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REPORT ON BLACK LAKE, CHEBOYGAN COUNTY

by

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Black Lake, previously called Cheboygan Lake, is located in Cheboygan and Presque Isle counties (T. 35, 36 N., R. 1, 2, E.) and is part of the Cheboygan River system, which drains northward to empty into Lake Huron. The lake itself is drained by the Black River, which runs 13 miles to the northwest, where it joins the Cheboygan.

A map showing the shoreline and contours was prepared during the winter of 1936-37 by the Michigan E.C.W. This was of material aid to the Institute for Fisheries Research survey party* which made a study of this lake during July 1-25, 1939.

Fishing in Black Lake has been reported as fairly good in the past, in spite of the steadily increasing number of fishermen using the lake. The Department of Conservation, however, has received a considerable number of complaints during the last two or three years regarding the depletion of the fisheries resources, particularly the northern pike.

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* The survey party included the following personnel: Hugo Kilpela, leader; Fred Locke, David Anderson, and Pat Galvin, assistants.

Besides fishing, the lake is utilized for swimming and boating. Although no very large towns are near, it has become a very popular summer recreational center. At present, approximately 150 cottages, 10 resorts, 1 hotel and 20 boat liveries are on its shores. In addition to these, the State Department of Conservation maintains a large park on the southeast side.

Black Lake is somewhat elongate in shape. The long axis runs about 6 miles in a northeast-southwest direction. Its greatest width is approximately 4 miles. It is of glacial origin, dating from the period of old Lake Algonquin, and occupies an intermoranic basin bounded by highlands on the northeast and southwest. The southwest highlands are broken by a broad depression through which the upper Black River enters the lake. There are some rock outcroppings on the southeast shore near the state park. The soil in the vicinity of the lake is generally poor, being composed chiefly of sand and other glacial deposits. The adjacent highlands as well as the depressions are wooded and very little of the surrounding country is utilized for agricultural purposes.

A dam (Alverno) has been constructed in Black River six miles down stream from the lake. This dam is high enough to regulate the level of Black Lake and is used to develop waterpower for the Michigan Public Service Company. During years of low water, the lake is drawn down somewhat, but fluctuation of the water level has not, in the past, been a serious problem. According to reports, the fishway at this dam is not effective and fish are unable to migrate up and down stream.

Black Lake has a surface area of 10,130 acres (15 square miles) and a maximum depth of 50 feet. The basin is somewhat irregular, sloping gradually from northeast to southwest. The deepest point in the lake is 1 1/2 miles directly north of Maxon's Resort or 1 3/4 miles northwest of the stone quarry on the state park. About 36% of the lake is shoal

(region shallow enough to produce aquatic plants). The large shallow area on the northwest end of the lake extends lakeward approximately 1 1/4 miles. This narrows greatly around the rest of the lake, varying in width from 330 to 2300 feet. The drop off is very abrupt except in the northwest end.

The bottom over the shoal area is almost entirely of sand containing considerable quantities of marl. Gravel patches occur near shore along the northwest, north and southeast sides. The lake bottom below the 20 foot contour is exclusively of muck. In the shoreward backwater of the upper Black River delta, some fibrous peat has accumulated.

There are two main inlets to Black Lake, the upper Black River and Rainey River. These drain the northwest part of Montmorency County and the southwest corner of Presque Isle County. Several other smaller tributaries enter the lake, the largest of which is Mud Creek, Stewart, Fisher, and Stoney Creeks enter the lake from the south. The only outlet is the lower Black River, which originates in the northwest end of the lake. It is over 100 feet wide at its source. This joins the Cheboygan as described above.

The water in Black Lake has no color. Any change in visibility through the water is due to turbidity caused by suspended matter such as clay, silt, plankton, etc. Secchi disc readings taken during the survey range between 12 and 15 feet, which indicates the water to be relatively clear. It is interesting that this summer visibility of 15 feet corresponds roughly to the lakeward limit of aquatic vegetation.

