

REPORT

OF THE

COMMISSIONERS OF FISHERIES

OF

NEW JERSEY.

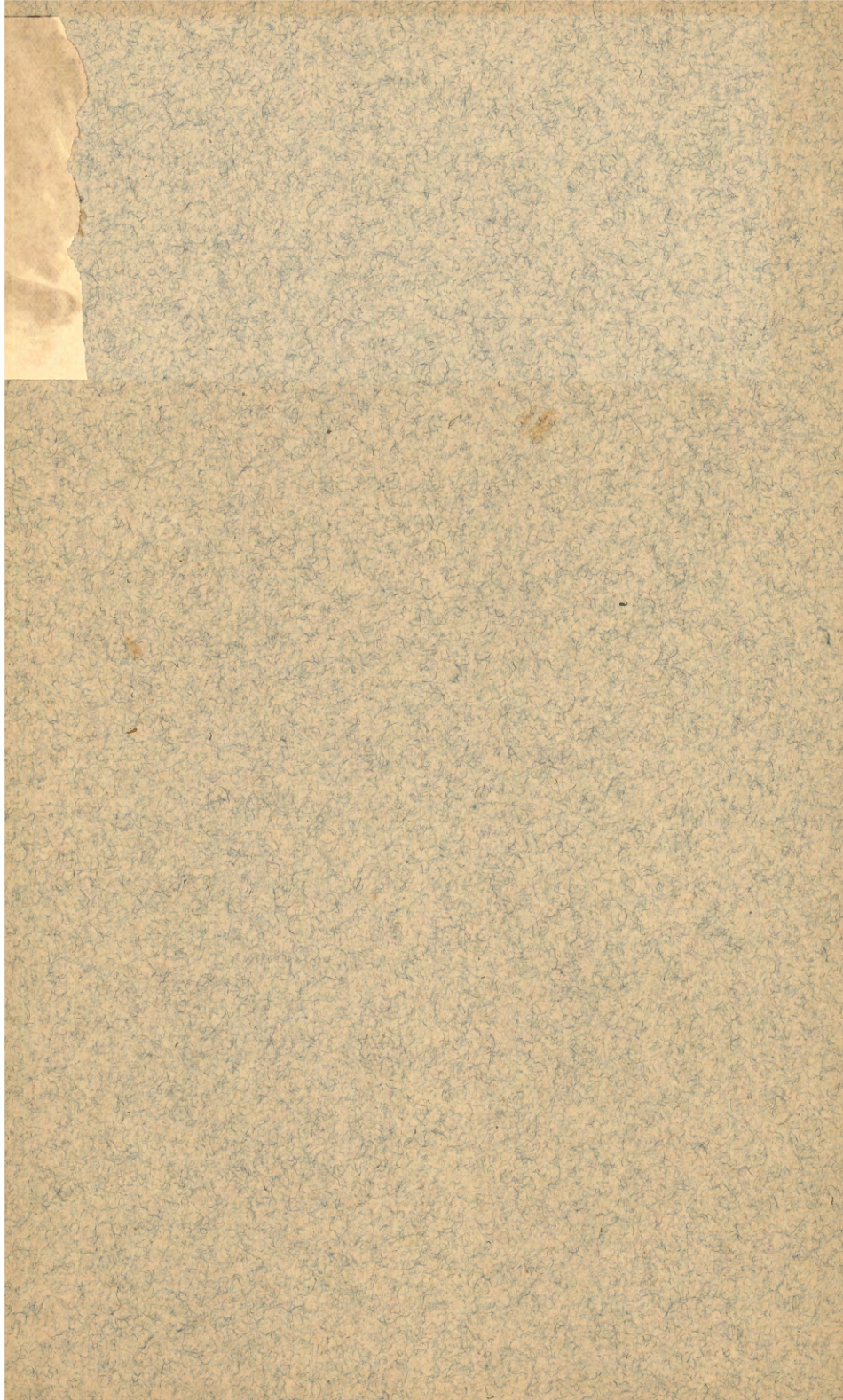
1884-1885.

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TRENTON, N. J.:

JOHN L. MURPHY, STATE PRINTER.

1886.



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William Wright,

State Fish Commissioner.

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1845

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# REPORT.

DECEMBER 31st, 1885.

*To His Excellency Leon Abbett, Governor of New Jersey :*

SIR—The Commissioners of Fisheries herewith present their report for the period from the date of the last report to January 1st, 1886.

## SHAD FISHERIES.

Since the earliest days in the history of New Jersey, the shad has been recognized as the most important and most profitable fish inhabiting the waters of the State, and although the shad fishing season is limited to a brief period, the value of the catch is invariably in excess of any other species of fish, and more money is invested in shad fisheries than is devoted to the capture of any other single variety of food fish. A comparison of the wardens' reports of 1884 and 1885 with those of former years shows that while the number of fishermen is less, the annual catch has not appreciably decreased in the last two years, indicating that the work of policing and restocking the Delaware and tributary waters has been productive of positive benefit. There is reason to believe that the steady decline which the fishermen claim to have observed in the last twenty years, has reached its lowest ebb and that the exercise of constant vigilance by the wardens, especially in policing the river, will be the means of bringing about the old-time abundance of shad in the Delaware. No appropriation will be necessary for the season of 1886, as the balance in the Commissioners' hands is ample for the work intended, as further experiments in artificial propagation are not immediately contemplated. The Commissioners are disposed to concentrate their efforts during the ensuing year upon the enforcement of existing protective laws, and the active prosecution of violators, not only on the Delaware river, but in every section of the State, believing that protection is as important as propagation, and that more importance should be attached to preventing the disturbance of the fish in the natural work of increase. The question of increasing the opportunity for the fish to run up the river by forbidding fishing from sunset on Saturday evening to midnight on Monday night, or adding one day to the present law on

this point, was discussed by the Commissioners last spring and the owners of many of the fisheries were consulted in regard to it. Without exception, shore fishermen and gillers said that if another day was taken from the fishing week it would cripple the industry by driving fishermen from the State. They said that it would be unprofitable to keep up the large plants and hard to induce the men to remain if the season was further abbreviated. While this argument on the part of the fishermen seems perfectly natural from a business point of view, it appears to the minds of the Commissioners that it would perhaps be better for all concerned if the fishing days were so arranged that the fish could have at least twelve hours more of immunity, and they recommend the extension of the close period to 12 o'clock on Monday night. This they feel will give the shad ample time to reach the spawning ground, and will be much better than adding another close day in the middle of the week.

That efficient work has been done by the State officers in preventing violations of the shad laws on the Delaware river is shown by the lack of complaints and the few arrests that were made last year. The import of the law, and the severity of the penalty, was taught in a number of cases in previous years, and the lesson sunk so deeply that few fishermen had the temerity to attempt illegal fishing, with the prospect of arrest and confiscation of their boats and nets. The necessity of vigilant and constant policing during the shad season scarcely exists in any other river in this State than the Delaware. Other rivers are so hopelessly polluted that it is extremely doubtful if shad fishing can ever be made profitable in them again.

The shad fishing of the Passaic river appears to be a thing of the past, owing to the pollution of the river by the sewage of two great cities and the refuse of numerous chemical works, gas houses, oil refineries and fertilizer manufactories. The Passaic at one time was second only to the Delaware for the production of shad for New Jersey markets, and a dozen fisheries were situated on its banks, but they have entirely disappeared and there is now seldom one shad net hauled during any season above the mouth of the river. The catch in seines and fykes in Newark bay is frequently large enough to encourage the fishermen along the Bergen county shore to maintain a score of fyke nets, and they find a ready sale for the fish in the markets of Newark and Jersey City. The average annual catch for the last five years is roughly estimated at fifty thousand (50,000) shad in the Hackensack and Passaic rivers and Newark bay. The Hackensack river fishing has visibly improved during the last two years. Fishermen along Newark bay, and both rivers emptying into it, complain loudly of the pollution of the water by the refuse from the oil refineries along the Kill von Kull. They claim that the oily and foul-smelling brown scum which frequently covers the greater part of the surface of the bay prevents shad and other food fishes from ascending the river. The shad fishing in the Raritan river is said to

have appreciably improved in the last three years, which is probably due to planting of young fish from the Delaware on several occasions at New Brunswick.

The difficulty of procuring accurate statistics of the annual catch of shad will be apparent to every one who is familiar with the matter and takes into consideration the immense expanse of river, the number of gilliers and the many avenues they have for disposing of their fares. Their voluntary statements have heretofore been accepted and they may have had private reasons for exaggerating or curtailing their reports. The wardens faithfully endeavored to obtain a correct estimate in both years covered by this report and their success may be judged from the fact that eight districts in five counties along the Delaware returned, in 1884, a total catch of one million nine hundred and eight thousand nine hundred and twenty-eight (1,908,928) shad, and in 1885 seven of the same districts showed a total catch of one million five hundred and eight thousand eight hundred and sixty-eight (1,508,868). Both of these reports probably fall far below the actual result. The season of 1885 was remarkable for two things, its lateness and the unusual size of its shad. Active fishing was delayed for three weeks longer than usual and yet the fishermen closed the season with a better balance in their favor than they did the previous year. Seven, eight and even eight and one-half pound shad were frequently displayed and the general run of fish was the best ever seen on the river. The prices obtained for the shad were unusually satisfactory and the market was never overstocked during the season. In the height of the season the United States steamer Fish Hawk spent several weeks at Gloucester City and other points along the river, taking spawning fish from the shore fisheries, hatching the eggs stripped from them and turning millions of young shad into the river every day. The Lookout, another government steamer, was engaged in the same work at Burlington and Lambertville for several weeks, and the total output of young fish by the government during the season was reported as twenty million (20,000,000).

Serious complications arose during the season of 1885 between the New Jersey fishermen and the authorities of the State of Delaware, and a number of fishermen were arrested and their boats and nets confiscated for alleged trespass on the rights of Delaware fishermen and violation of Delaware laws. An injunction of the Supreme Court of the United States was obtained, commanding and enjoining the State of Delaware, its officers and agents, to desist from arresting, imprisoning, fining, trying, or in any manner punishing or seizing, holding or selling any property of any citizen or resident of the State of New Jersey for fishing in the river Delaware. While this injunction was in force, and the Governors and Attorneys-General of the two States were conferring about the matter, the boats and nets of a citizen of New Jersey were seized by Delaware under the charge

that they had violated the statute law of Delaware by fishing within the limits of that State.

The Delaware authorities insisted that the law had been violated by the parties arrested because they fished within the limits of the State in Delaware bay, and therefore not within the territory covered by the injunction. The Governor of Delaware proposed at the conference, that the proper location of the dividing line between the river and the bay, for the purposes of the injunction, should be referred to the Attorneys-General of the respective States, and agreed that, during the pendency of the injunction, no citizen of New Jersey should be molested for fishing above the line so located.

Attorney-General Stockton, of New Jersey, and Attorney-General Paynter, of Delaware, with the aid of Professors Mitchell and Hilgard and Messrs. C. G. Garrison and A. H. Slape, of counsel for this State, decided that the dividing line between the river and the bay should be drawn from Cohansey Light to Bombay Hook Point. This agreement surrendered no right of any citizen of New Jersey, but was simply a construction of the term "Delaware river" as used in the injunction, so that no question could thereafter arise as to the extent of the territory protected by the court. The proceedings against the boats and nets were dropped by mutual agreement. The property was previously restored to the owner by the United States Marshal, by virtue of writs of replevin and other proceedings instituted by Attorney-General Stockton.

During the coming shad season the Commissioners will adopt a method which will insure an accurate report of all the details of the fisheries of the State. Blank forms will be distributed before the opening of the shad season, with instructions to the wardens which will aid them in securing detailed reports each day or week of the catch of shad and other fish, of the number of men employed, the amount of net used and the value of the catch.

