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FISHERIES SURVEY OF LAKE MICHIGAMME, MARQUETTE AND BARAGA COUNTIES

by

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Lake Michigamme (T. 47, 48 N., R. 29, 30, 31 W.) is situated in the extreme midwestern region of Marquette County with the exception of a small part of the west arm, which extends into Baraga County. It is approximately thirty miles west of the city of Marquette. The village of Michigamme is located on the northwest shore of the lake.

The lake itself is one of the beauty spots in the state and is possibly noted more for its scenic grandeur than for the fishing it affords, although northern pike fishing has been very good there at times in the past. It is near the headwaters of the Michigamme River system and is the largest lake found in that drainage.

A map of this lake was prepared during the early months of 1938. The outline was secured by enlargement from aerial photographic print made by the Agricultural Adjustment Administration. Using this outline as a base, the lake was then systematically sounded through the ice by an Institute for Fisheries Research party.*

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* The mapping party included O. H. Clark, leader, and Floyd Ames, assistant.

The regular biological inventory was carried out during the last two weeks of August, 1938, by the Institute.*

The recreational facilities afforded at this lake include fishing, boating and swimming. It is only moderately used for fishing. There are approximately 55 cottages, one hotel, two resorts, and two boat liveries on its shores. Future developments here may increase the use of this lake a great deal. Much of the high rocky, yet wooded, shore affords more or less ideal cottage sites.

In shape, Lake Michigamme resembles a large Y. Its two arms spread to the west and southwest respectively, each a distance of about six miles from its eastern end. I. D. Scott in his book Inland Lakes of Michigan gives the geological origin of the lake as follows:

> "Although the glacier covered this region and the rounded and smooth rock knobs present striking evidence of its action, it is necessary to go to the rock formations and structures in order to understand the origin of this peculiar basin. The ridge-and-valley topography of this section is due to the varying resistance of the rock formations of the Marquette Range which have a general east-west trend. In this region the range is a great trough or syncline which is deformed by a minor fold on the north side just east of the lake ... .
>
> "The upturned edges run along the north side of the lake in a narrow belt, but the range spreads out to the southwest, and from this expansion two small troughs extend to the south and southeast, the latter reaching to Republic. The different rock formations vary greatly in their resistance to erosion and of these the Michigamme, which underlies the greater part of the lake, is the least resistant. However, this formation is variable in hardness and is very resistant where changed by metamorphic processes. This is illustrated on the islands and along the southwest side of the lake, where the rocks stand in bold hills. These rocks were greatly eroded by running water previous to the invasion of the ice, and a general system of east-west valleys and ridges was formed. This trend is consistent along the north side of the lake, but on the opposite side swings towards Republic in a broad curve to the south and southeast. The valleys followed the least resistant rocks and, in particular, the Michigamme formation which in itself appears to be softer in proximity to adjacent formations. Thus, in addition

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* The inventory party included Dr. G. M. Moore, leader, G. S. Baker, W. C. Beckman, and Floyd Ames, assistants.

to the east-west valley in which the northern part of the lake lies, a branch extended towards Republic and is now occupied by the south arm and the outlet of the lake.

"Such probably was the topography in its main aspects when the ice advanced from the northeast. The presence of islands indicates that the scouring action of the ice was able only to modify the existing surface by rounding off the hills and deepening the basin. The passage of the ice was across the main trend of the ridges and, while its general movement was independent of the topography, that of the ice border must have been greatly influenced by the relief features over which it passed. Thus, it is probable that the ice poured through the gaps in the ridges on the north side of the lake and spread laterally into the valley, deepening it locally into a basin. As the glacier was disappearing a remnant of ice filled this basin and deposited great quantities of sand at the east and west ends and along the outlet. In this way the Michigamme basin, due largely to preglacial conditions, was modified and isolated by glacial action." *

Lake Michigamme has a surface area of 4,360 acres. The shoreline is extremely irregular and fairly well wooded. It is bounded by high rocks, gravel and sand. The shore line development is equal to 4.0. This simply means that Lake Michigamme has four times as much shore line as it would have if the area was unchanged and the lake was perfectly round. An irregular or increased shore line is an indicator of the productivity of a lake. Irregularity makes possible more extensive shallow bays, which in turn give a larger area for food production.

