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A FISHERIES SURVEY OF FENCE LAKE, BARAGA COUNTY

by

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Introduction

Fence Lake covers portions of Sections 9 and 16, T. 47 N., R. 31 W., of Spurr Township, Baraga County, in the western portion of the Upper Peninsula of Michigan. It is near the northern headwaters of the Fence (E. Br. River, and is situated within 2 1/2 miles of Spruce, Petticoat and Heart Lakes. The Village of Michigamme is located 5 miles northeast of the lake, and Highway US-41 and the Duluth, South Shore and Atlantic Railway pass 5 miles to the north.

The map of Fence Lake, showing the shoreline, shore features, depth contours and bottom types, was completed by an Institute for Fisheries Research lake survey party* on July 20, 1937. A regular physical, chemical and biological survey was made by the same field party during the period extending from July 17 to 20 of that year.

Fence Lake, being quite far removed from population centers and being relatively inaccessible, has never received extensive recreational or other use. A portion of the area in the vicinity of the lake has been logged

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* The survey party included Franklin Bond, leader; John Greenbank, William Beckman and Floyd Ames, assistants.

in the past, and its shores may have at one time been the site of a logging camp.

Brook trout have played an important part in the early history of Fence Lake, as fishing for this species is reported to have at one time been very good. There has been a steady decline in trout fishing in recent years, and at the time of the survey trout were no longer being caught. Bass were introduced, probably before 1930, and have furnished fair fishing since that time. A high degree of parasitism occurs in the fish, however, and it is believed that few fish taken by anglers are ever eaten.

There were three cottages at Fence Lake in 1937, and there were no boat liveries, resorts or hotels. Much of the shoreline is an excellent bathing beach, but the lake is little used for this purpose.

With the continuation of the present tendency toward increased outdoor recreation, it is to be expected that Fence Lake will become of somewhat increased importance. This will be particularly true if the lake is made more accessible in the future, and if proper advantage is taken of the suitability of the water for trout.

Physical Characters of Fence Lake

Fence Lake is a deep, irregularly shaped body of water, with an area of 310 acres. The country surrounding the lake is densely wooded, rolling, and has essentially sandy soils. The basin of Fence Lake was very probably of glacial origin and may have been formed by the melting of a large block of ice left by the retreating glacier.

Fence Lake is located near the northern headwaters of the East Branch of the Fence River. The stream flows in a southerly direction and enters the Michigamme River about 20 miles to the south. The drainage area of the lake is limited to about 2 square miles and is served by only one

short inlet stream, which enters the lake at its northern extremity.

Fluctuations in the water level of Fence Lake are minimal, being restricted to rises of 2 to 3 feet or less during the spring run-off and during periods of particularly heavy precipitation. The lake has a single outlet, the East Branch of the Fence River, which leaves the west end of the lake. This outlet is crossed by an old beaver dam which no longer effectively backs up water or restricts fish movement.

Fence Lake has a maximum depth of 62 feet, which is found in the north-central portion of the main body of the lake. A second depression of 50 feet in depth is located in the large west bay of the lake. The water has 4.6 miles of shoreline, and its shoreline development is 1.86. This means that the lake has 86 per cent (1.86 times) more shoreline than a perfectly circular lake of the same area would have. Ordinarily, the greater the shoreline development of a lake, the greater is its productivity, since extensive shallow bays and coves, found only in lakes with extended shorelines, provide more food, shelter and spawning facilities (for most species of fish) than open water does. Fence Lake has 3 islands which contribute to the length of its shoreline.

Only about 15 per cent of the area of Fence Lake is sufficiently shallow to be potentially suitable for the growth of aquatic vegetation. The declivity from shoals to the depths is quite steep. The sandy bottom soil typical of almost all the shallow areas in the lake extends in most cases down to a depth of about 25 feet. The deeper waters have a marly peat substratum. Fibrous peat is present in 3 rather restricted areas, in the extreme north, southwest and west extremities of the lake. Boulders, rubble and gravel occur along much of the sandy shoreline.

