American Fisheries Society
Transactions
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AMERICAN FISHERIES SOCIETY

TRANSACTIONS

Volume 14

1885

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TRANSACTIONS

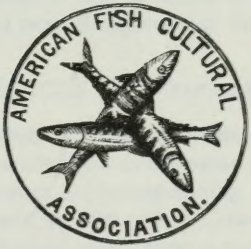
—OF THE—

AMERICAN FISHERIES SOCIETY,

Fourteenth Annual Meeting,

Held at the National Museum, in Washington, D. C.

MAY 5TH AND 6TH, 1885.



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1885.

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Proposed Constitution.

The Committee appointed by the President to revise the Constitution, offered the following to be considered until the next meeting, when it will be voted upon.

ARTICLE I.—Name and Objects.

The name of this Society shall be "The American Fisheries Society." Its object shall be to promote the cause of fish-culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of the interests of fish-culture and the fisheries; and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II.—Members.

Any person shall, upon a two-thirds vote and a payment of three dollars, become a member of this Society. In case that members do not pay their fees and are delinquent for two years, they shall be notified by the Treasurer, and if the amount due is not paid within a month, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at a regular meeting.

ARTICLE III.—Officers.

The officers of this Society shall be a President and a Vice-President, who shall be ineligible for election to the same offices until a year after the expiration of their terms, a Corresponding Secretary, a Recording Secretary, a Treasurer, and an Executive Committee of seven, which with the officers before named, shall form a council and transact such business as may be necessary when the Society is not in session; fou to constitute a quorum.

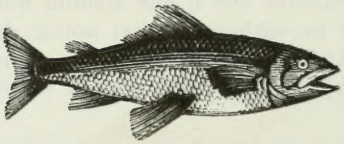
ARTICLE IV.—Meetings.

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting, or in default of such action, by the Executive Committee.

ARTICLE V.—Changing the Constitution.

The Constitution of the Society may be amended, altered or repealed, by a two-thirds vote of the members present at any regular meeting.

Signed, Fred Mather, *Chairman.*
W. V. Cox,
F. N. Clark.
Committee.



FOURTEENTH ANNUAL MEETING

OF THE

AMERICAN FISHERIES SOCIETY.

(AMERICAN FISH-CULTURAL ASSOCIATION.)

FIRST DAY.

THE Fourteenth Annual Meeting of the Society, and the first under the new name, was held in Washington, in the lecture room of the National Museum, on May 5th and 6th. The meeting was called to order at 12 M. on the 5th, by the President, Hon. Theodore Lyman, of Massachusetts, with the following remarks:

GENTLEMEN OF THE AMERICAN FISHERIES SOCIETY: We are at a season of the year when important events repeat themselves. It is the spring. Baneful influences have passed away. Ice-bound winter, as by a miracle, has given place to southern breezes, and—still more strange—Congress has adjourned and gone home. Good things come to the front, full of hope and energy, and intent on growth and reproduction. Asparagus protrudes its welcome green nose from the soil; the suggestive pea flourishes defiant of late frosts. The English sparrow industriously builds its nest in spots carefully selected to render it as much a nuisance as possible; the cows go forth to pastures green and reward the aqueous milkman with abundant flow of milk pleasingly redolent of garlic. Nor do the waters less respond to genial warmth; for now the shad and the herring,

intent on spawning and oblivious of the fatal seine, push up the Potomac and seek the safe shores of the District of Columbia, where they may breed under the parental protection of a special act of Congress. Last and greater than all these come the members of the American Fisheries Society, pregnant with great ideas and anxious to deposit them in Washington for the benefit of an ichthyophagous nation.

Gentlemen, I bid you welcome. You are surrounded here by great traditions and mighty influences. From the capstone of yonder monument ten entire weeks look down upon you. In the grand pile of the War, State and Navy Departments, you will have a valuable lesson of what is to be avoided in architecture. The hurrying crowds of office-seekers will prove to you how the busiest bee may, under adverse circumstances, collect no honey, and how the earliest bird may fail to catch the truly astute and resolute worm. The numerous "hansom" and "herdic" cabs will point the moral, that however long or agreeable or smooth be the road, we must all pay a price at the end. The suave manners of our negro population will bring to your mind the fact that some of the most agreeable lights in life, like those in a cathedral, come through a colored medium. In a single word, then, I bid you welcome to a sojourn which cannot fail to be profitable alike to humanity and to fish.

The PRESIDENT: Gentlemen of the Society, we first have to consider the routine business of the meeting, which will come up in its regular order. Has the Secretary any suggestions to offer?

The RECORDING SECRETARY: The first thing in the regular order of business is the appointment of Committees, etc. We have thought that our Constitution needs revision, and I would move that a Committee be appointed to revise it, and to prepare By-laws.

The PRESIDENT: Gentlemen, you hear the motion of your Secretary, that a Committee be appointed to revise the Constitution of this Society, and prepare By-laws. What is your pleasure?

No opposition being offered, it was made a vote.

The PRESIDENT: Of how many shall it consist?

MR. GOODE: I move that the Chair appoint a Committee of three to revise the Constitution and prepare By-laws.

This was voted upon and passed.

The PRESIDENT: The Chair will appoint Mr. Fred Mather, Mr. W. V. Cox and Mr. F. N. Clark.

One of the regular Committees to be appointed is that on nominations to report at the meeting to-morrow morning. That Committee is generally composed of five members.

MR. GOODE: I move that the Chair appoint the Committee on Nominations.

This was voted upon and passed.

The PRESIDENT: The Chair will appoint Mr. G. Brown Goode, Mr. W. L. May, Mr. T. B. Ferguson, Mr. E. G. Blackford and Dr. Tarleton H. Bean.

During the meeting the following were proposed and elected to membership: Hon. Geo. M. Robeson, of New Jersey; Dr. E. W. Humphries, Commissioner of Maryland; W. W. Ladd, Jr., New York City; Frederic R. Ryer, New York City; Prof. H. J. Rice, New York City; Prof. Chas. V. Riley, Agricultural Department, Washington; S. H. Kauffman, *Evening Star*, Washington; W. A. Butler, Jr., Michigan Commissioner; John A. Loring, Boston; Gwynne Harris, Inspector of Marine Products, Washington; S. C. Brown, Register National Museum; J. P. Wilson; W. E. Bailey, Engineer; Geo. H. H. Moore, Newton Simmonds, W. F. Page, J. F. Ellis, J. J. O'Connor, J. E. Brown, A. Howard Clark, W. W. J. Murphy, Thomas Lee and Peter Parker, Jr., all of the U. S. Fish Commission; Ed. H. Bryan and Henry W. Spofford, both of the Smithsonian Institution; Major G. I. Lydecker, U. S. Engineers, and Lieut. Pietmyer, U. S. N., commanding Steamer Fish-hawk.

On motion of Prof. G. Brown Goode, Hon. Spencer Walpole, Governor of the Isle of Man, was made a corresponding member.

The report of the Treasurer was read and accepted, and the meeting adjourned until 2 P. M.

AFTERNOON SESSION.

On assembling, the following was read:

THE GIANT CLAIMS OF PUGET SOUND.

BY ROBT. E. C. STEARNS.

Dr. Stearns, referring to the fact that his paper was the first on the programme, said: At the time my friend Prof. Goode asked me to say something to you about the big clams of the west coast, I supposed that my place would be toward the close of the feast, somewhere near the nuts and raisins, or the special delicacies and dainties of the dessert. However as this is a fish convention, and the Professor's request may be considered as semi-of-fish-ial, I accept the place assigned me, and you must regard what I have to say as being in the nature of grace before meat.

When an illustrious stranger from a remote country visits a great civilized center, it is customary to introduce him into the distinguished society of the place with some formality, if not ostentation. Gentlemen, permit me to make you acquainted with *Glycimeris generosa*, the boss clam of North America, recently from Puget Sound.

You will see that he is in that condition which prevents him from saluting you. Beside, he is by nature somewhat reticent. He is evidently in high spirits (95 per cent. alcohol), but nevertheless speechless (as an Irishman might say), "as many a gentleman has been before."

This clam, *Glycimeris generosa**, by far the largest found on either coast of North America, was first described by Dr. Augustus A. Gould from specimens (probably of the shells only) obtained by the exploring expedition commanded by Commodore Charles Wilkes, during his famous cruise in the years 1838 to 1842, inclusive.

It was detected in Puget Sound and subsequently collected in Awatska Bay, Kamschatka, by the North Pacific Exploring Expedition, under command of Commanders Ringgold and Rodgers; the late Dr. Willam Stimpson was the naturalist of the latter expedition.

The range of distribution, it will be noticed, is quite extensive as from the above points in the North Pacific it extends southerly along the west coast of America to San Diego, California, where it has been found by Mr. Hemphill. A range northerly and southerly twenty degrees of latitude. It is apparently much more abundant in the north than in the south, for Mr. Hemphill states that in the southern locality I have named, in the course of several years he had not been able to find more than a dozen.

From Capt. J. S. Lawson, of the U. S. Coast Survey, I learned some years ago of its frequent occurrence in Budd's Inlet, Washington Territory; from others residing in the same general neighborhood I had heard of its presence at various points in Puget Sound.

Aside from its large size, which would naturally attract attention, its excellence as an article of food is attested by all who have eaten it, and it holds by common consent a place in the front rank, in the opinion of the epicures of the northwest coast.

In the spring of 1882, Professor Baird, being desirous of obtaining further and more definite information as to the occurrence, habits, quality and abundance, etc., of *Glycimeris* or geoduck, † as it is called by the Indians, and also more special knowledge of the principle (so-called) clams of the region, I

*Etymology—*Glycimeris* from *glukous*, sweet, *meris*, bitter *generosa*, from its ample size, etc. Sometimes placed in the genus *Panopœa*, from *Panope* a nereid, ancient mythology.

†Accent the second syllable and pronounce hurriedly, with a hard g and a short o, as if spelled ge-wo'; gewo'duck.

went up to the sound at his request in June of said year, and fixed upon Olympia, at the head of Budd's Inlet, as a base. The character of the sea-bed here may be described as varying from sandy mud to muddy sand, occasionally gravelly, and there is sometimes found a patch of hardened or compactly indurated clay of a light blue color.

The most striking peculiarity of the environment, and the principal one relating to the presence and obtaining of geoduck, is the extreme tides which occur here from about the middle of May to the Summer solstice in June, or a little later, during which period the rise and fall of the tides, or in other words, the difference between high and low water, is twenty to twenty-five feet. Now it must be borne in mind that it is only during the season of these extraordinary tides that the big clam can be obtained. I found that by the 23rd of June, "the long run-outs," as they are called by the people there, had nearly ceased. The white men and Indians employed by me, who had been sent out in various directions, returning at night or early in the morning for three consecutive days had met with "fisherman's luck." I was not disappointed for I knew the cause, not having been able myself to reach the low water line of three or four days before.

By this we are able to perceive more clearly the force of the common expression, "as happy as a clam at high water."

It is presumable that the scarcity of the geoducks along the ocean coast as far to the south as the species are found, is more apparent than real. The rise and fall of the tides along the main coast is, say about six feet, and not sufficient to uncover that portion of the zone preferred by the geoducks; again the temperature of the water at the southerly stations may be too high and cause them to seek a cooler temperature by living at greater depths. As to the more special habits of the geoduck, such as burrowing, etc., the following is not without interest.

Captain Lawson informed me that upon one occasion he saw the end of the large siphon tube projecting above the surface of a small shoal. Upon examining the spot it was found to be sandstone; in order to capture the clam the stone had to be broken with a crowbar. Beneath this superstratum was found sand

and gravel, in which the huge mollusk was "at home." Its communication with the water above being by means of a hole in and through the sandstone capping—through this hole it extended and protruded its siphons. The hole, no doubt, was originally made by the clam, when quite small, in its younger stages, in order to reach a permanent and suitable burrow or bed, and of course the principal growth was attained after it had reached the more favorable substratum of easier material; the hole or perforation through the sandstone being enlarged, coincident with its growth, as needed to meet its requirements.

As may be supposed it is quite a job to remove a good-sized geoduck from its native bed without injury; to do so with proper care as many as three persons are needed, otherwise the clam will be more or less mutilated. The length of the siphons when extended indicates the depth of the burrow, if his word may be used, and an excavation equal to the size of a flour barrel has been made. The instance related of Capt. Lawson's specimen shows the difficulties which are sometimes met with in collecting these big fellows.

This mollusk may well be called *generosa*, for its ample and generous size makes it at least the mammoth clam of North America. According to the testimony of Captain Lawson it has been known to reach the weight of sixteen pounds and frequently seven to ten pounds, while the siphon tube may measure one and a half to two feet in length. Those collected and observed by me weighed from three and a half to seven and a half pounds.

More might be said of the many virtues, which in connection with high water, may be the cause of the clam's happiness, such as pertain to its gastronomic excellencies, etc. Geoduck is however, a real delicacy, and skillfully cooked, would completely puzzle anybody tasting it for the first time, as to whether he was eating fish, flesh or fowl.

The nearest guess that I have heard was by a person to whom I gave a piece, "That it tasted a little perhaps like nicely stewed crab," which hits the mark very nearly. The proper way to cook geoduck, or one way, is to parboil thoroughly, then remove the skin and cut in strips about one inch and a half wide by a half an inch thick (no thicker) and fry the pieces in good batter,

in very hot salt pork fat. I dare to say that parboiled, then stuffed and baked or roasted, geoduck would prove satisfactory to the daintiest epicure. Mr. Hemphill thinks it tastes somewhat like poached egg, but the taste to me did not suggest that of eggs cooked in any form. If fresh and well cooked it is, as I wrote to Professor Baird in my report, "suitable food for good men of scientific proclivities." *Washington, D. C.*

HIBERNATION OF THE BLACK BASS.

BY DR. JAMES A. HENSHALL.

That both species of black bass (*Micropterus*) hibernate in the northerly part of the country, is a fact too well known to admit of a doubt. But, notwithstanding the evidence heretofore adduced in support of this fact, the occasional catching of a black bass during the winter season, in the North and West, is sometimes heralded by correspondents of the angling papers as a proof that former observers have been mistaken, and that these fishes, or at least the large-mouthed species, do not hibernate. Perhaps the term hibernation is not well understood by these writers, which may account for their hasty and erroneous conclusions.

Hibernation does not necessarily imply, as supposed by some, a state of complete torpidity or profound sleep during the entire winter. To hibernate, according to Webster, is "To pass the season of winter in close quarters, or in seclusion," and that is just what the black bass of both species do in northern and western waters, every one who has given the subject any intelligent investigation is prepared to admit.

Hibernation of animals is influenced, doubtless, by conditions of temperature and food supply, and the duration, extent or degree of this period of repose or seclusion, is augmented or

diminished by the particular state of these conditions. In the opinion of the writer, hibernation of animals is influenced as much (if not more) by the supply of food as by the state of the temperature. This is proven by the fact that while the black bass hibernates, other fishes in the same waters are active during the entire winter; and this fact may be accounted for by a lack of the principal food of the hibernating species, and an abundance of the particular food of the non-hibernating species, for it is not likely that the temperature, *per se*, would affect one species more than another. To illustrate: The principal food of young black bass (say from six months to a year old) consists of insects, and of adult bass, of crawfish and other crustacea, and both of these classes of food are very scarce during the winter months in the North and West. On the other hand, pike, pickerel, pike-perch and other exclusively piscivorous fishes find an abundance of certain species, as minnows, yellow perch, etc.

To be sure the black bass feeds on minnows and yellow perch occasionally, but not to any great extent, nor for choice; its weak brush-like teeth are not so well adapted for a fish diet as the canine-teethed fishes above mentioned. And this is one of the strongest arguments in support of the fact of their hibernation, for were the black bass as piscivorous as many would have us believe, there would be no necessity for their winter seclusions on account of a lack of this kind of food. Of the two species of black bass the large-mouthed bass feeds more upon minnows than the small-mouthed bass, and hence is taken oftener during the winter. In the extreme Southern States the supply of crawfish and insects is constant, consequently the black bass does not hibernate in that region. Among the hibernating mammals the black bear, in the extreme South does not undergo the winter sleep of his Northern brethren because he finds his food abundant at that season. And even in the North, during mild winters when food can be procured, the black bear has been known to depart from his usual habit, and has been killed when roaming abroad, when he should have been asleep in his winter den; but such rare exceptions merely prove the

rule, and do not disprove the fact that the black bear is a hibernating animal.

In Europe, the German carp are typical hibernating fishes, burying themselves in the mud at the beginning of winter, their heads together in circles and their tails out, which are kept in motion more or less constantly. But American fish-culturists state that while the imported carp hibernate profoundly, their descendants, on the contrary, are more active during the winter, and the disposition to hibernate grows less with succeeding generations. This I believe to be more on account of an abundant supply of food than upon the temperature, for most carp culturists are liberal feeders, from the fact that carp will grow more rapidly than other fishes if well fed.

German authorities are of the opinion that the carp takes no food during the period of its hibernation (from four to six months), though it has been proved that it does not diminish in weight during this entire time. I do not believe it possible for an animal to abstain entirely from food and maintain a uniform weight for a period of several months, even though it sleep ever so profoundly. (The black bear goes into winter quarters excessively fat, but comes out in the spring weak and emaciated.) I am of the opinion that the German carp derives its nourishment during hibernation from the mud in which it is buried, for it is well known that all of the *Cyprinidæ*, *Catostomidæ*, etc., feed more or less upon the mud of the bottom, or at least upon minute organisms contained therein. This view seems plausible in connection with the fact that in Europe, carp kept in tanks for sale during winter rapidly lose in weight unless fed generously. In American waters, though frozen over during the entire winter, there are always some form of vegetation, larvæ and animalculæ, to be had by herdivorous and bottom-feeding fishes, as carp, minnows, suckers, sturgeon, etc., consequently these fishes are more or less active during the coldest weather, and some of them in turn furnish food for the piscivorous tribes during the same season.

The writer has elsewhere stated: "During a residence of ten years in Wisconsin, where fishing through the ice is constantly practiced during the winter, and where tons of pickerel, pike-

perch and yellow perch were so taken in a single season, I never knew of a single black bass being so taken except very late in the winter or in early spring, say in March, just before the breaking up of the ice; and even in those instances were of rare occurrence, and happened only during unusually mild weather; and these same waters, be it remembered, afforded the finest black bass fishing during the summer and fall."

The above applies to the usual fishing grounds of the lakes and streams of Wisconsin with the water at moderate depth, from four to twelve feet, which are frequented by the black bass, large-mouth and small-mouth, in common with the non-hibernating species in spring, summer and fall, but only by the latter in winter, the bass retiring to greater depths at the begining of winter and remaining until spring, and where they can be taken by the initiated with the right kind of bait; but as I deem such information of no special advantage, except to the poacher and law-breaker, I think it best and proper, for obvious reasons to withhold it. From personal observation I am pretty familiar with the habits of both species of black bass at all seasons of the year, in all of the States east of the Mississippi (except the New England States, New Jersey and Delaware), and with the exception of the Gulf States, I am convinced that both species of black bass hibernate in a greater or less degree, according to the supply of food in the winter season, or in other words, according to the climate. In these exceptional States, during the hottest weather, they retire to the deepest and coolest water to be found, and undergo a condition of rest and seclusion (æstivation) analagous to hibernation; perhaps an inherited instinct.

In the foregoing hastily-written paper I have endeavored to show: (1) That hibernation of fishes (and other animals) is influenced more by the supply of food than by the temperatures for it is well authenticated that fishes can endure extremes of temperature that would prove fatal to other vertebrates. (They have revived after being frozen in ice, and on the other hand, they live in apparent comfort in the water of hot springs of a temperature of above 100 degrees Fahr.) (2) That both species of black bass hibernate in the northern sections of America.—*Cynthiana, Ky.*

MR. GOODE—Mr. President, I should like to say a word or two on this question of hibernation. It seems to me that hibernation is by no means a voluntary act, as might possibly be inferred from some things which Dr. Henshall has said. It is purely a matter of physicial cause and effect, and the question whether the black bass will hibernate in a given latitude depends on the depth of water and the presenee of warm spots at great depths in that particular body of water. Every fish has, I think, a certain limit to its powers of activity, a certain limit which varies with different species according to a scale of temperature. Many of the southern fishes which come to our northern coast in summer, are in the fall seen in the cold tidal bays partially torpid. In such a state they cannot feed. It is the torpidity which prevents their feeding rather than the lack of food; and it seems to me that in almost every case the fish has no power to escape from that degree of cold which produces torpidity. From reliable testimony I learn that black bass are taken under the ice in some of the northern lakes, and have no doubt, that in other lakes not so deep, the fish become torpid before the ice forms on account of the shallowness of the water. I think, therefore, that Dr. Henshall's theory is somewhat exaggerated. He may have heard of fish feeding during the period of hibernation. I am not, however, inclined to believe that they ever do this. I certainly very much question the possibility of carp feeding during the period of hibernation. It is generally known that they are then buried in the mud at the bottom of the water. This is a very interesting question, and one whose solution involves a great deal of experimenting. I should, however, hardly like to see the question settled upon hypothetical grounds before such experiments are made.