The maximum depth of Lake Michigamme is 72 feet. The deepest point is approximately 2 miles due south of the east end of Wawa island. This limited depression is centered only 850 feet off the southeast shore. Another 60 foot depression is located about 2 1/4 miles southwest of the mouth of the Peshekee River, and a third depression (maximum depth 55 feet) is located two miles to the southeast of Stensrud Point. In general, the lake basin is fairly regular with respect to the declivity from the shore to the deeper water. The drop-off is abrupt to the 40 foot level at most

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* Scott, I. D., Inland Lakes of Michigan (Lansing: Wynkoop Hallenbeck Crawford Co., 1921), pp. 297-298.

points. There are no extensive regions of shallow water anywhere in the lake. Less than 20 per cent of the lake's bottom is shoal (water less than 15 feet in depth).

The bottom over the shoal is composed of sand, gravel and rock. Sand and gravel are predominant in the extreme ends of the three arms, while bed rock is most characteristic along the sides. The bottom of the deeper areas is composed almost wholly of silt and muck with the exception of a few scattered patches of sand and gravel.

There are three main inlets to Lake Michigamme. The largest and most important is the Peshekee River, which enters the lake from the north at a point near the east end of the lake. This stream is about 150 feet wide and 20 feet deep at its mouth. It drains approximately 75 square miles of the country directly north of the lake. The Spur River is next in size, having a width of about 50 feet and a depth of 3 feet at its mouth. It drains from the west and enters the lake at the apex of the west arm. This stream has a drainage of approximately 20 square miles which lies directly west of the lake. The third tributary, Brown's Creek, empties into Browns Bay on the north side of the lake. It drains less than two square miles adjacent to the lake. The other tributaries are small and mostly intermittent.

The outlet of Lake Michigamme is the head of the Michigamme River. This latter flows 50-60 miles before it reaches the Menominee River to the south.

There is a low dam acrossed the Michigamme River at the outlet of the lake. This raises the lake level about three feet and is probably an impediment to fish movements except during high water periods. This dam is owned and maintained by the Cleveland Cliff Iron Company and is retained for the purpose of water storage.

The water in Lake Michigamme is brownish in color. Secchi disc readings show a visibility range between 7 and 8 feet as compared to 12-15 feet for some of the larger lakes in the Lower Peninsula. Visibility through waters is influenced by the actual color of the water plus the suspended matter, such as clay, plankton, etc. Turbidity and color have a great influence on plant growths because they determine the depth to which light will effectively penetrate. Without light most aquatic plants, like terrestrial ones, are not able to survive.

Wave action is undoubtedly very severe at times along the east and southeast shores. This is a factor in preventing the growth of aquatic plants, which are completely absent from these shoals.

Temperatures taken at the time of the survey (8/18/38-9/1/38) show the surface water to vary between 68 and 76°F. The air temperature for this period was between 56 and 83°F. The surface temperature dropped from 72°F. on August 18 to 66° on September 1. Temperatures of 52-56°F. were recorded for the deeper waters (55-72 feet).

A very marked thermocline (a zone in which the temperature changes very rapidly, e.g. 1°C. drop in temperature per meter depth) was present throughout the period of this survey. It occupied the zone between 24 and 35 feet on August 18 and moved down to form a zone between 30 and 36 feet by the first of September. The relatively low bottom temperature in late summer indicates an early stratification in which all of the bottom waters became isolated by virtue of the intermediate zone or thermocline. The significance of this phenomenon to fish life can hardly be over estimated. The isolation of cold waters in our deeper lakes makes many of them suitable to cold water species such as trout, whitefish, etc.

However, temperature alone is not the controlling factor. This same isolation prevents mixing of the lower and upper layers of water and when the original supply of oxygen is removed, by the respiration of fishes and other living things, as also by the oxidation or decay of organic deposits, these waters no longer are suitable to cold water fishes or any other species.

