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A FISHERIES SURVEY OF INDIAN AND LITTLE WHITE GOAT LAKES IN MARQUETTE COUNTY, AND KEEWAYDIN LAKE IN MARQUETTE AND BARAGA COUNTIES

by

Eugene Roelofs

These three lakes are situated four miles north of Michigamme, Marquette County. Their specific locations are as follows:

	County	Township	T.	R.	Sections
Indian*	Marquette	Michigamme	48, 49 N.	30 W.	5-6, 32
Little White Goat	Marquette	Michigamme	49 N.	30 W.	32-33
Keewaydin*	Marquette Baraga	Michigamme Spurr	49 N.	30, 31 W.	31, 36

The lakes are inaccessible by road and can only be reached by foot trail from Michigamme. A north-south road comes within 2 miles of Little White Goat Lake, but there are several streams between the road and the lake.

All three lakes are tributary to the West Branch of the Peshekee River which flows into Lake Michigamme. The Michigamme River connects Lake Michigamme with the Menominee River and Lake Michigan.

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*Both of these lakes are sometimes referred to locally as Wolf Lake.

An Institute for Fisheries Research party* mapped these lakes and made biological surveys during August, 1937.

It is not known whether or not these lakes were formerly used in logging operations. Since they are tributary to the Michigamme, their use in the logging industry is entirely possible.

Indian and Little White Goat Lakes are said to have supported trout in the early logging days. The trout have now disappeared, and the only game species taken recently are perch and pumpkinseeds. Lumbering may have been largely responsible for this change. These lakes have a number of small inlets which might warm up considerably with the removal of timber. The inflow of larger amounts of warmer water into these shallow lakes would result in conditions unfavorable for trout. No other reason for the disappearance of trout can be advanced. The fact that trout still have access to the lakes (they are present in the immediate drainage below the lakes) and are not present is evidence that conditions are not suitable.

Keewaydin Lake has had only a perch fishery for many years, according to local reports.

Indian Lake had one cottage and two vacant log cabins on its shores at the time of the survey, while Little White Goat Lake had a girls camp, and Keewaydin Lake had no resort or recreational developments. These lakes are too inaccessible for extensive resort development, but offer fine camping facilities for those who enjoy getting away from the more public lakes. It is doubtful that these lakes will become important fishing waters, unless they are made more accessible, and this is not encouraged because lakes such as these will probably not stand a heavy

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*The party consisted of F. Bond, leader; W. C. Beckman, ~~W. F. Carbine~~ Floyd Ames, and J. Greenbank, assistants.

fishing pressure but will undoubtedly serve those few who enjoy a real hiking, camping, and fishing trip.

Physical Character of the Lakes

The lakes lie in a heavily wooded region characterized by rocky soil. All of the lakes have rocky, wooded shores.

The three basins are quite irregular in outline and relatively shallow. Each lake has several inlet streams, each of which is less than a mile in length.

Little White Goat and Keewaydin Lakes have old beaver dams in their outlets. These dams have no effect on the water levels and it is doubted that they impede fish movements.

A summary of the physical characters of the three lakes is given below.

Lake	Area	Maximum depth	Bottom type	Secchi disc	Shoreline development
Indian	86 A.	19 ft.	Sand - to 5 ft. contour Pulpy peat - below 5 ft.	6 ft.	2.35
Little White Goat	108 A.	14 ft.	Sand - to 5 ft. contour Pulpy peat - below 5 ft.	8 ft.	1.65
Keewaydin	151 A.	24 ft.	Sand - to 10 ft. contour Pulpy peat - below 10 ft.	9 ft.	2.38

From the standpoint of physical characters, these lakes favor high productivity. Shallow lakes are usually more productive than deep lakes, other conditions being favorable. The shoreline development (obtained by dividing the circumference of the lake by the circumference of a perfectly round lake of the same size) indicates the abundance of bays, coves, and other irregularities. In general, a high shoreline development is associated with high productivity.

The Secchi disc reading indicates the approximate depth to which light penetrates. This is important from the standpoint of plant growth.

These lakes are subject to variations in turbidity resulting from material carried in by the many small inlet streams. The water is colored (light brown) as are many Upper Peninsula lakes, which also decreases light penetration.

Temperature and Chemical Characters

Lakes vary in their temperature and chemical characteristics, and differences are reflected in the animal and plant life of the lake. Cold waters, for example, promote good growth of trout, while bluegills in the same water would grow slower. Fish also vary in their oxygen requirements. Plankton (small, free swimming or floating animals and plants), invertebrate animals, and aquatic plants all have a particular set of conditions which favors their growth. Hence, by collecting data on the temperature and chemical nature of lakes, it is often possible to understand why certain kinds do well and others do not.

A summary of the temperature and chemical characters of the lakes as of August 6-9, 1937, is given below.

