SIXTEENTH BIENNIAL REPORT

OF THE

STATE BOARD

OF

FISH COMMISSIONERS

FOR FISCAL YEARS 1903 AND 1904

BY AUTHORITY

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STATE BOARD OF FISH COMMISSIONERS.

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SIXTEENTH BIENNIAL REPORT OF THE MICHIGAN STATE BOARD OF FISH COMMISSIONERS.

To His Excellency, the Governor of the State of Michigan:

We submit herewith the report of the State Board of Fish Commissioners for the biennial period from July 1, 1902, to June 30, 1904.

The law requires that reports of State institutions shall cover fiscal years, that is, from July 1 to June 30. As this division of time breaks into what is really one year's work of the board, we have in this report carried the tables of our distribution of fish beyond the 30th day of June, 1904, so as to include what properly belongs to a full statement of the work accomplished in the season of 1904. A division of the tables of distribution giving only what had been done to June 30th of the last year covered by any of our reports would be misleading and result in confusion as to the actual work done.

This biennial period has been attended with very satisfactory results and the board is well satisfied with what has been accomplished with the means at hand. When the estimates were made upon which the appropriation of 1903 was based the board had in mind the desire of the Governor and members of the legislature to keep down the sum of the appropriations, therefore the amounts named in our estimates were made as small as possible. Subsequent events have shown that the aggregate was much less than was needed, and it has been necessary to practice the most rigid economy in order to get through the biennial period without a deficit. The work has suffered from this necessity, but it has been the policy and aim of this board to confine its expenditures to the amount appropriated. In this instance we feel that the public has suffered from this enforced necessity for economy.

It seems to this board very plain that the efficiency of its work could be greatly increased if appropriations for the current expenses could be included in the regular budget. With this provision for the work more could be accomplished than with the present system of uncertain biennial appropriations. Stable plans for the future could be formulated with the assurance that they could be carried out. It seems to the board that the time has come when the legislature can very properly follow this course. As we shall hereafter show in this report, the amount invested by this State in this work is already returned to the people with large profit. But it could be used still more economically if the amount to be used were known far enough in advance to perfect plans for its investment.

The propagation of food fishes constitutes the all-important feature of the work entrusted to the care and supervision of this board; and during the period under consideration this work has been carried on by practically the same methods and in the same general manner as here-

tofore. We do not mean by this that the routine of fish hatching and distribution has fallen into a rut nor that the work has proceeded along merely stereotyped lines, without advancement in the art and science of fish-culture. On the contrary, while clinging steadfastly to those principles and methods that have stood the test of time and yielded the fullest measure of results, our constant aim and effort has been to advance towards the highest plane of efficiency in every branch and department of the service, and no details have been considered too unimportant to become the subject of investigation and experiment.

Along this line of special study and attention in the direction of the highest standard of excellence, may be mentioned the various details that have a practical bearing on hatching percentages; the proper distribution, aeration and purification of the water supply, with special reference to the prevention and cure of diseases that frequently attack schools of fish crowded into narrow environments under semi-artificial conditions; the best foods and methods of feeding, as affecting the rate of growth and general health of stock fish reared in confinement, and held for breeding purposes; special care as to aeration and the safest limitations of water temperatures, in the transportation of the young, to insure their delivery in full strength and vigor; and a more careful discrimination in the stocking of public waters, with reference to their adaptability to the several kinds of fish propagated.

All of the fish produced under the direction of this board since the spring of 1897 have been planted in inland lakes and streams. The propagation of food fishes for waters bordering the State has been discontinued by this board, at least for the present, the general government having assumed full control of this branch of the work. The State, however, still retains ownership of its combination hatcheries—those that are equipped for supplying suitable varieties of fish for both inland and outlying waters; and these hatcheries are now operated jointly by the State and federal commissions, the State product going to inland waters exclusively and the government output to great lake and connecting waters.

Our discontinuance of the great lake hatching service dates really from the egg collecting season of the fall of '97, the appropriation then available being so greatly reduced that we were confronted with the alternative of dropping either the commercial or inland work. The succeeding legislature restored our appropriation to nearly its former average, but stipulated in effect that no part thereof should be expended in the production of so-called commercial fishes—principally whitefish, lake trout and pike-perch—for commercial fishing waters; a proviso that was inserted at the suggestion of this board for the purpose of removing all doubts as to the sincerity of our pledge to use the full amount allowed for propagation purposes solely for the benefit of inland waters.

The adoption of the policy of conducting our propagation service strictly for the benefit of the thousands of smaller waters lying wholly within the borders of the State, should not carry with it the inference that this board has lost or relaxed its interest in the present and future welfare of the commercial fisheries; on the contrary, so long as the enactment and enforcement of laws affecting the development and maintenance of this great industry remain under the jurisdiction of the State, it is our duty as well as pleasure to keep thoroughly informed with respect

to the conditions that make for the stability and permanence of this great source of food wealth, and to render all possible aid in safeguarding the State's interest therein. When the change was made, we were well aware that the hatching service for commercial waters would be continued; on a larger scale than heretofore and without expense to the State, the federal authorities having virtually agreed to occupy this field; in fact, negotiations for the lease of our whitefish hatcheries and equipment were then pending. A contract for the transfer of this service for a period of two years was closed soon after, on terms so advantageous to the State that we have renewed the same from year to year and shall endeavor to extend or renew the same indefinitely. Under this arrangement the production of whitefish and lake trout for stocking our border waters is provided for to the fullest working capacity of the hatcheries equipped for this purpose, while at the same time the inland interests are better served than ever before, with a substantial increase in the propagation service contemplated for the near future—advantages so obvious that further comment is unnecessary.

The whitefish work had been carried on by the State for a number of years with unqualified success, with the Detroit hatchery as the main collecting and distributing center. From very small beginnings the service expanded from year to year until it attained proportions far beyond the expectation of the pioneers in this field of endeavor. But it became manifest that where eight states and two provinces of the Dominion of Canada border on the great lakes, no one State could do the work satisfactorily. Uniformity of laws relating to the propagation and protection of fish in the lakes is very desirable. The influence most likely to bring this about is clearly our national government. At all events, the United States having undertaken the propagation of food fishes along the Atlantic and Pacific coast line and in the waters of the great lakes, there can scarcely be any doubt of the wisdom of leaving it to carry on that work with the fullest freedom, and to confine the efforts of the bordering States to propagation of fish in their inland waters, and co-operate with the national government and with each other in establishing and maintaining satisfactory and uniform fish protection laws.

The relations between the Department of Fisheries of the United States and this board have been and are most cordial and harmonious and of great benefit to the State. Notwithstanding loud and persistent calls from other states, the United States has annually planted along the shores of our State from two to three hundred million whitefish fry as well as many millions of lake trout and wall-eyed pike. We are also indebted to the federal authorities for many favors and courtesies extended to the State through our board.

The present standing of the whitefish industry in waters that are well within the sphere of hatchery influence affords ample and convincing evidence of the efficacy of hatchery propagation as a remedy for restoring and sustaining this important fishery. The three principal whitefish hatcheries on the great lakes are grouped within a radius of thirty miles at the head of Lake Erie, representing at least two-thirds of the total hatching capacity for whitefish on the lakes; and a very large proportion of the production within this radius finds its way into Lake Erie waters. As showing the result of this continued planting of the young, we quote

from Supt. Bower's report as far back as 1899: "The run of whitefish to the west end of Lake Erie and into the Detroit River was heavier this fall than for many years. The catch from the three seining grounds in the river operated by the U. S. Fish Commission was more than double the average catch from the same grounds for the past 10 or 15 years. A large increase in the pound and gill net catch between Sandusky and Monroe is also reported. In view of the fact that whitefish are more persistently pursued in Lake Erie than anywhere else, being taken practically the year round at one point or another, it is fair to conclude that the increase is merely the natural result of the introduction of large numbers of infant fish from the hatcheries. The evidence in support of this conclusion is so striking that the fishermen are practically unanimous in crediting the hatcheries with keeping up the supply against the most exhaustive methods of fishing employed in any similar body of fresh water in the world."

In short, the work of artificial propagation of food fishes is now a demonstrated success. It has spread all over the United States and beyond a doubt will be carried on for all time, because its benefits to the people have become so apparent to all who take the trouble to inquire into the matter.

It should not be denied, however, that in many respects the work is still in the experimental stage as to methods. Improvements in methods naturally will be made from time to time. But the essential fact remains that artificial propagation of the better food fishes is necessary if the people are to continue to have this cheap and healthy food for any considerable time in the future.

The great advantage of hatcheries as a factor in replenishing our fisheries rests on their wonderful superiority in the multiplication of fish life in its early stages, as compared with the net results of reproduction in natural or wild surroundings. "Survival of the fittest" is a universal law of nature, a law so merciless in its exactions and reprisals that the net results of reproduction are minimized to an extent that many forms of wild life soon disappear before civilization. Nature's scheme of wild life is so adjusted that a fairly even balance is maintained between its warring elements; continued existence for each of its multitude of forms is thus assured or made possible, and centuries if not ages elapse before natural evolution leads to undue prominence or extinction of any given form. But the unrestrained preying of one form on another is a fierce and never-ending struggle that may soon lead to extermination when the superior intelligence of man is brought to bear as an added element of destruction. But superior intelligence asserts itself in manifold compensations. Through selection, isolation, domestication and cultivation, order and system are brought out of chaos and confusion; warring forces are subdued and discordant elements are separated or harmonized; "survival of the fittest" is superseded by survival of the best; and thus, through beating off natural enemies and circumventing natural destruction, is propagation and production of the most useful species in the animal and vegetable world encouraged and enormously multiplied. This, in truth, constitutes civilization itself so far as the relations of men to all other forms of animate life are concerned. The discovery, therefore, that it is practical to isolate the reproductive germs of many forms of fish life and thus protect them from all harm for a definite period, howsoever important in itself, was nevertheless a mere incident in the broad scheme of an ever-unfolding and ever-progressive civilization. Of comparatively recent date, this discovery is destined to add immensely to the food wealth and resources of the world, merely by applying to water life, so far as is practical, the same broad principles underlying the production or cultivation of land flora and fauna.

The unique and commanding position of our State with reference to the greatest bodies of fresh water on the earth naturally tends by superficial comparison to belittle the value and importance of the inland waters of the State with reference to the production of food fishes. The vast area and depth of Michigan's share of the Great Lakes as compared with the aggregate volume of her inland waters quite naturally leads the popular mind to the conclusion that the fish producing capacity of the latter is correspondingly overshadowed by the former. This conclusion, however, is wholly erroneous as will be shown by a little study of the conditions essential to the creation and development of water life.

Fish must have food and the food of all fishes starts primarily from the lowest forms of organic life. Hence, the fish producing capacity of any water is determined by its wealth or poverty of this fundamental life. In the creation of this life, warmth, light and the fertility of the material deposited by rivers and watersheds are prime factors. Areas of water, therefore, are rich or poor, fertile or comparatively barren, like areas of land. A column of water from surface to bottom and ten miles in diameter in the middle of Lake Michigan, receiving per unit of volume a low average of warmth, light and fertilizing material, creates but a small fraction of the life developed in an equal volume of water spread out in shoal lake and river basins. Volume for volume our great lake waters are far poorer in water life and productive capacity than the inland waters.

It is not the intention to underrate the value and importance of our commercial fishing waters, but to emphasize the undoubted fact that acre for acre our inland waters are naturally much richer in water life from the lowest forms up, and through systematic and intelligent stocking and reasonable protective measures may be made relatively more productive in actual pounds of wholesome food fish. From the lakes and streams of Gogebic to the St. Joe and Raisin rivers in the southernmost corners of the State, every pond, lake, brook and river is capable of sustaining one variety or more of good, edible fish in fair and continued abundance. All they need is to be adequately stocked with suitable species from time to time and protected from wholesale and irrational methods of fishing.

To accomplish this great work requires patience and persevering effort. The efforts of this board to establish the brook trout as a dominant factor in unacclimated waters throughout the State have been rewarded with results that are as satisfying as they are remarkable, a fact so well and widely known that any extended comment on this subject would be superfluous. In justice to modern fish culture, however, as well as to the memory and struggles of pioneer trout culturists, we cannot refrain from stating that the brook trout service in this State, from its inception and growth to its present standing, constitutes one of the distinct and notable triumphs of recent fish cultural endeavor.

Prior to the organization of this board, there was a limited zone of trout waters in this State, chiefly in the upper peninsula, but Michigan was not considered or known as a distinctively trout State until after the propagation of trout in hatcheries was taken up as a public enterprize.

Brook trout were distributed by this board for the first time in the spring of 1879. The initial effort in this direction consisted of a few small plantings, 12,000 in all, in streams in the southwestern part of the State. The introduction of trout into streams where trout were unknown excited considerable local interest; but as the section in which the experiment was tried is nearly 200 miles below the southern limit of the natural trout zone, there was little confidence in the success of the venture. These initial plantings, however, proved distinctly successful in every instance, good catches of trout being reported the third year following. As these streams were fairly representative of hundreds of others throughout the State, it was at once realized that the opportunity for enlarging the scope and usefulness of the work was practically without limit. Distributions of trout to other waters followed as rapidly as the facilities for producing them would permit, until today the influence and value of this branch of our propagation service is recognized and acknowledged not only throughout the State but in fishing and fish cultural circles everywhere.

Black bass, both large and small mouth, belong to a comparatively small group of fishes that cannot, like the salmonids, be propagated by assuming control of the ova during the period of incubation for the purpose of protecting it from natural losses. Their spawning habits preclude the possibility of success in this direction, on a practical basis. Fortunately, however, the bass group is endowed with an instinct that induces guardianship of the ova and young, under favorable conditions—an instinct that is utterly wanting in nearly all forms of fish life. The two main points in successful bass culture, therefore, are to determine by observation and experiment what constitutes the most favorable conditions for natural guardianship, and then provide or meet those conditions.

The basses, sunfishes, catfishes, etc., comprising the bed-protecting group, would thus seem to have a decided advantage in the matter of reproduction over other species that waste most of their spawn by neglecting it and leaving it wholly unprotected in the midst of natural dangers. If not handicapped in other ways, as an offset to the inevitable loss of a large percentage of unguarded ova, the bed-protecting species would soon override all others and dominate their habitat through sheer force of numbers. Under natural conditions and environment, however, we find that they merely hold their own in the natural balance, making no headway towards gaining the ascendancy. Bass are quite prolific in the production of ova, and it is known that the hatching percentage in individual instances is sometimes very high, as many as 10,000 young fish having been taken from a small mouth bed and double that number from a large mouth bed. Why is it, then, that they barely hold their own against species whose hatching percentage, without protection from any quarter, is known to be low or merely nominal?

Whatever reasons may be advanced for the apparent disproportion in hatching percentages between the two general groups or divisions of

fishes—those that protect their beds and those that do not—it seems certain that the difference in hatching results is more apparent than real, and that the *average* hatching percentage of the bed-protectors in natural surroundings is generally misunderstood and greatly overestimated. A careful examination of a large number of bass beds in a number of lakes and streams in this State, and under varying conditions, developes the fact that a good proportion produce comparatively few fish or none at all, the ratio of such beds to those that are fairly productive varying according to temperature and weather conditions. A number of years ago, Mr. J. J. Stranahan, of the U. S. Fish Commission, informed the writer that he had recently examined a good many bass beds in the Chagrin river and other streams in Ohio, and found the eggs blasted and nests deserted. He concluded that the hatch of that season would be almost a total failure, owing to cold weather, heavy rains and roilly water. There is, of course, room for further observations along this line, but it seems to be universally true in this latitude that while, in the general run of lakes and streams, the number of small mouth fry rising from an occasional bed is exceptionally large, the average from the beds as a whole is small, also that the production of one season varies a good deal with that of another.

Unquestionably the vigilance exercised by the parent fish in behalf of its young is of vital importance, for without such guardianship production is practically *nil*. And yet, presupposing favorable spawning conditions and perfect fertilization, the extreme frailty of the germs still lays them open to loss from causes that are beyond the control of the ever-watchful parent and that may have little or no bearing as elements of danger to the more hardy ova of other species.

It has been suggested that the desertion of the spawning bed—not an uncommon occurrence in natural surroundings—is a deliberate shirking of parental duty that seriously affects production; but it is almost certain that the male bass retires only after the eggs are dead. The protective instinct is developed to an unusual degree during the period of incubation, and parental attachment is strong and assertive as long as life remains in the young. The loss of the latter invariably precedes desertion; abandonment is therefore the sequel and not the cause of such loss.

The time and place of spawning are important points to be considered in connection with the hatching percentage of bass. Repeated inspections of wild beds as well as those in protected ponds show that fertilized ova under strict parental surveillance will not hatch to any extent if the conditions incidental to the season and surroundings are unfavorable. Untoward conditions primarily dependent on the weather are largely responsible for poor results; and while the weather cannot be controlled, it is practical to avoid or counteract the effect of extreme or unseasonable influences, and to profit by such other protective agencies as it is the mission of fish cultural establishments to provide. A study of the relation of weather conditions to hatching results, therefore, throws a good deal of light on the question of partial or total loss on the spawning beds, and indicates the influences that must be prevailed over or minimized to secure the best results.

In this latitude the spawning season of the bass occurs in May and June, a season marked by heavy rains and sudden and wide fluctuations

in temperature, changes to which the ova of bass are known to be extremely sensitive. The spawning nests are located along the shoal margins of lakes and streams, where the temperature quickly responds to atmospheric changes and the water receives the full force and effect of surface drainage and washings. Roilly water and rapid and extreme fluctuations in temperature are elements of great danger to the ova when either or both of these conditions prevail for any length of time; and as the spawning occurs in the midst of these and other dangers, actual or impending, results in wild and unprotected waters are bound to be very uncertain.

It is evident, therefore, that the most suitable source of water supply, for a system of protected ponds for the propagation of bass, is the outlet of a lake or series of lakes of considerable depth and area, maintained chiefly by springs or inlets originating from springs of sufficient volume to insure an ample and continuous flow. The volume of the reserve supply insures a moderately steady or even temperature, the fluctuations being slow and never rising or falling to dangerous extremes during the spawning season. The outlet of a lake of this character is also clear at all times, its basin serving as a receptacle for the sediment and mechanical impurities washed into its shores.

There are, of course, other points of greater or less moment to be taken into account if the fullest measure of success is to be realized in the propagation of bass in protected ponds. Regularity of outline is not essential in the construction of ponds, nor perhaps desirable, but they should have sufficient elevation to admit of drainage at will, at least below the spawning shoals, for the purpose of cleaning and for convenience in arranging and setting the spawning beds; and the inlets and outlets should be so located as to prevent too great a degree of stagnation or staleness in any part. The question of food supply for the breeding stock is an important one, minnows having been found to be the most desirable and acceptable. If not available from outside sources, it is usually practical to hatch and liberally stock the ponds with fry of the common sucker. This practice is followed with considerable success at our Mill Creek station, though the bulk of the minnow supply is obtained by seining in brooks and streams. In most localities some provision for breeding minnows is an important essential of a well-equipped bass plant.

It is necessary that the breeders should approach the spawning season in good condition and with appetite fully appeased, for intense hunger during the mating season foments discord that proves a disturbing element in the reproductive programme. Under the favorable conditions herein outlined, in connection with the advantages accruing through protection from predaceous fishes and other enemies, conditions and advantages that can be provided with any degree of certainty only in private or controlled ponds, the small mouth bass should average a brood of 3,000 to 5,000 young each season from each spawning nest.

Our oldest bass hatching station, and at present the most productive, is located at Mill Creek, about five miles from Grand Rapids. It is the outcome of temporary experimental work at Cascade, which was abandoned when the development of the plant at Mill Creek was begun in 1897.

The land originally acquired for the bassery at this place, with a later

addition, includes about seven acres; practically all valley land available for pond construction, and bordering the stream known as Mill Creek, which empties into the Grand river at Mill Creek village.

The water supply for the ponds is drawn from this creek and is piped from a dam 75 rods above the ponds, giving an elevation of 4½ feet. A limited supply of spring water for special purposes is also piped to the hatchery from a spring 115 rods distant and having an elevation of 18 feet. The volume of Mill Creek is abundantly ample to support not only the ponds already completed, but also an extension of the pond system over the entire valley between our dam and the mill pond at Mill Creek village, which would more than double the capacity and output of the plant. We look forward to the acquirement and development of the remainder of this valley at the earliest possible date.

One large pond was added during the summer of 1903. There is room for one more pond of about the same size within the present station limits, and we hope to have the means to build this pond the coming summer. This will give us 9 ponds, large and small, and complete the pond construction on land now owned by the State.

In addition to the artificial ponds referred to, a small power pond on the grounds of the State Soldiers' Home, and two natural ponds or small lakes, all lying within easy distance from Mill Creek, are used for propagating bass to the extent that it is practical to do so under natural or partially controlled conditions. Under the circumstances the average cost of the young bass taken from these outside waters is low. Results, however, are and must continue to be uncertain; area for area, the production of fingerling and half fingerling bass falls far below that of artificial or controlled ponds that may be seined or drained at will, since it is not practical to empty the former and dispose of the various kinds and sizes of fish and other enemies that prey on them. Nor is it practical to capture the fingerlings to any extent in these waters; they must be secured in schools in the form of fry or advanced fry, while under guard or protection of the parent bass.

The buildings of this station are three in number, viz.: A two-story hatchery, a residence and barn. The first floor of the hatchery includes tank and pump rooms and an office; and the second floor a workshop and bedroom. The tank room is also equipped with a fifty-jar battery, for hatching wall-eyed pike on a modest scale. The original appropriation for this place being absurdly small, the hatchery was built on the principle of "cutting the garment according to the cloth." It should be at least twice as large to properly serve our present needs in the way of tank room, storage, etc. However, the demand for more ponds and increased rearing facilities is even more pressing and important, and must take precedence.

The output of bass from this station the first two or three seasons fell considerably below expectations, in fact was disappointing. But the propagation of bass on a scale of any magnitude and on a sound and sure basis was not at that time an accomplished fact anywhere, and many difficulties arose, under new and untried conditions, that were not encountered in our experimental work at Cascade. Mainly, however, through the resourcefulness and tireless energy and efforts of the overseer, Mr. Lydell, aided and supported in every way by the board and superintendent, one obstacle after another has been overcome, one

problem after another has been solved, until today the production of bass on a certain and stable basis, and of a size and age to insure good results when set free in wild waters, is an accomplished fact.

There is, of course, a field for further investigations and experiments, to increase the output per unit of effort and expense, but the work is no longer an experiment, as hundreds of applicants who have received shipments of advanced fry and fingerling bass from this board will testify. Our aggregate production, however, although very satisfactory in view of the limited hatching and nursery facilities, is wholly inadequate to satisfy the persistent calls for bass from every quarter, for the thousands of suitable lakes and rivers throughout the State.

Realizing the futility of attempting to meet this demand from Mill Creek alone, even with all suitable grounds adjoining put into commission for breeding purposes, and also taking into consideration the expense and inconvenience of shipping to all parts of the State from one point, our request for a modest sum for starting another bassery elsewhere was filed with the legislature of 1901 and granted.

This initial appropriation for an additional bass station was made available July 1, 1901. At that time the location of the proposed new station was undetermined. Shortly after, one or more of our employees were sent out in quest of the facilities desired, and a number of prospective sites in various parts of the lower peninsula were personally examined by experts. The prime considerations in view were, first, a stream or river of ample volume flowing through a lake of sufficient size to serve as a settling basin, to insure clear water at all times at the outlet; and second, ample area of lands below the outlet adapted to the development of hatching and rearing ponds. A number of situations were found that met these requirements in part, some having plenty of water but little or no land that could be utilized for ponds, and *vice versa*, but these important essentials are met in full, in fact are all that could be desired, at the site finally chosen at Drayton Plains, Oakland county.

The water privilege at this point is the Clinton river, flowing not less than 9,000 gallons per minute at lowest stages, and always clear. The property acquired consists of a power dam and the flowage rights involved, a mill building and residence, and 18 acres of land, of which about 12 acres are available for ponds. For a nominal sum an option on seven acres, adjoining and suitable for ponds, is carried by this board. In addition, areas of flat or valley lands much greater in extent than the tracts acquired and held under option, and all adapted to pond construction, lie contiguous. Thus, with a water supply of superb quality under control and more than ample to support a full development of the great area of pond lands below, it will be seen that the situation presents an opportunity probably unequalled in this country for expansion into a bass plant of the highest possible rank.

Our power dam backs the water into Loon and Silver lakes above, raising them above their original level, so that these lakes and the little mill pond at their outlet that is created by our dam, are practically a unit for power purposes. The head or fall at the dam is but three and seven-tenths feet, ample for our work but insufficient for profitable milling under present conditions; hence the acquirement by this board of the entire mill property—land, buildings, dam and water rights—for the very modest sum of $2,250.

The appropriations to date for improvements at this station have been expended in the construction of ponds and their connections, grading, repairs to dam and buildings, and re-arranging the latter to conform to our needs. The residence was greatly in need of the repairs that have been made. The mill building, 28 by 48 feet, and three stories high, has been moved a short distance to a more convenient location. It has been refloored and repaired, and partitioned into storage and ice rooms, workshop, bedroom and office. A boat house, 16 by 24 feet, has been built at the foot of the mill pond, near the main building. Grading and a general cleaning up of the premises, and the building of three propagating and rearing ponds having a combined area of 3¼ acres, complete the improvements to date.

With the exception of a small barn, no further buildings will be needed at this station for a long term of years. Since, however, the number of bass than can be grown to half fingerlings or fingerlings in a given area is limited, the necessity for greatly increasing our rearing or nursery facilities in the near future, is of paramount importance, and this point cannot be too often repeated nor too strongly emphasized. The further development of this station must be centered along this line to the limit of available funds.

Taking both stations into consideration, and in proportion to the pond facilities provided, our recent efforts to produce fingerling bass have been remarkably successful, justifying a positive conviction that it is entirely practical to produce bass of a suitable shipping size in numbers sufficient to stock and re-stock all bass waters throughout the State. We now have a start and in the right direction. We believe that the problem of meeting the urgent demand for bass for lower peninsula waters is now only a question of utilizing and developing the magnificent natural facilities within our grasp at the Drayton Plains and Mill Creek stations. It is for the people, through their representatives, to say how rapidly this development shall proceed, and thus decide to what extent the growing and insistent demand for bass shall be met through the agency of this board.

But the needs and wants of the upper peninsula along this line should not and must not be overlooked. There are many fine lakes in that section to which the bass, more especially the small mouth, is a stranger, and their introduction there is earnestly and urgently solicited by residents from practically every county above the Straits. Most of these waters, however, are inconvenient and expensive to reach from our stations below. It is our intention, therefore, at the earliest possible moment to take up the propagation of bass in connection with the present work at our Soo hatchery; in fact to make this a prominent feature of the work already established there. Some preliminary examinations for the purpose of introducing this auxiliary work have already been made at various points in the St. Mary's river. As the latter is a natural bass water, we believe that the species can be propagated there with marked success, and economically with the Soo hatchery as a base of operations.

During the summer of 1903, Professor Jacob E. Reighard, director of the zoological department of the University of Michigan, was employed by this board to make a scientific study of the subject of bass propagation at the Mill Creek station, and a comprehensive report of his work there is published in full in the appendix. No doubt this report will be read with deep interest by all who are interested in the subject.

Distributions of wall-eyed pike and lake trout have been and will continue to be made in increasing numbers. Next to the bass these are the most valuable of the lake fishes that are available for propagation in effective numbers with the means and facilities at our command.

Lake trout are native to but few of our inland waters and their range is limited to lakes that are in part deep and clear, with sufficient areas of gravel or stony shoals for spawning purposes. A considerable proportion of our inland lakes, however, meet these requirements, and there is no apparent reason why lake trout should not become as abundant in these as in corresponding waters throughout the State of New York. We have faith that it is not only possible, but practical, to bring this valuable food and game fish into much greater prominence, and shall govern ourselves accordingly. If planting of fry results in failure after due trial, fingerlings or yearlings will be tried; and if these fail to gain a foothold in new waters, then the transplanting of adult fish from native waters will be undertaken, though the latter is a slow and rather expensive process with lake trout and wall-eyed pike if much ground is to be covered, and is recommended only as an experiment worth trying after other methods have failed.

Rainbow trout have come to the front more rapidly in this State, in proportion to the number distributed, than any kind of fish propagated by this board. As is generally known, this important species, indigenous to the mountain and coast waters of the far West, was a stranger to Michigan waters until their eggs were shipped to local hatcheries for propagation and distribution. It thrives as well here, perhaps even better, than in its native habitat, not an unusual experience in the redistribution of species; as instances of which may be mentioned the introduction of rabbits in Australia and sparrows and German carp in this country.

The rainbow is adapted to a wider range of conditions than the brook trout, giving it on this account alone a marked advantage over the latter. The breeding or headwater range is much the same, but the rainbow descends to larger and warmer waters not penetrated by the brook trout, where the food conditions are more favorable both as to variety and abundance. The recent appearance of large rainbows in some of the better class of lakes leads to the belief that they will soon be established in such waters in considerable abundance; indeed, it is not improbable that they may attain some commercial importance in connection with the shore fisheries of the upper Great Lakes.

During the past two or three years, some opposition to the further distribution of rainbows in the better class of brook trout waters has developed, and in some instances these objections, it must be acknowledged, are reasonable and timely. So long as the rainbow is confined to its most congenial habitat, the river mouths and lower waters of the larger streams, or suitable lakes—waters for the most part beyond the range of brook trout—it constitutes a valuable and important contribution to our fishery resources.

During the season of 1903, this board distributed the following number of the different kinds of fish:

Brook trout	6,048,000
Rainbow trout	792,000
Lake trout	930,000
Small mouth bass (fry)	204,000
Small mouth bass (fingerlings)	2,500
Large mouth bass (fingerlings)	18,700
Large mouth bass (advanced fry)	676,000
Montana Grayling	200,000
Loch Leven trout	60,000
Wall-eyed pike	30,350,000

The output of 1904 is as follows:

Brook trout	6,037,500
Rainbow trout	721,000
Lake trout	1,647,000
Small mouth bass (fry)	94,000
Small mouth bass (fingerlings)	23,600
Small mouth bass (yearlings)	100
Large mouth bass (advanced fry)	550,000
Large mouth bass (fingerlings)	160,350
Montana Grayling	90,000
Wall-eyed pike	39,675,000

It is doubtful if another state in the Union can show a record equal to the above for the amount appropriated and expended.

There are now six stations under the care of this board, viz.: Detroit, Drayton Plains, Mill Creek, Paris, Harrietta and Sault Ste. Marie stations. Those at Paris and Harrietta are trout hatcheries exclusively; that at Sault Ste. Marie is a combination station for trout, wall-eyed pike and whitefish; Drayton Plains station is for bass exclusively; Mill Creek station is for bass and wall-eyed pike; while the Detroit station is used by the U. S. Fish Commission for hatching whitefish and by this board for hatching wall-eyed pike.

Harrietta station, although new and not yet completed, has been brought to a producing stage. It will require a comparatively small appropriation to make it the largest trout producing hatchery in the United States.

Paris station was established many years ago and the hatchery needs quite extensive repairs. The ponds also need to be repaired and five new ones added. For this work a special appropriation is needed, as will be seen by the estimates herewith submitted.

Michigan now expends $35,000 annually for fish propagation. This is spent in hatching eggs taken from brook trout, rainbow trout, large and small mouth bass, wall-eyed pike, lake trout and other species of food fishes, and distributing the fry among the inland lakes and streams of the State. There are over 1,500 streams now well stocked with brook trout. There are a large number of lakes in which bass, wall-eyed pike, and other varieties of food fish are found in plenty, due wholly to planting by the fish commission.

Notwithstanding we are increasing our output of fish fry and fingerlings each year, we have not kept pace with the growing demand of the people for them. In fact, we are obliged to say that we cannot meet one-half of the demands made upon us, and this is true of every variety of fish propagated. It may be added that this fact causes the board no little trouble and anxiety. It is the policy of the board to serve all applicants alike and it has applied the rule "first come first served," modified by a further rule that an applicant for a second time cannot be served until first applicants have been supplied.

This great and rapidly growing demand for fish planting coming from all parts of the State would seem to be pretty conclusive as to the general desire of the people to continue the benefits of public fish culture.

But there is another feature. It so happens that nearly all of the best food fishes, except the whitefish, are game fish as well. This fact alone makes the work of the State in this direction self-supporting.

With the last stroke of the lumberman's axe, much of the land denuded of pine reverted to the State for delinquent taxes. Revenue from these lands ceased. Running through were rivers, many of which were barren of edible fish. The Michigan Fish Commission began planting them with brook trout and rainbow trout. Today no state in the Union has a higher reputation for its trout streams. As a result the deserted lands along these streams are now being taken off the hands of the State and are again paying taxes. Schools have been built by the settlements which are growing up along these streams. It is quite safe to assert that the taxes upon lands thus again brought into use much more than pay the cost of the entire work of the State Board of Fish Commissioners.

There is yet another practical return for the work of the State. What it amounts to can only be approximated. The Grand Rapids and Indiana Railway officials estimate that over $300,000 is received each year by that road alone from people coming to Michigan to go fishing. Other railroads give like estimates. It would seem certain that those who come to the State spend at least twice as much as the amount paid to railroads among the people while remaining in the State. The money thus attracted into the hands of our own people will thus exceed a million dollars annually. It should be remembered that all this comes not as the object but as incidental to the great work of supplying ourselves with food fish in our own inland waters.

That Michigan stands among the foremost leaders in practical results of fish cultural effort is, we believe, conceded all over the country. In the present successful methods of bass culture it is the pioneer. For the discovery and installation of these methods credit is largely due to the persistent work of Mr. Dwight Lydell, then, as now, overseer of the Mill Creek station, assisted by the late Horace W. Davis.

Of Mr. Davis we can only speak in terms of high respect and deep affection. When the Drayton Plains station was established Mr. Davis was so desirous of its success that he resigned from this board to take personal charge of the work there. His death before this work is completed is a distinct loss to the State.

It is but just to add that whatever success has attended the work of this board is due very largely to the faithful work of our superintendent, secretary and the overseers of the respective hatching stations.

In submitting the estimates of the needs of the work which is entrusted

to our care, we beg to say that they are the result of careful examination in detail and are according to the best judgment of the board, aided by that of its most competent assistants. We believe that the appropriations should be in accord with these estimates.. We invite the most careful scrutiny of our work, including our expenditures, to the end that such appropriations and expenditures for public fish culture shall be made as shall be for the best interests of all the people of the State.

Respectfully submitted,

State Board of Fish Commissioners,

By C. D. JOSLYN, President.

F. B. DICKERSON, Commissioner.

GEORGE M. BROWN, Commissioner,

STATE BOARD OF FISH COMMISSIONERS.

Estimates for appropriation for fiscal years ending June 30, 1906, and June 30, 1907.

CURRENT EXPENSES, YEAR ENDING JUNE 30, 1907.

COMMISSIONERS.

Traveling expenses to attend meetings of the board, to inspect stations and to perform other duties of Commissioners	$1,000 00

SUPERINTENDENT.

Salary	1,800 00
Expenses, traveling, etc	300 00
	$2,100 00

SECRETARY.

Salary	$1,800 00
Travel and subsistence	75 00
	$1,875 00

STATISTICAL AGENT.

Salary	$900 00
Traveling expenses and subsistence	900 00
	$1,800 00

OFFICE OF BOARD.

Rent, 12 months at $70	$840 00
Stenographer and typewriter, 12 months at $40	480 00
Stationery and printing	300 00
Extra help and miscellaneous expenses	250 00
	$1,870 00

PARIS STATION.

Overseer, 12 months at $90	$1,080 00
3 assistants, 12 months each @ $60 per month each	2,160 00
1 assistant, 12 months @ $50	600 00
Temporary labor	400 00
Fish food	600 00
Subsistence of team	150 00
Painting buildings, 12 in all, besides water tank, windmill and outhouses	800 00
Cement floor for 2 hatchery buildings	350 00

Material for new tanks and hatching troughs	$300 00
3 cement bridges across waste ditch	100 00
Other general current repairs and improvements to ponds, raceways, buildings and equipment	200 00
New dray	75 00
Gas engine, for filling water tank and grinding food	125 00
Distribution of fish by messenger	300 00
Distribution of fish by baggage car	300 00
Fuel and lights	200 00
Telephone, telegraph, miscellaneous and incidental	300 00
	$8,040 00

MILL CREEK STATION.

Overseer, 12 months @ $100	$1,200 00
1 assistant, 12 months @ $60 per month	720 00
1 assistant, 8 months @ $50 per month	400 00
Temporary labor	400 00
Fuel and lights	150 00
Fish food	150 00
Distribution of fish by baggage car and messengers	500 00
Collecting stock fish	100 00
Current repairs and improvements to ponds, buildings and equipment	300 00
Subsistence of horse	75 00
Telephone, telegraph, miscellaneous and incidental	300 00
	$4,295 00

DRAYTON PLAINS STATION.

Overseer, 12 months @ $90	$1,080 00
1 assistant, 12 months @ $60	720 00
1 assistant, 8 months @ $50	400 00
Temporary labor	300 00
Collecting brood stock	100 00
Fish food	100 00
Fuel and lights	75 00
Current repairs and improvements to equipment, ponds and buildings	100 00
Distribution of fish by messenger	250 00
Gas engine, pump and piping	350 00
1 horse	150 00
1 platform wagon	40 00
1 buggy	65 00
2 sets harness	35 00
50 steel-clad cans	150 00
Telephone, telegraph, miscellaneous and incidental	200 00
	$4,115 00

HARRIETTA STATION.

Overseer, 12 months @ $90	$1,080 00
1 assistant, 12 months @ $60	720 00
2 assistants, 12 months each @ $50 per month each	1,200 00
Temporary labor	300 00
Fish food	500 00
50 steel-clad cans, @ $3.00	150 00
Distribution of fish by messenger	300 00
Collecting stock fish	300 00
Subsistence of horse	75 00
Current repairs and improvements to equipment and buildings	75 00
Telephone, telegraph, miscellaneous and incidental	200 00
	$4,900 00

SOO STATION.

Overseer, 12 months @ $100.00	$1,200 00
1 assistant, 12 months @ $60	720 00
1 assistant, 12 months @ $50	600 00
Temporary help	200 00
Fuel and lights	350 00
Distribution of trout by messenger	350 00
Collecting stock fish	100 00
Fish food	200 00
Painting buildings, interior and exterior, 2 coats	250 00
Current repairs and improvements to equipment, ponds and buildings	100 00
Collection and distribution of bass from Soo river	600 00
1 assistant for bass work, 12 months, @ $50	600 00
Telephone, telegraph, miscellaneous and incidental	200 00
	$5,470 00

DETROIT STATION.

4 men, 2 months @ $50 per month each	$400 00
2 men, 1 month @ $50 per month each	100 00
Collecting wall-eyed pike eggs	200 00
Expenses of distribution by messenger	100 00
Water rates	50 00
Draying and incidental	100 00
	$950 00

CAR "FONTINALIS."

1 man, 5 months @ $60	$300 00
1 man, 5 months @ $50	250 00
Subsistence of crew	250 00
Expenses of side trips from car	200 00
Fuel and lights	50 00
Telegrams and incidentals	100 00
Current repairs	250 00
Painting	200 00
	$1,600 00
Aquarial exhibits at fairs	$500 00

RECAPITULATION.

Paris Station	$8,040 00
Mill Creek Station	4,295 00
Drayton Plains Station	4,115 00
Harrietta Station	4,900 00
Soo Station	5,470 00
Detroit Station	950 00
Car	1,600 00
Aquarial exhibit at fairs	500 00
Commissioners	1,000 00
Superintendent	2,100 00
Secretary	1,875 00
Statistical Agent	1,800 00
Office of Board	1,870 00
	$38,515 00

CURRENT EXPENSES, YEAR ENDING JUNE 30, 1907.

Commissioners, Superintendent, Secretary, Statistical Agent and office of Board, same as preceding year	$8,645 00

PARIS STATION.

Same as preceding year, less items for painting buildings, cement floors and bridges, new tanks and troughs, dray and gas engine	6,290 00

MILL CREEK STATION.

Same as preceding year	4,295 00

DRAYTON PLAINS STATION.

Same as preceding year, less horse, wagon, buggy, harness, gas engine and 50 cans	3,325 00

HARRIETTA STATION.

Same as preceding year, less 50 cans	4,750 00

SOO STATION.

Same as preceding year, less painting buildings	5,220 00

DETROIT STATION.

Same as preceding year	950 00

CAR.

Same as preceding year, less painting	1,400 00
Aquarial exhibits at fairs	500 00
	$35,375 00
Year ending June 30, 1906	$38,515 00
Year ending June 30, 1907	35,375 00
Total current for 2 years	$73,890 00
Total special for 2 years	11,000 00
Grand total	$84,890 00

SPECIAL.

PARIS STATION.

Series of new ponds above present ponds	$1,000 00

MILL CREEK STATION.

Storage shed	300 00
Wing to hatchery	300 00
Completion of fence around premises	100 00
New ponds	1,300 00
	$2,000 00

DRAYTON PLAINS STATION.

Barn	$350 00
Fence around premises	100 00
New ponds	1,650 00
Payment on land acquired	500 00
	$2,600 00

HARRIETTA STATION.

New fence	$200 00
Additional hatching troughs	100 00
Extension of pond and raceway system	2,900 00
	$3,200 00

SOO STATION.

3 new ponds, with flumes and grading complete	$900 00
Land for bass work	300 00
Dock, storehouse and bass equipment	500 00
Boat house for launch	200 00
Lighter, 12x40, for conveying materials to and from station and depot	300 00
	$2,200 00

RECAPITULATION, SPECIAL.

Paris Station	$1,000 00
Mill Creek Station	2,000 00
Drayton Plains Station	2,600 00
Harrietta Station	3,200 00
Soo Station	2,200 00
	$11,000 00
Current expenses, for fiscal year ending June 30, 1906	38,515 00
Current expenses, for fiscal year ending June 30, 1907	35,375 00
Grand total	$84,890 00

FISH PLANTS

1903-1904.

Report of Statistical Agent, Financial Statement, and Inventory.

Brook Trout Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
Boyne River	Elmira	W. B. Stimson	April 13	20,000
Jordan river	Warner	James Deevy	April 4	20,000
Cedar river	Bellaire	H. L. Brady	Mar. 28	20,000
Coulter creek	Echo	John Boosinger	Mar. 28	2,000
Stevens creek	Chestonia	John Boosinger	Mar. 28	4,000
Mill creek	Jordan	John Boosinger	Mar. 28	4,000
Green river	Chestonia	Darre and Goodman	Mar. 28	4,000
Bennett creek	Echo	J. A. Boosinger	Mar. 28	6,000
Green river	Chestonia	J. A. Boosinger	Mar. 28	6,000
Cold creek	Custer and Helena	H. L. Brady	Mar. 28	16 000
Benway creek	Banks	J. C. Baker	Mar. 28	2,000
Ogletree, N. Br. of Ogletree and Burdick creeks	Central Lake	John Muckle	Mar. 28	10,000
Cady creek	Central Lake	Carl Strochel	Mar. 28	4,000
Wood creek	Banks	F. M. Parks	Mar. 28	2,000
Dyer creek	Banks	W. J. Crego	Mar. 28	4,000
Beals creek	Echo	Asa M. Beal	Mar. 28	2,000
McAllister creek	Echo	W. H. McAllister	Mar. 28	2,000
Burdick creek	Central Lake	W. F. Carpenter	Mar. 28	6,000
White creek	Kearney	F. M. Fisk	Mas. 28	6,000
Boss creek, No. 2	Banks	H. W. Madill	Mar. 28	4,000
Boss creek No. 1	Banks	H. W. Madill	Mar. 28	2,000
St. Clair creek	Banks	L. Van Skiver	Mar. 28	4,000
Town Line creek	Banks	J. L. Pelton	Mar. 28	4,000
King creek	Banks	W. J. Crego	Mar. 28	4,000
Jordan river	Several	E. Goodman	Mar. 28	24 000
Orr creek	Banks	H. W. Madill	Mar. 28	4,000
Dufore creek	Banks	C. S. Cambell	Mar. 28	4,000
Campbell creek		C. S. Campbell	Mar. 28	4,000
Town Line creek	Banks and Central Lake	W. F. Carpenter	Mar. 28	4,000
Fish brook	Kearney	F. M. Fisk	Mar. 28	4,000
Stream on Secs. 26 and 27	Forest Home	Wm. S. Gardner	Mar. 28	4,000
Wood creek	Banks	E. R. Harris	Mar. 28	2,000
Spring creek	Banks	J. E. Campbell	Mar. 28	4,000
Alpena county:				
Silver creek		W. B. Dobson	Mar. 30	6,000
Norwegian creek		W. B. Dobson	Mar. 30	2,000
Little Wolf creek		W. B. Dobson	Mar. 30	8,000
Mc. Gean creek		W. B. Dobson	Mar. 30	6,000
Wild Cat creek		W. B. Dobson	Mar. 30	8,000
Bolton creek	Several	C. W. Edwards	Mar. 30	20,000
Arenac county:				
Gilbert creek	19 N. 4 E.	D. H. McDonnell	Mar. 30	4,000
Big creek	Mason and others	D. H. McDonnell	Mar. 30	6,000
May creek	20 N. 4 E.	D. H. McDonnell	Mar. 30	4,000
Lynch creek	20 N. 4 E.	D. H. McDonnell	Mar. 30	4,000
Loser creek	20 N. 4 E.	D. H. McDonnell	Mar. 30	4.000
Stream on Secs. 24 19, 25, 36 and 1	Deep River	Nelson Deford	Mar. 30	4,000
Murphy creek	Clayton	Nelson Deford	Mar. 30	4,000
Stream on Secs 26, 35 and 36	Clayton	Nelson Deford	Mar. 30	2,000
Cedar creek	Turner	Jos. Chikey	Mar. 30	8,000
Cedar creek	Mason	R. J. Spofford	Mar. 30	8,000
Lincoln creek	Deep River	F. E. Abbott	April 7	2,000
Osterhout creek	Deep River	F. E. Abbott	April 7	4,000
N. Br. of Pine river	Adams and Deep River	F. E. Abbott	April 7	6,000
Wells creek	Moffat	F. E. Abbott	April 7	4,000
Alger county:				
Chappel river	Munising	Timothy Killean	April 7	6,000
Au Train river	Au Train	H. R. Harris	April 20	8,000
Sable creek	Forsythe	H. R. Harris	April 20	4,000
Anna river	Au Train	A. Christoferson	April 20	14,000
Three small lakes	46 N. 20 W.	A. Christoferson	April 20	4,000
Slapniek creek	Limestone	H. R. Harris	April 20	8,000
Whitefish river	Onota	H. R. Harris	April 20	8,000
Sucker creek	Burt	H. E. Carpenter	April 20	14,000
Alcona county:				
Sucker creek		W. B. Dobson	Mar. 30	6,000
Indian creek	Mitchell and Ossineke	Richard Collins	Mar. 30	16,000
Buff creek	Millen	Richard Collins	Mar. 30	6,000
Buff Brown creek	Hawes and Millen	L. A. Colwell	Mar. 30	6,000
Pine river	Gustin and others	L. A. Colwell	Mar. 30	16,000
W. Branch brook	Hawes and Mitchell	L. A. Colwell	Mar. 30	12,000
Mill creek	Harrisville	L. A. Colwell	Mar. 30	4,000

