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A PRELIMINARY REPORT ON THE FISHERIES INVESTIGATIONS ON CADILLAC LAKE,
WEXFORD COUNTY, MICHIGAN

By

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FISH DIVISION

Reports to the Fish Division on the numbers of undersized yellow pikeperch (walleyes) being caught in Cadillac Lake, Wexford County, and requests that the Department do something about this situation were the basis for several investigations on the lake.

A regular lake inventory was conducted on Cadillac Lake in 1941. The results of this survey were given in Institute Report Number 767. This investigation recommended that no warm-water fishes be planted in the lake as netting results showed the proper species were present and that adequate reproduction was occurring. There was some question as to the success of the reproduction and survival of the yellow pikeperch and in order to determine whether or not they were surviving no fry have been planted since 1940.

This stoppage of planting of the species in the lake caused considerable concern and resulted in other investigations in the form of shore seining and some gill netting. The results of these further investigations are found in Institute Reports Numbers 966, 1022, and 1105. Briefly the netting operations have shown an adequate reproduction of

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all species. The Cadillac Sportsman's Club, however, continued to express concern over the lake and in June, 1947, the Institute began further studies. This present report is a brief summary of the current season's work. The investigations are not complete and are being continued.

The past season's work consisted of a population estimate. The estimate of the existing legal sized fish population is made from the tabulation of the numbers of fishes taken in the trap netting procedure, in the following manner. Trap nets are set in various areas of the lake and are fished for a short time in each locale, and then moved. This prevents the fishes from becoming acquainted with the location of the net and avoiding that area. The fishes are taken alive from the net and placed in tubs and transported to designated release areas. These release points are usually near the center of the lake, and thus the fish have to swim considerable distances before reaching the shore and the netting areas. This gives them a chance to go in any direction. If they are released in the immediate vicinity of the net in which they were caught, certain species may be recaptured in that net in a short time and an unusually high percentage of recoveries occurs, giving an erroneous estimate of the total population. Before the fishes are released they are marked. In Cadillac Lake only a small portion of the dorsal fin was removed, just enough to insure recognition on recapture within a few weeks. Very few fish died from handling in the netting operations. The biggest loss occurred following a day of high winds and wave action which prevented the workers from lifting the net that day. The fish were in the net two days and had been buffeted about by the waves. Many of the fish removed from the nets after the storm were released without marking because of their weakened condition.

When it is possible to lift the nets every day little loss is experienced. There is always some loss to be expected when hundreds of fish are being handled, but every effort is made to keep this loss at a minimum. The estimate of the population is made from a mathematical formula involving the numbers of fish caught, the numbers of marked fish present in the lake, and the numbers of marked fish recaptured each day. A tabulation is run each day and the estimate made. The ideal condition for making an estimate is to be able to net for a sufficiently long period to have a large number of marked fish present in the lake and to net until a stable recovery rate is obtained each day. Due to previous commitments the netting operation on Cadillac Lake was not conducted to a point where a stable recovery rate was secured, and the population estimates that are given in Table 1 are to be considered as tentative. It is expected that another estimate will be made next spring to recheck the estimate of this season. Also it is to be remembered that the figures given in Table 1 represent the legal sized fishes only. The nets were of such a mesh size that few of the fishes of the shape of the blue-gills under six inches, and few fish under eleven inches if shaped like perch or bass were taken. In this connection a net is now available which will greatly aid in capturing the smaller fishes and this net will be available for next season's work. Every effort will be made to take samples of the fish between the young-of-the-year and the legal length. This gap in our data makes it difficult to interpret some of our present findings.