In late summer the water below about 50 feet in Lake Michigamme is so reduced in oxygen (2.0-0.8 ppm.) that most fishes cannot remain there for extended periods. There is a layer of water between 30 and 50 feet, however, which remains cold throughout the summer and also retains enough oxygen to support fish life. This layer may be used by the cold water species, such as cisco and trout. Free carbon dioxide occurred only in small quantities (2-13 ppm.) and has no serious effect on fish life.

Chemical tests show the waters in this lake to be distinctly acid (pH 5.6-6.7). The incoming water from the Spur River (6.7 pH) and Peshekee River (6.8 pH) was more alkaline than the lake average. We do not know the exact cause of this acid condition, but the fact that the water entering the lake is mostly brown (bog) water would account for it in part. The presence of large quantities of partially decayed plants and other organic matter usually contributes to acidity.

The water is "soft." Total or methyl orange alkalinity was between 12-16 ppm. Here again the reading was highest in the region of the tributaries. At the mouth of the Peshekee it was 22 ppm. and at the mouth of the Spur, 27 ppm. The drainage basin is apparently very poor in lime. Soft water lakes of this type are usually much less productive than those with moderately hard water. Much of the aquatic vegetation and plankton (small, microscopic life) seem to require considerable

calcium carbonate for abundant growth. However, excess quantities of this substance may inhibit aquatic life. The optimum seems to be between 100 and 200 ppm. other factors being favorable.

A summary of the temperature and chemical conditions during the period of survey is given in the following table (page 8).

There is no pollution of any consequence. The only possible source is the domestic sewage originating from the village of Michigamme and the cottages near the lake.

The aquatic vegetation in Lake Michigamme is very scant. Since most of the higher plants require considerable light, they are limited to the shallower water. All of the plant beds found were in water less than 10 feet in depth. The amount of suitable shoal at these depths is very small, being confined mainly to the bays at the end of the arms. The shoal bottom along the sides is almost wholly of bed rock and is therefore unsuited to plant growths. The highly colored water, an unsuitable substratum, and acidity of the water are the main factors in the limitation of plants. In conjunction with these conditions, there is intense wave action over much of the lake which in itself may seriously restrict plant growth.

All the plants taken during the survey are given in the following table (page 9). The common and scientific names are given along with the collecting station, abundance, depths and type of bottom.

No species were very abundant in the lake. Water lilies, pondweeds and cattails were the most numerous. There were a number of sparse patches of grass and sedge in the very shallow water of the bays.

There is no doubt but what Lake Michigamme has too little vegetation for the maximum productivity of fish. This is an inherent condition not easily altered by present known improvement methods. It would be necessary

Summary of Chemical and Temperature Conditions
in Lake Michigamme (8/18/38-9/1/38)

Location	Station 1 Depression northeast of Devils Island		Station 2 Depression southeast of Wawa Island		Station 3 Depression southeast of Stenruds Point	Station 4 Mouth of Spur River	Station 5 Mouth of Peshekee River
Date	8/18/38	9/1/38	8/18/38	9/1/38	8/18/38	8/20/38	8/23/38
Time	8:30 a.m.	10:30 a.m.	Noon	8:50 a.m.	2:00 p.m.	8:30 a.m.	9:30 a.m.
Air temperature °F	70	56	79	56	83	69	68
Surface temperature °F	72	66	75	66	75	69	67
Bottom temperature °F	52	53	53	54	56	...	...
Maximum depth - feet	73	73	65	65	59	...	...
Thermocline location	24-33	27-35	21-30	30-36	24-35	None	None
Top of							
Temperature	70	66	69	65	69		
Oxygen	5.9	6.7	6.0	...	5.5		
CO_2	2.0	2.0	2.0	...	3.0		
Bottom of							
Temperature	57	58	60	59	58		
Oxygen	3.3	4.2	4.5	3.0	3.1		
CO_2	7.0	7.0	6.0	5.0	8.0		
Oxygen							
Surface	6.4	6.7	6.8	6.7	6.1	5.7	5.7
Bottom	0.8	0.8	0.0	0.0	1.9	...	...
Carbon dioxide							
Surface	2.0	1.0	2.0	1.0	2.0	3.0	2.0
Bottom	13.0	10.0	...	11.0	12.0	...	...
Methyl orange alkalinity							
Surface	16.0	12.0	15.0	14.0	15.0	27.0	22.0
Bottom	19.0	14.0	...	16.0	15.0	...	...
pH							
Surface	6.6	6.7	6.7	6.6	6.7	6.7	6.8
Bottom	5.9	6.0	...	6.0	5.6	...	...