Brook Trout Plants, 1903—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Bear and Sand creeks	Heath and Monterey	Phil M. Grice	Feb. 17	6,000
Silver Creek	Heath	Chas. N. McDuffie	Feb. 17	6,000
Pine creek	Otsego	J. N. Perkins	Feb. 17	4,000
Silver creek	Gun Plains and Prairieville	A. A. Mansfield	Feb. 17	4,000
Kent creek	Watson	E. E. Pratt	Feb. 17	2,000
Delano creek	Gun Plains	E. W. Sherwood	Feb. 17	2,000
Nigger creek	Otsego and Alamo	Fred. Tubbs	Feb. 17	4,000
Yerrick creek	Alamo	Claud Carpenter	Feb. 17	2,000
Wing's creek	Otsego	Fred Tubbs	Feb. 17	2,000
Henry's creek	Alamo	C. F. Rathbun	Feb. 17	4,000
Mac Lelland's creek	Cheshire	Carl Tyman	Feb. 17	2,000
Bear creek	Heath	R. C. Eisley	Mar. 2	4,000
Duncan creek	Gun Plains	Ed. J. Anderson	Mar. 16	2,000
Butternut creek	Watson	J. C. Campbell	Mar. 16	2,000
Silver, Abrams and Brown's creeks	Gun Plains and Alamo	J. C. Campbell	Mar. 16	6,000
Green Lake stream	Leighton	Chas. Babbitt	Mar. 16	4,000
Branch county:				
Hog creek	Union	L. E. Larkin	Mar. 3	4,000
Dunk's creek	Sherwood	W. H. Hubbard	Mar. 3	2,000
Spencer brook	Sherwood	Boyd Miller	Mar. 9	4,000
Spencer brook	Sherwood	F. H. Mather	Mar. 9	4,000
Staniold creek	Sherwood	Chas. Z. Fox	Mar. 9	2,000
Spencer brook	Sherwood	Daniel Fox	Mar. 9	4,000
Ogden's creek	Kinderhook	T. E. Bushnell	Mar. 9	2,000
Girard creek	Girard	M. F. Morgan	Mar. 16	2,000
Allen's creek	Coldwater	H. E. Warner	Mar. 16	2,000
Batavia creek	Batavia	C. D. Warner	Mar. 16	2,000
Benzie county:				
Platte river	Almira and others	F. A. Mitchell	Mar. 25	12,000
Stream on Secs. 10, 12 and 22	Almira	Geo. H. Linhlettes	Mar. 25	4,000
South Branch	Platte	N. E. Degen	Mar. 25	4,000
Upper Herring creek and tributaries	Blain and Joyfield	N. A. Parker	Mar. 25	6,000
N. Br. of Platte river	Platte	Peter Slormer	Mar. 25	4,000
Otter creek	Lake	James Daly	Mar. 25	4,000
Gilmore creek	Lake	James Daly	Mar. 25	2,000
Betsey river	Thompsonville	J. J. Kirby	April 18	30,000
Platte river	Beulah	J. J. Kirby	April 18	30 000
Herring creek	Frankfort	J. J. Kirby	April 18	45,000
Baraga county:				
Fence River	Spurr	Duncan M. Miller	April 24	4,000
Sturgeon creek	L'Anse	J. E. Pepple	April 24	10,000
Spurr creek and Three Lakes	Spurr	Geo. L. Maker	April 24	2,000
Ogemaw creek	L'Anse	Alex. Martin	April 28	8,000
Clear creek	Baraga	Alex. Martin	April 28	8,000
W. Br. of Otter creek	Baraga	Alex. Martin	April 28	8,000
Silver river	L'Anse	C. P. Blankenhorn	April 28	8,000
Six Mile creek	Baraga	Alex. Martin	April 28	8,000
Barry county:				
Fish creek	Orangeville	J. N. Perkins	Feb. 17	4,000
Coldwater creek	Woodland	W. L. Glick	Feb. 17	6,000
Bullhead run	Carleton and Irving	W. L. Glick	Feb. 14	2,000
Cane creek	Irving and Brown	W. L. Glick	Feb. 14	2,000
Spring creek	Irving	W. L. Glick	Feb. 14	4,000
No name	Assyria	N. A. Beardslee	Mar. 7	2,000
Seven Mile brook	Bedford and Battle Creek	Geo. H. Williams	Mar. 7	4,000
Crooked brook	Assyria	V. H. Bramble	Mar. 7	2,000
Ellis brook	Assyria	V. H. Bramble	Mar. 7	2,000
McKee creek	Hope	B. M. Jenkins	Mar. 7	2,000
Jenkins creek	Hope	Edgar Otis	Mar. 7	2,000
No name	Rutland	Chas. A. Newland	Mar. 7	2,000
Fall creek	Hope and Hastings	Jonas A. Hall	Mar. 7	4,000
Gull creek		Chas. S. Barber	Mar. 7	2,000
Mill brook	Johnston	F. R. Pancoast	Mar. 9	2,000
Gesler creek	Hope and Baltimore	F. R. Pancoast	Mar. 9	2,000
Crosses' fish farm	Baltimore	Irving Philips	Mar. 9	2,000
Week's creek	Baltimore	Irving Philips	Mar. 9	2,000
Pritchard creek	Baltimore	Irving Philips	Mar. 9	2,000
Bentley creek	Rutland	Ira Baldwin	Mar 9	2,000
McCollom creek	Hope	F. R. Pancoast	Mar. 9	2,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Berrien county:				
Estis creek		Harry Rough	Mar. 2	2,000
S. Br. of Galien river	Galien	Chas. A. Clark	Mar. 2	4,000
Hitchcock brook	Weesaw	Eugene Hill	Mar. 2	2,000
Willow creek	Benton and St. Joseph	Geo. B. Thayer	Mar. 2	4,000
Sand creek	Benton	Geo. B. Thayer	Mar. 2	2,000
Little Blue creek	Bainbridge	Geo. B. Thayer	Mar. 2	2,000
Yellow creek	Benton	Geo. B Thayer	Mar. 2	2,000
Spring creek	Pipestone	Dr. A. C. Rickenburger	Mar. 2	4,000
Little brook	Berrien	A. J. Ridenour	Mar. 2	2,000
Farmer creek	Pipestone	A. J. Ridenour	Mar. 2	2,000
Bakeman brook	Pipestone	W. E. Lewis	Mar. 2	2,000
Wolf creek	Pipestone	W. E. Lewis	Mar. 2	2,000
Nostrant creek	Pipestone	W. E. Lewis	Mar. 3	2,000
Fall creek	Hope	E. B. Gates	Mar. 7	6,000
Clare county:				
Shingle creek	Lake George	J. J. Kirby	Feb. 23	9,000
Little Norway creek	Temple	J. J. Kirby	Feb. 23	15,000
Gishwash creek	Temple		Feb. 23	9,000
Little Norway creek	Redding	Harry Crill	Feb. 23	6,000
Gishwash creek	Redding	Harry Crill	Feb. 23	6,000
Green creek	Greenwood and Redding	K. C. Couch	Feb. 23	6,000
Chippewa county:				
Caribou creek	Detour	W. D. Hitchcock	April 18	10,000
East branch of Taquemenon river	Trout Lake	Chase S. Osborne	April 20	8,000
South branch of Charlotte river	Bruce	James Morrow	May 2	10,000
Albany Island trout stream	41 N. 3 E.	Leroy N. Hill	May 6	14,000
Clinton county:				
Fuller creek	Dallis	J. B. Miller	Mar. 12	4,000
Day Harsh creek	Essex	John Brownell	Mar. 12	4,000
Outlet of Muskrat lake	Olive	Frank Baumgardner	Mar. 12	4,000
Cass county:				
Christian creek	Penn, Calvin and Mason	James L. Odell	Mar. 3	8,000
James creek	Penn	A. N. Armstrong	Mar. 3	2,000
Stream on Secs. 29, 30 and 31	La Grange and Pokagon	R. W. Hain	Mar. 3	2,000
Shaw's creek	Jefferson and Howard	C. H. Kimmerle	Mar. 3	6,000
Centennial Mills creek	Jefferson and La Grange	C. H. Kimmerle	Mar. 3	4,000
Mechanicsburg creek	La Grange	C. H. Kimmerle	Mar. 3	2,000
Hampton's creek	Wayne	August Anderson	Mar. 3	2,000
Gage's creek	Wayne	David Van Hise	Mar. 3	2,000
Kinney's creek	Wayne	F. H Codding	Mar. 3	2,000
Glenwood creek	Wayne	F. H. Codding	Mar. 3	4,000
Miller's creek	Pokagon	B. A. Vrooman	Mar. 3	2,000
Spring creek	Wayne	James E. McOmber	Mar. 3	2,000
Tryon's creek	Wayne	Jerry Mosher	Mar. 3	2,000
Pokagon creek	Pokagon	Lester C. Willis	Mar. 3	6,000
No name	Porter	G. W. Eby	Mar. 3	4,000
Rock river or Big creek	Marcellus	Dr. C. R. Scott	Mar. 16	4,000
Rocky river	Marcellus	C. S. Jones	Mar. 16	4,000
Calhoun county:				
Alder brook	Newton	T. H. Whiting	Mar. 3	2,000
Parson's creek	Burlington and Union	Frank Whiting	Mar. 3	4,000
Lucas creek	Burlington and Union	H. T. Carpenter	Mar. 3	2,000
Richardson creek	Leroy	E. A Burns	Mar. 3	2,000
Warsop brook	Athens	Joseph Warsop	Mar. 3	2,000
Love's creek	Burlington and Newton	Morris Jones	Mar. 3	2,000
Smith's brook	Leroy	J. W. McCaslin	Mar. 3	4,000
Pigeon and Talmadge brook	Marshall	J. F. Garwood	Mar. 7	4,000
Hamlin's creek	Bedford	Fred D. Hall	Mar. 7	2,000
Talmadge creek	Fredonia	Earl L. Holmes	Mar. 7	2,000
Helmer's creek	Battle Creek	Fred D. Hall	Mar. 7	2,000
No name	Battle Creek	Fred D. Hall	Mar. 7	2,000
Graham brook	Newton	Dr. F. L. Hoffman	Mar. 7	4,000
Cummings brook	Battle Creek	Dr. F. L. Hoffman	Mar. 7	2,000
Hall Lake brook	Emmet	S. R. Rathbun	Mar. 7	2,000
Outlet of Pearl lake	Emmet	S. R. Rathbun	Mar. 7	2,000
Hamilton lake inlet	Bedford	Geo. D. Allen	Mar. 7	2,000
No name	Bedford	Geo. D. Allen	Mar. 7	2,000
No name	Bedford	Geo. D. Allen	Mar. 7	2,000
Minge's brook	Battle Creek	Edw. E. Weldy	Mar. 7	4,000
Crooked brook and others	Battle Creek and Penfield	F. H. Skinner	Mar. 7	4,000
Seven Mile brook	Bedford	E. Price Mayo	Mar. 7	4,000
Dickerson creek	Emmet	J. H. Knight	Mar. 7	4,000
Gulf brook	Emmet	J. H. Knight	Mar. 7	2,000
Hart lake inlet	Leroy	C. R. Newman	Mar. 7	2,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Calhoun county.—*Continued:*				
Holmes brook	Battle Creek	Sam O. Hewes	Mar. 7	2,000
No name	Convis	Geo. H. Williams	Mar. 7	2,000
Pigeon creek	Marshall	V. H. Bramble	Mar. 7	4,000
Spring brook	Battle Creek	S. W. Moody	Mar. 7	2,000
Up. Pine creek	Leroy	S. W. Moody	Mar. 7	4,000
No name	Battle Creek and Emmet	S. W. Moody	Mar. 7	2,000
No name	Battle Creek and Emmet	S. W. Moody	Mar. 7	2,000
Crooked brook	Pennfield	S. W. Moody	Mar. 7	2,000
Seven Mile creek	Bedford	F. C. Frazier	Mar. 7	4,000
Austin creek	Battle Creek	B. N. Beedon	Mar 7	2,000
Parson's creek	Burlington	Morris Jones	Mar. 7	2,000
Corey creek	Leroy	M. S. Emmons	Mar. 9	4,000
Shannon creek	Leroy	Fred. S. Hall	Mar. 9	4,000
Putnam creek	Athens and Leroy	David R. Rishel	Mar. 9	4,000
Notaway creek	Athens	R. A. Snyder	Mar. 9	6,000
Crawford county:				
Sauble river	Frederick	John D. Brown	April 7	20,000
Au Sable river	Frederick	Andrew Brown	April 7	20,000
E. Br. of Au Sable	Grayling	J. P. Marks	April 16	30,000
Cheboygan county:				
Welch's creek	Forest	J. M. Clark	April 2	8,000
McPherson's creek	Forest	J. M. Clark	April 2	4,000
Bowen's creek	Forest	J. M. Clark	April 2	4,000
Chandler creek	Forest	J. M. Clark	April 2	6,000
Stewart's creek	Waverly	J. M. Clark	April 2	4,000
Mill creek	Mackinaw	W. E. Robinson	April 7	12,000
Little Pigeon river	Nunda and Ellis	B. F. Butler	April 7	8,000
Sturgeon river	Mentor	C. E. Haak	April 7	20,000
E. Br. of Little Pigeon river	Koehler	J. N. Lester	April 9	4,000
Twin lake	Koehler	J. N. Lester	April 9	2,000
E. Br. Little Sturgeon river	Tuscarora	J. N. Lester	April 9	6,000
Cedar creek	Tuscarora	J. N. Lester	April 9	2,000
Stony creek	Tuscarora	J. N. Lester	April 9	6,000
Little Pigeon river	Burt	Wm. E. Shoemaker	April 9	10,000
Mud creek	Hebron	Wm. E. Shoemaker	April 9	6,000
Meyer creek	Benton	Wm. E. Shoemaker	Apri 9	12,000
Lapareil creek	Inverness	Wm. E. Shoemaker	April 9	12,000
Sturgeon river and tributaries	Tuscarora and others	V. D. Sprague	April 9	28,000
Lower Little Pigeon river	Koehler and Ellis	M. A. McHenry	April 9	12,000
Big Sturgeon river	Tuscarora and others	H. R. Field	April 9	20,000
Charlevoix county:				
Darre creek	South Arm and East Jordan	Darre & Goodman	Mar. 28	8,000
Newman creek	Marvin	R. W. Paddock	Mar. 28	6,000
Inwood creek	Norwood	A. L. Coulter	Mar. 28	4,000
Horton's creek	Hayes	Frank Chaloupka	Mar. 28	8,000
McGee's creek	Marvin	Frank Chaloupka	Mar. 28	4,000
Deer creek	Boyne Valley	J. A. Boosinger	Mar 28	6,000
Bennett creek	South Arm	J. A. Boosinger	Mar. 28	4,000
Monroe creek	South Arm and Eveline	J. A. Boosinger	Mar. 28	6,000
King creek	South Arm	E. R. Harris	Mar. 28	2,000
Findley creek	Boyne Valley	J. L. A. Galster	April 4	4,000
Boyne river	Boyne Valley	J. L. A. Galster	April 4	16,000
Jordan river	Boyne Valley	John Boosinger	April 4	50,000
Bear river	Clarion	W. B. Stimson	May 4	30,000
Clare county:				
Cranberry creek	Surrey	E. M. Dennis	Mar. 20	2,000
Elm creek	Surrey	J. L. Littlefield	Mar. 20	4,000
Spring brook	Surrey	J. L. Littlefield	Mar. 20	4,000
Littlefield creek	Surrey	J. L. Littlefield	Mar. 20	4,000
McKinley creek	Sheridan	F. C. Sanford	Mar. 20	6,000
Middle branch of Tobacco river	Several	J. H. Galliver	Mar. 20	6,000
South branch of Tobacco river	Several	J. H. Galliver	Mar. 20	6,000
Clear creek	Grant	O. S. Derby	Mar 20	4,000
Middle branch of Cedar river	Hamilton	Arthur Long	Mar. 20	6,000
Stream on Secs. 3 and 4	Hamilton	Arthur Long	Mar. 20	2,000
Popple creek	Franklin	S. W. Sly	Mar. 20	4,000
No name	Hamilton	R. W. Fenton	Mar. 20	2,000
Cedar creek	Franklin and Hamilton	W. E. Green	Mar. 20	10,000
Smith creek	Greenwood and Summerfield			
North branch of Floodwood creek	Summerfield	Geo. J. Cummins	Mar. 20	4,000
Joss creek	Hayes	Geo. J. Cummins	Mar. 20	4,000
Shingle lake creek	Lincoln	E. F. Wilson	Mar. 20	8,000
Middle branch of Cedar river	Hamilton	Lafayette Stanton	Mar. 20	4,000
		Ellsworth Eldredge	April 7	6,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Dickinson county:				
West branch Sturgeon river	Sagola	S. McGaughey	April 24	8,000
Waterworks creek	Norway	R. M. Sampson	April 9	4,000
Fern creek	Norway	R. M. Sampson	April 9	4,000
Gravel creek	Norway and Breen	R. M. Sampson	April 9	2,000
Cassiday creek	Norway and Breen	R. M. Sampson	April 9	4,000
Pine creek	Norway and Breitung	R. M. Sampson	April 9	4,000
North branch of Cassidy creek	Waucedah	E. N. Kraemer	April 9	6,000
Breen creek	Waucedah	E. N. Kraemer	April 9	6,000
Porcupine creek	Breitung	Geo. F. Sebert	April 22	4,000
Merryman creek	Breitung	R. C. Browning	April 22	4,000
Browning's lake	Felch	R. C. Browning	April 22	2,000
Pine lake	Felch and Breitung	W. H. Revin	April 22	4,000
Eaton county:				
Spring brook	Hamilton and Parma	E. R. Britton	Mar. 9	6,000
Maple river	Center	Belding Hall Mfg. Co.	April 4	50,000
Emmet county:				
Big Sucker creek	Bliss	A. B. Klise	April 4	6,000
Collins creek	Bliss	A. B. Klise	April 4	4,000
Carp river	Carp Lake	O. C. Cope	April 4	10,000
Minnehaha river	Petoskey	W. B. Stimson	April 12	25,000
Shiames creek	Oden	W. B. Stimson	April 12	15,000
Maple river	Pellston	W. B. Stimson	April 12	70,000
Carp river	Carp Lake	W. B. Stimson	April 12	20,000
Creek on Secs. 1 and 13	Little Traverse	W. L. Curtis	April 20	8,000
Creek on Secs. 1 and 18	Littlefield	W. L. Curtis	April 20	8,000
Gladwin county:				
McNella creek	Sage	F. L. Prindle	April 7	4,000
Howland creek	Grant	F. L. Prindle	April 7	4,000
Busch creek	Sage	F. L. Prindle	April 7	4,000
Gogebic county:				
Little Coon creek	Ironwood	R. D. Brown	April 17	4,000
Spring creek	Ironwood	John G. Beck	April 17	4,000
Summers creek	Ironwood	John G. Gooville	April 17	2,000
Sutherland creek	Ironwood	A. H. Thomas, M. D.	April 17	4,000
Birch creek	Ironwood	Chas. Hunn	April 17	2,000
Triplett's creek	Ironwood	Norman W. Haire	April 17	4,000
Beech creek	Ironwood	Norman W. Haire	April 17	4,000
Runstrom creek	Ironwood	C. E. Erickson	April 17	4,000
Maple creek	Ironwood	Robt. A. Douglas	April 17	4,000
Stream on Secs. 34, 35, 36 and 37	Ironwood	Robt. A. Douglass	April 17	6,000
East branch of Ontonagon river	Watersmeet	J. R. Moore	April 17	8,000
Birch creek	Ironwood	James Devay	April 17	4,000
Williams' creek	Ironwood	C. Nelson	April 17	4,000
Curry creek	Ironwood	Geo. A. Curry	April 17	4,000
Beck's creek	Ironwood	R. Sullivan	April 17	4,000
Maple creek	Ironwood	C. H. Mullen	April 17	2,000
Norris creek	Ironwood	C. H. Mullen	April 17	4,000
Ryan's creek	Ironwood	Jas. Thomas	April 17	2,000
Walstrom's creek	Ironwood	S. H. Wilbur	April 17	2,000
Hough creek	Ironwood	David S. Foley	April 17	2,000
Mill creek	Bessemer	David S. Foley	April 17	4,000
Wright's creek	Ironwood	D. F. Stabler	April 17	6,000
Cedar creek	Ironwood	D. F. Stabler	April 17	4,000
Welch creek	Ironwood	D. F. Stabler	April 17	4,000
Carter's creek	Ironwood	D. G. Hough	April 17	2,000
Poplar creek	Ironwood	D. G. Hough	April 17	4,000
Lindsay creek	Ironwood	D. G. Hough	April 17	2,000
Seaman's creek	Ironwood	D. G. Hough	April 17	6,000
East branch of Silver creek	Ironwood	Max Stevens	April 17	4,000
Clear creek	Ironwood	Max Stevens	April 17	4,000
Spring brook	Ironwood	Max Stevens	April 17	4,000
Norrie creek	Ironwood	Max Stevens	April 17	4,000
Guysrs creek	Bessemer	J. A. Vogthlin	April 17	2,000
Powder Mill creek	Bessemer	J. A. Vogthlin	April 17	4,000
Little Black river	Wakefield	Glanville B. Labb	April 17	4'000
Ross creek	Bessemer	Capt. J. F. Finnigen	April 17	2,000
Black river	Bessemer and Ironwood	Capt. J. F. Finnigen	April 17	8,000
Thayer creek	Watersmeet	A. D. Johnston	April 22	4,000
Henderson creek	Watersmeet	A. D. Johnston	April 22	6,000
Crooked creek	Watersmeet	A. D. Johnston	April 22	6,000
Morrison Creek	Watersmeet	A. D. Johnston	April 22	2,000
Slate river	Watersmeet	A. D. Johnston	April 22	10,000
Camp Two creek	Watersmeet	A. D. Johnston	April 22	4,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Grand Traverse county:				
No name	Green Lake	Ora Van Tassel	Mar. 23	2,000
No name	Green Lake	Ora Van Tassel	Mar. 23	2,000
Watson creek	Whitewater	Geo. White	Mar. 23	8,000
Boardman river	Whitewater	Frank Lydell	Mar. 23	16,000
Ulba creek	Acme	F. S. Wilson	Mar. 23	6,000
Boardman river	Blaine and Garfield	R. S. Hastings	Mar. 27	22,000
Boardman river	Traverse	Fred. D. Curtis	Mar. 27	16,000
Biddlecomb creek	Paradise	Fred. D. Curtis	Mar. 27	6,000
Whitewater creek	Whitewater	Fred. D. Curtis	Mar. 27	4,000
Acme creek	Whitewater and Acme	Fred. D. Curtis	Mar. 27	4,000
Sparling brook	Fife Lake	R. B. De France	Mar. 27	6,000
Bancroft creek	Fife Lake	R. B. De France	Mar. 27	6,000
Brownson creek	Paradise	R. B. De France	Mar. 27	4,000
Taferers creek	Paradise	R. B. De France	Mar. 27	6,000
Swanston creek	Paradise	Earl J. Case	Mar. 27	4,000
Burkis creek	Paradise	Earl J. Case	Mar. 27	4,000
High Bank creek	Paradise	Earl J. Case	Mar. 27	2,000
East or south branch of Mayfield creek	Paradise	Case & Croster	Mar. 27	4,000
North branch of Mayfield creek	Paradise	Case & Croster	Mar. 27	4,000
Saxton creek	Paradise	Case & Croster	Mar. 27	4,000
Mayfield creek	Paradise	Case & Croster	Mar. 27	6,000
East Brook creek	Paradise	Case & Croster	Mar. 27	6,000
Davenport	Mayfield	Case & Croster	Mar 27	4,000
East creek	Paradise	Frank Taylor	Mar. 27	12,000
Boardman river	Paradise and Union	Frank Taylor	Mar. 27	12,000
Genesee county:				
Swartz creek	Fenton	J. Max Davis	Mar. 12	8,000
Branch of Armstrong creek	Flushing	C. E. Williams	Mar. 12	2,000
Armstrong creek	Flushing and Montrose	C. E. Williams	Mar. 12	2,000
Brent Run	Flint and others	C. W. Barber	Mar. 12	6,000
Hillsdale county:				
Head of Raisin river	Somerset	John Van Allen	Mar. 9	4,000
Webster creek	Somerset	John Van Allen	Mar. 9	4,000
Branch of Kalamazoo river	Moscow	Thomas Tyron	Mar. 9	4,000
No name	Pittsford and Jefferson	P. E. Berger	Mar. 9	4,000
St. Joseph river and tributaries	Pittsford and Jefferson	S. E. Cook	Mar. 9	4,000
Houghton county:				
Smith's creek	Duncan	Wm. Kroll	April 24	8,000
White creek	Duncan	Wm. Kroll	April 24	4,000
Arnold creek	Duncan	Wm. Kroll	April 24	4,000
Shane creek	Duncan	Wm. Kroll	April 24	4,000
Stony creek	Duncan	Wm. Kroll	April 24	4,000
Beaver creek	Duncan	Wm. Kroll	April 24	4,000
Spargo creek	Duncan	Wm. Kroll	April 24	2,000
Jumbo creek	Duncan	Wm. Kroll	April 24	4,000
Hill creek	Duncan	H. C. Stewart	April 24	4,000
Boycroft creek	Duncan	H. C. Stewart	April 24	2,000
Sidnaw creek	Duncan	H. C. Stewart	April 24	2,000
Misery river	Elm River	W. J. Sender	April 28	10,000
Elm river	Adams	W. J. Sender	April 28	10,000
Graverat creek	Hancock	W. J. Sender	April 28	10,000
Sleeping river	Elm River	W. J. Sender	April 28	12 000
Salmon Trout river	Adams	E. H. Wright	April 28	10,000
Northwest branch of Otter river	Elm river	E. H. Wright	April 28	4,000
Breeman creek	Laird	E. H. Wright	April 28	4,000
North branch of Cole's creek	Hancock	H. G. Major	April 28	4,000
Trap Rock river	Calumet	L. M. Rutledge	April 28	4,000
Pike river	Chassell and Portage	R. R. Goodell	April 28	8,000
Otter river	Sunday	E. L. Power	April 28	8,000
Griemen creek	Laird	J. W. Alston	April 28	4,000
Alston creek	Laird	J. W. Alston	April 28	6,000
Oskais creek	Hancock	C. D. Shelden	April 28	6,000
Silver river	Laird	C. D. Sheldon	April 28	8,000
West branch of Pilgrim river	Portage	G. W. Williams	April 28	6,000
West branch of Otter river	Portage	A. J. Whitford	April 28	8,000
East branch of Sleeping river	Elm river	E. Pummerville	April 28	4,000
Coles creek	Adams and Hancock	E. Pummerville	April 28	4,000
Six Mile creek	Portage	H. G. Major	April 28	6,000
Perch creek	Several	D. D. Randall	April 28	8,000
Huron county:				
Allen creek	Sand Beach	Matthew D. Wagner	Mar. 18	16,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Isabella county:				
Ellis creek	Coldwater	J. D. Cameron	Feb. 11	3,000
Clear creek	Wise	Geo. L. Granger	Feb. 23	4,000
Fordyce creek	Gilmore and Nottaway	Geo. L. Granger	Feb. 23	4,000
Rocky creek	Deerfield	Geo. L. Granger	Feb. 23	4,000
Sibley creek	Isabella and Denver	Geo. L. Granger	Feb. 23	6,000
Paradise creek	Wise	Geo. L. Granger	Feb. 23	4,000
Hersey creek	Vernon and Wise	Geo. L. Granger	Feb. 23	6,000
Northern creek	Vernon and Wise	Geo. L. Granger	Feb. 23	6,000
Wickinhiser creek	Nottaway	Geo. L. Granger	Feb. 23	4,000
Russell creek	Vernon	Robt. M. Mussell	Mar. 20	2,000
Ingham county:				
Baldwin brook	Onondaga	Grove H. Wolcott	Mar. 30	2,000
Iosco county:				
Johnson creek	Burleigh	F. Duplantz	Mar. 30	8,000
Whitney creek	Burleigh	F. Duplantz	Mar. 30	4,000
Porterfield creek	Burleigh	F. Duplantz	Mar. 30	4,000
West branch of Au Gres river	Burleigh	F. Duplantz	Mar. 30	10,000
Iron county:				
Holmes creek	Crystal Falls	A. L. Flewelling	April 9	6,000
Deer river	Crystal Falls	A. L. Flewelling	April 9	6,000
Hemlock creek	Hematite	A. L. Flewelling	April 9	6,000
Briar Hill creek	Crystal Falls	A. L. Flewelling	April 9	2,000
Nash's creek	Iron River	I. W. Byers	April 22	4,000
Baker's creek	Stambaugh	I. W. Byers	April 22	2,000
Sunset Lake creek	Iron River	I. W. Byers	April 22	4,000
Kidney lake	Bates	John Melin	April 24	10,000
Dead river	Republic	D. D. Randall	April 28	2,000
Artificial Spring lake	Bates	D. D. Randall	April 28	8,000
East branch of Ontonagon river	Bates	D. D. Randall	April 28	16,000
Golden and Holmes creek, tributary to Paint river	Bates	D. D. Randall	April 28	8,000
Ionia county:				
Duck creek	Campbell and Bowne	G. G. Glick	Mar. 14	4,000
Taylor creek	Campbell and Bowne	G. G. Glick	Mar. 14	4,000
Messer creek	Campbell and Carleton	G. G. Glick	Mar. 14	2,000
East creek	Ionia	Robert Beard	Mar. 17	4,000
Mill creek	Boston	J. Wallington	Mar. 12	2,000
Church creek	Boston	J. Wallington	Mar. 12	2,000
Church creek	Boston	J. Wallington	Mar. 12	2,000
Timberland creek	Easton	J. Wallington	Mar. 12	2,000
Kimball creek	Easton	J. Wallington	Mar. 12	2,000
Cedar creek	Easton	J. Wallington	Mar. 12	2,000
Dexter creek	Easton	J. Wallington	Mar. 12	2,000
Miltenberg creek	Boston	J. Wallington	Mar. 12	2,000
Stevens creek	Keene	J. Wallington	Mar. 12	2,000
Randy Mouks creek	Keene	J. Wallington	Mar. 12	2,000
Pearsall creek	Keene	J. Wallington	Mar. 12	2,000
Hunt creek	Berlin	J. Wallington	Mar. 12	2,000
Williams creek	Kent and others	H. Compton	Mar. 12	2,000
Brown brook	North Plains	Hiram M. Brown	Mar. 12	4,000
Struble, Lost, McVeigh and Hole creeks	Lyons and Lebanon	James Davarn	Mar. 12	2,000
Williams creek	Kent and Otisco	H. Compton	Mar. 12	4,000
Vanderbrook brook	Keene	H. Compton	Mar. 30	4,000
Bowen brook	Keene	H. Compton	Mar. 30	2,000
Stocking and Cannon's creeks	Otisco	H. Compton	Mar. 30	2,000
Weter Spring brook	Otisco	L. E. Green	April 3	8,000
Timberland creek	Easton	C. M. Wise	April 3	2,000
		Samuel Stowell	April 3	6,000
Jackson county:				
No name	Spring Arbor	W. H. King	Mar. 3	4,000
North branch of Kalamazoo river	Concord	F. McKenzie	Mar. 3	6,000
Stream on Secs. 27 and 22	Leoni	E. A. Croman	Mar. 7	2,000
Willow or Collins creek	Grass Lake	E. A. Croman	Mar. 9	4,000
Kalamazoo and North Branch	Liberty and Hanover	C. J. Van Scharle	Mar. 9	4,000
Williams creek	Hanover	Dr. A. S. Ambrose	Mar. 9	2,000
Shady Brook	Spring Arbor	S. M. Watson	Mar. 9	2,000
Cleland brook	Hanover	Wells W. Dew	Mar. 9	2,000
Rice creek	Parma	C. E. Bridgeman	Mar. 9	4,000
No name	Spring Arbor	Chas. E. Noyes	Mar. 9	2,000
Crouch brook	Summit	Chas. E. Noyes	Mar. 9	2,000
Hall's brook	Summit	Chas. E. Noyes	Mar. 9	4,000
School House creek	Hanover	E. R. Hagen	Mar. 9	2,000
Pine creek	Sandstone	E. R. Hagen	Mar. 9	2,000
Spring creek	Summit	Chas. P. Kennedy	Mar. 9	2,000
Stream on Sec. 23	Liberty	Dr. W. E. Merritt	Mar. 9	2,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Jackson county.—*Continued:*				
Water cress creek	Spring Arbor	Dr. W. E. Merritt	Mar. 9	2,000
Jackson Spring brook	Summit	Dr. W. E. Merritt	Mar. 9	2,000
Mills' creek	Summit	L. A. Harraden	Mar. 9	2,000
No name	Grass Lake	L. A. Harraden	.....	3,000
East Branch creek	Summit	F. B. Havens	Mar. 9	2,000
Clear creek	Spring Arbor	F. B. Havens	Mar. 9	2,000
No name	Liberty & Summit	F. B. Havens	.....	2,000
Sandstone creek	Sandstone & Spring Arbor	Geo. E. Beebe	Mar. 9	6,000
Snyder's creek	Summit and Spring Arbor	Geo. E. Beebe	Mar. 9	4,000
Wade brook	Tompkins	Geo. E. Beebe	Mar. 9	2,000
Sweezy and Thayer creeks	Norvell	Geo. E. Beebe	Mar. 10	4,000
H. S. Spring brook	Parma	H. L. Brown	Mar. 31	4,000
Kent county:				
Harris creek	Bowne	W. L. Glick	Feb. 14	2,000
Bowne creek	Bowne	W. L. Glick	Feb. 14	2,000
Outlet of Campau lake	Caledonia	S. H. Sweet	Feb. 14	4,000
Stropes creek	Oakfield	E. A. Kemp	Feb. 17	2,000
Butternut creek	Spencer	John Griswold	Feb. 18	4,000
Crimion creek	Oakfield	Alonzo Griswold	Feb. 18	4,000
No name	Plainfield	C. H. Plumb	Mar. 11	4,000
No name	Plainfield	C. H. Plumb	Mar. 11	4,000
Armstrong creek	Cannon	John H. Baker	Mar. 11	4,000
Ronan's or Boylan's creek	Grand Rapids	Ed. J. Killean	Mar. 11	4,000
McCarty creek	Grattan	John H. Baker	Mar. 11	2,000
Baker creek	Cannon	John H. Baker	Mar. 11	4,000
Lambertson creek	Grand Rapids	H. D. Perkins	Mar. 12	2,000
Ovanaker creek	Grand Rapids and Ada	H. H. Haven's	Mar. 12	4,000
Honey creek	Ada	Jas. H. Ward	Mar. 12	6,000
Kopfif creek	Lowell	Frederick Jacobi	Mar. 12	2,000
Spring brook	Lowell	Frederick Jacobi	Mar. 12	2,000
Lee creek	Vergennes	Frederick Jacobi	Mar. 12	4,000
Kynion creek	Lowell	Frederick Jacobi	Mar. 12	4,000
Honey creek	Vergennes and Ada	John M. Bennett	Mar. 14	4,000
Stream on Sec. 25	Plainfield	Geo. C. Bratt	Mar. 14	2,000
Lewitt's creek	Ada	Geo. C. Bratt	Mar. 14	2,000
Reilley's creek	Grand Rapids and Ada	Geo. C. Bratt	Mar. 14	2,000
Streams on Secs. 1, 2 and 3	Grand Rapids and Ada	Geo. C. Bratt	Mar. 14	2,000
Whitneyville creek	Cascade	C. L. Schenkelberg	Mar. 14	4,000
Johnson creek	Ada	Frank Chickering	Mar. 14	2,000
Oberbeck creek	Ada	Frank Chickering	Mar. 14	2,000
Waddell's creek	Plainfield	W. D. Norris	Mar. 14	4,000
Spring brook	Solon	L. E. Haring	Mar. 14	4,000
Cedar creek	Nelson	L. E. Haring	Mar. 14	8,000
Little Cedar creek	Algoma and Courtland	L. E. Haring	Mar. 14	6,000
Stegman creek	Courtland	L. E. Haring	Mar. 14	4,000
Dop creek	Solon	L. E. Haring	Mar. 14	2,000
Austin brook	Courtland	L. E. Haring	Mar. 14	2,000
Bradley creek	Courtland	Lafayette Bradley	Mar. 14	2,000
Porter creek	Courtland	Geo. E. Rector	Mar. 14	4,000
Turner creek	Algoma	Geo. E. Rector	Mar. 14	2,000
Botruff creek	Algoma	Clark Smith	Mar. 14	4,000
Big creek	Algoma and Courtland	J. M. Bennett	Mar. 14	4,000
Bear creek	Cannon	J. M. Bennett	Mar. 14	4,000
Shaw creek	Courtland	Louis E. Sage	Mar. 14	4,000
Barclay creek	Cannon	Bert H. Coon	Mar. 14	2,000
North Austin creek	Courtland	Dewitt Perry	Mar. 14	4,000
Rum creek	Courtland	S. D Betts	Mar. 14	4,000
Lower Bear creek	Cannon	John Baker	Mar. 14	4,000
Wadden creek	Cannon	John Baker	Mar. 14	2,000
Sullivan creek	Plainfield	John Baker	Mar. 14	2,000
Spring creek	Cannon	John Baker	Mar. 14	4,000
Jastifer creek	Cannon	John Baker	Mar. 14	4,000
Upper Bear creek	Cannon	E. J. Killean	Mar. 14	4,000
Courtright	Ada	E. J. Killean	Mar. 14	2,000
Duke creek	Nelson	F. E. Shattuck	Mar. 14	6,000
Fall Branch creek	Gaines	Jas. F. Sharp	Mar. 16	4,000
Dutchman creek	Tyrone	E. A. Webb	Mar. 23	4,000
Snow creek	Tyrone	E. A. Webb	Mar. 23	2,000
Gunnison creek	Tyrone	E. A. Webb	Mar. 23	2,000
Spring creek	Tyrone	E. A. Webb	Mar. 23	2,000
South Crockery creek	Tyrone and Casnovia	J. W. Hayward	Mar. 23	6,000
North Crockery creek	Tyrone and Chester	Fred R. Hayward	Mar. 23	6,000
Barber's creek	Tyrone and Chester	C. S. Parks	Mar. 23	4,000
Duke creek	Tyrone	C. S. Parks	Mar. 23	4,000
Ball creek	Tyrone and Sparta	Fred R. Hayward	Mar. 23	4,000
Dutchman creek	Tyrone	Fred R. Hayward	Mar. 23	4,000
Fenton creek	Tyrone	Fred R. Hayward	Mar. 23	2,000
Stevens and Beaver creeks	Grattan	C. M. Wise	April 3	10,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Kalkaska county:				
Waldruth creek	Clearwater	R. P. McNulta	Mar. 23	6,000
Boardman river	South Boardman	W. B. Stimson	Mar. 23	25,000
Rapid river	Leetsville	W. B. Stimson	Mar. 23	20,000
Rapid river	Clearwater	A. G. Barber	Mar. 23	10,000
Rapid river	Rapid River	Ricker's Bros	Mar. 23	14,000
Keweenaw county:				
Gratiot river	Grant	W. H. Faudett	April 28	8,000
Montreal river	Coper Harbor and Grant	A. W. Kerr	April 28	8,000
Branch of Sibley river	Coper Harbor and Grant	J. Vivian, Jr.	April 28	6,000
Silver river or creek	Allouez	Victor Barguist	April 28	4,000
Tobacco river	Sherman	Alexander Levier	April 28	4,000
Traverse river	Sherman	Jas. V. Wells	April 28	6,000
Kalamazoo county:				
Clear creek	Alamo	Wm. Black	Feb. 27	4,000
Myron creek	Richland and Kalamazoo	Peter Allison	Feb. 27	4,000
Spring creek	Ross	S. Call	Mar. 5	10,000
Mygat creek	Charleston	Wm. Parks	Mar. 7	2,000
Hinten creek	Ross	Wm. Parks	Mar. 7	4,000
Four Mile creek	Charleston	Wm. Parks	Mar. 7	4,000
Eagle Lake inlet	Charleston	Willard Brewer	Mar. 7	2,000
No name	Charleston	J. P. Mayo	Mar. 7	2,000
Herndon brook	Charleston	Sherman W. Moody	Mar. 7	2,000
Allison's brook	Charleston	V. H. Bramble	Mar. 7	2,000
Eagle brook	Charleston	C. M. Wiseman	Mar. 7	4,000
Hamilton Lake inlet	Ross	Wm. W. McRae	Mar. 7	2,000
Travis lake	Cooper	F. D. Travis	Mar. 16	2,000
No name	Comstock	G. VanBochove	Mar. 16	4,000
Portage creek	Portage	A. C. Gilbert	Mar. 16	6,000
Coles creek	Comstock	C. A. Hemenway	Mar. 16	4,000
West St. creek	Comstock	C. A. Hemenway	Mar. 16	2,000
Axtell creek	Kalamazoo	M. Vandermass	Mar. 16	2,000
Honeyscott creek	Richland	M. Vandermass	Mar. 16	2,000
Portage creek	Kalamazoo and others	Walter Crawford	Mar. 16	6,000
Arcadia creek	Kalamazoo	Walter Crawford	Mar. 16	2,000
Olmsteads creek	Kalamazoo and others	F. J. Buckley	Mar. 16	4,000
Shafer's creek	Kalamazoo and others	Geo. W. Locke	Mar. 16	2,000
Asylum creek	Kalamazoo	A. J. Shakespeare, Jr	Mar. 16	2,000
Spring brook	Richland and Cooper	A. J. Shakespeare, Jr	Mar. 16	6,000
Spring brook	Richland and Cooper	A. J. Shakespeare, Jr	Mar. 16	10,000
Dorance creek	Climax	A. W. Eberstein	Mar. 16	4,000
Boles creek	Portage	Henry I. Allen	Mar. 16	2,000
Yetter creek	Several	John E. Pabst	Mar. 16	6,000
Indian lake	Brady and Pavillion	F. R. Lemon	May 2	20,000
Luce county:				
Silver creek	McMillian	R. C. Bradley	April 20	4,000
McLeod or Halfway lake	McMillian	R. C. Bradley	April 20	2,000
Stephen's creek	Pentland	R. C. Bradley	April 20	2,000
tream on Secs. 32, 33, 34, 35, 36, 45 T. 9, and 31, 32, 46 T. 8	Pentland	R. C. Bradley	April 20	6,000
West Branch Sage creek	McMillian	R. C. Bradley	April 20	4,000
No name	48-8 West	Jas. J. Glasford	April 20	4,000
Lake county:				
Little Manistee river	Newkirk and Ellsworth	Geo. Cutler	April 4	14,000
Pine river	Newkirk and Ellsworth	Goe. Cutler	April 4	16,000
Pine river or South Branch Manistee	Ellsworth	H. W. Marsh	April 8	40,000
North branch Little Manistee river	Ellsworth	H. W. Marsh	April 8	40,000
Sauble river	Elk	H. W. Marsh	April 8	40,000
Middle branch Pere Marquette river	Chase and Cherry Valley	J. P. Chatterton	April 11	11,000
Millbrook creek	Pleasant Plains	J. L. VanValkenburg	April 11	10,000
Middle Branch	Pleasant Plains	J. L. VanValkenburg	April 11	4,000
Little South creek	Pleasant Plains	J. L. VanValkenburg	April 11	4,000
East branch of Baldwin creek	Cherry Valley	Ralph H. Hollister	April 11	2,000
Sanborn creek	Cherry Valley and others	Ralph H. Hollister	April 11	6,000
Wheaton creek	Elk	Ralph H. Hollister	April 11	2,000
Bowman creek	Lake	L. A. Carpenter	April 11	2,000
Blood creek	Cherry Valley	L. A. Carpenter	April 11	4,000
Cold creek	Cherry Valley	L. A. Carpenter	April 11	2,000
Baker creek	Cherry Valley	L. A. Carpenter	April 11	4,000
Danaher creek	Pleasant Plains	L. A. Carpenter	April 11	4,000
West branch Danaher creek	Pleasant Plains	G. W. Morley	April 11	10,000
East branch Danaher creek	Pleasant Plains	G. W. Morley	April 11	4,000
Beech creek	Pleasant Plains	G. W. Morley	April 11	4,000
Pickerel creek	Pleasant Plains	W. B. Mershon	April 11	4,000
Cedar creek	Pleasant Plains	W. B. Mershon	April 11	4,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters	Town	Depositor	Date.	Number.
Lake county:—*Continued.*				
Avery creek	Cherry Valley	Farnham Lyon	April 11	4,000
Bowman creek	Lake	Farnham Lyon	April 11	6,000
Pere Marquette river	Several	Thos. A. Harvey	April 11	10,000
Hd. Brs. of AuSable river	Elk	Geo. B. Morley	April 11	10,000
Rain creek	Elk	A. H. Morley	April 11	4,000
Spring creek	Elk	A. H. Morley	April 11	2,000
Sweetwater creek	Several	H. T. Wickes	April 11	6,000
Little Manistee river	Ellsworth	L. A. Carpenter	April 11	14,000
Baldwin creek	Ellsworth	L. A. Carpenter	April 11	12,000
Leelanau county:				
Lardie creek	Empire	E. R. Dailey	Mar. 25	4,000
Albrect's creek	Empire	D. H. Day	Mar. 25	8,000
Pond fed by streams	Empire	D. H. Day	Mar. 25	8,000
First creek	Solon	A. W. Kilmer	Mar. 25	2,000
Second creek	Solon	A. W. Kilmer	Mar. 25	4,000
Third creek	Solon	A. W. Kilmer	Mar. 25	4,000
Cedar river	Solon	O. W. Laffler	Mar. 25	4,000
Foot's creek	Solon	O. W. Laffler	Mar. 25	2,000
Kruz creek	Cleveland	James Daly	Mar. 25	2,000
Knox creek	Empire	James Daly	Mar. 25	4,000
Gill Pier and Big Springs	Leelanau	G. M. Darne	Mar. 27	2,000
Northport creek and pond	Leelanau	G. M. Darne	Mar. 27	4,000
Hondeck creek	Leelanau and Leland	G. M. Darne	Mar. 27	2,000
Ennis or Haines creek	Leelanau	G. M. Darne	Mar. 27	12,000
Measeau's creek	Sutton's Bay	G. M. Darne	Mar. 27	10,000
Belknap creek	Elmwood	J. W. Milliken	Mar. 27	8,000
Kilbride creek	Elmwood	Frank Frederick	Mar. 27	6,000
Grellick creek	Elmwood	Frank Frederick	Mar. 27	8,000
Campbell creek	Bingham	J. W. Milliken	Mar. 27	6,000
Lenawee county:				
Little Poesy creek	Rollin	J. W. Hawkins	Mar. 10	4,000
Lapeer county:				
Borsig creek	Metamora	C. L. Randall	Feb. 24	2,000
Cold Spring creek	Metamora	C. L. Randall	Feb. 24	2,000
North Branch of Clinton river	Almont & Bruce	D. H. Bentley, M. D.	Mar. 18	8,000
Livingston conty:				
Williamsville creek	Unadilla	F. G. Marshall	Mar. 10	4,000
Beech creek	Hartland	H. S. Holdridge	Mar. 20	2,000
Portage creek	Putnam and others	L. D. Alley	Mar. 7	6,000
East Woodruff creek	Brighton and Green Oak	C. E. Cushing	Mar. 31	6,000
Winker's creek	Genoa	C. E. Cushing	Mar. 31	2,000
McDonald creek	Brighton	C. E. Cushing	Mar. 31	4,000
Ore Creek	Brighton	F. T. Hyne	Mar. 31	8,000
Mason county:				
Branches of Sauble river		Chas. S. Smith	April 11	6,000
Beebe creek	Lake and South Branch	H. G. Flint	April 11	2,000
Swan creek	Eden and Burton	H. G. Flint	April 11	10,000
Weldon creek	Custer and N. Branch	H. G. Flint	April 11	10,000
South Branch Pere Marquette river	Eden and South Branch	H. G. Flint	April 11	6,000
West Branch Swan creek	Riverton	Wm. R. Quinn	April 11	4,000
Weldon creek	Branch	E. B. Featherstone	April 11	4,000
Swan creek	Eden and Riverton	E. B. Featherstone	April 11	6,000
South Branch Lincoln river	Victory and Sherman	Wm. Schreiner	April 11	8,000
Lincoln creek	Victory and Sherman	Chas. S. Smith	April 11	8,000
Ritter creek	Freesoil	Thos. S. Stephens	April 11	2,000
Freesoil creek	Grant	W. P. Switzer	April 11	12,000
Scottville creek	Freesoil	John Mack	April 11	12,000
Sauble river	Freesoil	Thos. S. Stephens	April 11	8,000
Niekerson creek	Summit	C. F. Lewis	April 18	2,000
Wrighter creek	Freesoil	Thos. S. Stephens	April 18	8,000
Montmorency county:				
Cool creek	Rust & Hillman	Richard Collins	Mar. 30	8,000
Bullock creek	Rust	Richard Collins	Mar. 30	6,000
Mackinac county:				
Mille Couquin river	Garfield	R. C. Bradley	April 20	4,000
Craw river	Newton	A. McErchen	April 21	8,000
Epoufette river	Hendrick's	J. R. McLeod	April 21	4,000
Davenport creek	Hendrick's 43-7 West	Geo. R. Tucker	April 21	10,000
Hendrie river	Several	Chase S. Osborne	May 2	20,000
Carp river	St. Ignace and others	F. Kruger	May 2	20,000
Carmody creek	Brevort	J. D. Erskine	May 3	6,000
Maloney creek	Garfield	A. D. Day	May 5	10,000
Rock river	Garfield	A. D. Day	May 5	12,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Macomb county:				
Benjamin creek	Washington	J. A. Jelsch	Mar. 12	4,000
Marquette county:				
East Branch Chocolay river	Forsythe	H. R. Harris	April 20	12,000
Witch Lake	Republic	Geo. F. Sarbut	April 22	6,000
Harlow creek	Marquette and Ishpeming	John R. Gordon	April 24	4,000
Rainie's, Upper Harlow, Mill and West Branch creeks	Marquette	Fred H. Begole	April 24	10,000
Silver creek	Chocolay	E. B. Palmer	April 24	6,000
Little Garlic river	Marquette	E. B. Palmer	April 24	8,000
Cherry creek	Chocolay	E. B. Palmer	April 24	6,000
Nelson's Creek	Scandia	E. B. Palmer	April 24	6,000
Massey creek	Chocolay	E. B. Palmer	April 24	6,000
Rainey's creek	Marquette	E. L. Drake	April 24	4,000
Campbell creek	48-25-26	Frank Pendall	April 24	4,000
Harlow creek	49-26	Frank Pendall	April 24	2,000
Garlic river	Marquette	D. H. Merritt	April 24	8,000
East Branch of Little Garlic river	Marquette	J. W. Stone	April 24	8,000
West Branch of Little Garlic river	Marquette	J. W. Stone	April 24	8,000
Campau creek	Marquette	T. B. Werner	April 24	4,000
Trout creek	Republic	Frank Gardener	April 24	4,000
Magnetic creek	Republic	Frank Gardener	April 24	4,000
Head of Escanaba river	Humboldt	T. W. Smith	April 24	14,000
Lake Laurie	Ishpeming	Robert D. Kyle	April 24	8,000
Dead river	Ishpeming	Robert D. Kyle	Abril 24	8,000
Allen's creek	Eby	Geo. A. Newett	April 24	14,000
Boonbordt creek	Ishpeming and Eby	Geo. A. Newett	April 24	6,000
Volunteer creek	Richmond	Geo. A. Newett	April 24	10,000
Cooper Outlet	Ishpeming	Geo. Voelker	April 24	2,000
Stream on Section 35	Eby	Thos. P. Dundon	April 24	2,000
O'Neils creek	Sands	B. J. Goodman	April 24	4,000
Uncle Tom's creek	Sands	B. J. Goodman	April 24	2,000
Stream on Sections 21, 46-25w	Sands	B. J. Goodman	April 24	2,000
Spruce, Michigamme and Pasheker rivers	Michigamme	C. F. Ennedstrom	April 24	4,000
Carp river, Werner creek and tributaries to East Branch	Negaunee and Richmond	Chas. L. Sporley	April 24	12,000
Menominee county:				
Holmes brook	Holmes	C. G. Walton	April 7	4,000
Big Cedar and tributaries	Cedarville and Spaulding	G. T. Werline	April 7	12,000
Tributaries of Big and Little Cedar river	Nadeau and Spaulding	G. T. Werline	April 7	14,000
Little Cedar and Beaver creeks	Nadeau	G. T. Werline	April 7	14,000
Hay creek	Holmes	F. Copeland	April 9	4,000
Camp Three Creek	Meyer	G. W. Earle	April 22	4,000
Manistee county:				
Wilson's creek	Brown	Peter Schneider	Mar. 25	4,000
Chief creek	Bear Lake & Brown	C. Fleissner	Mar. 25	4,000
Beaver creek	Maple Grove	H. A. Danville	Mar. 25	6,000
Cedar creek	Marilla and others	H. A. Danville	Mar. 25	10,000
Pine creek	Stronach and Brown	T. G. Trimble	Mar. 25	24,000
Hatch's creek	Cleon	F. A. Mitchell	Mar. 25	16,000
Bear creek	Manistee	F. A. Mitchell	Mar. 25	18,000
Beaver creek	Beaver Lake and others	T. G. Trimble	Mar. 25	10,000
Kaiser creek	Bear Lake and Maple Grove	T. G. Trimble	Mar. 25	4,000
Cedar creek	Marilla and others	T. G. Trimble	Mar. 25	10,000
Clay Bank creek	Manistee and Stronach	James Henderson	Mar. 25	6,000
Spring Brook	Manistee	D. Creaser	Mar. 25	4,000
Claybank creek	Manistee and Stronach	T. A. Browne	Mar. 25	4,000
Cushman creek	Harlan	J. J. Kirby	Mar. 25	6,000
Killekinic creek	Copemish	J. J. Kirby	Mar. 25	15,000
Manistee creek	Copemish	J. P. Marks	Mar. 25	12,000
Montcalm county:				
Beveridge creek	Eureka and Fairplains	E. A. Kemp	Feb. 17	4,000
Turk Lake	Montcalm	E. A. Kemp	Feb. 17	2,000
McConnell creek	Pine	Fred D. Briggs	Feb. 17	4,000
Sucker brook	Pine and Douglass	Fred D. Briggs	Feb. 17	4,000
Broderick creek	Pine	Fred D. Briggs	Feb. 17	2,000
Tamarack creek	Cato	Frank J. Rossman	Feb. 17	6,000
Pickerel Lake	Cato	Frank J. Rossman	Feb. 17	4,000
Black creek	Belvidere and Millbrook	R. Fleck	Feb. 17	4,000
East Lake brook	Belvidere	R. Fleck	Feb. 17	2,000
Town Line creek	Belvidere	R. Fleck	Feb. 17	2,000
Cedar creek	Belvidere	R. Fleck	Feb. 17	4,000
Middle Branch of Chapin creek	Evergreen	Thos. S. Earle	Feb. 18	4,000
Bachman creek	Douglas and Sidney	Thos. S. Earle	Feb. 18	2,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Montcalm county.—*Continued:*				
Hooker creek	Day	H. H. Hempstead	Feb. 18	4,000
Hemingway creek	Douglas	Arthur Stein	Feb. 18	4,000
Lucas creek	Douglas	Arthur Stein	Feb. 18	2,000
Sucker brook	Douglas	Arthur Stein	Feb. 18	2,000
Kortes creek	Douglas	Arthur Stein	Feb. 18	2,000
North Branch of Fish creek	Evergreen and others	B. H. Sweet	Feb. 18	12,000
Middle Branch of Fish creek	Evergreen and others	B. H. Sweet	Feb. 18	6,000
Handy creek	Reynolds	J. A. Collins	Mar. 14	6,000
Tamarack creek	Several	F. C. Harrison	Mar. 14	10,000
Town Line creek	Winfield	J. W. Lovely	Mar. 14	4,000
Missaukee county:				
Butterfield creek	Butterfield	Orville Dennis	Mar. 24	12,000
West Branch of Muskegon river	Forest and West Branch	Geo. W. Wood	April 8	10,000
Mosquito creek	Reeder and Riverside	Geo. W. Wood	April 8	6,000
Mecosta county:				
Bromfler creek	Sheridan	W. E. Redick	Feb. 11	4,000
Rattail creek	Fork and Chippewa	W. E. Redick	Feb. 11	6,000
Tanner creek	Fork	W. E. Redick	Feb. 11	6,000
Bonney creek	Fork	W. E. Redick	Feb. 11	4,000
East Branch of Little Muskegon river	Morton and Martiny	A. R. Streeter	Feb. 18	8,000
Painter creek	Morton and Wheatland	A. R. Streeter	Feb. 18	2,000
Betts or Falass creek	Mecosta	C. D. Carpenter	Mar. 14	2,000
Cold Spring or Ganong creek	Big Rapids and Mecosta	C. D. Carpenter	Mar. 14	4,000
Ryne creek	Colfax	J. W. Morton	Mar. 14	4,000
Mitchell creek	Big Rapids	J. W. Morton	Mar. 14	4,000
Stream on Section 31	Grant, Greene and Colfax	Jas. Phillips	Mar. 14	2,000
Mack's creek	Mecosta and Austin	Lewis Ward	Mar. 14	4,000
Beaver Dam creek	Austin and others	Lewis Ward	Mar. 14	4,000
Stony creek	Deerfield	Jas. C. Boyd	Mar. 14	2,000
Little Muskegon river	Deerfield	Jas. C. Boyd	Mar. 14	6,000
Hyde creek	Mecosta	Fred I. Ladner	April 2	4,000
Davis creek	Hinton	W. A. Robbins	April 3	2,000
Pine creek	Millbrook	L. O. Patterson	April 3	8,000
West Branch of Pine River	Wheatland	J. M. Swisher	April 3	4,000
Bingen creek	Hinton	Wm. R. Hall	April 3	4,000
Muskegon county:				
Cedar creek	Holton and Cedar Creek	Stephen S. Skeels	Feb. 20	10,000
Skeels creek	Holton and Greenwood	Stephen S. Skeels	Feb. 20	6,000
Little Cedar creek	Holton	S. T. Murphy	Feb. 20	2,000
Beech Brook	Fruitland	Alfred Burland	Mar. 18	2,000
Stream on Section 4 and 5	Fruitland	Alfred Burland	Mar. 18	4,000
Power's Creek	Muskegon and Norton	E. D. Magoon	Mar. 18	2,000
Cedar creek	Several	E. D. Magoon	Mar. 18	8,000
Little Black creek	Norton and Muskegon	E. D. Magoon	Mar. 18	2,000
Cleveland creek	Blue Lake and Holton	E. D. Magoon	Mar. 18	8,000
Mosquito creek	Eggleston	E. D. Magoon	Mar. 18	6,000
Green's creek	Dalton and others	E. D. Magoon	Mar. 18	2,000
Duck creek	Dalton and Fruitland	E. D. Magoon	Mar. 18	6,000
Silver creek		E. D. Magoon	Mar. 18	4,000
Ryerson creek	Muskegon	E. D. Magoon	Mar. 18	4,000
Brown Pond or Sand creek	Blue Lake	Glen Tallant	Mar. 18	4,000
Lanford creek	Montague	Glen Tallant	Mar. 18	2,000
Flower creek	Muskegon	Adam Born	Mar. 18	4,000
Sand creek	Grant and Otto	Adam Born	Mar. 18	8,000
Carleton creek	Grant and Montague	C. A. Ohrenburger	Mar. 18	12,000
Silver creek	Blue Lake and Whitehall	F. Norman	Mar. 18	4,000
Thompson creek	Whitehall and Fruitland	F. Norman	Mar. 18	2,000
Dalton creek	Muskegon	F. W. Sadler	Mar. 18	2,000
Lampert creek	Montague	F. W. Sadler	Mar. 18	4,000
Dolling creek	Montague	Geo. Bergeon	Mar. 18	2,000
Herald creek	Casnovia	F. R. Hayward	Mar. 23	4,000
Muma creek	Casnovia	F. R. Hayward	Mar. 23	4,000
Monroe county:				
No name	Frenchtown	H. L. Danover	Mar. 20	4,000
Newaygo county:				
Big creek	Sherman	Cornelius Moll	Feb. 20	4,000
White river	Newfield	Harry Caldwell	Feb. 20	16,000
Reynolds creek	Ensley	Fred Frey	Mar. 14	4,000
Cedar creek	Lilley	A. G. Runnels	Mar. 14	14,000
Greenwood creek	Ashland	Arthur Sanders	Mar. 23	4,000
Nunnie creek	Lincoln	J. A. Gerber	April 2	4,000
Four Mile creek	Ashland and Garfield	J. A. Gerber	April 2	4,000
Biglow, Penoyer and Coolbaugh creeks	Several	S. D. Thompson	Mar. 23	24,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Newaygo county.—*Continued:*				
Sand creek	Ashland and Bridgeton	Robert Walmsley	Mar. 23	6,000
Five Mile creek	Wilcox	M. D. Hayward	Mar. 23	4,000
Flinton creek	Wilcox and Goodwell	M. D. Hayward	Mar. 23	4,000
Bayne creek	Everet	M. D. Hayward	Mar. 23	2,000
Right Hand creek at head of White river	Monroe	M. D. Hayward	Mar. 23	4,000
Upper and Lower Cole creek	Lincoln	M. D. Hayward	Mar. 23	4,000
Meadow Lands brook	Home	A. G. Runnels	Mar. 23	2,000
Cedar creek	Troy	A. G. Runnels	Mar. 23	4,000
North Crockery creek	Asaland and others	E. A. Webb	Mar. 23	4,000
Roque river and tributaries	Grant and Tyrone	Fred R. Hayward	Mar. 23	8,000
Cushman creek	Grant and Tyrone	J. A. Gerber	April 2	6,000
Pere Marquette river	Several	Big Rapids Fish and Game Club	April 21	37,000
Otsego county:				
Head of Pigeon river	Livingston	Wm. H. Smith	April 7	12,000
Au Sable river	Chester	Birney Dutton	May 7	20,000
Big Sturgeon river	Tuscarora and others	H. R. Field	April 9	20,000
East branch of Manistee river	Hayes	T. H. Glover	April 9	10,000
West branch of Sturgeon river		J. P. Marks	April 9	45,000
North branch of AuSable river		J. P. Marks	April 9	75,000
Ottawa county:				
Bear creek	Robinson	Harry A. Walter	Feb. 25	4,000
Pigeon river	Olive	Jacob Flieman	Mar. 2	4,000
Tenhagen creek	Olive	Jacob Flieman	Mar. 2	2,000
Little Sand creek	Talmadge	J. M. Bennett	Mar. 14	2,000
Little Sand creek	Allendale	J. M. Bennett	Mar. 14	2,000
Little Pigeon creek	Grand Haven	Lou H. VanDuzen	April 2	2,000
Bignell's creek	Grand Haven	Lou H. VanDuzen	April 2	4,000
Taylor creek	Spring Lake	Samuel Falls	April 2	4,000
Bethworth creek	Spring Lake	Samuel Falls	April 2	2,000
Oakland county:				
Shadbolt creek	Avon	S. Grube	Feb. 24	8,000
Deming creek	Oxford	Horatio S. Deming	Feb. 24	4,000
Thurston creek	Orion	Grant Whitmore	Feb. 24	4,000
Head of Paint creek	Oxford	C. J. VanWagoner	Feb. 24	4,000
Shadboldt creek	Orion	A. R. Bellaire	Feb. 24	4,000
Gardner creek	Oxford	D. M. Carpenter	Feb. 24	2,000
Tributary to Pine river	Oxford	Robt. Marshall	Feb. 24	4,000
No name	Orion and Brandon	W. J. Perry	Feb. 24	6,000
Allen creek	Bloomfield	T. D. Seeley	Mar. 12	8,000
Outlet of Long and Gilbert lakes	Bloomfield	S. Alexander	Mar. 20	8,000
Henewell's creek	Highland	H. S. Holdridge	Mar. 20	2,000
Sherwood's creek	Milford	Frank B. Hatch	Mar. 20	2,000
Huron river and tributaries	Milford	Thos. Padley	Mar. 20	8,000
Indian Garden streams	Milford	Lyman Cate	Mar. 20	6,000
Andrus creek	Highland and Hartland	H. S. Holdridge	Mar. 20	4,000
Pleasant Valley creek	Milford	H. S. Holdridge	Mar. 20	6,000
Pettibone creek	Highland	H. S. Holdridge	Mar. 20	4,000
Pettibone creek	Highland	H. S. Holdridge	Mar. 20	4,000
Andrus lake	Highland	H. S. Holdridge	Mar. 20	10,000
Ogemaw county:				
Whitney creek	Richland and Burleigh	Geo. Eymer	Mar. 30	6,000
Craner creek	Richland	Geo. Eymer	Mar. 30	2,000
No name	Goodar	Chas. M. Stewart	Mar. 30	2,000
No name	Goodar	Fred G. Wood	Mar. 30	2,000
South Branch creek	Goodar	Fred G. Wood	Mar. 30	6,000
Silver creek	Mills	F. H. Megie	Mar. 30	4,000
Hayes creek	West Branch	T. W. Hayes	April 7	4,000
Crapo creek	West Branch	John Tolfree	April 7	4,000
West branch Rifle river	West Branch	John Tolfree	April 7	16,000
Eddy creek	West Branch and Holton	John Tolfree	April 7	10,000
Wood's creek	West Branch	John Tolfree	April 7	6,000
Wood's creek	West Branch	John Tolfree	April 7	2,000
Wiegleman creek	West Branch	John Tolfree	April 7	2,000
Crapo creek	West Branch	John Tolfree	April 7	4,000
Weideman creek	West Branch	John Tolfree	April 7	4,000
Mansfield creek	West Branch and Edwards	John Tolfree	April 7	6,000
Prieur creek	Klacking and Cummings	John Tolfree	April 7	16,000
Prieur creek	Klacking and Cummings	John Tolfree	April 7	8,000
Klacking creek	Klacking, West Branch and Churchill	John Tolfree	April 7	8,000
East branch of Tittabawassee river	Klacking and others	John Tolfree	April 7	6,000
Eddy creek	Horton	John Tolfree	April 7	10,000
	Horton and Mills	John Tolfree	April 7	12,000

Brook Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Ogemaw county.—*Continued:*				
East branch of Tittabawassee river	Horton	John Tolfree	April 7	20,000
Mansfield creek	Edwards	John Tolfree	April 7	6,000
Johnson creek	Richland and Burleigh	Geo. Eymer	April 7	4,000
Oceana county:				
Cushman creek	Greenwood	Stephen S. Skeels	Feb. 20	6,000
Carlton creek	Rothbury and Montague	Jas. Tallant	Mar. 18	6,000
Tributary to Carlton creek	Grant	Wm. Broadwell	Mar. 18	2,000
Sand creek	Grant, Otto and Blue Lake	Wm. Broadwell	Mar. 18	6,000
South branch of Pentwater and tributaries	Hart and others	J. K. Flood	Mar. 18	24,000
South branch of Pentwater and tributaries	Pentwater and others	C. B. Stevens	Mar. 18	20,000
Ruby creek	Colfax	C. B. Stevens	Mar. 18	6,000
Hunter creek	Golden	L. P. Munger	Mar. 18	2,000
Sable creek	Golden	L. P. Munger	Mar. 18	4,000
Mills creek	Golden	W. P. Compton	Mar. 18	2,000
Silver creek	Golden	W. P. Compton	Mar. 18	6,000
Myers creek	Golden	W. P. Compton	Mar. 18	2,000
Petits Pt. AuSable creek	Golden	W. P. Compton	Mar. 18	6,000
Piper creek	Shelby and Benona	Shelby Fish & Game Protection Assn	Mar. 18	6,000
Toner creek	Shelby and Ferry	Shelby Fish & Game Protection Assn	Mar. 18	4,000
Hebby creek	Shelby and Benona	C. L. Churchill	Mar. 18	4,000
Stony creek	Shelby and Benona	C. L. Churchill	Mar. 18	6,000
Robinson creek	Shelby and Ferry	C. L. Churchill	Mar. 18	2,000
Big creek	Shelby and Grant	C. L. Churchill	Mar. 18	6,000
Amily creek	Weare	C. F. Lewis	Mar. 18	2,000
Mear's creek	Weare	C. F. Lewis	Mar. 18	2,000
South branch Cedar creek	Weare and Crystal	D. D. Alton	Mar. 16	4,000
North branch Cedar creek	Weare and Crystal	D. D. Alton	Mar. 18	4,000
Duman creek	Weare	D. D. Alton	Mar. 18	2,000
Littlebrant creek	Weare	D. D. Alton	Mar. 18	2,000
Webb creek	Hart	D. D. Alton	Mar. 18	2,000
Big creek	Grant	Frank Smith	Mar. 18	6,000
Cotton creek	Grant and Montague	C. A. Ohrenburger	Mar. 18	6,000
Ontonagon county:				
Trout creek	Interior	Trout Creek Mfg. Co	April 24	10,000
Flint Steel river	Winona	E. H. Wright	April 28	6,000
East branch Fire Steel river	Greenland	H. G. Major	April 28	4,000
Oscoda county:				
Big creek	Big Creek and Foster	Stewart Gordon	April 9	50,000
Osceola county:				
Sweet's creek	Richmond	John Sweet	April 4	4,000
Hersey creek	Lincoln	W. P. Young	April 4	12,000
Arnold creek	Cedar and Lincoln	W. P. Young	April 4	4,000
Carlson's creek	Lincoln	W. P. Young	April 4	4,000
West branch of Hersey	Osceola	H. L. Hand	April 4	16,000
East branch of Hersey	Osceola	H. L. Hand	April 4	16,000
Beaver creek	LeRoy	G. W. Kellogg	April 4	6,000
Cat creek	Hersey	Geo. W. Trumble	Mar. 20	4,000
Twin creek	Osceola and Cedar	F. S. Postal	Mar. 20	6,000
Grindstone creek	Sylvan and Hartwick	Frank Hodges	Mar. 20	10,000
Hoffmeyer creek	Osceola	C. J. Mills	Mar. 20	4,000
Hersey river	Ashton	W. B. Stimson	Mar. 20	25,000
Sandy Run	Sylvan	M. Schatz	Mar. 20	4,000
Presque Isle county:				
Upper Trout river or creek	Belknap	John Hoeft, Jr	April 2	4,000
Little Rainey river	Allis	J. M. Clark	April 2	6,000
Roger's creek	Allis	J. M. Clark	April 2	4,000
Glasier creek	Allis	J. M. Clark	April 2	2,000
Gray's creek	Allis and Forest	J. M. Clark	April 2	2,000
Stony creek	Allis and Waverly	J. M. Clark	April 2	6,000
East branch Rainey river	Allis	J. M. Clark	April 2	10,000
Swan river	Posen and Belknap	Louis Bouder	April 2	16,000
Little Ocquoce river	Bismark and others	Louis Bouder	April 2	4,000
Trout river	Rogers and others	Louis Bouder	April 2	6,000
Rainey river	Metz	John G. Krouth	April 2	8,000
No name, Secs. 32 and 33	Rogers	J. M. Clark	April 2	4,000
Little Rainey river	Metz	John G. Krouth	April 2	8,000
Rainey river	Allis	J. M. Clark	April 2	12,000
Tomahawk creek	Belknap and Metz	J. M. Clark	April 2	8,000

Brook Trout Plants, 1903.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Roscommon county:				
West branch Tittabawassee river	21 N. 1 W	John Tolfree	April 7	16,000
Stream on Sec. 24	4 W	John W. Derby	April 9	4,000
Wolf creek and Pop lake	Roscommon	Geo. W. Sackrider	April 9	16,000
South branch of AuSable river	Richfield and others	Wm. F. Johnson	April 9	50,000
St. Joseph County:				
Sherman creek and branches	Lockport	C. R. Jackson	Mar. 3	2,000
Perkins Spring Run	White Pigeon and Sherman	F. W. Wait	Mar. 5	4,000
St. Clair county:				
Spring creek	Clyde	David Herrick	Mar. 28	4,000
Van Buren county:				
Hall's Spring brook	Almena	J. C. Kennedy	Feb. 27	4,000
Campbell creek	Almena	J. C. Kennedy	Feb. 27	4,000
Sikes creek	Keeler	D. J. Morrison	Mar. 2	12,000
South branch Mill creek called Cox's creek	Keeler	M. A. Palmer	Mar. 2	4,000
North branch of Mill creek	Keeler	M. A. Palmer	Mar. 2	4,000
Peter's creek	Keeler	M. A. Palmer	Mar. 2	6,000
Webster's creek	Bangor and Hartford	M. A. Palmer	Mar. 2	2,000
Hart's creek	Hartford	M. A. Palmer	Mar. 2	2,000
Hog creek	Hartford	M. A. Palmer	Mar. 2	4,000
South West Branch	Lawton	C. F. Day	Mar. 3	4,000
Wickett brook	Decatur	F. C. Stapleton	Mar. 3	4,000
Hersey lake	Porter	John D. Bagley	April 29	10,000
Turkey lake	Pine Grove	H. Brambley	May 2	8,000
Washtenaw county:				
Stream on Secs. 31 and 32	Webster	C. H. Stannard	Mar. 7	2,000
Bruin brook	Bruin	F. G. Marshall	Mar. 10	2,000
Glazier's creek	Ann Arbor	J. L. Lawrence	Mar. 31	8,000
Fleming creek	Superior	C. P. Ferrier	Mar. 31	4,000
Wayne county:				
Orchard Hill and Spring brook	Plymouth	D. W. Packard	Mar. 21	4,000
Wexford county:				
Anderson creek		A. S. Moorland	Mar. 25	8,000
Dean's creek	Hanover and Wexford	A. S. Moorland	Mar. 25	4,000
Fletcher creek	Wexford and Springville	A. S. Moorland	Mar. 25	4,000
Useick creek	Antioch and Hanover	A. S. Moorland	Mar. 25	6,000
Cole creek	Antioch and Hanover	A. S. Moorland	Mar. 25	8,000
Lant's creek	Antioch and Springville	A. S. Moorland	Mar. 25	4,000
Wheeler creek	Hanover	Leroy P. Champenois	Mar. 25	4,000
Cushman creek	Wexford	M. L. Crowell	Mar. 25	8,000
Slagel river	Harrietta	J. J. Kirby	Mar. 25	36,000
Slagel river	Boone	Mich. Fish Commission	April 18	60,000
Cedar creek	Liberty	C. H. Tyler	April 18	10,000
Total				6,048,000

Brook Trout Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Green Lake stream	Latton	C. H. Babbitt	Mar. 21	4,000
Rabbit river	Wayland	Dr. C. W. Andrews	Mar. 21	10,000
Neeley's creek	Gun Plains	Ed. J. Anderson	Mar. 21	4,000
Duncan creek	Gun Plains	Ed. J. Anderson	Mar. 21	2,000
Silver, Abrams and Brown's creeks	Gun Plains and Alamo	Ed. J. Anderson	Mar. 21	6,000
Delano or Nichols brook	Gun Plains	Alex. Rankin	Mar. 21	4,000
John Opperman Spring brook	Dorr	John C. Newman	Mar. 21	2,000
Red Run	Dorr	John C. Newman	Mar. 21	6,000
New Salem Spring Brook	Salem	Julius Reva	Mar. 21	2,000
Bear creek	Monterey and Heath	Carl Symon	Mar. 21	4,000
MacClelland's Creek	Cheshire	Carl Symon	Mar. 21	2,000
No name	Valley	J. N. Choelbourne	Mar. 21	2,000
Sand creek	Heath and Valley	Adam Plotts	Mar. 21	4,000
Silver creek	Heath	Chas. A. McDuffee	Mar. 21	6,000
Miller creek	Monterey and Heath	H. D. McDuffee	Mar. 21	4,000
Rogers' Brook	Allegan	C. N. McDuffee	Mar. 21	4,000
Pine creek	Otsego	J. N. Perkins	Mar. 21	4,000
Antrim county:				
Jordan river	Several	East Jordan Game and Fish Association	April 6	38,000
Green river	Chestonia	John A. Boosinger	April 6	4,000
Bennett creek	Echo	John A. Boosinger	April 6	6,000
Streams on sections 26 and 27	Forest Home	Wm. Stanley Gardner	April 6	3,500
Cedar river		O. D. Tiffany	April 6	19,500
McAllister creek	Echo	Wilson H. McAllister	April 6	2,000
Beals creek	Echo	Asa M. Beal	April 6	4,000
Fish brook	Kearney	F. M. Fish	April 6	4,000
White creek	Kearney	F. M. Fish	April 6	4,000
Burdick creek	Central	W. F. Carpenter	April 6	3,500
Ogletree, Cady and Mohrmann creeks	Central Lake	W. S. Richardson, Sec'y.	April 6	12,000
Campbell creek	Banks	C. S. Campbell	April 6	4,000
Dufore creek	Banks	C. S. Campbell	April 6	4,000
Dennis creek	Banks	W. A. Boss	April 6	2,000
Noyes creek	Banks	W. A. Boss	April 6	2,000
St. Clair creek	Banks	L. Van Skiver	April 6	4,000
Boss creek	Banks	L. Van Skiver	April 6	4,000
King creek	Banks	W. J. Crego	April 6	4,000
Town Line creek	Banks	D. Denny	April 6	4,000
Isman creek	Banks	D. Denny	April 6	4,000
Hillman creek	Banks	D. Denny	April 6	4,000
Wood creek	Banks	E. R. Harris	April 6	2,000
Orr creek	Banks	Herbert Madill	April 6	4,000
Bass creek		Frank McDonald	April 6	4,500
Boss creek No. 2	Banks	H. W. Madill	April 6	4,000
St. Clair creek		Frank McDonald	April 6	3,000
Alpena county:				
Norwegian creek	Alpena	Robert E. Ellsworth	April 11	10,000
Davis and Simons creek	Ossineke	Robert E. Ellsworth	April 11	30,000
Kelley, Morse and Bolton creeks	Several	C. W. Edwards	April 11	20,000
Arenac county:				
Cedar creek	Mason	Rollin J. Spafford	April 11	8,000
Cedar creek	Turner	Jos. Cluskey	April 11	8,000
Alcona county:				
South branch of Pine river		Archie McGinnis	April 11	12,000
Mill creek	Harrisville	L. A. Colwell	April 11	6,000
Silver creek	Mitchell	Henry F. Wilson	April 11	6,000
Little Wolf creek	Mitchell	Henry F. Wilson	April 11	6,000
Indain creek	Mitchell and Ossineke	Richard Collins	April 11	4,000
Buff creek	Millen	Richard Collins	April 11	6,000
West Branch brook	Hawes and Mitchell	L. A. Colwell	April 11	8,000
Buff Brown creek	Hawes and Mitchell	L. A. Colwell	April 11	4,000
Pine river	Hawes and others	L. A. Colwell	April 11	12,000
West Branch creek	27 n of r 6-8 e	John Baird	April 11	8,000
Buff Brown creek	27 n of R 7 e	John Baird	April 11	4,000
West branch of Hubbard lake	Hawes and Mitchell	L. A. Colwell	April 11	8,000
Sucker creek	Hawes, Caledonia and Hayes	L. A. Colwell	April 11	8,000
Alger county:				
Chappell river	Munising	Timothy Killean	April 28	10,000
Anna river	Au Train	A. Christofferson	April 28	12,000
Inlets of three small lakes	T 46 R 20 W	A. Christofferson	May 3	6,000
Slopneck creek	Rock River	H. R. Harris	May 3	10,000
Sable creek	Forsythe	H. R. Harris	May 3	8,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Alger county.—*Continued:*				
Miner's river	Munising	H. R. Harris	May 3	8,000
Laughing White Fish river	Onota	H. R. Harris	May 3	10,000
Au Train river	Rock River	H. R. Harris	May 3	8,000
Barry county:				
Spring creek	Irving	W. L. Glick	Mar. 7	1,500
Coldwater creek	Woodland and others	W. L. Glick	Mar. 7	6,000
Bullhead Run	Carlton and Irving	W. L. Glick	Mar. 7	2,000
Cane creek	Irving and Brown	W. L. Glick	Mar. 7	2,000
Crosse's Fish Farm	Baltimore	Irving Phillips	Mar. 18	2,000
Week's creek	Baltimore	Irving Phillips	Mar. 18	2,000
Pritchard creek	Baltimore	Irving Phillips	Mar. 18	2,000
Bair creek	Barry and Hope	F. R. Pancoast	Mar. 18	2,000
Kelley creek	Baltimore	F. R. Pancoast	Mar. 18	2,000
Gesler creek	Baltimore and Hope	F. R. Pancoast	Mar. 18	2,000
Mill brook	Johnson	F. R. Pancoast	Mar. 18	1,500
Bentley creek	Rutland	Ira Baldwin	Mar. 21	2,000
Fish creek	Orangeville	J. N. Perkins	Mar. 21	2,000
No name	Prairieville	Chas. Barber	Mar. 21	2,000
Gull creek		Chas. Barber	Mar. 21	2,000
No name	Barry	Willie T. Pooley	Mar. 21	2,000
Jenkins creek	Hope	Edgar Otis	Mar. 21	2,000
Fall creek	Hope and Hastings	Jonas A. Hall	Mar. 21	4,000
No name	Assyria	N. A. Beardslee	Mar. 21	2,000
Seven Mile brook	Johnson and Bedford	Wm. H. Frey	Mar. 21	4,000
McCallum creek	Hope and Orangeville	Phillip T. Colgrove	April 4	3,000
Berrien county:				
Blue creek	Bainbridge and Benton	A. Rickaby	Mar. 15	6,000
Little Blue creek	Bainbridge	Geo. B. Thayer	Mar. 15	4,000
Willow creek	Benton and St. Joseph	Geo. B. Thayer	Mar. 15	2,000
Sand creek	Benton	Geo. B. Thayer	Mar. 15	2,000
Yellow creek	Benton	Geo. B. Thayer	Mar. 15	2,000
Puterbough creek	Berrien	Calvin Murphy	Mar. 15	3,000
Love's creek	Berrien	Calvin Murphy	Mar. 15	3,000
Snow Branch	Berrien	Calvin Murphy	Mar. 15	3,000
Frank creek	Berrien	Calvin Murphy	Mar. 15	3,000
Estis creek		Harry Rough	Mar. 15	2,000
Nonstrant creek	Pipestone	W. E. Lewis	Mar. 16	2,000
Wolf creek	Pipestone	W. E. Lewis	Mar. 16	2,000
Bakeman creek	Pipestone	W. E. Lewis	Mar. 16	2,000
Fall creek	Hope	E. B. Gates	Mar. 21	4,000
Branch county:				
Dunks creek	Sherwood	W. H. Hubbard	Mar. 16	2,000
Scott creek	Sherwood	J. R. Patterson	Mar. 16	2,000
Hog creek	Union	L. E. Larkin	Mar. 16	4,000
Five inlets of Vincent lake	Girard	E. F. Sinclair	Mar. 16	7,500
Staniold creek	Sherwood	Chas. J. Fox	Mar. 18	2,000
Spencer brook	Sherwood	Boyd Miller	Mar. 18	4,000
No name	Kinderhook and Ovid	P. G. Ogden	Mar. 21	2,000
Girard creek	Girard	M. F. Morgan	Mar. 21	2,000
Allen's creek	Coldwater	H. E. Warner	Mar. 21	2,000
Crooked creek	Kinderhook	P. G. Ogden	Mar. 21	2,000
Benzie county:				
Platte river	Almira, Inland and Homestead	F. A. Mitchell	Mar. 25	18,000
North branch Platte river	Platte	Peter Stormer	Mar. 25	4,000
South Branch	Platte	N. E. Degen	Mar. 25	6,000
Upper Herring creek and tributaries	Blaine and Jayfield	N. A. Parker	Mar. 30	10,000
Flat river		Edw. Smock	April 1	6,000
Brundage creek		Edw. Smock	April 1	3,000
Amidon creek		Edw. Smock	April 1	3,000
Little Betsey creek		Edw. Smock	April 6	10,000
Betsey river		Edw. Smock	April 6	10,000
Gilmore creek	Lake	Jas. Daly	April 5	2,000
Betsey river		J. J. Kirby	April 21	24,000
Platte river		J. J. Kirby	April 22	24,000
Baraga county:				
Fence river	Suprr	Duncan M. Millen	May 6	6,000
Spurr and Three lakes	Spurr	Geo. L. Maker	May 6	4,000
No name	T 48 R 23 and 33	E. W. MacPherran	May 6	6,000
Headwaters of Sturgeon river	T 49 R 32	E. W. MacPherran	May 6	6,000
No name	T 49 R 32	E. W. MacPherran	May 6	4,000
No name	T 48 R 32	E. W. MacPherran	May 6	6,000
No name	T 48 R 31	E. W. MacPherran	May 6	4,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Baraga county.—*Continued:*				
Inlet of Lake Two or Lake George	T 48 R 31	E. W. MacPherran	May 6	4,000
No name	T 48 R 31, 48 and 32	E. W. MacPherran	May 6	4,000
Sturgeon creek	L'Anse	J. E. Pepple	May 6	10,000
Slate river	Arvon	W. L. Mason	May 13	10,000
Ravine river	Arvon	W. L. Mason	May 13	8,000
Clear creek	Baraga	W. L. Mason	May 13	6,000
Falls river	L'Anse and Baraga	W. L. Mason	May 13	8,000
Meadow brook	L'Anse	W. L. Mason	May 13	4,000
Silver river	L'Anse and Arvon	W. L. Mason	May 13	8,000
Plumbago and Ogemaw creeks	Baraga and L'Anse	John G. Real	May 13	10,000
Silver creek	L'Anse	E. D. Monge	May 13	8,000
Kalz creek	L'Anse	Richard Fevre	May 13	6,000
Cass county:				
Van Riper creek	Pokagon	John Wyant	Mar. 15	1,500
Ireland creek	Silver Creek	W. E. Tuttle	Mar. 16	1,500
Maccombers creek	Wayne	Jas. Harley	Mar. 16	1,500
Kinney's creek	Wayne	F. H. Codding	Mar. 16	2,000
Hamptons creek	Wayne	F. H. Codding	Mar. 16	1,500
Glenwood creek	Wayne	Fred Phillips	Mar. 16	1,500
Pokagon creek	Pokagon	Lester C. Willis	Mar. 16	6,000
Tryons creek	Wayne and Silver Creeks	Jere Mosher	Mar. 16	2,000
Smith's brook	Pokagon	Harry C. Mosher	Mar. 16	4,000
Peavine creek	Pokagon	S. P. Mosher	Mar. 16	2,000
No name	Pokagon	C. E. Yaw	Mar. 16	1,500
No name	Pokagon	C. E. Yaw	Mar. 16	4,000
Miller's creek	Pokagon	Chris. A. Hux	Mar. 16	1,500
Miller's creek	Pokagon	Burt A. Vrooman	Mar. 16	2,000
Spring creek	Wayne	James E. MacOmber	Mar. 16	2,000
Spring Run	Wayne	Otis Freeland	Mar. 16	3,000
Taylor creek	Wayne	W. D. Van Hise	Mar. 16	3,000
Gage's creek	Wayne	W. D. Van Hise	Mar. 16	2,000
Broadhurst creek	Wayne	Chas. L. Schmitt	Mar. 16	3,000
Carman creek	Wayne	John H. Schmitt	Mar. 16	3,000
Island creek	Silver Creek	John H. Schmitt	Mar. 16	2,000
Charlevoix county:				
Steven's creek		Frank Chaloupka	April 6	4,500
Newman creek		Frank Chaloupka	April 6	4,500
Magee creek		Frank Chaloupka	April 6	4,500
Boyne river	Boyne Valley	L. A. Galster	April 6	16,000
Boyne river	Boyne Valley	W. B. Stimson	April 19	51,000
Spring brook	Melrose	W. B Stimson	April 19	20,000
Deer creek	Boyne Valley and others	John A. Boosinger	April 6	6,000
Inwood creek	Norwood	Frank Chaloupka	April 6	4,500
King creek	South Arm	E. R. Harris	April 6	2,000
Horton creek	Hayes	Frank Chaloupka	April 6	7,500
Chippewa county:				
Pine river	Rudyard	J. C. Sass	April 21	10,000
North Pine river	Rudyard and others	J. C. Sass	April 21	10,000
Trout brook	Rudyard	H. J. Fuerstman	April 21	6,000
Bear creek	Rudyard	H. J. Fuerstman	April 21	6,000
Caribou creek	Detour	W. D. Hitchcock	May 16	10,000
Trapper's creek	45 N of R 6 W	Chase S. Osborne	May 21	10,000
Bear river	Rudyard	W. R. Callaway	May 23	10,000
Biscuit river	Trout lake	W. R. Callaway	May 23	10,000
Lafamier creek	Sugar Island	John A. Colwell	May 23	6,000
Crawford county:				
North Branch of Au Sable river		Mich. Fish Commission	April 12	30,000
Au Sable river	Frederick	Andrew Brown	April 12	20,000
Sable creek	28 N R 4 W	John D. Brown	April 12	40,000
Au Sable river	Several	R. Hanson	April 12	108,000
Cheboygan county:				
Mill creek	Mackinaw	W. E. Robinson	April 6	12,000
Sturgeon river	Mentor	C. E. Haak	April 12	20,000
Sturgeon river and tributaries	Tuscarora	V. D. Sprague	April 12	24,000
Lower Little Pigeon river	Koehler, and Ellis	M. A. McHenry	April 12	12,000
Cedar creek	Tuscarora	J. N. Lester	April 12	2,000
Big Sturgeon river		J. N. Lester	April 12	20,000
Stoney creek	Ellis and Koehler	J. N. Lester	April 12	6,000
East branch of Little Pigeon river	Koehler	J. N. Lester	April 12	2,000
Twin lake branch of Little Sturgeon river	Koehler	J. N. Lester	April 12	2,000
East branch of Little Sturgeon river	Koehler and Tuscarora	J. N. Lester	April 12	4,000
Little Black river	Burt	Wm. E. Shoemaker	April 12	6,000
Laparell creek	Inverness	Wm. E. Shoemaker	April 12	10,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Cheboygan county.—*Continued:*				
Welch's creek	Forest	J. M. Clark	April 14	6,000
Milliken creek	Forest	J. M. Clark	April 14	10,000
Hayes creek	Forest	J. M. Clark	April 14	2,000
Black river	Forest	J. M. Clark	April 14	20,000
McPherson creek	Forest	J. M. Clark	April 14	6,000
Chandlers creek	Forest	J. M. Clark	April 14	4,000
Bowers creek	Forest	J. M. Clark	April 14	4,000
Stewarts creek	Waverly	J. M. Clark	April 14	4,000
Calhoun county:				
Ferris creek	Athens	W. H. Hubbard	Mar. 16	2,000
Van Vleets creek	Burlington	Milo Odren	Mar. 16	2,000
Thompson creek	Burlington	C. W. Perks	Mar. 16	3,000
Parson's creek	Burlington	Frank Hackett	Mar. 16	1,500
Lucas creek	Burlington	H. T. Carpenter	Mar. 16	2,000
Oberheiser creek	Burlington	H. T. Carpenter	Mar. 16	2,000
Katz creek	Burlington	Tom Carpenter	Mar. 16	2,000
Love's creek	Burlington and Newton	Maurice Jones	Mar. 16	2,000
Parsons creek	Burlington	Maurice Jones	Mar. 16	2,000
Parson's creek	Burlington and Union	Frank Whiting	Mar. 16	3,000
Alder brook	Newton	T. H. Whiting	Mar. 16	2,000
Richardson creek	Leroy	E. A. Burns	Mar. 16	2,000
Nottaway creek	Athens	R. A. Snyder	Mar. 18	6,000
Shannon creek	Leroy	Fred S. Hall	Mar. 18	4,000
Corey creek	Leroy	M. S. Emmons	Mar. 18	4,000
Putnam creek	Athens and Leroy	David R. Rishel	Mar. 18	3,000
No name	Bedford	Geo. O. Allen	Mar. 22	2,000
Dickinson creek	Marshall and Emmett	J. J. Buckley	Mar. 22	4,000
Hamilton lake inlet	Bedford	Geo. D. Allen	Mar. 22	1,500
No name	Bedford	Geo. D. Allen	Mar. 22	1,500
Holmes brook	Battle Creek	Sam O. Hewes	Mar. 22	2,000
Helmer's brook	Battle Creek	F. H. Skinner	Mar. 22	3,000
Bear creek	Marshall	J. F. Garwood	Mar. 22	2,000
Seven Mile brook	Bedford	W. H. Skinner	Mar. 22	4,500
Rice creek	Marshall	J. F. Garwood	Mar. 22	8,000
Talmadge brook	Marshall and Fredonia	Earl L. Holmes	Mar. 22	2,000
Clinton county:				
Strong's creek	Watertown	Bruce D. Douglas	April 16	1,500
Niles creek	Eagle	Geo. M. Kilmer	April 16	3,000
Jennison creek	Eagle	Geo. L. Granger	April 16	3,000
Fuller creek	Dallas	J. B. Miller	April 24	2,000
Redfern creek	Essex	F. W. Redfern	April 24	6,000
Clare county:				
Gishwash creek	Redding	Harry Crill	Mar. 18	4,000
Little Norway and Green creeks	Redding	Harry Crill	Mar. 18	8,000
Shingle, Dock and Tom and Silver creeks	Lincoln	L. D. Estee	Mar. 24	12,000
Popple creek	Franklin	S. W. Sly	April 4	4,000
Mostellar creek	Hayes	E. F. Wilson	April 4	6,000
Driftwood creek		Earl Wilson	April 4	4,000
Town Line creek		Earl Wilson	April 4	4,000
Branches of Tobacco river		G. L. Glick	April 4	12,000
Joss creek	Hayes	E. F. Wilson	April 4	8,000
Hemlock creek	Lincoln	E. M. Dennis	April 8	2,000
Cranberry creek	Surrey	E. M. Dennis	April 8	2,000
Shingle Lake creek		J. J. Kirby	April 13	6,000
Little Norway creek	Redding	J. J. Kirby	April 13	10,000
Gishwash creek		J. J. Kirby	April 13	6,000
Delta county:				
Thompson river	Several	W. R. Callaway	May 23	10,000
Ten Mile creek	Nahma	W. R. Callaway	May 23	10,000
Ogontz creek	Mason	W. R. Callaway	May 23	10,000
Day's creek	Several	W. R. Callaway	May 23	10,000
White Fish river	Several	W. R. Callaway	May 23	15,000
Rapid river	Several	W. R. Callaway	May 23	10,000
Scotts creek	Several	W. R. Callaway	May 23	10,000
Dickinson county:				
North branch Cassidy creek	Waucedah	E. N. Kraemer	April 29	6,000
Breen creek	Waucedah	E. N. Kraemer	April 29	6,000
Gravel creek	Norway and Breen	Richmond M. Sampson	April 29	4,000
Cassiday creek	Breen and Norway	Richmond M. Sampson	April 29	4,000
Fern branch of Pine creek	Norway	Richmond M. Sampson	April 29	4,000
Water Works creek	Norway	Richmond M. Sampson	April 29	4,000
Merriman creek	41 N. 30 W.	R. C. Browning	April 29	4,000
Pine creek	Felch and Breitung	W. H. Rezin	April 29	4,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Eaton county:				
Lawson, Gallups and Taylors creeks	Odessa and Delta	Frank Spencer	April 16	4,500
Carrier creek	Delta	Geo. L. Granger	April 16	1,500
Spring brook	Hamilton, Parma and Springport	E. R. Britton	Mar. 18	6,000
Herring creek	Alma and Vermontville	L. T. Slosson	Mar. 18	6,000
Emmet county:				
Creek on Secs. 1 and 13	Little Traverse	Wm. L. Curtis	April 6	6,000
Stream on Secs. 1 and 18	Littlefield	Wm. L. Curtis	April 6	6,000
Collins creek	Bliss	A. B. Klise	April 6	3,000
Big Sucker creek	Bliss	A. B. Klise	April 6	4,500
Carp river	Carp Lake	O. C. Cope	April 6	10,000
Maple river	Maple River	W. B. Stimson	April 19	99,000
Genesee county:				
Armstrong creek	Flushing and Montrose	C. E. Williams	Mar. 24	4,500
Branch of Armstrong creek	Flushing	C. E. Williams	Mar. 24	2,000
Swartz creek	Fenton	J. Max Davis	Mar. 24	8,000
Brent Run	Flint and others	Clare W. Barber	Mar. 24	8,000
Gladwin county:				
Little Molasses creek	Bentley	M. A. Denton	April 15	10,000
Gogebic county:				
North branch Mud creek	48—48	William Richards	April 26	4,000
Hows creek	Ironwood	O. F. Stabler	April 26	2,000
Mullen creek	Ironwood	D. E. Sutherland	April 26	4,000
Stevens creek	Ironwood	O. F. Stabler	April 26	6,000
Cedar river	Ironwood	O. F. Stabler	April 26	4,000
Wright's creek	Ironwood	O. F. Stabler	April 26	4,000
Milligan brook	Ironwood	David F. Foley	April 26	4,000
Hough creek	Ironwood	David F. Foley	April 26	4,000
Merrill brook	Ironwood	David F. Foley	April 26	4,000
Walstrom's creek	Ironwood	S. H. Wilbur	April 26	4,000
Lindsay creek	Ironwood	G. D. Hough	April 26	2,000
Carter's brook	Ironwood	D. G. Hough	April 26	2,000
Poplar brook	Ironwood	G. D. Hough	April 26	4,000
Runstrom creek	Ironwood	Carl E. Enckson	April 26	4,000
Spring and Walsh creeks	Ironwood	Chas. Graves	April 26	8,000
East branch Mud creek	48—47	Geo. F. Howe	April 26	4,000
Trins brook	Ironwood	B. E. Jussen	April 26	4,000
Johnston creek	Ironwood	B. E. Jussen	April 26	4,000
Tamarack creek	Ironwood	R. G. Spencer	April 26	8,000
Maple creek	Ironwood	C. G. Tabener	April 26	2,000
Ontonagon brook	Ironwood	Norman W. Haire	April 26	2,000
Hasheulds creek	Ironwood	Norman W. Haire	April 26	4,000
Harvey's creek	Ironwood	Wm. H. Cook	April 26	2,000
Lake brook	48 N. R. 48 W.	John L. McCarty	April 26	2,000
Mud creek	48 N. R. 47 W.	John L. McCarty	April 26	4,000
No name	48 N. R. 47 W.	Frank McClary	April 26	2,000
Silver creek	Ironwood	Max Stevens	April 26	4,000
East branch of Silver creek	Ironwood	Max Stevens	April 26	2,000
Currey creek	Ironwood	Max Stevens	April 26	4,000
Norrie creek	Ironwood	Max Stevens	April 26	2,000
Clear creek	Ironwood	Max Stevens	April 26	4,000
Ryans brook	Ironwood	John Charm	April 26	4,000
Kennedy creek	Ironwood	E. B. Williams	April 26	4,000
Ryans creek	Ironwood	Jas. Thomas	April 26	2,000
Mossie and Morse creeks	Bessemer	J. A. Vogtlin	April 26	4,000
Cox's creek	Bessemer	J. A. Vogtlin	April 26	2,000
Powder Mill creek	Bessemer	J. A. Vogtlin	April 26	4,000
Carlson's Spring brook	Bessemer	J. A. Vogtlin	April 26	4,000
Guysers creek	Bessemer	J. A. Vogtlin	April 26	2,000
Black river	Bessemer and Ironwood	J. F. Finnigan	April 26	10,000
Henderson	Watersmeet	A. D. Johnston	April 26	4,000
Slate river	Watersmeet	A. D. Johnston	April 29	8,000
Thayer creek	Watersmeet	A. D. Johnston	April 29	4,000
Mormon creek	Watersmeet	A. D. Johnston	April 29	2,000
Crooked creek	Watersmeet	A. D. Johnston	April 29	6,000
Duck creek	Watersmeet	A. D. Johnston	April 29	4,000
Morrison creek	Watersmeet	A. D. Johnston	April 29	2,000
East branch of east branch of Ontonagon river	Watersmeet	J. R. Moore	April 29	6,000
Tamarack river	Watersmeet	G. M. Cornell	April 29	4,000
Sisson and Lilly creeks	47 N. 41 W.	Jos. Brophy	May 6	4,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Grand Traverse county:				
Boardman river	White Water and others	Ralph S. Hastings	Mar. 30	40,000
Asylum creek	Garfield and Traverse City	Wm. H. Umlor	Mar. 30	2,000
Nickerson creek	Paradise	A. W. Overholdt	Mar. 30	8,000
Jackson creek	Paradise	A. B. Stinson	Mar. 30	4,000
Wynkoope creek	Paradise	A. B. Stinson	Mar. 30	4,000
East creek	Paradise	R. B. De France	Mar. 30	12,000
Newmarsh Spring brook	Paradise	R. B. De France	Mar. 30	4,000
Gray's creek	Paradise	R. B. De France	Mar. 30	4,000
Clark lake	Paradise	R. B. De France	Mar. 30	4,000
Slaughter House creek	Paradise	R. B. De France	Mar. 30	4,000
Potter creek	Paradise	R. B. De France	Mar. 30	2,000
Parker creek	Paradise	R. B. De France	Mar. 30	8,000
Biddlecomb creek	Paradise	R. B. De France	Mar. 30	6,000
Taber creek	Paradise	R. B. De France	Mar. 30	8,000
Mayfield brook	Mayfield	R. B. De France	Mar. 30	6,000
Harrison brook	Mayfield	R. B. De France	Mar. 30	6,000
Swainston creek	Paradise	Earl J. Case	Mar. 30	4,000
High Bank creek	Paradise	Earl J. Case	Mar. 30	2,000
Burke's creek	Paradise	Earl J. Case	Mar. 30	2,000
Taferer's creek	Paradise	R. B. DeFrance	Mar. 30	2,000
Bancroft creek	Fife Lake	R. B. DeFrance	Mar. 30	4,000
Sparling brook	Fife Lake	R. D. DeFrance	Mar. 30	4,000
Brownson creek	Paradise	R. B. DeFrance	Mar. 30	2,000
Fisher creek		G. A. Bingham	April 1	3,000
Carter creek		F. C. Desmond	April 1	6,000
Beatty creek		G. A. Bingham	April 1	3,000
Boitner creek		G. A. Bingham	April 1	6,000
Watson creek	Whitewater	George White	April 6	6,000
Uba creek		Mitchell Bros	April 6	4,50
Gratiot county:				
Cole creek	Seville	H. B. Currance	Mar. 24	8,000
Houghton county:				
Hill creek	Duncan	H. C. Stewart, P. M.	May 6	4,000
Roycroft creek	Duncan	H. C. Stewart, P. M.	May 6	2,000
Sidnaw creek	Duncan	H. C. Stewart, P. M.	May 6	2,000
Perch creek or south branch of Sturgeon river	Several	D. D. Randall	May 6	10,000
Smith's creek	Duncan	Wm. Kroll	May 6	6,000
White creek	Duncan	Wm. Kroll	May 6	4,000
Stoney creek	Duncan and Bates	Wm. Kroll	May 6	4,000
Jumbo creek	Duncan and Atkinson	Wm. Kroll	May 6	6,000
Beaver creek	Duncan	Wm. Kroll	May 6	4,000
Arnold Spring and Shane creek	Duncan	Wm. Kroll	May 6	8,000
Sleeping river	Elm River	E. H. Wright	May 10	10,000
Middle branch of Elm river	Elm River	E. H. Wright	May 10	8,000
North branch of Salmon trout river	Adams	E. H. Wright	May 10	8,000
Salmon Trout river	Adams	E. H. Wright	May 10	10,000
Breeneau creek	Laird	E. H. Wright	May 10	6,000
Northwest branch of Otter river	Elm River	E. H. Wright	May 10	6,000
Elm river	Adams	E. H. Wright	May 10	8,000
Misery river	Elm River	E. H. Wright	May 10	10,000
Graveraf creek	Hancock	E. H. Wright	May 10	10,000
East branch of Sleeping river	Elm river	F. Pummerville	May 10	10,000
Cole's creek	Adams and Hancock	F. Pummerville	May 10	6,000
West branch of Otter river		A. J. Whitford	May 10	10,000
North branch Cole's creek	Hancock	H. G. Major	May 10	4,000
Six Mile creek	Portage	H. G. Major	May 10	6,000
Middle branch of Fire Steel river	Elm River	Louis H. Richardson	May 10	8,000
Pike river	Chassell	Caspar Brand	May 10	10,000
Hennes creek	Portage	Charles Smith	May 10	6,000
East branch Salmon Trout river	Portage and Adams	H. M. Keever	May 10	4,000
Arcadian Mill creek	Torch Lake	John C. Wormer or Morin	May 10	4,000
Huron creek	Portage	Robert H. Shields	May 10	4,000
West branch of Santys creek	Elm River	John Duncan	May 10	8,000
Slock creek	Hancock	A. D. Edwards	May 10	4,000
Thirteen Mile creek	Elm River	Carlos D. Shelden	May 10	10,000
Oskais creek	Hancock	Carlos D. Shelden	May 10	6,000
Silver river	Laird	Carlos D. Shelden	May 10	8,000
Burt creek	Elm River	Geo. Williams	May 10	8,000
West branch Pilgrim	Portage	Geo. Williams	May 10	6,000
Trap Rock river	Calumet	Lincoln M. Rutledge	May 10	4,000
Grinien creek	Laird	Joseph W. Alston	May 13	6,000
Alston creek	Laird	Joseph W. Alston	May 13	4,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Hillsdale county:				
Branch of Kalamazoo river	Moscow	Thos. Tryon	Mar. 18	3,000
Goose creek and tributaries	Somerset	Guy L. Speer	Mar. 18	6,000
Grand river	Somerset and Liberty	Guy L. Speer	Mar. 18	6,000
Clement creek	Pittsford and Wheatland	Chas. H. Baker	Mar. 18	4,000
East branch of Perrins creek	Pittsford	James B. Thorn	Mar. 18	3,000
Huron county:				
Abandoned Quarry Hole	Port Austin	F. R. Barnum	April 19	8,000
Allen creek	Sand Beach	Matthew Wagner	April 19	24,000
Ionia county:				
Duck creek	Campbell and Browne	W. L. Glick	Mar. 7	4,000
Tylor creek	Campbell and Browne	W. L. Glick	Mar. 7	4,000
Messer creek	Campbell and Carleton	W. L. Glick	Mar. 7	2,000
Brown brook	North Plains and Ronald	Hiram M. Brown	Mar. 24	2,000
Kimball creek	Easton	John Wallington	Mar. 24	1,500
Cedar creek	Easton	John Wallington	Mar. 24	1,500
Arnold's creek	Easton	John Wallington	Mar. 24	1,500
Stevens creek	Keene and Easton	John Wallington	Mar. 24	1,500
Dexter creek	Easton	John Wallington	Mar. 24	1,500
Church creek	Boston	John Wallington	Mar. 24	1,500
Miltenberg creek	Boston	John Wallington	Mar. 24	1,500
Church creek	Boston	John Wallington	Mar. 24	2,000
Mill creek	Boston	John Wallington	Mar. 24	1,500
Hunt's creek	Boston and Berlin	John Wallington	Mar. 24	1,500
Hawns creek	Boston	John Wallington	Mar. 24	1,500
Pearshall creek	Boston and Keene	John Wallington	Mar. 24	1,500
Randy Monks creek	Keene	John Wallington	Mar. 24	1,500
Stockings or Cannons creek	Otisco	L. E. Green	Mar. 24	4,000
Spencer creek	Orleans	I. L. Hubbell	Mar. 24	4,000
Weter Spring brook	Otisco	C. M. Wise	Mar. 24	2,000
No name	Camble	A. J. Johnson	April 16	4,500
Williams creek	Keene and Otisco	H. Compton	April 16	3,000
Bowen brook	Keene	H. Compton	April 16	1,500
Vanderbrook brook	Keene	H. Compton	April 16	3,000
Isabella county:				
Russell creek	Vernon	Robert M. Mussell	Mar. 18	2,000
Ellis creek	Coldwater	J. A. Cameron	Mar. 18	3,000
Walker creek	Coldwater and Sherman	R. Aylsworth	Mar. 18	6,000
Coldwater river	Gilmore, Nottawa and Deerfield	R. Aylsworth	Mar. 26	8,000
Demont Lake creek	Rolland	Newman Smith	Mar. 26	4,000
Boyer creek	Rolland	Newman Smith	Mar. 26	2,000
Sawdy creek	Rolland	Newman Smith	Mar. 26	2,000
Babcock creek	Rolland	Newman Smith	Mar. 26	4,000
Skunk creek and South branch of Pine river	Rolland	Neils C. Mason	Mar. 26	4,000
Rocky creek	Deerfield	Geo. L. Granger	April 1	4,000
Ingler creek	Deerfield	Geo. L. Granger	April 1	4,000
Phillips creek	Deerfield	Geo. L. Granger	April 1	4,000
Thieson creek	Nottawa	Geo. L. Granger	April 1	4,000
Tupman creek	Nottawa	Geo. L. Granger	April 1	4,000
Seymour creek	Gilmore	Geo. L. Granger	April 1	4,000
Wickinhiser creek	Nottawa	Geo. L. Granger	April 1	4,000
Simmons creek	Deerfield	Geo. L. Granger	April 1	4,000
Paradise creek	Wise	Geo. L. Granger	April 1	4,000
Stoney creek	Deerfield	Geo. L. Granger	April 1	4,000
Wheeler creek	Union	Geo. L. Granger	April 1	4,000
Hersey creek	Wise	E. W. Allen	April 8	4,000
Willey creek	Wise	E. W. Allen	April 8	4,000
Iron county:				
Nash's creek	Iron River	I. W. Byers	April 29	4,000
Baker's creek	Stambaugh	I. W. Byers	April 29	2,000
Sunset Lake creek	Iron River	I. W. Byers	April 29	4,000
Deer river and tributaries above Deer lake	Crystal Falls	C. G. Campbell	April 29	10,000
Deer river	Crystal Falls	Arvid Bjork	April 29	10,000
East branch of Ontonagon river	Bates	D. D. Randall	May 6	16,000
Golden and Holmes tributaries to Paint river	Bates	D. D. Randall	May 6	8,000
Kidney lake	Bates	John Melin	May 6	6,000
Hemlock river	Hemetite	Geo. Premo	May 6	8,000
Little Hemlock	Hemetite	Geo. Premo	May 6	4,000
Net river	Hemetite	Geo. Premo	May 6	10,000
Ingham county:				
Baldwin brook	Onondaga	Grove H. Wolcott	Mar. 18	2,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Jackson county:				
Tributary to Kalamazoo river	Pulaski	Frank W. McKenzie	Mar. 16	1,500
Kalamazoo and North Branch	Liberty and Hanover	C. J. Van Schoick	Mar. 18	4,000
Wade brook	Tompkins	Grove H. Wolcott	Mar. 18	2,000
Sweezy and Thayer creeks	Norvell	F. W. Schofield	Mar. 18	4,000
Clelands brook	Hanover	Wells W. Dew	Mar. 18	2,000
Cleland brook	Hanover	Wells W. Dew	Mar. 18	2,000
Mills creek	Summit	Geo. E. Beebe	Mar. 22	2,000
Sandstone creek	Spring Arbor, Sandstone and Tompkins	Geo. E. Beebe	Mar. 22	6,000
Snyder's creek	Summit and others	Geo. E. Beebe	Mar. 24	4,000
East Branch creeks	Summit	F. B. Haven's	Mar. 24	2,000
No name	Liberty and Summit	F. B. Haven's	Mar. 24	2,000
Shady brook	Spring Arbor	S. M. Watson	Mar. 24	2,000
School House creek	Hanover	E. R. Hagen	Mar. 24	2,000
Pine creek	Sandstone	E. R. Hagen	Mar. 24	1,500
No name	Spring Arbor	C. E. Noyes	Mar. 24	2,000
Hall's brook	Summit	C. E. Noyes	Mar. 24	4,000
Rice creek	Parma	E. C. Budgman	Mar. 24	3,000
Stream on section 23	Liberty	Dr. W. E. Merritt	Mar. 24	1,500
Water Cress creek	Spring Arbor	Dr. W. E. Merritt	Mar. 24	2,000
Stream on sections 22 and 27	Leoni	E. A. Croman	Mar. 24	2,000
Willow or Collins creek	Grass Lake	E. A. Croman	Mar. 24	2,000
Kalamazoo county:				
Shafer's creek	Kalamazoo	Geo. W. Locke	Mar. 21	2,000
No name	Kalamazoo	L. J. Hengst	Mar. 21	2,000
No name	Comstock	G. Van Bochove	Mar. 21	4,000
Olmstead creek	Kalamazoo	G. Van Bochove	Mar. 21	4,000
Portage creek	Kalamazoo and Portage	John R. Van Bochove	Mar. 21	10,000
No name	Cooper	L. Walker	Mar. 21	2,000
Axtel creek	Kalamazoo	Henry Hobbs	Mar. 21	1,500
No name	Kalamazoo	Henry Hobbs	Mar. 21	1,500
No name	Kalamazoo	Henry Hobbs	Mar. 21	1,500
Deming's creek	Cooper	A. C. Gilbert	Mar. 21	2,000
Portage creek	Portage	A. C. Gilbert	Mar. 21	6,000
Burn's creek	Cooper	A. C. Gilbert	Mar. 21	3,000
Lombach's creek	Comstock	A. C. Gilbert	Mar. 21	2,000
Spring creek	Richland and Kalamazoo	S. Call	Mar. 21	8,000
Harrison creek	Schoolcraft	P. C. Pursel	Mar. 21	3,000
Harper's creek	Schoolcraft	Issaac Harper	Mar. 21	1,500
Yetter creek	Several	John E. Pabst	Mar. 21	6,000
Dorance creek	Climax	A. W. Ebberstein	Mar. 21	4,000
Portage creek	Charleston and Climax	M. C. Retallick	Mar. 21	6,000
Clear creek		Wm. Black	Mar. 21	2,000
Hopkins creek	Alamo	Geo. E. Hunt	Mar. 21	2,000
Buckhouts creek	Alamo	E. E. Cavenaugh	Mar. 21	1,500
Corbin creek	Alamo	Frank Ames	Mar. 21	1,500
Hinton creek	Charleston	H. D. Streator	Mar. 22	1,500
Earl's creek	Comstock	H. D. Streator	Mar. 22	2,000
Brady's creek	Ross and Johnson	Wm. F. Frey	Mar. 22	2,000
Hamilton Lake inlet	Ross	Wm. W. McRae	Mar. 22	1,500
Eagle Lake inlet	Charleston	Willard Brewer	Mar. 22	2,000
Keweenaw county:				
Gratiot river	Grant and Allouez	R. C. Faucett	May 13	10,000
Garden brook	Grant	Arnold Miller	May 13	4,000
Indian creek	Grant	W. R. Vivian	May 13	2,000
Silver river or creek	Allouez	Victor Barguist	May 13	4,000
Traverse river	Sherman	James V. Wells	May 13	6,000
Tobacco river	Sherman	Alexander Leveir	May 13	8,000
Montreal river	Copper and others	A. W. Kerr	May 13	8,000
Montreal creek		Henry M. Joy	May 13	8,000
Branch of Rivley river	Copper Harbor	J. Vivian, Jr.	May 13	4,000
Trap Rock creek	Allouez and others	Fred Roehm	May 13	10,000
Kalkaska county:				
22 creek	Union	R. B. De France	Mar. 30	10,000
Boardman river	Boardman	W. B. Stimson	April 19	75,000
Boardman river	Kalkaska	W. S. Stimson	April 19	75,000
Kent county:				
Harris creek	Bowne	W. L. Glick	Mar. 7	3,000
Bowne creek	Bowne	W. L. Glick	Mar. 7	2,000
Fall Branch	Gains	Jas. F. Sharp	Mar. 21	3,000
Lambertson creek	Grand Rapids	H. Perkins	Mar. 21	3,000
Spring brook	Lowell	Frederick Jacobi	Mar. 21	4,000
Kophf creek	Lowell	Frederick Jacobi	Mar. 21	4,000
Kynion creek	Lowell	Frederick Jacobi	Mar. 21	6,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Kent county.—*Continued:*				
Lee creek	Vergennes	Frederick Jacobi	Mar. 21	6,000
Cold Spring creek or Horse Spring creek	Oakfield	Chas. Dewey	Mar. 26	3,000
Beaver creek	Oakfield	C. M. Wise	Mar. 26	4,000
Stevens creek	Oakfield	C. M. Wise	Mar. 26	4,000
Stevens and Beaver Spring creeks	Grattan	C. M. Wise	Mar. 26	8,000
Fenton creek	Tyrone	Fred R. Hayward	Mar. 31	2,000
Dutchman creek	Tyrone	Fred R. Hayward	Mar. 31	4,000
Ball creek	Tyrone and Sparta	Fred R. Hayward	Mar. 31	4,000
Post creek	Tyrone	Fred R. Hayward	Mar. 31	2,000
Dutchman creek	Tyrone	Fred R. Hayward	Mar. 31	4,000
Snow creek	Tyrone	Fred R. Hayward	Mar. 31	2,000
Fenton creek	Tyrone	Fred R. Hayward	Mar. 31	2,000
Barber creek	Tyrone	Fred R. Hayward	Mar. 31	2,000
North Crockery creek	Casnovia and others	Fred R. Hayward	Mar. 31	6,000
Snow creek	Tyrone	E. A. Webb	Mar. 31	2,000
Spring creek	Tyrone	E. A. Webb	Mar. 31	2,000
Gunnison creek	Tyrone	E. A. Webb	Mar. 31	2,000
Lower Bear creek	Cannon	John H. Baker, P. M.	April 2	3,000
Spring creek	Cannon	John H. Baker, P. M.	April 2	3,000
Jastifer creek	Cannon	John H. Baker, P. M.	April 2	3,000
McCarty creek	Grattan	John H. Baker, P. M.	April 2	2,000
Baker creek	Cannon	John H. Baker, P. M.	April 2	4,000
Armstrong creek	Cannon	John H. Baker, P. M.	April 2	4,000
Wadden creek	Cannon	John H. Baker, P. M.	April 2	2,000
Sullivan creek	Plainfield	John H. Baker, P. M.	April 2	2,000
Duke creek	Nelson and Solon	Frank E. Shattuck	April 2	6,000
Black creek	Spencer	Patrick Higgins	April 2	6,000
York's creek and tributaries	Alpine	Mich. Fish Commission	April 4	10,000
Hayes creek	Plainfield and Alpine	Michael Hayes	April 2	4,500
Jastifer creek	Cannon	Chas. M. Wilson, M. D.	April 2	2,000
No name	Cannon	Chas. M. Wilson, M. D.	April 2	1,500
Porter creek	Courtland	Geo. E. Rector	April 2	3,000
Turner creek	Algoma	Geo. E. Rector	April 2	2,000
Bradley creek	Courtland	Lafayette Bradley	April 2	1,500
Austin creek	Courtland	L. E. Haring	April 2	2,000
Stegman creek	Courtland	L. E. Haring	April 2	4,000
Dop creek	Solon	L. E. Haring	April 2	2,000
Spring creek	Solon	L. E. Haring	April 2	3,000
Little Cedar creek	Algoma and Courtland	L. E. Haring	April 2	4,500
Cedar creek	Nelson	L. E. Haring	April 2	3,000
Duke creek	Spencer	Wm. McCormick	April 15	2,000
Upper Bear creek	Cannon	C. M. Wilson, M. D.	April 15	4,000
Reilley's creek	Grand Rapids and Ada	Geo. Bratt	April 15	2,000
Upper Bear creek	Cannon	E. J. Kilican	April 15	4,000
Doyle's creek	Grand Rapids and Ada	Geo. C. Bratt	April 15	2,000
No name	Plainfield	Geo. C. Bratt	April 15	2,000
Stream on Secs. 25 and 26	Plainfield	Geo. C. Bratt	April 15	2,000
No name	Plainfield and Cannon	Geo. C. Bratt	April 15	2,000
Stream on Secs. 1, 2 and 3	Grand Rapids	Geo. C. Bratt	April 15	2,000
Lewitt's creek	Ada	Geo. C. Bratt	April 15	2,000
Ronan creek	Grand Rapids	John M. Bennett	April 15	2,000
Courtwright creek	Ada	John M. Bennett	April 15	2,000
Hagadone creek	Walker	John M. Bennett	April 15	2,000
Honey creek	Vergennes and Ada	John M. Bennett	April 15	4,000
Bear creek	Cannon	John M. Bennett	April 15	4,000
Big creek	Algoma and Courtland	John M. Bennett	April 15	4,000
Whitneyville creek	Cascade	G. L. Schenkelberg	April 15	4,000
Leelanau county:				
Ennis or Haines creek	Leelanau	G. M. Dame	Mar. 30	7,500
Northport creek or pond	Leelanau	G. M. Dame	Mar. 30	3,000
Horndeck creek	Leelanau and Leeland	G. M. Dame	Mar. 30	3,000
Measeau's creek	Suttons Bay	G. M. Dame	Mar. 30	7,500
Gill Pier creek and Big Spring	Leelanau	G. M. Dame	Mar. 30	1,500
Kilbridge creek	Elmwood	Jas. M. Gillett	Mar. 30	4,000
Cedar river	Solon	O. W. Laffler	Mar. 24	6,000
Foot's creek	Solon	O. W. Laffler	Mar. 24	2,000
Victoria creek	Solon and Centreville	John Nolan	Mar. 24	18,000
Albrect pond	Empire	D. H. Day	Mar. 24	6,000
Kruz creek	Cleveland	Jas. Daly	April 5	2,000
Lardie creek	Empire	E. R. Dailey	April 5	6,000
Lake county:				
Pine river	Ellsworth and Newkirk	Geo. Cutler	April 1	16,000
Sauble river		A. F. Kelley	April 1	6,000
Little Manistee	Newkirk	Geo. Cutler	April 1	14,000
Little Manistee	Newkirk	A. F. Kelley	April 1	10,000
Sable river		H. W. Marsh	April 1	40,000