The characteristics listed above exert their individual and combined influence on the fisheries of Black Lake. The size and depth of a lake combined with the direction of its long axis as well as that of the prevailing wind are important in determining the shoals and shore line

configuration. The prevailing winds are parallel to the long axis of Black Lake and as a result, there is intense wave action, particularly in the southeast end of the lake. Waves cause currents and currents tear away the shore in one place and deposit it in another. The bottom materials in the shallower areas are almost always on the move. This in turn prevents the depositing of organic materials (which are lighter in weight than sand) on the shoals. The lack of organic materials and the constant movement of the sand prevent the establishment of vegetation so necessary to the productivity of a lake. Fortunately the largest shoal area in Black Lake is on the windward side and in this area most of the fish food supply is found. The part of the shoal at the "drop off" which lies too deep to be greatly disturbed by wave action is also an important fish food producing area. Less in importance, but not to be ignored, are the deep mucky bottoms which also harbor many forms of life.

The tributaries to the lake undoubtedly add to the water's fertility, and while a constant level is maintained, the lake should become more productive in years to come. The water being clear, allows vegetation to establish itself at greater depths than would otherwise be possible.

The temperature of lake waters as well as the chemical condition are also of great importance to fish production. Fish of different kinds have different requirements with regard to these factors.

Temperatures taken at the time of the survey (July 3-7, 1939), show the surface water to vary from 70-79°F. At this same time the surface temperature near the mouth of Rainey River was 71°F. and near the mouth of the upper Black was 78°F. The surface temperature near the outlet was 80°F. The air temperature varied between 68 and 87°F. during this period. Temperatures of 63-65°F. were recorded for the deeper water (43-46 feet). Although a thermocline (a zone of rapid change in temperature)

was present between 3 and 10 feet out in the open lake, this was probably only a temporary condition. The relatively high bottom temperature so early in the season almost precludes any possibility of thermal stratification of significant consequence.

The oxygen supply in the surface water varied from 4.6 ppm. near the mouth of Rainey River to 9.1 ppm. in the open lake. Even the deeper water contained plenty oxygen to support fish life (5.0-6.0 ppm. at 45-50 foot depths). No carbon dioxide was recorded for any of the samples taken.

The water is distinctly alkaline, having a pH varying between 8.0 and 8.4 and is hard, showing a methyl orange alkalinity between 150-164 ppm. in the open water of the lake. The water from the two large inlets, Rainey and upper Black Rivers, had 179 and 192 ppm. of methyl orange alkalinity respectively. A more complete description of the temperature and chemical data is given in Table I.

The water temperatures of Black Lake are suitable for warm water species but not for trout. The small difference between surface and bottom temperatures is indicative of fairly complete, regular mixing of the water. This action also ensures the presence of sufficient oxygen in the deeper parts so that the whole lake is probably suitable for fish life the year around.

Alkaline waters of the type found in Black Lake are potentially capable of high productivity as regards all kinds of life, but this productivity depends upon other factors such as the type of bottom, length of growing season, etc. The rather large barren sandy shoal in this lake is no doubt an important limiting factor in fish production.

There is no pollution of any consequence in this lake. The only possible source is the domestic sewage, originating from the cottages which are near the lake and a similar pollution from the few small villages located on its tributary streams.

Table I. Temperature and Chemistry of Waters in Black Lake as Recorded During a Survey in July, 1939

Location	Sta. 1 Deepest area of lake. 1.5 miles NW of quarry	Sta. 2 Mouth of Rainey River	Sta. 3 Outlet, source of Black River	Sta. 4 In center of lake-- equi-distant from east and west shores	Sta. 5 Mouth of Upper Black River
Date	7/3/39	7/5/39	7/6/39	7/7/39	7/7/39
Time	4 p.m.	4 pm.	2 p.m.	9 a.m.	11 a.m.
Air temperature °F.	72.5	68.0	87.0	84.0	87.0
Temperature surface °F.	70.0	71.0	80.5	79.0	78.0
Temperature bottom °F.	62.9	Not taken	78.4	65.3	Not taken
Depth at bottom in feet	46	...	3	43	...
Thermocline location	None	None	None	3-10 ft.	None
Temperature top °F.	...	...	...	83.3	...
Temperature bottom °F.	...	...	...	73.9	...
Oxygen in ppm.					
Surface	9.1	4.68	7.7	8.06	6.83
Bottom	5.5	...	8.7	5.08	...
Carbon dioxide	0.0	0.0	0.0	0.0	0.0
Methyl orange alk. in ppm.					
Surface	144	192	164	156	179
Bottom	150	...	154	154	...
pH					
Surface	8.0	8.0	8.2	8.2	8.0
Bottom	8.2	...	8.4	8.0	...