MR. MATHER—This question of the hibernation of fishes is one concerning which I have no special knowledge. I have, however, paid some little attention to it, having been recently engaged in endeavoring to learn the geographical range in which the black bass hibernates. As touching the question of temperature and food, I know that on our New York coast, in Long Island Sound, there are some fishes which are active all

winter, and others which bury themselves in the mud. The tautog, or blackfish, practically hibernates. I do not think it takes a particle of food during the winter. Flounders go into the mud and so does the eel, which latter buries all excepting its head. All the eels that are taken there in the winter are speared, the fishermen sounding in the mud with their spears. In the middle of April they come out and are taken in eel pots. The tom-cod and some other fishes are active all winter. It always seemed to me that some fishes might be more susceptible to the influences of temperature than others. In lakes north of the fortieth parallel we know that the black bass does not feed much during the winter. Occasionally a specimen is taken with hook and line. Dr. Henshall's theory concerning hibernation is certainly a new one to me, viz: that the question is one of food and not of temperature, and is one, I think, which will bear considerable examination before it be accepted as the correct solution.

PROTECTING AND HATCHING THE SMELT.

BY FRED MATHER.

I will preface this paper, gentlemen, by saying that my paper contains some statements which are so at variance with all my former experiences that I almost hesitate to read what I have written.

The smelt, *Osmerus mordax* (Mitch.) Gill, is not common on Long Island, and but few streams contain it. In the spring of 1884, I attempted to get eggs from a stream at Locust Valley, on the north side of the island, in Queens county. The fish run up the streams at night to spawn, and on this one I spent one night. There were about twenty men with lights at different points within half a mile using what they called "grab-alls" or "snatchers." These were variously shaped contrivances, some round, some square, and others triangular, but averaging about

five inches square, made of wire with frequent cross wires, to which were soldered fish-hooks. Imagine a small grill made by bending a wire so as to form a square, each side of which is six inches, with five interior wires one inch apart, soldered across it parallel to the handle, and on each of these wires, both interior ones and of the frame, are soldered fish-hooks one inch apart, forty-nine hooks in all, and you have one of the most merciless fishing implements that devilish ingenuity has devised. This is the "grab-all," and I have seen many a poor smelt impaled on it when seeking a place to deposit its precious burden of eggs, under cover of the night. I tried to buy one of these murderous implements to exhibit at the London Fisheries Exposition, but failed because the owners had use for them the night which I spent in their company. The men who used these implements were, to judge from their own lips, the most depraved wretches that I ever met. I never fell into worse company as far as language goes.

At Locust Valley there was a scarcity of ripe fish and an absence of milt on the night referred to, and I arranged with Mr. John Cashow, Supervisor of the town, to have one of his men save me some fish taken in nets. The man did so, and picked out, as he told me, "all the nice large ones," which of course were females, for the female smelt is many times larger than her mate. In addition to this judicious selection, he left the fish, some two hundred in number, in a can under the horse-shed all night without attention, and "the nice large ones" were dead in the morning. The season was getting late, and I sent my foreman, Mr. Walters, over there with a fyke-net; but he was threatened with death in several abhorrent forms by the men who handled the gentle "grab-all" if he persisted in taking a smelt in a fyke. He bought half a dozen fish and we tried to take and hatch the eggs, but failed. Milt was scarce and the eggs were not of the best.

The catch has been gradually decreasing for the past few years, not only at Locust Valley, but on all Long Island streams, a result which may be attributed to over fishing, and in my opinion there is need of legislation to protect this valuable little food fish. Their habit of ascending streams at

night and returning to salt water before day renders them liable to capture both ways, and is a habit that, so far as my knowledge extends, is shared by no other anadromous fish, and is not mentioned in any work that I have seen. The fish is well worth protection, for it is a favorite winter fish about New York. It will live in fresh water, and is said to have bred for some years in in the lakes of Vermont, where it is reported that its edible qualities are generally unknown, and it is only used as a bait fish. The fish is found in fresh water in New Hampshire and in Sweden, also in Lake Champlain, but whether it remains in the lake all year or not I cannot say. If they do not remain there the fish go higher up in this case than in any that I know of. On the coasts of New York and New Jersey, twenty miles is about the limit of their ascent.

The first report of the Fish Commissioners of Maine, 1867, under a heading of "Fresh Water Smelt," page 25, says: "Smelts are scattered all over the State. It seems probable that we have more than one species. Whether either of them is identical with the salt water smelt we cannot say, but the resemblance is very close. In several localities they attain a large size. Those of Harrison are said to exceed half a pound in weight, and those of Belgrade to measure fourteen inches in length." In the second report of the Maine Commission they they say, page 29: "It is said that at the mouth of a small stream, somewhere above Bay Bridge (on the Androscoggin), where smelts are accustomed to run in the spring to spawn, and where it has been the custom to dip for them, for several years a seine has been used, and tons of them were taken out when nearly worthless for food. Many were shipped to New York and commanded a price that hardly paid for transportation. This is an abuse which should be stopped. We think no smelts should be taken during the spawning season—say from April 1st to June 1st. Enough can be taken in the fall and winter, when they are in good condition, and it is wonderful that they can stand the draft that is then made on their numbers." In their third report, 1869, the Commissioners say: "The impression has been quite general that the smelt fishery is overdone, and unless some radical measures are taken, it will soon fall into as great

decay as have the salmon and alewife fisheries." * * * * * The act "to protect smelts in the waters of the Kennebec and Androscoggin rivers, approved March 4th, 1869, aims to lessen the catch by prohibiting the use of any implement but hook and line every alternate year, and at the same time allow the fish to ascend those rivers to the points where they were wont to be taken by hook and line. Undoubtedly, the first mentioned object would be attained, but whether the latter would is uncertain. It is desirable to substitute for this some act of wider application, and consequently bearing more equally on all who are engaged in this fishery. I suggest whether a prohibition to take smelts except during December, January and February, by any other mode than hook and line, and perhaps dip-net, would not apply well to the whole State."

Under the laws of Maine for 1874, chap. 248, sec. 58, it was forbidden to fish for smelts in any other way than by hook and line or dip-net, between April 1st and October 1st. The State of Massachusetts passed a law, approved April 9th, 1874, forbidding the offering for sale or having in possession any smelts between March 15th and June 1st, and forbade their capture by any other means than hook and line at any time except in the counties of Bristol, Barnstable and Dukes. I am not aware that any smelts are taken with a hook and line within the waters of New York, nor do I know that there is any law protecting them at any season. The numbers caught are quite small, the market supply coming mainly from the Eastern States, yet in view of the fact that the fish were formerly plenty on Long Island and have been gradually decreasing by reason of continued capture at the spawning season, I believe that it would be to the interest of the people and of the fishermen to protect them from February 20th to March 20th.

In this connection I will read an article written for *Forest and Stream*, headed "Torching for Smelts," by a gentleman from North Bridgeton, Me., in which he describes how smelts are murdered there; he says:

"On the 21st of April the word went round that the "big smelts" had put in an appearance in the streams the evening before. This was enough to bring over a dozen men and boys

to the banks of a certain well-known brook near the head of Long Pond. A part of these carried dip nets, and the most of the others bundles of pitch-wood or jacks, although two or three, one of whom was the writer, carried no equipments of any kind, but went 'merely to see the fun.'

"The evening was warm and very still, and a moon nearly at first quarter helped to prolong the lingering twilight. A fire had been kindled at some little distance from the stream, and as it had been agreed upon to keep away from the water until it was fully dark, all hands were grouped around the fire and were indulging in the usual gossip and jokes of such occasions. All at once some one asked, 'Where's Amasa?' A glance through the intervening alder thicket brought the answer, for in that direction a figure could be dimly seen standing in the brook and busily plying a long-handled dip net. This was sufficient to send everybody to the water, and jacks were soon flaring at intervals along the banks and showing fish by thousands. And now began the excitement. Those who had nets worked them, and those who came "just to see the fun" forgot that this was their object, and waded into the ice cold water, catching the fish in their hands and throwing them ashore. Boys screamed and men shouted. The air as well as water was full of fish, and the sedate man, regardless of shoes and stockings, was knee-deep in the current, his hands grasping here and there, while the pockets of his overcoat and the crown of his hat were full of wriggling fishes. Two dozen fish averaging nearly eleven inches in length, were captured with a single sweep of a dip net. The piles upon the bank were fast increasing to proportions far beyond a market stall, when a rational thought seemed to strike some of the cooler heads. 'Let's stop this, boys; it's nothing short of murder, for we have all we can make any use of.' For once men were reasonable, and boys, as usual, followed in their lead. The fish upon the bank were gathered up, and Rodger's Brook with its swarming waters was left to itself. But in a very short time over three hundred weight of a species of fish that can hardly be surpassed in table qualities were on their way to the village. The express the next morning showed plainly that distant friends had not been forgotten, while a large box placed in front of a store with a 'help yourself' attached was speedily relieved of its contents.'

"But this was only the work of one evening, and the next night the fish would be even more abundant. The word had spread, and long before dark everything for miles around that could be called a dip net was on its way. In place of a net one fellow carried a large corn popper with an extension lashed to

its handle, and another had a tin pan with its bottom punched full of holes and nailed to a pole. Quaint as these implements were, both, it is said, did good service. Through the evening and well into the night dozens of jacks and torches sent their brilliant glare along the stream and into the surrounding forest. No doubt the excessive light frightened the fish and kept many back in the lake, but still hardly an individual went away without fish enough for any reasonable demand. On either this or the preceeding night two men, one to carry a light and the other to handle the net, could have filled an ox cart. This last statement, of course, is on the supposition that the two men could have had the stream all to themselves. As it was, the large number of fishermen, especially on the second evening, rapidly scattered the fish and drove the most of them back into the deep water of the lake.

"The above is only a partial account of what happened on a single stream, and we hear similar reports from nearly every tributary of the Sebago waters. At Bear Brook, in Harrison, but little more than a mile away, the run has been longer and probably even more fish have been taken.

"It would be a work for the scientists to fully explain the different varieties of smelts and their habits. That they belong to the salmon family all agree, but in this particular locality there are three different varieties, commonly called the big, salt-water, and little smelts. The salt-water smelts, *Osmerus viridescens*, are common in all the rivers, creeks and streams along our coast. They are said to bear transferring well, even into waters entirely land-locked and fresh, but always with a diminution in size. The big smelts are like the salt-water variety in some respects, but are larger and darker colored. They are over ten inches in length, and average nearly a quarter of a pound in weight. Many occur much larger than this, and one was weighed here a few years ago that was caught through the ice with hook and line, and turned the scales at eleven ounces. A few are mentioned even larger, but they are rare, to say the least. The little smelts are but miniature representations of their larger relations, weighing less than half an ounce each. Some have thought that these little fellows were only the young of the larger variety, but this can hardly be true, as they seem to be fully developed and are ready to spawn as they descend the streams to their breeding grounds. They do not run up the streams until about a week later than the larger ones, and are much more abundant. They are also found in many localities where the big smelts do not occur. They vary somewhat in size in different places, and are said to be larger in Norway Lake,

only twelve miles away, than they are here. In the last mentioned lake no big smelts are found. An idea of the abundance of these little smelts may be had from the fact that a few evenings since three fellows dipped a shorts sack full (about three bushels) in less than an hour. That this party of wholesale fish killers were under the influence of something stronger than brook water was proved by what followed, for tying up the mouth of the sack, they threw it into the stream and allowed it to drift with its contents out into the lake.

"No person pretends to know anything about when these waters were stocked with smelts, but in all probability they were here long before the country was settled. Although they have been ruthlessly wasted year after year, their numbers have been larger this season than at any time previous. With the exception of the ten or twelve days that they are spawning in the spring, no smelts are ever seen in the streams here. They are caught some through the ice in winter and in very deep water almost always. Those caught through the ice, or with hook and line at any time, are generally larger than those taken in the streams in breeding time. On the whole, smelts in these parts are something of a puzzle, and the people who see the most of them simply expect them to put in an appearance at about such a time, kill them by the thousands when they do come, and think no more about them until their next appearance."

A year passed after the first attempt to get eggs, and late in February, 1885, while looking through Fulton Market, New York, Mr. Blackford told me that smelts were coming in from the southside of Long Island. I sent Mr. Walters down to Brookhaven, a place on the eastern end of the Great South Bay, where the Carman's River or as formerly called, the Connecticut River, comes in. I will here digress to say that the Shinnecock Indians are reported to have had a tradition that this river was a continuation of the great river of that name, which, by means of some subterranean passage under Long Island Sound, breaks out again on the island. The Connecticut River of Long Island is about five miles long, and the smelts often run up it in great quantities, but are said not to go further than half a mile from its mouth. They begin to run in about the 15th of February, and the run lasts one month. They are taken with seines and gill-nets, and an average catch for one man is seventy-five per night.

On the 4th of March, Mr. Walters returned with one hundred and twenty fish nearly ripe and a fair proportion of each sex. Eight had died on the journey from being caught in gill-nets when so nearly ripe, five more died shortly after, and all were more or less injured. From one of the five dead fish I took 30,000 eggs after the fish had been dead fifteen minutes, using a live male. The eggs were taken on a bunch of coarse meadow-grass and suspended in a glass tank with a flow of water from a ⅛-inch cock, and in three days many were dead, and all died at a week old. On the 5th, I repeated the experiment with a dying female. In five day three dead eggs showed, the sixth day 100 dead, seventh day one-fourth of the lot were dead. Up to the 17th, the thirteenth day after taking, there was little change, and on the 20th the eggs were put in a box outside the hatchery in swift water, as they began to show fungus. March 26th, about one-half were alive, and these were in bunches covered by dead eggs and fungus. All the outside eggs were dead, and I had little hopes of saving any. On April 3rd the fish could be plainly seen in the lower eggs by removing the coating of dead eggs and fungus which had covered them for two weeks. The eggs were again placed in the aquarium and 2,000 hatched on April 11th, and on the 16th, 9,000 more hatched and the rest were bad. About one-third of the eggs hatched under conditions which seemed hopeless, and under which it would be impossible to hatch the egg of a salmon or a trout. When the last ones hatched, the mass of dead eggs was rotten and foul. The temperature ranged from 40 to 42 degrees Fahr. In taking the eggs the grass was laid in a milk pan and covered with water. The female was manipulated first, and as the eggs do not stick fast untill some minutes after being taken, perhaps after impregnation takes place, they were distributed evenly over the grass with the tail of a fish.

Knowing nothing of smelt hatching, the literature of which is meager, we determined to try several plans. On March 5th, Mr. Walters took about 50,000 eggs from a weak female on stones the size of a man's fist, in water, and placed them outside the building in a covered waste trough which takes the water from the house to the ponds. The current was slow but the eggs

washed off, refusing to stick in bunches, as on grass. The consequence was that the stones were covered with eggs only one layer deep. Three days after this they looked well, but in a week were all dead, though no fungus had formed. He tried again on March 8th, by taking about 70,000 eggs by the dry method on tiles, letting them stand five minutes before adding water, and then placed them in one of the hatching troughs. On the 16th one-half were dead, and on the 24th they were covered with fungus. On April 7th there had been no change, the eggs underneath the fungus were bright and good, but he went away the next day and did not return until the 12th, when he found the trough empty. The other attendants pronounced them dead and threw them away. Neither of us saw them on the last day, and we do not feel certain that they were dead, for our experience this year tells us that it requires an expert to judge of this. A mass of smelt eggs all rotten on the outside and covered with fungus half an inch long, should be given the benefit of all doubts, and be carefully examined before condemnation.

On March 9th, we obtained 100 more fish which had been taken in seines. The first lot were so badly injured by gill-nets that they were covered with fungus in a few days. On the 12th we got 70,000 eggs on tiles and stones, taken in water, and placed them in a trough which receives the flow from nine hatching troughs, and is consequently carrying a swift current. These eggs were evenly distributed over the tiles and stones several deep, and did not flow off as in previous cases. Not until March 22nd, eleven days after, did we see any dead eggs or fungus. At five days old we could see the formation of the embryo with a microscope, and at fifteen days the fish could be seen with the unassisted eye. At this time fungus had spread all over the outside eggs, but underneath there were but few dead ones. On April 6th, when the eggs were twenty-six days old, they were placed in the glass tanks with a flow from above, and a siphon outlet, and four days later began hatching fast, and two days after we had 11,000 fish, all that we obtained, the temperature varying from 37 to 58 degrees, and the time thirty days. The water in all these experiments was pure spring water.

The last trial was in the McDonald hatching jars and was the

best of all, producing 60,000 fish from 200,000 eggs. They were taken on March 21st by the dry method, let stand five minutes and added half a pint of water and kept in motion twenty minutes by tipping the pan from side to side and occasionly using the tail of a fish. The object of this was to keep the eggs from sticking together, so that they might be treated as free eggs. After this more water was added and the eggs allowed to rest for twenty minutes. They were then washed twice and placed in a McDonald jar. They were taken at 5:10 P. M., were all loose at 6:30 P. M., and at 7 P. M. next day many were stuck fast to the jar and the tubes. On March 30th those still loose were placed in another jar, and on April 2d a few dead ones were observed, while four days later the eggs grouped together in bunches which increased in size until on April 15th, the bunches were of the size of walnuts and covered with fungus. On the 20th a few hatched and on the 21st all that were good came out. From this lot we got 60,000 fish in thirty days with a temperature varying from forty to sixty-five degrees.

The fish are the most minute of any that I have hatched and it troubled us to keep them. A strainer tube inclosing a siphon such as we use for whitefish, was entirely too large, for the fish passed through it with ease. After trying several things and having the aquarim overflow, and the fish go out into the trout ponds, we devised a spiral wire rolled on a stick of four inches diameter and covered with thin muslin; this kept the fish and allowed a small stream to flow out of the siphon which was inserted. I will here say that the lower end of such siphon should be placed in a jar of water in order that it does not suck dry. The difficulty with siphons as outlets is their tendency to empty faster than the inflow, and in consequence they empty themselves and then decline to start again. Placing their lower end in a fruit jar overcomes this failing; they will suck no lower than the top of the jar holding the lower end. I used this plan in the New York Aquarium in 1876, but do not claim to have originated it. Of the eggs remaining attached to the first jar and its tubes in a single layer, not one hatched—most of the fish came from eggs which were in masses surrounded by fungus. This year's experience upsets that of my eighteen previous years

which taught me that the egg of a fish should be clean and free from fungus. I now except the smelt from the rule and think it impossible that the embryo smelt must be protected from too much oxygen and good water by a coating of decayed eggs and fungus. Perhaps this is what gives the adult fish its peculiar cucumber odor.

On April 17th, we turned out in the hole below the waste flume of the mill pond, near the hatchery, 20,000, and 30,000 in a small spring run in the meadows of Mr. W. E. Jones, opposite the hatchery, while later 50,000 which were ordered by Commissioner Blackford to be sent to Mr. R. W. Howe, Ridgewood, Long Island, escaped into our ponds by the overflow of the tanks. The fish are so minute that muslin strainers were required, and an extra flow of water clogged them and the tanks overflowed, so that all our 100,000 fish will get into the harbor through three channels.