Aquatic Vegetation Found in Lake Michigamme

Station No. 1 = West Bay; No. 2 = Tower Bay; No. 3 = South Bay

Station No.	Species of Plant	Abundance	Extent of bed	Range of depth in feet	Bottom type
2, 3	Watershield, Brasenia shreberi	Common	1/8 acre	2-4	Sand and gravel
1	Sedge, Carex lenticularis	Sparse	...	0-½	" "
	Carex substricta	"	...	0-½	" "
2, 3	Spike rush, Dulichium arundinaceum	Common	1/4 acre	0-1	Peat
1, 2, 3	" " Eleocharis palustris var. major	Common	1/8 acre	0-½	Sand and gravel
1, 2	Horse tail, Equisetum fluviatile	Abundant	Several acres	0-2	" "
1, 3	Manna grass, Glyceria borealis	Common	Scattered	½	" "
1	St. Johns wort, Hypericum virginicum	Scarce	"	3	" "
1	St. Johns wort, Hypericum punctatum	"	"	0-6	" "
1	Rush, Juncus balticus var. littoralis	Scarce	"	0-6	" "
1	Water horehound, Lycopus americana	"	"	0-6	" "
2, 3	Loosestrife, Lysimachia terrestris	Common	1/2 acre	0-1	" "
3	Water milfoil, Myriophyllum	Scarce	Scattered	2-4	" "
2, 3	White water lily, Nymphaea odorata	Common	1/4 acre	2-4	Muck
1, 2, 3	Yellow water lily, Nymphar advena	Abundant	Several acres	1-4	"
1, 2, 3	Smart weed, Polygonum natans	Scarce	1/10 acre	½-2	"
1, 2	Pondweeds, Potamogeton epihydrus	Common	Scattered	3-6	"
2, 3	Potamogeton natans	Common	"	2-4	"
1, 2	Potamogeton pusillis	Common	"	½-3	"
3	Reed grass, Phragmites communis	Scarce	1/8 acre	0-1	Sand and gravel
1	Buttercup, Ranunculus reptans	"	Scattered	0-½	" "
3	Bulrush, Scirpus acutus	Common	1-2 acres	0-4	" "
1, 2, 3	Scirpus cyperinus	"	Few acres	0-½	" "
1, 2	Water parsnip, Sium suane	Common	Scattered	0-1	" "
3	Burreed, Sparganium subulata	Common	1 acre	½-1	Muck
3	Cattail, Typha latifoliata var. gracillima	Common	Several acres	0-1	Muck
1, 2, 3	Bladderwort, Utricularia vulgaris var. americanus	Common	Small patches	½-4	Muck
1, 2, 3	Arrowhead, Sagittaria latifolia var. gracilis	"	" "	1-2	Muck
1	Royal fern, Osmunda regalis	Rare	Scattered	½	...
1	Monkey flower, Mimulus rigens	Rare	"	½	...
1, 2	Moss, Leptodictum riparium	"	"	½	...

to restrain the wave action, alter the bottom, and probably fertilize the water in order to make the lake more suitable. This may be done on a small scale, but not to the extent needed in a lake of this size.

It is almost invariably true that the number of fish-food organisms is directly correlated with the abundance of vegetation. Those lakes lacking vegetation are never as productive of food as those containing it. Lake Michigamme is no exception, although the rocky shoals give cover to many important forms.

The microscopic and semi-microscopic animals and plants, such as waterfleas, rotifers and algae, were fairly abundant in this lake at the time the survey was made. Samples taken at only one time of year are no true picture, however, due to the seasonal and often daily changes in abundance. Algae (small plants) were most abundant in the shallow water, and zooplankton (small animals) in the deeper zones.