By the order of the Commissioners a shad hatchery was established at Lower Black's Eddy, on the Delaware river, on June 1st, 1885, under the charge of Mr. R. B. Reading, an experienced fish culturist. Operations were continued until July 4th, and in the short space of time intervening three million four hundred and forty-five thousand (3,445,000) shad were hatched and turned into the Delaware river. Two hundred thousand (200,000) eggs were turned over to J. Frank Ellis to be hatched in the U. S. Fish Commission-Car, No. 3, and placed in the upper reaches of the same river. Mr. Reading, in his report to the Commissioners, substantially says:

"Taking into consideration the lateness of the season, the unprecedented run of shad in May, which seemed to exhaust the run, and the bad weather in the early part of June, our operations have been in every way successful, and I take pride in being able to report that for the amount of money to which we were limited in our expenses our success seems most gratifying, and the result must be of vast benefit

to the shad-fishing of the Delaware river. The largest part of the shad were hatched in the Seth Green boxes, and where we have such an even current of water as can be had in the Delaware river, they give the best results. About eight hundred thousand (800,000) shad were hatched in McDonald jars, which also give good results, although the young shad do not seem to be as strong as those hatched in the boxes, where the water is of the same temperature as their natural spawning grounds."

The total expense for securing and hatching the eggs for the forty-one days demonstrated the possibility of hatching nearly seven thousand (7,000) shad for one dollar (\$1), or seventy (70) for one cent.

#### COAST FISHERIES.

This industry is a very important item in the economy of the State. The bays and estuaries along the coast of New Jersey annually furnish fish enough to place the State sixth in the list of fish producers, and give employment to between four and five thousand people. In exceptionally good years the value of the catch has reached considerably over one million dollars (\$1,000,000) exclusive of oysters and clams, and in the worst of seasons it has aggregated at least one million dollars (\$1,000,000).

The importance of this industry will be seen in the fact that over one million dollars (\$1,000,000) is invested in the apparatus for prosecuting it, and that over one hundred thousand dollars (\$100,000) worth of nets are annually used. The two seasons covered by this report have been unusually poor in results, and the decline of the industry has almost invariably been attributed to the reckless work of the menhaden fishers, who are known to destroy millions of pounds of marketable fish in their pursuit of material for making oil and manure. This, however, is the least part of the evil that they do, as it is asserted on the highest authority that the wholesale capture of menhaden is driving from our coast the fish that depend upon them for subsistence. Almost all of the salt water species prey upon menhaden, and the natural result of depleting their stock of food is to drive them to seek it elsewhere. Blue fish are especially valuable to our coast fishermen, and in 1880 the catch was valued at nearly one hundred thousand dollars (\$100,000). Last year, it is claimed, the aggregate did not reach one-seventh of that amount, and the blame is laid to the menhaden fishermen. Weak fish were also scarce during the season of 1884, while sea bass and other bottom fish were more numerous than usual and aided in bringing up the total figures of value, but this did not satisfy the fishermen who had invested their capital in seines, fykes and pounds. Mackerel were phenomenally plentiful last year, and the catch in Delaware bay and along the New Jersey coast exceeded anything in the recollection of the oldest fisher-

men. Only one good catch of Spanish mackerel was made during the season, and this was made by the pound fishermen at Seabright, early in July. The colonies of fishermen at Seabright and Galilee were loud in their denunciation of the menhaden fishermen, and, as at Holly Beach, threats were made of procuring cannon and firing upon the marauding steamers. In speaking of this matter, an old fisherman said: "There is no certainty about the fishing. The oil fishermen destroy everything that comes in the compass of their immense nets, and spoil the fishing not only off shore, but in the bays and sounds along the Jersey coast. They are always on the lookout, and at the first sight of a school of fish making for an inlet or skirting along shore, they are out with their boats, and in a twinkling the purse net is around the school, and all, pursued and pursuers, big and little, menhaden, blue fish, weak fish, drum fish, Spanish mackerel, and all, are gathered in to be ground into pulp and pressed for oil and manure, that a few rich monopolists may grow richer at the expense of the thousands who depend upon fishing for their bare existence. This thing is all wrong and should be stopped; it is crippling a great and vital industry and robbing the State. It robs the shore-men of thousands of dollars every year. The oil manufacturers claim that they give employment to hundreds of men, but at the same time they are robbing thousands. One of the most profitable sources of income to the bay fishermen exists in catering to the anglers who come to the shore every year. They are growing fewer every season, because the fishing is being destroyed. These thousands of men spend money freely among the fishermen, farmers and boarding-house keepers. It is safe to say that for every dollar spent in the State by menhaden fishermen, the anglers spend hundreds. Nor is this all; the wholesale destruction of food fishes, as the blue fish, weak fish and mackerel, is a wicked waste of what Providence provides for the poor and hungry, and to continue to permit the piratical invasion of the menhaden boats along the coast, in the face of a common protest, is a great wrong to the whole people. It was announced at the close of the season that the menhaden fishing had been unprofitable and that the business would probably be relinquished by many of the companies. This looks like an effort to forestall legislation by quieting the opposition. It is to be hoped that it will not succeed in producing any indifference to the great evil which now exists and will certainly continue until the last fish is caught or driven from the coast. The enormity of the business may be understood when it is known that over two hundred steamers, each with a capacity for catching from forty to fifty thousand fish per day, are constantly patrolling the coast."

Cod fish have been quite abundant on our coast during the two winters covered by this report, and upward of one million pounds were caught in each year. The fish are chiefly caught by smacks from

New York, and are sold in the markets alive or in fresh condition. Few are salted or sold to factories.

Crabs are among the most important products of New Jersey waters, and the annual catch averages over one hundred and fifty thousand dollars (\$150,000) in value, representing three million five hundred thousand (3,500,000) hard and soft shell crabs. The lobster industry is insignificant in comparison, and probably reaches about six thousand dollars (\$6,000) for the one hundred and fifty thousand (150,000) pounds annually captured. Weak fish form an important item, inasmuch as the yearly catch has frequently reached four million (4,000,000) pounds, valued at one hundred and twenty-five thousand dollars (\$125,000). Blue fish, in 1880, were estimated at three million six hundred and thirty-five (3,635,000) pounds, and valued at eighty-two thousand one hundred and twenty-five dollars (\$82,125). The sheepshead caught in the same year are said to have amounted to two hundred and seventy-five thousand (275,000) pounds, and the striped bass to three hundred and seventy-five thousand (375,000) pounds. The whole catch of sea-fish for the year was estimated at fourteen million twenty thousand five hundred (14,020,500) pounds, exclusive of menhaden, which were estimated at nearly thirty million (30,000,000) pounds.

Observation of the arrival of sea-fish in New Jersey shows that blue fish appear about the middle of May and leave in October, and weak fish observe about the same dates. Sheepshead come in the first week of June and remain until the first frost. Striped bass remain throughout the year and are caught in the shallow bay with nets as soon as the ice disappears. Black fish or tautog appear in April and cease biting in October. Sea bass are caught from June to October. King fish from July to October, and porgies observe about the same season. Cod fish are taken from the first week in October, and flounders come in October and disappear in May.

#### BLACK BASS.

The early history of black bass in this State is obscured, but there is reason to believe that Greenwood lake was the first body of water stocked with them, and that the first stocking of this lake was done by Thomas Storms, of Warwick, N. Y., and Stephen Garrison, of Avington. They placed fourteen bass in the lake in 1868. The bass were of the small-mouth variety, and came from a small lake in Orange county, N. Y. Since that time several additions of large and small-mouth bass have been made at intervals, and the lake now teems with both varieties, and is the most famous fishing ground for bass within one hundred miles of New York. From it have been taken many thousand young fish for stocking other waters of the State, and now there are but few clear ponds in the State that are not populated

by black bass taken from this and other waters by the Commission. The effort of the Commissioners has been to spread the bass as widely as possible, and as they cannot be successfully propagated artificially, it has been necessary to catch the fish and convey them over the State in cans, in charge of an attendant. The work is necessarily slow, expensive and laborious, but in every instance has been repaid with marked success. Black bass are not as prolific breeders as trout or salmon, but they deposit their eggs in nests and keep guard over them until hatched, driving off intruding fish, which prey upon the helpless spawn of other varieties. It is estimated that each full-grown female bass will successfully raise from twenty thousand (20,000) to forty thousand (40,000) young each year. Bass for stocking purposes are taken when near the spawning age, if possible, and plants of a few hundred are made in each designated locality. As far as possible it has been the aim of the Commissioners to distribute both varieties in all parts of the State, as the differing habits of the large and small-mouth bass make sure of the better of the two thriving in any particular pond. The small-mouth bass, as a rule, is fond of clear streams and ponds, with rocky or gravelly bottoms, while the large-mouth seeks shallower water, is content with sandy or even muddy bottom, and, like the pickerel, seeks the shelter of submerged stumps or logs, and the broad leaves of aquatic plants, and are not adapted to running water. Aside from its merits in the angler's eyes, the bass is a very profitable fish to cultivate. It is a very prolific breeder, under favorable conditions growing very rapidly, and commanding ready sale at good prices in all of our markets. As with all other varieties, opinions differ greatly as to the merits of the bass as a table fish, and possibly a great deal of the difference is due to the water in which the fish is raised. A black bass out of a clear, cold mountain lake has few superiors in firmness of flesh and delicacy of flavor, while on the other hand it is quite possible that one of his brothers taken from a stagnant, slank or muddy pond might retain a great deal of the rankness of his home, when baked, boiled or fried. The chief objection urged against the distribution of bass is that they speedily depopulate the waters of all the native fish. If they do, it is only to replace them with thousands of better fish, in the eyes of the angler or the marketman. Bass thrive well in reservoirs in every section of the State, and it is claimed by eminent authorities that they have a good effect in keeping the water clean and free from insect growth.

Mr. Seth Green, the veteran fish culturist of New York State, evidently thinks very highly of them, as the following expression of his opinion will show :

“In my opinion the black bass is one of the most valuable fresh-water fish we have in this country for several reasons, and if he were to be banished from all United States waters more anglers would cry for his return than for any other one fish we have, and if he was a

foreigner, and knowing him as well as I do, I would say spare no expense to get him here.

"They are a fish for the people, and I advocate putting them in all large lakes and rivers having in part rocky bottoms. They should not be put in waters inhabited solely by brook trout, as they are great feeders, and the majority of brook trout waters are too small to support them and furnish them with food, and if they got hungry, which would be very liable to be the case, I fear they would be inclined to think trout were good enough for them.

"The black bass is pluck clear through, and for all that is said concerning his voracity there are few fish beside that possess their tender, motherly qualities and take such care of their young until they have in a measure learned to look out for themselves. This is the reason why they increase so rapidly. They are not a difficult fish to catch, and can be taken in a variety of ways quite familiar to a large portion of your readers. They have no superior among fresh-water fish in point of gameness, and few excel them as a table fish when properly cooked and in season. I do not think any fish are as palatable when engaged in casting their spawn as at other periods.

"The fact that they are comparatively easy to transport and acclimate renders them doubly valuable as a people's fish. There is one fact that is commonly lost sight of in the matter of stocking waters, and that is that all waters are not suitable for all kinds of fish and cannot be stocked with them, and it is a useless expenditure of time and money and a waste of fish to attempt to make them live in waters which are not adapted to their requirements. Therefore we must study the habits of the fish and the character of the waters we wish to stock, and when we get them together success is sure to follow. Another point to be considered is that we cannot expect to raise much better fish than the waters they inhabit and the food they get would indicate. It is an impossibility to take certain kinds of fish out of thick, slimy water and expect them to equal in flavor those taken from clear, bright waters, and living on such food as is produced in such waters."

It is claimed that a bass will grow to the weight of eight ounces in one year, and that five-years-old bass often weigh between four and five pounds. The weight of the largest bass caught in this State thus far is eight and one-quarter pounds. It was of the large-mouth variety. It was caught at Greenwood lake last year by John Smith, a guide at Lakeside. During the year many fish were caught weighing from five to seven pounds.

While bass have been steadily increasing in the ponds and lakes of almost every county in the State, it is reported that the catch greatly decreased in numbers in the lower Delaware river, and no reason has been assigned for it.

The distribution of bass during 1884 and 1885 was done by the

Commission without direct appropriation for the purpose, and the bass were chiefly placed in the lakes and rivers of the northern counties. Swartswood lake, in Sussex county, received a large lot of full grown "Oswego," or large-mouth bass, taken from the Raritan river in October last, and during the same month Budd's lake, in Morris county, was replenished with eight hundred (800) full grown fish from the same source. The Orange reservoir, at St. Cloud, Essex county, received four hundred and sixty (460) large and small-mouthed bass in the fall of 1884, and at the same time three hundred and forty (340) large-mouth bass were placed in the Pompton river, at Mountain View.

