THIRTEENTH BIENNIAL REPORT

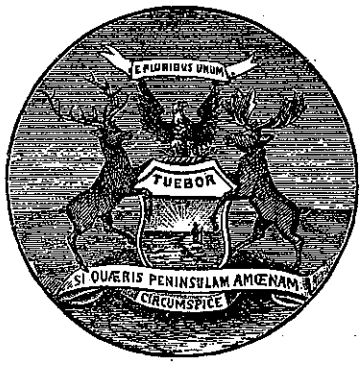
OF THE

STATE BOARD

OF

FISH COMMISSIONERS

FOR CALENDAR YEARS 1897 AND 1898



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STATE BOARD OF FISH COMMISSIONERS

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REPORT OF THE STATE BOARD OF FISH COMMISSIONERS FOR 1897–1898.

To His Excellency, Hazen S. Pingree, *Governor of the State of Michigan:*

In compliance with the requirements of law, the State Board of Fish Commissioners herewith submits its thirteenth biennial report, covering the calendar years 1897 and 1898.

During the period under consideration, the work of this board has been directed towards the hatching and distribution of food and game fishes on as large a scale as possible with the limited means at its command. Owing to a heavy cut in appropriations, the output of young fish has necessarily been greatly curtailed. Obviously the ratio of shrinkage in production is much greater than the ratio of decrease in expenditures, for certain fixed charges and current items of maintenance have to be met, and at par value, whether much or little remains for the actual work of production and distribution.

The hatching stations that have been in operation during a part or the whole of the biennial period are located at the following points: Paris, Detroit, Sault Ste. Marie, Charlevoix, Glenwood and Mill Creek.

As fiscal years run six months into calendar years, the work during the first half year covered by this report was not affected by the reduction in appropriations; all stations were operated on their regular basis and the spring distributions of 1897 were substantially the same as usual.

Beginning with July 1st of that year, however, a new situation had to be faced, and a readjustment in the lines and volume of work, to conform with the financial limitations imposed, was necessary. Although the act making an appropriation for current expenses was general—did not specify the kinds of fish to be propagated, nor discriminate for or against any class of waters—we were practically forced to choose between inland and outlying waters, for the amount appropriated was insufficient for both. To abandon the inland work would involve the necessity of turning loose all adult and growing stock held under control for breeding purposes. The reassembling of a corresponding stock, or its replacement at a subsequent period, would be no small undertaking and might require several years to fully accomplish. Under the circumstances, therefore, it was deemed best to devote our entire attention to the inland work and to suspend the hatching of commercial fish during the biennial period.

Intermitting the commercial work has closed the Detroit hatchery since the spring distribtion of 1897. The station is fully equipped for the

hatching of whitefish and wall-eyed pike in large numbers. The auxiliary station at Charlevoix for the distribution of whitefish has been discontinued and the hatching of lake trout at Paris and of whitefish and lake trout at the Sault has also been suspended.

A station for hatching small mouthed bass has been located at Mill Creek, near Grand Rapids, and a partial equipment provided. Steps have also been taken to propagate bass at Glenwood, the distribution of carp from that point by the State having been discontinued. At the Sault station suitable connections have been made whereby an abundant supply of water may be delivered to the hatching troughs through the main pipe, under pressure supplied by the Electric Power Co. This independent or emergency feeder is indispensable, as it insures a continuous supply whenever the hatchery pump is disabled or shut down for repairs. This improvement, together with some necessary repairs to the water tank at Paris, and the partial equipment of a new station at Mill Creek, covers practically all that has been attempted in the way of repairs and improvements during the biennial period.

As the usual or current repairs have necessarily been suspended during the past two years, it follows that the buildings and grounds at the three principal stations—Paris, Detroit and Sault Ste. Marie—are not at present up to that high standard of appearance that should be maintained at all public institutions. While not exactly "run down," the condition of these properties, with repairs passed over for two years, undoubtedly tends in that direction.

Not to mention a multitude of minor repairs, the buildings at every station need painting, inside and out. The springs and creeks at the Paris Station should be consolidated by a canal connecting them, and the ponds need a thorough overhauling and numerous repairs. All wood raceways and parts should be replaced with stone or cement. As foul ponds breed diseases and epidemics and cause most of the loss of parent fish that occurs, each pond should be provided with an independent drain or waste, so that it can be cleaned independently. Under existing arrangements the refuse and filth and decomposed matter that collect in any given pond must be driven or washed down through all others below.

The further development of the pond plant in connection with the stations at Sault Ste. Marie and Mill Creek, and the establishment of such auxiliary collecting and distributing stations as may be required to facilitate the work, are additional features in the line of expansion and improvements that must claim the careful attention of this board in the near future.

The following table shows the number and kinds of fish hatched and distributed during the period covered by this report:

Lake Trout	4,035,000
Brook Trout	4,184,500
Rainbow Trout	144,000
Landlocked Salmon	12,700
Small Mouth Bass (fry)	3,000
Small Mouth Bass (fingerlings)	3,150
Wall-eyed Pike	73,920,000
Whitefish	120,420,000
Total	202,722,350

DISTRIBUTING CAR.

Our distributing car, the "Attikumaig," built in 1888, has seen so much hard service and usage that a new car must soon be provided. The Attikumaig appears to have been permanently weakened when it was thrown from an embankment and badly wrecked near Traverse City some two or three years ago. A new car with up-to-date features and equipment is needed to handle the bulk of the spring distribution. The Attikumaig should be retained, however, for occasional trips during the spring rush, when a supplemental distributing service is invariably required, and which is now supplied by special messengers, or by fitting out and using an ordinary baggage car. The total mileage made by the Attikumaig during the past two years was about 31,000. This, owing to a suspension of the whitefish and lake trout work, was considerably less than usual for a similar period.

GERMAN CARP.

The hatching and distribution of German carp has been discontinued. Once quite popular everywhere, the carp has fallen into disfavor in many sections, owing largely to the generally accepted idea that their tendency to multiply rapidly is accomplished at the expense of other and better varieties of fish. Much of the popular prejudice against carp, however, is unwarranted. Its edible qualities have been underrated because it is not generally known that a carp properly dressed and salted for a few hours loses most of that muddy or swampy flavor characteristic of herbiverous fishes.

Many believe that it is a positive advantage to stock black bass waters with carp. As the latter are prolific breeders and subsist chiefly on vegetation, it is claimed that the young carp add largely to the available food supply of their predaceous neighbors. Whether this claim is well founded or not, we believe that the introduction of carp into commercial fishing waters containing a mixed and miscellaneous variety of high and low grade fish, is ill advised and detrimental to commercial fishing interests.

We have retaind control of the carp station at Glenwood, at a low rental, for the purpose of converting it into a black bass station if we find that the conditions there are suitable for bass propagation. About 75 adult small mouth bass were caught recently and transferred to the Glenwood ponds, and an experienced bass culturist will be placed in charge of operations during the ensuing hatching season. The prospects for success are bright, and it is quite probable that a bass station of considerable importance may soon be developed at this point.

BROWN TROUT.

A few years of experiment and experience have convinced us that the brown trout is inferior in every respect to either the brook or rainbow. With few exceptions, this conclusion is in harmony with the verdict of anglers and epicures everywhere. A number of streams have been successfully stocked with brown trout; but being outclassed, from every point of view, by two available species of equal range of habitat, we deem it poor policy to continue their propagation. The stock of adult

brown trout has therefore been turned adrift and no further distributions of this species will be made.

BROOK TROUT.

In no department of fish culture in this State has the work been attended with such uniformly excellent results as that in connection with the stocking of our streams with brook trout. Not many years ago it was believed that the brook trout region in this State could not be extended beyond those sections where the species was a natural product. This included the Upper Peninsula and coast belts in the Lower Peninsula extending from Mackinaw to Traverse City on the Lake Michigan side, and to Rogers City on the Lake Huron shore. Having invaded the Lower Peninsula from the Upper, and worked their way down to the points mentioned, it was quite natural to assume that nature had drawn the line at the points mentioned and that the limit of suitable trout waters had been reached.

That this belief was not well founded is evidenced by the fact that today some of our finest trout streams are found in the central part of the State; and the annual catch from streams into which trout were first introduced from hatcheries now exceeds the catch from native streams. Nearly the entire State may now be regarded as brook trout territory, for it has been demonstrated that nearly all brooks and smaller watercourses that receive occasional contributions from spring rivulets and that trace their way through occasional timber belts, are brook trout waters and may be planted with entire confidence as to results.

The expansion of the trout belt to cover nearly the entire State is one of a number of causes that have contributed to increase the demand for young trout far beyond the producing capacity of our trout stations as at present equipped; and if our reputation and standing as a brook trout State is to be sustained, it is imperative that provision be made at once for assembling and holding under control a largely increased stock of breeding fish.

Our facilities for carrying a breeding stock are practically no greater now than ten years ago. In the early days of fish culture it was the invariable rule to locate brook trout stations on spring brooks, or where the water was drawn directly from springs whose flow was limited to a few hundred gallons per minute, a supply quite ample merely for hatching purposes, but wholly inadequate for the support of a large stock of breeders. Our trout station at Paris, established 18 years ago, is no exception to the rule. At that time the volume of the creeks and springs under control there was more than ample to support a breeding stock sufficient for all demands. Trout culture in this State had scarcely passed the experimental stage, and the outcome of a wide and general distribution of fry in new waters was somewhat uncertain and problematical. No one could foresee the unbounded success that was in store, and none entertained the idea that the demand would soon far outstrip the capacity of the water supply for carrying an ample stock of breeders.

Since then, moreover, the supply at Paris, in common with springs and streams everywhere, has diminished in volume as a result of clearing the forests, or from some cause or causes unknown. This reduction as compared with corresponding periods is especially noticeable during the month of August. As the strength of a chain can be no greater than that

of its weakest link, so, likewise, must the fish-supporting capacity of a fluctuating water supply be determined by its lowest or hot weather stage.

The quality of the water at Paris is unsurpassed and the quantity is ample to run both the old and new hatcheries for an indefinite period, but the pond production has nearly or quite reached the limit. We cannot hope to secure more than two or three millions of ova annually from the pond stock, although the old and new hatcheries may easily be equipped to incubate at least 10,000,000. To operate the station to its fullest hatching capacity, therefore, a sub-station for the production of ova should be established, such ova to be transferred to Paris for hatching and distribution.

An admirable site for this purpose has been found on the Au Sable river. Here a large stock of adult trout may be accumulated and safely and cheaply held for breeding purposes. The water supply is practically without limit and the cost of producing ova under such conditions would be very much less than at Paris. With such an auxiliary plant, established and operated solely for the production of ova and not of fry, we could distribute 10,000,000 fish annually from Paris at less than double the present cost of about 2,500,000. A minimum annual production of 10,000,000 is needed at the present time for the streams of the Lower Peninsula alone.

For the Upper Peninsula not less than 5,000,000 trout fry should be turned out each year. To accomplish this a liberal sum should be applied to the development of a pond system in connection with the hatchery at Sault Ste. Marie, so that a sufficient number of breeding fish may be carried for the purpose. A beginning in this direction has already been made, three ponds having been constructed in the rough. These, however, are not only wholly inadequate, but they are not properly safeguarded against the extreme fluctuations in the source of water supply, due to tidal conditions on Lake Superior. A connection must be made with the water power canal or some permanent source of supply, or else the pond area must be enclosed with a barrier sufficiently water tight to prevent draining the ponds when the ground all around such enclosure is laid bare by the irregular and freakish action of the tides.

The development of our trout producing capacity to the point herein recommended—10,000,000 for the Lower Peninsula and 5,000,000 for the Upper—should be brought about as speedily as possible if we are to retain our prestige as a resort for anglers and to continue to attract thousands of non-residents within our borders.

The number of our own citizens, business and professional men, whose annual outing includes a few days of camp life along the banks of some favorite trout stream, is rapidly increasing. New clubs are continually forming and club houses are springing up along the banks of most of the noted streams. In exchange for health and pleasure, thousands on thousands of dollars are annually paid out by the well-to-do for transportation, hotel and livery service, boat hire, guides and supplies. In many of the poorer sections of the State the patronage of angling tourists is the chief source of support of the inhabitants.

Every dollar paid out for trout propagation is returned many fold to our own citizens. Other states lying within the trout belt, notably New York and Wisconsin, are keenly alive to this fact and are constantly in-

creasing their appropriations for this work, adding a new hatchery from time to time to keep pace with the demand. They fully realize and appreciate the fact that no expenditure of state funds yields such adequate returns. Michigan is unsurpassed in the number and unrivaled character of her trout streams, nature having been especially kind in this respect. As a business proposition, it would be folly to sacrifice so important a source of natural wealth and to allow such material interests to be diverted to our sister states.

If our brook trout waters are to receive the attention and support that they merit, propagation must be continued on a much larger scale than is possible with our present facilities. In conjunction with this the warden department must be maintained on a basis of the highest practical efficiency, if we are to realize the fullest measure of success and profit. The brook trout is strictly for the angler and should be caught in no other way; nevertheless, if the many rumors that are current have any foundation in fact, fishing by unlawful means is practiced to no little extent. Trout streams, like all shoal and restricted waters, suffer rapid depletion if nets, spears and dynamite are the agents of destruction.

We realize that it is impossible to wholly suppress poaching. Violations, if known, are too often witnessed by neighbors or by those who are themselves violaters. Nevertheless, much has been done and much may be done to confine trout fishing to legitimate methods. The warden department should receive liberal support and be given abundant means and power to inspire a wholesome respect for protective measures, for a full realization of the value of trout planting depends to a great extent on the enforcement of laws for their protection.

There should be no exception to the fish culturist's rule that all kinds of fish whose propagation and increase is desired, must not be caught prior to spawning age. They should be given an opportunity to spawn or be spawned at least once. For this reason, the legal limit for brook trout should be increased two inches in length. Brook trout spawn in the fall. A six inch trout, the present legal size, caught during the summer fishing season, could not possibly have spawned the preceding fall.

We believe that a license law for anglers, to apply only to the privilege of fishing in trout streams, would be both just and expedient. Such a law would be of great benefit to anglers themselves and to all who are most directly interested. The fee should be practically nominal, so that none would be barred and few would attempt to evade payment. One-half the net revenue from this source should be credited to the Fish Commission, to be expended exclusively for trout propagation, and the other half to the warden department, to be applied exclusively to the enforcement of laws for the protection of trout. A considerable sum would be raised in this way and without burdening anyone. A nominal assessment on each member of the angling fraternity would thus create an unfailing reserve fund, which, in case of a lapse in the contingent or legislative fund, would insure a continuance of the work of propagation and protection.

RAINBOW TROUT.

The rainbow is permanently established in popular esteem and continues to grow in favor, and it is our intention to propagate them on a much larger scale as soon as facilities for carrying the necessary breeders

are provided. The proposed plan of establishing an auxiliary trout station on the Au Sable or some large stream will, if realized, afford an excellent opportunity to assemble and harbor a large breeding stock.

In the Lower Peninsula rainbow trout show special adaptability for the deeper parts of our larger trout waters, being more inclined than brook trout to drop down stream and frequent or inhabit the deeper and warmer sections where food is more abundant. The inevitable result of this tendency is that they outstrip the brook trout in growth and size. Specimens of seven and eight pounds, equal to the largest of Lake Superior fontinalis, have been taken, while a four or five pound rainbow no longer attracts special attention.

We desire to thank the Wisconsin Fish Commission for a donation of 900 two-year-old rainbow trout from their ponds at Madison. This courtesy was extended during the summer of 1897. The fish were successfully transferred to the Paris ponds, where, having now attained a breeding size, they will materially increase the output of young rainbows another season.

BLACK BASS.

The small mouth bass is not only one of the most popular of fresh water species, but it is adapted to a wider range of waters, perhaps, than any fish of equal rank. It is equally at home in stream or lake, in waters that are cool or warm, deep or shoal. Its gameness and all-round good qualities justify its popularity and the high esteem in which it is held by all classes.

The demand for bass has grown enormously in the past few years, and we are literally deluged with applications for them. The increasing demand is due in a measure to a depletion brought about by excessive fishing. The force of anglers has greatly increased within a few years, as a natural result of the formation of clubs, the inauguration of resorts, and the building of hotels, club houses and cottages around the shores of our most attractive lakes.

We have as yet been unable to produce young bass in effective numbers, though it is expected that a good showing will be made when the station at Mill Creek is completed and put in working order. In 1897 the bass work at the experimental station at Cascade was a failure and that place was abandoned. At Mill Creek the following season the ponds which were excavated in 1897 yielded rather poor results on account of their incompleteness. The soil being light, the rain dissolved and washed the sloping sides sufficient to roil the ponds; these will have to be walled or cemented. In addition, two remarkably heavy precipitations, practically cloudbursts, occurred very inopportunely, roiling the creek to a disastrous degree just at the height of the bedding season.

About 100,000 fry were hatched, but they came out in a scattering way and it was decided to attempt to rear them to fingerling size on natural food. This was probably a mistake. Our experiments and further investigations show pretty conclusively that better results will follow the early release of the fry in weedy and grassy shoals where they may escape from one another. Bass fry grow rapidly, but so unevenly that when herded together in tanks or small ponds there is a heavy loss through the rapid and mysterious (?) disappearance of the smaller fish.

Mr. Carl G. Thompson, formerly of Warren, Indiana, succeeded in rais-

ing a fairly good percentage of bass, but he placed comparatively few fish in a very large and deep pond, filled with weeds and vegetation. The conditions in fact were to all intents and purposes the same as may be found in almost any lake or stream, clearly indicating that there is no advantage or gain in providing such conditions artificially.

The stock fish at Mill Creek were obtained from the Kalamazoo river, near Galesburg, and from the Grand river below the dam in Grand Rapids. The development of this station to its fullest capacity will still leave the board inadequately supplied with facilities for meeting the pressing demand for bass. The many beautiful lakes in the central and southern part of the State, notably in Oakland and several other counties, would easily and profitably absorb the entire production of a large and well equipped bass station, and the establishment and maintenance of such a station for this section is earnestly recommended.

LANDLOCKED SALMON.

For the angler and epicure, the landlocked salmon is perhaps without a rival among fresh water fishes. Universally acknowledged a gamey and intelligent fighter, its flesh is firm and fine in texture, sweet and delicately flavored with a flavor peculiarly its own. There is some doubt, however, as to whether the species may be acclimated to Michigan waters, although the clear and cold waters of Lake Superior and some inland lakes apparently correspond in all essential respects with the waters in Maine which have become their habitat.

We desire to acknowledge the courtesy of a donation by the United States Fish Commission of 15,000 eggs of landlocked salmon. These were produced at their station at Green Lake Maine, and were shipped to Detroit, arriving in good condition, 5,000 on February 6, 1897, and 10,000 February 12, 1898. After inspection they were forwarded to the hatchery at Sault Ste. Marie. Nearly 13,000 healthy fry resulted and these were released in St. Mary's River. As the landlocked salmon is rather peculiar in its spawning habits, descending outlets as well as ascending inlets for the purpose of spawning, the gravel and stony reaches of the St. Mary's River would naturally become spawning grounds for salmon in Lake Superior. It is to be hoped that additional and larger supplies of salmon ova may be procured, sufficient at least to permanently establish the species in Lake Superior and other waters if it is possible to do so. Salmon were planted in Torch Lake a few years ago and it has been reported that they have been caught there within the past year, but the report has not been positively verified.

PIKE PERCH OR WALL-EYED PIKE.

The wall-eyed pike, commonly called "pickerel," in commercial fishing circles, ranks high among the commercial fish of the Great Lakes. It is also firmly established in popular favor wherever it has been successfully introduced into inland waters. Judging from the favorable reports received from various parts of the State, we are convinced that the species may be successfully and permanently established in a majority of our inland lakes. This would be an important and a very welcome addition to the supply of food fish in such waters. In table qualities the wall-eyed pike is considered by many as the superior of whitefish and salmon

trout. As the ova of this desirable fish is available in large numbers and as they are adapted to the needs of our inland as well as outlying waters, the work of propagating them should be resumed and prosecuted on the largest scale possible.

Wall-eyed pike were hatched in quite liberal numbers at the Detroit hatchery in the spring of 1897. The eggs were taken from pound net fisheries operated in and adjacent to Maumee Bay, Lake Erie. Eight spawntakers were employed, one for each of the most promising pound boats. Each stripper was supplied with a fish keg, 100 pound size and provided with handles, a tobacco or candy pail, a dipper and a fish kit, ten pound size. The small kits were used in the place of ordinary spawning pans, the eggs being less adhesive to wood than tin.

The spawning season opened April 6th and closed April 25th. Owing to frequent gales and storms, the catch of fish fell off somewhat, likewise the crop of eggs, but the weather was cool and temperature conditions favorable for securing eggs of good quality. Total number of eggs taken, 130,000,000, from which about 71,000,000 fry were hatched, a percentage of 56—considerably above the average for pike perch.

A few lots of eggs were treated in starch water, but they turned out no better than the others. This may have been due to the fact that the conditions under which eggs must necessarily be taken in pound boats are such that it is not practical to properly work starch methods. It is not a fair test of this plan where there is neither time nor room, as there is when eggs are taken on shore from seines or crated fish.

Most of the eggs were transported to Detroit on flannel trays. By dividing a number of lots of eggs taken and treated exactly alike up to the point of shipping, we found that in every instance the tray eggs gave better hatching results than those conveyed in cans of water. We also found that eggs transferred to the hatching jars immediately on arrival, even though somewhat soft and not entirely filled, turned out better than those held a few hours on trays or in cans, the difference being especially noticeable with the latter.

As the water at the hatchery averaged several degrees cooler than during a corresponding period the preceding season, the eggs developed much slower and hatched several days later than usual. In fact the two seasons represent extremes in this respect, for the incubating period of the eggs first taken in 1897 was thirty days, or twice as long as the average for 1896. In 1897 the hatching occurred from May 6th to 16th, and the distribution from May 11th to 23d, inclusive. The shipments for inland waters were made by baggage car and special messengers. About 33 per cent of the hatch went to such waters, all that it was practical to handle with one car and crew in the brief period during which pike fry may be successfully transported. It is proposed hereafter to distribute eyed ova for the most part instead of the fry.

WHITEFISH.