Brook Trout Plants, 1094.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Lake county.—*Continued:*				
Little river or north branch Manistee		H. W. Marsh	April 1	12,000
Baldwin creek		H. W. Marsh	April 1	16,000
Weldon creek		B. F. Barnett	April 9	7,500
Middle branch Pere Marquette river	Cherry Valley and Chase	J. E. Chatterton	April 9	10,000
Sweetwater creek	Several	B. F. Barnett	April 9	6,000
Spring creek		Mrs. C. B. Bates	April 9	3,000
Bowman creek	Lake	Farnham Lyon	April 9	4,000
Ram creek	Elk	A. H. Morley	April 9	4,000
Head and branches of Sauble	Elk	A. H. Morley	April 9	10,000
Pere Marquette river	Several	Thomas A. Harvey	April 9	10,000
Middle Branch	Pleasant Plains	Mrs. J. Van Valkenburg	April 9	6,000
Middle Brook creek	Pleasant Plains	Mrs. J. Van Valkenburg	April 9	10,000
Little South creek	Pleasant Plains	Mrs. J. Van Valkenburg	April 9	4,000
Cold creek	Pleasant Plains	L. A. Carpenter	April 9	3,000
Blood creek	Cherry Valley	L. A. Carpenter	April 9	4,000
Baker creek	Cherry Valley	L. A. Carpenter	April 9	4,000
Daniher creek	Pleasant Plains	L. A. Carpenter	April 9	10,000
Bowman creek	Lake	L. A. Carpenter	April 9	2,000
East branch Baldwin creek	Cherry Valley	Ralph H. Hollister	April 9	2,000
Wheaton creek	Elk	Ralph H. Hollister	April 9	2,000
Sanborn creek	Cherry Valley and others	Ralph H. Hollister	April 9	6,000
Avery creek		L. D. Lacy	April 9	3,000
Small streams south of Pere Marquette river		Cartier Lumber Co	April 9	7,500
Lapeer county:				
Cedar creek	Mayfield	F. A. Tinker	April 8	4,000
Farmer's creek	Hadley and others	E. J. Thrasher	April 8	6,000
Pine creek	Dryden and others	E. J. Thrasher	April 8	4,000
Miller creek	Deerfield	E. J. Thrasher	April 8	2,000
Hunter's creek	Metamora and Lapeeer	E. J. Thrasher	April 8	6,000
No name	Deerfield	Kirk White	April 8	4,000
South branch Flint river	Almont and others	E. J. Thrasher	April 8	6,000
Cold Spring creek	Metamora	C. L. Randall	April 8	2,000
Borsig brook	Metamora	C. L. Randall	April 8	2,000
North branch Clinton river	Almont and Bruce	D. H. Burley, M. D	April 19	6,000
Lenawee county:				
East branch Iveson creek	Woodstock	Geo. S. Cook	Mar. 18	2,000
Little Posey creek	Rollin	J. W. Hawkins	Mar. 18	4,000
West branch Iveson creek	Woodstock	Geo. S. Cook	Mar. 18	4,000
Luce county:				
Silver creek	McMillan	R. C. Bradley	May 15	4,000
McLeod or Halfway creek	McMillan	John McLeod	May 15	4,000
Stream on Secs. 32, 33, 34, 35, 36 T. 9 and 31, 32 and 46 T. 8	Pentland	Roscoe C. Bradley	May 2	6,000
Stephens creek	Pentland	Roscoe C. Bradley	May 2	2,000
Livingston county:				
Sprouts creek	Marion and Putnam	E. M. Jeffery	Mar. 18	8,000
Honey creek	Putnam and Hamburg	E. M. Jeffery	Mar. 18	6,000
No name	Vandalia	Lewis Moore	Mar. 18	4,000
Unadilla ditch	Unadilla	Bert Sawdy	Mar. 18	4,000
Williamsville creek	Unadilla	Bert Sawdy	Mar. 18	4,000
Ellsworth creek	Marion	Bert Sawdy	Mar. 18	4,000
Portage river	Putnam and others	L. D. Alley	Mar. 22	6,000
Denton creek	Tyrone	J. Max Davis	Mar. 24	4,000
East branch Shiawassee river	Morrison and Genoa	Arthur Drew	April 16	3,000
Marquette county:				
Inlet of Witch creek	Republic	Geo. F. Garbut	April 29	6,000
Escanaba river	Humboldt	J. T. Pasco	May 3	8,000
Nelson creek	Skandia	H. R. Harris	May 3	6,000
Chocolay river	Forsythe	H. R. Harris	May 3	14,000
East branch of Chocolay river	West Branch	H. R. Harris	May 3	14,000
Headwaters of Escanaba river	Humboldt	T. W. Smith	May 6	16,000
Pashekee river	Michigamme	C. F. Sundstrom	May 6	10,000
Michigamme river	Michigamme	Frank Goodman	May 6	10,000
Stream on section 35	Ely	Thomas P. Dundon	May 16	4,000
Carp river and Werner creek tributaries to East Branch	Negaunee and Richmond	Chas. L. Sporley	May 16	12,000
Dead river	Ishpeming	Robert D. Kyle	May 16	8,000
Morgan creek	Negaunee	Jos. H. Winter	May 16	6,000
Allen's creek	Eby	Geo. A. Newett	May 16	10,000
Cooper creek	Ishpeming	Geo. Voelker	May 16	4,000
Boonbordt creek	Ishpeming and Eby	Geo. A. Newett	May 16	10,000
Volunteer river	Richmond	Geo. A. Newett	May 16	30,000
O'Neil's creek	Sands	B. J. Goodman	May 16	4,000
Uncle Tom's creek	Sands	B. J. Goodman	May 16	2,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Marquette county.—*Continued:*				
Streams on sections 21, 46 and 25	Sands	B. J. Goodman	May 16	2,000
Garlic river	Marquette	D. H. Merritt and J. W. Stone	May 16	10,000
Rainey's creek	Marquette	Dr. E. L. Drake	May 16	4,000
Campau creek	Marquette	T. B. Werner	May 16	4,000
Campbell creek	Marquette & Negaunee	Frank Pendall	May 16	4,000
Alder creek	Powell	Ben Petre	May 16	6,000
Harlow creek	Ishpeming and Marquette	John R. Gordon	May 16	4,000
No name	Marquette	Dr. F. McD. Harkin	May 16	6,000
Laughing Whitefish river		John B. Gordon	May 16	6,000
Bear creek	Negaunee	E. L. Kellan	May 16	2,000
Spring Hill creek	Marquette	Percival J. Delf	May 16	2,000
Stewart's creek	Marquette	John Stewart	May 16	4,000
Mill creek	Skandia	E. A. Derlith	May 16	4,000
Tank creek	Negaunee	W. C. Monroe	May 16	2,000
Rainey's, U. Harlow, Mill creek and West Branch	Marquette	Fred H. Begole	May 16	16,000
Small stream that empties into the Little Carp river	Marquette	Robert Biemhuber	May 16	6,000
Massey creek	Chocolay	E. B. Palmer	May 16	6,000
Little Garlic river	Marquette	E. B. Palmer	May 16	10,000
Cherry creek	Chocolay	E. B. Palmer	May 16	6,000
Silver creek	Chocolay	E. B. Palmer	May 16	6,000
Montcalm county:				
Black creek	Belvidere and Millbrook	R. Fleck	Mar. 26	4,000
Last Lake brook	Belvidere	R. Fleck	Mar. 26	2,000
Cedar creek	Belvidere	R. Fleck	Mar. 26	4,000
Town Line creek	Belvidere	R. Fleck	Mar. 26	2,000
Hooker creek	Day	H. M. Hempstead	Mar. 26	3,000
Bachman creek	Douglass and Sidney	Thos. S. Earle	Mar. 26	2,000
Bochman Stream	Douglass and Sidney	Thos. S. Earle	Mar. 26	2,000
Hooker creek	Day	Thos. S. Earle	Mar. 26	2,000
Chapin stream	Day and Evergreen	Thos. S. Earle	Mar. 26	6,000
Middle branch of Chapin creek	Evergreen	Thos. S. Earle	Mar. 26	4,000
Turk Lake creek	Montcalm	E. A. Kemp	Mar. 26	2,000
Strope's creek	Oakfield	E. A. Kemp	Mar. 26	3,000
Beveridge creek	Eureka and Fairplains	E. A. Kemp	Mar. 18	3,000
Tamarack creek	Cato & Windfield	E. E. Helmer	Mar. 26	8,000
Handy creek	Reynolds	J. O. Nelson, M. D	April 2	6,000
Bruce creek	Reynolds	R. H. O'Donald	April 2	4,000
Church creek	Winfield	J. A. Collins	April 2	3,000
Rice creek		J. A. Collins	April 2	3,000
Grant creek	Pierson	Frank E. Shattuck	April 2	2,000
Lucas creek		Fred F. Moffatt	April 16	1,500
Chapin creek		C. W. French	April 16	3,000
Dickinson creek		C. W. French	April 16	4,500
Fish creek		Will Newhouse	April 16	3,000
Hunter's creek		C. L. and C. B. Rarden	April 16	3,000
Hutchin's creek		C. L. and C. B. Rarden	April 16	3,000
Salt Marsh creek		C. L. and C. B. Rarden	April 16	3,000
Spring creek		A. L. Smith	April 16	1,500
Clear creek		A. L. Smith	April 16	3,000
North branch Fish creek	Evergreen and others	B. H. Sweet and O. R. Goodno	April 22	9,000
Middle branch Fish creek	Evergreen	B. H. Sweet and O. R. Goodno	April 22	4,500
Muskegon county:				
Norris creek	Sullivan and Fruitland	F. H. Abbott	Mar. 12	6,000
Fid creek	Sullivan and Fruitland	F. H. Abbott	Mar. 12	2,000
Vincent creek	Fruitland and Crockery	F. H. Abbott	Mar. 12	2,000
Big Deer creek	Fruitport	Edwin C. Torrans	Mar. 12	3,000
Norris creek	Fruitport and Sullivan	Edwin C. Torrans	Mar. 12	6,000
Vincent creek	Fruitport	Edwin C. Torrans	Mar. 12	4,000
Little Deer Lick creek	Fruitport	Edwin C. Torrans	Mar. 12	2,000
Little Cedar creek	Holton	S. P. Murphy	Mar. 26	2,000
Skeels creek	Holton	E. D. Magoon	Mar. 26	8,000
Cedar creek	Holton	S. L. Skeels	Mar. 26	10,000
Flower creek	Muskegon and White river	Adam Born	April 4	4,000
Sand creek	Grant and Otto	Adam Born	April 4	8,000
Carlton creek	Grant and Montague	Chas. A. Ohrenburger	April 4	10,000
Brown Pond or Sand creek	Blue Lake	Glen Tallant	April 4	2,000
Little Flower creek	White River	Glen Tallent	April 4	10,000
Lanford creek	Montague	Glen Tallant	April 4	1,500
Dolling creek	Montague	Geo. Bergeon	April 4	2,000
Dalton creek	Muskegon	F. W. Sadler	April 4	1,500
Lampert creek	Montague	F. W. Sadler	April 4	2,000
Stream on sections 4 and 5	Fruitland	Alfred Burland	April 4	2,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Muskegon county.—*Continued:*				
Birch brook	Fruitland	Alfred Burland	April 4	2,000
Muma creek	Casnovia	Fred R. Hayward	Mar. 31	4,000
South Crockery creek	Casnovia	Fred R. Hayward	Mar. 31	8,000
North Crockery creek	Casnovia	Fred R. Hayward	Mar. 31	12,000
Gilbert creek	Casnovia	Fred R. Hayward	Mar. 31	2,000
Herald creek	Casnovia	Fred R. Hayward	Mar. 31	2,000
Izenhart creek	Casnovia	Fred R. Hayward	Mar. 31	1,500
Herald creek	Casnovia	Fred R. Hayward	Mar. 31	4,000
Duck creek	Dalton and Fruitland	E. D. Magoon	April 2	6,000
Little Black creek	Norton and Eggleston	E. D. Magoon	April 2	2,000
Little Bear creek	Muskegon	E. D. Magoon	April 2	4,000
Green's creek	Fruitland and Dalton	E. D. Magoon	April 2	2,000
Big Black creek	Moorland and others	E. D. Magoon	April 2	12,000
Cleveland creek	Blue Lake and White river	E. D. Magoon	April 2	4,000
Ryerson creek	Muskegon	E. D. Magoon	April 2	4,000
Cedar creek	Several	E. D. Magoon	April 2	6,000
Silver creek		E. D. Magoon	April 2	6,000
Mason county:				
Wrighter creek	Freesoil	Thos. S. Stephens	Mar. 21	8,000
Sauble river	Freesoil	Thos. S. Stephens	Mar. 21	16,000
Percival creek	Freesoil	Thos. S. Stephens	Mar. 21	4,000
Old Freesoil creek	Grant	C. B. Sherman	Mar. 23	4,000
South branch Lincoln river	Victory and Sherman	Wm. Schreiner	April 9	6,000
Swan creek	Eden & Riverton	E. B. Featherstone	April 9	8,000
Weldon creek	Branch	E. B. Featherstone	April 9	6,000
Missaukee county:				
Butterfield creek	Butterfield	Orville Dennis	Mar. 18	12,000
Mosquito creek	Reeder and Riverside	Geo. W. Wood	April 6	12,500
West branch Muskegon river	Forest and West Branch	Geo. W. Wood	April 6	24,000
Mackinac county:				
Maloney creek	Garfield	A. D. Day	April 21	6,000
Rock river	Garfield	A. D. Day	April 21	6,000
Black river	Hendricks	J. G. Donaldson	April 21	6,000
Davenport river	Hendricks 43-7 west	Geo. R. Tucker	April 21	8,000
Corduroy creek	Brevort	J. D. Erskine	May 21	10,000
Carp river	St. Ignace and others	F. Krugar	May 21	20,000
Black river	Garfield	W. R. Callaway	May 21	10,000
Menominee county:				
Hay creek	Holmes	C. Harter	April 21	4,000
Holmes brook	Holmes	C. Harter	April 21	4,000
Arndt brook	Meyer	A. J. Kremer and J. D. Hayes	April 21	2,000
Stream on section 17	Spaulding and Meyer	A. J. Kremer and J. D. Hayes	April 21	4,000
Camp Three creek	Meyer	C. W. Earle	April 21	4,000
Pembinee creek	Holmes	C. W. Wilkins	April 21	4,000
Tributaries of Big and Little Cedar rivers	Nadeau and others	G. T. Werline	April 29	20,000
Branches and tributaries of Big and Little Cedar creeks	Spaulding and Nadeau	G. T. Werline	April 29	12,000
Holmes brook	Holmes	Cyrus G. Walton	April 29	4,000
Montmorency county:				
Bullock creek	Rust	Richard Collins	April 11	4,000
Cool creek	Rust and Hillman	Richard Collins	April 11	6,000
Middle Branch		H. Peterson	April 12	8,000
West Branch or Big creek		H. Peterson	April 12	16,000
Hunt creek	Albert	H. Peterson	April 12	8,000
Manistee county:				
Beaver creek	Maple Grove	H. A. Danville	Mar. 21	6,000
Cedar creek	Marrilla and others	H. A. Danville	Mar. 21	8,000
Chief creek	Brown	C. Fleissner	Mar. 17	6,000
Claybank creek	Manistee and Stronach	T. A. Browne	Mar. 23	6,000
Spring brook	Manistee	D. Creaser	Mar. 23	4,000
Pine creek	Stronach and Brown	T. G. Trimble	Mar. 23	20,000
Claybank creek	Manistee and Stronach	C. B. Sherman	Mar. 23	6,000
Cedar creek	Marilla and others	T. G. Trimble	Mar. 23	10,000
Bear creek	Springdale and others	F. A. Mitchell	Mar. 28	21,000
Beaver creek	Maple Grove	T. G. Trimble	Mar. 28	8,000
Kaiser creek	Maple Grove and Bear Lake	T. G. Trimble	Mar. 28	4,000
Hatch's creek	Cleon and Springdale	F. A. Mitchell	Mar. 30	20,000
Branches of Bear creek	Springdale and Maple Grove	G. C. Dickerson	Mar. 28	10,000
Cushman creek		J. J. Kirby	April 14	24,000
Killickinic creek		J. J. Kirby	April 14	24,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Mecosta county:				
Davis creek	Hinton	W. A. Robbins	Mar. 26	2,000
No name	Hinton and Morton	W. A. Robbins	Mar. 26	3,000
West branch of Pine river	Rolland	Newman Smith	Mar. 26	8,000
Bingen creek	Hinton	Wm. R. Hall	Mar. 26	4,000
East branch Little Muskegon river	Morton and Martiny	A. R. Streeter	Mar. 26	10,000
Painter creek	Morton and Wheatland	A. R. Streeter	Mar. 26	4,000
Abbey creek	Sheridan and Sherman	R. Aylesworth	Mar. 26	4,000
Indian creek	Sheridan and Sherman	R. Aylesworth	Mar. 26	4,000
Bonney creek	Fork	W. E. Redick	Mar. 26	4,000
Tanner creek	Fork	W. E. Redick	Mar. 26	4,000
Benjamin creek	Fork and Orient	W. E. Redick	Mar. 26	4,000
Bromfler creek	Sheridan	W. E. Redick	Mar. 26	4,000
Hyde creek	Mecosta	Fred I. Ladner	April 2	4,000
Stream on section 31	Grant and others	James Phillips	April 2	4,000
Mitchell creek	Big Rapids	J. W. Morton	April 2	4,000
Ryne creek	Green and Colfax	J. W. Morton	April 2	4,000
Cold Spring or Canong creek	Big Rapids and Mecosta	C. D. Carpenter	April 2	4,000
Betts or Palass creek	Big Rapids and Mecosta	C. D. Carpenter	April 2	4,000
Pine river		T. O. Patterson	April 16	4,500
Squaw creek		C. E. Hatfield	April 16	3,000
Poney creek		Peter Theisen	April 16	3,000
Statfield creek		Peter Theisen	April 16	3,000
Ingram creek		Peter Theisen	April 16	3,000
West branch Muskegon		B. S. Henry	April 16	6,000
Dye creek		B. S. Henry	April 16	3,000
Macomb county:				
Taft's creek	Bruce	George Nelson	Mar. 18	1,500
Hosner's creek	Bruce	George Nelson	Mar. 18	2,000
Silver creek	Bruce	Freemont Gillispie	Mar. 18	4,000
Benjamin creek	Washington	J. A. Jelsch	Mar. 18	2,000
Silver creek	Bruce	J. A. Jelsch	Mar. 18	6,000
Hilton's creek	Washington	Judson Harp	Mar. 18	1,500
Smith's creek	Bruce	H. W. Bradley	Mar. 24	4,500
Lockwood creek	Washington	H. Glassford	Mar. 24	3,000
Newaygo county:				
Cushman creek	13 N 14 W 13 N 15 W	E. P. Love	Mar. 26	6,000
Williams creek	Sherman and Garfield	Wm. D. Sargeant	Mar. 26	4,000
Minnie creek	Lincoln	J. A. Gerber	Mar. 26	4,000
Cushman creek		J. A. Gerber	Mar. 26	6,000
Dowling creek	White Cloud	J. A. Gerber	Mar. 26	4,000
Skeel's creek		J. A. Gerber	Mar. 26	4,000
White river		Harry Caldwell	Mar. 26	12,000
Mosquito creek	Eggleston and Muskegon	E. D. Magoon	Mar. 28	6,000
Greenwood creek	Ashland	Arthur Sanders	Mar. 31	4,000
Pickerel creek		A. Andrus	Mar. 31	3,000
Three Mile creek		A. Saunders	Mar. 31	3,000
Cedar creek	Troy	A. G. Runnels	Mar. 31	4,000
Winepasog creek	Home	A. G. Runnels	Mar. 31	8,000
Tributary to Cedar creek	Troy	A. G. Runnels	Mar. 31	2,000
Meadow Lands brook	Home	A. G. Runnels	Mar. 31	2,000
Meadow Lands Brook	Home	A. G. Runnels	Mar. 31	2,000
No name	Home	A. G. Runnels	Mar. 31	2,000
Big South Branch Pere Marquette river		A. Andrus	Mar. 31	15,000
Three rivers		C. D. Caswell	Mar. 31	4,500
Mullen creek		Adelbert Branch	Mar. 31	3,000
Biglow, Penoyer and Coolbaugh creek	Several	S. D. Thompson	Mar. 31	24,000
Flinton creek		C. D. Caswell	Mar. 31	3,000
Four Mile creek	Ashland and Garfield	Arthur Saunders	Mar. 31	3,000
Rogue river tributaries	Grant and others	Fred R. Hayward	Mar. 31	6,000
Sand creek	Ashland and Bridgeton	Robert Walmsley	Mar. 31	6,000
Lake creek		A. Sanders	Mar. 31	3,000
Reynolds brook	Ensley	Fred Frey	April 2	2,000
South branch Pere Marquette river	Home	Peter Currie, L. S. Griswold and H. I. Dresher	April 21	25,000
Reynolds creek	Ensley	Fred Frey	April 2	2,000
Ogemaw county:				
No name	Goodar	Chas. M. Stewart	April 11	2,000
South Branch	Goodar	Fred G. Wood	April 11	6,000
No name	Goodar	Fred G. Wood	April 11	2,000
Whitney creek	Richland and Burleigh	George Eymer	April 11	4,000
Craner creek	Richland	George Eymer	April 11	2,000
Johnson creek	Richland and Burleigh	George Eymer	April 11	6,000
Mills creek	Richland	F. H. Megie	April 11	4,000
Silver creek	Mills	F. H. Megie	April 11	4,000

Brook Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town	Depositor.	Date.	Number.
Ogemaw county.—*Continued:*				
Prieur creek	Klacking and Cumming	John Tolfree	April 15	14,000
Klacking creek	Klacking and others	John Tolfree	April 15	8,000
Crapo creek	West Branch	John Tolfree	April 15	4,000
Wodeman creek	West Branch	John Tolfree	April 15	4,000
Wood's creek	West Branch	John Tolfree	April 15	4,000
West branch of Rifle river	West Branch	John Tolfree	April 15	16,000
East branch Tittabawassee river	Horton	John Tolfree	April 15	16,000
Eddy creek	Horton and Mills	John Tolfree	April 15	12,000
West branch Tittabawassee river	T 21 N 1 W	John Tolfree	April 15	16,000
Mansfield creek	Edwards	John Tolfree	April 15	6,000
Adzitt creek	Cummings	E. Adzitt	April 15	4,000
Osceola county:				
Pine river or South Branch Manistee		H. W. Marsh	April 1	40,000
Beaver creek	LeRoy	G. W. Kellogg	April 6	6,000
Arnold creek	Cedar and Lincoln	W. P. Young	April 6	4,000
Carlson's creek	Lincoln	W. P. Young	April 6	4,000
West branch Hersey river	Osceola	H. L. Hand	April 6	16,000
Sweet's creek	Hersey	John Sweet	April 6	2,000
Sandy river	Sylvan	M. Schantz	April 8	4,000
Twin creek		Geo. W. Trimble	April 8	4,500
Tiny creek		Geo. W. Trimble	April 8	3,000
Cat creek		Geo. W. Trimble	April 8	3,000
Grindstone creek		J. J. Reik	April 8	7,500
Hoofmeyer's creek		Frank Hodges	April 8	3,000
Ontonagon county:				
Mersaw creek	Matchwood	Jos. Brophey	May 6	6,000
Weir creek	Matchwood	Jos. Brophey	May 6	4,000
Trout creek	Interior	Carl F. Moll	May 6	6,000
East branch Fire Steel river	Greenland	H. G. Major	May 10	10,000
Fire Steel river	Winona	E. H. Wright	May 10	8,000
Half Way creek	Carp Lake	R. A. Parker	May 13	4,000
Duck creek	Carp Lake	Ira E. Bush	May 13	4,000
Paddy's creek	Ontonagon	Frank W. Hahn	May 13	4,000
First creek	Ontonagon	W. A. Jamison	May 13	6,000
Oakland county:				
Smith's creek	Oakland and Washington	Fremont Gillispie	Mar. 18	4,500
Allen creek	Bloomfield	T. D. Seeley	Mar. 24	7,500
Huron river and tributaries	Milford	Thos. Padley	April 8	26,000
Sherwood creek	Milford	Frank R. Hatch	April 8	2,000
Huron river	Milford	F. S. Hubbell	April 8	6,000
Deming creek	Oxford	H. S. Deming	April 8	3,000
Gardner creek	Oxford	D. M. Carpenter	April 8	2,000
Thurston creek	Orion	Grant Whitmore	April 8	3,000
No name	Orion and Brandon	W. J. Perry	April 8	4,500
Section 6	Orion	C. L. Randall	April 8	1,500
Head of Paint creek	Oxford	C. J. VanWagoner	April 8	3,000
Shadboldt creek	Orion	A. R. Bellaire	April 8	3,000
Duck creek	Groveland	A. R. Bellaire	April 8	4,500
Moyer's creek	Oxford	Albert Marshall	April 8	3,000
Tributaries to Paint creek	Oxford	Robert Marshall	April 8	2,000
Tributaries to Pine river	Oxford	Robert Marshall	April 8	3,000
Oceana county:				
Conutison creek	T 14 N. 15, 13 N. 15 W. and 13 N. 16 W.	Montie Leland	Mar. 26	12,000
Tributaries to Carleton creek	Grant	Wm. Broadwell	April 4	1,500
Carleton creek	Greenwood	Joseph Apall	April 4	6,000
Carleton creek	Greenwood	Jas. Tallant	April 4	6,000
Wardell creek	Ferry	G. A. Kantz	April 4	2,000
Big creek	Shelby and Grant	C. L. Churchill	April 4	6,000
Bear creek	Ferry and Otto	G. A. Kantz	April 4	3,000
Williamson creek	Ferry and Otto	G. A. Kantz	April 4	3,000
Wiswell creek	Ferry and Otto	G. A. Kantz	April 4	1,500
Sand creek	Grant, Otto and Blue Lake	Wm. Broadwell	April 4	6,000
Robinson creek	Shelby and Ferry	C. L. Churchill	April 4	2,000
Hebby creek	Shelby and Benona	C. L. Churchill	April 4	4,000
Stoney creek	Shelby and Benona	Shelby Game and Fish Protective Association	April 4	6,000
Dorrance creek	Shelby and Benona	Shelby Game and Fish Protective Association	April 4	4,000
Piper creek	Shelby and Benona	Shelby Game and Fish Protective Association	April 4	4,000
Pentwater river and tributaries	Elbridge and Hart	Rufus F. Skeels	April 4	20,000
Ruby creek	Colfax	C. B. Stevens	April 4	4,000
South branch Pentwater and tributaries	Pentwater and others	C. B. Stevens	April 4	20,000

Brook Trout Plants, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Oceana county.—*Continued:*				
South branch Pentwater and tributaries	Hart and others	J. K. Flood	April 4	20,000
Cedar creek		Chas. R. Foote	April 4	3,000
Russell creek		Chas. R. Foote	April 4	3,000
Duman creek	Weaver	C. F. Lewis and D. D. Alton	April 4	2,000
Ottawa county:				
Beckwith creek	Spring Lake	Samuel Falls	Mar. 12	2,000
Taylor creek	Spring Lake	Samuel Falls	Mar. 12	3,000
Bear creek	Robinson	Harry A. Walter	Mar. 12	3,000
Little Pigeon creek	Grand Haven	Lou H. Van Duzen	Mar. 12	2,000
Bignell's creek	Grand Haven	Lou H. VanDuzen	Mar. 12	3,000
No name	Robinson	E. P. Cummings	Mar. 12	3,000
No name	Robinson	E. P. Cummings	Mar. 12	3,000
Rio Grande river	Chester	E. O. Dilley	April 4	3,000
Hedges creek	Talmadge	E. O. Dilley	April 4	3,000
Little Sand creek	Allendale	John M. Bennett	April 15	2,000
Little Sand creek	Talmadge	John M. Bennett	April 15	2,000
Otsego county:				
East branch Manistee river	Hayes	T. H. Glover and W. S. Schoaf	April 12	7,500
Presque Isle county:				
Little Ocqueoc river	Bismarck and others	Louis Bouder	April 14	6,000
Upper Trout river or creek	Belknap	John Hoeft, Jr.	April 14	4,000
Trout river	Rogers and others	Louis Bouder	April 14	8,000
Swan river	Posen and Belknap	Louis Bouder	April 14	8,000
Tomahawk creek	Belknap and Metz	J. M. Clark	April 14	8,000
Gray's creek	Allis and Forest	J. M. Clark	April 14	2,000
Rainey river	Allis	J. M. Clark	April 14	12,000
Roger's creek	Allis	J. M. Clark	April 14	4,000
East branch Rainey river	N. Allis and Ocqueoc	J. M. Clark	April 14	14,000
Stony creek	Allis and Waverly	J. M. Clark	April 14	6,000
Little Rainey river	Allis	J. M. Clark	April 14	14,000
Glasier creek	Allis	J. M. Clark	April 14	2,000
Hines creek	Belknap	A. S. Hunter	April 14	4,000
Roscommon county:				
Wolf creek and Pop lake	Roscommon	Geo. W. Sackrider	April 15	16,000
South branch of AuSable river	Richfield and others	Wm. F. Johnson	April 15	50,000
Sanilac county:				
Indian creek	Lexington	Wm. Wiltsie	April 19	4,000
London creek	Sanilac	Wm. Wiltsie	April 19	4,000
Lambert creek	Sanilac	Jas. P. Mugan	April 19	4,000
St. Joseph county:				
Sherman's creek and branches	Lockport	C. R. Jackson	Mar. 16	4,000
Van Buren county:				
Hart's creek	Hartford	W. A. Palmer	Mar. 15	3,000
Webster's creek	Hartford	W. A. Palmer	Mar. 15	2,000
Hayn's creek	Hartford	W. A. Palmer	Mar. 15	2,000
Hog creek	Hartford	W. A. Palmer	Mar. 15	4,000
Peter's creek	Keeler	W. A. Palmer	Mar. 15	6,000
Middle branch Mill creek	Keeler	W. A. Palmer	Mar. 15	6,000
South branch Mill creek	Keeler	W. A. Palmer	Mar. 15	4,000
Sicker creek	Keeler	D. J. Morrison	Mar. 15	10,000
Cold brook	Antwerp	C. W. Johnson	Mar. 16	3,000
South West Branch	Paw Paw and Decatur	C. F. Dey	Mar. 16	4,000
Hayden creek	Almena	George Langdon	Mar. 16	4,000
Hall's Spring brook	Almena	J. C. Kennedy	Mar. 21	3,000
Campbell creek	Almena	J. C. Kennedy	Mar. 21	2,000
Wexford county:				
Slagle river	Boon	Mich. Fish Commission	Mar. 12	50,000
Bear creek	Heads in Slagle	Mich. Fish Commission	Mar. 12	35,000
Dean's creek	Hanover and Wexford	A. S. Moorland	Mar. 22	4,000
Wheeler creek	Hanover	Leroy P. Champenois	Mar. 22	4,000
Pringle creek	Hanover	A. S. Moorland	Mar. 22	4,000
Cole creek	Antioch and Hanover	A. S. Moorland	Mar. 22	8,000
Anderson creek		A. S. Moorland	Mar. 22	8,000
Fletcher creek	Wexford and Springville	A. S. Moorland	Mar. 22	6,000
Useick creek	Antioch and Hanover	A. S. Moorland	Mar. 22	6,000
Wayne county:				
Orchard Hill Spring brook	Plymouth	D. W. Packard	April 16	4,500
Washtenaw county:				
Glasier's creek	Ann Arbor	John L. Lawrence	Mar. 24	6,000
Total				6,037,500

Rainbow Trout Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
No name	Forest Home	Wm. Stanley Gardner	April 21	8,000
Allegan county:				
New Salem Spring brook	Salem	Julius Reya	May 20	2,000
Red Run	Dorr and Salem	John C. Neuman	May 20	4,000
Bear creek	Heath and Monterey	C. N. McDuffee	May 20	6,000
Alger county:				
Silver creek	Onota	N. M. Kauffman	June 2	6,000
Barry county:				
Coldwater creek	Woodland and others	W. L. Glick	May 5	6,000
Cane creek	Irving and Bowne	W. L. Glick	May 5	4,000
Glass creek	Hope and others	F. R. Pancoast	May 23	6,000
Tamarack creek	Baltimore	F. R. Pancoast	May 23	4,000
Quaker creek	Maple Grove	C. M. Putnam	May 23	6,000
Thornapple river and tributaries	Castleton	W. A. Smith	May 23	6,000
Benzie county:				
Crystal Lake inlet	Several	David E. Burns	May 18	8,000
Branch county:				
Coldwater river	Quincy and others	John B. Shipman	May 20	6,000
Cass county:				
Tyron's creek	Wayne and Silver creek	Jere Mosher	June 1	4,000
Magician creek	Silver Creek	W. F. Hoyt	June 1	6,000
St. Mary's river	Chippewa	Mich. Fish Commission	June 1	5,000
Clinton county:				
Jennison creek	Eagle	Fred L. Berry	May 23	4,000
Niles creek	Eagle	Geo. M. Kilmer, Jr	May 23	4,000
Dickinson county:				
Sturgeon river	Waucedah	E. N. Kraemer	June 3	4,000
Eaton county:				
Sand Stone creek	Oneida	F. E. Spencer	May 23	4,000
Faber's creek	Oneida	H. R. Kent	May 23	2,000
Gratiot county:				
Pine river and tributaries	St. Louis	J. A. Gager	May 26	14,000
Gogebic county:				
Duck creek	Watersmeet	A. D. Johnston	June 3	4,000
Morrison creek	Watersmeet	A. D. Johnston	June 3	4,000
Crooked creek	Watersmeet	A. D. Johnston	June 3	2,000
Seaman's creek	Ironwood	Geo. D. Hough	June 3	4,000
Hough's creek	Ironwood	O. F. Stabler	June 3	4,000
Montreal river	Ironwood	G. M. Cornell	June 3	4,000
Black river	Bessemer	J. F. Finingen	June 3	4,000
Houghton county:				
North branch of Elm river and Lakewood lake	Elm River	E. H. Wright	June 3	4,000
Paint river	Sidnaw and Bates	D. D. Randall	June 3	6,000
Hillsdale county:				
Branch of Kalamazoo river	Moscow and Hanover	G. A. Durga	May 23	6,000
Ionia county:				
Dickerson creek	Otisco and others	Brinton F. Hall	May. 25	8,000
Edmonds, Wadden's, Cannon and Seely creeks	Otisco	C. M. Wise	May 25	12,000
Spring brook	Otisco	O. A. Mummer	May 25	6,000
Smyrna mill pond	Otisco	G. O. Bignell	May 25	4,000
Seely creek	Otisco and Grattan	G. O. Bignell	May 25	6,000
Duck creek	Campbell and Bowne	W. L. Glick	May 25	6,000
Morrison Lake creek	Boston	John Wallington	May 23	4,000
Isabella county:				
Salt river	Lincoln	F. A. Worthington	May 9	4,000
Potter creek	Chippewa	F. A. Worthington	May 9	4,000
Ingham county:				
Sycamore creek	Lansing and Delhi	Clarence D. Clark	June 19	15,000
Iron county:				
Stanley lake creek	Iron River	I. W. Byers	June 3	4,000

Rainbow Trout Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Kent county:				
Shaw creek	Courtland and Algoma	E. E. Johnson	June 6	14,000
Stegman creek	Courtland and Algoma	Louis E. Sage	June 6	6,000
Duke creek	Nelson	Wm. McCormic	June 6	4,000
Mill creek	Alpine	Dwight Lydell	June 6	10,000
Kalamazoo county:				
Wells creek	Schoolcraft	H. I. Allen	May 20	2,000
Harper creek	Schoolcraft	P. C. Pursel	May 20	2,000
Portage creek	Texas and others	A. J. Shakespeare	June 1	4,000
Small streams that flow into Portage creek	Portage	Henry Hobbs	June 1	2,000
Davis creek	Kalamazoo and Pavillion	Walter Crawford	June 1	6,000
Pine creek	Alamo	T. L. Weber	May 2	4,000
Lapeer county:				
Flint river and tributaries	Dryden	Leon Schuneman	May 21	16,000
Farmer's creek	Lapeer	F. A. Tinker	May 21	4,000
Pine creek	Mayfield	J. H. Burwell	May 21	6,000
Luce county:				
Lake and stream tributaries	McMillan	R. C. Bradley	June 2	4,000
Lenawee county:				
West branch of Iveson brook	Woodstock	Geo. S. Cook	May 23	4,000
East branch of Iveson brook	Woodstock	Geo. S. Cook	May 23	2,000
Lake county:				
Pere Marquette river	Pleasant Plains	Mrs. J. VanValkenburg	May 19	30,000
Baldwin creek	Pleasant Plains	Mrs. J. VanValkenberg	May 19	20,000
Missaukee county:				
Clam river	Lake	Chas Peterson	May 9	8,000
West branch Muskegon river	West branch and Enterprise	Chas. A. Miller	May 18	14,000
Montcalm county:				
Wabsis creek, Schouten Spring and Herrick brook	Eureka	L. E. Green	May 25	10,000
South branch Pine river	Home and Richland	F. L. Holmes	May 26	4,000
Fish creek	Ferris and others	F. S. Earle	May 26	6,000
West branch of Flat river	Pine	S. J. Youngman	May 27	4,000
West Branch	Pine	F. A. Briggs	May 27	8,000
West Lake creek	Pine	F. A. Briggs	May 27	4,000
Sucker creek	Pine and Douglas	F. A. Briggs	May 27	6,000
Briggs creek	Pine	F. A. Briggs	May 27	4,000
Little river	Hinton	C. W. Vining	May 27	8,000
Tamarack creek	Cato and others	Sid V. Bullock	May 27	14,000
Marquette county:				
Horseshoe lake	Negaunee	C. L. Sporley	June 2	6,000
Dead river	Ishpeming	Geo. A. Newett	June 2	10,000
Little lake	Forsythe	P. B. Kirkwood	June 2	4,000
Meale lake and tributaries		A. C. Seass	June 2	6,000
Mecosta county:				
Decker creek	Millbrook	Homer Morgan	May 26	4,000
East branch Little Muskegon river	Norton and Martiny	A. R. Strecter	May 26	8,000
Bingen creek	Norton	Wm. R. Hall	May 26	4,000
Pony creek	Wheatland and Bloomfield	Wm. R. Hall	May 26	4,000
Sylvester and Tamarack creek	Hinton and Cate	F. J. Rossman	May 27	8,000
Stream on Secs. 31 and 32	Deerfield	Henry Ewing	June 6	6,000
Muskegon river	Green	Mich. Fish Commission	June 20	25,000
Little Muskegon river	Deerfield	Jas. C. Boyd	June 20	20,000
Butts creek	Fort	W. E. Redick	May 6	6,000
Chippeway creek	Fort	W. E. Redick	May 4	8,000
South branch Chippeway creek	Fort	W. E. Redick	May 6	6,000
North branch Chippeway creek	Fort	W. E. Redick	May 4	6,000
Mackinac county:				
Crow river		J. G. Donaldson	July 2	10,000
Newaygo county:				
White river		F. Utley	June 3	14,000
Rogue river	Several	F. R. Hayward	June 3	10,000
Rogue river and Duke creek	Several	C. S. Parks	June 3	6,000
Rogue river below Rockford		J. M. Bennett	June 3	6,000
Rogue river below Rockford		J. M. Bennett	June 3	6,000
Little south branch Pere Marquette river		Mich. Fish Commission	June 15	25,000

Rainbow Trout Plants, 1903.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Oakland county:				
Kirsley brook	Ortonville	Albert Marshall	May 21	4,000
Stoney creek	Addison	D. M. Carpenter	May 21	6,000
Paint creek	Avon	S. Grube	May 21	4,000
Upper branch Paint creek	Orion and Oxford	J. M. Axford	May 21	2,000
Hummer brook	Orion	L. A. Haddrill	May 21	4,000
Thurston creek	Orion	C. L. Randall	May 21	4,000
Huron river	Milford	F. S. Hubbell	May 23	16,000
Huron river and Pettibone creek	Milford	F. S. Hubbell	May 23	4,000
Osceola county:				
Middle branch	Marion	J. B. Wagoner	May 9	8,000
Ottawa county:				
Crockery creek	Several	H. S. Harbeck	June 3	10,000
Schoolcraft county:				
Bear river		Will Mueller	July 2	10,000
St. Clair county:				
Mill creek	Brockway	V. A. Lacy	May 22	20,000
Van Buren county:				
Paw Paw river	Antwerp	C. F. Dey	June 1	6,000
Washtenaw county:				
South branch Paint creek	Pittsfield and Ypsilanti	Willard Clawson	May 29	2,000
North branch Paint creek	Ypsilanti	C. C. Sherwood	May 29	4,000
Harwood's creek	Pittsfield	C. C. Sherwood	May 29	4,000
Stony creek	Augusta	W. Clawson	May 29	6,000
Paint and Fleming creeks	Ann Arbor and Ypsilanti	C. P. Ferris	May 29	6,000
Total				792,000

Rainbow Trout Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
No name	Forest Home	Wm. Stanley Gardner	May 27	6,000
Allegan county:				
Bear creek	Heath & Monterey	C. N. McDuffee	June 21	3,000
John Schultz Spring brook	Dorr	John C. Newman	June 21	1,500
New Salem Spring brook	Salem	Phil Leonard	June 21	1,500
Baraga county:				
Perch creek	Baraga	H. C. Stewart	June 28	8,000
Falls river	L'Anse	W. L. Mason	June 28	8,000
Barry county:				
Highbank creek	Maple Grove and others.	C. M. Putnam	June 4	4,000
Quaker brook	Maple Grove	C. M. Putnam	June 4	3,000
Berrien county:				
Grey creek	Pipestone	Calvin Murphy	June 17	3,000
Branch county:				
Coldwater river	Quincy and others	John B. Shipman	June 4	4,000
Benzie county:				
Crystal lake inlet	Benzonia	David E. Burns	June 24	10,000
Clare county:				
Glass creek	Surrey	F. F. Grillet, M. D.	June 2	4,000
Johnston creek tributary of Tobacco	Hatton	Geo. W. Graham	June 2	1,500
Streams on Secs. 1, 17 and 5	Surrey	L. F. Leonard	June 2	1,500
Cheboygan county:				
Burt lake inlet	Tuscarora	D. Pifer	June 22	4,500
Clinton county:				
Jennison creek	Eagle	Fred L. Berry	May 21	2,000
Niles creek	Eagle	Geo. M. Kilmer	May 21	2,000
Cass county:				
Dowagiac creek	Hamilton and others	Fred Phillips	June 17	6,000
Kinney, Tryone and Spring brooks	Wayne	S. P. Mosher	June 17	3,000
Peavine creek	Pokagon	Chas. A. Schmitt	June 17	2,000
Silver creek	Silver Creek	A. W. Wares	June 17	2,000
Broadhurst and Munsey creeks	Wayne	Chris. A. Hux	June 17	3,000
Magician lake	Silver creek	F. H. Codding, D. D. S.	June 17	6,000
Dickinson county:				
Craney or East lake		G. T. Werline	July 2	6,000
Eaton county:				
Sandstone creek	Oneida	Fred L. Berry	May 31	2,000
Faber's creek	Oneida	H. R. Kent	May 31	1,500
Lawson's, Gallups and Taylor's creeks	Odessa and Delta	Frank Spencer	May 31	4,500
Emmet county:				
Crooked river	Littlefield and Maple Grove	W. W. Fairbairn	June 22	4,000
Gogebic county:				
Thoyer's river	Watersmeet	A. D. Johnston	July 2	10,000
East branch Ontonagon river		A. D. Johnston	July 2	10,000
Grand Traverse county:				
Boardman river	Traverse, Garfield and Mayfield	Ralph S. Hastings	June 6	20,000
Boardman creek	Grand Traverse and Kalkaska	G. A. Bingham	June 6	20,000
Anderson creek	Grand Traverse and Wexford	G. A. Bingham	May 22	4,000
Parker creek	Paradise	R. B. De France	June 6	4,000
Biddlecomb creek	Paradise	R. B. De France	June 6	8,000
Fisher creek	Green Lake and Blair	N. C. Stamp	May 27	4,000
Houghton county:				
North branch Elm river and lakewood lake.	Elm river	E. H. Wright	June 28	8,000
Paint river	Sidnaw and Bates	D. D. Randall	June 28	8,000
Hillsdale county:				
East branch Kalamazoo river	Moscow and Hanover	G. A. Durgs	June 10	4,000

Rainbow Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Ingham county:				
Portage creek	Stockbridge	H. D. Brown	June 10	2,000
Sycamore creek	Lansing and others	Clarence D. Clark	May 31	10,000
Isabella county:				
Walker creek and Coldwater river	Walker and others	John S. Weideman	June 4	10,000
Pumfrey creek	Rolland	Newman Smith	June 6	2,000
Skunk creek	Rolland	Newman Smith and T. Clark	June 6	4,500
Pony creek	Rolland	Newman Smith and T. Clark	June 6	4,500
West branch Pine river	Rolland and Millbrook	Newman Smith and T. Clark	June 6	2,000
Dwight creek	Rolland and Millbrook	Newman Smith and T. Clark	June 6	4,000
Ionia county:				
Flat river	Otisco	C. M. Wise	June 6	8,000
Edmonds, Wadden's, Spring Brook, Cannon and Seely creeks	Otisco	C. M. Wise	June 7	7,500
Smyrna mill pond tributaries	Otisco	G. O. Bignell	June 7	2,000
Seeley creek	Otisco and Grattan	G. O. Bignell	June 7	4,500
Mill creek	Boston	John Wallington	June 8	1,500
Monk's creek	Boston and Keene	John Wallington	June 8	1,500
Morrison Lake creek	Boston	John Wallington	June 8	1,500
Arnold's creek	Easton	John Wallington	June 8	1,500
Kimball creek	Easton	John Wallington	June 8	1,500
Dickerson creek	Otisco and others	Brinton F. Hall	June 8	6,000
Jackson county:				
No name	Liberty	Dr. W. E. Merritt	June 4	4,000
Van Schoick's creek	Liberty	Dr. W. E. Merritt	June 4	4,000
Beaver creek	Pulaski	Geo. M. Smalley	June 4	2,000
No name		C. P. Kennedy	June 4	2,000
Goose creek	Columbia and Norval	C. E. Noyes	June 4	2,000
Snyder's creek	Spring Arbor	Geo. E. Beebe	June 10	2,000
Crouch creek	Summit and Liberty	Geo. E. Beebe	June 10	4,000
No name	Spring Arbor and others	Geo. E. Beebe	June 10	4,000
Kent county:				
Mill creek	Alpine	Dwight Lydell	May 28	10,000
Rogue river	Sparta	H. E. Wolcott	June 14	6,000
Duke creek	Nelson	Wm. McCormick	June 14	2,000
Kalamazoo county:				
Davis creek	Kalamazoo and Pavillion	Walter Crawford	June 1	4,000
No name	Portage	Henry Hobbs	June 1	2,000
Small streams flowing into Portage river		Henry Hobbs	June 1	1,500
Olmstead creek	Kalamazoo and others	Henry Hobbs	June 1	6,000
Axtel creek	Kalamazoo	Henry Hobbs	June 1	2,000
Burn's creek	Cooper	A. C. Gilbert	June 1	2,000
Deming's creek	Cooper	A. C. Gilbert	June 1	2,000
Portage creek and tributaries	Portage and Kalamazoo	A. C. Gilbert	June 1	6,000
Harper creek	Schoolcraft	P. C. Purcel	June 21	1,500
Wells creek	Schoolcraft	Henry I. Allen	June 21	1,500
Lenawee county:				
East branch Iveson brook	Woodstock	Geo. S. Cook	June 10	2,000
West branch Iveson brook	Woodstock	Geo. S. Cook	June 10	2,000
Lake county:				
Baldwin creek		L. A. Carpenter	June 11	14,000
Pere Marquette River below Baldwin creek	Lake and Pleasant Plains	L. A. Carpenter	June 11	14,000
Pere Marquette river		H. C. Crosby	June 11	20,000
Middle branch Pere Marquette river	Pleasant Plains and Yates	W. C. Giberson	June 20	10,000
Pere Marquette river	Lake	Wm. B. Mershon	June 20	10,000
Pere Marquette river and tributaries between Branch Station and six miles east	Elk	M. Anderson	June 20	20,000
Luce county:				
Lake and stream tributaries	McMillan	R. C. Bradley	June 20	4,000
Lapeer county:				
Farmer's creek	Lapeer	F. A. Tinker	June 15	4,000

Rainbow Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Livingston county:				
Williamsville creek	Unadilla	F. G. Marshall	June 10	1,500
Honey creek	Putnam and Webster	E. M. Jeffery	June 10	4,000
Sprout's creek	Marion and Putnam	E. M. Jeffery	June 10	6,000
Mason county:				
Stuck's creek	Freesoil	Thos. S. Stephens	June 11	4,000
Marquette county:				
Meale Lake tributaries	Forsythe	A. C. Sears	June 28	4,000
Horseshoe lake, Secs. 27-48—26	Negaunee	Chas. L. Sporley	June 28	4,000
Little lake	Forsythe	P. B. Kirkwood	June 28	4,000
Mecosta county:				
Little Muskegon river	Deerfield	Chas. E. Hawley	May 28	8,000
East branch Big creek	Deerfield and Aetna	Chas. E. Hawley	May 28	4,000
Chippewa creek	Fork	W. E. Redick	June 4	4,000
South branch Chippewa creek	Fork	W. E. Redick	June 4	4,000
North branch Chippewa creek	Fork	W. E. Redick	June 4	4,000
Butts creek	Fork	W. E. Redick	June 4	4,000
Bingen creek	Morton	Wm. R. Hall	June 6	3,000
Pony creek	Wheatland and Bromfield	Wm. R. Hall	June 6	3,000
Little river	Hinton	C. W. Vining	June 7	8,000
Sylvester creek	Hinton	C. W. Vining	June 7	2,000
Montcalm county:				
Whitefish Lake inlets	Pierson	Wm. Aldrich Tateum	May 28	4,000
Tamarack creek	Winfield and Reynolds	Sid V. Bullock	May 28	10,000
South branch Pine river	Richland	A. B. Eldredge	June 6	3,000
Fish creek	Ferris and others	F. S. Earle	June 6	8,000
Flat river		C. L. & C. B. Barden	June 6	4,000
West Branch creek	Pine	C. W. Vining	June 7	4,000
Tamarack creek	Cato and Winfield	Frank J. Rossman	June 7	4,000
Wabasis, Schouten, Spring Brook and Herrick creeks	Eureka	L. E. Green	June 7	6,000
East Branch		E. A. Kemp	June 18	3,000
Wight's creek	Eureka	E. A. Kemp	June 18	3,000
Mackinaw county:				
Crow river		John G. Dondalson	July 1	10,000
Newaygo county:				
White river		Frank Utley	June 13	12,000
Rogue river	Several	F. R. Hayward	June 14	6,000
Rogue river and Duke creek	Several	C. S. Parks	June 14	6,000
Rogue river above Rockford		John M. Bennett	May 28	6,000
Rogue river below Rockford		John M. Bennett	May 28	6,000
Oakland county:				
Huron river	Milford	F. S. Hubbell	June 3	10,000
Sashabau creek	Independence	E. H. Stowell	June 8	4,000
Richmond creek	Waterford	Loren Richmond	June 8	4,000
Section 6	Orion	C. L. Randall	June 15	4,000
Tributaries to Paint creek	Oxford	Evi Dunn	June 15	4,000
North branch Rogue river	Novi	C. C. Yerkes	June 17	6,000
Ontonagon county:				
Inlet to Hill Crest Lake	Interior	Carl F. Moll	June 28	4,000
Ottawa county:				
McCarty branch		T. D. Porter	June 13	2,000
Crockery creek	Several	H. F. Harbeck	June 13	4,000
Pigeon river	Olive and Robinson	H. F. Harbeck	June 13	6,000
Osceola county:				
Hersey river above and below Reed City	Lincoln and others	G. M. Brown	June 20	12,000
Roscommon county:				
Spring brook	Denton	James White	June 22	3,000
Denton creek	Denton	James White	June 22	4,500
St. Clair county:				
Tributaries of Black river		Dr. Ardiel	June 24	8,000
Mill creek	Brockway	V. A. Lacy	June 3	6,000

Rainbow Trout Plants, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Schoolcraft county:				
Bear river		Wm. Mueller	July 1	12,000
Washtenaw county:				
Bruin brook	Lyndon	F. G. Marshall	June 10	1,500
Total rainbow trout fry				714,000

Rainbow Trout Fingerlings, 1904.