I have said that the literature of smelt hatching is meagre. Mr. George Ricardo, of New Jersey, has had experience with these fish for several years and has hatched some, but has published nothing to guide others. A search of my library, beyond which I have no knowledge of what may have been done, reveals the following:

Bulletin of the United States Fish Commission, Vol. I., p. 428 (1881, Charles W. Harding, King's Lynn, England, writes Prof. Baird for information, wants to know if the English and American smelts are identical and if the eggs are hatched in fresh water, says: "Smelts spawn in this river (Ouse) from April to beginning of June, and I am anxious to know if it is possible to obtain the ova either from the fish direct, or from the spawning ground, and hatch it out in gauze trays or troughs, and whether fresh water will do, or is it necessary to have the water partly salt."

Norris, "American Fish Culture" (1868) p. 200, says that here and in England the smelt has been naturalized in fresh water lakes, "although an interference with their anadromous habits produces generations of smaller and, perhaps less palatable fish." I note the caution with which the careful Norris, whom I am proud to call my old angling friend, and whose book gave

me some hints when I had started in as a novice in fish-culture nearly eighteen years ago, says, "perhaps" the fish are less palatable. The adverb shows that while he did not know it to be so he recognized the fact that no fish which lives in fresh water is as good for the table as if it dwelt in the sea, a thing well known to all who live near salt water, but "Uncle Thad." gives us no hint as to smelt hatching.

Jerome Von Crowninshield Smith, M. D., the most absurd and ignorant writer on fish that I know of, says ("Natural History of the Fish of Massachusetts,") 1833, p. 148: "An attempt has been made to acclimate the smelts in a fresh-water pond, but they have soon degenerated, becoming first emaciated, and disappeared, by degrees, till they probably all died." This is my experience with adult fish, although I have now about thirty male fish alive in fresh water, all the females having died.

Mr. Charles G. Atkins, "Report U. S. Fish Commission," 1879. p. 742, says: "November 6th.—This forenoon early, Mr. Munson found a great run of smelts at the spawning shed (above the dam). He said he could have dipped any number if they had not been so shy and quick. As it was he dipped 150 or 200, which I have preserved. They are mature, showing clearly spawn and milt through their transparent bellies. [These smelts are among the most diminutive of their genus, averaging in length but little more than two inches. They are found in several if not all the Schoodic Lakes. In one of the tributaries of the "Uper Dobsey" Lake (Indian name, *Sysladobsis-sis*) they are wont to spawn late in the month of February." See also a series of questions by Mr. Atkins, "Report U. S. Fish Commission," 1880, p. 44.

The best report on smelt hatching is contained in the report of a Commission of Fisheries of Maryland (Thomas B. Ferguson), 1878, pp. 41–94, by Prof. H. J. Rice. His field of operation was at the City of New Brunswick, about eight miles from the mouth of the Raritan River, N. J. Prof. Rice alludes, p. 44, to experiments of Mr. Atkins with the land-locked smelt which I do not find, but which was "not favorable to the handling of this species of adhesive spawn, and if I [he] mistake not, Mr. Atkin's conclusions were that it would not pay to handle it." Prof. Rice

states that Mr. Atkins hatched some eggs which were exposed to the full force of running water, "in fact, that spawn only hatched which remained attached to grass, twigs, or other articles situated in a direct raceway, and where the water rushed along very furiously. The spawn seemed to require, at least for its artificial culture, a constant and furious change of water, differing, undoubtedly in this respect, very widely from its requirements when deposited by the fish upon its natural spawning grounds. The fish the Commission had to deal with, on the contrary, anadromous, and we had no rush of water in which to deposit the spawn."

Prof. Rice used the Ferguson hatching jar. He records the use of glass, untwisted rope-warp, gauze, etc., and says: "The greater portion of these dead eggs were upon the grass, rope, moss and twigs already mentioned, and the greater portion of fish came from those eggs which were taken on trays covered with gauze, and those eggs which were massed together in the bottom of the jar, in the strength of whatever current there was." He says; p. 52, "This fungus covering the eggs must have a very deleterious effect upon them, and I do not think it would be very wrong to ascribe to it the death of a goodly portion of the eggs."

I read this some years ago and agreed to it because not only my own experience, but that of every other fish-culturist agreed that fungus meant death to all fish eggs. My lessons this winter seem to prove that with the eggs of the smelt a rush of water or rather an excess of oxygen which is brought by it, means death, and the outside eggs meet it first, and by the bulwark of their dead bodies those inside are preserved. I am aware that this is not only a new view to take of the development of a fish egg, but one that is liable to assault from many sides. Still, with only one season's experience, I launch it as my present belief, subject to change as the fugitive *Tempus* discloses new facts or brings forward new experiences. I have never feared to hold unpopular beliefs or to stand by what I thought to be right, and now only wish that the smelt had yielded more eggs, which might have been tried in all degrees of flow, from moderate to almost stagnant water. Certain it is that all the fish we hatched came from eggs protected from rapid changes of water by a

coating of dead eggs and fungus, which, by the time the interior eggs were hatched, was a most foul and filthy mass, really unfit for a visitor to look at, for he would not have believed that a fish could issue from it.

To complete this experience it will be necessary to say that Mr. Ricardo wished to try an experiment in transporting smelt eggs, and one morning brought to Mr. Blackford some twenty thousand eggs, taken on grass, sewed on muslin stretched on a wire frame, and packed in moss. This lot was placed in a hatching trough in swift water the night after receiving, and when removed at about the time of hatching to a glass tank, some twenty fish came out, a result not encouraging to that mode of packing. He afterward sent me eighty thousand fry by express in a ten-gallon can, which was twelve hours on the way without attention, but they arrived dead. It is his belief, and I understand that it is shared by Prof. Rice, that the fry need no change. I am not prepared to accept this view, which if true is singular, for the fish hatch in swift brooks.

—*Cold Spring Harbor, N. Y.*

Mr. Lyman: The results of Mr. Mather's experiments regarding the protection of eggs against the action of water, appear to me somewhat novel. Perhaps some gentleman would like to make some observations, or relate experiments of a kindred nature which he may have conducted.

Mr. H. J. Rice: In regard to the work of Mr. Atkins and myself it may be well to state that just before beginning operations at New Brunswick, a letter was received from Mr. Atkins detailing briefly his method and amount of success in his work in Maine and my work at New Brunswick, followed to a certain extent his experiments, modified very largely, of course, by the different conditions of our more southern locality. Some of his methods for gathering and holding the spawn I found to answer very well, but I misunderstood some of his writing and was under the impression that he had not been successful, but found out afterward in conversation with him, that he had hatched out quite a large number of the eggs with which he was experiment-

ing, and he thought that his experiments, taken as a whole, should be considered as fairly satisfactory. As to my own experiments since 1876 and 1877, the result serves to show greater success in hatching smelt in comparatively stagnant water than in any other manner. The smelt appear to be a peculiar form among fish, and is at present no longer considered as one of the *Salmonidæ*. Young smelt will live in the same water for nine days, and fish-culturists will at once recognize the vast difference in this respect, between these minute embryos and those of some of the *Salmonidæ*, where a constant change of water is absolutely necessary. Again, the warmer the water the better the smelt appear to thrive. If you take the smelt out of this bottle (pointing to a bottle of young smelt on the chairman's table) and put them in cold water, they will die. Place them near the stove and they will become more lively than ever. I do not know the limits of heat and cold which will respectively produce activity or death with these fish; but I do not know that if water containing smelt be cooled to a temperature in which trout would enjoy themselves, the smelt would die. With regard to the effect of fungus upon the fish, I think that, while in some cases it proves fatal to them, yet in others, as Mr. Mather has suggested, it forms a protection for the fish which are inside of the bunch. Last year and also this season experiments have been in progress to ascertain the feasibility of hatching young smelt in comparatively stagnant water. So far this plan appears to be successful. Large numbers have been hatched out and with comparatively little trouble. This corresponds in a great degree with what Mr. Mather has said, and I am inclined to think that eventually we shall find that the less cold water we use, the larger will be the number of eggs hatched out. It may possibly be necessary to kill the fungus by the use of salt mush.

Mr. Lyman: I recollect in 1867 or 1868 trying to hatch some of the large variety called Belgrade smelt. I put them in running water, somewhat swift, in which I kept my trout eggs, but none of them hatched. The smelt is, of course, a very interesting fish, and is one of the first species by which the fact was demonstrated that quantity might be increased by good laws.

As you will all recollect, some twenty years ago or rather more, in Massachusetts the smelt fishery had greatly declined. It was supposed to be due to the capture of the fish by means of nets stretched entirely across the brooks, which prevented the fish from ascending the stream. The law to which Mr. Mather has referred was passed on the recommendation of the Fishery Commissioners of Massachusetts. In two or three years the catch of fish was very greatly improved, so much so, that the bays and streams which had been nearly depopulated, once more became filled with valuable fish. Ever since then, we have had a pretty good supply of smelt in our State. I was very much interested in the reference of Mr. Mather to Dr. J. C. Smith, as being the most ignorant man that had ever written about fish. It illustrates the theory that in order to succeed one should always be profoundly ignorant of the subject. He took up the matter of naming American fishes, and for this purpose he used the Latin names that corresponded to European fishes, which bore the same English names as did American fishes. In this way he often stumbled on the right nomenclature. At that time it was supposed that the same species of fish were not to be found on the two sides of the Atlantic. Since then, however, many of these species have been proved to be identical, so that Dr. Smith was one of the first persons accidentally to recognize a prominent scientific fact which has only been attained by years of hard study.

THE PORPOISE FISHERY OF CAPE HATTERAS.

BY FREDERICK W. TRUE.

There is a legend among the Indians of Brazil that when the shades of evening are falling on the Amazon, the dolphin (called inia) becomes transformed from its peculiar fish-like form, and assumes that of a lovely maiden. Passing through the streets of the village, her fair hair floating on the breeze, the youths are

attracted by her charms and follow her in crowds. When she has walked through all the streets she reaches the banks of the river, dons her fish-like mien, and plunges in suddenly. The youths in hot pursuit, oblivious of their danger, fall down the steep and perish in the water.

Such a transformation as we have indicated, though certainly with some radical modifications, has taken place in the eyes of some capitalists of Philadelphia in regard to one of the porpoises of our own coast. They think they see in this common porpoise not a useless creature, but an animal from which great profit can be derived if proper means are taken to secure it. They have, therefore, undertaken to utilize this animal for industrial purposes. It is not the first time in the history of industries that porpoises have been made use of. Inhabitants of all Arctic countries, as the members of this Society are aware, are accustomed to feed upon porpoises, especially the smaller species, and to utilize especially their flesh and oil. In this country, too, certain species of porpoise have been employed at one time or another in connection with industrial pursuits.

About 1790 there was quite an important fishery for the capture of porpoises on Long Island. This was in operation for several years, but eventually failed to yield a profit. There is now a similar fishery, if such it may be termed, not only on our own coast at Cape Cod, but also on Norwegian shores. The object of capture in this instance, however, is a different species of the family of dolphin—namely, the blackfish. This animal is occasionally stranded on our shores, and usually is seen in herds comprising 400, 500 or 600 individuals. From these cetaceans valuable products are obtained, the most important of which is oil. It is a rather curious fact that many of the most important fisheries are carried on for the capture of animals other than fish. The whale, for whose capture so much energy is devoted, and so large an amount of capital invested, is not a fish. Again, the object of the seal fishery is a mammal: of the oyster fishery a mollusk, as also of the pearl fishery; of the lobster fishery, a crustacean; and it now seems as if we are to see the fishery rise to considerable importance, whose object of capture is not a fish, the common dolphin of our coast. The species, *Tursiops tursio*,

a cast of which I have placed before you, is exceedingly common.

It sports in the waves from Maine to Florida. I have observed them at various points, especially between Cape Cod and North Carolina. They are fearless, approaching very closely in shore, perhaps not further than twenty or thirty paces. They play around the steamers and sailing vessels regardless of any danger.

The specimen before you is not full grown. The species attain nine, ten and even eleven feet in length. They are not very rapid swimmers, but can attain considerable speed. Regarding their habits we really know very little. They appear to breed at all seasons of the year. It was this species and one other which were known to the ancients and entered into their art. They were portrayed with curious conventionalization on their coins, and were endowed with many peculiar attributes which certainly not even man himself possesses, much less the lower animals. The species before us has been known from time immemorial. Its distribution seems to be very wide. It probably occurs in all salt waters of the globe.

The fishery which is now being prosecuted at Cape Hatteras has been carried on in a minor degree for many years. As long as there has been a colony on the coast of North Carolina, the fishermen have been in the habit of catching some porpoise during the winter and converting them into oil. The apparatus used for this purpose was, however, very rude, and consequently the oil produced was of no great value. Last year, however, for some unknown cause, it occurred to certain gentlemen in Philadelphia that this animal could be made more profitable than had before appeared, and they therefore formed a company with their base of operations near to Cape Hatteras, where they were engaged last winter in catching porpoises. So abundant are the dolphins at this point that they had no difficulty in taking 2,000 during the cold weather. The fishing season is not yet finished, and it is probable that 1,000 more will be added to the number captured.

The method of the fishing is the same as has been in use for a long time by the fishermen of Cape Hatteras. Having explained this at length in print, it is perhaps unnecessary to dwell upon the details at this time. I may say, however, that it con-

sists simply in surrounding the animals with large nets, forming a great pond from which they cannot escape, and then sweeping out a few at a time by means of a smaller net. Sometimes 600 are surrounded by the large nets, and of this number fifty or sixty are hauled ashore at a time. They are drowned as they come up, or if still living, are killed with knives.

The products, which the Hatteras Porpoise Fishing Company hope to derive from the capture of these animals, are primarily oil and leather. There is no doubt that, if properly purified, their oil would be of a high grade, and could be used to great advantage in the arts. So far as the leather is concerned, it must be more or less a matter of experiment for the present. Unquestionably certain members of the family *Delphinidæ* furnish excellent leather. We have in the museum some which was made from the skin of the white whale. This is (or until recently was) extensively used in Canada. Excellent leather is also made from the skin of the blackfish, of which I have seen magnificent samples. From the skin of a blackfish a piece of leather of large size can be manufactured. This porpoise leather, though not very thick, is exceedingly tough and entirely waterproof. It has not great market value at present, excepting in a limited trade, but I think this is simply because it has not been put upon the market in any considerable quantities. As soon as people recognize the quality of this leather, and as soon as a sufficient quantity of it is made, so that it may be brought into general use, I think it will become very popular in the manufacture of articles for which a somewhat thin, very tough and entirely waterproof material is required. The Hatteras company, not satisfied to produce oil and leather only as fruits of their labors, hope to render the flesh palatable as food. In this I fear they will not be entirely successful. The flesh of this animal has a strong, oily flavor which does not disappear entirely until quite dry, in which state it would be, I fear, too tough to eat. In Arctic regions, however, the flesh of many such animals is eaten. In Norway, too, the flesh of considerable numbers of blackfish is consumed. It is cut up into small strips and dried in the sun until quite hard. I am not familiar with the process of cooking.

Regarding the value of this porpoise fishery, it may be said to be quite important. It has been calculated that each porpoise as it lies upon the beach is worth $25. If such an estimate be correct, it is not difficult to understand that the conversion of its oil and skin into objects of commercial use would add considerably to this sum. If the company captures 3,000 or 4,000 a year, the first value of the product to the company will, according to the figures, be $100,000. Of course this value would be greatly enhanced when the products were manufactured into objects of use. For a single fishery this is by no means a small sum. The success of this company will probably have an important bearing upon the formation of other similar companies in the future.

I can see no reason why the pursuit of an animal so easy to capture, and from which marketable articles of such undoubtedly high grade can be obtained, should not be profitable to the fishermen. Of course there are certain prejudices to be removed; but if the company shows a fair amount of persistence, I see no reason why their labors should not be crowned with great financial success.—*Washington, D. C.*

Mr. Goode—I should like to say a word or two about the products to be obtained from the porpoise. It seems to me that the possibilities of this fishery are very great, provided that the number of animals caught is sufficient to make it worth while bringing them into the markets. As regards the food value of the porpoise, I would say that I have tasted the Norwegian whale product—a whale hermetically sealed in tin cases at the London Fisheries Exhibition in 1883, and really it had in some way been divested of its oily taste, and resembled beef *a la mode.* It seems possible, therefore, that some method may be found for removing the oily taste from the porpoise flesh. As to the value of the oil it is undoubtedly so far superior to any other animal oil, that I cannot doubt its coming into general use for lubricating purposes, as soon as it can be sold for a reasonable price. At present twenty-five cents is charged for a bottle hardly larger than one's little finger, and I am not aware that any of the oil is put on the market in a cheaper form. The leather made from the skin of the porpoise is held in high

esteem in Europe for walking boots—especially by Alpine travelers. In London a good pair of such boots is worth fifteen to twenty dollars, nor can they be obtained for less. As you are all probably aware, the leather of the white whale was some years ago used by the Canadian government exclusively in the manufacture of mail bags, being indestructible and impervious to water. These qualities render it a most desirable leather for boots. I am also under the impression that this leather is particularly adapted for belting for machinery and for lace leather. Porpoise leather boot laces are in great favor abroad. I might perhaps enlarge upon what I have said in regard to the special applications of the products of this animal, but am satisfied that they are numerous and may be made of great commercial value.

Mr. H. J. Rice—It will perhaps not be out of place for me to say that at the present time porpoise leather is used to a large extent in New Brusnwick and along the coast of the British Provinces from the St. Lawrence down, and is highly esteemed. I have been informed by Commissioner Stillwell, of Maine, that he uses shoes made of this leather in preference to any others, and I understand that they are quite commonly used in St. Johns and other cities of the Provinces.

Mr. Lyman—In regard to the use of porpoise flesh as food, I find that like many other things in this world, it is a matter of taste. One gentleman in Washington has said that he considered smoked porpoise flesh superior to smoked beef, and another said he had eaten mule and consequently could eat porpoise. We all must have noticed, I think, that among civilized nations the favorite articles of food are the result of a passing fashion, certain conditions, as of nutrition and a fairly agreeable taste, being present. I remember that at one time about a dozen cusk would supply the whole of the Boston market, because there were only that number of families that knew it was good to eat. In external appearance the fish is extremely repulsive. At the present day this same fish commands a very large price as a delicacy. Again, in regard to the whiting of this coast, I have known it thrown away by the cartload because it could not be sold in our markets. On the shores of the

Mediterranean, in France, and generally throughout Europe wherever the whiting is found, it occurs in very great numbers, and is one of the highly prized species. Therefore, I believe that, if porpoise flesh can be made to taste like smoked beef, push and perseverance on the part of this company will crown their labors in success. Oleomargerine is unblushingly sold for butter everywhere, and one gentleman, a member of the U. S. Geological Survey, said he preferred it to butter because it would keep better.

[As Mr. True a few weeks later changed his opinion concerning the value of the flesh of the porpoise as food, I take the liberty of inserting the following from *Forest and Stream*, June, 1885.—RECORDING SECRETARY.]

PORPOISE STEAK.

Editor Forest and Stream:

We live in an utilarian age. An age in which a man anoints his rheumatic joints with the waste products of petroleum, fills his confectionery with the parings of hoofs and horns, and writes his *billets doux* on the pressed pulp of the rags that blow in the streets. Yet the historian of these times will write us down as an unenterprising and wasteful generation. With what abuse we should have loaded the Indian had he trusted for his subsistence to the animals he could tame and rear, and let the unnumbered herds of buffaloes that darkened the plains in the old days go by his lodge unmolested. We should have looked upon his destruction by our pious ancestors as not the least pious of their deeds. Yet we who esteem ourselves so much above the aborigines allow a vast race of food-supplying creatures to disport themselves before our very eyes and make no effort to utilize them. I mean the cetaceans. But you will say that porpoises are not fit to eat, that their flesh is too tough, coarse and ill-flavored. I have said so, too, and that recently before the American Fisheries Society. But I have been converted, and my conversion was in this wise.

On returning from their last cruise on the Hatteras ground, the naturalists of the Fish Commission's steamer *Albatross* captured and brought in on ice two specimens of the common dolphin (*Delphinus*

delphis), one quite young. When these had been properly examined from a scientific point of view, the proposition was made that the younger one be converted into steaks. A number of pieces were cut from the middle of the back, and in a few moments the most promising of them were broiling in fine style before the fire. When they came upon the table they had the appearance of small tenderloin steaks, such as one may have served up in any well regulated restaurant, and the best bull ever bred could have no spot in him more tender than were these same small steaks. But the flavor! Some one has said that the odor of a rose is not to be described. So with the flavor of this porpoise. If I say I was reminded of liver, you will cry out that it was coarse; if I say there seemed to be something in it akin to juicy duck, you will suspect rankness; while if I affirm that there was a suspicion of delicate fish, your thought will be on blubber. But even as in order to know the delicacy of a rose it is necessary to smell one, so if you would know how the flavor of a porpoise steak can combine harmoniously that of a liver, a canvasback and a king-fish, you must eat one.