The aquatic vegetation in Black Lake grows at depths ranging from the water's edge down to 20 feet. A large portion of the shoal in the northend is covered with bulrush (Scirpus) and reeds (Phragmites). In the sheltered bays from the mouth of the upper Black to the outlet, other species are found such as: white and yellow waterlilies (Nymphaea and Nuphar), pond weeds (Potamogeton), water shield (Brasenia), water weed (Anacharis), water milfoil (Myriophyllum), bladderwort (Utricularia), smart weed (Polygonum), horsetail (Equisetum), cattail (Typha), spike rush (Eleocharis), arrowhead (Sagittaria), pickerel weed (Pontederia), several sedges and some muck grass (Chara). A number of other less important species have been found in these beds, but no positive identification has been made on them.

The shoal areas on the east and west sides of the lake support sparse patches of bulrush and stunted pond weeds, but are for the most part devoid of plant life. No plants at all were found on the shoals in the south and southeast portions of the lake. The constant movement of sand in this area shear off the young plants as they might appear. Even the hardiest plants cannot establish themselves on a shifting sand bottom.

Along the drop off, in 10-20 feet of water, where wave action has little effect, a narrow belt of pondweeds (Potamogeton), eel grass (Vallisneria), coontail (Ceratophyllum), and musk grass (Chara) practically encircles the lake. The dominant species in this association is Potamogeton praelongus. This ring of plants is best known to fishermen who through experience have learned that here reside the greatest number of game fish.

In conclusion, we feel safe to venture that Black Lake has too little vegetation for maximum productivity of fish. This is an inherent condition not easily altered by our present improvement methods. Nor are we sure that a weedy lake is most desired to serve the recreational needs of all concerned--swimming and boating are too important to be overlooked even by a fish conservationist.

Black Lake, like other large lakes with extensive sandy shoals, considered as a whole is not very productive of fish food organisms. The scarcity of life is especially noticeable where the shoals bear the full impact of wave and current action. Samples taken from these areas only averaged 0.24 cc. of total organisms per square foot of bottom. Midges, fresh-water shrimp, fingernail clams and mayflies were the predominant forms present.

The most productive area of the lake at the time of the survey was within the transition zone between the sandy shoals and deep muck bottoms. The average square foot sample contained 0.70 cc. of total organisms. Plant samples studied from this zone were found to support an average of 64 organisms (vol. 0.20 cc) per pound of plants. The organisms most abundant on the plants of these samples included midges, aquatic sowbugs and freshwater shrimp--all excellent fish foods. On the lake bottom of this zone, midges, mayflies and fingernail clams were the most common fish food organisms.

Below the 20 foot contour in the mucky depths of the lake are rather large populations of midges (Chironomus and Corethra). Samples taken here averaged 46 organisms per square foot, which had an average volume of 0.84 cc. At the time of the survey this area actually supported more food organisms than the shoals. There is little reason to believe that bottom conditions as regards temperature and oxygen would change

sufficiently to alter this picture later in the summer.

The restricted areas around the mouths of the inlet streams produce large quantities of organisms but their extent is so limited they are not of great importance when viewing the lake as a whole.

In comparing the food conditions of this lake with that of other inland lakes studied, we must conclude that it is below average--possibly not below the average of the other large wind-swept lakes of the region. Including all the food samples taken, the average volume per square foot was 0.74 cc. and the average number of all organisms per square foot was 54.8.

Plankton studies at the time of the survey show phytoplankton to be most abundant in the shallow water and zooplankton in the deeper zones. The abundance of these microscopic forms is average or better when compared to other lakes of the region. It must be admitted, however, that although plankton is vastly important as a link in the food chains of fishes, a few collections of this sort, made at one time of year, is liable to give an impression far from the average. This is due to the instability of plankton populations, influenced by pulses and drifts.

A list of the fish taken during the survey as well as those captured later by fishing operations under the direction of the Department of Conservation are given in Table II.