The Rockaway river, at Boonton, was supplied with young and old fish of both varieties in September of last year, and two hundred fish were sent to each the Troy and Parsippany ponds, in Morris county. During the same month four hundred (400) bass were placed in Hopkins' pond and the Rockaway river, at Denville, Morris county, and three hundred (300) in the county pond at Caldwell, Essex county. On November 2d four hundred (400) large-mouth bass were consigned to the Passaic river, at Singack, Passaic county. The work of catching the bass was brought to a sudden conclusion early in November by the heavy storms which swelled the lakes and streams and made fishing impossible.

Many of the fish used by the Commission were caught in the Delaware and Raritan canal, near Bound Brook. The work can only be prosecuted from about September 1st until the weather becomes so cold that the bass retire to deep water to hibernate for the winter. Small fry can be caught and safely transported in the spring, but the spawning fish are then on their nests and should not be disturbed.

Rock bass (*Ambloplites Rupestris*) are found in many of the lakes and streams inhabited by black bass, and several of the wardens join with anglers in suggesting that they should be protected by law to the same degree that bass are now protected. Mr. Seth Green, the eminent fish culturist, says of them:

"The rock bass is an excellent fish for many waters. There are few of our clear waters, lakes or rivers where it will not thrive, especially those having rocky bottoms. They are a valuable fish to have in any waters, because it does not take a dancing master to catch them, and the ladies and children are almost sure to have a mess of fish of their own taking, if the rock bass are in the waters. They possess considerable game qualities, and on a light rod make quite a fight before they are brought to land. They will take most any kind of bait, worms, minnows, pieces of fish, grasshoppers and artificial flies, either trolling or casting, also the trolling spoon. I have recommended them for many waters, and in nearly every instance they have increased.

"They are a fish for the people, and I believe all waters, except

brook trout waters, are the better for having them in. They will hold their own against black bass and pickerel or any other fish, and do not grow to a great size, consequently do not require the amount of food to sustain them that is necessary for larger varieties of fish."

Among other suggestions made by the wardens are, the advisability of passing a law restricting the capture of black bass under one-half pound in weight or eight inches in length, and prohibiting the sale of bass in the close season. Both of these laws are in force in New York State, and the advisability of having concurrent laws is apparent. As the matter now stands, the markets of New Jersey are well filled with black bass in winter, and the fish are seldom found on sale at other times.

#### SMELT.

In consequence of the ice in the Hackenaack river last spring, the smelt season was very late, the fish did not run up the river above Cherry Hill to any extent, and at New Milford scarcely any smelt were caught. It was so late in the season when the fish arrived that some of them were found to have spawned. The catch was very good, but it did not last long. The smelt fishing generally commences in the Hackensack about March 3d, but the fish this spring did not make their appearance until April 1st.

I made an arrangement with a fishing crew to go out March 10th. We fished through the ice nearly every night until the river broke up, and did not catch our first fish until Wednesday night, April 1st. Then we caught about three hundred (300) fish, from which I took about seventy thousand (70,000) eggs and placed them on my hatching frames. On the night of April 2d about ninety-seven pounds of smelt were caught, from which I took about one million three hundred thousand (1,300,000) eggs. On the night of April 3d about four hundred pounds were caught, from I which took about three million (3,000,000) eggs. I did not go out again until the night of April 6th, as I had to arrange my frames in the hatching house and get my large hatching apparatus ready, as I now had more eggs than I could accommodate in the small one. I went out again on the night of April 6th, and caught about three hundred and fifty pounds, from which I took another three million (3,000,000) eggs. On the night of April 7th we caught about two hundred and fifty pounds, from which I took enough eggs to fill the balance of my frames; consequently, I did not follow the fishermen up any longer.

The freshly-laid smelt eggs vary in diameter from  $\frac{1}{50}$  to  $\frac{1}{30}$  of an inch, and are slightly irregular in outline, although generally round or oval (fig. 1, plate 1). The number of eggs which a fish of average size will spawn is about fifty thousand (50,000). By an average-size fish I mean one of the size represented in fig. 3, plate 2, but, of

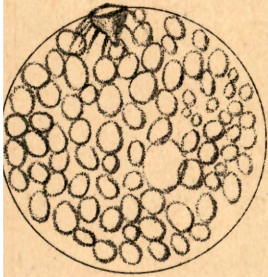
course, many fish will not yield this number of eggs, and many will yield more.

The eggs, as they issue from the female, are enclosed in or surrounded by a mucous or viscid substance, which seems to form a protection for the egg. This viscid matter has a tendency to adhere to whatever it touches, and although the eggs separate as soon as they touch the water, if in passing toward the bottom they come in contact with any object, they remain attached to it. The water then appears to act as a hardening agent upon this viscid coating, causing it to set in the form of a sack around the egg, with a slender stalk or handle between the egg and its attachment (fig. 8, plate 1). Sometimes a number of eggs remain in a little bunch together, or are gathered together by falling one upon another, the setting of the mucous around each one then transforms them into a cluster (fig. 12, plate 1). The unimpregnated ovum or egg, freshly taken from the female, presents a vitelline membrane or shell entirely filled with highly refractile oil globules of very uniform size; those oil globules constitute the vitellus or yolk. The vitellus membrane has upon one side a very prominent depression or pit—the micropyle—with an undoubted opening or pore at the bottom (fig. 1, plate 1). The micropyle at first indents the mass of oil globules, but as soon as the egg passes into water some of it is absorbed, and the vitellus shrinks in bulk and occupies a smaller space in the center of the egg (fig. 2, plate 1). From the absorption of water the micropyle soon becomes obliterated, and all traces of its position disappear soon after impregnation.

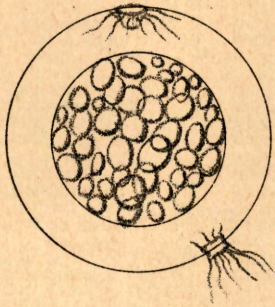
The absorption of water increases the size of the egg, although very slightly, the great change being the concentration of the yolk-mass. This distension of the vitelline membrane of course has very much to do with the disappearance of the micropyle. The micropyle is not constant in position as regards the stalk of the mucous sack, nor as regards the position of the embryo, it sometimes being over the head, sometimes over the tail, and sometimes at one side. This latter relationship, however, is of no special importance, since the yolk sack is movable, and the position of the micropyle, with relation to the embryo, thus a constantly changing one with every motion of the egg. After the absorption of water, the concentration of the yolk-mass, and the filling out of the vitelline membrane, the vitellus or yolk-mass becomes somewhat changed in character, the oil globules unite into each other directly, forming larger spheres in the center of the mass, with smaller ones filling up the interstices and forming a layer around the outside or periphery. This form continues with more or less distinctness, sometimes assuming the fissural condition of impregnated eggs until the yolk gradually turns white, disintegrates and dies.

The eggs were all placed in the hatching apparatus with the temperature of the water at 37° Fahr. The eggs developed very slowly until April 11th, when the temperature of water rose to 40°; on April

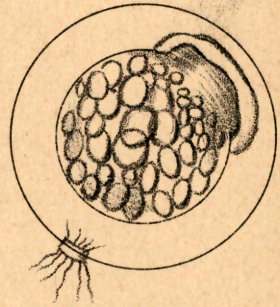
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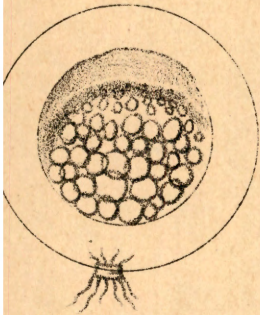
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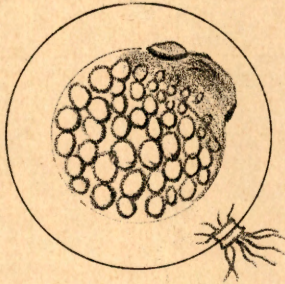
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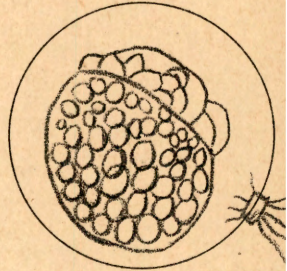
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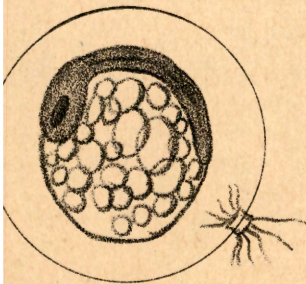
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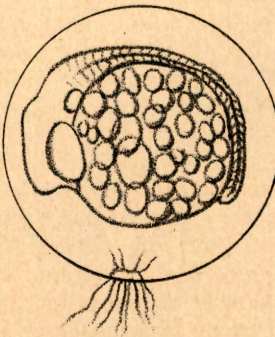
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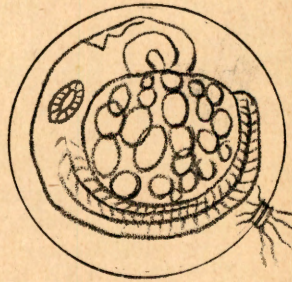
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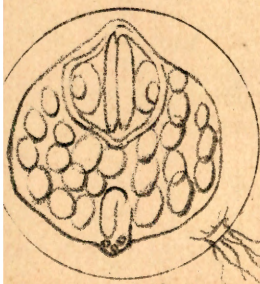
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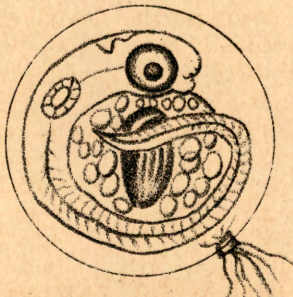
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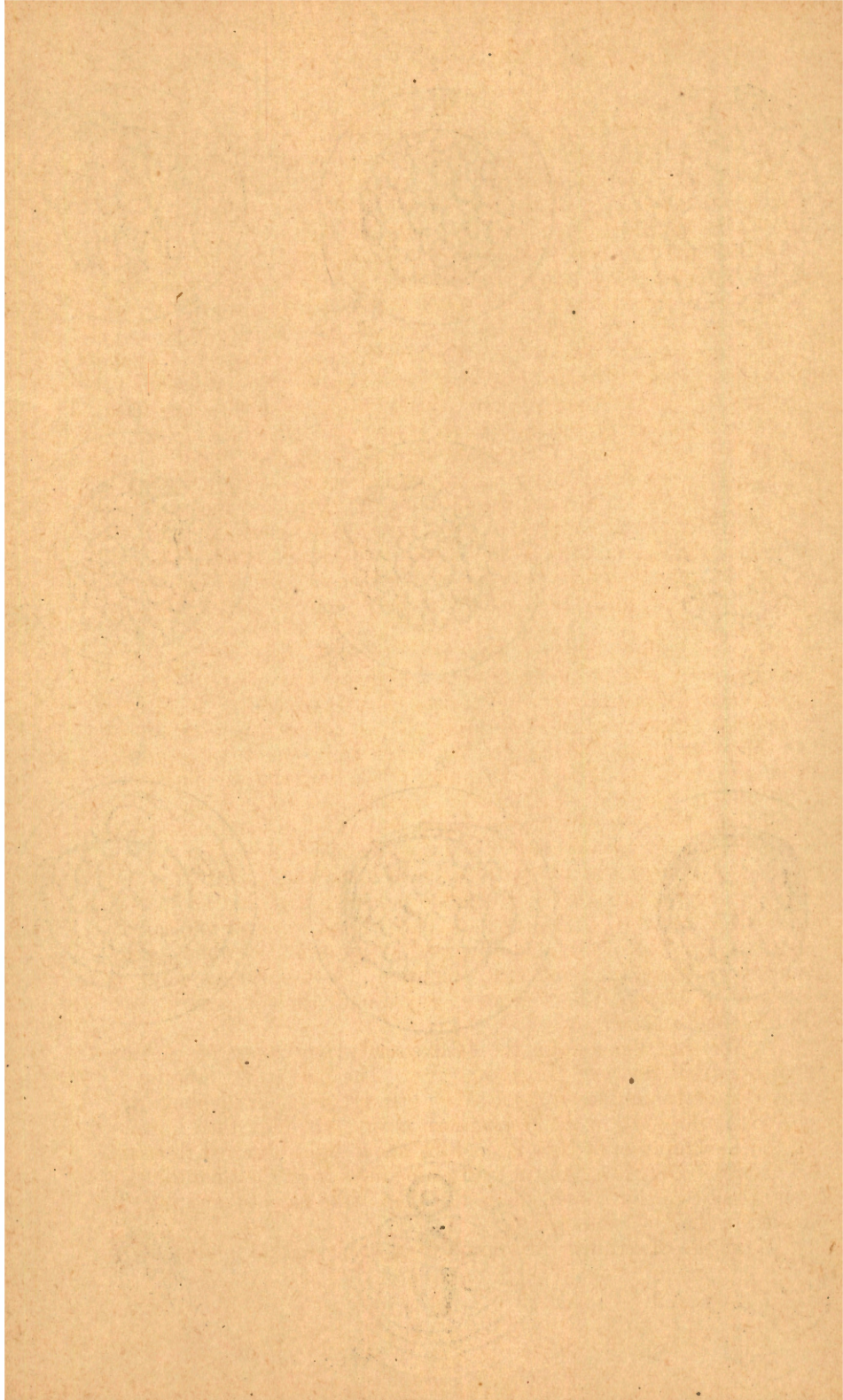


