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FISHERIES SURVEY OF HOFFMAN LAKE, CHARLEVOIX COUNTY

by

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Hoffman Lake is located in Hudson Township, Charlevoix County (T. 32 N., R. 4 W., Sec. 26, 27, 34, 35). It lies about 10 miles southeast of Boyne Falls and 7 1/2 miles northwest of Vanderbilt. The lake is also known locally as Huffman Lake and Branch Lake.

It was mapped by the Institute for Fisheries Research* during March of 1941. This map shows the depths and the types of bottom present in the lake.

Fish collections were made by the fish party** on July 15-17, 1941, and a biological survey*** was made August 18-19, 1941. This report is a summary of the data and observations collected by these three fisheries parties.

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* The mapping party included: Robert Matthews, leader, assisted by Oden State Hatchery personnel.

** The fish party included: W. C. Beckman, leader; L. Anderson, P. Galvin, and M. Pawlick, assistants.

*** The biological survey party included: John Funk, leader; E. W. Roelofs and S. J. Lievense, assistants.

Hoffman Lake is reported to have been a good fishing lake in the past, particularly for bass and perch. It is also reported that trout have been taken from the lake in earlier times. However, within the last few years catches of all fish are supposed to have decreased. Montana grayling were introduced in 1926, but apparently with no success.

The resort development on this lake is limited to four cottages. A large portion of the shoreline is low and swampy, limiting real estate development to the higher land on the east and southeast shores. The lake is very attractive because of its natural setting and undoubtedly will remain a popular lake if fishing is reasonably good. Fishing is almost limited to the summer months since roads leading to the lake are impassable during much of the winter.

Hoffman Lake lies in a region of the Lower Peninsula which received tremendous glacial deposits; consequently the topography is decidedly rough. It lies in a broad valley surrounded by hills. Much of the immediate shore consists of dense cedar swamps. Springs which originate in these swamps provide the major source of water for the lake; the water from several of these springs enters the lake in a small stream, the lake's only inlet. These waters also constitute the headwaters of the West Branch of the Sturgeon River, which is the only outlet of the lake. Since the lake occupies a position at the headwaters of the Cheboygan River system and lies in hilly country, its watershed area is rather small. The area drained is mostly covered by a second growth of hardwood, with scattered clearings occupied by farms. Due to the sandy soil and rough topography, the land is submarginal for farming.

Hoffman Lake maintains a rather constant water level. This is undoubtedly due to its uniform source of water. Small beaver dams in the outlet are believed to have little or no effect on the lake, either on the

fishing or maintaining the water level.

The lake has a surface area of 120 acres and a maximum depth of 22 feet. Approximately 75 per cent of the lake is considered shoal (less than 15 feet deep). The shoal area varies considerably in width--from 100 to 1,500 feet. The predominant bottom soil is marl, exceptions occurring in a few isolated places along the margin, where sand is present. Debris from the cedar swamps is common on the bottom, where the swamps form the lake shore.

The shoreline development of Hoffman Lake is 1.21. This means that the shoreline is 1.21 times as long as it would be if the lake were perfectly round and had the same area, and indicates a lack of bays and coves which often play an important part in providing food and shelter for fish.

The water is not especially turbid but has a greenish cast due to the marl bottom. The Secchi disc (black and white circular disc used to indicate light penetration) could not be seen in water deeper than 7 1/2 feet on a clear day. The distance to which sunlight penetrates into water is affected by the color and turbidity of the water. In this connection, it is interesting to note that vegetation in Hoffman Lake is restricted to the shallower waters (12 feet or less), whereas in many lakes plants are able to grow in 20 to 25 feet of water. Light penetration is often a controlling factor in the depth distribution of aquatic plants.

The large shoal area in Hoffman Lake is generally indicative of reasonably high productivity. The entire lake is somewhat protected from severe winds since it lies south of a rather high range of hills. This prevents wave action, which may under certain conditions greatly reduce plant growths; it also decreases evaporation--which may aid in the maintenance of a uniform water level. Production of vegetation in this lake, however, is limited by the almost pure marl bottom since few plants seem to grow well on this type of soil.

