Original: Fish Division
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February 23, 1942

REPORT NO. 750

FISHERIES SURVEY OF INDIAN LAKE, SCHOOLCRAFT COUNTY

by

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Introduction

Indian Lake is one of the larger and more popular lakes in the Upper Peninsula. It is situated 4 miles northwest of Manistique (T. 41, 42 N., R. 16, 17 W.).

The lake is in the Manistique River drainage system. The Indian River originates some 25 miles north of the lake, flows through the lake, and enters the Manistique River at Manistique.

A map of the lake showing the outline and depth contours was prepared during the winter of 1935-1936 by the C.C.C. The Institute for Fisheries Research* conducted a biological survey of the lake during late June and early July of 1937.

Indian Lake has maintained a reputation as a good fishing lake for many years. It is also a well known recreational center, providing excellent swimming, good boating, and pleasant cottage and camping facilities. Palms Book State Park, containing the "Big Spring", on the west side of the lake attracts tourists from great distances. This lake

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* The party consisted of: F. Bond, leader; J. Greenbank and W. C. Beckman, assistants.

is unusual in that it offers both good fishing and excellent recreational facilities. In addition, the region provides good hunting.

Physical Characters

The lake basin is roughly egg-shaped with the widest portion nearer the north end. It is relatively shallow and, due to its large size, roughened considerably by wind. This is probably largely responsible for the lack of vegetation on the east and southeast sides. Few plants are able to withstand the effect of severe wave action, because of molar action and instability of the bottom.

According to Scott*, Indian Lake was, at one time, a part of Lake Michigan but this connection was discontinued by a bar formation so that the lake now represents a lagoon.

The surrounding country is relatively flat and covered with second-growth hardwoods. The soil is largely sandy and there is little farming.

Indian Lake has a large watershed. The lake, through Indian River, drains a region 8 or 10 miles wide and 25 miles long. Several small inlets service the immediate vicinity on all sides but the east. The fertility, in the form of organic matter and mineral salts, carried from this large watershed into the lake is undoubtedly one of the chief reasons for the continuous productivity, even after extensive fishing.

A water fluctuation of 2 feet was reported by the survey party. This fluctuation seems unlikely, in view of the large number of inlets and a dam in the outlet.

There are two inlets bringing in large quantities of water, namely Indian River and Big Spring. In addition, there are 4 smaller streams entering the lake at various points along the margin. Smith's Creek

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* 1920. Scott, I. D. Inland Lakes of Michigan. Annual Report of the Board of Geological Survey for 1920.

enters at the northeast corner, Dead Creek at the northwest corner, Silver Creek on the west side, and Dufour Creek on the south end. Indian River flows out of the lake on the east side. A dam is situated at Manistique--3 miles downstream. With all these inlets and the proper regulation of the dam, there should be very little fluctuation in the water level of Indian Lake.

The following table summarizes the physical characters of Indian Lake.

Area (acres)	Maximum depth (feet)	Per cent shoal under 15 feet	Bottom types		Inlets	Outlets	Secchi disc (feet)
			Shoal	Depths			
8,000	18	90	Sand, pulpy peat	Pulpy peat	6	1	4-12

The shallowness of the lake is important to fisheries. It means a large area suitable for plant growth, good spawning facilities, and generally abundant food organisms. Shallow lakes generally have an abundance of oxygen in the water at all depths. Oxygen is essential to the life of fish and fish foods.

Light penetration does not exert as great an influence on plant distribution in a shallow lake as it does in a deeper lake where plant and animal distribution is subject to greater variation in depth.

Bottom type distribution is important in so far as it affects spawning facilities, plant growth, and fish food abundance. For example, smallmouth bass prefer a hard sand or gravel bottom for spawning. If this type of bottom is not present in suitable depths, spawning of this species will be limited. Most plants, on the other hand, do not grow well on wave-swept sand bottoms; most bottom food organisms do not prefer hard or shifting sand bottoms but thrive better in softer organic bottoms.

Hence, a balanced distribution of bottom types is essential to good productivity, and Indian Lake provides such conditions.

Temperature and Chemical Character

The shape of the basin, maximum depth, percentage of shoal, etc., constitute but a part of the factors involved in the productivity of lakes. The temperature of the water and the distribution of dissolved gases and mineral salts are also important. A summary of the temperature and chemical conditions found in Indian Lake is given below.

No. of station	Location of station	Surface						Bottom					
		Date	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M.O.Alk. p.p.m.	pH	Depth ft.	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M.O.Alk. p.p.m.	pH
1	½ mi. from Indian R. inlet	6/18/37	72	7.5	2.5	82	8.2	10	69	7.0	2.3	78	8.0
3	South end	6/21/37	70	7.2	1.0	74	8.2	13	68	6.8	3.0	77	8.2
5	Center of lake	6/22/37	70	7.4	1.5	76	8.4	12	69	7.3	1.5	76	8.4
6	East side, near outlet	6/22/37	73	6.6	1.5	79	8.4	12	70	7.2	1.0	77	8.4
7	North end	6/22/37	77	6.4	1.0	77	8.4	6	71	7.5	1.0	82	8.4

It is important to note that there is an abundance of oxygen at all depths and that the temperature is almost uniform in all parts of the lake. The water is alkaline and moderately hard. From a chemical standpoint, the water favors high productivity.