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14th the temperature of water rose to  $41^{\circ}$ , when the eye sockets of the young embryo could be plainly seen with the microscope (fig. 7, plate 1); on April 16th the temperature of the water fell to  $38^{\circ}$ , which retarded their development, and they made no change until the 19th, when the temperature of the water rose to  $44^{\circ}$ , and they appeared as shown in fig. 8, plate 1; was not bothered with any fungus on the eggs until the 21st, when the temperature rose to  $47^{\circ}$ . It then appeared on two frames and I immediately cleaned it off. As the temperature of the water rose the fungus increased, so that it compelled me to clean the eggs every day. Much can be accomplished by pains and attention in keeping the frames comparatively clear of dead material, and completely clear of fungus, and the greater the care and attention the greater will be the success. On April 25th the temperature of the water rose to  $50^{\circ}$ , and the pulsation of the heart of the young embryo could be plainly seen. They then appeared as in fig. 9, plate 1, and on the 30th the young embryo could be distinctly seen with the naked eye. At this time, to show the difference in the development of the smelt egg, I placed a cluster of eggs from the same female under the microscope, and they could be seen in all stages of development, from the young embryo just before the formation of the eye sockets (fig. 6, plate 1), to the full grown embryo ready to break the shell (fig. 11, plate 1).

The first embryo hatched May 2d, thirty-two days from the time the eggs were placed on the frames. Temperature of water  $48^{\circ}$ , or an average temperature of  $43\frac{3}{4}^{\circ}$  for the thirty-two days. On May 3d a few fish commenced to hatch from all the frames, but very slowly. On May 5th the temperature of the water again rose to  $50^{\circ}$  and the young embryo hatched very fast, and in two days the hatching boxes and troughs were alive with them. Having now reached the critical period of the work, the frames being full of shells and some dead eggs, fungus grows very rapidly and must be cleaned off, as it will yet be from twenty to twenty-five days before the last embryo hatches, the eggs on the outside of all clusters hatching first and so on until they are all hatched. The difficult part of the work is to clean the eggs without killing or detaching the young embryo when all the outside eggs are in a hatching condition, for the fungus must be cleaned off, because the presence of any fungus growth is sure death to the smelt embryo.

On May 6th I placed in the Hackensack river about one million five hundred thousand (1,500,000) fry. The fish still continued to hatch in vast numbers, and on May 9th I again placed about two million (2,000,000) in the Hackensack river. On May 14th I placed in the Raritan river at New Brunswick about eight hundred thousand (800,000). On May 29th, just fifty-nine days from the time the eggs were placed on the frames, the last of them were hatched and the fry placed in the Hackensack river.

To try the experiment of transporting smelt eggs, I placed about

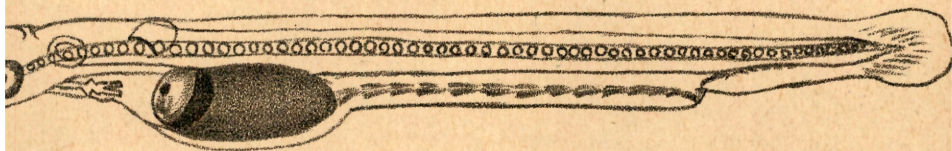
one hundred and fifty thousand (150,000) eggs on a tray, packed them in moss and sent them to Cold Spring, Long Island, to be hatched. The gentleman to whom I sent the eggs reported that he had received from me a lot of smelt eggs, taken on grass, sewed on muslin stretched on a wire frame and packed in moss. This lot was placed in a hatching trough in swift-running water the night after receiving, and when removed at about the time of hatching to a glass tank, about twenty fish came out, a result not encouraging to that mode of packing. But I do not consider that experiment satisfactory for two reasons: First, the person to whom I sent them advocates the theory that it is the water and not the fungus that kills the eggs. Second, that they must be protected from too much oxygen and good water by a coating of decayed eggs and fungus.

I have taken a frame of small eggs, packed them in moss, and placed them in a cool cellar for four days, and then put them back in the hatching box, without the removal resulting in any bad effects upon the eggs, as I hatched as many from that frame as from any other, by keeping it free from fungus, and giving it plenty of oxygen, through the medium of good, pure water. The effects of fungus on the smelt eggs can be seen by watching an egg containing a full-grown embryo. If the fungus attaches itself to the egg, the embryo will die in from twenty-four to forty hours.

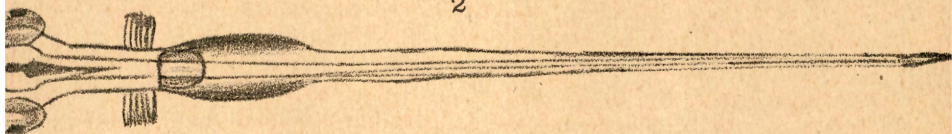
It has been an open question whether the young smelt fry could be transported with any degree of success, on account of their apparent delicacy and infinitesimal size, as it is almost impossible to change the water in the cans without a great loss of fish, for it seems that they can pass through anything that water will run through. I have tried a number of experiments last year in the transportation of smelt fry. I sent them all over the State in cans and bottles, without the loss of a fish. They will live for ten days without any change of water, and may easily be sent from New Jersey to California by express without requiring any attention en route.

At the last meeting of the American Fish Culture Association at Washington, D. C., I gave to Prof. H. J. Rice a number of smelt fry to be exhibited at that meeting. I put them in a bottle of water, and he placed them in his satchel and carried them to Washington without giving them any air. He reported to me that he did not lose a fish; a result showing beyond doubt that the young fry are very hardy and easy to transport.

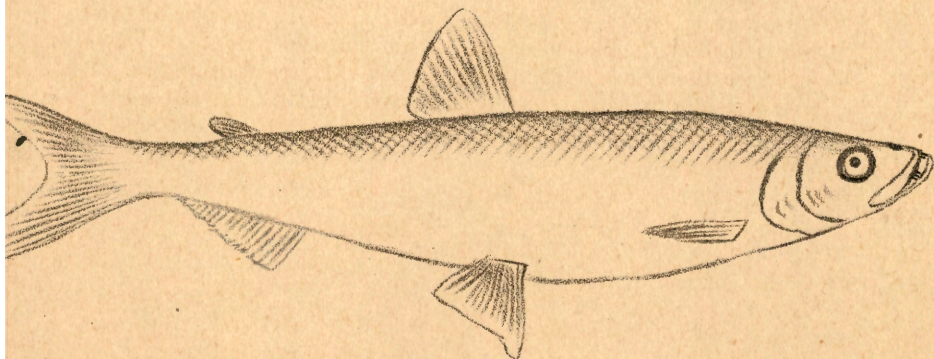
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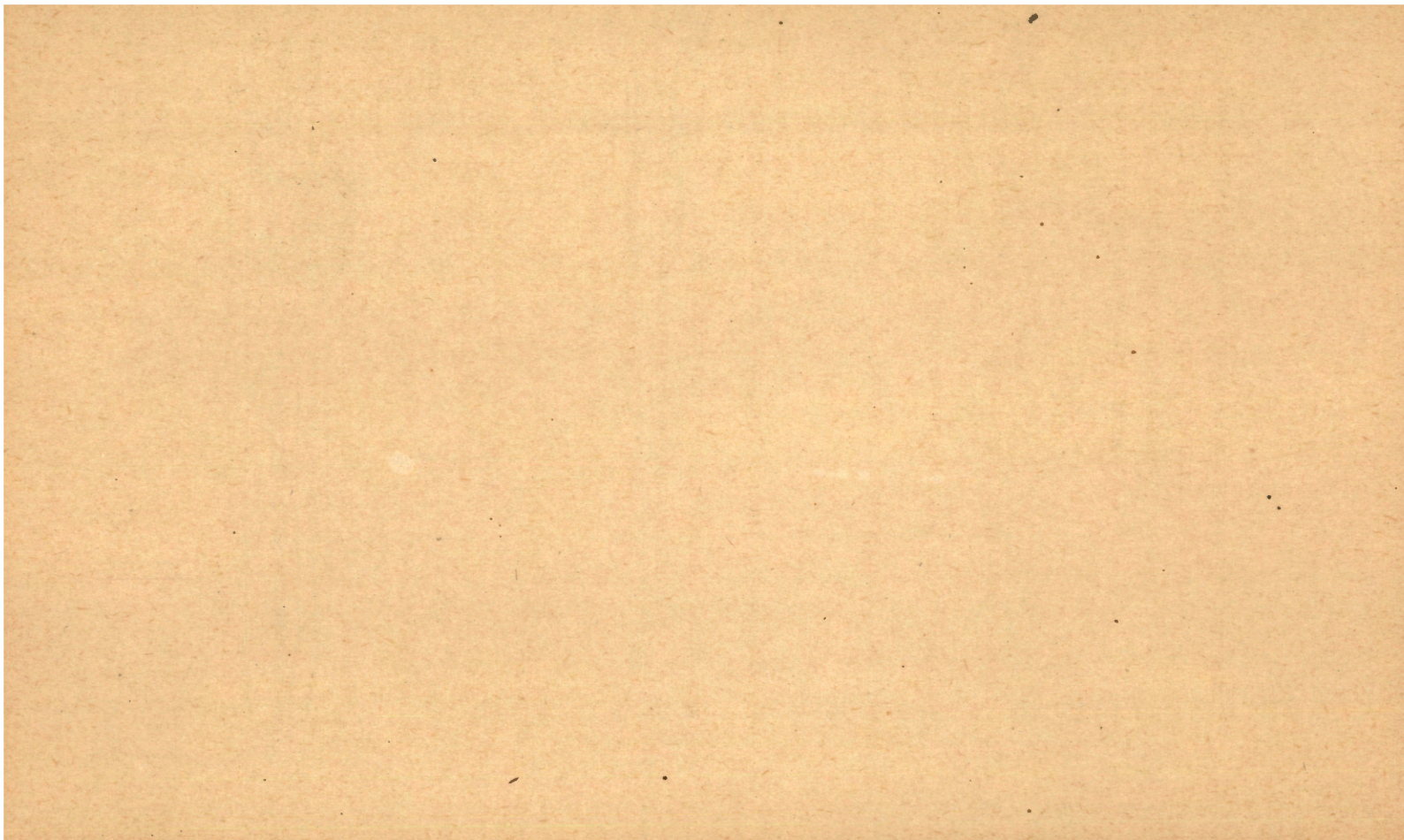


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## DESCRIPTION OF PLATES.

*Plate 1.*

Figure 1. Unimpregnated egg, freshly spawned, showing the micropyle on the top.

Figure 2. Profile view of unimpregnated egg after being in the water twenty minutes.

Figure 3. Two days after impregnation, showing the formation of the "limb."

Figure 4. Five days after impregnation, stage preceding the dorsal laminae.

Figure 5. Seven days after impregnation.

Figure 6. Ten days after impregnation.

Figure 7. Fourteen days after impregnation, showing anterior or head enlargement.

Figure 8. Twenty days after impregnation.

