Original: Fish Division
cc: Education-Game
Mr. James Wilkinson 12-15-41
Mr. Funk

INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

December 4, 1941

REPORT NO. 706

FISHERIES SURVEY OF LOUISE LAKE (THUMB LAKE)

CHARLEVOIX COUNTY

by

John Funk

I. Introduction

Louise Lake, or Thumb Lake as it was formerly called, is located in Hudson Township of Charlevoix County (T. 32 N., R. 4 W., Sec. 1, 2, 3, 9, 11). It is situated in a high, hilly section between the Boyne River drainage (Lake Charlevoix) on the west and the Cheboygan River drainage on the east. It has no outlet, however, so is not definitely in either watershed. It is about 8 miles from Vanderbilt on U. S. 27 and 9 miles from Boyne Falls on U. S. 131.

A map of the lake showing outline and bottom contours was prepared by the M. E. C. W. during the winter of 1935-36. This map was used in plotting vegetation beds and sampling stations during the subsequent biological survey. Fish collections* were made July 17 - 19, 1941, and a biological inventory** August 16 - 18, 1941. We are indebted to Mr. Earl May, Director of the Lake

---

* Personnel of party: W. C. Beckman, leader; Pat Galvin, Lee Anderson, and Mike Pawlick, assistants.

** Personnel of party: John Funk, leader; Eugene Roelofs, Stanley Lievense, assistants.

Louise Christian Cummunity Camp, for providing camp sites and other assistance to the parties.

We have no information on the past history of this lake and how it may have been used in lumbering operations. The presence of deadheads in the lake at the present time, however, is evidence of its use.

Some interesting information on the early fishing history of the lake is given in the reports of two rather superficial investigations made in 1925-26. These indicate that perch were very abundant at that time, and that good bass fishing was to be had. Rock bass were also numerous. The perch and bass had been planted about five years before the investigation. Previous to these plantings "a small, green-striped perch" and an occasional trout were supposedly the only fish in the lake. Stocking of more smallmouth bass and the introduction of bluegills were urged. Creel census records running back to 1929 show perch to be practically the only fish caught. Another interesting point in the history of the fishing in the lake is that the perch periodically die in great numbers during the summer. The last reported period of heavy mortality occurred in 1937.

II. Physical Characteristics

Thumb Lake is one of the most beautiful lakes in Michigan. It is surrounded by high wooded hills. The shores rise steeply from the margin and in most cases are wooded down to the beach. There is a sand beach most of the way around the lake. The shoal is generally narrow and the drop-off steep. This affords excellent swimming facilities. Most of the cottages are so hidden among the trees that they are very inconspicuous and do little to mar the natural aspect of the lake.

There are 35 cottages on the lake, 3 young people's camps, two camp grounds, and two boat liveries. Most of the margin is owned by the Lake

Louise Christian Association (Methodist). They maintain a young people's camp, a boat livery and a free camp ground. In addition they lease a limited number of sites for building cottages. Thus resort development is somewhat restricted although the public has access to the lake. It is easily reached from either U. S. 27 or U. S. 131 by a good gravel road. Since it is located in one of the best known vacation regions of the Lower Peninsula, the lake is undoubtedly of considerable potential importance as a public fishing water.

The geology of this region is quite complicated. Apparently the lake occupies a depression left between the moraines when the glacier receded. The basin is shaped somewhat like a capital T. The long leg of the T runs directly east and west and the cross arm is at the west end. The maximum length is about 1.8 miles. While this is somewhat interrupted by the island and a narrow portion connecting the cross arm of the T with the long leg, it is sufficient to allow considerable wave action at the east end of the lake. One depression (60 feet) occupies the cross arm of the T. The long leg contains two depressions (88 feet and 152 feet, respectively), separated by a bar extending across the lake. The deepest water is in the eastern end.

The lake has neither inlets nor outlet. It seems likely that it drains, if at all, by seepage through Standard (Booth) Lake and another small lake farther east which is the headwaters of a small tributary of the West Branch of the Sturgeon River.

At the time of the survey, the water level appeared to be possibly a foot lower than it had been earlier in the season. The level of lakes of this type is likely to fluctuate somewhat and since there is no outlet nothing can be done about it.

Additional physical characteristics of the lake are presented in the following table.

Area in acres	Maximum depth in feet	Shore development	Per cent of shoal	Bottom types		Color of water	Secchi disc	Slope at drop-off
				Shoal	Depths			
485	152	2.28	15	Sand, marl, pulpy peat	Pulpy peat, marl, sand, muck	Clear Colorless	13 - 17 feet	Steep

Some of these factors favor high productivity, some do not. The shore development is 2.28, which means that the shore line of the lake is 2.28 times as long as that of a perfectly round lake of the same area. This is considered a favorable factor since the productive areas of a lake are usually along shore. Hence the longer the shoreline the more productive the lake. Only 15 per cent of the area of this lake is estimated to be shoal. This is designated as that area potentially able to produce plants. Since lakes with much vegetation are generally more productive than those with less, a high per cent of shoal is an indication of high productivity. The fact that a Secchi disc is visible from 13 - 17 feet shows that the water is very clear and that light penetrates to at least that depth. This would seem to indicate that plants might grow to these depths. It also indicates, however, that there are very few floating organisms in the water. Productive waters are usually more turbid.