The predominating fish-food organisms found on the shoals were mayflies and midge larvae, while on the bottom in the deeper areas midge larvae were most abundant. Fresh water shrimp (amphipods) were fairly common on the bottom between the 30 and 60 foot contours. Occasional beetles and clams were found along the rocky shoals. Other kinds, such as water mites, leeches, snails, caddis flies, etc. were reported as scarce.

This lake gives the impression of being fairly productive of fish food considering the dearth of plants.

A list of the fishes taken during the survey and their relative abundance is given in the table on page 11. Stocking for the past five years is also included.

Collections made on this lake indicate perch to be the most abundant game species. This is followed by the black crappie and smallmouth bass, which appear to be about of equal number, then by northern pike. Bluegills,

List of fishes collected in Lake Michigamme, with an indication of their abundance and artificial stocking

Species		Total number stocked in 5 years previous to 1940
Game Fish		
Perch	Abundant	40,000
Smallmouth bass	Common	
Largemouth bass	Rare	
Northern pike	Common	
Black crappie	Common	
Bluegills	Rare	
Walleye pike	Rare	6,030,000
Smelt	Planted in 1939	1,500 & 4,500 planted in tributaries (near the lake)
Lake trout	Not taken during survey	2,500
Cisco	" " " "	
Coarse Fish		
Common sucker	Common	
Fine scaled sucker	Rare	
Obnoxious Fish	None taken	
Forage Fish		
Golden shiner	Common	
Blunt nose minnow	Common	
Common shiner	Fairly common	
Iowa darter	Fairly common	
Muddler	Rare	

largemouth bass and walleye pike are rare. This is rather discouraging since walleye pike have been most heavily stocked (over 6 million in five years). Lake trout and cisco have been reported but none were taken. During 1939, 6000 adult smelt were planted in the lake and immediate tributaries. The outcome of this planting is not known.

Two species of suckers were collected, the common sucker and fine-scaled sucker. No undesirable species of fish were taken or reported.

The forage fishes were not very abundant and were represented by only five species. The blunt-nose minnow was most abundant; golden shiner, second, and the common shiner third. Iowa darters were fairly common and muddlers were rare.

Lake Michigamme today seems to be supporting more smallmouth bass and crappie than northern pike. There is no explanation for this other than that it probably represents a trend or cycle. None of these species has been planted in the past five years so that would not explain this condition.

Creel census records taken by Conservation Officers from 1935-1938 show this trend toward bass and crappie. The number of records is so small, however, that their significance is open to question. A summary of creel census records showing the number and kinds of fish taken by years follows:

	1935	1936	1937	1938	1939
Northern pike	4	42	8	16	28
Perch			8	1	75
Walleye pike			1	2	1
Crappie			1		66
Smallmouth bass				20	35
Largemouth bass					2
No. of records	1	34	5	13	58

A study of the growth rate of the game fish collected shows that in general they reach legal length in about average time for the lakes of the region. Fourteen northern pike averaged 15.3 inches total length at the end of their second summer. One eight summer old fish was almost 36 inches total length and weighed 10 1/2 lbs. The yellow perch taken did not reach legal length until their fourth summer. They averaged approximately 10 inches during their sixth summer of life.

The one walleyed pike taken was 9 1/2 inches by August of its second summer. Smallmouth bass reached legal length in their third summer. One fish of this species was approximately 16 incheslong and weighed 2 1/4 pounds by the August of its sixth year.

A summary of the growth rate analyses is given in the table on page 14.

The abundance of sand and gravel shoals assures adequate spawning grounds for smallmouth bass and crappie. The natural facilities for perch presumably are limited to the weed beds in the bays, which are none too numerous, but must be adequate since young-of-the-year perch were taken in goodly numbers in almost every seine haul. Northern pike probably utilize the marshes found in the south bay and Towers Bay and in the lower portions of the Peshekee and Spur rivers. So little is known about the spawning habits of walleye pike that we cannot say how adequate natural facilities are for this species. The fact that this species has never significantly increased in spite of heavy and persistent planting, leads one to believe that either the spawning grounds or some other necessary requirement is lacking for this species.