Figure 9. Twenty-five days after impregnation.

Figure 10. Same period, showing face view of embryo.

Figure 11. Thirty-days after impregnation, showing young embryo ready to hatch.

Figure 12. Piece of grass containing a cluster of smelt eggs two-thirds natural size.

*Plate 2.*

Figure 1. Profile view of recently hatched smelt, very much enlarged.

Figure 2. Dorsal view of recently hatched smelt, very much enlarged.

Figure 3. Profile view of adult female smelt, Hackensack river form, natural size.

*Plate 3.*

Figure 1. Head of same with extended jaws.

Figure 2. Head of the Northern smelt.

Figure 3. Dorsal view of the Hackensack river smelt.

Figure 4. Dorsal view of the Northern or New England smelt.

## RECORD OF THE DISTRIBUTING OF SMELT FRY.

1885.			
May	6.	In the Hackensack river.....	1,500,000
"	9.	In the Hackensack river.....	2,000,000
"	12.	In the Hackensack river.....	1,000,000
"	14.	In the Raritan river.....	800,000
"	18.	In the Hackensack river.....	300,000
"	19.	In the Hackensack river.....	80,000
"	21.	In the Hackensack river.....	25,000
"	25.	In the Hackensack river.....	250,000
"	28.	In the Hackensack river.....	10,000
June	1.	In the Hackensack river.....	1,500
Total.....			5,966,500

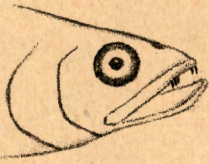
## RECORD OF THE DISTRIBUTING OF TOM COD FRY.

Feb'y	3.	In Passaic river, at Passaic Bridge.....	300,000
"	3.	In Saddle river, at Rochelle.....	200,000
"	3.	In Hackensack river, at Hackensack.....	450,000
"	6.	In Hackensack river, at Hackensack.....	100,000
"	7.	In Raritan river, at New Brunswick.....	500,000
Total.....			1,550,000

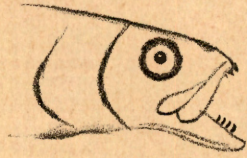
## VARIATION IN THE SMELT.

I have been asked a great many times what the difference was between the New Jersey and the Northern smelt, and I will quote from Report of Prof. H. J. Rice: "While at work upon the embryology of the smelt," he says, "I was constantly being reminded by the fishermen that the Raritan river smelt was entirely different from the New England, and by inquiring I found the difference to be in the size, flavor, and the transparency of the skull. The fishermen maintained very strongly that the New England smelt was a larger, coarser fish than theirs; that in the New England smelt no 'old man's face' could be seen through the skull; and that for the table the Raritan river fish was so much superior that there could hardly be any comparison between them. They also claimed two species of smelt for the Raritan river: one the common frost-fish, the other the silversides. This latter fish, according to them, never grows to a greater length than three or four inches, and the silvery sides, and the silvery reflections generally, are much more silvery than in the frost-fish. In other words, the frost-fish is a larger and less brilliantly-tinted fish than little Mr. Silversides. Persons acquainted with the Raritan river smelt only as a table luxury, were of the same opinion as the fishermen in regard to its being a distinct species, and I was desired to investigate the subject.

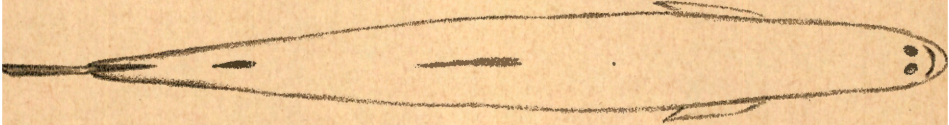
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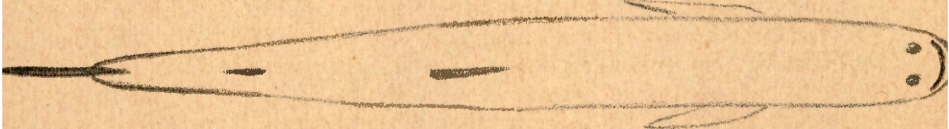
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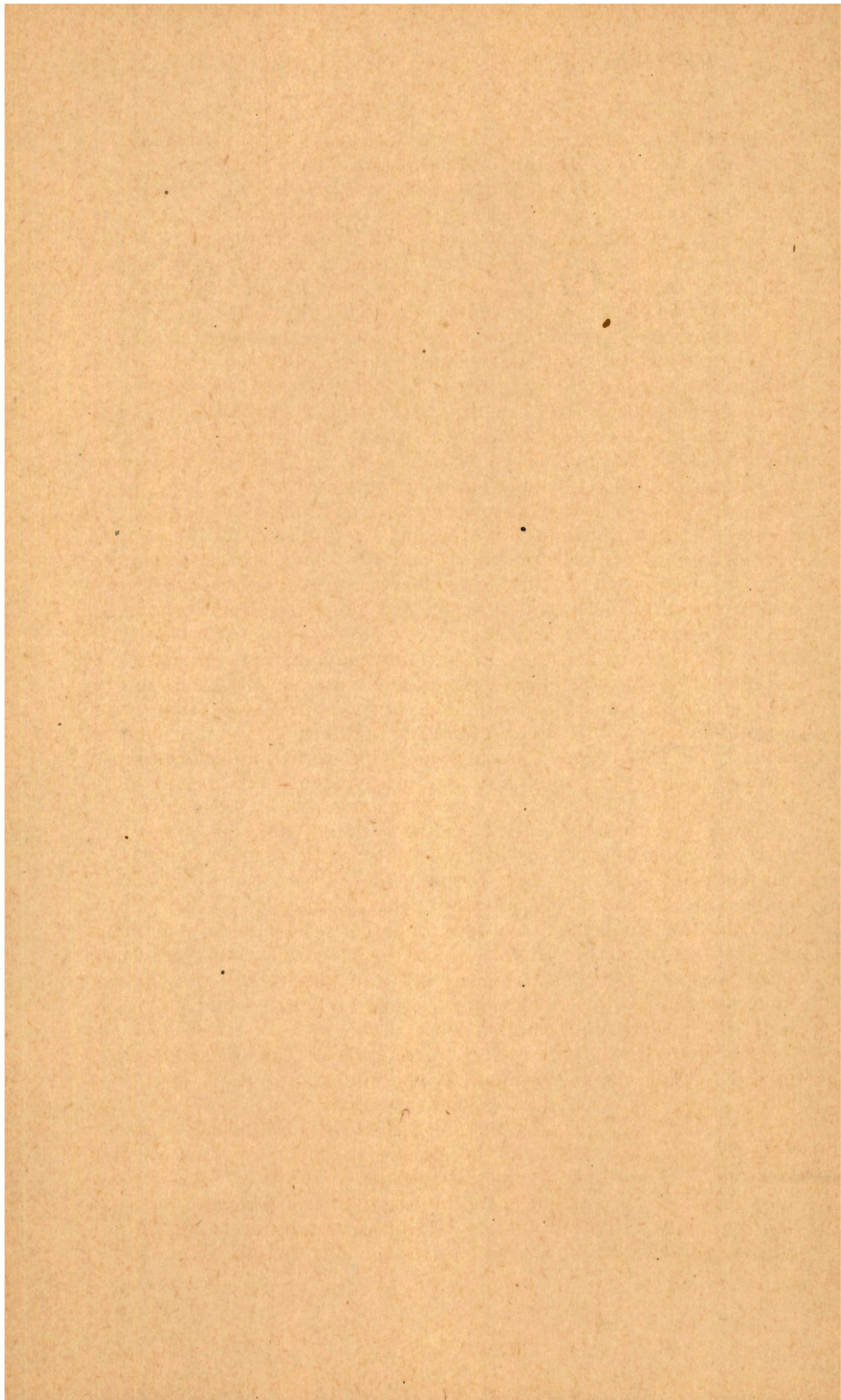


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"While at New Brunswick, with every day many of the Raritan river smelt on hand, I sent to Mr. E. G. Blackford, the well-known fish dealer in Fulton market, New York, for some male and female smelts, which he could guarantee me as having come from New England waters, and being genuine New England smelts, the *O. Viridescens* of Lesueur. With that kindness which he always shows toward scientific workers, he sent me some very fine fresh specimens of smelts, which he guaranteed as having been caught in Little Narragansett bay, R. I. With these specimens placed alongside of fresh specimens from the Raritan river, I was able to compare them with the greatest nicety. There were certain slight differences apparent. The color along the back and above the lateral line was of a slightly lighter shade of green in the New England smelt than in that of the Raritan; the first fin-ray in each fin in the Raritan fish was darker than the rest of the fin; while in the New England fish the fins were nearly uniform in color. In length the Raritan smelt would probably average five inches; the specimens of New England smelt which I had averaged about seven inches. The Commission, however, had Raritan smelt in their reservoir eight inches or more in length, and they have been taken in the Raritan of a length of thirteen inches, according to the fishermen; and in regard to the Northern smelt, Mr. Ch. Larman, in the United States Fish Commissioners' Report for 1872-3, page 224, says that the average size of smelt in Eastern Maine and New Brunswick is only five or six inches. The shape of the body, and the length of the body and head, compared with each other, in the two kinds, were nearly identical. The number of rays in the fins was the same in each. The scales were the same in shape, with similar concentric markings of proportional size, and nearly transparent. The teeth were alike, and consisted of a row of fine, closely-set teeth the entire length of the maxillaries; one or two pairs of vomerine fangs; two rows upon the tongue, of which the anterior four or five teeth were fang-like, and generally with a single fang at the extremity of the tongue; two rows of small teeth upon the anterior portion of the mandible, of which the inner were the larger; the outer row of mandibular teeth extended laterally upon the mandibles, but were more scattered and larger than anterior, and also larger than those in the inner anterior row. There were also rows of palatine and pterygoid teeth, but they were all small.

"All the teeth were recurved to a greater or less extent (figs. 1 and 2, plate 3). The viscera was similar, and the number of *pyloric cæca* five in each. The head in the two fish showed greater variation. In the New England smelt it was fuller; the lower jaw did not protrude so far beyond the upper, and the gape of the mouth was not as great vertically. The difference in the fullness of the head and rounder snout and less prominent mandible in the New England fish are shown in figs. 3 and 4, plate 3. The great gape of mouth in the Raritan smelt is shown in fig. 1, plate 3. The general shape of the

head in the Raritan smelt (fig. 3, plate 2) is more delicate and pointed than in the other (fig. 2, plate 3); the top of the head, back from the eyes, is slightly flattened, from whence there is a rise to the dorsal contour-line of the body. The delicacy of the head is due to the slight contraction of the sides of the head in the region of the eyes (fig. 3, plate 3), and the protrusion of the jaws thus narrowed into a more slender snout. The lateral line in each begins at the dorsal extremity of the gill-opening, curves ventrally and posteriorly for a short distance, then passes in a straight line to the tail, near its center. The differences upon which we have, then, to form two species of them are, first, a higher coloration of the back and of the first fin-rays in one than in the other; second, in size, and, third, in the shape of the head. As regards the frost-fish and silversides, upon placing side by side such specimens as were acknowledged by the fishermen to be types of the two kinds, no difference could be detected by the fishermen themselves, even in the brilliancy of the silver markings; and when convinced of this, they said, 'Well, these never grow any larger,' referring to the silversides. If size and, perhaps, a slight variation in coloration can determine species, then we have at least three species of smelt in this country."

Mr. Thaddeus Norris claims a new species in the smelt of the Raritan and Delaware rivers. His description was printed in the *American Angler's Book*, Phil., 1865, page 263. He says: "The points of difference between this and the *O. Viridescens* are the more southern habitat of the new species, its smaller and more uniform size, and the distinct roseate purple of the streak above the lateral line. *O. Viridescens*, the northern smelt, attains the length of twelve inches. I have seen the new species here described in quantities at New Brunswick, N. J., but never exceeding six and a half inches, exclusive of caudal." In his *American Fish Culture*, Philadelphia, 1868, page 202, he calls the Raritan river smelt "*O. Sergeantti*," thus taking it for granted that it is a new species.

GEO. RICARDO.

HACKENSACK, N. J., Dec. 31st, 1885.