III. Temperature and Chemical Characteristics

Temperature and chemical characters of a lake act as definitely limiting factors in many cases. Since fish are "cold blooded" animals, temperature directly affects the growth rate. In general, the warmer the water the more active the fish and the more rapid their growth. Some fish such as trout, however, cannot withstand water which is too warm, and do best at temperatures which would cause very slow growth in warm water fish.

Dissolved oxygen is necessary for life in the water. It is usually abundant at the surface or in the vicinity of plant beds. In the deeper parts

of lakes it may be nearly or quite exhausted, being used up by the decomposition of organic matter in the bottom. If the deeper waters of a lake are removed from circulation by the presence of a thermocline (zone of rapidly decreasing temperature), then an oxygenless zone is very likely to occur. This zone is practically removed from the productive area of the lake since it is uninhabitable by fish and most other organisms.

Dissolved solids in the water are necessary for plant growth since aquatic plants seem to get most of their mineral matter from the water itself rather than from the bottom soil. Therefore hard water (i.e., water with a moderate amount of dissolved minerals) is usually more productive than soft water. Likewise, water which is alkaline in reaction is usually more productive than acid waters. Of course, extremely hard water or that with extreme alkaline reaction is not as favorable to productivity as those having these factors in moderation. The temperature and chemical characteristics of Louise Lake are given in the following table.

Station	1			2			3		
Location	West depression			East depression			Middle depression		
Date	8-16-41			8-18-41			8-18-41		
	Depth in feet	Temp. in °F.	Oxygen in p.p.m.	Depth in feet	Temp. in °F.	Oxygen in p.p.m.	Depth in feet	Temp. in °F.	Oxygen in p.p.m.
Surface	...	70	8.2	...	70	8.5	...	71	8.4
Bottom	65	47	trace	136	42	0.2	63.5	46	1.6
Thermocline									
Top	30	67	7.9	35	65	9.2	40	69	8.1
Bottom	40	51	0.6	45	47	10.1	55	48	0.3
M. O. alkalinity	105.0 - 146.0			103.0 - 113.0			105.0 - 114.0		
pH range	7.0 - 8.3			7.0 - 8.4			7.4 - 8.4		

An inspection of the above table will show that the water of the lake is cold (surface - 70°F.). This is rather cold for warm water fish such as bass or bluegills. On the other hand, temperature conditions are nearly ideal for cold water fish such as trout. Oxygen is abundant above and within the thermo-

cline (7.9 - 8.4 p.p.m.) and, in the main depression, is plentiful below the thermocline (10.1 p.p.m.). A large part of the lake, therefore, is inhabitable for fish. This lake is peculiar in that oxygen is not entirely absent even at the bottom of the depressions. Other chemical conditions are about average for productive lakes. The water is moderately hard (M. O. alkalinity 103.0 - 146.0 p.p.m.) and slightly alkaline (pH 7.0 - 8.4). As indicated above, the influence of these factors is toward high productivity.

IV. Biological Characteristics

Vegetation in the lake is rather limited. This may be due in part to the fact that the zone of shallow water is quite narrow in some places and the drop-off so steep as to allow little room for plants. In other places, shallow bays, etc., which might be expected to support dense vegetation, are practically barren. This is due to the nature of the bottom which frequently is a very soft, flocculent type of pulpy peat.

The following table gives the species of plants collected in the lake with abundance and the type of bottom on which each was found.

Species	Abundance	Bottom type
Water milfoil (Myriophyllum sp.)	Few	Marl, pulpy peat
Bushy pondweed (Najas flexilis)	Common	Marl, pulpy peat
Large-leaf pondweed (Potamogeton amplifolius)	Common	Marl, pulpy peat
Variable pondweed (Potamogeton gramineus var. graminifolius f. myriophyllus)	Common	Marl, pulpy peat
Floating-leaf pondweed (Potamogeton natans)	Rare	Marl, pulpy peat
Sago pondweed (Potamogeton pectinatus)	Few	Marl, pulpy peat
White-stemmed pondweed (Potamogeton praelongus)	Few	Marl, pulpy peat
Arrowhead (Sagittaria latifolia f. grecilis)	Rare	Sand
Big bulrush (Scirpus acutus)	Rare	Sand
Musk grass (Chara fragilis)	Common	Sand, marl, pulpy peat

Only 10 species are represented and of these only four are common. There is a direct correlation between the abundance of vegetation in a lake and its productivity. The plants are beneficial in a number of ways. They add oxygen

to the water by their photosynthetic activity. They harbor large numbers of insects and other fish food organisms. Fish of all sizes utilize them for shelter and feeding grounds. While it is possible for a lake to have too many plants, it is safe to say that Louise Lake needs much more plant growth in order to make it a good lake for fish.

