess., Ch. II) provided a duty of 50 cents per quintal on dried or cured fish, 75 cents per barrel on pickled fish, and 5 per cent on all other fishery products imported. In 1804 the rate on pickled fish was changed to 40 cents to $1 per barrel according to varieties, and in 1812 all duties on imported fishery products were doubled. Most of these duties were affected by the Clay compromise act of 1833. The developing trade in sardines, canned fish, etc., resulted in imposing a duty of 20 per cent ad valorem on those products in 1842 and fresh fish intended for immediate consumption were admitted free of duty. The Walker tariff act of 1846 made a uniform duty rate of 20 per cent ad valorem, except that 30 per cent was required on salted salmon and 40 per cent on sardines and canned fish. Since then these rates have been modified from time to time, the duties have been changed from ad valorem to specific and vice versa, and certain minor articles have been placed on the free list. The rates of duty collected on the various imported fishery products from the origin of the United States Government to the present time are shown in the following compilation:

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*

Designation.	First Congress, first session, Ch. II, July 4, 1789, taking effect Aug. 1, 1789.	Eighth Congress, first session, Ch. LXVII, March 27, 1804, taking effect July 1, 1804.	Twelfth Congress, first session, Ch. CXII, July 1, 1812, taking effect July 1, 1812.	Fourteenth Congress, first session, Ch. CVII, April 27 1816, taking effect July 1, 1816.	Twenty-seventh Congress, second session, Ch. CCLXX, Aug. 30, 1842, taking effect Aug. 30, 1842.
Fresh fish, for daily consumption.					Free.
Dried or smoked fish, all kinds.	50 c. per quintal.	50 c. per quintal.	$1 per quintal.	$1 per quintal	$1 per quintal.
Pickled or brine-salted fish:					
Herring	75 c. per bbl.	40 c. per bbl.	80 c. per bbl.	$1 per bbl.	$1.50 per bbl.
Mackerel		60 c. per bbl.	$1.20 per bbl.	$1.50 per bbl.	$1.50 per bbl.
Salmon		$1 per bbl.	$2 per bbl.	$2 per bbl.	$2 per bbl.
All other—					
In barrels		40 c. per bbl.	80 c. per bbl.	$1 per bbl.	$1 per bbl.
Not in barrels					20 per cent.
Canned fish:					
Sardines					20 per cent.
Other canned fish					20 per cent.
Miscellaneous:					
Ambergris					20 per cent.
Coral					20 per cent.
Fish glue					20 per cent.
Oil—					
Cod liver				15 c. per gall.	15 c. per gall.
Sperm				25 c. per gall.	25 c. per gall.
Fish, seal, and whale.				15 c. per gall.	15 c. per gall.
Sounds or isinglass.					20 per cent.
Spermaceti	6 c. per lb	6 c. per lb	12 c. per lb	6 per cent.	8 per cent.
Sponges					20 per cent.
Whalebone					12½ per cent.
Unenumerated	5 per cent.	15 per cent.	30 per cent.	15 per cent.	20 per cent.

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*—Cont'd.

Designation.	Twenty-ninth Congress, first session, Ch. LXXIV, July 30, 1846, taking effect Dec. 1, 1846.	Thirty-fourth Congress, third session, Ch. XCVIII, Mar. 3, 1857, taking effect July 1, 1857.	Thirty-sixth Congress, second session, Ch. LXVIII, Mar. 2, 1861, taking effect Apr. 1, 1861.	Thirty-seventh Congress, second session, Ch. CLXIII. July 14, 1862, taking effect Aug. 1, 1862.	Thirty-eighth Congress, first session, Ch. CLXXI, June 30, 1864, taking effect July 1, 1864.
Fresh fish:					
Herring					
Salmon	20 per cent	15 per cent	½ c. per lb	½ c. per lb	½ c. per lb.
All other					
For immediate consumption.		15 per cent	Free	Free	Free.
Dried or smoked:					
Cod, hake, etc					
Herring	20 per cent	15 per cent	½ c. per lb	½ c. per lb	½ c. per lb.
All other (n. o. p.)					
Salmon	30 per cent	24 per cent	30 per cent	30 per cent	30 per cent.
Pickled fish:					
Herring			$1 per bbl	$1 per bbl	$1 per bbl.
Mackerel			$2 per bbl	$2 per bbl	$2 per bbl.
Salmon	20 per cent	15 per cent	$3 per bbl	$3 per bbl	$3 per bbl.
All other—					
In barrels			$1.50 per bbl	$1.50 per bbl	$1.50 per bbl.
Not in barrels			½ c. per lb	½ c. per lb	½ c. per lb.
Canned fish:					
Sardines	40 per cent	30 per cent	30 per cent	30 per cent	50 per cent.
Other fish in oil	40 per cent	30 per cent	30 per cent	30 per cent	30 per cent.
All other canned fish.	40 per cent	30 per cent	30 per cent	35 per cent	35 per cent.
Shellfish					Free.
Miscellaneous products:					
Ambergris	20 per cent	4 per cent	Free	Free	Free.
Cuttlefish bone	20 per cent	15 per cent		5 c. per lb	5 c. per lb.
Oil, fish and whale	20 per cent	15 per cent	20 per cent	20 per cent	20 per cent.
Seal		4 per cent	10 per cent	10 per cent	10 per cent.
Seaweed (dulse)					$5 per ton and 15 per cent.
Shells, unmanufactured.	5 per cent	4 per cent	Free	Free	Free.
Manufactures of.	30 per cent	24 per cent	30 per cent	35 per cent	35 per cent.
Skins, fish and shark.	20 per cent	15 per cent	20 per cent	20 per cent	20 per cent.
Sounds or isinglass	20 per cent	15 per cent	20 per cent	30 per cent	30 per cent.
Spermaceti	20 per cent	15 per cent	8 c. per lb	8 c. per lb	8 c. per lb.
Sponges	20 per cent	8 per cent	10 per cent	20 per cent	20 per cent.
Whalebone—					
Unmanufactured	20 per cent	15 per cent	20 per cent	20 per cent	20 per cent.
Manufactures of.			30 per cent	35 per cent	35 per cent.
Unenumerated—					
Crude	20 per cent	15 per cent	10 per cent	10 per cent	10 per cent.
Manufactured			20 per cent	20 per cent	20 per cent.

Designation.	Forty-second Congress, second session, Ch. CCCXV, June 6, 1872, taking effect Aug. 1, 1872.	Forty-third Congress, second session, Ch. XXXVI, Feb. 8, 1875, taking effect Feb. 8, 1875.	Forty-seventh Congress, second session, Ch. CXXI, Mar. 3, 1883, taking effect Mar. 4, 1883.	Fifty-first Congress, second session, Ch. MCCXLIV, Oct. 1, 1890, taking effect Oct. 6, 1890.	Fifty-third Congress, second session, Ch. CCCXLIX, Aug. 27, 1894, taking effect Aug. 27, 1894.
Fresh fish:					
Herring		½ c. per lb	½ c. per lb	¼ c. per lb	½ c. per lb.
Salmon	½ c. per lb	35 per cent	25 per cent	¾ c. per lb	½ c. per lb.
All other		½ c. per lb	½ c. per lb	¾ c. per lb	½ c. per lb.
For immediate consumption.	Free	Free	Free		
Frozen or packed in ice.					Free. *a*
Dried or smoked:					
Cod, hake, etc					
Herring	½ c. per lb	½ c. per lb	½ c. per lb	¾ c. per lb	¾ c. per lb.
All other (n. o. p)					
Salmon	30 per cent	30 per cent	25 per cent	1 c. per lb	¾ c. per lb.

a Other than herring or salt-water fish, which are classed with "all other." The Treasury Department has held that fish, fresh, whether caught in fresh or salt water, if imported otherwise than "frozen or packed in ice" are dutiable at the rate of ten per cent ad valorem, under section 3 of the act of 1894, as an unenumerated unmanufactured article.

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*—Cont'd.

Designation.	Forty-second Congress, second session, Ch. CCCXV, June 6, 1872, taking effect Aug. 1, 1872.	Forty-third Congress, second session, Ch. XXXVI, Feb. 8, 1875, taking effect Feb. 8, 1875.	Forty-seventh Congress, second session, Ch. CXXI, Mar. 3, 1883, taking effect Mar. 4, 1883.	Fifty-first Congress, second session Ch. MCCXLIV, Oct. 1, 1890, taking effect Oct. 6, 1890.	Fifty-third Congress, second session, Ch. CCCXLIX, Aug. 27, 1894, taking effect Aug. 27, 1894.
Pickled fish:					
Herring	$1 per bbl	$1 per bbl	½ c. per lb	$1 per bbl	½ c. per lb.
Mackerel	$2 per bbl	$2 per bbl	1 c. per lb	$2 per bbl	¾ c. per lb.
Salmon	$3 per bbl	$3 per bbl	1 c. per lb	1 c. per lb	¾ c. per lb.
All other—					
In barrels	$1.50 per bbl	$1.50 per bbl	1 c. per lb	$2 per bbl	¾ c. per lb.
Not in barrels	½ c. per lb	½ c. per lb	½ c. per lb	¾ c. per lb	¾ c. per lb.
Canned fish:					
Sardines in tin boxes—					
Not over 5 by 4 by 3½ inches.		15 c. per box	10 c. per box	10 c. per box	10 c. per box.
Not over 5 by 4 by 1⅝ inches.		7½ c. per box	5 c. per box	5 c. per box	5 c. per box.
Not over 4¾ by 3½ by 1¼ inches.	50 per cent	4 c. per box	2½ c. per box	2½ c. per box	2½ c. per box.
In any other form.		60 per cent	40 per cent	40 per cent	40 per cent.
Other fish in oil	30 per cent	30 per cent	30 per cent	30 per cent	20 per cent.
All other canned fish.	35 per cent	35 per cent	25 per cent	30 per cent	20 per cent.
Fish for bait	Free	Free	Free	Free	Free.
Shrimp and other shellfish.	Free	Free	Free	Free	Free.
Miscellaneous products:					
Ambergris	Free	Free	Free	Free	Free.
Ambergris oil	Free	Free	Free	Free	Free.
Coral—					
Not cut	Free	Free	Free	Free	Free.
Cut or manufactured.	30 per cent	30 per cent	25 per cent	25 per cent	25 per cent.
Cuttlefish bone	Free	Free	Free	Free	Free.
Oil—					
Cod liver				15 c. per gall	20 per cent.
Sperm	20 per cent	20 per cent	25 per cent	8 c. per gall	25 per cent.
Fish, seal, and whale.				8 c. per gall	25 per cent.
Seaweed (dulse)	Free	Free	Free	Free	Free.
Shells—					
Not cut or ground.	Free	Free	Free	Free	Free.
Manufactured	Free	35 per cent	25 per cent	Free	Free.
Pearl—					
Not cut	35 per cent	Free	Free	Free	Free.
Manufactures of.	35 per cent	Free	25 per cent	40 per cent	30 per cent.
Skins, fish and shark.	20 per cent	20 per cent	Free	Free	Free.
Sounds, or bladders—					
Crude	Free	Free	Free	Free	Free.
Prepared (isinglass).	Free	Free	25 per cent	1½ c. per lb., or 25 to 30 p. ct.	25 per cent.
Spermaceti	8 per cent				
Sponges	20 per cent	20 per cent	20 per cent	20 per cent	10 per cent.
Whalebone—					
Unmanufactured	Free	Free	Free	Free	Free.
Manufactures of.	35 per cent	35 per cent	30 per cent	30 per cent	25 per cent.

NOTE.—When no rates are affixed to articles in any column they are not enumerated in the respective enactments, and consequently must be regarded as "unenumerated" and subject to the duty levied thereon. But in some cases they are classed with enumerated articles of similar character.

The effect of the tariff regulations from 1869 to 1894, inclusive, appears in Table 16, showing the value of each principal class of fishery products imported for consumption and the amount of duty paid thereon during each of those years. For convenience of comparison, the total value of all imports for consumption into the United States, the amount of duties collected, exclusive of additional and discriminating duties, and the average ad valorem rate during each year is shown in the last three columns of this table.

16. *Classified statement of the values of fishery products imported for consumption and the amount of duties paid thereon during each year from 1869 to 1894, inclusive, and comparison with the total imports for consumption into the United States.*

Year ending June 30—	Fish and shellfish.		Marine oils.		Marine shells.		Sponges.		Sounds, isinglass, etc.	
	Values.	Duties.	Values.	Duties.	Values.	Duties.	Values.	Duties.	Values.	Duties.
1869	$1,869,350	$561,590	$426,874	$61,081	$1,826	$177	$74,731	$14,946	$8,719	$2,512
1870	2,179,745	727,976	369,167	48,640	8,441	2,214	93,952	18,790	8,089	2,128
1871	2,071,093	660,225	204,228	30,978	22,244	4,114	113,127	22,625	6,542	1,953
1872	1,833,205	547,547	158,504	31,701	188,283	8,040	153,443	30,689	28,437	8,328
1873	2,532,736	772,545	119,788	23,997	136,138	1,745	189,986	37,997	123,750	153
1874	3,111,739	499,253	163,046	14,221	129,887	1,074	121,798	24,360	96,244	....
1875	3,078,097	348,698	185,404	4,752	125,649	2	110,440	22,088	52,401	....
1876	2,585,773	353,587	151,249	9,928	257,241	....	87,621	17,524	42,322	....
1877	2,344,167	375,917	119,340	5,350	172,251	....	88,798	17,760	32,236	....
1878	2,975,458	337,473	211,847	7,093	187,507	....	90,127	18,025	104,552	....
1879	2,832,303	439,413	125,547	8,738	231,743	....	130,515	26,103	202,765	....
1880	3,187,360	601,089	223,139	10,509	294,730	....	183,690	36,738	198,025	....
1881	3,621,324	469,353	361,956	13,664	288,154	....	229,292	45,858	243,239	....
1882	3,783,228	414,916	270,250	17,508	239,231	....	293,621	58,724	169,148	....
1883	4,595,898	357,979	280,575	15,384	296,254	....	270,462	54,092	189,575	....
1884	5,322,348	352,177	373,773	32,508	258,639	3,967	241,874	48,375	129,224	9,078
1885	4,825,935	281,972	209,845	22,420	164,080	2,820	235,519	46,104	166,305	11,276
1886	3,251,878	502,288	88,811	22,203	245,848	5,663	296,963	59,393	181,784	9,283
1887	3,915,914	611,938	85,839	21,461	228,799	3,979	302,510	60,502	185,662	15,403
1888	4,451,092	645,507	92,515	23,128	178,839	4,619	268,651	53,730	176,843	8,864
1889	4,557,841	595,944	105,938	26,485	279,763	2,875	277,373	55,475	112,302	4,669
1890	4,925,351	674,642	95,947	23,987	340,654	8,652	352,885	70,577	63,186	3,162
1891	5,724,202	893,967	113,775	33,300	638,576	40,937	381,879	76,376	112,106	5,006
1892	5,002,433	880,385	151,000	40,603	1,116,536	78,041	331,241	66,248	76,093	4,079
1893	5,342,825	922,243	285,593	87,099	1,621,681	113,537	365,249	73,050	74,198	4,743
1894	4,782,082	795,488	184,510	61,810	1,037,152	151,353	217,456	43,491	42,309	1,736
Total	94,703,377	14,624,112	5,158,460	698,548	8,690,146	433,809	5,503,203	1,099,640	2,826,056	92,373

Year ending June 30—	All other fishery products.		Total fishery products.			All imports for consumption.		
	Values.	Duties.	Values.	Duties.	Average ad valorem rate of duty.	Values.	Duties. *a*	Average ad valorem rate of duty.
					Per cent.			*Per cent.*
1869	$29,809	$7,772	$2,411,309	$648,078	26.45	$394,449,174	$176,114,904	44.65
1870	26,129	6,796	2,685,523	806,544	30.03	426,346,010	191,221,769	42.23
1871	44,042	12,330	2,461,276	732,225	29.75	500,216,122	201,985,575	38.94
1872	72,098	19,798	2,433,970	646,103	26.55	560,419,034	212,030,727	37.00
1873	73,882	19,922	3,176,280	856,359	26.96	663,146,657	184,556,045	26.95
1874	43,587	9,557	3,666,301	548,465	14.96	567,443,527	160,185,383	26.88
1875	45,697	10,875	3,597,688	386,415	10.46	526,260,576	154,271,805	28.20
1876	53,103	10,793	3,177,309	391,832	12.33	464,586,307	144,982,442	30.19
1877	40,198	9,963	2,796,990	408,990	14.62	439,829,389	128,223,207	26.68
1878	22,588	5,524	3,592,079	368,115	10.25	438,422,468	127,015,185	27.13
1879	23,403	4,702	3,546,276	478,956	13.50	439,292,374	133,159,025	28.97
1880	28,510	3,121	4,115,454	651,457	13.39	627,555,271	182,415,162	29.07
1881	15,168	1,708	4,759,133	530,583	11.15	650,619,000	193,561,011	29.75
1882	16,393	1,623	4,771,871	492,771	10.33	716,213,948	215,617,669	30.11
1883	14,886	2,656	5,647,650	430,111	7.62	700,829,673	209,659,699	29.92
1884	35,857	271	6,361,715	446,376	7.02	667,575,389	189,844,995	28.44
1885	45,439	1,355	5,647,123	365,947	6.49	579,580,054	177,319,550	30.59
1886	19,435	1,151	4,084,719	599,981	14.68	625,308,814	188,379,397	30.13
1887	13,995	464	4,732,719	713,747	15.09	683,418,981	212,032,424	31.03
1888	15,670	817	5,183,610	736,665	14.21	712,248,626	213,509,802	29.98
1889	31,128	151	5,364,345	685,599	12.78	741,431,398	218,701,774	29.50
1890	33,537	11	5,811,560	781,031	13.44	773,674,812	225,317,076	29.12
1891	9,497	402	6,980,035	1,049,988	15.04	854,519,577	215,790,686	25.25
1892	10,143	1,746	6,687,446	1,071,102	16.00	813,601,345	173,097,671	21.26
1893	18,643	2,764	7,708,189	1,203,436	15.61	844,454,583	198,373,453	23.49
1894	13,394	1,731	6,276,903	1,055,609	16.82	636,614,420	128,881,869	20.25
Total	796,231	138,003	117,677,473	17,086,485	....	16,048,057,529	4,757,248,305	....

a Exclusive of additional and discriminating duties.

Reciprocity treaties of 1854 and 1873.—The principal imports of fishery products are from the British North American Provinces, and between those Provinces and the United States there have been two treaties permitting the free interchange of fishery products. The first was in force from September 11, 1854, to March 17, 1866; and the second, known as the Washington treaty, from July 1, 1873, to June 30, 1885. Information is not available to show the quantity of fish imported for consumption[1] from the Provinces during the continuance of the first treaty, nor the amount of duties thereby released, but during a period of 13 years preceding and following that treaty the duties collected on imports from the provinces amounted to $3,016,091, an average of $232,007 per annum. On the same basis the amount of duties released by that treaty was nearly $3,000,000, but it was actually much in excess of that amount. The following compilation shows the estimated amount of duties remitted by the second reciprocity treaty with the British North American Provinces:

17. *Statement of the value of fishery products imported for consumption free of duty under the second reciprocity treaty with the British North American Provinces and the estimated amount of duty remitted.*

Year ending June 30—	Fishery products imported for consumption.	Estimated duties remitted.
1874	$1,587,234	$392,882
1875	1,847,684	477,042
1876	1,555,861	363,564
1877	1,118,109	260,016
1878	1,859,772	431,564
1879	1,539,073	411,275
1880	1,557,667	475,688
1881	2,179,863	597,961
1882	1,148,725	937,088
1883	2,735,604	553,571
1884	3,147,716	635,528
1885	2,706,831	689,602
Total	22,984,139	6,225,781

Customs law of August 27, 1894.—The tariff enactment of 1894 made several modifications in the rates of duty exacted on fishery products by the customs law of 1890. The paragraphs relating to fishery products are set forth in the following comparative form, the first column containing the provisions in the law now operative and the second representing the rates of duty required by the law of 1890:

1894.	1890.
19. Gelatin, glue, isinglass or fish glue, and prepared fish bladders or fish sounds, 25 per cent ad valorem.	27. Gelatin, glue, and isinglass or fish glue, valued at not above 7 cents per per pound, 1½ cents per pound; valued at above 7 cents per pound and not above 30 cents per pound, 25 per cent ad valorem; valued at above 30 cents per pound, 30 per cent ad valorem.
28. Cod-liver oil, 20 per cent ad valorem.	38. Cod-liver oil, 15 cents per gallon.
34. Seal, herring, whale, and other fish oil not specially provided for in this act, 25 per cent ad valorem.	46. Seal, herring, whale, and other fish oil not specially provided for in this act, 8 cents per gallon.
69. Sponges, sea moss or Iceland moss, 10 per cent ad valorem.	86. Sponges, 20 per cent ad valorem.

[1] A classified statement of the imports (but not imports for consumption) from the British Provinces during the continuation of the reciprocity treaty from September 11, 1854, to March 17, 1866, is given in Table 6, on page 443.

1894—Continued.

208. Anchovies and sardines, packed in oil or otherwise, in tin boxes measuring not more than 5 inches long, 4 inches wide, and $3\frac{1}{2}$ inches deep, 10 cents per whole box; in half boxes, measuring not more than 5 inches long, 4 inches wide, and $1\frac{5}{8}$ inches deep, 5 cents each; in quarter boxes, measuring not more than $4\frac{3}{4}$ inches long, $3\frac{1}{2}$ inches wide, and $1\frac{1}{4}$ inches deep, $2\frac{1}{2}$ cents each; when imported in any other form, 40 per cent ad valorem.

209. Fish, smoked, dried, salted, pickled, or otherwise prepared for preservation, three-fourths of 1 cent per pound.

210. Herrings, pickled, frozen, or salted, and salt-water fish frozen or packed in ice, one-half of 1 cent per pound.

211. Fish in cans or packages made of tin or other material, except anchovies and sardines, and fish packed in any other manner, not specially enumerated or provided for in this act, 20 per cent ad valorem.

(Not provided for in tariff act of 1894.)

337. Pearls, including pearls strung but not set, 10 per cent ad valorem.

351. Manufactures of * * * bladders (3), coral (4), * * * or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 25 per cent ad valorem.

352. Manufactures of * * * whalebone, * * * 25 per cent ad valorem.

354. Manufactures of * * * mother-of-pearl, gelatin, and shell, or of which these substances or either of them is the component material of chief value, not specially provided for in this act, * * * 35 per cent ad valorem.

1890—Continued.

291. Anchovies and sardines, packed in oil or otherwise, in tin boxes measuring not more than 5 inches long, 4 inches wide, and $3\frac{1}{2}$ inches deep, 10 cents per whole box; in half boxes, measuring not more than 5 inches long, 4 inches wide, and $1\frac{5}{8}$ inches deep, 5 cents each; in quarter boxes, measuring not more than $4\frac{3}{4}$ inches long, $3\frac{1}{2}$ inches wide, and $1\frac{1}{4}$ inches deep, $2\frac{1}{2}$ cents each; when imported in any other form, 40 per cent ad valorem.

292. Fish, packed in barrels or half barrels, and mackerel or salmon, pickled or salted, 1 cent per pound.

293. Fish, smoked, dried, salted, pickled, frozen, packed in ice, or otherwise prepared for preservation, and fresh fish, not specially provided for in this act, three-fourths of 1 cent per pound.

294. Herrings, pickled or salted, one-half of 1 cent per pound; herrings, fresh, one-fourth of 1 cent per pound.

295. Fish in cans or packages made of tin or other material, except anchovies and sardines, and fish packed in any other manner, not specially enumerated or provided for in this act, 30 per cent ad valorem.

296. Cans or packages made of tin or other metal containing shellfish admitted free of duty, not exceeding one quart in contents, (1) shall be subject to a duty of 8 cents per dozen cans or packages, and when exceeding one quart (2) shall be subject to an additional duty of 4 cents per dozen for each additional half quart or fractional part thereof: *Provided*, That until June 30, 1891, such cans or packages shall be admitted as now provided by law.

453. Pearls, 10 per cent ad valorem.

459. Manufactures of * * * bladders, coral, * * * or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 25 per cent ad valorem.

460. Manufactures of * * * whalebone, * * * 30 per cent ad valorem.

462. Manufactures of * * * mother-of-pearl and shell, or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 40 per cent ad valorem.

The following articles were exempted from duty:

370. Ambergris.

403. Bladders, and all integuments of animals, and fish sounds or bladders, crude, salted for preservation, and unmanufactured, not specially provided for in this act.

456. Coral, marine, uncut, and unmanufactured.

465. Cuttlefish bone.

471. Eggs of birds, fish, and insects. * * *

481. Fish, frozen, or packed in ice, fresh.

482. Fish for bait.

483. Fish skins.

524. Kelp.

558. Moss, seaweeds, and vegetable substances, crude and unmanufactured, not otherwise specially provided for in this act.

568. Oils, * * * ambergris, * * * and also spermaceti; whale and other fish oils of American fisheries, and all fish and other products of such fisheries. * * *

580. Pearl, mother of, not sawed or cut, or otherwise manufactured.

613. Shells of all kinds, not cut, ground, or otherwise manufactured.

615. Shrimps and other shellfish, canned or otherwise.

661. Turtles.

671. Whalebone, unmanufactured.

480. Ambergris.

507. Bladders, including fish bladders or fish sounds, crude, and all integuments of animals, not specially provided for in this act.

457. Coral, marine, uncut, and unmanufactured.

555. Cuttlefish bone.

561. Eggs of birds, fish, and insects.

571. Fish, the product of American fisheries, and fresh or frozen fish (except salmon) caught in fresh waters by American vessels, or with nets or other devices owned by citizens of the United States.

572. Fish for bait.

573. Fish skins.

623. Kelp.

653. Moss, seaweeds, and vegetable substances, crude or unmanufactured, not otherwise specially provided for in this act.

661. Oils, * * * ambergris, * * * and also spermaceti; whale and other fish oils of American fisheries, and all other articles the product of such fisheries.

673. Pearl, mother of, not sawed, cut, polished, or otherwise manufactured.

701. Shells of all kinds, not cut, or otherwise manufactured.

703. Shrimps and other shellfish.

744. Turtles.

753. Whalebone, unmanufactured.

Import duties in foreign countries.—The rates of duty imposed on fishery products imported for consumption in the United States do not greatly differ from the average in other countries. Of European countries, the average rates of duty in Austria, France, Greece, Russia, Spain, and Switzerland are somewhat higher, while the average in Denmark, Germany, Italy, Netherlands, Portugal, and Sweden is generally less. There are no duties on fishery products imported into Great Britain, and most articles are admitted free into Belgium. On the American continent, the specific rates of duty in Haiti, Santo Domingo, Cuba, Puerto Rico, Mexico, Nicaragua, Salvador, Argentina, Bolivia, Brazil, Chile, Colombia, Uruguay, and Venezuela average greater than in the United States, while the duties are less in Canada, the Bahamas, Barbados, Jamaica, Leeward Islands, Windward Islands, Dutch West Indies, French West Indies, British Honduras, Ecuador, British Guiana, and Peru. In Australia the specific duties are greater than on similar products in the United States, but the ad valorem duties are much less, averaging only about 12 per cent. In French Oceanica, China, Korea, Siam, Japan, Ceylon, and British New Guinea the import duties are very much less than in the United States.

Table 18 shows approximately the rates of duty imposed on the principal fishery products imported into certain foreign countries, and is arranged so as to compare readily with the present rates of duty on similar products imported into the United States. The comparative rates of duty imposed in each foreign country on each of the principal fishery products are shown in succeeding tables.

18. *Comparative statement showing approximately the rates of duty imposed on fishery products imported into certain countries.*

Item.	Austria-Hungary.	France.	Germany.	Italy.	Canada.
Fish:	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	
Fresh	$0.29	$0.435	Free.	Free.	25 per cent ad val.
Dried or salted—					
Cod	.72	4.20	$0.32	$0.437	$0.50 per 100 lbs.*a*
Herring	.433	1.32			
Other dried fish	.72	2.19			
Pickled—					
Herring	2.17	2.19	.32 1.297	.525	.50 per 100 lbs.
Mackerel					1.00 per 100 lbs.
Salmon					Do.
Cod and other pickled fish.					.50 per 100 lbs.
Sardines—					
Whole boxes	5.80	2.19	6.486	2.626	.05 per box.
Half boxes					.025 per box.
Quarter boxes					.02 per box.
Other					30 per cent ad val.
Other canned fish.	5.80	2.19	6.486	2.626	25 per cent ad val.
Oil:					
Cod-liver	....	.526	....	1.31	20 per cent ad val.
Fish	....		....	.525	
Seal, whale, etc.	....	.439-1.317	....	1.31	
Fish glue	.871	3.50	....	1.31	$3 per 100 lbs.
Fish sounds	....	Free.	....	....	20 per cent ad val.
Spermaceti	.58	$0.439	....	....	Do.
Whalebone	.72	Free and $8.75	....	....	Free.

a Smoked, $1.

18. *Comparative statement showing approximately the rates of duty imposed on fishery products imported into certain countries*—Continued.

Item.	Haiti.	Jamaica.	Brazil.	British Guiana.	Cuba.	Santo Domingo.
Fish:	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*
Fresh	....	Free.	$1.00	Free.	Free.	....
Dried or salted—						
Cod	$1.35	$0.74				
Herring	.72	*a* .74	1.00	$0.44	$0.76	$0.85
Other dried fish	....	*b* .74				
Pickled—						
Herring		.304		.125		1.27
Mackerel				.50	.76	*c* No. 1, 1.90
Salmon	.72	.49	1.00		1.197	3.39
Cod and other pickled fish.				.125	.76	....
Sardines—	*Per box.*					
Whole boxes	$0.10					
Half boxes	.06	8 per cent ad val.	11.88	1.00	5.04	9.50
Quarter boxes	.04					
Other canned fish	9.65	do	11.88	*d* 1.00	....	....
Oil:						
Cod-liver	....		15.84		....	....
Fish	....	$0.18 per gall.	3.70	25c. per gal.	2.184	1.27
Seal, whale, etc	....		3.70		1.89	1.58
	Per 100 lbs.					
Fish glue	$4.82	....	....	....	....	....
Spermaceti	33.77	....	9.90	....	....	7.07
Whalebone	....	....	6.44	....	63.00	7.92

Item.	Costa Rica.	Argentina.	Chile.	Colombia.	Venezuela.	United States.
Fish:	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*	*Per 100 lbs.*
Fresh	$1.54	Free.	....	$1.10	....	$0.50
Dried or salted—						
Cod			$1.72	....		
Herring	1.54	$3.92			$2.20	.75
Other dried fish			2.17	....		
Pickled—						
Herring			1.72	1.10		.50
Mackerel						
Salmon	1.54	4.20	2.40		2.20	.75
Cod and other pickled fish.			1.72			
Sardines—						*Per box.*
Whole boxes	....		....	....	....	$0.10
Half boxes	....		....	....	....	.05
Quarter boxes	....	13.13	5.10	4.41	2.20	.025
Other	....	....	....	....	....	40 per cent ad val.
Other canned fish	....	....	2.40	4.41	6.57	20 per cent ad val.
Oil:	2.42	.14				
Cod-liver	....	2.19	....	....	10.94	20 per cent ad val.
Fish	....	....	....	....	6.57	
Seal, whale, etc	....	....	1.35	....	....	25 p. ct. ad val.
Fish glue	2.42	43.77	2.57	4.41	....	
Fish sounds	....	....	....	....	....	Free.
Spermaceti	1.54	8.75	8.30	4.41	6.57	25 per cent ad val.
Whalebone	11.90	....	4.55	....	....	Free.

a Smoked, $0.50.
b Smoked, $1.
c No. 2, $1.58 per 100 lbs.; No. 3, $1.27 per 100 lbs.
d Salmon and oysters free.

III.—THE EXPORT TRADE.

Exports from 1790 to 1820.—The products of the fisheries comprised a large portion of the early exports from the United States. At the close of the last century the value exceeded $2,000,000 annually, consisting almost entirely of products of the cod and whale fisheries, the former being from 5 to 10 times as valuable as the latter. The extent of the exports from 1790 to 1820, inclusive, is set forth in Table 19, compiled from the American State Papers and from Pitkin's Statistics. The value of the exports from 1792 to 1802, inclusive, is not definitely known, and for the years from 1803 to 1816, inclusive, the values of sperm oil and spermaceti are aggregated, as also are those of whale oil and whalebone.

19. *Statement of the exports of fishery products from the United States during each year from 1790 to 1820, inclusive.*

Year ending September 30—	Fish.					Marine oils.	
	Dried or smoked.		Pickled or brine-salted.			Sperm.	
	Quintals.	Values.	Barrels.	Kegs.	Values.	Gallons.	Values.
1790	378,721	$828,531	36,804	....	$113,165	*a*5,431	$79,542
1791	383,237	958,093	57,424	....	172,272	134,595	53,838
1792	364,898	(*b*)	48,277	....	(*b*)	63,383	(*b*)
1793	372,825	(*b*)	45,440	....	(*b*)	140,056	(*b*)
1794	436,554	(*b*)	36,930	....	(*b*)	82,493	(*b*)
1795	400,818	(*b*)	55,999	....	(*b*)	80,856	(*b*)
1796	377,713	(*b*)	84,558	5,256	(*b*)	164,045	(*b*)
1797	406,016	(*b*)	69,782	7,351	(*b*)	27,556	(*b*)
1798	411,075	(*b*)	66,827	6,220	(*b*)	128,758	(*b*)
1799	428,495	(*b*)	63,543	15,993	(*b*)	114,264	(*b*)
1800	392,726	(*b*)	50,388	12,403	(*b*)	221,762	(*b*)
1801	410,948	(*b*)	85,935	10,424	(*b*)	91,684	(*b*)
1802	440,954	(*b*)	75,819	13,229	(*b*)	28,470	(*b*)
1803	461,870	1,620,000	76,831	11,565	560,000	46,984	(*c*)
1804	567,825	2,400,000	89,442	13,045	640,000	5,550	(*c*)
1805	514,549	2,058,000	56,770	7,207	348,000	72,624	(*c*)
1806	537,457	2,150,000	64,615	10,155	366,000	42,785	(*c*)
1807	473,924	1,896,000	57,621	13,743	302,000	44,339	(*c*)
1808	155,808	623,000	18,957	3,036	98,000	612	(*c*)
1809	345,648	1,123,000	54,577	9,380	282,000	51,071	(*c*)
1810	280,804	913,000	34,674	5,964	214,000	63,910	(*c*)
1811	216,387	757,000	44,716	9,398	305,000	136,249	(*c*)
1812	169,019	592,000	23,609	3,143	146,000	63,216	(*c*)
1813	60,022	210,000	13,333	568	81,000	....	(*c*)
1814	31,310	128,000	8,436	87	50,000	....	(*c*)
1815	102,824	494,000	36,141	3,062	218,000	8,618	(*c*)
1816	217,892	935,000	37,979	6,983	221,000	2,756	(*c*)
1817	267,514	1,003,178	44,426	15,551	324,872	11,300	11,300
1818	308,717	1,080,510	55,119	7,100	317,355	208,467	156,350
1819	280,555	1,052,081	66,563	6,746	409,497	75,360	55,520
1820	321,419	964,257	87,916	7,309	538,433	9,307	6,980
Total	10,518,524	....	1,649,451	204,918	....	2,121,070 *a*5,431	....

a Barrels. *b* Not separately reported. *c* Included with whale and fish oil.

19. *Statement of the exports of fishery products from the United States during each year from 1790 to 1820, inclusive*—Continued.

Year ending September 30—	Marine oils (continued). Whale and fish.		Spermaceti.		Whalebone.		Total.
	Gallons.	Values.	Pounds.	Values.	Pounds.	Values.	Values.
1790	*a* 15, 765	$124, 908	70, 379	$27, 724	121, 281	$20, 417	$1, 194, 287
1791	447, 323	89, 465	182, 400	54, 720	124, 829	21, 966	1, 353, 354
1792	436, 423	(*b*)	157, 520	(*b*)	154, 407	(*b*)	....
1793	512, 780	(*b*)	235, 600	(*b*)	202, 620	(*b*)	....
1794	1, 000, 208	(*b*)	214, 960	(*b*)	354, 617	(*b*)	....
1795	810, 524	(*b*)	240, 720	(*b*)	410, 664	(*b*)	....
1796	1, 176, 650	(*b*)	221, 903	(*b*)	308, 314	(*b*)	....
1797	582, 425	(*b*)	130, 438	(*b*)	452, 127	(*b*)	....
1798	700, 040	(*b*)	144, 149	(*b*)	62, 805	(*b*)	....
1799	420, 949	(*b*)	240, 301	(*b*)	89, 552	(*b*)	....
1800	204, 468	(*b*)	181, 321	(*b*)	32, 636	(*b*)	....
1801	215, 522	(*b*)	290, 666	(*b*)	23, 106	(*b*)	....
1802	379, 976	(*b*)	135, 637	(*b*)	80, 334	(*b*)	....
1803	550, 535	*c* 280, 000	238, 034	*d* 175, 000	69, 802	(*e*)	2, 635, 000
1804	646, 505	*c* 310, 000	127, 602	*d* 70, 000	134, 006	(*e*)	3, 420, 000
1805	626, 089	*c* 315, 060	180, 535	*d* 163, 000	21, 335	(*e*)	2, 884, 000
1806	826, 233	*c* 418, 000	294, 789	*d* 182, 000	50, 594	(*e*)	3, 116, 000
1807	932, 797	*c* 476, 000	172, 132	*d* 130, 000	104, 635	(*e*)	2, 804, 000
1808	198, 019	*c* 88, 000	45, 130	*d* 23, 000	8, 660	(*e*)	832, 000
1809	421, 282	*c* 169, 000	214, 444	*d* 136, 000	8, 825	(*e*)	1, 710, 000
1810	544, 734	*c* 222, 000	187, 190	*d* 132, 000	42, 843	(*e*)	1, 481, 000
1811	186, 661	*c* 78, 000	257, 094	*d* 273, 000	30, 346	(*e*)	1, 413, 000
1812	106, 369	*c* 56, 000	157, 596	*d* 141, 000	8, 128	(*e*)	935, 000
1813	4, 979	*c* 2, 500	26, 522	10, 500	....	....	304, 000
1814	837	*c* 1, 000	21, 154	9, 000	....	....	188, 000
1815	68, 921	*c* 57, 000	312, 065	*d* 143, 000	174	(*e*)	912, 000
1816	177, 810	*c* 116, 000	116, 916	59, 000	....	....	1, 331, 000
1817	460, 888	230, 444	201, 939	100, 970	3, 668	734	1, 671, 498
1818	986, 252	493, 126	305, 142	137, 314	9, 300	1, 581	2, 186, 236
1819	860, 112	430, 056	169, 919	76, 463	8, 038	804	2, 024, 421
1820	1, 262, 094	631, 047	267, 177	106, 871	25, 202	5, 040	2, 252, 628
Total	15, 748, 405 *a* 15, 765	....	5, 741, 374	....	2, 942, 848	....	....

a Barrels.
b Not separately reported.
c Includes value of sperm oil.
d Includes value of whalebone.
e Included with spermaceti.

Exports from 1821 to 1894.—Table 20, compiled from the annual reports on commerce and navigation, United States Treasury Department, shows the exports of domestic fishery products during each year from 1821 to 1894, inclusive. Prior to 1865, fresh fish were not specially enumerated, and the same is true of "canned fish and other products" prior to 1869, and of oysters prior to 1864; but the imports of those articles before the years stated were not of great extent. It appears from this table that of the $274,096,530 worth of domestic fishery products exported since 1820, $86,744,975 worth, or 31 per cent, was marine oils; $51,990,798, or 19 per cent, dried or smoked fish; 12 per cent, whalebone; 6 per cent, brine-salted fish; 5 per cent, oysters, and 4 per cent, spermaceti.

20. *Classified statement of the domestic exports of fishery products from the United States during each year from 1821 to 1894, inclusive.*

Year ending—	Fish, shellfish, etc.							Marine oils.	
	Fresh fish.	Dried or smoked fish.		Brine-salted or pickled fish.		Canned and other prepared fish.	Oysters.	Sperm oil.	
	Values.	Quintals.	Values.	Barrels.	Values.	Values.	Values.	Gallons.	Values.
Sept. 30—									
1821		267,305	$708,778	76,950	$264,813			7,250	$5,340
1822		241,228	666,730	70,026	249,108			7,610	6,060
1823		262,766	734,024	76,772	270,776			18,333	8,972
1824		310,189	873,685	74,173	263,019			23,578	10,500
1825		300,857	830,356	71,902	248,417			30,548	17,679
1826		260,803	667,742	86,877	257,180			35,528	23,517
1827		247,321	747,171	67,054	240,276			78,661	48,220
1828		265,217	819,926	64,454	246,737			297,276	190,669
1829		294,761	747,541	62,030	220,527			140,241	92,554
1830		229,796	530,690	66,953	225,987			58,814	38,618
1831		230,577	625,393	92,861	304,441			78,159	53,526
1832		250,514	749,909	103,274	306,812			48,212	38,161
1833		249,689	712,317	86,897	277,973			50,392	42,589
1834		253,132	630,384	61,931	223,290			60,935	50,048
1835		287,721	783,895	52,097	224,639			63,827	52,531
1836		210,769	746,464	48,629	221,426			155,142	119,787
1837		188,943	588,506	40,946	181,334			177,004	151,875
1838		206,028	626,245	42,034	192,758			166,805	137,809
1839		208,720	709,218	24,328	141,320			86,047	85,015
1840		211,425	541,858	42,556	179,106			434,608	430,490
1841		252,199	602,810	36,927	148,973			349,393	343,300
1842		256,083	567,782	41,416	162,324			287,761	233,114
June 30—									
1843		174,220	381,175	29,537	116,042			476,688	310,768
1844		271,610	699,836	44,168	197,179			451,317	344,930
1845		288,380	803,353	43,478	208,654			1,054,301	975,195
1846		277,401	699,559	56,588	230,495			772,019	697,570
1847		258,870	659,629	31,072	136,221			795,792	738,456
1848		206,549	609,482	22,518	109,315			206,431	208,832
1849		197,457	419,092	22,636	93,085			526,817	572,763
1850		168,600	365,349	19,483	91,445			730,743	788,794
1851		151,088	367,729	21,616	113,932			905,778	1,044,967
1852		134,732	354,127	19,622	98,883			644,765	809,274
1853		131,665	371,607	15,060	89,409			1,131,098	1,418,845
1854		131,316	389,973	25,669	162,187			847,535	1,105,907
1855		119,926	379,892	17,176	94,111			958,744	1,593,832
1856		168,971	578,011	31,309	173,939			540,784	977,005
1857		174,765	570,348	36,048	211,383			819,081	1,216,888
1858		161,269	487,007	30,892	197,441			896,923	1,097,505
1859		209,350	642,901	35,361	203,760			1,341,025	1,737,734
1860		219,628	690,088	34,119	191,634			1,335,736	1,789,089
1861		219,324	634,941	48,685	244,028			1,518,457	2,110,823
1862	$79,453	250,819	712,584	68,642	330,685			739,477	962,603
1863		228,234	921,131	75,262	429,316			1,034,794	1,569,287
1864		192,505	967,918	75,280	508,568	$29,543	$85,089	851,066	1,298,058
1865	13,890	157,472	1,107,955	56,874	632,690		126,889	700,186	1,511,323
1866	192,198	139,693	734,427	34,305	360,074		200,409	510,978	1,180,381
1867	189,281	109,114	596,586	22,591	217,494		181,271	570,894	1,482,570
1868	184,774	129,074	598,137	25,033	209,461		121,946	662,570	1,379,814
1869	65,348	88,415	398,825	24,228	213,455	272,397	89,266	717,172	1,361,388
1870	69,131	111,672	579,334	30,935	253,211	387,739	134,804	499,797	794,432
1871	39,983	119,618	592,598	29,653	226,369	470,945	168,122	539,582	692,469
1872	67,832	126,613	588,194	30,642	209,077	635,533	173,711	693,674	979,682
1873	64,577	118,076	569,151	16,747	109,201	677,171	243,723	756,306	1,095,831
1874	56,974	129,982	612,589	29,000	226,041	1,128,208	223,733	529,903	827,991
1875	69,448	129,752	710,121	51,025	359,669	1,855,550	170,277	491,130	847,014
1876	80,879	175,528	900,306	54,291	417,281	2,102,522	214,196	892,762	1,366,246
1877	114,338	159,648	791,785	76,227	486,738	2,492,405	260,620	634,991	879,865
1878	84,278	188,831	766,154	57,554	416,162	3,204,965	393,061	723,398	801,218
1879	80,437	197,130	748,747	47,764	290,862	2,951,833	453,306	812,928	719,831
1880	124,962	179,450	739,231	54,345	284,293	2,336,893	543,895	482,153	487,004
1881	97,539	212,691	840,199	52,092	264,723	2,807,963	582,249	314,568	303,113
1882	89,148	159,512	635,155	38,224	244,454	3,221,707	612,793	540,064	551,212
1883	72,875	158,445	882,830	48,551	372,385	3,223,870	629,636	275,021	290,417
1884	62,009	197,352	1,149,952	45,034	296,896	2,661,587	572,487	343,069	325,385
1885	33,350	220,505	1,079,115	60,004	310,170	2,754,665	715,619	209,846	183,499
1886	29,734	190,253	890,311	59,371	288,188	2,268,649	732,019	179,808	149,936
1887	14,751	195,736	852,212	36,070	216,619	2,148,163	733,973	157,169	119,267
1888	28,965	201,590	988,401	19,981	156,454	2,145,458	858,652	136,092	94,568
1889	27,151	178,911	941,732	20,601	136,609	4,029,572	834,171	98,832	69,628
1890	48,086	198,308	980,245	26,898	136,036	4,039,220	837,239	162,565	124,601
1891	40,084	201,082	1,076,381	35,392	196,799	2,868,249	817,108	62,552	46,866
1892	66,498	173,024	933,324	39,505	216,751	2,561,919	744,271	140,655	103,031
1893	100,656	186,434	910,145	28,105	181,412	2,933,477	625,079	115,104	61,245
1894	48,820	190,456	879,500	36,593	192,398	1,682,830	688,653	85,204	72,141
Total	2,337,449	14,777,089	51,990,798	3,382,943	17,404,920	57,893,033	13,768,267	34,274,468	44,451,467

20. *Classified statement of the domestic exports of fishery products from the United States during each year from 1821 to 1894, inclusive*—Continued.

Year ending—	Marine oils (cont'd). Whale and fish oils.		Spermaceti.		Whalebone.		All other fishery products.	Total.
	Gallons.	Values.	Pounds.	Values.	Pounds.	Values.	Values.	Values.
Sept. 30—								
1821	1,068,025	$348,991	424,952	$169,777	16,349	$1,489	....	$1,499,188
1822	990,325	311,415	399,925	151,226	25,202	5,040	....	1,389,579
1823	1,453,126	415,713	749,973	212,337	86,474	16,402	....	1,658,224
1824	1,251,836	296,708	598,181	157,772	60,693	9,306	....	1,610,990
1825	1,072,615	250,200	617,072	202,188	212,062	46,225	....	1,595,065
1826	652,401	183,343	836,280	288,104	188,709	53,502	....	1,473,388
1827	481,180	142,648	1,003,658	316,061	241,085	80,956	....	1,575,332
1828	488,468	140,279	904,597	255,378	120,128	40,991	....	1,693,980
1829	1,237,962	358,822	1,055,906	261,315	464,225	136,341	....	1,817,100
1830	1,833,196	568,326	1,082,941	249,292	404,919	112,357	....	1,725,270
1831	1,637,534	554,440	847,384	217,830	565,926	133,842	....	1,889,472
1832	3,605,913	1,009,728	850,886	267,333	1,044,227	186,595	....	2,558,538
1833	3,298,872	924,810	905,318	259,451	1,203,176	185,329	....	2,402,469
1834	2,614,814	740,619	851,556	257,718	873,983	169,434	....	2,071,493
1835	2,217,321	773,486	920,746	284,019	270,977	55,954	....	2,174,524
1836	2,362,325	1,049,466	1,018,520	341,907	731,500	187,008	....	2,666,058
1837	3,624,001	1,271,545	892,852	294,510	1,129,509	223,682	....	2,711,452
1838	4,824,376	1,556,775	1,074,569	340,531	1,634,570	321,458	....	3,175,576
1839	1,482,908	515,484	466,896	178,142	1,445,098	288,790	....	1,917,969
1840	4,520,878	1,404,984	853,938	332,353	1,892,259	310,379	....	3,199,170
1841	4,094,924	1,260,660	599,657	231,960	1,271,363	259,148	....	2,846,851
1842	3,909,728	1,315,411	986,010	318,997	918,280	225,382	....	2,823,010
June 30—								
1843	2,479,916	803,774	965,073	243,308	898,773	257,481	....	2,112,548
1844	4,104,504	1,464,968	606,454	180,492	1,149,607	463,096	....	3,350,501
1845	4,505,662	1,520,363	812,879	236,917	2,084,019	762,642	....	4,507,124
1846	2,652,874	946,298	1,083,839	295,606	1,697,892	583,870	....	3,453,398
1847	3,189,562	1,070,659	705,150	191,467	2,031,137	671,601	....	3,468,033
1848	1,607,038	552,388	598,452	186,839	1,054,379	314,107	....	1,980,963
1849	2,783,480	965,597	503,911	159,403	1,198,250	337,714	....	2,547,654
1850	1,470,197	672,640	742,528	260,107	1,981,231	646,483	....	2,824,818
1851	2,004,886	882,485	538,549	195,916	2,281,931	689,662	....	3,294,691
1852	892,309	440,387	397,398	143,098	1,184,156	436,673	....	2,282,442
1853	321,989	223,247	343,992	112,600	2,825,069	1,063,705	....	3,279,413
1854	718,842	490,426	255,825	77,991	2,156,864	817,817	....	3,044,301
1855	705,492	485,505	666,680	181,874	1,944,809	781,680	....	3,516,894
1856	646,694	526,338	201,390	64,857	1,932,800	1,036,647	....	3,356,797
1857	414,466	363,665	185,563	70,038	2,042,390	1,307,322	....	3,739,644
1858	840,127	597,107	168,897	66,012	1,103,301	1,105,223	....	3,550,295
1859	996,341	598,762	126,229	46,278	1,380,465	1,233,539	....	4,462,974
1860	1,335,736	537,547	157,783	51,829	1,068,895	896,293	....	4,156,480
1861	1,009,468	581,264	456,408	143,907	979,231	736,552	....	4,451,515
1862	2,599,316	1,280,697	280,526	64,481	796,384	556,795	....	3,987,298
1863	2,055,511	1,483,593	229,472	76,946	603,186	575,733	....	5,056,006
1864	416,405	438,957	624,129	184,608	548,099	793,562	....	4,306,303
1865	644,547	816,494	224,162	93,062	313,912	493,316	....	4,795,619
1866	177,509	205,250	191,799	33,592	486,370	656,188	....	3,562,519
1867	426,882	319,840	77,715	23,339	618,363	653,253	....	3,663,634
1868	706,534	507,476	332,023	128,337	696,064	587,303	....	3,717,248
1869	94,361	81,860	253,445	88,706	405,396	384,435	$46,040	3,001,720
1870	310,878	228,278	82,520	27,172	386,728	343,937	52,479	2,870,517
1871	862,434	452,937	157,263	42,170	353,742	251,562	56,882	2,994,037
1872	1,171,646	552,756	190,736	56,996	172,889	137,855	41,535	3,443,171
1873	288,263	154,243	197,671	55,815	324,653	329,214	21,480	3,320,406
1874	573,775	280,750	304,865	78,346	114,530	115,098	17,013	3,566,743
1875	895,907	413,411	238,641	61,725	251,572	291,165	66,467	4,844,847
1876	1,067,515	436,072	141,157	35,915	154,500	215,327	37,701	5,806,445
1877	1,026,038	442,165	153,552	41,027	71,708	160,666	65,066	5,734,675
1878	904,988	411,808	228,276	58,302	154,016	264,980	35,320	6,436,248
1879	2,236,265	756,248	147,503	35,489	78,322	199,753	44,782	6,281,288
1880	1,022,889	349,109	197,847	45,018	131,332	255,847	81,879	5,248,131
1881	597,812	229,726	214,205	40,945	227,117	326,400	61,977	5,554,834
1882	1,083,925	420,730	265,593	48,721	220,787	325,333	64,105	6,213,358
1883	226,983	115,490	396,869	66,651	326,835	599,550	26,016	6,279,720
1884	488,915	190,704	259,947	48,553	92,653	319,508	37,804	5,664,885
1885	977,768	321,227	277,271	63,683	188,482	470,039	87,378	6,018,745
1886	1,184,871	361,171	334,918	125,840	165,436	385,058	33,740	5,264,646
1887	1,348,804	352,114	336,222	139,656	173,452	523,267	54,158	5,154,180
1888	1,360,409	315,277	226,576	84,018	318,056	799,042	47,717	5,518,552
1889	483,208	127,412	425,479	111,386	261,555	762,464	23,214	7,063,339
1890	1,844,041	440,773	449,384	116,757	190,484	705,500	29,928	7,458,385
1891	1,404,769	354,337	207,574	71,202	159,322	717,230	22,321	6,210,577
1892	829,173	234,937	273,981	90,842	82,797	427,462	24,552	5,403,587
1893	90,696	31,683	340,192	105,012	148,130	543,045	49,624	5,541,378
1894	209,167	68,710	342,786	99,467	152,709	441,969	83,818	4,258,306
Total	111,014,515	42,293,508	36,072,116	10,940,519	55,215,494	31,803,573	1,212,996	274,096,530

From the preceding compilation it appears that during the ten years following 1875 the value of the fishery products annually exported varied little from $6,000,000. From 1887 to 1890 the value steadily increased, reaching $7,458,385 during the last year, the highest record. A steady decline has occurred since 1890, the exports during 1894 being $3,200,079 less than in 1890 and smaller than during any previous year for twenty years.

While some falling off is apparent in the exports of dried or smoked fish, oysters, and the products of the whale fishery, yet the principal cause of the decrease since 1890 is the remarkable reduction in value of "canned and other prepared fish." The value of these decreased from $4,039,220 in 1890 to $1,682,830 in 1894, a difference of $2,356,390. This class is made up principally of canned salmon, the exports of which were worth $3,259,344 in 1890 and only $1,026,197 in 1894.

A series of tables is next presented, showing, so far as practicable, the quantities and values of the various kinds of fishery products included in each classification noted in the preceding table.

It is impracticable to show the quantity of fresh fish exported prior to 1884, but the quantity and value of those exported annually from 1884 to 1894, inclusive, are shown in Table 21. This consists of fresh or frozen fish shipped to countries adjacent to the United States, and principally to Quebec, Cuba, and Mexico.

21. *Statement of the domestic exports of fresh fish during each year from 1884 to 1894, inclusive.*

Year ending June 30—	Pounds.	Values.	Average values per pound.
			Cents.
1884	1, 641, 061	$62, 009	3. 8
1885	1, 035, 242	33, 350	3. 2
1886	913, 114	29, 734	3. 2
1887	463, 381	14, 751	3. 2
1888	919, 497	28, 965	3. 1
1889	1, 062, 557	27, 151	2. 6
1890	1, 043, 162	48, 086	4. 6
1891	868, 796	40, 084	4. 6
1892	1, 414, 019	66, 498	4. 7
1893	2, 718, 341	100, 656	3. 7
1894	1, 115, 742	48, 820	4. 4
Total	13, 194, 912	500, 104	....

During the 104 years ending in 1894 the exports of dried or smoked fish amounted to 25,295,613 quintals, valued at about $89,000,000. The exports prior to 1840 consisted almost entirely of dry-salted cod and similar fish, as haddock, hake, etc.; but the increasing trade in smoked herring resulted in the exportation of large quantities of that product, especially about 1860. In addition to those species, halibut, mullet, sturgeon, etc., either smoked or dry salted, are now exported in considerable quantities.

The following compilation shows separately the quantities and values of cod, herring, and other dried or smoked fish exported during a series of years ending in 1894:

22. *Statement of the domestic exports of dried or smoked fish during each year from 1884 to 1894, inclusive.*

Year ending June—	Cod, haddock, hake, etc.		Herring.		Other species.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
1884	14, 929, 123	$734, 946	(a)	(a)	7, 174, 332	$415, 006	22, 103, 455	$1, 149, 952
1885	18, 178, 987	724, 858	(a)	(a)	6, 517, 596	354, 257	24, 696, 583	1, 079, 115
1886	15, 664, 195	602, 934	(a)	(a)	5, 644, 202	287, 377	21, 308, 397	890, 311
1887	16, 943, 748	587, 082	(a)	(a)	4, 978, 826	265, 130	21, 922, 574	852, 212
1888	17, 820, 883	819, 559	2, 948, 620	$79, 539	1, 809, 568	89, 303	22, 579, 071	988, 401
1889	15, 625, 928	754, 619	2, 404, 433	80, 281	2, 007, 615	106, 832	20, 037, 976	941, 732
1890	17, 030, 019	793, 186	3, 664, 704	103, 091	1, 515, 790	83, 968	22, 210, 513	980, 245
1891	17, 313, 170	890, 277	3, 777, 535	105, 260	1, 431, 444	80, 844	22, 522, 149	1, 076, 381
1892	14, 435, 878	765, 199	3, 279, 263	82, 772	1, 663, 572	85, 353	19, 378, 713	933, 324
1893	14, 853, 627	728, 475	4, 085, 378	93, 412	1, 941, 591	88, 258	20, 880, 596	910, 145
1894	14, 733, 648	704, 652	5, 118, 025	123, 882	1, 479, 407	50, 966	21, 331, 080	879, 500
Total	177, 529, 206	8, 105, 787	25, 277, 958	668, 237	36, 163, 943	1, 907, 294	238, 971, 107	10, 681, 318

a Included with "Other species."

The brine-salted or pickled fish consist of herring, mackerel, salmon, cod, alewives, etc. Table 23 shows the quantities and values of the domestic herring exported during a series of years ending in 1894. The value of pickled salmon exported is shown in Table 24.

23. *Statement of the domestic exports of brine-salted or pickled fish (exclusive of salmon) during each year from 1884 to 1894, inclusive.*

Year ending June 30—	Herring.		Mackerel.		Others, except salmon.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
1884	(a)	(a)	13, 102	$107, 950	31, 932	$188, 946	45, 034	$296, 896
1885	(a)	(a)	24, 512	139, 663	35, 492	170, 507	60, 004	310, 170
1886	(a)	(a)	28, 505	143, 847	30, 866	144, 341	59, 371	288, 188
1887	(a)	(a)	15, 760	106, 967	20, 310	109, 652	36, 070	216, 619
1888	3, 668	$22, 146	7, 036	71, 149	9, 277	63, 159	19, 981	156, 454
1889	3, 221	17, 756	1, 303	18, 876	16, 077	99, 977	20, 601	136, 609
1890	2, 267	9, 614	948	15, 512	23, 683	110, 910	26, 898	136, 036
1891	3, 012	12, 352	2, 295	37, 128	30, 085	147, 319	35, 392	196, 799
1892	2, 700	11, 481	3, 490	47, 108	30, 315	158, 162	36, 505	216, 751
1893	1, 862	8, 660	2, 455	33, 480	23, 788	139, 272	28, 105	181, 412
1894	3, 501	13, 457	3, 224	43, 082	29, 868	135, 859	36, 593	192, 398
Total	20, 231	95, 466	102, 630	764, 762	281, 693	1, 468, 104	404, 554	2, 328, 332

a Included with "Others, except salmon."

The class "Canned and other prepared fish" is made up principally of canned salmon, but it also includes all other canned fish, brine-salted salmon, shellfish other than oysters, and all other fish. Table 24 shows, so far as practicable, the value of these exports during the twenty-six years ending in 1894.

24. *Statement of the domestic "Canned and other prepared fish" exported during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Salted salmon.	Canned salmon.	All other canned fish.	Shellfish other than oysters.	All other fish.	Total.
1869			$24,454		$247,943	$272,397
1870			4,941		382,798	387,739
1871			27,208		443,737	470,945
1872					635,533	635,533
1873					677,171	677,171
1874					1,128,208	1,128,208
1875					1,855,550	1,855,550
1876					2,102,522	2,102,522
1877				$1,746	2,490,659	2,492,405
1878				6,069	3,198,896	3,204,965
1879				11,846	2,939,987	2,951,833
1880				9,801	2,327,092	2,336,893
1881				4,327	2,803,636	2,807,963
1882				2,701	3,219,006	3,221,707
1883				21,308	3,202,562	3,223,870
1884	$110,531	$2,323,026		228,030		2,661,587
1885	82,114	2,260,567		411,984		2,754,665
1886	43,450	1,875,109		350,090		2,268,649
1887	78,208	1,719,685		350,270		2,148,163
1888	61,046	1,608,815	62,510	284,144	128,943	2,145,458
1889	54,173	3,364,560	100,023	359,256	151,560	4,029,572
1890	69,042	3,259,344	143,599	372,238	194,997	4,039,220
1891	83,993	2,098,957	139,392	337,893	208,014	2,868,249
1892	78,680	1,738,465	146,067	382,029	216,678	2,561,919
1893	49,230	2,279,625	166,902	275,793	161,927	2,933,477
1894	58,659	1,026,215	143,402	249,721	204,833	1,682,830

The miscellaneous fishery products exported consist principally of marine shells and sponges, but include also fish-skins and a variety of other articles. In customs returns many minor products are included with the unenumerated articles. The following table shows, so far as practicable, the exports of miscellaneous fishery products since 1868:

25. *Statement of the domestic exports of miscellaneous fishery products during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Caviar.	Clams for bait.	Fish sounds and glue.	Shells.	Sponges.	Walrus teeth.	*a* Whale and fish foots.	Miscellaneous.	Total.
1869				$11,008			$35,032		$46,040
1870			$4,605	2,100	$5,500		32,994	*b* $7,280	52,479
1871			163		1,546		39,546	*b* 15,627	56,882
1872							37,925	*b* 3,610	41,535
1873							21,480		21,480
1874							17,013		17,013
1875			2,587			$23,653	40,227		66,467
1876						8,076	29,625		37,701
1877				4,825	396	7,651	52,194		65,066
1878				9,172	8,000		18,148		35,320
1879				13,831	16,313	200	14,438		44,782
1880		$5,775		69,107	4,141		2,856		81,879
1881		7,249		39,792	6,736	400	7,800		61,977
1882		2,803		46,341	4,111		10,850		64,105
1883				15,148	7,518		3,350		26,016
1884			3,021	25,311	9,472				37,804
1885				63,898	23,480				87,378
1886				8,133	25,607				33,740
1887				16,572	37,586				54,158
1888				11,136	36,581				47,717
1889				2,243	20,971				23,214
1890				4,635	25,293				29,928
1891				1,500	20,821				22,321
1892				12,609	10,320			*c* 1,623	24,552
1893	$6,187			33,033	8,858			*c* 1,546	49,624
1894				74,328	8,497			*c* 993	83,818

a A residuum of whale and fish oil. *b* Sperm pressings. *c* Fish skins.