Lake	Surface					Thermocline																
						Top						Bottom						Bottom				
	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M. O. Alk. p.p.m.	pH	Depth in ft.	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M. O. Alk. p.p.m.	pH	Depth in ft.	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M. O. Alk. p.p.m.	pH	Depth in ft.	Temp. °F.	O_2 p.p.m.	CO_2 p.p.m.	M. O. Alk. p.p.m.	pH
Indian	79	6.3	2.5	10	5.8	10	67	3.4	7.0	15	5.8	18	54	0.0	17.5	30	5.8	18	54	0.0	17.5	30	5.8
Little White Goat	76	6.9	1.5	10	6.0	...	...	...	...	...	...	...	...	...	...	...	...	12	70	3.8	7.0	17	5.8
Keewaydin	75	6.9	1.5	9	6.0	15	67	5.6	4.0	12	...	20	58	0.8	13.5	26	...	23	56	0.0	20.0	39	5.8

These lakes have rather warm surface waters for Upper Peninsula lakes. This is undoubtedly due to their shallowness and their protection from the wind. These temperatures favor the growth of most fish, but are slightly beyond the toleration limit of trout. (Trout do not stand temperatures over 70° F. very long).

The chemical character of the water in all three lakes is not conducive to high productivity. The waters are quite soft; most plants and many animals require mineral salts in higher concentrations than are found here. While the lakes are not excessively acid, a scarcity of plant species is generally associated with a pH as low as 5.8. There may be an abundance of plants of one or two species so that the total plant crop is fairly large, but there is less diversity than in lakes more nearly neutral (pH 7.0 is neutral).

The waters of Indian and Keewaydin Lakes are divided into 3 vertical zones on the basis of temperature. The thermocline (see depth limits in above table) is a zone where the temperature changes rapidly--more than $\frac{1}{2}$°F. per foot of depth. The water above this zone, known as the epilimnion, is warmer and usually well aerated. Water below the thermocline (hypolimnion) is colder and often stagnant in late summer, due to organic decomposition and lack of circulation. (Notice in the table: those lakes having a thermocline have no oxygen at the bottom.) In shallow lakes such thermal stratification may render part of the lake unsuitable for all fish life. In deeper lakes, this may be true also, but there is a greater possibility of finding suitable conditions for cold-water fish in and just below the thermocline. Since the surface waters of Indian and Keewaydin Lakes are too warm for the cold-water fish, and the deeper, colder waters contain no dissolved oxygen, the survival of a trout population in these lakes is unlikely.

Biological Characters

In addition to the physical and chemical characters of the water, the kind and amount of vegetation, fish food, and fish, must be considered in a complete inventory, or any lake management plan.

Vegetation

The plants found in the three lakes are given below.

Plant	Scientific name*	Indian	Little White Goat	Keewaydin
Three-way sedge	(Dulichium arundinaceum)	...	Rare	...
Spike rush	(Eleocharis sp.)	...	Rare	Rare
Horsetail	(Equisetum limosum)	Common	Rare	Common
Pipewort	(Eriocaulon septangulare)	Rare	Rare	Rare
Water moss	(Fontinalis sp.)	Common	...	Few
Quillwort	(Isoetes sp.)	Rare	...	...
Water milfoil	(Myriophyllum sp.)	Few	...	...
White water lily	(Nymphaea odorata)	...	Rare	Rare
Yellow water lily	(Nuphar advena)	Rare	Abundant	Common
Large-leaf pondweed	(Potamogeton amplifolius)	...	Rare	...
Leafy pondweed	(Potamogeton epihydrus)	Rare	...	Rare
Floating-leaf pondweed	(Potamogeton natans)	...	Common	?
Bulrush	(Scirpus acutus)	Abundant	...	Rare
Bur reed	(Sparganium)	Abundant	Abundant	Abundant
Bladderwort	(Utricularia)	...	Rare	...

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

Fish foods

Bottom samples produced little in the way of food. Corethra (phantom midge) larvae and ~~chirmomid~~ chironomid (midge) larvae were the only two forms found, and they were found sparingly. Vegetation is scarce in all three lakes, so the food supply is inadequate for a large fish population.

Plankton samples indicated average production at the time of the survey, but, due to the tremendous fluctuations in plankton populations, this may have relatively little significance in fish food consideration.

Fish

The following table shows the kind and relative abundance of fish inhabiting the lakes.