The water of Fence Lake is colorless and quite clear. A Secchi disk (white metal disk about 6 inches in diameter) when lowered into the water at the time of the survey disappeared from view at an average depth of 17 1/2 feet. This indicates a transparency well above the average for the waters of the vicinity, particularly the bog-stained lakes of the Spruce River drainage, just to the north of Fence Lake, which are less than 1/3 as transparent. Degree of clearness of the water is an important factor in determining the depth to which aquatic plants will grow in a given water, since none of the higher aquatic plants can survive in the continued absence of light.

Temperature and Chemical Characters of Fence Lake

Temperature and chemical data are important in assisting the fisheries worker to predict the suitability of a given water for various fish species. With respect to temperatures as well as dissolved oxygen and other chemical factors, requirements differ among various fish species, as well as among fish food organisms, plants, etc. Temperature and chemical data frequently offer important clues concerning the reasons for the presence of existing fish populations and sometimes suggest means for improving the water's production of desirable game fishes.

Temperatures were taken and chemical analyses were made on the water July 19 and 20. A summary of the findings is shown in Table I.

As indicated in the table, the temperature of the water in Fence Lake at the time of the survey ranged from 45° to 73°F. The series of temperatures taken during the survey indicates the presence of a thermocline (zone of rapid change in temperature, e.g., 1°C. or more per meter of depth) in both depressions of the lake. A thermocline in a lake indicates the presence of three distinct strata with regard to temperature. The epilimnion is a warm, circulating layer of water above the thermocline

(in this case extending from the surface to a depth of 15 feet). The hypolimnion is an area of cold non-circulating water extending from the bottom of the thermocline to the bottom of the lake (from 30 to 59 feet and from 25 to 50 feet in the two depressions of Fence Lake). When a thermocline is present in a lake and sufficient oxygen exists in the thermocline or hypolimnion, the lake can ordinarily be managed for cold-water species, such as trout. If a thermocline is not present, then the lake water is ordinarily too warm to support trout, and the water can be managed for only warm water species. Fence Lake was found to have ample oxygen to support trout. In the major depression, at a depth of 30 feet (at the bottom of the thermocline) 5.7 parts per million of the dissolved gas were found. In the west bay, 6.3 parts per million were present at the bottom of the thermocline. More of the dissolved gas could logically be expected at lesser depths.

Table I

Summary of Temperature and Chemical Conditions

in Fence Lake, July, 1937

Station	1	3
Location	West bay depression	Central northeast portion of lake
Date	7/19/37	7/20/37
Air temperature, °F.	73	76
Surface temperature, °F.	72	73
Bottom temperature, °F.	46	45
Maximum depth, feet	59	50
Thermocline		
Location	15-30	15-25
Temperature		
Top of	71	70
Bottom of	47	47
Oxygen (p.p.m.)		
Surface	7.1	7.2
Bottom	1.4	0.3
Methyl orange alkalinity		
Surface, p.p.m.	43	39
Bottom, p.p.m.	53	68
pH		
Surface	6.2	6.2
Bottom	6.2	6.0

The water of Fence Lake was found to be moderately soft. Methyl orange alkalinity tests (which show the amounts of minerals and certain buffer salts in the water) resulted in the finding of a dissolved mineral and salt content ranging from 37 to 68 parts per million. Ordinarily from 100 to 200 parts per million are considered best for high productivity.

The water of Fence Lake was found to be quite acid, with a pH (Hydrogen ion concentration) ranging from 6.0 to 6.2 (7.0 is neutral). Ordinarily moderately alkaline waters are more productive than are acid waters.

No pollution was found in Fence Lake. This would be expected in view of the lake's far removal from sources of industrial or domestic wastes.

Biological Characters of Fence Lake

Several types of data were collected in order to determine the biological nature of Fence Lake. Representatives of the species of vegetation present in the lake were gathered and identified and samples of plankton (microscopic free swimming and floating plants and animals) were obtained. Bottom foods were studied, and fish collections including as many as possible of the available species and sizes were made in order to study rate of growth, condition, parasitism, etc. Spawning facilities for the various species of fish present in the lake were evaluated.