#### SALMON.

The work of hatching impregnated salmon eggs and placing the young fish in the waters of the State was abandoned in 1882, after nearly two million (2,000,000) fish had been planted. The only other attempt to stock the Delaware river with these noble fish was made last year by the U. S. Commission under the direction of Superintendent Fred Mather, of Cold Spring hatchery. A new plan of stocking was adopted at the suggestion of the State Commissioners, and one hundred thousand (100,000) California salmon were divided between points near the headwaters of streams emptying into the

Delaware river. The fish were placed in the Musconetcong, at Waterloo; the Pequest, at Andover, and the Paulins kill, near Newton. At the same time about seven thousand (7,000) rainbow trout were placed in the same streams. The experiment will be observed with interest by the Commissioners.

#### BROOK TROUT.

The distribution of brook trout during the two years covered by this report was inconsiderable, but the reports from many places stocked in former years were quite encouraging, and indicated the comparative success of planting in every instance where the fish were placed in suitable streams. The improvement is especially observable in the streams flowing into the Delaware river, where the character of the country and the water seem admirably suited for trout. The wardens and interested persons have frequently requested that certain waters be replenished with trout, and applications are constantly being made to the Commissioners to supply designated streams with fish, but they have seriously questioned the advisability of making further expenditures of public money for the propagation of a fish that can hardly be expected to furnish food for the masses, and which can only be looked upon as a luxury for the almost exclusive pleasure of the few who can command time and wealth to expend upon their pursuit. Hundreds of private streams in the State are well stocked with trout, and the supply is only maintained by the exercise of constant watchfulness upon the part of the owners. If the same care was observed in policing public streams, there is every reason to believe that trout would naturally maintain their position in the waters of the State, without further efforts in the direction of artificial propagation.

#### PICKEREL.

The pickerel (*esox reticulatus*) is a favorite native fish in this State and complaint is made that the species is rapidly becoming extinct. The black bass is generally blamed for the extirpation of the pickerel, and while the bass is probably, in a great measure, blamable, it is not just to claim that he is the greatest agent of destruction, as it is an assured fact that in the absence of restrictions upon pickerel fishing almost any body of water may be depopulated by the methods now pursued by anglers and pot hunters. With the growth of any community the pickerel will surely decrease, as the habits of this fish make him the easy prey of any ten-year-old boy who can procure a boat, a paddle and a piece of wire. The pickerel, though a rapacious fish, is one of the stupidest of all the species. He lies in shallow water throughout the greater part of the year and is shot, snared, speared

or netted without regard to law or reason. Pickerel bite eagerly in winter, and millions are caught through the ice by both sportsmen and market fishermen. The existing law prohibits pickerel fishing only between March 1st and May 1st, and is little known and less respected throughout the State. Many anglers urge the passage of a law prohibiting winter fishing by protecting the fish from December 1st until May 1st. Thousands upon thousands of small pickerel are used every season as bait for black bass and it is considered necessary to prohibit this obvious abuse by law.

#### TOM CODS.

An interesting experiment in the artificial propagation of tom cods was made last year by Warden Ricardo, at Hackensack, and successfully demonstrated that the fish were easily hatched by the system in use in his hatching house. He succeeded in hatching one million six hundred thousand (1,600,000) and planted one million five hundred and fifty thousand (1,550,000) in the Passaic, Raritan and Saddle rivers. While the experiment has considerable scientific value it is not proposed to continue it any further owing to the natural abundance and slight commercial value of the species.

#### GERMAN CARP.

From the fact that carp will live and thrive in ponds unsuited to sustain almost any other variety of fish, their distribution in this State is thought to have been productive of some benefit in many localities, and especially in the central and southern counties. Where the carp are intelligently cultivated in ponds made for their reception and kept free from other varieties of fish, they have invariably proved to be profitable. The rapid growth of carp is their only recommendation. Until last year the State Commissioners had but little to do with the distribution of the carp, and they were obtained by individuals directly from the U. S. Fish Commission in lots of twenty fish, which were safely transported to some part of the State by the express and railroad companies.

An exhaustive treatise on carp and carp culture was published in 1882 in the annual report of the Bureau of Statistics of Labor and Industries. This gave an impetus to carp industry and caused many applications for fish. The applications were speedily filled and new ponds were created or old ones stocked, in many localities in the State. Where carp have been left to their own devices in natural waters they have rapidly deteriorated, from hybridizing with suckers and other grosser fishes, but where carefully cultivated on correct principles, in ponds free from other fish, no change has been observed in

their progeny. Opinions differ widely in regard to the edible qualities of carp, but it is claimed that they are as good as any fish that will exist in shallow ponds, where the temperature of the water becomes very high in the summer months. It is claimed that the muddy flavor sometimes observed in carp can be removed by placing them in clear water for several days before they are needed for the table.

Mr. John H. Brakeley, of Bordentown, N. J., who is authority on carp culture, furnishes the following list of aquatic plants which thrive in New Jersey, and are admirably adapted for the sustenance of carp:

- " White water-crowfoot—*Ranunculus aquatilis*.
- " American lotus—*Nelumbium luteum*.
- " Egyptian lotus—*Nelumbium speciosum*.
- " White water-lily—*Nymphaea odorata*.
- " Yellow water-lily—*Nymphaea flava*.
- " Yellow pond-lily—*Nuphar advena*.
- " Water-cress—*Nasturtium officinale*.
- " Water-milfoil—*Myriophyllum*, several species.
- " Water-purslane—*Ludwigia palustris*.
- " Cardinal flower—*Lobelia cardinalis*.
- " Water-chestnut—*Trapa natans*.
- " B'adder-wort—*Utricularia gibba*.
- " Hornwort—*Ceratophyllum demersum*.
- " Water-starwort—*Callitriche heterophylla*.
- " Cat-tail flag—*Typha latifolia*.
- " Bur-reed—*Sparganium eurycarpum*.
- " Arrow-head—*Sagittaria variabilis*.
- " Blue flag—*Iris versicolor*.
- " Pickerel-weed—*Pontederia cordata*.
- " Mud plantain—*Heteranthera reniformis*.
- " Common rush—*Juncus effusus*.
- " Rice cutgrass—*Leersia oryzoides*.
- " Tuscarora rice—*Zizania aquatica*.
- " Rattlesnake grass—*Glyceria canadensis*.
- " Manna grass—*Glyceria fluitans*.
- " Manna grass—*Glyceria obtusa*."

## FINANCIAL STATEMENT.

The following statement shows the amount appropriated and the amount expended during the years covered by this report :

1883 and 1884.

To Balance on hand at date of last report.....		\$309 34
Amount of appropriation allowed by act approved April 15th, 1884.....		3,000 00
		<hr/>
		\$3,309 34
By Amount paid for procuring, hatching and distributing bass, shad fry and smelt fry....	\$1,401 70	
Amount paid for hatching jars.....	26 60	
Expenses attending U. S. Senatorial investigation of menhaden fishing.....	121 35	
Expenses of Commission.....	186 59	
		<hr/>
		1,736 24
		<hr/>
Balance on hand.....		\$1,573 10

1885.

To Balance from 1884.....		\$1,573 10
Amount of appropriation allowed March 24th, 1885.....		2,000 00
		<hr/>
		\$3,573 10
By Amount paid for procuring hatching bass, trout, shad fry, smelt fry and tom-cod fry.....		2,106 07
		<hr/>
		\$1,467 03

## CONCLUSION.

Complaint is frequently made that the seizure and sale of nets and other apparatus used in illegal fishing fails to accomplish the desired effect in proving either a severe penalty or warning to the violators of the law. It is shown that in fishing communities a neighborly feeling or the fear of incurring general enmity prevents the purchase of the apparatus by any one but the original owner, and this he invariably succeeds in doing at a price which falls far short of paying the expenses of seizure and sale. There is no fund for paying the shortage in such accounts, and the Commissioners have on hand many bills from Justices of the Peace which have not been paid for lack of any direct provision for the purpose.

The Commissioners would suggest that the law should be amended so that nets and other apparatus seized in illicit fishing could be condemned and destroyed as in many other States. They feel sure that this measure would be a wholesome one, as it would bring to bear a fear of serious consequences which is not now entertained by the infractors of the law. The Commissioners also suggest the advisability of the

thorough compilation and distribution of the fishing laws, in pamphlet form, throughout the State, as a dense ignorance of the provisions is apparent everywhere.

By an act passed April 16th, 1884, the Commissioners were instructed to cause efficient fish-ways to be built over the dams of the Passaic river at Dundee lake and Little Falls, at a cost not to exceed \$500. No provision was made, however, for paying for the necessary work, and the matter was left in abeyance after making an examination of the localities mentioned. The visit resulted in convincing the Commissioners that the sum allowed by the act was totally inadequate to pay for the construction of practical and efficient fish-ways at either of the designated obstructions in the stream, and notably so at Little Falls. The Commissioners recognize the importance of providing means for the fish to surmount the dams in many of the rivers of the State, and recommend that necessary appropriations for this purpose be made.

The Commissioners feel that their duty would not be fulfilled without an acknowledgment in this report of the many courtesies and kindly aid furnished at all times by Comptroller E. J. Anderson, whose interest in every subject pertaining to the fish and fisheries of the State is only equalled by his thorough knowledge of everything pertaining to the subject. He has invariably given advice and aid with the utmost willingness, care and particularity when applied to, and has greatly aided the Commissioners in their work.

WILLIAM WRIGHT,  
RICHARD S. JENKINS,  
F. M. WARD.



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SUPPLEMENTARY REPORT.

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## SUPPLEMENTARY REPORT.

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December 31st, 1885.

*To His Excellency Leon Abbett, Governor :*

SIR—The efforts of the Board of Commissioners during the two years covered by this report have been devoted more to the prevention of illegal fishing and the preservation of existing fish than to the propagation of old or introduction of new species. A great deal has also been done in the distribution of fish throughout the State with very satisfactory results. The hatching operations have been limited to the work of Mr. R. B. Reading, of Hunterdon county, at the hatchery at Bull's Island, where the hatching of shad was continued as long as ripe adults could be obtained, and that of Warden George Ricardo, at Hackensack, Bergen county, where a large number of smelts and tom cods were hatched and consigned to the waters of the State, as is fully shown in the reports furnished by these fish culturists.

Warden Shrope, of Hunterdon county, reported at the close of the season of 1884 the capture of seven thousand five hundred (7,500) salable shad, four thousand five hundred (4,500) of which were caught at the two fisheries at Lambertville. The warden also discovered a novel arrangement at Alexsauken creek for the purpose of frightening shad and preventing them from running further up the river. It consisted of a stout cord stretched across the river with seventy-five (75) shingles attached to it at intervals of a few feet. He removed the cord, but was unable to discover the persons who put it in place. Warden Shrope found no violation of law among the fishermen in his district, but much complaint that the fish were prevented from coming up to the spawning ground by the gill nets and other fishing apparatus in the river below. They were unanimous in asking that fishing be suspended for three full days in each week, and stated that shad fishing above tide was done at a loss except on Mondays and Tuesdays. He reported that the bass fishing was decreasing, although the river was entirely free from weirs or traps of any kind in his jurisdiction.

Warden Henry Hill, of Mercer county, in his report for 1885, stated that the season opened with a fine run of unusually large male

shad, and soon followed with equally good shad of both sexes. He reported fifteen (15) fisheries in his district, with thirty-eight (38) gill and nine (9) shore nets. His estimate of the catch was twenty-five thousand (25,000) shad, four-fifths of which exceeded in size those caught in former years. The catch, he thought, would have been much larger but for the dam erected by the Water Power Company at Scudder's Falls, which, in his opinion, prevents the shad from coming down the river. He says that the shad on their way to the sea are carried into the water power and destroyed, and recommends that some action be taken to remedy this evil. Warden Hill remarks that the catch of sturgeon annually decreases, and says that this fact materially affects the catch of shad in the upper river, as sturgeons destroy gill nets on their way up the river and open a passage for the shad. The run of herrings and striped bass or rock fish, with perch and other small fish, has been unusually large. He also says that black bass have recently been numerous in many localities in his district, and that they are credited with the destruction of countless small shad. In conclusion, he says that he has constantly patrolled his district faithfully, and is satisfied that his unexpected visits in different localities prevented general violation of the law. Five arrests were made by him during the season, but as in each case they were first offenses the prisoners were discharged with a reprimand by the justice before whom they were brought.