There are several morals which might be drawn from this simple and affecting tale, but perhaps the most important are these: (1) Take your steak from a young porpoise and (2) have it properly cooked.

If all young porpoises are as palatable as this dolphin of the ancients, it is a pity that so much succulence should waste itself upon the waves, and never a morsel come to relieve our *menu*. The golden age of gastronomy was long ago, and in that time kings and other great persons looked upon porpoise as a delicacy of delicacies. May we not hope that some day our *menus* may again be enlivened by some such phrase as "*Marsouin au Commissaire des Peches*," or "*Dauphin brasille aux Esquimeaux du pole arctique?*"

WASHINGTON, June 8. F. W. TRUE.

THE PRESIDENT: Under the instructions of the Executive Committee, the secretary has written to the private secretary of the President to ascertain if it will be convenient for the President to receive the members of the Society to-morrow morning. An answer has not yet been received, but the Society will be informed of the result to-morrow morning.

It was then proposed and carried to let the reading of papers be continued until Wednesay morning. The Society then adjourned until 11 A. M. Wednesday.

WEDNESDAY, May 6th, 1885.

The meeting was called to order and the reading of papers continued.

RESULTS OF PLANTING WHITEFISH IN LAKE ERIE.

BY FRANK N. CLARK.

After the close of the fishing season of 1884 in Lake Erie, I began an inquiry to ascertain whether there had been an increase or decrease in the catch of whitefish as compared with that of former seasons. The investigation was conducted by personal interviews, through a representative, a practical fisherman, with the leading fishermen and dealers, and covers most of the important fisheries of that part of the lake from Erie, Pa. westward to Toledo, Ohio. The results are most gratifying, as it is conceded by all and shown by the reports, that the aggregate catch of whitefish was considerably in excess of that of any season for several years. The results are especially encouraging to fish-culturists, as all the facts and statements point to but one conclusion, namely, that the increase is due to the planting of young fish from the hatcheries.

No disappointment would have been felt had there been no perceptible increase, as much was required to offset the extensive and exhausting fishing carried on all over the lake, on both the spawning and feeding grounds, which was causing a gradual decrease of the catch. For many years every spawning ground had been literally covered with nets during the spawning season, while hundreds of gill-nets have been employed on the feeding grounds in deeper water, and thrown across the path of the runs towards the spawning grounds. In no other of the great lakes has the fishing industry been pursued with greater persistence and skill than in Lake Erie. Notwithstanding this, however, we find that not only has the decrease been arrested, but that there is a tangible and satisfactory increase.

The figures given below show in round numbers the aggre-

gate plantings of whitefish fry in Lake Erie, from the beginning of the work by the United States and Ohio and Michigan Fish Commissions. Some plants were also made by the Canadian Commission during the years mentioned, but I am unable to give the figures:

Spring of 1875 -	150,000	Spring of 1879 -	7,000,000
Spring of 1876 -	300,000	Spring of 1880 -	7,000,000
Spring of 1877 -	450,000	Spring of 1881 -	13,000,000
Spring of 1878 -	12,000,000	Spring of 1882 -	42,000,000

These figures include the latest plantings that could possibly be called due in the fall of 1884. Under the current method of computing the numbers of young fish in tanks and cans, there is no doubt that the estimates shown in the above figures are much too large.

Following are a number of statements from fishermen and dealers, in substantially the exact language of the parties making them, with regard to the catch and the value of fish propagation and planting :

L. Streuber, Erie, Pa., says ; " Am dealer and shipper of frozen fish, and fish considerable twine. Can give you the figures of my catch for only the past two seasons, which is as follows : Catch of whitefish for 1883, 110 tons; 1884, 150 tons. I believe the propagation of whitefish to be a great help toward keeping up a stock in the lakes ; so much so that I am doing all I can to get a hatchery started here, believing it will pay."

C. D. Carter, another dealer and fisherman in the same city, says : " My catch of whitefish for the past two years is as follows : 1883, 175 tons ; 1884, 225 tons. I think that the planting of young whitefish in Lake Erie has already done a great good toward keeping up and increasing the stock of whitefish in its waters. I hope to see the hatcheries kept up, and would like to see one here in Erie, believing we have a good location for one, and that it is a good point to plant fish from, as there are no carnivorous fish caught at the season of the year when the young fish would be put in."

John Harlow & Co., of Erie, make the following statement : " For the past five years our annual catch of whitefish has

been about 150 tons, until 1884, when it was 200 tons. The increase of fifty tons I attribute to the planting of young whitefish from the hatcheries. I am very much in favor of the planting, and hope it will be kept up, as I am satisfied that it is of great benefit to the fishing interest of the lake. A few seasons since we commenced catching very small whitefish—so small that we had to get smaller-meshed nets, and now we are getting a larger class of fish again."

H. Divel, fish dealer and practical fisherman, also of Erie, says: "I have been fishing for some time, and think the whitefish for the past three years have been increasing. I can give the figures of my catch only for the past two seasons, as follows: 1883, thirty tons; 1884, fifty tons. I think the business of hatching and planting is of great benefit in keeping up the stock; for with the increase of twine, the whitefish must soon be caught off if nothing is done to keep the stock good. There can be no reasonable doubt about the young fish living and becoming full grown. They stand just as good a chance as those hatched naturally, their danger from carnivorous fishes being no greater than those hatched on the reefs."

B. Divel, of Erie, gives similar testimony: "My catch of whitefish has improved for two or three years. The figures for the last two seasons are: 1883, thirty tons; 1884, fifty tons. From the fact that whitefish are steadily increasing in numbers, I believe the hatching and planting of the young is a success, and the cause of the increase."

Charles Joles, of Erie, a gill-net fisherman, says: "I fish gill-nets off Elk Creek. Cannot say how many whitefish I caught in the different years, but know I caught more in 1884 than in any season for several years. I attribute the gain to the planting of young fish at the upper end of the lake. I am satisfied that were it not for this, whitefish would become so scarce that it would not pay to fish for them."

Rudolph Sifield, of North Bass Island, says: "I fish with pound nets and own some gill-nets, but would willingly put the latter in a pile and burn them, if gill-net fishing could be prohibited. Gill-nets are a great detriment to natural propagation,

as they are set on the reefs in spawning time, right where the fish go to breed, and the schools are broken up or driven off entirely, and the eggs are then deposited in the mud and never hatch. Good results may now be seen from fish-planting, but the business has not been carried on long enough, nor on a sufficient scale, to tell what it will do in the long run."

Simon Fox, of North Bass, gives his opinion thus: "Have been in the fishing business for years, and until the past season never believed there would be any results from the planting of young fish. Now I am fully convinced that good results are to be seen, and if it is continued, great results will follow."

Jasper Snide, of North Bass, says: "Our twine caught a few more whitefish in 1884 than in 1883, and I think we should have done still better but for the unfavorable fishing weather, it being so still that the fish remained on the reefs beyond our nets continuously until we got those heavy blows, which drove them off entirely. Formerly I did not have any faith in the planting of young whitefish, but am now sure we can see good results. We now catch a great many of a smaller class of fish, which we never did before the planting was commenced, and if the stock had not been kept up in some other than the natural way, they must have decreased in numbers, and we cannot see that they have in a few years."

George Axtell, of North Bass, states: "Whitefish are increasing in numbers all the time, at least this is true of my own nets, and I feel certain that it is owing to the planting of young fish from the hatcheries. Last fall I caught numbers of small whitefish, such as I never before caught in gill-nets."

William Axtell, practical fiisherman, of North Bass, says: "I know that the planting of young whitefish is a great help to the fishing industry. Would like to see more fisheries put up—enough to take care of all the eggs that could be taken."

Eugene McFall, clerk of the steamer *Jay Cooke*, freight and passenger boat plying between the islands and Sandusky, says: "I think there is an increase in the catch of whitefish, and I suppose the planting must account for it. We carried from the islands in 1883 about 132,000 pounds of whitefish, and in 1884, 170,000, an increase of nineteen tons for 1884."

George Winne, of Locust Point, says: I fish gill-nets on the reefs off Toussaint Point. In 1883 I caught two tons of whitefish from sixty nets, and in 1884 six tons from thirty-six nets. A few years ago it got so it did not pay to go out on the reefs to fish, and I quit and went sailing. Since the planting of young whitefish has been carried on, fish have become more numerous, and I have done very well fishing, but best this last fall. Think if the planting is not kept up whitefish will soon become scarce again. Think a much greater percentage of eggs put into hatcheries will live to become mature fish than those deposited on the reefs by the fish themselves, for the reason that the former are protected from their enemies while hatching, and after the young fish are planted their chances are just as good."

M. Shepherd, also of Locust Point, states: "Am fishing fifteen pound-nets off Locust Point. My catch the past season was about as usual—no material difference. Think the hatching business a good thing, but the proper place for a hatchery is on one of the islands; then the eggs would have the natural water, and when the fish are planted there would be no change from the water they were hatched in to that which they are planted in."

Nelson Parsons, a practical fisherman of Vermillion, says: "I have watched the fishing interests very closely for a number of years, and noticed that whitefish are steadily decreasing in numbers, until the supply was replenished by the planting of young fish from the hatcheries. If something of the kind had not been done, I think that whitefish would, ere this, have become so scarce that it would not pay to fish for them. Formerly we used to catch whitefish of all sizes at the same time, but this season at Cleveland, where I was, the fish were nearly all of one size—looked as if they were all of the same age, and I believe they were a school of the planted fish. I think if fishing is continued it must be done in this way."

Edson & Nichols, of Vermillion, caught one ton less of whitefish in 1884 than in 1883, but say: "We do not attribute the falling off to a growing scarcity, but to the direction and amount of wind, which is everything to us here in the fishing

season. We think the hatching business of great importance, and the only way of keeping up the fishing industry."

Bert Parsons, also of Vermillion, caught no more whitefish in his pound-nets off Vermillion in 1884 than in 1883, but caught double the number in his gill-nets near the islands. He says: "I think if there had been favorable winds for pound-net fishing we would have caught more than double the amount of whitefish in our pound-nets last fall. I know the business of planting has been of great benefit, for in my gill-nets fished about the islands I caught double the quantity last fall that I did the year before. The figures are: 1883, five tons; 1884, ten tons."

Leidheiser, of Vermillion, says: "I cannot give the amount of my catch, but it was rather light, owing to the unfavorable winds we had for our coast. I think the hatcheries are all right, and do a great deal toward keeping up the stock, and that the business should be continued and extended beyond where it now is."

Post & Co., of Sandusky, give some excellent testimony: "Yes, sir; I know that the business of propagating whitefish is a great benefit. In fact, if the United States and State hatcheries were to cease working, I believe it would pay the fishermen and dealers to continue it themselves. I would be willing to be taxed my share for supporting it. I understand that at Erie and Dunkirk a great many small whitefish were taken weighing a pound to a pound and a half, which was never done until the last two or three years, and they increase year by year, which is good proof that they are some of the planted fish.

"I received the fish from 100 pound-nets last year (1883) and from 110 this year (1884), with the following results: 1883, fifty tons whitefish; 1884, eighty tons whitefish.

"Whitefish are not now decreasing; but from the number of pound and gill-nets in use to catch them, a decrease is sure to follow unless the artificial hatching is continued to keep up the supply.

"I am opposed to fishing such long strings of pound-nets, and think the gill-netting needs regulating. The gill-netters commence away down below, off Buffalo and Erie, in deep

water, and fish all summer; then, as the fish move up toward the head of the lake to the spawning grounds, the nets are moved right along with the runs, so that they are hunted almost the year round, which is done with no other kind of fish."

Harry Molyneux, of Sandusky, gives some valuable testimony: "Am a practical gill-net fisherman. A few years ago fishing on the island reefs got so poor that I gave up going there; but in the fall of 1882 I tried it again, and did very well. In the fall of 1883 I caught double the amount of whitefish I did the fall before; and this last fall I caught almost twice as many as in 1883.

I credit all the increase to hatching and planting, and would like to see more hatcheries."

William Rehberg, pound-net fisherman, of Middle Bass Island, says: "Think the hatching a good thing, but the planting has not been properly done long enough to tell really how much benefit it is toward keeping up the supply of whitefish. Think the supply could be kept up in Lake Erie by prohibiting gill-net fishing west of Kelly's Island, which would give the fish a chance to breed on the natural spawning reefs, where the gill-nets are now placed."

Caspar Voight, of Sandusky, says: "My catch of whitefish in the past two seasons was as follow: 1883, from thirty-five pound-nets, thirty-seven tons; 1884, from thirty-five pound-nets, forty-five tons.

"I have not thought much about the hatching business, but it must do some good; at least there seems to be an increase in whitefish the past two or three years."

Simon Schact, of Sandusky, says: "My catch for the past two seasons is as follows: 1883, forty-two pound-nets, forty tons whitefish; 1884, forty-eight pound-nets, fifty tons whitefish.

"I believe the planting of fry to be a good thing, and the only way the fishing can be kept up. I fear, however, that the way the gill-netters are catching them, and going on the breeding grounds and disturbing them while spawning, will do more harm than the hatcheries can do good. The fishermen down at Erie and Dunkirk receive the most benefit from the planting, as they

fish with gill-nets all summer, and are using small-meshed nets every season, on purpose to catch the small whitefish."

Lay Brothers, of Sandusky, say: "Our catch of whitefish for the past two seasons was as follows: 1883, from twenty pound-nets, sixteen tons; 1884, from thirty pound-nets, twenty-six tons.

"We think it is plain to see that there is a benefit to be derived from the hatcheries, and would like to see as many in operation as there are eggs to fill."

Dewy & Co., of Toledo, say: "Our catch the past season was rather light. We do not attribute this to a scarcity of whitefish, but to the unfavorable winds that prevailed on our Monroe coast grounds all the fall until a late date; then just as the fish began to come on, we had two severe blows from the west, which drove the fish from the shore, and they did not come back, or, if they did, we did not get them, as our twine was out.

We think the business of planting young fish an excellent thing; we can see no reason why it should not be, as every fish planted in that way is a clear gain. We see no reason why planted fish should not stand as good a chance to live and become grown fish as those that hatch on the reefs."

Wm. St. John & Co., also of Toledo, say: "Our receipts of whitefish for the past two seasons are as follows: 1883, from twenty pound-nets, 6,000 pounds; 1884, from forty-five pound-nets, 18,000 pounds.

"We do not see that fish planting has been of much benefit to this end of the lake, but I am informed that great benefits have been realized further down.

"We would like to see Congress take hold of the matter and enact a law to control and restrict the fishing with gill-nets; also with such long strings of twine. Although we ourselves are fishing twenty and twenty-one pounds in a string, we would like to see them cut down to six at most on main shore, and not more than three off the islands, or any place where there is a narrow channel. Then the whitefish would have a better chance to get through to the coast and reef-spawning grounds at the head of the lake, which they would do if they were not turned back by the long strings of twine."

J. C. & J. H. Davis, of Toledo, says: "Our catch of white-

fish for the past two seasons was as follows: 1883, six tons, and 1884, from the same number of nets, six and one-half tons.

"Do not know that planting of young fish has been of much benefit to us at this end of the lake, but can see no reason why it should not benefit somebody. Certainly, every young fish put in makes one more chance for a whitefish, as the eggs would be lost if not taken."

E. Alvord & Son, of Sandusky, says: "Our receipts of whitefish for the past two seasons were: 1883, from fifty-two pound-nets, twenty-three tons; 1884, from the same number of nets, thirty and one-half tons.

"Yes, we think that propagation is a good thing and a great help in adding to the supply of fish in the lake. We think the young fry stand just as good a chance of becoming full-grown fish as those hatched in the lake.

"But there ought to be a law to stop fishing with gill-nets, for the reason that down below here, in deep water, where they fish through the summer, it is estimated that at least one-third of those caught in hot weather are unfit for market, and are thrown away, which is an outrage. And then in the fall the gill-nets are set on the spawning reefs, just when and where the fish should be left undisturbed."

Bear & Ruth, of Sandusky, state that in 1883 their catch of whitefish from nine pound-nets, was seven and a half tons, and in 1884, from eleven pound-nets, ten tons.

"The planting of young fish is undoubtedly of great benefit to the fishing interests. Were it not for this the stock in the lake would rapidly decrease."

A. Bremilier, of Sandusky, gives the following figures: Catch of whitefish in forty pound-nets in 1883, sixty-six tons; in 1884, sixty-nine tons.

"I think there is positive proof of the benefit of the hatcheries, from the fact that during late years, say the last two or three, there have been a great many small fish caught—smaller than ever were caught before the planting was commenced in the lake. Another fact to be taken into account is that the facilities for catching are becoming greater every year, and if the

supply had not been kept up in some way, the stock must certainly have decreased, which is not now the case."

A. J. Gustavus, pound-net fisherman, of Huron, puts it in this light: "For every million of fry planted there are a million more chances for whitefish. I think the greatest results are to come, as the business is not yet old enough for us to expect much benefit."

E. D. Smith, of Marblehead, says: "I know the fish-hatching to be a grand thing, for the reason that I have caught thousands of whitefish this season not weighing over a pound to a pound and a half each and formerly never caught them. I believe these small fish are some of those planted from the hatcheries."

Fred Motrie of Port Clinton, says: "I fished six pounds in the fall of 1883, and five in the fall of 1884. Have no record of my whitefish catch for either fall, but know I caught more in 1884 than in 1883, perhaps 20 per cent. more. The hatcheries are undoubtedly a good thing and should be kept up. While the eggs are in the jars they are out of the way of the sturgeon, suckers and all the fish that live mostly by sucking up spawn; and when the young fish are turned loose they will look out for themselves."

Felix Courchaine, also of Port Clinton, says: "I did very well the past fall, in fact the fishing was the best it has been for years. I caught six tons with tweny-six gill-nets. I have every reason to believe that we are getting results from the plantings from the hatcheries; and why shouldn't we? The fry planted in this way stand an equal chance with those hatched in the lakes, and as for taking care of themselves, I think nature will look out for that. I should be sorry indeed to see the hatching of whitefish discontinued."

F. Perry, a practical gill-netter, of Port Clinton, says: "In the fall of 1883 my catch of whitefish from nineteen nets was one ton, and in the fall of 1884, from thirty-seven nets, six tons —six times the catch of the year previous, with double the nets, on the same grounds. I think we are getting great results from the planting of young fish, for before it was commenced whitefish were fast playing out. But now they are becoming more

plentiful again, and I know of no cause for it except the planting of the young in large numbers from the hatcheries."

From all the places named above, as well as other points on the lake, much more evidence of the same kind might be offered; but it would be merely a repetition of what has already been given. Accurate data showing the total whitefish catch of the lake for a term of years, or even for one season, would be almost impossible to obtain, from the fact that many fishermen classify their entire catch simply as "hard fish," "soft fish," etc., whitefish, of course, being included in the former. The statements, however, cover sufficient grounds to form a reliable basis for conclusions. They show that while there was no perceptible increase the past season in the whitefish runs at the extreme west end of the lake, there was a decided increase on the coast and island reefs further down, and a very marked increase in numbers still further down on the feeding grounds, in deeper water, where gill-nets are operated. On the whole, sufficient is shown to prove beyond a doubt that the aggregate catch was greater than for several years, that whitefish are decidedly on the increase in Lake Erie, and that the increase is simply the legitimate result of the work of the hatcheries. The removal from the lake every year of thousands and hundreds of thousands of adult fish, whether taken directly from the breeding grounds or not (the results are the same), must certainly ere this have caused a very material decrease in the stock but for the compensation of young from the hatcheries.

Northville, Mich.

HOW TO RESTORE OUR TROUT STREAMS.

BY J. S. VAN CLEEF.