The importance of propagating a species that ranks with the very best strictly fresh water fish produced anywhere on a commercial basis is so apparent that the point need not be dwelt upon. The latest statistics show a gratifying increase in the catch of whitefish in our waters, an increase that would be far more pronounced if the wholesale slaughter of the small fish could be measurably checked. The Lake Erie

type has become an important and increasing factor in the catch of whitefish in other Great Lakes, proving beyond the shadow of a doubt the sustaining value of protected propagation.

At the close of the last biennial report, the Detroit hatchery was in operation with a large supply of whitefish ova in process of incubation. The whitefish department of the Sault hatchery was also carrying a supply of ova, though not running to its fullest capacity. Soon after, or in January and February, a sufficient quantity of ova was transferred from Detroit to practically fill the hatching jars at the Sault station, also to operate 200 jars to their fullest capacity at the Charlevoix station.

The development of the ova and distribution of the young fish proceeded smoothly and successfully, without special incident. The hatching season was somewhat later than usual at Detroit, the distribution being made in the first two weeks of April. At Charlevoix the fish were all out by April 23rd, but at the Sault station the final hatchings were delayed until after the middle of May.

The plan of releasing the fish practically as fast as hatched was rigidly adhered to all around. The wisdom of this course is beyond question. Our helplessness in providing available room and collecting natural food in practical quantities or in substituting it is acknowledged. Still, it is positively known that young whitefish begin to take food within a few days after hatching, and that their natural food in infancy is the cyclop and other minute crustacean forms that are found drifting or swimming in greater or less abundance in all parts of the Great Lakes that have ever been examined. Since, therefore, the mountain cannot be brought to Mahommet, Mahommet must go to the mountain.

The wisdom of providing auxiliary or distributing stations is also established beyond question; such stations being of great value because they place the work of distribution on a more equitable and effective basis.

LAKE TROUT.

The catch of this important food fish in Michigan waters has on the whole shown a marked falling off in recent years, notwithstanding that the capture of the young is not practiced to anything like the extent that it is with whitefish. The varying habits of the two species account in a measure at least for the difference in this respect. Young whitefish expose themselves to easy and wholesale capture by running inshore within convenient range of pound nets, while lake trout appear in shoal waters only at spawning time, being essentially a deep water fish at all other stages.

The work of propagating lake trout has never been pushed to the fullest practical limit, at least not until quite recently; in fact the conduct of this work on anything like an adequate basis and solely for Michigan Great Lake waters is a matter of such recent date that marked results are hardly due.

The lake trout eggs on hand at the beginning of the period covered by this report were carried at the Paris and Sault stations. Their hatching soon followed and they were successfully distributed to inland and Great Lake waters without special incident and as shown by the tables. The overseer at Paris was directed to ship fish only to such Great Lake ports as were known to be open. The cans were emptied by means of a syphon

trailing well clear of the tug as the latter drifted along or steamed slowly under check. Whenever fish were ready to be moved, or it was necessary to dispose of them, and lake ports were likely to be closed when reached, shipments were made to Charlevoix, where, if necessary, they could be taken care of at the hatchery until open waters could be reached.

The 4,000,000 lake trout hatched at Paris and at the Sault in the spring of 1897 were divided about equally between the Great Lakes and inland waters. Plants by the State and United States Fish Commission in former years are showing good results in a number of inland lakes. It is pretty well established, however, that the species will thrive only in waters of good depth. Lake trout were formerly quite abundant in Lake Erie, but they were found only in the deeper sections, very rarely appearing in the shoal area at the west end of the lake.

MAINTENANCE OF THE COMMERCIAL FISHERIES.

If the commercial fishing interests of this State are best served by making the better varieties of food fish more abundant, by making our border waters more productive, then the interests of fish catchers and fish consumers are in perfect accord. Unfortunately, however, the harmonizing of these interests on a basis of abundant and continued production from local waters often runs counter to non-resident interests, the business of which is based on fishery products derived chiefly from other waters, or waters in which this State has no concern. Such outside interests are of course interested in the suppression of all fisheries not under their control, so that the law of supply and demand may operate to increase their profits accordingly. With well-feigned solicitude for the welfare of Michigan fisheries, the agents of these outside interests besiege our legislative halls and urge the adoption of any measure that will afford relief from the competition that is bound to be created if fishing in our own waters is permitted during the season that yields the most profitable returns.

No doubt some combinations that are effected for the purpose of controlling prices are not opposed to public interests, but the price of fresh water products will enhance, relatively, all too soon, and despite increased production, for the producing area must necessarily remain stationary while the demand steadily grows with the increase in population and as improved facilities and methods of preservataion and distribution are employed. Already are the higher grades of fresh water and sea foods beyond reach of the poorer classes; consumption of these grades is confined practically to the well to do. Without any artificial encouragement, an upward tendency in values is inevitable with all grades of food fish, and sooner or later is bound to occur, for the simple reason that they are produced under conditions that fix a limit to the supply while the demand may increase indefinitely.

We believe that the establishment of the commercial fisheries of this State on a basis of permanency and increased productiveness is strictly in harmony with the interests of the public, as well as the interests of such of our citizens as are directly or indirectly dependent upon the fisheries for support. We believe that fish should be made more abundant in our waters and on our markets, regardless of the effect of such abundance on the profits of those who are interested in stifling competition in order

that their stock, acquired chiefly at other seasons from outside sources, may constitute a monopoly of fishery products.

So far as this board is concerned, however, the question of conflicting interests other than those of the public is merely incidental, although as between the interests of our own commercial fishermen and the interests of outside capitalists seeking to corner the market, we naturally favor the former, other things being equal.

But above and beyond all this, and without regard to how special interests or classes may be affected, the question to which it is the plain duty of this board to address itself is, how shall the better varieties of commercial fish be made more abundant? What restrictions must be imposed and conditions taken advantage of to force the annual fish crop to a reproducing or self-perpetuating basis? What is the limit to the number of fish that may be removed each year and still keep them replaced?

There is but one answer to the oft-repeated question: "What is the use of hatching fish unless you protect them?" Likewise there is but one answer to the question: What is the use of hatching fish and protecting them unless you catch them? Very many fall into the error of assuming that the more we restrict the catching or capture of fish, regardless of size, age or season, the more we "protect" them. Dealing as we are with a domain where there is perpetual warfare among its inhabitants, with a kingdom whose subjects are in a condition of hopeless savagery, the absurdity of this assumption is manifest. But were it true, the logic of indiscriminate and ever increasing abridgement drives us to the point of "protecting" a fish until it is destroyed by its natural enemies or dies of old age, thus eliminating production for the wants of man.

Protective measures, therefore, are of value only to the extent that they increase or sustain production. We protect fish at one stage of life for the express purpose of killing them at another; and since all adult fish are either spawn destroyers or fish destroyers, or both, it is evident that the very act of catching or killing the adults at any season of the year is of itself either a measure of protection to what they prey upon, or if the preying continues it is for the benefit of growing or succeeding generations.

Clearly the adults are in a state of warfare with their own progeny, for such species as do not destroy their own young are sooner or later their food competitors. Mature fish are manifestly in the way of the young and growing stock, and the sooner every adult fish is removed from the waters the better it is for all immature fish of the same species.

But the removal of the adults must be made with some reference to reproduction, which must be continued with certainty and regularity. If, then, the capture of the parent fish occurs coincidently with provisions for their reproduction, it is obvious that there is a blending of all conditions essential to sustain production indefinitely and at the highest point. When made to provide for replacing themselves, no restrictions are necessary. We need not feel concerned whether one hundred or one million parent fish are captured at any given time or place, if such capture or killing is coincident with provisions for fully restoring or replacing them.

Or, if the catching of any kind of fish at any season is attended with measures that insure the return of more infant fish than would be produced if the parent fish had not been caught, there can be but one opinion as to the wisdom of catching the greatest possible number or proportion during that particular time.

The spawning season is of necessity the only period when such measures of replenishment may be carried out. The conditions are such that if we can get possession of the matured spawn from only one out of several hundred fish caught on spawning grounds, more young fish may be returned to such grounds than would hatch there were fishing entirely suspended. This marvelous gain in the production of the young is the result merely of more perfect fertilization of the ova and of its withdrawal, during the period of incubation, from the presence of its natural enemies.

It is a very unusual circumstance to find not more than one out of two hundred females in spawning condition when taken from spawning grounds. On some spawning reefs, notably those near the islands of western Lake Erie, an average of one female whitefish out of every four not already spawned out is in condition to yield her spawn when the nets are lifted. At some points it has been the practice to convey the females not in spawning condition at the time of capture to a convenient inclosure and hold them until the ova has matured. Where this plan of procedure is admissible, the ova from three out of every four females is secured in its matured or reproductive condition.

At no point where unrestricted fishing on the spawning grounds of certain kinds of fish is permitted, will the hatching of young fish, as a result of securing and protecting what mature spawn may occur, fail to outnumber the natural hatch with fishing prohibited; while taking the spawning grounds of such species as a whole, the disparity in favor of open fishing and protected incubation for all of the ova that it is practical to get possession of, is simply enormous.

Nor is it a matter for consideration whether fisheries are operated during spawning seasons by private interests for private gain, or by public commissions for purposes of propagation, so long as the handling of the spawning fish and disposition of the ova are under the legal or actual control of such commissions. Results being the same, we need not consider the question of motives.

It is plain that if some of our most valuable fisheries are to be restored to former productiveness and placed on a self-sustaining basis, we must catch a larger proportion from their breeding grounds and a smaller proportion from their feeding grounds. When caught on feeding grounds they cannot be made to reimburse the waters; it is a loss that must be made up from those that remain.

But the fish that remain do well to replace themselves under natural conditions of reproduction, without providing for others, for the waters are a scene of warfare so savage and pitiless that no quarter is given. When exposed in this fierce struggle for a period of several months, the helpless germs of reproduction reproduce merely by accident or chance, a chance so small that comparatively few escape destruction and survive to the point of entering upon the second stage of fish life.

Nevertheless an overwhelming percentage of the catch of some of our most valuable commercial fish occurs at a time when they cannot be made to contribute in the least towards their replenishment. This throws the burden of reproduction on too few breeders for full recoupment under natural conditions. It is evident that recourse must be had to improved

means of reproduction and that such means must be brought into play to a greater extent than ever before. Nature must somehow or somewhere receive assistance. Natural losses must be eliminated by deliverance from natural enemies whenever and wherever practical. We repeat that a larger proportion of the catch of certain kinds of fish must come from their spawning grounds, in order that the production of infant fish may be greatly increased by getting possession of the ova and tiding over the frailest and most perilous period of fish life.

In a paper presented at the American Fisheries Society in 1894, the late Col. McDonald, then United States Commissioner of Fisheries, said:

"The value of this resource (artificial propagation) as a sufficient means of maintaining production and at the same time imposing little or no restraint upon the fishing enterprises is very forcibly illustrated by the history of the shad fisheries of the Atlantic coast rivers since 1880. This is a species which must find access to the fresh waters of the rivers in order to accomplish reproduction. Where the streams are unobstructed it pushes its way up hundreds of miles from tide water in order to find suitable spawning grounds. It does not spawn in the brackish or salt waters, and if it did the eggs would prove infertile. Under the present conditions of the shad fisheries, but a very small proportion of the shad approaching our rivers under the constraint of reproduction ever find their way to their spawning grounds in the rivers. Fully eighty per cent are taken in the brackish water of the estuaries of our rivers or on the shores of the ocean or the great bays which indent the shore line. Under these conditions, we are compelled to depend largely. if not entirely upon artificial propagation to repair the annual waste by natural casualties and the fisheries. This great fishery is under conditions as artificial as is the corn or the wheat crop. Its permanence and such marked improvement as has taken place since 1880 in the annual value of the product are unquestionably to be attributed to the extensive measures of artificial propagation which have been conducted with this species by the Fish Commission of the different states on the Atlantic Sea Board and by the United States Fish Commission. Since 1885 there has been a steady and progressive increase in the annual value of the shad taken on the Atlantic Sea Board, and at present the amount and value of the annual product is double what it was in 1880."

It will be noticed that although only a small proportion of the catch of shad was made on spawning grounds, yet the enormous gain in hatching results on what spawn it was possible to secure for hatchery treatment actually maintained and increased the supply of adults. The proportion of whitefish taken from spawning grounds is propably even smaller. In Michigan waters of the Great Lakes, *less than five per cent* of the catch of whitefish comes from their spawning grounds.

If fewer fish were taken from feeding grounds, it follows that more would be taken from spawning grounds if there were no restrictions. Any restraints, however, that are intended to shift a better percentage of the catch to spawning grounds should aim above all else to prevent the killing of immature fish. The destruction of the young of our more valuable commercial varieties is an evil deplored by all, an abuse that must be corrected if we are to receive satisfactory returns from our efforts to sustain production. In Michigan waters of the Great Lakes the whitefish suffers to a greater extent in this respect than any high grade fish

for, in point of numbers, at least 65 per cent of the entire catch is immature stock.

While all are agreed that the traffic in immature fish is an inexcusable and outrageous abuse of the fishing privilege, detrimental alike to public interests as well as the interests as a whole of those more immediately concerned, there is a diversity of opinion as to the most effective means of suppressing it. It is very doubtful if the capture of fish against which no reasonable objection can be made, and none others, can be regulated or controlled by laws and penalties that apply solely to the size of the mesh. Moreover, the conditions and circumstances are so varied that mesh laws applying arbitrarily and uniformly to all localities are unjust and unscientific. For example, on the north shore of Lake Michigan small whitefish run inshore in large numbers during the summer months and are trapped in pound nets. If fishing is allowed there at all when these fish are in shoal waters, certainly the mesh should be large enough to allow them to pass through uninjured. If, however, we force the same sized mesh on the fisheries of western Lake Erie and some other sections, we practically bar the catching of herring, perch, and saugers while not in the least favoring whitefish, whose young never appear at such points at any time of the year.

If we rely on meshes to protect immature fish at one point and yet not exclude the taking at another point of mature fish of other species but corresponding in size with the immature fish sought to be protected, it is evident that meshes must be adjusted to fit the conditions. Shoal water runs may be trapped or impounded, but fish in deep water must be gilled or entangled. The meshes of gill nets, like those of pound nets, must therefore be of two or more sizes and for the same reason.

Here then are two fishing devices that differ radically in principle and the meshes in each must be given a legal status in two or more sizes. Herein lies the difficulty of enforcing mesh regulations. One may have several kinds and sizes of nets in his possession but they cannot be seized so long as the various sizes are recognized as lawful for catching some kind or size of fish. It cannot be presumed or proved that such nets are or will be used in any other manner or for any other purpose than the law contemplated. They are contraband only when "caught in the act" of fishing illegally.

It is both difficult and expensive to make seizures and establish incriminating evidence where portable nets are used and they are set most anywhere within five to forty miles from shore or port. The cost of making a recent seizure of nets near the Beaver Islands is an illustration of the difficulty of securing evidence in the waters rather than on land. In this case, too, there were no complications; it was not necessary to secure proof that a legal meshed net was being fished illegally, of itself a rather difficult proposition; the mere fact that the nets were in the lake at the time was prima facie that they were there in violation of law.

The complications that arise when we seek to prevent the killing of immature fish on a mesh basis largely disappear when the *results* rather than the *act* of fishing are scrutinized. The catching and traffic in immature fish will be minimized only when such fish are made contraband wherever found, with a heavy penalty for buying, selling, transporting or having in possession. Seasons and meshes will be adjusted in

accordance with results. It is admitted that the killing of small fish cannot be prevented absolutely, for the largest size meshes of gill net in use will entangle or enmesh a small percentage of immature fish; but when fishermen cannot profit by the marketing of such fish, comparatively few will be caught. The motive or incentive for taking them will be reversed when it becomes a source of annoyance instead of profit to do so and when, in addition, it is a misdemeanor to attempt to market them. Under such conditions they are not likely to be caught unnecessarily or wastefully.

But the strong point in favor of solving the immature fish problem by outlawing the handling of such fish, rather than through mesh regulations, is that *possession* anywhere beyond the point of catching is made a basis of action. The conditions under which the catching occurred need not be inquired into and no evidence of an act or transaction of any kind, whether in the waters or on land is required, for the offense and the offender, the crime and the evidence are inseparable. Traffic in an article the mere possession of which constitutes an offense could not be carried on profitably without coming to the surface and becoming a matter of common knowledge. Prima facie evidence would be easily obtainable and conviction certain.

An optional weight and length limit should be established for both round and dressed fish, also a standard of weight for salted fish and fish dressed for salting.

We believe that commercial fishing should be allowed only under a license issued or authorized by the State, and that a light tax on such fishing should be imposed. Unquestionably the most equitable basis for laying such tax would be on the quantity or value of fish caught.

In conclusion we wish to heartily endorse the recent movement on the part of the United States Fish Commission to take up the examination of Great Lake waters on a systematic and scientific basis. Such investigation cannot but add to our knowledge of the waters and be of practical benefit. It is manifest, however, that a complete and exact knowledge of the inter-relations of water life is unattainable. Of necessity conclusions must be drawn from evidence that to some extent is circumstantial, though they need not be any the less accurate or just on that account.

Meantime while groping for that which may never be obtained, we need not throw up our hands in utter helplessness because we cannot trace the life history of all water forms, or of any particular form, with hair-splitting exactness. Because we do not know all or know more is no valid reason for not profiting by the knowledge we already possess. And to profit by what is already known we have only to examine the laws of cause and effect in the light of common sense and plain reasoning to determine upon what lines we must proceed.

One does not need the gift of prophecy to fortell the gradual but inevitable depletion of some of our most important fisheries if *natural* destruction of the ova and *artificial* destruction of the young fish is permitted to go on at the present rate. We have direct and circumstantial evidence of the most convincing character, evidence that would convict a saint of murder in the first degree, that too few young fish of certain species come into existence under natural conditions to survive subsequent natural dangers and still furnish a regular and permanent basis

of supply for man. Nothing can be more certain, no proposition more sound, than that such permanency of supply on a liberal basis must be provided for to a great extent at the fountain head. More young fish must be created; they must be produced in swarms by protecting the ova from natural destruction to the fullest practical limit that ova can be had through unrestrained fishing on every spawning ground throughout the chain of lakes.

HORACE W. DAVIS,
FREEMAN B. DICKERSON,
Commissioners.
SEYMOUR BOWER,
Superintendent.

REPORT OF STATISTICAL AGENT.

State Board of Fish Commissioners:

GENTLEMEN—I herewith submit report concerning the commercial fisheries of the State, covering the years 1896 and 1897:

Under the direction of the board, the work since 1891 has been prosecuted by districts, the coast of the State having been divided into five, making the work uniform each year, and the loss or gain of the catch of the various kinds of fish, together with weather conditions, a better basis for comparing one year with another, and arriving at a fair conclusion of the condition of the fisheries. In the preceding biennial reports, the limits of each district are given, and a repetition at this time seems unnecessary.

The devices used by the fishermen in taking fish are chiefly pound nets and gill nets, although in the shoal waters of the bays, fyke nets are employed, Saginaw bay and river using them more extensively than in any of the other districts. Seines are also hauled in many places on the shore of the lakes, and at the mouth of the rivers flowing into the lakes at various points along the coast. Hooks and set lines have been used quite extensively, mostly by the fishermen of Lake Michigan in taking trout, but for the past two years the catch by this mode of fishing has not been satisfactory, and many have abandoned them altogether.

The amount of twine fished each year and the number of men engaged in fishing vary somewhat, according to conditions. Some stop fishing from the fact that their catch did not pay for putting in their nets; while others, having fished out their twine, have not the money or credit to replace them.

The total catch of all kinds of fish for the past seven years has varied less than 4,000,000 pounds, the highest being 34,065,321 pounds in the year '94 and the lowest 30,160,670 pounds in the year '96. The catch of '97 was 32,521,695 pounds.

Weather conditions have much to do with the catch of fish. Especially is this true of pound net fishing. When the sweeping gales of wind come, which are most frequent during the spring and fall months, the nets are carried away by the fury of the winds, and often destroyed outright, being set off the shore of the lakes, and in many places subject to the most exposed condition of the elements.

The increase or decrease which occurs in the total catch of all kinds of fish from year to year, in a general way applies to all of the various kinds taken by the commercial fishermen and the favorable or unfavorable weather conditions of the seasons. The herring catch has varied

the least in the past five years of any one kind. Included with the shoal herring catch are the long jaws and black fins, which are a deep water fish with a protruded under jaw belonging to the same family, and which are caught from St. Joseph and Grand Haven almost entirely, two of the leading fishing stations on the east shore of Lake Michigan.

With reference to the catch of shoal water herring in the Great Lakes bordering upon the State, the fact that the production of this kind has kept up, is due in a great measure to the increased amount of netting used upon the herring grounds. Especially is this true of Saginaw bay, where for several years past the take of herring has been an important factor in the fish food supply of that bay.

The principal shoal herring fishing grounds of Michigan are located in Green bay from Menominee north a distance of fifty miles, Saginaw bay and Gros Cap. At this latter place, however, the catch is of little importance, as well as at many other stations on our lake coast.

Including the catch of long jaws and black fins with herring, the total herring catch of each year for the past three years has been ten to twelve million pounds, which is about one-third of the total catch of all kinds taken in each of those years.

The total lake trout catch of the commercial fisheries of the State gradually decreased from 1891 to 1895, 1896 and 1897 about holding their own. In 1891 the total of trout was 9,132,770 pounds, going down each subsequent year to 1895, when the lowest point of the past seven years was reached, viz., 6,293,545 pounds. 1896 shows a slight increase, being 6,899,877 pounds; 1897 a slight decrease again, being 6,580,454 pounds. Considering the conditions surrounding the catch of trout in each of these years, together with the amount of twine fished, which has been about the same since 1891, the conclusion is inevitable that the waters are being slowly but surely depleted of this valuable commercial fish. It could not well be otherwise when the character and extent of the apparatus and methods of fishing are considered.

There is another significant reason why the catch has fallen off, and that is, the taking of immature trout with the small mesh gill nets used by the fishermen of St. Joseph and Grand Haven in the catch of long jaws and black fins. I am informed this is also true of several stations in Wisconsin bordering upon Lake Michigan. This applies only to the waters of Lake Michigan from Charlevoix south.

During the period when the best catches of long jaws are made in the deep water of Lake Michigan, the small trout seem to be the most plentiful and their capture is unavoidable with the twine especially adapted and used for the long jaw catch. Both at St. Joseph and Grand Haven, I have seen 50 to 250 pounds of small trout taken at one lift from a gang of gill nets fished by one steamer. With several of these large outfits fishing from the above stations, the annual take of immature trout means a good many thousand pounds, and is a very serious inroad upon the growing supply of lake trout.