Chippewa county:				
St. Mary's river	Soo	Mich. Fish Commission	Aug. 15	7,000
Total				7,000

Lake Trout Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
St. Clair lake one of the intermediate chain	Banks	C. S. Campbell	April 20	10,000
Torch lake	Several	Mich. Fish Commission	April 27	110,000
Allegan county:				
Green lake	Leighton	A. M. Hooker	May 2	6,000
Berrien county:				
Paw Paw lake	Watervliet	Carmody Bros	April 28	20,000
Benzie county:				
Pearl lake	Almira	E. R. Dailey	April 22	10,000
Crystal lake	Several	David E. Burns	April 23	50,000
Cass county:				
Big Fish lake	Cass	Ebel Bros	May 2	6,000
Diamond lake	Penn	A. D. Baker	April 30	30,000
Charlevoix county:				
Walloon lake	Horton Bay and Melrose	Mich. Fish Commission	May 4	56,000
Cheboygan county:				
Burt lake	Tuscarora and Burt	H. R. Field	April 25	70,000
Mullett lake	Several	Mich. Fish Commission	April 25	50,000
Grand Traverse county:				
Long lake		Samuel R. Jewett	April 22	10,000
Genesee county:				
Long lake	Fenton	E. O. Wood	May 2	14,000
Hillsdale county:				
Baw Bees lake	Cambria	Wm. C. Kemp	April 30	10,000
Cub lake	Woodbridge	Wm. F. Savage	April 30	6,000
Crystal lake	Somerset	C. E. Freer	April 30	6,000
Moon lake	Somerset	C. E. Freer	April 30	6,000
Isabella county:				
Eldred lake	Bloomfield	J. M. Swisher	April 28	6,000
Blood and Hall's lake	Bloomfield	Wm. R. Hall	April 28	10,000
Jackson county:				
Farwell lake	Hanover	Wells W. Dew	April 30	6,000
Ackerson lake	Napoleon	Geo. E. Beebe	April 30	10,000
Brill's lake	Leoni	Geo. E. Beebe	April 30	4,000
Gillet's lake	Leoni	Geo. E. Beebe	April 30	6,000
Big Portage lake	Waterloo and Henrietta	Geo. E. Beebe	April 30	20,000
Wolf lake	Grass lake and Napoleon	Geo. E. Beebe	April 30	20,000
Vandercook's and Brown's lake	Summit	Geo. E. Beebe	April 30	20,000
Kalamazoo county:				
Indian lake	Brady and Pavilion	Frank R. Lemon	May 2	20,000
Lyon's lake	Comstock	C. E. Foote	May 2	10,000
Long lake	Portage	Henry Warup	May 2	10,000
Gull lake	Ross, Richland and Barry	W. Chipman	May 2	32,000
Kent county:				
Big Wabsis lake	Grattan	C. M. Wise	April 28	10,000
Livingston county:				
Patterson lake	Unadilla and Putnam	S. Placeway	April 30	6,000
Silver lake	Hamburg	Thos. J. Rice	April 30	6,000
Coon lake	Iosco	Bert Sawdy	April 30	6,000
Long lake	Genoa	K. S. B. Holt	April 30	10,000
Leelanau county:				
Glen lake	Glen Arbor and others	D. H. Day	April 22	50,000
Carp lake	Leland	G. H. Cordes	April 22	50,000
Well's lake	Kassen	E. R. Dailey	April 22	10,000
Cedar lake	Elmwood	F. Freidrich	April 22	10,000
Manitou lake	Leland	F. Newhall and Son	May 2	20,000
Mecosta county:				
Pine lake	Wheatland	Wm. R. Hall	April 28	4,000
Lake 28	Sheridan	J. M. Swisher	April 28	4,000

Lake Trout Plants, 1903.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Osceola county:				
Round lake	Cedar	J. A. Farnutzer	April 28	6,000
Roscommon county:				
Higgins lake	Several	Geo. H. Boyd	April 25	50,000
Van Buren county:				
Turkey lake	Pine grove	Harry Brambley	May 2	8,000
Gravel lake	Porter	N. L. Pitcher	April 29	10,000
Rush and Van Auken lake	Hartford and Bangor	W. A. Palmer	April 28	10,000
Washtenaw county:				
Bruin lake	Linden	E. B. Rogers	April 30	6,000
South lake	Linden	Bert Sawdy	April 30	10,000
Total				930,000

Lake Trout Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
Torch lake	Several	Mich. Fish Commission	May 23 and 25	100,000
Allegan county:				
Green lake	Leighton	Jerome Weaver	May 10	6,000
Alcona county:				
Hubbard lake	28 N. 7 and 8 E.	John Baird	June 2	20,000
Barry county:				
Green lake	Yankee Springs and Orangeville	R. J. Henderschott	June 4	20,000
Benzie county:				
Pearl lake	Almira	E. R. Dailey	May 14	10,000
Crystal lake	Benjamin	David E. Burns	May 14	30,000
Branch county:				
Kenyon lake	Sherwood	R. L. Rockwell	May 9	6,000
Lowell lake	Sherwood	Chas. S. Fox	May 9	6,000
Clare county:				
Town Line lakes	Hamilton	E. F. Wilson	May 21	6,000
Cheboygan county:				
Mullet lake	Several	Mich. Fish Commission	May 20	50,000
Burt lake	Burt	J. W. Leslie	May 31	40,000
Clinton county:				
Park lake	Bath	R. H. Loving	May 31	6,000
Charlevoix county:				
Walloon lake	Horton Bay and Melrose.	Mich. Fish Commission	May 17	56,000
Cass county:				
Big Fish lake	Cass	Ebel Bros.	May 11	6,000
Hemlock lake	Marcellus	J. D. Smith	May 11	6,000
Chippewa county:				
Hulbert lake		R. C. Hulbert	June 18	50,000
Calhoun county:				
Nottawaysippi lake	Tekonsha	Wm. R. Aurand	May 21	6,000
Dickinson county:				
Moon lake	Breitung	Armstrong & Kingsford	June 7	30,000
Lake Fumee	Breitung	Armstrong & Kingsford	June 7	30,000
Hamburg lake	Norway	F. Copeland	June 7	30,000
Emmet county:				
Crooked lake	Littlefield	Volney Powell	May 27	30,000
Gogebic county:				
Clark lake	Watersmeet	A. D. Johnston	June 7	45,000
Loon lake	Watersmeet	A. D. Johnston	June 7	30,000
Long lake	Watersmeet	J. R. Moore	June 14	15,000
Grand Traverse county:				
Silver lake	Blair and Garfield	G. A. Brigham	May 19	10,000
Elk lake	Whitewater and Milton	O. J. Smith	May 27	36,000
Genesee county:				
Long lake	Fenton	E. O. Wood	May 14	14,000
Houghton county:				
Klatt's lake	Winona	E. H. Wright	June 3	15,000
Long lake	Elm river	E. H. Wright	June 3	15,000
Lake Rowland	Adams	E. H. Wright	June 3	15,000
Otter lake	Chassell	Geo. Williams	June 3	30,000
Lake Gerald	Elm River	Carlos D. Sheldon	June 3	15,000
Twelve Mile lake	Adams	W. E. Parnell	June 3	15,000
Twin lakes	Elm River	F. W. Kroll	June 3	30,000
Hillsdale county:				
Cub lake	Woodbridge and Cambria.	Wm. F. Savage	May 21	6,000
Iron county:				
Kidney lake	Bates	John Melin	June 3	30,000
Fortune Chain of Lakes	Crystal Falls	A. L. Flewelling	June 6	30,000
Sunset lake	Bates	I. W. Byers	June 7	30,000
Chicagon lake	Crystal Falls	A. Lustfield	June 7	30,000

Lake Trout Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Isabella county:				
Stephenson lake	Vernon	John B. Eykes	May 21	6,000
Jackson county:				
Cranberry lake	Napoleon	Geo. E. Beebe	May 16	6,000
Wolf lake	Napoleon and Grass Lake	Geo. E. Beebe	May 16	6,000
Portage lake	Waterloo	Geo. E. Beebe	May 16	10,000
Brill's lake	Leoni	Geo. E. Beebe	May 16	6,000
Michigan Center mill pond	Leoni and Napoleon	Geo. E. Beebe	May 16	6,000
Gillett's lake	Leoni	Geo. E. Beebe	May 16	6,000
Ackerson lake	Napoleon	Geo. E. Beebe	May 16	6,000
Farwell lake	Hanover	Wells W. Dew	May 9	6,000
Kent county:				
Big Wabasis lake	Grattan	C. M. Wise	May 9	10,000
Pine Island lake		C. M. Wise	May 9	6,000
Kalamazoo county:				
Gull lake	Ross and Richland	M. M. Shipman	May 9	16,000
Gull lake	Ross, Richland and Barry	W. Chipman	May 9	16,000
Indian lake	Brady and Pavillion	Frank R. Lemon	May 10	20,000
Keweenaw county:				
Lake North, formerly Lake Lilley	Copper Harbor	Judson P. North	June 3	15,000
Leelanau county:				
Glen lake	Glen Arbor and others	D. W. Day	May 14	30,000
Carp lake	Leland	G. H. Cordes	May 14	50,000
Wells lake	Kassen	E. R. Dailey	May 14	10,000
Cedar lake	Elmwood	Frank Freiderich	May 19	20,000
Livingston county:				
Patterson lake	Unadilla and Putnam	Samuel Placeway	May 21	6,000
Marquette county:				
Four Lakes, Dewey, Charboneau, Island and Johnston	Tilden and Republic	Geo. A. Newett	June 3	45,000
Bass lake	Forsythe	A. C. Seass	June 3	15,000
Little lake	Forsythe	A. C. Seass	June 3	15,000
Me lake	Forsythe	A. C. Seass	June 3	15,000
Michigamme lake	Marquette	C. E. Sundstrom	June 3	30,000
Chief lake now Trout lake	45—30	R. C. Browning	June 7	45,000
Montcalm county:				
Bass lake	Belvidere	C. W. Vining	May 9	4,000
Ingram or West lakes, four connected		C. W. Vining	May 9	8,000
Tamarack lake	Cato	C. W. Vining	May 9	6,000
Town Line lake	Cato and Belvidere	C. W. Vining	May 9	6,000
Cowden lake	Maple Valley	F. U. O'Brien	May 9	6,000
Mackinac county:				
Brevoort lake	Brevoort and Moran	Massey Bros	June 18	50,000
Montmorency county:				
Wolf lake	Albert	H. Peterson	May 25	10,000
Mecosta county:				
Horsehead lake	Martiny	Luke Percy	May 9	6,000
Lake 23	Sheridan	J. M. Swisher	May 9	6,000
Pine lake	Wheatland	J. M. Swisher	May 9	4,000
Meeker lake	Wheatland	J. M. Swisher	May 9	6,000
Newaygo county:				
Diamond lake	Lincoln	Capt. W. H. Bigelow	May 21	10,000
Oakland county:				
Sylvan lake	Bloomfield	C. D. Standish	May 14	10,000
Echo lake	Addison	G. W. Patton	May 14	6,000
Ogemaw county:				
Sage lake	Hill	Frank Austin	May 23	16,000
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	May 27	10,000

Lake Trout Plants, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Roscommon county:				
Houghton lake		James White	May 25	24,000
St. Joseph county:				
Corey lake	Fabius	E. B. Linsley	May 21	6,000
Van Buren county:				
Hussey lake	Porter	John D. Bagley	May 7	10,000
Gravel lake	Porter	Nathan L. Pitcher	May 7	10,000
Duck lake	Bangor	Geo. Mutchler	May 7	6,000
Rush lake		B. H. McCain	May 7	6,000
Eagle lake	Decatur	C. A. Shafer	May 7	6,000
Cedar lake	Porter	W. A. Cash	May 7	8,000
North lake	Almena	Harry Brambley	May 7	6,000
Turkey lake	Pine Grove	Harry Brambley	May 11	8,000
Bruin lake	Linden	E. B. Rogers	May 21	6,000
Portage lake	Dexter	J. E. McGregor	May 21	10,000
Total Lake Trout plants				1,647,000

Wall-eyed Pike Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Miner lake	Allegan	C. N. McDuffee	May 12	125,000
Lake Sixteen and Middle lake	Trowbridge	C. N. McDuffee	May 12	125,000
Emerson lake	Trowbridge	C. N. McDuffee	May 12	125,000
Buck or Pike lake	Trowbridge	C. N. McDuffee	May 12	125,000
Pine lake	Gun Plains	John H. Madden	May 12	125,000
Pickerel lake	Wayland	C. W. Andrews	May 13	125,000
Hill's lake	Wayland	C. W. Andrews	May 13	125,000
Doane's lake	Wayland	C. W. Andrews	May 13	125,000
Selkirk lake	Wayland	C. W. Andrews	May 13	125,000
Green lake	Leighton	A. M. Hooker	May 13	125,000
Rabbitt river bayou	Heath	Gillies Bros	May 15	125,000
Base Line lake	Trowbridge	Allen Hadden	May 15	210,000
Antrim county:				
Six Mile lake	Banks and Charlevoix	C. S. Campbell	May 13	250,000
Bowers lake	Banks	C. S. Campbell	May 13	125,000
Lake St. Clair	Banks	C. S. Campbell	May 13	125,000
Grass lake	Kearney and others	O. W. Kibby	May 13	250,000
Barry county:				
Barlow lake	Yankee Springs	Fred O. Stokoe	May 11	125,000
Douds lake	Rutland	F. R. Pancoast	May 11	125,000
Middle lake	Carleton	F. R. Pancoast	May 11	125,000
Gun lake	Orangeville and others	R. I. Hendershott	May 11	250,000
Barryville pond	Carleton	Archie Soules	May 11	125,000
Pine lake	Prairieville	Ed. J. Anderson	May 12	125,000
Culver lake	Johnstown	J. C. Bayley	May 13	150,000
Berrien county:				
St. Joe river	Niles	Mich. Fish Commission	May 13	300,000
Murphy's lake	Berrien	M. O. Becker	May 15	125,000
Benzie county:				
Crystal lake	Several	David E. Burns	May 18	200,000
Pearl lake	Almira	E. R. Dailey	May 12	200,000
Branch county:				
Coldwater lake	Ovid	John B. Shipman	May 12	300,000
Kenyon lake	Sherwood	Chas. Z. Fox	May 13	150,000
Cass county:				
Kirk lake	Penn and Newberg	H. S. East	May 15	150,000
Robbins lake	Porter	E. D. Stoner	May 15	225,000
LaGrange Mill Pond	LaGrange	A. N. Armstrong	May 15	150,000
Stone lake	LaGrange	A. N. Armstrong	May 15	300,000
Birch lake	Porter	A. N. Armstrong	May 15	150,000
Diamond lake	Penn	A. N. Armstrong	.....	420,000
Driscol lake	Newberg	Tobias Meyers	.....	270,000
Calhoun county:				
Kalamazoo pond	Marengo	C. W. Pierce	May 13	300,000
Upper and lower Brace lake	Fredonia and Eckford	Earl L. Holmes	May 13	300,000
Nottawages lake	Tekonsha	Wm. R. Aurand	May 15	180,000
Clare county:				
Budd lake	Hayes	E. F. Wilson	May 21	100,000
Cheboygan county:				
French Farm lake	Cheboygan	C. R. Harris	May 19	200,000
Emmet county:				
Crooked lake	Littlefield	J. C. Carpenter	May 19	200,000
Carp lake	Carp Lake	R. E. MacDuff, Jr.	May 19	200,000
Cecil lake	Carp Lake	W. E. Robinson	May 19	200,000
Eaton county:				
Narrow lake	Brookfield	W. T. Hahn	May 11	250,000
Grand Traverse county:				
Boardman lake	Traverse	Fred D. Curtis	May 13	250,000
Spider lake	East Bay	Fred D. Curtis	May 13	250,000
Duck or Betsy lake	Green lake	O. Van Tassel	May 13	250,000
Fife lake	Fife Lake	W. W. Brower	May 19	100,000

Wall-eyed Pike Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Genesee county:				
Long lake	Fenton	J. Max Davis	May 18	250,000
Lobdell lake	Argentine	Geo. W. Emmons	May 18	400,000
Pine lake	Fenton	J. Max Davis	May 18	250,000
Long lake	Fenton	Edwin O. Wood	May 18	400,000
Argentine lake	Fenton	J. W. Manton	May 18	400,000
Barnum lake	Fenton	Levi Barnum	May 18	125,000
Gratiot county:				
Pine river	Pine River	C. J. VanDenBergh	May 22	100,000
Mattison lake	Seville	J. A. Gager	May 21	100,000
Hillsdale county:				
Lines lake	Wright	L. W. Palmer	May 12	300,000
Baw Bees lake	Cambria and Hillsdale	Wm. C. Kemp	May 12	150,000
Adams lake	Adams	Marvin E. Hall	May 12	150,000
Lake Pleasant	Cambria	Marvin E. Hall	May 12	150,000
Duck lake	Allen	H. L. Bishop	May 13	150,000
Hemlock lake	Allen	H. L. Bishop	May 13	300,000
Ionia county:				
Mason's lake	Boston	J. Wallington	May 9	200,000
Huhn pond	Boston	J. Wallington	May 9	50,000
Grand and Looking Glass rivers	Portland	Grant M. Morse	May 16	500,000
Flat river	Otisco	O. A. Mummer	May 21	150,000
Lowell Electric Light pond	Keen and Otisco	H. Compton	May 21	100,000
Flat river	Otisco	G. O. Bignell	May 21	100,000
Smyrna Grist Mill pond	Otisco	Rostan Skellenger	May 21	50,000
Ingham county:				
Lowe lake	Stockbridge	C. H. Lowe	May 15	150,000
Jackson county:				
Gillett's lake	Leoni	Geo. E. Beebe	May 12	150,000
Farwell lake	Hanover	Wells W. Dew	May 12	300,000
Vandercook's lake	Summit	Geo. E. Beebe	May 12	150,000
Spring Arbor lake	Spring Arbor	Geo. E. Beebe	May 12	150,000
Ackerson lake	Napoleon	Geo. E. Beebe	May 12	150,000
Big Portage lake	Henrietta and Waterloo	Geo. E. Beebe	May 12	150,000
Brill's lake	Leoni	Geo. E. Beebe	May 12	150,000
Cranberry lake	Napoleon	Geo. E. Beebe	May 12	120,000
Kalamazoo county:				
Gourd Neck lake	Portage	John A. Pyl	May 13	150,000
Long lake	Portage and Pavillion	J. A. VanBochove	May 13	175,000
Crooked lake	Texas	Oren Harris	May 13	150,000
Pretty lake	Texas	Amos Davis	May 13	150,000
Kent county:				
Scram lake	Oakfield	Alonzo Griswold	May 15	125,000
Camp lake	Sparta	C. C. Darling	May 13	125,000
Grand river	Grand Rapids	Dwight Lydell	May 12	250,000
Lambertson's lake	Grand Rapids	Mich. Fish Commission	May 12	375,000
Thornapple river	Caledonia	W. H. Ly Barker	May 11	250,000
Grand river	.....	Chas. B. Kelsey	May 7	400,000
Pond on Flat river	Vergennes	J. A. Mattern	May 21	100,000
Kalkaska county:				
Manistee lake	Cold Springs	E. A. Bates	May 19	100,000
Crawford lake	Excelsior	John Avery	May 19	100,000
Livingston county:				
Portage lake	Putnam and others	L. D. Alley	May 12	150,000
Big Whitmore lake	Hamburg	L. D. Alley	May 12	150,000
Little White Wood lake	Hamburg	L. D. Alley	May 12	150,000
Cedar lake	Marion	Bert Sawdy	May 15	90,000
Wasson lake	Iosco	Bert Sawdy	May 15	90,000
Williamsville lake	Unadilla	Bert Sawdy	May 15	90,000
Brewen lake	Unadilla	Bert Sawdy	May 15	90,000
Ore lake	Green Oak and Hamburg	C. D. Clark	May 16	500,000
Crooked lake	Genoa	Joe Hugger	May 16	250,000
Long lake	Genoa	K. S. B. Holt	May 16	250,000
Bidwell lake	Brighton	F. T. Hyne	May 16	150,000
Island lake	Hamburg	G. T. Almendinger	May 16	300,000
Silver lake	Hamburg	Thos. J. Rice	May 20	300,000

Wall-eyed Pike Plants, 1903.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Leelanau county:				
Glen lake	Glen Arbor and others	D. H. Day	May 12	350,000
Knox creek pond	Empire	E. R. Dailey	May 12	50,000
Carp lake	Solon and Centreville	J. W. Milliken	May 29	250,000
Lenawee county:				
Devils lake	Rollin	Hampton and Kimball	May 13	450,000
Rollin Mill pond	Rollin	F. W. Bowen	May 13	150,000
Montcalm county:				
Bass lake	Belvidere	C. W. Vining	May 14	125,000
Town Line lake	Cato and Belvidere	C. W. Vining	May 14	125,000
Tamarack lake	Cato	C. W. Vining	May 14	125,000
Six lakes	Belvidere	C. W. Vining	May 14	125,000
Baldwin and Menoka lakes	Eureka	E. A. Kemp	May 14	125,000
Ziegenfus lake	Belvidere	E. A. Kemp	May 14	125,000
Crystal lake	Crystal Lake	Geo. W. Soule	May 15	250,000
West or Ingham lakes	Pine	C. W. Vining	May 21	150,000
Long and Trufants lakes	Pine	C. W. Vining	May 21	75,000
Big and Little Brimmer lakes	Cato	C. W. Vining	May 21	150,000
Cowden lake	Maple Valley	C. W. Vining	May 21	75,000
Mecosta county:				
Muskegon river	Green	James Wright	May 12	250,000
Clear lake	Colfax	J. W. Morton	May 12	250,000
Missaukee county:				
Muskrat lake	Reeder, Lake and Caldwell	Geo. W. Wood	May 19	200,000
Lake Missaukee	Reeder, Lake and Caldwell	Orville Dennis	May 19	200,000
Lake Sapphire	Lake	Orville Dennis	May 19	100,000
Muskegon county:				
Lake Harbor	Norton	J. L. VanPelt	May 16	250,000
Mason county:				
Bass lake	Town 17	F. E. Pray & Son	May 16	125,000
Oakland county:				
Lake Orion	Orion	Lake Orion Assembly Resort		
Big lake	Springfield	Jas. J. Hubbard	May 14	450,000
Walled lake	Commerce and Novi	A. W. VanTassell	May 18	250,000
Echo lake	Addison	Geo. W. Paton	May 18	500,000
Loon lake	Waterford	Mich. Fish Commission	May 19	500,000
Austin or Moor's lake	Milford	F. S. Hubbell	May 19	500,000
Buckhorn lake	Rose	F. S. Hubbell	May 20	250,000
White lake	Highland	F. S. Hubbell	May 20	250,000
Indian Garden lake	Milford	H. O. Ruggles	May 20	250,000
Jakeway lake	White lake	C. E. Ruggles	May 20	250,000
Upper and Lower Pettibone lakes	Highland	F. S. Hubbell	May 20	250,000
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	May 16	125,000
Osceola county:				
Center lake	Sherman	C. A. Iler	May 19	140,000
Van Buren county:				
Van Auken lake	Bangor	Jeremiah Walker	May 15	125,000
Silver lake	Columbia	O. C. Eagan	May 15	200,000
Saddle lake	Columbia	O. C. Eagan	May 15	200,000
Hersey lake	Porter	R. W. Mitchell	May 13	150,000
Cedar lake	Porter	C. F. Day	May 13	300,000
Gravel or Round lake	Porter	F. R. Ward	May 13	210,000
Bankson lake	Porter	Geo. Showers	May 13	150,000
Washtenaw county:				
Huron river	Webster	L. D. Alley	May 12	150,000
Cavanaugh lake	Sylvan	A. R. Welch	May 12	150,000
Half Moon lake	Dexter	J. H. Cooke	May 12	150,000
South lake	Lyndon	Bert Sawdy	May 15	90,000
Joslin lake	Lyndon	F. G. Marshall	May 15	150,000
Bruin lake	Lyndon	F. G. Marshall	May 15	150,000
Wexford county:				
Big Clam lake	Selma and Cherry Grove	N. V. Gerrish	May 9	200,000
Total Wall-eyed Pike plants				30,350,000

Wall-eyed Pike Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Green lake	Latton	C. H. Babbitt	May 21	150,000
Doanes creek	Wayland	C. W. Andrews, M. D.	May 21	100,000
Pickerel lake	Wayland	Wm. Jones	May 21	100,000
Emerson lake	Trowbridge	C. N. McDuffee	May 23	100,000
Buck or Pike lake	Trowbridge	C. N. McDuffee	May 23	100,000
Miner lake	Allegan	C. N. McDuffee	May 23	100,000
Lake 16 and Middle lake	Trowbridge	C. N. McDuffee	May 23	100,000
Otsego mill pond	Otsego	J. P. Stuck	June 7	90,000
Schnauble lake	Watson	A. W. Livingston	June 7	75,000
Pine Creek mill pond	Otsego	David A. Carpenter	June 7	60,000
Pike lake	Trowbridge	J. L. Pike	June 7	150,000
Joseph Smith pond	Valley	Frank Smith	June 8	60,000
Miner lake	Allegan	T. E. Streeter	June 8	120,000
Minkler lake	Trowbridge	D. H. Kent	June 8	90,000
Antrim county:				
Thayer lake	Helena	Wm. Amerson	June 4	120,000
Alcona county:				
Hubbard lake	28 N. 7 and 8 E.	John Baird	May 25	450,000
Barry county:				
Fine lake	Johnstown	Wm. H. Frey	May 21	210,000
Gun lake	Orangeville and Yankee Springs	R. I. Hendershott	May 23	175,000
Gun lake	Yankee Springs	R. I. Hendershott	May 23	200,000
Weyley lake	Orangeville	Dayton Stanley	May 23	150,000
Pine lake	Prairieville	John T. Shelp	June 8	120,000
Carr lake	Woodland	D. S. England	May 23	75,000
Branch county:				
Vincent lake	Girard	E. F. Sinclair	May 20	150,000
Benzie county:				
Round lake	Lake	David E. Burns	May 23	250,000
Berrien county:				
Paw Paw lake	Watervliet	Carmody Bros	May 24	150,000
St. Joseph river	Niles	Mich. Fish Commission	May 24	480,000
Baraga county:				
Lake One or Three or South lake	T. 48, R. 31	E. W. Mac Pherran	June 10	140,000
Lake Two or Lake George	T. 48, R. 31	E. W. Mac Pherran	June 10	140,000
Emma lake	L'Anse	Herman J. Seifert	June 10	100,000
Bella lake	Avon	E. D. Menge	June 10	100,000
Burnt Plains lake	L'Anse	W. L. Mason	June 10	100,000
Lake Agassiz	T. 49 R. 32 Secs. 17 and 20	E. W. Mac Pherran	June 10	100,000
Spruce lake	T. 49 R. 32 Secs. 26 and 27	E. W. Mac Pherran	June 10	80,000
Cheboygan county:				
Burt lake	Burt and Tuscarora	J. M. Sager	May 19	225,000
Douglas lake	Monroe	John H. Martin	May 19	200,000
Burt lake	Tuscarora and Burt	H. R. Field	May 23	360,000
Mullett lake	Burt	Clarence J. Rumsey	May 23	450,000
Cass county:				
Kirk lake	Penn and Newberg	H. S. East	May 20	150,000
Driscoll lake	Newberg	Tobias Meyers	May 20	150,000
Dilley lake	Newberg	J. M. Wiltsie	May 20	150,000
Robins lake	Porter	E. D. Stoner	May 20	150,000
Diamond lake	La Grange and others	A. N. Armstrong	May 20	300,000
Indian lake	Silver Creek	R. Lewis	May 21	300,000
Pleasant lake	Ontwa	Henry Andrus	May 28	100,000
Eagle lake	Ontwa	Benj. L. Turner	May 28	100,000
Hyke's lake	Marcellus	C. H. Waterstradt	May 28	100,000
Big Fish lake		Ebel Bros	May 28	100,000
East Saddlebag lake	Cass	Ebel Bros	May 28	100,000
West Saddlebag lake		Ebel Bros	May 28	100,000
Little Fish lake		Ebel Bros	May 28	100,000
Long lake	Porter	L. I. Hitchcock	June 7	75,000
Baldwin lake	Porter	L. I. Hitchcock	June 7	75,000
Clinton county:				
Park lake	Bath	Wm. H. Cook	May 23	200,000
Park lake	Bath	R. H. Loving	May 26	300,000
Charlevoix county:				
Branch lake	Hudson	Alba Brooks	May 19	200,000
Walloon and Long lakes	Evangeline	G. R. & I. R. R. Co.	June 10	375,000

Wall-eyed Pike Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Chippewa county:				
St. Mary's river		Mich. Fish Commission	June 14	1,150,000
Clare county:				
Dock and Tom lake	Surrey	D. W. Holland	May 23	75,000
Shingle lake	Surrey	J. B. Borst	May 25	125,000
Lake George	Surrey	J. B. Borst	May 23	125,000
Bangs lake	Surrey	Winfield Cowles	May 25	150,000
McWatty lake	Hayes	Edmund Bailey	May 25	150,000
Budd lake	Harrison	George J. Cummins	May 25	240,000
Crooked lake	Garfield	Thos. Maltby	May 25	300,000
Calhoun county:				
Bristol lake	Johnstown	J. A. Parrott	May 21	210,000
Garfield lake	Convis	F. H. Gage	May 21	100,000
Clear lake	Penfield	Bert Granger	May 21	125,000
Hart's lake	Battle creek	E. L. Forbush	May 21	125,000
Dickinson county:				
Archibald lake	Breitung	E. A. Croll	June 14	150,000
Hamilton lakes	Waucedah	Burt Jones	June 14	150,000
Emmet county:				
Crooked river	Littlefield and Maple river	W. W. Fairbairn	May 19	125,000
Carp lake	Carp Lake	R. E. McDuff, Jr.	May 19	150,000
Eaton county:				
Saddlebag lake	Sunfield and Woodland	F. F. Hilbert	May 23	100,000
Grand river	Delta	W. Lazell	May 23	150,000
Gogebic county:				
Tamarack lake	Watersmeet	J. R. Moore	June 14	150,000
Crooked lake	Watersmeet	A. D. Johnton	June 14	150,000
Grand Traverse county:				
Brewster lake		R. B. DeFrance	May 19	100,000
Long lake	Long Lake	Mrs. Warren Neal	May 19	125,000
Hogsback lake	East Bay	E. H. Barnes	May 19	200,000
Fife lake	Fife Lake	W. W. Brower	May 23	125,000
Long lake	Long Lake	C. R. Wait	May 26	250,000
Rennie lake	East Bay	J. R. Paige	May 26	125,000
Elk lake	Whitewater	O. J. Smith	May 26	200,000
Silver lake	Blair and Garfield	G. A. Brigham	June 3	150,000
Gratiot county:				
Pine river	Pine River	C. F. Van Den Bergh	May 25	200,000
Gladwin county:				
McGilvery lake	Sage	E. Eldredge	May 25	210,000
Genesee county:				
Long lake	Fenton	J. Max Davis	May 24	300,000
Pine lake	Fenton	J. Max Davis	May 24	300,000
Barnum lake	Fenton	Levi Barnum	May 24	150,000
Hillsdale county:				
Two lakes called Cobb lakes	Scipio	Omega Portland Cement Co.	May 20	240,000
Sand lake	Fayette	Frank Thorpe	May 20	150,000
Long lake	Reading	E. I. Van Sickle	May 20	180,000
Cub lake	Woodbridge and Cambria	Wm. F. Savage	May 20	240,000
Houghton county:				
Portage lake	Portage	Geo. Williams	June 10	100,000
Thirteen Mile lake	Adams	Geo. Williams	June 10	100,000
Obenhoff's lake	Adams	Geo. Williams	June 10	100,000
Croze's lake		E. H. Wright	June 10	100,000
Lake Eva	Adams	E. H. Wright	June 10	100,000
Harris lake	Elm River	E. H. Wright	June 10	100,000
Twin lakes	Elm River	T. W. Kroll	June 10	100,000
Iron county:				
Holmes lake	Crystal Falls	Armstrong and Kingsford	June 14	150,000
Deer lakes	Crystal Falls	Armstrong and Kingsford	June 14	150,000
Ionia county:				
Walter's pond	Boston	John Wallington	May 21	100,000
Morrison's lake	Boston	John Wallington	May 21	100,000
Morrison's lake	Boston	John Wallington	May 21	75,000

Wall-eyed Pike Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Ionia county.—*Continued:*				
Huhn's pond	Boston	John Wallington	May 21	100,000
Peck lake	Berlin	John Wallington	May 21	75,000
Flat river	Otsego	G. O. Bignell	May 25	200,000
Smyrna Grist Mill pond	Otsego	Rostan Skellenger	May 25	125,000
Ingham county:				
Lowe lake	Stockbridge	F. G. Marshall	May 25	150,000
Iosco county:				
Loon lake	Plainfield	Frank Duplantz	May 23	180,000
London lake	Plainfield	Frank Duplantz	May 23	180,000
Jackson county:				
Farwell lake	Hanover	Wells W. Dew	May 20	180,000
Upper Sandstone lake	Spring Arbor	Geo. Douglass	May 20	150,000
Lower Sandstone lake	Spring Arbor	Geo. Douglass	May 20	150,000
Gillett's lake	Leoni	A. E. Clement	May 21	210,000
Kalkaska county:				
Manistee lake	Cold Springs and Excelsior	E. A. Bates	May 19	200,000
Grass lake	Cold Springs and Excelsior	E. A. Bates	May 19	125,000
Loss lake	Cold Springs	W. S. Schoof and T. H. Glover	May 23	300,000
Kent county:				
Pickerel lake	Plainfield	A. C. House	May 21	200,000
Thornapple river	Caledonia	W. H. Ly Barker	May 23	200,000
Pratt's, McEwan and Campau lake	Caledonia and Lowell	Earl Curtis	May 25	375,000
Silver lake	Cannon	John H. Barker	June 1	45,000
Bostwick lake	Cannon	John H. Barker	June 1	45,000
Crooked lake	Gratton	John H. Barker	June 1	30,000
Grand river	Grand Rapids	Dwight Lydell	June 2	225,000
Reed's lake	Grand Rapids	Grand Rapids R. R. Co.	June 4	225,000
Scram lake	Oakfield	Alonzo Griswold	June 6	60,000
Round lake	Oakfield	Alonzo Griswold	June 6	60,000
Wabsis lake	Gratton	C. M. Wise	May 25	125,000
Kalamazoo county:				
Paw Paw lake	Texas	J. H. Munson	May 21	300,000
Long lake	Portage and Pavillion	J. R. Van Bochove	May 21	150,000
Madigo and Big Gourdneck lake	Portage	Fred Webber	May 21	100,000
Hogshead or Little Gourdneck lake	Schoolcraft	E. E. Barbite	May 21	100,000
Potter's lake	Charleston	H. M. Percy	May 28	125,000
Long lake	Charleston	Morris Roof	May 28	125,000
Livingston county:				
Reeves Mill pond	Putnam	Jas. H. Cooke	May 21	150,000
Peterson lake	Putnam	F. G. Marshall	May 25	150,000
Horseshoe lake	Morrison	Arthur Drew	May 25	210,000
Island lake	Hamburg	G. T. Allmendinger	May 26	300,000
Leelanau county:				
Glen lake	Glen Arbor and others	D. W. Day	May 19	400,000
Cedar lake	Elmwood	Ralph H. Hastings	May 26	200,000
Lapeer county:				
Fish lake	Hadley and Brandon	C. F. Profrock	May 26	150,000
Mason county:				
Bachelor lake or Turtle lake	Sheridan	Phillip Weaver	May 26	210,000
Bass lake	Town 17	E. E. Pray and Sons	May 27	200,000
Muskegon county:				
White lake	Montague	F. D. Pryor	May 27	200,000
Michillinda lake formerly called Duck lake	Fruitland 11-17 and 11-18	John R. Austin	May 27	150,000
Big Blue lake	Blue Lake	E. D. Magoon	May 27	200,000
Wolf lake	Egelston	E. D. Magoon	May 27	150,000
Lake Harbor	Norton	John. L. Van Pelt	May 27	200,000
Missaukee county:				
Muskrat lake	Reeder, Lake and Caldwell	Geo. W. Wood	May 20	400,000
Lake Missaukee	Caldwell	Orville Dennis	May 20	400,000
Lake Sapphire (Sec. Ten Lake)	Lake	Orville Dennis	May 20	400,000

Wall-eyed Pike Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Marquette county:				
Lake Laurie				
Chief or Trout lake	Humboldt	Robert D. Kyle	June 10	200,000
Michigamme lake		R. C. Browning	June 14	150,000
Four lakes—Dewey, Charboneau, Island and Johnston	T. 47 and 48 Range 30	E. W. MacPherran	June 10	240,000
Mackinac county:				
Duell's lake	Tilden and Republic	Geo. A. Newett	June 10	200,000
Big Dollar lake	Newton	Simmons Lumber Co.	June 13	150,000
	Hendricks	J. G. Donaldson	June 13	150,000
Mecosta county:				
Clear lake	Colfax	F. W. Joslin	May 19	150,000
Bissell's lake	Hinton	C. W. Vining	May 25	75,000
Perch lake	Morton	John Miller	June 9	75,000
Clear or Pleasant	Martiny	Miss Rachael Lewis	June 9	75,000
Munger lake	Fork	W. E. Redick	June 9	90,000
Perch lake	Morton	John Miller	June 9	75,000
Muskegon river	Green	Mich. Fish commission	June 9	180,000
Mud lake	Grant	C. B. Fuqua	June 9	90,000
Pogy lake	Chippeway	C. B. Fuqua	June 9	180,000
Montcalm county:				
Six lakes	Belvidere	C. W. Vining	May 25	75,000
Tamarack	Cato	C. W. Vining	May 25	75,000
West or Ingram lake	Pine	C. W. Vining	May 25	75,000
Big and Little Brimmer lakes	Cato	C. W. Vining	May 25	75,000
Twin lakes	Pine	C. W. Vining	May 25	75,000
Deer lake		E. A. Kemp	May 25	200,000
Bass lake	Richland	C. Hoover	May 25	200,000
Loon lake	Crystal	W. H. Everest	June 6	60,000
Crystal lake	Crystal	Geo. W. Soule	June 6	90,000
Holland lake	Evergreen	A. N. Russell	June 6	60,000
Newaygo county:				
Pickerel lake	Home	H. Toncray	May 26	200,000
Diamond lake	Lincoln	Capt. W. W. Bigelow	May 6	200,000
Crystal lake	Sherman	John Mayo	May 26	150,000
Oakland county:				
Lake Orion	Orion	A. L. Parker	May 23	300,000
Long lake	Rose	Wallace Becker	May 24	150,000
Buckel's lake	Groveland	Jay K. Tindall	May 24	150,000
Sylvan lake	Bloomfield	C. D. Standish	May 24	300,000
Deer lake	Independence	Oliver N. Gardner	May 24	300,000
Cass lake	West Bloomfield	B. S. Tregent	May 25	450,000
Jakeway lake	White Lake	Don A. Jakeway	May 25	150,000
Schoolmarsh lake	Brandon	C. A. Flagler	May 26	150,000
Lawrence lake	Brandon	A. A. Zimmerman	May 26	150,000
Silver lake	Waterford	Mich. Fish Commission	May 26	750,000
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	May 27	200,000
Crystal lake	Hart	C. L. Churchill	May 27	100,000
Ogemaw county:				
Sage lake	Hill	Frank Austin	May 23	180,000
Edward's lake	Edwards	John Tolfree	May 23	150,000
Sidney lake	West Branch	John Tolfree	May 23	150,000
Crapo lake	West Branch	John Tolfree	May 23	150,000
Clear lake	Richland	George Eymer	May 25	150,000
Ottawa county:				
Spring lake	Spring Lake	B. M. Smith	June 2	120,000
Osceola county:				
Greggs lake	Sherman	John Eggle	May 19	50,000
Otsego county:				
Lake 27	Elmira	Wm. Weaver & Son	May 19	200,000
Otsego lake	Otsego Lake	Birney Dutton	May 23	300,000
Ontonagon county:				
Lake Gogebic	Several	G. A. Bergland	June 10	300,000
Six Mile lake	Bohemia	James E. Bower	June 10	100,000

Wall-eyed Pike Plants, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Roscommon county:				
Campbell's lake	Nester	John A. Tolfree	May 23	150,000
Clear lake	Nester	E. A. Coan	May 23	150,000
St. Joseph county:				
Thompson lake	Sherman	John Pagels	May 21	200,000
Lake Winnewaukon	Sherman	James Bowdish	May 21	200,000
Aldrich lake	White Pigeon	Luther O. Girton	May 21	150,000
Klinger's lake	White Pigeon	J. R. Watson	May 21	200,000
Corey lake	Fabius	E. B. Linsley	May 20	300,000
Tuscola county:				
Powder Horn lake	Millington	R. F. Sherman	May 23	150,000
Van Buren county:				
North lake		B. C. Chambers	May 21	360,000
Gravel or Round lake	Porter	F. R. Ward	May 21	240,000
Silver lake	Columbia	O. C. Eagan	May 24	150,000
Saddle lake	Columbia	O. C. Eagan	May 24	200,000
Munson lake	Columbia	V. N. Brant	May 24	100,000
Scott lake	Columbia and Arlington	Geo. S. Bigelow	May 24	250,000
Baker's lake	Lawrence	J. M. Blowers	May 24	100,000
Lake Cora	Paw Paw	Lake Cora Summer Association	May 24	150,000
Three Mile lake	Paw Paw	Wm. Kirkwood	May 24	250,000
Washtenaw county:				
Portage lake	Dexter	J. E. McGregor	May 21	210,000
Blind lake	Dexter	F. G. Marshall	May 25	150,000
Bruin lake	Lyndon	F. G. Marshall	May 25	150,000
Joslin lake	Lyndon	F. G. Marshall	May 25	150,000
Wexford county:				
Stone Ledge lake	Clam Lake	John Eggle	May 19	100,000
Big Clam lake	Selma and Cherry Grove	N. V. Gerrish	May 19	150,000
Round lake	Haring	Clyde McNitt	May 19	150,000
Wetmore lake	Haring	Clyde McNitt	May 19	100,000
Long lake	Haring	Clyde McNitt	May 19	150,000
Total				39,675,000

Small Mouth Bass Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Barry county:				
Gun lake	Yankee Springs	A. A. Anderson	May 23	6,000
Pine lake	Prairieville	John T. Shelp	May 26	4,000
Pine lake	Prairieville	Ed. J. Anderson	May 26	4,000
Cass county:				
Cable lake	Silver creek	Jas. Harley	May 23	4,000
Cook's lake	Wayne	John Crawford	May 23	4,000
Crooked lake	Keeler	T. Harley	May 23	4,000
Calhoun county:				
St. Mary's lake	Pennfield	F. Vannocker	May 26	6,000
Jackson county:				
Clark's lake	Columbia	Thos. H. Williams	May 26	6,000
Brill's lake	Leoni	Geo. E. Beebe	June 17	6,000
Ackerson lake	Napoleon	Geo. E. Beebe	June 17	6,000
Kalamazoo county:				
Paw Paw lake	Texas	Burt Ayers	May 22	4,000
Bankson lake	Porter	R. W. Mitchell	May 22	6,000
Livingston county:				
Silver lake	Hamburg	Thos. J. Rice	May 26	6,000
Monroe county:				
River Raisen	Monroe	River Raisin Game & Fish Protective Assn	May 27	10,000
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	May 30	8,000
Oakland county:				
Cass lake	West Bloomfield	Mich. Fish Commission	June 10	6,000
Maceday lake	Waterford	Seymour Bower	June 22	4,000
Lake Elizabeth	Waterford	Seymour Bower	June 22	2,000
Lake Angelus	Pontiac	John S. Gray	May 25	6,000
Union lake	Commerce and West Bloomfield	A. H. Paddock	May 25	6,000
White lake	Highland	F. S. Hubbell	May 26	6,000
Long lake	White Lake	Robt. S. Potts	May 26	8,000
Lower Pettibone	Highland	F. S. Hubbell	May 26	6,000
Walled lake	Commerce and Novi	A. M. Van Tassell	May 26	6,000
Orchard lake	West Bloomfield	F. S. Campbell	May 26	6,000
Van Buren county:				
Bankson lake	Porter	R. W. Mitchell	May 22	6,000
Gravel or Round lake	Porter	F. R. Ward	May 22	4,000
No name	Decatur	C. S. Smith	May 22	4,000
Hersey	Porter	V. B. Finch	May 22	4,000
Lake Cora	Paw Paw	Ihling Bros. & Everard	May 22	6,000
Three Mile lake	Paw Paw	Wm. M. Kirkwood	May 22	6,000
Cable lake	Keeler	Geo. W. Adams	May 23	4,000
Crooked lake	Keeler	M. Defendorf	May 23	4,000
Washtenaw county:				
Half Moon lake	Dexter	Jas. H. Cooke	May 26	6,000
Huron river	Ypsilanti	Edward King	May 26	8,000
Cavenaugh lake	Sylvan	A. R. Welch	May 26	6,000
Portage lake	Dexter and Webster	W. H. Sweet	May 26	6,000
Total				204,000

Small Mouth Fingerlings.

County and name of waters.	Town.	Depositor.	Date.	Number.
Gogebic county:				
Clark lake	Watersmeet	A. D. Johnston	July 10	400
Island lake	Watersmeet	A. D. Johnston	July 10	400
Crooked lake	Watersmeet	A. D. Johnston	July 10	400
Thousand Island lake	Watersmeet	A. D. Johnston	July 10	400
Kalamazoo county:				
White's lake	Kalamazoo	C. E. Foote	July 14	400
Otsego lake	Vanderbilt	Mich. Central R. R.	Aug. 25	500
Total				2,500

Small Mouth Bass Fry Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Pine lake	Gun Plains and Prairieville	John H. Madden	May 28	4,000
Witherall's lake	Watson	Stephen A. Pratt	June 15	4,000
Green lake		C. H. Babbitt	June 15	4,000
Cass county:				
Pleasant lake	Ontwa	Henry Andrus	May 28	4,000
Big Fish lake	Marcellus	C. S. Jones	May 28	4,000
Isabella county:				
Blood lake	Bloomfield	Wm. R. Hall	June 9	4,000
Kalamazoo county:				
Long lake	Portage	Henry Warut	May 28	4,000
Pickerell lake	Pavillion	John R. Van Bochove	May 28	4,000
Portage river	Schoolcraft and others	Chas. H. Schellhouse	June 15	4,000
Kent county:				
Camp lake	Algoma	D. E. Elliott	June 4	4,000
Muskegon county:				
Michillinda lake, known as Duck lake	Fruitland 11-7 and 11-18	John R. Austin	May 27	4,000
Big Blue lake	Blue Lake	Fred J. Russell	June 13	8,000
Mecosta county:				
Tufts lake	Sheridan	W. E. Redick	June 9	4,000
Montcalm county:				
Crystal lake	Crystal	Geo. H. Soule	June 6	4,000
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	May 27	6,000
Oakland county:				
Elizabeth lake	Waterford	T. Cross	May 16	6,000
Union lake	Commerce and West Bloomfield	Al. H. Paddock	May 16	6,000
St. Joseph county:				
Portage lake	Mendon	C. D. Best	May 28	4,000
Van Buren county:				
Eagle lake	Paw Paw	F. C. Benningfield	June 15	4,000
Lake of the Woods	Decatur	F. C. Benningfield	June 15	4,000
Hersey lake	Porter	C. F. Dey	June 15	4,000
Total				94,000

Small Mouth Bass Fingerlings and Baby Fingerlings, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
One of the Intermediate Chain	Banks	C. S. Campbell	July 16	1,000
Alger county:				
Perch lake	Munising	Cleveland Cliffs Iron Co.	Oct. 15	1,050
Alcona county:				
Shiawassee lake	28 N. 7 and 8 E.	John Baird	July 4	1,000
Allegan county:				
Kalamazoo river	Trowbridge and Allegan	C. N. McDuffee	Aug. 8	500
Benzie county:				
Crystal lake	Benjamin	D. E. Burns	July 13	500
Crystal lake	Crystal Lake	J. J. Kirby	Oct. 21	400
Berrien county:				
Smith's lake	Berrien and Pokagon	M. O. Becker	Aug. 4	500
O'Brien lake	Berrien	M. O. Becker	Aug. 4	500
Barry county:				
Gun lake	Yankee Springs	A. A. Anderson	July 19	750
Calhoun county:				
Lyon lake	Fredonia	E. L. Holmes	July 14	500
Kalamazoo river	Marshall	Faulkner and Grant	Aug. 8	500
Cheboygan county:				
Long lake	Benton and Grant	E. S. Ross	July 21	750
Douglas lake	Munro	W. B. Stimson	July 15	500
Douglas lake	Munro	W. B. Stimson	Sept. 3	500
Charlevoix county:				
Walloon lake	Melrose and Evangeline	W. B. Stimson	July 15	500
Crawford county:				
Mud lake		F. B. Dickerson	June 21	500
Genesee county:				
Pine lake	Fenton	J. Max Davis	July 22	1,000
Ionia county:				
Flat river	Otisco	C. M. Wise	July 6	750
Jackson county:				
Farwell lake	Hanover	Wells W. Dew	July 19	500
Kent county:				
McCarthy's lake	Grattan	E. J. Killean	July 11	500
Silver lake	Cannon	John H. Baker	July 11	500
Kalamazoo county:				
Gull lake	Richland and Ross	M. M. Shipman	July 25	500
Montcalm county:				
Kendall's, Herschal, Summit and Ingram lakes	Pine	S. J. Youngman	July 29	500
West or Ingram lakes	Pine	C. W. Vining	July 29	250
Town Line lake	Cato and Belvidere	C. W. Vining	July 29	500
Tamarack lake	Cato	C. W. Vining	July 29	500
Bass lake	Belvidere	C. W. Vining	July 29	500
Whitefish lake		Wm. Aldrich Tateum	Oct. 1	1,000
Mackinac county:				
Brevort lake	Moran	C. W. Eastman	July 15	500
Oakland county:				
Deer lake	Independence	Oliver N. Gardener	July 22	1,000
Cass lake	West Bloomfield	B. S. Tregent	July 29	500
Maceday lake	Waterford	Mich. Fish Commission	Aug. 5	900
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	July 9	1,000

Small Mouth Bass Fingerlings and Baby Fingerlings, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
St. Joseph county:				
Thompson lake	Sherman	John Pagels	July 27	500
Aldridge lake	White Pigeon	Luther O. Girton	July 27	500
Van Buren county:				
Three Mile lake	Paw Paw	Wm. Kirkwood	July 23	750
Washtenaw county:				
Huron river	Ypsilanti	Edward King	July 13	500
Half Moon lake	Dexter	Jas. H. Cooke	July 13	500
Total				23,600

Yearling Small Mouth Bass Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Mecosta county:				
Muskegon river	Grant	Bert Owens	June 11	100
Total				100

Large Mouth Bass Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Green lake	Leighton	C. H. Babbitt	June 20	6,000
Emerson lake	Trowbridge	C. N. McDuffee	June 6	6,000
Miner lake	Allegan	C. N. McDuffee	June 6	6,000
Buck lake	Trowbridge	C. N. McDuffee	June 6	4,000
Sixteen and Middle lakes	Trowbridge	C. N. McDuffee	June 6	4,000
Lyster lake	Lee	Fred C. Schelske	June 10	4,000
Doanes lake	Wayland	C. W. Andrews	June 15	4,000
Hill's lake	Wayland	C. W. Andrews	June 15	4,000
Kalamazoo river	Trowbridge and Allegan	C. N. McDuffee	May 22	4,000
Berrien county:				
Blossom lake	Sherwood	Frank Swain	May 29	4,000
Paw Paw lake	Watervliet	Carmody Bros	June 10	4,000
Big Paw Paw lake	Watervliet	Stanley D. Guy	June 10	4,000
Little Paw Paw lake	Watervliet	Stanley D. Guy	June 10	4,000
Paw Paw river	Watervliet	E. E. Rowland	June 10	4,000
Little Paw Paw lake	Watervliet	E. E. Rowland	June 10	4,000
Smith's lake	Berrien	M. O. Becker	June 10	4,000
Long lake	Berrien	M. O. Becker	June 10	4,000
Poor Farm dam	Berrien	Myron Murphy	June 10	4,000
Pottawatimie lake	New Buffalo	W. C. Weed	June 10	4,000
Mirror lake	New Buffalo	Aug. Vetterly	June 10	4,000
Benzie county:				
Sanford lake	Almira	R. B. Reynolds	June 12	8,000
Barry county:				
Barlow lake	Yankee Springs	J. D. Deitrich	May 29	4,000
Gun lake	Yankee Springs	A. A. Anderson	May 29	6,000
Fourth lake, known as Carr lake	Woodland and Sunfield	D. S. England	June 8	4,000
Long lake		Will Locher	June 20	6,000
Long lake	Prairieville	Chas. Barber	June 20	6,000
Wall lake	Hope	Geo. A. Eddy	June 20	4,000
Calhoun county:				
Garfield lake	Convis	F. H. Gage	June 8	4,000
Barnum's lake	Leroy	Dr. F. L. Hoffman	June 8	4,000
Paine's lake	Leroy	Dr. F. L. Hoffman	June 8	4,000
Mud lake	Leroy	Dr. F. L. Hoffman	June 8	2,000
Paul's lake	Leroy	Dr. F. L. Hoffman	June 8	4,000
Mill lake	Leroy	Dr. F. L. Hoffman	June 8	4,000
Clear lake	Penfield	Bert Granger	June 12	4,000
Clinton county:				
Round lake	Victor	J. C. Shaver	June 12	4,000
Cheboygan county:				
Long lake	Grant and Benton	E. S. Roos	June 10	8,000
Black lake	Waverly and Grant	Wm. E. Shoemaker	June 10	6,000
Cass county:				
West Goose lake	Jefferson	Dempsey & Westfall	May 29	4,000
Birch lake	Porter	C. A. King	May 29	4,000
Bear lake	Porter	Tobias Myers	May 29	4,000
Hutchings lake	Newburg	Albert Bogert	May 29	2,000
Holland lake	Penn	R. S. Pemberton	May 29	4,000
Donald's lake	Penn	D. K. Thurston	May 29	4,000
Indian lake	Silver creek	R. Lewis	May 21	4,000
Twin lake	Wayne	Luther Hedges	May 21	4,000
Pine lake	Wayne	C. W. Crawford	May 21	4,000
Eaton county:				
Flint river	Flint	W. R. Bates	June 6	6,000
Saddlebag lake	Sunfield and Woodland	F. F. Hilbert	June 8	4,000
Stanbaugh lake	Walton	D. L. Stanbaugh	June 8	4,000
Genesee county:				
Lobdell lake	Argentine	Geo. W. Emmons	June 18	6,000
Long lake	Fenton	Edwin O. Wood	June 18	8,000
Hillsdale county:				
Sand lake	Fayette	Frank Thorpe	June 4	4,000
Cobb lake	Scipio	Omega Portland Cement Co	June 4	4,000
Buck lake	Adams	G. A. Lynch	June 4	4,000
Duck lake	Allen	H. L. Bishop	June 4	4,000
Mallory lake	Pittsford	T. Baskerville	June 4	4,000

Large Mouth Bass Plants, 1903.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Hillsdale county.—*Continued.*				
Moon lake	Pittsford	Philo A. Silvernail	June 4	2,000
Moon lake	Somerset	Chas. E. Freer	June 12	4,000
Grand river	Somerset	Chas. E. Freer	June 12	4,000
Crystal lake	Somerset	Chas. E. Freer	June 12	4,000
Baw Beos lake	Cambria and Hillsdale	Wm. C. Kemp	June 12	5,000
Huron county:				
Pond at Bayport	Willow	Wm. H. Wallace	June 4	3,000
Quarries	Willow			
Quarry pond	Lake	Wm. H. Wallace	June 4	3,000
Rush lake		Leonard R. Thomas	June 4	10,000
Ingham county:				
Pine lake	Meridian	Chas. Downey	June 4	8,000
Fulcher lake	White Oak	C. H. Lowe	June 4	4,000
Lowe lake	Stockbridge	F. G. Marshall	June 4	4,000
Ionia county:				
Morrison's lake	Boston	John Wallington	June 1	6,000
Jackson county:				
Sweezy lake	Norvell	F. W. Schofield	June 4	4,000
Vineyard lake	Columbia and Norvell	Geo. S. Cook	June 4	6,000
Wolf lake	Leoni and others	T. H. Williams	June 4	4,000
Farwell lake	Hanover	C. J. VanCholck	June 12	4,000
Swain's lake	Pulaski	F. W. McKenzie	June 12	6,000
Round lake	Liberty	F. W. McKenzie	June 12	8,000
Big Portage lake	Henrietta and Waterloo	Geo. E. Beebe	June 12	4,000
Brown's lake	Summit	Geo. E. Beebe	June 15	4,000
Vandercook's lake	Summit	Geo. E. Beebe	June 15	4,000
Michigan Centre pond	Leoni and Napoleon	Geo. E. Beebe	June 15	4,000
Kalamazoo county:				
Blue lake	Charleston	Morris Roof	June 8	4,000
Little Portage lake	Charleston	M. C. Retallick	June 8	4,000
Kent county:				
Round lake	Tyrone	L. E. Haring	June 5	4,000
Long lake	Solon	L. E. Haring	June 5	4,000
Black lake	Solon	L. E. Haring	June 5	4,000
Zegenfus lake	Oakfield	E. A. Kemp	June 5	6,000
Campau lake	Caledonia	S. H. Sweet	June 8	4,000
Porters lake	Algoma and Portland	Geo. E. Rector	June 9	4,000
Munro pond	Algoma	Geo. E. Rector	June 9	4,000
Bradley's pond	Courtland	James Munro	June 9	4,000
Lowell Flat River pond	Lowell	J. A. Mattern	June 18	4,000
Livingston county:				
Long lake	Hartland	M. C. Williams	June 6	4,000
Round or Grubb lake	Hartland	J. N. Weaver	June 6	4,000
Long lake	Genoa	K. S. B. Holt	June 8	8,000
Island lake	Putnam and Unadilla	C. N. Bullis	June 19	4,000
Island lake	Hamburg	G. F. Almendinger	June 19	6,000
Williamsville lake	Unadilla	F. G. Marshall	June 19	4,000
Lenawee county:				
Tripp lake	Rollin	James B. Thorn	June 4	4,000
Horse Shoe pond	Rollin	Wm. Pomeroy	June 4	4,000
Devil's lake	Rollin	Hampton & Kimball	June 17	8,000
Evan's lake	Franklin	F. W. Ives	June 17	6,000
Wampler's lake	Cambridge	Geo. Eagan	June 17	8,000
Leelanau county:				
Glen lake	Glen Arbor and others	D. H. Day	June 12	8,000
Mecosta county:				
Pogy lake	Grant	J. P. Marks	June 9	6,000
Young's lake	Grant	J. P. Marks	June 9	4,000
Clear lake	Colfax	Chas. D. Carpenter	June 9	4,000
Mud lake	Grant	J. P. Marks	June 9	4,000
Missaukee county:				
Lake Sapphire	Missaukee	Orville Dennis	June 16	4,000
Lake Missaukee	Lake and others	Orville Dennis	June 16	8,000
Macomb county:				
Easton Glen pond	Bruce	Chas. Albertson	June 19	4,000

Large Mouth Bass Plants, 1903.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Montcalm county:				
Turk lake	Pine	E. A. Kemp	June 5	6,000
White Fish lake	Pierson	C. W. Hartt	June 9	4,000
Little White Fish lake	Pierson		June 9	4,000
Muskegon county:				
Lake Harbor	Norton	John L. Van Pelt	May 30	4,000
Duck lake	Fruitland	E. D. Magoon	May 30	4,000
Big Blue lake	Blue Lake	Fred J. Russell	May 30	4,000
White lake	Montague	Will M. Peck	May 30	4,000
Crystal lake	Whitehall and others	Gee & Carr	May 30	4,000
Manistee county:				
Portage lake	Onekama	W. W. Davis	June 12	8,000
Newaygo county:				
Maynard lake	Ensley	Fred Frey	June 9	4,000
North lake	Ensley	Fred Frey	June 8	4,000
Oakland county:				
Upper Pettibone lake	Highland	F. S. Hubbell	June 6	4,000
Highfield's lake	Highland	Geo. N. Hedden	June 6	4,000
Buckhorn lake	Rose	F. S. Hubbell	June 6	4,000
Drake lake	Holly	Thos. P. Green	June 6	4,000
Morris lake	Milford	Robt. S. Potts	June 6	4,000
Forebush lake	Milford	John N. Pickett	June 6	4,000
Milford Mill pond	Milford	Frank B. Hatch	June 6	4,000
Sear's lake	Milford	Frank B. Hatch	June 6	4,000
Troy lake	Commerce	C. E. Ruggles	June 6	4,000
Glaspie lake	Oxford	C. H. Glaspie	June 6	10,000
Oceana county:				
Gurney Mill pond	Hart	C. B. Stevens	May 30	4,000
Gilbert lake	Leavitt and Colfax	C. B. Stevens	May 30	4,000
Otsego county:				
Big lake	Chester	Wm. H. Smith	June 10	6,000
Otsego lake	Otsego	E. B. Bolton	June 10	10,000
Van Buren county:				
Sister lakes	Keeler	M. Devendorf	July 21	6,000
Round or Sister lakes	Keeler	T. Harley	July 21	6,000
Mud or Base Line lake	Columbia	Almer Deming	June 10	4,000
Little Bear lake	Columbia	A. D. Parker	June 10	4,000
Coffee lake	Columbia	A. D. Parker	June 10	4,000
Saddle lake	Columbia	N. B. Lester	June 10	2,000
Donovan lake	Bangor	Geo. Mutchler	June 10	4,000
Rush lake	Hartford	C. J. Jackson	June 10	4,000
Saddle lake	Columbia	O. C. Eagan	June 10	4,000
Washtenaw county:				
Bruin lake	Lyndon	F. G. Marshall	June 19	4,000
Joslin lake	Lyndon	F. G. Marshall	June 19	4,000
Island lake	Lyndon	S. A. Palmer	June 19	4,000
Total Big Mouth bass				676,000

Big Mouth Bass Fingerlings, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Barry county:				
Crooked lake	Prairieville	W. A. Spaulding	July 14	600
Cheboygan county:				
Douglas lake	Monroe	John H. Martin	Aug. 7	750
Lancaster lake	Monroe	John H. Martin	Aug. 7	750
French Farm lake	Mackinaw	C. R. Harris	Sept. 25	500
Clare county:				
Sutherland lake	Hayes	E. F. Wilson	July 7	250
McWatty lake	Hayes	E. F. Wilson	July 7	250
Little Long lake	Hayes	E. F. Wilson	July 7	250
Budd lake	Hayes	E. F. Wilson	July 7	500
Emmet county:				
No name		Robt. Summer	Aug. 7	500
Crooked lake	Littlefield	J. C. Carpenter	Aug. 7	750
Genesee county:				
Thread lake	Burton	H. M. Long	July 18	750
Coomer lake	Van Buren	John Maudt	July 18	500
Houghton county:				
Lake Gerald	Elm river	Geo. Williams	July 10	400
Lake Rowland	Elm River	Geo. Williams	July 10	400
Ingham county:				
Pine lake	Meridian	Clarence D. Clark	July 18	1,000
Iron county:				
Fortune lakes, a chain of lakes	Crystal Falls	A. Lustfield	July 10	400
Jackson county:				
Gilletts lake	Leoni	Annis Clement	Aug. 21	1,000
Kalamazoo county:				
Lyons lake	Comstock	C. E. Foote	July 14	400
Hipp lake	Alamo	A. M. Nutten	July 14	600
Shellman lake	Alamo	R. A. Garrison	July 14	600
Bonnecarlt's lake	Oshtemo	C. S. Bartholomew	July 14	400
Montcalm county:				
Duck lake	Crystal	B. F. Sweet and O. R. Goodno	July 2	500
Crystal lake	Crystal Lake	O. R. Goodno	July 2	500
Marquette county:				
Bass lake	Forsythe	A. C. Seass	July 9	400
Mason county:				
Gun lake	Freesoil	C. E. Root	July 9	1,000
Newaygo county:				
Hess lake		P. P. Shackelton	July 3	500
Oakland county:				
Cass, Sylvan and Otter lakes	West Bloomfield	B. S. Tregent	July 18	1,000
Pine lake	West Bloomfield	B. S. Tregent	July 18	750
Otsego county:				
Vanderbilt lake	Otsego	M. C. R. R. Co	July 18	2,000
Shiawassee county:				
Shiawassee river	Owosso	O. B. Estey	July 18	500
Total B. M. Bass fingerlings				18,700

Large Mouth Bass Advanced Fry Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Allegan county:				
Emerson lake	Trowbridge	C. N. McDuffee	June 18	6,000
Crutchers lake	Watson	Wm. Locher	June 15	4,000
Silkirk's lake	Wayland	C. W. Andrews	June 15	4,000
Doanes lake	Wayland	C. W. Andrews	June 15	4,000
Hill's lake	Wayland	C. W. Andrews	June 15	4,000
Indian lake	Leighton	J. Arthur Culp	June 15	4,000
Barry county:				
Kilpatrick lake	Woodland	C. M. Putnam	June 20	4,000
Ellis lake	Assyria	F. M. Quick	June 20	4,000
Podunk lake	Rutland	R. K. Grant	June 20	4,000
Pine lake	Hope	W. H. Ricle	June 20	4,000
Clear lake	Baltimore and Johnstown	C. E. Lunn	June 20	4,000
Leach lake	Carleton	D. W. Rogers	June 20	4,000
Branch county:				
Greenfield creek	Sherwood	Daniel Warsop	June 17	4,000
Kenyon lake	Sherwood	J. J. Snyder	June 17	4,000
Clater lake	Sherwood	Chas. Waterman	June 17	4,000
Kirby lake	Sherwood	Fred Waterman	June 17	4,000
Lower lake	Sherwood	Chas. H. Fox	June 17	4,000
Leir lake	Sherwood	Chas. H. Fox	June 17	4,000
Cass county:				
Saddlebag lake	Volinia and Marcellus	E. S. Jones	June 24	4,000
Mulford lake	Volinia and Marcellus	Albert Jaquays	June 24	4,000
Lower Goose lake	Jefferson	Frank S. Bishop	June 24	4,000
West Saddlebag lake	Cass	Ebel Bros	June 24	4,000
Little Fish lake	Cass	Ebel Bros	June 24	4,000
Finch lake	Cass	Ebel Bros	June 24	4,000
Otter lake	Cass	Fred Bailey	June 24	4,000
Mud lake	Marcellus	H. L. Leveridge	June 24	4,000
Calhoun county:				
Notawa lake	Athens	Boyd Miller	June 17	4,000
Grass lake	Athens	Wm. Hutchins	June 17	4,000
Cedar lake	Fredonia	E. L. Holmes	June 20	6,000
Brace lake	Marshall	J. F. Garwood	June 20	4,000
Rice lake	Marengo	Guy H. Grant	June 20	4,000
Long lake	Johnstown	J. A. Parrott	June 20	4,000
Hains lake	Bedford	Wm. H. Frey	June 20	4,000
Clinton county:				
Park lake	Bath	R. H. Loving	June 20	4,000
Emmet county:				
Carp lake	Carp Lake and Hebron	O. C. Cope	June 23	6,000
Crooked lake	Littlefield	E. L. Stricker	June 23	6,000
Pickerel lake	Littlefield	J. C. Carpenter	June 23	6,000
Grand Traverse county:				
Fife lake	Fife Lake	W. H. Brower	June 16	8,000
Hogsback lake	East Bay	E. H. Barnes	June 16	6,000
Rennie lake	East Bay	R. B. De France	June 16	4,000
Mud lake	East Bay	R. B. De France	June 16	4,000
Spiders lake	East Bay	R. B. De France	June 16	4,000
Ionia county:				
Flat river	Otisco	C. M. Wise	June 22	4,000
Woodward lake	Ronald	I. L. Hubbell	June 22	4,000
Long lake	Orleans	I. L. Hubbell	June 22	4,000
Jackson county:				
Portage lake	Waterloo	Geo. E. Beebe	June 24	3,000
Cranberry lake	Napoleon	Geo. E. Beebe	June 24	3,000
Ackerson lake	Napoleon	Geo. E. Beebe	June 24	3,000
Gillett's lake	Leoni	Geo. E. Beebe	June 24	3,000
Michigan Centre Mill pond	Leoni and Napoleon	Geo. E. Beebe	June 24	3,000
Brill's lake	Leoni	Geo. E. Beebe	June 24	3,000
Kalamazoo county:				
West lake	Portage	John A. Pyl	June 18	4,000
Austin lake	Portage	Sirk Wykkel	June 18	4,000
Knapp's lake	Charleston	E. M. Gray	June 18	4,000
Wood's lake	Climax	H. D. Streator	June 18	4,000
Three lakes	Richland	H. D. Streator	June 18	4,000
Butterfield lake	Ross	H. D. Streator	June 18	4,000
Smith's lake	Charleston	H. D. Streator	June 18	4,000

Large Mouth Bass Advanced Fry Plants, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Kalamazoo county.—*Continued:*				
Sherman's lake	Ross	H. D. Streator	June 18	4,000
Burnham lake	Charleston	H. D. Streator	June 18	4,000
Portage lake	Charleston	H. D. Streator	June 18	4,000
Indian lake	Pavillion and Brady	Frank R. Lemon	June 24	4,000
Hogshead or Little Gourdneck lake	Schoolcraft	E. E. Barbite	June 24	4,000
Kent county:				
Munro's pond	Algoma	Geo. E. Rector	June 14	4,000
Camp lake	Algoma	Chas. A. Johnson	June 14	4,000
Bradley's pond	Courtland	Geo. E. Rector	June 14	4,000
Big Wabasis lake	Grattan	C. M. Wise	June 22	4,000
Pine Island lake	Grattan	L. E. Green	June 22	4,000
Chapin lake	Grattan	L. E. Green	June 22	4,000
Lake county:				
Whelen lake	Webber	L. A. Carpenter	June 18	4,000
Twin or Hamlin's lake	Pleasant Plains	L. A. Carpenter	June 18	4,000
Coshron lake	Webber	L. A. Carpenter	June 18	4,000
Little Star lake	Webber	L. A. Carpenter	June 18	4,000
Livingston county:				
Paterson lake	Vandalia	F. G. Marshall	June 22	3,000
Williamsville lake	Unadilla	F. G. Marshall	June 22	3,000
Armstrong's lake	Hartland	C. E. Lovejoy	June 29	3,000
Green lake	Hartland	Weaver and Watkins	June 29	3,000
Long and Handy lake and Ore creek	Hartland	M. C. Williams	June 29	3,000
Round lake	Hartland	Weaver and Watkins	June 29	3,000
Lapeer county:				
Nippissing lake	Elba	E. J. Thrasher	June 23	3,000
Davis lake	Oregon	E. J. Thrasher	June 23	3,000
Spear's lake	Oregon	E. J. Thrasher	June 23	3,000
Pleasant lake	Attica	E. J. Thrasher	June 23	3,000
Bronson lake	Oregon	E. J. Thrasher	June 23	2,000
Middle lake	Elba	E. J. Thrasher	June 23	2,000
Montcalm county:				
Caskey lake	Winfield	John L. Watson	June 16	4,000
Wood lake	Pierson	M. W. Baker	June 16	4,000
Olson lake	Winfield	J. A. Collins	June 16	4,000
Whitefish lake	Pierson	J. A. Collins	June 16	4,000
Little Whitefish lake	Pierson	S. C. Scott	June 16	4,000
Bass lake	Pierson	J. C. Buck	June 16	4,000
Sanderson lake		E. Kemp	June 18	4,000
Ziegenfus lake		E. Kemp	June 18	4,000
Turk lake		E. Kemp	June 18	4,000
Rock lake	Richland	A. B. Eldredge	June 22	4,000
Fish creek or Owen's lake	Sidney	Wm. N. Owen	June 22	2,000
Muskegon county:				
Harbor and Little Black lakes	Norton	John L. Van Pelt	June 13	8,000
Big Blue lake	Blue Lake	Fred J. Russell	June 13	4,000
Crooked lake	Hattan	S. P. Murphy	June 21	4,000
Inglehart lake	Holton	Ole C. Oleson	June 21	4,000
Crooked lake		S. L. Skeels	June 21	4,000
Wood's lake	Blue Lake	S. P. Murphy	June 21	4,000
Clam lake	Cedar Creek	S. P. Murphy	June 21	4,000
Deer lake	Holton	S. P. Murphy	June 21	4,000
Hart lake	Holton	S. P. Murphy	June 21	4,000
Mecosta county:				
Clear lake	Colfax	Geo. E. Fairman	June 16	4,000
Newaygo county:				
Diamond lake	Lincoln	Capt. W. H. Bigelow	June 18	6,000
Maynard lake	Ensley	Fred Frey	June 23	4,000
Osceola county:				
Blackberry lake	Sherman	John Eggle	June 23	4,000
Oceana county:				
Silver lake	Golden	C. B. Stevens	June 13	4,000
Gurney Mill pond	Hart	Rufus T. Skeels	June 13	4,000
Hemlock lake	Greenwood and Holton	Rufus T. Skeels	June 21	4,000
McClaren lake	Newfield	Frank Utley	June 21	4,000
No name	Greenwood	H. S. Rhoades	June 21	2,000
Acker lake	Greenwood	H. S. Rhoades	June 21	2,000

Large Mouth Bass Advanced Fry Plants, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Oakland county:				
Three Mile lake	Pontiac	Ed. Nusbaumer	June 22	3,000
Deer lake	Independence	C. R. Lambert	June 23	3,000
Lake Angelus, formerly Three Mile lake	Pontiac	John S. Gray	June 25	8,000
Grierson lake	Milford	John N. Pickett	June 28	3,000
Sears lake	Milford	T. H. Padley	June 28	3,000
Kent lake	Milford	T. H. Padley	June 28	3,000
Sylvan lake	Bloomfield	C. D. Standish	June 28	3,000
Cass lake	West Bloomfield	B. S. Tregent	June 28	4,000
Moor's lake	Commerce	Don A. Jakeway	June 28	6,000
Long lake	White Lake	Robt. S. Potts	June 28	7,000
Walled lake	Commerce and Novi	A. M. Van Tassell	June 29	4,000
Lower Pettibone lake	Highland	F. S. Hubbell	June 29	4,000
White lake	Highland	F. S. Hubbell	June 29	4,000
Woodruff lake	Highland	Osson Kellogg	June 29	3,000
Cranberry lake	Oakland	J. A. Jelsch	June 30	3,000
St. Joseph county:				
Parkville Mill pond	Park	Wm. H. Adams	June 15	4,000
Mud lake	Sherwood	C. J. Huxley	June 17	4,000
Marle lake	Sherwood	F. O. Hutchins	June 17	4,000
Van Buren county:				
Mud lake	Antwerp	C. S. Smith	June 15	4,000
Sand lake	Antwerp	V. B. Finch	June 15	4,000
Bankson's lake	Porter	C. F. Dey	June 15	4,000
Washtenaw county:				
Blind lake	Lyndon	Jas. V. Palmer	June 22	3,000
Joslin lake	Lyndon	F. G. Marshall	June 22	3,000
Bruin lake	Lyndon	F. G. Marshall	June 22	3,000
Total				550,000

Large Mouth Bass Fingerlings and Baby Fingerlings, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Antrim county:				
Intermediate chain of lakes		Central Lake Fish & Game Protection Association	July 16	1,000
Allegan county:				
Base Line lake	Trowbridge	S. D. Rockwell	Aug. 30	400
Swan lake	Cheshire	I. E. Tripp	Aug. 8	500
Berrien county:				
Brash lake	Pipestone	L. E. Larkin	Aug. 3	500
Murphy lake	Berrien	M. O. Becker	Aug. 4	300
Long lake	Berrien	M. O. Becker	Aug. 4	300
Barry county:				
Carr lake	Woodland	D. S. England	June 25	2,000
Long lake	Hope	B. Dickinson	Aug. 8	500
Wall lake	Hope	J. C. Andrus	Aug. 16	500
Mud lake	Hope	W. D. Hayes	Aug. 16	500
Pleasant lake	Barry	Chas. Norwood	Aug. 16	500
Benzie county:				
Crystal lake	Benjamin	David E. Burns	July 13	500
Crystal lake	Crystal Lake	J. J. Kirby	Oct. 21	1,000
Cass county:				
Birch lake	Porter	W. T. Jefferson	July 14	600
Barron lake	Howard	Chas. Julius	July 14	750
Mud lake	Calvin	J. M. Wiltsie	July 27	400
Lime lake	Newbury	J. M. Wiltsie	July 27	400
Lewis lake	Penn	J. M. Wiltsie	July 27	400
Indian lake	Silver Creek	C. W. Crawford	July 28	800
Dewey lake	Silver Creek	Wm. Kauffman	Aug. 3	500
Mill Pond lake	Wayne	Jas. Harley	Aug. 3	1,000
Smith's lake	Pokagon	C. B. Harris	Aug. 3	500
Long lake	Porter	L. L. Hitchcock	Aug. 8	750
Chippewa county:				
Duck lake	Sugar Island	Mich. Fish Commission	Oct. 15	1,200
Calhoun county:				
Shedd lake	Tekonsha	E. F. Sinclair	July 27	600
Ackley lake	Convis	J. E. Cook	Aug. 2	750
Kalamazoo pond	Marengo	C. W. Pierce	Aug. 8	500
Crawford county:				
Mud lake		F. B. Dickerson	July 21	500
Cheboygan county:				
Douglass lake	Monroe	W. B. Stimson	July 15	500
Indian river	Tuscarora	C. E. Haak	July 21	750
Douglass lake		W. B. Stimson	Sept. 3	1,000
Charlevoix county:				
Walloon lake	Melrose and Evangeline	W. B. Stimson	July 15	500
Clinton county:				
Muskrat or Merlbeach lake	Olive	K. E. Moore	July 20	1,000
Looking Glass river	Watertown	Bruce B. Douglas	June 25	2,000
Emmet county:				
French Farm lake	Carp lake	Chas. E. Brewster	Oct. 15	750
Eaton county:				
Pine lake	Walton	D L. Lanbaugh	Aug. 2	750
Saddlebag lake	Sunfield and Woodland	F. F. Hilbert	June 25	2,000
Sobby lake	Sunfield	W. H. Warner	June 25	2,000
Narrow lake	Brookfield	W. T. Hahn	July 19	500
Hoover lake	Boland	J. W. Warner	July 21	500
Genesee county:				
Barnum lake	Fenton	Levi Barnum	July 20	800
Flint river	Genesee	Wm. L. Mead	Aug. 3	1,250
Hillsdale county:				
Cobb lakes	Scipio	Omega Portland Cement Co.	July 19	500
Bell lake	Jefferson	Amos Wilcox	July 19	500
Long lake	Reading	E. I. Van Sickle	July 19	750

Large Mouth Bass Fingerlings and Baby Fingerlings, 1904.—CONTINUED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Hillsdale county.—*Continued:*				
Debols lake	Pittsford	Jas. B. Thorn	July 19	500
Bird lake	Jefferson	Perry E. Burger	July 26	800
Pleasant lake	Jefferson	Dr. D. McKellar	July 26	800
Huron county:				
Rush lake	Lake	Leonard R. Thomas	Aug. 24	1,400
Iosco county:				
Long lake		J. H. Mount	Oct. 21	900
Ingham county:				
Pine lake	Meridian	Clarence D. Clark	July 6	750
Pine lake	Meridian	Chas. Downey	July 6	750
Ionia county:				
Morrison lake	Boston	John Wallington	July 12	4,000
Peck lake	Berlin	John Wallington	July 12	4,000
Huhn's lake	Boston	John Wallington	July 12	2,000
Walter's pond	Boston	John Wallington	July 12	2,000
Jackson county:				
Grass lake	Grass Lake	E. A. Croman	July 13	500
Line lake	Spring Arbor	H. C. Ranch	July 14	250
Lower Sandstone lake	Spring Arbor	Geo. Douglass	July 14	250
Peterson's lake	Summit	C. M. Brown	July 14	500
Mud lake	Pulaski	Edward G. Brail	July 14	500
Big Mud lake	Spring Arbor	H. C. Ranch	July 14	250
Sandstone lake	Spring Arbor	Geo. Douglass	July 14	250
Sweezy lake	Norvell	F. W. Schofield	July 19	500
Big and Little Sulfir lakes	Liberty	Gifford Patch	July 19	750
Swain's lake	Pulaski	F. W. McKenzie	July 27	600
Kent county:				
Slayton lake	Grattan	Clint Green	June 30	2,000
Green lake	Grattan	Clint Green	June 30	2,000
Burn's lake	Grattan	E. J. Killean	July 11	2,000
Stream Mills		Mich. Fish Commission	Aug. 18	200
Houses Lake		Chas. House	Sept. 12	200
Dunlop lake	Plainfield	David Dunlop	Sept. 25	100
Kalamazoo county:				
White's lake	Kalamazoo	C. E. Foote	July 7	500
Gull lake	Richland and Ross	M. M. Shipman	July 25	500
Bonnecastle lake	Oshtemo	Richard Bockeloo	July 7	4,000
Wyman lake	Wyman	Richard Bockeloo	July 7	4,000
Dustin lake	Oshtemo	Richard Bockeloo	July 7	4,000
Potter's pond	Charleston	M. H. Arnold	Aug. 2	1,000
Lenawee county:				
Ames Mill pond	Hudson	E. Walter Ames	July 19	500
Round pond	Rollin	Wm. J. Pomeroy	July 19	500
Lapeer county:				
Fish lake	Hadley	Chas. F. Profrock	July 29	1,000
Otter lake	Marathon	R. F. Sherman	July 7	2,000
Livingston county:				
Pardee lake	Genoa	R. E. Barron	July 20	500
Webster lake	Genoa	Gilbert Pardee	July 20	800
Leelanau county:				
Glen lake	Glen Arbor and others	D. H. Day	July 8	1,000
Macomb county:				
East's pond	Bruce	H. W. Bradley	July 18	750
Nowland's pond	Bruce	Geo. E. Newberry	July 18	750
Cusie lake	Washington and Bruce	Geo. E. Newberry	July 18	500
Clifton pond	Washington	Geo. E. Newberry	July 18	500
Mackinac county:				
Brevort lake	Moran	C. W. Eastman	July 15	500
Monroe county:				
River Raisin	Monroe	River Raisin Game & Fish Protective Assn	Aug. 5	1,750
Mason county:				
Pickerel lake	Freesoil	Thos. S. Stephens	July 1	3,000
Gun lake	Freesoil	Thos. S. Stephens	July 1	3,000

Large Mouth Bass Fingerlings and Baby Fingerlings, 1904.—CONCLUDED.