A rough idea of the relative abundance of certain species can be gathered from results of six days netting from November 15-20, inclusive. Using six 4-inch stretch trap nets with leads 600 feet long and wings 50 feet long, 1243 fish were taken. Of this number 38% were common suckers, 28% rock bass, 12% walleye pike, 6% red horse suckers, 6% sunfish, 3% bullheads, 3% northern pike, and the remaining 4% included whitefish,

Table II

Species	Relative Abundance	Total Number Stocked in Last Five Years
Game fish		
Northern pike	Common	
Perch	Abundant	56,000
Walleye	Common	2,540,174
Small-mouthed bass	Rare	(Note: 500 yrlg. Brown trout and 200 yrlg. Rainbow trout were planted in this lake--nohe taken or reported)
Long-eared sunfish	Common	
Pumpkinseed sunfish	Rare	
Rock bass	Abundant	
Sturgeon	Very rare	
Whitefish	Rare	
Coarse fishes		
Common sucker	Abundant	
Redhorse	Common	
Obnoxious fishes		
Long-nosed gar	Rare	
Dogfish	Rare	
Lampreys	Common	
Forage fishes		
Northern Dace	Rare	
Black-chin shiner	Rare	
Mimic shiner	Abundant-predominant	
Straw colored shiner	Common	
Spot-tail shiner	Rare	
Common shiner	Abundant	
Blunt-nosed minnow	Abundant	
Log perch	Common	
Johnny darter	Rare	
Iowa darter	Common	

smallmouth bass, largemouth bass, perch and sturgeon. All fish except the suckers and obnoxious fish were returned to the water. This catch percentage is probably not representative of certain groups. Such a method depends upon the movement of the fish and in the case of the bass and the sunfishes it is known that they move very little after the water cools down near the freezing point. Most of the perch would not be held by the size of net-mesh used and only a few of the very large individuals were retained. Rock bass, perch and walleye pike are probably the most numerous game species, with northern pike, large and smallmouth bass and sunfish in fewer numbers.

The stocking in this lake during the last five years has been confined to perch, walleye and trout. After an inventory of the lake it is not surprising to us that the trout plantings were unable to survive and establish themselves.

Six out of the ten forage fish present are common to abundant. If our collections are representative, the number and kinds of forage fishes present is adequate to supply the needs of the predacious game fish present.

According to the data produced by netting, the undesirable species such as the gar and dogfish are not generally abundant and are probably no great menace to the other fish population. At times the fish may concentrate in small areas in the lake which would explain the reports of abundance made by certain individuals. Lampreys were common but were found to inflict damage mainly on the already large sucker population.

A study of the growth rate of the various game species shows that in general the fish in this lake reach legal length in about average time for the species and region in question (Table III). Northern pike probably reach legal length early in their third growing season. In 4 1/2 years the pike collected had reached an average of 27.6 inches in

Table III. Ages and Average Lengths and Weights of Game Fish Taken From Black Lake, Cheboygan County, During the Survey, July 1-25, 1939

	Age Group	No. of Fish	Standard Length in Inches	Total Length in Inches	Weight in Pounds
Northern Pike	II	8	14.2	16.4	15.6 oz.
	III	3	19.8	22.8	2 lbs., 10.3 oz.
	IV	3	24.1	27.6	4 lbs., 13.6 oz.
Yellow Perch	II	10	5.1	5.98	1.4 oz.
	III	29	5.5	6.5	1.8 oz.
	IV	14	7.2	8.4	3.9 oz.
	V	10	7.9	9.4	5.5 oz.
	VI	4	8.6	10.1	7.1 oz.
	VII	1	10.7	12.5	9.2 oz.
	VIII	1	9.5	11.3	8.4 oz.
Walleye	I	2	8.1	9.5	4.6 oz.
	III	1	15.6	18.3	2 lbs., 2.5 oz.
	IV	4	16.4	19.4	2 lbs., 5.1 oz.
	V	3	17.2	20.2	2 lbs., 10 oz.
	VI	4	17.2	20.2	2 lbs., 10.1 oz.
Smallmouth Bass	II	1	8.4	10.0	9.0 oz.
Rock Bass	II	1	3.0	3.8	0.7 oz.
	III	2	3.8	4.9	1.5 oz.
	IV	5	5.4	6.8	4.1 oz.
	V	4	6.6	8.2	7.2 oz.
	VI	3	7.3	9.0	8.7 oz.
	VIII	2	8.3	10.4	13.5 oz.
	X	1	8.3	10.4	13.1 oz.

* Ages determined from scale studies by Mr. W. C. Beckman of the Institute staff.

total length and nearly 5 pounds in weight.

Perch reached legal length by the middle of the third growing season and grew to 10 inches in their seventh year. Walleye pike, like the northern pike become legal early in their third summer. Four 6 1/2-year old walleyes averaged 20.2 inches in total length and 2 5/8 pounds in weight. The one smallmouth bass taken was in its third summer and had just reached the legal length of 10 inches. The rock bass studied did not reach legal length until the end of their fourth year. Eight to ten-year-old fish of this species averaged 10 inches in length.