From the tentative population estimate it may be seen that the population of legal sized fishes in Cadillac Lake is relatively low. The estimated number of fish per surface acre was 13.25. The figure

Table 1

Estimate of the legal sized fish population in Cadillac Lake

Species	Population Estimate	Number of fish marked	Number marked fish recovered	Percentage marked fish recovered
Yellow pikeperch	3,278	688	74	11
Yellow perch	1,876*	163	7	4
Bluegill	3,104	1,251	324	26
Smallmouth black bass	960	308	58	19
Largemouth black bass	81	30	6	20
Black crappie	2,493	1,210	411	34
Pumpkinseed	827	308	69	22
Rock bass	1,016	435	112	26
Pike	45	13	2	17
Common sucker	1,417	141	7	5
Dogfish	150	38	4	11
Totals	15,247	4,569	1,076	24

*Estimate not accurate because of size of mesh in net. See text.

Cadillac Lake area - - - - - 1,150 acres
 Number of legal sized fish per acre - - - - 13.25
 Number of hours nets fished - - - - - 504
 Number of fish caught - - - - - 5,684
 Catch per net hour - - - - - 11.27

for perch, however, is not to be considered as anywhere near accurate because the nets take so few. We know from gill netting results that the perch population is considerably higher than our estimate, because as has been pointed out few perch under eleven inches were taken in the trap nets used.

During the netting period scale samples were collected along with lengths and weights from a representative series of fishes. The ages at the various sizes together with the weights are given in Table 2. With two exceptions the fishes of Cadillac Lake are growing at a rate considerably ahead of the average for the state. The bluegills, for example, in certain age-groups are as much as two inches ahead of the state average. The yellow pikeperch and the smallmouth black bass, however, are slightly behind the state average. The reasons for this are not completely clear and it is hoped that our future investigations will clear up this point.

Adequate natural reproduction of the yellow pikeperch in Cadillac Lake has been demonstrated by this study. During the investigation 756 pikeperch were caught and of this number 334 were weighed, measured, and scale sampled. Analysis of the ages showed that of the 334 fishes taken at random, 282 of them were of ages that had been spawned naturally in the lake. Any fish of Age-group VI or less could not have come from plantings since these were stopped after 1940. Also the fact that complaints of under-sized fish--ten to twelve inches in length--are still prevalent further proves the adequacy of natural reproduction.

The question now arises if there is adequate reproduction in the lake, and the fishes in general are growing at a rate considerably ahead of the average growth made in the state, why are there not more adult legal game and pan fishes present?

Table 2

Length and weight of the fishes at the various ages in Cadillac Lake

Species		I	II	III	IV	V	VI	VII	VIII	IX
Yellow Pikeperch	Total length	8.4 (4)*	11.5 (13)	13.2 (22)	14.6 (72)	15.5 (97)	16.8 (74)	17.7 (28)	18.5 (16)	19.3 (5)
	State average	9.2	11.9	14.7	16.3	17.3	16.4	17.3	21.2	19.5
	Weight	...	7 ounces	11 ounces	16 ounces	19 ounces	23 ounces	27 ounces	33 ounces	36 ounces
Bluegill	Total length	...	...	6.4 (8)	8.1 (25)	...	9.6 (5)	10.0 (4)	10.5 (5)	10.5 (4)
	State average	...	...	5.4	6.6	...	7.7	8.2	8.4	8.7
	Weight	...	...	5 ounces	9 ounces	...	15 ounces	18 ounces	21 ounces	21 ounces
Yellow Perch	Total length	4.0 (8)	7.1 (7)	9.1 (6)	9.6 (4)	10.9 (3)	11.4 (4)	11.8 (9)	11.8 (5)	12.7 (9)
	State average	4.1	5.8	6.4	7.5	8.5	9.5	10.4	10.8	11.3
	Weight	...	...	...	...	...	12 ounces	16 ounces	16 ounces	18 ounces
Rock Bass	Total length	...	...	6.3 (2)	7.5 (21)	10.7 (1)	9.5 (11)	...	10.7 (2)	10.9 (2)
	State average	...	...	5.2	6.2	7.3	7.9	...	9.0	9.9
	Weight	...	...	4 ounces	7 ounces	8 ounces	13 ounces	...	17 ounces	18 ounces
Black Crappie	Total length	...	6.0 (2)	8.9 (15)	10.1 (12)	10.9 (4)	11.7 (2)	12.7 (7)	12.8 (5)	13.3 (2)
	State average	...	5.9	8.0	9.0	9.9	10.7	11.3	11.6	...
	Weight	...	3 ounces	8 ounces	12 ounces	17 ounces	18 ounces	22 ounces	23 ounces	24 ounces
Smallmouth Black Bass	Total length	...	6.9 (2)	9.9 (22)	12.0 (5)	14.5 (4)	15.9 (1)	16.8 (3)	17.1 (2)	18.8 (3)
	State average	...	9.0	11.2	13.3	15.0	15.3	16.4	16.8	...
	Weight	...	3 ounces	9 ounces	14 ounces	26 ounces	36 ounces	41 ounces	44 ounces	53 ounces
Pumpkin-seed	Total length	...	...	5.9 (2)	6.8 (17)	7.9 (2)	8.0 (3)	...	...	...
	State average	...	...	4.9	5.7	6.2	6.8	...	...	...
	Weight	...	...	3 ounces	6 ounces	10 ounces	10 ounces	...	...	...