Warden J. R. Ivins, of Burlington county, having the river district, reports, in 1884, one hundred and sixty-five (165) gill nets in his district, with an average catch to each net of one thousand four hundred and thirty-one (1,431) shad, making a total of two hundred and thirty-six thousand (236,000) shad caught by gilling; and five shore nets, making catches as follows: Hay's fishery, three thousand six hundred (3,600); Badger's Island, four thousand five hundred (4,500); Hawk Island, five thousand (5,000); Plum Point, five thousand (5,000); Cinnaminson Cove, six thousand (6,000), making a total of two hundred and sixty thousand one hundred (260,100) shad.

In 1885, he reports one hundred and sixty-one (161) gill nets fishing in his district, and fourteen (14) shore nets located along the river. The total number of shad gilled he places at two hundred and fifty-seven thousand six hundred (257,600), and the result of shore fishing at sixty thousand eight hundred (60,800), making a total of three hundred and eighteen thousand four hundred (318,400) shad. The combined length of the gill nets was twenty-one thousand three hundred (21,300) fathoms, and the shore nets aggregated two thousand eight hundred (2,800) fathoms more. The gill nets employed three hundred and sixty (360) men, and the shore nets two hundred and eighty (280). Warden Ivins' jurisdiction extends twenty-two (22) miles, from Crosswicks creek to Pennsaukin creek. He seized, during

the year, twelve (12) set nets, two (2) fykes and three (3) drift nets, which were used in violation of the law. The property was condemned and sold, and, in many instances, the operators were arrested and fined.

Warden John McCormick, of the northern district of Camden county, reported, in 1884, fifty-nine (59) gill nets, measuring ten thousand two hundred (10,200) fathoms, and capturing twenty-five thousand (25,000) shad. In addition to these, he reports the capture of nine thousand two hundred (9,200) shad, by a shore net of two hundred and ninety (290) fathoms, at the Pavonia Water Works, making an aggregate of thirty-four thousand two hundred (34,200). Twenty-four (24) men being employed in the fishing.

The catch of herring was small, and but little attention was paid to their capture. A carp weighing fifteen pounds was caught in one of the gill nets.

Warden McCormick, in his report, said that the number of large nets, reaching almost from shore to shore, had so increased that it was a wonder that any fish reached the spawning grounds. He suggested the amendment of the law so that fishing could only be pursued on Monday, Tuesday, Friday and Saturday, and also recommends the prohibition of fyke nets, which destroy thousands of young shad. Another important suggestion by this practical warden is that gill nets be limited in length in proportion to the width of the river at the points at which they are used. He reports the capture in his district of eight shad nets, five herring nets, fifty-eight fykes, one purse net and nine large wing fykes, used in violation of the law, together with one boat and rigging. This property was condemned and sold according to law.

Warden McCormick's report for 1885 shows seventy (70) gill nets, aggregating ten thousand four hundred (10,400) fathoms, and making a total catch of twenty-seven thousand (27,000) shad. The Pavonia shore fishery, employing twenty-four (24) men and two hundred and ninety (290) fathoms of net, took nine thousand five hundred (9,500), making a grand total of ten thousand six hundred and ninety (10,690) fathoms of net and thirty-six thousand five hundred (36,500) shad. The run of shad was unusually large and fine, and the catch of herrings and other fish insignificant. The seizures during the season were one gill net, one rockfish net, two fykes and six set nets, all of which were condemned and sold.

Warden Patrick Gallagher, in his report for 1884, shows that in his district, the southern portion of Camden county, forty-one (41) gill nets; measuring four thousand (4,000) fathoms, were used in catching sixteen thousand five hundred (16,500) shad. The catch at the Gloucester shore fishery he places at twenty-six thousand four hundred and twenty-eight (26,428), and the total catch of the season forty-two

thousand nine hundred and twenty-eight. Ten (10) gill nets took one hundred and fifty thousand (150,000) herrings, and one hundred and sixty-two thousand four hundred and sixty-four (162,464) more were caught at the shore fishery, where three (3) sturgeon were also taken. His report for 1885 shows a large increase in the catch of shad, with but four hundred (400) fathoms more of gill nets in use, and no increase in the length of shore net. The forty-four gillers took twenty-eight thousand seven hundred (28,700) shad, an increase of twelve thousand two hundred (12,200). The shore fishery secured thirty thousand nine hundred and sixty-nine (30,969), or an increase of four thousand five hundred and forty-one (4,541) over the catch of the preceding season. The total catch was fifty-nine thousand six hundred and sixty-nine (59,669) shad. Six men, six skiffs and three nets were seized during the season.

Warden Lawrence, of the northern district of Salem county, reported in 1884 that the money invested in fisheries in his district amounted to thirty-four thousand eight hundred dollars (\$34,800), employing five hundred (500) men, using two hundred and forty (240) nets. The number of shad taken was twenty-eight thousand (28,000), and the average price received was eighteen dollars (\$18) per hundred. The average weight of the fish was four pounds each. He made captures of four nets during the season. His summary for 1885 was far in excess of this, and he reported sixty-two (62) nets of eighteen thousand six hundred (18,600) fathoms total, and the capture of one hundred and sixty-eight thousand (168,000) shad. The price was about the same, and the fish much larger. The catch of herrings was very light. In both seasons thirty or forty nets from Delaware and Pennsylvania were fished and no account made of their catch.

Warden Jaquett, of the southern district of Salem, reported three hundred and sixty-seven thousand nine hundred (367,900) shad caught in his district and brought from the bay during 1884. Of this number one hundred and fifty-seven thousand (157,000) were caught in the vicinity of Pennsville. The number of nets there was eighty (80), and the average catch of each two thousand and ninety-nine (2,099). The average price obtained was seventeen dollars (\$17) per hundred. His report for the following year showed a net catch of three hundred and fifty-five thousand (355,000) by three hundred and twenty-five (325) men with one hundred and forty (140) nets. The average price was twenty dollars (\$20) per hundred.

Warden Pierson, of Gloucester county, reported in 1884 that one hundred and forty-five (145) gill nets were used by about three hundred (300) men. The total catch was estimated at three hundred and eighty-five thousand (385,000) shad. The shore nets were six (6) in number, and made a total of two thousand and eighty (2,080) fathoms,

furnishing employment to two hundred and twenty-two (222) men and ten (10) horses. The general complaint was that the catch was one-third short of that of the preceding year, but the prices were correspondingly better and the season was profitable to the fishermen. Violations of the law were only prevented by constant watchfulness.

Warden Charles B. Platt, who succeeded Pierson, took charge of the same county, and reported in 1885 as follows: "The fishing season was short, owing to the lateness of spring, but the catch of shad was large and they were of good size and flavor. There were one hundred and forty (140) gill nets used by residents of the county and forty (40) by non-residents. The average length of the nets was three hundred (300) fathoms, making a total of fifty-four thousand (54,000) fathoms. Five (5) shore nets were used. Gilling employed four hundred (400) men and shore fishing two hundred and sixteen (216) men. The total catch of shad was five hundred and seventy-four thousand (574,000). There has been very little violation of the fishing laws, owing to the vigilance of the deputy wardens patrolling the river."

Warden William I. Conover, of Monmouth county, reported last year that the black bass distributed in his district were thriving except in one pond, which was strongly impregnated with iron ore. He stated that but few violations of the law had occurred, and that those were due to ignorance rather than criminal intent. He stated that the steam menhaden boats seriously injured the fishing in Raritan bay, where, at times, as many as forty of these boats had been seen fishing in a single day.

Warden C. W. Castner, of Middlesex, in his report of December 18th, 1885, says: "The fishing for smelt, shad and herring in the Raritan river has improved two-fold within the last two years. Three years ago the river was stocked with shad, and this year the fishermen have caught almost double as many as in any one year in two decades.

"The smelt fishing is done with small nets, which necessarily destroy many small fish, such as white and yellow perch, bass and dace. The smelt are sent from the Raritan to all markets within reach, and are esteemed as a much greater delicacy than the Eastern species. They are identical with the smelt of Long Island, and the Hackensack and Passaic rivers. I think that the increase of shad is mainly due to the fact that the fishermen obey the law. They cease fishing on June 10th and commence on August 1st to fish for striped bass and catfish.

The black bass are taken with hook and line in the Raritan river between New Brunswick and the Five-Mile dam, but the stocking of the river has not proved a decided success. The land in the upper Raritan is composed chiefly of red shale, and every freshet thickens the water so that the bass run down the river until they meet the salt

water, when they turn up South river. South river is always well stocked with bass, and the water is clear. The bass which were placed in the pond at the water works have thriven and increased wonderfully. Many fish, weighing from three to five pounds each, were taken from it last year. A request has been made to have this fine body of water stocked with yellow perch. Fishing is prosecuted in Raritan bay throughout the season, and after the shad and herring season is over the seines are used for catching menhaden, which are sold for manure to the farmers.

Warden Henry Keenan, of Passaic county, with the support of the Passaic County Game and Fish Protective Association, has been very energetic during the last two years in bringing to justice a score of violators of the law in his county, and in preventing illicit fishing in the Passaic and Pompton rivers and Greenwood lake. He reports a large increase of bass in the lake and rivers, and a wholesome fear of the law on the part of many heretofore notorious violators. He suggests the adoption of a badge of office for wardens, a law restricting the capture of rock bass in the spawning season, and the stocking of Greenwood and other lakes with alewives or fresh-water herring which abound in Lake Hopatcong and furnish abundant and constant food for the bass, preventing them from exterminating pickerel, perch and other fish.

In his report for 1885, Mr. Keenan cites the arrest of eleven persons in his district, in the prosecution of whom he was assisted by the Passaic County Fish and Game Protective Association. In all of these cases the prisoners were punished either by imprisonment or fines, and he says that the effect has been very wholesome in almost entirely stopping violations in Passaic county. Accompanying his report is a contribution by a Newarker who is deeply interested in the fish and fishing of the State.

The Passaic river above the falls at Paterson is well supplied with black bass of both varieties; the small-mouthed bass (*micropterus pallidus*) predominating. The small bass are abundant, and fish of from three to four and one-half pounds are frequently caught. Natural food is plentiful, cray fish abound throughout those sections of the river which have gravelly shore, and small varieties of fish are constantly supplied by the tributary brooks, consequently the fish are seldom very eager for the angler's lure, and if nets could be kept from the river bass would multiply very rapidly. It is impossible, however, with present facilities and laws, to prevent the use of both fykes and seines. Farmers living upon the banks of the river own and frequently use nets, claiming that they have a perfect right to all fish in waters which pass through their lands.

The Passaic receives a constant accession of bass from its tributary ponds and streams in Morris and Passaic counties and from the wastegates of the Morris canal, into which many bass escape each year from

Lake Hopatcong. Greenwood lake possibly adds to the number by the canal feeder and Wanaque river. The other varieties of fish found in the river are yellow perch, catfish, eels, suckers, dace, rock bass, sunfish and pickerel. The latter (*esox raticulatus*) were, at one time, very numerous in the river, but the prevailing practice of snaring the fish at all seasons when the river is open, has depleted their numbers and prevented them from attaining their full growth. Pickerel weighing in excess of one-half pound are now seldom caught in the river in sections where they formerly attained the weight of five or six pounds.

The Passaic County Game and Fish Protective Association were energetic last year in protecting that part of the river which lies between Paterson and Two Bridges. They have succeeded in a great measure in stopping the violations of the law, and obtained several convictions against malefactors.

The river between the bay and Passaic City is tide-water, in which a few black bass are frequently found. In fact the black bass of both varieties have occasionally been taken in the salt water of the bay, into which they have found their way from either the Passaic or Hackensack rivers.

The river between the bay and Belleville is polluted with sewage and factory refuse, and is untenable for anything but catfish and eels. Twenty years ago this stretch of the stream was famous for shad, smelt and striped bass, but at present these varieties are very seldom found in the filthy water. Could the river be rided of the causes of pollution, there is every reason to believe that the valuable fish would return to it.

The Hackensack river contains in its tide water striped bass, white perch, catfish, eels, weak fish, shad, smelts and several other varieties. The upper waters are well supplied with black bass of both species and other fresh-water fishes.