*/Ages and average lengths and weights of game fish taken from Lake Michigamme during the survey 8/18/38 - 9/1/38

Fish	**/Age Group	No. of Fish	Average total length in inches	Average Weight
Northern pike	I	14	15.3	12.4 oz.
	II	1	18.2	1#, 3.8 oz.
	III	6	21.4	1#, 15.8 oz.
	VI	1	30.0	5#, 12 oz.
	VII	1	35.8	10#, 8 oz.
Yellow perch	III	6	6.2	1.3 oz.
	IV	3	7.3	2.3 oz.
	V	8	9.8	6.9 oz.
	VI	2	11.0	8.8 oz.
	VII	1	8.5	3.9 oz.
	VIII	1	10.8	7.8 oz.
Walleyed pike	I	1	9.6	4.4 oz.
Smallmouth bass	III	3	11.0	8.6 oz.
	IV	1	12.5	15.4 oz.
	V	1	15.9	2#, 5.5 oz.

*/ Age determinations were made by W. C. Beckman.

**/ Add one summer to each, in order to get actual number of growing seasons.

Management Suggestions

Lake Michigamme is designated as a pike lake and the results of this survey do not justify a change in this designation. However, if the present increase in bass and crappies persists and the northern pike do not increase, a change to "all other lakes" designation may be desirable in three or four years. However, all of these suggestions depend upon the success of the smelt planted recently in this lake upon recommendation of the Institute.

This lake does not offer suitable conditions for sunfish, bluegills and largemouth bass. No future plantings of these species should be made. The futility of planting walleyed pike has already been proven. Smallmouth bass and crappie are already present in considerable numbers and natural propagation will certainly be adequate to maintain these species in numbers consistent with the carrying capacity.

We are uncertain whether or not the perch will be able to maintain themselves without stocking. The very limited weed beds make this somewhat questionable. The suspension of stocking perch for three or four years would test the effectiveness of natural propagation. Should there be a decrease in the perch during the third and fourth years, then regular plantings of this species can be justified.

It is our belief that a more careful attempt should be made to establish lake trout in reasonable numbers. Previous plantings have been of very small fish. The practice of planting small fish of any kind in an already established population of pike, perch and bass, is very difficult to justify. There is little question regarding the future of most fish planted under these conditions. It is suggested, therefore, that a reasonably large planting of lake trout (9-12 inches) be made in this lake, in an attempt to increase this species and establish an adequate

breeding stock. From the studies made, lake trout should be able to thrive in this lake. This stocking will be even more justified if smelt establish themselves in this lake.

There is no reason to believe that Lake Michigamme cannot maintain a population of northern pike, smallmouth bass, perch and lake trout. The lake is not rich however, and no phenomenonal production can be expected.

A considerable number of (bird) fish predators were reported. In view of what is known regarding the damage done by birds on an open lake, no control can be justified.

Nearly all of the game species present had the parasite known as black spot. These in small numbers certainly have little if any effect on the fish and under no circumstances are they able to attack man.

Some of the smallmouth bass were infected with the bass tapeworm (Proteocephalus). The presence of this parasite did not seem to seriously affect natural propagation since many small bass were observed. This parasite cannot attack man. Sometimes the bass tapeworm is very damaging to the reproductive organs of the fish and may produce sterility. There is no known practical method for the control of this parasite.

Lake Michigamme is rather poor in cover, particularly along the sandy shoals in the ends of the arms. Brush shelters scattered over these areas in water from 5-15 feet in depth would very probably encourage forage fishes and give protection to the young of game species. The number of devices to be installed will depend upon the amount of money available for such a project. Most of the cost would be for labor since there is adequate material along the shores.

The present water level seems to be satisfactory and the dam at the outlet helps to maintain a constant level. At most, there would only be a three foot fluctuation.

A subsequent examination should be made on this lake to test the effectiveness of the smelt planting. Future management will depend upon this and the balance between pike and bass.

INSTITUTE FOR FISHERIES RESEARCH