Vegetation in Fence Lake was found to be fairly sparse, although probably about as abundant as could be expected in an acid, soft water lake with chiefly sand and pulpy peat bottom types. Many of the shallow shoreward areas which have sandy soils and are somewhat exposed to wind action have no vegetation at all. Concentrations of water weeds occur in protected shallow areas with bottom soils composed of mixtures of sand and fibrous peat, and near the outlet. A record of the species of vegetation found in Fence Lake, with an estimate of abundance, is shown in Table II.

Table II

Aquatic Vegetation Found in Fence Lake*

Species	Abundance
Cattail (Typha latifolia)	Common
Bur reed (Sparganium sp.)	Sparse
Bushy pondweed (Najas flexilis)	Sparse
Yellow water lily (Nuphar sp.)	Common
Iris (Iris versicolor)	Sparse
Sedge (Carex sp.)	Common
Pickerelweed (Pontederia cordata)	Sparse
Largeleaf pondweed (Potamogeton amplifolius)	Common
Pondweed (Potamogeton angustifolius)	Common
Flat-stemmed pondweed (Potamogeton zosteriformis)	Common
Water moss (Fontinalis sp.)	Common

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

Plankton in Fence Lake was fairly abundant at the time of the survey. However, individual samples taken during a short survey period do not provide sufficient data to permit any definite conclusions regarding year-round plankton abundance.

Invertebrate bottom food in Fence Lake was found to be quite scarce. A total of 1 1/2 square feet of bottom sampled at various depths yielded only one mayfly nymph and 6 midge larvae. Samples taken in the deep-water areas of both depressions showed no organisms. The very limited basic fertility of the lake is reflected in the scarcity of bottom food.

The species of fish collected in Fence Lake by the survey party, and which have appeared on creel census records from this lake, are shown in Table III. An estimate of abundance of the various species is included, together with a record of artificial stocking during the four-year period immediately preceding the survey.

Table III

Fish Collected or Reported in Fence Lake;

Their Estimated Abundance and Artificial Stocking

Species	Abundance	Stocking
Game Fish		
Smallmouth bass	Abundant	800
Largemouth bass	Scarce	200
Bluegills	Rare or absent	7,000
Green sunfish	Common	...
*Long-eared sunfish	Common	...
Pumpkinseed x green sunfish	Scarce	...
Perch	Scarce	...
Forage Fish		
Bluntnosed minnow	Scarce	...
Northern dace	Common	...
Iowa darter	Common	...
Coarse Fish		
Common sucker	Common	...

* Identification questioned. No preserved specimens are available. May have been pumpkinseed ~~green~~ sunfish. The long-eared sunfish rarely occurs in Upper Michigan.

Largemouth bass did not occur in the survey collections, but appeared in creel census records during 1936 and 1938. On July 14 of the latter year, 12 hours of fishing yielded 19 largemouth bass averaging slightly over 15 inches in length. No smallmouth were reported although this was the dominant species the preceding year, according to survey records. The fish appearing in the creel census were probably smallmouth bass which were misidentified by the Conservation Officer who took the census. Bluegills which had been stocked during the 2 years immediately preceding the survey failed to show up in survey records.

Forage fish were, on the whole, not very abundant in the lake. The common sucker was the only coarse fish collected.

A record of the growth rate of game fish collected in Fence Lake is shown in Table IV. At the time of collection, the fish were nearing the middle of the growing season shown in the table. The number of fish upon which the averages is based is also shown. Averages based on only a very few specimens may not be accurate for the group as a whole in the lake due to individual variation. The collection of more growth data on the fish of Fence Lake would be highly desirable.

Michigan smallmouth bass growing at an average rate reach legal size (10 inches) during the third summer of life. The perch reaches keeper size in the third year of life. Pumpkinseeds and bluegills, to which long-eared sunfish are closely related, reach legal size in the fourth summer. Long-eared sunfish very seldom reach legal size in Michigan, which gives weight to the belief that this species may have been misidentified in the case of Fence Lake.