No pollution was observed or reported by the survey party.

Biological Characters

The lake has ample vegetation along the north and west sides. The south and southeast portions of the lake are lacking in vegetation, due, undoubtedly, to the effects of wave action, namely direct injury to plants and unstable bottom conditions so that plants cannot remain rooted. Plants found in Indian Lake are given in the following table.

Common name	Scientific* name	Abundance
Waterweed	(Anacharis canadensis)	Rare
Coontail	(Ceratophyllum demersum)	Rare
Musk grass	(Chara sp.)	Common
Spike rush	(Eleocharis palustris)	Rare
Water milfoil	(Myriophyllum sp.)	Abundant
White water lily	(Nymphaea odorata)	Few
Yellow water lily	(Nuphar advena)	Rare
Pickerel weed	(Pontederia cordata)	Rare
Pondweed	(Potamogeton Friesii)	Few
Pondweed	(Potamogeton gramineus)	Common
Pondweed	(Potamogeton natans)	Few
Pondweed	(Potamogeton lucens)	Few
Sago pondweed	(Potamogeton pectinatus)	Common
Pondweed	(Potamogeton perfoliatus)	Few
Flat-stemmed pondweed	(Potamogeton zosteriformis)	Few
Duck potato	(Sagittaria sp.)	Few
Bulrush	(Scirpus acutus)	Common
Bur reed	(Sparganium eurycarpum)	Few
Cattail	(Typha latifolia)	Few
Bladderwort	(Utricularia vulgaris)	Common

* Plants identified by Dr. C. O. Grassl, University of Michigan Botany Department.

The plants which are most abundant in Indian Lake are of a type which provides excellent cover and usually an abundance of fish food organisms. Fine plants such as Chara and Myriophyllum are good cover for scuds, water mites, and many aquatic insects.

Fish Foods

Fish feed on a variety of foods. Those dealt with in a regular Institute survey are the plankton (small, free swimming or floating animals and plants) and larger bottom organisms. Plankton was plentiful at the time of the survey. Plant forms, mostly filamentous algae, predominated. Since plankton populations vary tremendously from day to day, season to season, and year to year, an analysis covering 4 or 5 days has only general significance.

Bottom organisms in Indian Lake represent a large variety of forms, among which are aquatic worms, snails, scuds, mayfly nymphs, aquatic beetles, and midge larvae. Samples of vegetation were not taken, but recently this method of sampling has given a much better estimate of the abundance of fish food organisms. As mentioned above, the quantity of vegetation in Indian Lake should provide a large quantity of food. Crayfish, which are utilized by many game fish, are abundant.

Fish

Through netting, seining, and angling, the survey party collected the following species of fish. The abundance given is relative. Stocking records for 1936-1940, inclusive, are also given.

Species	Abundance	Number planted 1936-1940
GAME FISH		
Brook trout (Salvelinus f. fontinalis)	Rare (1 caught in 1934)	...
Northern pike (Esox vermiculatus)	Abundant	...
Perch (Perca flavescens)	Abundant	20,000 adult 16,000 yearling 11,000 7-month
Walleyes (Stizostedion vitreum)	Common	3,750,000 fry
Smallmouth bass (Micropterus dolomieu)	Rare	...
Bluegill (Lepomis macrochirus)	Few	...
Pumpkinseed (Lepomis gibbosus)	Few	...
Rock bass (Ambloplites rupestris)	Common	...
Cisco (Leucichthys artedi)	Rare	...
COARSE FISH		
Sucker (Catostomus commersonnii)	Abundant	...
Mullet (Moxostoma aureolum)	Rare	...
Brown bullhead (Ameiurus nebulosus)	Few	...
Black bullhead (Ameiurus melas)	Few	...
FORAGE FISH		
Straw-colored shiner (Notropis deliciosus)	Abundant	...
Common shiner (Notropis cornutus)	Abundant	...
Blunt-nosed minnow (Hyborhynchus notatus)	Abundant	...
Johnny darter (Boleosoma nigrum)	Common	...
Iowa darter (Poecilichthys exilis)	Few	...
Muddler (Cottus bairdii)	Rare	...
Stickleback (Eucalia inconstans)	Rare	...
Menona killifish (Fundulus diaphanus)	Rare	...
Log perch (Percina caprodes)	Few	...
Black-nosed shiner (Notropis heterolepis)	Rare	...
Black-chinned shiner (Notropis heterodon)	Rare	...
Golden shiner (Notemigonus crysoleucas)	Rare	...
Mud minnow (Umbra limi)	Rare	...
Fantail (Catonotus lineotalus)	Rare	...
Spot-tailed shiner (Notropis hudsonius)	Common	...
Mimic shiner (Notropis volucellus)	Abundant	...