* number of specimens in parenthesis

This question is a complicated one for which we do not have a complete answer. It is for this reason continued investigation on Cadillac Lake is needed. Answers found here may well be applied to other lakes with similar conditions. A possible explanation may be the numbers of fish-eating species in the lake. The survey of Cadillac Lake revealed the presence of 23 species of fishes, of which nine were of the game and pan fish classification, one so-called obnoxious fish, three species of coarse fishes, and nine forage fishes. Of this number of game and pan fishes seven species may be classed as fish eaters, namely: the yellow pikeperch, yellow perch, black crappie, rock bass, large- and smallmouth black bass, and northern pike. The two remaining species, the bluegills and pumpkinseeds, are fish eaters in their larger sizes, and from the sizes found in Cadillac Lake may well be classed as fish predators. Thus it would appear that the fishes present are simply eating themselves in order to live. One part of the investigation to be continued on the lake is the collection of stomachs of the various species to definitely establish this contention or disprove it and reveal the real feeding habits of these fishes. When this study is complete a much better program for improvement of the fishing can be made.

Another question on the growth of these fishes might be why are some fish growing at an above average rate and some not? A possible explanation as to why the smallmouth black bass and yellow pikeperch are not maintaining average growth would be their feeding habits. Both species in larger size groups are predominately fish eaters and take little other food. Smallmouth will eat considerable numbers of crayfish when these animals are present, but in Cadillac Lake they are not abundant and thus the larger smallmouth depends entirely upon fish for food. There appears to be a scarcity of forage fish of a size

suites to the smallmouth and pikeperch and possibly they do not get adequate amounts to make the necessary growth. The other species eat other organisms besides fish, such as insect larvae, scuds, etc. The bluegill and perch eat considerable quantities of plankton (free-swimming microscopic and semi-microscopic plants and animals) and thus they augment their fish diet with other forms and because they are few in number make excellent growth. But as stated previously further investigations are needed to substantiate the above theories.

The Cadillac Sportsman's Club can contribute greatly to this study by cooperating in the gathering of the stomachs. One big difficulty in securing the stomachs of fish from the fishermen's catches is that he may dislike to have the fish cut open before he cleans it. In order to make a good study of the food habits the stomachs should be removed and preserved as soon as possible after the fish has been caught. This is to prevent continued digestion and loss of identity of some organisms which might have been saved if they were immediately preserved. The Cadillac group can aid by permitting their fishes to be opened and the stomachs removed by our investigator, and also by spreading the word around to the non-residents who come to the lake to fish.

During the past season 292 yellow pikeperch were tagged and released in the lake. Signs were posted about the lake notifying the public of their presence in the waters and where to report their capture if any of the tagged fish were caught. The author does not know if any tagged fish were caught or not, but none have been reported to date. It is hoped that some of these fish will be caught and be taken to the checking station (located at District Biologist Stanley Lievens's home on the north shore of the lake) so that they may be weighed and measured and scale sampled. Some vital information on the growth of the pikeperch can be obtained if the fishermen will cooperate and report their catches of marked fish.