Nearly all of the numerous lakes and ponds in Morris county are now well supplied with black bass of one or both species, and in the periods of from six to eight years that they have been thus tenanted, many of the fish have attained the weight of six pounds. In small ponds, unless constantly fed by streams in which small fish are numerous, the bass soon destroy all other fish except the hardy sunfish, and watchful persons have observed that the bass destroy their own fry, and that the large fish are constantly engaged in a warfare of extermination.

But slight proof has been found of the attendance of any success upon the efforts to stock any of the waters in the northern part of the State with California or Penobscot salmon, and there is no evidence that any of the white fish placed in the lakes have survived. Proof is still wanting that the land-locked salmon have obtained a place in our waters, but lake trout have been taken at Greenwood lake on two occasions during the year.

During the continued dry weather of 1884, the water in Greenwood lake fell six feet, leaving thousands of small bass and perch imprisoned in pools along shore. Many of the fish perished when the pools dried up, but the greater part were rescued by guides and anglers who, where it was possible, trenched the pools into the lake and in other cases netted the fish and restored them to deep water. Their countless numbers proved that the famous angling resort was in no danger of being depleted of bass for many years. None of the new varieties of fish were found in the pools. It is encouraging to observe that hotel keepers and guides at this and other resorts have arrived at a proper understanding of their interest and evince a desire to prevent the destruction of fish as well as to punish violators of the laws.

Warden W. L. Force, of Union county, reports in December, 1885: "There have been several cases reported to me of violations of the fish laws during the past five months, occurring in the streams known as Green brook, Stony brook, Raritan and Cranford rivers, which are all stocked with black bass. I have given such cases my especial attention, but have failed, for want of sufficient evidence, to cause the arrest of any parties concerned in the alleged violation of the fish laws. I am satisfied, however, that the parties suspected discontinued the practice of drawing seines in the streams mentioned when they ascertained they were watched.

"There are several ponds in this vicinity, notably the New Brooklyn, New Market, Seebring's and Parkhurst's, which were liberally stocked with black bass some six years ago through the efforts of The New Jersey Game and Fish Protective Society, which have given admirable results. These ponds, with streams flowing through them, are prolific of young and grown bass. The members of the above society have been indefatigable in their efforts to protect the bass planted by them and the Fish Commission.

"There are other streams in Union county which are well adapted for black bass. Having been depleted of these fish in consequence of the great freshet of 1882 carrying away dams, I think it would be good sense to restock them if the small fry can be obtained.

"Several ponds in this county have been stocked with German carp by private enterprise. I do not think, however, that stocking with this fish pays.

"I would suggest to your honorable body the propriety of so changing the fish laws regarding the legal time of closing the black bass season as to make it conform with the same laws of the States of New York and Pennsylvania. That is, to extend the time of closing the season from November 1st to January 1st. It seems ridiculous that a person may legally fish for bass on the New York side of Greenwood lake, or the Pennsylvania side of the Delaware river, until January 1st, but must stop on the New Jersey side November 1st."

Warden John S. Able, of Morris county, in his report for 1884 says that one of the greatest evils is the destruction of small bass by pot-hunters and boys, and suggests a law protecting bass until they have attained eight inches in length. He said that the stocking of trout streams in his district a few years ago was attended with a considerable measure of success, which would have been much greater had not many of the fish been placed in small rills which were dried up in the two succeeding summers, and frozen solid during the unusually severe winter which intervened. He advises restocking some of the larger brooks. The bass placed in the Rockaway river and other streams he says have thrived and multiplied amazingly, and that the streams and ponds are well stocked with pickerel and perch. Violations of law have been few in his district. A report that the life of fish in Hopatcong Lake was endangered by acid refuse from a manufactory of high explosives was investigated last year and found groundless, as was a similar report about the Black river, near Dover. In each case the water above and below the works was analyzed by Prof. Chandler, of New York, and the report returned to the Commissioners by Mr. Able, showing that no traces of deleterious substance could be observed in the water. Mr. Able finds that few violations of the law have occurred in his district, and has been unable to obtain direct evidence against any suspected persons.

Warden George Ricardo, of Bergen county, reported in 1884 that few violations of the law had been brought to his attention. The shad season of the Hackensack he said was very late and the catch was below the average, although the fishing was good in the latter part of the season. He reported that about one million (1,000,000) young shad fry were placed in the Hackensack during the season. Smelt fishing was good, and, he thought, plainly showed the benefit of the work done by the Commissioners in artificial propagation. "When the Commissioners first took into consideration the project of restocking the Hackensack river, the catch of smelt was so small that smelt fishing was practically abandoned, owing to the fact that but five to fifty fish could be taken in a night. The work of hatching was begun in 1877, and has been continued every year up to date. In 1880, the number of nets used was nineteen (19), with a catch of eleven hundred and seventy-six (1,176) pounds, or an average to each net of sixty-two (62) pounds. In 1884 the nets had increased to seventy (70), and eight thousand nine hundred and sixty-four (8,964) pounds of smelt were caught, making a gain of over one hundred (100) per cent. for each net used. The number of young smelt hatched and placed in the river in 1884 was over two million (2,000,000).

The black bass fishing in the Hackensack and its tributaries was excellent, and many four-pound fish were taken during the season.

The fish are increasing very fast, and the upper waters of the river afford better fishing every year.

Mr. Ricardo has had a number of applications for brook trout, and says that there are many fine trout-brooks in the county that have been bare of fish for many years.

An interesting report on smelt-hatching, by Warden Ricardo, will be found under its proper head. In his general report for 1885 Mr. Ricardo notes few violations of the law in his jurisdiction, except in the matter of night-fishing with nets above tide water. He seized two nets during the season, but could not apprehend the owners. He failed in an effort to get ripe spawn of the striped bass for a contemplated experiment in hatching them. Shad fishing in the Hackensack river during the season, he reports, was not up to the usual standard, although good catches were made in the early part of the season, and a number of seven-pound shad were taken. The catch diminished so much toward the end of the season that it was abandoned before the close time. No shad were hatched or placed in the river last year. The herring fishing was good throughout the season, and from six thousand (6,000) to seven thousand (7,000) fish were frequently taken on a tide. In regard to the black bass of the Hackensack river Mr. Ricardo says:

"The black bass fishing is growing poorer in our county each year. I think the mistake has been made in stocking with small-mouth instead of large-mouth bass. I have gone quite thoroughly in the study of black bass, and I have found in all ponds where the small-mouthed bass have been placed the best fishing is during the sixth and seventh years after stocking. After that it falls every season. I find the same thing in the upper Hackensack, and I find as soon as there are a number of large bass in the pond or river they clean the small ones all out. The small-mouth bass protect their young until they get large enough, and of good flavor, and then eat them all up. I have caught a number of small and large-mouth bass and have never found a young bass in the stomach of the latter, while in the small-mouthed I have seen a number of them. I think the large-mouth bass the proper fish to place in our ponds if we wish good fishing; they are not so shy as the small-mouth and much more prolific."

Warden Obediah Bevans, of Sussex county, reported in the fall of 1884, that the catch of shad was equal to the average of former years, and that the fish were larger. His district covered the Delaware river from Warren county line to the New York State line, and he was charged with the removal of nets, traps and obstructions from the river. He found but few violations of the law and reported no arrests. Less black bass were caught than in former years, and he expressed the opinion that they were moving up the river, as they were found in large quantities in the upper waters. The other

streams and lakes of the county he found to be well stocked with thriving bass. In regard to brook trout he said that many of the streams afforded fine fishing, and that the stocking of the waters by the Commissioners a few years ago had very materially improved the trout-fishing. He attributed the improvement in the number and size of the fish to the efforts of the Commissioners and regretted that the work of replenishing the streams was not continued.

Warden Levi French, of Burlington county, reports a great deal of trouble in enforcing the law on the county coast, because the acts regulating the matter are not concurrent in Ocean and Burlington counties and there is always a doubt or disagreement about the point at which the county line crosses Little Egg Harbor. The law now permits the use of seines in Ocean county after July 15th, and in Burlington county they are prohibited until September 1st.

Warden Joseph Helfrich, of Ocean county, refers to the same difficulty, and in addition to asking that the law be made concurrent in the adjoining counties suggests that wardens and other officers of the law be empowered to arrest and seize the apparatus of fishermen who are found during the close season with nets in their boats on the fishing grounds. He says that the law-breakers make use of a system of sentries while fishing, and at the approach of a strange boat the nets are drawn from the water. When the nets are on board the warden is disarmed and cannot prove that the owners are guilty of any infraction of the law. In Mr. Helfrich's opinion the seizure and sale of nets is generally farcical. When a net is sold under seizure the owner is generally able to buy it back for a song, owing to the disinclination of his neighbors to put hardship upon him, and to his representations of poverty. The warden has captured thirty-one (31) nets in the last two years, and in no case has the cost of seizure and sale been realized. In two instances only were the law-breakers convicted and imprisoned. He reports the hook-and-line fishing of the last two years to be unusually good.

Warden Edwin F. Westcott, of Cape May county, in his report for 1884, said that he found but few violations of the law. He observed an extreme scarcity of fish at all points along the coast and joined with the fishermen attributing it to the depredations of the menhaden fishermen, who destroyed millions of menhaden, upon which edible fish feed, and while catching menhaden in the great purse nets and seines, they daily destroyed thousands of weak fish, blue fish and other fine table fish. He reports that the feeling along the Cape May coast is very hostile to the steam menhaden industry, and that the food fishermen feel that they are being robbed of their only means of support.

Warden John T. Cordery, of Atlantic county, found the laws well observed in his district. He patrolled the bays and thoroughfares in his jurisdiction during the close season and heard but few complaints of violation of the law. One arrest was made at Leeds Point and the case is still pending, the parties being bailed for appearance in the Atlantic County Court.

Warden Lambert Speer, of Essex county, reports having made six arrests for violation of the fishing laws in the last two years. In two of these cases fines were paid, in another the evidence was insufficient for conviction, and three of the recent cases are awaiting a legal decision in the Essex County Courts. He reports the streams of the county well stocked with fish and but few attempts at illegal fishing.

Abram Terhune, warden of Bergen county, reports an increase of bass and a corresponding decrease of pickerel, but attributes the latter to fishing through the ice. He says that the fine trout streams in his district are nearly all entirely fished out, and recommends limited restocking and a prohibitive law for three years thereafter. He has made no arrests for violation of law.

Warden John C. Kitchen, of Warren county, in his report of last year stated that the shad fisheries in his district had done unusually well, but gave no figures, except in the instance of Hutchinson's fishery, where one thousand five hundred (1,500) shad were caught. He recommended a continuation of the shad hatching, as in his opinion it had been beneficial in results. He reported black bass plentiful and large, and cited several fish of from five to seven pounds weight which were caught in the Delaware river. Striped bass were unusually plentiful, and the increase was attributed to the removal of fish-baskets and other obstructions from the river. He has made one arrest, for fishing with dynamite, and the case is awaiting the action of the grand jury.

Warden Thomas M. Warford, of Hunterdon county, reports the capture of three thousand (3,000) shad by the fisheries in his district during the season of 1885, and finds a healthy condition of affairs as far as an absence of law-breaking is concerned. He has removed all the obstructions in the streams of the district, and reports that all kinds of fishing was better last year than in several previous seasons. He reports no arrests for violation of the law.

WILLIAM WRIGHT,  
RICHARD S. JENKINS,  
F. M. WARD.

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## PROVINCE OF BRITISH COLUMBIA—

A. C. Anderson..... Victoria.

## PROVINCE OF NEW BRUNSWICK—

W. H. Venning.....St. Johns.

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## PROVINCE OF NOVA SCOTIA—

W. H. Rogers.....Amherst.

## PROVINCE OF PRINCE EDWARD'S ISLAND—

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Robert G. Pike.....Middletown.

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Enoch Moore, Jr.....Wilmington.

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# INDEX.

---

	Page.
Shad Fisheries.....	3
Coast Fisheries.....	7
Black Bass.....	9
Rock Bass.....	12
Smelt.....	13
Variation in the Smelt.....	18
Salmon.....	20
Brook Trout.....	21
Pickarel.....	21
Tom Cods.....	22
German Carp.....	22
Supplementary Report.....	27
State Fish Commissioners.....	41