Table IV

Growth Rate of Game Fish of Fence Lake*

Species and summer of growth	Number of specimens	Average total length, inches	Average weight, ounces
Smallmouth bass			
5	5	9 3/8	6.7
6	1	11 1/4	11.0
7	2	12 1/4	15.4
9	2	14 3/4	25.7
Perch			
5	1	6 3/4	1.5
7	2	6 3/4	1.5
Long-eared sunfish**			
5	5	6 5/8	3.8

* Age determinations by W. C. Beckman

** May be pumpkinseed sunfish.

Both perch and smallmouth bass in Fence Lake are stunted. The latter species, however, does reach legal size (probably late in the fifth summer of life) in sufficient numbers to provide fair fishing. At the time of the survey, however, smallmouth bass were heavily parasitized with bass tapeworms, black spots and yellow grubs. Although none of these parasites is harmful to man, the angler who will eat fish known to be infected with parasites appears to be the exception rather than the rule. Adhesions and larval tapeworms were so abundant in the bass in 1937 that they could not possibly escape detection when the fish were dressed.

The yellow grub occurred commonly in the musculature of the perch examined, and the black spot was common in the skin. Light infections of yellow grubs and a few black spots occurred in the sunfish examined.

Spawning facilities in Fence Lake appear to be entirely adequate for all the species known to occur there.

Management Suggestions for Fence Lake

Fair bass fishing is provided by Fence Lake at the present time. The smallmouth bass (and possibly the largemouth bass) is the only game species present which offers a real attraction to the angler. Although not growing as fast as the average smallmouth bass in Michigan waters, it is growing fairly well and is present in good numbers if the low basic fertility of the lake is brought into consideration. The heavy degree of parasitism is unfortunate and probably greatly reduces the numbers of fish which are ultimately consumed. The parasites are very difficult to control and known control measures are not practical.

To improve the fishing in Fence Lake, it appears desirable that another game species be added to the lake to improve the quality of the fishing. Any warm-water game species which might be added would no doubt

soon become infected by one or more of the same parasites which are attacking the other fish, and would occupy the same general habitat as the bass. In view of the above explained suitability of the lake for trout, it is recommended that rainbow trout be experimentally introduced into the lake. This species would not harbor the parasites found in the other fish and would furnish a very desirable additional game fish for the lake. In view of the rather large population of highly pisciverous bass present, only legal-size trout should be introduced. An initial planting of from 1500 to 2000 legal rainbows is advised. The stocking should be done in the late fall, just before the ice cover forms. It is realized that transportation of the trout to Fence Lake will be difficult and perhaps impossible at present since to our knowledge the road used for lumbering runs only to within about 1/4 mile of the lake. Probably the easiest way to get the trout in would be to wait until the first several inches of snow falls, bring the fish to the end of the road by tank truck and haul them in over the foot trail by toboggan or sled. The Michigamme Sportsmen's Association might be willing to give some good cooperation in this planting. The planting should be carefully watched for two years immediately following it, to determine the success of the experimental introduction of the new species and to determine future stocking needs. It is not expected that natural reproduction (although it might possibly occur) will be sufficient to maintain adequate numbers of trout in the lake to provide continued good fishing. Stocking of all warm water species should be discontinued.

Fence Lake is at present in the "all others" classification and no change in designation is considered desirable. The present classification will keep the lake open for fall rainbow trout fishing. It is recommended that the taking of this species in Fence Lake be permitted during the

fall, before the time of formation of the ice cover.

The only predators observed at Fence Lake at the time of the survey were a few great blue herons. This bird is commonly a final host in the life cycle of the yellow grub, and without doubt does more damage to the fishery in Fence Lake in contributing to the perpetuation of this parasite than in its capacity as a predator. Control of the blue heron or the parasite is costly and impracticable under present fishing pressures. No control measures are recommended.

Cover present at Fence Lake appears to be adequate to meet the needs of the present fish population. No improvements are suggested. No regulations of the water level or improvement of spawning facilities seem necessary.

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