The character of exports to each country.—The domestic fishery products exported from the United States are sent principally to England, Haiti, Germany, Canada, Australia, France, and Hongkong. In 1894 the value of the exports amounted to $4,258,306, of which $1,304,493 was sent to England, $652,723 to Haiti, $438,333 to Germany, $269,726 to Canada, $235,086 to Australia, $198,968 to France, and $175,743 to Hongkong.

The exports to England are principally canned salmon, fresh oysters, whale oil, and spermaceti. To Haiti are sent salted cod, smoked herring, pickled mackerel, and other pickled fish; to Germany, whalebone, spermaceti, and prepared fish of various kinds; Canada receives fresh oysters, smoked haddock, and various kinds of fresh fish; Australia, canned and pickled salmon, canned oysters, and spermaceti. The exports to France consist almost entirely of whalebone, spermaceti, and fish and whale oil; and those to Hongkong, of dried shrimp, with a small quantity of canned salmon and various kinds of dried fish.

Table 26 shows the quantities and values of domestic fishery products exported to various foreign countries during the fiscal year ending June 30, 1894. The quantity sent to Europe was valued at $2,088,958; to Canada and Newfoundland, $270,069; to other ports of the North American continent, $1,086,114; to South America, $241,234; to Asia and Oceanica, $537,455; to African and other ports, $34,476; making a grand total of $4,258,306.

The most valuable products were canned salmon, worth $1,026,215; salted cod, etc, $704,652; oysters, $688,653; whalebone, $441,969; shrimp and other shellfish, $249,721; and whale and fish oils, $140,851.

The dried or smoked and the brine-salted fish are marketed principally in the West Indies, those islands receiving, in 1894, 83 per cent of the exports of the former and 74 per cent of the latter. South America received 8 per cent of the dried fish and 3 per cent of the brine-salted. The canned fish are sent principally to England and Australia, those countries receiving 60 and 16 per cent, respectively, of the exports of this class. Of oysters, England received 64 and Canada 25 per cent of the total exports. Scotland ranks first in the marine oil trade, with England a close second, the exports to each amounting to 36 and 32 per cent, respectively, of the total. The whalebone is marketed almost exclusively in Germany, France, and the Netherlands, 97 per cent of the total exports going to those countries. England and France control the trade in marine shells, and the former receives the greater portion of the sponges exported from this country.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894.*

Countries to which exported.	Fresh fish other than salmon.		Dried, smoked, or cured.					
			Cod, haddock, hake, and pollock.		Herring.		Other.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Azores, and Madeira Islands			4,100	$204				
Belgium			48	10				
Total Europe			4,148	214				
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	27,500	$599	270	21	280	$20		
Quebec, Ontario, etc	824,663	41,331	235,066	13,371	2,086	132	84,497	$4,226
British Columbia	7,295	422	27,735	1,504	560	29	502	36
Mexico	12,749	877	20,075	1,269	2,176	63	686	67
Central America—								
Costa Rica			211,985	11,660	8,083	202		
Guatemala			54,510	3,405				
Honduras			15,385	810	305	13		
Nicaragua			47,937	2,816	924	32		
Salvador			7,200	459				
British Honduras			81,171	4,480	4,391	118		
Bermuda			7,995	419	420	12		
West Indies—								
British	2,932	246	735,635	36,006	197,590	4,423	372	14
Danish			7,800	417	1,050	24		
Dutch			71,093	3,767	45,380	1,157		
French			1,638	96	212,540	4,989		
Haiti			8,922,079	432,573	3,133,453	74,877		
Santo Domingo			1,038,927	47,281	789,385	18,475		
Spanish—								
Cuba	234,188	5,016	1,256,262	61,102	374,332	10,347	967,857	21,387
Puerto Rico			20,030	1,009	135,554	3,784		
Total North America	1,109,327	48,491	12,762,793	622,465	4,908,509	118,697	1,053,914	25,730
South America:								
Argentina			1,400	70				
Brazil			57,920	3,155	750	21		
Chile			3,300	165				
Colombia			219,135	12,783	31,016	863		
Ecuador			11,100	580				
Guianas—								
British	6,415	329	129,359	5,993	27,000	548	43	8
Dutch			737,278	22,181	28,300	619		
French			228,562	6,697	16,310	341		
Peru			560	35	100	3		
Venezuela			270,453	14,251	91,562	2,398		
Total South America	6,415	329	1,659,067	65,910	195,038	4,793	43	8
Asia and Oceanica:								
China			14,510	950	80	5		
Hongkong			20,600	1,181			152,600	9,182
Japan			750	48				
British Australasia			63,480	3,442				
French Oceanica			7,260	441				
Hawaiian Islands			179,275	9,040			272,850	16,046
Total Asia and Oceanica			285,875	15,102	80	5	425,450	25,228
Africa:								
British Africa			11,140	407	2,914	80		
Canary Islands					3,654	95		
Liberia			10,625	554	7,830	212		
Total Africa			21,765	961	14,398	387		
Grand total	1,115,742	48,820	14,733,648	704,652	5,118,025	123,882	1,479,407	50,966

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

Countries to which exported.	Pickled or brine-salted.						
	Mackerel.		Herring.		Salmon.*	Other.	
	Barrels.	Values.	Barrels.	Values.	Values.	Barrels.	Values.
Europe:							
Belgium	....	....	....	....	$12	....	....
Germany	....	....	....	....	369	12	$60
Netherlands	....	....	....	....	352	....	....
England	....	....	100	$350	763	18	110
Total Europe	....	....	100	350	1,496	30	170
North America:							
Canada—							
Nova Scotia, New Brunswick, etc	32	$256	....	....	....	345	1,222
Quebec, Ontario, etc	15	192	25	105	226	43	265
British Columbia	13	260	2	14	2,691	2	27
Mexico	8	127	....	2	1,224	....	....
Central America—							
Costa Rica	25	317	13	66	167	49	250
Guatemala	7	98	....	....	....	....	....
Honduras	1	17	....	....	18	....	....
Nicaragua	43	514	....	....	19	2	14
British Honduras	33	466	20	91	30	8	43
Bermuda	11	175	2	13	40	2	9
West Indies—							
British	276	3,688	1,871	6,553	2,510	3,153	13,682
Danish	5	60	5	20	6	24	110
Dutch	58	815	299	1,371	336	4	19
French	11	132	2	10	431	....	....
Haiti	1,758	24,717	362	1,522	742	25,367	115,361
Santo Domingo	635	7,517	427	1,708	254	12	77
Spanish—							
Cuba	100	1,250	6	32	371	96	487
Puerto Rico	34	478	....	....	304	....	....
Total North America	3,065	41,079	3,034	11,507	9,369	29,107	131,566
South America:							
Brazil	8	112	....	....	56	....	....
Chile	....	....	....	....	17	....	....
Colombia	76	1,064	262	1,149	126	5	28
Ecuador	5	66	....	....	....	....	....
Guianas—							
British	31	288	14	58	48	45	285
Dutch	....	....	....	....	232	536	3,021
French	10	115	....	....	....	22	166
Venezuela	15	219	13	65	348	2	10
Total South America	145	1,864	289	1,272	827	610	3,510
Asia and Oceanica:							
Hongkong	....	....	....	....	5	....	....
British Australasia	....	....	....	....	13,335	....	....
French Oceanica	....	....	....	....	1,976	....	....
Hawaiian Islands	....	....	....	....	30,709	....	....
Total Asia and Oceanica	....	....	....	....	46,025	....	....
Africa:							
British Africa	....	....	53	230	....	....	....
Liberia	14	139	25	98	....	121	613
Total Africa	14	139	78	328	....	121	613
All other islands and ports	....	....	....	....	942	....	....
Grand total	3,224	43,082	3,501	13,457	58,659	29,868	135,859

* Includes a small quantity of fresh salmon.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

Countries to which exported.	Canned.			All other fish.	Shellfish.		Fish oil.	
	Salmon.		Other.		Oysters.	Other.		
	Pounds.	Values.	Values.	Values.	Values.	Values.	Gallons.	Values.
Europe:								
Azores, and Madeira Islands	144	$18				$2,457		
Belgium	540	61			$490	290		
Denmark				$365	565			
France	280	28		3,421	406	1,782	17,392	$5,631
Germany	8,445	1,218	$1,591	158,433	6,452	802		
Italy	3,264	384	720			1,195	5,000	1,850
Netherlands			117	1,041	58	20		
Portugal						10		
Spain			9	55			500	100
Sweden and Norway				35	119			
United Kingdom—								
England	7,720,747	712,017	2,815	6,182	440,130	10,916	18,559	6,094
Scotland	1,440	179	210	50	5,858	225	54,105	16,240
Total Europe	7,734,860	713,905	5,462	169,582	454,078	17,697	95,556	29,915
North America:								
Canada—								
Nova Scotia, New Brunswick, etc				89	6,767	7,912		
Quebec, Ontario, etc			1,331	2,221	159,920	7,632	541	151
British Columbia	24,150	1,506	741	977	6,794	1,601		
Newfoundland and Labrador	288	28	43	63	205	4		
Miquelon, Langley, etc	1,600	175						
Mexico	59,625	5,986	7,211	9,820	13,344	3,067	978	482
Central America—								
Costa Rica	37,271	3,791	1,922	108	944	792	52	20
Guatemala	10,015	1,047	2,865	2	369	556		
Honduras	2,743	279	409	30	325	333		
Nicaragua	13,255	1,329	2,597	18	957	747	18	38
Salvador	2,730	284	1,323		160			
British Honduras	9,791	1,019	126		119	144		
Bermuda	20,759	2,504	2,068	114	647	427		
West Indies—								
British	185,459	19,199	9,273	2,663	2,041	544	2,841	1,126
Danish	4,404	469	132	50	276	328		
Dutch	5,265	612	1,914	162	228	12	8	3
French	1,110	117	123	40	7			
Haiti	660	78	980	909	303	140	130	71
Santo Domingo	2,048	212	3,910	2,862	258	45		
Spanish—								
Cuba	12,596	1,418	2,795	1,120	9,248	1,399	4,352	1,565
Puerto Rico	1,248	137	151	11	412	17	40	15
Total North America	395,017	40,190	39,914	21,259	203,324	25,700	8,960	3,471
South America:								
Argentina	30,010	3,283	5,501	30	4,799	2,017		
Brazil	89,759	9,501	30,631		3,345	14,347		
Chile	43,984	4,575	2,493		800	7,712		
Colombia	25,352	2,958	3,909	536	649	1,564	3	7
Ecuador	19,499	2,084	1,105		1,194	1,549		
Guianas—								
British	111,070	11,184	7,182	4,419	385	140		
Dutch	10,176	1,033	1,008	1,067	61	277		
French			524	282		335		
Peru	11,528	1,435	1,356	235	947	709	1,000	381
Uruguay	12,520	1,486	898		657	798		
Venezuela	31,577	3,291	13,167	201	1,321	699		
Total South America	385,475	40,830	67,774	6,770	14,158	30,147	1,003	388
Asia and Oceanica:								
China	4,305	448	205		1,073	383		
East Indies, British	49,200	5,056	524			220		
Hongkong	85,520	8,681	249	900		152,410		
Japan	8,870	915	267					
British Australasia	1,707,810	179,489	4,854	5,764	10,163	2,273		
French Oceanica	80,650	8,323	636			55		
Hawaiian Islands	199,469	20,364	3,368		5,206	20,112		
Total Asia and Oceanica	2,135,824	223,276	10,103	6,664	16,442	175,453		
Africa:								
British Africa	19,142	2,126	19,732	144	608	526		
Canary Islands	432	46			17	156		
Liberia	760	78		401				
Total Africa	20,334	2,250	19,732	545	625	682		
All other islands and ports	55,500	5,764	417	13	26	42		
Grand total	10,727,010	1,026,215	143,402	204,833	688,653	249,721	105,519	33,774

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

Countries to which exported.	Whale oil.		Spermaceti.		Whalebone.		Marine shells.	Sponges.	Total.
	Gallons.	Values.	Pounds.	Values.	Pounds.	Values.	Values.	Values.	Values.
Europe:									
Azores, and Madeira Islands									$2,679
Belgium			3,381	$1,020	1,157	$3,600			5,483
Denmark			309	87					1,017
France	31,030	$13,225	7,255	2,196	55,423	156,359	$14,980	$940	198,968
Germany	2,274	1,783	157,331	46,311	72,161	215,750	5,564		438,333
Italy			2,831	825				70	5,044
Netherlands			1,558	400	20,824	56,558		299	58,845
Portugal									10
Russia			4,708	1,280					1,280
Spain			6,694	1,922			25		2,111
Sweden and Norway								398	552
United Kingdom—									
England	59,906	38,278	79,125	22,646	3,002	9,091	50,528	4,573	1,304,493
Scotland	49,726	34,827	42,309	12,054			500		70,143
Total Europe	142,936	88,113	305,501	88,741	152,567	441,358	71,597	6,280	2,088,958
North America:									
Canada—									
Nova Scotia, New Brunswick, etc	303	269					*a*993	74	18,222
Quebec, Ontario, etc	2,193	1,144	1,092	255	108	492	137	966	234,097
British Columbia	2,041	800						5	17,407
Newfoundland and Labrador									343
Miquelon, Langley, etc									175
Mexico	14,265	5,446	1,477	87	8	25	4	235	49,336
Central America—									
Costa Rica	50	24							20,263
Guatemala	200	100							8,442
Honduras									2,234
Nicaragua									9,081
Salvador									2,226
British Honduras									6,636
Bermuda	5	5							6,433
West Indies—									
British	40	29					1,580	7	103,584
Danish									1,892
Dutch	92	44							10,440
French									5,945
Haiti	250	200						250	652,723
Santo Domingo									82,599
Spanish—									
Cuba	160	121			26	94			117,752
Puerto Rico	10	8						27	6,353
Total North America	19,609	8,190	2,569	342	142	611	1,721 *a*993	1,564	1,356,183
South America:									
Argentina									15,700
Brazil	20	15						200	61,383
Chile	16	9						286	16,057
Colombia	2,592	1,950						45	27,631
Ecuador									6,578
Guianas—									
British									30,867
Dutch									29,499
French									8,460
Peru									5,101
Uruguay								48	3,887
Venezuela	10	7	62	20				74	36,071
Total South America	2,638	1,981	62	20				653	241,234

a Fish skins.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

Countries to which exported.	Whale oil.		Spermaceti.		Whalebone.		Marine shells.	Sponges.	Total.
	Gallons.	Values.	Pounds.	Values.	Pounds.	Values.	Values.	Values.	Values.
Asia and Oceanica:									
China									$3,064
East Indies, British									5,800
Hongkong	8,117	$3,135							175,743
Japan									1,230
British Australasia	15,019	5,402	34,654	$10,364					235,086
French Oceanica									11,431
Hawaiian Islands	533	256							105,101
Total Asia and Oceanica	23,669	8,793	34,654	10,364					537,455
Africa:									
British Africa							$367		24,220
Canary Islands									314
Liberia									2,095
Total Africa							367		26,629
All other islands and ports							643		7,847
Grand total	188,852	107,077	342,786	99,467	152,709	$441,969	74,328 *a* 993	$8,497	4,258,306

a Fish skins.

Reciprocity treaties with other American countries.—The provisions of section 3 of the tariff act of 1890 resulted in reciprocal treaties or agreements relating to nine countries in the Western Hemisphere, by which the duties on fish (and about 2,000 other articles) of United States production were affected, in some cases being entirely abrogated and in others reduced 25 or 50 per cent. These agreements related to the following countries:

Countries.	Date of taking effect.
Brazil	April 1, 1891
Cuba	Sept. 1, 1891
Puerto Rico	Do.
Santo Domingo	Do.
Salvador	Feb. 1, 1892
British West Indies	Do.
Nicaragua	Mar. 12, 1892
Honduras	May 25, 1892
Guatemala	May 30, 1892

It does not appear, however, that these discriminations in favor of the United States had any appreciable effect toward increasing the fishery exports to those countries. The repeal in 1894 of the act of 1890 resulted in a termination of these reciprocal relations.

For an account of the Canadian reciprocity trade see p. 458.

IV.—COD, HADDOCK, HAKE, AND POLLOCK.

General statements of trade.—Dried cod was the first domestic fishery product exported from the United States. In 1774 the value of the exported cod was $1,000,000, constituting one-sixth of the whole commerce of the United States. In 1804 the domestic exports of the United States were valued at $41,467,477, of which the exports of cod amounted to 567,825 quintals, with a valuation of $2,400,000, this being the largest quantity ever exported from this country during any one year.

While large quantities of cured cod and similar fish are now imported for consumption in this country, yet the imports are exceeded by the exports. During the ten years ending June 30, 1894, imports of dried cod for consumption amounted to 106,377,963 pounds, valued at $3,352,739, while the domestic exports were 162,600,083 pounds, worth $7,370,841, an excess of 56,222,120 pounds and $4,018,102, an average of 5,622,212 pounds and $401,810 per year. This average excess is somewhat reduced, owing to the large imports of 1885, the last year in which the Washington treaty was operative. Considering only the last nine years, the average annual excess of the exports over the imports for consumption has been 7,818,868 pounds and $470,706. The annual product of dry-salted cod in the United States is about 65,000,000 pounds, valued at $2,600,000.

The following table shows for the ten years ending June 30, 1894, the quantity and value of the dry-salted cod imported for consumption, the quantity and value of the domestic exports, the balance of trade each year, and the average value per 100 pounds of imported and of exported fish. The extent of the imports of dried cod from 1821 to the present time is shown in the general tables of imports on pages 441–446. The domestic exports of cod are contained in Tables 19 and 20 on pages 462–464.

27. *Statement of the codfish trade during a series of ten years ending June 30, 1894.*

Year ending June 30—	Imports for consumption.		Domestic exports.		Balance of trade.		Average value per 100 pounds.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Dollars.	Imports.	Exports.
1885......	32, 326, 686	$943, 116	18, 178, 987	$724, 858	+14, 147, 699	+$218, 258	$2. 92	$3. 99
1886......	10, 998, 072	286, 505	15, 664, 195	602, 934	— 4, 666, 123	— 316, 429	2. 61	3. 85
1887......	8, 997, 750	264, 260	16, 943, 748	587, 082	— 7, 945, 998	— 322, 882	2. 94	3. 46
1888......	10, 446, 892	316, 259	17, 820, 883	819, 559	— 7, 373, 991	— 503, 300	3. 03	4. 70
1889......	9, 752, 941	317, 687	15, 625, 928	754, 619	— 5, 872, 987	— 436, 932	3. 26	4. 83
1890......	8, 303, 585	247, 327	17, 030, 019	793, 186	— 8, 726, 434	— 545, 859	2. 98	4. 66
1891......	6, 845, 576	254, 074	17, 313, 170	890, 277	—10, 467, 594	— 636, 203	3. 71	5. 14
1892......	5, 804, 548	229, 255	14, 435, 878	765, 199	— 8, 631, 330	— 535, 944	4. 95	5. 30
1893......	7, 433, 163	291, 531	14, 853, 627	728, 475	— 7, 420, 464	— 436, 944	3. 92	4. 90
1894......	5, 468, 750	202, 725	14, 733, 648	704, 652	— 9, 264, 898	— 501, 927	3. 71	4. 78
Total..	106, 377, 963	3, 352, 739	162, 600, 083	7, 370, 841	—56, 222, 120	—4, 018, 102	....	....

NOTE.—In balance of trade, + indicates excess of imports over exports, and — indicates excess of exports over imports.

During each year small quantities of brine-salted cod are imported into the United States. This trade has never been of great importance. The following compilation shows the imports for consumption during the ten years ending June 30, 1894:

28. *Statement of the quantity and value of brine-salted codfish imported for consumption during each year from 1885 to 1894, inclusive.*

Year ending June 30—	Barrels.	Values.	Average values per barrel.
1885	613	$2,030	$3.31
1886	193	839	4.36
1887	14	152	11.26
1888	131	626	4.80
1889	524	4,248	8.12
1890	342	3,363	9.86
1891	51	237	4.69
1892	76	724	9.53
1893	20	158	7.73
1894	20	112	5.52
Total	1,984	12,489	....

Table 29 shows for the ten years ending June 30, 1894, the quantities and values of dried cod and similar fish imported from and domestic dried fish exported to each foreign country, the balance of trade with each country, and the average value per 100 pounds of the imported and of the exported fish.

It appears that during this period the imports from Europe amounted to 4,172,214 pounds, and the exports to 1,950,312 pounds, the trade with that continent amounting to 2 per cent of the total trade in this product. The imports and exports to other North American States and colonies amounted to 149,504,941 and 120,092,877 pounds, respectively, or nearly 86 per cent of the total trade. The trade with South America is exclusively in exports, amounting to 33,961,845 pounds.

The exports of dried fish to Asia, Africa, and other ports amounted to 6,595,049 pounds, and the imports therefrom were 16,881 pounds, consisting principally of Chinese and Japanese dried fish.

Considering the average value, it appears that the imports from Europe were the most valuable, averaging $5.01 per 100 pounds. The imports from other American countries averaged $3.30 and those from Asia and Oceanica $3.98, giving an average value for all imports of $3.35 per 100 pounds. The exports were worth $4.53 per 100 pounds, those to France, Asia and Oceanica, and Central America being the most valuable. The large quantity exported to Haiti is worthy of note, that island receiving considerably over 50 per cent of the total exports of dried or smoked fish from the United States.

29. *Statement of the balance of trade in dry-salted cod and similar fish between the United States and each foreign country during the ten years ending June 30, 1894.*

Countries.	Imports.		Exports.		Balance of trade.		Average value per 100 pounds.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Imports.	Exports.
Europe:								
Azores, and Madeira Islands			817,968	$30,060	— 817,968	— $30,060		$3.67
Denmark			5,325	279	— 5,325	— 279		5.24
France	526,795	$26,370	8,350	542	+ 518,445	+ 25,828	$5.01	6.49
Germany	21,907	1,128	3,658	166	+ 18,249	+ 962	5.10	4.54
Italy	15,724	746			+ 15,724	+ 746	4.74	
Netherlands	5,368	374	25,750	1,288	— 20,382	— 914	6.97	5.01
Portugal			1,055,576	33,140	— 1,055,576	— 33,140		3.14
Spain	2,390	226	1,520	78	+ 870	+ 148	9.46	5.13
Sweden and Norway	3,552,488	179,953			+ 3,552,488	+ 179,953	5.07	
United Kingdom—								
England	36,516	1,727	32,165	1,683	+ 4,351	+ 44	4.73	5.23
Scotland	11,026	437			+ 11,026	+ 437	3.96	
Total Europe	4,172,214	210,961	1,950,312	67,236	+ 2,221,902	+ 143,725	5.01	3.45
North America:								
Canada—								
Nova Scotia, New Brunswick, etc.	113,944,077	3,669,498	223,520	5,606	+113,720,557	+3,663,892	3.22	2.51
Quebec, Ontario, etc.	605,263	17,286	300,369	17,182	+ 304,894	+ 104	2.85	5.72
British Columbia	13,230	1,041	212,338	12,275	— 199,108	— 11,234		5.78
Newfoundland and Labrador	22,419,258	835,535			+ 22,419,258	+ 835,535	3.29	
Miquelon, Langley, etc.	11,503,258	368,561			+ 11,503,258	+ 368,561	3.20	
Greenland, Iceland, and Faroe Islands	9,500	270			+9,500	+ 270	2.84	
Mexico			337,773	19,945	— 337,773	— 19,945		5.90
Central America—								
Costa Rica			1,946,603	112,378	— 1,946,603	— 112,378		5.77
Guatemala			297,623	19,207	— 297,623	— 19,207		6.45
Honduras			187,672	10,886	— 187,672	— 10,886		5.80
Nicaragua			684,379	39,658	— 684,379	— 39,658		5.79
San Salvador			41,980	2,704	— 41,980	— 2,704		6.44
British Honduras			1,306,704	59,965	— 1,306,704	— 59,965		4.59
Bermudas			56,434	2,493	— 56,434	— 2,493		4.42
West Indies—								
British			6,489,880	271,948	— 6,489,880	— 271,948		4.19
Danish			709,270	29,121	— 709,270	— 29,121		4.10
Dutch			818,972	41,374	— 818,972	— 41,374		5.05
French	688,988	24,732	1,168,045	50,748	— 479,057	— 26,016	3.59	4.34
Haiti			84,315,736	3,939,699	— 84,315,736	—3,939,699		4.67
Santo Domingo			8,039,647	353,013	— 8,039,647	— 353,013		4.39
Spanish—								
Cuba	321,367	23,238	12,527,558	515,839	— 12,206,191	— 492,601	7.23	4.12
Puerto Rico			428,374	18,093	— 428,374	— 18,093		4.22
Total North America	149,504,941	4,940,161	120,092,877	5,522,134	+ 29,412,064	— 581,973	3.30	4.60
South America:								
Argentina			34,900	1,243	— 34,900	— 1,243		3.56
Brazil			1,047,212	55,945	— 1,047,212	— 55,945		5.34
Chile			15,962	875	— 15,962	— 875		5.48
Colombia			10,458,011	618,111	— 10,458,011	— 618,111		5.91
Ecuador			21,240	1,152	— 21,240	— 1,152		5.42
Guiana:								
British			818,460	31,204	— 818,460	— 31,204		3.81
Dutch			11,340,852	335,356	— 11,340,852	— 335,356		2.96
French			7,315,471	234,703	— 7,315,471	— 234,703		3.21
Peru			14,502	847	— 14,502	— 847		5.84
Venezuela			2,895,235	140,837	— 2,895,235	— 140,837		4.86
Total South America			33,961,845	1,420,273	— 33,961,845	—1,420,273		4.18

29. *Statement of the balance of trade in dry-salted cod and similar fish between the United States and each foreign country during the ten years ending June 30, 1894*—Continued.

Countries.	Imports.		Exports.		Balance of trade.		Average value per 100 pounds.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Imports.	Exports.
Asia and Oceanica:								
China			111,198	$7,073	— 111,198	— $7,073		$6.36
Hongkong	10,090	$430	392,380	22,343	— 382,290	— 21,913	$4.26	5.69
Japan	3,798	123	51,480	3,048	— 47,682	— 2,925	3.24	5.92
British Australasia			2,955,850	180,059	—2,955,850	— 180,059		6.09
British East Indies			39,500	2,548	— 39,500	— 2,548		6.45
French Oceanica			41,860	2,618	— 41,860	— 2,618		6.25
Hawaiian Islands			2,406,769	121,609	—2,406,769	— 121,609		5.05
Total Asia and Oceanica	13,888	553	5,999,037	339,298	—5,985,149	— 338,745	3.98	5.65
Africa:								
British Africa			149,224	5,029	— 149,224	— 5,029		3.37
French Africa			7,353	282	— 7,353	— 282		3.83
Liberia			365,169	12,377	— 365,169	— 12,377		3.39
Spanish Africa			7,210	291	— 7,210	— 291		4.04
Total Africa			528,956	17,979	— 528,956	— 17,979		3.40
All other islands and ports	2,993	116	67,056	3,918	— 64,063	— 3,802	3.88	5.84
Grand total	153,694,036	5,151,791	162,600,083	7,370,838	—8,906,047	—2,219,047	3.35	4.53

NOTE.—In balance of trade, + indicates excess of imports over exports, and — indicates excess of exports over imports.

Imports of dried cod by countries.—Since the terminination of the Washington treaty, the imports of dried cod, haddock, and other ground fish have ranged from 10,500,000 to 15,000,000 pounds annually, but a large part of these imports is entered for the purpose of transshipment in bond to other countries, leaving, as already noted, only from 5,500,000 to 11,000,000 pounds as the quantity of foreign-cured cod, etc., entered for consumption in this country. During the operation of the Washington treaty the imports for consumption averaged about 30,000,000 pounds annually.

Nearly all of these fish are received from Nova Scotia, New Brunswick, and Newfoundland. Some come from Sweden and Norway, and from Miquelon and other French settlements on the south coast of Newfoundland. Shipments are also received nearly every year from other countries, as France, Germany, England, etc., but the imports from those countries are small.

Table 30 shows the quantities and values of dried or cured cod and other ground fish, imported into the United States from the various countries during a series of ten years ending June 30, 1894, the total quantities and values imported for consumption, and the amount of duties paid thereon. The total quantity entered during these ten years was 153,694,036 pounds, valued at $5,151,791. Of this quantity, however, 47,316,073 pounds were exported, leaving 106,377,963 pounds, worth $3,352,739, as the quantity of foreign dried or cured fish entered for consumption in this country, the duty on which amounted to $429,812.

30. *Statement by countries of the imports of dry-salted cod and similar fish during each of the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Germany	....	....	....	....	200	$44	....	....
Italy	....	....	870	$61	....	....	2,100	$73
Netherlands	....	....	....	....	110	4	....	....
Spain	....	....	....	....	....	....	700	95
Sweden and Norway	....	....	104,732	7,082	248,690	10,949	465,419	19,841
United Kingdom—England	....	....	9,381	677	10,064	171	173	7
Total Europe	....	....	114,983	7,820	259,064	11,168	468,392	20,016
North America:								
Canada—Nova Scotia, New Brunswick, etc	29,386,186	$823,110	11,717,524	263,036	9,476,948	231,593	11,541,168	383,829
Quebec, Ontario, etc	50,920	2,527	8,610	321	339,669	5,586	63,142	1,748
Newfoundland and Labrador	2,962,472	119,101	1,772,248	70,490	2,194,658	77,584	2,142,280	69,936
Miquelon, Langley, etc	....	....	207,938	8,082	2,187,989	70,036	823,855	31,453
West Indies—French	....	....	473,324	16,576	215,664	8,156	....	....
Spanish—Cuba	....	....	28,507	2,445	40,268	3,002	10,394	747
Total North America	32,399,578	944,738	14,208,151	360,950	14,455,196	395,957	14,580,839	487,713
Asia:								
Hongkong	....	....	212	19	....	....	....	....
All other islands and ports	....	....	734	31	115	5	....	....
Grand total	32,399,578	944,738	14,324,080	368,820	14,714,375	407,130	15,049,231	507,729
Total entered for consumption	32,326,686	943,116	10,998,072	286,505	8,997,750	264,260	10,446,892	316,259
Amount of duty	....	....	....	54,990	....	44,989	....	52,235

Countries from which imported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
France	....	....	....	....	1,702	$67	....	....
Germany	....	....	....	....	600	32	3	$1
Italy	400	$27	439	$16	6,025	312	2,738	119
Netherlands	1,000	100	....	....	2,000	100	1,410	107
Spain	900	95	....	....	750	30	40	6
Sweden and Norway	474,592	23,982	108,759	5,552	334,837	19,683	387,033	23,487
United Kingdom—England	8,560	419	1,600	97	2,800	134	738	49
Scotland	7,216	259	....	....	....	....	1,000	36
Total Europe	492,668	24,882	110,798	5,665	348,714	20,358	392,962	23,805
North America:								
Canada—Nova Scotia, New Brunswick, etc	9,290,614	327,013	8,638,337	290,115	9,189,943	376,963	7,500,390	316,531
Quebec, Ontario, etc	24,839	1,196	1,344	34	43,191	2,328	64,418	3,203
British Columbia	7,815	716	3,300	213	200	12	800	43
Newfoundland and Labrador	2,926,763	92,364	2,249,082	76,710	3,021,220	108,416	2,378,891	100,322
Miquelon, Langley, etc	1,155,342	28,717	1,741,451	36,471	326,722	15,445	....	....
Greenland, Iceland and Faroe Islands	....	....	6,000	180	3,500	90	....	....
West Indies—Cuba	....	....	....	....	48,529	3,501	70,607	5,537
Total North America	13,405,373	450,006	12,639,514	403,723	12,633,305	506,755	10,015,106	425,636
Asia:								
Hongkong	....	....	....	....	....	....	2,000	126
Grand total	13,898,041	474,888	12,750,312	409,388	12,982,019	527,113	10,410,068	449,567
Total entered for consumption	9,752,941	317,687	8,303,585	247,327	6,845,576	254,074	5,804,548	229,255
Amount of duty	....	48,765	....	41,518	....	47,016	....	43,534

30. *Statement by countries of the imports of dry-salted cod and similar fish during each of the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
France	110,438	$5,898	414,655	$20,405	526,795	$26,370
Germany	450	11	20,654	1,040	21,907	1,128
Italy	1,591	75	1,561	63	15,724	746
Netherlands	848	63			5,368	374
Spain					2,390	226
Sweden and Norway	1,026,002	49,361	402,424	20,016	3,552,488	179,953
United Kingdom—						
England			3,200	173	36,516	1,727
Scotland	1,810	93	1,000	49	11,026	437
Total Europe	1,141,139	55,501	843,494	41,746	4,172,214	210,961
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	9,048,423	358,053	8,154,544	299,255	113,944,077	3,669,498
Quebec, Ontario, etc	1,050	50	8,080	293	605,263	17,286
British Columbia	600	30	515	27	13,230	1,041
Newfoundland and Labrador	1,555,250	67,848	1,216,394	52,764	22,419,258	835,535
Miquelon, Langley, etc	1,954,590	67,421	3,105,371	110,936	11,503,258	368,561
Greenland, Iceland, and Faroe Islands					9,500	270
West Indies—						
French					688,988	24,732
Spanish—Cuba	56,547	4,100	66,515	3,906	321,367	23,238
Total North America	12,616,460	497,502	12,551,419	467,181	149,504,941	4,940,161
Asia:						
Hongkong	495	36	7,383	249	10,090	430
Japan	2,025	73	1,773	50	3,798	123
Total Asia	2,520	109	9,156	299	13,888	553
All other islands and ports	20	1	2,124	79	2,993	116
Grand total	13,760,139	553,113	13,406,193	509,305	153,694,036	5,151,791
Total entered for consumption	7,433,163	291,531	5,468,750	202,725	106,377,963	3,352,739
Amount of duty		55,749		41,016		429,812

Exports of cod by countries.—Exports of dried codfish are made principally to Haiti, Cuba, Colombia, Dutch Guiana, Santo Domingo, and other South and Central American States and the West Indian Islands. Of the 162,600,083 pounds exported during the last ten years, Haiti received 84,315,736 pounds, or 52 per cent. All the American States and colonies combined received 153,984,722 pounds, or 95 per cent; Asia and Oceanica received 5,999,037 pounds, or 3 per cent; Europe, 1,950,312 pounds, or 1 per cent; the remaining 596,012 pounds going to African and other ports. The exports of cod to European countries appear very small when compared with the large imports into those countries. In 1893 France imported 94,218,948 pounds of codfish, worth $4,949,037. During the same year Portugal imported 43,126,385 pounds, worth $1,789,560, and Spain 97,811,488 pounds, worth $4,795,278. The imports into other European countries doubtless equaled one-half those into France, Portugal, and Spain, making an aggregate of 350,000,000 pounds, valued at $17,000,000, of which the United States furnished only 48,350 pounds, or about $\frac{1}{75}$ of 1 per cent.

Table 31 shows the quantity and value of domestic dried or cured codfish, etc., exported to each foreign country during each of the ten years ending June 30, 1894:

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Azores	78,378	$2,584	214,957	$6,718	151,259	$4,202	21,980	$855
Denmark	...	...	...	...	1,800	90	2,400	144
England	5,120	256	148	10	...	...	...	...
France	...	...	...	...	8,000	520	350	22
Germany	621	44	87	5	200	15	...	...
Netherlands	25,750	1,288	...	...	...	...	...	...
Portugal	1,055,356	33,125	12	1	36	5	60	3
Spain	...	...	20	3	...	...	...	...
Total Europe	1,165,225	37,297	215,224	6,737	161,295	4,832	24,790	1,024
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	210,900	5,244	...	...	...	...	2,350	116
Quebec, Ontario, etc	34,042	1,830	18,606	1,209	6,955	425	5,100	307
British Columbia	41,545	1,833	38,501	2,214	34,110	1,865	14,312	904
Mexico	27,358	1,447	48,141	2,765	19,140	1,356	24,977	1,702
Central America—								
Costa Rica	85,248	4,858	86,728	5,419	119,653	7,100	144,562	8,021
Guatemala	14,855	865	15,803	962	15,867	1,025	19,416	1,252
Honduras	8,915	520	9,315	520	19,717	1,046	26,523	1,593
Nicaragua	21,790	1,264	22,883	1,279	48,647	2,408	49,772	2,740
San Salvador	990	60	880	55	1,180	72	1,750	104
British Honduras	200,665	7,342	154,561	5,331	151,702	5,138	136,438	5,911
West Indies—								
British	1,438,958	51,985	693,618	25,010	433,577	13,610	580,468	27,460
Danish	110,605	4,135	84,976	3,187	147,918	5,126	126,348	5,125
Dutch	72,692	3,186	69,480	2,932	91,333	3,376	87,350	4,540
French	132,452	5,283	274,245	9,106	60,197	1,716	112,416	4,882
Haiti	6,506,931	250,416	6,591,186	241,899	7,465,058	240,391	8,986,578	422,839
Santo Domingo	704,813	30,440	959,686	33,847	891,669	29,203	680,572	30,438
Spanish—								
Cuba	1,813,571	73,197	1,359,449	48,938	2,042,434	61,541	1,079,373	40,836
Puerto Rico	213,333	8,003	10,076	430	11,350	384	45,534	2,156
Total North America	11,639,663	451,908	10,438,134	385,103	11,560,507	375,782	12,123,839	560,926
South America:								
Argentina	100	7	...	...	10,000	300	...	...
Brazil	21,480	775	17,785	913	120,450	5,040	405,855	22,549
Chile	1,000	39	1,000	48	362	26	50	3
Colombia	1,547,328	97,601	1,670,638	101,386	1,953,465	107,596	1,803,520	100,794
Ecuador	...	...	...	...	7,765	425	1,250	85
Guianas—								
British	181,903	6,187	62,072	2,119	123,542	3,681	23,000	800
Dutch	1,672,895	53,387	1,543,287	42,684	1,289,106	29,220	1,220,278	34,571
French	869,620	27,459	878,518	25,413	909,912	21,692	982,912	29,221
Peru	8,650	506	...	...	2,057	124	1,750	99
Venezuela	245,989	10,646	343,411	13,545	290,598	12,241	282,833	14,502
Total South America	4,548,965	196,607	4,516,711	186,108	4,707,257	180,345	4,721,448	202,624
Asia and Oceanica:								
China	9,430	525	9,343	573	4,840	257	5,385	300
Hongkong	63,730	3,130	49,000	2,641	22,650	1,136	29,930	1,639
Japan	10,540	600	5,710	312	6,100	339	6,960	384
British Australasia	517,740	25,456	145,400	7,546	172,750	10,917	561,366	36,609
British East Indies	...	...	...	...	600	28	9,600	615
Hawaiian Islands	153,580	6,719	225,526	11,382	252,650	11,736	242,970	12,283
Total Asia and Oceanica	755,020	36,430	434,979	22,454	459,590	24,413	856,211	51,830
Africa:								
British Africa	14,514	480	2,350	74	1,125	37	1,925	77
French Africa	...	...	50	4	...	...	...	...
Liberia	46,060	1,640	33,777	1,121	43,110	1,107	83,984	2,550
Spanish Africa	...	...	5,560	233	...	...	...	...
Total Africa	60,574	2,120	41,737	1,432	44,235	1,144	85,909	2,627
All other islands and ports	9,540	496	17,410	1,100	10,864	566	8,686	528
Grand total	18,178,987	724,858	15,664,195	602,934	16,943,748	587,082	17,820,883	819,559

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Azores	142, 164	$6, 292	112, 900	$4, 390	42, 020	$2, 150	3, 360	$165
Denmark	....	....	....	....	1, 125	45	....	....
England	....	....	1, 000	30	3, 140	149	22, 757	1, 238
Germany	350	22	400	14	2, 000	66	....	....
Portugal	....	....	112	6	....	....	....	....
Total Europe	142, 514	6, 314	114, 412	4, 440	48, 285	2, 410	26, 117	1, 403
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	10, 000	225	....	....	....	....	....	....
Quebec, Ontario, etc	300	18	100	12	....	....	....	....
British Columbia	6, 650	420	15, 150	1, 055	13, 450	991	10, 210	737
Mexico	35, 997	2, 160	44, 974	2, 512	71, 733	4, 020	18, 731	1, 120
Cental America—								
Costa Rica	161, 731	9, 177	296, 416	17, 127	298, 500	17, 270	276, 890	16, 422
Guatemala	26, 007	1, 713	29, 669	1, 866	25, 653	1, 777	44, 170	3, 037
Honduras	16, 925	928	18, 082	1, 036	20, 300	1, 248	23, 335	1, 389
Nicaragua	76, 194	4, 615	99, 913	5, 883	144, 618	8, 201	94, 484	5, 861
San Salvador	3, 830	247	6, 080	404	4, 540	334	6, 560	423
British Honduras	127, 226	6, 324	115, 068	5, 781	126, 587	7, 137	117, 525	7, 025
Bermudas	....	....	....	....	....	....	37, 719	1, 544
West Indies—								
British	847, 635	40, 485	363, 107	15, 842	541, 374	23, 932	420, 294	17, 368
Danish	83, 981	3, 578	79, 430	3, 984	45, 002	2, 297	15, 060	830
Dutch	125, 762	6, 194	81, 243	4, 316	78, 035	4, 697	72, 724	4, 393
French	235, 428	11, 065	72, 040	3, 872	141, 019	7, 444	47, 400	2, 600
Haiti	6, 931, 362	337, 854	10, 609, 937	505, 010	10, 931, 449	574, 879	8, 846, 336	498, 842
Santo Domingo	1, 119, 327	54, 057	713, 829	32, 154	711, 732	34, 860	611, 376	31, 799
Spanish—								
Cuba	1, 184, 759	54, 277	644, 244	24, 007	552, 440	23, 595	639, 206	29, 826
Puerto Rico	4, 620	224	5, 000	284	16, 115	1, 151	43, 736	2, 313
Total North America	10, 997, 734	533, 561	13, 194, 282	625, 145	13, 722, 547	713, 833	11, 325, 756	625, 529
South America:								
Argentina	....	....	22, 400	800	....	....	600	40
Brazil	150, 742	8, 359	42, 405	2, 253	49, 018	2, 747	81, 057	4, 652
Chile	1, 700	100	150	8	....	....	6, 650	390
Colombia	1, 318, 951	79, 246	627, 203	37, 593	609, 418	37, 732	391, 504	25, 077
Ecuador	....	....	....	....	....	....	525	28
Guianas—								
British	62, 666	2, 393	56, 652	2, 886	113, 115	4, 143	29, 294	1, 223
Dutch	1, 077, 882	33, 200	1, 111, 415	35, 121	811, 673	27, 757	985, 468	31, 799
French	750, 633	26, 528	895, 974	31, 542	735, 805	29, 338	618, 011	23, 644
Peru	....	....	385	18	800	44	....	....
Venezuela	284, 306	15, 485	302, 257	14, 039	316, 846	16, 337	271, 027	15, 479
Total South America	3, 646, 880	165, 311	3, 058, 841	124, 260	2, 636, 675	118, 098	2, 384, 136	102, 332
Asia and Oceanica:								
China	13, 130	810	10, 470	687	12, 270	894	16, 150	1, 067
Hongkong	54, 530	3, 243	61, 000	3, 772	52, 700	3, 446	19, 190	1, 136
Japan	6, 510	393	3, 190	192	8, 700	601	1, 210	81
British Australasia	395, 460	26, 572	211, 270	14, 781	487, 420	33, 007	319, 964	17, 343
British East Indies	10, 900	712	1, 600	95	300	24	16, 500	1, 074
French Oceanica	....	....	10, 150	650	8, 910	611	8, 220	503
Hawaiian Islands	291, 090	14, 948	296, 478	16, 602	246, 410	14, 196	269, 960	13, 257
Total Asia and Oceanica	771, 620	46, 678	594, 158	36, 779	816, 710	52, 779	651, 194	34, 461
Africa:								
British Africa	13, 350	512	56, 910	2, 071	30, 610	966	10, 400	170
French Africa	2, 000	30	....	....	3, 303	200	....	....
Liberia	39, 200	1, 476	10, 016	421	49, 612	1, 691	36, 675	1, 205
Spanish Africa	....	....	....	....	1, 650	58	....	....
Total Africa	54, 550	2, 018	66, 926	2, 492	85, 175	2, 915	47, 075	1, 375
All other islands and ports	12, 630	737	1, 400	70	3, 778	242	1, 600	99
Grand total	15, 625, 928	754, 619	17, 030, 019	793, 186	17, 313, 170	890, 277	14, 435, 878	765, 199

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
Azores	46,850	$2,500	4,100	$204	817,968	$30,060
Denmark					5,325	279
England					32,165	1,683
France					8,350	542
Germany					3,658	166
Netherlands					25,759	1,288
Portugal					1,055,576	33,140
Spain	1,500	75			1,520	78
Total Europe	48,350	2,575	4,100	204	1,950,312	67,236
North America:						
Canada—						
Nova Scotia, New Brunswick, etc			270	21	223,520	5,606
Quebec, Ontario, etc	200	10	235,066	13,371	300,369	17,182
British Columbia	10,675	752	27,735	1,504	212,338	12,275
Mexico	26,647	1,594	20,075	1,269	337,773	19,945
Central America—						
Costa Rica	264,890	15,324	211,985	11,660	1,946,603	112,378
Guatemala	51,673	3,305	54,510	3,405	297,623	19,207
Honduras	29,175	1,796	15,385	810	187,672	10,886
Nicaragua	78,141	4,591	47,937	2,816	684,379	39,658
San Salvador	8,970	546	7,200	459	41,980	2,704
British Honduras	95,761	5,496	81,171	4,480	1,306,704	59,965
Bermudas	10,720	530	7,995	419	56,434	2,493
West Indies—						
British	435,214	20,250	735,635	36,006	6,489,880	271,948
Danish	8,150	442	7,800	417	709,270	29,121
Dutch	69,260	3,973	71,093	3,767	818,972	41,374
French	91,210	4,684	1,638	96	1,168,045	50,748
Haiti	8,524,820	434,996	8,922,079	432,573	84,315,736	3,939,699
Santo Domingo	607,716	28,934	1,038,927	47,281	8,039,647	353,013
Spanish—						
Cuba	1,955,820	98,520	1,256,262	61,102	12,527,558	515,839
Puerto Rico	58,580	2,139	20,030	1,009	428,374	18,093
Total North America	12,327,622	627,882	12,762,793	622,465	120,092,877	5,522,134
South America:						
Argentina	400	26	1,400	70	34,900	1,243
Brazil	100,500	5,502	57,920	3,155	1,047,212	55,945
Chile	1,750	96	3,300	165	15,962	875
Colombia	316,849	18,303	219,135	12,783	10,458,011	618,111
Ecuador	600	34	11,100	580	21,240	1,152
Guianas—						
British	36,857	1,779	129,359	5,993	818,460	31,204
Dutch	891,570	25,436	737,278	22,181	11,340,852	335,356
French	445,524	13,169	228,562	6,697	7,315,471	234,703
Peru	300	21	560	35	14,502	847
Venezuela	287,515	14,312	270,453	14,251	2,895,235	140,837
Total South America	2,081,865	78,678	1,659,067	65,910	33,961,845	1,420,273
Asia and Oceanica:						
China	15,670	1,010	14,510	950	111,198	7,073
Hongkong	19,050	1,019	20,600	1,181	392,380	22,343
Japan	1,810	98	750	48	51,480	3,048
British Australasia	81,000	4,386	63,480	3,442	2,955,850	180,059
British East Indies					39,500	2,548
French Oceanica	7,320	413	7,260	441	41,860	2,618
Hawaiian Islands	248,830	11,446	179,275	9,040	2,406,769	121,609
Total Asia and Oceanica	373,680	18,372	285,875	15,102	5,999,037	339,298
Africa:						
British Africa	6,900	235	11,140	407	149,224	5,029
French Africa	2,000	48			7,353	282
Liberia	12,110	612	10,625	554	365,169	12,377
Spanish Africa					7,210	291
Total Africa	21,010	895	21,765	961	528,956	17,979
All other islands and ports	1,100	70	48	10	67,056	3,918
Grand total	14,853,627	728,472	14,733,648	704,652	162,600,083	7,370,838

Import duties on cured cod, etc., in various countries.—The following compilation shows, approximately, the average rates of duty exacted on dried cod, etc., imported into various foreign countries. It appears that France, Argentina, San Salvador, Mexico, Spain, Nicaragua, and New Zealand impose the highest duties, while in Great Britain and certain of her colonies, Sweden, Guatemala, Japan, China, Germany, and most of the West Indies the duties are of least moment. The rate in the United States is 75 cents for 100 pounds.

32. *Statement of the approximate rates of duty exacted on dried cod, etc., imported into various foreign countries.*

Countries.	Duty per 100 lbs.
Europe:	
Denmark	$0.17
France	4.20
Germany	.32
Great Britain	Free.
Greece	1.36
Italy	.44
Portugal	1.91
Spain	1.58
Sweden	Free.
North America:	
Canada	.50
Newfoundland	1.34
Mexico	2.87
Central America—	
British Honduras	Free.
Costa Rica	1.54
Guatemala	Free.
Honduras	.93
Nicaragua	2.33
San Salvador	3.31
West Indies—	
Cuba	.76
Dutch West Indies	1¼ p. ct. ad val.
Guadaloupe	.26
Haiti	1.35
Jamaica	.74
Martinique	.35
Puerto Rico	.37
North America—continued.	
West Indies—continued.	
Santo Domingo	$0.85
South America:	
Argentina	3.92
Brazil	1.00
British Guiana	.44
Chile	1.72
Colombia	1.10
Ecuador	.44
Peru	.22
Venezuela	2.19
Africa:	
Liberia	1.00
Mauritius	.11
Asia and Oceanica:	
China	.11
Japan	5 p. ct. ad val.
New South Wales	2.06
New Zealand	2.17
Queensland	1.08
South Australia	2.06
Tasmania	2.06
Victoria	20 p. ct. ad val.
West Australia	12 p. ct. ad val.
French Oceanica	.73

V.—MACKEREL.

General trade since 1884.—Notwithstanding the large catch of mackerel in this country, the demand for this fish has for many years exceeded the domestic supply. During the last ten years the imports for consumption have been 739,536 barrels, valued at $7,898,911, while the exports have been only 89,528 barrels, worth $656,812, an average annual balance of 65,000 barrels and $724,210. During 1894 the product of salt mackerel in the United States was 46,321 barrels, while the excess of imports over exports amounted to 91,612 barrels, giving an aggregate consumption in this country of 137,933 barrels. This represents 41 per cent of the world's product, the latter approximating 338,880 barrels in 1894.

The annual imports of brine-salted mackerel since 1820 are shown in Tables 5, 6, and 10, on pages 441, 443, and 447; the exports for the same period are included in the classification "pickled or brine-salted," as given in Tables 20 and 23, on pages 464 and 467.

In addition to brine-salted mackerel, quantities of fresh and canned mackerel are imported. The value of the former ranges from $20,000 to $80,000 annually, and the latter from $1,000 to $6,000. For a statement of the quantities and values of each of these products imported for consumption during a series of years, see pages 445 and 448.

The following table shows for the ten years ending June 30, 1894, the quantity and value of brine-salted mackerel imported for consumption, the quantity and value of domestic mackerel exported, the balance of trade, and average value per barrel of imported and exported mackerel:

33. *Statement of the foreign trade in brine-salted mackerel during the ten years ending June 30, 1894.*

Year ending June 30—	Imports for consumption.		Domestic exports.		Excess of imports over exports.		Average values per barrel.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Dollars.	Imports.	Exports.
1885	92,147	$702,030	24,512	$139,663	67,635	562,367	$7.62	$5.70
1886	31,848	222,716	28,505	143,847	3,343	78,869	6.99	5.05
1887	64,925	563,855	15,760	106,967	49,165	456,888	8.69	6.79
1888	56,646	548,073	7,036	71,149	49,610	476,924	9.68	10.11
1889	42,394	574,722	1,303	18,876	41,091	555,846	13.56	14.49
1890	71,038	1,011,921	948	15,512	70,090	996,409	14.24	16.36
1891	113,276	1,356,113	2,295	37,128	110,981	1,318,985	11.97	16.18
1892	88,209	863,191	3,490	47,108	84,719	816,083	9.79	13.50
1893	84,217	960,588	2,455	33,480	81,762	927,108	11.41	14.45
1894	94,836	1,095,702	3,224	43,082	91,612	1,052,620	11.55	13.37
Total	739,536	7,898,911	89,528	656,812	650,008	7,242,099	10.68	7.34

Table 34 exhibits the extent of trade in brine-salted mackerel with each foreign country during the ten years ending June 30, 1894, and the average value per barrel of imported and of exported mackerel. The imports from Europe during this period amounted to 201,869 barrels, and from the British North American Provinces, 592,306 barrels. The exports are sent principally to Haiti, British West Indies, and the United States of Colombia. During the ten years in question the average value of the imported mackerel was $10.38, and of the exported mackerel \$7.18 per barrel. The most valuable mackerel are received from Norway and Sweden, averaging \$16.39 per barrel during the last ten years; those from Ireland rank next, averaging \$12.04 per barrel. The mackerel received from the British North American Provinces average only \$9.42 per barrel.

34. *Statement by countries of the total imports and exports of brine-salted mackerel and the average value per barrel during the ten years ending June 30, 1894.*

Countries.	Foreign imports.		Domestic exports.		Average values per barrel.	
	Barrels.	Values.	Barrels.	Values.	Imports.	Exports.
Europe:						
France	4, 829	\$51, 585	3	\$43	\$10. 68	\$14. 33
Germany	2	21	20	168	10. 50	8. 40
Italy	47	648	7	70	13. 80	10. 00
Netherlands	331	3, 351	....	....	10. 12	....
Portugal	13	125	50	200	9. 61	4. 00
Sweden and Norway	55, 296	906, 650	....	....	16. 39	....
United Kingdom	141, 290	1, 701, 515	701	6, 242	12. 04	8. 90
Others	61	633	91	466	10. 37	5. 12
Total Europe	201, 869	2, 664, 528	872	7, 189	13. 20	8. 24
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	586, 761	5, 531, 689	1, 040	3, 759	9. 44	3. 61
Quebec, Ontario, etc	4, 819	44, 300	99	819	9. 19	8. 17
British Columbia	....	....	42	584	....	13. 90
Newfoundland and Labrador	726	6, 184	....	....	8. 52	....
Mexico	....	....	82	1, 088	....	13. 27
Central America—						
Costa Rica	....	....	356	4, 990	....	14. 02
Guatemala	....	....	61	767	....	12. 57
Honduras	....	....	99	1, 087	....	10. 97
Nicaragua	....	....	581	7, 885	....	13. 57
British Honduras	....	....	651	7, 164	....	11. 00
Bermuda	....	....	42	600	....	14. 29
West Indies—						
British	....	....	11, 670	72, 167	....	6. 18
Danish	....	....	452	2, 517	....	5. 57
Dutch	....	....	928	9, 333	....	10. 06
French	....	....	4, 234	23, 587	....	5. 57
Haiti	....	....	42, 906	296, 748	....	6. 92
Santo Domingo	....	....	7, 918	58, 944	....	7. 44
Spanish—						
Cuba	....	....	1, 410	12, 849	....	9. 11
Puerto Rico	....	....	2, 191	15, 883	....	7. 25
Total North America	592, 306	5, 582, 173	74, 762	520, 771	9. 42	6. 97
South America:						
Argentina	....	....	20	144	....	7. 20
Brazil	....	....	36	478	....	13. 28
Chile	....	....	12	138	....	11. 50
Colombia	....	....	8, 915	94, 122	....	10. 56
Ecuador	....	....	6	79	....	13. 17
Guianas—						
British	....	....	1, 388	7, 664	....	5. 52
Dutch	....	....	348	2, 228	....	6. 40
French	....	....	816	5, 660	....	6. 94
Peru	....	....	15	133	....	8. 87
Venezuela	....	....	501	4, 931	....	9. 84
Total South America	....	....	12, 057	115, 577	....	9. 59
Asia and Oceanica:						
British Australasia	....	....	264	2, 546	....	9. 64
Africa:						
British	71	406	210	1, 741	5. 72	8. 29
French	....	....	3	17	....	5. 67
Spanish	....	....	5	40	....	8. 00
Liberia	....	....	1, 340	8, 819	....	6. 58
Total Africa	71	406	1, 558	10, 617	5. 72	6. 81
All other	....	....	15	112	....	7. 47
Grand total	794, 246	8, 247, 107	89, 528	656, 812	10. 38	7. 34

Imports of mackerel, by countries.—Prior to 1888 almost the entire supply of brine-salted mackerel imported into the United States was received from Nova Scotia, but the recent decrease of this fish on the American coasts has resulted in large importations from Norway, England, Ireland, and, to a less extent, from other European countries. Of the imports during the last ten years, 586,761 barrels, worth \$5,531,689, came from Nova Scotia and New Brunswick; 141,290 barrels, worth \$1,701,515, came from England, Scotland, and Ireland; and 55,296 barrels, worth \$906,650, from Sweden and Norway.

In 1890, 1891, 1892, and 1893 the receipts from France were comparatively large, aggregating 4,826 barrels, but the quantity received from that country during the remaining six of the last ten years was but 3 barrels.

Table 35 shows, for each of the ten years ending June 30, 1894, the quantity and value of salted mackerel imported from the various foreign countries, the imports for consumption, and the amount of duties paid thereon. Of the 794,246 barrels imported during that period, about 81 per cent came from the British North American Provinces, nearly 18 per cent from the British Isles, 7 per cent from Sweden and Norway, and less than 1 per cent from France. During these years, however, 54,710 barrels of foreign mackerel were exported, leaving 739,536 barrels, valued at \$7,898,911, as the quantity of foreign mackerel imported for consumption. The duties paid on these imports amounted to \$1,294,775.

35. *Statement of the brine-salted mackerel imported into the United States during the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Sweden and Norway							131	\$1,300
Turkey							58	597
United Kingdom—								
England							1,875	14,602
Scotland							2	20
Total Europe							2,066	16,519
North America:								
Nova Scotia, New Brunswick, etc	88,601	\$673,705	50,497	\$304,987	78,580	\$635,628	62,608	597,061
Quebec, Ontario, etc	3,079	25,117	343	2,542	339	2,684	236	1,419
Newfoundland and Labrador			49	335	253	2,230	77	762
Total North America	91,680	698,822	50,889	307,864	79,172	640,542	62,921	599,242
Grand total	91,680	698,822	50,889	307,864	79,172	640,542	64,987	615,761
Total entered for consumption	92,147	702,030	31,848	222,716	64,925	563,855	56,646	548,073
Amount of duty				63,695		129,849		113,292

35. *Statement of the brine-salted mackerel imported into the United States during the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1889.		1890.		1891.		1892.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Denmark	1	$16						
France			627	$3,651	977	$9,587	1,977	$24,041
Germany					2	21		
Italy					2	11	23	420
Netherlands					65	1,049		
Portugal					13	125		
Russia					1	11		
Sweden and Norway	637	5,732	3,045	48,465	11,493	180,210	12,075	177,996
Turkey					1	9		
United Kingdom—								
England	10,429	123,147	22,359	297,270			6,744	84,864
Scotland	50	730	1,008	14,290	33,960	431,014	546	6,251
Ireland			545	5,393			1,079	9,536
Total Europe	11,117	129,625	27,584	369,069	46,514	622,037	22,444	303,108
North America:								
Nova Scotia, New Brunswick, etc	30,780	437,279	42,838	641,369	71,585	788,572	69,334	579,973
Quebec, Ontario, etc	410	7,375			195	2,860	28	380
Newfoundland and Labrador	87	960	15	232			2	12
Total North America	31,277	445,614	42,853	641,601	71,780	791,432	69,364	580,365
Africa:								
British Africa					71	406		
Grand total	42,394	575,239	70,437	1,010,670	118,365	1,413,875	91,808	883,473
Total entered for consumption	42,394	574,722	71,038	1,011,921	113,276	1,356,113	88,209	863,191
Amount of duty		84,788		142,075		226,551		176,419

Countries from which imported.	1893.		1894.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:						
Denmark					1	$16
France	1,245	$14,282	3	$24	4,829	51,585
Germany					2	21
Italy	3	25	19	192	47	648
Netherlands	264	2,283	2	19	331	3,351
Portugal					13	125
Russia					1	11
Sweden and Norway	11,138	212,566	16,777	280,381	55,296	906,650
Turkey					59	606
United Kingdom—						
England	12,520	148,525	27,078	323,954		
Scotland	984	11,091	3,975	38,345	141,290	1,701,515
Ireland	7,135	81,282	11,001	111,201		
Total Europe	33,289	470,054	58,855	754,116	201,869	2,664,528
North America:						
Nova Scotia, New Brunswick, etc	52,610	494,643	39,328	378,472	586,761	5,531,689
Quebec, Ontario, etc	98	1,035	91	888	4,819	44,300
Newfoundland and Labrador	239	1,620	4	33	726	6,184
Total North America	52,947	497,298	39,423	379,393	592,306	5,582,173
Africa:						
British Africa					71	406
Grand total	86,236	967,352	98,278	1,133,509	794,246	8,247,107
Total entered for consumption	84,217	960,588	94,836	1,095,702	739,536	7,898,911
Amount of duty		168,434		189,672		1,294,775

Exports of mackerel, by countries.—Comparatively few choice mackerel are exported from this country, and the export trade is practically confined to the West Indies. Of the 89,528 barrels exported during the last ten years, the West Indies received 71,709 barrels, Colombia 8,915, the Guianas 2,552, and Liberia 1,340, leaving 5,012 barrels as the quantity shipped to all the remaining countries. In 1893 over 99 per cent, and in 1894 about 90 per cent of the exports of domestic mackerel went to the West Indies. From 1880 to 1886, when mackerel were abundant on the United States coasts, quantities were exported to European countries, but this has not been done during recent years.