County and name of waters.	Town.	Depositor.	Date.	Number.
Muskegon county:				
Wolf lake	Egelston	E. D. Magoon	June 20	2,000
Mona lake	Muskegon and Norton	E. D. Magoon	June 20	2,000
Bear lake	Fruitland	E. D. Magoon	June 20	2,000
White lake	Montague and others	T. W. Robson	July 9	750
Mecosta county:				
Lake 28	Sheridan	J. M. Swisher	June 30	1,000
Meeker lake	Wheatland	J. M. Swisher	June 30	1,000
Third lake	Wheatland	J. M. Swisher	June 30	1,000
Gingrich lake	Wheatland	J. M. Swisher	June 30	1,000
Pretty lake	Martiny	Miss Rachael Lewis	July 2	2,000
Mill pond	Millbrook	T. O. Pattison	July 2	2,000
Briscoe's lake	Hinton	C. W. Vining	July 29	500
Montcalm county:				
Twin lakes	Pine	C. W. Vining	July 29	500
Kendall's, Henschal, Summit and Ingram lakes	Pine	S. J. Youngman	July 29	500
The West or Ingram lakes	Pine	C. W. Vining	July 29	250
Newaygo county:				
Hess or Brook lake	Brooks	S. D. Thompson	July 1	3,000
Bills lake	Ensley	Jos. Tannewitz	July 16	500
Fremont lake	Sheridan	W. D. Sargent	June 21	3,000
First lake		W. D. Sargent	June 21	2,000
White river	Several	John Cole	June 21	2,000
Pickerel lake	Home	H. Toncray	June 22	500
Oakland county:				
Buckels lake	Groveland	Jay K. Tindall	July 12	1,000
Sam Perry lake	Brandon	C. A. Flagler	July 29	600
Lawrence lake	Brandon	A. A. Zimmerman	July 29	800
Osman lake	Pontiac	Jas. H. Osman	Aug. 3	1,000
Maceday lake	Waterford	Mich. Fish Commission	Aug. 5	3,200
Watkins lake	Waterford	Elmer Stowell	Aug. 17	2,400
Silver lake	Waterford	Mich. Fish Commission	Aug. 31	1,600
Foster lake	Independence	E. Foster	Oct. 4	1,050
Oceana county:				
Pentwater lake	Pentwater	R. M. Montgomery	July 9	500
St. Joseph county:				
Portage River Mill pond	Park	Chas. W. Schellhouse	June 24	6,000
Corey lake	Fabius	E. B. Linsley	July 14	500
Klinger's lake	White Pigeon	J. R. Watson	July 27	500
St. Clair county:				
Brandenburg pond	Kimball	Christ Brandenburg	Aug. 24	1,000
Saginaw county:				
Shiawassee lake	Spaulding and James	John Baird	June 22	8,000
Tuscola county:				
Barr lake	Watertown	R. F. Sherman	July 7	1,000
Van Buren county:				
Lake Cora	Paw Paw	Thos. M. Todd	July 23	750
North lake	Almena	B. C. Chambers	July 28	600
Huzzy lake	Porter	C. W. Johnson	July 28	600
Knickerbocker lake	Hamilton	F. A. Hemenway	July 28	600
Round lake	Keeler	M. Defendorf	Aug. 3	750
Keeler lake	Keeler	L. L. Bascom	Aug. 3	500
Fish lake	Almena	Anson D. Pease	Aug. 30	200
Long lake	Pine Grove	T. L. Waber	Aug. 30	200
Wayne county:				
Coomer lake	Van Buren	A. E. Smith	July 7	1,500
Washtenaw county:				
Cavanaugh lake	Sylvan	A. R. Welch	July 13	500
Portage lake	Dexter	Jas. E. McGregor	July 13	500
Whitemore lake	Northfield	Geo. H. Pond	July 12	3,000
Total				160,350

Montana Grayling Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Crawford county:				
Headwaters of Manistee river	Frederick	W. F. Schoaf	June 17	100,000
Emmet county:				
Maple river	McKinley	Mich. Fish Commission	June 17	50,000
Osceola county:				
Hersey creek	Lincoln	W. P. Young	June 16	50,000
Total				200,000

Montana Grayling Plants, 1904.

County and name of waters.	Town.	Depositor.	Date.	Number.
Alcona county:				
North Branch	26 and 28 N. of Range 6 and 7 E.	John Baird	June 17	20,000
Crawford county:				
Manistee river	Several	W. S. Schoaf	June 18	70,000
Total				90,000

Loch Leven Trout Plants, 1903.

County and name of waters.	Town.	Depositor.	Date.	Number.
Kent county:				
Egypt creek	Ada	E. J. Killean	Feb. 12	10,000
Upper Bear creek	Cannon	John H. Baker	Feb. 12	10,000
Mill creek	Several	Dwight Lydell	Feb. 12	25,000
York creek		Dwight Lydell	Feb. 12	5,000
Hayes creek	Plainfield and Alpine	Michael Hayes	Feb. 12	10,000
Total Loch Leven Trout plants				60,000

REPORT OF STATISTICAL AGENT FOR THE YEAR 1902.

To the State Board of Fish Commissioners:

Gentlemen—Following is a statement of the fish taken in the Michigan waters of the great lakes during the year 1902, together with a statement of the nets, boats and hooks used; the number of men employed and the amount invested in lands, buildings and apparatus:

FISH TAKEN.

Whitefish	5,371,683	Pounds,	Value	$307,860 34
Lake trout	9,363,030	"	"	431,630 50
Pike perch	2,289,150	"	"	129,540 50
Herring	19,112,125	"	"	385,875 75
Sturgeon	106,894	"	"	9,145 91
Bass	145,068	"	"	4,155 50
Saugers	125,240	"	"	2,847 20
Perch	3,297,800	"	"	63,622 00
Suckers	3,924,800	"	"	68,714 00
Caviare	11,645	"	"	8,669 55
Catfish	205,995	"	"	6,531 00
All other kinds	2,288,560	"	"	43,131 80
Total	46,241,990			$1,461,724 05

NETS USED.

Gill nets	49,251	Fathoms	4,032,358
Pound nets	1,667	"	305,531
Seines	53	"	4,540
Fyke nets	147		
Gobler nets	250		
Submarine nets	891		
Hooks	78,100		

BOATS USED.

Steamers	137
Sail boats	683
Pound boats	102
Skiffs	930
Men employed	5,889

AMOUNT INVESTED.

Value of nets	$707,859 00
Value of boats	397,584 00
Value of lands and buildings	565,435 00
Total invested	$1,670,878 00

The work of gathering and tabulating the statistics for 1903 is now in progress, but will not be completed in time to be included in this report.

C. H. MOORE,
Statistical Agent.

INVENTORY.

Paris Station:		
158 acres of land, including two small dwellings for employees, and the meander of Cheney creek		$4,550 00
Overseer's residence	$1,800 00	
1 barn	400 00	
1 tool house	75 00	
1 tool house	100 00	
1 ice and food house	300 00	
1 ice house	25 00	
1 wagon and store shed	200 00	
1 hatchery known as the "New Hatchery"	3,000 00	
1 hatchery known as the "Old Hatchery"	800 00	
1 windmill, water tank and connections	475 00	
1 fish car house	200 00	
Ponds, raceways and pipe connections	5,000 00	
1 fish car	2,000 00	
Apparatus, tools, camp outfits and office furniture and books	3,210 49	17,585 49
		$22,135 49
Detroit Station:		
Hatchery building and all tanks and permanent improvements		$7,000 00
875 Chase hatching jars complete	$1,093 25	
1 bolier and pump	500 00	
Apparatus, tools, etc	1,185 00	2,778 25
		$9,778 25
Sault Ste. Marie Station:		
Hatchery and equipment complete, including ponds and water connections		$9,000 00
1 motor car	$200 00	
1 tram car	20 00	
Apparatus, tools and furniture	2,071 45	2,291 45
		$11,291 45
Mill Creek Station:		
7 acres of land		$700 00
1 hatching house		600 00
1 dwelling		1,500 00
1 ice house		150 00
1 barn		250 00
Ponds, raceways and improvements		7,000 00
Apparatus and tools		2,099 45
		$12,299 45
Drayton Plains Station:		
Equity in land and permanent improvements		$7,000 00
Apparatus and tools		926 55
		$7,926 55
Harrietta Station:		
100 acres of land and all permanent improvements		$4,900 00
Apparatus and tools		627 83
		$5,527 83

Office:	
Furniture and pictures	$944 40
Library, books and stationery	276 52
	$1,220 92

SUMMARY.

Paris station	$22,135 49
Detroit station	9,778 25
Sault Ste. Marie station	11,291 45
Mill Creek station	12,299 45
Drayton Plains station	7,926 55
Harrietta station	5,527 83
Office	1,220 92
	$70,179 94

FINANCIAL STATEMENT.

CURRENT EXPENSES.

1902			
July 1	Balance	$1,545 08	
Sept. 30	Received from State during quarter	7,749 99	
	Vouchers paid during quarter		$8,441 86
	Balance		853 21
		$9,295 07	$9,295 07
Oct. 1	Balance	$853 21	
Dec. 31	Received from State during quarter	7,749 99	
	Vouchers paid during quarter		$7,746 00
	Returned to State, "Unexpended balance of appropriation for former year"		153 71
	Balance		703 49
		$8,603 20	$8,603 20
1903			
Jan. 1	Balance	$703 49	
Mar. 31	Received from State during quarter	7,749 99	
	Vouchers paid during quarter		$8,104 95
	Balance		348 53
		$8,453 48	$8,453 48
April 1	Balance	$348 53	
June 30	Received from State during quarter	7,750 03	
	Received from Geo. King	10	
	Vouchers paid during quarter		$7,686 81
	Balance		411 85
		$8,098 66	$8,098 66
July 1	Balance	$411 85	
Sept. 30	Received from State during quarter	8,237 49	
	Received from F. E. McCollom	10	
	Vouchers paid during quarter		$7,690 35
	Returned to State, "Unexpended balance of appropriation for former year"		2 88
	Balance		956 21
		$8,649 44	$8,649 44
Oct. 1	Balance	$956 21	
Dec. 31	Received from State during quarter	8,237 49	
	Received from G. R. & I. Ry. Co.	14 93	
	Vouchers paid during quarter		$7,838 34
	Balance		1,370 29
		$9,208 63	$9,208 63

1904			
Jan. 1	Balance	$1,370 29	
Mar. 31	Received from State during quarter	8,237 49	
	Received from D. Lydell	38 75	
	Received from J. Z. Stanley & Sons	38	
	Vouchers paid during quarter		$7,917 27
	Balance		1,729 64
		$9,646 91	$9,646 91
April 1	Balance	$1,729 64	
June 30	Received from State during quarter	8,237 53	
	Vouchers paid during quarter		$9,017 80
	Balance		949 37
		$9,967 17	$9,967 17

SPECIAL PURPOSES.

1902			
July 1	Balance	$3,695 20	
Sept. 1	Received from State during quarter	1,900 00	
	Vouchers paid during quarter		$5,309 13
	Balance		286 07
		$5,595 20	$5,595 20
Oct. 1	Balance	$286 07	
Dec. 31	Received from State during quarter	5,200 00	
	Vouchers paid during quarter		$3,456 98
	Balance		2,029 09
		$5,486 07	$5,486 07
1903			
Jan. 1	Balance	$2,029 09	
Mar. 31	Vouchers paid during quarter		$881 48
	Balance		1,147 61
		$2,029 09	$2,029 09
April 1	Balance	$1,147 61	
June 30	Received from State during quarter	3,500 00	
	Vouchers paid during quarter		$1,490 60
	Balance		3,157 01
		$4,647 61	$4,647 61
July 1	Balance	$3,157 01	
Sept. 30	Received from State during quarter	3,000 00	
	Vouchers paid during quarter		$5,976 21
	Balance		180 80
		$6,157 01	$6,157 01

Oct. 1	Balance	$180 80	
Dec. 31	Received from State during quarter	4,000 00	
	Vouchers paid during quarter		$3,082 39
	Balance		1,098 41
		$4,180 80	$4,180 80
1904			
Jan. 1	Balance	$1,098 41	
Mar. 31	Vouchers paid during quarter		$544 40
	Balance		554 01
		$1,098 41	$1,098 41
April 1	Balance	$554 01	
June 30	Received from State during quarter	500 00	
	Vouchers paid during quarter		$537 06
	Balance		516 95
		$1,054 01	$1,054 01

APPENDIX.

Bulletin of the Michigan Fish Commission

No. 7.

(Contributions from the Zoölogical Laboratory of the University of Michigan, No. 97.)

THE BREEDING HABITS, DEVELOPMENT AND PROPAGATION OF THE BLACK BASS

(*Micropterus dolomieu* Lacepede and *Micropterus salmoides* Lacepede.)

BY

JACOB REIGHARD

Professor of Zoölogy in the University of Michigan.

WITH TWO PLATES AND ELEVEN FIGURES IN THE TEXT.

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I.

INTRODUCTION.

In 1901, the last year for which there is an official statement, the black bass reported as having been taken in Michigan brought to the commercial fishermen but $1,170.[1] It is known that not all the bass sent to market were reported, and yet in spite of this, the direct commercial value of the black bass fisheries of the State must be conceded to be comparatively slight. Their indirect value is very great.

Thousands of pounds of bass, taken with the rod, are not marketed, but find their way directly to the tables of consumers. The sport of taking these fish not only furnishes recreation to the inhabitants of the State, but helps to attract large numbers of visitors. The railroads, the summer hotels and boarding houses, the merchants, the farmers who have land and produce to sell, and many other classes of citizens profit by their coming. Nearly one-half the area of the State of Michigan is said to be suitable for the growing of forests only, while the area of inland lakes is 784,000 acres, or about 1-150 of the total area of the State (Lane, 1899). The State is therefore eminently adapted to the production of fish and of game. It follows that the business of meeting the wants of the sportsman and summer visitor is certain to increase in importance.

There is no means of knowing the present extent of this business in Michigan, but for the State of Maine statistics are available. Only one-third of the area of that State is included in farms. The report of the Commissioners of Fisheries and Game for 1902 shows that in that year more than 133,000 persons visited Maine, "to fish, on vacation, or to hunt." "From six to twelve million dollars were spent by them. * * * The total value of all crops in Maine for the year 1899 was $21,954,054. Thus it will be seen that the total amount of money spent in Maine this year (1902) by non-resident fishermen, summer visitors and hunters is more than 30 per cent of the total value of all farm crops raised in Maine in the year 1899, the last year of which we have any report."

There is no reason why this business should not reach great proportions in Michigan as it has already in Maine. In this development the black bass, "inch for inch and pound for pound, the gamiest fish that swims," is, like the trout, destined to play an important part.

For some years efforts have been made, chiefly by the United States Fish Commission (now the Bureau of Fisheries of the Department of Commerce and Labor) and by the Michigan Fish Commission, to artificially propagate the black bass. These efforts have met with many difficulties. Recently the work of the United States Fish Commission at its San Marcos station has brought a large measure of success with the large-mouthed bass, while the work of the Michigan Fish Commission at its Mill Creek station has been successful with both species. The results of

[1] From the unpublished report of the Statistical Agent of the Michigan Fish Commission, on file in the Detroit office of the Commission.

the Mill Creek work have been briefly described in a paper read by Mr. Dwight Lydell, superintendent of the station, at the meeting of the American Fisheries Society in 1902 (Lydell, 1902) and republished by the United States Fish Commission. It is the purpose of the present bulletin to describe, as far as possible from personal observation, the breeding habits and development of both species of black bass, as well as the methods hitherto employed in their culture.

It has seemed to the writer that the time has come to set down in some detail and to subject to the check of personal observation and of criticism what is actually claimed to be known and what is actually done. With such an account as a basis we may proceed to discuss improvements in methods and remedies for existing difficulties. A considerable amount of what follows is of necessity an elaboration of what is found in Mr. Lydell's paper, and unless a statement to the contrary is made it is to be understood that the observations here recorded confirm his. Certain unpublished observations by Mr. Lydell, here introduced, are inclosed in quotation marks and followed by his initial in brackets, thus (L).

II.

BREEDING HABITS OF THE BLACK BASS.

There are two species of the black bass, the small-mouthed black bass (*Micropterus dolomieu* Lacépède) and the large-mouthed black bass (*Micropterus salmoides* Lacépède). Detailed descriptions of them are given by Henshall (1881), and by Jordan and Evermann (1896), and need not be here repeated. The difference in the habitats of the two species is of importance in the discussion of breeding habits and pond culture, and may here be recalled.

Jordan and Evermann say of the small-mouthed bass, "frequenting running streams and preferring clean and cool waters; *its southern limit is bounded by the presence of such waters.*"* Of the large-mouthed bass they say, "preferring lakes, bays and sluggish waters."

Both species, like other members of the sunfish family, build nests for the reception of the eggs, and the eggs and the young brood are then guarded by one of the parent fish.

A. THE SMALL-MOUTHED BLACK BASS.

1. *Nests and Nest Building.*—The small-mouthed black bass (*Micropterus dolomieu*), makes its nest by preference on coarse gravel. From the end of April until the end of June, the time depending on the latitude and the temperature of the water, the male fish make their appearance in shallow water and may be seen moving about in search of suitable nesting places. The male then frequently puts his snout to the bottom and roots as though to test for the presence of gravel. One may often see in the breeding ponds places that have been thus tested. They may be no more than four or five inches across or may be irregular linear patches several feet long, and in such spots the gravel is exposed while all about them it is hidden under a smooth layer of sediment. When he has found a suitable place the male takes a vertical position in the water,

* Original not italicized.

Fig. A. Nest of small-mouthed black bass in about eight inches of water in pond at Mill Creek. The large stones are at the center of the nest.

head up, and by a powerful sweeping movement of the tail he removes from an area two or three feet across the sediment which covers the gravel. When this occurs in a stream, the sediment, carried down by the current, settles to the bottom below the nest. In ponds where there is no current the sediment is not carried down and the water over the nest becomes consequently so much roiled during the sweeping that "the fish frequently is forced to leave the nest until the water has become clear again" (L). The sweeping clean of the gravel is the first stage in the building. The nest is then said to be "cleaned up," but is not yet completed. The fish next stands on its head, roots over the gravel, more particularly at the center of the nest, and then resumes sweeping with his tail. He thus alternately roots and sweeps until all the sand and smaller stones are swept to the edge of the nest, leaving only the larger stones at the center. This is shown in Fig. A, where the stones at the center of the nest are from three to five inches in diameter. This removal of material from the center of the nest and its accumulation at the border leaves the nest saucer-shaped. At the center the sand and fine gravel is removed, not merely from the upper surface of the stones, but between them to a considerable depth, so that the crevices between the stones are free from it. The stones are made perfectly clean by the sweeping process and have the appearance of being polished so that they stand out in conspicuous contrast to the sediment-covered stones surrounding them. This "hollowing out" of the nest is the second stage in its construction and it is now complete. In the breeding ponds one may find incomplete nests which have been merely "cleaned up," and others which have been completed by "hollowing out."

The small-mouthed bass not only seeks a gravel bottom of a certain coarseness for the preparation of his nest, but he places it, if possible, in a sheltered situation. Of fifteen nests examined in the Thornapple River at Cascade, Michigan, all but one was built either near the river bank or near a large boulder or log. These nests were thus protected from intrusion on at least one side. That such sheltered spots are selected for nests is further shown by the fact that in the breeding ponds where sheltered nests are provided, the fish almost invariably use these instead of using gravel which may have been placed for their use in unsheltered situations. Indeed the fish will sometimes use sheltered nests which have been placed in the ponds for large-mouthed bass and the bottoms of which are made of the fibrous Spanish moss imbedded in cement. Thus a sheltered situation appears at times to be a factor more important than the nature of the bottom in determining the location of the nest. The nests that I have seen in natural waters were all located where there was a current.

2. *Guarding the Empty Nest.*—When the nest has been prepared the male remains on guard over it, but makes frequent circles into deeper water as though in search of the female. The time between the completion of the nest and the actual spawning may be but a few minutes, as in one case that I observed, or it may be some days. The length of the interval depends, in part at least, upon the temperature. The males may begin nest building in a temperature somewhat below 60 degrees F. but the females do not spawn until the water has reached a temperature of between 62 degrees and 65 degrees F. If the male does not begin nest building until the water has reached

62 degrees F. the spawning may follow at once upon the nest building. If the male begins the nest when the water is below 60 degrees F. spawning is delayed until the weather conditions have brought the temperature of the water to a suitable point.

3. *Spawning.*—After the male has guarded the nest for a time he returns from one of his excursions into deeper water accompanied by the female. At most seasons there appears to be no external difference between the sexes so that it is impossible to distinguish them without dissection. At the breeding time there is ordinarily no difficulty. The females are then much thicker bodied and, particularly when seen from behind and somewhat from above, may be distinguished from the males by the form of the body, even at a distance of from ten to twenty feet. Small females sometimes spawn when they contain very few eggs and these of small size. It is then not easy to distinguish the sexes by the form of the body alone and if there were no other method mistakes might easily be made. But in all cases the behavior of the two sexes is so wholly different that the person who has once observed it in a case where the sexes were easily distinguishable by the form, need not afterward hesitate to distinguish the sexes at the spawning time by their behavior, alone. In addition to difference in form and behavior, a marked difference in color between male and female nearly always becomes evident as spawning proceeds. From a knowledge of these differences between the sexes at this season there can be no doubt of the correctness of the statement that the fish which builds the nest and which subsequently guards the eggs and the young fish is the male. As further evidence of this, "on five different occasions the fish which was guarding the nest of the young brood has been taken on the hook and on each occasion has been found upon dissection to be a male."—(L).

Although I have seen the small-mouthed bass on their nests probably hundreds of times and have four times observed the spawning in part and once throughout its whole duration, yet I have never seen a female on or near a nest except when actually engaged in spawning.

The following account of the spawning is from field notes of the case in which the whole process was observed. The other four cases in which the spawning was observed in part did not differ in any essential way from this one. "On May 11th, at 12:30 p. m., a fresh-built nest is found near the outlet of pond 1. It is in about eight inches of water in the open, that is, not within one of the artificial shelters provided for the nesting fish, and near shore. The male fish is on the nest, the water is clear, there is no wind and the sun is shining. The conditions are therefore ideal for observing the spawning habits. A weather-worn, batten-door is hastily obtained, a hole is knocked through it, and it is then propped on edge about ten feet from the nest. Through the opening one may observe the nest with field glasses as clearly as though he held it in the hand."

"The screen is hardly in place before the two fish, each about 10 inches long, are seen, one two yards north of the nest and the other two yards south of it. Both are small fish and at first the sexes can therefore not be distinguished. Presently one of the two approaches the other and urges it into the nest. Both fish are of the usual dark green-bronze color and both are apparently uniformly colored over the body." (Figure B.)

"In a few minutes after the fish have entered the nest one of them

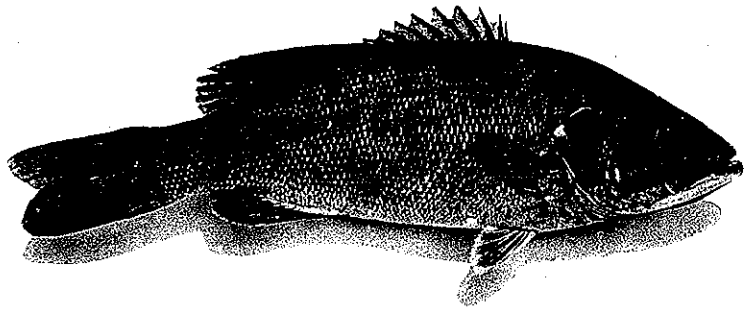

Fig. B. Female small-mouthed black bass in the usual dress, i. e. not mottled. The only markings that show distinctly are the three dark stripes on the side of the head.

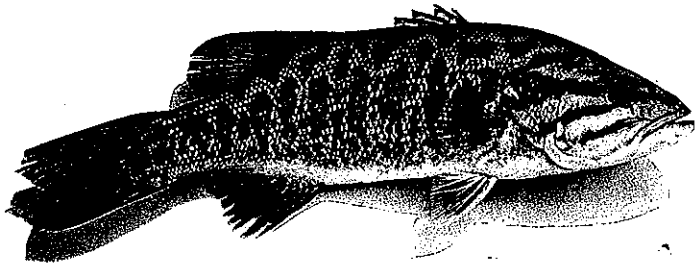

Fig. C. The female small-mouthed black bass, shown in Fig. B. but mottled or with the body covered with spots. These markings appear while the female is spawning. In the fish here shown they were brought out by transferring from warm to cold water. (65 degrees to 50 F.).

begins to show dark spots on the sides and at the end of five minutes is sharply mottled over the whole body (as shown in Figure C). (The subsequent behavior of this fish as well as the fact, later observed, that it is thicker bodied, showed it to be the female.)

"At the angle of the free border of the opercle of the female is a white spot and above this the caudal end of the stripe through the eye ends in a darker spot. This white spot stands out with great distinctness in this female under sexual excitement, though it is visible at all times in both male and female. It occupies the position of the ear flap in the other sunfishes. The female is but little thicker than the male and (contrary to the usual condition) is lighter colored. The male is slightly mottled and has the black and white ear spot. The upper and back part of his eye (iris) is scarlet, while that of the female remains brown, though in other females I have seen the eye temporarily red. The male is then distinguished by his red eyes, more slender form and darker color. The mottling of the body of the female here described is present at all times in both males and females (Fig. B), but is ordinarily very inconspicuous because the network in the meshes of which are the darker spots is itself almost as dark as the spots. Under sexual excitement this network fades (probably by contraction of its pigment cells) to a light green color and the darker spots enclosed by it are then thrown into strong relief. The fish is then said to be mottled. The mottling takes place not only under sexual excitement, but when the fish is suddenly transferred from warm to cold water. Figure C is from a fish thus transferred to cold water. Not only are the spots on the body of the female thus brought out with great distinctness under sexual excitement, but the spots themselves usually become darker. The female under sexual excitement thus appears darker than usual and usually darker than the male."

"While the color change has been in progress the fish have been moving slowly about over the nest, the male biting the female frequently, though gently, on the opercle, cheek and corner of the mouth. During most of the time the female swims slowly on her side in a circle. Frequently she floats motionless, partly or wholly turned on her side, and at such times the male often lies beside her. Every two or three minutes she takes an upright position and rubes her belly against the stones while at the same time she moves slowly forward with a deliberate bending of the body first to one side and then to the other."

"Now the female is seen to leave the nest. She goes to a distance of fifteen or twenty feet, but is pursued by the male and brought back. Now two strange males pass and are at once set upon by the male, who drives them off, while the female waits in the nest. One of them returns and enters the nest with the waiting female, but is at once vigorously repelled by her mate."

"At 1:20 (i. e. after 50 minutes) the movements first described are still in progress, but no eggs appear to have been laid. The male is never seen to elevate the gill covers or to pose before the female. When biting her he usually approaches from behind and lies at her side or below her. Frequently the two stop and lie quiet, side by side, the female turned partly on her side, the male upright. Such quiescent intervals last a few seconds and the circling movements are then resumed."

"At 1:30 (i. e. in one hour) egg laying begins. During the emission of eggs the two fish lie side by side on the bottom. The female is turned

partly on her side so that her median plane forms an angle of about 45 degrees with the plane of the horizon. The male remains upright with his head just back of the pectoral of the female or opposite it. While emitting the eggs the female moves her pectorals alternately and slowly back and forth like oars, at the same time her dorsal is partly depressed and rapidly vibrated. During this time the male lies quiet at the side of the female, but toward the close of the egg-laying interval he backs slowly with alternating movements of his pectorals until his snout is opposite her vent. He then usually bites her on the vent, appears to examine the emitted eggs and then moves forward and bites her once or twice on the opercle or cheek. Four successive egg laying periods timed with the watch are found to be 4 sec.: 4.5 sec.: 5.5 sec.: 6 sec."

"Each egg laying period is succeeded by an interval of circling over the nest or just at its edge, but the two fish are now less active. The female especially is more quiet and no longer rubs her belly on the pebbles. The male moves about somewhat, but less actively than before egg laying began. He occasionally bites the female. Since egg laying began the female has become much darker and is now as dark as the male. Five successive intervals between the egg laying periods timed by the watch are found to be 22 secs.: 28 secs.: 30 secs.: 32 secs.: 45 secs."

"With the aid of a field glass the eggs, it is now thought, may be seen issuing from the oviduct, but this is necessarily uncertain. No milt can be seen since the milt is colorless. After a time the eggs are clearly seen adhering to the stones of the nest bottom (Fig. D)."

"At 2:50 p. m., two hours and twenty minutes after the fish entered the nest, the female leaves it, pursued by the male. The male, no longer mottled, soon returns and takes up his position over the nest. There he poises and fans the eggs with his pectorals, but frequently goes outside the nest and circles the immediate neighborhood as though in search of possible enemies."

I have described this case in detail because it is rare that so good an opportunity offers for observing the spawning behavior of the bass. Mr. Lydell, who watched with me, was of the opinion that the movements of the fish were less vigorous than in other cases which he had observed, but admitted that he had never had a better opportunity. The eggs laid in this nest, after developing normally for about two days, died, and this I can attribute to no other cause than a lack of vigor on the part of one or both parents. Yet the spawning behavior of these fish was not seen to be in any way different from that of the four other pairs that were observed in a fragmentary way.

In another case in which the spawning was watched the female twice attempted to leave the nest, but was each time pursued by the male, who took up a position outside of her and bit her in such a way as to drive her into the nest. At the third attempt she escaped and was not seen to return.

Since the male examines the eggs after each act of emission he is in a position to know when the female has finished laying and it is then apparently that he drives her from the nest.

That a female may spawn in more than one nest is shown by the following observations:—"On the south side of pond No. 5, about eight feet from shore, I found a nest in which were a male and a female, easily distinguishable as such at a distance of fifteen feet. The male was lighter

Fig. D. Eggs of the small-mouthed bass attached to the stones of the nest bottom. Most of the eggs are dead as shown by the white spots in them. Natural size.

colored and was mottled; the female was darker, more mottled and plainly distended with eggs. There was the same swimming and floating in a circle on the side on the part of the female and the same biting on the part of the male that has already been described. This was interrupted by periods during which the fish lay on the center of the nest where they could not be plainly seen. At these times eggs were doubtless emitted. Presently the male apparently saw me and swam away with a start, as though frightened. The female remained waiting and appeared to become gradually lighter colored. After five minutes she also started away, but she was met by the male and, as she attempted to leave the nest, was headed off first on one side and then on the other, until finally she was brought again into the nest."

"In a short time the male was again frightened away and again the female remained in the nest. The male did not at once return, but remained circling about a neighboring nest situated at a distance of about fifteen feet from the original nest. At intervals he approached his own nest, coming nearer each time. After ten or fifteen minutes the female also started to leave the nest. The male then headed her off and brought her back. He was soon again frightened and both fish then went to the adjacent nest, about which the male had been circling, and there renewed the spawning activities. Both fish were still in the nest at the end of an hour."

In still another case:—"On May 9th a male and a female were seen together in a nest. The female left the nest and the male followed. In her flight she passed a second nest on which was a large male. He also pursued the female and after a minute or so succeeded in getting her away from the first male and took her into his own nest," (L) Both nests were subsequently found to have eggs in them.

That a single male may receive into his nest two females in succession and guard their eggs is shown by an experience in one of the breeding ponds at the Mill Creek hatchery. "This small pond contained a single large male, easily distinguishable from all other fish in the pond by his size and by a black spot on one side of his head. He was very tame and it was the practice of the employes to feed him frequently. Whenever a stray frog, grasshopper or crawfish was picked up it was carried and thrown in to him. During the season this fish reared on one nest two different broods of young." (L.)

I have had no opportunity to observe the fierce battles that are described (Lydell, 1902)* between the males for the possession of the females. This is no doubt due to the fact that in the breeding ponds, where there is an excess of females, such battles are infrequent.

4. *Care of the Eggs and Fry.*—The male now remains over the nest and guards it until the eggs are hatched and the young bass are ready to leave the nest. The development of the eggs and the behavior of the young fish will be described in a subsequent section. Here the behavior of the parent fish alone need interest us. The male remains over the nest and by alternating movements of his pectoral fins as well as by a vibrating movement of his caudal, executed either while he is poised over the nest or while he swims slowly across it, he gently fans the eggs and thus in a measure keeps them free from sediment. At frequent intervals he leaves the nest and circles close about it, now in this direction and now in that.

* The dates in parentheses refer to the alphabetical list of authors at the end of the paper.

Again he makes wide circles into the neighboring territory, as though to assure himself that no enemies are present. He is not easily frightened from the nest. As one approaches the nest at this time, if the male remains near, it will nearly always be found that the nest contains eggs or young fish. One may sometimes approach the nest and introduce the hand into it before the male takes flight. If the male leaves at once and hurriedly, as the nest is approached, it will usually be found to be empty.

If another fish approaches the nest at this time he is invariably attacked and driven away. I have never seen other fish stop to do battle at this time. They invariably flee, as though recognizing the ability of the brooding fish to successfully defend the nest. Although the presence of the male fish thus keeps the eggs in a measure free from sediment, it does not affect this completely. After a time the fry, newly hatched, fall into the crevices between the pebbles, where they may be seen only with the greatest difficulty. The pebbles in a freshly made nest are scoured clean and the nest is thus rendered conspicuous, owing to the fact that the nest pebbles, with their coating of eggs, stand out in sharp contrast to the sediment covered pebbles of the surrounding bottom. With the lapse of time the sediment gradually accumulates in the nest in spite of the movements of the male, which must not be too violent lest the loosely attached eggs or the helpless young fish be swept from the nest. The result is that by the time the eggs have hatched the nest is no longer conspicuous. He who would now find it, should search not for the nest itself but for the male that guards it. If a male bass is found, not readily frightened away at the sight of the observer, and if the frightened fish returns after a time to the same spot, a nest may be sought for in the neighborhood. A careful examination of the bottom may then show a depression in which the pebbles are less thickly covered with sediment than elsewhere. Such a nest may, however, have been so nearly obliterated by the deposit of sediment that it is only when one brings up the eggs or young fish from the bottom with a dipping tube that one may be sure of it.

The pertinacity with which the small-mouthed bass guards his nest is often conspicuous in the breeding ponds. Here it is the custom, as described in another part of this paper, to surround the nest by a cylindrical screen shortly before the young fish are ready to leave it. The parent fish is excluded from the screen, while the young fry confined within it are kept from scattering and may be readily had when needed for shipment. The male fish now returns to the nest after a little while and remains on guard outside the screen. It is usual to see the screens thus guarded. In one case an individual male was seen to continue guarding his screen, swimming continually in a circle about it, for six days. During this time he was repeatedly seen attempting to enter the screen by burrowing beneath it and by butting it again and again with his head.

When the eggs are hatched the young fish remain for some days on the nest and then leave it, accompanied and guarded by the male. The school of young fish now usually seeks shallow water and may be found along shore. Here the parent fish swims back and forth in a half circle outside his school. This care of the school by the male is continued until the young fish are from an inch to an inch and a quarter in length. They then scatter and the parent fish leaves them.

Both the eggs and the young fish have numerous enemies. Various sorts of minnows, sunfish, bluegills and young bass are ready to attack them during even a brief absence of the male. Against these the presence of the male fish affords a large measure of protection.

B. THE LARGE-MOUTHED BLACK BASS (MICROPTERUS SALMOIDES).

Fewer observations have been made on the large-mouthed bass than on the small-mouthed.

1. *Nests and Nest Building.*—I have been unable to watch the process of nest building, but have examined many natural nests in the pond at the Soldiers' Home near Grand Rapids. The water deepens rapidly from the shore line in this pond so that nearly all the nests are built close to the shore. They are much less conspicuous than the nests of the small-mouthed bass and are usually less excavated. Often the bottom is covered with dead leaves, fallen from neighboring trees, and the fish has merely swept away the thin layer of ooze from these and the eggs have been laid upon them. In other cases the roots or low growing shoots of water plants have been similarly cleaned. Sometimes an area of sandy gravel has been swept clean, but has not been hollowed out nor has the sand been removed from among the pebbles. All such nests are inconspicuous and are usually found only by first observing the presence of the male bass. In but one case have I seen a large-mouthed bass on a nest that was well hollowed out and in which the sand had been removed from among the pebbles at the center of the nest. This was, however, in a pond in which small-mouthed bass were also present, so that the work may have been in part that of a small-mouthed bass.

The large-mouthed bass is said (Lydell, 1902; Lamkin, 1901) to prefer to make its nest on the fibrous roots of water plants. For this reason artificial nests with fibre bottoms have been provided for it in the breeding ponds. In the Soldiers' Home I have found the large-mouthed bass nesting on all sorts of material. In the Mill Creek breeding ponds, in which both fibre and gravel nests are placed, the large-mouthed bass frequently makes use of the gravel nests, even when fibre nests are available.

The relatively less care exercised by the large-mouthed bass in the selection of a nesting place and in the preparation of the nest is doubtless correlated with the fact that the eggs remain but a short time in the nest, which therefore does not need to be so carefully prepared for their reception. The eggs are hatched usually at the end of three days.

2. *Guarding the Empty Nest.*—I have no observations on this point, but Lamkin (1900) records an interval of nine days between nest building and spawning in the large-mouthed bass.

3. *Spawning.*—A detailed account of the spawning habits of the large-mouthed bass is much to be desired. I have been able to observe the spawning fish but once and then imperfectly. This leads me to suspect that spawning occurs usually near dusk or dawn.

"At 6:15 p. m., June 8th, a pair of large-mouthed bass was seen in one of the breeding ponds in an artificial nest about eight feet from shore. The female was somewhat darker colored than the male and could be further distinguished by her somewhat thicker abdomen. The male was in the nest or near it and repeatedly the female approached. The male circled to her outer side and bit her flank and she then went away. Three or four other bass, probably males, were seen ten or fifteen feet

outside the nest. I returned at 7 p. m. and found the same conditions. The female was seen to approach the nest and to turn on her side with her head pointed obliquely downward and to float thus, as though half dead. In this position she entered the nest and the male followed and took up a similar position. What happened in the nest could not be clearly seen. The tails of the two fish could be seen and from their position it was clear that the fish lay side by side on the bottom with their tails together and parallel. It could also be seen that some times one and sometimes apparently the other fish lay turned party on its side. At this time no doubt the eggs were emitted. After being in the nest for a short time the fish came out, and the female was seen to be still floating, head downward. They then returned to the nest and continued thus for half an hour, alternately lying on the bottom within the nest and floating on its border. It was then too dark to make further observations."

That the male of the large-mouthed bass habitually receives more than one female into his nest or receives the same female a second time after a considerable interval is shown by the fact that in three nests in which the eggs were examined in their earlier stages some were found that had been recently laid and others that had been laid for forty-eight hours. Lamkin (1900) says: "On several occasions the male was seen to have two females on the nest with him at the same time, and as a rule this proved disastrous to the eggs. They were always more or less scattered about, sometimes covering several square feet of bottom." Again he describes a large male, known by being the largest fish in the pond as well as by having a split tail. This fish fathered eight different sets of eggs from April 8 to July 4. "On one occasion he was seen taking care of a large brood of fry and a nest at the same time."

4. *Guarding the Eggs and Young.*—I have very often watched the large-mouthed bass while on the nest and while guarding the young bass. Its behavior does not appear to differ essentially from that of the small-mouthed bass already described.

C. HISTORY OF OBSERVATIONS ON THE BREEDING HABITS OF THE BLACK BASS.

Rafinesque (1820), in the supplement of the Ichthyologia Ohiensis (p. 88), says: "Mr. Wilkins has informed me that this species watches over its spawn and prevents any small fish from coming near it; while thus employed it will not bite at the hook, but endeavors to drive away the bait." According to Gill (1889) the species here referred to as Lepomis flexuolaris is the small-mouthed bass.

John Eoff (1855) thus describes the habits of the small-mouthed bass: "In winter they apparently hide under rocks, logs, etc., until the first of April, when they come out and begin to ascend the streams, apparently to find a convenient place for spawning. They appear to separate into pairs, male and female, and hunt out some retired place or nook where the water is about eighteen inches deep and still, but adjoining deeper water, to which they can escape if alarmed. They then commence making their nests, i. e. working all the mud, etc., off the bottom so as to leave it perfectly clean in a circular form, the diameter of the circle or nest being about twice the length of the fish, after which the female begins depositing her eggs, which appear to become glued to the bottom or small stones in rows after the deposit has taken place. She remains night and day, either on the nest or swimming about it, apparently guarding the nest

and driving every other smaller fish away. This watching or guarding is continued until the eggs are what is called hatched, which occurs in from eight to ten days, according to the temperature of the water. The young fish at first remain near the bottom and appear like a gauze veil floating. In two or three days they gradually rise and spread, the old one leaves them, they separate and each one shifts for himself, i. e. hides under leaves, small sticks and stones."

Tisdale (1869), writing of the small-mouthed bass, says: "They spawn in May and appear to occupy their spawning beds for nearly two months. Large clean places are scooped out in four to eight feet of water, verging on the shore of the pond, and some four to ten feet in diameter. These beds are made on sandy or gravelly bottom, are distinctly visible with fish thereon from a boat as it passes over them. The trunk of a sunken tree, or beside a lone rock or bed of rocks or other hiding place is a favorite location for a spawning bed. They lie in one or more couples over their beds and here for the period of incubation they keep watch and ward with constant fidelity. Around their beds may be seen perch, suckers, eels and catfish in plenty, ready to devour a portion of the ova. The bass are constantly at war with these voracious depredators, driving them off from moment to moment 'under current of a heady fight.'" Again:—"From close observation in a small pond where I placed several fish in April and May, and where I could daily watch their movements, beds were made by several pairs, over which the female hovered continually. Here they remained until the 24th of June. Every hour I watched them without any evidence of young fry. In the afternoon of this day and after an hour's absence, I returned and discovered several hundred of minute young bass hovering at the surface of the water, while the parent fish was moving around her bed as usual. These young fish were darting about with activity—about three-eighths of an inch long, looking like black motes in the water. For three or four days they kept in this position and then scattered about the edge of the pond among the grass, a few being thus seen for about two or three weeks, when all sight of them was lost till September, at which time a few only were discovered of about two inches in length with the tail marked with a cross-bar." Again:—"One fish is generally on guard at the bed, seemingly quite docile, and if alarmed moves from it a few feet, but soon returns. This probably is the female, exercising her maternal care of the young."

These earlier accounts seem to have been frequently copied. Thus we find Forest and Stream (1875-6) quoting from the Mirror and Farmer an account not essentially different from that of Eoff, and later (1875) giving a second account which bears evidence of a knowledge of Tisdale, while Hallock, in the Sportsman's Gazeteer (1883 and probably in the earlier edition), gives an account which agrees closely with that in Forest and Stream, of which he was at the time editor.

Henshall (1880-1881) describes the breeding habits of the black bass, but adds practically nothing to the accounts of these earlier writers, though he appears to have made observations of his own. Whereas earlier writers refer to the fish guarding the nest as the female, Henshall avoids the error of his predecessors by speaking of it with circumspection as the "parent fish."

Arnold kept both large and small-mouthed bass in ponds in Indianapolis. He published a brief note in Forest and Stream, under the name of

Gringo (1881), and later gave an account under his own name (Arnold, 1882), from which I quote: "I think the female prepares the spawning ground or bed, after which the male joins her. While the female is preparing the bed the males fight one another for possession. The male presses the roe from the female by a series of bites or pressures along the belly with his mouth, the female lying on her side during the operation. The male ejects the milt upon the roe from time to time and the spawning process lasts for two or three days. When the spawning is over the male disappears from the scene and the female remains upon the nest, extremely pugnacious, allowing nothing to approach until the eggs have hatched and the young fry are a week or ten days old."

Arnold thus adds to what was already known some observations on the behavior of the fish while spawning, and restates the erroneous opinion that the female is the guardian of the nest.

Holt (1886, 1888) observed the small-mouthed bass in the Thornapple River in Michigan. He describes the male and female as working together at the bed and the female as guarding the eggs and young fish. The young fish are said to be helpless for from six weeks to two months, at the end of which time they begin to swim and are "led by the mother fish to shallow water near shore and left to care for themselves." In the same paper (1888) he describes the female as caring for the young fish until they are three-fourths to one and a half inches long.

Gill (1889) calls attention to the early accounts of Rafinesque and Eoff and expresses his dissent from the opinion that the female bass guards the nest. This he regards as an inference from the habits of mammals and reasoning from the known habits of other fish in which the male parent is the guardian, believes that this will be found to be the case in the bass also.

Bower (1896), in giving an account of the propagation of the small-mouthed black bass as carried on by the Michigan Fish Commission, describes the breeding habits. This description is chiefly from the observation of Lydell, then in charge of the Michigan Fish Commission's bass operations. Bower's paper is the first to assign to the male the role of guarding the nest and young fish. He further states that Holt had, in private conversation, said to him that his earlier statements (Holt, 1886, 1888) that the female was the guardian of the nest were erroneous.

Henshall, in his "More About the Black Bass" (1898), seems not to have known of Bower's paper. He quotes the account of Arnold (1882), which assigns to the female the construction of the nest and the care of the eggs and young, and says: "This accords in the main with my own observations, though I have never observed the male biting or pressing the abdomen of the female. I have often seen the female alone, and sometimes the male, and sometimes both together spinning rapidly around the nest, upon their sides, ejecting the eggs or milt, which sank at once to the bottom. When the fish were in pairs the edges of their bellies would be toward each other, sometimes in contact as they circled around quite close to the bottom with jerky, tremulous motions; but I never saw the male pressing the spawn from the female with his mouth."

Lydell (1902) published a brief account of the habits of the small-mouthed bass. This may be regarded as an elaboration of the paper of Bower (1896). Lydell's observations cover the nest building, spawning and care of the eggs and young and are in substantial agreement with the observations recorded in this paper. To him belongs the credit of the first accurate report of the phenomena under discussion.

Nevin (1903) seems still to think that the female builds the nest, since he says: "I had observed during the spawning season hundreds or nests, but in many the eggs were not fertilized eggs, as the fish did not mate." Presumably nests with unfertilized eggs laid by unmated fish were prepared by females. Again he says: "After they have done spawning they will hover about the nests for a time, but finally leave it." He does not believe that the bass guards its nest. The belief that the female bass builds the nest is then apparently not yet dead and may warrant the following resume of our knowledge on the subject.

That the bass guards its eggs was known as early as 1820 (Rafinesque). In 1855 the first detailed account of its breeding habits was published (Eoff). The nests are described and attributed to the two fish working together, while the female is said to guard the eggs and young fish. In 1869 Tisdale added a few observations and reiterated the statement that the female guards the nest. Until 1882 these three accounts seem to have formed the basis of all other published accounts. In that year Arnold described for the first time the act of spawning, especially the biting of the female by the male, but agreed with the earlier observers in giving to the female the role of guarding the nest. This error has been reiterated by Holt (1886, 1888) on the basis of his own observations, and by Henshall (1898), who quotes Arnold, as well as apparently by Nevin (1903). Lydell (Bower, 1896, and Lydell, 1902) was the first who from his own observations ascribed the building of the nest and the care of the eggs and young to the male fish. At the same time he described in more detail then previous writers the method of building the nest, the act of spawning and the care of the eggs and young by the male fish.

The observations on the breeding habits of the small-mouthed black bass recorded in the present paper confirm and extend somewhat the observations of Lydell and may be now summarized as follows:

D. SUMMARY OF OBSEVATIONS ON THE BREEDING HABITS OF THE BLACK BASS.

1 *Small-mouthed Black Bass.*

1. The nests are built preferably on coarse gravel by the male fish working alone.
2. The male fish standing upright sweeps the gravel with the tail until it has been freed from sediment. The nest is then said to be "cleaned up," but is not yet completed.
3. The male then roots over the pebbles with his snout and sweeps the sand and small pebbles from between them. The nest is thus "hollowed out" and is now complete.
4. The male guards the empty nest until a female appears or is found.
5. The activities connected with spawning may be divided into two periods.
6. During the first period, which may occupy half of the whole spawning time, no eggs are emitted, but the male by biting the female brings her into that condition of sexual excitement necessary to the laying of the eggs.
7. During the second period the eggs are laid at intervals of about thirty second and probably not more than twenty-five or thirty at one time. Each act of egg emission occupies about five seconds.

8. While emitting the eggs the female lies on the bottom on her side and moves her pectoral fins slowly and alternately and her contracted dorsal with a characteristic fluttering movement.

9. In the intervals between the emission of eggs the female floats listlessly or swims very slowly on her side at the edge of the nest, usually with her head somewhat lower than her tail.

10. While the eggs are being emitted the male lies quiet and upright at the side of the female.

11. In the intervals between the emission of the eggs the male swims about the female and bites her on the mouth, cheeks, opercles and on the vent.

12. The biting of the male is not of such character as to press the eggs from the female and it does not take place while the eggs are being emitted. It is less frequent in the region of the vent than on the cheeks, opercles and corners of the mouth and is to be regarded as wholly in the nature of a stimulus rather than as a mechanical aid to the emission of the eggs.

13. Before spawning neither fish is mottled. While spawning both fish are mottled, but the female is usually darker and always more conspicuously mottled than the male.

14. Upon completion of spawning the mottling disappears from the male and he then appears to be uniformly dark-colored. The mottling presumably also disappears from the female, but she is no longer seen.

15. The female has not been seen near the nest, except when spawning.

16. The male guards the nest until the young fish leave it and guards the young fish until they are about an inch long. During this time he repels all intruders.

2. *Large-mouthed Black Bass.*

1. The nests of the large-mouthed black bass are the property of individual males. They may be made on fallen leaves of trees, fibrous roots or leaves of water plants, gravel or sand or other bottom material.

2. The spawning is intermittent and sexual excitation of the female takes place by means of biting by the male as in the case of the small-mouthed bass.

3. The male guards the empty nest until the female appears or is found.

4. The individual nests contain eggs which differ from one another in development by as much as forty-eight hours and indicate that more than one female spawns in a nest (polygamy) or that an individual female spawns a second time after forty-eight hours.

5. In other respects the breeding habits are not known to differ from those of the small-mouthed bass.

III.

DEVELOPMENT OF THE BLACK BASS.

A. DEVELOPMENT OF THE SMALL-MOUTHED BASS.

1. The Ovaries and the Eggs.

The ovaries of the small-mouthed bass, examined before spawning, are elongated, cylindrical sacs, with rounded ends. In a fish twelve

inches long, taken May 12th, before spawning, each ovary measured 40 mm. by 9.0 mm. (1.6 in. by .36 in.). Its outer wall is a very thin membrane. The two ovarian sacs unite, and a tapering duct 5.0 mm. (.2 inch) long leads from them to the external opening situated between the anal and urinary openings. If a sac is opened it is found to be filled with eggs, which are attached to ridges running crosswise of it. There is a small irregular cavity between these ridges and it extends through the duct to the external opening, so that a probe may be readily passed from the outside into the cavity of the ovary or in the opposite direction. There is, therefore, no obstruction to hinder the exit of the ova, which might be readily stripped from the fish except for the fact that they are closely adherent to the ridges on the inner surface of the ovarian sac. This adherence is so close that when the ovary is slit open and shaken in water the ova are not detached. In a fish 30 cm. (12 inches) long and of 661 grammes (22 oz.) weight, the ovaries weighed 51 grammes (1.7 ounces) or about one-thirteenth the weight of the fish. In such an ovary one may distinguish in the spring before spawning, eggs of three sizes—large opaque yellow eggs, about 2.5 mm. (0.1 in.) in diameter and nearly ready to be laid, medium sized, white opaque eggs from 0.5 mm. (0.02 inch) to 1.5 mm. (0.06 inch) in diameter probably the eggs of the next season, and very small, transparent colorless eggs of uniformly about 0.25 mm. (0.01 inch) in diameter, the eggs of the third, perhaps of subsequent seasons. The number of mature eggs in these ovaries was determined by weighing a small piece, counting the eggs in it and then estimating the whole number. There were found 5,440 mature eggs. In a second specimen the ovaries of which weighed 38.4 g. there were found 3,664 mature eggs. Stranahan (1898) has reported 4,011 eggs in a female small-mouthed bass weighing one and one-half pounds.

The fresh-laid eggs of a single fish that have been some time in water are of nearly uniform size, but those from different fish vary with the size of the fish and possibly with other conditions. The range of variation that I have found is 2.17 mm. (0.087 inch) to 2.8 mm. (0.112 inch). In other words, the eggs run from 8.9 to 11.5 to the linear inch.

The egg consists of the following parts (Fig. 1, Pl. I.): On the outside is the shell consisting of a thin outer adhesive layer and of an inner layer, the zona radiata, pierced by radial canals which are visible only under a higher power. Within the shell is a narrow space, the perivitelline space, filled with a fluid, probably albuminous. This fluid corresponds in position to the white of the hen's egg. In many bony fishes this fluid is watery, abundant and colorless so that it fills a large space between the shell and the surface of the yolk. In the small-mouthed black bass the perivitelline fluid is thin, scant and of a brown color. The egg is therefore smaller than many other bony-fish eggs which contain no more food material. The fluid is so thick that in preserved eggs it forms, on account of the action of preserving fluids on it, a small elastic mass which must be dissected off before the surface of the egg can be examined.

The perivitelline space measures 0.054 mm. to 0.096 mm. in width (about 0.002 to 0.004 inches). Within the perivitelline fluid is the yolk of the egg, with its enclosed oil drop. The yolk is not in direct

contact with the perivitelline fluid but is separated from it by a layer of protoplasm which completely encloses the yolk. This protoplasmic layer is thickened on one side to form the germinal disc, clearly seen in the upper left hand egg in Fig. 1. The yolk enclosed within the protoplasmic layer is of a light yellow color and tansparent. At its center it is quite homogeneous and of a semi-fluid consistence. Near the surface it is composed of separate, rounded yolk masses of various sizes, so arranged that the smaller of them are next the protoplasmic layer. Embedded in the yolk is the oil drop. It is a little less than half the diameter of the yolk and lies on one side of it so that the surface of the oil drop projects slightly above the yolk surface and the protoplasmic layer is stretched outward over it. On account of the lesser specific gravity of the oil drop, that side of the yolk which contains it is always uppermost, if the egg is free to move. The oil drop then appears to be exactly at the center of the yolk when the egg is viewed from above. The young fish, when it develops, appears on the upper side of the egg and is thus protected from the weight of the yolk upon it. When the eggs are not free to move the oil drop may, when the egg is viewed from above, appear to be in any part of the yolk, as in Fig. 1. In addition to the oil drop there are about its edges numerous smaller oil droplets.

The structure of the egg of the small-mouthed bass makes it an exceedingly delicate egg, easily injured. This is in part due to the small amount of perivitelline fluid and in part to the oil drop. For purposes of microscopic examination it is often desirable to free these eggs from adherent particles by brushing them with a feather or soft brush. With most bony-fish eggs this procedure does not injure the eggs. In the case of the small-mouthed bass eggs a large per cent of the eggs thus brushed is injured by the bursting of the protoplasmic layer and the escape of the yolk into the perivitelline space. Yolk which has thus escaped breaks up into minute spherules and then appears white so that eggs so injured are recognizable by the presence in them of a white spot. The rupture of the protoplasmic layer occurs at the border of the oil drop, that is along the line where the protoplasmic layer stretches from the surface of the yolk to the surface of the oil drop. This is mechanically the weakest part of the egg, and owing to the slight protection against mechanical deformation of the egg afforded by the scant perivitelline fluid, it is here that injury occurs. It is here also that the protoplasmic layer is ruptured when the egg is dead. The white spots of such dead eggs are readily seen in most of the eggs in Fig. D.

2. *The Development After Hatching.*

The writer has already described in detail (Reighard, 1900) the development of the wall-eyed pike as it may be followed in the living egg. In its essential features the development of the black bass is nearly the same as that of the wall-eyed pike, so that it is unnecessary for our purpose to describe it in detail. The development of the bass before hatching is moreover difficult to observe. The egg is too opaque to admit of clear views of what takes place within. Its natural opacity is increased by particles adherent to the shell and in the earlier stages an attempt to remove these with a brush is likely to injure the egg. If the eggs are preserved, the preserving

fluids harden the perivitelline fluid so that it forms a tough, opaque layer over the surface of the egg and hinders any clear view of its surface. If the hardened perivitelline fluid is dissected away the structures beneath it are more or less injured. The egg before hatching is therefore a very unfavorable object. It may be best studied by means of microscopic sections. For these reasons the following account of the development of the black bass proceeds at once from a description of the egg to the hatching stage.

Since the stage in which the fish is at any age depends on temperature, the ages are given merely as approximate guides to the stage in which the fish is. It is better to designate the stages arbitrarily by letters, and this has been done in the following section of this paper.

a. The recently hatched fish.—In the small-mouthed bass at the time of hatching (Figs. 3, 4 Pl. I) the yolk, relieved from its confinement within the shell, becomes elongated. Its ends are rounded and its longer axis, which is roughly about one and one-half times its shorter axis, is parallel to the long axis of the body of the embryo. Within it is seen the oil drop, which is of a bright golden color, while the yolk is pale yellow. The yolk is enclosed within the yolk sac, the outline of which may be seen following that of the yolk in Fig. 3. In front there is, between the yolk and the external yolk sac, a space, a part of the future body cavity of the embryo. (Fig. 2.) This space is that part of the body cavity which contains the heart and is known as the pericardial cavity.

The head and nearly the whole trunk of the embryo are broad and flat and closely attached to the upper surface of the yolk sac, while the tail which is flattened in a direction at a right angle to the body projects beyond the yolk sac and is about equal to it in length. In the head one may see the developing eyes, each of which contains a central smaller body, the lens. In front of each eye and in contact with it is an open pit, the olfactory pit, which develops into the olfactory organ or organ of smell in the adult fish. A little way behind each eye is a simple closed vesicle, one of the auditory vesicles out of which develops one of the ears of the adult. The same structures are more clearly shown in the figure of the large-mouthed bass at the time of hatching. (Fig. 19 Pl. II.)

Running along the middle of the body and tail may be seen the notochord, the supporting axis of the embryo, about which the backbone of the adult fish develops. Crossing the notochord and extending above and below it are seen parallel V-shaped lines, with the points of the V directed forward. These lines separate from one another the muscle segments out of which develop the muscles of the adult fish. A little way back of the yolk sac on the lower side is seen a projecting papilla contained in a slight notch. This marks the position of the vent and at this point the tail and body join one another. The embryo and yolk are transparent and except for the yellow of yolk and oil drop, colorless.

The heart is beating feebly, about seventeen beats to the minute. The embryo is able to lash the tail from side to side but these movements are insufficient to move the heavy yolk sac.

The most convenient method of describing the development of the

embryo into the adult fish is to follow separately the history of each of its parts. When this has been done certain characteristic stages may be designated. Figures 3 to 12 represent the developmental stages which are passed through in the nest after hatching and each of these figures is ten times (linear) the actual size of the fish represented. Figures 13 to 16 are five times the actual size of the fish. Figure 13 is of the same stage as figure 12, and represents a young fish which is just swimming up from the bottom of the nest, while figures 14, 15, 16 and 17 represent fish that have left the nest. Figures 13 to 16 represent fish magnified but five times, that is only one-half as much as figures 3 to 12; while figure 17 represents a fish of it natural size. In comparing the figures, therefore, figures 13 to 16 must be thought of as twice their actual size when compared with figures 3 to 12, while figure 17 must be imagined to be ten times its actual size when compared with figures 3 to 12; or one may compare all the other figures with figure 17, by thinking of figures 14 to 16 as one-fifth their present size and of the remaining figures as one-tenth their present size.

b. Yolk and oil drop.—The yolk does not diminish greatly in size until three or four days before the young fish is ready to swim up from the bottom of the nest, when it is about eight days old (Fig. 8.). It undoubtedly does, however, lose in density and consequently in weight during this time, since the material of which it is composed is being absorbed and used in building the body of the embryo. During its early history the yolk also changes shape. Its front part projects from the remainder as a kind of papilla (Fig. 7). Along the groove between this papilla and the remainder of the yolk there runs on each side one of the great veins (Ducts of Cuvier) which bring the blood from the body of the embryo to the lower or back end of the heart (Fig. 6). This yolk papilla is now gradually absorbed or withdrawn so that in figure 10 it is quite small while in figure 12 it is no longer to be seen. At the same time the yolk has become more pointed at its back end and more elongated so that in figure 10 it is egg shaped. In the young fish which is swimming and no longer lying on the bottom of the nest (Figs. 12 and 13) the yolk sac is considerably reduced in size and is still more elongated. Figure 12 represents a fish with contracted pigment cells seen by transmitted light so that the yolk is clearly seen. Figure 13 shows a fish of the same age as seen by reflected light and with the pigment cells not contracted. In this figure the yolk is hidden by the pigment and one sees merely the rounded protuberance formed by the projecting yolk-sac between the base of the lower jaw and the root of the tail. This protuberance now gradually disappears as the yolk is absorbed from the yolk-sac with the growth of the young fish, and in consequence the outline of the lower surface of the body gradually approaches the gentle curve characteristic of the adult fish. About eight days after the fish have arisen from the bottom of the nest (Fig. 14) the last trace of the yolk is absorbed. The precise time when this takes place cannot be told by inspection of the fish from the exterior but only by dissection. Thus in figure 15, there is seen a greater protuberance of the ventral surface than in figure 14, though the fish represented in figure 15 is the older by two days. The difference is due wholly to the different amounts of food present in the alimentary canal; in both fish the yolk is wholly absorbed. The oil drop is absorbed after the greater part of the yolk. Thus in figure 12 it is still of nearly or quite full size and in a fish like that represented in figure 14, in which the yolk is absorbed a small part of the oil drop still remains. The oil drop furnishes nourishment to the young fish but no doubt, like the air bladder, it also helps to float the young bass in the water.

c. The head.—The head is flattened at the time of hatching and its whole lower surface is attached to the upper surface of the yolk-sac. As development proceeds the head grows gradually forward so that it projects beyond the yolk-sac and as the yolk is absorbed, the lower surface of head and body as seen in profile come to form parts of an uninterrupted curve. While the head is growing forward it changes shape. At hatching all parts of the brain lie in nearly a single plane, a plane which is curved only enough to conform to the surface of the yolk-sac. At the end of the first day the front part of the brain (forebrain) is bent downward so that it forms almost a right angle with the parts behind it (Fig. 5). This bend, known as the parietal flexure, takes place in the second division of the brain, or mid-brain, which is seen in the figures just above the eye. On the second day (Fig. 6) a second bend. The bridge-bend or pontial flexure, appears in the brain behind the first and in a direction opposite it. The result of this is that the parts of the brain are again brought nearly into the same plane. This bending of the brain may be illustrated by placing the hand palm down on a table in such a way that the extended fingers project beyond the edge of the table. By bending the hand at the knuckle joints so that the fingers are kept straight while their tips are carried downward, the parietal flexure is imitated. If now while keeping the fingers and hand in the same position with reference to one another, the wrist be bent so as to bring the tips of the fingers again to the level of the table top the bend of the wrist imitates the pontial flexure. When the second bend has been made there is a cavity or angle between the back of the hand and the upper surface of the arm.