The fish food taken from the waters of the Great Lakes include various edible kinds that are nowhere excelled in any of the bodies of fresh water in the world, and the whitefish stands in the list as fish food par excellence. In the work of protected propagation, this board has made a large output of whitefish fry, especially so since the acquisition of the Detroit river fisheries, and the value of this work to the supply of whitefish is

very significant where plants have been freely distributed. Only a small portion of Lake Erie comes under the jurisdiction of our State, but the following figures will show the whitefish catch of that lake for the years 1891 to 1897, inclusive:

1891, 144,355; 1892, 123,050; 1893, 61,000; 1894, 74,600; 1895, 104,300; 1896, 59,000; 1897, 146,950.

Of the seven years' catch, that of 1896 was the lowest and that of 1897 the highest. In the west end of Lake Erie upon which Michigan borders, very few whitefish are taken except from the last half of October to the 10th of December of each year, the length of the season depending upon weather conditions. During the fall of 1896, when an extremely small catch was made, the constantly recurring gales made it impossible for the nets to be kept in the water in a condition to catch fish but a few days at a time. Therefore the light catch was inevitable, but it is clearly shown by the catch of the following year (1897), (which was the largest of any of the whole seven years), that the supply of whitefish had not diminished in Lake Erie, but, on the contrary, had increased.

If what is true of all the Great Lakes that border upon Michigan is true of Lake Erie, somewhere upon the fishing grounds of this body of water immature whitefish are taken, but if any and to what extent is not known. Having no positive data bearing upon this point, it is impossible to estimate what part of the catch of whitefish each year in Lake Erie is adult fish.

The greatest barrier in the way of restoring the waters of the Great Lakes lies in the yearly capture of the immature fish. The adult fish should be taken, thereby leaving the feeding grounds in better condition to supply the young and growing fish. When these conditions are observed, in connection with the work of protected propagation, some of our most important fisheries will have been placed on a healthy and permanent basis. Not until the work of 1891 and 1892 had been completed, did the necessity of inquiring more fully into the catch of young whitefish become apparent. Therefore, beginning with the year 1893, up to and including the year 1897, the catch of young whitefish in Michigan waters has been carefully noted in each of those years.

The catch of all kinds of fish are taken in pounds, and as near as possible are correct, or practically so. The total catch of whitefish of the fisheries in the State during the years above referred to, is as follows:

1893, 5,345,800; 1894, 4,469,755; 1895, 3,353,187; 1896, 3,783,634; 1897, 4,639,014.

In that part of Lake Erie lying within the State only adult whitefish are taken. All the rest of the Great Lakes bordering upon the State, however, have contributed to the catch of young whitefish to a greater or less extent, governed by the varied conditions of the whitefish grounds in those waters. In the waters of Lake Huron and Lake Michigan, the immature whitefish are taken chiefly with the pound nets in shoal water from about the 15th of June to the 25th of July. In Lake Superior, about one month later in the season. In making this classification, the No. 1 whitefish are included in the adult catch, and all under No. 1 (2's, 3's, small 3's and herring size) are included in the immature catch.

Taking each of the five years' catch of whitefish referred to, five-twelfths of the total catch by weight were immature fish, but in actual

count would considerably exceed the number of adult fish taken during the same period. By referring to a letter from W. E. Robinson, of Mackinaw City, contained in our twelfth biennial report, you will more fully understand and appreciate what the effect of taking young whitefish has been upon the fisheries of the State. He says: "From one fishery at Point Au Sable, I have seen small whitefish mixed with herring, and have taken out of a package eight fish that weighed one pound, or just two ounces each." The writer was present at the time, took the whitefish from the half barrel and put them upon the scales. There were sixteen half barrels in the lot. The week previous, Mr. R. received nineteen half barrels of small whitefish from the same fishery, and his books show that the price paid for the whole thirty-five half barrels was $1.25 each, just what he was paying for herring at that time. At two ounces each, each package would contain 800 fish. But to be on the safe side, allow 600 fish to the half barrel, and in count the thirty-five packages would contain 21,000 fish; whereas a fair estimate put upon No. 1's or adult fish, could not be less than two pounds each, or 50 to the package, which would make the count for the same number of packages 1,750 fish.

In taking so large a proportion of whitefish in immaturity, the great loss which the second and third year's growth would add, represents really but a small part of the waste, for we must take into account the fact that the market value of one pound of mature whitefish is equal to about five pounds of the immature, the flesh of the former being firm and hard, while that of the latter is too soft to bear transportation and must be salted. We must also consider the further and more important fact that reproduction by either protected or natural means is absolutely denied to all whitefish and lake trout taken under three years of age. This wasteful catch of young whitefish is not covered by the short term of five years in which this investigation has been going on, but dates back many years to the time when the pound net was first introduced. That it is one of the most effective modes of taking them, is fully confirmed by the statements of fishermen who have been fishing these waters for the past 35 or 40 years.

Primarily the State is interested in the protection of young whitefish till they become adult fish, but the fishermen who get the direct benefit, should be more zealous even than the State in their protection, and conduct the business of fishing upon the same plan of economy that is followed in all the various branches of business. In the products of the soil, what would be said of the husbandman who harvested his crops before maturity?

The planting of fish and their protection to maturity go hand in hand, if the best results are to be attained, and each is dependent upon the other. While all the fishermen appreciate the conditions that have so long been a menace to the young fish, and no one knows better than they the serious effect that it has upon the business, yet year after year the practice goes on regardless of how detrimental it may be to fishing and public interests.

Referring to the whitefish catch of Lake Michigan, very few are caught in that part of the lake south of Frankfort. The figures herein given include the catch of the 2d and 3d districts, and cover all of that part of Lake Michigan lying within the State:

1891, 2,768,192; 1892, 2,999,335; 1893, 2,454,950; 1894, 1,696,505; 1895, 1,219,650; 1896, 1,750,800; 1897, 2,640,020.

1895 showed the lightest catch of any of the seven years, with an increase in 1896, and in 1897 a still further increase, almost equal to that of 1892, which was the largest.

The plants of whitefish fry have been liberal in these waters, and the good results are shown by the above data.

The catch of whitefish along the Michigan coast of Lake Huron for the past seven years has been more uniform, although 1896 and 1897, from the following data, show a decided improvement:

1891, 377,940; 1892, 470,850; 1893, 406,250; 1894, 303,550; 1895, 312,017; 1896, 571,934; 1897, 432,760.

The catch of whitefish in Michigan waters of Lake Superior from 1891 to 1897, inclusive, is as follows:

1891, 4,819,900; 1892, 2,754,200; 1893, 2,423,600; 1894, 2,395,100; 1895, 1,717,220; 1896, 1,401,900; 1897, 1,419,284.

Some years ago, sturgeon were abundant in the waters of our State, but since 1891 the decrease in each year's catch has been rapid, with slight hopes of their restoration, as little attention has been given to their propagation. In 1891, the sturgeon catch was 831,606 pounds, going down each subsequent year to 1897, amounting in that year to 184,881.

When they were the most abundant, little attention was given to their capture, their market value being the lowest of all kinds of fish, but for the past ten years or more, the curing and smoking of their meat, together with caviare made from the ova, has made them one of the most profitable fish taken from the fishing grounds of our State. Detroit river seems to be a favorite place for the sturgeon, especially during the spawning season, and the device most extensively used in their capture is most barbarous. Their well known habit of keeping near the bottom, makes the set lines with hooks the cheapest and easiest method of taking them, much less laborious and expensive than hauling seines. In the use of hooks, the sturgeon come rolling along and are caught. However, many of them tear loose and get away, but the laceration made by the hooks in most cases means death in a short time. The pound nets fished in Lake Erie verify this statement, by getting a number of the wounded sturgeon every season in such a putrid condition that they are entirely worthless.

Of my own personal knowledge, the catch of young sturgeon as small as two pounds in weight, is of frequent occurrence on the fishing grounds of the State. It should not be tolerated. The taking of immature fish of all kinds is the most destructive agency in depleting the commercial fisheries of the State, and should be abandoned by the fishermen, thereby preserving their own means of livelihood, and also for a reason greater than all else, the preservation of our commercial fisheries.

C. H. MOORE,
Statistical Agent.

STATEMENT OF FISH CAUGHT DURING YEAR 1896.

DETAILED REPORT OF DISTRICT NO. 1.

Fish Caught.	Pounds.	Value.
Whitefish	59,000	$3,617 50
Lake Trout	.....	.....
Pike-perch	590,700	18,681 50
Herring	110,200	1,674 25
Sturgeon	55,850	2,340 50
Bass	8,100	113 50
Saugers	112,500	1,183 75
Perch	202,100	2,228 50
Suckers	271,000	1,735 00
Cat fish	111,200	3,206 00
All other kinds	392,170	4,647 15
Total	1,912,820	$39,377 65

AMOUNT INVESTED.

Value of nets	$33,429 00
Value of boats	4,190 00
Value of lands and buildings	35,990 00
Total	$73,609 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	9	225,237
Pound nets	237	28,508
Seines	150	6,909
Total	396	260,654

BOATS IN USE.

Steamers	..
Sail	25
Pound	19
Skiffs	88
Total	132
Number of men employed	247

DETAILED REPORT OF DISTRICT NO. 2.

Fish Caught.	Pounds.	Value.
Whitefish	751,700	$29,335 00
Lake Trout	1,779,900	62,564 50
Pike-perch	12,350	520 50
Herring	1,382,500	28,713 00
Sturgeon	40,732	2,366 77
Bass	5,150	159 50
Saugers	.....	.....
Perch	66,250	1,629 50
Suckers	102,600	967 50
Cat fish	760	150 00
Caviare	4,749	1,136 56
All other kinds	34,450	483 50
Total	4,181,141	$128,026 33

AMOUNT INVESTED.

Value of nets	$115,400 50
Value of boats	90,414 00
Value of lands and buildings	40,365 00
Total	$246,179 50

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	18,771	920,868
Pound nets	197	20,932
Seines	1	50
Total	18,969	941,850

BOATS IN USE.

Steamers	31
Sail	168
Pound	57
Skiffs	106
Total	362
Number of men employed	968

DETAILED REPORT OF DISTRICT NO. 3.

Fish Caught.	Pounds.	Value.
Whitefish	999,100	$33.091 25
Lake Trout	1,364,400	46,296 00
Pike-perch	304,500	9,642 50
Herring	3,972,500	29,878 00
Sturgeon	45,620	1,656 00
Bass	9,980	631 80
Perch	52,400	922 00
Suckers	89,000	770 00
All other kinds	263,100	5,514 00
Total	7,100,550	$128,401 55

AMOUNT INVESTED.

Value of nets	$86,160 00
Value of boats	50,730 00
Value of lands and buildings	46,150 00
Total	$183,040 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	7,147	445,479
Pound nets	288	27,654
Seines	22	778
Total	7,457	473,911

BOATS IN USE.

Steamers	9
Sail	141
Pound	98
Skiffs	140
Total	388
Number of men employed	949

DETAILED REPORT OF DISTRICT NO. 4.

Fish Caught.	Pounds.	Value.
Whitefish	571,934	$25,799 96
Lake Trout	1,068,927	46,205 29
Pike-perch	1,139,920	37,764 20
Herring	6,464,836	28,556 71
Sturgeon	70,077	3,105 09
Bass	44,920	972 05
Saugers	50	1 00
Perch	1,685,712	14,565 22
Suckers	1,376,633	16,262 20
Cat fish	158,218	2,887 85
Caviare	33,650	6,381 50
All other kinds	181,763	4,273 70
Total	12,796,590	$186,774 77

AMOUNT INVESTED.

Value of nets	$119,128 50
Value of boats	42,935 00
Value of lands and buildings	110,625 00
Total	$272,688 50

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	3,127	203,616
Pound nets	581	96,817
Seines	206	10,826
Total	3,914	311,259

BOATS IN USE.

Steamers	5
Sail	169
Pound	25
Skiffs	509
Total	708
Number of men employed	1,908

DETAILED REPORT OF DISTRICT NO. 5.

Fish Caught.	Pounds.	Value.
Whitefish	1,401,900	$49,906 00
Lake Trout	2,686,650	85,837 00
Pike-perch	73,900	2,548 00
Herring	185,800	3,190 33
Sturgeon	12,650	497 20
Bass	4,180	129 00
Perch	3,800	48 00
Suckers	57,500	332 50
All other kinds	217,420	5,834 25
Total	4,643,800	$148,322 28

AMOUNT INVESTED.

Value of nets	$99,611 00
Value of boats	89,735 00
Value of lands and buildings	44,780 00
Total	$234,126 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	7,755	839,587
Pound nets	232	29,419
Seines	62	3,370
Total	8,049	872,376

BOATS IN USE.

Steamers	13
Sail	167
Pound	63
Skiffs	131
Total	374
Number of men employed	807

SUMMARIZED REPORT OF ALL DISTRICTS FOR 1896.

Fish Caught.	Pounds.	Value.
Whitefish	3,783,634	$141,749 71
Lake Trout	6,899,877	240,902 79
Pike-perch	2,121,370	69,106 70
Herring	12,115,836	92,012 29
Sturgeon	224,929	9,965 56
Bass	72,280	2,005 85
Saugers	112,550	1,184 75
Perch	2,010,262	19,393 22
Suckers	1,896,733	20,067 20
Cat fish	270,178	6,243 85
Caviare	38,399	7,518 06
All other kinds	1,088,903	20,752 60
Total	30,634,951	$630,902 58

AMOUNT INVESTED.

Value of nets	$453,729 00
Value of boats	278,004 00
Value of lands and buildings	277,910 00
Total	$1,009,643 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	36,809	2,409,775
Pound nets	1,535	212,700
Seines	441	21,933
Total	38,785	2,644,408

BOATS IN USE.

Steamers	58
Sail	670
Pound	262
Skiffs	974
Total	1,964
Number of men employed	4,879

STATEMENT OF FISH CAUGHT DURING YEAR 1897.

DETAILED REPORT OF DISTRICT NO. 1.

Fish Caught.	Pounds.	Value.
Whitefish	146,950	$8,584 50
Pike-perch	418,100	14,174 50
Herring	7,560	75 60
Sturgeon	46,320	2,733 20
Bass	30,600	706 50
Saugers	101,500	1,036 00
Perch	117,000	1,697 50
Suckers	199,700	1,581 00
Cat fish	35,600	955 00
Caviare	5,400	1,386 00
All other kinds	406,940	3,730 40
Total	1,515,670	$36,660 20

AMOUNT INVESTED.

Value of nets	$21,340 00
Value of boats	18,815 00
Value of lands and buildings	18,350 00
Total	$58,505 00

NETS IN USE.

Kind.	Number.	Fathoms.
Pound nets	220	30,244
Seines	80	4,290
Total	300	34,534

BOATS IN USE.

Steamers	3
Sail	25
Pound	5
Skiffs	56
Total	89
Number of men employed	208

DETAILED REPORT OF DISTRICT NO. 2.

Fish Caught.	Pounds.	Value.
Whitefish	1,127,000	$45,117 88
Lake Trout	1,569,250	58,263 80
Pike-perch	5,550	225 00
Herring	1,298,036	31,906 51
Sturgeon	27,480	1,950 70
Bass	2,010	95 90
Perch	133,350	3,574 00
Suckers	136,500	1,275 75
Cat fish	100	3 00
Caviare	3,569	837 60
All other kinds	56,490	841 60
Total	4,359,335	$144,091 74

AMOUNT INVESTED.

Value of nets	$112,755 00
Value of boats	72,415 00
Value of lands and buildings	37,130 00
Total	$222,300 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	17,146	912,636
Pound nets	168	20,572
Seines	4	17
Total	17,318	933,225

BOATS IN USE.

Steamers	32
Sail	145
Pound	58
Skiffs	94
Total	329

Number of men employed 871

DETAILED REPORT OF DISTRICT NO. 3.

Fish Caught.	Pounds.	Value.
Whitefish	1,503,020	$52,616 15
Lake Trout	1,452,500	45,498 25
Pike-perch	293,100	10,016 00
Herring	6,334,700	32,356 17
Sturgeon	35,100	1,422 85
Bass	7,690	422 80
Saugers	1,000	10 00
Perch	128,650	2,478 50
Suckers	286,500	1,966 25
Caviare	295	44 25
All other kinds	279,900	5,899 50
Total	10,322,455	$152,730 72

AMOUNT INVESTED.

Value of nets	$106,716 50
Value of boats	58,174 00
Value of lands and buildings	47,650 00
Total	$212,540 50

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	8,909	541,557
Pound nets	335	30,750
Seines	33	1,308
Total	9,277	573,615

BOATS IN USE.

Steamers	14
Sail	182
Pound	70
Skiffs	117
Total	383

Number of men employed 858

DETAILED REPORT OF DISTRICT NO. 4.

Fish Caught.	Pounds.	Value.
Whitefish	432,760	$23,836 95
Lake Trout	1,006,362	44,187 68
Pike-perch	1,647,147	56,048 74
Herring	4,890,650	29,452 25
Sturgeon	64,900	3,132 40
Bass	14,750	378 80
Saugers	1,100	11 00
Perch	1,693,850	17,172 92
Suckers	1,480,100	19,307 50
Cat fish	193,950	4,848 50
Caviare	34,855	7,395 50
All other kinds	275,914	4,887 10
Total	11,736,338	$210,659 34

AMOUNT INVESTED.

Value of nets	$108,916 00
Value of boats	50,690 00
Value of lands and buildings	134,030 00
Total	$293,636 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	2,656	258,046
Pound nets	511	135,404
Seines	290	11,135
Total	3,457	404,585

BOATS IN USE.

Steamers	10
Sail	166
Pound	23
Skiffs	597
Total	796

Number of men employed 1,877

DETAILED REPORT OF DISTRICT NO. 5.

Fish Caught.	Pounds.	Value.
Whitefish	1,419,284	$56,621 70
Lake Trout	2,552,342	98,171 42
Pike-perch	68,700	2,518 00
Herring	426,700	4,720 00
Sturgeon	11,081	401 04
Bass	2,700	77 50
Perch	18,000	250 00
Suckers	59,500	297 50
All other kinds	99,640	2,632 75
Total	4,657,947	$165,689 91

AMOUNT INVESTED.

Value of nets	$105,367 00
Value of boats	61,760 00
Value of lands and buildings	67,875 00
Total	$235,002 00

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	7,560	743,981
Pound nets	205	132,536
Seines	47	2,076
Total	7,812	878,593

BOATS IN USE.

Steamers	11
Sail	145
Pound	57
Skiffs	98
Total	311
Number of men employed	625

SUMMARIZED REPORT OF ALL DISTRICTS FOR 1897.

Fish Caught.	Pounds.	Value.
Whitefish	4,639,014	$186,777 18
Lake Trout	6,580,454	246,121 15
Pike-perch	2,432,597	82,982 24
Herring	12,957,646	98,510 53
Sturgeon	184,881	9,640 19
Bass	57,750	1,681 50
Saugers	103,600	1,057 00
Perch	2,090,850	25,172 92
Suckers	2,163,300	24,428 00
Cat fish	229,650	5,806 50
Caviare	44,119	9,663 35
All other kinds	1,118,884	17,991 35
Total	32,602,745	$709,831 91

AMOUNT INVESTED.

Value of nets	$455,094 50
Value of boats	261,854 00
Value of lands and buildings	305,035 00
Total	$1,021,983 50

NETS IN USE.

Kind.	Number.	Fathoms.
Gill nets	36,271	2,456,220
Pound nets	1,439	349,506
Seines	454	18,826
Total	38,164	2,824,552

BOATS IN USE.

Steamers	70
Sail	663
Pound	213
Skiffs	962
Total	1,908
Number of men employed	4,439

APPENDIX

FISH PLANTS, 1897-1898

TEMPERATURES AND OTHER INFORMATION

Whitefish Plants, 1897, from Detroit House.

Name of waters.	Where deposited.	Date.	Number.
Lake Michigan	One and one-half miles south of Frankfort	April 2	2,000,000
Lake St. Clair	One-half mile off Grosse Point light	" 2	3,000,000
Lake Michigan	Eight miles southwest from Grand Haven	" 3	2,000,000
Detroit river	Belle Isle—Willis fishery	" 4	3,000,000
" "	Foot of Belle Isle	" 4	3,000,000
" "	Belle Isle	" 4	3,000,000
" "	Belle Isle—Willis fishery	" 5	3,000,000
" "	Foot of Belle Isle	" 5	3,000,000
Lake St. Clair	One-half mile off lightship	" 5	3,000,000
Lake Michigan	Off St. Joseph	" 6	2,000,000
"	Four miles southwest from Ludington	" 6	2,000,000
Lake St. Clair	One and one-half miles off Grosse Point light	" 6	1,560,00
" " "	" " " " " " " "	" 6	1,560,000
Detroit river	Belle Isle—Willis fishery	" 6	1,560,000
Lake Huron	Off Au Sable	" 7	1,440,000
Lake St. Clair	Two miles off Grosse Point	" 7	3,000,000
Detroit river	Belle Isle—Willis fishery	" 7	3,000,000
Lake Michigan	Four miles northwest from Manistee	" 7	2,000,000
Lake St. Clair	One-half mile off Grosse Point light	" 8	3,000,000
Lake Huron	Cheboygan, south of Bois Blanc Island	" 9	2,000,000
" "	Six miles southeast from Au Sable	" 10	2,000,000
Detroit river	Foot of Belle Isle	" 11	3,000,000
Lake Michigan	Six miles west from St. Joseph	" 12	2,000,000
" "	Three miles west of Pentwater	" 12	2,000,000
Lake St. Clair	One-half mile off Grosse Point light	" 13	3,000,000
Detroit river	Belle Isle—Willis fishery	" 14	3,000,000
Lake St. Clair	Off Grosse Point light	" 14	3,000,000
Total			66,120,000

From Charlevoix House.