In 1877 and the two following years, the supervisors of one of the counties of the State of New York lying east of the Hudson River, made appropriations for restocking the waters of the county with fish, and a committee of which the writer was the chairman was intrusted with the work.

The supply of fish from the State was liberal, and in each of the springs of 1878, 1879 and 1880 many thousand small fry of trout were distributed, those streams which had been noted trout streams in the past being especially favored.

In one of these years thirty-five streams were restocked. The fish were deposited under careful instructions, and considerable effort was made to protect the streams, and yet after the most careful inquiry, the committee has failed to hear of any practical benefit resulting from its efforts.

Many of these streams already abounded to some extent in trout, and it was hoped that the protection afforded after restocking would result in a marked increase of the fish; but that hope was not in any single instance realized, and the committee has been irresistibly forced to the conclusion that some force other than excessive fishing had led to the universal depletion of these streams, and that the same cause still existed to prevent their restoration.

After the fullest investigation and examination of these and other streams, I have become satisfied that the destruction of the trees bordering on these streams and the changed condition of the banks produced thereby, has resulted in the destruction of the natural harbors or hiding places of the trout, that this is the main cause of the depletion, and that until these harbors are restored, it will be useless to hope for any practical benefit from restocking them.

By giving a few of the facts which have led me to this conclusion, its correctness will, I think, be made apparent:

1. In the heart of the Catskills there is a natural trout lake of about twenty-five acres. Being too remote for successful protection, which has only been attempted within the last ten or twelve years, it has been for many years the resort of anglers the year round. Trout have been taken in enormous numbers through the ice, which usually lasts until May, and it has been the very paradise of poachers by day and by night. And yet the fish in this lake are substantially as abundant to-day as they have been for the past twenty years, and during all this time there has been no marked diminution of the trout.

This lake is fed by a stream which runs through a quarter of

a mile or more of wet, marshy land, which is so completely covered by large alders that it is almost impossible to penetrate them. In this stream the small fry and fish of one or two years' growth abound in myriads. In other words, the natural harbors and hiding places for the trout in and about this lake have been left undisturbed, and this is the secret of its continued wealth of trout.

2. Thirty or forty years ago a brook in Dutchess county, about five miles long, was noted for the abundance and size of its fish. The angler in the early spring was usually rewarded with a well filled creel, and from this little stream, which a child could jump across, trout were often taken of from one to two pounds in weight. Early in each summer the trout disappeared, only to appear again the next spring in equal numbers; near the center of this stream, it ran through a marsh, which so abounded in black alders that they protected it from approach. Through this marsh the stream was much broader and the water deeper than elsewhere, and the bed was composed of thin, deep mud, making wading impossible. Some twenty or more years ago the owner of this meadow cut down every alder, at the only point where the fish had found a safe refuge, and in a few years the trout, large and small, practically disappeared, and though recent efforts have been made to restore and restock this stream, under full protection, they have substantially failed.

3. In one of the principal streams running through Ulster and Sullivan counties, it has been my privilege to fish many times during the last twenty-five years. Here were two pools which always furnished rare sport, and the adjacent pools were always full of fish. On one of the banks of each of these pools the trees had been left standing, their roots had preserved the upper portion of the bank, but below these roots the ground had been washed away, so that deep hiding places were thus formed for the trout. It was very seldom that one or more large fish failed to rise to the fly at these points.

Some twelve or fifteen years ago these trees were removed, the stumps decayed, the bank fell in, the fish no longer had a refuge, and since that time the angler has been fortunate if he has raised a fingerling at or near either of these points.

The conditions as to the waterflow are still relatively the same in all three of these waters, the spawning grounds are unchanged, the only difference is in the harbors for the trout, which are unchanged in the first, totally destroyed in the second, and partially so in the third. And the depletion of the fish has been in precise proportion to such destruction.

Lest these may be regarded as somewhat isolated cases, I will cite two more.

Near the center of Dutchess county a brook rises in the side of a small mountain, at the base of which it enters a swamp through which it runs, with occasional openings for two or three miles, where it iscompletely protected by the trees and bushes, which have never been disturbed. In these open places and below this swamp, where for a distance of several miles there are but few places where the stream cannot be reached, it has been and still is freely fished, and yet there has been no serious diminution in the number or size of the fish. While other streams have failed, this one has always yielded good sport, trout of from one to two pounds being frequently taken.

In the eastern part of the same county there is a long, sluggish stream running for miles through a marsh. Its very name, "Swamp River," indicates its character. Its bottom is one long stretch of ooze; its banks are almost everywhere covered with a dense growth of bushes. It has always been noted for the size of its trout, but on account of the difficulty of access they are seldom taken. It is fed by several tributaries of three or four miles or more in length, as well as numerous little streams, all of which are open and freely fished, and they are all good trout brooks.

As soon as the water in these brooks becomes low, the trout disappear, but where? The water flow is increased by the generous rain, they appear again in large numbers, and at such times large fish is often taken even in the smallest tributaries.

This last instance is especially interesting, as it shows that when the streams are full of water the trout will travel a long distance from their haunts, and that when warned of danger by the receding of the waters, the instinct of self-preservation leads them to hasten back to them.

Unfortunately very many of our most noted streams are not favored with lowlands and swamps, where the fish can find safe refuge, and in these and our mountain streams especially we must unquestionably lookto the larger pools in time of drouth, as the principal places of refuge for the trout, and when these are accessible from every point, the trees are cut and the banks fall in, so that every pool assumes about the shape of a huge wash basin. No system of protection will prevent their being dragged with nets in the night, or the commission of other depredations almost equally destructive of the fish.

I have the most abundant proof that fishing with nets has been constantly done in our finest Catskill streams, such as the Beaverkill, Neversink and Rondout, and where the trout cannot take refuge under the banks, they must necessarily be taken by the net.

I have not referred to the foregoing facts as in any wise new, nor in the belief that they may have escaped the observation of anglers; but rather that their significance has not been generally understood or appreciated.

When the trout become scarce, the reason most commonly given and accepted is that "the stream is fished out."

It is not the rod, however, but the axe and the net that have ruined and are ruining our streams.

The natural homes of the trout are the sluggish waters of the swamp, cold and pure, with their bed of ooze and sheltered bank, or in our upland streams the deep cavities under banks or roots.

We have destroyed his home, and he has perished. Let us restore it to him again, and he will thrive.

I believe it possible to restore most of our streams, where the waterflow has not decreased too greatly, especially when they are under the control of clubs or associations who can and will make the effort.

The remedy which I suggest is briefly as follows:

First—Prohibit the further destruction of either tree or bush upon or near the bank of the stream.

Second—Where the soil is wet and suitable, protect the pools by an abundant growth of alders or other bushes.

Third—Plant trees on the banks wherever feasible, especially

where their roots will protect the surface of the ground, and at the same time permit the washing away of the soil underneath, so that large hollows may be formed as hiding places for the fish.

Fourth—In each year, after the spring freshets are over, protect every pool as far as practicable by placing stumps, or trees or bushes in them, so that fishing with nets will be impossible. And also that the trout may be provided with artificial harbors until the natural ones are again restored.

Fifth—As far as possible prohibit fishing with bait, so that the haunts of the trout may be safe against invasion by the hook.

Let the home of the trout be regarded as his castle. Entice him from it if you can, but do not invade it.

Poughkeepsie, N. Y.

DOES TRANSPLANTING AFFECT THE FOOD OR GAME QUALITIES OF CERTAIN FISHES?

BY A. N. CHENEY.

This rather imposing caption opens a wide field with many ramifications, and I cannot hope to do more than skirmish around the edges of the subject, but hope thereby to induce others to give from their personal knowledge that which will cover more of the field. In one sense it is not a new question to the members of the American Fisheries Society or the writer, for the effect of food upon our game fishes has been discussed, and it is a self-evident proposition that a well-fed fish, transplanted or otherwise, makes the best food fish; therefore, it is safe to say that if fish are taken from lean waters and planted in fat waters, their food qualities will be improved.

In another sense, the effect transplanting has upon the game

qualities of our game fish I do not remember to have read of being discussed. The question has been asked me a number of times, in one or both forms, by angling friends, and quite recently the matter was again brought to my attention by a letter from a gentleman of long and varied experience as an angler, who asked if I had found the black bass gamer on the hook in waters to which they were alien, than in waters to which they were native; and he answered the question from his own experience, by saying he had so found them. To me it seems a case of cause and effect, for an abundance of food and game qualities are inseparable, and go hand and hand to produce this desired result. I never caught a half-starved fish that exhibited marked game qualities on the hook, and the test of gameness is accepted as the power of a hooked fish to fight or resist capture by the angler. I don't believe a fish can fight on a stomach that is habitually empty any better than a man whose stomach is in the same state, for there is a heap of courage in a good dinner, which is increased by the knowledge that the good dinners are to be a regular thing in the future.

I can, perhaps, do no better than give a few results of fish transplanting that have come under my own observation, and I do so, looking with the eyes of an angler rather than with those of a fish-culturist.

Before going further I might answer the question asked by the friend above mentioned, by stating that the gamest black bass that ever I caught were taken from waters to which the fish were native, and I never caught black bass that were in better condition than these same fish. I have taken bass with more fat, but it was abnormal fat that took away the dash and vigor that characterize the bass, and the angler had to overcome but little more than the avoirdupois of the fish; but the loss to the rod was a gain to the gridiron.

Saratoga lake black bass stocked Effner lake. Effner lake bass stocked Schroon lake, Luzern lake and the Hudson, Schroon and Sacandaga rivers. It would not be just to compare lake bass with river bass; but Saratoga lake and Schroon lake bass are gamer than Effner lake bass. There is, apparently, little difference in the temperature and clearness of the

water in these lakes, but Effner lake seems to have the poorest supply of fish food. Lake George black bass stocked Long pond, and afterward Long pond stocked Round pond. Long pond bass are least gamy of the fish in the three waters, but they are far the largest. Long pond is just a mass of fish food, and the water is warm and thick. On the contrary, Round pond, forty rods away, is a great spring of clear, cold water, lacking outlet or inlet, with an abundance of fish food, and the bass therein, while not exceeding in size the Lake George bass, fight like fiends when hooked.

Without further multiplying instances, I think it prudent to say that when black bass in alien waters are found to possess superior game qualities, it is because they have found better pasturage or better water than in the homestead.

Hudson river pike (*E. lucius*) were used to stock Schroon lake and river, and both furnish pike of greater growth than the parent waters, but one cannot compare their game qualities, for they have none.

It is natural, perhaps, that the quiet lake waters should be more conducive to aldermanic proportions in the pike than is the rapid river water, but a recent local newspaper states that Schroon river has produced a larger pike than the lake.

Oneida pond was also stocked with pike from the Hudson, and it has yielded these fresh-water sharks of greater size than those from any of the other waters I have named. The pond is small and the pike soon cleaned out the food, and then commenced a warfare of the survival of the one with the largest mouth. The large fish have been caught, and those that remain are all of the same size, with the clefts in the mouth yearning to extend back to the dorsal fin.

I have somewhere seen a statement, and I think it was in one of the reports of the New York State Fish Commission, that whenever the New York lakes containing a remnant of lake trout have had a contribution of lake trout fry from the great lakes, the addition or deposit has increased the average size of the trout in such waters. This, at least, is the idea that has been fixed in my mind from reading the statement; but I do not think that it was coupled with, or contingent upon, an ad-

ditional supply of fish food. I have closely watched this improvement in the trout of Lake George, New York. Before the lake was restocked by the State, the trout were very poor and small, and because of the gradual taper from their heads to their tails were called "wedges" by the fishermen. I do not know as they appeared starved so much as they appeared dwarfed. Every spring during the trolling season when the trout were "on top," quantities of small whitefish were seen at the surface of the water, so the lake was not entirely barren of food for the native trout. Five years after the State made the first deposit of trout fry, it planted some whitefish for trout food. There was a marked improvement in the trout almost from the first planting of fry, and each year since the average in size of the catch has been larger and the condition of the trout better. I have often wondered if this was entirely owing to the food, for the anglers can discover no increase in the whitefish fry on the surface in the spring.

In other words, does not the fresh blood or out-cross improve the natives and leaven the whole. Among the mammals, this fresh blood is sometimes necessary to prevent a "going to seed," and even man in families of high degree deteriorates or "peters out" occasionally from too much blue blood and not enough red. I know it is presumption on my part to intimate that there is any affinity between the workings of warm blood —particularly the blue kind—in man, and the workings of cold blood in fishes, and I only do it to ask the scientists here gathered together, if it is possible for the infusion of fresh blood to act upon and improve and strengthen fishes that have been in breeding for ages in circumscribed waters. Whatever scientists may say about the infusion of fresh fish blood, which would apply only in certain cases, I am satisfied that fish in alien waters improve in food and game qualities only when they find better feed or better water, which causes a more vigorous condition, which is the gameness desired by anglers.

Glens Falls, N. Y.

Mr. MATHER—The observations of Mr. Cheney correspond with those of others who have given attention to this subject.

As a rule, a transplanted animal does either better or worse than if left in its native place, especially if carried to a considerable distance. The brown trout, *Salmo fario*, of Europe, grow rapidly here, while our eastern trout, *Salvelinus fontinalis*, have made rapid growth in Germany. The German carp is another instance of rapid growth after transplanting, for in America they have far exceeded their growth in their native land. I do not know the history of the black bass in Saratoga and Effner lakes, to which Mr. Cheney refers, and which he claims stocked the Hudson. I have been under the impression that the first black bass in the Hudson river came down the Erie canal when it was opened, some fifty years ago ; but they have never increased much below Troy during this time.

ON SOME OF THE PROTECTIVE CONTRIVANCES DEVELOPED BY AND IN CONNECTION WITH THE OVA OF VARIOUS SPECIES OF FISHES.

BY JOHN A. RYDER.

MR. PRESIDENT AND GENTLEMEN : A discussion of the apparatus by means of which the ova of fishes are protected will, I think, be of interest to the members of this society. I will roughly classify the eggs of fishes into four divisions, and call one of the groups "buoyant eggs," another "adhesive eggs," another "suspended eggs," and the fourth "transported eggs," the latter class embracing such as are hatched in the mouth or in receptacles especially developed on the outside of the abdomen or under the tail of the parent fish—usually the male—in nests built by the males, or viviparously developed in the ovary of the oviduct of the mother.

The egg of the cod will serve as the type of the first group. It is without an oil-drop, but is buoyant notwithstanding. There

is another type of buoyant egg, similar to that of the cod, but with an oil-drop opposite the germinal pole, where the embryo develops, consequently the egg is rendered buoyant. That type is represented by the eggs of the Spanish mackerel, of the bonito in the Chesapeake bay, and of the cusk and a number of other marine fishes.

The second group, which I have called adhesive, is represented very well by the eggs of the goldfish, which adhere singly to plants and weeds. Other species whose eggs are similar to those of the goldfish, are the blennies, which lay eggs in radiating adherent groups. The gobies have a curiously shaped oval egg, almost conical at either end, with tufts at one of their tips. These tufts seem to be made up of small filaments. In other species, too, the eggs are adherent, as is the case with those of the cunning little *Gobiesox*. In other cases the eggs are held together in enormously extended bands or membranes, which float, as in the case of the goosefish or fishing frog. Yet other eggs are held together in narrow strips, and adhere together by means of an exterior mucous or sticky envelope, just within which again is a very thick, elastic, perforated membrane, as the eggs of the yellow perch. This sticky substance glues the round eggs together at their points of contact, leaving spaces between the ova, enabling the water to pass directly through the openings which are thus left in the bands of eggs. This form of band of adherent eggs is found in the yellow perch, in contrast to which may be cited the white perch, whose eggs adhere by a mucous secretion which seems to glide down on one side to the point where the attachment takes place, and where this mucous substance hardens under water, firmly fixing the egg to the foreign bodies.

The eggs of the slime-eels or hags, which are parasitic upon the cod and on sharks, are also peculiar. These eggs are supplied with a bundle of hooks at each end. I am not sure of the special function of these hooks, but it is probably for suspending the eggs in some way. There are other cases in which adherent eggs are held together in large masses as thick as a man's hand, or they may be spread out over a flat surface. This is the case with the eggs of the catfish. In these, however, we find

a contrivance which is peculiarly adapted for protecting the eggs against the violent motions made by the male who ærates, attends and incubates the eggs. In these eggs there is an inner true egg membrane, and an exterior mucous adhesive layer, separated from the inner one by elastic pillars, placed at intervals, so that the resulting arrangement is an extremely elastic one, and yields readily to the motions made by the male with his fins. In this case the eggs adhere together in masses very much the same way as in the eggs of the frogs.

There is yet another singular contrivance, which was first described by Professor Jeffries Wyman, of Boston. This is found in a species of the armored catfish of South America. In this case (*Aspredo*) the male fish is provided with a numerous series of little stalks, formed on the under surface of the abdomen, and the cup-like extremities of the stalks into which the eggs are received are supplied with capillary vessels, an arrangement being thus developed which constitutes not only a supporting stalk, but also a kind of placenta. It is said—although I am not sure that the evidence is very trustworthy—that one species of the gar lays its eggs in strings in a single row, like the common toad. There are other cases in which the ova are uncovered and directly adherent to the abdomen or under side of the tail, as in the case of some of the pipe fishes of Europe. In some of our American species of pipe fishes the eggs adhere beneath the tail in a couple of rows, but are covered by expanded folds of the skin. There are other cases in which the eggs are carried into a pouch formed by the ventral fins. In other species there exists an abdominal or rather caudal pouch which opens just behind the vent of the male, and into which the eggs are received and incubated. In one instance a fish of this class (*Hippocampus*) hatched out under my observation about 150 ova; the drove of embryo sea horses which were finally set free in the aquarium, were an interesting study.

Then the number of species which suspend their eggs is quite considerable. The black, leathery case of the common oviparous ray has four filamentous horns, one at each corner, which wind around plants and suspend the eggs to weeds, so that as the tide sweeps by these horns, which have openings in them,

fresh water is carried into the case to aerate the embryo and favor its incubation. This peculiar egg case is formed in the end of the oviduct, which is different from the egg membrane occurring in any of the true bony or Teleost fishes, since it is formed of horizontally interwoven fibres. The egg case of the cestracion, or Port Jackson shark, is formed in the same way, but instead of being flat and quadrangular, is twisted into a spiral. I am not positive, however, that the eggs of the Port Jackson shark are suspended. Another type is found in the *Scombere-socidæ*, in which the entire egg membrane is covered with strong filaments, which wind round each other and intertwine with the similar filaments of contiguous eggs, which are consequently, held together and suspended, sometimes in masses several inches in length, such masses being commonly found in great numbers hanging to the meshes of pound nets during July and August. The egg itself measures one-eighth of an inch in diameter. There is another somewhat similar type in which the egg is very much smaller. This is the egg of one of the commonest fishes found in the waters tributary to the Chesapeake bay, viz., *Menidia*, one of the *Antherinidæ*. They are provided with four filaments, attached to one side of the egg, by which they are in like manner suspended and held together in strings. Again, there are still other types in which the ova are hatched in the mouth, as in the case of *Arünæ*, or marine catfishes. Their eggs are very few in number, but they are as large as those of a robin. Some of the smaller blennies take advantage of a dead oyster shell in which to conceal and deposit their adherent eggs.

There are yet other cases in which the male builds a nest. One of the most extraordinary instances of this kind is the common four spine stickleback (*Apeltes*), which I described four years ago. The male, which is much smaller than the female, has a pouch on the right side of the rectum, from which is poured out a viscid secretion, and which is spun out into threads fitfully by the animal, as he goes around a bunch of water weeds like a bobbin to build a little basket-like nest for the eggs. After he has induced the female to oviposit, he tends the eggs very faithfully until they hatch. Some investigators go so far as to say that after the eggs are hatched, the male stickleback will

follow the young ones which leave the nest too young to take care of themselves, and put them back in the little cradle in which they were born, to thus prevent their being prematurely devoured by other fishes. At one side of the eggs of the stickleback there are minute button-like excrescences. These are also found on the eggs of European species. One of the South American catfishes (*Callicthys*) also builds a nest, but the nature of it I am not familiar with. The male of the paradise-fish ejects from its mouth bubbles of mucilaginous matter, which floats in the form of a cake, and on this the eggs are deposited and hatched out. The *Antennarius* and the fishing frogs of the deeper ocean deposit their eggs on floating masses of sargossa weed.