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Azores	33	$141	50	$215	....	....	2	$27
England	532	4,677	79	753	72	$623	12	115
France	....	....	....	....	....	....	1	8
Germany	5	35	11	75	2	20	....	....
Italy	7	70	....	....	....	....	....	....
Portugal	....	....	50	200	....	....	....	....
Total Europe	577	4,923	190	1,243	74	643	15	150
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	937	2,938	....	....	....	....	58	406
Quebec, Ontario, etc	....	....	68	389	5	44	....	....
British Columbia	3	24	7	86	1	12	....	....
Mexico	9	84	4	26	3	36	5	59
Central America—								
Costa Rica	26	257	24	203	24	255	36	527
Guatemala	6	35	....	....	3	25	1	19
Honduras	13	107	17	174	10	112	31	308
Nicaragua	70	676	33	272	63	728	51	635
British Honduras	151	1,223	136	989	74	659	51	636
West Indies—								
British	3,588	18,874	5,142	24,823	1,556	10,435	272	2,646
Danish	59	355	159	652	177	997	47	385
Dutch	161	1,103	215	1,300	211	1,920	100	1,387
French	1,574	6,483	1,657	8,246	412	2,207	188	1,454
Haiti	11,468	61,013	12,851	57,410	8,646	51,207	3,919	37,566
Santo Domingo	1,512	7,698	2,838	13,942	1,269	9,396	525	5,186
Spanish—								
Cuba	273	1,661	359	2,032	157	1,018	64	631
Puerto Rico	576	2,570	613	2,994	369	2,008	8	100
Total North America	20,426	105,101	24,123	113,538	12,980	81,059	5,356	51,945
South America:								
Argentina	15	60	....	....	....	....	....	....
Brazil	2	30	....	....	3	31	7	68
Chile	....	....	....	....	4	41	4	35
Colombia	1,698	20,666	2,757	21,805	2,006	19,594	1,331	15,373
Guianas—								
British	478	1,787	381	1,504	162	904	52	211
French	253	1,264	280	1,568	154	1,130	42	429
Dutch	210	1,160	106	571	....	....	5	60
Peru	13	103	....	....	1	12	....	....
Venezuela	211	1,142	42	285	53	481	50	650
Total South America	2,880	26,212	3,566	25,733	2,383	22,193	1,491	16,826
Asia and Oceanica:								
British Australasia	30	300	134	805	....	....	73	1,000
Africa:								
British Africa	101	569	20	87	10	60	60	745
French Africa	....	....	3	17	....	....	....	....
Liberia	494	2,532	457	2,349	312	3,002	40	471
Spanish Africa	2	11	1	7	1	10	1	12
Total Africa	597	3,112	481	2,460	323	3,072	101	1,228
All other islands and ports	2	15	11	68	....	....	....	....
Grand total	24,512	139,663	28,505	143,847	15,760	106,967	7,036	71,149

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1889.		1890.		1891.		1892.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Azores	....	....	5	$68	1	$15	....	....
England	....	....	....	....	6	74	....	....
France	....	....	....	....	1	18	1	$17
Germany	....	....	....	....	2	38	....	....
Total Europe	....	....	5	68	10	145	1	17
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	....	....	1	12	....	....	4	67
Quebec, Ontario, etc	....	....	3	57	....	....	....	....
British Columbia	....	....	2	39	1	13	....	....
Mexico	9	$92	7	124	4	73	20	286
Central America—								
Costa Rica	48	760	54	818	42	664	53	824
Guatemala	1	13	3	49	27	328	1	11
Honduras	11	147	2	34	2	34	5	72
Nicaragua	62	853	41	772	124	2,029	44	671
British Honduras	50	838	23	439	19	288	60	836
Bermuda	....	....	....	....	....	....	13	177
West Indies—								
British	184	2,312	153	2,186	97	1,707	225	3,127
Danish	....	....	....	....	2	33	....	....
Dutch	27	406	36	619	35	557	48	701
French	43	483	50	451	129	1,944	151	1,997
Haiti	128	1,784	306	5,423	1,143	19,188	1,515	21,591
Santo Domingo	31	506	34	637	142	2,525	445	5,466
Spanish—								
Cuba	18	270	5	92	59	1,013	241	3,177
Puerto Rico	12	190	25	431	94	1,454	349	4,374
Total North America	624	8,654	745	12,183	1,920	31,850	3,174	43,377
South America:								
Argentina	3	53	2	31	....	....	....	....
Brazil	2	29	....	....	....	....	3	40
Chile	....	....	1	18	3	44	....	....
Colombia	629	9,405	79	1,288	130	2,274	144	1,718
Ecuador	....	....	....	....	....	....	....	....
Guianas—								
British	....	....	22	274	172	1,826	90	870
French	4	75	20	430	16	242	32	359
Dutch	10	161	15	250	....	....	....	....
Peru	....	....	....	....	....	....	1	18
Venezuela	27	434	36	633	38	643	18	277
Total South America	675	10,157	175	2,924	359	5,029	288	3,282
Asia and Oceanica:								
British Australasia	....	....	....	....	2	36	25	405
Africa:								
British Africa	3	45	12	195	....	....	....	....
Liberia	1	20	11	142	4	68	2	27
Total Africa	4	65	23	337	4	68	2	27
Grand total	1,303	18,876	948	15,512	2,295	37,128	3,490	47,108

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:						
Azores					91	$466
England					701	6,242
France					3	43
Germany					20	168
Italy					7	70
Portugal					50	200
Total Europe					872	7,189
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	8	$80	32	$256	1,040	3,759
Quebec, Ontario, etc	8	137	15	192	99	819
British Columbia	15	150	13	260	42	584
Mexico	13	181	8	127	82	1,088
Central America—						
Costa Rica	24	365	25	317	356	4,990
Guatemala	12	189	7	98	61	767
Honduras	7	82	1	17	99	1,087
Nicaragua	50	735	43	514	581	7,885
British Honduras	54	790	33	466	651	7,164
Bermuda	18	248	11	175	42	600
West Indies—						
British	177	2,369	276	3,688	11,670	72,167
Danish	3	35	5	60	452	2,517
Dutch	37	525	58	815	928	9,333
French	19	190	11	132	4,234	23,587
Haiti	1,172	16,849	1,758	24,717	42,906	296,748
Santo Domingo	487	6,071	635	7,517	7,918	58,944
Spanish—						
Cuba	134	1,705	100	1,250	1,410	12,849
Puerto Rico	111	1,284	34	478	2,191	15,883
Total North America	2,349	31,985	3,065	41,079	74,762	520,771
South America:						
Argentina					20	144
Brazil	11	168	8	112	36	478
Chile					12	138
Colombia	65	935	76	1,064	8,915	94,122
Ecuador	1	13	5	66	6	79
Guianas—						
British			31	288	1,388	7,664
Dutch	2	26			348	2,228
French	5	48	10	115	816	5,660
Peru					15	133
Venezuela	11	167	15	219	501	4,931
Total South America	95	1,357	145	1,864	12,057	115,577
Asia and Oceanica:						
British Australasia					264	2,546
Africa:						
British Africa	4	40			210	1,741
French Africa					3	17
Liberia	5	69	14	139	1,340	8,819
Spanish Africa					5	40
Total Africa	9	109	14	139	1,558	10,617
All other islands and ports	2	29			15	112
Grand total	2,455	33,480	3,224	43,082	89,528	656,812

Import duties on salt mackerel.—In the following table the approximate rates of import duty levied on brine-salted mackerel in various foreign countries are shown, the unit being a barrel of 200 pounds. The rate in the United States is $2 per barrel.

37. *Statement of the approximate rates of duty exacted in various foreign countries on pickled or brine-salted mackerel imported therein.*

Countries.	Duty per barrel, or 200 pounds.	Countries.	Duty per barrel, or 200 pounds.
Europe:		North America—continued.	
France	$4.38	West Indies—continued.	
Germany	.644	Martinique	$2.80
Great Britain	Free.	Puerto Rico	.76
Italy	1.05	Santo Domingo	2.54 to 3.80
Portugal	1.96	South America:	
North America:		Argentina	8.40
Canada	2.00	Brazil	2.00
Mexico	5.74	British Guiana	1.00
Central America—		Chile	3.43
Costa Rica	3.08	Colombia	2.20
Guatemala	6.62	Peru	.44
Honduras	1.86	Venezuela	4.38
Nicaragua	6.52	Africa:	
British Honduras	Free.	Liberia	1.00
West Indies—		Mauritius	.26
Bahamas	.98	Asia and Oceanica:	
Barbados	.10	New South Wales	4.12
Cuba	1.52	New Zealand	4.34
Dutch West Indies	1¼ p. c. ad val.	Queensland	2.16
Guadaloupe	6 p. c. ad val.	Tasmania	12½ p. c. ad val.
Haiti	1.50	South Australia	12 p. c. ad val.
Jamaica	.98		

VI.—HERRING AND SARDINES.

Branches of the trade.—The extensive herring fisheries of this country do not suffice to furnish the markets with sufficient products of this species, and the imports of herring and sardines greatly exceed the exports in value. In fact, these constitute the most important fishery imports of the United States. The imports are in the form of sardines, pickled herring, smoked herring, and small quantities of fresh herring for bait and for food. The exports are smoked herring and small quantities of pickled herring.

The following table shows the value of the several varieties of herring products imported and exported during the seven years ending June 30, 1894, and the total balance of trade during each year:

38. *Condensed statement of the foreign trade in herring and sardines during the seven years ending June 30, 1894.*

Year ending June 30—	Imports for consumption.					Domestic exports.			Excess of imports over exports.
	Fresh herring.	Smoked herring.	Pickled herring.	Sardines.	Total.	Smoked herring.	Pickled herring.	Total.	
1888	(*a*)	$88,607	$826,251	$940,036	$1,854,894	$79,539	$22,146	$101,685	$1,753,209
1889	(*a*)	122,027	796,651	806,077	1,724,755	80,281	17,756	98,037	1,626,718
1890	(*a*)	99,362	880,238	764,507	1,744,107	103,091	9,614	112,705	1,631,402
1891	$11,589	91,032	951,697	1,008,843	2,076,161	105,260	12,352	117,612	1,958,549
1892	4,894	52,442	1,167,376	1,175,892	2,400,604	82,772	11,481	94,253	2,306,351
1893	10,262	33,815	1,151,112	1,258,158	2,453,347	93,412	8,660	102,072	2,351,275
1894	5,919	23,570	950,260	900,780	1,880,529	123,882	13,457	137,339	1,743,180
Total	32,664	510,855	6,726,585	6,854,293	14,134,397	668,237	95,466	763,703	13,370,684
Average per year	8,166	72,979	960,941	979,185	2,019,200	95,462	13,638	109,100	190,097

a No information.

FRESH HERRING, FOR BAIT AND FOR FOOD.

During each year a quantity of bait fish is imported for use in the winter bank fisheries. All of it is received from the British North American Provinces, chiefly from Newfoundland, and consists almost entirely of frozen herring. The following statement shows the quantities and values of bait herring imported during the last four years. The small quantities of fresh or frozen herring imported for food during the same period are also shown in this table.

39. *Statement of fresh or frozen herring imported for bait and for food by foreign vessels.*

Year ending June 30—	Herring for bait.		Herring for food.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
1891	350,000	$3,418	966,954	$8,171	1,316,954	$11,589
1892	502,032	2,636	160,868	2,258	662,900	4,894
1893	574,500	5,325	383,619	4,937	958,119	10,262
1894	391,892	2,829	211,991	3,090	603,883	5,919
Total	1,818,424	14,208	1,723,432	18,456	3,541,856	32,664

The foregoing table does not include all the herring received in this country from the British North American Provinces during those years, but only those brought in by foreign vessels. It has been the practice of the customs officials to admit free of duty the frozen herring brought in by United States vessels as product of the domestic fisheries. All the frozen herring used in this country are received from foreign countries, and about one-third are used for bait. The receipts of frozen herring from the Provinces range from 5,000,000 to 15,000,000 pounds annually.

SMOKED OR CURED HERRING.

Balance of trade in smoked herring.—During the last eight years the exports of smoked or cured herring have about equaled the imports. During the seven years ending June 30, 1894, the exports amounted to 25,277,958 pounds, worth $668,237, while the imports during the same period were 31,806,495 pounds, worth $732,029. The imports for consumption during that period, however, were but 21,626,128 pounds, worth $508,855. The terms of the Washington treaty had a very depressing effect on the smoked-herring industry of the United States. During 1885, the last year of that treaty, the imports for consumption of foreign smoked herring amounted to 10,441,355 pounds, while in the year following they were but 4,246,970 pounds. The imports for consumption have continued to decrease up to the present time, the quantity in 1894 being only 852,480 pounds, the smallest for twenty years. The exports have shown a correspondingly large increase. In 1888 they were but 2,948,620 pounds, worth $79,539; while in 1894 the exports of domestic smoked herring were 5,118,025 pounds, valued at $123,882. Table 40 shows the imports for consumption and the exports during each of the seven years ending in 1894, and the annual average value per 100 pounds of each class. The imports for consumption from 1874 to 1894, inclusive, as shown in Table 9 on page 446, amount to 74,548,529 pounds, worth $1,638,295.

40. *Statement of foreign trade in smoked herring during seven years ending June 30, 1894.*

Year ending June 30—	Imports for consumption.		Domestic exports.		Balance of trade.		Average values per 100 pounds.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Imports.	Exports.
1888	3,994,101	$86,607	2,948,620	$79,539	+1,045,481	+ $7,068	$2.17	$2.70
1889	4,226,839	122,027	2,404,433	80,281	+1,822,406	+ 41,746	2.89	3.34
1890	4,824,261	99,362	3,664,704	103,091	+1,159,557	— 3,729	2.06	2.81
1891	3,723,654	91,032	3,777,535	105,260	— 53,881	— 14,228	2.44	2.79
1892	2,294,159	52,442	3,279,263	82,772	— 985,104	— 30,330	2.29	2.52
1893	1,710,634	33,815	4,085,378	93,412	—2,374,744	— 59,597	1.98	2.29
1894	852,480	23,570	5,118,025	123,882	—4,265,545	—100,312	2.76	2.42
Total	21,626,128	508,855	25,277,958	668,237	—3,651,830	—159,382	2.35	2.64

NOTE.—The + indicates excess of imports over exports; — indicates excess of exports over imports.

Imports of smoked herring by countries.—Nearly all of the smoked herring imported into the United States is from Nova Scotia and New Brunswick, the remainder coming principally from Sweden, England, the Netherlands, and Newfoundland. Of the 53,685,414 pounds imported during the ten years ending June 30, 1894, 48,041,778 pounds, or 90 per cent, came from Nova Scotia and New Brunswick; 1,900,142 from Sweden; 1,486,403 from Newfoundland; 747,904 from England; and 1,509,187 pounds from all the remaining countries. The accompanying tabulation indicates the receipts of smoked or cured herring from each foreign country during each of the ten years ending June 30, 1894:

41. *Statement by countries of the imports of smoked or cured herring into the United States during the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Germany			8,394	$111	5,952	$147		
Italy							4,915	$256
Netherlands			33,464	2,105	166,586	9,305	40,100	2,031
Sweden and Norway			5,826	241	53,371	1,966	184,451	7,409
United Kingdom—								
England			34	2	32,419	1,126	84,031	4,096
Ireland							25,830	1,109
Total Europe			47,718	2,459	258,328	12,544	339,327	14,901
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	10,138,618	$122,379	4,602,498	75,302	5,325,520	76,246	5,100,002	101,366
Quebec, Ontario, etc	419,697	8,301	23,500	418	21,060	532	89,915	2,164
Newfoundland and Labrador			1,038,879	19,825	2,431	102	20,000	280
Total North America	10,558,315	130,680	5,664,877	95,545	5,349,011	76,880	5,209,917	103,810
Other islands and ports			130	17	540	29		
Grand total	10,558,315	130,680	5,712,725	98,021	5,607,879	89,453	5,549,244	118,711
Total entered for consumption	10,441,355	129,034	4,246,970	64,457	5,533,802	86,390	3,994,101	86,607
Amount of duty				21,235		27,669		19,971

41. *Statement by countries of the imports of smoked or cured herring into the United States during the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Germany	229,418	$8,111	26,189	$697	6,748	$321	....	....
Italy	....	....	2,132	102	....	....	....	....
Netherlands	28,148	2,239	96,670	2,854	48,416	1,880	2,646	$252
Sweden and Norway	329,668	16,677	701,288	27,373	317,730	10,298	35,510	1,675
United Kingdom—								
England	108,275	3,053	10,130	448	94,166	3,836	153,141	6,576
Ireland	144,625	5,751	....	....	....	....	4,931	179
Scotland	20,000	730	....	....	....	....	4,032	170
Total Europe	860,134	36,561	836,409	31,474	467,060	16,335	200,260	8,852
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	4,884,013	128,762	5,608,944	107,610	3,791,091	84,443	2,900,092	57,460
Quebec, Ontario, etc	18,655	593	20	1	1,010	27	....	....
Newfoundland and Labrador	326,623	6,718	57,200	1,059	40,200	687	70	4
Total North America	5,229,291	136,073	5,666,164	108,670	3,832,301	85,157	2,900,162	57,464
All other islands and ports	4,012	27	....	....	12	1	3,506	140
Grand total	6,093,437	172,661	6,502,573	140,144	4,299,373	101,493	3,103,928	66,456
Total entered for consumption	4,226,839	122,027	4,824,261	99,362	3,723,654	91,032	2,294,159	52,442
Amount of duty	....	21,134	....	24,121	....	23,412	....	17,206

Countries from which imported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
Germany	2,750	$70	1,090	$35	280,541	$9,492
Italy	....	....	....	....	7,047	358
Netherlands	2,846	161	7,227	341	426,103	21,168
Sweden and Norway	51,925	1,786	220,373	6,961	1,900,142	74,386
United Kingdom—						
England	155,394	6,544	110,314	4,864	747,904	30,545
Ireland	....	....	10,296	752	185,682	7,791
Scotland	....	....	....	....	24,032	900
Total Europe	212,915	8,561	349,300	12,953	3,571,451	144,640
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	2,815,352	47,853	2,875,648	63,939	48,041,778	865,360
Quebec, Ontario, etc	....	....	1,800	160	575,657	12,196
Newfoundland and Labrador	....	....	1,000	16	1,486,403	28,691
Total North America	2,815,352	47,853	2,878,448	64,115	50,103,838	906,247
All other islands and ports	1,865	71	60	11	10,125	296
Grand total	3,030,132	56,485	3,227,808	77,079	53,685,414	1,051,183
Total entered for consumption	1,710,634	33,815	852,480	23,570	41,848,255	788,736
Amount of duty	....	12,830	....	6,394	....	173,972

Exports of smoked herring by countries.—The exports of domestic smoked herring are confined almost exclusively to the West Indies and the Central and South American countries. More than one-half are sent to Haiti, with Santo Domingo, Cuba, Jamaica, Puerto Rico, and Venezuela ranking next in order.

Of the 25,277,958 pounds exported during the last seven years, Haiti received 15,566,663 pounds and Santo Domingo and Cuba 3,364,038 and 2,026,087 pounds, respectively. The American continent and adjacent islands received 24,881,338 pounds, or almost 99 per cent of the total exports, Africa 367,400, and Europe only 25,135 pounds.

The following table shows these exports in detail:

42. *Statement by countries of the quantities and values of domestic smoked herring exported from the United States during the seven years ending June 30, 1894.*

Countries to which exported.	1888.		1889.		1890.		1891.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Azores, and Madeira Islands	3,150	$98	850	$25	7,100	$248	3,210	$97
England	....	......	....	......	....	......	2,000	65
Total Europe	3,150	98	850	25	7,100	248	5,210	162
North America:								
Canada—								
Nova Scotia, etc	....	......	....	......	2,500	60	....	......
Quebec, Ontario, etc	315	15	....	......	....	......	270	12
Mexico	1,323	49	793	27	1,720	47	3,190	103
Central America—								
Costa Rica	3,082	104	1,839	71	5,690	162	3,255	100
Guatemala	67	4	64	2	360	11	150	5
Honduras	108	6	549	28	742	43	100	3
Nicaragua	640	19	1,860	91	3,500	104	4,532	137
British Honduras	3,336	97	6,502	246	6,804	300	5,524	188
West Indies—								
British	58,759	1,764	164,703	4,862	121,717	3,447	80,877	2,038
Danish	16,625	414	19,700	526	9,910	273	15,240	449
Dutch	41,483	1,081	22,249	833	27,721	796	33,674	1,009
French	77,650	1,901	87,639	2,596	137,944	3,969	160,876	4,211
Haiti	1,832,143	51,046	1,237,419	42,589	2,391,372	65,027	2,401,496	63,975
Santo Domingo	272,315	7,464	385,710	12,806	418,729	13,006	613,310	18,973
Spanish—								
Cuba	173,883	4,292	172,814	5,713	228,566	6,989	207,514	6,492
Puerto Rico	65,738	1,686	82,133	2,721	132,390	4,018	66,856	2,141
Total North America	2,547,467	69,942	2,183,974	73,111	3,489,665	98,252	3,596,864	99,836
South America:								
Colombia	119,169	3,039	86,011	2,843	20,700	665	42,220	1,308
Guianas—								
British	....	......	1,100	36	14,580	453	2,500	80
Dutch	9,555	207	10,360	304	17,375	472	11,105	328
French	40,955	803	26,410	668	32,700	909	35,915	1,041
Venezuela	41,999	1,203	33,290	1,236	48,371	1,146	50,398	1,413
Total South America	211,678	5,252	157,171	5,087	133,726	3,645	142,138	4,170
Africa:								
British Africa	10,500	225	4,000	170	14,728	440	....	......
French Africa	15,400	252	4,500	81	....	......	700	16
Liberia	142,800	3,196	42,418	1,414	15,630	389	20,632	702
Spanish Africa	17,500	569	10,015	343	3,180	98	11,991	374
Total Africa	186,200	4,242	60,933	2,008	33,538	927	33,323	1,092
All other islands and ports	125	5	1,505	50	675	19	....	......
Grand total	2,948,620	79,539	2,404,433	80,281	3,664,704	103,091	3,777,535	105,260

42. *Statement by countries of the quantities and values of domestic smoked herring exported from the United States during the seven years ending June 30, 1894*—Continued.

Countries to which exported.	1892.		1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Azores, and Madeira Islands	....	....	....	....	....	....	14, 310	$468
United Kingdom—								
England	1, 600	$56	....	....	....	....	3, 600	121
Scotland	2, 675	54	4, 550	$138	....	....	7, 225	192
Total Europe	4, 275	110	4, 550	138	....	....	25, 135	781
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	....	....	....	....	280	$20	2, 780	80
Quebec, Ontario, etc	....	....	100	2	2, 086	132	2, 771	161
British Columbia	....	....	75	5	560	29	635	34
Mexico	10, 132	248	11, 532	327	2, 176	63	30, 866	864
Central America—								
Costa Rica	4, 116	131	5, 158	121	8, 083	202	31, 223	891
Guatemala	75	2	880	43	....	....	1, 596	67
Honduras	2, 427	27	25	1	305	13	4, 256	121
Nicaragua	1, 519	49	1, 513	47	924	32	14, 488	479
British Honduras	5, 284	154	5, 847	149	4, 391	118	37, 688	1, 252
Bermuda	585	16	105	3	420	12	1, 110	31
West Indies—								
British	84, 176	1, 773	105, 840	2, 102	197, 590	4, 423	813, 662	20, 409
Danish	4, 389	125	1, 400	35	1, 050	24	68, 314	1, 846
Dutch	34, 883	932	53, 904	1, 306	45, 380	1, 157	259, 294	7, 114
French	77, 040	1, 940	22, 050	564	212, 540	4, 989	775, 739	20, 170
Haiti	2, 006, 370	46, 868	2, 564, 410	52, 630	3, 133, 453	74, 877	15, 566, 663	397, 012
Santo Domingo	303, 454	9, 250	581, 135	15, 950	789, 385	18, 475	3, 364, 038	95, 924
Spanish—								
Cuba	499, 869	14, 657	369, 109	11, 006	374, 332	10, 347	2, 026, 087	59, 496
Puerto Rico	82, 554	2, 463	69, 407	2, 026	135, 554	3, 784	634, 632	18, 839
Total North America	3, 116, 873	78, 635	3, 792, 490	86, 317	4, 908, 509	118, 697	23, 635, 842	624, 790
South America:								
Colombia	13, 732	447	18, 219	537	31, 016	863	331, 067	9, 702
Guianas—								
British	24, 850	458	2, 780	75	27, 000	548	72, 810	1, 650
Dutch	19, 940	460	36, 370	817	28, 300	619	133, 005	3, 207
French	27, 580	777	17, 950	385	16, 310	341	197, 820	4, 924
Venezuela	54, 803	1, 365	190, 471	4, 507	91, 562	2, 398	510, 894	13, 268
Total South America	140, 905	3, 507	265, 790	6, 321	194, 188	4, 769	1, 245, 596	32, 751
Africa:								
British Africa	2, 940	98	7, 418	198	2, 914	80	42, 500	1, 211
Canary Islands	1, 240	38	700	20	3, 654	95	5, 594	153
French Africa	....	....	....	....	....	....	20, 600	349
Liberia	12, 280	361	14, 430	418	7, 830	212	256, 020	6, 692
Spanish Africa	....	....	....	....	....	....	42, 686	1, 384
Total Africa	16, 460	497	22, 548	636	14, 398	387	367, 400	9, 789
All other islands and ports	750	23	....	....	930	29	3, 985	126
Grand total	3, 279, 263	82, 772	4, 085, 378	93, 412	5, 118, 025	123, 882	25, 277, 958	668, 237

Import duties in various countries on smoked herring.—The approximate rates of duty levied on smoked herring imported into various foreign countries are indicated in comparative form in the following statement. The present rate in the United States is 75 cents per 100 pounds.

43. *Approximate rates of duty on smoked herring imported into various foreign countries.*

Countries.	Duty per 100 pounds.	Countries.	Duty per 100 pounds.
Europe:		North America—continued.	
Austria-Hungary	$0.43	West Indies—	
Denmark	.17	Cuba	$0.76
France	1.32	Guadaloupe	6 p. c.
Germany	.32	Haiti ... per box	.06
Great Britain	Free.	Jamaica	.50
Greece	2.04	Puerto Rico	.38
Italy	.44	Santo Domingo	.85
Portugal	.98	South America:	
Russia	.29	Bolivia	.66
North America:		Colombia	1.10
Canada	1.00	British Guiana	.50
Mexico	2.87	Peru	.44
Central America—		Venezuela	2.19
Costa Rica	1.54	Africa:	
Honduras	.93	British Cape Colony	2.00
Nicaragua	2.33	French Gaboon	.05
British Honduras	10 p. c.	Liberia	1.00

BRINE-SALTED OR PICKLED HERRING.

General trade in pickled herring.—While the United States exports as well as imports pickled or brine-salted herring, yet the exports are vastly exceeded by the imports, the former averaging about 3,000 barrels while the latter average 135,000 barrels per annum. The average value of those imported has been about $7.12 and of those exported about $4.72 per barrel. Table 44 shows the extent of the foreign trade in pickled herring during the seven years ending June 30, 1894. It is impracticable to show the extent of the exports of pickled herring prior to 1888, as they were not separately classified, being included with all other pickled or brine-salted fish. The imports of pickled herring since 1820 are included in Tables 5, 6, and 10, on pages 441, 443, 447.

During the twenty-six years ending June 30, 1894, the imports for consumption were 2,831,992 barrels, worth $16,978,802, as shown in Table 10.

44. *Statement of the foreign trade in pickled or brine-salted herring during the seven years ending June 30, 1894.*

Year ending June 30—	Imports for consumption.		Domestic exports.		Excess of imports over exports.		Average value per barrel.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Dollars.	Imports.	Exports.
1888	126,104	$826,251	3,668	$22,146	122,436	804,105	$6.55	$6.04
1889	112,453	796,651	3,221	17,756	109,232	778,895	7.08	5.52
1890	123,831	880,238	2,267	9,614	121,564	870,624	7.11	4.24
1891	128,363	954,697	3,012	12,352	125,351	942,345	7.44	4.10
1892	150,603	1,167,376	2,700	11,481	147,903	1,155,895	7.75	4.25
1893	163,050	1,151,112	1,862	8,660	161,188	1,142,452	7.06	4.65
1894	141,476	950,268	3,501	13,457	137,975	936,811	6.71	3.84
Total	945,880	6,726,593	20,231	95,466	925,649	6,631,127	....	....

The extent of the imports of pickled herring from and the exports to each foreign country during the seven years ending June 30, 1894, is shown in Table 45. It appears that during this period the imports from Europe aggregated 689,445 barrels, or 71.72 per cent of the total imports.

The receipts from the British North American provinces were 270,840 barrels, or 28.17 per cent. Exports are principally to British West Indies, Haiti, Santo Domingo, and other islands of the West Indies.

45. *Statement by countries of the foreign trade in salted or pickled herring during the seven years ending June 30, 1894.*

Countries.	Imports.		Exports.		Average values per barrel.	
	Barrels.	Values.	Barrels.	Values.	Imports.	Exports.
Europe:						
Germany	74,566	$554,989	....	....	$7.44	....
Netherlands	292,064	3,352,666	....	....	11.48	....
Sweden and Norway	198,224	955,736	....	....	5.02	....
United Kingdom—						
England	14,140	96,205	150	$570	6.79	....
Scotland	109,322	790,568	....	....	7.23	$3.80
Ireland	642	4,316	....	....	6.72	....
Others	487	4,088	....	....	8.40	....
Total Europe	689,445	5,758,568	150	570	8.36	3.80
North America:						
Nova Scotia and New Brunswick	170,766	545,047	313	1,280	3.19	4.09
Quebec, Ontario, etc	29,224	148,759	61	303	5.08	5.00
British Columbia	....	....	6	54	....	9.00
Newfoundland	70,850	298,447	....	....	4.21	....
Miquelon, Langley, etc	1,034	3,487	....	....	3.37	....
Bermuda	....	....	6	30	....	5.00
Central America—						
Costa Rica	....	....	57	285	....	5.00
Honduras	....	....	7	54	....	7.71
Nicaragua	....	....	39	241	....	6.27
British Honduras	....	....	112	556	....	4.93
West Indies—						
British	....	....	7,811	31,017	....	3.97
Danish	....	....	1,266	6,531	....	5.16
Dutch	....	....	1,429	6,990	....	4.89
French	....	....	883	4,922	....	5.57
Haiti	....	....	5,039	28,137	....	5.58
Santo Domingo	....	....	1,550	6,981	....	4.50
Cuba and Puerto Rico	....	....	328	1,464	....	4.46
Total North America	271,874	995,740	18,908	88,845	3.61	4.69
South America:						
Colombia	....	....	463	2,151	....	4.86
Guianas—						
British	....	....	134	797	....	5.95
Dutch	....	....	76	410	....	5.40
French	....	....	49	322	....	6.55
Venezuela	....	....	68	368	....	5.41
Total South America	....	....	790	4,048	....	5.15
Africa:						
British	....	....	183	833	....	4.55
Liberia	....	....	129	795	....	6.17
Total Africa	....	....	312	1,628	....	5.22
All other islands and ports	50	242	72	375	4.84	5.14
Grand total	961,369	6,754,550	20,231	95,466	7.03	4.72

Imports of pickled herring by countries.—Pickled herring are received principally from Netherlands, Canada, Norway, Germany, Scotland, and Newfoundland. During the ten years ending June 30, 1894, the imports from the Netherlands amounted to 377,480 barrels, worth $4,379,171; from Canada 372,755 barrels, valued at $1,240,293; from Norway 231,098 barrels, worth $1,125,838; from Germany 112,250 barrels, from Scotland 111,198 barrels, from Newfoundland 94,187 barrels, and from all the remaining countries 22,052 barrels, worth $141,740;

making a grand total of 1,321,020 barrels, worth $8,983,326. The imports from the continent of Europe were 852,987 barrels, worth $7,357,293, and from North American provinces 467,976 barrels, worth $1,625,723.

The Netherlands herring are the most valuable, averaging $11.48 per barrel; those from Germany and Scotland rank next, with averages of $7.44 and $7.23, respectively. The cheaper herring are received from Nova Scotia and Newfoundland, their average value being $3.19 and $4.21, respectively, per barrel.

Notwithstanding the greater value of the Dutch herring as compared with those from England and Scotland, they are caught almost on the same ground. The difference in value (about $4.50 per barrel) is due entirely to the greater care exercised in preservation. The Dutch bleed each fish, use the best quality of salt, and take the greatest care in the manipulation. During recent years, however, the herring received from the Netherlands have not been entirely free from complaint, some New York importers claiming that the quality is not what it was formerly. This complaint is lodged against the consignments rather than the direct purchases. The imports and sales of Scotch herring are on the increase, brought about principally on account of better selection and more uniformity in quality.

46. *Statement by countries of the imports of pickled herring during the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Austria-Hungary	....	....	....	....	1	$6	....	....
Belgium	129	$1,252	26	$299	....	....	....	....
Denmark	19	134	6	28	1	11	20	$107
France	62	434	50	316	....	....	....	....
Germany	11,381	116,989	11,797	115,029	14,506	124,289	16,327	113,877
Italy	2	29	....	....	45	401	42	455
Netherlands	32,441	392,964	22,117	273,914	30,858	359,627	37,400	422,926
Sweden and Norway	4,218	29,474	9,024	46,303	19,632	94,325	22,237	100,124
United Kingdom—								
England	640	5,389	2,783	14,473	1,928	10,562	1,271	7,568
Scotland	186	1,708	814	5,048	876	5,721	1,943	12,767
Total Europe	49,078	548,373	46,617	455,410	67,847	594,942	79,240	657,824
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	91,171	259,783	30,223	88,848	22,599	79,292	36,712	114,733
Quebec, Ontario, etc	9,271	40,961	8,216	28,347	11,285	49,256	7,174	32,350
Newfoundland and Labrador	4,864	14,800	12,824	44,764	5,649	23,932	8,241	36,067
Total North America	105,306	315,544	51,263	161,959	39,533	152,480	52,127	183,150
All other islands and ports.	1	5	....	....	6	63	1	4
Grand total	154,385	863,922	97,880	617,369	107,386	747,485	131,368	840,978
Total entered for consumption	183,818	858,249	92,660	617,035	107,189	748,321	126,104	826,251
Amount of duty	....	49,088	....	92,660	....	107,189	....	126,104

46. *Statement by countries of the imports of pickled herring during the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1889.		1890.		1891.		1892.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
Austria-Hungary			4	$23	50	$279		
Belgium			174	1,571				
Denmark	15	$63	1	9	3	28		
France					1	8	6	$49
Germany	10,609	74,229	10,791	73,107	13,283	109,042	11,303	95,741
Italy	26	283	53	488	5	35	28	371
Netherlands	34,249	429,071	39,466	470,133	35,616	407,040	39,553	481,621
Sweden and Norway	22,994	110,046	27,709	117,100	21,849	130,531	32,161	190,842
United Kingdom—								
England	2,907	19,838	3,731	24,300			3,655	29,013
Scotland	3,791	23,842	6,374	48,375	19,027	133,990	24,250	215,769
Ireland	190	794	70	438			151	1,591
Total Europe	74,781	658,166	88,373	735,544	89,834	780,953	111,107	1,014,997
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	24,262	80,342	17,645	61,612	23,322	69,669	23,377	83,833
Quebec, Ontario, etc	5,370	28,094	5,389	26,606	5,264	31,299	3,091	15,827
Newfoundland and Labrador	9,044	37,266	14,033	58,056	9,707	40,139	15,212	63,817
Total North America	38,676	145,702	37,067	146,274	38,293	141,107	41,680	163,477
All other islands and ports	7	20			8	39	10	40
Grand total	113,464	803,888	125,440	881,818	128,135	922,099	152,797	1,178,514
Total entered for consumption	112,453	796,651	123,831	880,238	128,363	954,697	150,603	1,167,376
Amount of duty		112,453		123,831		128,363		150,603

Countries from which imported.	1893.		1894.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:						
Austria-Hungary					55	$308
Belgium	14	$86			343	3,208
Denmark	13	81	24	$70	102	531
France					119	807
Germany	7,844	57,855	4,409	31,138	112,250	911,296
Italy	1	16	7	66	209	2,144
Netherlands	58,788	643,780	46,992	498,095	377,480	4,379,171
Sweden and Norway	32,521	155,100	38,753	151,993	231,098	1,125,838
United Kingdom—						
England	1,398	8,886	1,178	6,600	19,491	126,629
Scotland	22,809	155,301	31,128	200,524	111,198	803,045
Ireland	191	1,217	40	276	642	4,316
Total Europe	123,579	1,022,322	122,531	888,762	852,987	7,357,293
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	28,675	87,002	16,773	47,856	314,759	972,970
Quebec, Ontario, etc	2,712	13,726	224	857	57,996	267,323
Newfoundland and Labrador	9,293	41,853	5,320	21,249	94,187	381,943
Miquelon, Langley, etc			1,034	3,487	1,034	3,487
Total North America	40,680	142,581	23,351	73,449	467,976	1,625,723
All other islands and ports	3	39	21	100	57	310
Grand total	164,262	1,164,942	145,903	962,311	1,321,020	8,983,326
Total entered for consumption	163,050	1,151,112	141,476	950,268	1,304,547	8,950,198
Amount of duty		163,050		141,476		1,194,817

Exports of pickled herring by countries.—The exports of domestic pickled herring are principally to the West Indies and the Central and South American States. The customs returns do not separately classify the exports of these fish prior to 1888, but during the seven years beginning July 1, 1888, and ending June 30, 1894, the exports to the West Indies aggregated 18,306 barrels, worth $86,042; to the South American countries, 790 barrels, worth $4,048, and to all other countries, 1,135 barrels, worth $5,376; a total of 20,231 barrels, valued at $95,466, or an annual average of 2,890 barrels and $13,638.

47. *Statement by countries of the domestic exports of pickled herring during the seven years ending June 30, 1894.*

Countries to which exported.	1888.		1889.		1890.		1891.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
North America:								
Canada—								
Nova Scotia, etc.	101	$507	....	....	....	....	....	....
Quebec, Ontario, etc	....	2	....	....	....	....	....	....
Central America—								
Costa Rica	....	....	3	$15	7	$34	4	$18
Honduras	3	18	2	25	2	11	....	....
Nicaragua	23	156	2	16	7	32	4	20
British Honduras	9	54	26	154	15	70	2	11
West Indies—								
British	273	1,495	1,424	6,836	1,485	5,898	1,705	6,021
Danish	367	1,874	314	1,817	306	1,472	151	800
Dutch	129	759	50	269	169	834	232	1,061
French	213	1,404	95	517	60	285	400	1,932
Haiti	2,185	13,386	1,047	6,841	170	775	150	734
Santo Domingo	55	558	192	946	8	35	146	715
Spanish—								
Cuba	22	140	....	....	8	40	1	4
Puerto Rico	....	....	32	130	6	30	40	201
Total North America	3,380	20,353	3,187	17,566	2,243	9,516	2,835	11,517
South America:								
Colombia	72	452	2	11	15	60	22	94
Guianas—								
British	9	63	....	....	....	....	6	20
Dutch	20	120	6	32	....	....	....	....
French	11	92	20	107	1	5	....	....
Venezuela	34	204	....	....	5	21	4	20
Total South America	146	931	28	150	21	86	32	134
Africa:								
British Africa	30	103	....	....	....	....	100	500
Liberia	97	669	....	....	....	....	....	....
Total Africa	127	772	....	....	....	....	100	500
All other islands and ports	15	90	6	40	3	12	45	201
Grand total	3,668	22,146	3,221	17,756	2,267	9,614	3,012	11,517

Countries to which exported.	1892.		1893.		1894.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
Europe:								
England	50	$220	....	....	100	$350	150	$570
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	150	525	62	$248	....	....	313	1,280
Quebec, Ontario, etc	31	175	5	21	25	105	61	303
British Columbia	3	31	1	9	2	14	6	54
Central America—								
Costa Rica	22	109	8	41	13	68	57	285
Honduras	....	....	....	....	....	....	7	54
Nicaragua	3	17	....	....	....	....	39	241
British Honduras	21	91	19	85	20	91	112	556
Bermuda	4	17	....	....	2	13	6	30

47. *Statement by countries of the domestic exports of pickled herring during the seven years ending June 30, 1894*—Continued.

Countries to which exported.	1892.		1893.		1894.		Total.	
	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.	Barrels.	Values.
North America—Continued.								
West Indies—								
British	529	$1,856	533	$2,358	1,871	$6,553	7,811	$31,017
Danish	81	365	42	183	5	20	1,266	6,531
Dutch	280	1,431	270	1,265	299	1,371	1,429	6,990
French	100	715	13	59	2	10	883	4,922
Haiti	926	3,654	199	1,225	362	1,522	5,039	28,137
Santo Domingo	370	1,615	352	1,404	427	1,708	1,550	6,981
Spanish—								
Cuba	11	51	28	115	6	32	76	382
Puerto Rico	82	363	92	358			252	1,082
Total North America	2,604	11,015	1,624	7,371	3,034	11,507	18,907	88,845
South America:								
Colombia	17	76	73	309	262	1,149	463	2,151
Guianas—								
British			105	656	14	58	134	797
Dutch			50	258			76	410
French	17	118					49	322
Venezuela	5	24	7	34	13	65	68	368
Total South America	39	218	235	1,257	289	1,272	790	4,048
Africa:								
British Africa					53	230	183	833
Liberia	7	28			25	98	129	795
Total Africa	7	28			78	328	312	1,628
All other islands and ports			3	32			72	375
Grand total	2,700	11,481	1,862	8,660	3,501	13,457	20,231	95,466

Import duties in various countries on pickled herring.—The following compilation shows in comparative form (in some instances approximately) the rates of duty imposed on pickled herring imported into the various foreign countries. The rate in the United States is $1 per barrel of 200 pounds.

48. *Statement showing approximately the rates of duty imposed in various countries on pickled herring imported therein.*

Countries.	Duty per barrel, or 200 pounds.	Countries.	Duty per barrel, or 200 pounds.
Europe:		North America—continued.	
Austria-Hungary	$0.86	West Indies—continued.	
Denmark	.34	Guadaloupe	6 p. c. ad val.
France	2.64	Haiti	1.44
Germany	.64	Jamaica	.60
Great Britain	Free.	Martinique	2.80
Italy	1.05	Puerto Rico	.76
Russia	.58	Santo Domingo	2.54
Sweden	Free.	Central America—	
Switzerland	.17	Honduras	1.86
North America:		British Honduras	Free.
Canada	1.00	South America:	
West Indies—		Brazil	2.00
Bahamas	.98	Colombia	2.20
Barbados	.10	Guiana, British	.25
Cuba	1.52	Peru	.44
Dutch West Indies	1¼ p. c. ad val.	Venezuela	4.38

SARDINES.

Sardine imports.—The importation of sardines into this country was begun about 1835, since which time they have been the principal fishery product imported. From 1858 to 1894, inclusive, the value of the sardines imported for consumption has amounted to $26,567,457. During each of four years, 1880, 1891, 1892, and 1893, the value has exceeded $1,000,000, the trade in 1893 surpassing that of any previous year. The smallest importations since 1872 have been $610,705 in 1875; $587,880 in 1876; and $677,068 in 1885.

Table 49 shows the value of the sardines imported during each of the thirty-seven years ending June 30, 1894. The custom-house returns do not indicate the quantity imported prior to 1876.

49. *Statement of the sardines imported for consumption into the United States from 1858 to 1894, inclusive.*

Year ending June 30—	Whole boxes.		Half boxes.		Quarter boxes.		In any other form.	Total values.
	Boxes.	Values.	Boxes.	Values.	Boxes.	Values.	Values.	
1858								$274, 137
1859								251, 278
1860								299, 679
1861								226, 624
1862								186, 417
1863								383, 223
1864								504, 079
1865								304, 713
1866								937, 920
1867								478, 619
1868								471, 707
1869								640, 159
1870								980, 989
1871								912, 555
1872								683, 095
1873								986, 769
1874								886, 677
1875								610, 705
1876	5, 382	$2, 253	412, 374	$64, 885	6, 297, 945	$506, 150	$14, 592	587, 880
1877	5, 813	2, 338	264, 285	48, 044	7, 985, 401	661, 597	11, 018	722, 997
1878	7, 182	2, 615	184, 539	35, 801	7, 175, 982	631, 736	11, 521	681, 673
1879	2, 424	1, 010	117, 320	23, 865	9, 875, 648	798, 563	9, 864	833, 302
1880	4, 792	1, 805	263, 728	52, 549	13, 378, 244	1, 048, 536	12, 772	1, 115, 662
1881	2, 834	982	131, 533	31, 543	10, 028, 535	913, 057	10, 440	956, 022
1882	2, 554	1, 351	51, 340	13, 435	8, 405, 856	767, 352	14, 141	796, 279
1883	2, 446	1, 447	180, 415	47, 901	6, 250, 832	710, 311	13, 970	773, 629
1884	5, 515	2, 421	503, 334	114, 403	9, 501, 850	837, 674	22, 256	976, 754
1885	7, 910	2, 834	235, 526	51, 130	6, 805, 187	599, 518	23, 586	677, 068
1886	5, 279	2, 248	241, 356	55, 250	7, 418, 010	677, 919	27, 462	762, 879
1887	3, 010	1, 117	209, 765	48, 203	8, 617, 967	739, 256	29, 099	817, 675
1888	5, 999	2, 510	406, 930	92, 014	9, 606, 262	815, 357	30, 155	940, 036
1889	4, 330	1, 458	606, 333	117, 825	8, 782, 343	657, 435	29, 359	806, 077
1890	3, 782	1, 387	343, 536	63, 690	10, 031, 656	662, 775	36, 654	764, 506
1891	4, 517	1, 271	408, 064	72, 987	12, 213, 829	879, 477	47, 108	1, 000, 843
1892	5, 841	1, 967	362, 253	79, 562	13, 237, 725	1, 049, 660	44, 703	1, 175, 892
1893	6, 353	2, 109	569, 607	126, 981	13, 454, 536	1, 083, 824	45, 244	1, 258, 158
1894	9, 985	2, 793	471, 995	91, 254	9, 365, 021	766, 637	40, 096	900, 780
Total	95, 948	35, 916	5, 964, 233	1, 231, 322	178, 432, 809	14, 806, 834	474, 040	26, 567, 457

The packing of sardines began in this country about 1875 and has gradually increased in importance, though it was confined within comparatively narrow limits until 1880. Since 1886 the value of the annual output of domestic sardines has averaged about $2,000,000, nearly all of which are consumed in this country. There is some foreign trade in domestic sardines; the United States canneries market a large quantity in Canada and ship several thousand cases to South America each year. The half-pound can of sardines in mustard is the most popular in the Canadian market. Several shipments have been sent to Australia, but considerable competition exists in that market with the English sprats, the preparation of which was begun at Dover, England, about 1883. It is not possible to show the extent of the export trade in this product, as it is not separately listed in the customs returns

While the sardines of the Maine coast differ from those occurring along the French and Portuguese coasts, yet, when carefully prepared, they are scarcely inferior to the general run of the latter. There are many consumers, however, who prefer French brands to the domestic goods. For this reason the importation of the French sardines continues to increase, and among them are large quantities of cheaper grades, which are readily marketed because they come from France.

By far the greater portion of the sardines imported into the United States are received from France, Portugal supplying the next largest quantity. Of the $9,355,286 worth received during the ten years ending June 30, 1894, $7,633,485 worth came directly from France and $589,805 from Portugal; from England direct were received $475,309 worth; from Germany, $112,412; from Sweden and Norway, $198,950; from Belgium, $93,616; and from all other countries, $251,709. However, nearly the whole of those imported into this country are the product of the French, Portuguese, and Norwegian fisheries.

The following table shows the value of sardines imported from each foreign country, the value of the imports for consumption, and amount of duty paid thereon, during the ten years ending June 30, 1894:

50. *Statement by countries of the imports of anchovies or sardines into the United States during each of the ten years ending June 30, 1894.*

Countries from which imported.	1885.	1886.	1887.	1888.	1889.	1890.
Europe:						
Austria-Hungary	$6,442	$30,354	$18,729	$7,336	$7	$26
Belgium	62	202	3,355	4,129	8,652	11,953
Denmark	417	89	158	24	91	7
England	56,506	40,782	56,213	76,996	31,073	34,843
France	489,553	708,840	619,801	792,820	699,121	625,109
Germany	4,025	8,331	6,102	7,244	6,405	5,664
Italy	2,275	4,095	5,366	5,303	4,744	7,007
Netherlands	8,263	7,024	6,013	8,543	6,058	5,637
Portugal	7	5,375	59,545	46,499	19,742	20,060
Spain	1,254	3,968	8,686	19,147	3,857	....
Sweden and Norway	9,054	11,883	14,419	22,554	11,926	14,415
Total Europe	577,858	820,943	798,387	990,595	791,676	724,721
North America:						
Nova Scotia, New Brunswick, etc	....	1,086	267	....	....	....
Quebec, Ontario, etc	2	19	1,334	241	88	1,154
Cuba	454	887	1,193	1,961	1,789	1,534
Total North America	456	1,992	2,794	2,202	1,877	2,688
All other islands and ports	1,413	765	....	762	416	699
Grand total	579,727	823,700	801,181	993,559	793,969	728,108
Total entered for consumption	677,068	762,879	817,675	940,036	806,077	764,506
Amount of duty	192,131	209,030	237,878	273,166	262,052	283,008

50. *Statement by countries of the imports of anchovies or sardines into the United States during each of the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1891.	1892.	1893.	1894.	Total.
Europe:					
Austria-Hungary	$9	$1,564	$54	$22	$64,543
Belgium	9,052	13,569	20,834	21,808	93,616
Denmark	6		715		1,507
England	65,540	52,889	39,441	21,026	475,309
France	883,321	888,780	1,084,763	841,377	7,633,485
Germany	9,998	44,742	17,998	1,903	112,412
Italy	10,725	8,864	11,081	9,497	68,957
Netherlands	1,915	318	652		44,423
Portugal	80,310	156,162	154,631	47,474	589,805
Spain	179	4,669	2,438	1,022	45,220
Sweden and Norway	25,565	26,481	32,226	30,427	198,950
Total Europe	1,086,620	1,198,038	1,364,833	974,556	9,328,227
North America:					
Nova Scotia, New Brunswick, etc					1,353
Quebec, Ontario, etc	1,539	571	613	767	6,328
Cuba	1,735	2,383	1,371	1,340	14,647
Total North America	3,274	2,954	1,984	2,107	22,328
All other islands and ports	81	157	149	289	4,731
Grand total	1,089,975	1,201,149	1,366,966	976,952	9,355,286
Total entered for consumption	1,000,843	1,175,892	1,258,158	900,779	9,103,914
Amount of duty	345,044	367,521	383,577	274,762	2,828,169

During the last few years the sardine fishery along both the French and Portuguese coasts is reported to have been poor, the run of fish being small and of inferior quality. It is further stated that there is a growing habit in those countries of catching and preserving a fish that somewhat resembles the true sardine, but which appears to be inferior to the average quarter-oil sardine packed on the Maine coast.

It is clear that this is an opportune time for the American canners, by strict attention to the quality of their output, to make special efforts to capture trade that the French and Portuguese are likely to lose in the event of placing poor sardines upon the market. Aside from this, the conditions existing in Europe should tend, in some measure, to aid the sale of American fish, since, according to late accounts, many canners in France and Portugal have not attempted to pack during the last two years on account of the scarcity of the sardines.[1]

Import duties on sardines.—The customs law of August 30, 1842, imposed a duty of 20 per cent ad valorem on sardines imported into the United States. This rate was doubled by the law of July 30, 1846, but the customs enactment of March 3, 1857, reduced the rate to 30 per cent. The act of July 30, 1864, raised the duty to 50 per cent ad valorem; but in 1872 it was again reduced to 30 per cent, where it remained until February 8, 1875, when specific duties were imposed. These were as follows: On boxes measuring not over 5 by 4 by $3\frac{1}{2}$ inches, 15 cents per box; those measuring not over 5 by 4 by $1\frac{5}{8}$ inches, $7\frac{1}{2}$ cents each; measuring not over $4\frac{3}{4}$ by $3\frac{1}{2}$ by $1\frac{1}{4}$ inches, 4 cents per box; and for sardines in any other form, an ad valorem duty of 60 per cent. The customs

[1] See New York Commercial Bulletin, July 24, 1894.

law of March 3, 1883, reduced these duties to 10 cents, 5 cents, 2½ cents, and 40 per cent ad valorem, respectively, at which rate they remain at the present time. The duties imposed in the principal foreign countries on imported sardines are shown in the accompanying compilation:

51. *Statement showing approximately the rates of duty on sardines imported into various foreign countries.*

Countries.	Duty per 100 pounds.	Countries.	Duty per 100 pounds.
Europe:		North America—continued.	
Austria-Hungary	$5.80	Central America—	
Belgium	Free.	British Honduras	10 per cent ad val.
Denmark	1.70		
France	2.19	Costa Rica	$1.54
Germany	6.48	Guatemala	5.51
Great Britain	Free.	Honduras	1.86
Greece	13.59	Nicaragua	3.26
Italy	2.63	Salvador	4.40
Netherlands	4.56	West Indies—	
Norway	2.40	Cuba	5.04
Portugal	.24	Haiti—	
Russia	5.38	Whole boxes	.10 per box.
Sweden	2.43	Half boxes	.06 per box.
Switzerland	1.39	Quarter boxes	.04 per box.
North America:		Santo Domingo	9.50
Canada—		South America:	
Whole boxes	.05 per box.	Argentina	13.13
Half boxes	.025 per box.	Bolivia	1.92
Quarter boxes	.02 per box	Brazil	11.88
Others	30 per cent. ad val.	Chile	5.10
		Guiana, British	1.00
Mexico	3.59	Peru	2.20
		Uruguay	14.10

VII.—SALMON.

Branches of trade.—The foreign trade in salmon is in fresh, salted, and canned salmon imported, and canned and salted salmon exported. A considerable trade is being developed in shipping fresh salmon to Europe, principally to Hamburg and London, the fish being first frozen. These shipments are made via New York and via New Zealand. The following statement shows briefly the extent of trade in these products during a series of ten years ending in 1894:

52. *Statement of the foreign trade in salmon during a series of ten years ending in 1894.*

Year ending June 30—	Imports for consumption.				Domestic exports.			Excess of exports over imports.
	Fresh salmon.	Salted salmon.	Canned salmon.	Total.	Salted salmon.	Canned salmon.	Total.	
1885	$152,822	$73,000	$9	$225,831	$82,114	$2,260,567	$2,342,681	$2,116,850
1886	144,719	46,073	3,503	194,295	43,450	1,875,109	1,918,559	1,724,264
1887	119,361	67,092	719	187,172	78,208	1,719,685	1,797,893	1,610,721
1888	77,726	68,916	1,109	147,751	61,046	1,608,815	1,669,861	1,522,110
1889	104,875	77,070	2,193	184,138	54,173	3,364,560	3,418,733	3,234,595
1890	91,022	68,102	479	159,603	69,042	3,259,344	3,328,386	3,168,783
1891	80,649	79,959	388	160,996	83,993	2,096,957	2,180,950	2,019,954
1892	105,565	60,918	88	166,571	78,680	1,738,465	1,817,145	1,650,574
1893	116,124	63,722	56	179,902	49,230	2,279,625	2,328,855	2,148,953
1894	156,163	84,442	620	241,225	58,659	1,026,197	1,084,856	843,631
Total	1,149,026	689,294	9,164	1,847,484	658,595	21,229,324	21,887,919	20,040,435

Imports of fresh salmon.—The principal supply of fresh salmon in the eastern markets is obtained from New Brunswick and other Canadian Provinces. The fish thus imported is the Atlantic salmon (*Salmo salar*). A few Pacific salmon, principally the chinook or quinnat salmon (*Oncorhynchus tschawytscha*), are imported from British Columbia. These imports are received principally by rail, the largest supplies entering the Maine and New York customs ports.

Prior to 1890 fresh salmon were imported free of duty, but the customs act of that year taking effect October 6, 1890, imposed a duty of three-quarters of 1 cent per pound. This duty had no appreciable effect on the quantity imported, the imports for consumption during the three years following the act averaging 1,457,702 pounds, against an average of 884,399 pounds during the three years immediately preceding it.

Table 53 shows the whole quantity and value of fresh salmon imported annually into the United States from various countries during the series of ten years ending June 30, 1894, the quantity and value entered for consumption, and the amount of duty collected during the period in which this commodity was dutiable.

According to this account, during the ten years here reported there were 12,123,613 pounds of fresh salmon, worth $1,175,645, entered at the United States customs ports. Of these, 9,644,990 pounds, worth $963,169, came from New Brunswick and Nova Scotia; 2,390,300 pounds, worth $207,625, from Quebec and Ontario; 84,581 pounds, worth $4,570, from British Columbia, and 3,635 and 107 pounds from Newfoundland and England, respectively. The total amount entered for consumption in this country was 12,109,853 pounds, worth $1,149,026, the duty on which during the four years in which the customs act of 1890 was operative amounted to $36,579. The largest quantity entered for consumption during any one year was 1,891,742 pounds in 1894, and the smallest was 768,727 pounds in 1888.

53. *Statement by countries of the imports of fresh salmon into the United States during each of the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
North America:								
Nova Scotia and New Brunswick	1,081,922	$125,459	1,118,933	$115,563	844,392	$81,433	993,897	$98,187
Quebec, Ontario	254,569	27,353	303,687	29,216	259,698	25,120	230,078	21,365
Newfoundland and Labrador	50	10	100	10	....	....	....	....
Total	1,336,541	152,822	1,422,720	144,789	1,104,090	106,553	1,223,975	119,552
Total entered for consumption	1,336,541	152,822	1,303,704	144,719	1,583,464	119,361	768,727	77,726

Countries from which imported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
North America:								
Nova Scotia and New Brunswick	865,531	$89,727	644,120	$67,476	*235,361 †496,482	$22,710 47,338	1,103,866	$98,900
Quebec and Ontario	151,491	14,951	205,183	20,931	*101,939 †6,066	9,522 894	75,863	6,249
British Columbia	....	....	4,660	241	*3,700 †1,250	95 75	6,288	301
Newfoundland and Labrador	3,485	209	....	....	....	....	....	....
Total	1,020,507	104,887	853,963	88,648	844,798	80,634	1,186,017	105,450
Total entered for consumption	1,011,456	104,875	873,014	91,022	*341,000 †503,940	32,327 48,322	1,242,760	105,565
Amount of duty	....	....	....	....	....	3,780	....	9,321

Countries from which imported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
England	107	$52	....	....	107	$52
North America:						
Nova Scotia and New Brunswick	1,017,846	100,405	1,242,640	$115,971	9,644,990	963,169
Quebec and Ontario	155,902	12,028	645,824	39,996	2,390,300	207,625
British Columbia	64,811	3,639	3,872	219	84,581	4,570
Newfoundland and Labrador	....	....	....	....	3,635	229
Total	1,238,666	116,124	1,892,336	156,186	12,123,613	1,175,645
Total entered for consumption	1,238,605	116,124	1,891,742	156,163	12,109,853	1,149,026
Amount of duty	....	9,290	....	14,188	....	36,579

* Free of duty. † Dutiable.

Trade in salted salmon.—Little difference exists between the quantity of pickled or salted salmon imported for consumption and the extent of the domestic exports. The value of the former during the ten years ending June 30, 1894, was $689,294, and the domestic exports during the same period were valued at $658,595. A statement of the imports for consumption of salted salmon from 1869 to 1894, inclusive, is given in Table 10, on page 447, and the exports since 1883 are noted in Table 24, on page 468.

The pickled or salted salmon imported into the United States come principally from Nova Scotia, New Brunswick, Quebec, and Newfoundland. Smaller quantities are received from British Columbia, the Netherlands, England, Asiatic Russia, etc.

The accompanying table shows by countries the extent of these imports during each of the last ten years, the imports for consumption during the same period, and the duty collected thereon.

54. *Statement by countries of the imports of pickled salmon into the United States during each of the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Italy			200	$8				
Sweden and Norway			200	10				
North America:								
Nova Scotia, New Brunswick, etc	668, 600	$43, 909	580, 200	33, 456	580, 000	$42, 771	665, 600	$50, 652
Quebec, Ontario, etc	169, 400	9, 491	78, 200	3, 726	25, 600	1, 918	82, 800	5, 118
British Columbia			5, 600	224	200	4	86, 000	4, 031
Newfoundland and Labrador	336, 400	22, 589	248, 000	11, 390	335, 600	24, 305	178, 400	13, 610
Total	1, 174, 400	75, 989	912, 400	48, 814	941, 400	68, 998	1, 012, 800	73, 411
Total entered for consumption	1, 124, 254	73, 000	879, 510	46, 073	917, 560	67, 092	934, 615	68, 916
Amount of duty		22		8, 795		9, 176		9, 346

Countries from which imported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
England	2, 800	$195			2, 000	$178		
Italy							406	$27
Netherlands	12, 600	924						
North America:								
Nova Scotia, New Brunswick, etc	580, 200	47, 123	350, 600	$32, 074	451, 400	41, 405	481, 900	34, 114
Quebec, Ontario, etc	7, 600	583	44, 200	2, 203	38, 839	2, 479	15, 941	1, 631
British Columbia	18, 200	860	600	36	200	5		
Newfoundland and Labrador	406, 200	28, 731	393, 800	32, 836	461, 480	36, 245	362, 600	24, 646
Total	1, 027, 600	78, 416	789, 200	67, 149	953, 919	80, 312	860, 847	60, 418
Total entered for consumption	992, 505	77, 070	797, 850	68, 102	967, 094	79, 959	878, 362	60, 918
Amount of duty		9, 925		7, 979		9, 671		8, 784

Countries from which imported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
England					4, 800	$373
Italy	69	$5	11	$1	686	41
Netherlands					12, 600	924
Sweden and Norway	35	8			235	18
North America:						
Nova Scotia, New Brunswick, etc	467, 057	36, 095	536, 520	36, 182	5, 362, 077	397, 781
Quebec, Ontario, etc	44, 000	2, 768	2, 658	217	509, 238	30, 134
British Columbia	5, 478	291	149, 410	17, 592	265, 688	23, 043
Newfoundland and Labrador	358, 428	24, 055	405, 407	30, 396	3, 486, 315	248, 803
Asia:						
Hongkong			1, 200	29	1, 200	29
Russia			11, 875	298	11, 875	298
Total	875, 067	63, 222	1, 107, 081	84, 715	9, 654, 714	701, 444
Total entered for consumption	908, 113	63. 722	1, 101, 502	84, 442	9, 501, 355	689, 294
Amount of duty		9, 081		11, 015		83, 794

Trade in canned salmon.—Practically all the canned salmon of the world are produced on the Pacific Coast of the North American continent. The extent of the product along each section of that coast for the four years, 1889, 1890, 1891, and 1892 is shown in the following table:

55. *Statement of the yield of canned salmon on the west coast of North America during the years 1889, 1890, 1891, and 1892.*

Localities.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Alaska	28, 770, 912	$2, 996, 970	30, 779, 552	$2, 629, 491	38, 827, 584	$3, 235, 632	22, 510, 360	$1, 969, 674
British Columbia	20, 122, 128	2, 414, 655	19, 895, 992	2, 387, 519	15, 170, 592	1, 517, 061	11, 928, 576	1, 043, 750
Washington	10, 129, 584	1, 050, 790	8, 094, 288	874, 784	8, 957, 136	951, 999	11, 460, 384	1, 163, 590
Oregon	11, 874, 192	1, 372, 679	15, 612, 624	1, 743, 111	13, 827, 792	1, 596, 904	18, 835, 328	2, 985, 072
California	3, 708, 960	361, 934	1, 465, 920	141, 690	599, 904	58, 990	762, 432	75, 696
Total	74, 605, 776	8, 197, 028	75, 848, 376	8, 528, 470	77, 383, 008	7, 360, 586	65, 497, 080	7, 237, 782

The principal markets for canned salmon are San Francisco and London, the former being the general shipping port, while London is the center of distribution throughout the world. Of the 28,781,661 pounds of canned salmon exported from this country in 1890, 23,740,740 pounds were sent to England for distribution. The shipments from the principal customs districts were as follows: San Francisco, 21,638,144 pounds; Oregon, 6,382,272 pounds; New York, 627,623 pounds; Puget Sound, 85,930 pounds; the shipments from all the remaining ports aggregating only 47,692 pounds. Of the 10,727,010 pounds exported in 1894, England received 7,720,747 pounds, the shipments from the principal ports being as follows: San Francisco, 6,770,108 pounds; Puget Sound, 1,325,326 pounds; Philadelphia, 1,038,087 pounds; New York, 746,581 pounds, and Oregon, 622,848 pounds.