Name of waters.	Where deposited.	Date.	Number.
Lake Michigan	Seven miles west from Charlevoix	April 10	1,520,000
" "	Five miles north from Charlevoix	" 12	2,000,000
" "	Four miles southeast from Beaver Harbor	" 13	1,640,000
" "	Ten miles southwest from Charlevoix	" 13	960,000
" "	Two miles south from Old Mission Point	" 14	2,000,000
" "	Seven miles north by west from Charlevoix	" 14	2,500,000
" "	Two miles west from Norwood	" 15	2,000,000
" "	Two miles west from Bay Shoal	" 15	2,000,000
" "	Two miles west from North Point	" 16	2,000,000
Pine lake	Off Oyster Bay	" 16	2,250,000
Lake Michigan	Five miles northwest from Cathead Point	" 17	2,000,000
" "	Five miles southwest from Norwood	" 18	2,250,000
" "	Four miles west from Fisherman's Island	" 18	2,000,000
" "	Seven miles west from Charlevoix	" 20	2,580,000
" "	High Island Shoals	" 23	2,000,000
" "	Three miles from Fisherman's Island	" 23	2,200,000
Total			31,300,000

From Sault Ste. Marie House.

Name of waters.	Where deposited.	Date.	Number.
Sault Rapids	Sault Ste. Marie	Apr. 15 & May 5, 17 & 29	1,500,000
Lake Michigan	Manistique	May 8 & 18	5,500,000
Lake Superior	Marquette	April 25	2,000,000
Little Bay de Noquette	Escanaba	" 29	2,000,000
Whitefish Bay	Indian Mission	May 1	2,000,000
Detour passage	Detour	April 29	2,000,000
Straits of Mackinac	St. Ignace	May 17	2,000,000
Lake Superior	Grand Marais	" 22	2,000,000
Whitefish Bay	Whitefish Bay	" 25	2,000,000
" "	" "	" 27	2,000,000
Total			23,000,000

RECAPITULATION.

From Detroit House	66,120,000
" Charlevoix House	31,300,000
" Sault Ste. Marie	23,000,000
Total	120,420,000

Brook Trout Plants, 1897.

County and name of waters.	Town.	Depositor.	Date.	Number.
Alcona county:				
Buff Brown creek	Hawn	Chas. Conklin	March 15	6,000
Black river	Harrisville and others	" "	" 15	6,000
Middle branch of Pine river	Mikado	" "	" 15	3,000
Vanettan creek	Harrisville and Mikado	" "	" 15	6,000
Pine river	Gustin and Mikado	" "	" 15	5,000
Sucker creek	Hawn	" "	" 15	3,000
Mill creek	Harrisville	" "	" 15	3,000
Pine river	Hawn	C. W. Luce	" 15	5,000
South branch of Pine river	Curtis	J. W. Ferguson	" 15	6,000
Banfield's creek	"	Lott Simons	" 15	3,000
"	"	George A. Loud	" 15	3,000
"	"	Wm. M. Featherly	" 15	4,000
South branch of Pine river	Gustin	B. Anger	" 15	15,000
East branch of Pine river	Millen	H. W. Lyman	" 15	6,000
Mudlake branch of Pine river	"	" "	" 15	3,000
East br. of Buff Brown creek	"	" "	" 15	
Alger county:				
Beaton creek	Burt	Henry E. Carpenter		3,000
Grand Marais lake	"	" " "		15,000
Grand Marais creek	"	Grand Marais Mill Co.		3,000
Sauble river	"	" " " "		3,000
Allegan county:				
Plummerville creek	Ganges	J. M. Lusk	February 6	3,000
Rose creek	Otsego	Fred Tubbs	" 8	3,000
Warren's creek	Otsego and Alamo	" "	" 8	3,000
Burch run	Alamo	C. R. Rathbun	" 8	6,000
Mitchell creek	Adams and Otsego	Conrad Bros.	" 8	3,000
Butternut creek	Otsego	Sherwood Bros.	" 8	3,000
Clear lake outlet	Trowbridge	Geo. D. Higgins	" 8	3,000
Spencer's creek	Otsego	A. A. Mansfield	" 8	1,000
Norman creek	Gun Plains	" "	" 8	3,000
Blackman creek	Trowbridge	" "	" 8	3,000
Barn's creek	Otsego	C. Engels	" 8	3,000
Rabbit river	Wayland	John A. Turner	" 8	6,000
Gregg brook	Wayland and Martin	" " "	" 8	3,000
Page brook	Martin	John Burges	" 8	3,000
Miller brook				
Yerrick's creek	Otsego and Gun Pl'ns	Chas. W. Edsell	" 8	6,000
Devo's creek	Otsego	John N. Perkins	March 25	3,000
Little Rabbit river	Dorr	John C. Neuman	April 7	6,000
Sebright creek	Monterey	L. F. Stuch, M. D.	" 7	6,000
Reid's creek	"	" " "	" 7	6,000
Alpena county:				
Norwegian creek	Alpena	W. E. Rogers	March 15	3,000
Trout creek	"	" "	" 15	2,000
Antrim county:				
Cedar river	Chestonia & Kearney	C. L. Bailey	" 2	3,000
Saloon creek	Custer	" "	" 2	3,000
Baraga county:				
Three Lakes, on Sec. 14	Spurr	Geo. McDonald	May 13	6,000
No name	L'Anse	M. C. Heath	" 13	3,000
Sturgeon river	"	C. D. Sheldon	" 13	9,000
Ravine river	Avon	N. S. Pennock	" 13	9,000
Ogema creek	L'Anse	" "	" 13	6,000
Silver river	Baraga	" "	" 13	9,000
Koltz creek	L'Anse	" "	" 13	10,000
Clear creek	Baraga	" "	" 13	10,000
Barry county:				
Bostwick creek	Barry	C. W. Collins	February 11	3,000
Pine Gulley run	Baltimore	Charles Pritchard	" 11	3,000
McCallum creek	Hope	T. R. Pancoast	" 11	3,000
Glass creek	Hastings	W. S. Wheelwright	" 11	3,000
Ream's creek	"	Fred H. Barlow	" 11	3,000
Shultz creek	Hope	Afton D. Smith	" 11	3,000
Black Lake brook	Irving	Seymour G. Jordan	" 11	3,000
Murphy creek	Hope	A. L. Campbell	" 11	3,000
Stream on Sec's 35 and 36	"	W. J. Lance	" 11	3,000
Cox creek	"	A. Cox	" 11	3,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Benzie county:				
Platte river	Almira and others	W. H. Shroeder	March 18	6,000
Sherman river	Inland and Almira	" "	" 18	6,000
Ransom pond and creek	Almira	" "	" 18	3,000
Aux Bees Scies creek	Weldon	W. H. Bennet	" 18	10,000
Platte river	Homestead	" "	" 18	6,000
Berrien county:				
Hog or Putnam creek	Sodus and Benton	E. E. Plimpton	February 6	3,000
Sand creek	Benton	" "	" 6	6,000
Farmer's creek	Pipestone and Sodus	" "	" 6	3,000
Blue creek	Bainbridge & Benton	D. J. Morrison	" 6	6,000
Lore creek, Lemon creek, Penterbaugh creek	Berrien	Henry Frank	" 6	6,000
Branch county:				
Coldwater river	Union	Walter H. Hawley	" 11	6,000
Vincent's creek	Girard	L. M. Wing	March 26	1,000
Sherman creek	Coldwater	Henry H. Barlow	" 26	3,000
Calhoun county:				
Wanondoger creek	Pennfield	Edward J. Smith	February 11	6,000
Indian creek	Marshall	Andrew McRoberts	" 11	1,000
Perrin's creek	Marengo	" "	" 11	1,000
Eldred creek	Tekonsha	A. D. Eldred	" 11	3,000
Buchanan creek	Burlington	Ira Warsop	" 11	3,000
Notawa creek	Athens	" "	" 11	10,000
Holmes creek	"	Geo. Buchanan	" 11	3,000
Thompson's creek	"	Joseph Beadle	" 11	6,000
Fountain's creek	Newton	J. F. Garwood	" 11	1,000
Dixon brook	Pennfield	" "	" 11	1,000
Hibbard's creek	Marshall	" "	" 11	3,000
Lenhart's brook	"	" "	" 11	3,000
Cass county:				
No name, on Sec's 20 and 21	Volinia	G. W. Gard	" 26	1,000
Cobert's creek	Ontwa	N. A. Hastermann	" 9	6,000
"	Jefferson and Milton	J. A. Parsons	" 9	3,000
Brandywine creek	Marcellus	Charles Loop	" 9	2,000
Landers creek	"	W. B. Young	" 9	1,000
Stream on Sec's 5 and 8	"	C. M. Beardslee	" 9	2,000
Beardslee creek	"	W. L. Arnold	" 9	6,000
Lewis creek	"	" "	" 9	3,000
Benette creek	"	" "	" 9	3,000
Worden's creek	"	" "	" 9	9,000
Dowagiac creek	"	C. S. Jones	" 9	2,000
Bogart creek	"	H. Terry	" 9	2,000
Wattles creek	"	Eber Vilet	" 9	3,000
Sheldon brook	"	Wells McKerby	" 9	3,000
Wither's creek	Porter	J. H. Hahn	" 9	9,000
Charlevoix county:				
Inwood creek	Norwood	L. D. Bartholemew	March 1	3,000
Monroe creek	South Arm	" "	" 1	1,000
McGeogh creek	Norwood	" "	" 1	6,000
Stover creek	Charlevoix & Marion	" "	" 1	3,000
Bear river, South Arm creek	Melrose	W. H. Ellis	" 2	6,000
Spring brook	"	C. J. Mizer	" 2	5,000
Spring brook and branch of Bear river	"	W. B. Stimson	" 2	5,000
Cheboygan county:				
Stuart creek	Waverly	J. M. Clark	" 2	2,000
Stony creek	"	" "	" 2	6,000
Silver creek	Nunda	Samuel Simon	" 2	3,000
Big Pigeon river	"	Leverne Ford	" 2	10,000
Little Pigeon river	"	Jacob R. Shook	" 2	10,000
Little Sturgeon river	34 and 35	M. A. McHenry	" 2	10,000
Little Black river	Beauregard	W. E. Shoemaker	" 2	6,000
Myer's creek	Benton	" "	" 2	3,000
Chippewa county:				
Trout brook	Rudyard	H. H. Wyatt	May 3	2,000
South br. of Shelldrake river	Whitefish Point	Penoyer Bros	June 1	6,000
Not given	" "	" "	" 1	3,000
St. Mary's river	Rapids	Michigan Fish Com	" 1	74,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Clare county:				
Little Tobacco river	Grant and Vernon	O. S. Derby	February 25	6,000
Beaver creek	Grant	" "	" 25	6,000
Cedar creek	"	" "	" 25	3,000
Becker creek	"	" "	" 25	3,000
Randall creek	"	" "	" 25	3,000
Hay creek	"	" "	" 25	3,000
Waldo creek	"	" "	" 25	3,000
Chard creek	"	" "	" 25	6,000
Whitney creek	"	" "	" 25	6,000
Utley creek, Wagner creek	Surrey	Nat D. Watkins	" 25	6,000
Dickinson county:				
Stream on Sec's 6, 41 and 27	Breene	S. H. Bridges	May 4	6,000
Davis creek	Breene and others	" "	" 4	6,000
Eaton county:				
Boyer creek	Chester	F. S. Jordan	February 11	3,000
Roll brook	"	" "	" 11	3,000
Jennie and Beeman creek	"	" "	" 11	3,000
Hanes creek	Vermontville	" "	" 11	3,000
Gale creek	Hamlin	George D. Wilcox	" 11	1,000
Genesee county:				
Begole's creek	Genesee	C. M. Begole	" 27	6,000
Gogebic county:				
Duck creek	Watersmeet	L. L. Wright	May 4	10,000
Montreal river	"	" "	" 4	10,000
Welch creek	Ironwood	" "	" 4	6,000
" "	"	" "	" 4	10,000
Siemen's creek	"	" "	" 4	6,000
Bessemer creek	Bessemer	" "	" 4	10,000
Black river	"	" "	" 4	10,000
McDonald river	"	" "	" 4	9,000
Little Presque Isle river	Wakefield	" "	" 4	10,000
Pelton creek	"	Henry B. Roney	" 4	3,000
"	"	" " "	" 4	3,000
Trout creek	"	" " "	" 4	9,000
Slate river	Marenisco	J. M. Whitman	" 4	9,000
Grand Traverse county:				
Stream on Sec's 15, 16 and 22	East Bay	Fred D. Curtis	March 1	3,000
Mitchell's creek	" "	" " "	" 1	3,000
Bertner creek	Blair	J. K. V. Agnew	" 1	6,000
Stream on Sec's 4 and 5	Garfield	Howard A. Dockery	" 1	2,000
East creek	Paradise	J. C. Crotser	April 2	6,000
Mayfield creek	"	" "	" 2	6,000
Gratiot county:				
Adams creek	Arcada, Seville and Sumner	Birton I. Gee	March 15	6,000
Bullock creek	Sumner	" " "	" 15	3,000
Hillsdale county:				
Stream on Sec's 23, 25, 30 and 35	Reading and Cambria	E. D. Babcock	February 9	3,000
Silver creek	Cambria, Woodbridge and others	" "	" 9	3,000
Spring brook	Woodbridge and Amboy	W. C. Young	" 9	3,000
Stream on Sec's 11, 13 and 23	Camden	Ira D. Eldridge	" 9	3,000
Wells creek	Reading	M G Mallery	" 9	1,000
Robinson creek	"	A. H. Robinson	" 9	1,000
Hodges creek	Scipio	T. J. Strait	" 9	3,000
Houghton county:				
Otter creek and branches	Portage and Chassell	C. D. Sheldon	May 13	9,000
Salmon Trout river	Portage	" "	" 13	9,000
Hill's creek	Houghton and Keweenaw	Wm. W. Ellis	" 13	3,000
Blackman creek	Duncan	Geo. W. Shane	" 13	3,000
Bad Water creek	"	" " "	" 13	3,000
Shane creek	"	" " "	" 13	6,000
McCullom's creek	Torch Lake	James B. Cooper	" 13	6,000
Saw Mill creek	Schoolcraft	" " "	" 13	6,000
West br. of Traverse river	"	" " "	" 13	6,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Huron county:				
Spring creek	Sand Beach	Bela W. Jenks	February 26	3,000
Allen's creek	" "	" "	" 26	6,000
Elm creek	Sherman and Paris	" "	" 26	6,000
Pigeon river and branches	Grant and Sheridan	W. C. Sanford	March 27	6,000
Ionia county:				
Brown creek	Lyons	Albert Roof	February 22	3,000
West creek	"	" "	" 22	3,000
Knapp creek	"	" "	" 22	3,000
Stone Quarry creek	"	" "	" 22	3,000
Struble creek	Lyons and N. Plains	" "	" 22	3,000
Errett creek	Lyons	" "	" 22	3,000
Ronald creek	Ronald	" "	" 22	6,000
Troyer creek, Silver creek, McVeigh creek	Pewamo	F. C. Hathaway	" 22	6,000
Bear creek	Campbell	L. E. Harkin	" 22	3,000
Kane creek	Otisco	H. A. Lamb	March 9	2,000
Seeley's creek	Otisco and Grattan	G. O. Bignell	" 9	6,000
Iosco county:				
Hatt's creek	Plainfield	C. W. Luce	" 15	6,000
Iron county:				
West branch of Jumbo river	46 N., 37 W.	G. W. Shane	May 13	3,000
Isabella county:				
Dixon creek	Vernon	O. S. Derby	February 25	6,000
Johnson creek	Union	Geo. A. Chatterton	March 15	6,000
Loomis creek	Wise	E. W. Allen	February 25	6,000
Willey creek	"	" "	" 25	6,000
Hersey creek, Scofield creek, Three br'hes of Chippewa	"	" "	" 25	3,000
Chippewa Cedar creek	Gilmore	Dr. C. S. Park	March 15	3,000
Stony brook	Deerfield	Geo. A. Hicks	" 15	3,000
Camfro creek	"	" "	" 15	3,000
Darrough creek	"	" "	" 15	3,000
Cedar creek	Union	" "	" 15	3,000
Wheeler's creek	Deerfield	Geo. A. Chatterton	" 15	3,000
	Union	" "	" 15	3,000
Jackson county:				
Sandstone creek	Spring Arbor	Michael Bacon	February 11	6,000
Kalamazoo county:				
Franklin creek	Alamo	A. D. Baker	" 8	6,000
Chamberlain brook	Prairie Ronde	Henry J. Allen	" 8	9,000
Frazier creek	Schoolcraft	" "	" 8	1,000
Pine creek	Alamo	George E. Hunt	" 8	3,000
Olmstead creek	Kalamazoo	Wm. McKie	" 8	3,000
Russell creek	Cooper	Wm. O'Bryne	" 8	1,000
Pierson creek	Alamo	John Frank	" 8	3,000
Stacey creek	Richland and Cooper	" "	" 8	3,000
Kalkaska county:				
Rapid river	Clearwater & others	Elmer E. Wealch	March 1	6,000
South Boardman river	Boardman	W. B. Stimson	" 2	6,000
Rapid river	Rapid River	" "	" 2	6,000
Middle Boardman river	Boardman	" "	" 2	10,000
Rapid river	Rapid River	C. L. Bailey	" 2	6,000
Kent county:				
Spring creek	Colon	C. S. Ford	February 8	6,000
Cedar creek	Nelson and others	" "	" 8	6,000
Duke creek	Nelson and Solon	" "	" 8	6,000
Gardner's creek	Bowne	Louis J. Boulard	" 22	3,000
Foster creek	"	Wm. H. Silcox	" 22	2,000
Silcox creek	"	" "	" 22	1,000
Barber's creek	Tyrone	Henry H. Wylie	March 1	1,000
Keweenaw county:				
Montreal river		Will T. Ellis	May 13	9,000
Gratiot river	Allouez	Charles Schenck	" 13	3,000
Silver creek	"	Will T. Ellis	" 13	6,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Lake county:				
Stream on Sec's 10, 11 and 12	Center	J. K. V. Agnew	March 1	6,000
Roach creek	"	" "	" 1	6,000
Little Danaher creek	Plains	" "	" 1	5,000
Little Manistee river	Ellsworth	W. B. Stimson	" 3	10,000
Sauble river	Sheridan	H. W. Marsh	" 18	15,000
North br. Pere Marquette		Michigan Fish Com.	" 18	10,000
Lapeer county:				
Mill creek branches Elk creek, Spring brook, etc.	Goodland and others	Geo. R. Manwaring	February 22	6,000
Terry's creek	Almont	F. P. Andrus	" 22	6,000
Gutches creek	Almont and Bruce	" "	" 22	3,000
North br. of Clinton river	Almont	" "	" 22	6,000
Elk creek	Marathon	J. L. Preston	" 26	6,000
North branch of Flint river	Rich	" "	" 26	10,000
Smith's creek	Deerfield	" "	" 26	6,000
Sandies creek	"	Will J. Till	" 26	2,000
Farmer's creek	Elba, Hadley and others	Levi Copeman	" 26	6,000
No name	Metamora and Lapeer	" "	" 26	1,000
Lenawee county:				
Wells creek	Clinton	W. T. Eccles	" 11	5,000
Leelanau county:				
Mosseau's creek	Leelanau	Omena Hotel Ass'n	March 1	3,000
Stream on Sec's 4, 9 and 10	Bingham	Fred D. Curtis	" 1	3,000
No name	Solon	" "	" 1	3,000
Crystal river	Glen Arbor	D. H. Day	" 19	6,000
Singrey creek, Everetts creek, Clear creek	Solon	N. W. Hetherington	" 18	6,000
Cedar creek	"	" "	" 18	6,000
Livingston county:				
Beach's creek	Hartland	H. S. Holdridge	February 27	6,000
Pleasant Valley creek	Brighton	" "	" 27	5,000
Macomb county:				
McKay's creek	Bruce	H. W. Bradley	" 22	6,000
Streetor's creek	"	" "	" 22	3,000
Smith's creek	Washington	" "	" 22	3,000
St. John's brook	Shelby and Sterling	Geo. B. Davis	March 27	3,000
Leech brook	" "	" "	" 27	3,000
Marquette county:				
Switzer's creek	Richmond and Negaunee	John Quincy	May 13	6,000
Cook's creek	Ishpeming	Geo. A. Newett	" 13	3,000
Manistee county:				
Little Bear creek	Springdale	J. K. V. Agnew	March 1	6,000
Secor's creek	Manistee	Thomas H. Peterson	" 18	3,000
Knickerbocker or Gilson creek	Marietta and Maple Rapids	M. S. Hawes	" 18	9,000
Clay Bank creek	Manistee	T. A. Browne	" 18	6,000
Pine creek	Stronach	J. K. V. Agnew	" 1	10,000
Mason county:				
Quinn creek	Summit and Riverton	D. C. Wickham	" 5	4,000
Nickerson creek	Summit	" "	" 6	6,000
Reid creek, Quinn creek	Riverton and Eden	P. F. Harley	" 18	6,000
Weldon creek	18 and 15	James Connors	" 18	6,000
Karston creek	Pere Marquette	F. W. Graham, M. D.	" 18	3,000
Not given	Amber	J. D. Gebolt & Co.	" 18	3,000
Gebolt's creek	"	" " "	" 18	3,000
Mecosta county:				
Mitchell creek	Big Rapids	H. A. Lazelle	" 5	3,000
Bill Raub creek, Fuells's creek	Mecosta	J. H. Megerole	" 5	6,000
Ryan creek	Big Rapids and others	W. A. Whitney	" 5	5,000
Ryne creek	Big Rapids	Geo. W. Milner	" 5	4,000
Dalziel creek	Green and Barton	E. H. Merrett	" 5	6,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Mecosta county—*Continued:*				
Mitchell creek	Big Rapids	E. H. Merrett	March 5	3,000
Cedar creek	Grant	James A. Roop	" 9	6,000
Pointer creek	Morton	Amos S. Johnson	" 9	6,000
Bengin creek	"	" " "	" 9	3,000
East branch of Big creek	Deerfield	Geo. F. Hinst	" 12	6,000
Quigley creek	"	Fred C. Boyd	" 12	6,000
Gill creek	"	" " "	" 12	6,000
Stony creek	"	" " "	" 12	6,000
Little Muskegon river	"	W. B. Stimson	" 12	10,000
Borland creek	Ætna	" "	" 12	6,000
Paris creek	Green	L. S. Swiger	" 13	9,000
Pere Marquette		Michigan Fish Com.	" 17	30,000
Midland county:				
Pine river	Homer, Porter and others	Wm. Booth	February 25	10,000
Spring creek	Geneva	Chas. H. Spencer	" 25	5,000
Warner creek	"	" " "	" 25	6,000
Missaukee county:				
West Branch	West Branch	S. H. Hovey	March 2	9,000
Clam river	Lake, Reider & others	" "	" 2	10,000
Mosquito creek	Reider	" "	" 2	6,000
No name	Riverside	J. O. Packard	" 15	6,000
" "	Clam Union	Gerret Herweiger	" 15	3,000
Montcalm county:				
Alder creek	Sidney	C. E. Elliott	" 9	6,000
Entrecan creek	Douglass	" "	" 9	3,000
Wabsis creek	Eureka	H. P. McElroy	" 9	10,000
Curtis creek	Pine	Fred Spooner	" 15	9,000
West branch of Flat river	"	" "	" 15	3,000
Caorbon creek		Birton I. Gee	" 15	3,000
Montmorency county:				
Brush creek	Montmorency	James Hubert	" 15	10,000
Muskegon county:				
Norris creek and tributaries	Sullivan & Fruitport	Miles D. Bradford	" 5	6,000
Cleveland creek	Blue Lake	John Haverkate	" 5	3,000
Gordon creek	Muskegon & Fruitp't	G. S. Gordon, M. D.	" 5	3,000
Mitchell creek }	Ravenna	Miles W. Bradford	" 5	6,000
Roswell creek }				
Vincent creek	Fruitport	Edwin C. Torrans	" 5	6,000
Big Deer Lick creek	"	" " "	" 5	3,000
Little Deer Lick creek	"	" " "	" 5	3,000
Silver creek	Blue Lake	E. D. Magoon	" 5	6,000
Big Bear creek	"	" "	" 5	6,000
Cleveland creek	Blue Lake	" "	" 5	3,000
Big Black creek	Moreland and others	" "	" 5	3,000
Newaygo county:				
Rattlesnake creek	Wilcox	J. K. V. Agnew	" 1	3,000
Peterson creek	Lincoln	" "	" 1	6,000
Barnhard creek	"	" "	" 1	3,000
Miller creek	Wilcox and Grant	" "	" 1	6,000
Mullen creek	" " "	" "	" 1	5,000
Mertens creek	Wilcox	" "	" 1	9,000
Holcomb creek	Lincoln	" "	" 1	6,000
Morgan creek	Wilcox	" "	" 1	3,000
Garmon creek	Wilcox and Grant	" "	" 1	3,000
Head of Rouge river	Croton	George King	" 1	3,000
Stream on Sec's 3, 10, 15 & 16	Wilcox	M. D. Hayward	" 1	6,000
Lower Cold creek	Lincoln	" "	" 1	6,000
Upper Cold creek	"	" "	" 1	6,000
Minnie creek	"	" "	" 1	6,000
Five Mile creek	Wilcox	" "	" 1	6,000
Flinton creek	"	" "	" 1	9,000
White river	"	" "	" 1	10,000
Little Muskegon river	Croton	S. B. Ganweiler	" 1	9,000
Coolbaugh creek	Brooks	Frederick Jacobi	" 1	3,000
Odell creek	Sherman & Douglass	Frank E. Cole	" 6	3,000
Williams creek	Sherman & Garfield	" " "	" 6	3,000
Brooks creek	Sheridan & Bridgeton	W. D. Sargeant	" 6	10,000
Cushman creek	Dayton & Greenwood	J. A. Gerber	" 6	6,000
Peas creek		Michigan Fish Com.	" 30	10,000
S. br. Pere Marquette river		" " "	" 30	25,000
Grass Lake creek		" " "	" 30	5,000