The above table indicates an abundance of game fish and plenty of food for the predominant species. Northern pike, perch, and walleyes should have adequate food in the forage fish present. The single brook trout taken in 1934 may have found its way into the lake from Big Spring, where a few are planted for exhibition purposes.

In addition to determining the abundance of the various species of fish, growth rate studies were made on the game fish. Numbers of fish do not mean a great deal unless considered in the light of their growth rate. For example, a large population of stunted fish is not nearly as desirable as a smaller population of fast- or even normal-growing fish.

The average size of the various age groups of the game fish are given in the following table.

Species	Number	Age group*	Average size (inches)
Rock bass	4 (all ♀s)	VI	8.9
	1 (♂)	VII	8.1
Bluegill	2	V	7.1
	2	VI	7.4
Perch	1	III	5.8
	3	IV	7.3
	2	VI	8.5
	4	VII	8.7
	3	VIII	9.7
	4	IX	11.5
Smallmouth bass	1	III	10.7
	1	IV	12.2
Walleye	1	III	13.0
	4	IV	15.6
	3	V	17.4
	7	VI	16.8
	4	VII	17.2
Northern pike	2	II	17.1
	6	III	19.8
	8	IV	23.1
	6	V	22.1

* Age determinations made by W. C. Beckman.

These studies indicate that average growth rate occurs in all species, except perhaps the yellow perch. The average Michigan perch, according to W. C. Beckman, is reported to reach legal size during its third summer of life and at the age of four years should reach eight inches. The perch in Indian Lake are growing slower than the state

average but this is not regarded as serious because the two predacious species of pike should prevent perch from becoming too numerous.

Indian Lake has a well balanced fish population. The pike predominate in the game fish class and are successful because of the generous food supply largely in the form of perch and minnows. Undoubtedly other game species are also preyed upon, but due to the abundance of perch and minnows, they would naturally constitute the major source of food for the pike.

The balanced fish population is possible largely because the lake offers suitable spawning habitats for all of the species present. Shallow, weedy areas are common along the northwest side of the lake, sand bottoms are common around the entire lake, and the numerous inlets provide running water for the species desiring it. Natural propagation of all species, except possibly walleyes, should therefore be sufficient to keep the population balanced. The extent to which walleyes spawn in inland lakes is not definitely known and until that is determined, stocking may be necessary.

Management Suggestions

Designation

The lake is designated as a "pike lake" and there certainly is no present or foreseen need for its being changed.

Stocking

From 1928 to 1939, walleyes and perch have been planted annually. In 1940 no perch were stocked. This is regarded as a favorable move in the management of Indian Lake since perch are abundant and there are ample spawning facilities.

The necessity for stocking walleyes is questionable. It should be determined whether the present population is entirely the result of the stocking efforts or whether natural propagation is taking place on a large scale so that artificial plantings are no longer necessary. A modification of the stocking policy which will permit this study and which will not seriously interfere with the population, in case no natural reproduction occurs, is advisable. This might be done by stocking during alternate years and attempting to take the young-of-the-year fish by intensive seining during the years when no stocking occurs. The schedule recommended is as follows:

1942 - No stocking, and intensive seining of the shoal areas during May.

1943 - Stock with walleye fry.

1944 - No stocking--same as 1942.

1945 - Policy revised on the basis of findings during 1942 and 1944.

If no young of the year are found in 1942 or 1944, or if in the next three or four years no fish which are known to have been hatched during 1942 or 1944 are taken, walleyes should be stocked regularly if it is desired to maintain this species. If natural reproduction does occur, it is recommended that stocking be stopped.

Predators and Parasites

The loss of fish through predation and parasitism is thought to be negligible. A few parasites were found in the perch but none that would cause serious damage. Predators are limited to a small number of kingfishers and herons.

Regulation of Water Level

The survey party reports a fluctuation in water level of two feet. If this is true, some regulation of the level should be enforced. The dam at Manistique can and should be used in such regulation. A fluctuation of this magnitude would destroy many of the weed beds and habitats for young and small fish.

Winter Fishing

This lake was closed to fishing during the winters of 1936, 1937, and 1938. It was reopened to the hook and line fisherman in 1939 but continued to be closed to spearing. This regulation was made effective until January 1, 1945 by ~~the 1941 legislature.~~ order of the Conservation Commission. It is doubtful that any sound biological reasons exist for closing this lake to winter fishing. Intensive research on some smaller lakes in southern Michigan, where the winter fishing pressure is proportionately much greater, indicates that while considerable numbers of fish may be removed, winter fishing does the lake no harm and does not materially effect the fishing during subsequent summer seasons. If heavy winter fishing does no harm to small lakes such as Craig Lake in Branch County, and Bear Lake in Hillsdale County, moderate fishing--spearing or otherwise--should not harm a lake of 8,000 acres.

INSTITUTE FOR FISHERIES RESEARCH

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