Small quantities of canned salmon are each year imported into this country for consumption. The extent of these imports is so inconsiderable that they have no effect on the canned-salmon trade in the United States. During the ten years ending June 30, 1894, the value of these imports amounted to only $9,157, as shown in Table 11.

Table 56 shows the exports of canned salmon to various countries during the ten years ending June 30, 1894. Of the $21,229,324 worth of salmon exported during this period, $17,152,152, or 81 per cent, went to England; $2,587,972, or 12 per cent, to Australia; the exports to all other ports being only $1,489,200, or 7 per cent. It appears that the exports reached a maximum in 1889 and 1890, when they exceeded 28,000,000 pounds each year. The extensive product during these and the preceding years resulted in overstocking the market to such an extent that at the opening of the fishing season of 1891 it was reported that 400,000 cases of canned salmon were in London warehouses. This naturally resulted in decreasing the product of the canneries and the exports during the following years; and to the overstocked condition of the markets is almost entirely due the small quantity exported in 1894.

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Belgium	....	$12,745	....	....	72	$6	48	$9
France	....	24,058	....	$4,541	3,128	330	....	....
Germany	....	317	....	471	2,608	353	6,384	981
Italy	....	51	....	130	162	22	....	....
Netherlands	....	....	....	....	92	15	....	....
United Kingdom—								
England	....	1,686,375	....	1,441,456	11,995,345	1,254,875	10,282,780	1,218,956
Scotland	....	2	....	288	12,682	1,696	....	....
Total Europe	....	1,723,548	....	1,446,886	12,014,089	1,257,297	10,289,212	1,219,946
North America:								
Canada—								
Quebec, Ontario, etc	....	24,897	....	23,980	16,250	1,625	327,225	34,100
British Columbia	....	....	....	51	108,142	10,584	858	81
Mexico	....	6,334	....	4,160	56,949	6,466	69,403	8,175
Central America—								
Costa Rica	....	1,030	....	912	18,213	2,064	34,134	4,268
Guatemala	....	1,350	....	1,193	2,612	335	3,188	384
Honduras	....	630	....	558	1,212	146	3,011	400
Nicaragua	....	1,050	....	929	16,750	1,975	24,266	3,136
Salvador	....	85	....	75	....	....	1,777	205
British Honduras	....	722	....	994	7,780	1,047	5,130	783
West Indies—								
British	....	4,775	....	5,400	83,925	10,653	65,750	9,078
Danish	....	210	....	171	2,537	324	3,072	483
Dutch	....	1,213	....	1,032	9,651	1,237	7,110	1,043
French	....	47	....	150	192	22	348	52
Haiti	....	577	....	132	304	34	866	122
Santo Domingo	....	231	....	234	1,572	217	480	76
Spanish—								
Cuba	....	841	....	224	2,676	334	912	149
Puerto Rico	....	200	....	470	144	17	432	73
Total North America	....	44,192	....	40,665	328,909	37,080	547,962	62,608
South America:								
Argentina	....	2,894	....	998	21,716	2,696	30,702	5,116
Bolivia	....	....	....	....	....	....	960	168
Brazil	....	147	....	432	7,354	892	8,108	1,167
Chile	....	11,763	....	8,374	41,720	5,291	33,676	4,920
Colombia	....	18,542	....	17,165	185,754	22,183	120,627	16,034
Ecuador	....	....	....	....	26,968	3,404	25,928	4,246
Guianas—								
British	....	2,843	....	1,811	54,832	6,854	30,480	4,371
Dutch	....	90	....	169	1,248	175	....	....
French	....	116	....	188	240	31	912	130
Peru	....	890	....	3,528	9,600	1,080	7,864	1,163
Uruguay	....	80	....	129	480	72	336	42
Venezuela	....	4,277	....	3,113	25,119	3,260	40,485	5,622
Total South America	....	41,642	....	35,907	375,031	45,938	300,078	42,979
Asia and Oceanica:								
China	....	3,035	....	1,770	2,100	216	3,876	446
Hongkong	....	8,039	....	6,869	57,744	6,418	93,220	11,445
Japan	....	2,480	....	4,044	9,700	1,035	8,164	910
British Australasia	....	383,992	....	290,857	3,030,453	327,180	2,008,145	242,509
British East Indies	....	2,824	....	856	11,048	1,341	3,520	514
Hawaiian Islands	....	20,724	....	21,575	111,953	11,787	110,121	12,362
Total Asia and Oceanica	....	421,094	....	325,971	3,222,998	347,977	2,227,046	268,186
Africa:								
British Africa	....	585	....	2,983	27,280	3,580	39,665	5,741
Liberia	....	57	....	24	96	11	436	60
Spanish Africa	....	30	....	90	....	....	....	....
Total Africa	....	672	....	3,097	27,376	3,591	40,101	5,801
All other islands and ports	....	29,419	....	22,583	260,760	27,802	80,167	9,295
Grand total	20,550,609	2,260,567	17,046,445	1,875,109	16,229,163	1,719,685	13,484,566	1,608,815

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values
Europe:								
Azores, and Madeira Islands	....	....	96	$5	....	....	....	....
Belgium	....	....	....	....	900	$119	1,850	$245
France	9,000	$1,500	12,950	1,971	152,178	17,099	37,300	4,150
Germany	8,640	1,079	25,560	3,217	14,178	1,794	10,896	1,259
Italy	1,240	184	48	10	144	20	2,280	318
Netherlands	....	....	....	....	....	....	1,248	143
United Kingdom—								
England	24,841,364	2,942,937	23,740,740	2,678,691	19,397,441	1,792,938	15,452,993	1,465,738
Scotland	....	....	6	1	....	....	135	19
Total	24,860,244	2,945,700	23,779,400	2,683,895	19,564,841	1,811,970	15,506,702	1,471,872
North America:								
Canada—								
British Columbia	119,550	5,300	75,970	6,092	7,200	750	300	24
Newfoundland and Labrador	300	45	....	....	....	....	....	....
Mexico	61,518	7,376	59,250	6,749	47,031	5,402	73,489	8,091
Central America—								
Costa Rica	34,286	4,223	39,966	4,668	96,966	10,282	16,813	1,816
Guatemala	8,086	961	6,275	711	5,646	625	12,454	1,324
Honduras	4,305	562	2,339	299	4,400	475	3,670	422
Nicaragua	16,491	2,156	13,784	1,640	32,510	3,904	14,827	1,441
Salvador	1,950	220	2,856	320	1,943	219	3,500	365
British Honduras	11,787	1,604	5,640	706	12,760	1,488	13,177	1,567
Bermuda	....	....	....	....	....	....	20,685	2,519
West Indies—								
British	88,592	13,053	77,792	10,223	112,521	13,669	79,791	9,251
Danish	2,889	432	1,095	170	2,765	368	1,810	212
Dutch	5,304	755	5,298	763	7,687	970	8,281	1,016
French	1,402	225	264	34	5,213	552	1,226	137
Haiti	482	77	1,700	253	989	139	936	107
Santo Domingo	1,104	174	1,440	229	2,192	366	1,200	159
Spanish—								
Cuba	3,024	482	5,616	903	5,148	779	19,184	2,292
Puerto Rico	624	98	4,002	643	528	85	2,160	270
Total	361,694	37,746	303,287	34,403	345,499	40,073	273,503	31,013
South America:								
Argentina	39,008	6,113	49,715	7,245	6,884	995	600	70
Bolivia	....	....	1,200	145	....	....	....	....
Brazil	2,172	321	3,998	528	6,246	824	3,854	422
Chile	67,716	9,602	86,952	10,598	189,672	18,911	219,208	21,363
Colombia	75,866	10,425	14,042	1,947	20,237	2,952	24,332	2,869
Ecuador	16,352	2,286	35,094	4,198	102,690	8,229	7,782	886
Guianas—								
British	39,768	5,721	43,263	5,633	43,020	4,781	36,288	3,834
Dutch	1,460	215	3,853	542	3,216	438	4,944	551
French	1,884	239	1,260	140	280	30	432	42
Peru	18,389	2,824	13,698	2,089	19,320	2,419	53,540	4,947
Uruguay	2,446	394	624	100	3,600	555	96	14
Venezuela	35,717	5,581	45,041	6,376	44,924	5,774	43,013	4,891
Total	300,778	43,721	298,740	39,541	440,089	45,908	394,089	39,889
Asia and Oceanica:								
China	5,080	573	2,660	293	4,030	441	3,210	337
Hongkong	135,423	16,349	194,530	21,380	141,465	14,561	81,440	8,308
Japan	19,929	2,429	7,500	828	11,950	1,269	3,740	382
British Australasia	2,322,468	270,316	3,768,460	429,367	1,479,470	140,855	1,636,200	152,979
British East Indies	53,430	6,594	28,000	3,176	18,280	1,801	19,680	1,959
French Oceanica	....	....	48,860	5,530	44,755	4,743	65,918	6,758
Hawaiian Islands	139,184	15,278	191,690	20,435	239,830	25,408	173,860	17,975
Total	2,675,514	311,539	4,241,700	481,009	1,939,780	189,078	1,984,048	188,698
Africa:								
British Africa	102,832	15,234	87,735	13,477	41,508	6,429	39,193	5,238
Liberia	336	44	96	11	48	8	96	14
Spanish Africa	240	44	144	27	768	107	....	....
Total	103,408	15,322	87,975	13,515	42,324	6,544	39,289	5,252
All other islands and ports	91,502	10,532	70,559	6,981	34,692	3,384	17,394	1,741
Grand total	28,393,140	3,364,560	28,781,661	3,259,344	22,367,225	2,096,957	18,215,025	1,738,465

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
Azores, and Madeira Islands	....	....	144	$18	....	$23
Belgium	2,890	$324	540	61	....	13,509
France	4,550	480	280	28	....	54,157
Germany	1,082	158	8,445	1,218	....	10,847
Italy	2,800	325	3,264	384	....	1,444
Netherlands	48	7	....	....	....	165
United Kingdom—						
England	18,867,748	1,958,169	7,720,747	712,017	....	17,152,152
Scotland	12,000	1,400	1,440	179	....	3,585
Total Europe	18,891,118	1,960,863	7,734,860	713,905	....	17,235,882
North America:						
Canada—						
Quebec, Ontario, etc	....	....	....	....	....	84,602
British Columbia	270,480	15,080	24,150	1,506	....	39,468
Miquelon, Langley, etc	....	....	1,600	175	....	175
Newfoundland and Labrador	....	....	288	28	....	73
Mexico	83,759	9,024	59,625	5,986	....	67,763
Central America—						
Costa Rica	38,748	4,313	37,271	3,791	....	37,367
Guatemala	15,178	1,597	10,015	1,047	....	9,530
Honduras	2,722	293	2,743	279	....	4,064
Nicaragua	11,403	1,166	13,255	1,329	....	18,726
Salvador	6,840	699	2,730	284	....	2,472
British Honduras	14,699	1,548	9,791	1,019	....	11,478
Bermuda	22,975	2,800	20,759	2,504	....	7,823
West Indies—						
British	113,456	12,380	185,459	19,199	....	107,681
Danish	5,266	572	4,404	469	....	3,411
Dutch	5,832	677	5,265	612	....	9,318
French	3,390	364	1,110	117	....	1,700
Haiti	648	85	660	78	....	1,604
Santo Domingo	944	110	2,048	212	....	2,008
Spanish—						
Cuba	13,872	1,630	12,596	1,418	....	9,052
Puerto Rico	1,004	128	1,248	137	....	2,121
Total North America	611,216	52,466	395,017	40,190	....	420,436
South America:						
Argentina	36,930	3,984	30,010	3,283	....	33,394
Bolivia	....	....	....	....	....	313
Brazil	84,461	9,497	89,759	9,501	....	23,731
Chile	135,420	14,201	43,984	4,575	....	109,598
Colombia	33,548	3,818	25,352	2,958	....	98,893
Ecuador	45,975	5,124	19,499	2,084	....	30,457
Guianas—						
British	87,920	9,232	111,070	11,184	....	56,264
Dutch	5,068	589	10,176	1,033	....	3,802
French	....	....	....	....	....	916
Peru	7,290	899	11,528	1,435	....	21,274
Uruguay	1,584	190	12,520	1,486	....	3,062
Venezuela	47,736	5,126	31,577	3,291	....	47,311
Total South America	485,932	52,660	385,475	40,830	....	429,015
Asia and Oceanica:						
China	7,256	768	4,305	448	....	8,327
Hongkong	95,430	9,805	85,520	8,681	....	111,855
Japan	1,700	180	8,870	915	....	14,472
British Australasia	1,648,770	170,428	1,707,810	179,489	....	2,587,972
British East Indies	30,170	3,130	49,200	5,056	....	27,251
French Oceanica	57,465	5,893	80,650	8,323	....	31,247
Hawaiian Islands	151,380	15,561	199,469	20,364	....	181,469
Total Asia and Oceanica	1,992,171	205,765	2,135,824	223,276	....	2,962,593
Africa:						
British Africa	37,386	4,480	19,142	2,126	....	59,873
Liberia	....	....	760	78	....	307
Spanish Africa	....	....	....	....	....	298
Total Africa	37,386	4,480	19,902	2,204	....	60,478
All other islands and ports	34,220	3,391	55,932	5,792	....	120,920
Grand total	22,052,043	2,279,625	10,727,010	1,026,197	197,846,887	21,229,324

Import duties on canned salmon.—The rates of duty imposed in various foreign countries on canned salmon imported therein are shown in the appended compilation. The rate in the United States is 20 per cent ad valorem.

57. *Statement showing approximately the rates of import duty in various countries on canned salmon.*

Countries.	Duty per 100 pounds.	Countries.	Duty per 100 pounds.
Europe:		West Indies—Continued.	
Austria-Hungary	$5.80	Haiti	$9.65
Belgium	Free.	Jamaica	8 p. ct. ad val.
Denmark	3.96	Martinique	1.40
France	2.19	San Domingo	6.33
Germany	6.48	South America:	
Great Britain	Free.	Argentina	13.13
Italy	2.63	Bolivia	1.10
Netherlands	4.56	Brazil	11.88
Norway	4.80	Chile	3.19
Sweden	3.65	Colombia	4.41
Switzerland	1.39	British Guiana	Free.
North America:		Peru	2.64
Canada	25 p. ct. ad val.	Uruguay	14.10
Mexico	3.59	Venezuela	6.57
Central America:		Africa:	
Costa Rica	1.54	Cape Colony	2.00
Guatemala	5.51	Asia and Oceanica:	
Honduras	3.73	Japan	5 p. ct. ad val.
Nicaragua	3.26	New South Wales	2.06
Salvador	4.40	New Zealand	4.12
British Honduras	10 p. ct. ad val.	Queensland	4.12
West Indies:		Tasmania	12½ p. ct. ad val.
Cuba	.76	South Australia	4.12
Dutch West Indies	1¼ p. ct. ad val.	Victoria	20 p. ct. ad val.
Guadaloupe	3.48	French Oceanica	.73

VIII.—OYSTERS.

Origin and extent of export trade.—In this branch of trade with foreign countries the United States acts as a producer entirely, no oysters whatever being imported into this country. The exported product is probably about evenly divided between fresh and canned oysters, although the form of the customs returns does not permit a separation of the two classes.

The export trade is divided into three branches, viz, the shipment (1) of canned oysters, (2) of shucked oysters in tubs, etc., and (3) of barreled oysters.

The exportation of canned oysters began about 1864, and increased until about 1875, since which year it has been quite constant.

The foreign trade in shucked oysters in kegs and barrels has been confined largely to Canada, Mexico, Cuba, and other countries conveniently located, and originated with the development of the oyster trade in this country and the establishment of facilities for shipping to those countries.

The barrel trade in shell oysters has been almost entirely from New York to Liverpool, only those oysters produced between New Haven, Conn., and Barnegat, N. J., being utilized. This trade began about

1870, and the returns made by the English brokers permit the presentation of the following compilation, showing the number of barrels of shell oysters shipped from the United States to Europe each season since 1878:

58. *Statement of the exports of American oysters in barrels to Europe during each year from 1879 to 1894, inclusive.*

Year ending June 30—	Barrels.
1879	50, 063
1880	67, 116
1881	70, 768
1882	65, 012
1883	64, 437
1884	71, 021
1885	98, 802
1886	98, 997
1887	100, 906
1888	99, 123
1889	103, 109
1890	122, 163
1891	98, 802
1892	109, 657
1893	68, 966
1894	75, 428

The customs returns show the domestic value of the oysters exported from 1864 to 1894, inclusive, to have been $13,768,267. During the last ten years little variation has occurred, as may be observed in the statement showing the value of the oysters exported annually since 1863, as given in Table 20 on pages 464–465.

The principal exports of oysters are made to England, Quebec, and Ontario, those countries receiving about nine-tenths of the total quantity exported. The shipments are made chiefly from the customs districts of New York, Buffalo, Champlain, Baltimore, and Vermont. Of the $688,653 worth exported in 1894, $440,130 were consigned to England and $159,920 to Quebec and Ontario. The shipments through New York aggregated $459,048; Buffalo, $91,435; Champlain, $40,125, and through Baltimore, $38,413.

Table 59 gives the values of oysters exported to the various countries during a series of ten years ending June 30, 1894. This table shows that during the period indicated the exports to Europe were valued at $5,520,830, or 73 per cent of the whole; to British North America, $1,204,743, or 16 per cent; to the remaining portions of the American continent, $622,731, or 8 per cent, and all other countries, $238,480, or 3 per cent. The value of the exported oysters was greatest in 1888, reaching a total of $858,652; the smallest value during any year herein reported was $625,079 in 1893.

59. *Statement by countries of the exports of oysters during each of the ten years ending June 30, 1894.*

Countries to which exported.	1885.	1886.	1887.	1888.	1889.
Europe:					
Belgium	$91	$6	$20	$86	$366
Denmark	31	....	5	49	55
France	525	599	412	537	4,866
Germany	12,506	10,619	14,873	23,221	4,149
Italy	....	37	128	....	....
Netherlands	723	39	30	9	8
Portugal	....	....	....	24	282
Spain	....	4	94	36	63
Sweden and Norway	....	....	....	34	....
United Kingdom—					
England	512,115	518,469	533,471	585,792	570,836
Scotland	9,103	7,838	8,751	16,177	9,517
Total Europe	535,094	537,611	557,784	625,965	590,142
North America:					
Canada—					
Nova Scotia, New Brunswick, etc	5,294	3,581	3,717	3,427	3,064
Quebec, Ontario, etc	101,507	96,762	86,199	116,235	113,939
British Columbia	6,081	4,980	5,574	5,941	7,405
Newfoundland and Labrador	176	434	126	196	209
Mexico	6,766	5,928	7,861	9,785	8,580
Central America—					
Costa Rica	750	803	684	2,523	1,585
Guatemala	780	845	398	613	765
Honduras	302	323	62	382	285
Nicaragua	187	200	911	1,416	2,700
San Salvador	97	104	33	461	501
British Honduras	619	472	639	441	590
West Indies—					
British	2,368	2,884	3,967	3,629	2,449
Danish	221	243	342	362	413
Dutch	394	493	396	479	360
French	28	43	10	4	2
Haiti	260	381	324	312	239
Santo Domingo	643	138	232	194	436
Spanish—					
Cuba	5,146	5,358	5,986	4,447	4,646
Puerto Rico	219	367	257	301	550
Total North America	131,838	124,339	117,718	151,148	148,718
South America:					
Argentina	14,120	9,768	14,398	21,105	27,673
Bolivia	....	....	....	72	....
Brazil	1,371	892	2,513	1,097	957
Chile	2,502	5,079	5,033	5,503	6,229
Colombia	3,822	3,993	4,361	3,460	3,030
Ecuador	....	....	1,421	2,601	2,552
Guianas—					
British	294	582	539	711	223
French	....	16	....	....	....
Peru	670	494	67	827	817
Uruguay	5,530	3,385	4,682	6,034	7,110
Venezuela	2,760	2,829	2,384	2,600	3,819
Total South America	31,069	27,038	35,398	44,010	52,410
Asia and Oceanica:					
China	70	87	....	11	84
Hongkong	167	672	290	152	146
Japan	36	217	....	83	131
British Australasia	11,043	29,977	11,638	26,558	32,859
British East Indies	37	29	25	90	....
Hawaiian Islands	4,512	7,990	9,394	5,735	7,183
Total Asia and Oceanica	15,865	38,972	21,347	32,629	40,403
Africa:					
British Africa	317	402	1,287	....	1,720
Liberia	....	8	....	6	10
Spanish Africa	30	....	20	3,570	17
Total Africa	347	410	1,307	3,576	1,747
All other islands and ports	1,406	3,649	419	1,324	751
Grand total	715,619	732,019	733,973	858,652	834,171

59. *Statement by countries of the exports of oysters during each of the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1890.	1891.	1892.	1893.	1894.	Total.
Europe:						
Belgium	$739	$464	$218	$120	$490	$2,600
Denmark		342	371	30	565	1,448
France	326	208	822	533	406	9,234
Germany	5,727	8,623	6,204	5,820	6,452	98,194
Italy			87	8		260
Netherlands	46	812	151	65	58	1,941
Portugal	109	24				439
Spain	12					209
Sweden and Norway		312	80		119	545
United Kingdom—						
England	614,006	612,659	550,499	391,623	440,130	5,329,600
Scotland	8,321		5,081	3,794	5,858	74,440
Ireland			1,920			1,920
Total Europe	629,286	623,444	565,433	401,993	454,078	5,520,830
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	4,593	5,734	6,169	7,947	6,767	50,293
Quebec, Ontario, etc	112,767	96,339	78,190	118,891	159,920	1,080,749
British Columbia	9,646	13,899	6,952	4,370	6,794	71,642
Newfoundland and Labrador	170	114	334	95	205	2,059
Mexico	8,543	15,729	9,701	7,337	13,344	93,574
Central America—						
Costa Rica	1,502	1,295	1,082	1,550	944	12,718
Guatemala	662	558	1,265	729	369	6,984
Honduras	116	345	209	179	325	2,528
Nicaragua	1,807	2,254	691	550	957	11,673
San Salvador	461	392	812	508	160	3,529
British Honduras	221	224	87	208	119	3,620
Bermuda			975	1,147	647	2,769
West Indies—						
British	1,857	2,525	2,135	1,954	2,041	25,809
Danish	389	191	187	215	276	2,839
Dutch	318	537	518	427	228	4,150
French	47	102	32	6	7	281
Haiti	340	449	394	442	303	3,444
Santo Domingo	652	427	174	108	258	3,262
Spanish—						
Cuba	4,331	5,150	13,635	11,841	9,248	69,788
Puerto Rico	272	414	513	342	412	3,647
Total North America	148,694	146,678	124,055	158,846	203,324	1,455,358
South America:						
Argentina	12,800	5,264	2,084	12,842	4,799	124,853
Bolivia	100			250		422
Brazil	1,319	1,351	615	1,615	3,345	15,075
Chile	3,553	1,965	3,510	4,016	800	38,190
Colombia	955	1,595	893	1,187	649	23,945
Ecuador	1,066	1,244	1,028	1,143	1,194	12,249
Guianas—						
British	916	1,564	571	719	385	6,504
Dutch	6			111	61	178
French						16
Peru	1,013	647	522	583	947	6,587
Uruguay	4,750	2,659	943	3,939	657	39,689
Venezuela	3,819	6,460	2,767	2,823	1,321	31,582
Total South America	30,297	22,749	12,933	29,228	14,158	299,290
Asia and Oceanica:						
China	116		142	15	1,073	1,598
Hongkong	395	24	31			1,877
Japan	46	59				572
British Australasia	15,446	11,723	32,996	28,823	10,163	211,226
British East Indies	44		90	7		322
French Oceanica	279	162	138	59		638
Hawaiian Islands	9,751	9,959	7,910	5,186	5,206	72,826
Total Asia and Oceanica	26,077	21,927	41,307	34,090	16,442	289,059
Africa:						
British Africa	2,586	1,050	427	866	608	9,263
Liberia	15	10	106			155
Spanish Africa	4	132				3,773
Total Africa	2,605	1,192	533	866	608	13,191
All other islands and ports	280	1,118	10	56	43	9,056
Grand total	837,239	817,108	744,271	625,079	688,653	7,586,784

Import duties on oysters in various countries.—The following compilation shows approximately the rates of duty exacted in various foreign countries on oysters imported therein:

60. *Comparative statement of the approximate rates of duty exacted in various countries on oysters imported therein.*

Countries.	Condition.	Duty per 100 pounds.
Europe:		
Austria-Hungary	Not prepared	$3.62
	In cans, hermetically sealed	5.80
Belgium		Free.
Denmark	Fresh	Free.
	Preserved or spiced	1.70
	In cans, hermetically sealed	3.96
France	Fresh, young	Free.
	Fresh, other	$0.29 per 1,000 in number.
	Pickled or preserved	.44
Germany	Fresh	5.39
	Preserved	6.48
Great Britain	All kinds	Free.
Greece	Fresh	Free.
	Preserved	3.40
Italy	Fresh	Free.
	Preserved	2.63
Netherlands	Preserved in tins	4.56
Portugal	Shellfish	.29
Russia	Hermetically sealed	5.38
Spain	Cultivated	.26
	Uncultivated	.70
Sweden		Free.
Switzerland	Fresh	2.62
North America:		
Canada	Opened, in bulk	$0.10 per gallon.
	In the shell	25 p. ct. ad val.
	Canned, 1-pint cans	$0.03 per can.
	Canned, 1-quart cans	$0.05 per can.
Newfoundland	In the shell	Free.
Mexico	Fresh	Free.
	Canned	3.59
Central America:		
Costa Rica	Preserved in cans or otherwise	1.54
Guatemala	Preserved in any form	5.29
Honduras	Canned	3.73
Nicaragua	Preserved	1.86
Salvador	Canned	4.40
British Honduras	Fresh	Free.
West Indies:		
Barbados	Fresh or in cans	Free.
Cuba	Fresh or canned	.76
Dutch West Indies	All forms	1½ p. ct. ad val.
Guadaloupe		1.31
Haiti	Pickled, in kegs or pots	$0.18 per keg.
Jamaica	Canned	8 p. ct. ad val.
	Fresh	Free.
Puerto Rico	Fresh or preserved	.38
Santo Domingo	However packed	2.82
South America:		
Argentina		3.94
Bolivia	Canned	1.10
Brazil	Fresh	1.00
	Canned	17.33
Chile	In water, in tin, etc	3.60
Colombia	Fresh	1.10
	Canned	4.41
Guiana, British	Fresh and canned	Free.
Peru	Canned	2.64
Uruguay	Including packages	14.10
Venezuela	Canned	6.57
Africa:		
Cape Colony		Free.
Asia and Oceanica:		
Japan		5 p. ct. ad val.
Ceylon		1.03
New South Wales		Free.
New Zealand	Preserved	4.12

IX.—LOBSTERS AND OTHER CRUSTACEANS.

Imports of canned lobsters.—The foreign trade in lobsters consists entirely of imports, no domestic lobsters being exported from this country. The imports comprise canned and fresh lobsters, nearly all of which come from the British North American Provinces.

Prior to 1870 almost the entire product of canned lobsters was prepared in the United States, but the growing scarcity and increased price of these crustacea on the Maine coast resulted during 1870 in the establishment of numerous canneries in the British Provinces by New England capitalists. The number of these canneries has greatly increased, and they now furnish nearly the whole supply of this product, the present yield of canned lobsters in the Dominion of Canada being equivalent to about 13,000,000 one-pound cans, with a valuation of $1,800,000. The annual product in the United States is only about 1,250,000 one-pound cans, worth $180,000. As the consumption is about 5,250,000 cans each year, the importation of 4,000,000 cans is necessary to supply the markets.

Table 61 shows the quantities and values of canned lobsters imported and the quantities and values imported for consumption during a series of ten years ending June 30, 1894, and the average value per pound of those entered for consumption, the difference between the imports and the imports for consumption representing exports of foreign canned lobsters from this country:

61. *Table of the imports, imports for consumption, and average value per pound of canned lobsters during a series of years.*

Year ending June 30—	Imports.		Imports for consumption.		
	Pounds.	Values.	Pounds.	Values.	Average values per pound.
1885	4, 212, 745	$429, 700	3, 523, 032	$357, 730	$0. 102
1886	3, 356, 257	338, 982	2, 487, 645	252, 054	. 101
1887	4, 434, 829	337, 047	3, 549, 197	267, 901	. 076
1888	4, 827, 730	429, 668	4, 511, 153	412, 863	. 089
1889	5, 390, 979	517, 534	5, 457, 862	522, 547	. 096
1890	4, 940, 434	568, 150	4, 934, 649	568, 150	. 115
1891	7, 324, 106	966, 782	7, 309, 122	966, 008	. 132
1892	4, 197, 632	604, 052	3, 883, 248	561, 778	. 145
1893	4, 113, 913	589, 909	4, 212, 968	609, 741	. 145
1894	3, 898, 582	549, 049	4, 071, 397	574, 710	. 141
Total	46, 697, 207	5, 330, 873	43, 940, 273	5, 093, 482	. 116

By far the greater portion of canned lobsters imported into the United States are received from Nova Scotia. Of the 3,898,442 pounds imported during the year 1894, 3,862,162 came from Nova Scotia and New Brunswick, 35,560 from Quebec and Ontario, and 720 and 140 pounds from Newfoundland and Germany, respectively. Sometimes the Newfoundland receipts are quite large; in 1891, for instance, their value was $87,386.

Table 62 shows the quantities and values of lobsters received from each foreign country during the ten years ending in 1894:

62. *Statement of the imports of canned lobsters into the United States during each of the ten years ending June 30, 1894.*

Countries from which imported.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
	Values.	Values.	Values.	Values.	Values.	Values.	Values.
Europe:							
England	....	....	....	....	$4	$691	....
Germany	....	....	....	....	....	....	$4
Netherlands	....	....	....	....	....	131	....
Total Europe	....	....	....	....	4	822	4
North America:							
Nova Scotia, New Brunswick, etc	$416, 163	$336, 728	$327, 992	$403, 757	488, 709	486, 591	832, 921
Quebec, Ontario, etc	13, 537	2, 254	9, 055	12, 694	2, 135	4, 691	46, 471
Newfoundland and Labrador	....	....	....	13, 217	26, 686	76, 046	87, 386
Total North America	429, 700	338, 982	337, 047	429, 668	517, 530	567, 328	966, 778
Grand total	429, 700	338, 982	337, 047	429, 668	517, 534	568, 150	966, 782

Countries from which imported.	1892.		1893.		1894.		Total.
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Values.
Europe:							
England	4, 800	$681	36, 806	$5, 324	....	....	$6, 700
Germany	....	....	....	....	140	$22	26
Italy	450	39	....	....	....	....	39
Netherlands	....	....	....	....	....	....	131
Total Europe	5, 250	720	36, 806	5, 324	140	22	6, 896
North America:							
Nova Scotia, New Brunswick, etc	3, 974, 304	570, 133	3, 962, 674	568, 841	3, 862, 162	543, 830	4, 975, 665
Quebec, Ontario, etc	28, 478	4, 468	58, 309	6, 368	35, 560	5, 122	106, 795
Newfoundland and Labrador	189, 600	28, 731	56, 124	9, 376	720	75	241, 517
Total North America	4, 192, 382	603, 332	4, 077, 107	584, 585	3, 898, 442	549, 027	5, 323, 977
Grand total	4, 197, 632	604, 052	4, 113, 913	589, 909	3, 898, 582	549, 049	5, 330, 873

It is much cheaper to can lobsters in the British North American Provinces than in the United States. In this country the 9-inch lobsters cost about $1.25 per 100; the wages of men in canneries range from $1.50 to $2 per day, and women and boys receive from 75 cents to $1 per day. In the Provinces the lobsters cost about 75 cents per 100; the men's wages are about $1, while women and boys receive only about 50 cents per day. In addition to this, there is a duty on the tin in the United States, while that article is free of duty in the Provinces.

Fifteen years ago London was the principal market of the world for canned lobsters, England, France, and Germany receiving about three-fourths of the entire product. At that time the world's output amounted to about 400,000 cases of 48 one-pound cans. Comparatively few were then consumed in the United States; but the consumption has steadily increased in this country, so that while the total pack has now decreased to about 250,000 cases a year, the United States consumes about 110,000 cases, or 44 per cent of the entire yield.

Import duties in various countries.—Canned lobsters have at all times been imported into the United States free of duty, but by the tariff act of 1874 a tax of $1\frac{1}{2}$ cents was imposed on each can containing this product. In 1890 this duty was reduced to 8 cents per dozen cans, to take effect July 1, 1891. The customs law of 1894 did not provide for this duty.

63. *Statement of the approximate rates of duty imposed upon canned lobsters imported into various foreign countries.*

Countries.	Duty per 100 pounds.
Europe:	
Austria-Hungary	$5.80
Belgium	Free.
Denmark	3.96
France	2.19
Germany	5.39
Great Britain	Free.
Greece	13.59
Italy	2.63
Netherlands	4.56
Norway	4.80
Portugal	9.79
Russia	5.38
Sweden	4.08
North America:	
Dominion of Canada	25 p. ct. ad val.
Mexico	3.59
Central America:	
Costa Rica	1.54
Guatemala	5.51
Nicaragua	1.86
Salvador	4.40
West Indies:	
Cuba	.76
Dutch West Indies	1¼ p. ct. ad val.
Guadaloupe	3.48
West Indies—Continued.	
Haiti	$9.65
Martinique	1.40
South America:	
Argentina	13.13
Brazil	11.88
Colombia	4.40
Guiana, British	1.00
Peru	2.64
Venezuela	6.57
Asia and Oceanica:	
Japan	5 p. ct. ad val.
Philippine Islands	2.27
Queensland	4.12
South Australia	4.12
West Australia	12 p. ct. ad val.
Victoria	20 p. ct. ad val.
New Zealand	4.12
Tasmania	12½ p. ct. ad val.
French Oceanica	2.13
Africa:	
Mauritius	7½ p. ct. ad val.
Cape Verde Islands	20 p. ct. ad val.
Cape Colony, Orange Free-State, and British Bechuanaland	2.00

Fresh lobsters and shrimp and turtles.—A considerable trade has been built up during the last fifteen years in the importation of fresh lobsters from New Brunswick, Nova Scotia, and Newfoundland. These are received alive in bulk and in packages holding about 140 pounds, Boston being the principal port of entry.

The customs returns do not permit an exact statement of the importation of fresh lobsters, but combine these with fresh and dried shrimp, crawfish, and turtles. The total value of these products imported amounts to about $210,000 annually, of which about $185,000 represents fresh lobsters; $20,000 shrimp, and the remaining $5,000 turtles. The shrimp come principally from China and Hongkong, the turtles from Mexico and the West Indies. The value of the fresh lobsters and shrimp and turtles imported for consumption during each year from 1876 to 1894, inclusive, is shown in Table 7 on page 444.

Table 64 shows the value of the fresh lobsters and shrimp and turtles imported from each country during the nine years ending June 30, 1894, and the value of those imported for consumption.

64. *Statement by countries of the imports of fresh lobsters and of shrimp and turtles into the United States during each of the ten years ending June 30, 1894.*

Countries from which imported.	1886.	1887.	1888.	1889.	1890.
Europe:					
England	$47	$65	$5	$78	....
France	26	63	128	14	$48
Germany	....	....	....	53	....
All others	4	....	2	9	3
Total Europe	77	128	135	154	51

64. *Statement by countries of the imports of fresh lobsters and of shrimp and turtles into the United States during each of the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1886.	1887.	1888.	1889.	1890.
North America:					
Canada—					
Nova Scotia, New Brunswick, etc	$61,669	$62,974	$100,315	$112,914	$109,176
Quebec, Ontario, etc			3	79	30
British Columbia	25		137	12	33
Newfoundland and Labrador				7,027	
Mexico	305	679	668	647	1,420
Costa Rica		10	10		472
West Indies—					
British	613	1,187	2,154	2,239	2,179
Dutch	460	542	582	287	50
Spanish—					
Cuba	653	404	710	353	6,095
Santo Domingo	65	83	55	20	
Total North America	63,790	65,879	104,634	123,578	119,455
South America:					
Colombia		30	130	160	3
Venezuela	834	1,121	142		
Total South America	834	1,151	272	160	3
Asia:					
China	1,931	1,594	3,296	3,691	10,015
Hongkong	225	184	121	151	1,540
Japan			38		11
Total Asia	2,156	1,778	3,455	3,842	11,566
All other countries	250	25	719		
Grand total	67,107	68,961	109,215	127,734	131,075
Total entered for consumption	64,632	76,452	105,161	123,093	125,831

Countries from which imported.	1891.	1892.	1893.	1894.	Total.
Europe:					
Austria-Hungary		$1,037			$1,037
England	$22	49	$101	$51	418
France	69	536	199	144	1,227
Germany	120	5	100		278
All others			22		40
Total Europe	211	1,627	422	195	3,000
North America:					
Canada—					
Nova Scotia, New Brunswick, etc	146,944	174,995	226,551	180,177	1,175,715
Quebec, Ontario, etc	13	65	173	429	792
British Columbia	37	6			250
Newfoundland and Labrador		4	5		7,036
Mexico	3,618	2,155	2,035	2,825	14,352
Costa Rica			970		1,462
West Indies—					
British	3,045	1,421	2,654	2,217	17,709
Dutch			67	85	2,073
Spanish—					
Cuba	1,510	2,541	1,347	850	14,463
Santo Domingo					223
Total North America	155,167	181,187	233,802	186,583	1,234,075
South America:					
Colombia					323
Venezuela			45	75	2,217
Total South America			45	75	2,540
Asia:					
China	21,126	14,910	16,491	13,325	86,379
Hongkong	2,725	4,828	3,518	3,483	16,775
Japan	195	241	241	370	1,096
Total Asia	24,046	19,979	20,250	17,178	104,250
All other countries	470	545			2,009
Grand total	179,894	203,338	254,519	204,031	1,345,874
Total entered for consumption	180,783	207,221	255,780	199,199	1,338,152

X.—MARINE OILS.

General foreign trade in marine oils.—The decrease in exports of marine oils is largely responsible for the falling off in the extent of our foreign trade in fishery products, and the decrease in oil exports is a necessary consequence of the decline in the whale fishery. In 1876 the value of the domestic marine oil exported was $1,802,318; in 1894 it was only $140,851. The total value of fishery products exported during the former year was $5,806,445, and in the latter it was but $4,258,306. A large quantity of menhaden oil is now exported for use as a lubricant and in dressing leather, etc.

The following compilation shows for a series of twenty-six years ending June 30, 1894, the quantity and value of foreign marine oil imported into the United States, the domestic oil exported, the excess of each item over the other, and the average value per gallon of each class:

65. *Statement of the foreign trade in marine oils during the twenty-six years ending in 1894.*

Years ending June 30—	Imports for consumption.		Domestic exports.		Balance of trade.		Average value per gallon.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Dollars.	Imports.	Exports.
1869	897, 388	$426, 874	811, 533	$1, 443, 248	+ 85, 855	—$1, 016, 374	$0. 476	$1. 778
1870	723, 626	369, 167	810, 675	1, 022, 710	— 87, 049	— 653, 543	. 510	1. 262
1871	397, 386	204, 228	1, 402, 016	1, 145, 406	— 1, 004, 630	— 941, 178	. 514	. 817
1872	346, 183	158, 504	1, 865, 320	1, 532, 438	— 1, 519, 137	— 1, 373, 934	. 458	. 822
1873	261, 314	119, 788	1, 044, 569	1, 250, 074	— 783, 255	— 1, 130, 286	. 458	1. 197
1874	301, 585	163, 046	1, 103, 678	1, 108, 741	— 802, 093	— 945, 695	. 541	1. 005
1875	334, 495	185, 404	1, 387, 037	1, 260, 425	— 1, 052, 542	— 1, 075, 021	. 554	. 909
1876	202, 192	151, 249	1, 960, 277	1, 802, 318	— 1, 758, 085	— 1, 651, 069	. 748	. 919
1877	188, 736	119, 340	1, 661, 029	1, 322, 030	— 1, 472, 293	— 1, 202, 690	. 632	. 796
1878	377, 898	211, 847	1, 628, 386	1, 212, 026	— 1, 250, 488	— 1, 000, 179	. 561	. 744
1879	246, 749	125, 547	3, 059, 193	1, 476, 079	— 2, 812, 444	— 1, 350, 532	. 509	. 483
1880	495, 775	223, 139	1, 505, 042	836, 113	— 1, 009, 267	— 612, 974	. 450	. 556
1881	787, 264	361, 956	912, 380	532, 839	— 125, 116	— 170, 883	. 460	. 584
1882	553, 641	270, 250	1, 623, 989	971, 942	— 1, 070, 348	— 701, 692	. 488	. 598
1883	483, 710	280, 575	502, 004	405, 907	— 18, 294	— 125, 332	. 580	. 809
1884	782, 301	373, 773	831, 984	516, 089	— 49, 683	— 142, 316	. 478	. 620
1885	402, 503	209, 845	1, 187, 614	504, 726	— 785, 111	— 294, 881	. 521	. 425
1886	183, 599	88, 811	1, 364, 679	511, 107	— 1, 181, 080	— 422, 296	. 484	. 375
1887	187, 577	85, 839	1, 505, 973	471, 381	— 1, 318, 396	— 385, 542	. 458	. 313
1888	55, 705	92, 515	1, 496, 501	409, 845	— 1, 440, 796	— 317, 330	1. 661	. 274
1889	387, 021	105, 938	582, 040	197, 040	— 195, 019	— 91, 102	. 274	. 339
1890	305, 591	95, 947	2, 006, 606	565, 374	— 1, 701, 015	— 469, 427	. 314	. 282
1891	300, 159	113, 775	1, 467, 321	401, 203	— 1, 167, 162	— 287, 428	. 379	. 273
1892	329, 945	151, 000	969, 828	337, 968	— 639, 883	— 186, 968	. 458	. 348
1893	922, 107	285, 593	205, 800	92, 928	+ 716, 307	+ 192, 665	. 310	. 452
1894	588, 978	184, 510	294, 371	140, 851	+ 294, 607	+ 43, 659	. 313	. 478
Total	11, 043, 428	5, 158, 460	33, 189, 845	21, 470, 808	—22, 146, 417	—16, 312, 348	....	....

The sign + indicates excess of imports over exports; — indicates excess of exports over imports.

66. *Statement by countries of the foreign trade in marine oils during the ten years ending June 30, 1894.*

Countries.	Imports.		Exports.		Balance of trade.		Average value per gallon.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Dollars.	Imports.	Exports.
Europe:								
Azores, and Madeira Islands	22,733	$5,408	....	....	+ 22,733	+ 5,408	$0.238	......
Belgium	1,125	584	37,089	$14,253	— 35,964	— 13,669	.519	$0.384
France	8,136	3,353	1,310,334	438,721	—1,302,198	— 435,368	.412	.335
Germany	226,992	107,677	454,648	130,179	— 227,656	— 22,502	.474	.286
Italy	....	....	3,000	1,100	— 3,000	— 1,100	......	.367
Netherlands	1,651	571	15,062	7,017	— 13,411	— 6,446	.346	.466
Sweden and Norway	1,337,077	686,161	....	....	+1,337,077	+ 686,161	.513	......
United Kingdom—								
England	84,305	47,780	3,505,300	1,331,719	—3,420,995	—1,283,939	.567	.380
Scotland	7,168	2,669	4,748,433	1,335,450	—4,741,265	—1,332,781	.372	.281
Total Europe	1,689,187	854,203	10,073,866	3,258,439	—8,384,179	—2,404,236	.506	.323
North America:								
Canada—								
Nova Scotia and New Brunswick	977,184	252,745	10,749	2,577	+ 966,435	+ 250,168	.259	.240
Quebec and Ontario	47,597	18,796	18,990	12,123	+ 28,607	+ 6,673	.397	.638
British Columbia	134,685	38,373	72,263	22,007	+ 62,422	+ 16,366	.284	.304
Newfoundland	571,600	180,243	....	....	+ 571,600	+ 180,243	.315	......
Miquelon and Langley	15,431	3,501	....	....	+ 15,431	+ 3,501	.227	......
Mexico	....	....	88,452	37,311	— 88,452	— 37,311	......	.422
Central America	....	....	3,775	2,339	— 3,775	— 2,339	......	.619
West Indies	10,011	5,324	39,900	19,699	— 29,889	— 14,375	.532	.495
Total North America	1,756,508	498,982	234,129	96,056	+1,522,379	+ 402,926	.284	.410
South America:								
Argentina	....	....	185	138	— 185	—138	......	.746
Brazil	....	....	3,127	1,839	— 3,128	— 1,839	......	.588
Chile	....	....	2,543	2,076	— 2,543	— 2,076	......	.816
Colombia	....	....	5,252	3,274	— 5,252	— 3,274	......	.623
Peru	....	....	12,086	4,039	— 12,086	— 4,039	......	.334
Uruguay	....	....	2,216	528	— 2,216	— 528	......	.238
Venezuela	....	....	4,378	1,244	— 4,378	— 1,244	......	.284
Total South America	....	....	29,787	13,138	— 29,787	— 13,138	......	.441
Asia and Oceanica:								
China	5,430	1,000	....	....	+ 5,430	+ 1,000	.184	......
Hongkong	2,293	594	118,616	44,526	— 116,323	— 43,932	.259	.376
Japan	473,549	84,881	....	....	+ 473,549	+ 84,881	......	.180
British Australasia	10,153	2,914	612,335	215,677	— 602,182	— 212,763	.287	.352
Hawaiian Islands	....	....	7,796	3,376	— 7,796	— 3,376	......	.433
Total Asia and Oceanica	491,425	89,389	738,747	263,579	— 247,322	— 184,190	.182	.343
All other islands and ports	470	367	4,204	1,211	— 3,734	— 844	.781	.288
Grand total	3,937,590	1,442,941	11,080,733	3,632,423	—7,143,143	—2,189,482	.366	.328

NOTE.—In balance of trade, + indicates excess of imports over exports; — indicates excess of exports over imports.

Imports of marine oils.—The marine oils imported consist of three classes, viz, cod-liver oil, seal oil, and whale and fish oil. Of the imports during the last ten years, the first-named comprised 53 per cent, the seal oil 3 per cent, and the whale and fish oil the remaining 44 per cent. The following compilation shows the quantity and value of each class imported for consumption during the twenty-six years ending in 1894 and the average value per gallon.

67. *Statement of the quantities and values of marine oils imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Cod-liver oil.			Seal oil.		
	Gallons.	Values.	Average values per gallon.	Gallons.	Values.	Average values per gallon.
1869	2, 682	$1, 234	$0. 460	429, 432	$242, 937	$0. 566
1870	158, 739	73, 020	. 460	477, 050	251, 929	. 528
1871	44, 513	20, 476	. 460	188, 076	100, 994	. 537
1872	249, 934	114, 870	. 460	308	254	. 825
1873	198, 856	94, 862	. 477	10	2	. 200
1874	181, 759	105, 595	. 581	354	173	. 489
1875	236, 579	142, 319	. 602	220	156	. 695
1876	108, 798	71, 920	. 661	20, 954	23, 216	1. 108
1877	141, 995	97, 041	. 683	410	80	. 195
1878	297, 269	179, 534	. 604	24, 282	11, 369	. 468
1879	172, 176	94, 671	. 550	218	89	. 408
1880	315, 910	152, 441	. 483	4, 287	1, 938	. 452
1881	516, 657	236, 763	. 459	100	72	. 720
1882	302, 137	162, 563	. 538	76, 380	30, 861	. 404
1883	218, 716	159, 271	. 733	612	550	. 899
1884	412, 135	275, 078	. 667	14, 868	7, 719	. 519
1885	221, 030	153, 945	. 696	2, 423	1, 087	. 449
1886	115, 454	67, 652	. 586	2, 561	943	. 368
1887	130, 296	69, 326	. 532	4, 728	2, 586	. 547
1888	165, 633	78, 233	. 472	1, 216	573	. 471
1889	287, 183	81, 589	. 284	1, 338	670	. 501
1890	267, 555	86, 476	. 323	2, 574	758	. 294
1891	248, 894	98, 865	. 397	250	97	. 388
1892	202, 959	115, 577	. 569	27, 712	9, 046	. 326
1893	190, 432	99, 709	. 524	54, 821	18, 706	. 341
1894	209, 865	99, 318	. 473	7, 869	2, 956	. 376
Total	5, 598, 156	2, 932, 348	....	1, 343, 053	709, 761	....

Year ending June 30—	Whale and fish oils.			Total.		
	Gallons.	Values.	Average values per gallon.	Gallons.	Values.	Average values per gallon.
1869	465, 274	$182, 703	$0. 393	897, 388	$426, 874	$0. 476
1870	87, 837	44, 218	. 503	723, 626	369, 167	. 510
1871	146, 797	82, 758	. 564	397, 386	204, 228	. 514
1872	95, 941	43, 380	. 452	346, 183	158, 504	. 458
1873	62, 448	24, 924	. 399	261, 314	119, 788	. 458
1874	119, 472	57, 278	. 479	301, 585	163, 046	. 541
1875	97, 696	42, 929	. 439	334, 495	185, 404	. 554
1876	72, 440	56, 114	. 775	202, 192	151, 249	. 748
1877	46, 331	22, 219	. 479	188, 736	119, 340	. 632
1878	56, 347	20, 944	. 372	377, 898	211, 847	. 561
1879	74, 355	30, 787	. 414	246, 749	125, 547	. 509
1880	175, 578	68, 760	. 392	495, 775	223, 139	. 450
1881	270, 507	125, 121	. 463	787, 264	361, 956	. 460
1882	175, 122	76, 826	. 439	553, 641	270, 250	. 488
1883	264, 382	120, 754	. 457	483, 710	280, 575	. 580
1884	355, 298	90, 976	. 256	782, 301	373, 773	. 478
1885	179, 050	54, 813	. 306	402, 503	209, 845	. 521
1886	65, 584	20, 216	. 308	183, 599	88, 811	. 484
1887	52, 553	13, 927	. 265	187, 577	85, 839	. 458
1888	54, 489	13, 709	. 252	55, 705	92, 515	1. 661
1889	98, 500	23, 679	. 240	387, 021	105, 938	. 274
1890	35, 462	8, 713	. 246	305, 591	95, 947	. 314
1891	51, 015	14, 813	. 290	300, 159	113, 775	. 379
1892	99, 274	26, 377	. 266	329, 945	151, 000	. 458
1893	676, 854	167, 178	. 247	922, 107	285, 593	. 310
1894	371, 244	82, 236	. 222	588, 978	184, 510	. 313
Total	4, 249, 850	1, 516, 352	....	11, 043, 428	5, 158, 460	....

These oils are received principally from Norway, Nova Scotia, Newfoundland, Japan, and Germany. During the last ten years the imports from Norway and Sweden have amounted to 1,337,077 gallons, worth $686,161; from Nova Scotia and New Brunswick, 977,184 gallons, worth $252,745; from Newfoundland, 571,600 gallons, worth $180,243;

from Japan, 473,549 gallons; and from all other countries combined, 580,180 gallons, making a grand total of 3,937,590 gallons, the value of which was $1,442,941, exclusive of import duties. The European continent furnished 1,689,187 gallons, worth $854,203; the American continent, 1,756,508 gallons, valued at $498,982; and Asia and Australasia, 491,425 gallons, worth $89,389.

The greatest annual receipt during this period was 967,438 gallons in 1893, and the smallest was 181,835 in 1886, the annual average for the period being 393,759 gallons. The receipts from Europe are quite constant, none of the last eight years varying more than 35 per cent from the annual average. The imports from the British Provinces are far less regular, sometimes varying over 200 per cent from the annual average. The receipts from the Provinces in 1892 were 99,299 gallons, while in 1893 they reached 548,181 gallons, an increase of 554 per cent. In 1894 they decreased to 160,960 gallons.

Table 68 shows the imports from each country, the imports for consumption, and the amount of duties paid thereon during each of the ten years ending June 30, 1894.

68. *Statement by countries of the imports of marine oils into the United States during the ten years ending June 30, 1894.*

Countries from which imported.	1885.		1886.		1887.		1888.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:								
Azores, and Madeira Islands	5,974	$1,501	12,007	$2,718	1,875	$375	1,217	$384
Belgium	....	....	....	....	50	26	....	....
France	....	....	1,250	587	688	246	....	....
Germany	15,852	14,061	12,036	7,568	14,494	7,569	20,038	10,994
Netherlands	....	....	39	18	25	20	34	13
Sweden and Norway	46,857	45,283	73,795	50,519	99,974	53,621	116,854	66,177
United Kingdom—								
England	5,444	6,071	9,704	6,881	3,921	2,961	13,382	8,560
Scotland	....	....	360	115	....	....	....	....
Total Europe	74,127	66,916	109,191	68,406	121,027	64,818	151,525	86,128
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	148,966	60,837	31,108	8,548	14,078	3,384	77,468	16,427
Quebec, Ontario, etc	9,794	5,470	1,763	898	1,071	696	1,347	346
British Columbia	46,348	13,932	32,175	8,578	34,051	9,067	9,002	2,800
Newfoundland and Labrador	62,011	50,912	2,585	1,568	1,888	867	1,034	347
Miquelon, Langley, etc	....	....	....	....	....	....	2,064	479
British West Indies	8,216	4,941	....	....	....	....	....	....
Total North America	275,335	136,092	67,631	19,592	51,088	14,014	90,915	20,399
Asia:								
China	....	....	2	1	750	389	....	....
Hongkong	....	....	....	....	1,243	281	10	23
Japan	101,265	24,832	5,010	786	170	151	....	....
Total Asia	101,265	24,832	5,012	787	2,163	821	10	23
All other islands and ports	453	323	1	17	....	....	....	....
Grand total	451,180	228,163	181,835	88,802	174,278	79,653	242,450	106,550
Total entered for consumption	*224,030 178,473	*120,168 89,676	183,599	88,811	187,577	85,839	221,077	92,514
Amount of duty	....	22,418	....	22,203	....	21,459	....	23,128

* Free of duty.

68. *Statement by countries of the imports of marine oils into the United States during the ten years ending June 30, 1894*—Continued.

Countries from which imported.	1889.		1890.		1891.		1892.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:								
Azores, and Madeira Islands	....	....	1,660	$430	....	....	....	....
Belgium	....	....	....	....	....	....	625	$364
England	5,620	$2,258	4,293	1,602	16,183	$7,182	1,538	863
France	....	....	....	....	30	117	100	90
Germany	14,471	5,008	26,397	8,541	20,674	8,398	39,375	20,573
Netherlands	35	15	1,480	471	17	13	14	11
Sweden and Norway	109,532	44,458	147,824	56,977	218,881	93,616	161,949	95,298
Total Europe	129,658	51,739	181,654	68,021	255,785	109,326	203,601	117,199
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	164,185	29,084	67,578	12,725	35,890	7,383	90,960	24,601
Quebec, Ontario, etc	83	50	269	132	14,705	4,495	....	....
British Columbia	9,805	2,994	....	....	450	112	184	46
Newfoundland and Labrador	130,367	27,212	11,578	2,730	13,027	3,767	8,155	1,975
Miquelon, Langley, etc	950	190	....	....	....	....	....	....
British West Indies	210	84	....	....	216	107	1,369	192
Total North America	305,600	59,614	79,425	15,587	64,288	15,864	100,668	26,814
Asia:								
British East Indies	10,153	2,914	....	....	....	....	....	....
China	....	....	....	....	....	....	10	3
Hongkong	606	194	....	....	192	39	132	32
Japan	9,848	1,401	6,300	1,828	250	55	2,398	426
Total Asia	20,607	4,509	6,300	1,827	442	94	2,540	461
All other islands and ports	....	....	....	....	....	....	6	20
Grand total	455,865	115,862	267,379	85,436	320,515	125,284	306,815	144,494
Total entered for consumption	387,020	105,937	305,591	95,947	300,159	113,775	329,944	151,000
Amount of duty	....	26,483	....	23,987	....	33,299	....	40,603

Countries from which imported.	1893.		1894.		Total.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:						
Azores, and Madeira Islands	....	....	....	....	22,733	$5,408
Belgium	....	....	450	$194	1,125	584
France	6,068	$2,313	....	....	8,136	3,353
Germany	39,542	13,920	24,113	11,045	226,992	107,677
Netherlands	7	10	....	....	1,651	571
Sweden and Norway	165,209	87,123	196,202	93,089	1,337,077	686,161
United Kingdom—						
England	13,017	5,879	11,203	5,523	84,305	47,780
Scotland	3,452	1,296	3,356	1,258	7,168	2,669
Total Europe	227,295	110,541	235,324	111,109	1,689,187	854,203
North America:						
Canada—						
Nova Scotia, New Brunswick, etc	242,515	64,683	104,436	25,073	977,184	252,745
Quebec, Ontario, etc	18,023	6,476	542	233	47,597	18,796
British Columbia	2,041	690	629	154	134,685	38,373
Newfoundland and Labrador	285,602	75,980	55,353	14,885	571,600	180,243
Miquelon, Langley, etc	....	....	12,417	2,832	15,431	3,501
British West Indies	....	....	....	....	10,011	5,324
Total North America	548,181	147,829	173,377	43,177	1,756,508	498,982
Asia:						
British East Indies	....	....	....	....	10,153	2,914
China	....	....	4,668	607	5,430	1,000
Hongkong	110	25	....	....	2,293	594
Japan	191,852	30,746	156,456	24,656	473,549	84,881
Total Asia	191,962	30,771	161,124	25,263	491,425	89,389
All other islands and ports	....	....	10	7	470	367
Grand total	967,438	289,141	569,835	179,556	3,937,590	1,442,941
Total entered for consumption	922,105	285,592	588,977	184,510	3,828,552	1,413,669
Amount of duty	....	87,099	....	61,810	....	362,489

Exports of marine oils.—The marine oils exported are classified as sperm oil and whale and fish oil. The extent of the export trade from 1790 to 1820 is given in Table 19. The exports since 1820 are shown in Table 20, on pp. 464–465. During recent years the exports have been principally to Scotland, England, France, Australia, and Germany, those five countries receiving over 95 per cent of the total quantity exported. The remaining exports are sent to Hongkong, Mexico, British Columbia, Belgium, etc. During the last ten years the exports to Scotland have aggregated 4,748,433 gallons; to England, 3,505,300; to France, 1,310,334; to Australia, 612,335; to Germany, 454,648, and to all other countries combined only 449,683, making a grand total of 11,080,733 gallons.

Table 69 shows by countries the quantity and value of the marine oils exported during each of the ten years ending June 30, 1894:

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:								
Belgium	1,030	$1,070	4,600	$3,470	....	....	....	....
France	231,694	90,722	468,617	154,649	143,579	$44,482	244,327	$58,501
Germany	63,974	20,633	76,523	21,977	145,784	38,085	87,007	22,872
Italy	....	....	3,000	1,100	....	....	....	....
Netherlands	491	413	7,400	3,352	532	406	993	741
United Kingdom—								
England	507,747	207,365	386,255	165,333	535,819	198,321	430 984	156,833
Scotland	219,610	115,729	317,335	117,043	584,372	156,955	589,183	127,023
Total Europe	1,024,546	435,932	1,263,730	466,924	1,410,086	438,249	1,352,494	365,970
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	350	272	148	46	128	97	4,860	1,204
Quebec, Ontario, etc	4,200	1,502	9,402	8,671	....	....	....	....
British Columbia	13,186	3,708	1,875	787	505	137	2,934	816
Mexico	5,025	1,943	7,055	3,326	5,375	2,234	7,914	2,388
Central America—								
Costa Rica	579	377	963	538	117	98	126	72
Guatemala	3	6	6	8	30	10	203	148
Honduras	72	45	121	64	....	....	145	60
Nicaragua	60	45	101	64	25	11	53	20
San Salvador	36	44	60	62	50	69	10	8
West Indies—								
British	1,715	917	2,589	1,023	901	306	795	324
Danish	....	....	....	....	....	....	20	16
Dutch	....	....	101	44	60	31	112	69
French	900	710	....	....	....	....	....	....
Haiti	271	107	493	345	297	187	751	462
Santo Domingo	187	112	188	123	524	196	388	209
Spanish—Cuba	739	457	1,281	869	517	891	386	302
Puerto Rico	....	....	214	210	30	15	....	....
Total North America	27,323	10,245	24,597	16,180	8,559	4,282	18,697	6,098
South America:								
Argentina	....	....	52	35	53	34	....	....
Brazil	426	338	720	520	20	15	498	350
Chile	73	90	1,516	1,417	....	....	30	28
Colombia	4	7	182	116	827	312	283	196
Peru	329	183	506	253	346	136	782	266
Venezuela	10	14	....	....	....	....	....	....
Total South America	842	632	2,976	2,341	1,246	497	1,593	840
Asia and Oceanica:								
Hongkong	13,635	5,701	15,430	5,688	16,787	6,091	14,521	4,199
British Australasia	120,024	51,664	54,032	18,585	68,729	22,075	107,540	31,971
Hawaiian Islands	862	392	1,749	919	467	124	1,461	628
Total Asia and Oceanica	134,521	57,757	71,211	25,192	85,983	28,290	123,522	36,798
All other islands and ports	382	160	2,165	470	99	63	195	139
Grand total	1,187,614	504,726	1,364,679	511,107	1,505,973	471,381	1,496,501	409,845

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1889.		1890.		1891.		1892.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:								
Belgium	200	$65	15,967	$3,839	85	$30	15,207	$5,779
France	10,484	3,694	99,134	41,383	3	1	30,668	11,683
Germany	2,595	1,670	15,786	5,813	49,008	13,654	11,349	3,422
Netherlands	....	....	490	135	....	....	....	....
United Kingdom—								
England	351,189	112,303	537,403	177,889	383,600	141,240	220,250	102,992
Scotland	153,463	56,150	1,210,048	293,728	919,559	204,731	609,240	181,124
Total Europe	517,931	173,882	1,878,828	522,787	1,352,255	359,656	886,714	305,000
North America:								
Canada—								
Nova Scotia, New Brunswick, etc	50	22	....	....	4,910	667	....	....
Quebec, Ontario, etc	....	....	220	96	....	....	90	78
British Columbia	9	9	35,581	9,086	10,291	4,315	4,797	1,946
Mexico	5,232	3,006	4,105	1,258	7,194	3,536	18,375	7,716
Central America—								
Costa Rica	50	16	29	36	....	....	....	....
Guatemala	10	8	....	....	....	....	....	....
Honduras	98	34	122	42	....	....	....	....
Nicaragua	71	52	5	6	24	52	15	30
San Salvador	25	19	....	....	35	26	....	....
West Indies—								
British	1,321	521	1,502	561	966	340	740	304
Danish	39	18	....	....	....	....	26	14
Dutch	65	43	5	2	26	17	82	64
Haiti	655	571	231	82	130	75	374	234
Santo Domingo	188	73	998	563	299	153	294	144
Spanish—								
Cuba	792	794	2,101	500	417	163	4,055	1,978
Puerto Rico	50	20	....	....	....	....	....	....
Total North America	8,655	5,206	44,899	12,232	24,292	9,344	28,848	12,508
South America:								
Argentina	50	55	....	....	....	....	....	....
Brazil	....	....	314	162	....	....	108	82
Chile	128	91	60	62	60	59	560	250
Colombia	599	287	281	133	134	97	244	128
Peru	1,677	673	3,763	1,046	1,662	460	2,021	641
Uruguay	2,216	528	....	....	....	....	....	....
Venezuela	35	20	4,223	1,141	30	20	50	30
Total South America	4,705	1,654	8,641	2,544	1,886	636	2,983	1,131
Asia and Oceanica:								
Hongkong	12,357	4,072	11,006	4,630	9,644	4,110	11,126	4,585
British Australasia	35,527	11,210	63,076	23,131	78,708	27,211	40,157	14,744
Hawaiian Islands	2,218	832	....	....	506	225	....	....
Total Asia and Oceanica	50,102	16,114	74,082	27,761	88,858	31,546	51,283	19,329
All other islands and ports	647	184	156	49	30	21	....	....
Grand total	582,040	197,040	2,006,606	565,374	1,467,321	401,203	969,828	337,968

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Gallons.	Values.	Gallons.	Values.	Gallons.	Values.
Europe:						
Belgium					37,089	$14,253
France	33,406	$14,750	48,422	$18,856	1,310,334	438,721
Germany	348	270	2,274	1,783	454,648	130,179
Italy					3,000	1,100
Netherlands	156	120	5,000	1,850	15,062	7,017
United Kingdom—						
England	73,588	25,071	78,465	44,372	3,505,300	1,331,719
Scotland	41,792	31,900	103,831	51,067	4,748,433	1,335,450
Total Europe	149,290	72,111	237,992	117,928	10,073,866	3,258,439
North America:						
Canada—						
Nova Scotia, New Brunswick, etc			303	269	10,749	2,577
Quebec, Ontario, etc	2,344	481	2,734	1,295	18,990	12,123
British Columbia	1,044	402	2,041	800	72,263	22,007
Mexico	12,934	5,976	15,243	5,928	88,452	37,311
Central America—						
Costa Rica	108	47	102	44	2,074	1,228
Guatemala	103	40	200	100	555	320
Honduras					558	245
Nicaragua			18	38	372	318
San Salvador					216	228
West Indies—						
British	965	388	2,881	1,155	14,375	5,839
Danish					85	48
Dutch			100	47	551	317
French					900	710
Haiti	278	140	380	271	3,860	2,474
Santo Domingo	89	40			3,155	1,613
Spanish—						
Cuba	1,750	734	4,512	1,686	16,550	8,374
Puerto Rico	80	56	50	23	424	324
Total North America	19,695	8,304	28,564	11,656	234,129	96,056
South America:						
Argentina	30	14			185	138
Brazil	1,021	357	20	15	3,127	1,839
Chile	100	70	16	9	2,543	2,076
Colombia	103	41	2,595	1,957	5,252	3,274
Peru			1,000	381	12,086	4,039
Uruguay					2,216	528
Venezuela	20	12	10	7	4,378	1,244
Total South America	1,274	494	3,641	2,369	29,787	13,138
Asia and Oceanica:						
Hongkong	5,993	2,315	8,117	3,135	118,616	44,526
British Australasia	29,523	9,684	15,019	5,402	612,335	215,677
Hawaiian Islands			533	256	7,796	3,376
Total Asia and Oceanica	35,516	11,999	23,669	8,793	738,747	263,579
All other islands and ports	25	20	505	105	4,204	1,211
Grand total	205,800	92,928	294,371	140,851	11,080,733	3,632,423

Import duties on marine oils.—From the organization of the United States Government to the present time foreign fish and whale oils have been subject to duties when imported into this country, except as affected by the reciprocity treaties of 1854 and 1873. The first duty imposed (taking effect August 1, 1789) was 5 per cent ad valorem, and this was increased in 1812 to 10 per cent. The customs law of 1816 imposed specific duties of 25 cents per gallon on sperm, and 15 cents per gallon on all other whale or fish oils. These remained constant until 1846, when a return was made to ad valorem duties, 20 per cent being imposed. A reduction of 5 per cent was made in 1857, but in 1861 a return was made to 20 per cent, and this rate remained until 1883, when it was increased 5 per cent. In 1890 specific duties were again imposed, 15 cents on cod-liver oil and 8 cents on seal, whale, herring, and other fish oils; but in 1894 a return was made to ad valorem duties, 20 per cent being imposed on cod-liver oil and 25 per cent on other fish oils.