Brook Trout Plants, 1897.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Oakland county:				
Branch of Rouge river	Bloomfield	S. Alexander	February 22	6,000
Spring Mills creek	Highland	H. S. Holdridge	" 27	3,000
Andrus creek	"	" "	" 27	5,000
Livonia stream	Livonia	Fred M. Warner	" 27	6,000
Farmington creek	Farmington	" " "	" 27	6,000
Oceana county:				
Armley creek	Weare	D. C. Wickham	March 5	3,000
Mears creek	"	" "	" 5	3,000
Cedar creek	Weare and others	" "	" 5	9,000
Shigley creek	Hart	J. K. Flood	" 5	3,000
North branch of Pentwater and tributaries	Weare and Crystal	" "	" 5	10,000
North branch of White river	Terry and Leavitt	" "	" 5	10,000
Russell creek	Hart	" "	" 5	3,000
South br. of Pentwater river	Pentwater & others	" "	" 5	10,000
Stony creek	Shelby and Benona	" "	" 5	6,000
Parish creek	Elbridge and Hart	" "	" 5	6,000
Howell's creek	Otto	E. D. Magoon	" 5	3,000
Headwaters of north branch of White river	Newfield	Wm. Hayward	" 6	6,000
Ontonagon county:				
Cedar creek	Interior	Annie M. Powell	May 13	3,000
Baltimore creek	"	Alex T. Simpson	" 13	10,000
Francis creek	"	Edmund Wilson	" 13	3,000
Osceola county:				
Isaacson creek	Richmond	J. W. Densmore	" 1	3,000
Hersey river	"	" "	" 1	15,000
Johnson's creek	"	" "	" 1	3,000
East tributary to Pine river	Sherman	Charles Larson	" 2	6,000
Beaver creek	Leroy	Theo. Rogers	" 2	3,000
Pine river	Burdell	W. B. Stimson	" 2	9,000
Middle br. of Muskegon river	Marion	J. B. Wagner	" 15	9,000
No name	Reed City	Geo. M. Brown	April 26	10,000
Oscoda county:				
Gilchrist creek	Cummins	Henry A. Bauman	March 30	9,000
Hunt creek	Greenwood	" "	" 30	9,000
Hunell creek	Harmon	Ezekiel Marsh	" 15	9,000
Armstrong creek	Mentor	Peter Cauchy	" 15	6,000
Otsego county:				
Lake on Sec's 22, 27 and 28	Dover	John Gaslow	" 2	3,000
Brown creek	"	Dota Whitmarsh	" 2	3,000
Ottawa county:				
Bertselis creek	Holland	A. G. Baumgartel	February 6	3,000
Waverly brook	"	" "	" 6	3,000
Pine creek	"	" "	" 6	6,000
Presque Isle county:				
Rainey river	Allis	J. M. Clark	March 2	15,000
Little Rainey river	"	" "	" 2	3,000
Glasier creek	"	" "	" 2	3,000
Roscommon county:				
North branch of Banks creek	St. Helen	John M. Yates	" 3	3,000
Schoolcraft county:				
Mead creek	Germfask	Edward Menere	May 12	3,000
Bear creek	"	" "	" 12	6,000
St. Joseph county:				
Spring run	Sherman	Frank Kenyon	February 8	3,000
Spring run	Flowerfield	P. C. Pursel	" 8	3,000
Brandy brook	"	Harvey Ayers	" 8	6,000
Butternut creek	"	" "	" 8	1,000
Fawn river	Fawn River	H. Driesbach	" 8	6,000
Parrin creek	Sherman	J. A. Geist	" 8	1,000
Robinson creek	"	A. H. Wait	" 8	1,000
Abigal's run	Fawn River	" "	" 8	3,000
Stream on Sec's 5, 8 and 7	" "	Ferman L. Miller	" 8	3,000
Tributary to Mill creek	Constantine	L. H. George	" 8	6,000
Bear or Salsbury creek	Colon	Samuel H. Frederick	" 8	3,000

Brook Trout Plants, 1897.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Tuscola county:				
Stream on Sec's 20, 23, 29, 32, and 33	Elkland and Norton	W. C. Sanford	March 27	3,000
No name	Elkland	W. J. Frost	" 27	6,000
Wexford county:				
Pine river	Cherry Grove	Willis J. Cornwell	" 2	15,000
Van Buren county:				
Brush creek	Van Buren	George McFern	February 6	3,000
Sikes creek	Keeler	D. J. Morrison	" 6	3,000
Brush creek	Hamilton	Jacob Knolls	" 6	3,000
Branch of Brush creek	"	A. A. Olds	" 6	3,000
Tributary to West branch of Paw Paw river	Paw Paw	Wm. M. Thayer	" 6	6,000
East br. of Paw Paw river	Antwerp	J. M. Free	" 6	6,000
Bear creek	Bloomingdale	Baxter Bros.	" 6	3,000
Hall's Spring brook	Almena	Charles Veley	" 6	3,000
Campbell's creek	"	" "	" 6	3,000
Cox creek	Keeler	H. C. Crosby	March 5	3,000
Carter's creek	Pine Grove	A. P. Stuck	February 8	6,000
Bower creek	Porter and Marcellus	Emmens Sheldon	" 9	6,000
Ionia county:	Yearlings.			
State ponds	Prison grounds	Otis Fuller	July 17	500
Total				2,160,500

Brook Trout Plants, 1898.

County and name of waters.	Town.	Depositor.	Date.	Number.
Alcona county:				
Pine river	Hawes	C. W. Luce	March 22	5,000
Mud lake, branch of Pine river	Millen	H. W. Lyman	" 22	6,000
E branch of Buff Brown creek	Millen	" "	" 22	3,000
Cedar creek	Greenbush	R. W. Downer	" 22	1,000
Freer creek	Mitchell	Chas. Conklin	" 22	6,000
Silver creek	Mitchell	" "	" 22	8,000
Mill creek	Harrisville	L. A. Colwell	" 22	3,000
Bamfield creek	Curtis	George A. Loud	" 22	3,000
Pine river	Alcona	J. D. Hawks	" 21	5,000
Alger county:				
Laughing Whitefish river	Onota	S. M. Billings	May 12	6,000
Grand Marais pond	Burt	Chas. F. Hickok	" 31	6,000
Sucker river	"	" "	" 31	15,000
Grand Marais lake	Grand Marais	Mich. Fish Com		21,000
Allegan county:				
Silver creek	Gun Plains	Ed. J. Anderson	February 25	2,000
Red run	Dorr	John C. Newman	" 25	7,000
Green Lake stream	Laughton	W. H. Brooks	" 25	8,000
Laraway brook	Wayland and Martin	David D. Harris	" 25	4,000
Delano creek	Gun Plains	Ed. J. Anderson	" 25	2,000
Warren's creek	Otsego and Alamo	Fred Tubbs	" 25	3,000
Reid's creek	Monterey	L. F. Stuch, M. D.	" 25	4,000
Sebright creek	"	" " "	" 25	5,000
Alpena county:				
Smith creek	Green	D. D. Hanover	March 22	3,000
Antrim county:				
Canan river	Stratford	J. K. V. Agnew	April 12	15,000
Spencer creek	Helena	" "	April 13	10,000
Saloon creek	Custer	C. L. Bailey	March 25	3,000
Cedar river	Chestonia & Kearney	" "	" 25	3,000
Arenac county:				
The Dead branch	Arenac & Deep River	D. H. McDonell	March 22	8,000
Big creek	Arenac & Mason	" "	" 22	8,000
Town Line creek	Arenac, Clayton & Mason	" "	" 22	8,000
Barry county:				
Black Lake brook	Irving	Seymour G. Jordan	February 2	2,000
Cox creek	Hope	W. J. Lance	" 2	2,000
Hill creek	Carlton & Johnston	J. H. Neiss	" 2	3,000
Mitchell creek	Irving	" "	" 2	3,000
Butler creek	Hastings	" "	" 2	2,000
Martin Smith creek	Irving	" "	" 2	2,000
Glass creek	Hope, Rutland & Irving	Thos. E. Waters		6,000
Fall creek	Hastings, Baltimore & Hope	F. H. Barlow	" 2	4,000
Tamarack creek	Hastings & Baltimore	" "	" 2	2,000
Glasgow creek	Baltimore	J. A. Van Arman	" 2	2,000
Mangham creek	"	Will R. Cook	" 2	2,000
McOmber creek	"	McOmber Bros.	" 2	2,000
McCallum creek	Hope	T. R. Pancoast	" 2	2,000
Durfee brook	Baltimore	W. A. Hams	" 2	2,000
Squaw creek	Maple Grove	C. W. Taylor	" 2	3,000
Caro creek	Orangeville	J. E. Cairns	" 2	3,000
Three Spring brook	"	" "	" 2	3,000
Benzie county:				
Woodcock creek	Almira	M. L. Lake	March 18	4,000
Ransom creek	"	" "	" 18	3,000
Sherman creek	Almira & Inland	" "	" 18	4,000
Stony brook	Almira	Geo. E. Habeller	" 18	3,000
North branch	Platt	M. L. Lake	" 18	3,000
Berrien county:				
Hog or Putman creek	Sodus & Benton	E. E. Plimpton	February 25	2,000
Sand creek	Benton	" "	" 25	4,000
Eidson creek	Oronoko	James A. Brown	" 25	2,000
Wilson creek	"	" "	" 25	2,000
Love creek	Berrien	" "	" 25	2,000
Pipestone inlet	Bainbridge	Geo. B. Thayer	" 25	2,000
Crooked creek	Bainbridge & others	" "	" 25	7,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Branch county:				
Mootl's brook	Kinderhook	T. E. Bushnell	February 22	4,000
Silver creek	"	A. B. Walker	" 22	3,000
Tallahasse creek	Algansee	W. B. Forward	" 22	4,000
Hikes creek	California	C. D. Warner	" 22	2,000
Coldwater river	Union	Walter A. Hawley	" 22	6,000
Mill creek	Girard	Frank Noyes	" 22	2,000
Calhoun county:				
Wanandoger creek	Pennfield	Edward J. Smith	February 11	5,000
Perrin's creek	Marengo	Andrew McRoberts	" 11	1,000
Indian creek	Marshall	" "	" 11	1,000
Fountains creek	Newton	J. F. Garwood	" 11	3,000
Dixons creek	Pennfield	" "	" 11	1,000
Squaw creek	Marshall	" "	" 11	4,000
Hoyt's creek	Marengo	" "	" 11	3,000
Cass county:				
No name, on Secs. 20 and 21	Volinia	G. W. Gard	February 11	1,000
Walter's creek	Marcellus	Eber Vliet	" 8	3,000
Worden's creek	"	W. L. Arnold	" 8	2,000
Lewis creek	"	" "	" 8	3,000
Benette creek	"	" "	" 8	3,000
Stream on Secs. 18, 13 and 14	Penn & LaGrange	A. Garwood	" 8	3,000
Cobert's creek	Ontwa	N. N. Hasteman	" 8	4,000
Beardslee creek	Marcellus	C. M. Beardslee	" 8	2,000
Charlevoix county:				
Inwood creek	Charlevoix & Antrim	L. D. Bartholemew & Co.	March 10	4,000
McGeogh creek	Norwood	L. D. Bartholemew & Co.	" 10	4,000
Stover creek	Charlevoix & Marion	L. D. Bartholemew & Co.	" 10	4,000
North Boyne river	Boyne Valley	W. B. Stimson	April 3	5,000
Bear river	Melrose	" "	" 3	15,000
South arm Bear river	Melrose	W. H. Ellis	March 25	6,000
Spring brook	Melrose	C. J. Mizer	" 25	5,000
Cheboygan county:				
Little Black river	Hebron & Beauregard	W. E. Shoemaker	March 14	6,000
Myers creek	Benton	" "	" 14	3,000
Lapperd creek	Inverness & Beauregard	I. S. Cooper	" 14	6,000
Nigger creek	Burt	" "	" 14	3,000
Lower Little Pigeon river	Tuscarora & Ellis	M. A. McHenry	" 14	9,000
Bowen creek	Forest	Horace D. Graves	" 23	3,000
Welsh creek	"	" "	" 23	3,000
McPherson creek	"	" "	" 23	3,000
Gregg creek	"	" "	" 23	3,000
Stewart's creek	Waverly	J. M. Clark	" 23	1,000
Chippewa county:				
Pine river	Rudyard	N. L. Field	May 4	9,000
St. Mary's river	Sault Ste. Marie	Mich. Fish Com.	" 4	30,500
Clare county:				
Cedar creek	Grant	O. S. Derby	March 18	2,000
Whitney creek	"	" "	" 18	5,000
Eaton county:				
Shanty brook	Vermontville & Kalamo	E. D. Barber	February 11	4,000
Scipio creek	Vermontville	" "	" 11	2,000
Gale creek	Hamlin	George D. Wilcox	" 11	1,000
Emmet county:				
Roaring brook	Bear Creek	W. B. Stimson	April 3	5,000
Creek between Conway and Oden	Little Traverse	" "	" 3	5,000
Maple river	Maple River	" "	" 3	15,000
Minnehaha river	Littlefield	" "	" 3	5,000
Tannery creek	"	" "	" 3	5,000
Stream on Secs. 7, 8, 9, 10, 15 and 22	Eggleston	Van Every Bros	March 25	15,000
Page creek	Littlefield	W. B. Stimson	April 3	5,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Gogebic county:				
Duck creek	44	Bent Bros.	May 5	10,000
Stream on Secs. 13, 19 and 24	44	" "	" 5	3,000
W. branch of Middle branch of Ontonagon river	Watersmeet	A. D. Johnston	" 5	6,000
Upper Tamarack creek	"	" "	" 5	6,000
Clearwater creek	Watersmeet and McMillan	" "	" 5	6,000
Henderson creek	Watersmeet	" "	" 5	6,000
Camp Two creek	"	" "	" 5	6,000
Crooked creek	"	" "	" 5	6,000
Monson creek	"	" "	" 5	6,000
Johnston's creek	"	L. L. Wright	" 5	6,000
Mill creek	Bessemer	" "	" 5	6,000
Sleman's creek	Ironwood	" "	" 5	6,000
Seven Mile creek	"	" "	" 5	6,000
McDonald creek	Bessemer	" "	" 5	9,000
Spring creek	"	Conrad Carlson	" 5	6,000
Powder Mill creek	"	J. A. Vogtlin	" 5	6,000
Cox's Spring creek	"	" "	" 5	3,000
Grand Traverse county:				
Mitchell's creek	East Bay	Fred D. Curtis	March 10	3,000
Stream on Secs, 15, 16 and 22	" "	" "	" 10	3,000
Hillsdale county:				
Stream on Secs. 11, 13 and 23	Camden	Ira D. Eldridge	February 22	3,000
Spring brook	Woodbridge and Amboy	W. C. Young	" 22	3,000
Wells brook	Reading	M. G. Mallery	" 22	2,000
Stream on Secs. 23, 25 and 30 and 39	Reading & Cambria	E. D. Bacock	" 22	2,000
Perrin's creek	Pittsford	Amos Wilcox	" 22	6,000
Leonardson's creek	Jefferson	James B. Thorne	" 22	2,000
North branch	Adams & Jefferson	" "	" 22	4,000
Merritt's creek	Pittsford	" "	" 22	2,000
Houghton county:				
McGun's creek	Calumet	Morgan Williams	May 18	3,000
Goose Neck creek	Osceola	Hancock Chem. Co.	" 18	3,000
Spring creek	"	" "	" 18	3,000
Stream on Secs. 35 and 2	"	R. H. McDonald	" 18	3,000
Huron county:				
Pigeon river and branches	Grant and Sheridan	W. C. Sanford	February 18	6,000
Spring creek	Sand Beach	Bela W. Jenks	March 1	3,000
Elm creek	Sherman and Paris	" "	" 1	4,000
Allen's creek	Sand Beach	" "	" 1	4,000
Ionia county:				
Popple creek	Ronald	H. E. Howarth	March 4	3,000
Seely creek	Otisco and Grattan	C. M. Wise	" 4	6,000
Strubles creek	Lyons & North Plains	W. S. Terrill	February 17	3,000
Stone Quarry creek	Ionia	Albert K. Roof	" 17	1,000
Faxon creek	Lyons	" "	" 17	1,000
Bear creek	Campbell	L. E. Harkin	" 14	3,000
Iosco county:				
Hall's creek	Plainfield	C. W. Luce	March 22	6,000
Silver creek	Tawas	" "	" 22	6,000
Silver creek	Wilber	J. D. Hawks	" 21	5,000
Iron county:				
Chicagoan creek	Bates	August Kranz	May 5	3,000
Isabella county:				
Walker creek	Nottawa	R. F. Gibbs	March 4	12,000
Sucker creek	Gilmore	G. W. Wixom	February 28	3,000
Kirkpatrick creek	Vernon	O. S. Derby	" 28	6,000
Little Tobacco river	Grant and Vernon	" "	" 28	5,000
Dixon creek	Vernon	" "	" 28	4,000
Potter creek	Coe and Union	J. E. Meyer	March 18	9,000
Hog creek	Nottawa	Geo. A. Hicks	" 18	3,000
Darror or Little Salt creek	Union	" "	" 18	3,000
Big Cedar creek	Deerfield	" "	" 18	3,000
Cedar creek	"	" "	" 18	3,000
Johnson creek	Union	Geo. A. Chatterton	" 18	4,000
Jenner creek	Union and Lincoln	" "	" 18	4,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Jackson county:				
Marsh brook	Norvell	L. Whitney Watkins	February 22	2,000
Sandstone creek	Spring Arbor	Michael Bacon	" 22	5,000
Kalamazoo county:				
Sumner creek	Comstock	Guy C. Sumner	February 11	2,000
Frazier creek	Schoolcraft	Henry I. Allen	" 8	1,000
Chamberlain brook	Prairie Ronde	" "	" 8	6,000
Portage creek	Kalamazoo and Portage	John A. Milham	" 25	2,000
Olmstead creek	Kalamazoo	Wm. McKie	" 25	3,000
Stacey creek	Richland & Cooper	John Frank	" 25	3,000
Pierson creek	Alamo	Geo. W. Locke	" 25	3,000
Pine creek	"	Geo. E. Hunt	" 25	3,000
Russell creek	Cooper	Wm. O. Byrne	" 25	1,000
Abram's creek	Alamo	Ed. J. Anderson	" 25	2,000
Kalkaska county:				
Rapid river	Rapid River	J. K. V. Agnew	April 3	11,000
Middle Boardman river	Boardman	W. B. Stimson	March 25	10,000
South Boardman river	"	" "	" 25	6,000
Rapid river	Rapid River	" "	" 25	6,000
Rapid river	"	C. L. Bailey	" 25	6,000
Kent county:				
Mill creek	Plainfield	James F. Lamoreaux	March 9	4,000
Lamoreaux's creek	Walker	" "	" 9	1,000
Gork creek	Alpine	" "	" 9	3,000
Ball creek	Sparta and Tyrone	C. C. Darling	" 10	3,000
Clear creek	" "	" "	" 10	2,000
Barber's creek	Tyrone	Henry H. Wylie	" 10	1,000
Spring creek	Colon	C. S. Ford	February 21	4,000
Cedar creek	Nelson, Solon and Algoma	" "	" 21	4,000
Duke creek	Nelson and Solon	" "	" 21	4,000
Silcox creek	Bowne	W. H. Silcox	" 14	1,000
Foster creek	"	" "	" 14	2,000
Gardner creek	"	Lewis J. Boulard	" 14	3,000
Keweenaw county:				
Snake creek	Sherman	Morgan Williams	May 18	6,000
Gratiot river	Allouez	W. W. Ellis	" 18	9,000
Lake county:				
Little Danaher creek	Plains	J. K. V. Agnew	April 3	9,000
Little Manistee river	Center	" "	" 3	12,000
Corfu creek	Webber	" "	" 3	6,000
Cedar creek	"	" "	" 3	12,000
N. branch of Pere Marquette	Nervania	Mich. Fish Com	March 28	10,000
Little Manistee river	Ellsworth	W. B. Stimson	" 25	10,000
Lapeer county:				
Frews creek	Lapeer	Jay White	March 14	2,000
Pine creek	"	" "	" 14	2,000
Sandles creek	Deerfield	Will J. Till	" 14	2,000
Farmer's creek	Elba, Hadley and Metamora	Levi Copeman	" 14	5,000
Stream on secs. 6 and 31	Metamora & Lapeer	" "	" 14	1,000
Terry's creek	Almont	F. P. Andrus	" 1	4,000
Gutches' creek	Almont and Bruce	" "	" 1	3,000
N. branch of Clinton river	Almont	" "	" 1	4,000
Brower or Ellern creek	North Branch	Jeptha Bradshaw	February 18	4,000
Grand creek	" "	" "	" 18	4,000
Mill creek, branches of Elk creek, Spring brook, etc.	Goodland and others	Geo. R. Manwaring	" 18	4,000
Bottom creek	North Branch	Jeptha Bradshaw	" 18	7,000
Leelanau county:				
Stream on secs. 4, 9 and 10	Bingham	Fred D. Curtis	March 10	3,000
No name	Solon	" "	" 10	3,000
Livingston county:				
East Woodruff creek	Brighton	C. E. Cushing	March 14	6,000
Headwaters of Shiawassee river	Genoa	A. Sharp & Sons	" 14	6,000
No name	Brighton	Lyman Cate	February 15	7,000
Beach's creek	Hartland	H. S. Holdridge	" 15	4,000
Pleasant Valley creek	Brighton	" "	" 15	3,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Macomb county:				
St. John's brook	Shelby and Sterling	Geo. B. Davis	March 14	3,000
Leech brook	" "	" "	" 14	3,000
Smith's creek	Oakland & Washington	H. W. Bradley	February 17	3,000
Streeter's creek	Bruce	" "	" 17	2,000
Marquette county:				
Stream on secs. 8, 12 and 20	Towns 47 and 28	Edward C. Anthony	May 18	3,000
Sec. 32, stream	Marquette	J. C. Fowle	" 18	4,000
Compeau's creek	"	" "	" 18	2,000
Nelson's creek	Chocolay	" "	" 18	4,000
Silver creek	"	" "	" 18	4,000
Tributary to Harlow's creek	49 and 26	Horatio Seymour	" 18	2,000
Harlow's creek	49 and 26	" "	" 18	3,000
Headwaters of Compeau Ck	48 and 25	" "	" 18	4,000
Cherry creek	Chocolay	S. M. Billings	" 13	3,000
Tributary to Carp river	Negaunee	" "	" 13	8,000
Tributary to Chocolay creek	Chocolay	" "	" 13	2,000
Chocolay creek	"	" "	" 13	2,000
Ludwick creek	Tilden	George A. Newett	" 13	2,000
Newett's creek	Ishpeming	" "	" 13	2,000
Perch creek	Tilden	" "	" 13	2,000
Tribs. to Escanaba river	Forsythe	A. Maitland	" 13	16,000
Mason county:				
Old Freesoil creek	Freesoil	T. A. Browne	March 17	13,000
Weldon creek	18 and 15	James Connors	" 17	4,000
Karston creek	Pere Marquette	F. W. Graham, M. D.	" 17	2,000
Quinn's creek	Summit	George McKee	" 7	3,000
Nickerson creek	"	D. C. Wickham and C. R. Johnson	" 7	3,000
Mecosta county:				
Spring creek	Colfax	W. A. Whitney	March 16	3,000
Ryne creek	Big Rapids	Geo. W. Milner	" 16	4,000
Ryan creek	Big Rapids & others	W. A. Whitney	" 16	5,000
Sealey creek	Grant	" "	" 16	3,000
Mitchell creek	Big Rapids	H. G. Lazelle	" 16	3,000
Bill Raub or Fuelin's creek	Mecosta	J. H. Megerole	" 16	6,000
Dalzell creek	Green	E. H. Merrett	" 16	6,000
Mitchell creek	Big Rapids	" "	" 16	3,000
Dalzell creek	Green and Barton	" "	" 16	5,000
Bruce creek	Deerfield	John H. Clink	" 16	7,000
Tributary to Bruce creek	"	" "	" 16	3,000
Tributary to Handy creek	"	" "	" 16	3,000
Cheney creek	Green	Mich. Fish Com	April 8	10,000
Cheney creek	"	" "	" 2	10,000
Little Muskegon river	Deerfield	W. B. Stimson	February 21	8,000
Borland creek	Ætna	" "	" 21	6,000
E. Branch of Big creek	Deerfield	Geo. F. Haist, Borland	" 21	4,000
Homer creek / Shingle Bolt creek	Hinton	Geo. W. Bigelow	March 4	8,000
Stream on secs. 16 and 17	Martiny	Wm. F. Jehnzen	" 4	2,000
Pointer creek	Morton	V. E. Lemley	" 4	5,000
Bengin creek	"	Amos S. Johnson	" 4	3,000
Headwaters of Pine river	Wheatland	C. Murphy	" 4	5,000
Crooked creek	"	" "	" 4	3,000
Headwaters of Pine river	Millbrook & Rolland	N. C. Mason	" 4	5,000
Midland county:				
Spring creek	Geneva	Charles C. Spencer	February 28	4,000
Warner creek	"	" "	" 28	4,000
Missaukee county:				
No name	Riverside	J. O. Packard	March 18	4,000
No name	Clam and Union	Gerrit Herwizer	" 18	3,000
Musquito creek	Reeder	S. A. Hovey	" 25	6,000
Clam river	Lake, Reeder and others	" "	" 25	10,000
West branch	West Branch and Forest	" "	" 25	9,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Montcalm county:				
Off & Near creek	Home	Er. Shelley	March 4	2,000
Peterson creek	Home and Belvidere	" "	" 4	2,000
Sackett's creek	Home	" "	" 4	4,000
Fern creek	Richland	E. S. Wager	" 4	9,000
Cedar Lake creek	Home	" "	" 4	3,000
Castle creek	Bushnell	H. E. Howarth	" 4	3,000
Cooper's creek	Bloomer	" "	" 4	5,000
Bacon creek	Bushnell	" "	" 4	4,000
West branch	Pine	F. D. Briggs	" 4	7,000
West Lake creek	"	" "	" 4	3,000
Briggs creek	"	" "	" 4	3,000
No name	"	" "	" 4	4,000
Springstream, Briggs creek	Montcalm	T. I. Phelps	" 4	4,000
Turk Lake creek	"	" "	" 4	3,000
Wabasis creek	Eureka	H. P. McElroy	" 4	8,000
Muskegon county:				
Duck creek	Datton and Fruitland	E. D. Magoon	March 7	6,000
Green's creek	Fruitland and Muskegon	" "	" 7	4,000
Little Black creek	Muskegon & Norton	" "	" 7	3,000
Little Bear creek		" "	" 7	4,000
Cleveland creek	Blue Lake	" "	" 7	8,000
Musquito creek		" "	" 7	7,000
Silver creek	Blue Lake	" "	" 7	4,000
Little Deer Lick creek	Fruitport	Edwin C. Torrent	" 7	3,000
Big Deer Lick creek		" "	" 7	3,000
Norris creek and tributaries	Sullivan & Fruitport	Miles D. Bunker	" 7	4,000
Crockery creek and 2 trbs	Casenovia	A. Ruby	" 8	6,000
Bennett creek	White River	Wyman A. Jackson	" 7	3,000
Newaygo county:				
Dowd creek	Dayton & Greenwood	Wm. Leonard	March 8	5,000
Cushman creek	" "	J. A. Gerber	" 8	6,000
S. branch Marquette river	Monroe	Mich. Fish Com.	April 5	25,000
Peas creek	"	" " "	" 5	10,000
Hocome creek	Sherman & Lincoln	M. D. Hayward	March 17	3,000
Petterson creek	Wilcox & Sherman	" "	" 17	6,000
Mullen creek	" "	" "	" 17	4,000
Garmon creek	Wilcox	" "	" 17	3,000
Morgan creek	"	" "	" 17	3,000
Five Mile creek	"	" "	" 17	4,000
Flinton creek	"	" "	" 17	4,000
Upper Cole creek	Lincoln & Sherman	" "	" 17	3,000
Pooi or head of White river	Wilcox & Moore	" "	" 17	4,000
Boyne creek	Wilcox & Evart	" "	" 10	4,000
Miller creek	" "	" "	" 17	4,000
Minnie creek	Lincoln and Denver	" "	" 10	7,000
Bigelow creek	Brooks and Evart	J. K. V. Agnew	" 10	3,000
Gannon creek	Wilcox and Grant	" "	" 10	3,000
Peterson creek	Lincoln	" "	" 10	6,000
Rattle Snake creek	Wilcox	" "	" 10	3,000
Barnhard creek	Lincoln	" "	" 10	3,000
Brooks creek	Brooks	Frederick Jacobi	" 10	4,000
Coolbaugh creek	Brooks and Croton	" "	" 10	6,000
Penoyer creek	Brooks and Garfield	Dr. Tyson Smith	" 10	6,000
Bigelow creek	Evert and Brooks	" "	" 10	6,000
Little Muskegon river	Croton	Seymour B. Gunweller	" 10	6,000
Oakland county:				
Clinton river	Waterford	Lewis L. Richmond	February 17	2,000
Clinton river	Independence	A. DeMund	" 17	3,000
Spring Mills creek	Highland	H. S. Holdridge	" 15	3,000
Andrew creek	"	" "	" 15	3,000
Branch of River Rouge	Bloomfield	S. Alexander	" 17	4,000
Field's creek	White Lake and Commerce	Stephens Bros	" 15	2,000
Farmington creek	Farmington	Fred M. Warner	" 15	4,000
Livonia stream	Farmington and Livonia	" "	" 15	4,000
Buckhorn creek	Highland and Rose	Geo. N. Hedden	" 15	7,000