We are, of course, all aware of the number of forms of salmonoids which prepare beds for the better protection of their eggs. The same may be said also of the black bass, sun perch and lampreys.

I also wish to call your attention to the physical behavior of different species of ova as seen in several groups. This consists of the disposition manifested by certain types of eggs to place the germinal disk in some particular position with reference to the yolk. This disk is directed almost downward in light or buoyant eggs. In the case of the salmon, whose eggs are very heavy, the disk rests on the top of the yolk, and the larger oil drops lie just underneath the germinal disk. In the case of the shad the germinal disk always lies at one side of the yolk, no matter in what position the eggs may be placed. The buoyancy of the oil drops in the salmon's egg keeps the germinal disk directed upward. In the Spanish mackerel its buoyancy keeps the disk directed downward. This peculiarity has some physiological significance, but I do not know what it may be, unless it be for the purpose of the better protection of the egg, so that the embryo may have a better chance to survive.

It was remarked yesterday in Mr. Mather's paper that the eggs of the smelt were remarkably hardy and would stand usage which other ova would not. This calls to my mind the capacity which some eggs have for resisting adverse conditions. There are species which, in order to hatch them out successfully, it is only necessary to change the water once in three or four hours, as, for

example, in the case of the stickleback. With the shad this method would not answer. Nor could the ova of salmon be successfully hatched out by such treatment. What I have said on this point shows, I think, that there is a great difference in the power of resistance to adverse conditions manifested by different species of eggs under similar conditions. In the case of the silver gar, for instance, I had at last only three eggs with which to work out the later stages of development, and, although I had them under the microscope fully twenty successive times, each time brushing off the accumulations of filth which would lodge among the filaments covering the egg membrane, yet during all these manipulations the normal development of the embryos remained unimpaired.

I will call your attention to the viviparous types. The one which I have worked out most fully is the genus *Gambusia*. The parent fishes were from 1⅛ inches to 1¾ inches in length, and are found along the Chesapeake bay and its smaller southern tributaries. This is a fresh-water, or at least anadromous vivaparous species, spawning in July and August. The ovary is lodged in the body cavity, and the vessels pass backward to it, like the subdivided stem in a bunch of grapes to the single berries, each one of the follicles in which the single eggs grow receives a twig from the main vessel and is covered with a network of vessels, which branch off from the main twig which enters it, and just at the point where the vessel enters the single follicle, there is a large round opening which answers to the micropyle of the ordinary fish egg laid directly in the water. The egg of *Gambusia* is, however, without a true egg membrane, the thin vascular follicle takes its place. The little fish develops within the follicle, in which fertilization also takes place, the spermatozoa finding their way to the egg through the round pore in the follicle spoken of, the male conveying his milt into the ovary by means of an actual copulation with the female by means of his prolonged anal fin. The development goes on until the fish becomes active and the yolk-sac is aborbed. The young fish then ruptures the follicle in which it is imprisoned, and slips out through the abdominal pore, perfectly capable of taking care

of itself. Not more than twenty or twenty-five individuals are produced at one spawning.

In another type, *Anibleps*, a form described by Professor Jeffries Wyman, the yolk-sac itself is covered with villi, and, strange to say, continues to grow for some time after the yolk has been absorbed, but the reason for this I am at a loss to understand. It may, however, be that the function of the empty yolk-sac is in this case somewhat similar to that of a placenta.

The eggs of the surf perches of the west coast are developed in membranous curtain-like folds of the upper wall of the ovarian sack. These membranes have a longitudinal direction, and after the female is pregnant, and the embryos are somewhat advanced in development, they hang down between the embryos, the latter being packed into the ovary somewhat like sardines in a box. The peculiarity about the development of the young in the ovary is that the vertical fins of the fœtuses soon acquire an exaggerated development and have a special set of blood vessels sent to them, the fins also develop marginal prolongations which become highly vascular, but afterward atrophy. This arrangement, as well as the highly vascular skin of the fœtuses, clearly has relation to the respiration of the embryos while in the ovary. Another peculiarity about this type is the enormous development in the embryos of the back part of the intestine beyond anything I have found in any other kind of fish embryos. This hypertrophy of the intestine is of transient character, because this structure afterward gradually diminishes in proportional size, and acquires the relative proportion in respect to its diameter found in the adult fishes in which there is no such an exaggerated development of the intestine. The earlier writers, Girard and others, who described these forms, mistook this projecting back part of the intestine for a yolk bag. The fact, however, is, as we know from the figures which are in existence, that this was not a true yolk bag, but merely the intestine developed as I have described it to you, with its terminal part thrust down and backward, so as to project below the abdominal profile, somewhat after the manner of a yolk bag.

Washington, D. C.

THE USE OF THE THROWING STICK BY THE ESQUIMAUX.

Everything that exists should have a reason for its existence; so I must tell you why I am before you to-day. Prof. Goode, the assistant director of this museum, came up on my balcony the other day, and asked me if I would not read a short paper to you on some one of my studies connected with fishing among the savage people of the world. So it is at Prof. Goode's request that I am here this afternoon, to say a few words about the use of the instrument known as the throwing-stick by the Esquimau in fishing.

In the east north range of the National Museum you will see many specimens of modern apparatus for capturing fish, and probably in the next case you will see the savage apparatus for the same purpose; and you will be astonished over and over again at the similarity between the modern and savage forms.

Scarcely a week passes in which some patent office examiner does not come to the museum to examine the collections to see whether that for which a patent has been claimed is not merely a duplicate of something invented years and years ago. Patents have been claimed for things used in the days of Abraham, Isaac and Jacob.

One of the most interesting implements invented by savages is the little wooden instrument which I am now going to show and explain to you.

In southwestern Greenland, the eastern part of Labrador, mouth of the McKenzie river, Point Barrow, Bristol bay, Norton sound and Kodiac island this instrument is in use. From Sitka to Columbia river grow the great cedar trees, out of which these immense dugout canoes are made, in which the navigator carries a long spear, twelve or fifteen feet in length, and on the end of that a harpoon used for whales.

The Esquimau almost lives in his kyak or skin boat, and is so securely fastened in that any accident to the boat is certain death to him. Were he to use his spear alone in making a lunge, he would overturn his boat and expose himself to greater

danger. So he is compelled to make use of some means which will both answer the purpose of giving the required force to his spear and avoid the danger incurred without its use. He cannot use the bow in giving the required force to the spear, necessary in harpooning the seal. It is very difficult to use either a bow or firearm in a boat. So he is driven to the use of this invention, happily hitting upon the device of the throwing-stick.

The principle upon which the instrument is used, is this: The fisher takes the throwing-stick in his right hand, usually with spear firmly pressed down in the groove of the stick with the fingers. He then brings it up, throwing it a little back over the right shoulder. There is a little hook, generally of ivory, at the upper end of the groove of the stick in which the spear rests, which fits in a notch made in the end of the spear. After getting the weapon in position, without moving his body, he gives a swift and abrupt motion forward, the spear darting from the throwing-stick with great rapidity, the fingers having been raised to allow its passage.

An interesting fact has grown out of the study of the throwing-stick, namely, that it is in use in only three different regions of the world: In Australia in a very simple form, with a hole for the forefinger; in South America and among the Esquimaux of North America. In those three localities alone is it used.

I shall give you a brief description of some individual specimens, and let you look at the others when I am through talking. We will commence with this one from Greenland (showing specimen). There is a groove for the spear, notches on opposite sides for thumb and forefinger, a small hole midway in the groove, near the notches, for a peg, which is inserted in the shaft of the spear. Instead of a hook at the opposite end, there is an oblique hole in the ivory, into which another peg near the end of the spear fits. The next is from Cumberland gulf (showing specimen). Very clumsy and roughly made, a groove for the spear, a hole for the forefinger, a notch for the thumb, also three notches on opposite side for the fingers. A goose-spear is also used with this one, which when thrown at the goose just as likely hits the gander. Ungava bay (showing specimen).

Shaped very much like a fiddle-head; a hole for the forefinger. The bend is a great advantage to the hunter, as it increases the facility of launching the weapon, and a spear, when used with this, will go a great distance. Mouth of McKenzie river (showing specimen). Most primitive of all the collection, a very rude furrow for the spear, a hole for the forefinger.

The Anderson river is the dividing line between the eastern and western Esquimaux. From that line going westward and southward the throwing-stick improves very rapidly. The form begins to greatly resemble the razor strop handle, with hook or peg at the end of the grove for catching the notch in the end of the spear, groove, hole for the forefinger, notch for the thumb, and in some instances ivory pegs are inserted, thus making spaces for the fingers, affording a better grasp.

In Alaska, great headlands project out into the water, thus creating barriers among the people and causing sharp dividing lines and differences in the forms and degree of elaboration of the throwing-stick. After passing the Island of Nunivak, the finger hole disappears, and is not again seen until we come to Kodiak island toward the east. From one of the Aleutian islands we have a left-handed throwing-stick with hole for the forefinger, and another left-handed specimen from Nunivak, razor strop handle, no hole for forefinger, thumb notch and pegs on opposite side making finger spaces.

I will not try to tell you how far back in the past this invention must have been made. References are made in old classical literature to one or two forms of contrivances for giving additional force to weapons used in throwing or darting, and I think probably this device is the descendant or offspring of something of that kind for giving additional momentum, rather than a transformation of the bow.

By using the throwing-stick with the spear, the force is given to that weapon which the bow gives the arrow, or the sling to the missile thrown. So that this little instrument lends its aid in the three regions mentioned, supplying a great need, probably to be met by no other means.

Washington, D. C.

THE CHIEF CHARACTERISTICS OF THE NORTH AMERICAN FISH FAUNA.

BY PROF. THEODORE GILL.

I do not think that I can appropriate the time which I was requested to devote to a communication for your society more profitably, than by inviting your attention to some of the characteristic features of the North American fish fauna.

If we include the marine as well as the fresh-water fishes in our study, we would have to consider the constituents of four primary different geographical divisions or realms, and we are therefore compelled by the limits of time to restrict ourselves to the consideration of the fresh-water forms alone. America, north of Mexico, forms a primary terrestrio-aquatic realm which has been variously designated as the North American, Nearctic and Anglogæan region or realm. It is one of the very richest of all in fresh-water types, considerably over six hundred species living exclusively, or nearly so, in the rivers and lakes, and these represent nearly one hundred and fifty genera and about thirty-four families. It is a large exhibit compared with the fauna of any of the other realms.

If we notice the constituents of this North American fauna, we find that they may be segregated into two primary categories. A considerable number of the families are shared with European and Northern Asia, and many may be designated as the Arctogean, while an exceptional number of families are peculiar to our continent. Those peculiar are the Amiidæ, Hyodontidæ, Percopsidæ, Amblyopsidæ, Aphredoderidæ, Elassomidæ and Centrarchidæ, and several well-marked sub-families are also limited to the regions. Such are the Campostominæ, Exoglossinæ, Plagopterinæ, Etheostominæ, Haploidinotinæ and Hysterocarpinæ. It is possible that even the Lepidosteidæ are at present peculiar, but Dr. Bleeker has named as such a species, based upon a Chinese drawing of a fish supposed to have been obtained in China. Fifteen families represented chiefly by marine species, but with members also in the fresh water, are the Petromyzontids, Silurids, Clupeids, Dorosomids, Argentinids, Sal-

monids, Cyprinodontids, Anguillids, Gasterosteids, Atherinids, Labracids, Sciænids, Embiotocids, Cottids and Gadids, and among these we find the families which are represented by the same genera in both the old and new worlds.

The fresh-water species and even the genera of most of these families are, however, to a large extent, peculiar to the interior waters; of the others, (1) some are anadromous, like certain of the Salmonids, Clupeids and Labracids; (2) others inhabit fresh and salt water almost indifferently, as the Dorosomids, many Cyprinodontids, and most Gasterosteids, and (3) one (the eel) perhaps should be considered as a salt-water rather than a fresh-water species, inasmuch as it is catadromous and appears to breed only in the sea. Conversely, these fishes which resort to fresh water to spawn and therein spend their early days may be considered to be fresh-water forms. If all species which, to some extent, run up into fresh water were included, the list might be very greatly increased, and it is by this inclusion of these species running up into fresh water that the faunas of other countries have been unduly enhanced.

If now we consider the bearings of the known facts, we may deduce the following conclusions:

(1) The number of family types peculiar, or almost peculiar, to North America and the very large number of genera also confined to the temperate and cold regions of the continent, indicate that the region specified has such characteristics as to entitle it to be considered a primary geographical division of the globe, which will appropriately bear the name of the Anglogæan realm, inasmuch as its habitable portions are occupied by the largest portion of the Anglo-Saxon race. Several of the families peculiar to this realm are almost coincident in their range with its limits, and such coincidence is especially manifested in the case of the family of Centrarchids.

(2) If we compare the constituency of our ichthyic fauna with that of the Eurasiatic realm, we find several notable contrasts. The North American is distinguished by the great development of Acanthopterygian types, while there are few in the Eurasiatic one. North America has as many as 180 species, while nineteen are all that have been credited to Eurasia. The Centrar-

chids and certain little fishes related to the perches, which have been distinguished as Etheostomines, are very characteristic for the American fauna, and are among the most prominent features, while those types are entirely wanting in Europe. The catfishes so abundant in America, and of which there are at least twenty-six species, are represented by only one in Europe, and even that one is of an entirely different type.

Another noteworthy contrast is exhibited by the Cyprinids. The species of Europe and Asia are almost all of large size, and are the most conspicuous fresh-water fishes of that region, whereas the American species of the family are almost all small and even of minute size, and (if we except the Pacific slope, which has features in common with Eurasia) there are not more than a couple of what can be called large species of the family in the entire region. It is indeed to a related family, the suckers or Catastomids (entirely wanting in Europe proper), that we have to look for analogue of the European Cyprinids. Among them we havs forms equalling in size the European carp, barbel and others, and some quite similar in superficial appearance. Summing up all the species we find that Europe has been accredited with 360 fresh-water fishes, while the North American fauna has at least 625.

The number of the genera common to North America and Europe is indeed extremely few, and the idea suggested by some recent authors, that the North American fauna is merely a subdivision of a common Arctogean, Triarctic or Holarctic realm, is entirely traversed and negatived by the fish fauna.

It is also especially noteworthy that a number of the types peculiar to America are distinguished by the care which the parents take of their young; whereas the European forms are generally indifferent to the future progeny, and after spawning, leave the eggs to take care of themselves. In this connection it may be recalled to the American Fisheries Society, that the care of the eggs and young is accompanied by an apparent diminution of the number of eggs, and we have a sort of analogy in this respect to the relation between fish-culture and nature. The fish-culturists assume the parts which, in nature, is exercised by the attentive parent, and the eggs and young being pro-

vided for, stand a less danger of destruction, and consequently in such, the ratio between the eggs laid and fertilized and the young matured, is very much less than that between the number of eggs of the indifferent parents and that of other progeny matured.

SOME OBJECTIVE POINTS IN FISH-CULTURE.

BY M. M'DONALD.

I do not propose in this paper here presented to the consideration of the members of the American Fisheries Society, either to describe the apparatus, discuss the methods, or estimate the results accomplished by the work of artificial propagation and planting of fish in the inland, river and coast waters of the United States.

These topics have been and will be discussed during the progress of our meetings, by gentlemen much better qualified to instruct and interest you than I profess to be.

Your attention is invited not to what fish-culture has already accomplished, but rather to what remains to be done, before we can consider its mission ended.

It is proposed, as briefly as may be, to indicate the objective points yet unattained, toward which our efforts, energies and investigations should be directed, and to suggest some of the agencies which must be invoked, and which must co-operate in dealing with the important question: How shall we restore our inland, coast and ocean fisheries to their former abundance and maintain them at a maximum of production?

Less than a generation ago fish-culture was an art rude in appliances, crude in its methods, sentimental rather than practical in its aims, and insignificant in its results. To-day it confronts us as an industrial and economical question of the first rank—too grave in its issues, too vital in its relations to be ignored or disregarded.

In its inception, the artificial propagation of certain species of *Salmonidæ*, with the view of planting them in depleted streams in which the species was native or indigenous, was the aim and limit of fish-culture as then understood and practiced.

The fish-culture of to-day, broader in its aims, grander in its achievements, more rational in its methods and infinite in its possibilities, finds in the artificial propagation and planting of fish but one of the means to an end. This resource places at our command, in measure without stint, the seed of the harvest; we may scatter it broadcast in rivulet and river, in pond and lake and tidal waters, but whether the seed thus sown will grow and ripen to a full fruition depends upon conditions which must be studied, interpreted and defined, and where unfavorable, modified or eliminated.

We should be prepared, therefore, to appreciate and provide for the wide range of inquiry and investigation we, as a society, are called upon to suggest, to foster, or to inaugurate.

PHYSICAL AND BIOLOGICAL INVESTIGATIONS.

Each species with which we have to deal has a life history of its own. In its manner or mode of reproduction and development, in its habits, food and habitat, it is in essential relations to its environment. Our success in repopulating our rivers with species indigenous to them and in acclimating in new waters species which are valuable for food or sport, will be measured by the fidelity and precision with which we study, interpret and apply the lessons taught us by the naturalist, the biologist, the physicist and the chemist.

It should be the business of this society to enlist in its service or to invite to co-operation in its work, all those whose intellectual activities find occupation and engrossment in studies and investigations which may seem to the casual observer to have no practical application, but which are just as essential to the accomplishment of the work we have set before us, as is the artificial propagation and planting of fish; for upon the right interpretation of such investigations depends success or failure in the practical work of fish-culture.

The biologist with his microscope, is needed to reveal to eye and comprehension the marvellous story of embryonic development, and interpret and define the conditions which are favorable or unfavorable. With the thermometer in hand, the physicist marks out the paths traversed by the wandering schools of fish in the pathless ocean, and circumscribes the limits beyond which they may not pass.

With balance and reagents, the chemist appreciates those infinitesimal differences of salinty or composition which may or do determine the presence or absence of certain species in certain areas of water. Nearly all departments of science may be, indeed must he, laid under contribution to furnish us the data upon which to build our conclusions.

REGULATION AND PROTECTION OF THE FISHERIES BY LAW.

Another important subject which should enlist the attention and engage the efforts of this society, is the securing, through State or Federal legislation, of the enactment and enforcement of such laws as will regulate the seasons of fishing, the methods and apparatus of capture, and conserve, as far as may be, favorable natural conditions of reproduction.

It is true there are upon our statute books now laws without number, seeking to regulate the fisheries. Usually, these laws are dead letters, mere forceless verbiage. In some cases framed in ignorance, or dictated by the private interest which, for the time, dominates in the legislative assembly, they invite the very evils they seek to remedy.

Public sentiment everywhere has awakened to the necessity of rational legislation in reference to our fisheries. The fish-cultural and fish-protective associations, and the numerous fishing or angling clubs, in organized and active existence in all the States, are composed of men who are intelligent, educated and interested. They largely mould, direct and voice the public sentiment which suggests and controls legislation. It is the function—I may say it is the business—of this society, both as a body and through individual members and co-workers, to stimulate inquiry and investigation in every direction, to collect

digest and interpret the data thus obtained, and be prepared to suggest and recommend necessary legislation in the interest of the fisheries.

To secure the enactment of such legislation, all these associations, societies and clubs should be brought into sympathy with our aims, and into co-operation with our efforts. As organized bodies or as individual members, they should become integral factors in the organization and work of this society.

STATISTICS OF THE FISHERIES.

A third important objective point to be aimed at by this society is to secure the institution by the National Government of measures to collect each season complete statistical returns of the fisheries. Such data are of the greatest importance in giving us a measure of the improvement or depreciation of our fisheries year by year, and in appreciating and interpreting local fluctuations in the fisheries. I may add that the want of authentic statistical data of the sea fisheries has already cost the general Government not less than $5,000,000 under the provisions of the reciprocity treaty now in force between the United States and Canada.

Like questions of reciprocity and compensation may arise at any time between our Government and the Canadian, or other foreign governments. An accurate statistical presentation of the extent and value of our own sea fisheries, which we should always be prepared to furnish, will be our best protection against the extravagant demands and unwarranted concessions which have been asked and yielded in the name of reciprocity.