Fish	Indian	Little White Goat	Keewaydin
GAME FISH			
Perch (Perca flavescens)	Common	Common	Common
Common sunfish (Lepomis gibbosus)	Abundant	Abundant	Abundant
Green sunfish (Lepomis cyanellus)	Few	Few	Rare
Green x Common sunfish	Rare	Rare	Rare
COARSE FISH			
Common sucker (Catostomus commersonnii)	Common	Abundant	Common
FORAGE FISH			
Blunt-nosed minnow (Hyborhynchus notatus)	Abundant	Abundant	Abundant
Black-nosed shiner (Notropis heterolepis)	Common	Common	Common
Common shiner (Notropis cornutus)	Abundant	Abundant	Abundant
Golden shiner (Notemigonus crysoleucas)	Common	Abundant	Abundant
Creek chub (Semotilus atromaculatus)	Abundant	Abundant	Common
Iowa darter (Poecilichthys exilis)	Common	Common	Few
Fat-headed minnow (Pimephales promelas)	Abundant	Few	Common
Northern dace (Margariscus margarita)	...	Few	...

According to stocking records, no fish have been planted in any of these lakes. The populations, therefore, are native and the natural balance seems to have favored the forage fish and less important game fish (sunfish).

Growth studies of the perch from these lakes are given below.

		Indian		Little White Goat		Keewaydin	
Species	Age*	Number of fish	Average length	Number of fish	Average length	Number of fish	Average length
Perch	II	2	6.6	2	6.7	...	...
	III	5	6.1	5	6.6	1	6.2
	IV	2	7.9	1	9.6	6	7.2
	V	1	8.9	...	...	2	9.9
	VI	2	8.9	1	11.8	2	9.9
	VIII	1	10.4	...	...	1	12.3

* Age determinations by W. C. Beckman.

The number of fish examined is too small to warrant definite conclusions as to growth rate. The perch from Little White Goat Lake seem to be making better growth than those from the other two. The Keewaydin Lake perch are apparently stunted.

All of these lakes have suitable spawning areas for the sunfish. Perch have few specialized spawning requirements so that almost any lake is satisfactory for their natural reproduction. Natural propagation is responsible for the maintenance of the present population.

While natural propagation is usually adequate to keep a lake populated, it is necessary in certain cases to make artificial plantings for the purpose of introducing new species. This introduction may balance the fish population in such a way as to benefit the existing species and add an additional game fish.

Management Suggestions

In line with the above discussion, the following programs are suggested for the three lakes.

Indian Lake

This lake has a perch population which seems to be growing fairly well, but it is believed that there is ample room and food to support another species. A planting of 40-50 largemouth bass (adults) is recommended for this spring (April or May, 1942) so that spawning may occur normally. There should be facilities for spawning, and it is believed that the introduction of bass into this lake will not harm the perch population to an appreciable degree and, if they become established, will add considerably to the sport fishing on the lake. There is little reason to doubt their ability to become established, because they have every advantage.

The source of the largemouth stock must be a lake in the vicinity since the hatcheries do not carry this species as adults. Local suggestions and help might be solicited.

The designation of the lake should remain as "all other".

Keewaydin Lake

This lake contains a perch population believed to be stunted. Rather heavy predation will undoubtedly improve the growth rate. There are many other fish present that may be used as forage, so there should be no fear of completely destroying the perch population by a larger species.

A planting of 25 northern pike is recommended and is to be made as soon as possible, preferably before the 1942 spawning season. These pike may perhaps be obtained from local sources.

Pike may spawn in the lake, or run up the four inlets, or perhaps down the outlet. Seining these streams for young-of-the-year pike should yield evidence of successful propagation. If young are produced, it is recommended that the designation of the lake be changed to a "pike" lake.

Little White Goat Lake

The perch in this lake are making satisfactory growth. It is suggested that the lake be left as it is. This will serve two purposes, namely, save the lake for a good perch lake, and serve as a check or comparison with the other two lakes. If the plantings in the other lakes take hold and bass and pike populations become established, the differences between managed and unmanaged lakes of this type will be more apparent if one is left undisturbed.

The "all other" designation of Little White Goat Lake should be retained.

Other Management Suggestions

Predators on these lakes consist of loons, gulls, and great blue herons. They are not present in sufficient numbers to warrant control.

Parasites are limited to black spot (Neascus) and grubs (Clinostomum). A few heavy infestations of the latter were found in perch from Indian and

Keewaydin Lakes, and it is reported as common in all three lakes. This parasite seldom affects the well being of the fish and does not usually influence the eating qualities of the flesh. Control therefore is unnecessary; control of such parasites in natural waters is also very difficult, if not impossible. This parasite seems to be confined to perch in these 3 lakes.

Vegetation is sparse, except at the margin, but it is believed impractical to attempt the establishment of weed beds. Cover is adequate. Spawning facilities require no change.

The water level does not fluctuate abnormally.

The lakes in which planting occurs should be checked during the summer of 1942 to ascertain whether or not spawning has been successful.

If young are produced, samples of fish should be taken for study after 3 or 4 years to determine growth rate and condition of the introduced species, as well as of the perch. The effect of adding a predatory species to a stunted population may then be determined.

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