The following statement shows approximately the rates of duty exacted in various foreign countries on marine oils imported therein.

70. *Statement of the approximate rates of duty imposed in various foreign countries on fish and whale oils imported therein.*

Countries.	Duty per 100 lbs.
Europe:	
Belgium	Free.
Denmark	$1.13
France	.53
Germany	.32
Great Britain	Free.
Greece	3.52
Italy:	
Sperm	1.31
Fish and whale	.52
Netherlands	.10
Russia	.65
Spain	.09
Norway	.48
Sweden	Free.
Switzerland	.04
North America:	
Canada	20 per ct. ad val.
Mexico	2.40
Central America:	
Costa Rica	2.42
Guatemala:	
Fish and whale	2.20
Cod-liver	4.41
Nicaragua	1.40
Salvador:	
Fish and whale	1.76
Cod-liver	6.60
Honduras	.93
British Honduras	.60
West Indies:	
Bahamas	2.43
Cuba	2.19
West Indies—continued.	
Guadaloupe	$1.31
Puerto Rico	1.89
Santo Domingo—	
Sperm	1.58
Fish	1.27
South America:	
Argentina:	
Fish and whale	.14
Cod-liver	2.19
Bolivia:	
Crude	.80
Refined	1.32
Brazil:	
Crude	3.70
Refined	12.38
Cod-liver	15.84
Chile:	
Crude	1.35
Refined	2.27
Cod-liver	7.20
Venezuela:	
Fish and whale	6.57
Cod-liver	10.94
Asia and Oceanica:	
China	5 per ct. ad val.
Japan	5 per ct. ad val.
New South Wales	1.21
New Zealand	Free.
Queensland and Victoria	1.21
Tasmania	3.03
West Australia	1.21

XI.—SPERMACETI.

Exports of spermaceti.—The exports of spermaceti vary little from year to year, averaging about 300,000 pounds, with a valuation of about $100,000. It is sent principally to England, Germany, and Scotland, with smaller quantities to France, Italy, and Spain. Of the exports during the last ten years, 50 per cent went to England, 28 per cent to Germany, and 13 per cent to France.

The quantity and value exported during each of the last twenty-six years and the average value per pound are shown in Table 71. A statement of the annual exports since 1821 is given in Table 20, on pages 464-465, and the exports from 1790 to 1820, inclusive, are shown in Table 19, on page 462. From these compilations it appears that from 1790 to 1894, inclusive, 41,813,490 pounds of spermaceti have been exported from the United States.

Small quantities of spermaceti are imported into the United States in the form of candles. The imports during each year from 1869 to 1883 are shown in Table 12, on page 449. The customs returns do not indicate the imports during later years.

71. *Statement of the exports of domestic spermaceti during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Exports.		Average values per pound.
	Pounds.	Values.	
			Cents.
1869	253,445	$88,706	35.0
1870	82,520	27,172	32.9
1871	157,263	42,170	26.8
1872	190,736	56,996	29.9
1873	197,671	55,815	28.2
1874	304,865	78,346	25.7
1875	238,641	61,725	25.8
1876	141,157	35,915	25.4
1877	153,552	41,027	26.7
1878	228,276	58,302	25.5
1879	147,503	35,489	24.1
1880	197,847	45,018	22.8
1881	214,205	40,945	19.1
1882	265,593	48,721	18.3
1883	396,869	66,651	16.8
1884	259,947	48,553	18.7
1885	277,271	63,683	22.9
1886	334,918	125,840	37.5
1887	336,222	139,656	41.5
1888	226,576	84,018	37.1
1889	425,479	111,386	26.2
1890	449,384	116,757	26.0
1891	207,574	71,202	34.3
1892	273,981	90,842	33.2
1893	340,192	105,012	30.9
1894	342,786	99,467	29.0
Total	6,644,473	1,750,708	....
Average per year	255,557	67,335	26.4

Table 72 shows the quantity and value of domestic spermaceti exported to each foreign country during each of the ten years ending June 30, 1894. It appears that Europe received 3,157,181 pounds, or over 97 per cent; American countries, 21,391 pounds, or less than 1 per cent; and all other countries, 35,811 pounds, or less than 2 per cent.

72. *Statement by countries of the domestic exports of spermaceti during the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Austria-Hungary	1,415	$311						
Belgium					610	$256	1,850	$650
France			3,160	$1,250	9,556	4,128	7,556	2,852
Germany	87,645	21,723	71,657	27,780	88,191	38,292	52,364	19,595
Italy					2,421	1,050	3,188	991
Netherlands					922	410		
Portugal					957	416		
Spain					7,821	3,220	3,565	1,273
United Kingdom—								
England	113,432	24,638	146,776	53,851	219,122	89,140	138,645	50,511
Scotland	63,824	14,907	112,929	42,777	6,246	2,580	18,690	7,860
Total Europe	266,316	61,579	334,522	125,658	335,846	139,492	225,858	83,732
America:								
Mexico			396	182	70	29	618	256
Central America	5,617	1,024			180	83		
Brazil	5,338	1,080						
Total America	10,955	2,104	396	182	250	112	618	256
All other islands and ports					126	52	100	30
Grand total	277,271	63,683	334,918	125,840	336,222	139,656	226,576	84,018

Countries to which exported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Belgium	1,550	$460	4,977	$1,125	4,640	$1,206	1,521	$500
France	17,763	5,226	16,535	4,519	63	25	16,147	5,634
Germany	140,371	39,227	110,120	27,137	1,958	682	71,967	27,237
Italy	18,156	4,776	25,883	7,390	17,271	6,503	3,143	1,108
Netherlands	6,331	1,600						
Portugal	945	220			50	18	306	107
Spain	7,968	2,339	3,802	898			1,855	568
United Kingdom—								
England	173,497	42,966	254,178	66,630	183,033	62,556	117,608	37,667
Scotland	54,928	13,341	33,504	8,960			60,905	17,832
Total Europe	421,509	110,155	448,999	116,659	207,015	70,990	273,452	90,653
America:								
Mexico	3,458	1,079	241	59			160	55
Central America							206	74
Brazil					509	195		
Total America	3,458	1,079	241	59	509	195	366	129
Asia and Australasia:								
British Australasia	113	37						
All other islands and ports	399	115	144	39	50	17	163	60
Grand total	425,479	111,386	449,384	116,757	207,574	71,202	273,981	90,842

72. *Statement by countries of the domestic exports of spermaceti during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
Austria-Hungary					1,415	$311
Belgium	3,402	$1,050	3,381	$1,020	21,931	6,267
Denmark			309	87	309	87
France	11,594	3,734	7,255	2,196	89,629	29,564
Germany	111,137	35,791	157,331	46,311	892,741	283,775
Italy	7,449	2,338	2,831	825	80,342	24,981
Netherlands			1,558	400	8,811	2,410
Portugal					2,258	761
Russia			4,708	1,280	4,708	1,280
Spain	7,397	2,133	6,694	1,922	39,102	12,353
United Kingdom—						
England	170,698	51,544	79,125	22,646	1,596,114	502,149
Scotland	26,486	7,715	42,309	12,054	419,821	128,026
Total Europe	338,163	104,305	305,501	88,741	3,157,181	991,964
America:						
Quebec and Ontario			1,092	255	1,092	255
Mexico	1,854	637	1,477	87	8,274	2,384
Central America	175	70			6,178	1,251
Brazil					5,847	1,275
Total America	2,029	707	2,569	342	21,391	5,165
Asia and Australasia:						
British Australasia			34,654	10,364	34,767	10,401
All other islands and ports			62	20	1,044	333
Grand total	340,192	105,012	342,786	99,467	3,214,383	1,007,863

Import duties on spermaceti.—The import duties exacted on spermaceti in various foreign countries are set forth in comparative form in the appended compilation. The tariff rate in the United States is 25 per cent ad valorem.

73. *Statement of the approximate rates of duty exacted on spermaceti imported into various foreign countries.*

Countries.	Duty per 100 lbs.	Countries.	Duty per 100 lbs.
Europe:		North America—continued.	
Austria-Hungary	$0.58	Mexico	$7.99
Belgium	Free.	Central America—	
France—		Costa Rica	1.54
Crude	.439	Guatemala	5.51
Pressed	.875	Honduras	1.86
Refined	1.317	Salvador	4.40
Germany	.322	West Indies—	
Great Britain	Free.	Haiti	9.65
Greece	13.59	Puerto Rico	1.89
Italy	Free.	South America:	
Netherlands	5 p. ct. ad val.	Argentina	8.75
		Bolivia—	
Norway	.485	Crude	4.63
Portugal	1.079	Refined	6.61
Russia	1.29	Brazil	9.90
Spain	1.75	Chile—	
Switzerland	.04	Crude	8.30
North America:		Refined	14.40
Canada	20 p. ct. ad val.	Venezuela	6.57

XII.—WHALEBONE.

General trade.—The foreign trade in whalebone is almost entirely of an export nature, only a small quantity being imported into this country. During recent years the quantity exported has averaged about 150,000 pounds annually, with a valuation of about $4 per pound. During the twenty-six years ending June 30, 1894, the exports aggregated 5,307,203 pounds, valued at $10,295,706. The largest quantity exported in any one of those years was 405,396 pounds in 1869, but the greatest value was $799,042 in 1888. From 1821 to 1894, inclusive, 55,215,494 pounds of whalebone, valued at $31,803,573, have been exported, as shown in Table 20, on page 464–465. The exports were most extensive from 1844 to 1860, the quantity exceeding 1,000,000 pounds annually. The exports in 1853 were 2,825,069 pounds, valued at $1,063,705, and in 1857, 2,042,390 pounds, worth $1,307,322. The exports from 1791 to 1820, inclusive, as compiled from Pitkin's Statistics, and shown in Table 19, on page 462, amounted to 2,942,848 pounds, with an estimated value, at 20 cents per pound, of $588,570. This gives a total of 58,158,342 pounds, worth $32,392,143 of domestic wholebone exported from 1791 to 1894, inclusive.

Table 74 shows in detail the extent of the whalebone trade during the twenty-six years ending in 1894.

74. *Statement of the foreign trade in whalebone during each year from 1869 to 1894, inclusive.*

Year ending June 30—	Imports for consumption.					Domestic exports.			Excess of exports over imports.
	Unmanufactured.			Manufactures of.	Total.				
	Pounds.	Values.	Average value per pound.	Values.	Values.	Pounds.	Values.	Average value per pound.	
1869	3,030	$962	$0.32	$381	$1,343	405,396	$384,435	$0.95	$383,092
1870	1,135	332	.29	....	332	386,728	343,937	.89	343,605
1871	748	309	.41	....	309	353,742	251,562	.71	251,253
1872	20,635	1,416	.07	1,644	3,060	172,889	137,855	.80	134,795
1873	9,000	4,622	.51	418	5,040	324,653	329,214	1.01	324,174
1874	8,700	4,921	.57	829	5,750	114,530	115,098	1.00	109,348
1875	3,247	2,034	.63	1,638	3,672	251,572	291,165	1.16	287,493
1876	10,673	10,598	.99	79	10,677	154,500	215,327	1.39	204,650
1877	1,880	1,379	.73	851	2,230	71,708	160,666	2.24	158,436
1878	1,982	666	.34	734	1,400	154,016	264,980	1.72	263,580
1879	2,823	3,355	1.19	741	4,096	78,322	199,753	2.55	195,657
1880	10,506	13,337	1.27	190	13,527	131,332	255,847	1.95	242,320
1881	5,620	5,507	.98	107	5,614	227,117	326,400	1.44	320,786
1882	10,892	2,822	.26	9	2,831	220,787	325,333	1.47	322,502
1883	3,657	1,824	.50	2,863	4,687	326,835	599,550	1.83	594,863
1884	32,709	29,438	.90	902	30,340	92,653	319,508	3.45	289,168
1885	18,787	32,568	1.73	1,144	33,712	188,482	470,039	2.49	436,327
1886	14,696	12,614	.86	2,069	14,683	165,436	385,058	2.33	370,375
1887	10,172	6,579	.65	1,126	7,705	173,452	523,267	3.02	515,562
1888	215	382	1.78	1,326	1,708	318,056	799,042	2.51	797,334
1889	11,029	19,179	1.74	402	19,581	261,555	762,464	2.92	742,883
1890	19,097	23,295	1.22	33	23,328	190,484	705,500	3.70	682,172
1891	75	168	2.24	1,341	1,509	159,322	717,230	4.50	715,721
1892	608	563	.93	3,017	3,580	82,797	427,462	5.16	423,882
1893	11	25	2.27	4,756	4,781	148,130	543,045	3.67	538,264
1894	640	669	1.04	1,523	2,192	152,709	441,969	2.89	439,777
Total	202,567	179,564	....	28,123	207,687	5,307,203	10,295,706	....	10,088,019

Notwithstanding the large domestic product of whalebone, small quantities are imported into this country each year, being entered free of duty. The whalebone imported is not so good in quality as that exported, the average value per pound of the former being only about one-half the latter. The imports of whalebone during the twenty-six years ending in 1894 amounted to 202,567 pounds, worth $179,564, or less than 4 per cent of the domestic exports.

Exports of whalebone by countries.—The exports of whalebone are principally to Germany, France, and England, the Netherlands and Belgium receiving smaller quantities. Of the 1,840,423 pounds exported during the ten years ending June 30, 1894, 973,001 pounds, or over 50 per cent, went to Germany; 620,785 pounds, or 34 per cent, to France; while all the countries of Europe received 1,838,947 pounds, or 99.92 per cent. The following statement shows the exports to each foreign country during the ten years ending June 30, 1894:

75. *Statement by countries of the domestic exports of whalebone during the ten years ending June 30, 1894.*

Countries to which exported.	1885.		1886.		1887.		1888.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Belgium							125	$350
Denmark			294	$763			77	261
England	20, 330	$40, 408	6, 840	15, 702	14, 688	$44, 776	28, 344	67, 108
France	85, 198	231, 118	77, 816	189, 374	75, 379	231, 450	109, 281	276, 225
Germany	82, 767	197, 924	80, 286	178, 719	82, 267	243, 605	168, 594	427, 459
Netherlands	157	459	200	500	1, 065	3, 195	10, 704	25, 178
Total Europe	188, 452	469, 909	165, 436	385, 058	173, 399	523, 026	317, 125	796, 581
America:								
Nova Scotia, New Brunswick, etc							9	27
Quebec, Ontario, etc	5	30						
Cuba					53	241	922	2, 434
Colombia	25	100						
Total America	30	130			53	241	931	2, 461
Grand total	188, 482	470, 039	165, 436	385, 058	173, 452	523, 267	318, 056	799, 042

Countries to which exported.	1889.		1890.		1891.		1892.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Belgium	2, 196	$6, 272	3, 124	$11, 345	3, 429	$18, 800	1, 190	$4, 350
England	43, 198	113, 407	2, 936	9, 975	16, 974	67, 086	3, 365	14, 863
France	63, 085	202, 847	46, 828	180, 363	35, 957	163, 902	27, 183	145, 691
Germany	140, 637	400, 574	126, 519	464, 951	95, 631	434, 672	47, 234	242, 065
Netherlands	12, 263	38, 869	11, 052	38, 806	7, 275	32, 516	3, 782	20, 278
Total Europe	261, 379	761, 969	190, 459	705, 440	159, 266	716, 976	82, 754	427, 247
America:								
Nova Scotia, New Brunswick, etc							5	19
Mexico							6	30
Santo Domingo	6	13						
Cuba	160	442	25	60	56	254	20	110
Brazil	10	40					12	56
Total America	176	495	25	60	56	254	43	215
Grand total	261, 555	762, 464	190, 484	705, 500	159, 322	717, 230	82, 797	427, 462

75. *Statement by countries of the domestic exports of whalebone during the ten years ending June 30, 1894*—Continued.

Countries to which exported.	1893.		1894.		Total.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:						
Belgium	1,565	$5,846	1,157	$3,600	12,786	$50,563
Denmark					371	1,024
England	15,065	61,032	3,002	9,091	154,742	443,448
France	44,635	164,595	55,423	156,359	620,785	1,941,924
Germany	76,905	278,114	72,161	215,750	973,001	3,083,833
Netherlands	9,940	33,349	20,824	56,558	77,262	249,708
Total Europe	148,110	542,936	152,567	441,358	1,838,947	5,770,500
America:						
Nova Scotia, New Brunswick, etc.	4	18			18	64
Quebec, Ontario, etc	16	91	108	492	129	613
Mexico			8	25	14	55
Santo Domingo					6	13
Cuba			26	94	1,262	3,635
Brazil					22	96
Colombia					25	100
Total America	20	109	142	611	1,476	4,576
Grand total	148,130	543,045	152,709	441,969	1,840,423	5,775,076

Import duties.—The import duties exacted on whalebone in various foreign countries are shown in Table 76. This article has been admitted free of duty into the United States since 1873, previous to which time a duty of 20 per cent ad valorem was imposed.

76. *Statement of the approximate rates of duty exacted on whalebone imported into various foreign countries.*

Countries.	Duty per 100 lbs.	Countries.	Duty per 100 lbs.
Europe:		North America:	
Austria-Hungary	$0.725	Canada	20 p. ct. ad val.
Belgium	5 p. ct. ad val.	Mexico	$2.40
Denmark	9.066	Central America:	
France:		Costa Rica	11.90
Uncut	Free.	Guatemala	6.53
Prepared	8.75	Nicaragua	18.64
Germany	Free.	Salvador	12.04
Great Britain	Free.	West Indies:	
Italy:		Cuba—	
Unmanufactured	Free.	Rough	63.00
Manufactured	7.003	Polished	109.20
Netherlands	5 p. ct. ad val.	Puerto Rico	63.00
Norway	Free.	Santo Domingo	7.92
Russia	2.85	South America:	
Switzerland:		Bolivia—	
Raw or stripped	.344	Rough	2.64
Polished	1.403	Manufactured	16.53
		Brazil	6.44

XIII.—FISH SOUNDS AND ISINGLASS.

Imports.—Large quantities of fish sounds are used in the United States for clarifying beers, wines, etc., for the best grades of mucilage, and to a small extent for food purposes; but only during the last thirty years has any use been made of the domestic product. Isinglass is now made from the sounds of many varieties of American fishes, but principally from hake, sturgeon, cod, and squeteague or sea trout. The domestic yield of fish sounds amounts to about 200,000 pounds annually, but the market requires over twice this amount, necessitating a large importation each year. This importation ranges from 200,000 pounds to over 425,000 pounds annually. During the ten years ending June 30, 1894, the smallest imports were 199,571 pounds in 1894, and the largest 442,229 pounds in 1891. The total imports for consumption during that period amounted to 3,402,769 pounds, an annual average of 340,277 pounds. These figures do not include the imports of fish sounds in the form of glue, of which from 5,000 to 100,000 pounds are received annually. The quantity and value of fish sounds and glue imported for consumption during the twenty-six years ending in 1894 are shown in the following table:

77. *Statement of the imports for consumption of fish sounds and fish glue into the United States from 1869 to 1894, inclusive.*

Year ending June 30—	Fish sounds or fish bladders.			Fish glue or isinglass.			Total.		
	Pounds.	Values.	Average value per pound.	Pounds.	Values.	Average value per pound.	Pounds.	Values.	Average value per pound.
1869	....	....	....	....	....	....	a 17,438	$8,719	a $0.50
1870	....	....	....	....	....	....	a 16,178	8,089	a .50
1871	....	....	....	....	....	....	a 13,084	6,542	a .50
1872	....	....	....	....	....	....	a 56,874	28,437	a .50
1873	....	....	....	....	....	....	a 247,500	123,750	a .50
1874	....	....	....	....	....	....	187,384	96,244	.46
1875	....	....	....	....	....	....	117,909	52,401	.51
1876	....	....	....	....	....	....	73,552	42,322	.44
1877	....	....	....	....	....	....	75,267	32,236	.58
1878	....	....	....	....	....	....	159,344	104,552	.43
1879	....	....	....	....	....	....	287,625	202,765	.66
1880	....	....	....	....	....	....	330,719	198,025	.71
1881	....	....	....	....	....	....	393,801	243,239	.60
1882	....	....	....	....	....	....	289,165	169,148	.62
1883	....	....	....	....	....	....	304,991	189,575	.59
1884	270,822	$92,914	$0.34	72,504	$36,310	$0.50	343,326	129,224	.38
1885	341,483	121,201	.36	59,178	45,104	.76	400,661	166,305	.42
1886	424,430	144,652	.34	57,483	37,132	.65	481,913	181,784	.38
1887	380,445	124,050	.33	132,176	61,612	.47	512,621	185,662	.36
1888	434,440	141,388	.33	78,379	35,455	.45	512,819	176,843	.34
1889	356,740	93,626	.26	18,757	18,676	1.00	375,497	112,302	.30
1890	279,932	51,202	.18	6,306	11,984	1.90	286,238	63,186	.22
1891	442,229	94,130	.21	18,222	17,976	.99	460,451	112,106	.24
1892	300,283	62,351	.21	13,957	13,742	.98	314,240	76,093	.24
1893	243,216	57,884	.24	36,890	16,314	.44	280,106	74,198	.26
1894	199,571	36,375	.18	5,352	5,934	1.11	204,923	42,309	.21
Total	3,673,591	1,019,773	....	499,204	300,239	....	6,743,626	2,826,056	....

a Estimated.

It appears from the foregoing table that the average value per pound of imported fish bladders, or sounds, has decreased almost constantly. In 1885 it was 36 cents; in 1889 it had decreased to 26 cents, and in 1894 it was only 18 cents per pound.

Imports of sounds by countries.—The largest imports of fish sounds are from Nova Scotia and New Brunswick; England, Venezuela, Denmark, Brazil, Russia, and India also supply sounds for the United States market. Comparatively few of the sounds from England are obtained in the fisheries of that country, the bulk of the shipments coming from Russia, India, and other countries. The following table shows the imports from each country during the four years ending June 30, 1894, the custom-house returns not showing by countries the quantity imported prior to July 1, 1891:

78. *Statement by countries of the imports of fish sounds into the United States during the four years ending June 30, 1894.*

Countries from which imported.	1891.		1892.		1893.		1894.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Europe:								
Denmark	55,188	$5,679	33,077	$4,135	4,191	$530	11,527	$1,191
England	98,582	26,350	71,130	17,238	63,798	13,730	55,896	17,464
France			396	97				
Germany	6,034	1,374	1,711	231	2,546	398	173	14
Italy	84	18			7	2	219	10
Netherlands			466	57				
Russia	55,994	12,045	11,197	2,827	216	349		
Sweden and Norway	495	96			449	89	214	38
Total Europe	216,377	45,562	117,977	24,585	71,207	15,098	68,029	18,717
North America:								
Nova Scotia, New Brunswick, etc	120,128	21,637	126,754	26,946	82,049	14,704	87,601	10,306
Quebec, Ontario, etc	535	366	360	188	31	36	45	23
Mexico	356	111					530	104
Haiti			3,411	829				
Cuba			20	5	225	22	1,664	82
South America:								
Brazil	15,533	3,653	3,180	735	37,444	16,496	9,664	1,266
Venezuela	83,432	21,520	34,948	7,817	42,344	9,923	33,437	5,912
Total America	219,984	47,287	168,673	36,520	162,093	41,181	132,941	17,693
Asia and Oceanica:								
Hongkong	20	4	50	8	451	107		
British East Indies	8,044	1,774	5,020	1,196	8,587	1,498		
Total Asia and Oceanica	8,064	1,778	5,070	1,204	9,038	1,605		
Grand total	444,425	94,627	291,720	62,309	242,338	57,884	200,970	36,410

Countries from which imported.	Total.		Average value per pound.
	Pounds.	Values.	
Europe:			
Denmark	103,983	$11,535	$0.110
England	289,406	74,782	.259
France	396	97	.245
Germany	10,464	2,017	.193
Italy	310	30	.097
Netherlands	466	57	.122
Russia (Baltic and White seas)	67,407	15,221	.226
Sweden and Norway	1,158	223	.184
Total Europe	473,590	103,962	.220

78. *Statement by countries of the imports of fish sounds into the United States during the four years ending June 30, 1894*—Continued.

Countries from which imported.	Total.		Average value per pound.
	Pounds.	Values.	
North America:			
Nova Scotia, New Brunswick, etc	416,532	$73,593	$0.177
Quebec, Ontario, etc	971	613	.631
Mexico	886	215	.243
Haiti	3,411	829	.243
Cuba	1,909	109	.057
South America:			
Brazil	65,821	22,150	.337
Venezuela	194,161	45,172	.233
Total America	683,691	142,681	.209
Asia and Oceanica:			
Hongkong	521	119	.228
British East Indies	21,651	4,468	.206
Total Asia and Oceanica	22,172	4,587	.207
Grand total	1,179,453	251,230	.214

Import duties on fish sounds and isinglass.—Crude or unmanufactured fish sounds are admitted free of duty into the United States, but a rate of 25 per cent ad valorem is exacted on the manufactured product. On fish glue or isinglass the rate is 1½ cents per pound on all valued at not above 7 cents per pound, 25 per cent ad valorem when valued at above 7 cents and not above 30 cents per pound, and 30 per cent when valued at above 30 cents per pound.

The following compilation shows, in some cases approximately, the present rates of duty imposed on fish sounds or isinglass imported into various foreign countries:

79. *Statement of approximate rates of duty exacted on fish sounds, etc., imported into various foreign countries.*

Countries.	Designation.	Duty on 100 pounds.	Countries.	Designation.	Duty on 100 pounds.
Europe:			North America—continued.		
Austria-Hungary	Fish glue	$0.87			
France	Fish bladders, raw or dried.	Free.	Honduras	Fish glue	$8.39
	Fish glue or isinglass	3.501	Nicaragua	do	2.80
Italy	Fish glue	1.313	Salvador	do	2.20
Great Britain		Free.	South America:		
Greece	Fish glue, common	2.72	Bolivia	Isinglass	3.96
	Fish glue, refined	6.80		Fish glue	19.84
Norway	Isinglass or fish glue	18.23	British Guiana	Isinglass	5.00
Russia	Fish glue	6.46	Chile	Fish glue	2.57
Sweden	Sturgeon sounds	20.67	Colombia	do	4.41
	Fish glue	2.43	Peru	do	.22
Switzerland	do	.61	Asia and Oceanica:		
North America:			British New Guinea.		2.06
Haiti	Fish glue	4.82	Fiji		6.18
Mexico	do	3.59	Japan		5 p. ct.
Costa Rica	do	2.42			

XIV.—SPONGES.

General trade since 1868.—The foreign trade in sponges is of considerable importance. The typical forms of commercial sponges are essentially confined to the waters of the southern and western coasts of Florida, and the waters of the Bahama Archipelago in the Western Hemisphere, and to the Mediterranean and Red seas in the Eastern Hemisphere. The importation of sponges is of growing importance in the United States, and the domestic exports have decreased considerably since 1885, as indicated in the following table, showing for the 26 years ending in 1894 the value of the foreign sponges imported for consumption, the domestic exports, and the excess of the imports over the exports:

80. *Statement of the foreign trade in sponges from 1869 to 1894, inclusive.*

Year ending June 30—	Imports for consumption.	Domestic exports.			Excess of imports over exports.
		Pounds.	Values.	Average values per pound.	
1889	$74,731				$74,731
1870	93,952		$5,500		88,452
1871	113,127		1,546		111,581
1872	153,443				153,443
1873	189,986				189,986
1874	121,798				121,798
1875	110,440				110,440
1876	87,621				87,621
1877	88,798		396		88,402
1878	90,127		8,000		82,127
1879	130,515		16,313		114,202
1880	183,690		4,141		179,549
1881	229,292		6,736		222,556
1882	293,621		4,111		289,510
1883	270,462		7,518		262,944
1884	241,874	17,400	9,472	$0.544	232,402
1885	235,519	30,006	23,480	.782	212,039
1886	296,963	44,839	25,607	.571	271,356
1887	302,510	59,106	37,586	.636	264,924
1888	268,651	55,903	36,581	.654	232,070
1889	277,373	37,119	20,971	.665	256,402
1890	352,885	45,222	25,293	.559	327,592
1891	381,879	36,966	20,821	.564	361,058
1892	331,241		10,320		320,921
1893	365,249	15,891	8,858	.557	356,391
1894	217,456	18,329	8,497	.463	208,959
Total	5,503,203		281,747		5,221,456

Imports by countries.—These sponges are received principally from the British West Indies, Cuba, Great Britain, Greece, and Austria. During the ten years ending June 30, 1894, the receipts from the British West Indies amounted in value to $1,736,332; from Cuba, $479,961; from Great Britain, $933,154, and from Greece, $244,851. The imports from countries on the American Continent amounted to $2,233,002; from Europe, $1,379,494; and from Asia and Oceanica, $9,080. Table 81 shows, by countries, the receipts during each year from 1885 to 1894, inclusive:

81. *Statement by countries of the imports of sponges during the ten years ending June 30, 1894.*

Countries from which imported.	1885.	1886.	1887.	1888.	1889.	1890.
Europe:						
Austria-Hungary	$8,578	$15,247	$12,757	$9,247	$4,830	$5,467
Belgium	342	1,019	1,375	3,623	1,656	330
France	7,308	6,028	10,093	3,019	3,813	1,586
Germany	1,954	2,234	3,209	6,818	8,200	1,912
Greece	....	6,961	10,192	16,452	22,646	48,131
Italy	2,870	....	5,016	....	2,866	1,367
Netherlands	125	1,225	....	....	....	....
United Kingdom	100,089	100,372	103,132	101,626	82,740	115,205
Total Europe	121,266	133,086	145,774	140,785	126,751	173,998
America:						
Mexico	....	106	495	1,387	336	902
Central America—						
Honduras	....	504	345	223	572	....
Nicaragua	....	....	....	27	....	....
British Honduras	250	2,854	1,458	2,150	355	165
British West Indies	130,035	189,511	151,512	169,591	162,688	214,883
Cuba	81,981	60,700	43,534	38,533	27,195	26,741
Colombia	....	....	5	12	....	....
All others	111	....	15	3	488	....
Total America	212,377	253,675	197,364	211,926	191,634	242,691
Asia and Oceanica:						
Japan	....	1	108	....	....	....
Turkey in Asia	131	....	65	5,393	....	29
Hawaiian Islands	....	622	....	....	....	....
Total Asia and Oceanica	131	623	173	5,393	....	29
Grand total	333,774	387,384	343,311	358,104	318,385	416,718

Countries from which imported.	1891.	1892.	1893.	1894.	Total.
Europe:					
Austria-Hungary	$14,517	$12,329	$9,118	$7,730	$99,820
Belgium	....	201	118	....	8,664
France	1,074	3,825	4,105	2,889	43,740
Germany	15	456	812	1,007	26,617
Greece	39,423	32,917	56,262	11,867	244,851
Italy	3,655	3,235	3	910	19,922
Netherlands	....	....	13	265	1,628
United Kingdom	121,136	69,283	80,798	58,773	933,154
All others	....	1,098	....	....	1,098
Total Europe	179,820	123,344	151,229	83,441	1,379,494
America:					
Mexico	326	....	6	....	3,558
Central America—					
Honduras	....	....	....	5	1,649
Nicaragua	....	....	....	....	27
British Honduras	....	112	3	82	7,429
British West Indies	190,943	170,722	216,298	140,149	1,736,332
Cuba	58,476	56,662	50,598	35,541	479,961
Haiti	....	....	11	....	11
Colombia	....	....	....	....	17
All others	502	2,899	....	....	4,018
Total America	250,247	230,395	266,916	175,777	2,233,002
Asia and Oceanica:					
Japan	897	30	19	148	1,203
Turkey in Asia	909	644	....	80	7,251
Hawaiian Islands	....	....	....	....	622
All others	....	3	1	....	4
Total Asia and Oceanica	1,806	677	20	228	9,080
Grand total	431,873	354,416	418,165	259,446	3,621,576

Exports by countries.—The domestic sponges exported are sent principally to England; yet France, Quebec, and a number of other countries receive small quantities. The customs returns do not show separately the extent of these exports prior to 1894, but the exports during that year were as follows:

82. *Statement of the exports of domestic sponges during the year ending June 30, 1894.*

Countries.	Pounds.	Values.
Europe:		
England	12,239	$4,573
France	1,485	940
Italy	115	70
Netherlands	700	299
Sweden and Norway	724	398
North America:		
Nova Scotia and New Brunswick	90	74
Quebec and Ontario	931	966
British Columbia	11	5
Mexico	528	235
North America—continued.		
West Indies—		
British	11	$7
Haiti	250	250
Puerto Rico	40	27
South America:		
Brazil	400	200
Chile	505	286
Colombia	80	45
Uruguay	100	48
Venezuela	120	74
Total	18,329	8,497

Rates of duty imposed on sponges.—No special duty was imposed on sponges imported into the United States prior to 1842. From 1789 to 1832 they were classed with unenumerated articles, and from 1832 to 1842 they were admitted free of duty. The tariff law of 1842 (Laws Twenty-seventh Congress, second session, chapter 270) imposed a duty of 20 per cent ad valorem on all sponges imported after August 30, 1842. This rate remained operative until July 1, 1857, when it was reduced to 8 per cent (Laws Thirty-fourth Congress, third session, chapter 98); but in 1861 (Laws Thirty-sixth Congress, second session, chapter 68) it was increased to 10 per cent ad valorem, taking effect April 1, 1861. In 1862 the duty was increased to 20 per cent, and it remained at that rate until 1894 (Laws Fifty-third Congress, second session, chapter 349), when it was again reduced to 10 per cent ad valorem, taking effect August 28, 1894.

83. *Statement of the approximate rates of duty imposed on sponges imported into various foreign countries.*

Countries.	Designation.	Duty per 100 pounds.
Europe:		
Austria-Hungary	Bathing and horse	$2.17
	Others	8.71
France	Raw	3.04
	Prepared, fine	5.69
Germany	Wash sponges	Free.
Great Britain		Free.
Italy	Common, crude	Free.
	Common, cleaned	3.50
	Fine, crude	Free.
	Fine, cleaned	17.51
Norway		32.45
Portugal		13.22
Russia	Greek	2.58
Switzerland		1.75
North America:		
Canada		20 p. ct. ad val.
Mexico	Fine	47.90
	Common	9.58
Central America—		
Guatemala		132.27
Honduras		23.30
Nicaragua		46.59
Salvador		110.22

83. *Statement of the approximate rates of duty imposed on sponges imported into various foreign countries*—Continued.

Countries.	Designation.	Duty per 100 pounds.
North America—continued.		
West Indies—		
Bahamas		Free.
Guadaloupe		10 p. ct. ad val.
Haiti	Fine	\$33.77
	Common, for horses	5.79
South America:		
Argentina	Fine, for toilet	547.10
	Fair, for toilet	218.84
	Bath and carriage	87.54
	For horses	38.29
	For scrubbing	21.88
Bolivia	Fine	79.34
	Common	16.53
Brazil	Fine	346.71
	Common	74.30
Venezuela		10.94
Australasia and Oceanica:		
Queensland		15 p. ct. ad val.
Tasmania		12½ p. ct. ad val.
Polynesia		10 p. ct. ad val.
French Oceanica	Fine	4.40
	Common	1.13

XV.—MARINE SHELLS.

General trade since 1868.—Among the miscellaneous fishery products that enter into our foreign trade, marine shells call for special notice. Of these there are several classes, viz, (1) shells, not cut or ground; (2) mother-of-pearl, not cut or ground; (3) shells and mother-of-pearl, manufactured, and (4) cuttlefish bone. The uncut shells imported into this country consist of ornamental shells, shells for manufacture of buttons, etc. They are received principally from England, French Oceanica, Colombia, Mexico, and France, but nearly all are originally obtained from tropical waters. Little variation exists in the quantity of cuttlefish bone imported during recent years, averaging about 150,000 pounds, worth 10 cents per pound.

An interesting feature of this shell trade is the large number of shells imported during recent years for use in the shell-button factories in the United States. During the last four years several of these factories have been established in the interior of this country, and in addition to the fresh-water shells of the adjacent regions, they utilize quantities from Japan, India, Australasia, and especially Tahiti.

The marine shells exported are not of great value, and consist largely of abalone shells.

Table 84 shows the extent of the foreign trade in marine shells during the twenty-six years ending in 1894. The imports have gradually increased since 1885, reaching a maximum value of \$1,621,681 in 1893. The imports for 1894 show a considerable decrease, because of the general depression of business, which naturally affects the importation of ornamental articles more seriously than the more necessary ones. The value of domestic exports shows a very great fluctuation, ranging from \$1,500 to \$74,328 per year.

84. *Statement of the foreign trade in marine shells during the twenty-six years ending in 1894.*

Year ending June 30—	Imports for consumption.						Domestic exports.	Excess of imports over exports.	Excess of exports over imports.
	Shells, not cut or ground.	Mother-of-pearl, not cut or manufactured.	Cuttlefish bone.		Shells and mother-of-pearl, manufactures of.	Total.	All kinds.		
			Pounds.	Value.					
1869	$44		18,404	$1,292	$490	$1,826	$11,008		$9,182
1870	9		32,911	2,112	6,320	8,441	2,100	$6,341	
1871	8,545		21,993	1,945	11,754	22,244		22,244	
1872	163,027		28,504	2,286	22,970	188,283		188,283	
1873	128,774		21,388	2,320	5,044	136,138		136,138	
1874	121,640		46,586	5,178	3,069	129,887		129,887	
1875	121,289		37,192	4,355	5	125,649		125,649	
1876	251,424		49,736	5,817		257,241		257,241	
1877	162,769		54,215	9,482		172,251	4,825	167,426	
1878	177,492		101,518	10,015		187,507	9,172	178,335	
1879	220,564		129,827	11,179		231,743	13,831	217,912	
1880	283,088		129,398	11,642		294,730	69,107	225,623	
1881	280,472		85,292	7,682		288,154	39,792	248,362	
1882	218,383		124,269	20,848		239,231	46,341	192,890	
1883	273,296		178,789	22,958		296,254	15,148	281,106	
1884	220,316		163,344	22,455	15,868	258,639	25,311	233,328	
1885	140,576		190,785	12,223	11,281	164,080	63,898	100,182	
1886	207,966		161,696	15,232	22,650	245,848	8,133	237,715	
1887	196,984		196,437	14,899	15,916	228,799	16,572	212,227	
1888	149,539		114,457	10,824	18,476	178,839	11,136	167,703	
1889	258,206		94,495	10,058	11,499	279,763	2,243	277,520	
1890	288,885		166,778	17,162	34,607	340,654	4,635	336,019	
1891	506,723	$3,593	151,114	20,089	108,171	638,576	1,500	637,076	
1892	886,191	11,372	220,131	23,869	195,104	1,116,536	12,609	1,103,927	
1893	1,270,811	51,616	139,260	15,412	283,842	1,621,681	33,033	1,588,648	
1894	643,251	2,507	149,708	13,013	378,381	1,037,152	74,328	962,824	
Total	7,180,264	69,088	2,808,227	294,347	1,145,447	8,690,146	464,722	8,234,606	9,182

Imports of shells by countries.—Of the $643,349 worth of shells entered at United States custom-houses during the year ending June 30, 1894, $291,691, or 45 per cent, came from England; $224,757, or 35 per cent, from French Oceanica; $44,822, or 7 per cent, from Colombia; and $28,473 from Mexico. The inhabitants of some of the Pacific islands depend almost entirely on their export of marine shells.

The subjoined compilation shows in detail the value of the unmanufactured shells, other than mother-of-pearl, imported from each foreign country during the four years ending in 1894. The customs returns do not indicate the origin of the shells imported previous to 1891:

85. *Statement by countries of the value of unmanufactured shells, other than mother-of-pearl, imported into the United States during each of the four years ending June 30, 1894.*

Countries from which imported.	1891.		1893.	1894.
Europe:				
Austria-Hungary	$3,616	$7,724	$9,281	$3,260
England	274,316	622,502	814,036	291,691
France	8,280	34,243	50,176	12,125
Germany	12,810	19,604	29,612	244
Italy	2	148	311	54
Netherlands	5,604	4,107	8,585	3,257
Total Europe	304,628	688,328	912,001	310,631
North America:				
Mexico	5,819	46,286	30,256	28,473
Central American States—				
Costa Rica	2,817	1,578	1,084	1,214
Honduras			613	172
Nicaragua			1,519	1,605

85. *Statement by countries of the value of unmanufactured shells, other than mother-of-pearl, imported into the United States during each of the four years ending June 30, 1894*—Cont'd.

Countries from which imported.	1891.	1892.	1893.	1894.
North America—continued.				
Bermuda		$133	$97	$60
West Indies—				
British	$13,658	9,215	9,249	3,150
Danish	4,798	7,797	3,200	4,716
French				100
Cuba	358	795	8,492	
Haiti	2,134	3,000	3,152	1,712
Santo Domingo	3,234	2,194	3,197	2,328
Puerto Rico				411
Total North America	32,818	70,998	60,859	43,941
South America:				
Brazil		20		19
Colombia	20,090	28,172	31,699	44,822
Venezuela				
Total South America	20,090	28,192	31,699	44,841
Asia and Oceanica:				
China		281		3
East Indies—				
British	3,326	11,341	6,135	5,466
Dutch	8,746	11,650	5,352	167
Hongkong	123	156	18	320
Japan	891	1,349	3,514	1,488
Turkey		2,491		2,945
British Australasia		154	2,780	3,304
French Oceanica	132,965	65,256	236,521	224,757
Philippine Islands				479
Hawaiian Islands				33
Total Asia and Oceanica	146,051	92,678	254,320	238,962
Africa:				
British	9	24	999	
French				100
Other African ports	2,708	3,763	811	2,065
Total Africa	2,717	3,787	1,810	2,165
All other islands and ports	932	2,300	8,830	2,809
Grand total	507,236	886,283	1,269,519	643,349
Imports for consumption	506,723	886,191	1,270,811	643,251

86. *Statement by countries of the imports of manufactures of shells, including mother-of-pearl, during each year from 1891 to 1894, inclusive.*

Countries from which imported.	1891.	1892.	1893.	1894.
Europe:				
Austria-Hungary		$10,668	$35,686	$157,379
Belgium		8	57	13
England	$11,440	44,026	25,469	25,208
France		109,800	177,473	136,487
Germany		14,437	19,301	29,523
Italy		1,367	1,766	11,340
Netherlands		50	87	27
Switzerland		2,511	2,745	3,223
Turkey		23	836	45
Total Europe	11,440	182,890	263,420	363,245
North America:				
Canada		57	257	50
Mexico		89	268	99
Nicaragua		212	126	
West Indies:				
British		776	473	619
Cuba		12	48	
Haiti			10	
Total North America		1,146	1,182	768

86. *Statement by countries of the imports of manufactures of shells, including mother-of pearl, during each year from 1891 to 1894, inclusive*—Continued.

Countries from which imported.	1891.	1892.	1893.	1894.
Asia and Oceanica:				
China				$16
East Indies—British				670
Hongkong		$12	$177	138
Japan		779	625	1,896
Turkey		987	1,608	2,976
French Oceanica			204	
Total Asia and Oceanica		1,778	2,614	5,696
All other islands and ports		69	30	127
Grand total	$11,440	185,883	267,246	369,836

The imports of mother-of-pearl, not cut or manufactured, were first separately classified in 1891, and from the following table it appears that most of these are received from England, with occasionally large imports from the Netherlands, France, Germany, etc.

87. *Statement by countries of the imports of mother-of-pearl, not cut or manufactured, during each of the four years ending June 30, 1894.*

Countries from which imported.	1891.	1892.	1893	1894.
England	$2,177	$4,641	$27,014	$2,507
France		5,746		
Germany			2,231	
Netherlands	1,600		22,225	
Quebec, Ontario, etc		853		
Total	3,777	11,240	51,470	2,507

Exports by countries.—The shells exported consist largely of abalone shells from the Pacific coast, which are sent principally to England and France. Table 88 shows the value of those exported to each foreign country during the year ending June 30, 1894. The customs returns do not show similar data for preceding years.

88. *Statement by countries of the exports of unmanufactured shells from the United States during the year ending June 30, 1894.*

Countries.	Value.
France	$14,980
Germany	5,564
Spain	25
United Kingdom	51,028
Quebec	137
Mexico	4
British West Indies	1,580
Turkey in Asia	643
Egypt	367
Total	74,328

XVI.—MISCELLANEOUS ARTICLES.

In addition to the aforementioned articles, there are several fishery products that enter into our trade with foreign countries in small quantities. Among these are ambergris, ambergris oil, coral, fish skins, seal skins, seaweeds, etc. It remains to give a brief account of the extent of the trade in these articles.

Ambergris and ambergris oil.—The quantity of ambergris and ambergris oil placed on the world's markets annually is very small, rarely exceeding 1,000 pounds. It is obtained principally by whale fishermen, and probably 20 per cent is secured by American vessels. Only a small quantity is used in this country, most of the domestic production being sent to Europe. Each year, however, a small quantity specially prepared is imported for use in the preparation of choice perfumery and other purposes. The following table shows the imports for consumption of these products from 1869 to 1894, inclusive:

89. *Statement of the imports for consumption of ambergris and ambergris oil into the United States from 1869 to 1894, inclusive.*

Year ending June 30—	Ambergris.			Ambergris oil.			Total values.
	Pounds.	Values.	Average values per pound.	Pounds.	Values.	Average values per pound.	
1872		$1,328					$1,328
1873		1,110		0.33	$31	$93.36	1,141
1874		4,046		1.62	322	198.16	4,368
1875		5,217					5,217
1876		1,700		1.87	706	377.54	2,406
1877		694		3.90	745	191.03	1,439
1878		93		1	185	185.00	278
1879		3,215					3,215
1880				16.06	2,962	184.43	2,962
1881		55		6.50	2,462	378.77	2,517
1882		5,408					5,408
1883		2,715		.44	390	886.36	3,105
1884	18	4,015	$226.20	.25	92	369.84	4,107
1885	47	5,685	120.96				5,685
1886	101	1,673	16.17	.50	175	350.38	1,848
1887	23	2,649	117.42	6.13	542	88.49	3,191
1888	93	6,774	72.67				6,774
1889	437	5,852	13.39				5,852
1890	50	1,454	29.08	11.23	2,920	260.00	4,374
1891	71	3,731	52.55	8	1,509	188.63	5,240
1892	6	1,288	226.36	1.22	427	350.00	1,715
1893	26	6,667	256.42				6,667
1894	37	5,112	138.16				5,112
Total		70,481		59.05	13,468		83,910

Coral.—Coral is obtained principally from the waters of the Mediterranean Sea and by Italian fishermen. The most extensive markets are Genoa, Leghorn, and Naples. No commercial coral is produced in the United States. Twenty-five years ago this article was in great demand for ornamental purposes, but at present it is not so highly esteemed in America.

The imports of coral for consumption from 1869 to 1894, inclusive, have been as follows:

90. *Statement of the imports for consumption of coral into the United States from 1869 to 1894, inclusive.*

Year ending June 30—	Not cut, or unmanufactured.	Cut, or manufactured.	Total.	Year ending June 30—	Not cut, or unmanufactured.	Cut, or manufactured.	Total.
1869	....	$22,417	$22,417	1883	$681	$1,302	$1,983
1870	....	18,975	18,975	1884	....	....	158
1871	....	37,877	37,877	1885	....	....	659
1872	$83	59,598	59,681	1886	....	....	218
1873	230	63,805	64,035	1887	....	....	307
1874	528	28,152	28,680	1888	....	....	594
1875	1,278	33,567	34,845	1889	....	....	461
1876	109	33,559	33,668	1890	....	....	531
1877	718	28,650	29,368	1891	....	....	213
1878	1,252	12,667	13,919	1892	533	845	1,378
1879	147	11,327	11,474	1893	608	657	1,265
1880	62	5,492	5,554	1894	153	1,758	1,911
1881	89	2,502	2,591				
1882	1,474	669	2,143	Total	....	....	374,905

Fish skins.—Skins of various fishes, but principally of sharks, are imported into the United States for use in arts and manufactures. They come principally from England, but are originally obtained largely from the Mediterranean Sea. The imports from 1869 to 1894, inclusive, amounting in value to $4,333 are shown in Table 12, on page 449.

A large quantity of skins produced in the fisheries of the United States are annually exported. Among these are alligator hides, porpoise skins, etc. The customs-house returns, however, do not indicate separately the quantity or value of these products exported. Small quantities of fish skins have been exported during recent years, a statement of the extent of which is given in Table 25, on page 468.

Seal skins.—Another important product of the United States fisheries dependent on foreign countries is seal skins. The customs returns do not classify this article separately, but the exports amount to at least 99 per cent of the domestic product. The San Francisco value of the undressed skins produced in the United States fisheries in 1895 approximated $659,000, and in 1894 about $600,000. Practically all of these skins are sent to London to be dressed, and doubtless a large portion of them are again imported into this country. When imported they are listed with other furs, both of land and marine animals, and a separate statement of the imports is impracticable.

Seaweeds.—The uses of marine plants as food and for manufacturing and agricultural purposes are of more value than is generally supposed, and doubtless capable of much greater development, especially in this country. In France, China, and Japan numbers of people find profitable employment in collecting and preparing them.

In the United States large quantities of seaweeds are gathered from along the shore for fertilizing the adjacent fields, but they are rarely carried into the interior of the country. Irish moss (*Chondrus crispus*) is gathered in small quantities on the coast of Massachusetts and sold for culinary purposes and for sizing calicoes, etc. Dulse (*Rhodymenia palmata*) is quite common on the New England coast, but is gathered only to a very limited extent. Small quantities are imported each year from the British Provinces and sold rough-dried, principally in the sea-port towns. No doubt several important industries could be developed in this country in gathering and preparing seaweeds.

The imports of seaweed and seaweed preparations during each year from 1869 to 1894, inclusive, are shown in Table 12 on page 449.

XVII.—APPENDIX.

A series of compilations is here presented, showing approximately the rates of duty exacted on fishery products and fishing appliances imported into various foreign countries. These data have been compiled from the publications of the Bureau of American Republics and the International Customs Journal, published by the International Customs Tariff Bureau, Brussels, Belgium. The figures in certain instances given in the first column are the numbers that the different items bear in the original tariff enactments. In reducing to American equivalents, the valuation on July 1, 1895, is adopted for fluctuating currencies.

AUSTRIA-HUNGARY.

(General law of May 25, 1882, with alterations of law of May 21, 1887.)

[Florin = $0.32. Kilogram = 2.2046 pounds.]

No.	Items.	Duty.		Rate per 100 pounds.
		Unit.	Rate.	
			Florins.	
51	Fish, fresh; river and creek crawfish; snails, fresh (by convention, free)	100 kilos	2.00	$0.29
52	Shellfish from the sea (i. e., oysters, lobsters, crabs); turtles, not prepared	do	25.00	3.62
59	Sponges:			
	Bathing and horse	do	15.00	2.17
	Other	do	60.00	8.71
68	Spermaceti	do	4.00	.58
	Fish oil	do	1.00	.15
86	Herrings, salted or smoked	do	3.00	.43
87	Fish, not otherwise provided for, salted, smoked or dried (by convention, 3 florins)	do	5.00	.72
88	Fish, prepared (pickled or preserved in oil, etc.), in casks	do	15.00	2.17
89	Caviar	do	50.00	7.24
92	All eatables contained in boxes, jugs, cans, and bottles, hermetically sealed	do	40.00	5.80
105	Ambergris	do	15.00	2.17
230	Whalebone, split	do	5.00	.72
248	Corals, prepared, i. e., ground, cut, or otherwise worked upon; genuine pearls, not set, if not coming under fancy goods	do	24.00	3.48
272	Fishing tackle	do	50.00	7.24
326	Glue of all kinds	do	6.00	.87
341	Spermaceti candles	do	11.00	1.60

AZORES.

(The customs duties operative in the Azores are those of Portugal, in addition to which there are certain municipal import duties.)

BELGIUM.

No.	Items.	Duty.
15	Fish, including oysters and all preserved fish and shellfish	Free.
21	Nets and other articles for sea fishing (such as fishhooks, cutlasses, blocks, tubs, axes, etc., necessary to fishermen)	Do.
30	Fish oil	Do.
33	Whalebone and mother-of-pearl	5 p.ct.

DENMARK.

(Revised to December, 1894.)

[Kroner = $0.268. Pound = $\frac{100}{101.5}$ United States pound.]

No.	Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Kroner.	
2	Turtles	100 pounds	0.50	$0.14
6	Bones (n. e. s.)	do	33.33	9.06
22	Fish:			
	Alive and fresh		Free.	
	Dried, smoked, salted, preserved, or spiced—			
	Anchovies, lampreys, salmon, sardines, caviar, mussels, and oysters	100 pounds	6.25	1.70
	Other sorts	do	.62	.17
	In hermetically closed cans	do	14.58	3.96
47	Oils, not otherwise specified	do	4.16	1.13

FRANCE.

(Tariff law of January 11, 1892.)

[Franc = $0.193. Kilogram = 2.2046 pounds.]

No.	Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Francs.	
14	Turtles	100 kilos	20.00	$1.75
29	Poil de messine (silk gut used only for fishing lines)		Free.	
44	Fish:			
	Fresh, sea	100 kilos	20.00	1.75
	Fresh, fresh-water of the salmonoid family	do	10.00	.875
	Fresh water, other	do	5.00	.44
45	Dried, salted, smoked, cod, or klipp fish	do	48.00	4.20
	stockfish and herrings	do	15.00	1.32
	Other dried, salted, or smoked	do	25.00	2.19
46	Preserved in oil or pickled	do	25.00	2.19
47	Oysters:			
	Fresh, seed		Free.	
	Fresh, other	Per thousand.	1.50	
	Pickled	100 kilos	5.00	.44
48	Lobsters:			
	Alive or fresh boiled	do	15.00	1.32
	Preserved or prepared	do	25.00	2.19
49	Mussels and other shellfish		Free.	
50	Fish oils	100 kilos	6.00	.526
51	Whale oil, spermaceti:			
	Crude	do	5.00	.439
	Pressed	do	10.00	.875
	Refined	do	15.00	1.317
52	Roe, cod and mackerel	do	.60	.053
53	Whalebone, uncut		Free.	
54	Seal skins, raw		Free.	
55	Coral, rough, uncut		Free.	
56	Pearls, fine (natural)		Free.	
57	Fish bladders, raw or simply dried		Free.	
58	Sponges, raw	100 kilos	35.00	3.045
	prepared, fine	do	65.00	5.687
62	Turtle shell		Free.	
64	Nacreous shells, mother-of-pearl, haliotis, and others for working		Free.	
321	Spermaceti candles	100 kilos	16.00	1.40
324	Fish glue or isinglass	do	40.00	3.50
547	Fishhooks	do	100.00	8.75
539	Fishing nets	do	20.00	1.75
629	Coral, cut, unset		Free.	
631	Strips of whalebone, cut and prepared	100 kilos	100.00	8.75

GERMANY.

(Tariff law of July 15, 1879, as amended May 22, 1885, and again December 21, 1887.)

[Mark=$0.238. Kilogram=2.2046 pounds.]

No.	Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Marks.	
2	Cotton fish nets, new	100 kilos	3.00	$0.32
5	Sea grass and sea tangle		Free.	
12	Seal skins and skins of fish, for leather		Free.	
20	Wares partially or entirely of genuine pearls or corals	100 kilos	600.00	64.77
20	Wares partially or entirely mother-of-pearl, or turtle shells	do	200.00	21.59
25	Fish:			
	Fresh		Free.	
	Salt (with exception of herring), imported in barrels; dried, smoked, roasted, cooked. (Stockfish, dried cod.)	100 kilos	3.00	.32
	Preserved with vinegar, oil, or spices, imported in barrels	do	12.00	1.30
	Other prepared fish of all sorts, hermetically sealed	do	60.00	6.48
	Herring, salt	Per barrel	3.00	.16
	Salt herring not in usual commercial packing	100 kilos	2.00	.22
	Salt herring intended for manure after denaturalization		Free.	
	Caviar and caviar surrogate	100 kilos	150.00	16.19
	Sea animals, and the like, preserved, steamed, or salted, in bottles, cans, and the like	do	60.00	6.48
	Other sea mussels, or shellfish	do	24.00	2.59
	Oysters, lobsters, and turtles	do	50.00	5.39
33	Pearls and coral, unset	do	60.00	6.48
26	Fish fat and fish oil	do	3.00	.32
37	River crabs, fresh or cooked; wash sponges, and other fish products, mussels from the sea, fresh or cooked, unshelled, with exception of oysters		Free.	

ITALY.

(Tariff law of January 1, 1892.)

[Lira=$0.193. Kilogram=2.2046 pounds.]

No.	Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
6	Fixed oils:		*Lira.*	
	Mixed fish	100 kilos	6	$0.525
	Not otherwise mentioned	do	15	1.31
102	Fishing nets, as the material, and in addition thereto	10 per cent		
306	Fish:			
	Fresh of all kinds		Free.	
	Dried or smoked	100 kilos	5	.437
	In brine	do	6	.525
	Seasoned in oil or vinegar (including tunny fish) in boxes	do	30	2.626
	Seasoned in oil or vinegar (including tunny fish) otherwise preserved	do	30	2.626
307	Caviar and other prepared fish eggs	do	30	2.626
320	Fish glue or isinglass	do	15	1.31
323	Sponges:			
	Common—			
	Crude		Free.	
	Cleaned	100 kilos	40	3.50
	Fine—			
	Crude		Free.	
	Cleaned	100 kilos	200	17.508
324	Coral:			
	Not manufactured		Free.	
	Manufactured, if not mounted with gold	Kilo	1,000	87.54
325	Mother-of-pearl:			
	Not manufactured		Free.	
	Manufactured	100 kilos	150	13.13

GREECE.

(Law of 1887, as amended to take effect 1st (13th) February, 1892.)

[Drachma = $0.193. Oke = 2.84 pounds.]

No.	Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Drachma.	
12	Candles, sperm	Oke	2.00	$13.59
22	Fish:			
	Fresh fish in general, and sponge		Free.	
	Salted, smoked, or dried, except following	Oke	.30	2.04
	White mullet, sardines, tunny, lobsters, etc., in cans	do	2.00	13.59
	Inkfish, octopod, eels, oysters	do	.50	3.40
	Codfish and stockfish	do	.20	1.36
	Red caviar	do	.20	1.36
	Black caviar	do	3.00	20.39
	Shellfish, except oysters	do	.05	.35
28	Fish glue:			
	Common	do	.40	2.72
	Refined	do	1.00	6.79
38	Real pearls, prepared		Free.	
	Coral	Oke	1.00	6.79
47	Fish oil	do	.50	3.40

NETHERLANDS.

(Tariff law in effect July 1, 1895.)

[Florin = $0.402. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Florins.	
Candles, sperm		5 per cent.	
Coral, manufactured		do	
Fish, preserved in tins	100 kilos	25.00	$4.56
Mother of pearl shells, manufactured		5 per cent.	
Oil	100 kilos	.55	.10
Whalebone (mercery)		5 per cent.	

NORWAY.