Brook Trout Plants, 1898.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Oceana county:				
Carlton creek	Grant	Geo. W. Renwick	March 7	10,000
Howell's creek	Otto	E. D. Magoon	" 7	3,000
AuSable creek	Golden	W. J. Compton	" 7	3,000
Stony creek and branches	Shelby	O. B. Estey	" 7	7,000
Flower creek	Grant and others	H. H. Terwilleger	" 7	7,000
River House creek	Weare & Pentwater	D. C. Wickham	" 7	3,000
Denman creek		" "	" 7	4,000
Cedar creek	Crystal and Weare	" "	" 7	1,000
Comstock creek	" "	" "	" 7	3,000
Amily creek	Weare	" "	" 7	3,000
Mears creek	"	" "	" 7	2,000
Gustavus creek	Newfield	John Gustavus	" 7	5,000
Lawrence creek	"	Geo. Sturtevant	" 8	3,000
Clark's creek	14 N., 14 W.	Frank Utley	" 8	5,000
No name, on Sec. 9	14 N., 15 W.	Leyland Poe	" 8	1,000
Outlet to Darlington Lake	Newfield	Robert Darlington	" 8	4,000
Ogemaw county:				
Mansfield creek	West Branch and Edwards	S. V. Thomas	March 14	8,000
Crapo creek	West Branch	" "	" 14	3,000
Eddy creek	West Branch & Mills	" "	" 14	8,000
Wood's creek	West Branch	" "	" 14	4,000
Forest Home stream	" "	G. N. Hauptman	" 14	7,000
No name, on Secs. 4 and 9	Edwards	" "	" 14	5,000
Branch of Weideman creek	Ogemaw	" "	" 14	4,000
Hale creek	Rose	J. D. Hawks	" 21	5,000
Ontonagon county:				
First creek	Ontonagon	H. M. Powers	May 18	3,000
Pine creek	"	" "	" 18	6,000
Paddy's creek	"	" "	" 18	10,000
Osceola county:				
Hunt creek	Greenwood	Henry A. Bauman	March 14	9,000
Gilchrist creek	Cummins	" "	" 14	9,000
Calson creek	Richmond	Frank Calson	April 8	6,000
Pine river	Burdell	W. B. Stimson	March 25	9,000
Beaver creek	Leroy	Theo. Rogers	" 25	3,000
Middle br. of Muskegon river	Marion	J. B. Wagner	" 18	9,000
Otsego county:				
Middle br. of Sturgeon river	Corwith	L. A. Harris	March 14	6,000
Brown creek	Dover	Dota Whitmarsh	" 14	3,000
Boyne river	Elmira	W. B. Stimson	April 3	10,000
Franklin creek	Allegan	A. D. Baker	February 25	4,000
Ottawa county:				
Pine creek	Holland	Arthur M. Baumgartel	February 7	4,000
Vanderveau's creek	Georgetown	Charles C. Haire	" 25	3,000
Breman's creek	"	" "	" 25	3,000
Presque Isle county:				
Gray's creek	Allis and Forest	J. M. Clark	March 2	2,000
Bower's creek	" "	" "	" 2	3,000
Glasier creek	Allis	" "	" 2	3,000
Little Rainey river	"	" "	" 2	3,000
Rainey river	"	" "	" 2	10,000
Glasier creek	"	" "	" 23	3,000
Stony creek	Waverly and Allis	" "	" 14	5,000
Little Rainey river	Allis	" "	" 23	3,000
Stuart creek	Waverly and Allis	" "	" 14	2,000
E. branch of Rainey river	Allis and Case	" "	" 14	6,000
Mail Trail creek	33 N. 8 E.	C. B. Warner	" 22	8,000
Sanilac county:				
Hollister creek	Worth & Burchville	A. M. Cook	March 1	5,000
Stream on Sec. 12	Worth	Grant H. Smith	" 1	3,000
Schoolcraft county:				
Head of Little Murphy creek	Inwood	Robert McKesson	May 4	3,000

Brook Trout Plants, 1898.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
St. Joseph county:				
Dry Lake Stream	Sherman	A. H. Walt	February 25	2,000
Robinson creek	"	" "	" 25	1,000
Abigal's Run	Fawn river	" "	" 25	2,000
Butternut creek	Flowerfield	Henry Ayers	" 25	1,000
Brand brook	"	" "	" 25	4,000
School creek	"	Bert L. Pixley	" 25	4,000
Crooked creek	"	" "	" 25	4,000
Wolf creek	Constantine	Arthur N. Culp	" 25	3,000
Parrin creek	Sherman	J. A. Geist	" 25	4,000
Spring Run	"	Frank Kenyon	" 22	1,000
Tributary to Mill creek	Constantine	L. H. George	" 22	2,000
Grass creek	Lakeport	H. H. Whipple	" 8	4,000
Bear or Salesbury creek	Colon	Samuel H. Frederick	" 8	4,000
				3,000
Tuscola county:				
Butternut creek	Watertown	A. T. Gill	March 1	8,000
Stream on Secs. 20, 29, 28, 33 and 32	Elkland and Novesta	W. C. Sanford	February 18	3,000
Stream on Secs. 31, 32, 33, 28 and 20	Elkland	W. J. Frost	" 18	4,000
Van Buren county:				
Brush creek	Hamilton	Jacob Krolls	February 11	3,000
Nesbitt creek	"	" "	" 11	3,000
Boner creek	Porter & Marcellus	Emmons Sheldon	" 8	4,000
Cox creek	Keeler	H. H. Crosby	" 7	3,000
Sikes creek	"	D. J. Morrison	" 7	3,000
Washtenaw county:				
Iron creek	Manchester	L. Whitney Watkins	February 22	4,000
Willow run	Ypsilanti	C. P. Ferrier	" 22	3,000
Wexford county:				
Cedar creek	Cedar Creek	W. B. Stimson	April 3	10,000
Pine river	Cherry Grove	Willis J. Cornwell	March 27	15,000
Upper Little Pine creek	"	H. F. Hodges	" 27	15,000
Bear creek	Schlagle & 22 others	A. L. Griffin	" 18	12,000
Seaton	22 N. 12 W. & 22 N 13 W.	" "	" 18	7,000
Perkins creek	Boon, Schlagle and others	" "	" 18	3,000
Blind creek	Colfax & Greenwood	E. B. Stanley	" 18	3,000
Anderson creek	Hanover	" "	" 18	6,000
Louk's creek	Antioch	" "	" 18	3,000
Cole creek	Antioch & Hanover	" "	" 18	8,000
Burt creek	"	" "	" 18	3,000
Filer creek	Colfax & Greenwood	" "	" 18	7,000
Adams creek	Antioch & Hanover	" "	" 18	7,000
Sturr creek	Colfax & Greenwood	" "	" 18	7,000
Farnsworth creek	Wexford & Springville	" "	" 18	7,000
Total				2,024,500

Rainbow Trout Plants, 1897.

County and name of waters.	Township.	Depositor.	Date.	Number.
Arenac county:				
Boge creek	Mason	J. H. Willis	June 14	3,000
Monroe creek	"	" "	" 14	2,000
Rifle river	Arenac	D. H. McDonald	" 14	5,000
Cheboygan county:				
Smith creek	Wilmot	Wm. E. Shoemaker	June 22	3,000
Carp creek	Nunda and Ellis	" "	" 22	3,000
Lake county:				
Middle branch of Pere Marquette river	Nirvana	Mich. Fish Com	June 16	5,000
Manistee county:				
Bear creek	Brown and Maple Grove	Robert Porteous	June 16	5,000
Mecosta county:				
Muskegon river	Green	Mich. Fish Com	June 22	5,000
Oceana county:				
Toner's creek	Shelby and Terry	Josephus Blake	June 10	3,000
S. branch of Pentwater river	Hart	J. K. Flood	" 10	8,000
Russell creek	"	" "	" 10	4,000
Otsego county:				
Chatman creek	Livingston	Frank Calkins	June 22	3,000
No name on Sec. 34	"	" "	" 22	2,000
Chippewa county:				
Sault rapids	Sault Ste. Marie	Mich. Fish Com	June 25	5,000
Total				56,000

Rainbow Trout Plants, 1898.

County and name of waters.	Township.	Depositor.	Date.	Number.
Berrien county:				
Blue creek	Benton & Bainbridge	E. E. Plimpton	May 27	3,000
Calhoun county:				
Rice creek	Marshall	J. F. Garwood	June 15	3,000
Clare county:				
Three Lakes creek	Garfield	O. S. Derby	May 30	2,000
Norway creek	Reading	" "	" 30	2,000
Gisswassee creek	"	" "	" 30	2,000
Hable creek	Grant	" "	" 30	1,000
Silver creek	"	" "	" 30	1,000
Mats creek	"	" "	" 30	1,000
Chippewa county:				
Sault river	Sault Ste. Marie	Mich. Fish Com.	June 3	5,000
Grand Traverse county:				
Boardman river	Traverse, Maxfield and Union	Dennis Cochlin	May 24	6,000
Ionia county:				
Stream on Sec. 22	Otisco	G. O. Bignell	June 7	3,000
Isabella county:				
Russell creek	Gilman and Vernon	O. S. Derby	May 30	2,000
Little Tobacco river	Clare and Isabella	" "	" 30	3,000
Lake county:				
Middle branch of Pere Marquette	Pleasant Plains	Mich. Fish Com.	May 9	10,000
Mecosta county:				
Muskegon river	Green	Mich. Fish Com.	May 11	2,000
Bruce creek	Deerfield	John H. Clark	" 27	6,000
S. branch of Pine river	Millbrook	Lorenzo D. Decker	June 7	3,000
Montcalm county:				
Stony run	Pine	W. A. Bunting	June 7	3,000
Ogemaw county:				
Pryor creek	Cumming	J. D. Hawks	May 31	6,000
Wilkin's creek	"	" "	" 31	6,000
Brooks creek	Rose	" "	" 31	6,000
Osceola county:				
Grindstone creek	Middle Branch and Sylvan	B. Wolf	May 30	3,000
Washtenaw county:				
Branches of Paint creek	Ypsilanti	C. P. Ferrier	June 15	3,000
Wexford county:				
Headwaters of Pine river	Cherry Grove	Willis J. Cornwell	May 24	6,000
Total				88,000

Landlocked Salmon Plants, 1897.

County and name of waters.	Location.	Depositor.	Date.	Number.
St. Mary's river	Sugar Island	Mich. Fish Com.	June 8	4,000

Landlocked Salmon Plants, 1898.

St. Mary's river	Sugar Island	Mich. Fish Com.	May 25	8,700

Lake Trout Plants, 1897.