A consideration of the objective points in fish-culture, a few of which are here briefly brought to your attention, will give some idea of the extent of the field which is to be exploited before this society, and the agencies which it may enlist in organized and concerted action, shall have accomplished the mission committed to it.

Of the importance of this mission I need hardly speak. The necessity of utilizing every food resource of land and water grows more urgent as populations increase. It is an economical necessity that sea and lake, pond and river, should be

brought up to and maintained at a maximum production, and to this society is largely committed the satisfactory solution of this important question of political economy. When the methods of artificial propagation have been so perfected and cheapened as to be justified even from the standpoint of the utilitarian ; when the conditions of success in breeding and rearing fish have been so wel established and secured, that we may be sure that the seed sown shall ripen to a productive harvest ; when insurmountable obstructions no longer bar our migratory fishes from access to their spawning grounds or hinder the free circulation of the resident species in our rivers ; when factories no longer discharge their poisonous waste into our rivers, so that they may flow from their mountain sources unpolluted to the sea ; when the modes and apparatus of fishing are so regulated and restrained by law as not to tax too severely natural resources for recuperation and the permanent productiveness of the fisheries is thus established—then the aggressive mission of this society will have, in a measure, ended.

It will still remain for us, by incessant watchfulness, vigilance and surpervision, to conserve the important results which our efforts will have accomplished.

A GLANCE AT BILLINGSGATE.

BY WILLIAM VAN ZANDT COX.

The Thames being the highway to London and originally the source of its fish supply, it was very natural that some point upon it should become the center of the fish trade. Billingsgate has for centuries been that point. As to the origin of both name and market there are many traditions. One is that Belin, an ancient Britain ruler, who lived there three or four centuries B. C. and was held in great reverence by the fisher folk, constructed a gate in the immediate proximity to the present market and gave it his name.

Stow, a very practical writer, after considerable research, comes to the conclusion that a Mr. Beling or Billing, in the time of Elizabeth, had a wharf there. This commencement, though less flavored with romance and more of fish than others, we think more than likely was the beginning of this unpoetical fish mart. The market has been the property of the city of London for centuries, and the revenues derived from it, though no statistics seem to have ever been compiled on the subject, must in the aggregate be enormous.

Originally the market was very primitive, both in structure and equipments—indeed, until within the memory of those still living, it consisted of "a batch of uncleanly old sheds, reeking with fishy smells, and more or less beset by ruffianly company."

The language used by those who frequented it has, as is well known, become proverbial for its coarseness. At one time women were engaged in selling fish in the market, and, it is said, were largely instrumental in giving the place the bad name it bore, and though at this time it has entirely changed from what it once was, it still bears the stigma of coarseness in the minds of many, illustrating, says a clever writer, that "as in the case of men, the evil that women do lives after them."

The old sheds disappeared some years ago, their places being occupied by a building which in turn has given way to the present market. This structure extends north and south from the Thames river to Thames street, and was built with the idea of having not only ground space, but also space in the basement below and the gallery overhead. The basement part was intended for shellfish dealers. But it was not occupied by them long, for being twenty-six feet below the level of the river, it was so dark, damp and disagreeable that few buyers cared to go there. Several deaths also occurred among its occupants, and those remaining being unwilling to stay longer in the "black hole," it was abandoned, except as a place of storage and for lobster-boiling purposes. The overhead space was for dealers in dried fish, and is connected with the ground floor both by spacious stairs and elevators. Being sought, however, by few patrons, it was also abandoned, and its occupants went below and squeezed in, as did the shellfish dealers from the basement, so that at this

time the entire trade is concentrated on the ground floor. Without going into details concerning the architecture of the building, it is sufficient to say that it is generally admitted that the corporation did not act wisely in enlarging the market at a great expense, and in a way that is of no practical use, instead of widening the approaches to it on the Thames street side. The floors of the building are of polished granite, concealed beneath which are drains of iron for carrying off the dirt and refuse when the market is flushed, which is done daily at the close of the market hours.

At the present time there are 156 stalls and fourteen shops on the ground floor. The former are located in the center, while the latter are on the sides of the building. There is also a tavern where fish are served as the leading article of diet. Formerly there were three taverns, Simpson's, Bowle's and Bacon's, where in other days the salesmen congregated before daylight, drank their black coffee and "aff and aff," ate fish and talked over the prices, sales and supply of fish for the coming day. In order to have more space, however, the number of taverns has been reduced to one, which now brings in a rental of $4,000 annually. The stalls vary in size, averaging thirty-two square feet, according to the clerk of the market, Mr. John Little, to whom I am indebted for many courtesies. The stalls, according to location, bring from ten to eighteen cents per square foot per week, or an annual rental from $166 to $300 each. The shops bring from $1,700 to $2,000.

Avenues cross the market at regular intervals, and from necessity are very narrow. Great effort is required to keep them open, and the rules of the market are very explicit in regard to placing obstructions in them. Porters carry the fish into and from the market in baskets, boxes, crates, barrels, in fact, in all kinds of ways. No one is permitted to perform the duties of porter without a license, for which he has to pay 2s. 6d. When on duty, in order to readily distinguish him, the porter is obliged to wear on his left arm a metallic badge having on it the armorial bearing of the city of London. If a porter misbehaves, uses any abusive or obscene language, gets intoxicated, steals, commits assaults or violates any of the rules of the mar-

ket, his license is at once taken from him. I was told that the present conduct of employes in Billingsgate so happily in contrast with "ye olden times," is due to rigid enforcement of rules similar in tenor to those just mentioned.

The porter's dress consists of cotton overalls, a coarse cotton shirt, worn on the outside of the trousers, which from the begrimmed and bespattered appearance are very appropriately called "slops." The head is protected by a "porter's knot," a hat which has a cushion in the crown, very necessarily padding, it might be remarked, as the rough and heavy "trunks" are either borne directly on the top of the head, or resting on the shoulders, back and neck. Wooden sandals are generally worn on the feet to keep the bottoms of the shoes from contact with the sloppy surface. The porter receives on an average about a penny farthing for carrying each box of fish to the salesman. The taking of it from the salesmen to the conveyance of the buyer is an optional charge, depending upon the kinds of fish and distance to be carried.

Land-borne fish enter the building on the Thames street side, while river-borne fish are brought into the market through the south door facing the river. The boats bringing them to London are not permitted to come alongside the building to unload, but, for some reason unknown to me, are required to make fast to fastenings provided for them adjacent to floating pontoons and barges that intervene. Planks, mostly unprotected by side rails, extend from boat to market about a hundred feet distant. Up and down and across these planks the porters tramp with their heavy burdens, for each trunk weighs about 100 pounds.

Nine steam carriers run to and from Billingsgate and the fleets in the North sea, and bring the bulk of the water-borne fish. The unloading of these boats—indeed all kinds of craft—is an interesting sight. But let Sala tell the story: "This wharf is covered with fish, and the scaly things themselves are being landed with prodigious celerity, and in quantities almost as prodigious, from vessels moored in tripple tier before the market. Here are Dutch boats that bring eels, and boats from the North sea that bring lobsters, and boats from Hartlepool, Whitstable, Harwich, Great Grimsby and other English seaports and

fishing stations. They are all called boats, though many are of a size that would render the term ship, or at least vessel, far more applicable. They are mostly square and squat in rigging, and somewhat tubby in build, and have an unmistakably fishy appearance. Nautical terms are mingled with London street vernacular; fresh mackerel competes in odor with pitch and tar; the tight-strained rigging cuts in dark indigo relief against the pale blue sky; the whole is a confusion, slightly dirty, but eminently picturesque; of ropes, spars, baskets, oakum, tarpaulin, fish, canvas trousers, osier baskets, loud voices, trampling feet and 'perfumed gales,' not exactly from 'Araby the blest' but from the holds of the fishing craft."

The method of handling and carrying the fish may strike the author of "Twice Around the Clock" as one of "prodigious celerity," but to an American familiar with steam appliances and labor-saving machinery, it appears to be very tedious, costly and old-fashioned, and in great contrast to systems seen with us, where a vessel puts in, unloads, packs up and leaves the wharf in two hours.

Steam appliances have not been adopted at Billingsgate, I am informed, because the fish would be more rapidly brought to the salesmen than they could be handled, and so the old system is clung to, and porters with trunks on their heads approach the salesman, stand in waiting, then deposit them only as rapidly as they can be sold and again borne away.

The salesman or auctioneer gets five per cent. on the sales made. Many fish were formerly sold at "Dutch auction," where the salesman names a high figure, then drops to a lower one, and so on until a bid is made which is accepted, and the procedure is gone through with *de novo*. No license is required to sell fish by Dutch auction, and this method is still in great favor in many of the fishing ports.

The Bummaree appears to be an individual essential to Billingsgate.

Jonathan Bee, in his slang dictionary ("Lexicon Balatronicum,") published 1823, defines the bummaree to be the man who at Billingsgate takes the place of the salesman, and generally after 8 o'clock A. M., buys the last lot of fish.

The author of "London Labor and London Poor," 1853, says that at that time Billingsgate was opened at 4 A. M., but for two hours it was attended only by the regular fishmonger and the bummaree. At the present time, however, not only is the bummaree the first to arrive, but, as in 1823, he is the last to leave. He now purchases from the salesman and sells to small dealers, costermongers and consumers. Before making a sale, the bummaree breaks the packages and assorts the fish, supplying the buyers with the kinds, sizes and quality desired. A very useful function, it might be remarked when we remember that a "ped" often contains various kinds of fish, suitable and unsuitable for the uses for which they are wanted by different classes of purchasers. But however useful the bummaree may be, that such an individual exists at all, only goes to prove the inadequate accommodations of Billingsgate for the trade, and whether there is foundation or not for such accusations as are heard concerning him, the bummaree will exist so long as the fish supply of populous London has to pass through this limited, inaccessible market in a limited time.

The market is opened at 5 o'clock in the morning and is practically over at 10 o'clock. Before the opening, however, the auctioneers are in their places, behind what are called "bulks" or "forms," upon which the fish are deposited in "trunks," "doubles," etc. Little, if any, opportunity is given buyers to ascertain the condition of the fish, for no sooner is the box deposited on the "bulks" than it is knocked down as sold, and again borne away. If the buyer is not informed in some way in regard to the condition of the fish, to purchase the unopened boxes so rapidly, and with such apparent indiscriminate recklessness, it would seem to an outside observer, to put it mildly, great confidence in the condition of the fish, and in the honesty of the salesman.

During the whirl of business all seems confusion and chaos. Porters are seen rushing hither and thither with reeking barrels, baskets and boxes. Auctioneers with long, narrow account books in their hands, are bawling to buyers, who, with hands by the side of their mouths, direct back their shouting answers, while the uninitiated explorer stands bewildered in their midst

until he is called to his senses by the exclamation, "Hout the way." "The only comparison I can find for the aspect, the sights and sounds of the place," says a well known writer, "is a rush hither and thither at a helter shelter speed, apparently blindly, apparently without motive, but really with a business-like and engrossing pre-occupation for fish and all things fishy. Baskets full of turbot, borne on the shoulders of the facchini of the place, skim through the air with such rapidity that you might take them to be flying fish."

"At that piscatorial bourse," says Bertram ("Harvest of the Sea," p. 59), we can see in the early morning the produce of our most distant seas brought to our greatest seat of population, sure of finding a ready and profitable market. The aldermanic turbot, the tempting sole, the gigantic codfish, the valuable salmon, the cheap sprat and the universal herring, are all to be found in their different seasons in great plenty at Billingsgate and in the lower depths of the market buildings, countless quantities of shellfish of all kinds stored in tubs may be seen, and all over is sprinkled the dripping sea water, and all around we feel that 'ancient and fish-like smell' which is concomitant of such a place."

Commercially speaking, fish are divided by the Londoner into two classes: 1. Prime. 2. Offal. The former comprehend the choice varieties, such as sole, brill, turbot, etc. The latter includes the commoner, coarse kinds, such as place, roker, haddock, etc. The quantities that come into Billingsgate are very disproportionate. Mr. Little says that thirteen boxes of offal reaches the market to one box of prime. That gentleman has very kindly furnished me a table showing the quantity of fish arriving at Billingsgate per month during the year 1883, which I shall make a part of this paper, as also a series of tables showing the amount of fish coming to London since 1875. It will be seen from Mr. Little's statement, that the quantity coming by water is much less than by land. Special trains bearing fish alone run daily to London from Grimsby, Hull, Yarmouth and other places. As these trains do not come in the vicinity of Billingsgate, the fish have to be carted through the narrow streets and tortuous lanes, across the city to the market, in

order to be sold, and when sold to be again carted over the same streets through which it has already with difficulty passed.

Speaking of the approaches to Billingsgate, the *Quarterly Review*, October, 1882, says: "Their badness was of comparatively slight importance, so long as the bulk of the fish was brought thither by water. When, however, it became necessary to deal each year with some 90,000 tons of railway-borne fish, and to deliver them at Billingsgate, through choked streets and narrow lanes which would disgrace a city of 50,000 inhabitants, the difficulties were so augmented that fish vans sometimes took eight hours to get from the Great Eastern or Great Northern railway terminus to the market where they had to unload."

This statement has greater force when it is remembered that the width of the roadway of Lower Thames street, on which the market is situated is but sixteen and a half feet wide. St. Mary-at-hill has a width of sixteen feet, while Botolph lane and Pudding lane are each but seven feet three inches wide.

Language fails to convey to one's mind the bewildered condition of things in the congested approaches to the market, where the stopping of a "shandry," for instance, will block the entire street. It was shown in an investigation made by Spencer Walpole, late H. M. Inspector of Fisheries, that ordinarily it not only took hours for fish vans to reach the market, but in one instance a van of "fresh fish" was eleven days *en route*, and all the time trying to get unloaded. A vast amount of good food is very naturally spoiled before it reaches the market, and afterwards, too, for that matter, simply from the absence of proper appliances for its preservation; and it is not strange that when the fish reach the consumer it is so enhanced in price as to have become a luxury instead of an ordinary article of diet.

The *Times* of October 30, 1883, despondingly asks, "Could not science have fish vaults where the temperature was kept at about thirty-three degrees at the markets? Could not science improve on the ice chests fishmongers use?"

We answer unhesitatingly in the affirmative, and cordially invite the editor of the "*Thunderer*" to visit America and see the fish markets in Boston, New York and other centers, where the

application of scientific methods of refrigeration to the fish trade that have long been in use could be seen.

What London requires in order to have the price of fish reduced and the quality improved, and a cessation from talk about "Billingsgate ring" and "Billingsgate monopoly," is to have a more commodious market—a market with refrigerating appliances, a market on the river side, easily accessible not only for boats, but for cars, vans and all kinds of conveyances.

Thus far it has been impossible to agree upon a new site. If the market has to remain where it now stands, so choked for space and difficult of approach, then if it be desirable to remedy the patent evils, the streets leading to Billingsgate will have to be widened. The postponement of the widening to a more convenient season will not lessen the cost. In 1862 the approaches could have been widened for £88,000, and twelve years afterward the estimated cost was £525,000, and now, doubtless, it would be much more.

In conclusion, I regret to say there is little, if anything, at Billingsgate for American fish dealers to learn, except how far in advance of them in every respect we are on this side of the Atlantic.

RETURN OF THE QUANTITY OF FISH DELIVERED AT BILLINGSGATE MARKET DURING THE YEAR 1883—(JOHN LITTLE, CLERK, BILLINGSGATE).

Month.	Land carriage. Tons.	Water carriage. Tons.	Total. Tons.
January	6,015½	2,949	8,964½
February	5,562¼	1,969	7,531¼
March	6,983¼	2,622	9,605¼
April	6,394	3,911	10,305
May	5,898¾	4,765	10,663¾
June	8,536	4,679	13,215
July	5,400	3,353½	8,753½
August	5,678	3,486	9,164
September	7,104½	4,671	11,775¼
October	6,583¼	2,028	8,611⅜
November	7,401¾	1,984	9,385¾
December	9,166¼	2,529	11,695¼
Total	80,723¼	38,946½	119,669¾

N. B.—There was also from 20,000 to 25,000 tons of fish delivered in the immediate vicinity during the year, which is not included in the above.

The quantity destroyed by the officers of the Fishmongers' Company, as being unfit for food, was 273 tons, 16 cwt., 1 qr., and of this ninety-five tons was composed of shellfish.

APPROXIMATE QUANTITIES OF FISH DELIVERED AT BILLINGSGATE MARKET AND VICINITY, 1875-1884.

(British Fisheries Directory and Mr. Little's Report.)

	Tons.		Tons.
1875	94,949	1880	130,629
1876	99,425	1881	137,000
1877	107,168	1882	150,000
1878	126,764	1883	144,669¾
1879	126,892	1884	156,005

Washington, D. C.

THE OYSTER BEDS OF NEW YORK.

BY EUGENE G. BLACKFORD.

During the past year an investigation has been in progress in the State of New York, under my charge, for the purpose of ascertaining the actual condition of the oyster areas of the State, and to gain some general knowledge of the oyster industry as carried on in our waters.

This work was begun on the supposition that there was danger of a failure in our oyster supplies in the near future, unless some steps were taken toward remedying certain practices and evils which were thought to be detrimental to the success and continuance of the industry. Thus far only a portion of the oyster territory of the State has been examined, and that only superficially; yet the examination has been sufficient to establish two points, one of which shows conclusively the need of such an investigation, and the other that there is no danger of a

failure in the supply of these mollusks for our markets. These two points are, first, that the natural oyster areas of the State are in bad condition and very much less in extent than they were a score or more of years ago, and, second, that the loss in the natural areas has been much more than made up in the formation of planted beds, some of which occupy the localities of natural areas, which have been exhausted of their natural supplies, and have been repopulated by artificial means, and some of which have been formed on territory that never was natural oyster ground, and by reason of this increase in the amount of territory upon which oysters are grown, a great many more oysters are now sent into market each year than were thus shipped some few years ago. This is true to a very large extent of all the oyster regions of our State ; the natural areas have been worked until, in many instances, they have been entirely depleted, and in all cases very much lessened in productiveness ; and then the planters have appropriated the exhausted lands for planting purposes, and extended the planted areas outside of the old bed limits, but some of the oyster regions show much greater changes in this direction than the others. This is perhaps more noted in the neighborhoods of Staten Island and City Island than elsewhere, since these regions are not only close to our great metropolitan markets, and therefore can be drawn upon at short notice, but they have suffered more than the others from the direct action of the refuse materials thrown into the waters from the cities of New York, Brooklyn, Jersey City and their suburbs. This has been a source of great injury, and where formerly many oysters were obtained from along the shores of the lower bay, around the northern end of Staten Island and along the East river, now there are none to be got, or if any can be secured, they are so contaminated with the acids and filth of the waters that they are of no value as food. This is an evil which can only be remedied by careful and consistent legislation regarding the sewerage of the great cities and the disposal of waste matters.

In the neighborhood of City Island there were formerly many large tracts of natural oyster beds, from whence great quantities of fine oysters were obtained ; but as there were no stringent

regulations in regard to the working of the beds, or the protection of the oysters during the breeding season, and no system of guarding the beds, they were gradually despoiled and their places taken by the planted areas ; and the same may be said as regards the lower portion of Staten Island, and in fact, of all portions of our State. To a certain extent, this is an advantage to the oyster industry of the State, and to a certain extent it is a disadvantage. By having these lands brought under the direct influence of individual oystermen, that is, by transforming them from public into private property, they can be better protected than when open to every one, as each individual planter will feel more of an interest in guarding his own land than in guarding the land of the public domain, and they can accordingly be worked in a manner to promote the welfare and continuance of the bed, rather than in such a manner as to exhaust it as quickly as possible.