While it is necessary to wait for the remainder of the investigation to be completed before any management proposals are finally established one suggestion seems to be in order. It would be desirable to install some brush shelters in Cadillac Lake particularly on the northern shore. It is recommended that the Cadillac Sportsman's Club follow a suggestion made to the author by one of the members of the club to utilize the discarded Christmas decorations from the streets of Cadillac as brush shelters. Great numbers of trees are used for decorations and then hauled to the dump for burning. The Club might well organize a project involving the wiring together of numbers of these trees and properly weighting and sinking them along the north shore of the lake between the ten and fifteen foot contours. The District Biologist who is located on Cadillac Lake would be available for supervision on this project. It is believed that the brush shelters would serve as places of protection for the smaller fishes and also as a concentration center for larger fishes. In some waters excellent fishing in the vicinity of brush shelters has been found due to this concentration. Definite proof of the value of shelters in increasing a fish population is lacking but presumably added shelter might increase survival of more of the many young fish produced in this lake. In building up this population, however, the average size of the fishes may be reduced, but for the most part this is of no consequence because the fish now exceed the state average. If the population of small fish can be built up, more of the size suited to the pikeperch and smallmouth will be available and these species might increase in growth rates.

Next summer's program also calls for an intensive shore seining investigation to make a thorough check on the quantities of forage fishes as well as game and pan fishes. An evaluation of the spawning facilities will be made at the same time. It may be advisable to attempt

the introduction of some additional forage species or some spawning improvement devices but this should wait until the investigation is complete.

It has been suggested that there be a reduction in the legal length of the yellow pikeperch so that the fisherman might keep the numbers of now undersized fish they are taking. It is recommended, however, that this not be done until the completion of the present investigation. Work now being done on the yellow pikeperch will shed much needed light on the whole pikeperch situation in Michigan and may change our present concepts on legal lengths needed for the pikeperch.

In the meantime it is suggested that the fishermen on Cadillac Lake begin to fish for some of the other species, such as the black crappies, perch, or bluegills. It appears that the main fishing in the lake at present is for the pikeperch. The black crappies grow to a weight of nearly two pounds, and many bluegills taken in the nets were over a pound in weight. In fact the average weight of age-group VIII was one pound five ounces, with a total length of 10.5 inches. Winter fishing for both bluegills and black crappies is an excellent sport, and they are the best eating in the winter. Perch fishing is increasing somewhat but could be heavier. The reduction of these species might well increase the food supply for the pikeperch and permit them to attain an average rate of growth.

In summary it is suggested that:

1. The study of Cadillac Lake be continued through 1948 and include a stomach analysis of the game and pan fishes, a survey of the forage fish population, a recheck on the bottom food organisms, another population study to check on the estimates made in 1947, and a creel census during the winter of 1947-48 and the spring, summer, and fall of 1948 to secure a better knowledge of the numbers and kinds of fishes removed by the anglers;

2. The Cadillac Sportsmen's Club sponsor the placing of brush shelters on the northern shoal area of the lake under the supervision of the District Biologist;

3. Urge the fishermen on Cadillac Lake to fish for other species than the yellow pikeperch, particularly in the winter period;

4. Urge the Cadillac Sportsman's Club to participate in the securing of the creel census data and stomach collections that are needed, and to publicize the work that is being done to the visitors so that they will cooperate in reporting marked fishes and understand why they are asked a lot of questions by creel clerks and;

5. Postpone until 1949 any changes in the existing size limits or introduction of new species of minnows into Cadillac Lake.

Acknowledgments

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The Cadillac Sportsman's Club cooperated in the work, particularly some of the officers. Their help and courtesies materially helped the crew.

The Cadillac newspapers generously contributed space to acquaint the public with the work being done. It is regretted that more sportsmen did not take advantage of the opportunity to witness the netting operations.

INSTITUTE FOR FISHERIES RESEARCH

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