The temperature and chemical nature of the water affect plant and animal life in any given lake. Data with regard to these characters as taken August 20, 1941, are presented in the following table:

Depth in feet	Water temperature		Oxygen (p.p.m.)		Methyl orange alkalinity (p.p.m.)		pH	
	Depression	Outlet	Depression	Outlet	Depression	Outlet	Depression	Outlet
0	67	67	8.3	8.3	148	155	8.2	8.2
10	67	...	...	...	...	...	...	...
15	67	...	...	...	...	...	...	...
20	67	...	8.2	...	150	...	8.2	...

The temperature of the water did not vary from top to bottom. As shown in the above table, it was 67°F. on the date of the survey. The fish party reports a surface temperature of 70°F. on July 16 and 17. This probably represents the maximum summer temperature and from this standpoint the lake is suitable for the cold water fish. These data also indicate that the lake does not stratify thermally but is in more or less continuous circulation. This is probably due to the inflow of the cold spring water into the surface layer; colder water being heavier than warm water, sinks and replaces the warmer waters--keeping the lake in circulation and of uniform temperature. This is important in fisheries management because it results in suitable temperatures and an adequate oxygen supply for fish in all regions of the lake.

The water in Hoffman Lake is distinctly alkaline with a pH of 8.2 and moderately hard, the methyl orange alkalinity ranging from 148 to 155 parts per million. These characteristics are usually coincident with high productivity, but, in Hoffman Lake, other factors--chiefly the heavy marl deposition--exert a contrasting influence so that plant and animal life is reduced.

Vegetation in this lake is limited both with respect to amount and variety. Only 10 species of plants are reported and no single species is considered abundant. Dense weed beds do not occur in any portion of the lake. A summary of the kind of plants, their abundance, and their distribution with regard to depth is given in the table below. Since the bottom is almost entirely marl, the distribution of plants with respect to bottom soil is omitted.

Common name	Scientific name	Abundance	Range of depth (feet)
Sedge	Carex lasiocarpa	Rare	0 - 1/2
Musk grass	Chara	Rare	0 - 12
Bushy pondweed	Najas flexilis	Rare	0 - 12
Reed grass	Phragmites maximus	Rare	2
Pondweed	Potamogeton americanus	Rare	1
Pondweed	Potamogeton angustifolius	Rare	
Floating-leaf pondweed	Potamogeton natans	Rare	
Sago pondweed	Potamogeton pectinatus	Rare	
Hard-stem bulrush	Scirpus acutus	Common	0 - 4
White water lily	Nymphaea odorata	Rare	

The scarcity of vegetation is undoubtedly one of the chief reasons for the lack of productivity in the lake. Weed beds not only provide protection for the younger fish but constitute a major habitat of fish food organisms. The relatively pure marl bottom is not suitable for the majority of food organisms. This, together with the lack of vegetation, results in a low production of the larger fish food organisms.

Plankton (microscopic and semi-microscopic plants and animals) samples taken during the survey show that this form of food is below average. Plankton provide a source of food for the larger fish food organisms as well as a direct source of food for the smaller fish. Recent studies also show that larger fish may feed on plankton, particularly in winter. In the plankton from Hoffman Lake, the animal forms are predominant.

Available bottom foods in the lake are not sufficient to supply a large fish population. While a wide variety of bottom organisms is present, the numbers are extremely small. The latter is true of both the shallow and the deeper waters. Midge larvae and fresh-water shrimps are more abundant than are any of the other forms--mayflies, dragonflies, damselflies, aquatic earthworms, and snails--but even they are not considered common.

An examination of one of the marl-covered logs was made. This produced an abundance of fresh-water shrimp and one of the aquatic beetles (Dryopidae)--both larvae and adults. These organisms, however, are embedded in the marl and in cracks in the log to such an extent that they would not be readily available to fish.

Collections made by the fish party show that perch, rock bass, and pumpkinseeds are predominant game fish in Hoffman Lake, with smaller numbers of brook trout and largemouth bass.

Forage fish were abundant, and no obnoxious fish were seen, taken, or reported.

A summary of all the fish taken is given in the following table. The game fish are listed in order of their abundance, as judged by the collections of the fish party. Stocking records are also shown in this table.

Species	Abundance	Stocking 1936-1940
GAME FISH		
Yellow perch	Common	
Rock bass	Common	
Pumpkinseed	Few	
Largemouth bass	Few	
Brook trout	Few	5,500
Bluegill	Reported	5,000
COARSE FISH		
Common sucker	Common	
OBNOXIOUS FISH (none seen, taken, or reported)		
FORAGE FISH		
Mimic shiner	Common	
Common shiner	Common	
Blunt-nosed minnow	Few	
Log perch	Few	
Iowa darter	Few	
Creek chub	Rare	

The following table shows the results of a growth rate study of the game fish from this lake.