Although this study only represents a small number of fish, we feel safe in concluding that the game fish in this lake are growing at a satisfactory rate, possibly as good as or better than the average for large lakes of this type in the region.

The spawning facilities in Black Lake appear to be adequate for the maintenance of all species with the possible exception of walleye pike, whose requirements for reproduction are not thoroughly known at present. The large number of small perch captured during the survey seining operations is testimony to the adequacy of natural propagation of this species. Rock bass and sunfish use the expansive shoal and gravel patches as do the black bass. The great expanse of marshy shoal in the northwest end of the lake no doubt serves as a breeding ground for northern pike. Since very little is known about the spawning requirements for walleye pike, we are not certain that the conditions in Black Lake are suitable for successful natural propagation of this species. However, the success with which this species has established itself would indicate at least some successful natural propagation.

Management Suggestions

Black Lake is now designated as a pike lake and results of this survey give evidence that this designation should be retained. Northern and walleye pike and smallmouth bass should be encouraged by present size limits and adequate protection during the breeding season. The waters of this lake are not at all suited to trout mainly because of the high summer temperatures which prevail from top to bottom. No further plantings of trout should be made.

It should not be necessary to stock the lake with either perch or northern pike. We are not so certain about the walleyes which may or may not be able to maintain themselves by natural propagation. If stocking of this species is discontinued for three years, it might be possible to judge just how effective natural propagation is. Further study of the breeding habits of this species will probably answer this question. There is every reason to believe the perch are already more abundant than the lake can carry and maintain.

Considerable numbers of predators were reported on Black Lake. There is a heron rookery near the outlet which accounts for the rather large concentration of these birds in the vicinity. We have no evidence however that the heron or any other fish-eating bird is of the slightest importance in the reduction of fish in a large lake of this type. We therefore recommend that no measures be taken to reduce their populations.

The only parasite of any importance is the lamprey which was found in rather large numbers attached to suckers, northern pike, walleyes and rock bass. It might be possible to control the lamprey by locating their spawning beds in the various inlet streams, which almost certainly are the spawning grounds used by this fish. No very specific method can be recommended for their destruction until further study is made on this problem now under investigation.

Internal parasites are confined to a few tapeworms which are neither serious to the well being of the fish nor responsible for any damage to the flesh as food.

There does not seem to be adequate cover or shelter in Black Lake. Vegetation beds are only fairly dense and not very numerous. Even granting that sufficient cover were present during the growing season, the lake is still without proper hiding places for the fish during the winter.

A considerable number of brush shelters have already been installed and this type of improvement should be continued. A CCC project for this winter has been approved for the installation of additional shelters along the drop off in 10-20 feet of water and some to be scattered over the bottom in 20-40 feet of water. The possibilities of this project are almost unlimited, but the shelters should be widely spaced and properly anchored. As is already known, the establishment of shelters in the shallow shoal areas is not recommended since they are a menace to boating and are easily torn out by wave and ice action.

The water level, if maintained as at present, is very satisfactory. Any great fluctuations should be avoided insofar as possible, since the vegetation and other organisms growing in shallow water are destroyed by such practice.

A complete creel census for the next ten years is suggested as a means of checking the actual fish harvest. The past general creel census taken by conservation officers includes so few records that no valid information can be secured from it. Evidence points to the fact that fish populations pass through more or less regular cycles. It doesn't seem possible in nature to have a crop of large fish ready to harvest every year. In the years of "good fishing" there are a large number of big fish which keep the oncoming younger generations of the same species reduced. This is due to competition for food and actual predation of the

large on the small. Then due to the removal of the larger fish either by angling, old age or disease, the new crop of young fish for a year or two find no great competition and as a result develop rapidly. The time between the removal of the old fish and the growing up of the new crop is that of "poor fishing." Sometimes game species alternate so that e.g. when pike fishing is good, bass fishing is poor. No alarm should be felt for this natural phenomenon which has probably been going on since fish first inhabited our lakes. Stocking probably doesn't alter this picture in lakes where natural propagation is adequate and may even slow down the growing up process because the more fish that are present of a like competitive class, the slower they will grow, i.e. other factors being constant. A creel census of the type mentioned above would show what the natural cycles are and aid materially in proper management.

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