County and name of waters.	Township.	Depositor.	Date.	Number.
Antrim county:				
Lake of the Woods	Custer	T. A. Price	March 2	15,000
Elk lake	Elk Rapids	Mich. Fish Com.	April 17 & 28	140,000
Barry county:				
Sugar Loaf lake	Irwin	Walter Burling	April 23	10,000
Upper Little Cedar lake	Hope	S. S. Stanton	February 11	15,000
Big Cedar lake	"	W. J. Lance	" 11	10,000
Bowker lake	"	G. A. Valentine	" 11	10,000
Horse Shoe lake	"	Fred H. Janch	" 11	10,000
Middle lake	Carlton	W. D. Bunsett	" 11	15,000
Benzie county:				
Crystal lake	Crystal Lake	Mich. Fish Com.	April 19	80,000
Lake Ann	Almira	M. L. Lake	March 18	20,000
Berrien county:				
Paw Paw lake	Watervliet	W. M. Baldwin	March 25	30,000
Cass county:				
Garver's lake	Ontwa	N. N. Hasterman	February 9	10,000
Calhoun county:				
Clear lake	Penfield	Edward J. Smith	February 11	10,000
Deep lake	"	" "	" 11	10,000
Kesler lake	Albion	G. H. Haynes	" 11	15,000
Goguac lake	Battle Creek	F. M. Dunning	March 26	15,000
Charlevoix county:				
Bear lake	Evangeline	W. B. Stimson	April 8	50,000
Cheboygan county:				
Burt lake	Burt	John Johnson	March 2	25,000
Chippewa county:				
Trout lake	Trout Lake	Oliver W. Smith	May 26	15,000
Clare county:				
Budd lake	Hays	George M. Brown	April 19	20,000
Crooked lake	Surrey	" "	" 19	20,000
Clinton county:				
Muskrat lake	Clinton	Richard Moore	February 22	10,000
Genesee county:				
Long lake	Fenton	J. W. McCollum	February 22	10,000
Byron lake	"	Anson Shotwell	" 22	15,000
Long lake	"	Ransom C. Johnson	" 22	15,000
Long lake	"	J. W. McCollum	March 27	15,000
Gogebic county:				
Whitefish lake	44	Burt Bros.	May 27	20,000
Clark lake	44	" "	" 27	20,000
Thousand Isle lake	44	" "	" 27	20,000
Deer Island lake	44	" "	" 27	20,000
White Sand lake	44	" "	" 27	20,000
Clark lake	Watersmeet	L. L. Wright	" 27	15,000
Thousand Island lake	"	" "	" 27	20,000
Duck lake	"	A. D. Johnston	" 27	15,000
Grand Traverse county:				
Boardman lake	Traverse	Fred D. Curtis	March 1	15,000
No name	East Bay	" "	" 1	15,000
Spider lake	" "	" "	" 1	15,000
Ionia county:				
Jordan and Tupper lakes	Odessa	H. F. Miner	February 22	15,000
Pine Island	Gratten	W. P. Hetherington	March 30	10,000
Lake Odessa	Odessa	J. K. V. Agnew	April 17	25,000
Iron county:				
Lake Chicagoan	Stambaugh	J. W. Byers	March 27	20,000
Isabella county:				
Stevenson lake	Verhon	O. S. Derby	February 25	15,000
S. bay of Coldwater lake	Nottawa	Wm. Delo	March 15	15,000

Lake Trout Plants, 1897.—CONTINUED.

County and name of waters.	Township.	Depositor.	Date.	Number.
Jackson county:				
Clark's lake	Columbia	John Delemater	March 26	20,000
Kalamazoo county:				
Paw Paw lake	Texas	Levi Davis	March 26	15,000
Campbell's or Long lake	Comstock	B. A. Wood	" 26	10,000
Kent county:				
Camp lake	Algoma	C. C. Darling	April 23	10,000
Big Wabasis lake	Oakfield	Benton F. Hall	March 30	20,000
Lake county:				
Star Lake	Lake	Geo. M. Brown	April 26	15,000
Lapeer county:				
Chain of lakes	Oregon	Will J. Till	February 26	15,000
McKeon lake	"	" "	" 26	15,000
Otter Lake	Marathon	" "	" 26	10,000
Hall lake	Lapeer	Chauncey Tibbetts	" 26	10,000
Long lake	Elba	" "	" 26	10,000
Otter lake	Marathon	J. C. Mason	" 26	15,000
Leelanau county:				
Glen lake	Glen Arbor & others	D. H. Day	March 19	25,000
Lenawee county:				
Devil's lake	Woodstock	J. B. Flanders	March 27	50,000
Livingston county:				
Oar lake	Hamburgh	C. E. Cushing	February 22	15,000
Big Portage lake	"	M. E. Fahy	March 26	15,000
Little Portage lake				
Ovis lake	Green Oak	Ira M. Fisher	" 26	10,000
Silver lake	" "	" "	" 26	5,000
Mason county:				
Hamlin lake	Hamlin	W. B. Cole	March 18	15,000
Mackinac county:				
Straits of Mackinac	Mackinaw City	Mich. Fish Com	April 16	100,000
Mecosta county:				
Big Evans lake	Martiny	J. K. V. Agnew	April 23	25,000
Muskegon county:				
Blue lake	Blue Lake	E. D. Magoon	April 10	25,000
Newaygo county:				
Bill's lake	Croton	J. K. V. Agnew	April 13	25,000
Pickerel lake	Garfield	" "	" 13	25,000
Brooks lake	Brooks	" "	" 15	25,000
Little Brooks lake	"	" "	" 15	25,000
Big Twin lake	Everett	M. D. Hayward	March 1	15,000
Big Roberson lake	Sherman	E. Branch	" 1	15,000
Oakland county:				
Deer lake	Independence	Abram DeMund	February 22	15,000
Pine lake	Bloomfield	Morgan W. Rundell	" 22	25,000
Pine lake	West Bloomfield	Wm. L. Wild	" 22	15,000
Stony lake	Oxford	Chas. Funsted	" 26	15,000
Spring lake	Commerce	Matthew Manza	March 26	10,000
Oceana county:				
Pentwater lake	Pentwater	Phillip R. Dorrance	March 25	25,000
Otsego county:				
Clifford lake	Livingston	Wallis Cogswell	March 3	10,000
Clear lake	Charlton	Edwin Carpenter	" 30	10,000
St. Joseph county:				
Corey lake	Fabius	J. H. Hahn	February 11	25,000
Klinger lake	White Pigeon	Mich. Fish com	April 28	50,000
Van Buren county:				
Van Auken lake	Bangor	Jeremiah Walker	February 6	15,000
Bankinson lake	Porter	Levi Davis	March 26	10,000

Lake Trout Plants, 1897.—CONCLUDED.

County and name of waters.	Township.	Depositor.	Date.	Number.
Washtenaw county:				
Frane's lake	Superior	Henry F. Horner	April 10	25,000
Wexford county:				
Big Clam lake	Cherry Grove	H. F. Hodges	April 14	20,000
Little Clam lake	Clam Lake			
Lake Michigan	Charlevoix	Mich. Fish Com	January 18	200,000
" "	"	" "	" 20	200,000
" "	"	" "	February 15	200,000
" "	"	" "	" 17	200,000
" "	"	" "	March 22	200,000
" "	Frankfort	" "	" 8	200,000
" "	"	" "	" 15	200,000
" "	"	" "	" 30	200,000
Torch lake	Torch Lake	" "	May 31	200,000
Lake Michigan	Manistique	" "	June 1	200,000
Lake Superior	Whitefish Pt.	" "	" 3	180,000
" "	Detour	" "	" 3	100,000
Lake Gogebic		" "		
Total				4,035,000

Wall-eyed Pike Plants, 1897.

County and name of waters.	Township.	Depositor.	Date.	Number.
Allegan county:				
Dorris lake	Wayland	Thomas Griswold	May 19	200,000
Lake Sixteen	Martin	W. F. Kimball	" 19	200,000
Antrim county:				
Intermediate lake	Central Lake	O. P. Barber	" 13	800,000
Barry county:				
Pleasant lake	Barry	Addison Pennock	" 19	400,000
Cedar lake	Hastings	F. H. Barlow	" 19	200,000
Benzie county:				
Crystal lake	Benzonia	W. H. Bennett	" 21	800,000
Berrien county:				
Paw Paw lake	Watervliet	Parsons & Baldwin	" 14	280,000
" " "	"	Geo. F. Collett	" 14	280,000
" " "	"	C. J. Leach	" 14	160,000
Cass county:				
Indian lake	Silver Creek	E. Barton Jewell	" 14	400,000
Cheboygan county:				
Douglass lake	Munro	B. H. Cook	" 13	400,000
Silver lake	Wilmot	Geo. E. Downer	" 13	400,000
Clare county:				
Lake George	Surrey	W. H. Bennett	" 21	440,000
Arnold lake	Grant	O. S. Derby	" 21	240,000
Smith lake	"	" "	" 21	240,000
Clinton county:				
Park lake	Bath	W. J. Beal	" 17	200,000
Maple river mill pond	Duplain	B. M. Wooley	" 21	240,000
Emmet county:				
Carp lake	Carp Lake	B. H. Cook	" 13	400,000
Crooked lake	Littlefield	" "	" 13	400,000
Round lake	Little Traverse	" "	" 13	200,000
Bear lake	Bear Lake	" "	" 13	400,000
Grand Traverse county:				
Rainey lake	26 N., 10 W.	Gilbert Hodges	" 21	200,000
Crooked lake	" "	" "	" 21	200,000
Spider lake	" "	" "	" 21	200,000
Gratiot county:				
Pine river	Bethany	J. P. Gladding	" 17	200,000
Hillsdale county:				
Sand lake	Hillsdale	Wm. C. Kemp	" 22	200,000
Baw Beese lake	Cambria & Hillsdale	" " "	" 22	400,000
Ionia county:				
Emmons lake	Grattan	W. P. Huntington	" 17	400,000
Jackson county:				
Vineyard lake	Columbia	George S. Cook	" 22	400,000
Gillet's lake	Leoni	V. L. Sullivan	" 19	200,000
" "	"	Wesley N. Baraga	" 19	200,000
Crisnall lake	Liberty	C. J. VanSchoick	" 22	200,000
Kalamazoo county:				
Round lake	Texas	Levi Davis	" 14	200,000
Campbell's lake	Comstock	J. J. Campbell	" 19	800,000
Barton lake	Schoolcraft	Henry J. Allen	" 19	400,000
Kalkaska county:				
Twin lakes	Cold Springs	L. E. Slusser	" 13	200,000
Cory lake	Rapid River	Wm. Thompson	" 13	200,000
Wetzell lake	Cold Springs	L. E. Slusser	" 13	200,000
Kent county:				
Reed's lake	Grand Rapids	G. S. Johnson	" 19	400,000
Fiske's lake	" "	" "	" 19	200,000

Wall-eyed Pike Plants, 1897.—CONCLUDED.

County and name of waters.	Township.	Depositor.	Date.	Number.
Lapeer county:				
Nipissing lake	Elba	J. H. Bidwell	May 18	440,000
Davis lake	Oregon	A. A. Barber	" 18	440,000
Otter lake	Marathon	Will J. Till	" 18	880,000
Elk lake	Attica	L. H. Peck	" 18	480,000
Leelanau county:				
Cedar lake	Elmwood	W. E. Grielick	" 21	400,000
Livingston county:				
Island lake	Green Oak	F. G. Russell	" 17	400,000
Dollar lake	Brighton	J. J. Van Lewen	" 17	200,000
Fonda lake	"	C. E. Cushing	" 17	200,000
Lake Maltby	Green Oak	" "	" 17	200,000
Zuke lake	Hamburg	W. H. Bennett	" 21	400,000
Mecosta county:				
Horsehead lake	Martiny	E. H. Merritt	" 17	200,000
Jebnsen lake	"	" "	" 17	200,000
Chippewa lake	Chippewa	" "	" 17	200,000
Missaukee county:				
Dyer's lake	Clam Union	J. O. Packard	" 21	200,000
Montcalm county:				
Bass lake	Richland	Chas. Wilkins	" 13	200,000
Ware's lake	Pierson and Nelson	J. W. Brayman	" 13	400,000
Round lake				
Crooked lake				
Fish lake	Montcalm	Albert S. Allen	" 17	200,000
Demers lake	Richland	Edward Wilson	" 17	200,000
Spring lake	Evergreen	H. L. Bailey	" 17	200,000
Baldwin lake	Eureka	T. I. Phelps	" 17	400,000
Muscallonge lake	Maple Valley	Sid V. Bullock	" 17	360,000
Oakland county:				
Stoney lake	Oxford	And. Sutherland	" 18	360,000
St. Joseph county:				
Portage lake	Mendon	C. L. Hasbrouck	" 19	400,000
Palmer lake	"	J. K. Farrand	" 19	600,000
Long lake	Colon	" "	" 19	600,000
Fisher's lake	Park			
Klinger's lake	White Pigeon	R. L. Duncan	" 19	400,000
Van Buren county:				
Eagle lake	Paw Paw	T. W. Thomas	" 14	400,000
Fisk lake	Arlington	B. D. Hicks	" 14	200,000
Bankson lake	Porter	Levi Fellows	" 14	200,000
School Section lake	Bangor	Eugene Kemp	" 14	80,000
Washtenaw county:				
Whitmore lake	Northfield	W. H. Bennett	" 21	400,000
Stone Ledge lake	Clam Lake	Alex G. Barnam	" 13	200,000
Wayne county:				
Detroit river	Belle Isle	Michigan Fish Com.	" 11	2,100,000
" "	Willis fishery	" " "	" 14	3,500,000
" "	Belle Isle	" " "	" 21	7,000,000
" "	" "	" " "	" 21	7,000,000
" "	" "	" " "	" 22	7,000,000
" "	Willis fishery	" " "	" 22	7,000,000
" "	" "	" " "	" 22	7,000,000
Lake St. Clair	Grosse Point	" " "		7,000,000
Lake Erie	Monroe	" " "		3,000,000
Total				73,920,000

Small Mouth Bass Plants, 1897.

County and name of waters.	Township.	Depositor.	Date.	Number.
Kent county:				
Reed's lake	Grand Rapids	G. S. Johnson	January 6	3,000

Small Mouth Bass Plants, 1898.—Fingerlings.

County and name of waters.	Township.	Depositor.	Date.	Number.
Berrien county:				
Clear lake	Buchanan	J. C. Rough	August 9	100
Calhoun county:				
Goguac lake	Battle Creek	Eugene Glass	August 6	100
Cass county:				
Diamond lake	LaGrange and others	A. D. Baker	August 9	150
Genesee county:				
Flint river	Burton	W. R. Bates	July 29	100
Jackson county:				
Clark's lake	Columbia	J. A. Seward	August 6	100
Portage lake	Henrietta and Waterloo	W. L. Park	July 12	150
Kalamazoo county:				
White lake	Kalamazoo	C. E. Foote	July 12	100
West lake	Portage	" "	" 12	100
Sherman lake	Rose	Corydon Beach	August 6	100
West Three lakes	Richmond	" "	" 6	100
Asylum lake	Kalamazoo	Herman Ostrander, M. D.	July 12	150
Kent county:				
Pine Island lake	Plainfield	John Shumway	August 17	300
Reed's lake		G. S. Johnson	" 17	100
Livingston county:				
Pleasant Lake	Hamburg	Jacob Reighard	August 2	100
Mecosta county:				
Little Pickerel lake	Colfax	J. Frank Clark	August 13	50
Young's lake	Grant	James S. Canaan	" 13	50
Chippewa lake	Chippewa	E. H. Merritt	" 13	50
Town Line lake	Colfax	W. A. Whitney	" 13	50
Montcalm county:				
Whitefish lake	Pierson	S. C. Scott	August 13	100
Crooked lake	"	James H. Brayman	" 13	100
Oakland county:				
Lotus lake	Waterford	A. W. Blain	July 15	100
Strait's lake	West Bloomfield	Fred M. Warner	August 2	100
Orchard lake	" "	" "	" 2	100
Island lake	Bloomfield	G. S. Shattuck	July 15	100
Oceana county:				
Round lake, Crystal lake	Hart and Golden	J. K. Flood	August 4	100
Pentwater lake	Pentwater	R. M. Montgomery	" 4	100
St. Joseph county:				
Crotch lake	Sherman	A. H. Wait	August 12	150
Johnson or Williams lake	Fawn river	" "	" 12	150
Van Buren county:				
Sister lakes	Keeler & Silver lake	Marvin Defendorf	August 9	100
Washtenaw county:				
Cavinaugh lake	Sylvan	Frank P. Glazier	July 15	100
Total				3,250

INVENTORY.

PARIS STATION.

158 acres of land including two small dwellings for employes, and the meander of Cheney creek		$4,740 00
Overseer's house	$1,500 00	
Barns and sheds	375 00	
Car house	200 00	
Old hatchery	800 00	
New hatchery and permanent equipment	4,000 00	
Ponds, races and improvements to ponds	4,500 00	
Windmill, tank and connections	500 00	
Apparatus, tools, camp outfits and office furniture and books	2,212 25	$14,087 25
		$18,827 25

Car for transporting fish	$3,550 00	
Outfit	135 80	
		$3,685 80

DETROIT STATION.

Building, whitefish hatchery, and all tanks and permanent improvements	$8,000 00	
954 Chase hatching jars, complete	1,908 00	
One stationary boiler and pump complete	800 00	
Apparatus, tools, furniture, fishing outfits, etc	1,698 53	
		$12,406 53

SAULT STE. MARIE STATION.

One hatchery and equipment complete including ponds and water connections	$6,000 00	
One trolley line and car complete	365 00	
One tram car	40 00	
200 Chase hatching jars	400 00	
Apparatus, tools and furniture	921 80	
		$7,726 80

DETROIT RIVER FISHERIES.

Two buildings at fisheries	$350 00	$700 00
Lumber and material for docks and sheds		100 00
Apparatus and tools		775 68
Total		$1,575 68

MILL CREEK BASS STATION.

Five acres of land and improvements	$1,500 00	
Apparatus and tools	228 65	
Total		$1,728 65

GLENWOOD STATION.

One building and fixtures	$200 00	
Apparatus and tools	18 70	
Total		$218 70

SECRETARY'S OFFICE.

Furniture	$305 90	
Library, books and stationery	202 02	
Total		$507 92

RECAPITULATION.

Paris Station	$18,827 25
Car	3,685 80
Detroit Station	12,406 53
Sault Ste. Marie Station	7,726 80
River Fisheries	1,575 68
Mill Creek Bass Station	1,728 65
Glenwood Station	218 70
Secretary's Office	507 92
Total	$46,677 33

FINANCIAL STATEMENT.

FOR CURRENT EXPENSES.

1896.			
Oct. 1.	Balance	$3,651 60	
	Received from loan	4,000 00	
	Received from fish sold	2,678 78	
	Vouchers paid during quarter ending Dec. 31		$10,505 41
Dec. 31.	Overdraft	175 03	
		$10,505 41	$10,505 41
1897.			
Jan. 1.	Overdraft		$175 03
	From State Treasurer during quarter	$13,750 00	
	From fish sold	8 91	
	Vouchers paid during quarter		6,621 59
	Loan paid		4,000 00
Mar. 1.	Balance		2,962 29
		$13,758 91	$13,758 91
April 1.	Balance	$2,962 29	
	Received from loan	4,000 00	
	Vouchers paid during quarter		7,604 68
June 30.	Overdraft	642 39	
		$7,604 68	$7,604 68
July 1.	Overdraft		$642 39
	From State Treasurer during quarter	$8,750 00	
	Vouchers paid during quarter		3,913 53
	Loan paid		4,000 00
Sept. 30.	Balance		194 08
		$8,750 00	$8,750 00
Oct. 1.	Balance	$194 08	
	From State Treasurer during quarter	3,750 00	
	From rebate on insurance	4 00	
	Vouchers paid during quarter		3,660 35
Dec. 31	Balance		287 73
		$3,948 08	$3,948 08
1898.			
Jan. 1.	Balance	$287 73	
	From State Treasurer during quarter	2,500 00	
	From loan	4,500 00	
	Vouchers paid during quarter		3,289 34
Mar. 31.	Balance		3,998 39
		$7,287 73	$7,287 73
April 1.	Balance	$3,998 39	
	From sale of nets	65 00	
	Vouchers paid during quarter		4,063 39
		$4,063 39	$4,063 39
July 1.	From State Treasurer during quarter	$8,750 00	
	From rebate on insurance	7 00	
	Loan paid		4,500 21
	Vouchers paid during quarter		3,301 79
Sept. 30.	Balance		955 00
		$8,757 00	$8,757 00

Oct. 1.	Balance	$955 00	
	From State Treasurer during quarter	3,750 00	
	From G. R. & I. Railway	2 95	
	Vouchers paid during quarter		$3,445 39
Dec. 30.	Balance		1,262 56
		$4,707 95	$4,707 95

FOR SPECIAL PURPOSES.

1896.			
Oct. 1.	Balance	$838 03	
	Vouchers paid during the quarter		$208 63
Dec. 31	Balance		629 40
		$838 02	$838 03
1897.			
Jan. 1.	Balance	$629 40	
	Vouchers paid in June		$33 00
June 30.	Balance		596 40
		$629 40	$629 40
July 1.	Balance	$596 40	
	From State Treasurer during quarter	1,500 00	
	Vouchers paid during quarter		$1,564 80
Sept. 30.	Balance		531 60
		$2,096 40	$2,096 40
Oct. 1.	Balance	$531 60	
	Vouchers paid during quarter		$236 78
Dec. 31.	Balance		294 82
		$531 60	$531 60
1898.			
Jan. 1.	Balance	$294 82	
	Vouchers paid during the year 1898		$201 52
Dec. 31.	Balance		93 30
		$294 82	$294 82

THE REPRODUCTION AND METAMORPHOSIS OF THE COMMON EEL (ANGUILLA VULGARIS).[1]

BY G. B. GRASSI, PROFESSOR IN ROME.

Four years of continual researches made by me in collaboration with my pupil, Dr. Calandruccio, have been crowned at last by a success beyond my expectations—that is to say, have enabled me to dispel in the most important points the great mystery which has hitherto surrounded the reproduction and the development of the common eel (Anguilla vulgaris). When I reflect that this mystery has occupied the attention of naturalists since the days of Aristotle, it seems to me that a short extract of my work is perhaps not unworthy to be presented to the Royal Society of London, leaving aside, however, for the present, the morphological part of my results.

The most salient fact discovered by me is that a fish, which hitherto was known as Leptocephalus brevirostris, is the larva of the Anguilla vulgaris.

Before giving the proofs of this conclusion, I must premise that the other Muraenoids undergo a similar metamorphosis. Thus I have been able to prove that the Leptocephalus stenops Bellotti, for the greatest part, and also the Leptocephalus morrisii and punctatus belong to the cycle of evolution of Conger vulgaris; that the Leptocephalus haeckeli, yarrelli, bibroni, gegenbauri, köllikeri, and many other imperfectly described by Facciola, and a part of the above named Leptocephalus stenops of Bellotti, belong to the cycle of evolution of Congromuraena mystax; that the Leptocephalus taenia, inornatus, and diaphanus belong to that of Congromuraena balerica; that under the name of Leptocephalus kefersteini are confounded the larvae of various species of the genus Ophichthys; that the Leptocephalus longirostris and the Hyoprorus messanensis are the larvae of Nettastoma melanurum, and that the Leptocephalus oxyrhynchus and other new forms are larvae of Saurenchalys cancrivora, and that finally a new little Leptocephalus is the larva of Muraena helena.