Fish	Age group	Average length (inches)	Average weight (ounces)	Number of specimens
Brook trout	II	7.5	2.4	1
	III	10.5	6.9	2
	IV	12.0	7.6	1
Largemouth bass	III	11.9	15.7	1
	IV	13.7	23.0	4
Pumpkinseed	II	3.8	0.6	2
	III	5.1	1.4	1
	IV	5.2	1.5	4
	V	5.9	2.5	3
	VI	6.8	3.9	5
Rock bass	I	2.1	...	1
	II	3.3	0.3	1
	III	3.7	0.5	2
	IV	5.3	1.6	2
	V	5.9	2.0	2
	VI	6.1	2.3	2
	VII	5.9	2.5	6
	VIII	7.3	4.4	4
Yellow perch	I	3.4	0.3	4
	II	4.0	0.4	4
	III	4.8	0.5	2
	IV	6.1	1.2	7
	V	6.2	1.8	6
	VI	6.8	1.7	2
	VII	9.0	3.9	2
	VIII or over	12.2	9.9	2

These data indicate good trout growth, fair growth of largemouth bass, but poor growth of pumpkinseeds, rock bass, and yellow perch. Largemouths undoubtedly do well because of the abundance of forage fish.

Management Suggestions

While spawning facilities are probably adequate for largemouth bass, rock bass, pumpkinseeds, and bluegills, the nature of the water makes the lake more suitable for trout.

The cold water retards the growth of the warm water fish but is excellent for trout. Perch, pumpkinseeds, and rock bass grow very slowly; largemouths do fairly well, but since the lake is suitable for trout, no other forms should be encouraged.

Spawning facilities for brook trout are not adequate at present since a pure marl bottom is not known to be used by this species. However, this condition, in all probability, can be remedied and the designation of Hoffman Lake should remain a "trout lake," at least until other management practices have been attempted. The propagation of trout should be encouraged and the stocking of other game fish discontinued.

Stocking records show that brook trout of fingerling size have been planted. When fish of this size are introduced into a lake containing a population of adult bass and perch and having as little natural cover as does Hoffman Lake, it is not likely that the plantings will be very successful because of the predaceous feeding habits of the bass and perch. While deadheads and other debris are abundant in the lake, they are not of a type which offers protection to small fish.

Several suggestions for increasing the trout population can be advanced. First, larger trout might be planted. As an experiment, a thousand each of brook and rainbow trout of legal size could be planted in an attempt to determine the survival of a planting of this type.

If it is impractical to plant the larger fish, some protection should be offered the smaller fish before plantings are continued. This can probably best be done by brush shelters, which have proven to be very helpful in similar cases. These shelters should be of the "hollow-square" type as described in the bulletin of the Institute for Fisheries Research entitled "The Improvement of Lakes for Fishing." This type of shelter, if scattered about the margin of the lake, where the bottom slope is gradual, should be effective in providing shelter and food for the smaller fish. They should be placed in water from 6 - 12 feet deep. This type of shelter has the advantage of aiding in the establishing of weed beds, which are conspicuously lacking in this lake. Organic matter tends

to accumulate, thus enriching the bottom and encouraging weed growth.

Since the lake is spring fed and there is some seepage into the shoal area, the spreading of small patches of gravel on the shoal, at the entrance and in the small spring "runs" (after being rid of debris), and in the small inlet stream should prove very satisfactory as spawning areas for brook trout. If this is done, the brush shelters as described above should be installed to provide shelter for the young. If the bottom should prove too soft to support gravel patches, boxes as described in "The Improvement of Lakes for Fishing" should be constructed.

Inasmuch as the marl bottom is not suitable for the production of dense plant growths, it is not advisable to make artificial plantings of weeds--unless the soil is enriched or modified as it would be in the hollow-square brush shelter.

There is little evidence of predation in the lake.

Parasites such as the yellow grub, bass tapeworm, black spot, and liver cysts are present in the game fish. Since few severe infestations were noted, control seems unnecessary and impractical. Moreover, these parasites seem to have little effect on the well-being of the fish and have no influence on the eating qualities of the flesh.

The water level is subject to very little fluctuation and requires no regulation.

INSTITUTE FOR FISHERIES RESEARCH

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