It is on the principle, of course, that business, in order to be successful, must be personal to those engaged in it, and while this may be largely true as regards the oyster property of the State, yet if the beds are permitted to become exhausted in this manner, and then to be taken up, as they have been in the past, by any one who desires to appropriate this kind of property, it will cut off a great number of people from obtaining seed oysters, and furnish private property to a greater or less number of individuals, without any recompense being given, even to the State, or to those deprived of the privilege of gathering oysters from public beds. It would seem as if it would be better to guard the public beds, and preserve them as seed grounds, and encourage the planters to appropriate land for artificial cultivation that is not suitable for natural growth, enacting suitable laws for the protection and guarding of the natural areas, and for the perpetuity and protection of the planting industry. Many of the oystermen feel at the present time that there is no certainty, from the present condition of the laws, that they will ever gain anything from any improvements they may make, or for any expense that they may be to in fitting up territory which is not now natural bottom, but which might be rendered excellent for plants, and so they do not enter into the work as heart-

ily as they otherwise might do. And in view of the chaotic state of the laws in general, and the peculiar way in which many of them are carried out, it is somewhat to be wondered at that so much has been accomplished in the direction of artificial culture, as has been done. The possibilities in this direction are well illustrated in Jamaica and Hempstead bays, upon the shore of Long Island. In the towns bordering upon these bays, laws have been enacted, under authority from the State, whereby any resident can appropriate three acres or less of land under water, for the purpose of oyster cultivation, and the occupant is protected in his rights and titles to such land, so long as he works the land and pays the rent upon it. The land under water thus becomes practically the same as the land above water, a permanent property of the planter, and is worked just as upland is, to preserve it and yet get as much out of it as possible. The consequence is that where a few years ago only a few oysters were raised for market, to-day the industry represents hundreds of thousands of dollars annually, and can be yet greatly increased by the employment of new methods of getting seed and caring for the growing stock. As it is, it represents the most active and progressive oyster center in our waters.

One great difference between this and other oyster regions is, that here they recognize the value of a thorough working of a small amount of territory, while in other localities the oystermen generally try to get and hold all the territory they can, without any particular regard to how well such territory is worked. Some of the other regions are following to a certain extent in the footsteps of the planters of Jamaica and Hempstead bays, and just in this proportion are they meeting with success. While the industry in the State is, as a whole, in fair condition, so far as regards the number of oysters sent to market, the number being, perhaps, three or four times what it was fifteen years or so ago. It is not what it ought to be or may become, and the future supplies will depend largely upon the care with which the oystermen guard the present seed beds and work their planted territory. The possibilities are great, provided advantage is taken of all improved methods of culture, and some desire is shown to perpetuate rather than destroy the natural areas.

It is to be hoped that the oystermen will cordially co-operate in the work now in progress, and that by means of judicious legislation the natural beds may be preserved and protected, and the industry stimulated and permanency given to it in our waters.

Fulton Market, New York.

THE BIENNIAL SPAWNING OF SALMON.

(The Bucksport Experiments.)

BY CHARLES G. ATKINS.

After the organization of the establishment for the collection of eggs of sea-going salmon at Bucksport, on the Penobscot river, in 1872, it was one of the earliest suggestions of Professor Baird that we should attempt, as occasion might offer, to obtain evidence bearing on the frequency and duration of the salmon's migrations and its rate of growth.

To carry out these suggestions it seemed requisite that observations should be made on individual fishes at successive periods in their lives; yet, whatever means should be taken to secure and identify them must, it was evident, not prevent free movement in the open river to and from the sea, or interfere in any way with the development of their functions or their regular growth. They must be distinctly and durably marked, yet in such a way as to do them no injury. The cutting of the fins would answer the purpose only in part, since it would not afford a sufficient variety in form to enable us to distinguish a great number of individuals. Branding upon the side of the fish was thought of and even tried, but the serious mutilation that befel the first fish operated on, and the extreme probability that those marks that were so lightly impressed as to do no injury to the fish would soon become illegible, or so nearly

so as to be overlooked by fishermen, caused that method to be abandoned. A metallic tag, stamped with a recorded number, appeared to offer the greatest promise of success. The first tag tried was of thin aluminum plate, cut about a half inch long and a quarter wide, and attached to a rubber band which encircled the tail of the fish. It is possible that most of the bands slipped off, and that those which were tight enough to stay on cut through the skin, and produced wounds that destroyed the fish. At any rate, no salmon thus marked were ever recovered.

The next method employed was the attachment of an aluminum tag by means of a platinum wire to the rear margin of the first dorsal fin. This place of attachment was chosen because, being near the middle of the fish, it has less lateral motion when the fish is swimming than any point nearer the head or tail, and because the tag, lying thus in the wake of the fin and close to the back, would be better protected from contact with foreign objects than elsewhere. The attachment was effected by placing the fish upon a narrow table, confining it by straps, and piercing the thin membrane of the fin between the last and next to the last ray, by means of a needle, into the eye of which was threaded the wire already connected with the tag ; the ends of the wire were then twisted together, so as to form a loop, and neatly trimmed with scissors. The tags were stamped with dies. This mode of marking has been adhered to in all subsequent experiments of the kind, with no change except that the aluminum tag has been replaced by one of platinum.

The marking was always done in the fall, after the fish had been relieved of their spawn. They were then liberated, either in tide water or in fresh water whence egress to the sea was easy.

Of the salmon marked with rubber bands in 1872, as has been said, none were recovered. In November, 1873, there were marked 391 salmon. In the ensuing year rewards were offered to the fishermen for the return of any marked specimens. In response, there were sent in to the station twenty salmon, the first in January (taken in a smelt net), and all the others in April and May. All of the twenty retained the wire, by which they were with certainty recognized as having been marked in the preced-

ing autumn. Sixteen of them still retained the tags. One of them was found to have lost eight ounces in weight, eight others had lost from one to two pounds each; all had fallen away in flesh since November. The males had faded in color; the hooks on their lower jaws were still present, but had decreased much in size. The females had regained their bright silvery color to a great extent; in their ovaries were the germs of the next litter of eggs, but they were very small. No food could be found in the stomachs of either sex. It was quite evident from their condition that these fishes could not have been to their feeding grounds during the winter. Twelve out of the twenty were taken in the Penobscot above Bucksport, and nine of these were taken at Veazie, twenty-five miles above Bucksport, in close proximity to the first serious obstacle they would encounter in ascending the river. Salmon in their condition should be bound toward the sea, and had they, as may have been the case with some, reached the upper waters, it is quite impossible that they could have become breeders the same year. That all these loiterers dropped down to the sea before the first of June, we may conclude from the fact that after that date no more were captured. During the whole year not a single marked fish was recovered or reported, that had in any degree mended from the condition in which it was released the preceding autumn.

In 1875 the offer of a reward was renewed, and this time resulted in the recovery, in May and June, of eight specimens, and among our breeding fish there was found in the autumn another whose mark had escaped observation at the time of capture. Of these nine fish, four were females, three males, and two not determined. They were all of good size, weighing from sixteen to twenty-four and a quarter pounds, and measuring thirty-four and a half to forty and a half inches in length, and were all fat and apparently healthy. One of the females was placed alive in our inclosure and yielded in the fall about 11,500 eggs. Unfortunately, the tags, supposed to have been good aluminum plate, proved deficient in durable properties, became (as we learned by direct observation) weak and brittle after a short time in water. All of them had fallen off from these

specimens, and we could not therefore trace the record of the individual salmon, but the wire remained and proved beyond question that these salmon were marked and released in November, 1873, as none others had up to this time been marked in the same manner, and none at all marked in 1874. They had thus been absent eighteen or nineteen months, and had (we cannot doubt) passed the intervening months, including the summer of 1874, mainly on their feeding grounds in the sea. The experiment was repeated in 1875 and in 1880, with platinum tags, which proved durable.

In 1875 there were marked and released in tide water, at Bucksport, 357 salmon. In the spring of 1876 a considerable number of these were taken in the river ; but without exception they were, as in 1874, all poor. In 1877 three specimens were recovered, all in good condition and of larger size than when released. The first, No. 1019, was caught on Cape Gellison in April. This was a female fish ; before spawning it weighed twenty-one pounds six ounces, and at time of release sixteen pounds. When retaken, seventeen months later, it weighed thirty-three and a half pounds. The second individual, No. 1,010, was also a female ; weighed before spawning eighteen pounds two ounces, after spawning thirteen pounds eight ounces, and on recapture in Lincolnville, nineteen months later thirty pounds eight ounces. The third individual was also a female ; weighed twenty pounds seven ounces before spawning fifteen pounds on release, and twenty-six pounds on recapture in Lincolnville, nineteen months later. The results of this second experiment supported the conclusions drawn from those of the first in every particular.

The salmon marked in 1880, numbering 252, were released in the fresh waters of Eastern river, a small branch of the Penobscot. The distance from the point of liberation to tide-water was two miles, and the only impediment a dam over which they could easily go down in the spring, or at any high water when the river was not very low, but which during the winter must have constituted a serious impediment. There is reason for thinking that the larger part of these salmon remained above the dam until the spring floods. A small reward was offered

for the return of fish or tags taken the next spring, and twelve tags were received. Nine of the fish bearing them were weighed and found in every instance to have fallen away in weight since marking. No fully or partially mended fish were obtained or heard of that year. But in June, 1882, five prime salmon were recovered bearing the tags affixed in October and November, 1880. The following statement shows the date for each individual:

RECORD OF MARKING.

No.	Date. 1880.	Sex.	Length inches.	Weight before spawning. lbs.	oz.	Weight of eggs. lbs.	oz.	Weight on release. lbs.	oz.
1135	Oct. 28	F.	30	9	7	1	15	7	8
1136	Oct. 28	F.	30	9	5	2	1	7	4
1239	Nov. 5	F.	36	17	12	3	8	14	8
1248	Nov. 5	F.	32	10	5	2	5	8	0
1247	Nov. 12	M.	30½					8	8

RECORD OF RECAPTURE.

	Date. 1882.	Place.	Length inches.	Weight. lbs.	oz.
1135	June 20	Bucksport Center.	34½	16	8
1136	June —	Searsport.	35½	17	4
1239	June 22	Sandy Point.	39¼	21	0
1248	June 27	North Bucksport.	39	21	0
1274	June 23	Frankfort.	—	14	12

The results of this third experiment coincide, it will be seen, with those of the other two, and they leave little room for doubt that it is the normal habit of the Penobscot salmon to spawn every second year. Had any considerable number of them recovered condition in season to return to the river for spawning the year after their first capture, they would hardly have escaped detection altogether; indeed, they would have been much more likely to retain their tags, since they would have borne them only six or seven months, instead of eighteen or nineteen. This view is further supported by what we know of the reduced condition in which the end of the spawning season finds the salmon, the short time, only six months, that intervenes between the spawning season and the time for the next "run" up the river, the low temperature then prevailing in the river and bay, and the fact, which is pretty well established, that a large part, perhaps nearly all the salmon, instead of proceeding at once to sea

after spawning, linger in the fresh water all the winter, and descend only with the spring floods. *Bucksport, Me.*

WORK AT COLD SPRING HARBOR.

BY FRED MATHER.

In this paper will be given merely a glance at the work done at the hatchery, under my care, on Long Island, during the season of 1884–85. The place is leased, and most of the work done, by the New York Fish Commission, although the United States Commission on Fisheries has considerable work done there. In the fresh-water department we can report:

A. SHAD.—On May 20, 1884, I received 80,000 shad eggs from Washington, in compliance with my request to be allowed to experiment with them in spring water. They were placed in the McDonald jars, and on May 29, there were planted in the Nissequoge river, at Smithtown, Long Island, 72,000 fry. This seems to have been the first trial of hatching this fish in spring water, and as Col. M. McDonald wrote me that the success privately reported might revolutionize present methods, I will give the details in full:

[May 20, received 80,000 eggs at 6:20 P. M., put them in the jars at 7:30 P. M. Temperature of water 58° Fahr.; of eggs, 55°. Eggs began hatching May 24, finished May 27.]

Date.	Temp. of water.	Loss of eggs.	Loss of fry.
May 21	60	30	....
May 22	59	45	....
May 23	60	60	....
May 24	71	40	125
May 25	62	25	20
May 26	60	20	42
May 27	58	15	800
May 28	59	....	150
May 29	60	....	40
		235	
Dead on unpacking		380	
		615	1,177
Total loss			1,792.

A similar trial made later proved a failure.

From the preceding table of losses and the figures given as planted, it will be seen that there is a discrepancy of only 208 fish, and these are on my side. Further, my estimate of eggs received exceeds that of Col. McDonald by about 5,000. The cool spring water, say of about 60 degrees (the mean of the above table is 60.7 degrees), seems to account for the absence of fungus on the dead eggs. Having hatched shad eggs in iced water (see Report U. S. Fish Commissioner for 1873, '74 and '75, pp. 372, 376), and on the rivers of the Atlantic coast from the Pamunky to the Connecticut, where it has often reached eighty degrees, I find spring water at about sixty degrees to be the best medium for shad eggs which I have used. In the summer of 1884, I made an examination of the shad fisheries of the Hudson for the New York Fishery Commission to find the best place to take eggs. There are several points on the river where eggs can be obtained, and these lie between Kingston and Hudson. The catch of fish during the season of 1884 was a very fair one, owing, no doubt, to the plantings by the State and by the U. S Fish Commission.

B. Brown Trout.—On Feb. 24, 1885, we received from the Deutschen Fischerei Verein a box of 40,000 eggs of the brown trout (*Salmo fario*), half of which were billed to Mr. E. G. Blackford, and the remainder to me. The loss in transit was 1,020, and we afterward lost 2,594 eggs and 8,131 fry ; 28,900, according to our estimate, were planted in Queens, Suffolk, Westchester and Rockland counties, N. Y. These fish are destined to become great favorites, and the demand for them increases.

C. Brook Trout.—We received 7,000 eggs from the United States Fish Commission at Northville, Mich., Frank N. Clark, superintendent, and a lot of Rangely and blueback trout eggs from the Maine Fish Commission, on account of Mr. Francis H. Weeks, of Cold Spring Harbor, but which were so arranged that we could not tell which was which, and no careful estimate of the number was made, as a mistake occurred in shipping ; probably there were 50,000 in all. These, together with some 16,000 eggs taken from our pounds, were hatched and distributed on Long Island.

D. Rainbow Trout.—From 20,000 eggs received from the

United States Fish Commission, Northville, Mich., we hatched and distributed 14,500 in Kings, Queens, Westchester, Suffolk and Rockland counties, N. Y.

E. Salmon (Penobscot).—From 500,000 eggs received from the United States Fish Commission station at Bucksport, Maine, Mr. Chas. G. Atkins, superintendent, we planted 269,300 in the tributaries of the Hudson, in Warren county; 99,350 in the tributaries of the Delaware, in New Jersey; 46,000 in the Oswego river, and 4,900 on Long Island. The success of former plants in the Hudson is announced by Mr. A. N. Cheney, of Glens Falls, N. Y., who says they are plenty in Clendon brook, and promises specimens.

F. Land-Locked Salmon.—Of 60,000 eggs of the land-locked salmon presented to the State by the United States Fish Commission, only 16,300 fry were distributed, owing to their being retarded in troughs too long awaiting orders. The fish were assigned to Adirondack waters, but for lack of orders were finally distributed on Long Island.

G. Whitefish.—We have favorable reports from former plantings of whitefish on Long Island, but lack specimens, and therefore have no proof that they have lived. From one million eggs we distributed 990,000 fry as follows: 600,000 in Great pond, near Riverhead (where success was reported); 340,000 in Lake Ronkonkoma, and 50,000 in St. John's lake, Cold Spring Harbor.

H. Smelt.—The result of experiments with these refractory eggs will be found in another paper read before the society yesterday, and there is nothing new to add.

SALT-WATER DEPARTMENT.

A. Codfish.—Owing to bad weather and perhaps other causes, no good eggs of the cod were taken. There has been no decided success in the hatching of this fish, although a few have been hatched by Capt. H. C. Chester and Prof. J. H. Rider, both of the United States Fish Commission. This fall we hope to have a smack come in to the station with live cod, and try to obtain good eggs.

B. TOM-COD.—With these eggs we have good results. We took 280,000, and turned loose 213,000 fish. The eggs are not adhesive like the smelt's, nor buoyant like the cod's. These hatched in about twenty-five days.

This record shows that between two and three million eggs were placed in the troughs at this station, and besides this there were over 3,000 more handled and repacked for foreign shipment, or received from foreign countries for hatcheries in America, all the foreign receipts and shipments passing through my hands for inspection or repacking, in which great successes have been scored. We propose to begin the artificial culture of oysters this summer.

Cold Spring Harbor, Suffolk Co., N. Y.

THE RIVER EXCURSION.

On Thursday, May 7th, the society made a trip to the shad hatching grounds of the Potomac on the U. S. Commission steamer *Fish Hawk*, by invitation of Prof. S. F. Baird. Col. Marshall McDonald acted as master of ceremonies, and was ably assisted in doing the honors by Lieut. Pietmeyer, Prof. Goode and Mr. Cox.

Arriving at Fort Washington, an attendant showed four million eggs in process of packing for shipment to the central station at Washington. At 3 P. M. the company sat down to a lunch of planked shad, corn bread and coffee, and then made ready to return. On the homeward trip a meeting of the Executive Committee was held in the cabin, Hon. Theodore Lyman presiding. Mr. Lyman suggested that the present was a proper time to transact any unfinished business, and to make any necessary arrangements for the next meeting.

Prof. GOODE moved that a vote of thanks be tendered to Prof. Spencer F. Baird, Commissioner of Fisheries for the United States, for his courtesy in placing the *Fish Hawk* at the disposal of the society for this trip. Carried.

Mr. CLARK moved that the next annual meeting of the society

be held in Chicago. He said that it would be a great gain in the membership to the society to hold it there, for many Western men had held aloof from it, thinking it to be an Eastern society entirely, and that little or no attention was paid to Western fisheries.

Prof. GOODE.—The remarks of Mr. Clark carry great weight. It is desirable to meet in other places than New York and Washington, although the latter is common ground. I think it would be well to meet in Chicago next year.

Dr. HUDSON.—In 1876 we met in Philadelphia, but did not gain any members to speak of, yet if it is believed to be the best to meet in Chicago, we might try the experiment.

Mr. MATHER.—If it is necessary to meet at different points to avoid the charge of localism, it may be well to do so. But why any person should consider that the society is in any sense a local one I fail to see. Its name covers the continent, and the subjects treated of are not at all restricted to any locality. It has been suggested, and I thought it understood, that the next meeting should be in New England, perhaps in Boston, and we certainly should meet there some time, if we propose to change about. New York and Boston are the great fish centers, and Washington, as Prof. Goode has said, is common ground. I do not think that any place is as good as Washington, but will agree to anything the majority think best.

Mr. BUTLER.—If we go West one year, we will not lose members, but will gain them. The Commissioner of Agriculture hoped that we would go west of the Mississippi, and if so we would have a large meeting ; but at Chicago we would certainly have a most interesting and profitable one.

Mr. MAY.—I hope that this question will be decided to-day, and that it will be in favor of Chicago. We will then begin to urge Western commissioners, and those interested in fish-culture and in fishing to attend.

Mr. CLARK moved that the next meeting be held in Chicago, and that a local committee be appointed to fix the date and make all necessary arrangements. Carried.

The President appointed as such committee, Messrs. F. N. Clark, W. L. May, Dr. R. O. Sweeney, A. P. Butler, Fred Mather and W. V. Cox. The meeting then adjourned.

TREASURER'S REPORT.

DR. EUGENE G. BLACKFORD, Treas. in account with AMERICAN FISHERIES SOCIETY. CR.

1885.		
May 12th,	To amount of annual dues collected during past year, - -	$147 00
	To balance from last year, -	205 75
	To " due Treasurer, - -	102 58
		$455 33

1884.		
May 15th,	By bill omnibus fare for members attending White House reception, - - - -	$10 00
May 15th,	By cash paid messenger, -	60
" 15th,	" " " telegrams, - -	40
" 15th,	" " " Fred Mather, (telegram), - - - -	25
May 15th,	By cash paid Fred Mather, (telegram), - - - -	50
May 15th,	By cash paid Fred Mather (postage), - - - -	12
May 19th,	By cash paid for account book, -	50
June 6th,	" " " R. J. Geer, stenographer, - - -	78 12
June 6th,	By cash paid Col. M. McDonald postage, - - - -	3 00
July 10th,	By cash paid W. V. Cox, expenses of meeting, - - -	37 40
Nov. 10th,	By cash for postage on reports,	7 50
Dec. 1st,	" " " type-writing, - -	4 00
" 3rd,	" " " J. M. Davis for printing reports, notices, bills, &c.,	312 94
		$455 33
	Balance due Treasurer, - -	$102 58

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