(Law as amended, to go into effect August 1, 1892.)

[Krone = $0.268. Kilogram = 2.2046 pounds.]

Item.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Krone.	
Coral, crude or unmanufactured		Free.	
Cotton fish nets, as the material, and in addition thereto		10 per cent.	
Fish, pickled, spiced, or preserved in oil, smoked, and caviar	Kilogram	.40	$4.80
Other fish		Free.	
Fishing rods	Kilogram	.35	4.25
Fish and whale oil	do	.04	.48
Isinglass or fish glue	do	1.50	18.23
Linen fish nets, as the material, and in addition thereto		10 per cent.	
Pearls, natural, not set		Free.	
Sardines or anchovies	Kilogram	.20	2.40
Other canned fish	do	.40	4.80
Seal skin, dressed, single or sewed together	do	2.40	29.17
Spermaceti oil	do	.04	.48
Sponges	do	2.67	32.45
Whalebone, cut		Free.	

PORTUGAL.

(Tariff law of June 17, 1892.)

[1000 reis=$1.08. Kilogram=2.2046 pounds.]

No.	Item.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Reis.	
13	Sponges	Kilogram	270	$13.22
26	Fish oil	do	10	.49
38	Pearls		3 per cent ad val.	
152	Wax, animal	Kilogram	22	1.08
348	Codfish	do	39	1.91
349	Shellfish	do	6	.29
	Fish:			
350	Fresh, unprepared	do	10	.49
351	Salted, pressed, smoked, or pickled	do	20	.98
352	Sardines, fresh, salted, or pressed	do	5	.24
357	Alimentary preserves	do	200	9.79
404	Fishing nets	do	120	5.42
429	Whalebone, prepared in the rough	do	800	39.19
590	Candles, sperm	do	120	5.87

RUSSIA.

(Revised to January, 1891.)

[Ruble=$0.389. Pound=14 ounces avoirdupois. Pood=36.112 English pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Rubles.	
Spermaceti	Pood	1.20	$1.29
Whale and cod-liver oil, unpurified	do	.60	.65
Mother of pearl	do	2.40	2.58
Fish glue	do	6.00	6.46
Fish skins	do	10.80	11.64
Sponges	do	2.40	2.58
Whalebone of all kinds	do	2.65	2.85
Fish:			
Fresh—			
Turbot, soles, trout	do	2.40	2.58
All other kinds	do	.12	.13
Pickled and prepared in oil, also caviar	do	5.00	5.38
Salted and smoked, except herrings	do	1.20	1.29
Herrings, salted or smoked; cod and all other fish, kippered or air dried.	do	.27	.29
Oysters, lobsters, etc., in hermetically sealed vessels	do	5.00	5.38
Furs:			
Seal skins	do	18.00	19.39
Sea otter	do	36.00	38.77

SPAIN AND BALEARIC ISLANDS.

(Tariff law taking effect February 1, 1892, modified by law of July 16, 1892.)

[Peseta = $0.193. Kilogram = 2.2046 pounds.]

No.	Item.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
			Pesetas.	
125	Sperm of whale:			
	In mass	100 kilos	20.00	$1.75
	Manufactured	do	25.00	2.19
250	Animal fats	do	1.00	.09
290	Codfish and stockfish	do	18.00	1.58
	Law of July, 1876—provisional duty	do	3.00	.26
	Law of July, 1877—municipal duty	do	3.00	.26
291	Fresh fish	do	1.50	.13
292	Fish, salted, smoked, or pickled	do	12.00	1.05
293	Seed oysters and shellfish	do	3.00	.26
294	Oysters and shellfish	do	8.00	.70
341	Whalebone, shell, and coral, in the rough or cut in strips	Kilogram	.10	.87
342	Coral and mother-of-pearl, manufactured	do	17.10	149.62
343	Whalebone, manufactured	do	2.50	21.88

SWEDEN.

[Kroner = $0.268. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Kroner.	
Bones:			
Walrus teeth	100 kilos	118.00	$14.35
Other kinds	do	35.00	4.26
Fish:			
Anchovies and sardines, in oil or brine, hermetically sealed (weight of boxes included).	do	20.00	2.43
Other kinds preserved (weight of boxes included)	do	30.00	3.65
All other kinds of fish, fresh, dry or salted		Free.	
Fish glue	100 kilos	20.00	2.43
Oils		Free.	
Otter skins, undressed	100 kilos	25.00	3.04
Otter skins, dressed	do	40.00	4.86
Sturgeon sounds	do	170.00	20.67

SWITZERLAND.

(General tariff law of January 1, 1893.)

[Franc = $0.193. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Francs.	
Sponges	100 kilos	20.00	$1.75
Fish glue and isinglass	do	7.00	.61
Fresh fish	do	2.50	.22
Fish, dried, salted, pickled, smoked, or otherwise prepared:			
In receptacles of less than 5 kilograms weight	do	16.00	1.40
In receptacles of more than 5 kilograms weight	do	1.00	.09
Shellfish: Oysters, lobsters, etc., fresh	do	30.00	2.62
Fish oil, in casks	do	.50	.04
Spermaceti	do	.50	.04
Whalebone:			
Raw or stripped	do	4.00	.34
Polished	do	16.00	1.40
Mother-of-pearl	do	10.00	.87
Pearls, not set	do	50.00	4.38
Coral, not set	do	30.00	2.63

UNITED KINGDOM.

(There are no customs duties on fishery products imported into Great Britain and Ireland.)

DOMINION OF CANADA.

(Revised to November, 1895.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Ambergris		Free.	
Fish:			
Mackerel	Pound	1 cent.	$1.00
Herrings, pickled or salted	do	½ cent.	.50
Salmon, pickled or salted	do	1 cent.	1.00
All other fish, pickled or salted, in barrels	do	1 cent.	1.00
not in barrels	do	½ cent.	.50
Smoked and boneless fish, not in barrels	do	1 cent.	1.00
Anchovies and sardines—			
In boxes, 5 by 4 by 3½ inches	Per box	5 cents.	
5 by 4 by 1⅝ inches	do	2½ cents.	
4¾ by 3½ by 1¼ inches	do	2 cents.	
In any other form		30 per cent.	
Other fish, preserved in oil		30 per cent.	
Oysters—			
In the shell		25 per cent.	
Shelled, in bulk	Gallon	10 cents.	
Canned, in cans not over 1 pint (including cans)	Can	3 cents.	
in cans over 1 pint and not over 1 quart	do	5 cents.	
All other fish		25 per cent.	
Fishhooks, nets and seines, and fishing lines and twines, but not to include sporting, fishing tackle, hooks and flies, trawling spoons, threads or twines used for sewing or manufacturing purposes		Free.	
Fishing rods		30 per cent.	
Fish skins, for manufacture		Free.	
Glue, sheet, broken sheet, and ground	Pound	3 cents.	3.00
liquid, including mucilage		30 per cent.	
Kelp, seaweed, and sea grass		Free.	
Mother-of-pearl, unmanufactured		Free.	
Spermaceti, whale, and other fish oils		20 per cent.	
Tortoise and other shells, unmanufactured		Free.	
Whalebone, unmanufactured		Free.	
All other articles, the product of the fisheries, not specially provided for		20 per cent.	

NEWFOUNDLAND.

[Dollar = $1.014.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:			
Cod and haddock	Quintal	$1.50	$1.34
Oysters and clams in shells		Free.	
Fish of British catch and cure, and oil, the produce of such fish		Free.	
Fishing tackle (except fishing tackle for anglers)		7½ per cent.	

MEXICO.

(Law of May 15, 1891, modified by decree of April 30, 1894, to take effect July 1, 1894.)

[Peso=$0.528. Kilogram=2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Pesos.	
Candles, sperm	Kilogram	0.20	$4.79
Coral, in the rough	do	.25	7.99
Coral, wrought	do	1.50	35.93
Fish: Fresh and in ice		Free.	
Fish and shellfish, dry, salted, smoked, or pickled	Kilogram	.12	2.87
Preserved fish and shellfish	do	.15	3.59
Fish glue	do	.15	3.59
Mother-of-pearl, in the rough	do	.25	7.99
Oil, cod liver	do	.10	2.40
Oil, fish	do	.10	2.40
Pearls, unset	Carat	.50	....
Spermaceti	Kilogram	.25	7.99
Sponges, fine	do	2.00	47.90
Sponges, common	do	.40	9.58
Whalebone	do	.10	2.40

COSTA RICA.

(Tariff law of September 7, 1885.)

[Peso=$0.486. Kilogram=2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:		*Pesos.*	
With or without oil, in tins or otherwise	Kilogram	0.07	$1.54
Shellfish, preserved, with or without oil, or with condiments, in cans, or otherwise	do	.07	1.54
Fishhooks	do	1.09	24.03
Glue	do	.11	2.42
Mother-of-pearl, manufactured	do	2.17	47.84
Oil	do	.11	2.42
Pearls, fine, unmounted	do	100.00	....
Spermaceti	do	.07	1.54
Whalebone	do	.54	11.90

GUATEMALA.

(Tariff promulgated November 4, 1893, and in force since January 1, 1894, and supplementary decree of December 20, 1893, reducing the additional duties imposed by former laws to 15 per cent.)

[Peso=$0.486. Kilogram=2.2046 pounds.]

No.	Items.	Duty.		Rate per 100 pounds.
		Unit.	Rate.	
			Pesos.	
47	Cod, dried, salted, or smoked, in bulk		Free.	....
924	Fishhooks, all kinds, with or without gut and float, including weight of container	Kilogram	.30	$6.61
1701	Coral, wrought, polished, or cut into beads, including weight of container	do	2.00	44.09
1748	Fish glue	do	.80	17.64
1861	Spermaceti, in cakes, gross weight	do	.25	5.51
1862	Spermaceti, in candles, gross weight	do	.30	6.61
1863	Sponges	do	6.00	132.27
1904	Whalebone	do	.75	16.53
2038	Caviar, gross weight	do	.25	5.51
2047	Codfish and herring, dried, salt, smoked, or pickled, packed in wood or earthen vessels	do	.15	3.31
2048	Canned, preserved, or in oil	do	.25	5.51
2075	Lobsters, preserved	do	.25	5.51
2101	Salmon, canned	do	.25	5.51
2102	Sardines, smoked, salted, pickled, or dried, not in cans	do	.15	3.31
2103	Sardines, in cans	do	.25	5.51
2113	Shellfish, preserved in any package	do	.24	5.29
2114	Shrimp, canned	do	.25	5.51
2174	Ambergris, net weight	Gram	1.00	....
2550	Isinglass	Kilogram	.80	17.63
2639	Fish oil	do	.10	2.20
2641	Cod-liver oil	do	.20	4.41

HONDURAS.

[Peso = $0.486. Libra = 1.043 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Candles, sperm	Libra	.04	$1.86
Coral in any form, except when set in gold or silver	do	.50	23.30
Fish:			
Pickled, salted, or smoked	do	.02	.93
Canned	do	.08	3.73
Sardines, in oil or otherwise	do	.04	1.86
Fish glue	do	.18	8.39
Mother-of-pearl	do	.24	11.18
Oil, cod-liver	do	.02	.93
Oil, other	do	.02	.93
Spermaceti	do	.04	1.86
Sponges	do	.50	23.30

NICARAGUA.

(Tariff law of July 25, 1888.)

[Peso = $0.486. Libra = 1.043 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Candles, sperm	Libra	.05	$2.33
Coral, manufactured	do	2.50	116.45
Coral, mounted with gold or silver	do	5.00	232.90
Fish:			
Shellfish, all kinds, preserved in oil, vinegar, etc	do	.04	1.86
Dried or smoked	do	.03	1.40
Preserved in oil, vinegar, etc	do	.07	3.26
Dried or smoked	do	.05	2.33
Fish glue	do	.06	2.80
Fishhooks	do	.20	9.32
Oil, cod-liver, and other	do	.03	1.40
Pearls, real, not set	do	5.00	232.90
Sponges of all kinds	do	1.00	46.59
Whalebone	do	.40	18.64

NOTE.—Decree of December 19, 1891, No. IV, increased above duties 100 per cent.

SALVADOR.

(Law of March 24, 1888, revised to March 23, 1892.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Coral, unmanufactured	Kilogram	5.00	$110.22
Fish:			
Herring, cod, and other fish, not further prepared than dried, salted, or smoked	do	.15	3.31
Fish prepared in vessels of tin, glass, or earthenware	do	.20	4.40
Fishhooks	do	.35	7.71
Fish glue	do	.10	2.20
Mother-of-pearl, unmanufactured	do	.20	4.40
Oil, cod liver	do	.30	6.60
whale	do	.08	1.76
Pearls, fine	do	10.00	220.45
Spermaceti, in mass	do	.20	4.40
manufactured in any form	do	.30	6.60
Sponges of all kinds	do	5.00	110.22
Whalebone	do	1.00	22.04

BRITISH HONDURAS.

(Act of January 4, 1895.)

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
Candles, sperm	Pound	$0.02	$2.00
Fish, salted, dry, or wet		Free.	
Fresh fish and fresh oysters		Free.	
Oil	Gallon	.06	
Turtle, live		Free.	
Other products		10 per cent.	

BRITISH WEST INDIES—BAHAMAS.

[Shilling = $0.243.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		s. d.	
Candles, sperm	100 pounds	11 0	$2.67
Caviar and other fish ova		Free.	
Fish:			
Dried or salted	100 pounds	2 6	.50
Pickled salmon, shad, and mackerel	Barrel	4 6	.49
Pickled herring, alewives, and other kinds	do	4 6	.49
Fresh		Free.	
Sperm oil	Gallon	1 0	
Sponges		Free.	
Turtle		Free.	

BRITISH WEST INDIES—JAMAICA.

(Revised to January, 1893.)

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		s. d.	
Candles, sperm	Pound	0 2	$4.05
Fish:			
Fresh fish and turtle		Free.	
Canned		8 per cent.	
Dried or salted	100 pounds	3 6	.74
Smoked, not otherwise numerated or described	Pound	0 0½	1.00
Alewives, pickled	Bbl., 200 lbs	2 6	.30
Herring, pickled	do	2 6	.30
smoked	Pound	0 0¼	.50
Mackerel, pickled	Bbl., 200 lbs	4 6	.49
Pickled, not otherwise enumerated or described	do	4 6	.49
Salmon, smoked	Pound	0 2	4.05
wet or salted	Bbl., 200 lbs	10 6	1.22
All others		12½ per cent.	

BRITISH WEST INDIES—BARBADOS.

(Tariff of 1889.)

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
Blubber and heads and offal of fish		Free.	
Fish:			
Dried, salted, or smoked	Quintal	$0.05	$0.045
Pickled	Barrel	.10	.05
Fresh fish and turtle		Free.	
Fish on ice and salmon and oysters in cans		Free.	
All others		8 per cent.	
Turtle-shells, unmanufactured		Free.	

DUTCH WEST INDIES.

(All fishery products imported pay 1¼ per cent ad valorem.)

FRENCH WEST INDIES—GUADALOUPE.

[Franc = $0.193. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Francs.	
Ambergris		10 per cent.	
Fish:			
Canned	100 kilos	40.00	$3.48
Codfish, dried, salted, or smoked	do	3.00	.26
In oil	do	21.00	1.83
Oil: Cod liver	do	15.00	1.32
Fish	do	15.00	1.32
Oysters	do	15.00	1.32
Sponges		10 per cent.	
Turtles		5 per cent.	
All others		6 per cent.	

FRENCH WEST INDIES—MARTINIQUE.

[Franc = $0.193. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Francs.	
Candles, sperm	100 kilos	4.30	$0.38
Fish:			
Dry, salted, or smoked codfish	do	4.00	.35
Anchovies	do	16.00	1.40
In cans, natural state, pickled or otherwise prepared	do	16.00	1.40
Others	do	2.70	.24
Fish fat	do	3.75	.33
Turtles, sea	do	6.46	.57
All others		5.35 per cent.	

CUBA.

[Peso = $0.926. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
Fish:		*Pesos.*	
Live		Free.	
Common sorts, smoked, dried, salted, or pickled, as Halifax and Newfoundland cod, herring, mackerel, skate, hake, haddock, pressed sardines, exclusive of weight of brine	100 kilos	1.80	$0.76
Superior sorts, dried or pickled, as anchovies, tunny fish, salmon, cod sounds, Norwegian, Swedish, and Scotch cod, stockfish, and other north European and all classes of live and dried shellfish, including weight of brine and package, if glass	do	2.85	1.20
Sardines preserved in tins, including package	do	12.00	5.04
Fish of other kinds preserved in oil, not specified above, pickled or otherwise prepared; fresh or canned oysters, including package	do	1.80	.76
Oil, fish, liquid, including weight of interior package when of glass	do	5.20	2.19
Oil, solid, as spermaceti	do	4.50	1.89
Whalebone, coral, and mother-of-pearl, rough	Kilogram	1.50	63.00
Whalebone, cut and prepared to be used, but unpolished	do	2.60	109.20
Whalebone, polished and prepared for use	do	2.60	109.20

PUERTO RICO.

[Peso=$0.926. Kilogram=2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Alimentary conserves	Kilogram	.01	4.20
Coral and mother-of-pearl, not cut	do	1.50	63.00
Fish:			
Codfish and stockfish	100 kilos	.90	.38
Fresh, salted, smoked, pickled, and shellfish	do	.90	.38
Live		Free.	
Oils	100 kilos	4.50	1.89
Whalebone	Kilogram	1.50	63.00
Spermaceti, manufactured or crude	100 kilos	4.50	1.89

HAITI.

(Revised to September 1, 1893.)

[Gourde=$0.965.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Gourde.	
Alimentary conserves	Can	.10	$9.65
Fish:			
Anchovies—			
In cases of 12 boxes	Dozen	.30	
In pots	Pot	.15	
Codfish	Cwt	1.40	1.35
Codfish tongues, in kegs or pots	Each	.12	
Eels	Quintal	2.00	1.93
Alewives	Barrel	1.50	.72
smoked	Box	.06	
Herring	Barrel	1.50	.72
smoked, in ¼ or ⅛ barrel or box	Each	.06	
Mackerel	Barrel	1.50	.72
Oysters, pickled in kegs or pots	Each	.18	
Salmon—			
In barrels (200 pounds)	Barrel	1.50	.72
In half barrels (100 pounds)	Half-barrel	.75	.72
In quarter barrels (50 pounds)	Quarter-barrel	.37	.72
Sardines—			
In barrels	Barrel	.50	
In pots	Pot	.20	
In oil, tin boxes	Box	.10	
Same, half boxes	Half boxes	.06	
Same, quarter boxes	Quarter box	.04	
Fish glue	Pound	.05	4.82
Fishhooks, assorted	Thousand	.50	
Fishing lines	Pound	.04	3.86
Pearls, fine		20 per cent.	
Spermaceti	Pound	.10	9.65
Sponges, fine	do	.35	33.77
common, for horses	do	.06	5.79

SANTO DOMINGO.

[Mexican dollar = $0.528. Liter = 1.0567 quarts. Quintal = 112 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Mexican dollars.	
Candles, sperm	Quintal	24.00	$11.32
Coral, not made into ornaments	Pound	3.60	190.08
Fish:			
Anchovies	do	.18	9.50
Cod, dry or salt	Quintal	1.80	.85
Herring, smoked	do	1.80	.85
pickled	Barrel	4.80	1.27
Mackerel, No. 1	do	7.20	1.90
No. 2	do	6.00	1.58
No. 3	do	4.80	1.27
Oysters, however packed	Quintal	6.00	2.82
Salmon, pickled or unpickled	do	7.20	3.39
Sardines, salted	do	4.80	2.26
in oil, however packed	Pound	.18	9.50
Tunny, in brine	do	.06	3.17
in oil	do	.12	6.33
Fishhooks	do	.90	47.52
Fishing lines	Quintal	7.20	3.39
Oil, cod liver	Liter	.30	....
4 to 32 ounce phials	Pound	.24	12.67
fish	Gallon	.24	1.27
spermaceti or whale	do	.30	1.58
Pearls	Ounce	3.60	....
Preserved food, in cans	Pound	.12	6.33
Spermaceti, crude	Quintal	15.00	7.07
manufactured	do	30.00	14.13
Sponges, fine	Pound	3.60	190.08
common	do	2.40	126.72
Whalebone	do	.15	7.92

ARGENTINA.

(January 1, 1893.)

[Peso = $0.965. Kilogram = 2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Pesos.	
Ambergris	Gram	.25	....
Caviar	Kilogram	.20	$8.75
Fish:			
Fresh		Free	....
Cod and other similar fish	Kilogram	.09	3.92
Same in pieces	do	.15	6.57
Codfish tongues, wrapping or vessel included	do	.138	6.04
Fish in brine or pressed, vessel included	do	.096	4.20
Fish and shellfish, preserved in oil or natural	do	.30	13.13
Herring—			
Smoked, in firkins	do	.144	6.29
Smoked, in boxes	do	.24	10.51
Oysters, including container	do	.09	3.94
Shrimps, dry	do	.312	13.65
Stockfish, in bundles, including wrapper	do	.12	5.26
Fish glue	do	1.00	43.77
Fishhooks	do	.155	6.78
Oils	100 kilos	.32	.14
Oil, cod liver	Kilogram	.05	2.19
Pearls	Gram	.36	....
Spermaceti	Kilogram	.20	8.75
Spermaceti candles, in packages, including wrapper	do	.225	9.85
Sponges:			
Fine for toilet	do	12.50	547.10
Fair for toilet	do	5.00	218.84
Bath and carriage	do	2.00	87.54
For horses	do	.875	38.29
Medicated, Bahama, for scrubbing	do	.50	21.88

BOLIVIA.

(Law of November 25, 1893.)

[Boliviano = $0.486. Kilogram = 2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Bolivianos.	
Ambergris	Kilogram	18.00	$396.72
Caviar	do	.30	6.60
Coral, in natural state	do	1.50	33.06
Fish:			
Codfish	do	.0375	.83
Dried, smoked; not canned	do	.03	.66
Canned	do	.05	1.10
In brine, in wood	do	.025	.55
Fish or shellfish, in oil or water	do	.075	1.65
Lobsters, shrimps, and oysters	do	.05	1.10
Sardines, in oil	do	.0875	1.92
Fish glue	do	.90	19.84
Fishhooks, all sizes	do	.15	3.30
Isinglass	do	.18	3.96
Oil:			
Cod liver	do	.21	4.62
Whale and seal, crude	do	.036	.80
refined	do	.06	1.32
Sperm, crude	do	.06	1.32
refined	do	.105	2.31
Spermaceti, crude	do	.21	4.63
refined	do	.30	6.61
Sponges, fine	do	3.60	79.34
common	do	.75	16.53
Whalebone, rough	do	.12	2.64
manufactured	do	.75	16.53

BRAZIL.

(Tariff promulgated by decree No. 836 of the Provisional Government on the 11th of October, 1890.)

[Milreis = $0.546. Kilogram = 2.2046 pounds. Gram = 15.432 grains.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Milreis.	
Ambergris	Gram	.30	....
Coral, branch or manufactured	Kilogram	5.00	$123.82
Fish:			
Dried, salted, or pickled	do	.04	1.00
Fresh or frozen	do	.04	1.00
Sardines and other preserved fish	do	.48	11.88
All others	do	.70	17.33
Fishing nets	do	2.40	59.42
Mother-of-pearl, rough, sawed, or prepared	do	.64	15.84
Oil, for lubricating	do	.15	3.70
purified	do	.50	12.38
cod liver	do	.64	15.84
Shells, not classified	do	.30	7.43
Spermaceti	do	.40	9.90
Sponges:			
Fine	do	14.00	346.71
Common	do	3.00	74.30
Whalebone	do	.26	6.44

CHILE.

[Peso = $0.912. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Ambergris	Kilogram	15.00	$620.50
Coral, rough or unworked		15 per cent.	
Candles, spermaceti	Kilogram	.35	14.49
Caviar, in wood, including package	do	.28	11.58
Fish:			
Anchovies, sardines, etc., dried, smoked, or in brine—			
In wood, gross weight	do	.0595	2.40
In tin, crockery, or glass, gross weight	do	.0875	3.60
Codfish, mackerel, etc., dried, smoked, or in brine—			
In wood, gross weight	do	.042	1.72
In tin, including package	do	.0595	2.40
Fish tongues, in brine, gross weight	do	.105	4.30
Large dogfish, in packing cloth, gross weight	do	.0525	2.17
Lobsters and shrimps, in water, gross weight	do	.0875	3.60
Oysters, in water, in tin, crockery, or glass, gross weight	do	.0875	3.60
Salmon, in water, in tin, crockery, or glass, gross weight	do	.0875	3.60
Salmon, dried, smoked, or in brine, in wood, gross weight	do	.0595	2.40
in tin, including package	do	.077	3.19
Sardines in oil, gross weight	do	.1225	5.10
Fish glue	do	.0625	2.57
Fishhooks, including wrapper	do	.15	6.20
Fishing nets		15 per cent.	
Isinglass, shredded, including wrappings	Kilogram	.75	31.03
Oil:			
Cod liver	do	.175	7.20
Whale or seal, crude, gross weight	do	.0325	1.35
refined, gross weight	do	.055	2.27
Sperm, crude, gross weight	do	.06	2.47
refined, gross weight	do	.105	4.35
Spermaceti, crude	do	.20	8.30
refined	do	.3125	11.49
Sponges, fine, conical, sample No. 183	do	5.00	206.85
medium, sample No. 184	do	2.50	103.42
common, sample No. 185	do	.75	31.03
Whalebone, in the rough	do	.11	4.55

COLOMBIA.

(Revised to December, 1893.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Peso.	
Codfish in brine, and all fresh fish	Kilogram	.05	$1.10
Salmon and other preserved fish	do	.20	4.41
Fish glue	do	.20	4.41
Spermaceti, not manufactured	do	.20	4.41
in candles, etc	do	.30	6.62

ECUADOR.

(Law of September 4, 1890.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pesos.	
Candles, sperm	Kilogram	.05	$1.10
Coral	do	1.50	33.07
Fish, salted, like that imported from Peru	do	.02	.44

NOTE.—A surcharge of 20 per cent for the distinct purposes specified by law went into effect after the signing of an agreement for the liquidation of the English debt; also an additional duty of 10 per cent for the liquidation of the national debt.

BRITISH GUIANA.

(Ordinance 1892; revised to June, 1894.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:			
Dried	112 pounds	$0.50	$0.44
Pickled—			
Mackerel	Barrel	1.00	.50
Salmon	do	2.00	1.00
Others	do	.25	.125
Preserved in tins or bottles, except oysters and salmon	Pound	.01	1.00
Salmon and oysters in cans		Free.	
Smoked	Pound	.005	.50
Fresh fish, turtles and fish on ice		Free.	
Fishing apparatus of all kinds		do	
Isinglass	Pound	.05	5.00
Oil	Gallon	.25	

URUGUAY.

[Peso = $1.034. Kilogram = 2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Pesos.	
Ambergris	Hectogram	28.80	
Candles, sperm, including package	Kilogram	.14	$6.58
Coral	do	2.74	128.60
Fish:			
Anchovies—			
In oil, including package	do	.30	14.10
In brine, in flasks, tins, or crocks	do	.10	4.70
In brine, in barrels or boxes, gross weight	do	.07	3.29
Codfish, dry, and stockfish in general, gross weight	do	.09	4.23
Codfish tongues, gross weight	do	.09	4.23
Dried fish—			
In jars, cans, or crocks, including package	do	.30	14.10
In casks or boxes, gross weight	do	.05	2.35
Herrings dried, in boxes of one dozen	Dozen	.093	
Oysters and lobsters, including packages	Kilogram	.30	14.10
Fish pickled in boxes or casks	do	.07	3.29
In jars or crocks, including package	do	.10	4.70
Preserved fish, including package	do	.30	14.10
Sardines—			
In oil, including packages	do	.30	14.10
Pressed, gross weight	do	.05	2.35
Pickled, in boxes or casks, gross weight	do	.07	3.29
Pickled, in jars, cans, or crocks, including package	do	.30	14.10
Fishhooks, not snedded	do	.31	14.57
snedded	do	.62	29.14
Horsehair fishing lines	Thousand	.62	
Oil:			
Cod liver, in kegs or tins	Kilogram	.159	7.47
Whale	Quart	.0465	
Fish	Kilogram	.0558	2.63
Sponges:			
Pressed	do	.31	14.57
Washed, in general, with or without sand	do	1.55	72.85
Small, medium, and fine	do	10.85	509.90
Whalebone, smooth or rough	do	1.86	87.42

PERU.

[Sol=$0.486. Kilogram=2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Sol.	
Candles, sperm, in baskets, bales, or cases, gross	Kilogram	.1625	$3.59
Coral, in natural state	do	2.00	44.08
Fish:			
Dried or smoked, not in tins, gross weight	do	.01	.22
in tins, gross weight	do	.02	.44
In brine, in wooden packages	do	.01	.22
in tins or jars	do	.02	.44
Preserved fish and shellfish	do	.12	2.64
Sardines in tins, gross weight	do	.10	2.20
Fish glue	do	.01	.22
Fish hooks	do	.40	8.82
Fishing lines	do	.10	2.20
Oil cod lines	do	.18	3.97
Pearls, unset		3 per cent	
Spermaceti, in cakes	Kilogram	.40	8.82
Sponges:			
Fine	do	4.00	88.18
Common	do	1.20	26.45

VENEZUELA.

(Revised to October, 1895.)

[100 Centimos=1 bolivar. Bolivar=$0.193. Kilogram=2.2046 pounds.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Centimos.	
Candles, sperm	Kilogram	125	$10.94
Fish:			
In brine, salted, or smoked, not in tins	do	25	2.19
In cans, not specified	do	75	6.57
Sardines packed in oil or any other form	do	25	2.19
Fishhooks		Free.	
Fishing lines of hair	Kilogram	75	6.57
Fishing nets of all kinds	do	1,000	87.50
Fishing twine of linen or flax for nets and lines	do	75	6.57
Isinglass	do	125	10.94
Oil:			
Cod liver	do	125	10.94
Fish	do	75	6.57
Pearls	do	1,000	87.50
Shells, loose or made up in pieces or ornaments	do	250	21.88
Spermaceti	do	75	6.57
Sponges	do	125	10.94

CAPE VERDE ISLANDS.

(All fishery products imported pay a duty of 20 per cent ad valorem.)

EGYPT.

Commercial treaty with United States November 16, 1884. A duty of eight per cent ad valorem is imposed on all products from the United States, computed on the price at the port of discharge.

LIBERIA.

(March 1, 1890.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish, dried	Pound	$0.01	$1.00
pickled	Barrel	1.00	.50

MAURITIUS.

(Law of January 1, 1894.)

[Rupee=$0.231. Kilogram=2.2046 pounds. Hectoliter=22 imperial or 26.417 U. S. standard gallons.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:		*Rupees.*	
Dried or salted	100 kilos	1.08	$0.113
Pickled	do	1.25	.131
Glue	do	3.00	.314
Oil	Hectoliter	2.50	
All other		7½ per cent.	

CHINA.

[10 candarins=1 mace. 10 mace=1 tael. 1 tael=$0.80. 1 picul=100 catties=133⅓ pounds.]

No.	Items.	Duty.		Rate per 100 pounds.
		Unit.	Rate daily.	
			t. m. c.	
12	Candles, sperm		Free.	
22	Fish:			
	Dried	Picul	5	$0.30
	Salt	do	1 8	.11
	Fresh		Free.	
	Shellfish, caviar, etc		do	
28	Glue	Picul	1 5 0	.90
47	Oil		5 per cent.	

JAPAN.

(All fishery products imported pay a duty of 5 per cent ad valorem.)

KOREA.

Items.	Duty.
	Per cent.
Candles, sperm	7½
Coral	10
Fish, fresh	5
Fish, dried and salted	7½
Isinglass, all kinds	7½
Preserved goods	7½
Sea products, as seaweed, beche-de-mer, etc	7½

PHILIPPINE ISLANDS.

(Royal decree of January 8, 1891.)

[Kilogram=2.2046 pounds.]

No.	Items.	Duty.		Rate per 100 pounds.
		Unit.	Rate.	
96	Spermaceti	100 kilos	$3.30	$1.50
236	Salt codfish and stockfish	Kilogram	.04	1.81
237	Fish, fresh	do	.01	.45
238	Fish, salted, pressed, smoked, or pickled	do	.06	2.72
239	Shellfish	do	.05	2.27
	Whalebone and mother-of-pearl:			
274	In rough or cut in strips or plates	do	.01	.45
275	In form of jewelry or ornament	do	.05	2.27
291	Candles, sperm	do	.22	9.98

NOTE.—By decree of July 10, 1895, a transitory impost of 4 per cent on above was established.

BRITISH EAST INDIES—CEYLON.

(Law of January, 1890.)

[Rupee=$0.231.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Rupees.	
Candles, sperm	....	6½ per cent.	....
Coral	....	Free.	....
Cowries and shells (not tortoise shell)	....	Free.	....
Fish, dried, salted, roes, fins, skins, and blood, the produce of creatures living in the sea.	Cwt	0.50	$0.103
Fish oil	....	Free.	....
Fishermen's nets	....	Free.	....
Machinery for the manufacture of fish manures	....	Free.	....
Pearls	....	Free.	....
Pearl oysters	....	Free.	....

AUSTRALASIA—NEW SOUTH WALES.

(Act of March 2, 1892.)

[Shilling=$0.243.]

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Pence.	
Candles, sperm	Pound	1	$2.06
Fish, dried, preserved, or salted	do	1	2.06
Oil:			
Sperm, not in bottles	....	Free.	....
Black whale, not in bottles	....	Free.	....
Others	Gallon	6	1.21
Oysters	....	Free.	....
Pearl shell	....	Free.	....
Shark fins and beche-de-mer	....	Free.	....

AUSTRALASIA—NEW ZEALAND.

(Revised to November 30, 1891.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		s. d.	
Candles, sperm	Pound	0 2	$4.12
Fish:			
Dried, pickled, or salted	Cwt	10 0	2.17
Potted and preserved	Pound	0 2	4.12
Oysters, preserved	do	0 2	4.12
Sardines	do	0 2	4.12
Anchovies, salted in casks	....	Free.	....
Fishing lines	....	20 per cent.	....
Isinglass	....	15 per cent.	....
Fish glue	Pound	1½	3.09
Oil, cod liver, fish, whale, and seal	....	Free.	....

AUSTRALASIA.—QUEENSLAND.

(Revised to October 4, 1892.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:		s. d.	
In pickle or brine	Cwt	5 0	$1.08
Dried and salted	do	5 0	1.08
Preserved, potted or paste	Pound	2	4.12
Sardines	12 pounds	2 0	4.05
Fishing material		15 per cent.	
Oil:			
Cod liver, medicinal	Gallon	1 0	
Fish, seal, and whale	do	6	
Sponges		15 per cent.	

AUSTRALASIA—TASMANIA.

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:		s. d.	
In pickle or brine		12½ per cent.	
Dried and salted	Pound	1	$2.06
Preserved, potted or paste		12½ per cent.	
Maws		12½ per cent.	
Sardines		12½ per cent.	
Fishing lines		12½ per cent.	
Fishing material, not cordage		12½ per cent.	
Oil:			
Cod liver, medicinal		12½ per cent.	
Fish, seal, and whale	Gallon	1 3	
Sponges		12½ per cent.	

AUSTRALASIA—SOUTH AUSTRALIA.

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
Fish:		*Pence.*	
Dried and salted, and sardines (except in pickle or brine)	Pound	1	$2.06
Preserved	do	2	4.12
Fish glue	do	2	4.12
Fishing nets		Free.	
Oil		Free.	
Pearls, unset		Free.	
All others		12 per cent.	

AUSTRALASIA—VICTORIA.

(Revised to March, 1894.)

Items.	Duty.		Rate per 100 pounds.
	Unit.	Rate.	
		Pence.	
Candles, sperm	Pound	2	$4.12
Fish		20 per cent.	
Oil, fish	Gallon	6	1.22

AUSTRALASIA—WEST AUSTRALIA.

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pence.	
Candles, sperm	Pound	2	$1.12
Fish		12 per cent.	
Oil, fish	Gallon	6	1.22
cod liver		Free.	

POLYNESIA—BRITISH NEW GUINEA.

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pence.	
Candles, sperm	Pound	1	$2.06
Fish:			
Preserved		10 per cent.	
Dried or salted		Free.	
Isinglass	Pound	1	2.06
Oils, except for medicinal use	do	6	12.36
Pearl shells		Free.	
Sponges		10 per cent.	

POLYNESIA—FIJI.

Items.	Duty. Unit.	Duty. Rate.	Rate per 100 pounds.
		Pence.	
Beche-de-mer		Free.	
Fish, dried, preserved, and salt		10 per cent.	
Fishing lines		10 per cent.	
Fishing nets		Free.	
Glue		10 per cent.	
Isinglass	Pound	3	$6.18
Live oysters		Free.	
Oil, except cod liver	Gallon	9	1.88
Pearl shells		Free.	
Sponges		10 per cent.	
All other		5 per cent.	

7.—REMARKS ON THE MOVEMENTS AND BREEDING-GROUNDS OF THE FUR-SEAL, BASED ON OBSERVATIONS MADE WHILE ON THE UNITED STATES NAVAL PATROL OF BERING SEA IN 1894.

By JOHN J. BRICE, *Commander, United States Navy.*

Under the terms of the award of the Bering Sea arbitration tribunal, as enacted into law by the act of Congress of April 6, 1894, the fur-seal received the following protection while absent from its breeding-grounds on the Pribilof Islands:

(1) Immunity from pursuit or capture at any time and in any manner in Bering Sea within a radius of 60 geographical miles of the seal islands.

(2) Further immunity from pursuit or capture in any manner between May 1 and July 31, inclusive, in that part of the Pacific Ocean, including Bering Sea, north of the thirty-fifth degree of north latitude and east of the one hundred and eightieth degree of longitude from Greenwich continued as far north as the sixtieth degree of latitude; thence the protected area is bounded by a line drawn northeast to the center of Bering Strait.

(3) Immunity from pursuit by any other than sailing vessels and canoes or undecked boats propelled by sails or oars.

(4) Immunity from capture by nets, firearms, air guns, or explosives, except that shotguns may be used outside of Bering Sea during the lawful season.

The migrations of the fur-seal are so regular and well marked that they are easily taken advantage of by sealers, who know where the seal herd may be looked for at any given time. The seal is thus differently, and much more unfavorably, placed as regards natural protection than are some other marine mammals that are sought by man, the whales, porpoises, and sea-otter, for instance, whose movements are either irregular or not fully understood by the hunters.

The movements of pelagic animals are influenced to a very great extent by the temperature of the water in which they exist. The migratory instinct, whether leading them to feeding-grounds or to breeding-grounds, appears to be dominated by the water temperature. In the case of oceanic fishes like the cod and mackerel, and of anadromous fishes like the salmon and shad, the determination of the time and general course of their migrations by the water temperature is well recognized. This same influence is not less strikingly exemplified in the extensive migrations of the Alaskan fur-seal, which cover diagonally 25 degrees of latitude, and, following the route of the herds, embrace a distance of over 2,500 miles, which is traversed when the seals are bound north to their breeding-grounds in Bering Sea and again when they seek the coast of the United States after the breeding season.

The fur-seal, although usually described as having almost human intelligence, is really a rather stupid animal, whose reputation for intelligence is based largely upon appearances (especially its soft, beautiful eyes, which appeal to one in their apparent innocence) and upon the cleverness displayed in finding its way over immense distances in the ocean. Great stress has been laid on the latter faculty, which has been a matter of more or less speculation. In this and most other movements, however, the fur-seal is very largely governed by the temperature of the water, and is controlled by circumstances rather than guided by intelligence, as it requires but little mental capacity to carry out the laws that nature has provided for it by which it finds its way to distant points in the ocean. When compared with the subtle instinct displayed by many species of migratory birds on their way to and from the same regions resorted to by the fur-seal, the movements of the latter are rather commonplace. Combined with the directing influence of the temperature of the water is the wonderful rapidity of action which enables the animal to cover with little effort a vast area of ocean in a remarkably short time.

The lonely and remote islands of St. Paul and St. George are admirably adapted for the breeding purposes of the fur-seal, and are the only islands in the eastern part of Bering Sea or the North Pacific Ocean suited to the requirements of this animal. Owing to the stupidity of the seals they are almost defenseless when on shore, and many would fall an easy prey if the islands were infested with predatory mammals or birds, while their timidity would probably cause the eventual abandonment of the islands if, while on the rookeries, they were liable to the sights and sounds of modern civilization.

The seals leave the rookeries in the fall and are driven out of Bering Sea by the decreasing temperature of the water as winter approaches. They then seek the more genial waters off Vancouver and California. On withdrawing from Bering Sea, they follow its current south through the passes in the Aleutian Islands and then meet with the Japan current, which leads them to the coast of Alaska, where there is an abundance of food. Thence they follow the cold current down the coast to Vancouver, off which land the old male seals remain and disperse over the adjacent ocean, having found a temperature suited to their condition in a region well stocked with fish food.

The old male seal is six or eight times larger than the female, and, having a superabundance of fat, requires a lower temperature of water in which to live than do the female and young male seals. This fact accounts for the separation of the old males from the rest of the herd. The females and small seals of both sexes continue their southward movement in the cold Humboldt current off the coast of California, where, having found the slightly higher water temperature adapted to their needs, they disperse over the ocean in search of food.

The same laws govern the seals on their way to the breeding-grounds, combined with the strongest instincts in all animals—propagation and care of the young. In spring the old males are the first to become uneasy under the increasing temperature of the water, which has risen from about 42° F. early in February to 50° late in April, the normal temperature sought by the seals being between 40° and 46°. To seek relief by reducing the temperature, they start toward the north (the only direction in which this object can be attained), and, guided by the cold stream which flows along the coast of Alaska and Vancouver, they are led in the direction of the rookeries.

The course of the seal herd to the Pribilof Islands, by the cold currents which flow from that direction through the passes in the Aleutian chain, is only interrupted near the "Fairweather Ground" off Sitka, where the influence of the warm water of the Japan current causes some confusion in the progress of the seals. This region is much resorted to by the pelagic hunters and is a vast slaughtering-ground. Off Sitka large portions of the herd are often found, in their bewilderment, heading in various ways, and sometimes they make considerable progress in the direction from which they have come; but finally the seals get within the influence of the cold stream in the vicinity of Kadiak and then, through the passes in the islands, they enter Bering Sea and are virtually on the breeding-grounds.

The females and young males are influenced in their northern movements by the same conditions which affect the old males. The females, however, on account of their being with young, make slower progress than the others, and are easily approached and killed when fatigue compels them to rest at the surface of the water. The presence of food off the coast and estuaries of the rivers also affects in some degree the course of the seals.

The feeding habits of the breeding males are similar to those of some fish, as, for instance, the salmon. During their absence from the rookeries they accumulate a vast amount of energy and food in the form of fat, which is deposited under the skin, in the muscles, and about the viscera; so that after the breeding season begins they abstain wholly from food and, during a period of more than three months, retain their vitality by assimilating the stored fat, while the other seals are obliged to make frequent excursions to the fishing banks. In like manner, after the salmon leave the ocean, enter the rivers, and commence their long journey to the spawning-grounds, they eat nothing, but maintain their strength on the fat with which they were fortifying themselves while at sea, together with the supply of nourishment from the disintegration of the oil-bearing tissues surrounding the ovarian and spermatic parts, which begins as soon as the fish enter the streams.

Aside from the destruction of the females and young by sealing in Bering Sea, the animals are disturbed or harassed at a time when they have sought seclusion to rear their young. Already a restlessness and a change in the habits of the seals have been observed which are indications of the breaking up of the herd. The use of firearms for killing seals in Bering Sea being prohibited by law, the spear has been substituted. The silent destruction of the latter instrument does not frighten the seals, and its aim is more certain and deadly than the rifle or shotgun. The warning noise of the firearm renders the seals more shy and wary as the season progresses, but with the spear the slaughter of unsuspicious animals continues uninterruptedly from the commencement to the end of the season. As a proof of this, it is only necessary to cite the wonderful catch of the sealing schooners this year by means of the spear. Notwithstanding the comparative unfamiliarity of most of the crews with the use of the spear, the number of seals secured by the pelagic sealers was greater than ever before, and the catch is almost certain to increase year by year, as the men become more dexterous in handling the spear, provided the supply of seals holds out. Instead, therefore, of the prohibition of firearms in Bering Sea being a serious restriction on the depredations of the sealers, it really aids them and renders the rookeries even more liable to rapid decimation than they were under previous regulations.

It is reported that the catch of seals by predatory sealers in 1894 was in the neighborhood of 105,000. Of this number about 57,000 seals were taken from the herds belonging on the Asiatic shores of the North Pacific Ocean and the remainder, 48,000, from the Alaskan herd. In the previous year the seals secured from the herd rendezvousing at the Pribilof Islands numbered about 36,000, and in 1892 about 25,000. Of the seals from the Alaskan rookeries taken by pelagic sealers in 1894, about 80 per cent were killed by vessels clearing from Victoria, B. C., and 20 per cent by vessels from United States ports.

The prohibition of pelagic sealing between May 1 and July 31, during which time the seals are moving northward off the coasts of the United States, British Columbia, and southeast Alaska and entering Bering Sea, necessarily concentrated the operations of the sealers on Bering Sea—that is, during the breeding season. The numbers of seals killed beyond the 60-mile zone in Bering Sea between August 1 and August 15, 1894, were large, and perhaps 75 or 80 per cent were nursing females that had left their pups on the Pribilof Islands and gone for food to the cod banks lying from 75 to 200 miles from the rookeries. The death of a female seal under these circumstances meant also the death of her young by starvation. It is therefore evident that more harm is done to the seal herd in the few weeks of sealing in August than at any other time.

Permission was given by the Treasury Department to the lessees of the seal islands to kill 20,000 young male seals in 1894. Notwithstanding that only 7,500 seals had been killed there during each of the preceding years and only 14,000 and 20,000, respectively, during the third and fourth years before (against 100,000 annually for many years without any detriment to the herd before the ravages of the poacher began), the lessees were able to obtain only 16,000 marketable skins of young male seals.

The preservation of the Alaskan fur-seal under existing conditions and regulations rests on the very slender contingency of the prevalence of tempestuous weather during the month of August. Two or three weeks of good weather at this time, by permitting the sealers to operate without interruption outside the 60-mile zone and on the feeding-grounds of the female seals, mean the ultimate and rapid destruction of the seal herd on the Pribilof Islands.

The Bering Sea question, when stripped of the maze of minor points and diplomatic usages incident to its discussion and adjustment, offers the following definite alternatives of settlement:

(1) Shall the United States Government effectually and forever terminate this international dispute by absolutely annihilating the Alaskan seal herd as the animals arrive on the seal islands? or

(2) Shall the United States permit the pelagic poachers of British Columbia to destroy the seals on their way to the rookeries and in the vicinity, and thus ultimately destroy the legitimate industry of killing selected seals on the islands? or

(3) Will the British Government enact laws to protect an industry which is now generally conceded in America to have from the outset been of more commercial interest to Great Britain than to the United States?

The first proposition may seem needlessly harsh and cruel, but the action indicated is indeed humane and is fully warranted by the facts that no amount of protection under existing regulations is adequate to preserve the seal herd and that the patrol of Bering Sea by American naval and revenue vessels does not prevent the havoc wrought by the pelagic hunters in killing annually 25,000 or 30,000 nursing female seals and leaving their pups to die of starvation, besides sacrificing the same number of unborn seals. No one who has had the opportunity to visit the seal islands during the breeding season and witness the distressing spectacle of thousands of young seals in various stages of starvation will fail to acknowledge the merciless barbarity of pelagic sealing and the humane principle involved in the proposition to wipe out the Alaskan seal herd at one blow.

8.—AN ANNOTATED CATALOGUE OF THE FISHES KNOWN FROM THE STATE OF VERMONT.

By Barton W. Evermann and William C. Kendall.

This paper is based chiefly upon observations and collections made in July, 1894, by the senior author and Mr. Barton A. Bean, of the United States National Museum, while engaged in the investigation of the waters along the Canadian border of the United States under the direction of Mr. Richard Rathbun, the representative of the United States on the International Fishery Commission.

The report upon the special purpose of the investigation has been made to Mr. Rathbun. The present paper is a report upon the species of fishes collected or known to occur in the waters of Vermont. We have included not only the species obtained in 1894, but all others which have been recorded from that State by other writers.

The only ichthyologist who has written extensively upon the fishes of Vermont is the Rev. Zadock Thompson, of Burlington. In 1842 Mr. Thompson published his "History of Vermont, Natural, Civil, and Statistical, in three parts, with a new map of the State and 200 engravings." Twenty-five pages of this interesting and very creditable volume are devoted to the fishes of the State. Not only does he give a catalogue of the species known to him to occur in the State, but much interesting information concerning the habits of many of them. This list and the annotations are particularly valuable, as they are based almost wholly upon the personal observations of Mr. Thompson, who was for many years a careful and conscientious student of the natural history of the region in which he lived.

The total number of species of Vermont fishes listed by Mr. Thompson is 48; these represent 43 species as we now understand them. Among the species, listed the following were described as new: *Pimelodus vulgaris* (*Ameiurus vulgaris*), *Lepisosteus lineatus* (the young of *L. osseus*), *Esox nobilior* (*Lucius masquinongy*), and *Salmoperca pellucida* (*Percopsis guttatus*).

The following table gives the nominal species listed by Mr. Thompson, together with our identification of each and the water from which each was recorded.

List of the fishes given in Thompson's Natural History of Vermont.

Page.	Nominal species.	Identification.	Locality.
129	Perca serrato-granulata	Perca flavescens	Lake Champlain basin.
130	Lucio-Perca americana	Stizostedion vitreum	Do.
130	Pomotis vulgaris	Lepomis gibbosus	Do.
131	Pomotis megalotis	Lepomis megalotis	Connecticut River at Barnet.
131	Centrarchus æneus	Ambloplites rupestris	Lake Champlain basin.
131	Centrarchus fasciatus	Micropterus dolomieu	Vermont.
132	Etheostoma caprodes	Percina caprodes	Lake Champlain basin.
133	Corvina oscula	Aplodinotus grunniens	Lake Champlain.
133	Catostomus cyprinus	Carpiodes thompsoni	Vermont.
134	Catostomus oblongus	Moxostoma aureolum	Lake Champlain basin.
134	Catostomus teres	Catostomus commersonii	Do.
135	Catostomus nigricans	Catostomus nigricans	Walpole, Mass.
135	Catostomus longirostrum	Catostomus catostomus	Vermont.
135	Leuciscus pulchellus	Semotilus corporalis	Lake Champlain basin.
136	Leuciscus crysoleucas	Abramis crysoleucas	Do.
136	Leuciscus atronasus	Rhinichthys atronasus	Do.
137	Hydrargyra fusca	Umbra limi	Do.
137	Esox estor	Lucius lucius	Do.
138	Esox reticulatus	Lucius reticulatus	Connecticut River basin.
138	Pimelodus vulgaris	Ameiurus vulgaris	Lake Champlain.
139	Pimelodus nebulosus	Ameiurus nebulosus	Connecticut River at Barnet.
139	Pimelodus sp.?	Ameiurus lacustris	Winooski River; Lake Champlain.
140	Salmo salar	Salmo salar	Lake Champlain and Connecticut River.
140	Salmo namaycush	Cristivomer namaycush	Lake Champlain; ponds in western part of State; Orleans County; Bellwater Pond in Barton; several ponds in Glover, Charleston, etc.
141	Salmo fontinalis	Salvelinus fontinalis	Vermont.
142	Osmerus eperlanus	Osmerus mordax	Lake Champlain.
143	Coregonus albus	Coregonus clupeiformis	Do.
144	Alosa vulgaris	Alosa sapidissima	Connecticut River.
144	Hiodon clodalus	Hiodon tergisus	Lake Champlain.
145	Lepisosteus oxyurus	Lepisosteus osseus	Lake Champlain; Winooski River.
145	Lepisosteus lineatus	Lepisosteus osseus (young)	Winooski River at Burlington.
146	Lota maculosa	Lota lota maculosa	Lake Champlain basin.
147	Lota compressa	do	Connecticut River basin.
147	Muræna vulgaris	Anguilla chrysypa	Vermont.
148	Muræna bostoniensis	do	Connecticut River basin.
148	Muræna argentea	do	Vermont.
149	Acipenser rubicundus	Acipenser rubicundus	Lake Champlain.
149	Acipenser oxyrhynchus	Acipenser rubicundus (young)	Do.
150	Petromyzon nigricans	Petromyzon marinus	Vermont.
150	Ammocœtes concolor	Icthyomyzon concolor	Winooski River.
30*	Lucio-perca canadensis	Stizostedion canadense	Lake Champlain.
31	Boleosoma tessellatum	Boleosoma nigrum olmstedi	Vermont.
31	Cottus gobioides	Cottus gracilis gobioides	River Lamoille, Johnson, Vt.
32	Leuciscus atromaculatus	Semotilus atromaculatus	Western part of State.
32	Esox nobilior	Lucius masquinongy	River Lamoille.
33	Salmoperca pellucida	Percopsis guttatus	Lake Champlain at Burlington and Winooski River.
34	Coregonus clupeiformis	Argyrosoma artedi	Lake Champlain.
35	Amia ocellicauda	Amia calva	Lake Champlain at Whitehall and mouth of Otter Creek.

* These references, pp. 30 to 35, indicate pages in the appendix.

A few other writers have mentioned one or more species each from waters of this State. In 1817, in the Journal of the Academy of Natural Sciences of Philadelphia (p. 102), LeSueur described as new *Catostomus longirostrum* (*Catostomus catostomus*) from the State of Vermont. In the same Journal for 1818 (p. 421) Rafinesque described as new *Exoglossum nigrescens* (*Exoglossum maxillingua*) from Lake Champlain.

In 1842, DeKay, in the volume on fishes of his Natural History of New York (p. 209), described as new *Leuciscus nitidus* (*Semotilus corporalis*) from Lake Champlain, and on page 383 of the same volume he describes as new *Ammocœtes unicolor* (*Petromyzon marinus unicolor*) from a specimen sent him from Lake Champlain by Zadock Thompson.

In 1850 Girard (Proc. Amer. Assoc. Adv. of Sci., II, 1850, 411, and Proc. Bost. Soc. Nat. Hist., III, 1850, 189; also monograph of Cottoids, in Smithsonian Contributions to Knowledge, 55, December, 1851) described as new *Cottus gobioides* from "a specimen of 4 inches that we have had figured [and for which] we are indebted to the kindness of Rev. Z. Thompson, of Burlington, to whom it was presented by Mr. Ransom Colberth, who caught it in June, 1844, while fishing for the brook trout in a branch of the Lamoille River, in the town of Johnson, Lamoille County."

He also describes as new *Cottus boleoides*, from a series of individuals collected by Ed. Cabot, esq., of Boston, at Windsor, Vt. In 1855 Agassiz gave the original description of *Carpiodes thompsoni* in the American Journal of Science and Arts (p. 76), the type locality being Lake Champlain; and in 1872 Duméril, in his Histoire Naturelle des Poissons (vol. II, p. 419), describes the bowfin (*Amia calva*) as new, giving it the name *Amia thompsoni.* The specimen described came from Lake Champlain, and was sent to the Paris Museum by Zadock Thompson.

The waters of Vermont are chiefly tributary either to the St. Lawrence or the Connecticut River. In the southwestern part of the State a small area has its drainage westward into the Hudson. About two-thirds of the western boundary of the State is formed by Lake Champlain, into which flow the principal rivers of Vermont, among them being the Missisquoi, Lamoille, Winooski, and Otter. The outlet of Lake Champlain is the Richelieu River, which joins the St. Lawrence at the head of Lake St. Peter. The northeastern portion of Lake Champlain is Missisquoi Bay, which is crossed by the international boundary, and lies, therefore, partly in Canada. This bay is important in that it contains extensive spawning beds of the wall-eyed pike and the shadwaiter, and more commercial fishing has been carried on here than elsewhere in the lake in recent years.

Just east of the middle of the northern boundary of the State is Lake Memphremagog, one of the most beautiful bodies of water to be found anywhere in America. It extends for 30 miles in a general north-and south direction, the international boundary line crossing it about 8 miles from the southern end. The greatest width of this lake is said to be about 6 miles, but the average probably does not exceed 2 miles. That portion of the lake lying in Vermont is comparatively shallow, the depth rarely exceeding 18 or 20 feet; near the State line it is probably 25 feet or even more. On the Canadian side the depth is much greater; at one place, near the Mountain House, about 8 miles north of the Vermont line, a depth of 700 feet is said to have been found. The south end of the lake has a sandy bottom in most places, with some gravel. At Horseneck Island is a ledge, apparently of limestone, which almost reaches the surface. The bottom on the Canadian side has more gravel and numerous rock ledges.

In most places the shores of the lake rise gently into low mountains, which are covered with forests of birch, maple, fir, pine, beech, cottonwood, and other hardwood trees. At several places on the Canadian side the shores are rocky and rise abruptly.

The outlet of Lake Memphremagog is the St. Francis River, which flows into that expansion of the St. Lawrence River known as Lake St. Peter.

The principal streams flowing into Lake Memphremagog are Black, Barton, and Clyde rivers, all of which enter near the south end of the lake. These are all clear and rather swift streams, but the water is not cold. The temperature in Clyde River in 2 feet of water at noon, July 23, was 79°. This stream was examined at various places in the last 4 miles of its course and was found to be quite rocky and full of snags in places.

Collections were made in the lake at the camp of Hon. L. D. Miles, about 4 miles down the east shore from Newport. A small stream flowing into the lake near here was much colder, and a spring near by had a temperature of 48°.

The Connecticut River forms the entire eastern boundary of Vermont. It receives a number of tributaries from Vermont, but the only ones from which collections have been made are Sleeper and Passumpsic rivers, near St. Johnsbury.

Sleeper River was examined July 25, through more than 2 miles of its course, near the United States fish-hatchery. At that time the stream was 30 to 50 feet wide and ½ to 2 feet deep, with occasional holes of considerable depth. The bed is mostly of rock, apparently a micaceous schist, with a thin coating of gravel, shingle, and sandy mud. The water was clear and apparently pure, but not cold.

The Passumpsic was examined July 26 about 4 or 5 miles above St. Johnsbury, near St. Johnsbury Center. This stream is larger than the Sleeper, but of the same general character. It is 40 to 60 feet wide and, at the time of our visit, 1 to 3 feet deep on the riffles, and deeper in the quiet reaches. The bed is of rock, gravel, or mud. A good many mills along this stream throw their refuse into it; sawdust was abundant in several places in the quiet portions of the stream.

Fishes are very scarce in both of these rivers.

The present list is only approximately complete for the State of Vermont; further investigations will doubtless add some species which are not now known from Vermont, and much remains to be learned regarding the migrations and spawning habits of even the most common and important species.

The specimens obtained by us in 1894 were collected in the following places: Missisquoi Bay at Alburg Springs and on the west shore of Hog Island, July 20; Clyde River near Newport, July 23; Lake Memphremagog at Miles's clubhouse, July 24; Sleeper River, near St. Johnsbury, July 25; Passumpsic River near St. Johnsbury Center, July 26.

For courtesies extended to us we are under especial obligations to the following gentlemen: Hon. L. D. Miles and Mr. Frank Biddell, of Newport; Mr. John W. Titcomb, superintendent United States fish-cultural station at St. Johnsbury; and Mr. Samuel Decker, of Hog Island. Each of these gentlemen did much to assist us in our investigations.

With the growth of population and the consequent cutting away of the forests, cultivation of the land, building of stream-polluting mills and factories, and destructive methods of fishing, a great change has taken place in the fish fauna of the State since the first settling of the country. The changes since Thompson's time have been very great, as may readily be seen by comparing present conditions with his remarks on various species. And Mr. Thompson calls attention to the serious decrease of several important species prior to 1842. He says:

In a country like Vermont, situated so remote from the ocean, and watered only by small fresh-water streams and lakes, a very great variety or abundance of fish is hardly to be expected; and yet it is a notorious fact that when the country was new all our waters swarmed with fishes of various kinds. Salmon and shad were taken in the greatest plenty and perfection in Connecticut River, and the former, together with the salmon trout, were abundant in Lake Champlain and in most of the streams connected with it. In the spring of the year, when these fishes were ascending our streams to their breeding-places, they could be taken at the falls and rapids in scoop nets, or in baskets fastened to poles, in almost any quantities desired. Brook trout, weighing from 1 to 3 pounds, were plentiful in nearly all our streams and ponds, but with the clearing and settling of the country these kinds of fishes have diminished till the three former have become extremely rare, and the latter, though still numerous in many parts, are seldom taken exceeding half a pound in weight. For the production of this state of things several other causes have operated besides their diminution by fishing. The salmon and shad have probably been driven from our waters chiefly by the erection of dams across nearly all our streams, which prevent their ascent to their favorite spawning-places. Freshets, also, which have become more sudden and violent since the country has become cleared, have swept out the logs and other obstructions which formed their places of resort and concealment, and have thus tended not only to diminish the number of our fishes but to prevent their attaining so great magnitude as formerly. Those fishes of our lakes which do not ascend far up our streams to deposit their spawn have not been so much affected by these causes. These, however, though still taken in considerable quantities, are not so abundant as formerly.

LIST OF FISHES FOUND IN VERMONT.

Family PETROMYZONIDÆ. The Lampreys.

1. Petromyzon marinus Linnæus. *Great Sea Lamprey; "Blue Lamprey."*

Recorded from Vermont by Thompson, who says:

"The fresh-water *lampreys*, or *lamprey-eels*, as they are more commonly called, resemble in their habits the blood-sucker much more than the ordinary fishes. They obtain their subsistence principally by attaching themselves by their mouths to the bodies of larger fishes, and drawing nourishment from them by suction; for this purpose their mouth and tongue are admirably adapted, the latter acting in the throat like the piston of a pump, while the circular lips of the former adhere closely to the side of the fish, and by these means the softer parts of the larger fish are drawn into the mouth and swallowed by the parasite. When a lamprey once fastens himself in this manner upon a large fish he adheres with such force as to baffle all the efforts of the fish to rid himself of his unwelcome incumbrance. Fishes are frequently taken in the seine with lampreys still adhering to them, and others with deep depressed wounds upon their sides, affording indubitable proof of their having been attached. The fresh-water lampreys seldom exceed 6 or 8 inches in length, and no account is made of them as an article of food."

2. Ichthyomyzon concolor (Kirtland). *Silver Lamprey; "Mud Lamprey."*

Recorded from Winooski River by Thompson:

"During the drought in September, 1841, I found large numbers of these fishes, which had buried themselves in the mud at the bottom of the small coves along the banks of Winooski River, from which the water had evaporated. This fish is known in many places by the name of *mud-eel*, or *blind-eel*."

Family ACIPENSERIDÆ. The Sturgeons.

3. Acipenser rubicundus LeSueur. *Lake Sturgeon; "Rock Sturgeon."*

Mr. Thompson regarded the round-nosed sturgeon and the rock sturgeon as two different species, but we now know that the latter is simply the young of the former. Concerning the latter he says:

"This fish is occasionally taken in Lake Champlain, and is here known by the name of *rock sturgeon*. It seldom exceeds 3 feet in length or 20 pounds in weight, but is much more generally and highly esteemed as an article of food than the preceding species, some even ranking it as one of our best fishes for the table. This, like the preceding, should be skinned before it is cooked, and for the same reasons."