These bends in the brain are accompanied by corresponding changes in the form of the head, rendered possible by the gradual separation of the head from the yolk-sac. Thus in figure 5 the front end of the head is pointed downward in correspondence with the parietal flexure while in figure 7 it is directed forward in correspondence to the formation of the pontial flexure. In the same figure the depression back of the head marks roughly the position of the pontial flexure. This depression is seen in the other figures to figure 13. In figure 14 and the remaining figures it is seen to be gradually filled up, so that the upper profile of head and body form a uniformly curved line. The filling up of the depression is brought about by the extension into it of muscles produced from the muscle segments and by the development of their supporting bones.

Further change in the form of the head is due to the development of the mouth and jaws. In figure 6 the depression between the lower surface of the head and the yolk leads to a shallow mouth cavity but there are as yet no jaws. Twenty-four hours later (Fig. 7) the

lower jaw may be seen attached to the surface of the yolk-sac above the pericardial cavity and above it may be seen the mouth cavity bounded above by the part of the head in which the upper jaw subsequently forms. The lower jaw now gradually extends forward as seen in figures 9 to 13 and at the same time the upper jaw develops opposite it. Both jaws then elongate (Figs. 14-17) so that the eye comes to lie farther from the end of the snout. The head which meantime has become flatter from side to side thus assumes its adult form.

The eye at the time of hatching is transparent and colorless. At its center is seen the lens. At the end of one day (Fig. 5) black pigment has begun to develop in the eye outside the lens. At the end of two days (Fig. 6) this pigment has increased and on the third day (Fig. 7) it is so abundant that the eye is quite black. After the third day an iridescent golden layer develops on the surface of the eyeball and partly conceals the black pigment. This iridescence increases until at the time the young fish swims up from the nest bottom (Fig. 11) the exposed surface of the eyeball is wholly iridescent. Meantime the iris, immediately surrounding the pupil, has developed and appears in the older specimens as a bright ring of gold. Extending from the edge of the pupil to the lower border of the eyeball is a slit (the choroid slit) which soon closes to form a seam, along which the black pigment is not concealed by the iridescent layer. This slit thus appears as a black line on the surface of the eyeball and is best seen in figures 6 and 12. After the young fish swim up from the nest bottom (Figs. 14 to 17) this black line is covered by the iridescent layer and is no longer visible.

d. Heart and pericardial cavity.—With the forward growth of the head the pericardial cavity becomes larger (Figs. 5 to 8). At first it extends in a vertical direction, downward from the lower jaw along the front of the yolk. As the head continues to grow forward and the yolk is absorbed the lower end of the pericardial cavity is carried backward (Figs. 9, 10, 11), until finally the cavity occupies a horizontal position behind the lower jaw (Fig. 12) as in the adult fish. The heart is at first a straight tube and may be seen in figure 6 as a dark line running through the pericardial cavity. At its lower or venous end it is formed by the junction of three great veins, the two ducts of Cuvier, which are seen in figure 6 extending from the body of the fish across the oil drop and yolk-sac, and the vitelline vein which enters from behind and brings the blood from the yolk-sac and tail. The upper or arterial end of the heart is separated from the venous end by valves. From it the blood pours through the aortic arches to the head and body. The venous and arterial ends of the heart are barely distinguishable in figure 6 but each makes up about half the length of the heart tube. Each part subsequently becomes swollen while the portion between them forms a constriction in which are the valves (Fig. 11). With the carrying backward of the lower end of the pericardial cavity the venous end of the heart is also carried back and there is produced consequently a bend in the heart tube at the junction of the venous and arterial portions (Fig. 11). The later history of the heart can be followed only by dissection.

e. The body is flattened from above downward at the time of hatching (Figs. 3 and 4), but as it separates from the yolk-sac and as the

yolk is gradually absorbed the body becomes flattened in the opposite direction, i. e. from side to side like the body of the adult fish. At the same time the muscle segments, which in the younger stages lie only at the sides of the notochord, extend upward until they meet above the nervous system and below the body cavity. Thus the body wall is greatly thickened and strengthened while at the same time the body of the fish is increased in depth and the hollow at the back of the head is filled out.

f. The fins.—When the fish is hatched the tail is thick at its middle where the notochord, muscle segments and nervous tube extend lengthwise through it, but it is very thin at the edge. This thin edge forms a continuous thin fold (the median fin-fold) which extends from the yolk-sac along the lower side of the tail and then about its end and forward on its upper side to a point on the body about midway of the yolk-sac. As development proceeds there are developed out of this median fin-fold the three unpaired fins, the caudal, and anal and dorsal, while the parts of the fold not converted into these fins disappears.

That part of the fin lying below the tip of the tail gives rise to the caudal or tail fin. The first trace of this fin is seen in figures 9 and 10. In these figures the layer of black pigment cells covering the muscle segments along the sides of the body is seen to be interrupted on its lower edge not far from the end of the notochord. This is still more evident in figure 11 and in this figure it is seen that the fin-fold on the lower side of the notochord opposite the points where the pigment band is interrupted, is broadened and marked with radiating lines of pigment. This broader part of the median fin-fold on the lower side of the tail now increases in size and at the same time pushes the end of the notochord upward as the seen in figure 13. In this way the caudal fin which at first lies on the lower side of the tail gradually shifts its position to the end of the tail (Figs. 14, 15, 16). As it shifts its position it bends the end of the notochord upward, until finally the back part of the notochord and the original terminal part of the tail lie along the upper edge of the caudal fin (Fig. 15). Here they become inconspicuous as growth takes place (Fig. 16) until finally they no longer show from the surface (Fig. 17) but are to be found by dissection. While the caudal fin is shifting position strong branched supporting rays are developed in it.

In figure 11 it is seen that immediately in front of the caudal fin the median fin-fold both above and below is broader than it is further forward. The broader front portion of this fold above the notochord becomes the dorsal fin, while the broader portion below the notochord becomes the anal fin. In figure 15 the narrower intermediate portion of the median fin-fold is seen to be very much reduced. In figure 16 it is absent below though still present above and in figure 17 it has disappeared both above and below. In this way the dorsal and anal fins become wholly separated from the caudal. At the same time these fins develop supporting rays which appear as very delicate structures about four days after hatching and become gradually thicker. They appear in the dorsal first in its broader back parts and later in its narrower front part.

Of the paired fins the pectorals develop very early. One day after

hatching they are thin, low semicircular ridges, shown in figure 5 above the oil drop and opposite the notochord. Their line of attachment is paralel to the long axis of the body and their free edges are directed upward. Each of the ridges now changes in shape, direction of its line of attachment, and structure. The semicircular ridges become higher (Figs. 6 and 7) and the line of attachment then shortens (Fig. 8) so that the ridges are triangular with two rounded free angles and a short truncated angle of attachment (Fig. 14). The whole fin then elongates to its adult form. While the fin is changing shape its line of attachment shifts from the horizontal (Fig. 5) until it makes an angle of about 45 degrees with the long axis of the body (Figs. 7 and 8) and finally into a nearly vertical position (Fig. 14). At the same time also the fin divides into two parts, a thick basal portion consisting of muscles and bone and a thin border with supporting rays (Fig. 14). The border subsequently grows so that it becomes much larger relative to the basal portion than in the earlier stages (Fig. 16).

The pelvic fins do not make their appearance until some ten days after the young fish have risen from the nest bottom and some twenty-four days after hatching. They have their adult form and position when they first appear but are very small (Fig. 16). They then increase rapidly in size (Fig. 17).

g. Color changes.—The newly hatched fish is colorless and transparent. The first color is the black pigment which appears in the eyes at the end of about twenty-four hours. Subsequently branched, black pigment cells appear in the yolk-sac. They appear first in a band which extends from the pectoral fin backward along the junction of yolk-sac and body (Fig. 6). On the next day a second band appears parallel to the first and extends from the auditory vesicle backward along the upper edge of the muscle segments (Fig. 7).

These two bands now gradually extend backward to the tip of the tail (Fig. 8). Then pigment appears between them until the two bands are connected and the whole sides of the muscle segments are covered (Fig. 9). At the same time the pigment extends down over the yolk-sac and forward onto the top of the head and the lower jaw (Fig. 10). Finally the whole fish is covered with dense black pigment, except the fins, which contain only a little pigment at their bases, and an area along the ventral side of the yolk-sac which is wholly free from pigment (Figs. 12, 13). Finally the black pigment covers the whole of the yolk-sac (Fig. 14). The fish are then intensely black. When the fish are about 12 mm. (0.5 in.) long the intense black becomes tinged with green or bronze (Figs. 14 and 15) and by the time they are three-quarters of an inch long the whole body is of a uniform grey-green color, fading to white in the lower surface (Fig. 16). Later vertical dark bands and stripes appear on the light background and by the time the young fish is two inches long, it has the appearance shown in figure 17. The stripes on the head are well marked. On the body are about nineteen dark bands, very nearly like those of the adult fish. At the base of the tail is a black spot and across the tail a characteristic black band. The black band on the tail remains for a year and with its disappearance the young bass has taken on adult colors.

3. *Arbitrary Stages in the Development of the Small-Mouthed Black Bass.*—For the purpose of the fish culturist it is convenient to distinquish those stages in the development of the bass that may be easily recognized with a hand lens. Since the rate of development varies with the temperature this may best be done not by reference to the age of the fish but by reference to certain well marked peculiarities. The number of stages to be recognized is wholly a matter of choice; by using higher powers of the microscope and detailed anatomical characters one might readily distinguish a much larger number than is here given. It is believed that the stages distinguished below are sufficiently numerous for the purpose of the fish culturist. The measurements given are those of individual fish and are the lengths from tip to tip. These measurements doubtless vary considerably with different lots of fish.

A: No pigment; head does not extend beyond the yolk-sac; no cranial flexure; at time of hatching; length 4.6 mm.=0.18 inches. (Figs. 3, 4).

B: Pigment beginning to appear in eyes (retina), none elsewhere; head extends somewhat beyond yolk-sac and the parietal flexure is formed so that the tip of the head points downward; pectoral fin present as a low ridge; fish able to glide along bottom by movements of tail; 1 day (24 hours) after hatching, length 5.4 mm. = .22 inch (Fig. 5).

C: Eye uniformly black; a pigment band along junction of yolk-sac and body; pontial flexure formed and head consequently directed nearly forward; mouth cavity formed but no jaws; pectoral fin semicircular; 2 days after hatching; length 6 mm.=0.24 inch (Fig. 6).

D: Eye becoming iridescent; two parallel bands of pigment on body from auditory vesicle to posterior limit of yolk-sac; head directed forward; mouth cavity deeper and lower jaw formed; 3 to 4 days after hatching; length 6.75 mm. = 0.27 inch (Figs. 7 and 8).

E: Ventral band of pigment extends entire length of tail, dorsal band shorter; a few pigment cells between the two bands; pigment on yolk-sac to a horizontal line through middle of oil globule; mouth large; lower jaw partly free from the pericardial sac and moving; pectoral triangular, set at an angle of 45 degrees and in rapid vibration; six days after hatching; length 7.5 mm. = 0.3 inch (Fig. 9).

F: The two pigment bands united by intervening pigment which covers the muscle segments; nearly the whole yolk-sac pigmented; upper and lower jaws of equal length; the latter wholly free from the pericardial cavity; pericardial cavity nearly horizontal, under and behind lower jaw; yolk egg shaped; caudal fin beginning to develop; 8 days after hatching; length 8.3 mm. = 0.33 inch (Fig. 11).

G: Whole body, except fins and lower surface of yolk-sac, covered with intensely black pigment; end of notochord bent upward; separation of dorsal, anal and caudal fins beginning; yolk not yet all absorbed; swimming up from nest bottom; 14 days after hatching; length 9.3 mm. ≐ 0.37 (Figs. 12, 13).

H: Color becoming bronze or green; whole yolk-sac pigmented; caudal fin at end of tail, not notched; original end of vertebral column hardly visible externally; no pelvic fins; dorsal and anal well developed, still connected with the caudal; nostril a long slit; 22-24 days after hatching; length 10.5 to 11.1 mm or 0.42 inch (Figs. 14, 15).

I: Same as H but with very small pelvic fins; 26 days after hatching; length 11.5 mm. = .46 inch (no figure).

J: Color uniformly grayish green, lighter below; caudal fin notched; original tip of vertebral column scarcely visible externally; dorsal and anal separated from caudal and fully formed; form nearly that of the adult; about 30 days after hatching; length 19 mm. = .76 inch (Fig. 16).

The difference in size between stages I and J is due in part to the fact that the fish representing stage J was reared in a large pond while that representing stage I was confined in a screen. If the fish taken as the type of stage J had been reared in a screen it would have been considerably smaller.

K: About ten black bars on side; no black bar on tail; otherwise like adult bass except in proportional size of head and eye; about 40 days after hatching: length 27 mm. = 1.08 inch (no figure).

L: Sides banded in a pattern resembling that of an adult female under sexual excitement; cheeks with stripes like the adult; a black spot at base of the caudal; a black band on the tail; about 60 days after hatching: length 50 mm. = 2 inches (Fig. 17). Except for the larger size of the eye and the black band on the caudal the fish is now like the adult. The black band on the tail persists for a year and then gradually grows fainter.

4. *Behavior of the Developing Small-Mouthed Bass.*—As the young bass lie in the nest immediately after hatching they are transparent and colorless and thus practically invisible to the naked eye. Only as one catches the glint of the oil globule are the young fish visible. In most cases the use of a glass dipping tube is necessary to determine whether or not there are fish in the nests. The lightness of the oil globue which lies on the side of the yolk in which is the fish, causes that side to turn uppermost. The young fish thus lie with the yolk-sac against the bottom. The lower surface of the yolk-sac is adhesive and soon becomes covered with a layer of adherent particles. When first hatched, the young bass makes no other movement than a lashing of the tail and this is not sufficient to move the heavy yolk sac, especially when the sac is loaded with adherent particles of foreign matter. Twenty-four hours after hatching (stage B) the movements of the tail are sufficiently vigorous to cause the fish to move forward for a short distance if placed on a smooth surface. Such movements probably occur on the stones in the nest. At any rate in one or two days after hatching most of the young fish will be found to have fallen down into the crevices between the stones, so that on casual inspection the nest appears empty. As development proceeds pigment develops and the fish are then more easily seen in the nests. The development of the iridescent coat of the eye also adds greatly to their visibility.

When stage E has been reached the gliding movements of the fish over the bottom have become much more vigorous and the pectoral fins, which are now in rapid vibration, doubtless aid somewhat in this movement. It is not until stage F is reached that the young fish are able to swim up from the bottom. At this time they are able to leave the bottom for an instant but return to it again immediately. The frequency of these excursions from the bottom and their length now steadily increase until in stage G the young fish are in continuous movement from the bottom. The movement is due to intermittent vibration of the tail and pectoral fins. This swimming up from the bottom has been rendered possible in part by the increased size and strength of the fish and by the development of the caudal and pectoral fins, but also in part by the reduction in the weight of the yolk and by the development of the air bladder. The air bladder begins its development in stage G and twenty-four hours after the fish have left the nest bottom the air bladder is one-fourth as large as the yolk-sac. The persistence of the oil globule in this stage also adds to the buoyancy of the fish.

For some days the young bass continue to hover about the nest and form over it a swarm in which the individual fish are darting here and there irregularly. The swarm then gradually leaves the nest still attended by the male. I have not had opportunity to study the swarms after they have left the nest, but they are said to persist "until the young bass are about an inch and a quarter long."—(L.). The swarms then disperse and the young bass remain hidden among weeds each caring for itself. The swarms of small-mouthed young "are large and loosely aggregated measuring from fifteen to thirty feet in diameter. In these swarms the young are not moving together in one direction as in a school of fish but each individual or each small group of individuals moves independently this way and that, back and forth within the limits of the swarm."—(L.).

In stage G the young bass begin to feed on small crustacea and continue on this diet exclusively until they are large enough to capture insect larvae, when these are added to their diet. They appear to feed continuously, night and day, so that where food is abundant the alimentary canal is always full, the abdominal walls are distended and strings of foecal matter project from the anus.

In stage G the young fish show no marked reaction to mechanical shock. Nearly the whole swarm may often be taken with a single sweep of the net. If a stick be moved about in the swarm at this time the individuals do not necessarily flee from it but quite as often move toward it. Later, in stage H, they begin to react to mechanical shock and by the end of the stage flee actively from the pursuing net or from a stick thrust among them.

B. DEVELOPMENT OF THE LARGE-MOUTHED BASS.

1. *The Eggs of the Large-Mouthed Bass.*—(Fig. 18, Pl. II) Closely resemble those of the small-mouthed bass, but are smaller. The average size of the eggs of a single female was found to be 1.5 mm. or 0.06 inch. That is, there are between sixteen and seventeen eggs to the linear inch. The shell consists of two layers, the outer of which is transparent, about three times as thick as the inner, rough on its outer surface and very adhesive. Soon after the eggs are laid the outer layer becomes covered with a coating of adherent particles, including living diatoms. The view of the interior is then much obscured. Thus in figure 18 the central egg at the top has been cleaned by brushing and its interior with the embryo fish is fairly well shown. The two eggs at the right have not been cleaned, while the remaining three eggs have been partly cleaned. The inner layer of the shell is a zona

radiata. The perivitelline space is of about the same relative size as in the small-mouthed bass and its fluid is much the same. The apperance and structure of the yolk is the same, but the oil drop is relatively smaller. In the small-mouthed bass it has about one-half the diameter of the yolk, in the large-mouthed bass, about one-third the diameter of the yolk.

2. *Development after hatching.*—It is unnecessary to follow in detail the development of the large-mouthed bass, since in its general features it is like that of the small-mouthed bass. The small-mouthed bass requires usually ten days for hatching while the large-mouthed bass in the same waters hatches in from three to four days.

At hatching (Fig. 19) the young fish shows the same parts in the same stages of development as the small-mouthed bass of the same age. Its head is relatively large and extends a little further forward. The yolk is elongated. The pectoral fin, which is only visible in the small-mouthed bass after twenty-four hours, has begun to form, but is scarcely visible in the figure. From the rudiments present at the hatching stage the individual organs develop in the same manner as in the small-mouthed bass. Their history may be seen in the figures and need not be repeated. The color development is, however, very different from that of the small-mouthed bass.

Black pigment appears in the eye forty-eight hours after hatching (Fig. 20) and three days after hatching the eye is very black (Fig. 21) and at the same time black pigment cells have appeared along the junction of the yolk with the body. This black pigment is later to be found on the body along two parallel bands as in the small-mouthed bass. Nine days after hatching the black pigment covers the whole fish except that part of the head below a line drawn through the middle of the eye, and covers also the yolk-sac (Fig. 25). But although the black pigment cells are found over the whole fish they are scattered so that the fish is by no means black. In addition to the black pigment there are developed between eight and nine days after hatching, a large number of cells containing a transparent yellow pigment. These are found among the black pigment cells over the whole body, except on the lower half of the first two-thirds of the sides of the tail. The yellow pigment cells are rather more numerous than the black. They do not occur in the yolk-sac. The effect of the yellow and black pigments is that the young fish of nine days has a yellow-grey color. This is more pronounced eleven days after hatching (Fig. 26) when the grey of the body contrasts with the black of the yolk-sac. Subsequently a glittering silvery color replaces the black of the yolk-sac. This may be seen beginning in fish of fourteen days after hatching (Fig. 27). A little later the whole lower surface of the body and throat have become silvery and a black stripe has appeared along the sides and runs through the eye, while the rest of the fish is grey or greenish grey (fish of 20 mm., Fig. 28). Later still (fish of 50 mm., Fig. 29) the dark lateral stripe has broken up into spots and a row of similar spots has appeared along the back on each side. The color is then essentially that of the adult fish. The black tail band characteristic of the young small-mouthed bass does not occur in the large-mouthed bass.

3. *Arbitrary stages in the development of the large-mouthed bass.*

A: No pigment; head scarcely extends beyond the yolk-sac; only slight cranial flexure; able to move along a smooth surface by action of tail; at time of hatching: length 4.2 mm. = 0.17 in. (Fig. 19).

B: No pigment in eye or elsewhere; head extends somewhat beyond the yolk-sac; parietal flexure formed so that tip of the head points downward; pectoral fin present as a low ridge; movements as in stage A; 1 day after hatching: length 4.75 mm. = 0.19 in. (Fig. 20).

C: Eye slightly pigmented; no pigment elsewhere; pontial flexure formed and head directed nearly forward; mouth cavity formed but no jaws; pectoral more prominent; two days after hatching: length 5.3 mm. = 0.21 + inch (Fig. 21).

D: Eye very black and becoming iridescent; a few black pigment cells along junction of body and yolk-sac and on yolk-sac; lower jaw not yet visible; pectoral fin attached at an angle of about 45 degrees; lower surface of yolk-sac very adhesive; yolk with a mammilla; 3 to 4 days after hatching: length about 5.6 mm. = 0.22 + in. (no figure, though scarcely distinguishable from Fig. 22.)

E: Whole eye iridescent; ventral band of black pigment well marked; dorsal band beginning; pigment on yolk-sac; lower jaw developed and free from yolk-sac, not reaching to end of snout; pectoral fin moving vigorously; mammilla absorbed from the yolk; gill filaments begin to form; 6 days after hatching: length 6.3 mm. = 0.25 + in. (Fig. 23).

F: Very little pigment yet developed except along the ventral band; yolk reduced and pear shaped; air bladder prominent above and in front of oil globule; hind-gut very prominent behind yolk; jaws of equal length; general condition that of small-mouthed bass of same stage; at this stage the young fish swim up from the nest bottom; eight days after hatching: length 6.5 mm. = 0.26 in. (Fig. 24).

G: Pigment over whole body and yolk-sac; on body, in part black pigment cells, in part yellow, on yolk-sac black pigment; end of vertebral column not yet bent upward and tail not heterocercal; caudal, anal and dorsal fins differentiating; yolk nearly absorbed; oil globules wholly absorbed; air bladder now as large as the original oil globule; intestine very large and visible through the body wall; 9-11 days after hatching: length 7.3 mm. to 8.0 mm. = 0.29 in. 0.32 in. (Figs. 25, 26).

H: Yolk-sac becoming silvery; end of vertebral column bent upward and heterocercal tail with its rays developing; caudal and anal fins pigmented; anal and dorsal still broadly continuous with caudal; 14 days after hatching: length 9.6 mm. = 0.38 + in. (Fig. 27).

Further stages have not been distinguished but may be readily designated by size and colors. The 20 mm. stage and the 50 mm. stage are shown in figures 28 and 29. In the 20 mm. stage the adult form but not the adult proportions are reached; all fins are present and the colors are nearly those of the adult. It will be noted that up to and including stage F, the stages recognized for the large-mouthed bass are the same as those recognized for the small-mouthed bass. After stage H the caudal fin develops less rapidly in the large-mouthed bass and the colors of the two are different.

4. *Behavior of the Developing Large-mouthed Bass.*—If young large-mouthed bass, immediately after hatching, are placed in a dish of water with smooth, level bottom and stimulated by touching them with a needle they respond by vigorous lashing movements of the tail, which cause

them to glide forward over the bottom of the dish. The forward movement may be in a circle which is either right or left handed. In that case the young fish lies on either the right or left side. Or the fish may progress in a straight line. When the young fish is progressing in a straight line it does not lie on one side, but rocks from side to side on the yolk sac so that the right and left sides of the yolk sac are alternately in contact with the bottom of the dish. This rocking movement takes place at the rate of about ten vibrations per second, five toward each side, and the fish progresses no more than one or two inches. It is clear that the apparently straight course that the fish keeps is really made up of small arcs directed alternately toward the right and left. While the fish is rocking toward the right it is progressing through a small arc directed toward the right and while rocking toward the left through a small arc directed toward the left. The summation of these arcs makes an *apparently* straight line. The fish is unable to maintain a strictly upright position while progressing, so that it is only by rocking or falling first on one side and then on the other that an approximately straight course is possible for it. When it comes to rest the yolk is downward and in contact with the glass; or the left side of the yolk sac is down and the right side, on which the oil globule lies, is up, or any position between these two is assumed.

At this time the lower surface of the yolk sac, about one-half its area, is adhesive. If touched with a needle a viscous string of mucus may be drawn away from it and is rendered visible by enclosed particles of sediment. If now the young fish are placed in a glass vessel, the bottom of which is roughened inside by grinding, the yolk sac adheres to the glass and they are unable to progress or are able to progress for only a very short distance. Often one makes vigorous movements of the tail without being able to move ahead. If they are placed on a bottom of ooze or sediment from the pond, the particles of this ooze soon form over the lower half of the yolk sac a coating which fits the yolk sac like a little shell and has considerable coherence. When removed from the yolk sac this shell keeps its form and has a considerable thickness. It weights the young fish and holds them in place, so that, although they make vigorous movements, they do not progress. If thick sediment or ooze be allowed to fall from a pipette onto the young fish, there is at once a vigorous wriggling movement which throws off the sediment so that the young fish, while retaining their positions, soon free themselves from the sediment. At the same time the shell of adherent particles on the lower face of the yolk sac keeps them from sinking deeper into the ooze. *Thus the adhesive yolk sac and the wriggling movements protect the young fish from being smothered by sediment.*

This is shown by the following experiment:

In a dish on the bottom of which was a layer of ooze one-eighth of an inch thick were placed four recently hatched young fish and the water was then vigorously stirred until the sediment was uniformly distributed and was then allowed to settle.

After two and a half minutes two of the fish were free from sediment and on top of the layer which had settled on the bottom.

After five minutes the third was on top and there could be seen about it a pit-like disturbed area out of which it had emerged.

After nine minutes the fourth was on top under the same conditions as the third.

Fig. E. School of young large-mouthed bass about 20 mm. (0.8 in.) long, in an aquarium.

In Stages B, C, D and E the young fish are still in the same condition, held down by the weight of the particles adherent to the yolk sac and wriggling actively when disturbed. In Stage E the pectoral fin is moving vigorously, the air bladder is developed and covered with pigment.

In Stage F the young fish are able to break away from their attachment to the bottom and when disturbed swim up for an instant from the bottom and then return to it. The yolk sac now shows little trace of adhesiveness.

By Stage G the oil globule is absorbed and the yolk is no longer visible from the exterior and is probably absorbed. The yolk sac is no longer adhesive; the air bladder is large and the young fish are swimming free above the bottom.

At what stage they leave the nest I do not know, but for some time (days?) after rising from the bottom they hover over the nest in a swarm like that of the small-mouthed bass. Gradually this swarm assumes a progressive character, that is, becomes converted into a school. The school then leaves the nest, guarded by the male fish, and remains there until the young bass are at least three-quarters of an inch long (about the stage shown in Fig. 28).

The young fish which have just hatched are wholly invisible to the naked eye as one looks into the nests. It is only by the use of a dipping tube that their presence is detected with certainty. As they grow older and darker colored and begin to swim up from the bottom they are somewhat more easily seen, but at no time are they easy to see. During the first few days of its life outside the nest the school of young fish keeps near the bottom in shallow water. The fish are then grey and the school is exceedingly difficult to see. As they grow older they approach the surface more frequently, the stripe develops on the side and they are more easily seen. When I have seen the schools in natural waters they were along shore and the parent fish was swimming back and forth in the arc of a circle in deep water outside of them, as though to keep them inshore. The young fish now progress all in the same direction and the school often moves rapidly. At what time the swarms break up I do not know, but I have not seen fish taken from schools in natural waters that were more than three-quarters of an inch long. A school of young fish is represented in Fig. E.

As soon as they swim up from the bottom they begin to feed on small crustacea. Specimens 10 mm. (0.4 in.) long have the alimentary canal filled with crustacea. As many as twenty have been taken from the alimentary canal of a sigle specimen. As they grow older there is added to the crustacean diet insect larvae.

IV.

PROPAGATION OF THE BLACK BASS.

There are three methods by which the problem of propagating black bass may be attacked: 1. Conceivably the eggs may be taken from the parent fish, *artificially fertilized,* and hatched by suitable apparatus. 2. *Pond culture* may be resorted to; that is, adult fish may be kept in ponds from which all enemies of the fish, eggs and fry have been excluded. From these ponds eggs naturally deposited or the young fish, naturally

hatched, may be taken and either planted at once or planted after the young fish have been brought to any desired size by means of artificial or natural foods supplied to them while confined in rearing troughs or rearing ponds. 3. *The young fish or the adults may be taken from their natural waters and transferred* to waters which it is proposed to stock. These three methods will be spoken of in turn, although the second and third of them only are in use.

A. ARTIFICIAL FERTILIZATION OF BLACK BASS EGGS.

In nearly all fish propagated by fish culturists it is the custom to press or "strip" the eggs from the female, to fertilize them with milt stripped from the male and to hatch them in a suitable hatching apparatus. The procedure is known as "artificial propagation" of which "artificial fertilization" is a necessary part. This method of dealing with the bass naturally early suggested itself to fish culturists.

Tisdale (1869) was the first to attempt the artificial fertilization of black bass eggs. He says: "The act of emitting their spawn I have never seen; and repeated efforts to express it from these fish in May, when supposed to be ripe, for the purpose of artificial impregnation, proved abortive. The ova of this fish are small, about one-fourth the size of salmon or trout spawn, very compactly laid in a film covered sac and apparently difficult to escape through any artificial process. Further experiments beyond doubt will effect this."

For many years fish culturists do not seem to have repeated Tisdale's attempt at artificial fertilization. It was generally held that the parent bass gave such good care to its eggs and offspring that nothing more than the introduction of adult bass was necessary to stock any water. Thus *Seth Green* (1877), *Henshall* (1880), *Goode* (1884) and *Holt* (1886) held to the view that artificial cultivation of the black bass in any form was either impossible or unnecessary.

Some ten years ago, owing to the increased interest taken by anglers in the black bass and owing to the depletion of some bass waters, urgent requests for the artificial culture of this fish came to the United States Fish Commission as well as to the State Commissions. We then find renewed attempts at artificial fertilization. Thus in 1896 *Page* (1898), at the United States station at Neosho, Missouri, took wild black bass in April, confined them in a pool until the end of the season and attempted artificial spawning, but without success. Failure was attributed to the low temperature of the pond selected. The species used is not stated.

In the same year *Stranahan* (1898) took males and females of the small-mouthed black bass from their beds, apparently in the act of spawning. "But in only one instance were fry hatched from eggs collected in this way. The eggs were forced from the female with great difficulty, and in no instance could milt be obtained from the male; hence it became necessary to open the fish and remove the spermaries, which were then cut up and mixed with the eggs, a little corn starch being added to prevent adhesion." Eighty-five per cent of these eggs were impregnated. They hatched in four days.

Again, in the same year, *Lydell* (Bower, 1896; Lydell, 1902) attempted artificial fertilization in small-mouthed bass seined from their beds while spawning. He succeeded in this way in stripping two females, but

in order to secure milt found it necessary to open the males. About 60 per cent of these eggs were hatched. *Bower* (1896) concludes that artificial impregnation is impossible. He says: "A preliminary coaxing or caressing by the male seems imperative not only to bring the female to the point of spawning, but also to develop the milt. These preliminary proceedings are sometimes carried on for several hours and again only for a few moments; if the fish are interrupted or handled at this time or prior to the orgasmic stage neither the eggs nor milt will flow, so that artificial impregnation may be accomplished only during the few moments of actual spawning or after the natural spawning has begun. Under the strictest surveillance the opportunity is too seldom presented or known for practical operations in this direction. In any event, however, we would lose instead of gain by the artificial handling of bass eggs, owing to the relatively high percentage of natural results in protected ponds and the relatively low percentage of results by artificial treatment of adhesive eggs."

As the result of these several attempts artificial fertilization was rightly abandoned as impracticable. As already noted, the writer has found nothing in the structure of the sexual organs to prevent forcing of the eggs from the female by pressure. No obstruction or occlusion has been found within the cavity of the ovary or oviduct which could hinder the eggs from passing directly to the exterior. In all cases of small-mouthed bass with ripe ovaries the ova have been found rather firmly attached to the inner surface of the ovarian wall, so that slitting open the ovary and agitating it in water does not cause the eggs to become detached. It is probably this firm attachment of the ova to the ovarian wall that prevents stripping under ordinary circumstances. By what natural means eggs are set free at the spawning time can be only conjectured, although this might be determined by the examination of females taken in the act of spawning. Probably under sexual excitement there is a greatly increased flow of blood to the ovaries and a consequent swelling and weakening of the ovarian tissues immediately surrounding the ripe ova, so that this tissue is ruptured under the pressure produced by contraction of the muscles of the abdominal walls and the eggs escape.

B. POND CULTURE OF THE BLACK BASS.

is the method now almost universally employed. A specific case of pond culture as carried on successfully at the Mill Creek hatchery of the Michigan Fish Commission may be first considered, after which the development of the methods employed and the variations at present in use may be taken up. In describing the methods in use at Mill Creek, as observed by the writer, the two species of black bass may be most conveniently treated separately.

1. *Pond Culture of the Small-Mouthed Black Bass at the Mill Creek Station.*

a. *Ponds.*—Seven large ponds are now in use at Mill Creek. (Fig. J.) These are either approximately square or elongated. They vary in dimensions from 50 x 80 to 150 x 200 feet. The total area of all the ponds is approximately 1.25 acres. In their present form these ponds are merely excavations, with sides and bottoms of the natural sand. They are constructed on the model of a natural lake.

At the center of the pond is a bowl like excavation in which the water is about six feet deep. This is known as the kettle. From the edge of the kettle nearly to the shore the water is uniformly of about two feet depth. Surrounding the central deep water there is thus on all sides an area of shallow water. The bottom over this shallow area may be called the terrace. From the outer edge of the terrace the water shallows abruptly and in from two to four feet the shore line is reached. The terrace is from ten to twenty feet wide and on the average the kettle has an area of about one-sixth that of the terrace. Water is supplied to the ponds from Mill Creek by means of a twelve-inch pipe carried from a dam situated some twelve hundred feet from the hatchery. This pipe entres a catch basin, or water tank of wooden staves set into the ground and from this is distributed to the ponds through three feed pipes. One of these runs to an isolated pond (X) separated from the remaining six ponds by the creek and not shown in the figure. The water in this pond discharges directly into the creek. The remaining six ponds are arranged in two series of three ponds each. To each series extends a feed pipe and the water flows from this into the first pond of the series and thence througth the other two ponds (each lower than the preceding) and into the creek. From the middle pond (No. 4) of one of the series water passes to three small experimental ponds and from this through a larger experimental pond and thence into the creek. The experimental ponds are seen in the foreground of the figure. Thus but one of the ponds in each series has an independent water supply and of the remaining ponds all but two receive water which has already passed through one or more ponds.

The water entering a pond whether directly from the feed pipe or from another pond passes into a sluicebox. The box is about four feet wide and is deep enough to extend from the level of the ground to the pond bottom. Across it is a partition of movable boards (slash boards). The water entering on one side of this partition fills the space on that side, flows over the partition as over a dam and falls six to twelve inches to the level of the pond. By removing or adding slash boards the height of the fall may be regulated. The fall serves to keep the small fish from leaving the pond through the sluicebox and at the same time aerates the water. At its exit from the sluicebox the water passes through a rack or screen which excludes the larger fish.

The water leaves the pond through a similar sluicebox, passing first through a screen or rack, then over slash boards, thence either directly into another pond, or through a pipe to a sluicebox through which it enters another pond or through a pipe which discharges into the creek. Where small ponds are to be supplied from larger ones a pipe having the form of an inverted siphon or U-tube is used. The water enters the screened bottom of a box about a foot square and two feet deep and so placed that its upper edge projects about four inches above high water level. It passes upward into this box, thence into a shallow trough from which it passes downward into the feed pipe. The feed pipe turns upward at its other end to a point a few inches above the water level and the water leaves it by a shallow trough and falls into the pond below. By this device the cool water is drawn from the bottom of the larger pond and enters above the water level of the smaller pond. In all the ponds it is possible to draw the water down only far enough to ex-

Fig. J. Michigan Fish Commission ponds at Mill Creek as they appeared in 1903.

pose the terrace. The kettle can be emptied only by pumping or dipping out the water.

In addition to the supply of creek water, the ponds are provided with spring water introduced under gravity pressure from a spring which yields 32 gallons per minute. This is caried only to the uppermost pond of each of the series and into the hatchery where it supplies the hatching jars and retaining tanks. Mill Creek runs through a farming country. It is fed by many springs and brooks but is likely to become extremely turbid after heavy rains. At such times the water in the ponds becomes also highly turbid. The degree of turbidity has not been determined, and varies so much that a determination of it at any one time could have little value. The turbidity is sometimes so great as to form a deposit one-half inch thick on the pond bottom in a single night. When the water has had time to settle it becomes perfectly clear and has no noticeable color. The creek water has a hardness of 16.4.

The temperature varies greatly during the twenty-four hours. The creek is shallow and runs through an open country, so that on bright days its water becomes warm through the action of the sun. With the setting of the sun the water is rapidly cooled, partly by radiation and convection, but probably chiefly because of the large volume of cold water entering the creek from the numerous spring brooks which feed it. The daily variations of the temperature of the creek water are illustrated by the following:

1898, April 18th (a sunny day), 46 deg. F. at 7 A. M.; 57 deg. F. at 6 P. M.; 11 deg. variation.
1898, April 19th (a cloudy day), 51 deg. F. at 7 A. M.; 56 deg. F. at 6 P. M.; 5 deg. variation.
1898, May 1st (a sunny day), 49 deg. F. at 7 A. M.; 62 deg. F. at 6 P. M.; 13 deg. variation.

From the turbid water there is deposited a layer of light loam which covers the whole bottom of the ponds and soon becomes very thick. This bottom soil supports a rich growth of water plants. This growth consists chiefly of four species, Elodea canadensis *Mchx.* and a variety of Chara foetida, with a considerable amount of Potamogeton foliosus *Raf.* and a small amount of Ceratophyllum demersum. There is an occasional Sagittaria and a few Nymphaea, but no other plants than the four first mentioned are present in sufficient abundance to be of practical consequence. In May and later these four form a dense growth over nearly the whole terrace in all the ponds and also cover the bottom of the kettle. Indeed one cannot reach the bottom with a vertical net without first clearing away the vegetation. That this abundance of vegetation is due to the richness of the bottom soil is shown by the fact that over a part of one of the experimental ponds which has a cement bottom there is practically no plant growth, while in another pond, in which there remains a considerable area of an original board bottom, there is only a very sparse growth of plants over the boarded area. When the ponds are cleaned in the fall it is the custom to remove the vegetation and a part of the sediment accumulated from the turbid water. Over the small areas where there is cement or board on the bottom the sediment is wholly removed, while

over the rest of the ponds only the superficial two or four inches is removed. When the growth of the next season starts it finds therefore a much thinner accumulation of sediment over the boarded or cemented bottom areas than elsewhere and over these there is consequently a sparser growth of plants.

In addition to the larger aquatic plants there is at times a considerable growth of a filamentous alga (a Spirogyra) whose dense masses sometimes fill the water and interfere with the movements of the young fish to such an extent that it is necessary to remove them with a seine or rake.

These ponds support in the spring an abundance of small crustacea—Cladocera and Copepoda. The species have not been determined. It has not been found possible by reason of the abundance of the vegetation to secure even an approximate measure of the abundance of these forms, which make the first food of the young bass. The vegetation prevents the use of a net, while the material collected by the plankton pump is so contaminated with vegetable debris that a volumetric measurement of it is of little value. It can be said only that the small curstacea are exceedingly abundant. In addition to them there is among the aquatic plants an abundance of insect larvae and of small snails, while along the shores may be seen shoals of young Corixa.

b. *The Brood Fish* are all wild fish and were taken with the hook. The fish are usually taken in the fall and breed without difficulty the following spring. In the spring of 1903 two of the ponds were supplied with fish taken in March of that year. By the first of May these fish were feeding regularly. They remained in good condition and up to the date of writing (July 26th) none of them had died. In spite of their apparently healthy condition none of them had spawned. The ovaries in several specimens examined were found to be fully developed and well filled with eggs that seemed to be nearly ripe. The failure of the fish to spawn can be attributed only to the effect on them of handling and of the new conditions in which they found themselves. The effect on the breeders of failure to spawn when the ova are ripe can be determined only by experience. Obviously, however, small-mouthed bass intended for pond breeders should be taken in the fall rather than before spawning in the spring.

About four hundred breeders are usually kept in the ponds, that is about three hundred to each acre of water surface.

The breeders are fed on live minnows whenever these are to be had. In the fall these are seined from the neighboring streams where they are found in large numbers. Thus species of Notropis, Fundulus, Campostoma, Semotilus, Rhinichthys, etc., are obtained. They are kept in one of the larger ponds, reserved for the purpose and are there fed on bread. The minnows are seined from the pond as wanted or taken with the dip net and in order to avoid the introduction of live minnows into the pond are allowed to die before they are thrown to the fish. Beginning in September minnows are fed until the fish stop feeding and begin to hibernate. Then a considerable number of live minnows is placed in the pond so that the fish may find them as soon as they begin to feed in the spring. When the ice leaves the ponds in the spring feeding with minnows is resumed. Just before the spawning season the

ponds are drawn down in order to place the artificial nests in position. At that time all minnows are seined from the ponds, since their presence is believed to annoy the breeding fish. During the spawning season the fish are not fed, but after it they are again fed on minnows until the supply is exhausted. This happens about the middle of June, when the water in the ponds becomes warm and the minnows no longer thrive. In order to further insure a supply of small fish to be used as food, large numbers of suckers of several species are taken in Grand river in the spring, and their eggs are artificially fertilized and placed in Mill Creek at the hatchery. Later thousands of young suckers seined from a neighboring pond into which their parents were introduced some years ago, are also placed in Mill Creek. The young suckers appear to find abundant food in the sediment covered creek bottom and in the fall they are seined in immense numbers and fed to the stock bass. They are then about two inches long.

When the supply of minnows is exhausted in June and from that time until September the breeders are fed on liver. This is cut into slices about half an inch thick and these are then cut into strips about six inches long and half an inch wide. These strips are then thrown over the water a few at a time, with a motion like that used in skipping stones. As they strike the water they are given a wriggling motion not unlike that of a worm and are then readily taken by the fish. The fish have refused to take liver fed to them in other forms.

Black bass do not take liver in any form by preference. After they have taken all the liver they will eat they will then, if minnows are thrown to them, again feed eagerly. It is believed at this station that they do not thrive indefinitely on liver and that when thus fed they are in poor condition in the winter when they begin to hibernate. In the spring there is not time for them to get into good condition between the end of the hibernating season and the spawning time. A large proportion of the eggs produced by liver fed fish have been found to die before or soon after hatching. Thus of 11 nests made by small-mouthed bass at Cascade in 1896 all contained eggs, but of these only three produced fry. In the other eight nests the eggs died and were then abandoned by the male. This has been attributed to the too-continuous feeding of liver and to the consequent poor condition of the parent fish which resulted in a lack of vigor in their sexual products. Whether this is or is not the case can be determined only by carefully controlled experiments carried out in ponds set aside for that purpose. At any rate by the method of feeding described the breeders are apparently in excellent condition at the beginning of winter and since the feeding of minnows is resumed in the spring they are brought to the spawning season in the same condition.

c. *Breeding Operations.* 1. *Preparation of the Ponds.*—In the fall (October) the water is drawn out of all of the ponds until the terrace is fully exposed. By means of a rake the plant growth is then removed from the terrace and kettle and carted away. The rake used is of wood: Its back is about eight feet long with teeth eighteen inches long, one and one-half inches in diameter and spaced five inches apart. One man holds the rake in position while a second pulls it from the center of the pond to shore by means of a rope.

When the plants have been removed the upper layer of the accumulated sediment to the depth of from two to four inches is scraped up and carted away. Such fingerling bass as may have been overlooked earlier in the season are now from four to six inches long. As the plants are raked out they escape from among them and pass into the kettle with the back-flowing water. From here they are taken with a fine seine, after first removing the old bass with a coarse seine, and are planted.

2. *Sorting the Stock Fish.*—The ponds are now allowed to refill with water and are not again disturbed until spring. At the end of March or early in April the ponds are again drawn down so as to expose the terrace. The stock bass are now seined and sorted in such a way that there shall be in each pond about forty males to each sixty females. Experience at this hatchery has shown (Lydell, 1902) that if there is an excess of male fish they fight for the possession of the females, with the result that many fish are injured and many nests destroyed. It is said to have sometimes happened that male fish which had not succeeded in mating, have gone about from nest to nest in bands attacking the owners of the nests and destroying the nests themselves. Whether this is done in order to feed on the eggs, or in satisfaction of the natural nest building instinct remains to be determined. Whatever the cause, the difficulty is obviated if there is an excess of female fish, for in that case every male is supplied with at least one mate, and each is too busy caring for his nest and young brood to occupy himself much with fighting. Since a single male may receive more than one female into his nest the excess of females does no harm and it is probable that ordinarily every female finds an opportunity to lay her eggs.

No external differences between the male and female of the black bass have been detected and it is ordinarily not possible to distinguish them except by dissection. At the breeding season, or just before it, the distension of the female with eggs makes it possible to distinguish the sexes in most cases. The method is shown in figure F.

The forefinger pressed against the ventral surface of the fish several inches in front of the vent causes the position of the ovaries to be indicated by two rounded thickened ridges, one on either side of the finger. If these fail to appear the fish is considered a male. The method is by no means infallible—and no doubt frequently young females are sorted as males. This must result at times in a greater excess of females than was intended, but it may be doubted whether such excess is harmful. It might result at most in the failure of a certain number of females to spawn.

3. *Placing the artificial nests.*—When the fish have been sorted the artificial nests are placed in position. These are the invention of Mr. Lydell (Lydell, '02) and may be called the Lydell shielded nests. The nest frame has the form of a cubical box, (Figs. G, H center) without either bottom or top and with two contiguous sides four inches high, while the other two are sixteen inches high. The four inch sides and the corresponding part of the higher sides are of inch stuff, while the remainder of the higher sides is of half inch material. The frame is strengthened at the corners by two-inch-wide strips of inch stuff. These nest frames are placed on the terrace in rows which are parallel to the shore and extend about the entire pond. The first row is placed eight or ten

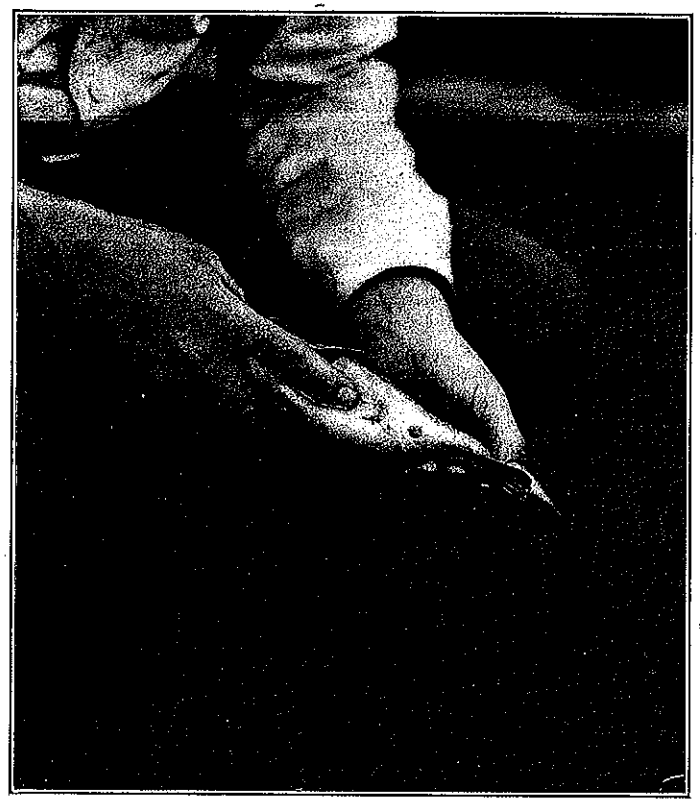

Fig. F. Showing the method of distinguishing between male and female black bass, when sorting the fish in the spring. The specimen shown is a female. The ridges shown on her ventral surface on each side of the finger of the operator mark the position of the swollen ovaries.

feet from shore; the second is placed six or eight feet further from shore than the first and parallel to it. Usually but two rows are placed in a pond and these are enough to occupy the width of the terrace, but in cases where the terrace is broad a third row is added about six feet inside the second. In each row the frames are about twenty-five feet apart and they are so placed that they alternate with the frames in the next row, that is, the frames in each row are placed half way between those in the adjacent rows. There is thus one frame to each 150 square feet of suitable bottom. Each frame is so placed that the angle joining its two low sides points toward the kettle or center of the pond. The frames are set directly on the level bottom where the water will be about two feet deep. Each thus encloses an area of the bottom two feet on each side and each is now filled with gravel to the upper edge of its low sides. The gravel should be carefully selected so as to be like that preferred by the fish for its natural nest. It should consist of pebbles of three or four inches in diameter and smaller with a good admixture of sand. Across the angle formed by the two high sides of each frame is now laid a board and on this a heavy stone. The nest is then complete. The board affords some shade, while the stone prevents the nest frame from floating when the pond is filled with water, which is at once admitted.

The shielded nests, besides affording shelter to the male fish so that he is less disturbed by what takes place on shore, prevents his seeing the fish on adjacent nests and thus prevents much of the fighting that would go on between males if unshielded nests were placed so close together. The idea of the shielded nest was suggested by the observation that natural nests are usually built in shielded situations, against the bank or near stumps or logs and that, in general, nests are much nearer together when so located that their occupants are unable to see one another than when located in open water. The Mill Creek experience with this form of nest is believed to show that it greatly lessens the fighting among males occupying adjacent nests. This is probably not due merely to the fact that the fish see one another less frequently. The shielded nest is conspicuous and detached, so that a fish in or near it has the air of being at home in his own castle and is presumably less likely to be attacked by a neighboring fish than he would be over a less conspicuous nest, over which he might be taken for a marauder.

4. *Control of Ponds during the Breeding Season.*—With a water supply of more uniform quality probably the breeding ponds would require no further attention until the young fish were ready to leave their nests. At Mill Creek it has been pointed out that extraordinary variations occur in the temperature of the water and in its turbidity. Either a low temperature or great turbidity of the water is likely to prove fatal to the eggs or the young bass. In order to keep the temperature as uniform as possible the temperature of the ponds is taken at intervals and whenever, during cold weather or toward night it falls to about 60° F., owing to cold water entering from the creek, the water from the creek is shut off and the ponds are permitted to remain without running water until such time as the creek water again warms up. Usually during the coldest weather that occurs the water must be shut off about 9 P. M. and not again turned on until noon of the following day. By this method the temperature of the pond water

need not vary more than 1° F. between 6 P. M. and 7 A. M. At the temperatures which then prevail the fish do not appear to suffer at all from the lack of running water.

The turbidity of the ponds is controlled in the same way. Whenever the pond water is seen to be extremely turbid the creek water is shut off. Turbidity of the creek water frequently makes it necessary to shut it off from the ponds for several days at a time. The water in the ponds may then become very low through seepage. At such times the spring water is allowed to enter in order to keep the ponds at a more nearly constant level. During cold weather the spring water, on account of its low temperature, cannot be used in this way and it then sometimes happens that the water in the ponds becomes very low before it is safe to introduce either creek or spring water. At such times there is probably always a certain risk that the water may become so low that the males will leave the nests and the eggs will perish. As a matter of fact the coincidence of long continued turbidity in the creek water and cold weather has never yet brought the water in the Mill Creek ponds to so low a level that the bass have been driven from their nests. A layer of clay placed in the pond bottom when the pond is made would prevent seepage and make it possible to maintain the water level under all circumstances. That a failure to control the temperature and turbidity of the water in the breeding ponds may result disastrously to the eggs and young fish is indicated by the following experience at Mill Creek:

"In 1899 when the bass had made their nests and the eggs had been laid it often happened that shortly thereafter the temperature of the water fell so much during the night (to 50° F.) that the bass deserted their nests and remained away for several days. When they returned the eggs were dead. They then cleaned out the nests and made preparation to start again with new females. In the same way the recently hatched fry while still on the bottom of the nest have been found dead after they had been deserted by the parent fish owing to fall of the temperature of the water to 48° or 50° F. The sediment from the creek water after a rain storm was also accountable for the destruction of eggs as well as of young fry. This sediment was sometimes deposited to the depth of one-half inch in a single night. This caused the parent fish to leave the nest and killed all eggs and fry under a week old. Owing to these two causes, out of a hundred nests in which eggs were laid only about one-third brought the fry to the stage where they were able to leave the nest. The eggs and fry on the other two-thirds of the nests perished owing to fluctuation in the temperature of the water and to deposit of sediment." (L.) There can be but little doubt that the losses above referred to are to be attributed to low temperature and turbidity of the water and yet, without control experiments, this cannot be positively asserted. Similar losses have occurred where the water was neither cold nor turbid. The precise degree of cold and turbidity that can be endured by bass eggs is capable of experimental determination and such determination should be made. During the season of 1903 not enough small-mouthed bass eggs were available for the purpose.

5. *Screening the nests.*—Aside from control of the temperature and

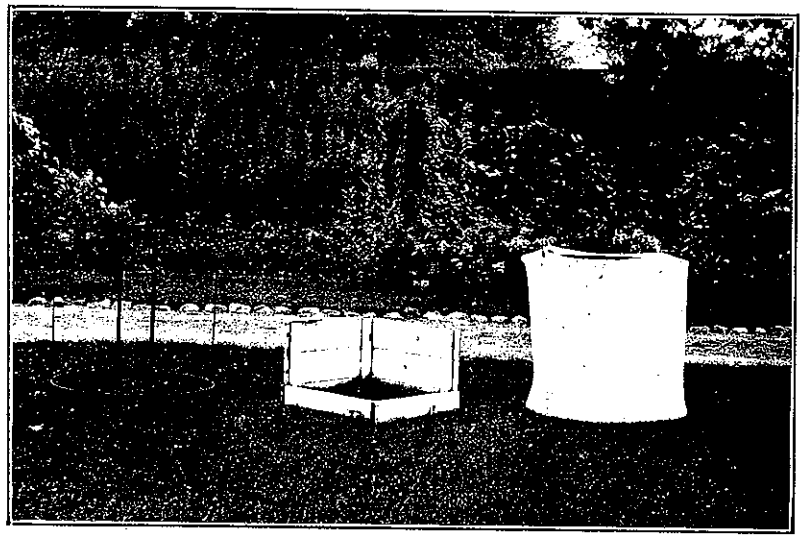

Fig. G. At the left is shown the iron frame of the fry retainer; at the right is the retainer completed by covering with cheese cloth. In the center is a frame of a Lydell shielded nest.

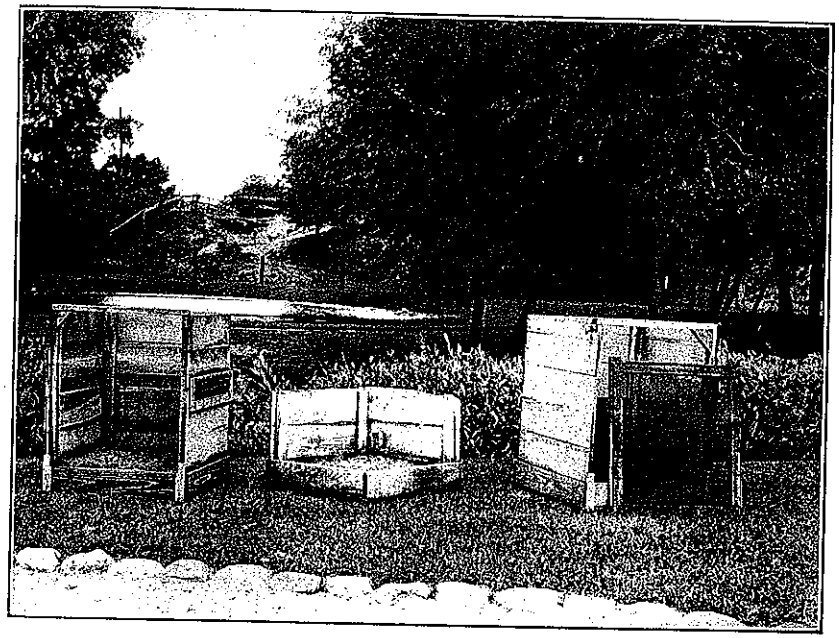

Fig. H. Screened nest box for large-mouthed bass. The screened boxes are shown at the right and left. The one at the right shows the sliding frame leaning against it but is without the strips of wire cloth. The same nests with gravel in the bottom are used for small-mouthed bass. At the center is shown an ordinary shielded nest frame.

turbidity of the water, the breeding ponds require no care until the young fish are about ready to rise from the nest bottom. As this time approaches, the nests are visited occasionally with a light, flat-bottomed boat and the stage of development of the eggs or fry examined by taking up a few of them with a glass dipping tube. Those nests in which the young fry have begun to turn black and in which they are thus known to be about to swim up are then surrounded by a screen of cheese cloth—a *fry retainer* (Fig. G), the invention of Mr. Lydell. This consists of an iron frame and a covering of cheese cloth. The frame is made of band iron seven-eighths of an inch wide and one-eighth of an inch thick. It is formed of two hoops each two and one-half feet in diameter and held together by four straight pieces so that the whole forms a cylinder two and one-half feet long, of which the hoops are the ends. The side pieces project three inches beyond the hoop at one end and are pointed at that end. The cheese cloth cover is sewn into a cylinder with hemmed ends and is then pulled over the band iron frame, sewn fast to the ring at one end and tied to the projecting ends of the side pieces at the opposite end. When a nest is found on which the young fry are about to rise the stone and board are removed from the top and the nest frame, which then floats, is removed. This leaves the gravel of the nest on the pond bottom with the young fry on it. The fry retainer is at once placed about this gravel so as to enclose the fry. The pointed ends of the side pieces of band iron were originally intended to be imbedded in the bottom when the screen was put in place so as to hold it in position. This was found to be impossible in practice and unnecessary and the screens are now placed with the projecting ends of the side pieces pointing upward, as shown at the right in Figure G. This operation is usually performed from a flat-bottomed boat. The water enclosed within the retainer contains an abundance of small crustacea, which serve the fry for food for a considerable time, usually until they are shipped. If this supply becomes exhausted it may be renewed by taking crustacea from the adjacent pond with a tow net and placing them in the retainers.

In removing the wooden nest frame and placing the fry retainer in position there is more or less disturbance and considerable roiling of the water. This kills a few of the young fish and when the retainer is in place a few fry will usually be found to have been left on the outside of it. To overcome these difficulties Mr. Lydell has devised a combined nest and fry retainer—or what may be called a screened nest (Fig. H. right and left). This is a box two feet square on one end and three feet high. There is no top and one side is formed by a sliding frame filled with brass wire netting of a fineness of thirty-two meshes to the inch. On the three other sides at a distance of twenty inches from the bottom of the box, are inserted horizontal strips of wire netting three inches wide (Fig. H. left). Boxes are also used without the strips of wire cloth (Fig. H, right). Before these screened nests are placed in position on the terrace, the sliding frame is removed. The nests are then put in position and the bottom of the box is filled with gravel, which serves to weight it and hold it in position, so that it is not necessary to place a stone on top of it. If the nests are for large-mouthed bass a bottom of fibre is inserted as shown in the figures.

The top of the box projects about six inches above the surface of the water. There is thus formed a nest shielded on three sides instead of on two. The open side and the strips of wire cloth on the other sides give opportunity for the circulation of water through the nest. When the fry are ready to rise from the nest the open side of the box is closed by sliding into it the frame covered with wire cloth. This is accomplished without disturbing the fry or roiling the water and the fry remain in the box until ready to ship. A number of these screened nests were used at Mill creek during the season of 1903—and proved to be entirely satisfactory at that time.*

6. *Collecting and shipping fry.*—It is the practice at Mill creek to ship most of the small-mouthed fry within a few days after they swim up. Armed with a hand net of fine bobbinet and a large pan or tub a man wades or goes with a boat from one retainer to another until he has collected the desired number of fry. The larger part of the fry in a retainer may be obtained by a few dips of the net but a certain number of the fry take refuge in the weeds at the bottom so that it is necessary to collect several times in succession from each retainer before all the fry are collected. They may now be placed at once in the shipping cans or held in a cheese cloth screen set in the pond until it is desired to ship them. For holding the fry a screen is used which is identical with the fry retainer, except that it is provided with a bottom.

In transferring the fry to the shipping cans those intended for a single can are first placed in a tin pan in order to estimate their number. The estimates are always made by the same person who by repeatedly counting out two thousand fry into a pan of a given size with a certain amount of water has become expert in judging when the pan contains that number. (See Fig. 1.)

Each pan of two thousand is transferred to a separate can for shipment. During shipment the water in the cans is kept at between 60° F. and 70° F., by renewal or by the use of ice, and aerated by pouring when necessary. If the temperature of the water is reduced below 50° F. the fry die.

7. *Raising fingerlings.*—The use of the fry retainer as above described is not merely a convenience, it is a necessity if it is desired to ship small-mouthed bass as fry. If the fry are permitted to leave the nest they form a swarm which is guarded by the male fish. This swarm is large, covering an area from fifteen to thirty feet in diameter and the fry are loosely aggregated. They do not swim together in one direction after the manner of a school of large-mouthed fry but the individual fry move about in the swarm independently or in small groups. If the attempt be made to capture the fry of such a swarm with a hand net very few are obtained, while the most of the swarm disappears among the water plants. If it is attempted to capture the swarm with a seine the fry at once scatter and hide among the water plants. For this reason a fry retainer is necessary if it is desired to ship fry. If it is desired to ship fingerlings the fry may be allowed to leave the nest and to grow into fingerlings in the pond in which they were hatched and in which the adult fish still remain. Early in July

*NOTE.—In the season of 1904 the screened nests were less successful than the shielded nests and their use has been now abandoned.

Fig. I. Pan containing 2000 small-mouthed bass fry ready for transfer to shipping can.

when the young fish have reached a length of between two and three inches they no longer escape the seine and may be taken and shipped. Those which remain in the pond are captured in the fall when the ponds are cleaned. At that time they are from four to six inches long. Doubtless a certain number of the fingerlings thus reared in ponds with the adult fish are destroyed by the adults, yet the plant growth is so dense and the area of shallow water so large that the destruction is not as great as might be supposed.

The following experiment at Mill Creek illustrates this: "In May, 1899, in a pond 45x50 feet were one hundred adult small-mouthed bass. On June 7th 5,000 large-mouthed fry were counted and placed in this pond. The old bass were kept well fed with liver and minnows. On July 5, 2,000 of the fry, then one and one-half inches long, were removed with a seine, on July 6, 500, on July 11, 497, on July 15, 170, on July 19, 785—making a total of 3,952. Probably not all the young fish were taken in the seine. At any rate the destruction from all causes in about six weeks was only about 20%—and this does not indicate any considerable destruction of young bass by the adults." (L.)

On several occasions as many fingerlings have been taken from such a pond as there were of fry known to be put into it. The practice of leaving fry in the ponds with adults is, however, only followed at Mill Creek because of a lack of special rearing ponds. At this station a certain number of fingerlings are raised in ponds to which the fry are transferred from the fry retainers and which contain no other fish. All fingerlings find their own food in the ponds and repeated examination of the stomachs has shown that food is present in abundance.

2. *Pond Culture of the Large-Mouthed Black Bass.*

Very little work has been done at the Mill Creek ponds with the large-mouthed bass, though, as noted below, large numbers of their fry have been transferred from auxiliary ponds. The methods employed are the same as for the small-mouthed bass, except in two particulars.

a. *The nests* provided for the large-mouthed bass are like those for the small-mouthed bass except that they are provided with a bottom of boards upon which is placed a layer of Portland cement. While the cement is still soft there is embedded in it a layer of the fibre known to upholsterers as Spanish moss. This projects from the cement so as to form a fibrous felt-work over its surface and upon this the eggs are laid. This material has been used in both the ordinary nests and the screened nests. (Fig. H.) The shielded nests intended for large-mouthed bass may be provided with a bottom. This is then covered with a layer of cement and upon this is placed a layer of fibre, the lower stratum of which is then forced into the cement while it is still soft. Another method of preparing the nest and one which holds the fibres more firmly is to fill the bottom of the box with alternate strips of soft cement and fibre. The strips of fibre are held below by the cement but fray out and come in contact above the cement so as to form a continuous layer. Strips of wood an inch wide nailed together and to the nest bottom, and with strips of fibre included between them have also been used. In either case the bottom of the shielded nest may, if desired, be made separate from the nest frame, which then has no bottom.

The screened nests are always provided with bottoms and the material to hold the fibre is placed on this. Fibre nests are usually preferred by the large-mouthed bass to nests with gravel bottom. Nevertheless the large-mouthed bass not infrequently spawns in the gravel nests provided for small-mouthed bass even when fibre nests are available. The use of fibre is based on the observation that the eggs of the large-mouthed bass are laid often on the fibrous roots of water plants. It has been already pointed out that they are laid also, and perhaps as frequently, on gravel, while in the south the fish spawns on clay and mud as well as on gravel. It is the belief at the Mill Creek station that the eggs of the large-mouthed bass thrive better on fibre than on gravel, but on this point I have been unable to get decisive evidence. In one fibre nest examined it was found that the eggs were attached to the fibre singly or in small bunches of two to six. Some eggs had also become attached to the cement at the edge of the fibre and these were in larger masses of perhaps a hundred. Several such masses were found. Some of the eggs in this nest subsequently fungussed and it was then evident that the larger masses attached to the gravel were entirely covered with fungus while the smaller bunches attached to fibre were but little affected. When this observation is taken in connection with the fact that the eggs of the large-mouthed bass become thickly covered with foreign material and are not kept free from it by the parent fish, we have reason to believe, pending the collection of further evidence, that the fibre nest is preferable for this fish. To insure its use the large-mouthed bass should be kept in ponds by themselves and furnished only with nests of this pattern.

b. *Handling the fry.*—The fry of the large-mouthed bass remain together in a compact school, in which the individual fish move together in one direction. When the school is approached with a net the fish do not scatter and hide among the water plants but remain together. It is therefore easy to take them with the seine at any time when they can be found. If they are found among water plants through which the seine cannot be drawn, the seine may be drawn over the plants with the lead line forced to drag as deep as possible among them. As the fry are disturbed by the dragging lead line they seek the surface and pass into the net. The ease with which these fry may be seined makes the use of the fry retainer unnecessary. It is the custom to allow the fry to leave the nests with the parent fish and to seine them when wanted. The fry obtain their own food.

3. *The History and Present Forms of Pond Culture of the Black Bass.*

a. *General Outline.*—The first attempt at pond culture seems to have been that of *Arnold* (1882) at the Indianapolis (Ind.) arsenal. The fish (both large-mouthed and small-mouthed) were confined in a small pond from which, after a season's disastrous experience, the destructive sun perch were removed. One end of the pond was partitioned off as a rearing pond and to it the young fish were transferred as fast as they came off the nests. Here great loss was encountered through cannibalism. For this reason, as well as for some other undetermined reason, the young fish did not do well in the enclosure. Openings were finally made in the partition so that the young fish could pass back and forth between the enclosure and the pond proper. In the pond

itself brush was used to protect the young fish from the old ones. A shallow ditch covered with brush was also provided for the young fish. In this way they were protected from birds. In order to protect them from injury at the outflow a horizontal screen was there substituted for the usual vertical screen. We thus have introduced the practice of isolating the parent fish in breeding ponds and of protecting the young fry from the older fish and from other enemies.

Stranahan (1882) raised fry in similar ponds and subsequently (1893) either transferred the fry to a rearing pond as soon as they rose and fed them clotted blood or planted them at once. This seems to have been the first attempt at artificial feeding of the fry.

In 1886 the *United States Fish Commission* began pond culture of the black bass at Wytheville, Va., and in 1888 at Neosho, Mo., and in 1891 at Washington, D. C. In 1897 the same commission inaugurated black bass culture at Manchester, Ia., but abandoned it in 1900. An attempt was also made at the Northville (Mich.) station in 1895 but without result. In 1896 large-mouthed bass work was begun at the United States station at San Marcos, Texas. More recently the Cold Spring station has been established in Georgia and the Erwin station in Tennessee. The last named station had not distributed any fish at the time of the last published report. Of these United States stations that at San Marcos has been most successful. In 1900 only the stations at Neosho, San Marcos, Washington, Wytheville and Cold Spring, Ga., were successful by means of pond culture, as appears from the last published report of the United States Fish Commission, that for 1901. San Marcos produced 89,985 fingerlings; Washington, 64,605; Neosho, 8,116; Wytheville, 1,812, and Cold Spring, 275, a total of 164,793 fingerlings. It is not stated whether those reared at Neosho and Wytheville are large-mouthed or small-mouthed bass; those reared at the other stations were large-mouthed.

Of the *State Fish Commissions* only those of Michigan, Wisconsin, Missouri and Nebraska have carried on pond culture and this chiefly of small-mouthed bass. The Wisconsin work is of recent date and in 1902 its product was about 10,000 small-mouthed fingerlings. The Michigan commission has given attention chiefly to the small-mouthed bass. It began operations in an experimental way in 1894 and in 1902 produced 404,000 small-mouthed fry and fingerlings. The details of the Missouri and Nebraska commissions' work are unknown to the writer.

There are thus in operation at the present time, if the writer's information is correct, six stations of the United States Fish Commission, producing almost wholly large-mouthed bass and two state stations, producing chiefly small-mouthed bass. At these stations various practices and various devices have been developed out of the earlier and simpler methods.

These may best be considered separately and it would add to clearness to consider separately the methods employed with large-mouthed and small-mouthed bass. This would involve considerable repetition and is moreover rendered difficult by the fact that writers frequently do not distinguish between the species so that one is uncertain whether reference is made to large-mouthed bass or to small-mouthed bass or

to both together. The methods and devices employed will therefore be treated as such, but wherever possible their application to the different species will be indicated.

b. *Ponds: Their construction and management.*—In the matter of the general construction of breeding ponds the practice has from the first been to to build them on the model of natural ponds. (See the Manual of Fish Culture, published by the United States Fish Commission.) The deviations from this practice, in so far as they are of importance, are referred to below. The important relation of the temperature of the water to the health of the eggs was early recognized. Thus *Stranahan* (1898) speaking of small-mouthed bass at Put-in-Bay in 1896, says that "every nest in the bay, both natural and artificial, contained fungussed eggs" after a rise in the temperature from 64° F. to 69° F. and in 1897 owing to high wind and low temperature only three broods of young fish were hatched. *Leary* (1901) says of the large-mouthed bass at San Marcos, "owing to a sudden cold change late in February, however, nearly all the eggs and fry in the pond at that time were lost." At Mill Creek "when the bass had made their nests it often happened that shortly thereafter the temperature of the water fell so much during the night (to 50° F.) that the bass deserted their nests and remained away for several days. When they returned the eggs were dead. They then cleaned out the nests and made preparation to start again with new females. In the same way the newly hatched fry, while still on the bottom of the nest, have been found dead after they have been deserted by the parent fish, owing to a fall of the temperature of the water to 48° F. or 50° F." (L.)

The disastrous effect of excessive turbidity of the water was first pointed out by *Lydell* (1902) and his experience is quoted above (p. 44). Lydell (*1902*) has suggested the control of both temperature and turbidity in the manner already pointed out. His observations and recommendations on these points have reference to small-mouthed bass exclusively. Whether the large-mouthed bass is similarly sensitive to low temperature and turbidity remaines to be determined, although Leary's (*1901*) observations indicate a sensitiveness to low temperature.

c. *Brood Fish.*—In the case of the brood fish time has brought no other improvement that the method devised by Lydell (*1902*) and already described by which the fish are induced to take liver or other flesh food.

d. *Artificial Nests.*—*Hessel* (*1896*) seems to have first used artificial nests for large-mouthed bass in 1895. They were of cement faced with gravel, two feet across and with a concavity on the upper surface three inches deep. Again in 1897, Hessel (*1898*) used piles of gravel, cement nests and Seagle nests and found the fish using the artificial nests quite as much as the natural ones.

Stranahan (*1898*) used the cement-gravel nests in 1896 and again in 1897. His purpose was to transfer the nest with eggs to the hatchery and there care for them.

Worth (*1898*) used at Wytheville wooden boxes filled with gravel. At the side of the nest was driven a stake which supported a wooden shield to afford shade for the parent fish. The nest is figured and described in the Manual of Fish Culture and is apparently the nest referred to by Hessel as the Seagle nest. These nests also were meant to be transferred to rearing ponds when filled with eggs, but the plan was unsuccessful with bass.

O'Brien (1898) in 1896 used gravel piles sheltered by willow brush.

Lamkin (1900) describes a nest of cement faced with fibre that was intended for the use of large-mouthed bass. It was claimed for this nest that it afforded "more surface to the square inch than gravel or clay;" that the eggs were held more securely; and that the eggs were kept freer from sediment than they could be on gravel or clay. Lamkin suggested that such nests might be lifted and transferred to rearing ponds.

The nests thus far described have had one or more of three purposes. In the first place they afforded shade or shelter for the parent fish (Seagle and O'Brien nests). In the second place they afforded a suitable material for the deposit of the eggs, where this was not present on the natural bottom. With this end in view this material was that of the natural nest or an imitation of it. In the third place, the cement and Seagle nests were designed to be transferred to rearing ponds, as soon as eggs were laid in them. The writer has found no record of success in rearing bass by this means of transfer of nests and it is no longer practiced.