The form known as Tylurus belongs to Oxystoma, of which we unfortunately know nothing more than a figure by Raffinesque. I have not been able to find the Leptocephalus of Myrus vulgarus, of which I have had only a single individual, in which the transformation was already far advanced. Neither have I found the Leptocephalus of Chlopsis bicolor, a very rare form, which is related to Muraena and to Muraenichthys. As the result of these observations, the family of the Leptocephalidae has been definitely suppressed by me; the various forms of that family are, in fact, the normal larvae of the various Muraenoids.

[1] From the "Proceedings of the Royal Society," November, 1896.

In regard to the greater part of the above named species, the control has been threefold, namely:

Firstly, anatomical. I have compared the various stages in all their structures, and have made the due allowance for the changes brought about by the metamorphosis at the close of larval life.

Secondly, natural. I have found in nature all the required transitional stages.

Thirdly, experimental. I have followed, step by step, the metamorphosis in aquariums.

Therefore the hypothesis of Gunther that the Leptocephali are abnormal larvae, incapable of further development, must be rejected. All this is related by myself at length, with all historical details which concern the question, in a large memoir which is about to appear in the journal edited by Professor Todaro.

Until now all these facts have been unknown, because normally they can only be observed in the abysses of the sea at a depth of at least 500 metres. Fortunately, along a part of the coast of Sicily strong currents occur, which must be ascribed to the tide, producing very large displacements of the water in the narrow Strait of Messina. I shall give further details concerning these currents in my large memoir. In consequence of the strong currents sometimes—I say sometimes because there is no regularity, and one may have to wait for a year without obtaining any material—not only many deep-sea fishes, but also all stages of the development of the Muraenoids are met with in the surface-water. To these currents we owe all the captures of Muraena helena with ripe eggs, which is in accordance with what I have already argued from other facts, namely, that the reproduction of the Muraenoids takes place at great depths of thhe sea.

Before I proceed to speak of the common eel, I must premise that Dr. Raffaele has described certain pelagic eggs as belonging to an undetermined species, putting forward the suggestion that these eggs belong to some Muraenoid. This matter has been investigated by myself, and I have shown that the newly hatched larvae (called "prae-larvae" by me) derived from these eggs have essentially the character of Leptocephali.

The life history of the Muraenoids, leaving aside for the present the common eel, is as follows: Females can only mature in very profound depths of the sea, that is to say, at least a depth of 500 metres. This fact I established by finding well-known deep-sea fishes together with Leptocephali, ripe Muraenae, and quite ripe eels (see below). The females of those species which do not live at this depth must therefore migrate to it. The male, however, can mature at a smaller depth, and therefore they migrate into the greater depth when they are already mature. Fertilisation takes place at great depths; the eggs float in the water; nevertheless they remain at a great depth in the sea, and only exceptionally, for unknown reasons, some of them mount to the surface.

From the egg issues rapidly a prae-larva, which becomes a larva (Leptocephalus) with the anus and the urinary opening near the tip of the tail. The larva then becomes a hemi-larva, the two apertures just named moving their position towards the anterior part of the body, which becomes thickened and nearly round. By further change the

hemi-larva assumes the definitive or adult form. The larva, as well as the hemi-larva, shows a length of body much greater than that exhibited by the young Muraenoid of adult form into which they are transformed. By keeping specimens in an aquarium I was able to establish a diminution of more than 4 cm. during the metamorphosis. With regard to the greatest length which the larva can attain in a given species, and the amount of diminution which accompanies metamorphosis, there are great individual variations.

The history of the common eel, to which I am now about to refer, is very similar to that given above for the other Muraenoids. The common eel (Anguilla vulgaris) undergoes a metamorphosis, and before it assumes the definitive adult form it presents itself as a Leptocephalus. which is known as Leptocephalus brevirostris. This Leptocephalus was discovered in the Straits of Messina many years ago. A specimen was also captured by the "Challenger," and another specimen was taken by the Zoölogical Station of Naples in the Straits of Messina. This form is occasionally carried to the surface by currents. By exception, in the month of March, in the year 1895, we captured several thousands of them in one day; but the best way to secure this Leptocephalus (and a very easy one) is to open the intestine of the Orthagoriscus mola, a fish which is common in the Straits of Messina, and in it one is certain to find a very large number of specimens. It must be observed that Orthagoriscus mola is a deep-sea fish. The specimens of Leptocephalus brevirostris found in the intestine of Orthagoriscus are more or less altered by digestion. Those specimens of Leptocephalus brevirostris which are taken near the surface in the open sea are in a better state of preservation, but, unfortuntaely, these also frequently have the epidermis injured so that they cannot maintain their life in an aquarium for more than a few days; they live long enough, however, to allow us to observe that it is their habit to conceal themselves in the sand or in the mud as the common eeel (Anguilla) does. Here it is to be noted that the various forms of Leptocephali have habits resembling those of the Muraenoids to which they belong, i. e., they dig into the sand or abstain from doing so according as the adult form has or has not this habit.

I now pass on to the characters of Leptocephalus brevirostris. I give them here in the same order as I shall use in my larger memoir. The length varies from 77 to 60 mm., the same extent of variation as observed in other Muraenoids. The caudal fin tends to assume the form which it has in the Elver[1] or young Anguilla.

It is to be noted that in other Leptocephali the caudal fin also tends always to exhibit the adult form. The lower jaw projects sometimes more than the upper jaw, as in Anguilla. The margin of the mouth is wide, as in Anguilla. The tongue is free, as in Anguilla. On the other hand, the youngest elvers which I have observed have smaller eyes than Leptocephalus brevirostris, and this need not surprise us, since we know that in other species of Muraenoids the diminution of the eyes occurs during the metamorphosis. The nostrils are separated from one another, the anterior tubes are relatively at a considerable distance from the tip of the snout and from the rim of the mouth. They are in a position in which they are observed in many other Leptocephali, which are

[1] The word "Elver" is used in this paper in its strict sense, viz., for the young form of Anguilla Vulgaris as taken when ascending rivers in vast numbers.

destined to transform themselves into adult forms having the anterior nostrils in nearly the same position as in the common eel. The posterior nostrils, on the contrary, are not tube-like, and are in the same position as those occupied in the adult Anguilla. It is worth remarking that in other Leptocephali also the posterior nostrils have already assumed the adult position when the anterior ones are still far removed from it. In L. brevirostris I find a larval dentition which resembles that of the other Leptocephali. In correspondence with the small size of Leptocephalus brevirostris the number of larval teeth is small. Researches founded, firstly, on the enumeration of the myomeres; secondly, upon the enumeration of the dorsal and ventral arches of the vertebrae of the caudal extremity (hypurals); and thirdly, upon the enumeration of the posterior spinal ganglia, lead with great certainty to the conclusion that the Leptocephalus brevirostris is the larva of a Muraenoid, the number of whose vertebrae must lie between 112 and 117, most probably 114 or 115. Such a Muraenoid is the Anguilla vulgaris. The Muraenoid indicated cannot be any other of those occurring in the Mediterranean, because they all have a number of vertebrae higher than 124.[1] Counting the myomeres in Leptocephalus brevirostris, one finds generally only 105 complete, five others incomplete, and all the others in a state of transparency and incomplete formation. These latter are fortunately at the posterior extremity, where other criteria come to our assistance, namely, the spinal ganglia and the vertebral arches. To show how I arrive at the number of vertebrae which must be possessed by the adult individual, corresponding to a given Leptocephalus brevirostris, I quote the following example: I assume that three vertebrae develop themselves in correspondence to the first four incomplete myomeres, and that 105 must develop themselves in relation to the 105 complete myomeres, that is to say, between the fourth and fifth myomeres, between the fifth and sixth, and so on until we reach the 105th myomeres. I further conclude that seven other vertebrae are developed at the caudal extremity, as indicated by the number of vertebral arches and the spinal ganglia in that region. We count, therefore, in all 105 vertebrae, and this is the number which can be easily seen in many specimens of Anguilla vulgaris.

Here I must particularly insist that I have ascertained in an absolute manner that during the metamorphosis of the Muraenoids the number neither of the myomeres, nor of the vertebral arches, nor of the spinal ganglia is subjected to any change. The hypurals of Leptocephalus brevirostris are precisely the same as in the elver of Anguilla vulgaris. The last hypural which is fused with the urostyle may present itself as a single piece, or may be more or less cleft. These are variations which are met with also in the elver. Just as in the elver, the last hypural but one is always extensively cleft, or, if the expression is preferred, doubled. To the last hypural correspond five rays, while four correspond to the last but one, and one to the last but two, the whole structure being identical with that found in the elvers of Anguilla vulgaris. Of these ten rays, the eighth, seventh, and sixth are bifid, both in Leptocephalus brevirostris and in the elvers of Anguilla vulgaris. In the pectoral fin of Leptocephalus brevirostris the definitive rays can be observed, and

[1] Muraenesox savanna is said to have 109 vertebrae, but it is doubtful whether it really occurs in the Mediterranean. The position of its nostrils and the number of its branchiostegal rays render its association with Leptocephalus brevirostris impossible.

these are of the same number as in the elvers of Anguilla vulgaris. Leptocephalus brevirostris is transparent, and has colorless blood. The red corpuscles are wanting, but there are present so-called "blood-plates" ("blutplättchen" in German) similar to those of the inferior vertebrates. The bile is also colorless. This fact is observed in all the other Leptocephali. Leptocephalus brevirostris is, however, the only one which is free from all pigmentation. Correspondingly, the common eel is the only species of Muraenoid which at the close of metamorphosis (i. e. in the youngest elvers) is devoid of all trace of larval pigmentation. It was this observation which first led us to the discovery of the relations between Leptocephalus brevirostris and Anguilla vulgaris.

In making transverse sections of Leptocephalus brevirostris I found other characters which confirm the relation between it and the common eel; for instance, the branchiostegal rays are ten to eleven in number, as is also observed in the elvers of Anguilla vulgaris. In the common eel the well-known lateral branch of the fifth pair of the cranial nerves exists. It is also found in Leptocephalus brevirostris. This lateral branch could not be found by Dr. Calandruccio in the other common Muraenoids of Sicily, and is wanting also in the other Leptocephali.

The mucous canal-system (sensory canals) in the head are already developed, partially in Leptocephalus brevirostris, and are incompletely developed in the elver. As in the elver, so in Leptocephalus brevirostris, the pyloric caeca are wanting. The blind extremity of the stomach and the incompletely developed swim-bladder, which is as yet free from contained gas, are present both in Leptocephalus brevirostris and in the elver of Anguilla vulgaris. The pronephros is in active function, as in the other Leptocephali. The Malpighian glomerules of the kidney (mesonephros) are lobed as in the eel, and their number corresponds with that observed in the Helmichthys stage, of which I will speak further on. The genital gland, not yet sexually differentiated, is almost identical with that of the same stage.

In short, it may be said that the whole organization of Leptocephalus brevirostris corresponds with the organization of the common eel, if we make allowance for those changes which are observed in the metamorphosis of the other species of Muraenoids, such as reduction of the pancreas and of the liver, disappearance of the protoskeleton, complication of the musculature, increase in size of the cerebellum, loss of the larval teeth, development of the definitivee teeth, etc.

From the description of these Leptocephali I must pass on briefly to speak of the stages nearer to the condition of the elver. I am, however, obliged to leave a break in the series, which, however little its significance, yet certainly will make some impression on the minds of those who do not realize with what caution I have formed my conclusions. I must confess that since I have learned how difficult it is to procure an entire series of the development of a Muraenoid, I am more astonished at being able to recognize a single stage in the development of a given species than at not finding the whole series. I must point out that the break in my series of the development of Anguilla vulgaris would have been much smaller if I could have persuaded myself to kill and preserve one of the hemi-larvae which I happened to meet with at the end of the year 1892. They were really transitional stages between Leptocephalus brevirostris and that stage which I shall describe further on.

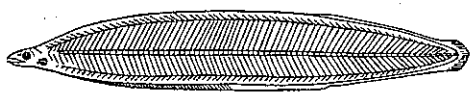

FIG. 1.

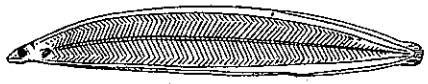

FIG. 2.

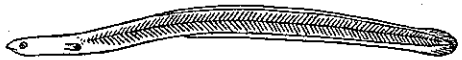

FIG. 3.

FIG. 4.

FIG. 1.—Leptocephalus brevirostris. Natural size.
FIG. 2.—Leptocephalus brevirostris. Later stage. Natural size.
FIG. 3.—Anguilla vulgaris. Transition stage. Natural size.
FIG. 4.—Anguilla vulgaris. Definitive habit (Elver). Natural size.

I published this fact in a preliminary note in the month of May, 1893. They were transparent with almost colorless blood, without any trace of pigmentation except at the eyes, and had lost all the larval teeth, whilst they possessed already very few and very minute teeth of the definitive series. The body was thickened, and already showed the cylindrical form. They measured less than 8 cm. In short, they were Leptocephalus brevirostris on the way to transformation into Anguilla vulgaris. As a matter of history they actually did transform themselves in my aquarium with the usual diminutions in their dimensions, and subsequently proceeded to increase in bulk.[1] The metamorphosis took place, as usual, without the animal taking in any nourishment whatever. The resumption of growth was accompanied by a resumption of feeding. Unfortunately I had no other individuals of this stage.

The stage which I now pass on to describe (Fig. 3) can be obtained during the winter in the sea. I have never found them at the mouths of rivers. The length varies from 54 to 73 mm. Most individuals measured about 65 mm. The body is relatively longer than in the elver. It is also relatively deeper, as in Leptocephalus. We are reminded of Leptocephalus also by the pigment of the eye, the vitreous transparency of the body, the swim-bladder being indistinguishable in the living animal, and the absence of all larval pigmentation. The blood is slightly colored and the bile is already green. Slight pigmentation can be seen along the central nervous system, and at the middle part of the caudal fin. This commencement of the definitive or adult pigmentation in the regions named before it occurs in any other part is also seen in other Muraenoids. The definitive teeth are very minute, and few in number. The intestine contains no food. After what I had observed in the other Muraenoids, the simple observation of the barely indicated teeth, and of the absence of aliment in the gut, would have been sufficient to convince me that the stage now under notice must be preceded by a Leptocephalus phase. Indeed if we did not admit such a preceding history, we could not understand how this little fish could have attained such a size without acquiring well developed teeth, and without nourishing itself.

In conclusion, no one would hesitate, even not knowing Leptocephalus brevirostris, to refer the stage now under discussion to a Muraenoid about to complete its Leptocephalus metamorphosis, were it not for the fact that there has been so much question concerning the reproduction of the common eel, and that so many capable observers have failed in dealing with it, that every new observation is received with skepticism. The stage of which I am now speaking, in the hands of a pure systematist, would probably be described as a Helmichthys, a genus established for certain forms of Leptocephali far advanced in transformation.

The next forms to which I have to refer are captured in the course of migration from the sea into fresh water. When kept in an aquarium they assume the characters of the elver, diminishing more or less in volume, and without nourishing themselves. The elvers of the common eel can present themselves in stages differing little from those last described, as well as in a form that has already developed the full pigmentation of the adult. Even those which most resemble the preceding stage always have a character which distinguishes them easily, namely, the presence of a definitive pigment, more or less superficially placed on the head, and not to be confounded with the pigment round the posterior extremity of the brain, which latter is already present in the preceding stage. In specimens taken at the mouths of rivers this more or less superficial pigment was, so far as I could ascertain, always present.

As the pigmentation develops itself, the little eel gradually undergoes a diminution in all its dimensions. It results from my measurements, that the fully pigmented elver has an average length of 61 mm., while for the more or less colorless elver the average length is 67 mm. I found pigmented elvers which were reduced in length to 51 mm., a size which I never observed in those elvers in which the development of pigment had not taken place.

The facts which I have stated demonstrate that the eel goes through a metamorphosis, and that Leptocephalus brevirostris is its larva. Some further considerations remain to be given, although I believe that zoölogists will not consider the question still an open one after the record of facts given above—facts which any one may verify by examining the material which is preserved in my hands. Many to whom I have related

[1] The fact that I actually have obtained in an aquarium the transformation of L. brevirostris into Anguilla Vulgaris is of prime importance. The time occupied was one month.

my discovery of the history of the common eel have objected that eels are found almost everywhere, whilst Leptocephalus brevirostris is limited to Messina. In reply, I must say that, first of all, it is not true that Leptocephalus brevirostris is limited to Messina; secondly, that at Messina there are special currents, which tear up the deep-sea bottom which everywhere else is inaccesible; thirdly, although it is true that on the coasts of many countries where Anguilla vulgaris is found, no one has ever seen a Leptocephalus brevirostris; it is also true that in no country, not even in those where eels are abundant, has anyone ever seen an eel of less than 5 cm. in length. Since it has to be admitted that no one knows the eel before it arrives at the length of 5 cm., there is no greater difficulty in supposing that during this unknown period the eel passes through a Leptocephalus stage than in supposing that it does not do so. The critical study of all the literature of this subject, and a great many continued observations, have occupied me for many years, and have been undertaken just in those places where young eels are to be found. They enable me, from my own studies, to affirm with assurance that young eels with the definitive adult form do not exist of less than 5 cm. in length.

From the study of the memoir of Raffaele on pelagic eggs, I have come to the conclusion that the eggs of his undetermined species No. 10, having a diameter of 2.7 mm., and differing from all the others in the absence of oil-globules,[1] must belong to the Anguilla vulgaris, because from them Dr. Raffaele obtained prae-larvae which had only forty-four abdominal myomeres. I endeavored for two years in vain to study these eggs at the Zoölogical Station of Naples. I found only a few of them, and these died prematurely.

In another point my researches have yielded a very interesting result. As a result of the observations of Petersen, we know now that the common eel develops a bridal coloration or "mating habit," which is chiefly characterized by the silver pigment without trace of yellow, and by the more or less black color of the pectoral fin, and finally by the large eyes. Petersen inferred that this was the bridal coloration from the circumstance that the individuals exhibiting it had the genital organs largely developed, had ceased to take nourishment, and were migrating to the sea. Here Petersen's observations cease and mine begin. The same currents at Messina which bring us to the Leptocephali bring us also many specimens of the common eel, all of which exhibit the silver coloration. Not a few of them present the characteristics described by Petersen in an exaggerated condition,—that is to say, the eyes are larger and nearly round instead of elliptical, whilst the pectoral fins are of an intense black. It is worth noting that in a certain number of them the anterior margin of the gill-slit is intensely black, a character which I have never observed in eels which had not yet migrated to the sea, and which is wanting in the figures and in the originals sent to me by Petersen himself. Undoubtedly the most important of these changes is that of the increase of the diameter of the eye, because it finds its physiological explanation in the circumstance that the eel matures in the depths of the sea. That as a matter of fact, eels dredged from the bottom of the sea

[1] Renewed researches have convinced me that this egg is that of Anguilla vulgaris. There is, however, another egg belonging to an undetermined Muraenoid which is devoid of oil-drops, and can easily be confused with the true eggs of Anguilla.

have larger eyes than one ever finds in fresh-water eels I have proved by many comparative measurements, made between eels dredged from the sea bottom and others which had not yet passed into the deep waters of the sea. Thus, for instance, in a male eel taken from the Messina currents, and having a total length of 34½ cm., the eye had a diameter, both vertical and transversal, of 9 mm., and in another eel of 33½ cm. the same measurement was recorded. In a female eel, derived from the same source and purchased in the market, whose length was 48½ cm., the vertical diameter of the eye was 10 mm., and the transversal diameter rather more than 10 mm. These are not the greatest dimensions which I observed, and I conclude from these facts that the bridal habit described by Petersen was not quite completed in his specimens, and that it becomes so only in the sea and at a great depth. In relation to these observations of mine stands the fact that the genital organs in the eel taken in the Messina currents are sometimes more developed than the eels which have not yet entered the deep water. Thus it has happened that male individuals have occurred showing in the testes here and there knots of spermatozoa. The spermatozoa are similar to those of the Conger vulgaris, and must be considered as ripe.

As is well known, so advanced a stage of sexual maturity has never before been observed in the common eel. This appears to be due to the fact that the males hitherto examined had not yet migrated into the deep water of the sea.

Eels with big eyes taken from the depths of the sea were, before the above facts were known, described as a distinct species under the name of Anguilla bibroni (Kaup) and of Anguilla kieneri (Kaup), not to be confounded with Anguilla kieneri (Günther), which is a synonym of Lycodes kieneri.

In certain cloacae of ancient Rome which today are disused and contain pure water, remarkable eels are found of a length of 20 to 30 cm., of a grey color, without trace of yellow, of male and female sex, with enormous eyes, and with more or less rudimentary genital organs. They are individuals which, confined in a place without light, have acquired prematurely one of the characters of the bridal habit without a corresponding development of the genital organs. These individuals are probably incapable of ulterior development, as the condition of their genital organs seems to demonstrate.

Under the name of Anguilla kieneri (Kaup) there have probably been included some individuals which had acquired big eyes under conditions similar to those described for the eels of these Roman cloacae. From these and similar observations it clearly results that all the European eels must be included under a single species; and this is an important fact from another point of view, namely, that it destroys an objection which might be raised against my conclusion with regard to the development of Anguilla vulragis from Leptocephalus brevirostris, namely, the objection that Leptocephalus brevirostris belongs not to Anguilla vulgaris, but to Anguilla kieneri, or to Anguilla bibroni.

To sum up, Anguilla vulgaris, the common eel, matures in the depths of the sea, where it acquires larger eyes than are ever observed in individuals which have not yet migrated to deep water, with the exception of the eels of the Roman cloacae. The abysses of the sea are the spawning-places of the common eel: Its eggs float in the sea water. In devel-

oping from the egg it undergoes a metamorphosis, that is to say, passes through a larval form denominated Leptocephalus brevirostris. What length of time this development requires is very difficult to establish. So far we have only the following data:—First, Anguilla vulragis migrates to the sea from the month of October to the month of January; second, the currents, such as those of Messina, throw up, from the abysses of the sea, specimens which, from the commencement of November to the end of July, are observed to be more advanced in development than at other times, but not yet arrived at total maturity; third, eggs, which according to every probability belong to the common eel, are found in the sea from the month of August to that of January inclusive; fourth, the Leptocephalus brevirostris abounds from February to September. As to the other months, we are in some uncertainty, because during them our only natural fisherman, the Orthagoriscus mola, appears very rarely; fifth, I am inclined to believe that the elvers ascending our rivers are already one year of age, and I have observed that in an aquarium specimens of L. brevirostris can transform themselves into young elvers in one month's time.