Sturgeon are still occasionally taken in Lake Champlain, according to Mr. A. S. Hilliker, of Alburg Springs. Fishermen are said to catch them sometimes with grappling hooks fastened to poles; these hooks are said to be most used in the rivers at the foot of the falls.

Mr. Titcomb says sturgeon weighing 75 pounds and over are often taken in Lake Champlain.

Family LEPISOSTEIDÆ. The Gar Pikes.

4. Lepisosteus osseus (Linnæus). *Long-nosed Gar; "Billfish."*

Concerning this species Thompson has the following interesting remarks:

"This singular fish was described by Samuel Champlain as an inhabitant of the lake now bearing his name more than two hundred years ago. He called it *chausarou*, which was probably the Indian name. The Indians assured him they were often seen 8 or 10 feet long, but the largest he saw was only 5 feet long and about the thickness of a man's thigh. It is considered a very voracious fish, and when any of them are taken or seen in the water the fishermen calculate upon little success in taking other kinds.

"Charlevoix tells us that he preys not only upon other fishes, but upon birds also, and that he takes them by the following stratagem: Concealing himself among the reeds growing on the marshy borders of the lake, he thrusts his bill out of the water in an upright position. The bird, wanting the rest, takes this for a broken limb or dry reed, and perches upon it. The fish then opens his mouth and makes such a sudden spring that the bird seldom escapes him. Charlevoix also assures us that the Indians regarded the teeth of this fish as a sovereign remedy for the headache, and that pricking with it where the pain was sharpest took it away instantly. The scales with which this fish is covered are so thick and strong as to form a coat of mail which is not easily pierced with a spear. They are taken only occasionally in the seine at the present day, but are said to be sometimes seen in considerable numbers lying in the marshy coves. Its flesh is rank and tough and is not used for food. The usual length of those now taken is from 2½ to 3 feet, though they are often much longer. The specimen from which the preceding figure and description were made was taken at the mouth of Winooski River May 11, 1841. One of the largest specimens which I have seen was taken at the same place June 16, 1838, and is now in my possession. It is 46 inches long, and when caught weighed 9½ pounds. This species is found in the great western lakes and in the Ohio River, where this and several other species are known by the name of *gar fishes*."

This gar is still common in Lake Champlain. We obtained no specimens on the Vermont side of the lake, but secured some on the New York side near Rouses Point.

Family AMIIDÆ. The Bowfins.

5. Amia calva Linnæus. *Mudfish; Bowfin.*

Recorded by Thompson from the mouth of Otter Creek and from Lake Champlain at Whitehall. He says:

"This fish abounds upon the muddy bottoms and the marshy coves of the southern part of Lake Champlain. It is very plentiful in the vicinity of Whitehall and also about the mouth of Otter Creek. From its partiality to muddy bottoms, it has acquired in many places the name of *mudfish*. From its resemblance in form to the ling, it is called in some places the *scaled ling*. But its more common appellation in Vermont is that of *bowfin*. It attains to considerable size, frequently exceeding 2 feet in length and weighing 10 or 12 pounds; but its flesh is soft and ill-flavored—very little esteemed as an article of food."

Family SILURIDÆ. The Catfishes.

6. Ameiurus lacustris (Walbaum). *Great Lakes Catfish.*

This catfish, so common in the Great Lakes region, has apparently never been common in Vermont waters. Thompson speaks of it as being occasionally taken in the vicinity of Burlington, but in other parts of the lake it is reputed quite plentiful. He says it is a very good food-fish.

Among a fine lot of fresh specimens received by the Commission April 25, 1896, from Mr. A. L. Collins, Swanton, Vt., at the instance of Mr. John W. Titcomb, is one large example of this species. It, like all the specimens sent by Mr. Collins, came from Missisquoi Bay. It is a female with the ovaries but little developed. The stomach and intestines contained no food that could be identified. Total length of this specimen, 25 inches; weight, 7¼ pounds. Called "catfish" by Mr. Collins.

7. Ameiurus vulgaris (Thompson). *"Bullpout."*

This species was originally described from Lake Champlain. Thompson reported it quite plentiful in Lake Champlain, where it is generally known as bullpout. He says those taken from the lake are usually from 9 to 13 inches in length.

8. Ameiurus nebulosus (LeSueur). *"Horned Pout"; "Bullpout"; Bullhead.*

According to Thompson, common in Connecticut River and in many of its larger tributaries. It is undoubtedly an abundant species throughout the State. In Shelburn Pond it is said to be exceedingly abundant. In Lake Champlain the bullhead is at present the most important commercial fish, larger amounts of it than of any other species being handled. The local fishermen say that they run from ½ to 1½ pounds dressed, which is probably an overestimate. Mr. Joseph Laundrie, of Rouses Point, says that it takes 500 to 600 dressed fish to make a barrel and that they sell for 6 cents a pound. They can be caught on mud bottom. According to Mr. Eli Cameron, of Rouses Point, the bullheads spawn in July. In the fall they "mud up" or bury themselves more or less. According to Mr. J. W. Titcomb the grass along the shores of some of the waters in the State is mown in the spring to allow seines to be hauled for bullheads. In Lake Memphremagog the bullhead is one of the most abundant species. Our collections contain two examples, 4 and 4½ inches long, respectively, from Clyde River at Newport, and one small specimen from Missisquoi Bay. The collection received from Mr. Collins contained two examples of this species, one 10½ inches long and weighing one-half pound, the other 11½ inches long and weighing three-fourths pound. The stomachs contained nothing identifiable.

Family CATOSTOMIDÆ. The Suckers.

9. Carpiodes thompsoni Agassiz. *Lake Carp; "Buffalo"; "Carp Sucker"; "Drum."*

Lake Champlain is the type locality of this species. Thompson says it ranges from 1 to 4 pounds in weight, but it is not common. It is still taken by the local fishermen in some numbers. Among the fishes kindly sent us by Mr. Collins is a fine example of this species which he calls "drum." It is a nearly ripe female, 21 inches long and weighing 7 pounds. The roe alone weighed 2½ pounds.

The condition of this fish indicates that the spawning period begins as early as the last of April. The stomach contained nothing.

10. Catostomus catostomus (Forster). *Long-nosed Sucker, "Sucker."*

This sucker was found by us in abundance in Sleeper River It is doubtless a common species throughout the State, but Thompson states that he never met with it. On the other hand, LeSueur, in describing *C. longirostrum*, which he took to be different from this species, says: "This fish I discovered in the State of Vermont. I had not seen it in any other State."

11. Catostomus commersonii (Lacépède). *Common Sucker; "Sucker"; "Black Sucker"; "Black-fin Sucker."*

Said by Thompson to be quite common in Lake Champlain and in most of the large streams and ponds connected with it. Specimens were obtained by us in Passumpsic River near St. Johnsbury and in Clyde River and Lake Memphremagog near Newport. Two large examples were taken in a gill net at the Miles's clubhouse, Lake Memphremagog, July 24. A nearly ripe female, 18 inches long and weighing 3 pounds, received from Missisquoi Bay April 25. This fish would have spawned early in May. The stomach contained nothing.

In Shelburn Pond, a sucker, probably this species, is said to be very abundant.

12. Catostomus nigricans LeSueur. *Black Sucker.*

This species Thompson supposes to be common on the east side of the Green Mountains. It was seen by us only in Sleeper River at St. Johnsbury.

13. Moxostoma aureolum (LeSueur). *Redhorse Sucker; "Mullet."*

This is the common mullet or large-scaled sucker of Vermont, and seems to be common in Lake Champlain. It is one of the principal species taken in gill nets by the fishermen of Lake Champlain. It is said to be quite abundant in Missisquoi Bay. Our collections contain two large examples taken there in a seine July 20, and two large examples were received April 25 from Missisquoi Bay. One was a nearly ripe male 15 inches long and weighing 1½ pounds, the other a nearly ripe female 25½ inches long and weighing 7¼ pounds. They probably would have spawned in two or three weeks. The stomachs were empty. Mr. Collins called the smaller of these a "redfin sucker," the other a "mullet."

Concerning this species Thompson has the following:

"This fish is described by Dr. Mitchill under the name of the *chub of New York*. It is here very generally known by the name of *mullet*, under which name several species of lake suckers are confounded, although it belongs to a family of fishes entirely distinct from the real mullet. This is one of our most common fishes, and in the spring and early part of summer is caught with the seine in large quantities, both in Lake Champlain and in the mouths of its larger tributaries. The flesh of this fish is rather soft, and is considerably filled with the knots of fine bones so common to this family, and yet it is regarded as a very good fish for the table. There are various methods of cooking it, but it is generally most highly esteemed when baked. The fish grows to a larger size, and is taken in Lake Champlain in larger quantities than any other species of this family. Their usual length is from 15 to 20 inches, and their weight from 2 to 5 pounds. But individuals are often taken which are much larger, weighing, in some cases, 9 or 10 pounds. The usual price, when fresh, is from 3 to 4 cents a pound."

Family CYPRINIDÆ. The Minnows.

14. Pimephales notatus (Rafinesque). *Blunt-nosed Minnow.*

Apparently not common; two specimens, 2 and 2¾ inches long, respectively, obtained by us in Missisquoi Bay.

15. Semotilus corporalis (Mitchill). *Fallfish; Silver Chub.*

Obtained by us in Clyde River at Newport and Passumpsic River near St. Johnsbury. It appears to be common in each of these streams, and, according to Mr. Titcomb, throughout the State and in Lake Champlain. According to Thompson "this fish is quite common in Lake Champlain and its tributaries. It is readily caught with the hook, and the flavor of its flesh is agreeable, but it is so soft and filled with small bones that it is not much valued as an article of food. The length of those usually taken varies from 5 to 12 inches, but they sometimes grow to the length of 20 inches."

16. Semotilus atromaculatus (Mitchill). *Horned Dace; Creek Chub.*

This chub was taken by us in Clyde River and in Lake Memphremagog near Newport, the specimens being 2½ to 5 inches long. It is probably not uncommon throughout the State. Mr. Thompson says:

"This is one of the most common fishes of this genus in the western part of Vermont. It abounds almost everywhere, both in the rivers and small streams. Its insipidity and small size prevent its being sought as an article of food; but, as it takes the hook with great readiness, it affords the boys an opportunity to indulge in the cruel sport of catching them for mere amusement. They are also caught to be used as bait in taking larger fishes."

Mr. Titcomb says;

"I have caught it quite frequently in a branch of East Creek, Rutland County, and it takes a fly readily and will fight well. Confined with trout of equal or larger size than itself, it will fight them and kill them."

17. Abramis crysoleucas (Mitchill). *Shiner; Roach.*

Not obtained by us, but Thompson says: "This fish is quite common, particularly in the small ponds and coves along the shore of Lake Champlain and about the mouths of our large streams, where it is found associated with perch, bullpouts, and mudfishes."

18. Notropis hudsonius (Clinton). *Shiner; Spot-tail Minnow.*

Probably common in most waters of the State, but it was taken by us only in Missisquoi Bay.

19. Notropis cornutus (Mitchill). *Shiner; Redfin Dace.*

Numerous examples were taken in Clyde River at Newport and Passumpsic River near St. Johnsbury. They vary in length from 1¾ to 3½ inches. Probably the most abundant and most generally distributed minnow in the State.

20. Rhinichthys cataractæ (Cuvier & Valenciennes). *Long-nosed Dace.*

Several specimens obtained by us near St. Johnsbury, in Sleeper and Passumpsic rivers; not seen elsewhere in Vermont by us, nor is it recorded by Mr. Thompson.

21. Rhinichthys atronasus (Mitchill). *Black-nosed Dace.*

Sleeper River at St. Johnsbury, 17 specimens 1½ to 2½ inches long; Passumpsic River at St. Johnsbury, 1 specimen 1¾ inches long; Clyde River at Newport, 18 specimens 2 to 2¾ inches long; Lake Memphremagog, 2 specimens 2 and 2¾ inches long. Next to *Notropis cornutus*, this is probably the most common minnow in Vermont. Concerning it Mr. Thompson says:

"This species is quite common in most of the streams in Vermont, and particularly so in those that fall directly into Lake Champlain. It is an active, lively little fish, and on account of the stripes on its sides, the colors of which are changeable, according to the direction of the light falling upon them, it is one of the most beautiful of fishes. When fully grown, this fish is only from 2½ to 3 inches long, and though found in great numbers, its diminutive size renders it of no account as an article of food. It is chiefly sought to be used as bait for pike and other large fishes."

22. Couesius plumbeus (Agassiz).

From Clyde River at Newport we obtained 11 specimens of this species, 2¾ to 4½ inches long. It was not seen by us elsewhere in the State, but it doubtless occurs in all the clearer, colder streams.

23. Exoglossum maxillingua (LeSueur). *Cutlip Minnow; Nigger Chub.*

In 1818 Rafinesque described a specimen of this species from Lake Champlain under the name *Exoglossum nigrescens*. Whether his type came from the Vermont side of the lake we do not know. We have obtained it at Plattsburg, and it doubtless will be found in Vermont waters.

Family ANGUILLIDÆ. The Eels.

24. Anguilla chrysypa Rafinesque. *Common Eel.*

Mr. Thompson gives three species of eels (*Muræna vulgaris*, *M. bostoniensis*, and *M. argentea*) as being found in the waters of Vermont. All, however, belong to the one species, which appears to be common in Lake Champlain and the Connecticut. Concerning it Mr. Thompson says:

"The common eel, found in Connecticut River and in the streams and ponds in this State on the east side of the Green Mountains, I suppose to belong to this species. Not having obtained specimens of this and the following species, I can only give Dr. Storer's description of them. In some of the ponds this eel grows to a very large size. They are frequently taken at the outlet of Barnard Pond, weighing 8 or 10 pounds."

Family HIODONTIDÆ. The Moon-eyes.

25. Hiodon tergisus LeSueur. *Moon-eye; "Winter Shad."*

Thompson says this is often called the whitefish by the fishermen, and that it is considered a very good fish for the table, but that it is not taken in Lake Champlain very plentifully.

Family CLUPEIDÆ. The Shad.

26. Alosa sapidissima (Wilson). *Common Shad.*

Concerning the occurrence of the shad in Vermont, Mr. Thompson remarks:

"This excellent and valuable fish, which is common both to Europe and America, was formerly taken in Connecticut River in large quantities, particularly in the neighborhood of Bellows Falls. It is still taken plentifully in Merrimac River and in many other streams which flow into the Atlantic Ocean from New England. I can not learn that it has ever been taken in Lake Champlain, but on account of some resemblance in form and appearance between this species and the *Coregonus albus*, [*C. clupeiformis*] or whitefish, the name of shad, or lake shad, is here very generally applied to the latter."

Family SALMONIDÆ. The Trouts and Whitefishes.

27. **Coregonus quadrilateralis** Richardson. *Round Whitefish; Menominee Whitefish; Shadwaiter.*

We obtained no examples of this whitefish in Vermont and have no absolutely certain evidence of its occurrence in the waters of that State. We have seen specimens, however, from small lakes in New Hampshire and in the Adirondacks. In the Adirondacks it is a common species, and we have no doubt of its occurrence in both Lakes Champlain and Memphremagog.

28. **Coregonus clupeiformis** (Mitchill). *Common Whitefish.*

Exact information concerning the presence of this and other species of whitefishes in Lakes Champlain and Memphremagog is very much to be desired. There is in the National Museum a single specimen of the true whitefish, said to have been taken in Missisquoi Bay. Under the name *Coregonus albus* (which he called *whitefish*, or "*lake shad*") Mr. Thompson has the following:

"This fish, though the same as the celebrated *whitefish* of the Western and Northwestern lakes, is generally known in Vermont by the name of *lake shad*. Its Indian name at the Northwest is *attihawmeg*. This fish is quite common in Lake Champlain, and, in some years, is taken in the months of May and June in considerable quantities with the seine. It is also found in many of the small lakes in Lower Canada connected with the St. Lawrence on the south side, notwithstanding the assertion of Dr. Richardson* that it does not exist in the St. Lawrence below the Falls of Niagara. This is universally considered a most excellent fish, and nearly all are disposed to acquiesce in the opinion of Charlevoix that, 'whether fresh or salted, nothing of the fish kind can excel it.' But few, I think, will agree with the Baron La Hontan, who says that it should be eaten without any kind of seasoning, because 'it has the singular property that all kinds of sauce spoil it.' In warm weather this fish should be either cooked or salted soon after it is taken, as it quickly becomes soft and is spoiled. It is excellent either boiled or fried. The mode of boiling at the Northwest, according to Dr. Richardson, is as follows:

'After the fish is cleansed and the scales scraped off, it is cut into several pieces, which are put into a thin copper kettle, with water enough to cover them, and placed over a slow fire. As soon as the water is on the point of boiling the kettle is taken off, shook by a semi-circular motion of the hand backward and forward, and replaced on the fire for a short time. If the shaking be not attended to exactly at the proper moment, or be unskillfully performed, the fish, coagulating too suddenly, becomes comparatively dry to the taste, and the soup is poor.'

"The stomach of this fish is remarkably thick, and when cleansed and cooked is esteemed a great luxury. The whitefish is very thick and fleshy, and on account of the smallness of the head, fins, and intestines the waste in dressing is less than in any other fish. The greater part of those taken in Lake Champlain are from 15 to 20 inches in length, and weigh from 1 to 3 pounds, though smaller ones are often taken, and occasionally larger ones, weighing from 3 to 6 pounds. They are usually sold fresh as taken from the water, and the price varies from 6 to 10 cents a pound. The whitefish seems to subsist principally upon small molluscous animals. I have sometimes found more than 100 univalve and bivalve shells in the stomach of a single fish."

Mr. Thompson does not give either the round whitefish (*C. quadrilateralis*) or the Musquaw whitefish (*C. labradoricus*) as found in the waters of Vermont, but the second of those species is undoubtedly found there and the other almost certainly occurs in the Vermont lakes. It is evident that Thompson confounded two or three species and that much of what he says of the common whitefish really applies to the Musquaw whitefish. All the specimens of so-called "whitefish" or "shadwaiters" which we were able to secure belonged to the single species *C. labradoricus* (the Musquaw whitefish). The probabilities are that there are four species of whitefish

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* Fauna Boreali Americana, vol. III, page 196

in Lake Champlain, viz, the true whitefish (*C. clupeiformis*), the Musquaw whitefish (*C. labradoricus*), the round whitefish (*C. quadrilateralis*), and the lake herring (*Argyrosomus artedi*), but further evidence is necessary to settle the exact status of each. The artificial propagation and planting of the various food-fishes greatly complicates questions of distribution of this kind. The true whitefish and perhaps others have been planted in Lake Champlain, and it will now be difficult to determine the natural relations of the species of fishes in this lake.

29. Coregonus labradoricus Richardson. *"Shadwaiter"; "Shad"; Musquaw Whitefish.*

We have examined the following specimens of this species from Vermont waters: Two, Nos. 67 and 68, 15 and $19\frac{1}{2}$ inches long and weighing $1\frac{1}{4}$ and $2\frac{1}{4}$ pounds, respectively, from Missisquoi Bay, obtained by Mr. Richard Rathbun in 1894, and one 18 inches long, weighing a little over $2\frac{1}{8}$ pounds, caught in Lake Memphremagog, received from Hon. L. D. Miles, of Newport, November 23, 1894. The following are descriptions of these specimens:

No. 67. Head $4\frac{5}{6}$; depth, $3\frac{1}{2}$; eye $4\frac{3}{5}$; snout $4\frac{3}{5}$; D. 11; A. 11, not counting rudiments; maxillary 4 in head, just reaching front of pupil, lower jaw included; the distance from snout to occiput $2\frac{1}{5}$ in the distance from occiput to dorsal; scales 10–72–9; gillrakers 9+17 (counting the one in the angle with those on the long arm) short, $2\frac{1}{2}$ in eye.

No. 68. Head 5+; depth $3\frac{3}{4}$; eye 5; D. 12; A. 11; snout 5; maxillary just reaching front of eye, $3\frac{4}{5}$ in head, lower jaw included; distance from snout to occiput $2\frac{2}{5}$ in distance from occiput to dorsal; scales 10–71–8; gillrakers 9+16 (counting the one in the angle as one of the long arm) short, the longest 2 in eye. Color dark on back and sides, but paler than the above; white below; fins all black-tipped as in No. 67.

Description of specimen from Lake Memphremagog, a spent female, 18 inches long: Head $4\frac{4}{5}$; depth 4; eye 5; snout $4\frac{1}{5}$; D. 10; A. 11; maxillary 4 in head, just reaching front of eye; mandible $2\frac{2}{5}$ in head, reaching past middle of pupil, lower jaw included; snout projecting, pig-like; height of dorsal 2 in head, last ray 4 in head; first ray of anal 2, last ray 6, in head; pectorals equal last ray of dorsal or the ventrals in length; caudals deeply forked; scales 10–87–9; gillrakers, 10+15, and 10+16, the longest 2 in eye. Color rather dark olivaceous; sides silvery with greenish reflections, white below; scales on sides of belly with few dusky spots; fins all black-tipped, as in *A. nigripinnis*, all paler at base.

There is a large specimen in the National Museum (No. 102881) from Lake Champlain, collected by Mr. P. S. Phelps.

The two examples from Missisquoi Bay were collected in October, 1894, by Mr. Niles, who called them true whitefish; the one received from Mr. L. D. Miles from Lake Memphremagog, November 23, 1884, is what he called "shadwaiter."

Mr. Eli Cameron, of Rouses Point, says the fishermen often spear bluebacks through the ice in winter. These also are probably *C. labradoricus*.

Mr. A. S. Hilliker, of Alburg Springs, says that "the principal catch by the licensed seines in Missisquoi Bay in the fall is the shad, a kind of whitefish. They bring about 8 cents a pound shipped to New York. They are ripe with spawn in November, when they come from deep water into shallow water, where they spawn."

Mr. Samuel Decker, of West Swanton, says that the "shad" are gotten mostly in the fall, when they come into shallow water for spawning.

Hon. L. D. Miles, of Newport, says the shadwaiters spawn in the fall, when they come near the shores from deep water.

We have received two fine specimens of this fish from Mr. Collins. One was a male, $16\frac{1}{2}$ inches long, and weighed 2 pounds; the other a female, 23 inches long, and weighing 6 pounds. They had apparently spawned last fall. They were called "whitefish or shad" by Mr. Collins.

30. Argyrosomus artedi (LeSueur). *Lake Herring; Cisco.*

Recorded by Mr. Thompson from Lake Champlain:

"This fish is only occasionally met with in Lake Champlain, but they sometimes appear here in myriads. In the spring of 1847 they were, for a short time, taken at Burlington in very large numbers, as many as 200 being taken at one haul of the seine. In some years none at all are taken here. The specimen from which the preceding description is made was taken in 1848, and I learned of only two others being taken at that season. It resembles somewhat the lake shad, *C. albus* [*C. clupeiformis*], but is a rounder fish, having much less depth in proportion to its length. It is much esteemed as an article of food. It is common in Lake Ontario and Lake Erie, and is called in many places the shad salmon."

Mr. Titcomb informs us that this species is quite common in several Vermont lakes, notably Lake Bomoseen, in Rutland County. For the protection of other fish it is not lawful to net them, and they are seldom caught for market except an occasional illegally taken haul. In the fall of the year, October or November, they appear in large schools, close to the rocky shores of the lake, for the purpose of spawning. They are not seen at any other season of the year.

The National Museum contains a specimen (No. 17000) of this species, sent from Vergennes, Vt., by Mr. M. E. Hall. We know of no other definite record of its presence in the waters of that State.

31. Salmo salar Linnæus. *Common Atlantic Salmon.*

We have no record of any recent occurrence of the Atlantic salmon in Vermont. Concerning this fish Mr. Thompson says:

"The salmon, formerly very plentiful in nearly all the large streams in this State, is now so exceedingly rare a visitant that I have not been able to obtain a specimen taken in our waters from which to make a description for this work. They have entirely ceased to ascend our rivers, and only straggling individuals are now met with in Lake Champlain. I have heard of only one being taken here during the past summer, and that I did not see. The causes which have been principally operative in driving these fishes from our waters have already been mentioned. When the country was new, according to Dr. Williams, there was a regular and abundant migration of these fishes to and from our waters in spring and autumn.* They came up Connecticut River about the 25th of April and proceeded to the highest branches. Shortly after they appeared in Lake Champlain and the large streams which fall into it. So strong is their instinct for migration that, in ascending the streams, they forced their passage over cataracts of several feet in height and in opposition to the most rapid currents. They were sometimes seen to make six or seven attempts before they succeeded in ascending the falls. When thus going up in the spring they were plump and fat and of an excellent flavor, and from the beginning of May to the middle of June they were taken in great numbers. When they arrived in the upper parts of the streams they deposited their spawn. Toward the end of September they returned to the ocean, but so emaciated and lean as to be of little account as an article of food. In the spring salmon were often taken weighing from 30 to 40 pounds."

32. Cristivomer namaycush (Walbaum). *Lake Trout; Longe; Togue.*

The lake trout or longe is said to be uncommon in Lakes Champlain and Memphremagog now. Mr. H. M. Price, of Burlington, says that one is occasionally taken. Mr. Miles, of Newport, says that very large longe are occasionally taken in Lake Memphremagog. One weighing 24 pounds was recently taken near the Mountain House.

Concerning this species Mr. Thompson has the following:

"This species of trout bears considerable resemblance to the *Salmo trutta*, or salmon trout, of Europe, and, being mistaken for that fish by the first European settlers of this country, it has since usually borne the name of *salmon trout*. In the

* History of Vermont, vol. 1, page 147.

northern parts of this State and in the eastern townships in Canada it is at present extensively known by the name of *longe*. In Pennant's Arctic Zoology and by the fur-traders at the Northwest its more common appellation is *namaycush*, or *namaycush salmon*. It is called by Dr. Mitchill the *Great Lake trout*, and he describes it under the scientific name of *Salmo amethystus*.* This magnificent trout equals or surpasses the common salmon in size, and is found in most of the lakes and large ponds in the northern parts of North America. In the Great Lakes at the Northwest it is often taken weighing from 30 to 60 pounds, and, according to Dr. Mitchill, it has been taken at Michilimackinac of the enormous weight of 120 pounds. This fish was formerly common in Lake Champlain and in several ponds in the western part of the State, but, like the salmon, it is now rarely caught in those waters. It is, however, still found in considerable plenty in several ponds in the northern part of Vermont, particularly in Orleans County. Bell-water Pond, in Barton, and several ponds in Glover, Charleston, etc., are much celebrated on account of the fine longe which they afford. These usually vary from half a pound to 10 pounds, but are often much larger. Individuals are said to have been taken recently in Glover weighing 25 pounds and in Charleston exceeding 40 pounds.

"This fish passes most of the time in the deepest parts of the lakes and ponds, but, according to Dr. Richardson, resorts to the shallows to spawn in October. It is a very voracious fish, and is sometimes termed the tyrant of the lakes. It is taken with the hook and line, and is also speared by torchlight. Its flesh is of a reddish-yellow color, and is very much esteemed as an article of food. Roasting is said to be the best method of cooking it. 'The Canadian voyageurs are fond of eating it raw, in a frozen state, after scorching it for a second or two over a quick fire, until the scales can be easily detached, but not continuing the application of heat long enough to thaw the interior.'" †

According to Mr. Titcomb, "Lake Dunmore, in Addison County, is good fishing for longe. Willoughby Lake is the largest and best lake for them in northern Vermont. Maidstone Lake, in Essex County, is inhabited by a longe so distinctly individual that many consider it a distinct variety. It is highly prized as a table fish, but does not grow so large as in many other lakes. The average weight of those found in Maidstone Lake is 2 to 3 pounds."

33. Salvelinus fontinalis (Mitchill). *Common Eastern Brook Trout.*

One specimen, 4¾ inches long, was obtained in Sleeper River at St. Johnsbury. Numerous young trout were seen in a small stream on the east side of Lake Memphremagog. The brook trout is, of course, well distributed over this region. Mr. Thompson has the following interesting paragraphs concerning its former abundance:

"The brook trout is more generally diffused over the State than any other species of fish, there being scarcely a brook or rill of clear water descending from our hills and mountains in which it is not found. When the country was new they also abounded in the larger streams, where they often grew to the weight of 2 or 3 pounds. But they have been diminished by the causes already mentioned and have been sought after with such eagerness as the most delicious article of food of the fish kind that they are now seldom taken in our streams exceeding half a pound in weight, and much the greater number of them weigh less than a quarter of a pound. In many of the ponds they are still taken of a larger size, but their flavor is thought to be less delicious than that of those taken in running water, especially in ponds with muddy bottoms. The rapidity with which this and other species of fishes multiply under favorable circumstances was exemplified in an astonishing manner at an early day, in Tinmouth, in this State. 'A stream which was about 20 feet wide and which, like other streams, contained trout and suckers of the ordinary size and number, had a dam built across it for the purpose of supplying water for a sawmill. This dam formed a pond,

*Jour. Ac. Nat. Science, Philadelphia, vol. 1, page 410.
†Richardson's Fauna Boreali-Americana, vol. III, page 180.

which covered, by estimation, about 1,000 acres, where the trees were thick and the soil had never been cultivated. In two or three years the fish were multiplied in the pond to an incredible number. At the upper end, where the brook fell in, the fish were to be seen in the spring running over one another, so embarrassed by their own numbers as to be unable to escape from any attempt made to take them. They were taken by the hands at pleasure, and swine caught them without difficulty. With a small net the fishermen would take half a bushel at a draft and repeat their labors with the same success. Carts were loaded with them in as short a time as people could gather them up when thrown upon the banks, and it was customary to sell them in the fishing season for a shilling a bushel. While they thus increased in numbers they also became more than double their former size. This great increase of fishes is supposed to have been occasioned by the increased means of subsistence in consequence of carrying the water over a large tract of rich and uncultivated land.'*

"The trout is usually taken with the hook, and the bait universally used is the red earthworm, everywhere known by the name of *angle worm*. Fishing for trout is a favorite and common amusement, and parties frequently go 15 or 20 miles for the sake of indulging in it."

Mr. Titcomb is very properly of the belief that the majority of the fish referred to by Williams were suckers rather than trout. He says:

"While it is the trout for which Vermont is famous and it is a fact that they increase rapidly and grow to an astonishing size in a short period, when in a stream or pond which has been raised or flowed over new ground, I doubt very much the story about the pond in Tinmouth, referred to by Thompson. I think the fish he describes were suckers. The same wonderful catch of suckers can be made to-day."

Family ARGENTINIDÆ. The Smelts.

34. Osmerus mordax (Mitchill). *Smelt; Ice-fish.*

The smelt is said to be an abundant fish in Lakes Champlain and Memphremagog. At the time of our visit to those lakes these fish were in deep water and would not readily take a hook, so no specimens were obtained then. In the fall they come out into shallow water, when they can be caught. During the winter they bite freely and can be taken through the ice. They can be taken with hook and line, but are also sometimes seined. They are said to make an excellent bait for longe. Through the kindness of Hon. L. D. Miles we received on November 23, 1894, twenty-one fine specimens of smelt taken in Lake Memphremagog. These present the following measurements:

Head 4; depth 6; eye $4\frac{1}{2}$; maxillary reaching posterior margin of eye; D. 10; A. 15; length in inches, $6\frac{3}{4}$; $6\frac{7}{8}$; 7; 7; 7; 7; $7\frac{1}{8}$; $6\frac{7}{8}$; $7\frac{1}{4}$; $7\frac{3}{8}$; $6\frac{5}{8}$; $6\frac{1}{2}$; $6\frac{3}{4}$; $6\frac{3}{4}$; $6\frac{3}{4}$; $6\frac{3}{4}$; $7\frac{1}{4}$; $7\frac{1}{8}$; $6\frac{3}{4}$; 7; $7\frac{3}{8}$. Weights in grams (1 ounce equals 28.35 grams): 28, 29, 32, 29, 32, 29, 32, 27, 33, 38, 27, 27, 27, 30, 31, 29, 35, 31, 29, 32, 34. The total weight was 641 grams, or a little less than $2\frac{1}{2}$ pounds.

According to Mr. Titcomb, "Smelt do not come to the surface in our fresh-water lakes until late in winter or early spring. They are then taken through the ice with hook and line. No one appears to know whether they enter our streams to spawn or spawn in the lakes, and I have never been able to settle this question, but presume they enter and leave the streams before the ice is out."

The United States Fish Commission has received a number of unusually large smelt through the kindness of Mr. S. F. Lane, of Port Henry, N. Y. These fish were taken by hook and line in Lake Champlain March 7, in 15 to 70 feet of water, and are locally known as ice-fish. The largest example measured $12\frac{1}{2}$ inches in total length and weighed 214 grams, or nearly one-half pound.

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* Williams's History of Vermont, vol. 1, page 149.

In a recent number of *Forest and Stream* Mr. A. N. Cheney has the following very interesting account of this species as an inhabitant of Lake Champlain:

"More than twenty years ago I first heard of the 'ice-fish' of Lake Champlain, and when I saw them I found them to be the common smelt; but from that time to this the identity of the fish has been questioned at recurring intervals. Last year when I saw smelts being taken at Port Henry over 1 foot long and weighing one-half pound each, and was told that even larger ones were caught through the ice at Port Henry and Westport, I was obliged to admit that I had never seen smelts of such great size; nevertheless that is what they were. Last week I was at Port Henry and the identity of the 'ice-fish' was once again discussed, with the added information that the fish were now sent quite regularly to New York City, where they were pronounced to be different from the smelt. I had some packed to bring home with me, and asked to have several of the very large ones put in the box to have the matter of species set at rest. The man who furnished the fish told me that after Mr. Cobb's visit to the lake the United States Fish Commission had sent for specimens to determine just what 'ice-fish' really were, and that specimens had been forwarded to Dr. Hugh M. Smith. I asked Dr. Smith about them and he writes me:

'The specimens of "ice-fish" recently sent to us from Lake Champlain were the salt-water smelt (*Osmerus mordax*). They were fine examples, the largest being more than 1 foot in length and weighing one-half pound. The females were filled with ripe spawn. I have never seen such fine smelts on the New England coast, although they are sometimes taken in Maine and Massachusetts fully as large as those under consideration. As you know, this species is landlocked in some of the Maine lakes, and Professor Evermann took specimens in Lake Memphremagog; the fish in the latter lake, however, are quite small. In your opinion do the Lake Champlain smelts come up the St. Lawrence River each year for the purpose of spawning, or are they permanent residents of the lake?'

"I believe that smelts are not permanent residents of Lake Champlain, as they are caught only through the ice in February and March, and a search for them by the anglers in the summer and fall months has proved fruitless. In New Hampshire, where the smelt is landlocked, I have caught them in June, July, and August, and if they remained in Lake Champlain permanently they would be found by those who have persistently sought them. Another reason for thinking that they come from the St. Lawrence only to spawn, for it will be noticed that they are caught in the lake just before the spawning season, is that they have two runs of smelt in that river, one of small fish and one of large fish, such as are mentioned by Dr. Smith, the large fish of the lake answering to those known to run up the river. The landlocked smelt that I have caught in New Hampshire are much more slender, length for length, than the Champlain fish, showing that the latter are accustomed to rich pasturage probably not found in the lake. In Lake Champlain the large and small smelts are caught together, showing that the schools must mingle after they reach the lake, and they mingle in more than one way, for large smelts have been caught with small smelts inside of them, showing that the big fellows feed on their small brethren. One big smelt has been convicted of eating seven small ones at a single meal. This I learned only a few days ago."

The views expressed by Mr. Cheney do not meet the approval of all the anglers or persons who have observed the fishes of Lake Champlain. In another issue of *Forest and Stream* Mr. Bainbridge Bishop, of New Russia, N. Y., takes issue with Mr. Cheney upon the question as to whether the smelt come up regularly from the sea. We make the following extract from Mr. Bishop's interesting letter:

"As a rule Lake Champlain smelt and herring do not migrate to salt water, but at the approach of summer retire to the deepest part of the lake, where they find 200 to 400 feet of water. Here they stay at the bottom most of the time. When the broad lake freezes over they work up in shoaler water, where the fishermen take them through the ice. They are caught later in the winter at Port Henry, it being farther away from the deeper part of the lake. I have seen smelt in the lake every month in the year, and have caught them in most of the summer and fall months. While trolling off Cedar Beach in very deep water, with a lake-trout rig, I caught a smelt 14 inches in length. This was in July. I was running a good-sized dace 150 feet below the surface, using 1½ pounds lead. Also in August, while trolling, I caught a one-half-pound smelt in the middle of the lake opposite Westport, where I was running a minnow 200 feet below the surface. When camping in August at Apple Tree Point, a little north of Diamond Island, I used to go out before sunrise to fish for wall-eyed pike in about 100 feet of water. Very often the pike would chase and drive schools of smelt to the surface. They would leap out of the water by hundreds; they were fair-sized smelt.

"In September I was fishing on a reef far out in the lake opposite Westport. This reef has 18 feet of water on it, breaking off suddenly to 200 feet. A strong current was running from the deep water over the reef. Pike were biting finely. Once in a while the water would fairly boil close around the boat, caused by the smelt coming to the surface, driven up by large fish. Some of the pike threw smelt from their mouths after they were in the boat. Game Protector Goper Liberty was with me at the time. Once while anchored on this reef in a still time, with the current running as before, suddenly I noticed great quantities of air bubbles rising to the surface all over the reef. This was a mystery, but it was soon solved by the appearance of thousands of smelt leaping from the water, apparently disabled and in trouble. It seems that the current brought them up from deep water and the diminished pressure expanded their air bladders to such a degree that it brought them to the surface in distress, notwithstanding that they expelled part of the air before they broke water.

"I have taken fair-sized smelt from the mouths and throats of wall-eyed pike all through the summer and fall months—this was when fishing in and near very deep water—and have frequently used smelt so taken for bait with good success. My friend, Samuel P. Avery, jr., tells me that he picked up a dead smelt on the shore of his island at Button Bay. He went out on his favorite reef, and with this single smelt caught five fine wall-eyes. Smelt are the natural food of wall-eyes in Champlain and make the best of bait. I have never found smelt in black bass taken in Lake Champlain. Sometimes smelt come to the surface toward night, and in cloudy weather, when the lake is still, observing persons can see them swimming about in large schools, making a wide and curious ripple on the water. This is generally seen at the middle of the lake, where the water is the deepest. Smelt can be caught in Lake Champlain in any of the summer months by going to the right place and using the right means, but I do not think to much advantage, as they lie in deep water and are more scattered than in winter; still, by a little effort enough can be caught to use for bait.

"Here I want to raise a note of warning to those that think of introducing smelt to feed lake trout. They are ferocious little brutes and persistent destroyers of small fish living in all depths of water; they would destroy the young trout. This I think is one reason lake trout are not more plenty in Champlain."

In another issue of *Forest and Stream* Mr. Cheney gives still further information upon this subject. He says:

"In *Forest and Stream* of March 28 I wrote of the smelts, or, as they are called locally, 'ice-fish,' of Lake Champlain, and said that I believed that they were not permanent residents of the lake, 'as they are caught only through the ice in February and March, and a search for them by the anglers in the summer and fall months has proved fruitless.' My friend, Mr. Roland E. Robinson, has written me a letter upon this subject, from which I quote:

'Hon. M. F. Allen, of that place (Ferrisburg, Vt.), told me a few years ago of catching pike-perch off Split Rock, in Lake Champlain, that were gorged with smelt. I do not recall the date, but it could not have been earlier than the middle of June, and may have been in July or August. Mr. Allen is an old angler, well acquainted with the varieties of fish common in our waters, and could not have been mistaken in the identity of the smelt. I well remember seeing an occasional specimen among the great hauls of other fish taken in the old days of unrestricted seining on the then famous fishing-ground at the mouth of Lewis Creek, the Sungahneetook, or Fishing Weir River of the Waubanakees. These facts go to show that the smelt remain in the lake during at least part of the summer.'

"The author of 'Uncle 'Lisha' is the first person to my knowledge residing on or near Lake Champlain to call the smelt of the lake by its proper name, or, in fact, to admit that it is a smelt. That Mr. Robinson has himself observed the smelt among the fish caught in the lake, and that Senator Allen bears like testimony, should settle the question of their presence in the lake in summer. There is a whitefish found in Lake Champlain the young of which might be mistaken for the smelt when found inside other fish, unless the observer was familiar with both species, but this would not apply to either of the gentlemen quoted. A strange thing about the smelt is that they have not been caught by those who have searched for them in the summer months. My information on this subject comes from fishermen at Port Henry only. A year ago, when smelt fishing through the ice was at its height, I visited the fishermen on the ice and questioned them as to their knowledge of the smelt in the summer months. All agreed that, although search had been made for them, they had not been taken. Another strange thing is that no one seems to know anything about where they spawn."

Hon. L. D. Miles, of Newport, says that the smelt is not native to Lake Memphremagog, but was planted there several years from Lake Champlain, and that it has increased quite rapidly. It remains in the lake all the time, coming into shallow water from the first of October to the middle of June. He thinks they spawn on the same beds used by the shadwaiter. They are caught in spring and fall, chiefly in seines, but some are taken with hook and line.

Mr. Bishop's experience with this fish seems to furnish pretty conclusive evidence that it is permanently resident in Lake Champlain, as it doubtless is in Lake Memphremagog.

Knowing what we do of the physical environment of the landlocked smelt in the small lakes of Maine, one would be disposed to believe, in the absence of evidence to the contrary, that those in Lakes Champlain and Memphremagog are also landlocked.

The smelt from Cobessicontic Lake, Kennebec County, Me., was described as a distinct species by Professor Cope in 1870, under the name *Osmerus abbotti*. In the same year Professor Cope described specimens from Wilton Pond, in the same county, as *Osmerus spectrum*. These two supposed new species have usually been regarded as not being specifically distinct from *Osmerus mordax*. The Cobessicontic smelt is said to have the head shorter, the body more slender, and the eye smaller than in the common smelt. The Wilton smelt is said to have the body still more slender, the eye large, and the mouth and maxillary short. We have no specimens of either of these varieties and have had no opportunity to compare them with the true smelt. We have, however, compared examples from Lakes Champlain and Memphremagog with specimens from salt water, and, being unable to discover any tangible differences, are not willing to admit them even to subspecific rank.

Concerning this species Thompson says:

"The smelt is one of those migratory species of fishes which pass a part of the time in salt water and a part in fresh. Though not a constant visitant in our waters, he occasionally makes his appearance, and is sometimes taken in Lake Champlain in very considerable numbers. The form of this fish is long and slender, and its bright silvery hue renders it very beautiful. It is sometimes taken with the hook, but more commonly with the net, and is very highly esteemed as an article of food. In Massachusetts, according to Dr. Storer's report, 750,000 dozen of these fishes are taken annually in Watertown alone and sent to Boston market."

Family UMBRIDÆ. The Mud Minnows.

35. Umbra limi (Kirtland). *Mud Minnow; Mudfish.*

No specimens were obtained by us, but it is doubtless a common fish in suitable places in Vermont. Concerning it Mr. Thompson has the following:

"These fishes exist in considerable numbers in the marshes and coves along the margin of Lake Champlain, and of the rivers which fall into it. They are very tenacious of life, and live longer than most fishes without water. During droughts, as the waters subside and recede from the coves, they have the power, by a springing motion, of transporting themselves from one little puddle to another. They also have the power of partially burying themselves and living in the mud and among the moist grass roots, after the other small fishes associated with them are all dead for the want of water. In these situations vast numbers of them are devoured by birds, muskrats, and foxes. In severe droughts, like that of 1841, the quantity of small fishes which die in consequence of the drying up of the coves is exceedingly great. In one small cove, which I visited on the 24th of September, 1841, I found mudfishes and other small fishes dead in piles in the low places which had become dry. One small portion of the cove, still covered with water and leaves to the depth of 4 or 5 inches, was literally filled with fishes struggling together for existence. This portion amounted to about one square rod, and in this space there could not have been much less than a barrel of fishes. They consisted of pickerel, yellow perch, shiners, bullpouts, and mudfishes, but mostly of the two last. My feelings were really pained at the sight, and, moved by compassion for the poor fishes, I heartily wished for rain, which, on the next day, came in abundance, to the joy not only of the fishes and their sympathizers, but of the whole country."

Family LUCIIDÆ. The Pikes.

36. Lucius reticulatus (LeSueur). *Pickerel.*

Our collection contains a fine example of this species, weighing 3 pounds, for which we are indebted to the skill and kindness of Mr. J. F. Lincoln, who took it while trolling in Missisquoi Bay, July 20.

Mr. Titcomb writes us that "*Lucius reticulatus* is common on both sides of the Green Mountains. When it gets into our ordinary trout lakes or ponds it means extermination to the trout. If bullheads follow the pickerel in waters where food is not abundant, the pickerel gradually grow less in numbers. One informant says he has found the *reticulatus* dead on the surface of the water with bullheads in them, and that the latter often kill the fish which swallow them."

According to Thompson, this is the common pickerel east of the Green Mountains, as the next species is the more common on the west side:

"This is the common pickerel on the east side of the Green Mountains in Vermont, as the preceding species is on the west side. It is found in Connecticut River and most of its larger tributaries, and it has multiplied exceedingly in several ponds to which it has been transported by the inhabitants in the neighborhood. This is the common pickerel of Massachusetts and the other New England States."

37. Lucius lucius (Linnæus). *Common Pike; Pickerel.*

This is a common fish in Vermont, especially in the western part. It is usually called pickerel, but toward the north end of the State and in Canada it is generally called pike. Two fine examples were obtained by us in Missisquoi Bay. It seems to be common in Lakes Memphremagog and Champlain, and is one of the principal species taken in gill nets when used. They are also caught by trolling and are considered good game fish by many. They spawn in the spring, when they come out into the marshes for that purpose.

Mr. Thompson says:

"This species is very common in Lake Champlain and in all its larger tributaries. It is generally known in Vermont by the name of *pickerel.* About the north end of the lake and in Canada generally it is called the *pike*, on account of its resemblance to the English pike. Indeed, the resemblance is so close that Dr. Richardson regards them as identical, and has described our pike in his Fauna Boreali-Americana, under the name of the foreign species *Esox lucius*, but they are generally regarded by naturalists as distinct species. This fish grows to a large size, frequently exceeding 30 inches in length and weighing 10 or 12 pounds. It is very voracious and devours great numbers of reptiles and small fishes. It is taken both with the hook and seine, and is considered a very good fish for the table. The fishermen say that there is another fish of this family in Lake Champlain, which they call the *Maskalongè*. If so, it is probably the fish which Richardson (*Fauna Boreali*, p. 127) calls *E. estor, maskinongè*. I lately received one which was sent me as a *maskalongè*, but which proved to be only a plump specimen of the *common pike*."

38. Lucius masquinongy (Mitchill). *Maskallonge; Muskallonge; Mascalonge.*

The maskallonge is said to be taken occasionally in Lake Champlain and the mouths of the larger tributary streams. It is said not to occur in Lake Memphremagog. Thompson records it from the Lamoille River, but we have seen no examples from those waters. It is seldom reported from any tributary to Lake Champlain except the Missisquoi River, in which it furnishes good sport to the few initiated fishermen.

Thompson has the following interesting remarks regarding the "Masquallonge:"

"This fish has, till lately, been confounded with the *Esox estor*, or common pike, or lake pickerel. When my description of the *E. estor* was published, in 1842, I doubted the existence of this species in our lake, but since that time my mind has changed on the subject. In May, 1847, I received from my friend, the Hon. A. G. Whittemore, of Milton, a fish caught near the mouth of the River Lamoille, which the fishermen called masquallonge. It was 26 inches long and weighed about 6 pounds. Upon examining it I was fully satisfied that it was of a species distinct from *E. estor*, and, as I could find no description of it under any other name, I made out a description and gave it the name of *Esox nobilior*.

"In April, 1848, I received another specimen from the same source, which weighed 19 pounds and was 41½ inches long. In May, 1849, two specimens were brought along, both caught near the mouth of the Lamoille, one of which weighed 40 pounds and the other 27 pounds. I purchased the latter, and from it the preceding description is chiefly drawn. Believing this species to attain a larger size and to be a more excellent fish for the table than any other species of the pike family found in the United States, I have given it the specific name of *nobilior*. It is a fish which is eagerly sought and commands the highest price in market, but it is rare in Lake Champlain, compared with *E. estor*, or common pike. Very good figures of both of these species are given in Frank Forester's Fish and Fishing, but both under wrong names; the *E. nobilior* being figured under the name of *E. estor*, and the *E. estor* under that of *E. lucioides*.

"The vulgar name *masquallonge* appears to have been given by the early French settlers of Canada to the pikes and pickerels generally, it being a term or phrase descriptive of the whole family—*Masque*, signifying face or visage, and *allonge*, lengthened, they all having lengthened or elongated heads. In modern times this name, *masquallonge*, has been confined, by the fishermen, to the species here described, while the other species bear the vulgar name of pike or pickerel. The methods of spelling this Canadian-French name have been almost as numerous as the authors who have used it, as may be seen by the following: *Maskallonge*, LeSueur; *masquinongy*, Dr. Mitchill; *maskinonge*, Dr. Richardson; *muskallonge*, Dr. Kirtland; *muskellunge*, Dr. DeKay.

"The oldest forms of this name, it will be seen, approach nearest, both in spelling and pronunciation, to the phrase *Masque allonge*, which we have supposed to be its origin, and, therefore, afford presumptive proof of the correctness of our supposition.

"This fish may usually be distinguished from the common pike by its dark circular markings and its more robust proportions. Its head is proportionally shorter, the face flatter and less grooved, and the width across the eyes and upper jaw greater than in the *estor*. But, perhaps, the mark by which it may be most readily distinguished is on the cheek, the lower half of the cheek in the *E. nobilior*, in front of the preoperculum, being naked, or without scales, while in the *E. estor* the whole cheek is covered with scales. The difference in the general aspect of the two species may be seen by comparing the figure of the *E. estor* below with the *E. nobilior* at the head of this article.

"The specimen here described was a female with her abdomen filled with eggs, contained in two ovaries which extended nearly the whole length of the cavity. This fish abounds much more in the streams and smaller lakes in Canada than in Lake Champlain."

Family GASTEROSTEIDÆ. The Sticklebacks.

39. Eucalia inconstans (Kirtland). *Brook Stickleback.*

Through the kindness of Mr. John W. Titcomb the Commission has received a specimen of this species from a small brook in Franklin County, Vt. This brook, which is the outlet of Franklin Pond, empties into Pike River, which flows from Vermont, through Canada, into Missisquoi Bay. Mr. Titcomb says that the stickleback is reported to be common in that particular brook, but he does not think he has seen it elsewhere in the State.

Mr. Thompson appears not to have noticed it.

Family PERCOPSIDÆ. The Trout Perch.

40. Percopsis guttatus Agassiz. *Trout Perch.*

Concerning the discovery and naming of this interesting fish Mr. Thompson has the following:

"The first knowledge I had of this fish was in the summer of 1841, when I found a specimen of it, 5 inches long, which was dead, and had been drifted up by the waves on the lake shore in Burlington. On examining it I found it to possess the adipose and abdominal fins of the trout, but in its teeth, gillcovers and particularly in its hard, serrated scales, to bear considerable resemblance to the perch family. After searching all the books within my reach without finding it described I concluded that it might be new, both in genus and species, and accordingly, in allusion to the above-mentioned properties, I described it in my journal under the provisional generic name of *Salmoperca*. A notice of this fish was omitted in my History of Vermont, published in 1842, because I had then only one specimen, and upon that one, with my little experience, I did not think it prudent to found a new genus and species. When Professor Agassiz was at Burlington in 1847 I submitted the above-mentioned specimen to his inspection, having at that time obtained no others. At first sight he thought it might be a young fish of the salmon family, but upon further examination he said it was not a salmon, nor any other fish with which he was acquainted.

"During the summer of 1847 I found three other specimens of this fish, dead, on the lake shore. One of these I took with me to Boston in September to the meeting of the Association of American Geologists and Naturalists, and put it into the hands of my friend, D. H. Storer, M. D., with a request that he would ascertain what it was and let me know.

"In May, 1849, I obtained from Winooski River a number of living specimens, which I kept alive for some time; and, observing the great translucency of the living fish when held up toward the light I gave it the specific name of *pellucida*, having previously called it, in my journal, *eoceta*, from its wing-like pectoral fins.

"About this time I noticed, in the proceedings of the Boston Society of Natural History, that Professor Agassiz had laid before the society an account of a new genus of fishes discovered by him in Lake Superior, which he proposed to call *Percopsis*. Suspecting, from the brief description given of it, that it was identical with my *Salmoperca*, I wrote to Dr. Storer and inquired of him if the specimens from Lake Superior presented to the society by Professor Agassiz were like the one I put into his hands in 1847. He wrote me that he could not say—that the specimen went out of his hands soon after he received it and he had not seen it since.

"In Professor Agassiz's Lake Superior, page 248, I find an account of his genus *Percopsis* and his species *P. guttatus*, and I have no doubt that it is identical with my *Salmoperca pellucida*. Still, I have thought it best to let it remain, in this Appendix, under the name I had given."

Family CENTRARCHIDÆ. The Sunfishes and Basses.

41. Ambloplites rupestris (Rafinesque). *Rock Bass.*

According to Thompson, "this fish is here known by no other name than *rock bass.* It is quite a common fish in Lake Champlain and its larger tributaries. It is usually taken with the hook along the precipitous rocky banks of the lake and rivers, and from this circumstance it derives its name. It is considered a very good fish for the table, and its weight is usually about half a pound." A nearly ripe female was received from Missisquoi Bay April 25.

Mr. Titcomb says that the rock bass is quite common in many lakes other than Champlain, particularly in Lake Bomoseen.

42. Lepomis megalotis (Rafinesque). *Big-eared Sunfish.*

This sunfish is recorded by Thompson from the Connecticut River at Barnet.

43. Eupomotis gibbosus (Linnæus). *"Sunfish"; "Pond Perch."*

Mr. Thompson says:

"This is a very common fish in the coves along the margin of Lake Champlain, and about the mouths of our rivers. Though extensively known by the name of *sunfish* and *pond perch,* it is perhaps more generally known by the name of *pumpkin seed.* It is also sometimes called *bream.* This fish, though said in Jardine's Naturalists' Library to be of unobtrusive colors, is one of the highest colored and most beautiful fishes found in our waters, 'oftentimes vieing in brilliancy with the tropical fishes.' The sunfish, though often taken with other fishes in the seine, is more commonly taken with the hook, at which it bites with avidity. Its flesh is white and palatable, but the fish being small, thin, and bony, is little sought as an article of food."

Two examples, the larger 9 inches long and weighing 10½ ounces, were received April 25 from Missisquoi Bay.

44. Micropterus dolomieu Lacépède. *Small-mouthed Black Bass.*

This important game fish is pretty generally distributed throughout the State, and it is probably more abundant now than it was in Thompson's time. He says:

"The black bass, by which name this fish is here generally known, ranks as one of the best fishes taken from our waters; but, as is apt to be the case with good fishes, it is much less abundant than several other species which are greatly its inferior in point of quality. It is usually taken with the seine, and its weight varies from 1 to 5 or 6 pounds."

One small specimen was obtained by us in Missisquoi Bay. Mr. Eli Cameron, of Rouses Point, says there are a good many bass in Lake Champlain, and that they spawn in May and the fore part of June. Samuel Decker says the black bass are abundant and that they spawn in May and June. Others state that the black bass is common in Vermont, and that they spawn in May and June or even as late as July, when they come upon the reefs for that purpose. Mr. Miles claims that the small-mouthed black bass is not indigenous to Lake Memphremagog, but that it was planted there some years ago. An unripe male, 14 inches long and weighing 1½ pounds, was received from Missisquoi Bay. Mr. Collins states that only two examples of the species were taken in his seine during the six weeks of its operation ending April 15.

Mr. Titcomb says:

"Black bass spawn in June and July. Many fishermen insist that they spawn earlier. On June 12, 1896, I took two small-mouthed black bass in Lake Champlain on one of the fishing-grounds where it was claimed they did not spawn, but came there from the spawning-grounds. Upon examination both fish were found to be females and full of spawn. The intestines of the stomach were empty and clean, as if they had been washed and wiped out. They undoubtedly took my hook to get it off from their spawning bed."

Family PERCIDÆ. The Perches and Darters.

45. Stizostedion vitreum (Mitchill). *Wall-eyed Pike; Pike.*

Mr. Thompson says:

"The usual length of this fish is from 14 to 20 inches and its weight from 1 to 4 pounds. It is taken very plentifully from the waters of Lake Champlain and its tributaries. It is a firm, bony fish, but as the bones are large and easily separated from the flesh, they are much less troublesome than in the perch and some other species. Its flesh is well flavored, though not so juicy and rich as that of our white-fish and some few others. In the form of its body and the situation of its fins it closely resembles the perches, but its head and teeth are more like the pikes, and hence its name, *Lucio-Perca,* or *Pike-Perch.* This fish is called by Dr. Williams, in his History of Vermont, the *white perch,* but is generally known in Vermont simply by the name of *pike,* while the fish usually called pike in other places is here called *pickerel.* This fish, on the contrary, is called pickerel in Canada. We have another species of this genus, probably the *L. canadensis,* but I am unable to say so positively at present."

The pike is perhaps the most important food and game fish of Lake Champlain, and in the spring of the year it constitutes the principal catch. According to Mr. John W. Titcomb, they go up the east side of Missisquoi Bay when going to their spawning-grounds, but return to the lake by going down the west side. The fishermen on the Hog Island side get them full of roe, while those on the other side get only spent fish. The principal spawning-grounds about Lake Champlain seem to be in Missisquoi Bay and in the lower parts of the larger rivers, particularly the Lamoille and the Missisquoi. The spawning time in Lake Champlain is quite early in the spring, chiefly in April and May. Mr. A. L. Owen, of Burlington, thinks they spawn even before the ice goes out, as he has caught spent fish in April. Mr. A. L. Barrows, of Burlington, thinks they spawn about April 20; says he has caught many full of spawn in April as they were passing Highgate on their way to Missisquoi River; many spawn in Lamoille River. Mr. B. R. Seymour, of Burlington, says they spawn early in the spring, even before the ice goes out, and that their principal spawning-grounds are in Missisquoi Bay and Missisquoi, Lamoille, and Winooski rivers. He says that, after spawning, the pike run down the east shore of the lake until stopped by the Sand Bar Bridge. This he regards as a calamity in that it prevents the fish from going on into the southern portion of the lake. This bridge connects Grand Isle with the Vermont shore and has no opening under it through which fish may pass. They might work to the westward and then on south, but Mr. Seymour thinks they are more likely to return north.

The wall-eyed pike is one of the principal game fishes of Lake Champlain. Mr. H. M. Price, of Burlington, says they range in weight from 2 to 5 pounds, the average being, perhaps, 2½ pounds. Mr. Barrows says they average about 2 pounds. According to Mr. Miles, the wall-eyed pike is not found in Lake Memphremagog.

According to Mr. Titcomb, its spawning season in the rivers seems governed by the time the ice leaves the river. They appear immediately after the breaking up of ice in the spring in Missisquoi River, near the dam at Swanton. This is as far as they can ascend the river, and they do not make their appearance until the ice goes out.

Among the fishes sent by Mr. Collins from Missisquoi Bay are two wall-eyed pike. One is an unripe male 25 inches long weighing 5½ pounds, the other an unripe female 18¼ inches long and weighing 2½ pounds. The condition of the reproductive organs indicates that the spawning period would not begin until near the middle of May. The stomachs contained nothing that could be identified.

46. Stizostedion canadense (Smith). *Sauger; "Ground Pike-Perch."*

Mr. Thompson says there is a second species of *Stizostedion* in Vermont, and thinks it is probably this species. In the Appendix (p. 30) he says:

"When the Natural, Civil, and Statistical History of Vermont was published I was well satisfied that the species here described was distinct from the *L. americana,* but was not so clear whether it was a species already described or not. The difference between this species and the *L. americana* is so obvious that they are instantly distinguished, even when there is no difference in size; but while the latter species often exceeds 2 feet in length, and weighs 5 or 6 pounds, the *L. canadensis* seldom, if ever, exceeds 14 inches in length, or half a pound in weight. It is much less common in Lake Champlain than the *L. americana*, but is frequently taken in company with it. It usually swims very near the bottom of the water, and hence it has received the name of *ground pike* (pike perch). As an article of food this species is held in the same high esteem as the common pike perch."

Mr. Titcomb writes us that the sauger or rock pike, as it is locally called, is caught in seines while fishing for the pike perch. It does not grow as large as the latter, and is not much valued as a food-fish. It is usually sold as "cull fish" rather in the barrels of clear pike perch.

Two examples of the sauger or sand pike were received from Mr. Collins. One was a nearly ripe female 14½ inches long, weighing three-fourths of a pound, the other an unripe male 15 inches long, weighing three-fourths of a pound. These would indicate an earlier spawning time than that for the wall-eyed pike. The stomach of the male contained a 3-inch minnow, too badly digested for identification, and a number of small insects.

47. Perca flavescens (Mitchill). *Yellow Perch; Ringed Perch.*

Mr. Thompson says:

"The yellow perch is one of the most common fishes found in Lake Champlain and in the mouths of the rivers falling into this lake. They are taken both with the seine and hook, but chiefly with the latter. In the winter they are caught by cutting holes in the ice. They vary from 8 to 12 and even 14 inches in length, and are carried around for sale from house to house in the villages along the lake, at all seasons of the year, neatly scaled and dressed ready for cooking. In this condition they are sold at from 10 to 20 cents a dozen, according to the season and their abundance. The flesh of the perch is white, firm, and agreeable to the palate, but is rather dry and bony.

"This fish agrees throughout with Dr. Mitchill's description of his *Bodianus flavescens*, and is undoubtedly the species from which his description was drawn. Cuvier having obtained specimens of this and another species which very closely resembles it, from the waters of the United States, gave to this species the name of *P. serrato-granulata*, on account of its serrated and granulated gill-covers; to the other, distinguished from this by the want of granulations, by its smaller size and greater number of brown bands upon its sides, he gave the name of *P. flavescens*."

The yellow perch is one of the most common fishes of the State and is said to be particularly abundant in Missisquoi Bay. Specimens were obtained by us in Clyde River, near Newport, and from Missisquoi Bay.

Three specimens were received April 25 from Missisquoi Bay. They were 9½ to 10 inches in length and weighed about 7 ounces each. Two were fully ripe females, the other a nearly ripe male.

48. Percina caprodes (Rafinesque). *Log Perch; "Hogfish."*

This species, which is one of the largest of the darters, was found in abundance in Missisquoi Bay; the eleven examples saved are all small, measuring from 1¾ to 3¼ inches in length. We obtained it at Rouses Point and Plattsburg on the west shore of the lake, but did not find it elsewhere in Vermont, though it doubtless occurs throughout the State. Concerning this species Mr. Thompson has the following:

"This fish, though its vulgar name might be thought to imply the contrary, is certainly one of the most symmetrical and beautiful fishes found in our waters. It received the name of *hogfish* from a resemblance in the form of its snout and lower jaw to those of that quadruped. It is quite common in the mouths of the streams which fall into Lake Champlain, but being a slender fish and never exceeding 4 or 5 inches in length, no account is made of it as an article of food, and very little is known of its habits. It swims low in the water, and when at rest usually lies at the bottom."