Lydell (*1902*) planned his shielded and screened nests so that they would serve not only the purposes above indicated but the further use of preventing the male fish on adjacent nests from seeing one another as frequently as they otherwise would. By the adoption of this form of nest and by the arrangement of the nests on the spawning ground, as already described, it is believed that fighting among the male small-mouthed bass is greatly lessened. It may be doubted whether such shielded nests are necessary for the large-mouthed bass, or indeed whether any nest is needed for this species. The point may best be determined by a more careful study than has yet been made of the breeding habits of this fish. According to the second edition of the Manual of Fish Culture (1900) "artificial nests for bass have been used at one or two stations, as an experiment, but have been abandoned, except for rock bass at Wytheville, Va."

e. *Devices for Separating Fry from Adults without handling either.*—There are clearly two ways by which one may separate the fry from the adult fish without handling either. The adults, when about to spawn, may be confined within a portion of the pond separated from the remainder by a coarse wire screen and the young fish may later pass through this screen into the main pond; or the spawning area for the adults may be so arranged that, when the fry are ready to leave the nests, the adults may be driven from the spawning area and this area then separated from the rest of the pond by a screen of sufficient fineness to retain the fry.

1. *Screened spawning areas from which the fry are permitted to escape.*—*Arnold* (1882) originated the plan of dividing his pond by a partition into two parts in one of which were the breeding fish while to the other the young fry were transferred when ready to leave the nests. Later he made openings in the partition to allow the fry to pass back and forth. The fry in the rearing compartment did not thrive as well as those left in the breeding compartment with the parent fish.

Hessel (*1895*) thus describes the method in use at the United States fish ponds at Washington in 1893. "The method of handling black bass

at this station is to place a limited number of spawning fish in a small pond a few rods square in which the water is shallow, the bottom being covered with clean gravel, the small pond being connected with another ten or twenty times as large by means of wire screen of proper sized mesh to permit the young to pass out. After the young have left the nest and obtained access to this larger and more fruitful feeding ground, they are safe from being eaten by their parents."

Hessel (1896) again in 1895 used a similar arrangement. In a pond of four and one-half acres he confined the brood fish (large-mouthed bass) in a small section in which they spawned and the fry, about sixty thousand, passed through a wire grating into the larger portion of the pond. Small-mouthed bass were similarly treated in a one and a half acre pond.

Johnson (1899) used a similar method at Manchester in 1898. "Artificial nests and piles of gravel were located at suitable points in the three large stock ponds and in the 80-foot rearing ponds. The spawning beds were partitioned off with inch-mesh wire netting, so that the young fish by passing out into the main ponds might escape the depredations of the adults."

Page (1900) suggested a modification of this method in the Manual of Fish Culture. "A plan has been suggested which combines the features of a spawning and nursing pond, by constructing one comparatively long pond narrow near the middle so that the general shape will be like a dumb-bell with a very short handle. Across the narrow part is to be stretched a screen of ¼ inch wire cloth which will confine the spawners to the deeper end of the pond while the fry following their instincts of moving up stream will find their way through the screen into the upper, shallower end. This method would apparently not only save much labor in transferring the fry but obviate the risk involved in handling them." Still another form of pond for the same purpose is suggested by Page (1900) in the Manual of Fish Culture. "The shallow part near the inlet has a long narrow neck and the general shape, where the ground permits, follows the outline of a gourd. That part which resembles the handle is screened off from the remainder with wire netting with a quarter inch or less mesh. The young fish after the dispersal of the school seek the shallow waters, which, warmed by the sun, at this time of year afford rich pasture of Cyclops, Daphnia, young Corixa and other small invertebrates. Following the natural inclination of young fishes to head toward the source of the water supply, they pass through the screen and collect within the neck of the pond, where the food supply will be found to be greater than around the margin. From this part of the pond the fry have no inclination to retreat, and the parent fish cannot follow and devour them." This form of pond appears to be in use at Neosho.

Finally *Bastedo* (1903) suggests that breeding pens might be screened off along shore and the adult fish removed after the fry have risen from the nest, leaving the fry to make their own way into the lake.

2. *Screened spawning ponds from which adults are driven out.*—A method devised by *Lydell* for small-mouthed bass is described by Bower (1896). At Cascade, Michigan, two ponds were in use. A side pond nine by twelve feet and eighteen inches deep and with gravel bottom was built in 1895 and connected with one of these ponds by a race-

1898

Fig. L. Michigan Fish Commission Ponds at Mill Creek, as they appeared in ~~1900~~, showing the spawning ponds at the sides of the large stock ponds.

way. Eight nests were made in this spawning pond, though not all at one time. Five of these were productive. The old fish were driven from the spawning pond and a screen inserted to separate it from the main pond. Sixteen thousand fry were obtained. In 1896 eight beds were made in the spawning pond and one in the raceway and 20,000 to 30,000 fry were obtained. Owing to the success at Cascade an effort was made during the first years of the work at Mill Creek to greatly extend the use of spawning ponds. "Two large ponds were built, each 45x80 feet and of a uniform depth of four feet, i. e., without a shallow margin or terrace. They had the natural sand bottom. Along the sides of each of these ponds were built six smaller spawning ponds, three on each side and each 16x24 feet. These had a uniform depth of 18 inches and were provided with gravel bottoms. Each was connected with the larger pond by a channel, four feet wide. The large ponds were intended for the ordinary use of the stock fish while the smaller ponds were meant to afford ground on which the bass should spawn naturally. (Fig. J.) "In the spring of 1898 the bass from the central pond entered the side pond to spawn. Usually three or four males entered each side pond, occasionally as many as eight entered. Usually two or three nests had been completed in each side pond and the remainder were half completed when one of the male bass would leave the pond to fetch a mate. When he entered the side pond with his female and saw the other males at work, he at once attacked them as rivals. In the ensuing struggle some of the nests were certain to be destroyed and the female was likely to be frightened away. Even when the male succeeded in driving out the other occupants of the side pond and in inducing his female to spawn he was certain to be frequently interrupted by the attempts of the other males to enter and regain possession of their nesting grounds. As the result of this the eggs laid in his nest were apparently only fertilized in part, many of them afterward died and the whole nest became fungussed. After the eggs were laid the male was certain to thereafter regard the whole side pond as his exclusive territory and to attack and try to drive away any other male attempting to enter it through the channel. Sometimes a male thus holding sole possession of a side pond would be attacked by from ten to twenty other males seeking a nesting ground. The result of such attack was usually the death of the male and the destruction of the nest and thereafter the whole course of events was repeated from the beginning with new actors. This drama was thus repeated for about a month (May 15—June 16, 1898)."

"An attempt was made to protect the nests from the attacks of males by placing a circular wire screen around each as soon as the eggs had been laid. Owing, however, to the fact that the eggs were now not kept free of sediment by the parent fish they all died."

"The final result was that in each side pond never more than one brood was raised and frequently none. From 200 adult fish fifty one nests were spawned in, but so many of them were destroyed by the fighting males that only about 15,000 fry were obtained." (L.)

Why the use of such side ponds or spawning ponds for small-mouthed bass was successful at Cascade and under apparently the same conditions unsuccessful at Mill creek can only be surmised. Possibly the spawning season was shorter at Mill Creek that year so that a larger

number of males sought the spawning pond at one time, possibly the fish were in better condition and more combative. The result of the year's experience was that the use of spawning ponds was abandoned at Mill Creek and all ponds are now constructed on the model of a natural lake. The use of a pond separated into two parts by a screen seems to be still in use at Neosho and spawning ponds or spawning areas separated from the main pond by screens are in use to a limited extent at the Washington Fish ponds. At all other stations this practice seems no longer to hold. The success of the Mill Creek Station with small-mouthed bass and of the San Marcos Station with large-mouthed bass, in both cases without the use of special forms of ponds, seems good evidence that these have no advantage. It is now the universal practice to use a breeding pond built somewhat on the model of a natural pond, that is, with shallow margins and a deeper center. The brood fish are placed in these ponds in the spring and are provided with artificial nests as in the case of the small-mouthed bass at Mill Creek or allowed to make their own nests. At San Marcos twelve pairs of large-mouthed bass are allowed to each half acre of pond area. At Mill Creek about one hundred pairs of small-mouthed bass to each half acre. The arrangements differ in detail. Thus at San Marcos has been built one large circular pond divided by embankments into four ponds each of which forms a quadrant of the circle. Each quadrant pond is deepest at its central end and shallow towards the circumference of the circle. The water enters at the center of the circle.

f. *Separation of Fry from Adults by Handling:*

1. *Removal of adults from breeding ponds* is not usually considered practicable. If the adults are taken with a seine it is necessary first to remove the vegetation from the ponds. The resulting disturbances are great and the fry do not afterward do well. If a hook is used there is injury to the adult fish. *Kent* (1897) records removing the adult fish with a hook after they had spawned but no other record of similar procedure has been found.

2. *Removal of fry from the breeding ponds.*—It is now the almost universal practice to remove the fry from the breeding ponds in order to ship them or in order to place them in special rearing troughs or rearing ponds in which they are to be reared to fingerlings. At Mill Creek a certain number of fry are left in the breeding ponds and permitted to grow to fingerlings there, but this is done because separate rearing ponds are not available. On account of the different habits of the fry of the two species of bass the procedure of removing them from the breeding ponds is different in each case.

a. Small-mouthed bass.—*Hessel* (1898) found that he did not succeed in seining the small-mouthed fry with a fine-meshed seine such as he had been accustomed to use successfully with the large-mouthed fry.

This same difficulty led *Lydell* (1902) to devise the fry retainer and the screened nest. The use of these and the purpose which they serve have been already described. Without their use the small-mouthed fry could not be captured until they had reached a length of between two and three inches.

b. Large-mouthed bass.—It is now the custom at most stations to take the large-mouthed fry from the breeding ponds when they are between three-quarters of an inch and an inch and a half long. At Mill

Fig. K. Showing the method in use at Mill Creek of capturing a school of large-mouthed fry by throwing a seine over it. The same method may be used from a boat.

Creek most of them are shipped at that time. At the Neosho and San Marcos hatcheries of the U. S. Fish Commission and at the Washington fish ponds they are placed in rearing troughs or rearing ponds. For the purpose of taking the fry a seine of bobbinet is used. If the fry are still in schools mere random hauling of the seine in the ponds is not usually productive of results. It is better to first find a school of fry. This often requires long searching, but when the school has been found it may often be taken by a single haul of the seine. At Mill Creek hauls are made by throwing the seine over the school. (Fig. K.) The seine is heavily leaded and is so thrown that it makes a circle in the air; the lead line falls first into the water outside the school and the seine is then rapidly drawn in. The seine is lifted as gently as possible and the fry transferred to a tub or pail of water. The seine may be thrown from shore as shown in the figure or from a boat. If the fry have scattered and are no longer in schools, as is usually the case when they are over an inch long, the pond must be systematically seined.

g. *Rearing of Fingerlings.*—At Mill Creek this is accomplished with both species of bass by merely leaving a certain number of the fry in the ponds with the adult fish or by transferring them to ponds from which other fish have been removed. In these ponds the fish find their own food. Toward the end of June or early in July the schools have dispersed and the fingerlings are between two and three inches long. They are then seined and shipped. Those that escape the seine at this time are obtained in the fall when the ponds are drawn down. They are then four to six inches long.

In the establishments of the United States Fish Commission it has been the practice to transfer the fry to rearing troughs or rearing ponds or pools. The method of transfer and the subsequent handling of the fish is described in detail in the second edition of the Manual of Fish Culture. At San Marcos fry are not transferred until they are an inch and a half long, but at Neosho they are apparently transferred while much smaller. Leary (1900) has described experiments which seem to show that it is best not to transfer fry to rearing ponds until they are an inch and a half long. Of fry transferred just after absorption of the yolk sac from 15% to 20% lived, while of fry transferred when one and one-half inches long 73% to 80% lived. Probably the 80% or 85% per cent of small fry which perished in the rearing ponds would have perished in any case in the breeding ponds, so that delaying the transfer of fry to the rearing ponds until they are an inch and a half long does not save fry that would otherwise perish,—it merely postpones the transfer until the period of greatest mortality is past, and then makes it easier and more economical to bring up the fry in the rearing ponds. In the rearing troughs or ponds the fry are fed in part on natural food taken from neighboring waters, but chiefly on chopped crayfish or chopped fish and as they grow larger on small minnows or young carp. At Neosho they are shipped in early winter, at San Marcos a part in the spring and a part in the fall.

In the present practice of the San Marcos station the fry are permitted to attain their growth in the breeding ponds, which contain an abundance of food. They are transferred to small rearing ponds a few days only before shipment. In other words, the practice is now the same as with the majority of the fry at the Mill Creek station.

C. TRANSFERRING OF BLACK BASS.

The transferring of black bass from well stocked waters to new or impoverished waters has been practiced for many years both with the adult and with the fry.

1. *Transferring of adult black bass.*—*Goode* (1884) gives a brief account of the efforts made to transfer the black bass. Other accounts of early transferring practices may be found in *Norris* (1865), *Tisdale* (1869), *Shriver* (1871), *Stebbins* (1880), *Silk* (1880), *Stone* (1882), *Page* (1884), *Borne* (1884, 1884a), *Sharp* (1897), *Prince* (1897). According to Goode's account the earliest recorded effort was in 1847. Since then adult black bass have been transferred to New England and the North Atlantic seaboard, to Utah, California and probably to every State in the Union in which they were not native. They have been introduced in this way into England, Germany, Finland, and into other European countries. The fish are transported with relative ease and have shown the capacity to adapt themselves to every water in which they have been placed.

Usually in transferring adult bass to any new locality but a single shipment is made, at most two or three. The natural increase of the fish thus introduced has been depended on to stock the waters. Indeed earlier writers, *Greene* (1877), *Henshall* (1880), considered no other method of stocking depleted waters to be necessary. The method has therefore not usually in recent years, been thought of as a substitute for the planting of fry or fingerlings. Consequently the regular stocking of waters year after year with adult fish, as they are customarily stocked with fry or fingerlings, is an unusual procedure. The transferring of adults and yearlings from the overflow waters of the Mississippi river was long ago undertaken by the *Illinois Fish Commission.* In 1888 this work was taken up by the *United States Fish Commission.* (Sixteenth Annual Report of the Commissioner) and has since been carried on by that commission. In 1900 about 50,000 yearlings and adults of large-mouthed bass were distributed in this way. The *California State Board of Fish Commissioners* (1900) has undertaken similar work with the small-mouthed bass along the Russian River. In this work along the Mississippi river and in California the motive has been in part to save bass that would otherwise perish, when the waters of the river recede and in part, of course, to secure a supply of fish for stocking other waters.

Under the direction of Professor Prince this plan has been recently tried on an extensive scale by the fisheries department of the Province of Ontario and *Bastedo* (1903), who had charge of the operations, has given an account of them. Nearly 10,000 adult bass, ranging from 12 to 20 inches in length were planted in some eighteen different lakes and rivers. A passenger coach was fitted with tanks for transporting the fish, which were delivered to the car under contract. They were planted by interested parties working under government inspectors and deposited before they had spawned for the year.

2. *Transferring Bass fry.*—The transferring of black bass fry instead of adults seems to have been first undertaken by the *Wisconsin Fish Commission* (1893) in the sloughs along the Mississippi river. The report for 1893 says, "That river overflows its banks in times of floods, forming shallow lakes and sloughs along the banks and on the islands. Into that shallow water the bass go to deposit their eggs. On the subsidence of the water the parent fish return to the channel waters. The eggs hatch by the millions and the young fish are left to perish either by the sloughs drying up in summer or freezing in winter." This work of transferring was continued by the Wisconsin Commission until the pond culture of bass was undertaken by that commission, *Nevin* (1901).

In connection with the regular pond culture work of the Michigan Fish Commission at Mill Creek, the Commission has taken large-mouthed bass fry from three neighboring auxiliary ponds. Two of these are natural lakes; the third is a mill pond. Adult bass were placed in all three of them. From one of them an attempt has been made to remove the turtles and from another large numbers of sunfish and blue-gills have been seined, while suckers have been introduced into it. All the ponds still contain the usual fish native to such ponds, and are in other respects in their natural condition. In two of the ponds fishing is not permitted and in the third is permitted only in the fall.

The young fry, when three-fourths inch to one inch long and while still in schools, are taken from the ponds with a seine operated in the manner already described and are transferred to the tanks at Mill Creek, from which they are shipped within a few days. The number of fry thus transferred at Mill Creek from the three ponds now in use is shown in the following table:

	1899.	1900.	1901.	1902.	1903.
House's Lake	11,000	not used.	4,000	124,000	162,000
Soldier's Home Pond	116,000	260,000	182,000	136,000	166,000
Morgan's Pond	.....	.....	36,000	262,000	184,000
Totals	127,000	260,000	222,000	522,000	512,000

V. DISCUSSION OF METHODS OF BASS PROPAGATION.

A. GENERAL CONSIDERATIONS.

The efforts of the fish culturist should be directed toward protecting the eggs and the young of food fishes, during that developmental period during which they are most subject to destruction. With nearly all fish this period is between the laying of the eggs and the time when the young fish are able to swim and take food for themselves. During the whole of this period the future fish is helpless and unprotected—a prey to many enemies. With the black bass, on the other hand, both the eggs and the young fish are protected by the parent fish so that in any discussion of methods of propagating the black bass it is of importance to know the effectiveness of this parental protection. It is safe to say at the outset that practically all the eggs of the black bass are fertilized. This follows almost of necessity from the fact that

the male is invariably present when the eggs are laid. Moreover, no authentic cases of unfertilized bass eggs naturally deposited and occurring in considerable numbers have ever been reported. On the other hand *Holt* (1888) says, "In the past three years I have never found more than one per cent of unfertilized eggs." The writer has examined eggs from eight natural bass nests without finding any that could be said to be unfertilized. To be sure we find in the literature many references to unfertilized eggs in this and in other fish, but if these references be examined it will be found that the only ground upon which the eggs are pronounced unfertilized is that they are dead. Eggs may, of course, be found dead from other causes than lack of fertilization. To determine whether or not they have been fertilized requires, if the eggs are in their earlier stages, a microscopic examination. If cleavage (segmentation) or any of the developmental processes following it, are found to have taken place the eggs were fertilized. Dead eggs which have not undergone any of the early stages of development may be safely pronounced unfertilized. Eggs which have undergone any of these stages are certainly fertilized. The writer has examined probably the whole literature of the subject and has yet to find any case of eggs naturally deposited and reported as unfertilized, in which there was evidence produced to show that the eggs had not undergone the early stage of development. It cannot be too strongly insisted upon among fish culturists that eggs should not be pronounced unfertilized merely because they are dead and without other evidence. So far as the evidence goes we may then say that lack of fertilization is not a factor in causing the death of bass eggs.

In breeding ponds the greatest loss with the small-mouthed bass occurs before the eggs are hatched or while the fry are very young. After pigment has begun to develop in the fry, they are very hardy. This is shown by the following experience with pond No. 1 at Mill creek in 1903.

Table showing the results of examination of nests in Mill creek pond No. 1, May 15, 1903, small-mouthed bass. Fractional percentages are neglected:

Number of brood fish in pond (May 7), males, 28; females, 50; total, 78.

Number of nests in pond		48		
Number of nests in which eggs were laid		30		
Lot 1.	Number of nests in which all eggs died before hatching	9	30%	44 per cent unproductive.
Lot 2.	Number of nests in which all young fish died at about time of hatching	2	7%	
Lot 3.	Number of nests in which all young fish died soon after hatching	2	7%	
Lot 4.	Number of nests in which a large part (1-3 to 1-2) of young fish died soon after hatching	3	10%	57 per cent productive.
Lot 5.	Number of nests in which few or no eggs of fish died	14	47%	
		30	100%	

These nests were examined but twice, once about two days after the young fish had hatched and again when they were ready to rise from the nest, so that the losses cannot be attributed to the disturbances resulting from examination of the eggs. At the first examination the nests in which the eggs were all found dead but not hatched were placed in the first category. Those which contained only dead eggs with fully developed embryos and recently hatched dead fry were placed in the second category. Those which contained only very young dead fry were placed in the third category. Those which contained both dead and living fry in large numbers in the fourth, and those which contained nearly all living fry in the fifth. At the second examination it was found that all the nests in the fourth and fifth categories contained fry ready to leave the nests. We have thus a loss of about 44% of all nests in which eggs were laid, with, it may be added, an average output of about 5,200 fry per productive nest.

Without discussing at this time the cause of the death of eggs and fry in these nests it is clear that in the unproductive nests the losses occur before the eggs hatch (9 nests or about 70% of those unproductive), at the time of hatching (2 nests or about 15% of those unproductive) or shortly thereafter (2 nests or about 15% of those unproductive). Fry which had survived the first two to four days after hatching, were found to be in good condition when ready to leave the nests. (Lot 4.) The critical period seems to extend from two or three days after the eggs are laid to the time when pigment is developed in the young fish. Fry which are beginning to develop pigment may be placed in a shallow dish of water and without change of water or further attention will continue to develop and remain healthy until death ensues from starvation.

What is true in the breeding ponds as to the period when the greatest losses occur is probably also true in natural waters. Such losses as have been reported in natural waters have been attributed to changes of temperature or turbid water (Stranahan, 1899, 1898) and have resulted in fungussed eggs. Loss of older fry while still on the nest seems not to have been reported and presumably rarely occurs.

After the fry have left the nest and while they are still guarded by the parent fish losses undoubtedly occur from the attacks of minnows, sunfish, young bass and other fish as well as from the death of the parent fish. How serious this loss is might be determined by following the history of schools of fry in their natural waters and learning approximately how rapidly their numbers decrease, or it might be determined by an extensive examination of the stomach contents of the fish in a bass lake during the breeding season of the bass. One who has watched the male bass guarding his brood and has noted the vigor with which he repels intruders and the wide berth usually given his neighborhood by other fish will not readily believe that many of his fry are destroyed by marauding fish. Such fish are sometimes seen hanging on the outskirts of a school of bass fry and when opportunity offers are ready to devour the fry. "Thus in seining a school of large-mouthed fry in Morgan's pond in 1902, many yearling bass were seen hanging about the school. The old bass had, of course, been driven away and now when the seine had been drawn and about one-third of the school obtained, the small bass rushed in eagerly and seized the fry that had

escaped the net. They were so numerous and active that the water was made to boil by their rushes." (L.) The greatest danger to fry still guarded by the parent fish lies, without doubt, in the death or temporary absence of the parent, which affords the opportunity for all sorts of marauding fish to destroy the fry.

That in natural waters a very large number of large-mouthed fry still in schools may reach a length of three-quarters of an inch to an inch is shown by the number that may be taken from such waters with a seine. Thus in 1902 the Michigan Fish Commission took from House's lake which has an area of about six acres and in which 225 adult bass had been placed, 124,000 fry; from Morgan's pond with an area of one and one-half acres and 80 introduced bass 262,800 fry; from the Soldiers' Home pond with an area of two and one-half acres, and 200 introduced bass, 136,000 fry. It is not to be supposed that all the fry present in these lakes were captured. It we assume that all the adult fish placed in the ponds were still there they number 505; if half of them are females they number roughly 250—from which there were obtained 522,000 fry still in schools and about an inch in length. This is about 2,000 fry to each female fish. If the lakes be considered separately we have the largest production for Morgan's pond, 6,570 fry per pair of adult fish and the lowest for House's lake, about 1,100 per pair of adults. Fishing is prohibited in two of these ponds, but is permitted in the third in the fall—yet it undoubtedly occurs in all, so that the number of adult fish is certainly less than the number introduced and is believed to be approximately half that number. If this be taken into account along with the fact that only a part of the fry produced are actually seined, it is probable that the number of large fry still in schools is more nearly 5,000 or 10,000 per pair of adult fish than 2,000. This is the only approximation known to the writer of the actual production of bass fry per adult fish under nearly natural conditions.

The records of production in breeding ponds are meager. At San Marcos in 1901, 150 large-mouthed brood fish (75 pairs) were added to the stock already on hand and the total of fry one and one-half inches long taken from the breeding ponds for transfer to rearing ponds was 89,600—a trifle less than 1,200 to each pair of the recently added brood fish. The actual output per pair of fish, if the total number of fish present be considered, was considerably less. At Mill Creek in 1903 there were 11 pairs of breeding fish in two ponds. The output of fry about an inch long, was 108,000, about 10,000 to each pair.

B. POND CULTURE OF SMALL-MOUTHED BASS.

In what has preceded the difficulties encountered in attempts at pond cultivation of the small-mouthed bass have been enumerated and the ingenious methods devised to overcome these difficulties have been described. We now know that ponds must contain abundant vegetation, that the temperature and turbidity of the water must be controlled during the spawning season, that the adult fish placed in the breeding ponds must be sorted, that shielded nests should be provided and that in the case of small-mouthed bass fry retainers should be placed about

the nests before the fry rise from the bottom. The difficulty which remains to be overcome is the loss which occurs during the critical period between the laying of the eggs and the time when the fry are a few days old. From the data given above (p. 58) it is seen that this loss in a year which may be regarded as moderately successful, has reached more than 44% of all the eggs laid. In other seasons it may be greater, while in still other seasons it may be almost nothing. Is it possible to determine the cause of this loss and find a remedy for it?

1. *Cause of the loss of eggs and young fry during the critical period.*—In the case of pond No. 1 at Mill Creek, in 1903, the temperature of the water was controlled and remained normal while the turbidity of the water was not permitted to become so great as to be harmful. The loss cannot then be attributed to these causes. Moreover, all the eggs in certain nests were lost while in neighboring nests practically none were lost. In certain nests half the eggs or young fry died while the other half lived. Losses due directly to temperature or turbidity would be unlikely to be distributed in this way. They might rather be expected to affect all the eggs equally. It has been shown above that the losses cannot be attributed to lack of fertilization.

It may be suggested that the losses were due to the male fish having been frequently disturbed while guarding the nest and to his having consequently deserted the nest so that the eggs afterward died. In order to determine whether this might be the case, the nests in three ponds were charted to see whether those nests which produced fry were the ones least disturbed. The nests are arranged in rows about the shore. We may for convenience number the rows, beginning with that next the shore. We should now expect if the losses are due to disturbance of the nests, that row No. 1, which is nearest the shore and the nests in which are more subject to disturbance by persons passing along the shore, would show a smaller number of nests with fry than row No. 2 which is less disturbed.

Tabulating the twenty-eight productive nests in ponds 1, 3 and 5, the only ponds in which small-mouthed bass eggs were produced in 1903, we get the following:

Table showing productive nests, in rows 1 and 2, in ponds 1, 3, and 5, Mill Creek Station, 1903.

Small-mouthed Bass.

Pond Number.	Row 1.	Row 2.
1	6	5
3	5	1
5	5	6
Total	16 or 57%	12 or 43%

These somewhat meager data do not appear to show any relation between the location of the rows of nests with reference to disturbances and the number of productive nests. We find not infrequently that a nest in which the eggs die is in the same row with one in which they

thrive and next to it so that the amount of disturbance to which the two nests are subjected must be nearly the same. Some of the best nests have been situated where there was frequent passing, while in others far from any disturbance all the eggs have died.

In pond No. 1 all the nests, both productive and unproductive, were examined and platted. The records of this pond may therefore be examined in order to determine whether, of all the nests in which eggs are laid, a larger percentage is productive in row 2 than in row 1. The terrace in this pond is of varying width, so that on one part of it there is but a single row of nests while on another part there are three rows. The pond, moreover, contains an island which interrupts one of the rows. For these reasons the rows are not comparable throughout. Along the southwest corner of the pond are, however, two rows of nests apparently alike, and each containing nine nests. If these two rows are compared the following table results:

Table showing percentage of productive nests in identical parts of rows 1 and 2, pond 1, Mill Creek, 1903.

Small-mouthed Bass.

Row.	Total nests.	With eggs.	Productive.	Unproductive.	Percentage productive of nests with eggs.
1	9	6	4	2	67
2	9	6	4	2	67

No other pond or part of a pond permits of a direct comparison of the two rows and the comparison in this case does not show a lower percentage of good nests in row 1, situated along the driveway and frequently disturbed than in row 2, six to ten feet farther from the driveway.

Further evidence that the death of the eggs and fry is not to be attributed to the guardian male being disturbed is obtained by the examination of deserted nests. In three small-mouthed bass nests in pond No. 1, located where the male was frequently annoyed, the nests were visited from time to time and a few from each nest examined microscopically. After a few days a large percentage of the eggs were found to be dead. This number increased until all the eggs were dead. Meantime some of the eggs which first died were attacked by fungus, which after a time spread over the whole nest. In each of these cases the male continued to guard the eggs until all were dead and until a considerable proportion was already attacked by fungus. He was probably made aware of the death of the eggs by their offensive odor. In these cases it is clear that the eggs did not die because of desertion by the frequently disturbed males, but rather the males deserted the nests probably because of the death of the eggs, at any rate after the eggs had died. Although in this case the disturbances to which the males were subjected does not account for the death of the eggs, it does not follow that such disturbances may be permitted with impunity. On the other hand every care should be taken to guard the nests against them.

There is in this case another possible explanation of the location of the productive nests, namely, their relation to the current of water through the ponds. If a line be drawn in each of the three ponds from each side of the inlet to a corresponding point on each side of the outlet in such a way as to enclose that part of the pond through which the greater part of the water must flow in passing from inlet to outlet, the following facts appear:

In pond No. 1 certain nests are so located as to get more current than others, and this relation to current may properly be taken into account in attempting to account for the proportion of productive nests in different situations. If now we examine the relation of the productive nests to the part of the pond through which there is most current we get the following table:

Table showing relation of productive nests to current.

Mill Creek. 1903. Small-mouthed bass.

Pond.	Total productive nests.	In current.	Not in current.	Per cent in current.	Per cent not in current.
1	16	10	6	63	37
3	7	6	1	86	14
5	11	8	3	73	27

From this it might seem that the relation of the nests to the current determined their productivity. And yet, as in the case of external disturbances, we find in pond No. 1 adjacent nests in the same row with apparently identical relations to current and external disturbances in one of which the eggs thrive while in the other they die. Again in 1902, a large number of the best nests in pond 2 were located at that end of the pond through which there is the least flow of water. The following experience moreover shows that current is in no way necessary to the health of the eggs: At the experimental station maintained by the Michigan Fish Commission at Cascade, Michigan, in 1894, 1895 and 1896, there was a small spawning pond 20x25 feet, connected with the main pond by a channel leading from one of its ends, while its opposite end was without inlet or outlet. The flow of water was through the main pond, and since the spawning pond referred to had an opening at but one end, there was no current through it. From about forty-five pairs of fish there were obtained in 1896, 176,800 fry. All the nests were made in this spawning pond. These facts make us hesitate, pending the collection of further data, to attribute the vitality of the eggs in certain nests to their relation to the feeble current present in the Mill Creek ponds.

Since we are unable to attribute the death of eggs and young fry directly to the effect on them of any element of the immediate physical environment, its cause is to be sought in the other factor in the case, the parent fish. Of two pairs of fish one may, as we have seen, produce eggs nearly every one of which becomes a vigorous young fish, while another may produce eggs, which, while under apparently identical conditions, all die before or shortly after hatching. I can attribute this

to nothing else than a difference between the parent fish. Under the conditions prevailing in the ponds certain fish produce eggs lacking in vitality and these eggs shortly die. It is conceivable that the same thing may happen in natural waters when the fish are suffering from lack of food, disease or other causes tending to lower their vitality. While by a process of exclusion we are led to the tentative position that the death of eggs and fry of the small-mouthed bass in the Mill Creek pond is attributable to the lack of vitality of the parent fish there is some direct corroboratory evidence to be had from the deaths among adult fish in ponds 1, 3 and 5. In the year 1902 the nests in these ponds were practically all productive and the average product of these nests was 6,000 fry; in 1903, but 57% of the nests in which eggs were laid were productive and the average product per productive nest was but 5,200 fry. In the following table there is shown the deaths of adult fish in these three ponds in May and June of each of these two years:

Deaths of adult fish, ponds 1, 3, 5, Mill Creek, 1902, 1903.

Small-mouthed Bass.

Pond.	1902.				
	Number of adults.	Average fry per nest.	Deaths, May.	Deaths, June.	Percentage deaths.
1	130	6,000	18	4	.....
3	44	6,000	11	2	.....
5	94	6,000	6	0	.....
Totals	268	.....	41		15

Pond.	1903.				
	Number of adults.	Average fry per nest.	Deaths, May.	Deaths, June.	Percentage deaths.
1	120	2,700	35	6	.....
3	48	2,700	9	5	.....
5	75	2,700	19	10	.....
Total	243	.....	84		35

From this it appears that in 1902 with an insignificant loss of eggs and fry there were relatively few deaths among the adult fish in the breeding season (15%), while in 1903 with a great loss of eggs and fry there was a practically simultaneous loss of adult fish (35%), together with a reduction in the average output per nest. There can be no doubt that a large number of deaths is an indication of lack of vigor in the stock. The writer has been unable to detect any disease or infestation of parasites in these fish in 1903 or to assign any other specific cause for the deaths.

The postulated lack of vigor in the adult fish may be the result of confinement. The small-mouthed bass lives by preference in running water, and the small amount of this, the lack of exercise, the character of the food or all three may be responsible for the condition of the fish. The phenomenon of lack of vigor and lack of fertility is common among animals in confinement.

2. *Remedies for loss of eggs and young fry.*—Three methods of securing a continuously vigorous stock of brood fish may be suggested, though whether any of them will succeed can be determined only by trial.

a. *The old stock may be disposed of* after each breeding season and fresh brood fish may be obtained each fall. Such fish should breed once successfully before the vigor of the stock is reduced by confinement. The cost of this procedure, especially if the old stock be marketed, would probably not be greater than the cost of caring for the adult fish during the summer. Owing to the sensitiveness of the fish to handling it is better to secure the brood fish in the fall, so as to give them time to recover before the ensuing breeding season.

b. *Brood fish may be reared in the station ponds.*—It is probable that such fish as survived the rearing process would be acclimated to the ponds and it is to be expected that they would breed there successfully; but here again experience is the only certain guide.

c. *It has been suggested by Mr. Lydell that a vigorous stock of brood fish may possibly be obtained by a process of selection.*—Of the fish taken from their native waters in any given year and placed in the ponds, those which survive are the more vigorous or those best adapted to pond conditions. If now all the fish thus taken in a given year be kept by themselves, the less vigorous fish will, in the course of a few years, be eliminated by death, and those remaining should constitute a vigorous brood stock. This stock may be augmented from time to time by fish similarly selected until a sufficient stock of brood fish is accumulated. In this connection the importance of keeping separate the brood fish taken in different years and from different sources may again be pointed out.

We have no sufficient data by means of which to determine which of these methods is to be preferred. When the experimental bass station of the Michigan Fish Commission was established in 1893 at Cascade, Mich., about ninety brood fish were placed in the ponds, and not more than half a dozen fish were subsequently added to this stock. In 1894, the product per pair of adults was about 200, in 1895, about 450, in 1896 about 4,000. Not all the fry of 1894 were obtained, so that the figures show only that small-mouthed bass, after three years confinement in a small pond may be very productive. On the other hand in ponds 1, 3 and 5 at Mill Creek, in 1903 none of the brood fish had been in confinement less than eighteen months while some of them may have been in confinement six years and yet the output was only about 600 fry per pair of breeding fish in the ponds at the beginning of the breeding season. But again, at Mill Creek in 1900 there was an output of about 3,000 fry per pair of adults, none of which had been in confinement less than one year. In other years at Mill Creek the brood fish taken in different years have not been kept separate. Nothing further

can therefore be said said as to the effect on the output of confinement of the brood fish.

In addition to attempting to keep the stock of breeding fish vigorous by one of the above methods, an effort may be made to maintain their vigor by placing them in more nearly natural conditions. The small-mouthed bass is native to running waters and the Great Lakes. It occurs naturally in but few of the inland lakes of Michigan. It is possible that the brood fish would remain in better condition if confined in ponds which were essentially parts of a river. A small river below its point of exit from a large lake should be most suitable since here the temperature of the water should be nearly constant and there should be less liability to floods and turbid water. Brood fish might be confined by racks in a portion of such a river and fed on live minnows. Deep pools should be provided in which the fish may winter. Shielded or screened nests should be placed in the river and the fry held by fry retainers from which they may be taken for planting or transferred to rearing ponds. Under such conditions the brood fish would necessarily be more active since they would have to maintain themselves against the current and would have to seek their food. If the plan were successful it could be easily modified so as to adapt it to use on a larger scale. Large spawning ponds might be provided at the sides of the main stream and connected with it by channels.

At Mill Creek in 1898 nests and adult fish were placed in the creek as well as in the ponds. Of sixty nests in the ponds, twenty-two contained eggs and two of these were productive. In the creek of twenty-eight nests, twenty-six contained eggs and of these ten were productive. The losses in the creek were due to floods but the results show that the experiment of using running water for the breeding fish is worthy of further trial. This plan might be readily tried at the station of the Michigan Fish Commission at Drayton Plains, under conditions where floods and fluctuations in the temperature and turbidity of the water are not to be expected. If running water cannot be had the ponds used should be large with an abundance of deep water. The more nearly the ponds approach a natural lake in size and depth, the better are the results to be expected. In such ponds the fish have room to move about and may be permitted to seek for themselves living food introduced for their use.

If by the means here suggested or by other means the vigor of the brood stock can be maintained it seems to the writer that all that can be hoped for in the way of pond culture of the small-mouthed bass up to the time of hatching will have been accomplished. The maximum product at Mill Creek per pair of breeding fish was 3,000 in 1900. If with a sufficiently vigorous brood stock this output can be had annually, the problem of producing small-mouthed fry in large numbers is one of providing large water areas and large numbers of breeding fish.

C. POND CULTURE OF LARGE-MOUTHED BASS.

The cultivation of this species appears to be much simpler than with the small-mouthed bass, so that in the present practice of the United States Fish Commission, the breeding fish are merely placed in suitable ponds and the fry seined out when about one and one-half inches long.* The observations of the writer at Mill Creek are to the effect that the

adult fish are not seen to attack the fry until they have reached at least this size. Toward the end of July when the fry are two inches or more in length the adult fish may often be seen hunting them in the shallow water of the breeding ponds. If the fry are to be raised beyond an inch and a half it is advisable to transfer them to rearing ponds. The output of 10,000 large-mouthed fry per pair of adult fish reached at Mill Creek in 1903 indicates what may be accomplished with this fish and indicates that more than half the eggs laid produce fry of this size. The experience with this fish at Mill Creek is too limited to afford a basis for any suggestions as to improvements in its culture. From the habits of the fish and from the fact that success has more often followed attempts to cultivate it in ponds than in the case of the small-mouthed bass, it would seem to be better adapted to pond culture. It may therefore be expected to yield better results at Mill Creek than the small-mouthed bass, which on the other hand may be expected to do better at the Drayton Plains station.

As in the case of the small-mouthed bass, the large-mouthed taken in different years and those from different localities should be kept in separate ponds and a record kept of deaths and of production per nest and per pair of adult fish. In this way something may in time be learned as to the effect of confinement on the fish.

D. WHAT SHOULD BE THE SIZE OF YOUNG BASS WHEN PLANTED?

As shown above (p. 31) fry of less than three-quarters of an inch are not active in escaping their enemies and may readily be taken with a dip net. As they grow larger and the time for the dispersal of the school approaches, they become more wary and immediately after dispersal of the school the individual fry are extremely active and wary. A movement on shore or the approach of a hostile fish causes them at once to flee or take shelter. What may be called fear is thus strongly developed in the young fry at the time the parent fish leaves them and the schools disperse. It is better not to plant the fry until they have reached this stage. They are then like adult fish except in color and in the proportions of the body. As they grow larger their protection from their enemies is greater by reason of increase in size. We have no evidence of a corresponding increase in wariness, and to one watching the young fish, those of two or three inches seem to be quite as wary as those of six or eight.

VI.

SUMMARY OF FACTS CONCERNING BASS PROPAGATION.

1. Three methods of bass propagation have been tried—artificial fertilization and hatching, pond culture and transference.
2. Artificial fertilization has been found impracticable and has been abandoned.
3. Pond culture is the method now almost universally employed and has resulted in the following practices and devices:

* Letter to the writer from Mr. J. W. Titcombe in charge of the Fish Cultural Division of the U. S. Fish Commission.

a. Ponds are now commonly built on the model of the natural pond.

b. It is the practice to have the ponds well grown with vegetation.

c. In ponds intended for small-mouthed bass it has been learned that the temperature and turbidity of the water are important and must be controlled.

d. Brood fish are sorted just before the breeding season so that the males in any pond shall not be in excess of the females.

e. Brood fish are fed as far as possible on minnows.

f. Artificial nests have been gradually evolved. The earliest nests were merely gravel piles. The latest forms are the shielded and screened nests of Lydell, designed to afford shelter for the parent fish and a suitable material upon which to lay the eggs; gravel for the small-mouthed bass and fibre for the large-mouthed.

g. Owing to the impossibility of seining the young small-mouthed fry, fry retainers (Lydell) have been devised to keep them from leaving the nests and to hold them until ready for shipment.

h. The practice of confining the breeding fish within a screened area of the pond from which the fry could escape into the main pond has generally been abandoned.

i. The use of special spawning ponds from which the adults are removed or driven out so as to leave the fry in the spawning ponds has been generally abandoned.

j. It is the present practice to leave the fry in the ponds with the adults until they are from three-quarters of an inch to an inch and a half long. Small-mouthed fry, if intended for shipment soon after rising from the nest, are surrounded by a fry retainer, large-mouthed fry are not restrained.

k. For rearing into fingerlings most fry are now, in the practice of the Michigan Fish Commission, transferred to rearing ponds when about one inch long; a few are left in the breeding ponds.

4. The difficulty which still remains to be overcome in pond culture is the death of eggs before or soon after hatching.

5. This death is to be attributed to lack of vigor of the parent stock, and a remedy is to be sought in the following directions:

a. By maintaining a more vigorous breeding stock, either by annually replacing the stock with fresh breeders from the natural waters, or by rearing the breeders from the egg in the artificial ponds or by selection.

b. By keeping the brood fish under more natural conditions, in larger and deeper ponds, or, in the case of the small-mouthed bass, where practicable, in running water.

6 The age at which young bass should be planted is dependent in some degree on the kinds and relative abundance of the fish already in the waters to be planted, but present experience does not warrant the expensive practice of rearing large fingerlings or yearlings.

7. Transference of large-mouthed bass fry has been shown to be feasible by the Wisconsin Fish Commission and by the Michigan Fish Commission at its Mill Creek station.

8. The transference of large-mouthed fry from auxiliary rented ponds or lakes is much less expensive than rearing them and yields as uniform

an annual output. It should be made as large a part as possible of a station's work.

9. Transference of adult fish should be tried experimentally and may be found to be feasible for certain regions or under certain circumstances.

Ann Arbor, Mich., September, 1903.

VII.

LITERATURE CITED.

Arnold, Major Isaac, Jr., U. S. A.
1882—Successful Propagation of Black Bass. (From letters to Prof. S. F. Baird.)
Bull. U. S. Fish Commission, II, 113-116.

Bastedo, S. T.
1903—The Stocking of Inland Waters With Black Bass.
Forest and Stream, LX, 130-31.

Borne, Max von dem.
1884—Spawning in Germany of the Large-Mouthed Black Bass sent from the United States in 1882.
Bull. U. S. Fish Com., IV, 1884.
1884a—The American Black Bass.
Bull. U. S. Fish Com., III. 1888 (1884) 221-224.
Translated from Circular No. 2, 1883, of the Deutsche Fischerei Verein, Berlin, April 30, 1883, by Hermann Jacobson.

Bower, Seymour.
1896—The Propagation of Small-Mouthed Black Bass.
Trans. Am. Fish Soc., XXV, 1896, 127-136.

California State Board of Fish Commissioners.
1900—XVth Biennial Report, p. 42: an account of saving small-mouthed bass from the overflow waters of the Russian River.

Eoff, John.
1855—On the Habits of the Black Bass of the Ohio.
IXth Annual Report of the Board of Regents of the Smithsonian Institution, 289-290.

Forest and Stream.
1875—The Habits of the Black Bass. Forest and Stream, IV. 342.
1875-6—The Introduction and Habits of the Black Bass. (Quoted from the Mirror and Farmer of New Hampshire.) VI, 163.

Gill, Theodore.
1889—Nesting of the Black Bass. Forest and Stream, XXXIII (1889) 163-4.

"Gringo" (Major Isaac Arnold, Jr.)
1881—How Do Black Bass Spawn? Forest and Stream, XVI, 113.

Goode, G. Brown.
1884—The Fisheries and Fishery Industries of the United States. 7 Vols.
Vol. I (1884) Natural History of Aquatic Animals, p. 401-404, 134. The Big-Mouthed Black Bass (Micropterus salmoides) and the Small-Mouthed Black Bass (M. dolomieu).

Green, Seth.
1877—Artificial Culture of Black Bass. Forest and Stream, VIII, 359.
Hallock, Charles.
1875—Propagation of the Black Bass. Forest and Stream, IV, 357.
1883—The Sportsman's Gazeteer and General Guide.
Henshall, Dr. J. A.
1880—Black Bass for Inland Waters. Forest and Stream, XIV, 350. An extract credited to "Dr. J. A. Henshall in *Ohio Report.*"
1881—The Book of the Black Bass. 8vo., 463 pp. illstr. Cincinnati: The Robert Clark Co.
1898—More About the Black Bass, pp. viii, 204. Illstr. Cincinnati: The Robert Clark Co.
Hessel, Rudolph.
1896—Report as Superintendent of the U. S. Fish Commission. Ponds at Washington, D.C.
Report of U. S. Fish Commissioner for 1895 (1896) p. 25.
1898—Ibid.
Ibid. for 1896 (1898) pp. 42-43.
1898—Ibid.
Ibid. for 1897 (1898) p. L.
Holt, Charles F.
1886—Breeding of Black Bass. Forest and Stream, XXVI, 91. (Read before the Michigan Sportsmen's Association.)
1888—Some Observations on the Black Bass. Forest and Stream, XXXV (1888), 48.
(Read before the American Fisheries Society.)
Also in *Trans. Am. Fish Soc.,* xvii meeting 1888, 33-36.
Johnson, R. S.
1899—Report as Superintendent of Manchester Station, Ia.
Report U. S. Fish Commission for 1898 (1899).
Jordan, D. S. and Evermann, B. W.
1896—The Fishes of North and Middle America.
Bull. U. S. Natl. Mus. No. 47, Pt. I, pp. LX, 1240.
Black Bass pp. 1010-1012.
Kent, Clark Edwin.
1897—Rearing Black Bass, a letter to Mr. A. N. Cheney.
Forest and Stream, XLVIII, 467.
Lamkin, J. Bayard.
1900—The Spawning Habits of the Large-Mouthed Black Bass in the South. Trans. Am. Fish Soc., XXIX meeting, 129-138.
1902—A Few Points on the Black Bass for Discussion.
Trans. Am. Fish Soc., xxxi meeting, 1902.
Lane, Alfred C.
1899—Water Resources of the Lower Peninsula of Michigan.
Water Supply and Irrigation Papers of the U. S. Geological Survey, No. 30, 95 pp. 14 text figures.
Lydell, Dwight.
1902—The Habits and Culture of the Black Bass. Trans. Am. Fish Soc., xxxi meeting, 1902, pp. 45-47.
Also reprinted in Forest and Stream, LX, 249-250.

March 28, 1903, and in
Bulletin U. S. Fish Commission, 1903.
Leary, John J.
1900—Report of the Superintendent of the San Marcos Station, Texas. Report U. S. Fish Commissioner for 1899 (1900).
1900—Ibid. for 1900 (1901).
Nevin, James.
1901—Superintendent's Report, Biennial Report of the Commissioner of Fisheries of Wisconsin for the years 1889-1900, Madison.
1903—Superintendent's Report. Biennial Report of the Commissioner of Fisheries of Wisconsin for the Years 1901 and 1902. Madison. Pamphlet, 115 pp.
Black Bass, pp. 20-22.
Norris, Thaddeus.
1865—The American Angler's Book, etc.
Philadelphia: E. H. Butler & Co., pp. xxiii, 27-701. 87 wood cuts.
O'Brien, W. J.
1898—Large-Mouthed Black Bass: Methods of Hatching and Rearing.
Proc. (Transactions) Am. Fish Soc., xxvii meeting (1898) pp. 84-88 (including discussions).
Also in Forest and Stream, LI, 393.
Page, George Shepard.
1884—Black Bass in Maine.
Trans. Am. Fish Cult. Assoc. (Am. Fish Soc.), xiii, May 13, 1882.
Page, W. H.
1898—Report as Superintendent U. S. Fish Commission Station at Neosho, Mo.
In Reports U. S. Fish Commissioner for 1896 (1898) p. 60.
1900—See U. S. Fish Commission: Manual of Fish Culture.
Prince, E. E.
1897—The Propagation of Black Bass.
Pamphlet—probably extracted from Canadian Fisheries Report.
Rafinesque, C. S.
1820—Ichthyologia Ohiensis or Natural History of the Fishes Inhabiting the Ohio River and its Tributary Streams.
Call's reprint of 1899—reference to habits of small-mouthed bass, p. 157, Sub Lepomis flexuolaris (p. 88 of the original).
Reighard, Jacob.
1890—The Development of the Wall-Eyed Pike, A Popular Introduction to the Development of Bony Fishes.
Ninth Biennial Report Michigan State Board of Fish Commissioners, Dec., 1888-Oct. 1, 1900 (Appendix), pp. 96-158. Plates I-X.
Sharp, John.
1897—The Large-Mouthed Black Bass in Utah.
Bull. U. S. Fish Com. xvii (1897), 363-368.

Shriver, W. W.
1871—(Letter Describing the Introduction of Bass into the Potomac.) Baltimore Sun, April 28, 1871.
Silk.
1880—Introduction du Black Bass (Grystes nigricaus) en Angleterre.
Bull. Soc. d. Acclimitization: II, (7), 685.
Stebbins, Barney M.
1880—Result of Propagating Black Bass.
Rept. U. S. Fish Commissioner for 1878, Pt. VI (1880), 936-937.
Stone, Livingstone.
1882—Report on Overland Trip to California with Living Fishes, 1879.
Report of U. S. Fish Commissioner, Pt. VII (1879), 1882, pp. 637-644.
Stranahan, J. J.
1882—Black Bass Culture in Ohio. Forest and Stream, XIX, 112.
1893—Rearing Black Bass. Forest and Stream, XL, 277—Letter.
1898—Report as Superintendent of Put-in-Bay Station.
Report, U. S. Fish Commissioner 1897 (1898) p. LIV.
Tisdale, S. J. Esq.
1869—Fish Culture in New England. The Albion, Aug. 14, 1869.
Reprinted in Fifth Annual Report of the Commissioners of Inland Fisheries of Mass., January, 1871, pp. 24-28, from which my abstract is taken. Also reprinted in Am. Nat. V, 361-364.
U. S. Fish Commission.
1900—Manual of Fish Culture.
2nd Edition Revised. Black Bass, pp. 159-197, by W. H. Page.
Wisconsin Commissioners of Fisheries.
1893—Report of the Commissioner for 1893.
Quoted from Prince, 1897.
Worth, S. G.
1898—Report as Superintendent of Wytheville Station, Va.
Report U. S. Fish Commissioner for 1896 (1898), p. 48.

VIII.

EXPLANATION OF PLATES.

PLATE I.

The figures represent the developmental stages of the small-mouthed bass. They are reproductions of photographs made on non-halation plates with a vertical camera. Figures 1 to 15 were made with the microscope with a Bausch and Lomb-Zeiss 3-in. Planar lens; Fig. 17 with a Bausch and Lomb-Zeiss Unar lens. Figs. 1 to 12 represent the object seen by transmitted light; Figures 13 to 17 by reflected light.

Fig. 1.	Eggs 24 to 48 hours after laying	× 10*	
2.	24 hours before hatching	× 10.	
3.	At hatching, seen obliquely from above	× 10	Stage A
4.	Three or four hours after hatching, seen from the side	× 10	Stage A
5.	One day (24 hours) after hatching	× 10	Stage B
6.	Two days after hatching	× 10	Stage C
7.	Three days after hatching	× 10	Stage D
8.	Four days after hatching	× 10	Stage D
9.	Six days after hatching	× 10	Stage E
10.	Seven days after hatching	× 10	
11.	Eight days after hatching	× 10	Stage F
12.	Fourteen days after hatching; swimming up from nest bottom	× 10	Stage G
13.	Fourteen days after hatching	× 5	Stage G
14.	Twenty-two days after hatching	× 5	Stage H
15.	Twenty-four days after hatching	× 5	Stage H
16.	Nineteen millimetres long, probably thirty days after hatching	× 5	Stage J
17.	Fifty millimetres long, probably sixty days after hatching	× 1	Stage K

PLATE II.

The figures represent the developmental stages of the large-mouthed bass and were made in the same manner as those of Plate I: Figure 29 with Unar lens, the other figures with the Planar. Figures 1 to 25 represent the object seen by transmitted light; Figures 26-29 by reflected light.

Fig. 18.	Twenty-four to forty-eight hours after laying	× 10	
19.	At hatching	× 10	Stage A
20.	One day (24 hours) after hatching	× 10	Stage B
21.	Two days after hatching	× 10	Stage C
22.	Five days after hatching	× 10	
23.	Six days after hatching	× 10	Stage E
24.	Eight days after hatching	× 10	Stage F
25.	Nine days after hatching	× 10	Stage G
26.	Eleven days after hatching	× 5	Stage G
27.	Fourteen days after hatching	× 5	Stage H
28.	Twenty millimetres long, × 1.		
29.	Fifty millimetres long, × 1.		

*In preparin6 the plates from the original photographs the engraver has slightly changed the magnifications from those here given. For exact measurements consult the text.

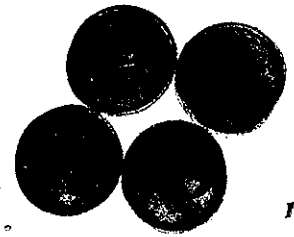

Fig. 1

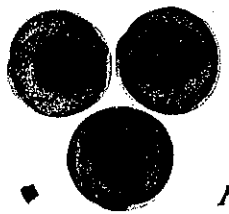

Fig. 2

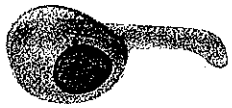

Fig. 3

Fig 4

Fig. 5

Fig. 6

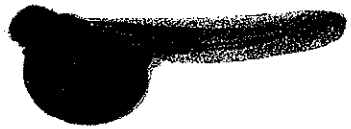

Fig. 7

Fig. 8

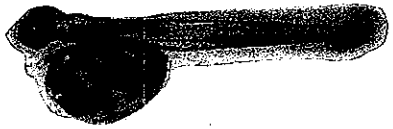

Fig. 9

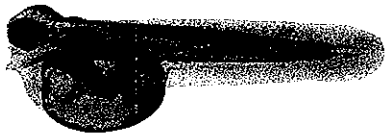

Fig. 10

Fig. 11

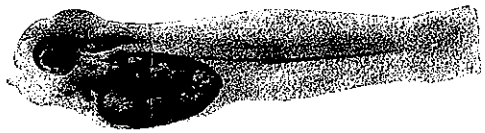

Fig 12

Fig. 13

Fig 14

Fig 15

Fig 16

Fig. 17

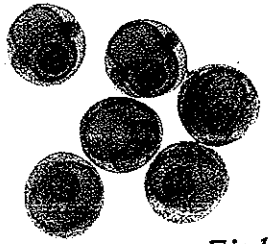

Fig 18

Fig 19

Fig 20

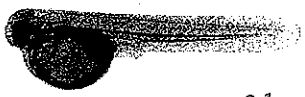

Fig 21

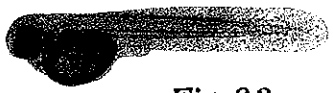

Fig 22

Fig 23

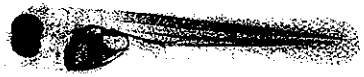

Fig 24

Fig 25

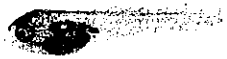

Fig 26

Fig 27

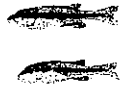

Fig 28

Fig 29

CATALOGUE

OF

MICHIGAN FISH

BY

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INTRODUCTORY REMARKS.

Edward D. Cope in 1864 and 5 published, in the Proc. Ac. Nat. Sci. Phila., a "Partial Catalogue of the Cold Blooded Vertebrates of Michigan," in which he described the fishes sent to him by Prof. Miles from the Flint Scientific Institute, the State Agricultural College and the State Collection; he recorded sixty-three species within the State. Later, in 1888, Charles H. Bollman published, in the Bull. U. S. F. C., a "Report of the Fishes of Kalamazoo, Calhoun and Antrim Counties, Michigan," in which he recorded fifty-three species. Again, in 1893, Philip H. Kirsch investigated the fauna of the Maumee River Basin, the result of which he published in the Bull. U. S. F. C. for that year; he recorded fifty-two species of fish from Michigan. These three papers constitute the only ichthyological records bearing directly upon the fish fauna of this State.

Many papers, of various kinds, have been written that incidentally touch upon Michigan fish, but these are so scattered as to be inaccessible to one carrying on ichthyological investigations. Because of this the writer has deemed it well to compile all the known records of our fish fauna and publish a catalogue of Michigan fish that will adequately represent all the work of the past besides being a stimulus to future ichthyological investigations within the State.

In compiling the catalogue, Jordan and Evermann's "Fishes of North and Middle America," together with their "Check List," has been used as the basis of classification and synonymy. Thus the numbers of the families and species used are those of the "Check List," while the nomenclature is that of the larger treatise. In arranging the data, in addition to the actual Michigan records, the writer has endeavored to embody the general distribution, as given by Jordan and Evermann's "Fishes of North and Middle America." Throughout the catalogue, this treatise is referred to by the authors' initials, J. & E., followed by the number of the volume and page.

In a compilation of this sort it is always an easy matter to make mistakes in determining the synonymy and a great deal of this michief is caused by ignorance of how this or that writer developed his synonyms. For this reason there is given below the methods by which the synonymy herein contained has been determined. I. The specific name followed by the name of the man who discovered the species was taken as of greatest significance and was compared with the synonym in Jordan and Evermann. If the same species was found therein the matter was considered as settled. II. If not found, the papers of the author were reviewed until a third synonym was found that was given in Jordan and Evermann. III. Where the name of the discoverer was not given, but in place a description of the species, the synonymy has been based upon the

description. IV. With an absence of both name of discoverer and description the synonymy was judged from (a) order of mention of the fish, (b) the localities given and (c) the nature of both generic and specific names.

The fishes of Michigan, as shown in this catalogue represent one hundred twenty-six species, distributed among twenty-four families. The largest family is that of Cyprinidae, represented by thirty-five species. The Siluridae and Catostomidae include nineteen, the Percidae eighteen, the Salmonidae fourteen, the Centrarchidae ten, and the Cottidae five. Of the remaining families the Lucidae and Poecilidae are represented by three species respectively, the Petromyzontidae, Lepisostidae and Gasterostidae by two respectively, and the Acipenseridae, Amiidae, Anguillidae, Hiodontidae, Dorosomatidae, Thymallidae, Umbridae, Percopsidae, Aphredoderidae, Atherinidae, Serranidae, Sciaenidae and Gadidae by a single species each.

It might prove interesting to compare the results obtained from Michigan with those for Ohio, Indiana and Illinois.

In his "Report on the Fishes of Ohio," published in the Geol. Survey of Ohio, Vol. IV, 1882, D. S. Jordan has recorded one hundred sixty-five species, distributed among twenty-seven families. Of these the Cyprinidae is represented by thirty-five species, the Percidae by twenty-eight, the Catostomidae by twenty-three, the Siluridae by fifteen, the Centrarchidae by fourteen, the Salmonidae by eleven, and the Cottidae by six. Of the remaining families, the Acipenseridae, Lepisostidae, Lucidae and Poecilidae each include three species, the Petromyzontidae, Clupeidae, Hiodontidae, Amblyopsidae, Serranidae and Gasterostidae each include two species, while the Amiidae, Polyodontidae, Anguillidae, Dorosomatidae, Percopsidae, Umbridae, Atherinidae, Aphredoderidae, Sciaenidae and Gadidae include but one species respectively.

In the Geol. Rept. of Indiana for 1894, O. P. Hay has published his paper on "The Lampreys and Fishes of Indiana." This report includes one hundred forty-nine species, representing twenty-six families. Here, also, the Cyprinidae is the largest family, containing thirty-two species. The Percidae, Catostomidae, Centrarchidae, Siluridae, and Salmonidae contain respectively, twenty-eight, nineteen, fifteen, thirteen and seven species. Of the remaining families, the Poecilidae contains four species, the Lepisostidae and Lucidae are each represented by three, the Petromyzontidae, Acipenseridae, Hiodontidae, Gasterostidae, and Serranidae each contain two, while the Polyodontidae, Amiidae, Clupeidae Dorsomatidae, Amblyopsidae, Umbridae, Atherinidae, Aphredoderidae and Sciaenidae include but one species each.

S. A. Forbes, in his "Catalogue of the Native Fishes of Illinois," published in the Rept. Ill. State Fish Com., 1886, records one hundred thirty-two species, distributed among twenty-seven families. The largest family, that of Percidae, contains thirty-eight species. The next largest family, Cyprinidae, is represented by thirty-three species, the Centrarchidae includes seventeen species, the Catostomidae thirteen, the Siluridae twelve and the Poecilidae four. Of the remaining families three species are included in the Lepisostidae, Salmonidae, Poecilidae, and Lucidae, two in the Petromyzontidae, Acipenseridae, Hiodontidae, and Serranidae, while but one is incuded in the Polyodontidae, Amiidae, Clupeidae, Dorosomatidae, Percopsidae, Amblyopsidae, Umbridae, Atherinidae Gasterostidae, Anguillidae, Aphredoderidae, Sciaenidae, Cottidae and Gadidae.

The author desires to acknowledge his indebtedness to Prof. Jacob Reighard and Mr. Chas. C. Adams for valuable suggestions and assistance in the preparation of this catalogue, and to Dr. David S. Jordan for his kind criticism of the same. Thanks are also due Dr. Barton A. Bean for the use of material in the U. S. Nat. Mus., and to Dr. Hugh M. Smith for use of the U. S. F. C. records.

CATALOGUE OF MICHIGAN FISH.

I.

Family IV. Petromyzontidae. (The Lampreys.)

(9) ICHTHYOMYZON CONCOLOR (Kirtland). *Silvery Lamprey.*
Great Lakes and Upper Mississippi valley.—(J & E-I-11).
Great Lakes—List—Evermann—Bull. U. S. F. C.—1901, 95.
Recorded in Michigan.
Petromyzon concolor (Kirt) Bollman. Bull. U. S. F. C. 1888, 221 Wilder Creek (one specimen clinging to dead Catostomus teres).
Ichthyomyzon argentius. Cope Proc. Ac. Nat. Sci. Phila. 1864, 276, Michigan (no locality given).
Petromyzon argentius—Recorded in U. S. Nat. Mus. at Washington —Ecorse, Mich.
Ichthyomyzon concolor—Has been collected from Detroit River at Belle Isle Nov. 17, 1903. Now in University of Michigan Museum.

(15) LAMPETRA WILDERI (Gage). *Small Black Lamprey.*
Great Lakes and Upper Miss. valley—(J & E-I-13).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lampetra wilderi. Young and Cole. Amer. Nat. 1900—Vol. 34, 617. Honey Creek. Tributary of Huron River west of Ann Arbor, Mich.
Lampetra wilderi—Collected from Grand Rapids by G. Sones, May 5, 1898; from tributary of Huron River at Dixboro; and from Honey Creek west of Ann Arbor. Specimen now in University of Michigan.
Ammocoetes wilderi—Recorded by Bryant Walker from Pine River, Marquette Co., August 10, 1903.

Family XXXI Acipenseridae. (The Sturgeons.)

(152) ACIPENSER RUBICUNDUS. Le Sueur. *Lake Sturgeon.*
Mississippi valley, Great Lakes and northward—(J & E-I-106).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Acipenser rubicundus—Dumeril—Hist.—Poisse II—1870—162 Michigan (no locality given).
Acipenser rubicundus—Jordan. Bull. U. S. F. C. 1885—191, Marquette market.
Acipenser rubicundus. Goode. Fishery Industries of U. S. Sect. I. 1884, 661—Kalamazoo River at Saugatuck, Pier Cove, Benton Harbor, Green Bay.
Acipenser rubicundus. Milner. U. S. F. C. Report, 1872-3, 73—Ecorse, Detroit River, west end of Lake Erie.
Acipenser—Strange Smithsonian. Report, 1854, 283, Beaver Isle, Mich.

Family XXXII Lepisosteidae. (The Gar Pikes.)

(155) LEPISOSTEUS OSSEUS. (Linnaeus.) *Long Nosed Gar.*
Great Lakes and Rivers of U. S. from Ver. to Rio Grande. (J & E-I-109.)
Great Lakes—List—Evermann—U. S. F. C.—Bull.—1901, 95.
Recorded in Michigan.
Lepisosteus osseus. (Lin.)—Bean. Proc. U. S. Nat. Mus. Vol. III—1880, 113. Detroit, Mich.
Lepisosteus osseus. (Lin.) Kirsch. Bull. U. S. F. C. XIV, 1893, 327. Devils Lake at Manitou Beach.

(156) LEPISOSTEUS PLATOSTOMUS. Rafinesque. *Short Nosed Gar.*
Great Lakes and Rivers of South and West—less abundant. (J & E-I-110.)
Great Lakes—List-Evermann—Bull. U. S. F. C.—1901, 95.
Recorded in Michigan.
Lepidosteus oculatus. Winchell—Proc. Ac. Nat. Sci., Phila. 1864, 183. Huron River.
Lepidosteus platostomus—Bollman. Bull. U. S. F. C., 1888, 221. Long and Austin Lakes.
Lepidosteus huronensis—Cope—Proc. Ac. Nat. Sci., Phila., 1864, 276. Saginaw Bay and Duck Lake, Calhoun Co.

Family XXXIII Amiidae. (The Bowfins.)

(159) AMIA CALVA. Linnaeus. *Dogfish.*
Great Lakes and sluggish waters from Minn. to Vir., Fla. and Tex. (J & E-I-113.)
Great Lakes—List—Evermann—Bull. U. S. F. C.—1901, 95.
Recorded in Michigan.
Amia occidentalis—DeKay. New York Fauna: Fishes, 1842, 269. St. Mary's River, Mich.
Amia calva. Bollman—Bull. U. S. F. C.—1888, 221. Long and Austin Lakes.
Amia calva. New York State Museum Rept. 1870, 40. Detroit.
Amia calva. Kirsch. Bull U. S. F. C.—1893, 327. Tiffin River. at Manitou Beach. This fish has been obtained by Prof. Reighard from the Huron River, east of Ann Arbor.

Family XXXIV. Siluridae. (The Catfishes.)

(215) ICTALURUS PUNCTATUS. (Rafinesque.) *Channel Cat.*
Rivers of the Great Lakes and Miss. Valley to Gulf of Mex. (J & E-I-134.)
Great Lakes—List—Evermann—Bull. U. S. F. C.—1901, 95.
Recorded in Michigan.
Ictalurus gracilis (Gill.)—Cope. Proc. Ac. Nat. Sci. Phila. 1864, 276. Michigan (locality not given).
Ichthaelurus punctatus (Raf.) Bean. Proc. U. S. Nat. Mus. 1880, 111. Michigan (locality not given).
Ictalurus punctatus. Recorded by U. S. F. C. at Washington. Sandusky Bay.

(221) AMEIURUS CATUS. (Linnaeus.) *White Cat.*
Delaware River to Tex. (J & E-I-138.)
Recorded in Michigan.
Ameiurus catus. Collected by A. Jenkins from Plumb Creek, Monroe Co., Mich. Now in the University of Michigan Museum.

(224) AMEIURUS NATALIS. (Le Sueur.) *Yellow Cat.*
Great Lake Region to Vir. and Tex. (J & E-I-139.)
Great Lakes—List—Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ameiurus cupreus—Cope. Proc. Ac. Nat. Sci. Phila. 1846, 276. Oakland Co.
Ameiurus natalis (Le S.) Kirsch. Bull. U. S. F. C. 1893, 327. Tiffin River at Manitou Beach.

(225) AMEIURUS VULGARIS. (Thompson.)
Vir. to Minn. and Ill., chiefly northward. (J & E-I-140.)
Great Lakes—List—Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Pimelodus dekayi Gird. Cope. Proc. Ac. Nat. Sci, Phila. 1864, 276. Michigan (no locality given).

(226) AMEIURUS NEBULOSUS. (Le Sueur.) *Common Bullhead.*
Great Lakes, Ohio Valley, east to Me. and southwest to Tex. (J & E-I-140.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ameiurus nebulosus (Le S.) Bollman. Bull. U. S. F. C. 1888, 221. Long, Austin, Indian, Gourdneck, Rawson, Goguac, Barnum, St. Mary's, Upper and Lower Brace and Lyon Lakes; Kalamazoo River.
Ameiurus nebulosus. In U. of M. Museum, from Huron River at Ann Arbor.

(227) AMEIURUS MELAS. (Rafinesque.) *Black Bullhead.*
N. New York to Kansas and Tex., abundant. (J & E-I-141.)
Great Lakes—List-Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ameiurus melas (Raf.) Kirsch. Bull. U. S. F. C. 1893, 327. Tiffin River and St. Joseph River at Hudson.

(231) NOTURUS FLAVUS. (Rafinesque.) *Stone Cat.*
Great Lake region, west and south to Wyo., Mont. and Tex. (J & E-I-144.)
Great Lakes—List—Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Noturus flavus (Raf.) Bollman. Bull. U. S. F. C. 1888, 221. Kalamazoo River at Battle Creek (one specimen guarding progeny under stone).
Noturus flavus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 277. Swartz Creek, Genesee Co.
Noturus flavus (Raf.) Kirsch. Bull. U. S. F. C. 1893, 327. St. Joseph River at Hudson.

(232) SCHILBEODES GYRINUS. (Mitchell.)
Hudson River and west throughout entire Miss. Valley. (J & E-I-146.)
Great Lakes—List—Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Noturus gyrinus (Mitch.) Kirsch. Bull. U. S. F. C. 1893, 328. Tiffin River at Manitou Beach.

(236) SCHILBEODES EXILES. (Nelson.)
Miss. to Mo. and Kan. (J & E-I-147.)
Recorded in Michigan.
Noturus exiles (Nelson). Kirsch. Bull U. S. F. C. 1893, 327. Tiffin River at Manitou Beach.

(240) SCHILBEODES MIURUS. (Jordan.)
Miss. valley and tributaries of Lake Michigan, southward to Louisiana. (J & E-I-148.)
Great Lakes—List—Evermann. Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Noturus miurus (Jordan) Kirsch. Bull. U. S. F. C. 1893, 327. Tiffin River at Manitou Beach and Hudson.

Family XXXVI. Catostomidae. (The Suckers.)

(276) CARPIODES THOMPSONI. Agassiz. *Lake Carp.*
Great Lakes region—abundant. (J & E-I-167.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Carpiodes selene (Cope). Cope. Proc. Amer. Phil. Soc. 1870, 481 Root River.
Carpiodes thompsoni (Ag.) Cope. Proc. Amer. Phil. Soc. 1870, 481. Lake George and Saginaw Bay.
Carpiodes thompsoni (Ag.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 285. Saginaw Bay.

(293) CATOSTOMUS CATOSTOMUS. (Forster.) *Long nosed sucker.*
Great Lakes to upper Mo., Columbia and northwest to Alaska. (J & E-I-176.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Catostomus longirostris (Le S.) Jordan—Bull. U. S. Nat. Mus. 1878—XII, 177. Au Sable River.
Catostomus (suckers) Strange—Smithsonian Report, 1854, 286. Beaver Isles.
Catostomus catostomus—Recorded by U. S. F. C. at Washington. Sand Beach and Bois Blanc Isle.
Catostomus aurora—Recorded in U. S. Nat. Mus. at Washington. Grand Junction.

(300) CATOSTOMUS COMMERSONII. (Lacepede.) *Common Sucker.*
Quebec and Great Lakes to Mont., Col., Mo. and Ga. (J & E-I-178.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Catostomus teres (Mitch.) Bollman. Bull. U. S. F. C. 1888, 221. Indian, Rawson, Goguac, St. Mary's, Barnum, Paynes, Upper and Lower Brace and Torch Lakes, Kalamazoo River.
Catostomus teres (Mitch.) Jordan. Bull. U. S. Nat. Mus. 1878—XII, 169 and 70. Port Huron, Ecorse and Huron River.
Catostomus commersonii (Lac.) Bean. Proc. U. S. Nat. Mus, 1880—III, 110. Detroit River and Ecorse.
Catostomus commersonii. Coll. by Jacob Reighard, 5, 10, '03, from Mill Creek, Kent Co., Mich. In U. of M. Museum; also Coll. by E. L. Michael, 11, 16, '03, from Belle Isle.
Catostomus teres (Mitch.) Jordan. Bull. U. S. F. C. 1885, 191. Lake Superior and Sault St. Marie.
Catostomus teres (Mitch.) Kirsch. Bull. U. S. F. C. 1893, 328. Tiffin River and St. Joseph River at Hudson.
Catostomus (Suckers) Strange—Smithsonian Report, 1854, 286. Beaver Isles.
Catostomus commersonii (Lac.). Recorded by U. S. F. C. at Washington. Sand Beach, Saginaw Bay and Caseville.
Catostomus teres. Recorded in U. S. Nat. Mus. at Washington. Ecorse and Northville.