49. Boleosoma nigrum olmstedi (Storer). *Tessellated Darter.*

This darter is contained in Thompson's list, and it appears to be quite common in Missisquoi Bay. Our collection contains a dozen examples, $1\frac{1}{4}$ to $1\frac{5}{8}$ inches long, from that place. It probably occurs elsewhere in the State, but we have no exact information upon the matter. Thompson says:

"The habits of this fish are quite peculiar. It moves not from place to place by an even, labored motion, like other fishes, but proceeds by sudden leaps or darts, impelling itself forward by its tail and pectoral fins, which it moves as a bird does its wings. It remains suspended in the water no longer than it keeps its pectoral fins in rapid motion. When the motion of its fins ceases the fish sinks at once to the bottom, showing that its specific gravity is greater than water, owing, doubtless, to its want of a swimming bladder. When it reaches the bottom it alights upon its stiff ventral fins, upon which it stands on the bottom, balanced with its head elevated, as a bird stands on its feet. I kept several specimens of this fish alive in a vessel of water for some time for the purpose of watching their motions and learning their habits. They were very uneasy and seemed extremely anxious to escape from their confinement. Aided by their caudal and pectoral fins in giving them an impulse upward, and by their ventrals in climbing and adhering, they would often raise themselves up the perpendicular sides of the vessel, entirely above the surface of the water, excepting only the caudal fin. Another peculiarity of this fish is its power of bending its neck and moving its head without moving the body, in which respect it equals many of the reptiles. This fish is entitled to the name of *darter*, both from its sudden motion and from its having the general form of a dart."

In the stomach of a small ling (14 inches long), caught by Mr. Collins in Missisquoi Bay about April 23, were found at least thirty examples of this darter.

Family SCIÆNIDÆ. The Drums.

50. Aplodinotus grunniens Rafinesque. *Fresh-water Drum; "Sheepshead."*

"This fish is quite common in Lake Champlain, and is here generally known by the name of *sheepshead*. It is also found in the western lakes and Ohio River, where it is more commonly called the *white perch*. This fish, taken from the Ohio River, is said to be fat, tender, and well flavored; but ours is lean, tough, and bony, and seldom eaten. It received its vulgar name from its resemblance in appearance to the *Sargus ovis*, which is also called *sheepshead*, on account of its 'arched nose and smutty face'; but the resemblance is in appearance only, for while the latter is considered one of the most delicious fishes for the table, the former is seldom carried to the table."

The fresh-water drum is still a common fish in Lake Champlain, but we know nothing of its occurrence elsewhere in the State. We obtained one large example with Mr. Decker's seine in Missisquoi Bay July 20, and on April 25, 1896, Mr. Collins sent us two examples taken in Missisquoi Bay at Swanton. One of these was an unripe male 28 inches long weighing $12\frac{1}{2}$ pounds, the other a more nearly ripe male 19 inches long and weighing $3\frac{3}{4}$ pounds. Their stomachs were empty.

Family GADIDÆ. The Codfish.

51. Lota maculosa (LeSueur). *Ling; "Methy;" Cusk.*

Mr. Thompson says:

"This fish, which is quite common in Lake Champlain and its tributaries, I have referred to LeSueur's species the *Gadus maculosus*, as agreeing more nearly with his description than with any other to which I have access. There are, however, several differences between them. In LeSueur's species the jaws are said to be equal; in ours the upper jaw is uniformly longest; in his the lateral line is said to be in the middle of the body; in ours, anterior to the vent, it is much nearer the back than the belly. Our fish bears considerable resemblance to the *Lota brosmiana* described by Dr. Storer in the Boston Journal of Natural History, vol. IV, page 58. But it differs from his description and figure in having the upper jaw longest, in having the snout more pointed and less obicular, etc. Judging from the descriptions, without specimens for comparison, I should say that our fish differs as much from either of the species referred to as they differ from each other, and that they either constitute three distinct species or are all varieties of the same species.

"The ling is held in very low estimation as an article of food, the flesh being tough and the flavor unpleasant. This fish is one of the greatest gormandizers found in our waters. If he can procure food he will not desist from eating so long as there is room for another particle in his capacious abdomen. He is frequently taken with his abdomen so much distended with food as to give him the appearance of the globe or toad-fish. The smallest of the three before me, when my description was made, being 16 inches long, was so completely filled with the fishes swallowed that their tails were plainly seen in its throat by looking into its mouth. On opening it I found no less than 10 dace, *L. pulchellus* [*Semotilus corporalis*], all about the same size, and none of them less than 4 inches long. Seven of these were entire, and appeared as if just swallowed. Upon the others the digestive process had commenced."

The ling is still found in Lake Champlain, but it is said not to occur in Lake Memphremagog. According to Mr. Titcomb, the cusk, which is common in the Connecticut River, is caught with hook and line, and in the winter by fishing through the ice in the night, setting a number of lines and baiting with live bait. It will take live minnows about sundown and from that time until sunrise. This method of fishing is carried on by local fishermen at Lunenburg, Vt. It is also found in Willoughby Lake. It spawns in March or April, and is regarded as a valuable food-fish.

An unripe male ling was received from Missisquoi Bay through the kindness of Mr. A. L. Collins April 25. It was 14 inches long and weighed 1 pound. In its stomach we found thirty individuals of the common darter of that lake—*Boleosoma nigrum olmstedi*. Besides this number, which could be identified, there was a large mass of material too badly digested to permit of certain identification, but which probably represented still other darters.

Family COTTIDÆ. The Sculpins.

52. Cottus gracilis boleoides (Girard). *Blob; "Chucklehead."*

One specimen obtained in Sleeper River near St. Johnsbury, July 25. Mr. Titcomb says it is common in that stream. It was not seen by us elsewhere, though it is doubtless not rare throughout that portion of the State drained by the Connecticut.

Mr. Titcomb says the "chucklehead" is found on both sides of the Green Mountains and is often used as bait for large trout by the patient fisherman.

53. Cottus gracilis gobioides (Girard). *Blob.*

This fish was originally described from specimens obtained in Lamoille River near Johnson, Vt. Thompson has the following:

"For the specimen here described I was indebted to the kindness of Mr. R. Colberth. He caught it while fishing for trout in a branch of the river Lamoille, in Johnson. This fish usually lies still at the bottom, or concealed under the stones in the streams, and seldom moves, except when disturbed, and then its motions are sluggish and labored. It is called in some places the 'slow fish.' It probably derived the name of 'star-gazer' from the favorable position of its eyes for looking upward, they being placed very near the top of the head. It seldom exceeds 4 inches in length."

9.—A REPORT UPON THE FISHES OF SOUTHWESTERN MINNESOTA.

By Ulysses O. Cox.

During the past five years the writer has been making collections of the fishes from the various streams and lakes in the southwestern part of Minnesota, especially from the Minnesota and Blue Earth rivers and their tributaries. In June, 1894, at the suggestion of the United States Commissioner of Fish and Fisheries, several additional lakes and streams were visited for the express purpose of learning as much as possible concerning the run of the buffaloes and suckers, about which so much has been said by various persons in this region.

All of that portion of the State where these investigations were made lies in the region of glacial drift, and, with the exception of limited areas around Mankato, where limestone and sandstone outcrop, and at Ortonville and a few other places along the Upper Minnesota River, where granite outcrops, the entire surface is covered with drift matter.

A large area near Mankato is wooded, and this wooded area extends in a greater or less degree on the east to the State line, while west from Mankato it is but a few miles to the eastern border of the Great Plains.

The fishes here listed were taken from Minnesota River and its tributaries or Des Moines River and its tributaries, but most of them are from the former. It is thought desirable to include in the list those fishes which were collected by Prof. A. J. Woolman and the writer from Upper Minnesota River and Big Stone Lake in July, 1892, and which have been listed by Mr. Woolman in the Report of the United States Fish Commission for 1893 pages 343 to 373.

The following is a classified list of the waters from which the fishes here listed were taken:

Minnesota system.

- Little Minnesota River at Browns Valley.
- Big Stone Lake at Browns Valley and Ortonville.
- Minnesota River at Ortonville, Appleton, Montevideo, and Mankato.
- Pomme de Terre River at Appleton.
- Chippewa River at Montevideo.
- Blue Earth River at Mankato.
- Minneopa Creek near Mankato.
- Lake Washington near Mankato.
- Lake George near Mankato.

Des Moines system.

- Des Moines River at Windom.
- Wood Lake at Windom.
- East and West Okabena Lake at Worthington.
- Heron Lake at Heron Lake.
- Round Lake near Worthington.

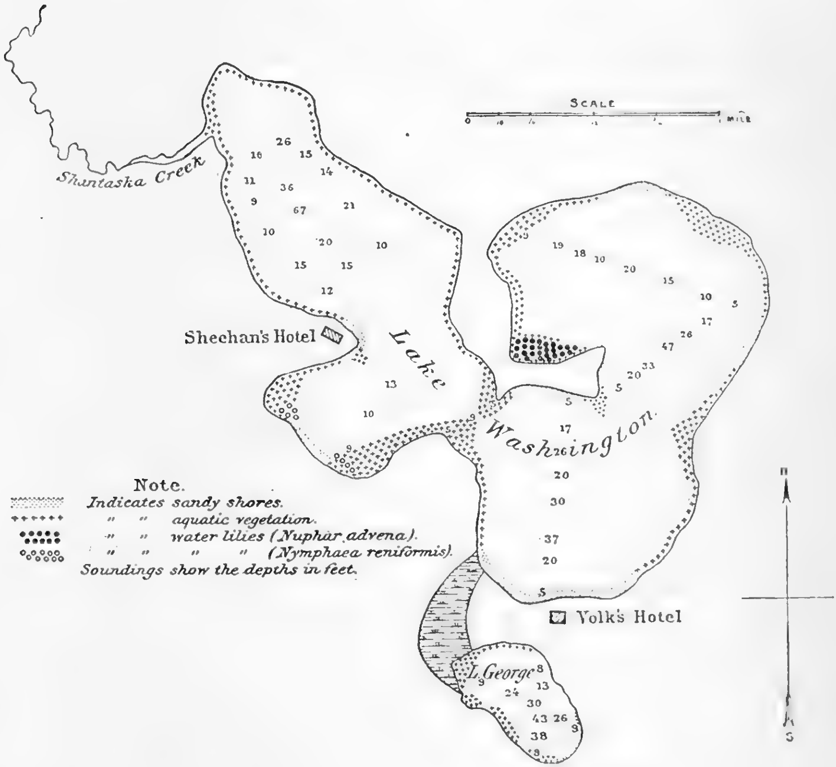
Minnesota River rises in Roberts County, S. Dak., where it is known as the Little Minnesota. It flows southeast and empties into the head of Big Stone Lake, where, at its mouth, it is nothing more than a small creek. Throughout its entire length its course is tortuous, its current sluggish, and its bottom muddy. Big Stone Lake is nothing more than the remains of an ancient glacial river bed. It varies in width from a mile to 1½ miles and is about 40 miles in length, its greatest extent being from northwest to southeast. It is shallow everywhere, the greatest depth not supposed to exceed 20 feet, and the average less than 10. Lying in the prairie region, there is no timber except a narrow belt along its shores, and even this has been nearly all removed by the settlers in the vicinity. At the southern end of Big Stone Lake the Minnesota River again emerges, not any larger than when it entered. It still has a muddy bottom and takes a very winding course. It continues to flow southeast until it reaches Mankato, in Blue Earth County, where it changes its course to due north and finally northeast, until it empties into the Mississippi near St. Paul. At Mankato it has a bed about 525 feet wide, which it fills during high water, but during the greater part of the year the stream is not more than 40 feet wide and 1½ feet deep on an average. The current is not swift, averaging during low water 1¼ feet per second and at high water seldom gains a velocity exceeding 3 feet per second. The river bottom at Mankato is sandy and gravelly, as might be judged from the banks, which are in many places made up of sand and gravel. Except when the water is disturbed by rains it is clear, comparatively free from aquatic vegetation, and quite pure above the city of Mankato. Below the city it is very much contaminated by sewage, where, during low water, very few of the higher forms of aquatic animals are found.

Minnesota River has but two northern tributaries of any importance, Pomme de Terre and Chippewa rivers. From the south it receives Lac qui Parle, Yellow Medicine, Redwood, Cottonwood, and Blue Earth rivers, the latter emptying into the Minnesota near where the Minnesota makes the bend in Blue Earth County. Blue Earth River, which rises in northern Iowa, is the largest tributary of the Minnesota. At Mankato it has a bed which is 200 feet in width, but the stream during the dry season narrows down to a mere brook not more than 10 feet in width on the ripples and having a depth of 6 inches or less. Notwithstanding, there are holes in which fish can live the entire year, and at the proper season bass and pike fishing is excellent at various places.

The bottom is generally sandy or gravelly, and in a few places it is covered with bowlders. The water is pure but warm.

Minneopa Creek is a very small brook which enters the Minnesota River from the south, 4 miles above Mankato. At certain seasons it becomes almost dry, but at one place there is a large hole and a waterfall, when the stream is running, and in this there are some fishes. Those referred to below were taken near the falls, known as Minneopa Falls.

Lake Washington lies in the southern part of Lesueur County, about 12 miles northeast from Mankato, and contains in the neighborhood of 1,100 acres. It has an outlet on the northwest which is known as Shantaska Creek, and which flows into Minnesota River near St. Peter. By reference to the map it will be seen that the shores of this lake are somewhat irregular and that in places the water is quite deep as compared with similar lakes of the region. In a bay on the west there are sedges and lily pads (*Nymphæa reniformis*), several species of



Map of Lakes Washington and George, LeSueur County, Minnesota.

Potamogeton, algæ, and various other aquatic plants, and these are densely populated with the lower forms of animal life commonly found in such places. In the northern part of the eastern point there is also much vegetation, but no lily pads, and at many places along the shore sedges grow. This lake has long been noted for its commercial fishing, and is at present one of the best fishing-points in this part of the State. The fishes commonly taken are the pickerel, wall-eyed pike, large-mouthed black bass, rock bass, and crappie. The pickerel and the wall-eyed pike are most abundant.

Lake George, which lies a few hundred yards to the south of Lake Washington, is not one-fourth the size of the latter, is almost circular, and does not have such deep water, the deepest sounding showing 43 feet. Along its southern, western, and northern shores there is an abundance of aquatic vegetation, water lilies being found in the southern and northwestern portions. At the northwestern shore there is a marsh, which represents the former outlet of the lake and which leads into Lake Washington. The shores of the lake are wooded. Black bass and crappies are very common in this lake.

The following is a list of the fishes which have been taken from the Minnesota River and its tributaries:

FISHES FROM THE MINNESOTA RIVER AND ITS TRIBUTARIES.

1. **Ichthyomyzon castaneus** Girard. *Lamprey.* One specimen was taken from Minnesota River at Mankato in 1892, and so far this is the only one that has been recorded.
2. **Polyodon spathula** (Walbaum). *Paddle-fish; Spoon-bill; Duck-billed Cat.* Several specimens have been taken from Minnesota River at Mankato in the springtime, generally about June 1.
3. **Scaphirhynchus platorhynchus** (Rafinesque). *Shovel-nosed Sturgeon; White Sturgeon.* Several specimens have been taken from Minnesota River at Mankato, generally in springtime.
4. **Lepisosteus osseus** (Linnæus). *Common Gar-Pike; Long-nosed Gar; Billfish.* Specimens have been taken from Lake Washington, near Mankato, where they are very numerous, but they are reported by fishermen from nearly all the lakes and streams of the region.
5. **Amia calva** Linnæus. *Mudfish; Dogfish; Bowfin; Lawyer.* Two specimens were taken from LeSueur River near Mankato; it is reported common in Lake Washington.
6. **Ictalurus punctatus** (Rafinesque). *Channel Cat; Silver Cat.* Mr. Cram reports this fish very common in Minnesota River near Mankato in the spring.
7. **Ameiurus nebulosus** (LeSueur). *Common Bullhead; Horned Pout.* Three specimens were taken in Blue Earth River at Mankato in 1891. It seems to be rare.
8. **Ameiurus melas** (Rafinesque). *Big Stone Lake, common; *Chippewa River at Montevideo; ponds near Minnesota River at Mankato; Blue Earth River at Mankato, very common; Minneopa Creek near Mankato, common; Lake Washington.
9. **Noturus flavus** Rafinesque. *Stone Cat.* Blue Earth River at Mankato, not common.
10. **Schilbeodes gyrinus** (Mitchill). *Pomme de Terre River at Appleton.
11. **Schilbeodes exilis** (Nelson). Blue Earth River at Mankato, one specimen; not common.
12. **Ictiobus cyprinella** (Cuvier & Valenciennes). The large buffalo referred to further on is supposed to be this species. If correct, it is common in Big Stone Lake and Lake Washington.
13. **Ictiobus bubalus** (Rafinesque). *Sucker-mouthed Buffalo; Small-mouthed Buffalo.* A number of small specimens were taken from the Minnesota River at Mankato.

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*All data starred were taken from Prof. A. J. Woolman's paper, Report of the United States Fish Commission for 1893 (1896), pages 343-373.

14. **Carpiodes difformis** Cope. Several specimens taken from Blue Earth River at Mankato.

15. **Carpiodes velifer** (Rafinesque). *Big Stone Lake; Minnesota and Blue Earth rivers at Mankato.

16. **Catostomus commersoni** (Lacépède). *Common Sucker; Black Sucker.* *Little Minnesota River at Browns Valley; Minnesota and Blue Earth rivers at Mankato; Lake Washington. Common at all these places.

17. **Catostomus nigricans** LeSueur. *Hog Sucker; Stone-roller; Hog Mullet.* Minnesota River at Mankato, not common; very common in Blue Earth River at the same place. In 1891 the writer saw a large school of several hundred large ones near the mouth of this river.

18. **Moxostoma aureolum** (LeSueur). *Redhorse; Mullet; Large-scaled Sucker.* Minnesota and Blue Earth Rivers at Mankato, common. Frequently taken by hook and line in springtime.

19. **Campostoma anomalum** (Rafinesque). *Stone-roller; Stone-lugger;* Minnesota and Blue Earth rivers at Mankato, very common.

20. **Hybognathus nuchale** Agassiz. *Silvery Minnow.* Ponds near Minnesota River at Mankato; Minneopa Creek; Blue Earth River at Mankato.

21. **Pimephales promelas** Rafinesque. *Flat-head; Black-headed Minnow.* *Big Stone Lake; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato; Minneopa Creek at Mankato. Very common everywhere.

22. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* *Big Stone Lake; *Pomme de Terre River at Appleton; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Common.

23. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* *Big Stone Lake; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.

24. **Abramis crysoleucas** (Mitchill). *Golden Shiner; Bream.* A few small ones taken from Blue Earth River, Mankato.

25. **Notropis cayuga** Meek. *Pomme de Terre River at Appleton; Minnesota and Blue Earth rivers and ponds near Minnesota River at Mankato. Very common.

26. **Notropis heterodon** (Cope). *Pomme de Terre River at Appleton. Not common.

27. **Notropis blennius** (Girard). *Straw-colored Minnow.* *Chippewa River at Montevideo; ponds near the Minnesota River and the Blue Earth River at Mankato. Common.

28. **Notropis hudsonius** (De Witt Clinton). *Spawn-eater; Spot-tailed Minnow; Shiner.* *Little Minnesota River at Browns Valley; Lake Washington. Common. Specimens from Lake Washington are very much darker in color and appear at first to be a different species.

29. **Notropis whipplii** (Girard). *Silver-fin.* Ponds near Minnesota River and Blue Earth River at Mankato. Common.

30. **Notropis cornutus** (Mitchill). *Shiner; Red-fin; Dace.* *Little Minnesota River at Browns Valley; *Big Stone Lake; Minnesota River; ponds near the Minnesota River, Blue Earth River, and Minneopa Creek, Mankato. Very common everywhere.

31. **Notropis dilectus** (Girard). Minnesota and Blue Earth rivers at Mankato. Very common here, but it has not been taken in any other place in southern Minnesota so far as known.

32. **Rhinichthys cataractæ** (Cuvier & Valenciennes). *Long-nosed Dace.* Pomme de Terre River at Appleton, common.

33. **Hybopsis hyostomus** (Gilbert). Blue Earth River at Mankato. Several specimens have been taken, but it is not common.
34. **Hybopsis kentuckiensis** (Rafinesque). *Chub; Jerker.* * Big Stone Lake; Blue Earth River at Mankato. Not common.
35. **Anguilla chrysypa** Rafinesque. *Common Eel.* One specimen has been reported from the Minnesota River at Mankato. This was taken by hook and line.
36. **Dorosoma cepedianum** (LeSueur). *Gizzard Shad; Hickory Shad.* Just as the ice broke in the Minnesota River at Mankato in the spring of 1891 a number of large specimens were taken and the fishermen commented on the fact, saying that these fish had not been seen here for a number of years. A few small ones were taken in a seine in September, 1892. Since that time they have been scarce.
37. **Umbra limi** (Kirtland). *Mud Minnow; Dogfish.* Lake Washington, common.
38. **Lucius lucius** (Linnæus). *Common Pike; Pickerel.* Very common in all of the lakes of the region and occasionally taken in the streams.
39. **Fundulus diaphanus** (LeSueur). * Big Stone Lake; * Pomme de Terre River at Appleton; Blue Earth River at Mankato; Lake Washington. Rather common.
40. **Eucalia inconstans** (Kirtland). *Brook Stickleback.* Minnesota River, Blue Earth River, and Minneopa Creek at Mankato. Not common.
41. **Percopsis guttatus** Agassiz. * Big Stone Lake.
42. **Pomoxis sparoides** (Lacépède). *Calico Bass; Strawberry Bass; Grass Bass.* Blue Earth River at Mankato and Lake Washington. Very common.
43. **Ambloplites rupestris** (Rafinesque). Blue Earth River at Mankato, common.
44. **Apomotis cyanellus** (Rafinesque). *Blue-spotted Sunfish; Green Sunfish.* Minnesota and Blue Earth rivers and Minneopa Creek at Mankato. Common.
45. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish.* * Chippewa River at Montevideo.
46. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; River Bass.* Common in Blue Earth River at Mankato. Many fine specimens are taken with hook and line.
47. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass; Oswego Bass; Green Bass; Bayou Bass.* * Big Stone Lake; Lake Washington. Very common in nearly all the lakes of the region.
48. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* * Big Stone Lake; * Chippewa River at Montevideo; Minnesota River at Mankato; Lake Washington. Very common and a valuable food-fish.
49. **Perca flavescens** (Mitchill). *Yellow Perch; Ringed Perch.* * Little Minnesota River at Browns Valley; * Chippewa River at Montevideo; ponds near the Minnesota River and Blue Earth River at Mankato; Lake Washington. Very common.
50. **Hadropterus aspro** (Cope & Jordan). *Black-sided Darter.* * Big Stone Lake; * Pomme de Terre River at Appleton; * Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.
51. **Boleosoma nigrum** (Rafinesque). *Johnny Darter.* * Big Stone Lake; * Pomme de Terre River at Appleton; * Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.
52. **Ammocrypta pellucida clara** Jordan & Meek. *Sand Darter.* Minnesota and Blue Earth rivers at Mankato. Common on sand bars.
53. **Etheostoma zonale** (Cope). A few specimens have been taken in Blue Earth River at Mankato.
54. **Etheostoma iowæ** Jordan & Meek. * Little Minnesota River at Browns Valley; * Big Stone Lake; * Pomme de Terre River. Common.
55. **Etheostoma cœruleum** Storer. *Blue Darter; Rainbow Darter.* Ponds near Minnesota River and Blue Earth River at Mankato. Not common.
56. **Boleichthys fusiformis** (Girard). A few specimens taken from Blue Earth River at Mankato. Rare.

57. **Roccus chrysops** (Rafinesque). *Striped Bass; White Bass.* Rather common in Big Stone Lake. Several specimens were taken here in 1892.

58. **Aplodinotus grunniens** Rafinesque. *Sheepshead; Thunder-pumper; Drum; White Perch.* A large specimen was taken in Little Minnesota River at Browns Valley in 1892 and several in Big Stone Lake. A number have been taken from Minnesota River at Mankato, and it is reported very common in Lake Washington, where its grunting or croaking is often heard.

Des Moines River rises in Murray County, Minn., flows southeast across Cottonwood and Jackson counties, and thence south through Iowa. At Windom, Minn., where it was examined, it was but a small stream 40 to 50 feet wide and averaging a foot in depth, although there were many holes that were deeper. The bottom was gravelly. A dam had been built across the river here and no provision had been made for a fishway. Fish were quite abundant below the dam where we seined.

Cottonwood Lake lies a mile east of Windom and covers about a quarter section. Its shores are mostly gravelly and free from trees except on the southeast portion. A small area on the west side contained some aquatic plants. A few minnows, sunfish, and catfish were taken in the seine, and pickerel fishing was reported good in season. No suckers were taken. The lake was reported as being quite shallow, and dead fish are common along the shores after a hard winter.

Heron Lake, lying in the northwest portion of Jackson County, is 12 miles long and about 3 miles wide at its widest place. Nearly all of the northern half is grown up with sedges and other aquatic plants. On the west side, about midway between the two ends of the lake, is a projection known as Pelican Point, and here the shores are sandy and there is very little aquatic vegetation. At this point the average depth is 4 feet, the greatest depth not exceeding 5 feet. The southern end of the lake is generally open, and here the commercial fishing is good, although limited to a few species, pickerel being the fish commonly taken. Bass and pike were reported, but very few were caught. A better breeding-place for fish than the north end of Heron Lake would be hard to find, but the shallowness of the water is a serious drawback to its becoming an important fish lake. Two creeks empty into Heron Lake from the west, the one farthest north being Jack Creek. Okabena Creek, farther south, is the largest, but both are small and of little importance.

Okabena lakes lie in the southeastern part of Nobles County, at Worthington. East Okabena Lake is now about dry, but the west lake still contains some fish. It is 2¼ miles long from east to west and averages a mile in width, but the greatest depth in 1894 was 6 feet, and in 1895 the depth was considerably less than this. It is a typical prairie lake, with shores built of bowlder walls and with gravelly beaches. The water was quite well filled with aquatic vegetation the latter part of June, 1894, and at the west end of the lake there was a swampy shore at the mouth of a small creek where sedges grew and which was an excellent breeding-place for fishes, although of limited area. The commercial fishes of the lake are pike, pickerel, suckers, and buffalo.

Round Lake lies 12 miles southeast of Worthington and is known as a fishing-point, although small and shallow. It is about 2 miles broad from north to south and probably three fourths of a mile longer than broad. The soundings made at the time visited did not show a depth beyond 7 feet. There was an abundance of aquatic vegetation, which ought to furnish excellent breeding-grounds for fishes. The fishes commonly taken are pike and pickerel.

The following is a list of the fishes which have been taken by us from the Des Moines River and its tributaries:

FISHES FROM THE DES MOINES RIVER AND ITS TRIBUTARIES.

1. **Lepisosteus osseus** (Linnæus). *Common Gar-pike.* Reported common in Okabena Lake.
2. **Ameiurus melas** (Rafinesque). *Bullhead.* Des Moines River and Cottonwood Lake at Windom; Jack Creek near Heron Lake. Common.
3. **Schilbeodes gyrinus** (Mitchill). Des Moines River at Windom; Jack Creek. Not common.
4. **Ictiobus cyprinella** (Cuvier & Valenciennes). *Common Buffalo-fish.* Reported very common in Round and Okabena lakes, if this is the species.
5. **Catostomus commersoni** (Lacépède). *Black Sucker; Common Sucker.* Reported Common in Okabena Lake. Several specimens taken from Des Moines River at Windom.
6. **Moxostoma anisurum** (Rafinesque). *White-nosed Sucker.* One specimen was taken from Des Moines River at Windom.
7. **Moxostoma aureolum** (LeSueur). *Redhorse.* Des Moines River at Windom. Common.
8. **Pimephales promelas** Rafinesque. *Flathead; Black-headed Minnow.* Des Moines River at Windom; Cottonwood Lake at Windom; Heron Lake; Round Lake. Common everywhere.
9. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Des Moines River at Windom. Common.
10. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* Des Moines River at Windom. Common.
11. **Abramis crysoleucas** (Mitchill). *Golden Shiner; Bream.* Des Moines River and Wood Lake at Windom; West Okabena Lake at Worthington; Round Lake. Very common.
12. **Notropis cayuga** Meek. Des Moines River at Windom; Heron Lake; West Okabena Lake at Worthington; Round Lake. Common.
13. **Notropis blennius** (Girard). *Straw-colored Minnow.* Common in Des Moines River at Windom.
14. **Notropis hudsonius** (De Witt Clinton). *Spawn-eater; Spot-tailed Minnow.* Very common in Round Lake.
15. **Notropis cornutus** (Mitchill). *Shiner; Red-fin; Dace.* Des Moines River at Windom. Common.
16. **Notropis rubifrons** (Cope). Des Moines River at Windom. Not common.
17. **Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* Des Moines River at Windom. Not common.
18. **Lucius lucius** (Linnæus). *Common Pickerel.* Very common in Heron, Round, and Okabena lakes.
19. **Fundulus diaphanus** (LeSueur). West Okabena Lake at Worthington; Round Lake.

20. **Eucalia inconstans** (Kirtland). *Brook Stickleback.* Des Moines River at Windom. A few specimens taken.
21. **Ambloplites rupestris** (Rafinesque). *Rock Bass* One specimen taken in Des Moines River at Windom. Rather common.
22. **Apomotis cyanellus** (Rafinesque). *Blue-spotted Sunfish; Green Sunfish.* One specimen taken in Des Moines River at Windom.
23. **Lepomis pallidus** (Mitchill). *Blue Sunfish.* Several small specimens were taken from West Okabena Lake at Worthington.
24. **Eupomotis gibbosus** (Linnæus). *Common Sunfish; Pumpkin Seed.* One specimen taken in West Okabena Lake at Worthington. Reported to be common.
25. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* West Okabena Lake at Worthington; Round Lake. Common.
26. **Perca flavescens** (Mitchill). *Yellow Perch; Ring Perch.* Des Moines River at Windom; Cottonwood Lake at Windom; Heron Lake; West Okabena Lake at Worthington; Round Lake. Very common.
27. **Hadropterus aspro** (Cope & Jordan). *Black-sided Darter.* Des Moines River at Windom. Not common.
28. **Boleosoma nigrum** (Rafinesque). *Johnny Darter.* Des Moines River at Windom. Very common.
29. **Etheostoma iowæ** Jordan & Meek. Des Moines River at Windom; West Okabena Lake at Worthington. Not abundant.
30. **Etheostoma flabellare lineolatum** (Agassiz). *Fan-tailed Darter.* One specimen taken in Des Moines River at Windom.

NOTES ON THE RUN OF SUCKERS AND BUFFALO-FISH.

From the information stated below and from the many other reports given by old residents of southern Minnesota it is evident that at one time large buffalo-fish and suckers literally filled many of the lakes in this portion of the State, and were especially noticeable during the spawning season. Just what has become of these fishes is still a question, for they do not seem to be present in any of these lakes now where they were once so abundant, or, if so, only in limited numbers. Probably many of them have been killed by freezing, since the water in all the lakes is now so much more shallow than it was formerly. This is certain in some of the lakes, for the fish have been found along the shores in the spring in immense numbers dead, but it is not true of all the lakes. It is not certain just what species of buffalo is referred to in these reports, for none have been examined since the writer began to collect information concerning them. A dead one found on the shore of Big Stone Lake in 1892 was identified as *Ictiobus cyprinella*, and it is thought that possibly this is the species referred to in the other lakes of the region.

Buffaloes were reported to be very common in Big Stone Lake in 1892 and were often taken in large numbers during the spawning season, which is the latter part of May or the first of June, or, as the old settlers put it, "when the plum blossoms are out." Both the buffaloes and the suckers (*Catostomus commersonii*) are seen but a short time, generally for only a day or two, but at that time every fish seems to have come to the shore, and each scrambles to see how near he can get out of the water and yet remain under. They are reported as often seen with their entire dorsal fins projecting above the water, and at this time men have gone into the water and thrown the fish out with their hands.

Lake Washington was at one time much higher than at present, and there was a large stream leading from it, and the buffaloes and suckers would crowd into this outlet, and at one of the mills several wagon-loads of large buffaloes were once taken. The following is a statement from Mr. Wildes, who still lives in the region, concerning Lake Washington:

When I came to Minnesota, more than 35 years ago, Lake Washington was a magnificent body of water, the largest of a number of lakes all more or less closely connected and whose outlet was Shantaska Creek, which emptied into the Minnesota River at Kasota. This section of Minnesota was then covered with an almost unbroken forest of gigantic deciduous trees, beneath whose branches, covered with dense foliage, the yearly rains sank into the soil to fill the sloughs and lakes to overflowing. The creeks and outlets of the lakes and sloughs were obstructed with fallen trees and leaves; the land surface was covered with leaves, weeds, and grass. Six flour and saw mills were located along Shantaska Creek and did a good business, and most of the time had an abundant supply of water. Now this creek is dry the greater part of the year. In 1860, and for a number of years after, the rainfall was at least three times what it is now. The water has receded greatly in all the lakes, and some have completely dried up and are now turned into cultivated fields and hay meadows. In those days the fish were very abundant and the mills along Shantaska Creek were sometimes stopped by their getting into the waterwheels.

The buffalo ran out of the large lakes into the inlets and outlets generally during the month of May, sometimes earlier or later, and only once a year, rarely staying more than two or three days. I have noticed that the run was almost always at the beginning or during a rain storm. In the spring of 1894, during a rain storm, some buffalo-fish ran out of Lake Washington into a small lake and remained there during the summer and were seen through the ice at the beginning of the following winter. The buffalo-fish attain a large size in Lake Washington, often more than 3 feet in length and 1 foot in depth. When the buffalo are running they always stir up the mud so that it is impossible to observe their doings, but I imagine that they were spawning.

Suckers are not so numerous as the other kinds of fish. Some suckers reach a weight of 6 pounds.

John Kendall, who formerly lived on Lake Washington, states that in 1850 the buffalo ran down the outlet every spring to the Minnesota River, but since the outlet became so small these fish go to the inlet, a very small creek, to spawn. He also states that but one buffalo was seen in 1894, and this was taken in the inlet. A few suckers were taken there also.

Patrick Sheehan states that there are still many buffaloes and suckers in Lake Washington, in his opinion, although he has not seen many in the last few years. Mr. Sheehan has lived on the shore of Lake Washington for a number of years.

Careful inquiry was made of the residents along Heron Lake, when it was visited in 1894, and everyone reported that the buffaloes and suckers were abundant in the lake, but were only seen for a few days in the spring, and that in the spring of 1894 very few had been seen. None are ever taken with hook and line. Careful seining failed to capture the young of either.

A number of citizens of Worthington reported that in 1893 the buffaloes tried to pass from one Okabena Lake into the other, and that immense numbers were speared, many of them weighing 40 pounds apiece. It is reported that the farmers came there and hauled away wagonloads of these fishes and dressed and dried them for winter use. During the last few years very few have been seen. Many dead suckers were reported along the shores of West Okabena Lake in the spring of 1894, when the ice melted. Similar reports come from Round Lake, but at the time it was visited by the writer (spring of 1894) the buffalo had not been seen, and careful seining failed to secure specimens of either suckers or buffalo.

What information the writer has been able to obtain concerning these fish is very unsatisfactory. Their sudden appearance and their as sudden disappearance render it difficult to make observations on them, and the fact that they are never taken during the remainder of the year increases the difficulty of obtaining accurate information concerning them.

DESCRIPTION OF A NEW SPECIES OF LEUCISCUS FROM THE UPPER MISSISSIPPI RIVER BASIN IN MINNESOTA.

Leuciscus nachtriebi, new species.

Type locality: Mille Lacs Lake, Aitkin County, Minn., where several specimens were taken by the Minnesota Natural History Survey in 1892. Associate type localities: Man Trap, Mud, and Elbow lakes in the region of Park Rapids, Hubbard County, where several specimens were taken by the Minnesota Natural History Survey in 1893. In all about 40 specimens have been taken. (Type, No. 47688, U. S. Nat. Mus. Co-type in Leland Stanford Jr. Univ. Mus.)

Description: Head $4\frac{1}{4}$ to $4\frac{1}{2}$; depth 5 ($4\frac{1}{5}$ to $5\frac{1}{2}$); eye 4; snout $4\frac{2}{3}$; dorsal 8; anal 8. Body rather heavy, not greatly compressed; back slightly elevated, its curve a little greater than that of the belly; caudal peduncle rather stout, its depth one-half the length of the head. Head rather short, not any more compressed than the body, upper surface slightly flattened; snout quite blunt in mature specimens, its length $1\frac{1}{4}$ times width of eye; mouth not very large, but little oblique, lower jaw included; maxillary scarcely reaching to front of orbit; pharyngeal teeth 2, 4–5, 2. Dorsal fin inserted nearer base of caudal than tip of snout, also slightly back of ventrals; caudal fin forked; anal slightly smaller than dorsal; ventrals small, not reaching vent by one-third their length; pectorals inserted rather high, not reaching the ventrals by three-fourths their length; scales small, 12–72–9, lateral line complete on mature specimens, decurved, the pores extending on head in several lines, one passing back of eye, another down to nostril. General color dusky, darkest on back; sides above lateral line dull silvery, below lateral line light silvery; a faint dark dorsal band in some specimens, in others absent; no black lateral band, but some specimens have a very faint dusky shade along lateral line; no light stripe above lateral line; upper portion of opercles with a dusky shade, lower part bright silvery; upper part of head dark-colored; all the above colors typical in the young as well as adults. Length 4 inches.

L. nachtriebi differs from *L. neogaeus* in having a well-developed lateral line, a smaller eye, fewer scales, less oblique mouth, a shorter maxillary, and in being a larger fish and differently colored. It differs from *L. elongatus*, a species which might occur in the State, in having a smaller mouth, the lower jaw never projecting, head less pointed, a shorter maxillary, finer scales, and the absence of the black lateral band. The accompanying tabulated measurements will give some idea of the variation in the species. The species is named for Prof. Henry F. Nachtrieb, State zoologist of Minnesota.

Tag.	Length, inches.	Head.	Depth.	Dorsal fin.	Anal fin.	Scale.	Lateral line.	
							Right.	Left.
*4	$3\frac{3}{4}$	$4\frac{1}{2}$	5	8	8	12-75- 9	Complete	Complete.
5	$3\frac{5}{8}$	$4\frac{1}{3}$	$4\frac{7}{8}$	8	8	12-72- 9	.....do	Complete, except about 6 scales.
6	$3\frac{1}{2}$	$4\frac{1}{4}$	5	8	8	12-73- 8	.....do	Complete.
†7	$3\frac{3}{8}$	$4\frac{1}{4}$	5	8	8	12-72- 9	Complete, except 3 or 4 scales.	Complete, except 3 or 4 scales.
8	$3\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{7}{8}$	8	8	13-74- 9	Complete	Complete.
9	$3\frac{1}{8}$	$4\frac{1}{4}$	5	8	8	11-74- 9	Complete, except 3 or 4 scales.	Complete, except 3 or 4 scales.
10	3	$4\frac{1}{3}$	5	8	8	12-76-10	Complete	Complete.
11	$3\frac{1}{8}$	$4\frac{1}{4}$	5	8	8	12-72- 9	.....do	Do.
12	4	$4\frac{1}{2}$	$5\frac{1}{2}$	8	8	12-79- 9	.....do	Do.
13	$3\frac{1}{2}$	$4\frac{1}{3}$	5	8	8	12-74- 9	.....do	Do.
14	$2\frac{3}{8}$	4	$4\frac{3}{4}$	8	8	12-72- 9	.....do	Do.
15	$2\frac{1}{4}$	4	$4\frac{3}{4}$	8	8	12-71- 9	.....do	Do.
16	$2\frac{5}{16}$	$4\frac{1}{8}$	$4\frac{7}{8}$	8	8	12-71- 9	.....do	Do.
17	$2\frac{1}{2}$	4	$4\frac{7}{8}$	8	8	12-72- 9	Complete, except 3 or 4 scales.	Complete, except 3 or 4 scales.
18	$2\frac{3}{16}$	$4\frac{1}{8}$	5	8	8	12-71- 9	Complete, except 15 scales.	Complete, except last few scales.
19	$2\frac{1}{8}$	4	5	8	8	12-71- 8	Complete, except last 3 or 4 scales.	Complete, except last 3 or 4 scales.
20	$2\frac{1}{8}$	4	$4\frac{7}{8}$	8	8	12-74- 9	Nearly complete	Nearly complete.
21	$2\frac{1}{8}$	$4\frac{1}{8}$	5	8	8	12-71- 8	Complete	Complete.
22	$2\frac{1}{8}$	$4\frac{1}{8}$	5	8	8	12-72- 8	.....do	Complete, except 30 scales.

* Co-type, in Leland Stanford Jr. Univ. Mus. † Type, No. 47688, U. S. Nat. Mus.

Eight specimens, each $1\frac{1}{8}$ inches long, from the same locality as Nos. 14 to 22, are similar in color and other characteristics, but the lateral line is entirely absent. The pores on the head are developed in some. Nos. 4 to 11, inclusive, are from Mille Lacs Lake, Aitkin County, and Nos. 12 to 22, inclusive, are from Mud and Elbow lakes, Hubbard County.

10.—LIST OF PUBLICATIONS OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES FROM ITS ESTABLISHMENT IN FEBRUARY, 1871, TO FEBRUARY, 1896.

By CHARLES W. SCUDDER.

During the quarter of a century in which the United States Commission of Fish and Fisheries has been in existence, it has issued 18 volumes of annual reports, 14 volumes of annual bulletins, and 7 volumes on the Fishery Industries of the United States, as follows:

ANNUAL REPORTS. (Octavo.)

Designation.	For the year—	Published.	Pages.	Plates.
Part I	1871-2	1873	XLVII + 852	40
II	1872-3	1874	CII + 808	37
III	1873-5	1876	LI + 77	....
IV	1875-6	1878	L + 1029	9
V	1877	1879	XLVIII + 981	35
VI	1878	1880	LXIV + 968	36
VII	1879	1882	LI + 846	62
VIII	1880	1883	XLVI + 1060	44
IX	1881	1884	LXXI + 1146	27
X	1882	1884	XCII + 1101	54
XI	1883	1885	XCV + 1206	161
XII	1884	1886	LXXI + 1204	46
XIII	1885	1887	CXII + 1108	230
XIV	1886	1889	LVII + 1071	46
XV	1887	1891	LXIII + 900	112
XVI	1888-9	1892	CXXVIII + 902	90
XVII	1889-91	1894	.... + 664	67
XVIII	1892	1894	CCIV + 528	47

ANNUAL BULLETINS. (Octavo.)

Designation.	For the year—	Published.	Pages.	Plates.
Vol. I	1881	1882	VIII + 466	21
II	1882	1883	VIII + 467	3
III	1883	1883	IX + 497	1
IV	1884	1884	XII + 488	3
V	1885	1885	XI + 494	2
VI	1886	1887	X + 495	7
VII	1887	1889	VIII + 475	39
VIII	1888	1890	IX + 494	74
IX	1889	1892	XI + 504	166
X	1890	1893	VII + 400	94
XI	1891	1894	VI + 431	88
XII	1892	1894	VII + 489	118
XIII	1893	1894	VII + 462	41
XIV	1894	1895	V + 496	25

FISHERY INDUSTRIES OF UNITED STATES. (Quarto.)

Designation.	For the year.	Published.	Page.	Plates.
Sec. I (text)	1880	1884	XXXIV + 895	
I (plates)	1880	1884	XX	277
II (text)	1880	1887	IX + 787	
III } 1 vol.	1880	1887	XVIII + 238	49
IV } 1 vol.	1880	1887	V + 178	19
V (text), Vol. I	1880	1887	XXII + 808	
V (text), Vol. II	1880	1887	XX + 881	
V (plates)	1880	1887	XVI	255

These publications are all Congressional documents, and a certain number are allotted to each Senator and Member of the House of Representatives; a small quota is also assigned to the Commission, from which various libraries, institutions of learning, and such persons as are specially interested in the subject-matter are supplied.

Each volume is made up of separate papers pertaining chiefly to investigations conducted by the Commission; and a small edition of each paper is issued as it is printed and completed, in advance of the entire volume, in order that it may reach the public as soon as possible. All of the Fishery Industries of the United States and the annual reports and bulletins prior to 1887 are out of print, and the quota allowed this Commission of some of the more recent publications has been distributed.

The following list gives the title of each paper that has been published by the Commission, but does not give the subtitles. It is arranged alphabetically by authors, and is followed by a subject index.

LIST OF PAPERS PUBLISHED BY THE UNITED STATES FISH COMMISSION.

1. Abbe, W. A. Proposed limitation of menhaden fishing to July 1, and of mackerel fishing to June 15. Occurrence of herring. Bulletin, III, for 1883, p. 468. 1883. (Out of print.)
2. Abbott, Charles C. Notes on some fishes of the Delaware River. Report for 1875-76, IV, pp. 525-845. 1878. (Out of print.)
3. Abernethy, A. S. Salmon in the Clackamas River. Bulletin, VI, for 1886, p. 332. 1886. (Out of print.)
4. Adams, A. C., and W. C. Kendall. Report upon an investigation of the fishing-grounds off the west coast of Florida. Bulletin, IX, for 1889, pp. 289-312 (including 2 figs.), plate CXI. 1891. Pamphlet No. 162.
5. Adams, A. Leith. The lake trouts. Report for 1872-73, II, pp. 357-362. 1874. (Out of print.)
6. Adams, Emma H. Salmon canning in Oregon. Bulletin, V, for 1885, pp. 362-365. 1885. (Out of print.)
7. Akekio, Sekizawa, Memorandum on fish-culture in Japan, with a notice of experiments in breeding the California trout. Report for 1879, VII, pp. 645-648. 1882. (Out of print.)
8. Albro, Samuel. Condition of the shore fisheries of Massachusetts and Rhode Island in 1871. Report for 1871-72, I, p. 8. 1873. (Out of print.)
9. Allen, Joel A. Natural history of the seals and walruses. The fisheries and fishery industries of the United States, sec. I, pp. 33-74, plates 12-25. 1884. (Out of print.)
10. Allen, William S. Statement concerning the menhaden fishery. Report for 1877, V, p. 413. 1879. (Out of print.)
11. Allport, Morton. Present state of the salmon experiment in Tasmania. Report for 1878, VI, pp. 819-823. 1880. (Out of print.)
12. Ameln, Johan. Society for promoting the Norwegian fisheries. Report for 1878, VI, pp. 241-243. 1880. (Out of print.)
13. Amtliche Berichte, &c. Transportation of live fish. Bulletin, II, pp. 95-102 (including 4 figs.). 1882. (Out of print.)
14. Ancher, Ernst. The Kurren and Keitel (fishing vessels) of the Courland Haff. Bulletin, IV, for 1884, pp. 167-168. 1884. (Out of print.)
15. Anderson, G. A. Report on shad-hatching in New Jersey in 1874. Report for 1873-74 and 1874-75, III, pp. 327-328. 1876. (Out of print.)
16. Anderson, John. Notes upon the biology of the salmon and grilse. Bulletin, III, for 1883, p. 429. 1883. (Out of print.)
17. Anderson, John. Notes upon the Scotch fish and fisheries. Bulletin, V, for 1885, pp. 217-221. 1885. (Out of print.)
18. Anderssen, Joakim. Report upon the department of fisheries in the world's exposition in Philadelphia, 1876. Report for 1878, VI, pp. 47-71. 1880. (Out of print.)
19. Anderton, J. L. Statement concerning the menhaden fishery. Report for 1877, V, p. 460. 1879. (Out of print.)
20. Annaniassen, A. Extracts from the report on his voyage to Iceland. From "Selskabet for de Norske Fiskeriers Fremme." Report for 1884, XII, pp. 309-322. 1886. (Out of print.)
21. Annaniassen, Abr. Klip-fish at the Shetland Islands. Bulletin, V, for 1885, pp. 316-319. 1885. (Out of print.)
22. Annin, jr., James. Poachers or destructive visitors to fish ponds. Bulletin, IV, for 1884, pp. 85-86. 1884. (Out of print.)
23. Anonymous. Statistics of the fisheries of the United States in 1880. Bulletin, III, for 1883, pp. 269-271. 1883. (Out of print.)

24. ANONYMOUS. Extracts from the first annual report of the Fishery Board of Scotland for the year ending December 31, 1882. Report for 1882, x, pp. 229–236. 1884. (Out of print.)
25. ANONYMOUS. The British sea-fisheries act, 1883. Report for 1883, XI, pp. 259–278. 1885. (Out of print.)
26. ANONYMOUS. Distribution of duplicate sets of marine invertebrates, 1879–1886. Report for 1886, XIV, pp. 843–867. 1889. (Out of print.)
27. ANONYMOUS. Resolution asking for the abrogation of the fishery clause of the Washington treaty, passed at a convention of New England fishermen which met at Gloucester, December 27, 1884. Bulletin, v, for 1885, p. 447. 1885. (Out of print.)
28. ANONYMOUS. Report of distribution of fish and eggs by the U. S. Fish Commission from July 1, 1887, to June 30, 1888. Report for 1887–88, XV, pp. 363–370. 1891. (Out of print.)
29. ANONYMOUS. Report of distribution of fish and eggs from July 1, 1888, to June 30, 1889. Report for 1888, XVI, pp. 379–394. 1892. Pamphlet No. 179.
30. ARMISTEAD, A. WILSON. A transfer of leather carp (*Cyprinus carpio*) from the Government ponds at Washington, U. S. A., to Scotland. Bulletin, I, for 1881, p. 341. 1882. (Out of print.)
31. ARMISTEAD, J. J. Atmospheric and other influences on the migration of fishes. Bulletin, XIII, for 1893, pp. 93–99. 1894. Pamphlet No. 249.
32. ARNOLD, jr., ISAAC. Successful propagation of black bass. Bulletin, II, for 1882, pp. 113–115. 1882. (Out of print.)
33. ARTHUR, W. Shipment of whitefish eggs to New Zealand in 1878. Report for 1878, VI, pp. 857, 859, 864, 879. 1880. (Out of print.)
34. ATLANTIC CITY REVIEW. Large haul of drumfish. Bulletin, III, for 1883, p. 462. 1883. (Out of print.)
35. ATKINS, CHARLES G. On the salmon of eastern North America, and its artificial culture. Report for 1872–73, II, pp. 226–337, plates IV–XIII. 1874. (Out of print.)
36. ATKINS, CHARLES G. On fishways. Report for 1872–73, II, pp. 591–616, plates XX–XXXIV. 1874. (Out of print.)
37. ATKINS, CHARLES G. Report on the collection and distribution of the Penobscot salmon in 1873–74 and 1874–75. Report for 1873–74 and 1874–75, III, pp. 485–530. 1876. (Out of print.)
38. ATKINS, CHARLES G. On the collection of eggs of the Schoodic salmon in 1875 and 1876. Report for 1875–76, IV, pp. 910–919. 1878. (Out of print.)
39. ATKINS, CHARLES G. Report upon the collection and distribution of Schoodic salmon eggs in 1877–78. Report for 1877, V, pp. 817–846, 1 plate. 1879. (Out of print.)
40. ATKINS, CHARLES G. Report on an attempt to collect eggs of Sebago salmon in 1878. Report for 1878, VI, pp. 775–787. 1880. (Out of print.)
41. ATKINS, CHARLES G. Report on the collection and distribution of Schoodic salmon eggs in 1878–79. Report for 1878, VI, pp. 789–814. 1880. (Out of print.)
42. ATKINS, CHARLES G. Cheap fixtures for hatching of salmon. Report for 1878, VI, pp. 945–966 (including 15 figs.). 1880. Also as pamphlet No. 21.
43. ATKINS, CHARLES G. Report upon the propagation of Schoodic salmon in 1879–80. Report for 1879, VII, pp. 733–766. 1882. (Out of print.)
44. ATKINS, CHARLES G. Report on the propagation of Penobscot salmon in 1879–80. Report for 1879, VII, pp. 721–731. 1882. (Out of print.)
45. ATKINS, CHARLES G. Sketch of the Penobscot salmon-breeding establishment. Bulletin, II, for 1882, pp. 373–378. 1883. (Out of print.)
46. ATKINS, CHARLES G. Sketch of the Schoodic salmon-breeding establishment. Bulletin, II, for 1882, pp. 379–382. 1883. (Out of print.)
47. ATKINS, CHARLES G. Report on propagation of Schoodic salmon in 1880–81. Report for 1880, VIII, pp. 623–631. 1883. (Out of print.)
48. ATKINS, CHARLES G. Report on the propagation of Penobscot salmon in 1880–81. Report for 1880, VIII, pp. 633–651. 1883. (Out of print.)
49. ATKINS, CHARLES G. Report on the propagation of Schoodic salmon in 1881–82. Report for 1881, IX, pp. 1091–1105. 1884. (Out of print.)
50. ATKINS, CHARLES G. Report upon the propagation of Penobscot salmon in 1881–82. Report for 1881, IX, pp. 1085–1089. 1884. (Out of print.)
51. ATKINS, CHARLES G. Report on the propagation of Penobscot salmon in 1882–83. Report for 1882, X, pp. 857–862. 1884. (Out of print.)
52. ATKINS, CHARLES G. Report on the propagation of Schoodic salmon in 1882–83. Report for 1882, X, pp. 863–871. 1884. (Out of print.)

53. ATKINS, CHARLES G. Memoranda relative to inclosures for the confinement of salmon, drawn from experience at Bucksport, Penobscot River, Maine. Bulletin, IV, for 1884, pp. 170–174. 1884. (Out of print.)
54. ATKINS, CHARLES G. Memoranda on landlocked salmon. Bulletin, IV, for 1884, pp. 341–344. 1884. (Out of print.)
55. ATKINS, CHARLES G. Ten questions concerning the habits and breeding of landlocked salmon, with replies. Bulletin, IV, for 1884, pp. 383–384. 1884. (Out of print.)
56. ATKINS, CHARLES G. Report on the propagation of Penobscot salmon in 1883–84. Report for 1883, XI, pp. 1007–1009. 1885. (Out of print.)
57. ATKINS, CHARLES G. Report upon the propagation of Schoodic salmon in 1883–84. Report for 1883, XI, pp. 1011–1015. 1885. (Out of print.)
58. ATKINS, CHARLES G. The Penobscot and Schoodic salmon work of 1884–85. Bulletin, V, for 1885, p. 51. 1885. (Out of print.)
59. ATKINS, CHARLES G. Report upon the Schoodic salmon work of 1884–85. Bulletin, V, for 1885, pp. 323–324. 1885. (Out of print.)
60. ATKINS, CHARLES G. Report on the propagation of Penobscot salmon in 1884–85. Report for 1884, XII, pp. 177–179. 1886. (Out of print.)
61. ATKINS, CHARLES G. Report on the propagation of Schoodic salmon in 1884–85. Report for 1884, XII, pp. 181–187. 1886. (Out of print.)
62. ATKINS, CHARLES G. Report upon the propagation of Penobscot salmon in 1885–86. Report for 1885, XIII, pp. 141–144. 1887. (Out of print.)
63. ATKINS, CHARLES G. Report upon the propagation of Schoodic salmon in 1885–86. Report for 1885, XIII, pp. 145–156. 1887. (Out of print.)
64. ATKINS, CHARLES G. Report upon the propagation of Penobscot salmon in 1886–87. Report for 1886, XIV, pp. 747–749. 1889. (Out of print.)
65. ATKINS CHARLES G. Report on the propagation of Schoodic salmon at Grand Lake Stream, Maine, 1886–87. Report for 1886, XIV, pp. 751–759. 1889. (Out of print.)
66. ATKINS, CHARLES G. Report on the artificial propagation of codfish at Woods Hole, Mass., for the season of 1886–87. Report for 1886, XIV, pp. 783–791. 1889. (Out of print.)
67. ATKINS, CHARLES G. The river fisheries of Maine. Report on the Fisheries and Fishery Industries of the United States, sec. V, vol. 1, pp. 673–728, plates 164–168. 1887. (Out of print.)
68. ATKINS, CHARLES G. Methods employed at Craigs Brook Station, in rearing young salmonoid fishes. Bulletin, XIII, for 1893, pp. 221–228. 1894. (See also Stilwell and Atkins.) Pamphlet No. 258.
69. ATWATER, W. O. Menhaden and other fish and their products as related to agriculture. Report for 1877, V, p. 194. 1879. (Out of print.)
70. ATWATER, W. O. Report of progress of an investigation of the chemical composition and economic values of the fish and invertebrates used for food. Undertaken for the United States Fish Commission. Report for 1880, VIII, pp. 231–285. 1883. (Out of print.)
71. ATWATER, W. O. Tables illustrative of the nutritive value of fish. Bulletin, IV, for 1884, pp. 203–205. 1884. (Out of print.)
72. ATWATER, W. O. Report on analysis of a sample of fish guano made from salmon offal; by Mr. Joseph Spratt, of Victoria, British Columbia. Bulletin, IV, for 1884, p. 238. 1884. (Out of print.)
73. ATWATER, W. O. Contributions to the knowledge of the chemical composition and nutritive values of American food-fishes and invertebrates. Report for 1883, XI, pp. 433–499, 2 colored plates. 1885. Pamphlet No. 98. (Out of print.)
74. ATWATER, W. O. The chemical composition and nutritive values of food-fishes and aquatic invertebrates. Report for 1888, XVI, pp. 679–868, plates LXXXI–LXXXIX. 1892. Pamphlet No. 185.
75. ATWOOD, NATHANIEL E. Fisheries on the coast of Massachusetts. Report for 1871–72, I, p. 117. 1873. (Out of print.)
76. ATWOOD NATHANIEL E. Abstract of an address in opposition to legislation concerning traps and pounds. Report for 1871–72, I, p. 223–227. 1873. (Out of print.)
77. ATWOOD NATHANIEL E. Unexplained variations in the yield of oil from cod livers. Bulletin, III, for 1883, pp. 431–432. 1883. (Out of print.)
78. ATWOOD WILLIAM. Statement concerning the menhaden fishery. Report for 1877, V, p. 404. 1879. (Out of print.)
79. AUGUR, C. H. Fish nets; some account of their construction and the application of the various forms in American fisheries. Bulletin, XIII, for 1893, pp. 381–388. 1894. Pamphlet No. 275.

80. AUSLAND, DAS. An account of the Loffoden Islands of Norway. Report for 1877, v, p. 559. 1879. (Out of print.)
81. BABBITT, JOHN O. The injurious effect of menhaden steamers upon the food fisheries. Bulletin, III, for 1883, pp. 463–464. 1883. (Out of print.)
82. BABCOCK, WILLIAM C. Report of shad operations conducted at Fort Washington, Md., in the spring of 1883. Report for 1883, XI, pp. 1035–1041. 1885. (Out of print.)
83. BABCOCK WILLIAM C. Report of operations at Fort Washington, Md., for the purpose of collecting shad eggs during the season of 1884. Report for 1884, XII, pp. 189–192, 2 plates. 1886. (Out of print.)
84. BABSON, F. J. Statement concerning the menhaden fishery. Report for 1877, v, p. 395. 1879. (Out of print.)
85. BAIRD, G. W. Report on the working of the boilers and engine of the United States Fish Commission steamer Albatross. Bulletin, IV, for 1884, pp. 145–151. 1884. (Out of print.)
86. BAIRD, G. W. Annual report on the electric lighting of the United States steamer Albatross, December 31, 1883. Bulletin, IV, for 1884, pp. 153–158, (incl. 8 figs.). 1884. Pamphlet No. 73.
87. BAIRD, SPENCER F. Report on the condition of the sea fisheries of the south coast of New England in 1871 and 1872. Report for 1871–72, I, pp. I–XLI, plate XLI. 1873. Pamphlet No. 3.
88. BAIRD, SPENCER F. Memoranda of inquiry relative to the food-fishes of the United States. Report for 1871–72, I, pp. 1–6. 1873. Pamphlet No. 1. (Out of print.)
89. BAIRD, SPENCER F. Testimony in regard to the present condition of the fisheries, taken in 1871. Report for 1871–72, I, pp. 7–72. 1873. (Out of print.)
90. BAIRD, SPENCER F. Report of State commissions in regard to regulating the sea fisheries by law. Report for 1871–72, I, pp. 104–109. 1873. (Out of print.)
91. BAIRD, SPENCER F. Report of conference of the United States Commissioner with the Commissioners of Rhode Island and Massachusetts. Report for 1871–72, I, pp. 125–131. 1873. (Out of print.)
92. BAIRD, SPENCER F. Draft of law proposed for the consideration of and enactment by the legislatures of Massachusetts, Rhode Island, and Connecticut. Report for 1871–72, I, pp. 132–134. 1873. (Out of print.)
93. BAIRD, SPENCER F. Statistics of fish and fisheries on the south shore of New England. Report for 1871–72, I, pp. 173–181. 1873. (Out of print.)
94. BAIRD, SPENCER F. Supplementary testimony and information relative to the condition of the fisheries of the south side of New England, taken in 1872. Report for 1871–72, I, pp. 182–195. 1873. (Out of print.)
95. BAIRD, SPENCER F. Pleadings before the senate committee on fisheries of the Rhode Island legislature, at its January session of 1872. Report for 1871–72, I, pp. 196–227. 1873. (Out of print.)
96. BAIRD, SPENCER F. Natural history of some of the more important food-fishes of the south shore of New England. Report for 1871–72, I, pp. 228–252. 1873. (Out of print.)
97. BAIRD, SPENCER F. Description of apparatus used in capturing fish on the seacoast and lakes of the United States. Report for 1871–72, I, pp. 253–274 (including 19 figs.), plates XXXIX and XL. 1873. (Out of print.)
98. BAIRD, SPENCER F. List of fishes collected at Woods Hole. Report for 1871–72, I, pp. 823–827. 1873. (Out of print.)
99. BAIRD, SPENCER F. Report of the Commissioner for 1872 and 1873.—A. Inquiry into the decrease of the food-fishes.—B. The propagation of food-fishes in the waters of the United States. Report for 1872–73, II, pp. I–CII. 1874. Pamphlet No. 4.
100. BAIRD, SPENCER F. Note on Dr. Suckley's article on the North American species of salmon and trout. Report for 1872–73, II, p. 91. 1874. (Out of print.)
101. BAIRD, SPENCER F. Correspondence with railroad companies in reference to facilities for transfer of shad and other fish. Report for 1872–73, II, pp. 749–756. 1874. (Out of print.)
102. BAIRD, SPENCER F. Reports of special conferences with the American fish-culturist's association and State commissions of fisheries.—A. At Boston June 13, 1872.—B. At New York October 19, 1872. Report for 1872–73, II, pp. 757–773. 1874. (Out of print.)
103. BAIRD, SPENCER F. Report of the Commissioner for 1873–74 and 1874–75.—A. Inquiry into the decrease of the food-fishes.—B. The propagation of food-fishes in the waters of the United States. Report for 1873–74 and 1874–75, III, pp. VII–LI. 1876. Pamphlet No. 15.

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