(304) CATOSTOMUS NIGRICANS. Le Sueur. *Stone Roller.*
N. Y. to Minn., Kan., Ark. and Carolinas. (J & E-I-181.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Catostomus nigricans. Le S.—Bollman. Bull. U. S. F. C. 1888, 222. Kalamazoo River—common.
Hylomyzon nigricans. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 285. Grosse Isle.
Catostomus nigricans. Jordan. Bull. U. S. Nat. Mus. 1878, XII, 164. Ecorse.
Catostomus nigricans. Bean. Bull. U. S. Nat. Mus. 1884, XXVII, 478. Ecorse.
Catostomus nigricans. Jordan. Bull. U. S. F. C. 1885, 191. Sault Ste. Marie.
Catostomus nigricans. Kirsch. Bull. U. S. F. C. 1893, 328. Tiffin and St. Joseph Rivers at Hudson and Devil Lake at Manitou Beach.
Catostomus nigricans. Recorded in U. S. Nat. Mus. at Washington from Ecorse.

(313a) ERIMYZON SUCETTA OBLONGUS. (Mitchell.)
Great Lake region to Me. and Dakotas, south to Va., Ind. and Tex. (J & E-I-186.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Erimyzon sucetta (Lac.) Jordan. Bull. U. S. Nat. Mus. 1878, XII, 147. Detroit.
Erimyzon sucetta oblongus. Bollman. Bull. U. S. F. C. 1888, 222. Long, Austin, Rawson, Howard, Barnum and St. Mary's Lakes.
Erimyzon oblongus. Recorded in U. S. Nat. Mus. at Washington. Detroit River.

(314) MINYTREMA MELANOPS. (Rafinesque.) *Spotted Sucker.*
Great Lake region to N. Car. and west to Tex. (J & E-I-187.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Minytrema melanops. (Raf.) Kirsch. Bull. U. S. F. C. 1893, 328. St. Joseph River at Hudson.

(316) MOXOSTOMA ANISURUM. (Rafinesque.) *White nosed sucker.*
Ohio River and Great Lake region. (J & E-I-190.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Myostoma carpio. (Jordan & Wal.) Jordan. Bull. U. S. Nat. Mus. XII, 119. Alpena and Lake Huron.

(325) MOXOSTOMA AUREOLUM. (Le Sueur.) *Common Redhorse.*
Lake Ontario and Michigan to Ark. and Ga. (J & E-I-192.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ptychostomus aureolus. (Le S.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 285. Saginaw Bay and Grosse Isle.
Ptychostomus aureolus. (Le S.) Cope. Proc. Amer. Phil. Soc. 1870, XI, 2nd series 476. Saginaw Bay.
Moxostoma aureolum. Recorded by U. S. F. C. at Washington from Saginaw Bay and Caseville.
Moxostoma aureolum. Recorded in U. S. Nat. Mus. from Ecorse.
Moxostoma aureolum. In U. of M. Museum. Coll. by E. L. Michael, 11, 16, '03, from Belle Isle.

(335) PLACOPHARYNX DUQUESNII. (Le Sueur.)
Mich. to Tenn., Ga. and Ark. (J & E-I-198.)
Recorded in Michigan.
Moxostoma duquesnii. (Le S.) Bollman. Bull. U. S. F. C. 1888, 222. Lower Brace Lake and Kalamazoo River at Battle Creek and Marshall.
Placopharynx carinatus. Cope.—Jordan. Bull. U. S. Nat. Mus. 1878, XII, 109. Detroit River.
Moxostoma macrolepidotum. Kirsch. Bull. U. S. F. C. 1893, 328. Devils Lake at Manitou Beach: Tiffin and St. Joseph Rivers at Hudson.
Myostoma macrolepidota. Recorded in U. S. Nat. Mus. at Washington. Ecorse.
Placopharynx carinatus. Recorded in U. S. Nat. Mus. at Washington. Detroit River.

Family XXXVII. Cyprinidae. (The Minnows.)

(339) CAMPOSTOMA ANOMALUM. (Rafinesque.) *Steel backed Chub.*
Cen. N. Y. to Tenn., Wyo. and Texas. (J & E-I-206.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Campostoma callipteryx. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 284. Flint River.

Campostoma mormyrus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 284. Bruce, Macomb Co.

Campostoma gobionum. Cope. Pros. Ac. Nat. Sci. Phil. 1864, 284. Bruce and Grosse Isle.

Campostoma— { mormyrus. callipteryx. gobionum. } Cope. Cypr. Penn. 1869, 395.

Flint River and waters flowing into Lake St. Clair.

Campostoma dubium. (Kirt.) Cope. Cypr. Penn. 1869, 396. St. Joseph River.

Campostoma anomalum. (Raf.) Kirsch. Bull. U. S. F. C. 1893, 328. St. Joseph and Tiffin Rivers at Hudson and Devils Lake at Manitou Beach.

Campostoma anomalum. Coll. by Jacob Reighard, 5, 24, '03, from Mill Creek.

(345) CHROSOMUS ERYTHROGASTER. (Rafinesque.) *Red-bellied Dace.*

Ohio, Mich. to Iowa. (J & E-I-209.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Leuciscus erythrogaster. Gunther's Cat, VII, 248. Michigan (no locality given).

Chrosomus erythrogaster. Cope, Cypr. Penn. 1869, 391. Macomb Co., from waters flowing into Lake St. Clair.

(345a) CHROSOMUS ERYTHROGASTER EOS. Cope.

Susquehanna River. (J & E-I-210.)

Recorded in Michigan.

Chrosomus eos. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 281. New Hudson and streams of Lake Erie.

(353) HYBOGNATHUS NUCHALE. Agassiz. *Silvery Minnow.*

Del. and Neuse River to Upper Mo. River and to Ga. and Tex. (J & E-I-213.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Hybognathus nuchale. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 284. Grosse Isle, Detroit River.

(362) PIMEPHALES PROMELAS. Rafinesque. *Fathead.*

Lake Champlain to Dak., Kent and Rio Grande. (J & E-I-217.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Pimephales milesii. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 282. Grosse Isle, Detroit River.

Pimephales promelas. Raf. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 282. Vicinity of Lansing.

Pimephales promelas. Raf. Kirsch. Bull. U. S. F. C. 1893, 328. Tiffin River at Hudson.

Pimephales milesii. Gunther's Cat, VII, 181. Grosse Isle, Detroit River.

(363) PIMEPHALES NOTATUS. (Rafinesque.) *Blunt nosed minnow.*

Quebec to Del., Ky., Ala., Ark. and Dakotas. (J & E-I-218.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Pimephales notatus. Bollman. Bull. U. S. F. C. 1888, 222. All waters in Kalamazoo, Calhoun and Antrim Counties.

Hyborynchus notatus. (Raf.) Cope, Cypr. Penn, 1869, 392. Michigan (no locality given).

Hybopsis haematurus. Cope. Cypr. Penn. 1869, 382. St. Joseph River.

Hyborynchus notatus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 282. Grosse Isle, Detroit River.

Pimephales notatus. (Raf.) Kirsch. Bull. U. S. F. C. 1893, 328. Tiffin and St. Joseph River at Hudson.

Leuciscus haematurus. Günther's Cat, VII, 259.

Pimephales notatus. Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 134. Sault Ste. Marie.

Pimephales notatus. In U. of M. Museum from Mill Creek, 5, 24, '03.

(367) SEMOTILUS CORPORALIS (Mitchell.) *Silver Chub.*

Abundant from St. Lawrence to the James, east of the Alleghanies. Found not west of Alleghanies. (J & E-I-221.)

Recorded in Michigan.

Semotilus rhotheus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 277. Michigan (no locality given).

Semotilus corporalis. Recorded in U. S. Nat. Mus. at Washington. Northville and Port Huron.

(368) SEMOTILUS ATROMACULATUS. (Mitchell.) *Horned Dace.*

Maine to Mo.—abundant. (J & E-I-222.)

Recorded in Michigan.

Semotilus atromaculatus. (Mitch.) Bollman. Bull. U. S. F. C. 1888, 222. Howard Lake, Austin Creek and Kalamazoo River.

Semotilus corporalis. (Put.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 277. New Hudson, Calhoun Co.; Swartz Creek, Genesee Co., and Grosse Isle.

Semotilus atromaculatus. (Mitch.) Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson and Tiffin River at Manitou Beach.

Semotilus atromaculatus. Coll. by Jacob Reighard, 6, 1, '03, from Mill Creek.

(391) LEUCISCUS ELONGATUS. (Kirtland.) *Red-sided shiner.*

Great Lakes and Upper Mississippi valley. (J & E-I-240.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Squalus priger. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 280. Michigan (no locality given).

(393) LEUCISCUS NEOGAEUS. (Cope.)
Mississippi valley and neighboring waters. (J & E-I-241.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Phoxinus neogaeus. Cope. Cope. Cypr. Penn. 1869, 375. New Hudson, Livingston Co.
Phoxinus neogaeus. Cope. Günther's Cat, VII, 247. New Hudson, Livingston Co.

(410) ABRAMIS CRYSOLEUCAS. (Mitchell.) *Golden Shiner.*
Nova Scotia and Md. to Dak. and Texas. (J & E-I-250.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Notemigonus crysoleucas. (Mitch.) Bollman. Bull. U. S. F. C. 1888, 222. Long and Lyon Lakes—not common.
Plargyrus americanus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 281. Saginaw Bay and Grosse Isle, Detroit, River.
Notemigonus crysoleucas. Recorded in U. S. Nat. Mus. at Washington. Bay City and Grand Haven.

(414) CLIOLA VIGILAX. (Baird and Girard.)
Ohio to Georgia, Iowa and Texas. (J & E-I-253.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hybopsis tuditanus. (Cope.) Cope. Cypr. Penn. 1869, 381. Detroit and St. Joseph Rivers.
Leuciscus tuditanus. Günther's Cat, VII, 259. Detroit River.

(420) NOTROPIS CAYUGA. Meek.
Cayuga Lake and N. New York to Assiniboia, South Dakota, Nebraska, Kansas and Arkansas. (J & E-I-260.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Notropis cayuga. Meek. Kirsch. Bull. U. S. F. C. 1893, 328. Devils Lake at Manitou Beach.
Notropis cayuga. Meek. Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 134. Sault Ste. Marie.

(421) NOTROPIS HETERODON. (Cope.)
New York to Michigan and Kansas—common. (J & E-I-261.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Alburnops heterodon. (Cope.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 281. Lansing and Grosse Isle.
Notropis heterodon. (Cope.) Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 134. Sault Ste. Marie.
Leuciscus heterodon. Günther's Cat, VII, 261. Lansing and Grosse Isle.

(422) NOTROPIS FRETENSIS. (Cope.)
Detroit River, Mich. (J & E-I-261.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hybopsis fretensis. Cope. Cypr. Penn. 1869, 382. Detroit River.

(423) NOTROPIS BLENNIUS. (Girard.)
Ohio and Michigan to Tennessee, Dakota and Kansas. (J & E-I-262.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hybognathus stramiens. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 283. Grosse Isle, Detroit, River.

(425) NOTROPIS VOLUCELLUS. (Cope.)
Michigan to Wisconsin and Northern Indiana. (J & E-I-263.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hybognathus volucellus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 263. Grosse Isle, Detroit, River.
Leuciscus volucellus. Günther's Cat, VII, 260. Grosse Isle, Detroit River.

(443) NOTROPIS HUDSONIUS. (De Witt, Clinton.) *Spot-tailed Minnow.*
Dakotas and Lake Superior to New York and South Carolina. (J & E-I-269.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Notropis hudsonius. (De W. Cl.) Bollman. Bull. U. S. F. C. 1888, 222. Long, Austin, Indian, Gourd Neck, Rawson, Howard, Clam Lakes.
Hybopsis hudsonius. Cope. Proc. Ac. Nat. Sci. Phil, 1864, 279. Michigan (no locality given).
Notropis hudsonius. (De W. Cl.) Kirsch. Bull. U. S. F. C. 1893, 329. Devils Lake and Tiffin River at Manitou Beach.
Hybopsis hudsonius. Cope. Cypr. Penn. 1869, 386. Michigan (no locality given).
Notropis hudsonius. Recorded in U. S. Nat. Mus. at Washington. Ecorse, Port Huron and Detroit River.

(443a) NOTROPIS HUDSONIUS SELENE. (Jordan.)
Lake Superior. (J & E-I-269.)
Recorded in Michigan.
Notropis selene Jordan. Jordan. Bull. U. S. F. C. 1888, 137. Keweenaw Point, Lake Superior.

(443b) NOTROPIS HUDSONIUS AMARUS. (Girard.)
Delaware and Potomac Rivers. (J & E-I-270.)
Recorded in Michigan.
Hybopsis storeianus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 279. Flint River at Flushing, Genesee, Co.

(463) NOTROPIS WHIPPLII. (Girard.) *Silver fin.*
Central New York to Minnesota, Alabama and Arkansas. (J & E-I-278.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Photogenis spilopterus. Cope. Cypr. Penn. 1866, 378. St. Joseph River in Southwestern Michigan.
Notropis whipplii. (Gir'd.) Kirsch. Bull. U. S. F. C. 1893, 329. Devils Lake at Manitou Beach and St. Joseph River at Hudson.
Leuciscus spilopterus. Günther's Cat, VII, 254. St. Joseph River.
Notropis analostanus. Recorded in U. S. Nat. Mus. at Washington. Detroit River.

(471) NOTROPIS CORNUTUS. (Mitchell.) *Red fin.*
All small streams east of Rockies. (J & E-I-281.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Alburnops plumbeolus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 282. Flint River on branch of the Saginaw.
Hybopsis cornutus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 279. Pine Lake, Emmet Co.; Bruce, Macomb Co., and Swartz Creek, Genesee Co.
Leuciscus cornutus. Günther's Cat, VII, 249. Flint River and Lake Erie.
Notropis megalops. (Raf.) Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson and Tiffin River and Devils Lake at Manitou Beach.
Notropis cornutus. (Mitch.) Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 134. Sault Ste. Marie.
Notropis megalops. (Raf.) Bollman. Bull. U. S. F. C. 1888, 222. Kalamazoo River at Battle Creek and Marshall.
Minnilus cornutus. Goode. U. S. F. C. Hist. Aquatic Animals, Section I, 1884, 617. Mouths of small rivers emptying into Lake Michigan.
Notropis cornutus. In U. of M. Museum. Coll. by Jacob Reighard, 6, 10, '03, from Mill Creek.
Notropis cornutus. Recorded in American Mus. at New York. Belle Isle, Detroit River.
Luxilus cornutus. Recorded in U. S. Nat. Mus. at Washington. Detroit and Port Huron.

(471a) NOTROPIS CORNUTUS FRONTALIS. (Agassiz.)
Great Lakes, everywhere aboundant in small brooks. (J & E-I-283.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hypsilepis frontalis. (Ag.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 279. Monroe Co., Grosse Isle, Detroit River; Three Mile Lake and Waterford, Oakland Co.; Schwartz Creek, Genesee Co.

(471b) NOTROPIS CORNUTUS CYANEUS. (Cope.)
N. Peninsula of Michigan. (J & E-I-283.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hypsilepis cornutus cyaneus. Cope. Proc. Ac. Nat. Sci. Phila. 1867, 160. Montreal River, Keweenaw Point, Lake Superior.

(499) NOTROPIS ATHERINOIDES. Rafinesque.
Great Lake region. Mississippi and Ohio valleys to Winnipeg. (J & E-I-293.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Notropis atherinoides. Bollman. Bull. U. S. F. C. 1888, 222. Kalamazoo River at Battle Creek, Spencer Creek and Torch Lake.
Alburnellus jaculus. Cope. Cypr. Penn. 387. St. Joseph and Dowagiac Rivers.
Alburnus rubellus. (Ag.) Cope. Proc. Ac. Nat. Sci. Phila. 1864, 282. Flint.
Notropis atherinoides. Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson.
Leuciscus copii. Günther's Cat, VII, 255. Michigan (no locality given).

(500) NOTROPIS ARGE. (Cope.)
Upper Wabash valley. Southern Michigan and Green River, Ky. (J & E-I-294.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Alburnellus Arge. Cope. Cypr. Penn. 388. Detroit or St. Joseph River.

(501) NOTROPIS DILECTUS. (Girard.)
Lower Ohio to Rio Grande. (J & E-I-294.)
Recorded in Michigan.
Notropis dilectus. Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson.

(512c) NOTROPIS UMBRATILUS LYTHRURUS. (Jordan.)
Ohio valley and rivers of neighboring states. (J & E-I-300.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hypsilepis diplaemia. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 279, also 1867, 156. Near Lansing.
Notropis ardens. (Cope.) Kirsch. Bull. U. S. F. C. 1893, 329. Devils Lake at Manitou Beach and St. Joseph River at Hudson.

(513) ERICYMBA BUCCATA. Cope.
Michigan and W. Pennsylvania to Kansas and W. Florida. (J & E-I-302.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ericymba buccata. Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson and Devils Lake at Manitou Beach.

(521) RHINICHTHYS CATARACTAE. (Cuvier and Valenciennes.) *Long nosed Dace.*
New England to Virginia and Wisconsin. (J & E-I-306.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Rhinichthys cataractae. (C. & V.) Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 135. Sault Ste. Marie.
Rhinichthys cataractae. Recorded in U. S. Nat. Mus. at Washington from Northville.

(523) RHINICHTHYS ATRONASUS. (Mitchell.) *Black nosed Dace.*
New England to Minnesota, Alabama and Virginia. (J & E-I-307.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Rhinichthys atronasus. Kirsch. Bull. U. S. F. C. 1893, 329. St. Joseph River at Hudson.
Rhinichthys atronasus. Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 135. Sault Ste. Marie.
Rinichthys atronasus. Recorded in U. S. Nat. Mus. at Washington from Huron River.
Rhinichthys atronasus. In U. of M. Museum. Coll. by Geo. Wagner, 5, 26, '00, from Pittsfield Junction.

(523b) RHINICHTHYS ATRONASUS LUNATUS. (Cope.)
Common in lakes and brooks of Michigan, Indiana, Wisconsin and Minnesota. (J & E-I-308.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Rhinichthys atronasus lunatus. (Cope.) Bollman. Bull. U. S. F. C. 1888, 222. Austin and Spencer Creeks, Clam and Torch Lakes.
Rhinichthys lunatus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 278. Grosse Isle.
Rhinichthys lunatus. Cope. Journ. Ac. Nat. Sci. IV, 2nd series, 228. Michigan (no locality given).
Rhinichthys obtusus. Günther's Cat. VII, 190. Michigan (no locality given).

(547) HYBOPSIS AMBLOPS. (Rafinesque.) *Silver Chub.*
New York to Iowa and Alabama. (J & E-I-321.)
Recorded in Michigan.
Hybopsis amblops. Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson, also Tiffin River at Manitou Beach.

(550) HYBOPSIS KENTUCKIENSIS. (Rafinesque.) *Horney Chub.*
Pennsylvania to Wyoming and Alabama, in large streams. J & E-I-322.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ceratichthys cyclotis. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 278. Grosse Isle, Waterford, Oakland Co., Clinton River and Bruce, Macomb Co.
Ceratichthys stigmaticus. Cope. Proc. Ac. Nat. Sci. Phila. 1864, 278. Michigan (no locality given).
Hybopsis kentuckiensis. Bollman. Bull. U. S. F. C. 1888, 222. Kalamazoo River at Battle Creek and Marshall.

Hybopsis kentuckiensis. Kirsch. Bull. U. S. F. C. 1893, 329. Tiffin and St. Joseph Rivers at Hudson, also Tiffin River at Manitou Beach.
Nocomis biguttatus. Recorded in U. S. Nat. Mus. Grosse Isle and Huron River.

(552) COUESIUS PLUMBEUS. (Agassiz.)
Streams and lakes from Lake Superior to the Adirondack region. (J & E-I-323.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Couesius prosthemius. Recorded in U. S. Nat. Mus. Grand Isle, Lake Superior.
Couesius prosthemius. Bean. Bull. U. S. Nat. Mus. 1884, 485. Grand Isle, Lake Superior.

Family XLIII. Anguillidae. (The Eels.)

(588) ANGUILLA CHRYSPA. Rafinesque. *American Eel.*
Atlantic Coast of U. S. from Maine to Mexico; south of Canada and east of Rockies. (J & E-I-348.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Anguilla chrysypa. Bollman. Bull. U. S. F. C. 1888, 223. Gourd Neck and Rawson Lakes.
Anguilla chrysypa. Kirsch. Bull. U. S. F. C. 1893, 330. Tiffin River and Devil's Lake at Manitou Beach, and all immediate vicinities. Reported from Tiffin and St. Joseph Rivers at Hudson.
Anguilla vulgaris. Goode. U. S. F. C. Hist. Aquatic Animals, Sect. I, 1884, 633. Eaton Rapids and Elkhorn River.

Family LVIII. Hiodontidae. (The Moon-Eyes.)

(690) HIODON TERGISUS. Le Sueur. *Moon-Eye.*
Great Lakes and Mississippi valley. (J & E-I-413.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Hiodon tergisus. Le S.—Bean. Proc. U. S. Nat. Mus. III, 1880, 107. Ecorse, Mich.
Hiodon tergisus. In U. of M. Museum. Coll. by E. L. Michael, 11, 16, '03, from Belle Isle.
Hiodon tergisus. Le S. Recorded by U. S. F. C. at Washington. Sandusky Bay.

Family LX. Dorosomatidae. (The Gizzard Shads.)

(693) DOROSOMA CEPEDIANUM. (Le Sueur.) *Hickory Shad.*
Cape Cod to City of Mexico, large streams of Mississippi valley. Introduced into Lake Erie and Michigan, landlocked from New Jersey to Texas. (J & E-I-416.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Dorosoma eepedianum heterurum. Goode. Bull. U. S. Nat. Mus. XIV, 58. Sarnia, Lake Huron.
This is not a Michigan locality, but is so close to Michigan waters as to justify its inclusion in this list.

Family LXIV. Salmonidae. (The Salmon.)

(777) COREGONUS QUADRILATERALIS. Richardson. *Menominee White Fish.*
Lakes of New England and Great Lakes to Alaska. (J & E-I-465.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus quadrilateralis. In U. of M. Museum. Coll. by Richardson from Au Sable River.
Coregonus quagrilateralis. Rich. Bean. Bull. U. S. Nat. Mus. XXVII, 1884, 422. Mackinac Straits.
Coregonus quadrilateralis. Evermann and Smith. U. S. F. C. Report, 1894, 297. Northville, Sault Ste. Marie, Mackinac Straits.
Coregonus quadrilateralis. Meek. Field Columbian Mus. Publ. Zool. Series III, 1902, No. 7, 135. Sault Ste. Marie.
Coregonus quadrilateralis. Recorded by U. S. F. C. at Washington. Thunder Bay, Lake Superior.

(778) COREGONUS CLUPEIFORMIS. (Mitchell.) *Common White Fish.*
Great Lakes and neighboring streams. (J & E-I-465.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus clupeiformis. Bollman. Bull. U. S. F. C. 1888, 222. Torch Lake.
Salmo clupeiformis. Mitchell. Amer. Monthly Mag. 1818, 321. Sault Ste. Marie.
Coregonus clpeiformis. Goode. Bull. U. S. Nat. Mus. XIV, 57. Ecorse.
Coregonus clupeiformis. Bean. Bull. U. S. Nat. Mus. XXVII, 84, 422. Detroit River.
Coregonus clupeiformis. Jordan. Bull. U. S. F. C. 1885, 191. Marquette, Munising and Sault Ste. Marie.
Coregonus clupeiformis. Clarke. Bull. U. S. F. C. 1886, 395. Northville and Alpena.
Coregonus clupeiformis. Kirsch. Bull. U. S. F. C. 1893, 330. West end of Lake Erie.
Coregonus clupeiformis. Everman and Smith. U. S. F. C. Report, 1894, 299. Chaumont Bay, Three Mile Bay, Fox Isle and Point Peninsula.
Coregonus clupeiformis. Goode. U. S. F. C. Hist. Aquatic Animals, 1884, 507. Thunder Bay, Sault Ste. Marie, Point Detour, Ecorse, Detroit River, Green Bay, Grand Haven, Royal Isle and neighboring points.

Coregonus albus. (Le S.) Milner. U. S. F. C. Report, 1872-3, 45-50. Sault Ste. Marie, Detroit River, Torch Lake, Grand Traverse region, Thunder Bay Isles, Point Detour, Baileys Harbor, Door Isle, St. Clair River, Fort Gratiot and Ecorse.
Coregonus (white fish) Strange. Smithsonian. Report, 1854, 285. Beaver Isles.

(708) COREGONUS LABRADORICUS. Richardson. *Labrador Whitefish.*
Winnipeg and Great Lakes to Adirondacks.—(J & E-I-466).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus labradoricus. Jordan. Bull. U. S. F. C. 1885, 191. Sault Ste Marie.
Coregonus labradoricus. Evermann and Smith. U. S. F. C. Report, 1894, 303. Hudson Bay and Ecorse.
Coregonus labradoricus. Recorded by U. S. F. C. at Washington. Straits of Mackinaw.

(782) ARGYROSOMUS ARTEDI. (Le Sueur.) *Lake Herring.*
Great Lakes and neighboring waters.—(J & E-I-468).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus artedi. Bollman. Bull. U. S. F. C. 1888, 222. Torch Lake and Traverse Bay.
Argyrosomus artedi. Goode. Bull. U. S. Nat. Mus. XIV, 57. Au Sable River.
Argyrosomus artedi. Bean. Proc. U. S. Nat Mus., 1880, III, 105. Au Sable River.
Argyrosomus artedi. Bean. Bull. U. S. Nat. Mus., 1884, 423. Ecorse.
Argyrosomus artedi.—In U. of M. Museum. Collected by E. L. Michael from Belle Isle, November 16, 1903.
Coregonus artedi. Jordan. Bull. U. S. F. C. 1885, 191. Marquette, Munising and Sault Ste. Marie.
Argyrosomus artedi. Evermann and Smith. U. S. F. C. Report, 1894, 308. Chaumone and Three Mile Bays, Grenadier, Strong and Fox Isles, and St. Clair River.
Argyrosomus harengus. (Rich.) Milner. U. S. F. C. Report, 1872-3, 65. St. Clair River, Detroit River and Sault Ste. Marie.
Coregonus (herring) Strange. Smithsonian. Report, 1854, 286. Beaver Isles.

(782a) ARGYROSOMUS ARTEDI CISCO. Jordan.
Small Lakes of Indiana and Wisconsin.—(J & E-I-469).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus artedi cisco. Bollman. Bull. U. S. F. C. 1888, 222. Indian and Rawson Lakes.

(783) ARGYROSOMUS HOYI. Gill. *Moon-Eye Cisco.*
Deep waters of Lake Michigan.—(J & E-I-469).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Argyrosomus hoyi. Jordan. Geol. Rept. of Ind., 1874, 195. Lake Michigan, Superior and inland lakes of Michigan.

(787) ARGYROSOMUS PROGNATHUS. (H. M. Smith.) *Bloater.*
Lakes Ontario, Michigan, Superior and entire Great Lake Basin.—(J & E-I-472).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus prognathus. H. M. Smith. Bull. U. S. F. C. 1894, 4. Lakes Ontario and Michigan, and at Petoskey.
Argyrosomus prognathus. Recorded by U. S. F. C. at Washington. Lake Huron, 18 miles south of Detour, Mich., also Devils Isle, Lake Superior.

(788) ARGYROSOMUS NIGRIPINNIS. Gill. *Blue fin.*
Deep waters of Lake Michigan and lakes of Wisconsin and Minnesota. (J & E-I-472).
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus nigripinnis. Bean. Bull. U. S. Nat. Mus., 1884 423. Grand Haven.
Coregonus nigripinnis. Hay. Geol. Report of Indiana, 1894, 231. Grand Haven.
Argyrosomus nigripinnis. Milner. U. S. F. C. Report, 1872-3, 35. Grand Haven.
Coregonus nigripinnis. Recorded in U. S. Nat. Mus. at Washington. Grand Haven.
Argyrosomus nigripinnis. Evermann and Smith. U. S. F. C. Report, 1894, 320. Grand Traverse Bay.
Coregonus nigripinnis. Milner. U. S. F. C. Report, 1872-3, 9. Grand Traverse Bay.
Argyrosomus nigripinnis. Jordan. Geol. Report of Indiana, 1874, 195. Grand Traverse Bay.

(789) ARGYROSOMUS TULLIBEE. (Richardson.) *Tullibee.*
Great Lakes—Lake of the Woods and northward. (J & E-I-473.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus tullibee. Recorded in U. S. Nat. Mus. at Washington. Northville.

(789a) ARGYROSOMUS TULLIBEE BISSELLI. (Bollman.)
Small lakes of Michigan. (J & E-I-473.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Coregonus tullibee bisselli. Bollman. Bull. U. S. F. C. 1888, 223. Rawson and Howard Lakes.

(799) SALMO IRRIDEUS. Gibbons. *Rainbow Trout.*
Mountain streams of Pacific Coast. (J & E-I-500.)
Recorded in Michigan. (Introduced from McCloud River, Cal.)
Salmo irrideus. Clarke. Bull. U. S. F. C. 1886, 398. Northville, Mich.
Salmo irrideus. Meek. Field Columbian Mus. Publ. Zool. Series III, No. 7, 1902, 136. Sault Ste. Marie.

(800) CRISTIVOMER NAMAYCUSH. (Walbaum.) *Great Lake Trout.*
Great Lake region and lakes of northern New York, New Hampshire and Maine. Columbia and Frasier Rivers, north to Arctic Circle. (J & E-I-505.)
Great Lakes—List—Everman—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Salvelinus namaycush. Bollman. Bull. U. S. F. C. 1888, 223. Torch Lake.
Salmo amethystinus. Mitchell. Journ. Ac. Nat. Sci. Phila. 1818, 410. Sault Ste. Marie.
Frutta namaycush. Cope. Proc. Ac. Nat. Sci. Phila., 1865, 80. Saginaw Bay.
Salvelinus namaycush. Bean. Bull. U. S. Nat. Mus., 1884, 426. Mackinaw Straits.
Salvelinus namaycush. Jordan. Bull. U. S. F. C., 1885, 191. Marquette, Munising and Sault Ste. Marie.
Salvelinus namaycush. Clarke. Bull. U. S. F. C., 1886, 398. Northville.
Salvelinus namaycush. Goode. U. S. F. C. Hist. Aquatic Animals, Sect. I., 1884, 485. Green Bay, Grand Traverse Bay, Grand Haven, Thunder Bay, Detour, Mackinaw, Huron Bay at L'Anse, Bete Grise Bay, Port Gentre, Big Presque Isle, Laughing Fish Isle, Sharp Point, and Sauk's Head, St. Joseph, Port Huron, Beaver Isle, etc.
Salmo namaycush. Miller. U. S. F. C. Report, 1872-3, 39. West end of Lake Erie, Summer Isle, Lake Michigan, Detour, Lake Huron, St. Joseph, Shoal Isle, Lake Superior, Grand Haven and Mackinaw.
Salmo amethystus. Strange. Smithsonian Report, 1854. Beaver Isles.

(800) CRISTIVOMER NAMAYCUSH SISCOWET. (Agassiz.) *Siscowet.*
Lake Superior; abundant.—(J & E-I-505.)
Recorded in Michigan.
Salvelinus namaycush siscowet. Bean. Bull. U. S. Nat. Mus., 1884, 427. Straits of Mackinaw.
Salvelinus namaycush siscowet. Goode. U. S. F. C. Hist. Aquatic Animals, Sect. I, 1884, 496. Sault Ste Marie, Detroit, Royal Isle and vicinities.
Salmo siscowet. Suckley. U. S. F. C. Report, 1872-3, 157. Sault Ste. Marie and Detroit.
Salmo siscowet. Strange. Smithsonian Report, 1854, 283. Beaver Isles.
Cristivomer siscowet. Recorded by U. S. F. C. at Washington. Siscowet Lake, Royal Isle, Lake Superior.

(801) SALVELINUS FONTINALIS. (Mitchill.) *Brook Trout.*
Maine and Saskatchewan to Labrador, Alleghanies, Chatthoochee Catawa and French Broad; introduced into Western streams.—(J & E-I-506.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Salvelinus fontinalis. Bollman. Bull. U. S. F. C., 1888, 223. Spencer and Austin Creeks, Rapid River and Torch Lake.
Salvelinus fontinalis. Goode. Bull. U. S. Nat. Mus., XVIII, 1880, 35. Bay City.
Salvelinus fontinalis. Jordan. Bull. U. S. F. C., 1885, 192. Marquette, Munising, Sault Ste. Marie and vicinity.
Salvelinus fontinalis. Clarke. Bull. U. S. F. C., 1886, 397. Northville.
Salvelinus fontinalis. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902, 136. Sault Ste. Marie.
Salvelinus fontinalis.—In U. of M. Museum. Collected by Mitchell from Au Sable River.

Family LXV. Thymallidae. (The Graylings.)

(806) THYMALLUS TRICOLOR. Cope. *Michigan Grayling.*
Streams of Michigan, formerly abundant in Au Sable River, Jordan River and other rivers of Southern Peninsula, Otter Creek near Keweenaw, Mich.—(J & E-I-518.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Thymallus tricolor. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 80. Au Sable River.
Thymallus tricolor. Goode. Bull. U. S. Nat. Mus., XIV, 58. Au Sable River.
Thymallus tricolor. Goode. Bull. U. S. Nat. Mus., XVIII, 1880, 35. Au Sable River.
Thymallus tricolor. Bean. Proc. U. S. Nat. Mus., 1880, III, 105. Au Sable River.
Thymallus tricolor. Bean. Bull. U. S. Nat. Mus., XXVII, 1884, 423. Au Sable River.
Thymallus tricolor. Gunther's Cat., VI, 201. Michigan (no locality given).
Thymallus tricolor. Goode. U. S. F. C. Hist. Aquatic Animals, Sect. I, 1884, 506. Muskegon and Manistee Rivers, Au Sable River, Jordan River, Pine Lake, Great and Little Traverse Bays, Cheboygan River, Thunder Bay, Rifle River, Grayling, Portage Lake.

Family XC. Umbridae. (The Mud Minnows.)

(938) UMBRA LIMI. (Kirtland.) *Mud Minnow.*
Quebec to Minnesota, and south to Ohio River; Basin of Great Lakes. Rare in Ohio and Illinois.—(J & E-I-624.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Umbra limi. Bollman. Bull. U. S. F. C., 1888, 223. Brook emptying into Howard Lake, one specimen in Goguac Lake, three specimen in Rapid River.
Melanura limi (Ag.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 78. Flint River, Grosse Isle, and Oakland Co.
Umbra limi. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin River at Hudson and Manitou Beach.
Umbra limi. Collected by R. H. Pettit from Ingham Co., now in Agricultural College.
Umbra limi.—In U. of M. Museum. Collected by Geo. Wagner May 26, 1900, from Pittsfield Junction.

Family XCI. Luciidae. (The Pikes.)

(941) LUCIUS VERMICULATUS. (Le Sueur.) *Little Pickeral.*
Mississippi valley and tributaries of Lake Erie, Michigan.—(J & E-I-627.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lucius vermiculatus. Bollman. Bull. U. S. F. C., 1888, 223. Rawson and Goguac Lakes, and Wilder Creek.
Esox cypho. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 78. Waterford, Oakland Co.
Esox porosus, E. umbrosus. Cope. Cypr. Penn., 1869, 408. Waterford, Oakland Co., Grosse Isle and Detroit.
Lucius vermiculatus. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin and St. Joseph Rivers at Hudson, Tiffin River and Devil Lake at Manitou Beach.

(943) LUCIUS LUCIUS. (Linnaeus.) *Common Pike.*
Fresh water of northern Europe, Asia and North America to Alaska and Siberia.—(J & E-I-628.)
Recorded in Michigan.
Lucius lucius. Bollman. Bull. U. S. F. C., 1888, 223. Indian, Gourd Neck, Rawson, Goguac, Lower Brace and Clam Lakes; Spencer Creek.
Esox lucius. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 79. Michigan (no locality given).
Esox lucius. Bean. Bull. U. S. Nat. Mus., 1884, XXVII, 469. Michigan (no locality given).
Esox lucius. Jordan. Bull. U. S. F. C., 1885, 192. Marquette, Munising, Sault Ste. Marie and vicinity.
Lucius lucius. Kirsch. Bull. U. S. F. C., 1893, 330. St. Joseph River at Hudson.
Esox lucius. Goode. U. S. F. C. Hist. Aquatic Animals, 1884, 461. West end of Lake Erie.
Pike and Pickeral. Strange. Smithsonian Report, 1854, 283. Beaver Isles.
Lucius lucius. Recorded by U. S. F. C at Washington. Milk River, Lake St. Clair.

(944) LUCIUS MASQUININGY. (Mitchill.) *Muscalonge.*
Great Lake region, Upper Mississippi and northward.—(J & E-I-629.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Esox nobilior. (Thomp.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 80. Saginaw Bay.
Esox nobilior. (Thomp.) Cope. Cypr. Penn.,1869, 410. Saginaw Bay, Mich.
Esox nobilior. Goode. U. S. F. C. Hist. Aquatic Animals, Section I, 1884, 464. Keweenaw Point, Huron Bay, Cedar River, Menominee River, Saugatuck, South Haven, St. Joseph and Grand Haven. Little Traverse Bay, Thunder Bay, Mackinac Straits, Saginaw Bay, Point 'aux Barque, and Port Huron, St. Clair and Detroit Rivers.

Family XCII. Poecilidae. (The Killfishes.)

(959) FUNDULUS DIAPHANUS. (Le Sueur.)
Coast of Maine to Cape Hatteras.—(J & E-I-645.)
Recorded in Michigan.
Fundulus multifasciatus. (C. & V.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 78. Frederic, Macomb Co., Grosse Isle, and Oakland Co.
Fundulus diaphanus. Kirsch. Bull. U. S. F. C., 1893, 330. Devil Lake at Manitou Beach.

(959a) FUNDULUS DIAPHANUS MENONA. (Jordan and Copeland.)
Lakes and Ponds from Ohio to Mississippi River.—(J & E-I-646.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Fundulus diaphanus menona. Bollman. Bull. U. S. F. C., 1888, 223. Goguac, St. Mary's, Upper and Lower Brace and Lyon Lakes.

(986) FUNDULUS NOTATUS. (Rafinesque.) *Top Minnow.*
Michigan to Alabama, Mississippi and Texas.—(J & E-I- 659.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Zygonectes notatus. Bollman. Bull. U. S. F. C., 1888, 223. Rawson and Howard Lakes.
Fundulus aureas. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 78. Detroit River and Grosse Isle.
Haplochilus aureas. Gunther's Cat., VI, 315. Grosse Isle.
Hylorchychus notatus. Recorded in U. S. Nat. Mus. at Washington. Detroit River.
Fundulus notatus.—In U. of M. Museum. From Houses Lake, Kent Co., June 6, 1903.

Family XCVIII. Gasterosteidae. (The Stickle backs.)

(1117) EUCALIA INCONSTANS. (Kirtland.) *Brook Stickle-back.*
New York to Kansas and north to Saskatchewan, Great Lakes, and south to central Ohio and Illinois.—(J & E-I-744.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Gasterosteus inconstans. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 81. Grosse Isle.
Eucalia inconstans. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 137. Sault Ste. Marie.
Eucalia inconstans. Collected by R. H. Pettit. Agricultural College, from Ingham Co.
Eucalia inconstans.—In U. of M. Museum. April 23, 1903, from Steers Swamp, south of Ann Arbor.

(1118) PYGOSTEUS PUNGITIUS. (Linnaeus.) *Nine-spined Stickle-back.*

Northern Europe and Atlantic Coast of U. S. from Long Isle to Artic Sea, Great Lakes to Saskatchewan.—(J & E-I-745.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Pygosteus pungitius. Bollman. Bull. U. S. F. C., 1888, 223. Rapid River.

Family CV. Percopsidae. (The Sand Rollers.)

(1169) PERCOPSIS GUTTATUS. Agassiz. *Trout-perch.*
Kansas and northward, Great Lakes and Hudson Bay, rare in Lake Erie and Upper Mississippi.—(J & E-I-784.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Percopsis guttatus. Gunther's Cat., VI, 207. Sault Ste. Marie.
Percopsis guttatus. Recorded in U. S. Nat. Mus at Washington. Bay City and Ecorse. Reported by D. S. Jordan from Green Bay.

Family CVI. Aphredoderidae. (The Pirate Perches.)

(1171) APHREDODERUS SAYANUS. (Gilliam.) *Pirate Perch.*
New York to Texas and throughout Mississippi valley.—(J & E-I-786.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Aphredoderus sayanus. Bollman. Bull. U. S. F. C., 1888, 223. Howard Lake.

Family CVII. Atherinidae. (The Silver sides.)

(1202) LABIDESTHES SICCULUS. (Cope.) *Brook Silver side.*
Lake Ontario and southern Michigan to Iowa, Texas and Florida.—J & E-I-806.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Labidesthes sicculus. Bollman. Bull. U. S. F. C., 1888, 223. Long, Austin, Gourd Neck, Rawson, Howard, Goguac, St. Mary's and Lyon Lakes.
Chirostoma sicculum. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 81. Grosse Isle, Detroit River.
Labidesthes sicculus. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River and Devil Lake at Manitou Beach.

Family CXLIII. Centrarchidae. (The Sun-fishes.)

(1410) POMOXIS SPAROIDES. (Lacépède.) *Calico Bass.*
Great Lakes and Upper Mississippi valley.—(J & E-I-987.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Pomoxis sparoides. Bollman. Bull. U. S. F. C., 1888, 223. Long, Indian, Austin, Gourd Neck, Rawson, Howard, Goguac, St. Mary's, Upper and Lower Brace, and Lyon Lakes.
Hyperistius hexacanthus. (Gill.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 84. Saginaw Bay.
Pomoxis sparoides. Recorded by U. S. F. C. at Washington. Sandusky Bay.

(1413) AMBLOPLITES RUPESTRIS. (Rafinesque.) *Common Rock Bass.*
Vermont to Great Lake region and Manitoba.—(J & E-I-990.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Ambloplites rupestris. Bollman. Bull. U. S. F. C., 1888, 224. Long, Gourd Neck, Rawson, Goguac, Lower Brace, Torch and Clam Lakes.
Ambloplites rupestris. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 84. Algonia, St. Clair Co., and Flint River.
Ambloplites rupestris. Bean. Proc. U. S. Nat. Mus., III, 1880. Alpena.
Ambloplites rupestris. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River and Devil Lake at Manitou Beach.
Ambloplites rupestris.—In U. of M. Museum. Collected by E. L. Michael May 5, 1903, from Huron River at Ann Arbor.
Ambloplites rupestris. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902, 137. Sault Ste. Marie.

(1415) CHAENOBRYTHUS GULOSUS. (Cuvier and Valenciennes.) *Goggle Eye.*
Eastern U. S. from Great Lakes to Carolina and Texas, Kansas and Iowa.—(J & E-I-992.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Chaenobrythus gulosus. Bollman. Bull. U. S. F. C., 1888, 224. Rawson and Lower Brace Lakes.
Chaenobrythus gulosus. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin River at Manitou Beach.

(1419) APOMOTIS CYANELLUS. (Rafinesque.) *Blue Spotted Sunfish.*
Great Lake region to Mexico, Ohio to Rio Grande.—(J & E-I-996.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lepomis cyanellus. Bollman. Bull. U. S. F. C., 1888, 224. Rawson, Goguac and St. Mary's Lakes.
Lepomis cyanellus. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River at Manitou Beach.

(1427) LEPOMIS MEGALOTIS. (Rafinesque.) *Long-eared Sun-fish.*
Michigan to Minnesota, South Carolina and Rio Grande.—(J & E-I-1003.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lepomis megalotis. Bollman. Bull. U. S. F. C., 1888, 224. Rawson, Paynes and Clam Lakes, also Kalamazoo River.
Lepomis peltastes. Cope. Proc. Amer. Phil. Soc., 1870, XI, 2nd Series 454. Huron River, Ann Arbor.
Xenotis peltastes. Bean. Proc. U. S. Nat. Mus., 1880, III, 98. Michigan (no locality given).
Lepomis megalotis. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin River and St. Joseph River at Hudson, Tiffin River and Devil Lake at Manitou Beach.
Sunfish. (Pomotis.) Strange. Smithsonian Report, 1854, 287. Beaver Isle.

(1431) LEPOMIS PALLIDUS. (Mitchill.) *Blue Sun-fish.*
Great Lakes to Florida and Rio Grande.—(J & E-I-1005.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lepomis pallidus. Bollman. Bull. U. S. F. C., 1888, 224. Kalamazoo River, Long, Austin, Goguac, Upper and Lower Brace, Howard, Indian, Gourd Neck, Rawson, St. Mary's, Barnum and Paynes, Lyon and Clam Lakes.
Lepomis longispines. Cope. Journ. Ac. Nat. Sci., Phila., VI. 2nd series, 220. Michigan (no locality given).
Lepomis pallidus. Bean. Bull. U. S. Nat. Mus., 1884, XXVII, 463. Pine Lake, Ingham Co.
Lepomis pallidus. Kirsch. Bull. U. S. F. C., 1893, 330. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River and Devil Lake at Manitou Beach.
Pomotis maculatus. (Gill.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 83. Waterford, Oakland Co., Clinton River, Long Lake and Copenaconic Lakes, Genesee Co., and Grosse Isle.
Lepomis incisor. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 83. Same as above with the addition of Straits Lake, Oakland Co., and Crooked Lake, Genesee Co.
Lepomis pallidus.—In U. of M. Museum. From Button Lake, May 21, 1903. Also collected by E. L. Michael from Huron River at Ann Arbor May 5, 1903.

(1435) EUPOMOTIS EURYORUS. (McKay.)
Upper Great Lakes.—(J & E-I-1008.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lepomis euryorus. McKay. Proc. U. S. Nat. Mus., 1881, 89. Fort Gratiot.
Lepomis auritus. Boulenger. Cat. I, 1895, 24. Iowa to Michigan.

(1436) EUPOMOTIS GIBBOSUS. (Linnaeus.) *Common Sun-fish.*
Great Lake region to Maine and Florida.—(J & E-I-1009), and northern parts of Mississippi valley.
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lepomis gibbosus. Bollman. Bull. U. S. F. C., 1888, 224. Kalamazoo River, Long, Austin, Goguac, Upper and Lower Brace, Howard, Indian, Gourd Neck, Rawson, St. Mary's, Barnum and Paynes, Lyon and Clam Lakes.
Pomotis vulgaris. C. & V. Hist. Nat. Poisse, III, 91. Lake Huron.
Lepomis gibosus. Kirsch. Bull. U. S. F. C., 1893. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River and Devil Lake at Manitou Beach.
Eupomotis Gibbosus. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902, 137. Sault Ste. Marie.

(1437) MICOPTERUS DOLOMIEU. Lacépède. *Small-mouthed Black Bass.*
Lake Champlain to Manitoba from James River to South Carolina and Arkansas.—(J & E-I-1011.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Micropterus dolomieu. Bollman. Bull. U. S. F. C., 1888, 224. Torch Lake, Goguac Lake (young only found) and Kalamazoo River.
Micropterus fasciatus. (Gill.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 83. Schwartz Creek, Saginaw Bay and Grosse Isle.
Micropterus fasciatus. (Gill.) Cope. Journ. Ac. Nat. Sci., Phila., VI, 2nd series, 216. Michigan (no locality given).
Micropterus dolomieu. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River at Manitou Beach.

(1438) MICROPTERUS SALMOIDES. Lacépède.) *Large-mouthed Black Bass.*
Rivers of U. S. from Great Lakes and Red River to Florida, Texas and Mexico.—(J & E-I-1012.)
Recorded in Michigan.
Micropterus salmoides. Bollman. Bull. U. S. F. C., 1888, 224. Long, Austin, Indian, Gourd Neck, Rawson, Howard, Goguac, Paynes, Barnums, St. Mary's, Upper and Lower Brace, Lyon, Torch and Clam Lakes, Spencer Creek and Kalamazoo River.
Micropterus salmoides. Bean. Proc. U. S. Nat. Mus., 1880, III, 96. Bay City and Alpena.
Micropterus salmoides. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River and Devil Lake at Manitou Beach.
Micropterus nigricans. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 83. Lake Superior, Orchard and Straits Lakes, Bald Eagle and Copenaconic Lakes and Grosse Isle.
Micropterus salmoides.—In U. of M. Museum. Collected by Cole and Beckwith, 1899, from Huron River near Geddes.

Family CXLV. Percidae. (The Perches.)

(1441) STIZOSTEDION VITREUM. (Mitchill.) *Wall-eyed Pike.*
Great Lake region, Upper Mississippi to Assiniboia, Vermont and Pennsylvania, Georgia and Alabama.—(J & E-I-1021.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Stizostedion vitreum. Bollman. Bull. U. S. F. C., 1888, 225. Gourd Neck Lake.
Stizostedion vitreum. Bean. Proc. U. S. Nat. Mus., 1880, III, 100. Au Sable and Ecorse.
Stizostedion vitreum. Jordan. Bull. U. S. F. C., 1885, 192. Sault Ste. Marie.
Stizostedion vitreum. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902. Sault Ste. Marie.
Stizostedion vitreum. Goode. U. S. F. C. Hist. Aquatic Animals, Section I, 1884, 417. Ontonagon, Squaw and Siscowet Bays, Keweenaw Point, Marquette, Portage Entry, L'Anse, Laughing Fish Point, Short Point, Big Presque Isle, Grand Isle, Escanaba, Chippewa Point, Summer Isle, St. Martin's Isle and Point aux Barque, Cedar River, Peshtego River, Menominee River, Longtail Point, Saugatuck, South Haven, St. Joseph, Ludington, Point Sable, Grand Haven, Little and Great Traverse Bays, Fox Isle, Mackinac Straits, Mud Lake, Sault Ste. Marie, Saginaw Bay, Alpena, Detroit River, St. Clair River, Port Huron and Maumee Bay.
Stizostedion americanum. Milner. U. S. F. C. Report, 1872-3, 10, 11 and 34. Green Bay to Pestego, Saginaw and Thunder Bays, Bay City and west end of Lake Erie.
Stizostedion americanum. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Saginaw Bay.
Stizostedion vitreum. Recorded by U. S. F. C. at Washington. Saginaw Bay, Caseville.
Stizostedion vitreum. Recorded in U. S. Nat. Mus. at Washington. Ecorse.
Stizostedion vitreum.—In U. of M. Museum. Collected by E. L. Michael November 16, 1903, from Belle Isle.

(1442a) STIZOSTEDION CANADENSE GRISEUM. (DeKay.) *Pickering.*
Great Lakes and south to Kentucky and Arkansas.—(J & E-I-1022.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lucioperca grisa. Recorded in U. S. Nat. Mus. at Washington, from Ecorse.

(1443) PERCA FLAVESCENS. (Mitchill.) *American Perch.*
East U. S., Great Lakes, Upper Mississippi valley, Iowa and Minnesota west to Dakota's and Missouri River.—(J & E-I-1023.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Perca flavescens. Bollman. Bull. U. S. F. C., 1888, 225. Long, Austin, Indian, Gourd Neck, Rawson, Howard, Goguac, St. Mary's, Barnums, Paynes, Upper and Lower Brace, Lyon, Torch and Clam Lakes.

Perca flavescens. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Oakland Co.; Saginaw Bay, Pine Lakes and vicinity.

Perca fluviatilus. Bean. Proc. U. S. Nat. Mus., 1880, III, 100. Ecorse and Van Hutton Lake.

Perca lutea. (Raf.) Jordan. Bull. U. S. F. C., 1885, 192. Sault Ste. Marie.

Perca flavescens. Kirsch. Bull. U. S. F. C., 1893, 331. Devil Lake and Tiffin River at Manitou Beach.

Perca flavescens. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902. Sault Ste. Marie.

Perca Americana. Goode. U. S. F. C. Hist. Aquatic Animals, Sect. I, 1884, 417. South shore of Lake Superior, east to Keweenaw Point and Isles included. Cedar River, Marquette Harbor, New Buffalo, St. Joseph, Ludington, Manistee, Grand Haven, Little and Great Traverse Bays, Fox Isles, Straits of Mackinac, Saginaw Bay, Menominee River, White Fish Bay, Sheboygan, west shore of Lake Huron to Detroit, Thunder Bay, Port Huron and St. Clair River.

Perch. Strange. Smithsonian Report, 1854, 285. Beaver Isles.

Perca americana. Recorded in U. S. Nat. Mus. at Washington, from Fort Gratiot.

(1445) PERCINA CAPRODES. (Rafinesque.) *Rock-fish.*

Great Lakes and streams of southwest from Quebec to Lake Superior and Iowa, south to Mississippi and Rio Grande.—(J & E-I-1026.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Etheostoma caprodes. (Raf.) Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson and, Tiffin at Manitou Beach.

Percina caprodes. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902, 138. Sault Ste. Marie.

(1445a) PERCINA CAPRODES ZEBRA. (Agassiz.) *Manitou Darter.*

Lakes of northern Indiana, Michigan and Wisconsin to Great Lakes. —(J & E-I-1027.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Etheostoma caprodes zebra. (Ag.) Bollman. Bull. U. S. F. C., 1888, 224. Goguac and Torch Lakes and Spencer Creek.

Percina caprodes. (Gir'd and Putnam.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Grosse Isle.

Percina caprodes zebra. Recorded in U. S. Nat. Mus. at Washington from Fort Gratiot and Port Huron and Sault Ste. Marie.

Pileoma zebra. Recorded in U. S. Nat. Mus. at Washington from Sault Ste. Marie and Ecorse.

(1448) HADROPTERUS MACULATUS. (Girard.)

Michigan.—(J & E-I-1031.)

Recorded in Michigan.

Alvordius maculatus. Girard. Proc. Ac. Nat. Sci., Phila., 1859, 67. Fort Gratiot.

Hadropterus maculatus. Recorded in U. S. Nat. Mus. at Washington from Ann Arbor.

(1449) HADROPTERUS ASPRO. (Cope and Jordan.) *Black sided Darter.*

Great Lake region to Middle Missouri and Minnesota to Indiana, Kentucky and Arkansas.—(J & E-I-1032.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Etheostoma aspro. Bollman. Bull. U. S. F. C., 1888, 224. Kalamazoo River at Kalamazoo.

Etheostoma aspro. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River at Manitou Beach.

Hadropterus aspro. Recorded in U. S. Nat. Mus. at Washington from Port Huron.

(1463) COTTOGASTER COPLANDI. (Jordan.)

Great Lake region to Lake Champlain—to Missouri, Central Indiana and Ozark region.—(J & E-I-1045.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Cottogaster putnami. Recorded in U. S. Nat. Mus. at Washington from Ecorse.

(1471) DIPLESION BLENNIOIDES. Rafinesque. *Green sided Darter.*

Pennsylvania to South Dakota and Kansas south to Alabama.—(J & E-I-1053.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Etheostoma blennioides. (Raf.) Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River at Manitou Beach.

Hyostoma cymatogramma. (Abbot.) Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Grosse Isle.

(1474) BOLEOSOMA NIGRUM. (Rafinesque.) *Johnny Darter.*

East U. S. especially in Ohio valley, Great Lake region and Upper Mississippi to Columbia and Manitoba.—(J & E-I-1056.)

Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.

Etheostoma nigrum. Bollman. Bull. U. S. F. C., 1888, 224. Goguac, Long, Torch and Clam Lakes, Spencer Creek, and Kalamazoo River.

Etheostoma nigrum. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson, and Devil Lake at Manitou Beach.

Boleosoma nigrum. Meek. Field Columbian Mus. Publ. Zool, Series III, No. 7, 1902, 738. Sault Ste. Marie.

(1474a) BOLEOSOMA NIGRUM OLMSTEDI. (Storer.) *Tessellated Darter.*
Lake Ontario to Virginia, chiefly coastwise and east of the Alleghanies.—(J & E-I-1057.)
Recorded in Michigan.
Boleosoma olmstedi. Recorded in U. S. Nat. Mus. at Washington from Port Huron.

(1478) AMMOCRYPTA PELLUCIDA. (Baird.) *Sand Darter.*
Lake Erie to Minnesota, Kentucky and Texas.—(J & E-I-1062.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Etheostoma pellucidum. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph Rivers at Hudson, and Tiffin River at Manitou Beach.
Pleurolepsis pellucidus. Recorded in U. S. Nat. Mus. at Washington from Detroit River and Port Huron.

(1502) ETHEOSTOMA JESSIAE. (Jordan and Brayton.)
Indiana to Iowa and south to Mississippi and Texas.—(J & E-I-1084.)
Recorded in Michigan.
Etheostoma jessiae. Kirsch. Bull. U. S. F. C., 1893, 331. Devil Lake and Tiffin River at Manitou Beach.

(1505) ETHEOSTOMA COERULEUM. Storer. *Rainbow Darter.*
Mississippi and Ohio valleys.—(J & E-I-1088.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Etheostoma coeruleum. Bollman. Bull. U. S. F. C., 1888, 224. Kalamazoo River.
Etheostoma coeruleum. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin River at Hudson, and at Manitou Beach.
Poecilichthys coeruleus. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Grosse Isle.

(1518) ETHEOSTOMA FLABELLARE. Rafinesque. *Fan-tailed Darter.*
New York to Virginia, Iowa, South Carolina and Alabama.—(J & E-I-1097.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Etheostoma flabellare. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin and St. Joseph River at Hudson, and Devil Lake at Manitou Beach.

(1522) BOLEICHTHYS FUSIFORMIS. (Girard.)
Streams and ponds from Massachusetts, Minnesota and Rio Grande.—(J & E-I-1102.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Etheostoma fusiforme eos. (J. & C.) Bollman. Bull. U. S. F. C., 1888, 224. Rawson, Goguac, St. Mary's, and Thayer Lakes.
Etheostoma eos. Kirsch. Bull. U. S. F. C., 1893, 331. Tiffin River at Manitou Beach.
Etheostoma fusiforme eos. Jordan. Bull. U. S. F. C., 1888, 118. Clam Lake.

(1523) BOLEICHTHYS EXILES. Girard.
Upper Missouri River to basin of Red River of North.—(J & E-I-1103.)
Recorded in Michigan.
Etheostoma fusiforme exiles. Jordan. Bull. U. S. F. C., 1888, 118. Thayer Lake.
Etheostoma exiles. Bollman. Bull. U. S. F. C., 1888, 224. Clam Lake.

(1525) MICROPERCA PUNCTULATA. Putnam. *Least Darter.*
Indiana, Michigan, Minnesota to Arkansas.—(J & E-I-1104.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Microperca punctulata. Putnam. Bull. I, Mus. Comp. Zool., 1863, 4. Michigan (various points).
Microperca punctulata. Recorded in U. S. Nat. Mus. at Washington from Ecorse and Port Huron.

Family CXLVII. Serranidae. (The Sea Basses.)

(1557) ROCCUS CHRYSOPS. (Rafinesque.) *White Bass.*
Great Lake region to Upper Mississippi and Ohio Valley.—J & E-I-1132.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Roccus chrysops. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 83. Saginaw Bay.
Roccus chrysops. Goode. U. S. F. C. Hist. Aquatic Animals, Section I, 1884, 428. Siscowet and Fry Bays, Cedar River, Menominee and Peshtego, St. Martins Isle, New Buffalo, Saugatuck, St. Joseph River, east shore of Lake Michigan from Allegan Co., to Leelanau Co., Manistee, Ludington, Point Au Sable, Grand Haven, Grand and Little Traverse Bays, Fox Isles, Presque Isles, Mackinac Straits, Alpena, Thunder and Saginaw Bays, Port Huron, St. Clair River, Point aux Barques and Detroit River.

Family CLVII. Sciaenidae. (The Croakers.)

(1900) APLODINOTUS GRUNNIENS. Rafinesque. *Lake Sheepshead.*
Great Lake region to Texas.—(J & E-II-1484.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

Recorded in Michigan.
Haploidonotus grunniens. Bean. Proc. U. S. Nat. Mus., 1880, III, 94. Detroit and Au Sable Rivers.
Haploidonotus grunniens. Bean. Bull. U. S. Nat. Mus., XXVII, 1884, 460. Ecorse.
Coirina richardsonii. Gunther's Cat. II, 298, 1860. Lake Huron.
Aplodinotus grunniens. Recorded by U. S. F. C. at Washington from Sandusky Bay.

Family CLXXX. Cottidae. (The Sculpins.)

(2335) COTTUS ICTALOPS. (Rafinesque.) *Miller's Thumb.*
Middle and northern States east of Dakota's and Kansas to New York and Virginia.—(J & E-II-1950.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Cottus bairdi. (Gir'd.) Bollman. Bull. U. S. F. C., 1888, 225. Rice and Spencer Creeks, Rapid River and Torch Lake.
Potamocottus alvordii. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Dexter, Washington Co., and Grosse Isle.
Cottus alvordii. Girard. Monograph Cottoids, 1851, 46. Fort Gratiot.
Uranidea richardsonii. (Ag.) Jordan. Bull. U. S. F. C., 1885, 192. Marquette.
Cottus ictalops. Meek. Field Columbiam Mus. Publ. Zool., Series III, No. 7, 1902, 138. Sault Ste. Marie.
Cottus alvordii. Gunther's Cat. II, 158. Streams of Lake Huron.

(2346) COTTUS SPILOTUS. (Cope.)
Michigan.—(J & E-II-1962.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Uranidea spilota. Cope. Proc. Ac. Nat. Sci., Phila., 1865, 82. Grand River at Grand Rapids.

(2350) URANIDEA FRANKLINI. (Agassiz.)
Lake Superior.—(J & E-II-1967.)
Recorded in Michigan.
Cottus franklini. Girard. Monograph Cottoids, 1851, 53. South and east shores of Lake Superior.
Uranidea franklini. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902. Sault Ste. Marie.

(2352) URANIDEA GRACILIS. (Heckel.)
Streams of New England and New York, recorded from tributaries of Connecticut, Lake Champlain, Hudson, Delaware and Susquehanna.—(J & E-II-1968.)
Recorded in Michigan.
Uranidea gracilis. Among the collection in the University of Michigan Museum from Miller's Thumb.

(2375) TRIGLOPSIS THOMPSONI. Girard.
Deep waters of Great Lakes.—(J & E-II-2005.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95

Recorded in Michigan.
Triglopsis thompsoni. Bollman. Bull. U. S. F. C., 1888, 225. Torch Lake (found in the stomach of Cristivomer mamaycush).

Family CCXX. Gadidae.

(2915) LOTA MASCULOSA. (Le Sueur.) *Lawyer.*
New England and Great Lake region, north to Artic seas and west to Frasier River basin.—(J & E-III-2551.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.
Recorded in Michigan.
Lota lota. Bollman. Bull. U. S. F. C., 1888, 225. Torch Lake.
Lota maculosa. Bean. Proc. U. S. Nat. Mus., III, 1880, 81. Alpena.
Lota. Strange. Smithsonian Report, 1854, 287. Beaver Isles.
Lota lota. Jordan. Bull. U. S. F. C., 1885, V., 192. Marquette, Munising, Sault Ste. Marie and vicinity.
Lota maculosa. Meek. Field Columbian Mus. Publ. Zool., Series III, No. 7, 1902. Sault Ste. Marie.
Lota maculosa. Occurs quite abundantly in the Detroit River at Belle Isle, where it has been collected by myself.

Partial Table of Michigan Fish in U. S. Nat. Museum.

Catalogue No.	Name.	Synonym.	Collector.	Locality.
11214	Myostoma carpio	Moxostoma anisurum	J. W. Miller	Alpena, Mich.
8742	Erimyzon oblongus	E. Sucetta oblongus	S. F. Baird	Detroit river.
.....	Catostomus nigricans	C. nigricans	J. W. Miller	Ecorse, Mich.
10563	Hylomyzon nigricans	C. nigricans	J. W. Miller	Ecorse, Mich.
8329	Catostomus teres	C. commersonii	S. F. Baird	Port Huron.
8728	Catostomus teres	C. commersonii	S. F. Baird	Huron river.
9393	Catostomus teres	C. commersonii	G. Clarke	Ecorse, Mich.
.....	Catostomus teres	C. commersonii	.....	Ecorse and Northville.
11212	Catostomus longirostris	C. catostomus	J. W. Miller	Au Sable river.
11213	Catostomus longirostris	C. catostomus	J. W Miller	Au Sable river.
12210	Catostomus longirostris	C. catostomus	J. W. Miller	Au Sable river.
20285	Catostomus aurora	C. catostomus	J. W. Miller	Grand Junction.
8895	Moxostoma aureolus	M. aureolum	G. Clarke	Ecorse, Mich.
10254	Placopharynx macrolepidota	P. duquesnii	J. W. Miller	Ecorse, Mich.
9462	Placopharynx carinatus	P. duquesnii	S. F. Baird	Detroit river.
.....	Coregonus nigripinnis	Argyrosomus nipriginnis	J W. Miller	Grand Haven.
.....	Petromyzon argentius	Ichthyomyzon concolor	.....	Ecorse, Mich.
.....	Coregonus tullibee	Argyrosomus tullibee	.....	Northville.
.....	Rhinichthys cataractae	Rhinichthys cataractae	J. W. Miller	Northville.
8953	Rhinichthys atronasus	Rhinichthys atronasus	S. F. Baird	Huron river.
20916	Notemigonus chrysoleucus	Abramis crysoleucas	Fitsgerald	Bay City, Mich.
36936	Notemigonus chrysoleucus	Abramis crysoleucas	Hutty	Grand Haven.
19791	Notropis megalops	Notropis cornutus	Milner	Alpena, Mich.
19792	Notropis megalops	Notropis cornutus	Milner	Alpena, Mich.
35767	Notropis hudsonius	Notropis hudsonius	Milner	Ecorse, Mich.
8593	Notropis hudsonius	Notropis hudsonius	S. F. Baird	Port Huron, Mich.
36594	Notropis hudsonius	Notropis hudsonius	S. F. Baird	Detroit river.
8733	Luxilus cornutus	Notropis cornutus	S. F. Baird	Detroit river.
8910	Luxilus cornutus	Notropis cornutus	S. F. Baird	Detroit river.
8699	Luxilus cornutus	Notropis cornutus	S. F. Baird	Port Huron.
8589	Notropis analostana	Notropis analostanus	S. F. Baird	Detroit river.
3991	Luxilus storerianus	Notropis hudsonius amarus	Milner	Ecorse, Mich.
8593	Luxilus storerianus	Notropis hudsonius amarus	S. F. Baird	Port Huron.
8445	Nocomis biguttatus	Hybopsis kentuckiensis	S. F. Baird	Grosse Isle.
8452	Nocomis biguttatus	Hybopsis kentuckiensis	S. F. Baird	Huron river.

Partial Table of Michigan Fish in the U. S. Nat. Museum.

Catalogue No.	Name.	Synonym.	Collector	Locality.
20416	Semotilus corporalis	Semotilus corporalis	Milner	Northville..
8416	Semotilus corporalis	Semotilus corporalis	S. F. Baird	Port Huron.
6860	Hyborynchus notatus	Fundulus notatus	S. F. Baird	Detroit river.
20332	Couesius prosthemius	Couesius plumbeus	Milner	Grand Isle.
35302	Cottogaster putnami	Cottogaster copelandi	Milner	Ecorse.
10555	Lucioperca grisa	Stizostedion canadense grisium	Milner	Ecorse, Mich.
7268	Perca americana	Perca flavescens		Ft. Gratiot, Mich.
1201	Percina caprodes zebra	Percina caprodes zebra	Alvord	Ft. Gratiot, Mich.
1285	Percina caprodes zebra	Percina caprodes zebra (type)	S. F. Baird	Port Huron, Mich.
36605	Percina caprodes zebra	Percina caprodes zebra	Milner	Sault Ste. Marie, Mich.
3530	Microperca punctulata	Microperca punctulata	Milner	Ecorse, Mich.
1288	Microperca punctulata	Microperca punctulata	S. F. Baird	Port Huron, Mich.
1286	Hadropterus aspro	Hadropterus aspro	S. F. Baird	Port Huron, Mich.
32545	Percopsis guttatus	Percopsis guttatus	Fitzhugh	Bay City, Mich.
24773	Percopsis guttatus	Percopsis guttatus	Milner	Ecorse, Mich.
15254	Pileoma zebra	Percina caprodes zebra	Milner	Sault Ste. Marie, Mich.
379	Pileoma zebra	Percina caprodes zebra	Milner	Ecorse, Mich.
1295	Pleurolepsis pellucidus	Ammocrypta pellucida	S. F. Baird	Detroit river.
1289	Pleurolepsis pellucidus	Ammocrypta pellucida	S. F. Baird	Port Huron.
10552	Lucioperca americana	Stizostedion vitrium	Milner	Ecorse, Mich.
8711	Lucioperca americana	Stizostedion vitrium	Clarke	Ecorse, Mich.
1292	Hadropterus maculatus	Hadropterus maculatus	S. F. Baird	Ann Arbor, Mich.
1287	Boleosoma olmstedi	Boleosoma nigrium olmstedi	S. F. Baird	Port Huron, Mich.
23494	Coregonus quadrilateralis	C. quadrilateralis	L. Kumlien	Mackinac straits.
10574	Coregonus clupeiformis	C. clupeiformis	J. W. Milner	Sand Isle, Lake Superior.
28569	Coregonus clupeiformis	C. clupeiformis	Frank N. Clark	Detroit river.
10258	Coregonus artedi	Argyrosomus artedi	J. W. Milner	Ecorse.
10257	Coregonus nigripinnis	Argyrosomus nigripinnis	J. W. Milner	Grand Haven.
11115	Thymallus tricolor	Thymallus tricolor	J. W. Milner	Au Sable river.
32583	Salvelinus namaycush	Cristivomer namaycush	Frank N. Clark	Michigan.
23493	Salvelinus namaycush siscowet	Cristivomer namaycush siscowet	L. Kumlien	Mackinac straits.
10542	Haploidonotus grunniens	Aplodinotus grunniens	J. W. Milner	Ecorse.
8410	Lepomis pallidus	Lepomis pallidus		Pine lake, Ingham Co.
32584	Esox lucius	Lucius lucius	Frank N. Clark	Michigan.
11087	Thymallus tricolor	Thymallus tricolor	J. W. Milner	Au Sable river.

HYPOTHETICAL LIST OF MICHIGAN FISH.

(148) POLYODON SPATHULA. (Walbaum.)
Mississippi valley and rivers of Southern States; Lake Erie—(J & E-I-101.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(219) AMEIURUS LACUSTRIS. (Walbaum.)
Saskatchewan River and Great Lakes to Florida and Texas.—J & E-I-137.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(270) ICTIOBUS CYPRINELLA. (Cuvier and Valenciennes.)
Mississippi Valley, abundant in larger streams.—(J & E-I-163.)

(271) ICTIOBUS URUS. (Rafinesque.)
Mississippi Valley.—(J & E-I-164.)

(273) ICTIOBUS BUBALUS. (Rafinesque.)
Mississippi River and Valley and southward.—(J & E-I-164.)

(313) ERIMYZON SUCETTA. (Lacépède.)
Great Lakes and Mississippi Valley, in lakes and lowland streams.—(J & E-I-185.)

(330) MOXOSTOMA BREVICEPS. (Cope.)
Ohio Valley and Great Lakes, abundant in Lake Erie.—(J & E-I-195.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(407) OPSOPOEODUS EMILLAE. Hay.
Lake Erie and Southern Indiana to Georgia and Mississippi.—(J & E-I-248.)

(409) NOTROPIS ANOGENUS. (Forbes.)
Western Ohio to Illinois.—(J & E-I-248.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(419) NOTROPIS ANOGENUS. Forbes.
Western New York to northern Illinois. (J & E-I-259.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(503) NOTROPIS RUBRIFRONS. (Cope.)
New York and Western Pennsylvania to Southern Michigan, Kansas and Kentucky.—(J & E-I-295.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(512) NOTROPIS UMBRATILIS. (Girard.)
Minnesota to Western New York, North Carolina, Alabama and Kansas.—(J & E-I-298.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(542) HYBOPSIS DISSIMILIS. (Kirtland.)
Lake Erie to headwaters of Tennessee, west to Arkansas and Iowa.—(J & E-I-319.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(548) HYBOPSIS STORERIANUS. (Kirtland.)
Lake Erie to Nebraska, Wyoming, Tennessee, Arkansas and Iowa.—(J & E-I-321.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(689) HIODON ALSOIDES. (Rafinesque.)
Ohio River and north to the Saskatchewan.—(J & E-I-413.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(705) POMOLOBIS CHRYSOCHLORIS. (Rafinesque.)
Gulf of Mexico and Mississippi valley. Introduced into Lakes Erie and Michigan.—(J & E-I-425.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(942) LUCIUS RETICULATUS. (Le Sueur.)
Maine to Florida and Louisiana, Arkansas and Tennessee, Ozark region.—(J & E-I-627.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(985) FUNDULUS DISPAR. (Agassiz.)
Lakes and sluggish streams from Northern Ohio to Missouri and Mississippi.—(J & E-I-658.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(1409) POMOXIS ANNULARIS. Rafinesque.
Middle U. S. from Great Lakes to Texas, Kansas and Nebraska.—(J & E-I-987.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(1464) COTTOGASTER SHUMARDI. (Girard.)
Michigan, Ohio, Indiana and Illinois to Kentucky and Arkansas.—(J & E-I-1046.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(1518b) ETHEOSTOMA FLABELLARE LINEOLATUM. (Agassiz.)
Minnesota and Northern Indiana to Missouri.—(J & E-I-1098.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(2336) COTTUS RICEI. (Nelson.)
Great Lakes.—(J & E-II-1952.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(2351) URANIDE KUMLIENII. Hay.
Lake Michigan, in deep water.—(J & E-II-1968.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

(2354) URANIDE HOYI. Putnam.
Lake Michigan, in deep water.—(J & E-II-1969.)
Great Lakes—List—Evermann—Bull. U. S. F. C. 1901, 95.

University of Michigan, Ann Arbor, Mich., Jan. 20th, 1904.

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