V. Fish Food Conditions

Microscopic or nearly microscopic plants and animals which float free in the water are known as plankton. These organisms are important because they are used as food by very small fish and by the larger fish food organisms. Plankton was only moderately abundant in Louise Lake at the time of the survey (1.23 - 2.67 cc. per cubic meter). Of the three hauls made, zooplankton or animal organisms were predominant in two. Since plankton populations are known to vary greatly from day to day and from place to place in a lake, a few hauls taken at one time may not give an accurate picture of the true conditions. However, the sampling in this case bears out the evidence of other factors that the lake is low in productivity.

Bottom food organisms are sampled in two ways. Definite areas of the bottom material may be taken up with an Ekman dredge, the debris washed out through a screen, and the animals which remain sorted and counted. This method is most effective where vegetation is scarce. Since most bottom organisms live on plants, a different method is used where the vegetation is dense. A weighed collection of plants is washed thoroughly several times and the wash water screened to remove the organisms. Since plants were not abundant in Louise Lake, not many collections of this type were made.

The relative abundance of bottom organisms in the various types of samples and from various depth and bottom types is shown in the following table.

Bottom Sample Table

Type	Depths	Shoal	Vegetation
Number of samples	3	7	3
Depth range (feet)	63 - 136	1 - 5	3 - 6
Bottom types	Pulpy peat, muck	Sand, marl, pulpy peat	Sand, marl, pulpy peat
Total area or weight	1½ square feet	5½ square feet	20½ pounds
Planaria (Turbellaria)	...	Rare	Rare
Aquatic worms (Oligochoeta)	...	Rare	Rare
Leeches (Hirudinea)	...	Rare	...
Snails (Gostropoda)	...	Rare	Common
Clams (Pelecypoda)	...	Rare	Rare
Scuds (Amphipoda)	...	Few	Rare
Mites (Hydracarina)	...	Rare	Few
Mayflies (Ephemeroptera)	...	Rare	Common
Dragonflies (Anicoptera)	...	Rare	Rare
Damselflies (Gygoptera)	...	...	Rare
Hellgramites (Neuroptera)	...	...	Rare
Caddisflies (Trichoptera)	...	Rare	Rare
Beetles (Coleoptera)	...	Rare	Few
Mosquitoes (Corethra)	Rare	...	...
Midges (Chironomidae)	Rare	Common	Common

It will be seen that no bottom organisms were abundant. Midge larvae were common on the shoals and in vegetation and rare in the deep water. Snails and mayflies were common in the plant samples. All others were few or rare.

The estimated abundance of fish taken or reliably reported from the lake and the planting made during the last 7 years is given in the table below. This is followed by a table summarizing the creel census records obtained from the lake.

Fish Table

Species	Abundance	Stocking 1934-40
GAME FISH		
Rainbow trout (Salmo gairdnerii)	Reported rare	...
Brook trout (Salvelinus fontinalis)	Reported rare	...
Northern pike (Esox lucius)	Reported rare	...
Yellow perch (Perca flavescens)	Abundant	49,000
Walleyed pike (Stizostedium vitreum)	...	1,300,000
Smallmouth bass (Micropterus dolomieu)	Few - rare	4,481
Largemouth bass (Huro salmoides)	Rare	750
Bluegill (Lepomis macrochirus)	Rare	98,500
Pumpkinseed (Lepomis gibbosus)	Common - few	...
Rock bass (Ambloplites rupestris)	Few - rare	...
COARSE FISH		
Common sucker (Catostomus commersonnii)	Common	...
FORAGE FISH		
Straw-colored shiner (Notropis deliciosus stromineus)	Few - rare	...
Blunt-nosed minnow (Hyborhynchus notatus)	Common	...
Menona killifish (Fundulus diaphanus menona)	Rare	...
Iowa darter (Poecilichthys exilis)	Common	...
Black-nosed shiner (Notropis heterolepis)	Reported common	...
Brook stickleback (Eucalia inconstans)	Reported rare	...
OBNOXIOUS FISH		
None taken, seen, or reported.		

Creel Census Table

Year	No. of hours fished	No. of small fish returned	Brook trout	Rainbow trout	Small-mouth bass	Large-mouth bass	Bluegill	Pumpkin-seed	Rock bass	Perch
1928	157	209	...	...	2	...	...	...	...	316
1929	155½	342	2	6	2	...	...	...	...	247
1931	128½	195	...	...	...	1	...	...	...	420
1932	32	...	...	...	...	...	...	...	30	165
1934	11	16	...	...	...	...	...	...	...	60
1940	162½	145	...	...	17	4	16	3	6	216

Both survey results and creel census show the yellow perch to be by far the most abundant fish in the lake. No walleyes are reported although over one million have been planted since 1934. Reports and observations indicate that rock bass are somewhat more numerous than the survey results show. The reported forage fish were collected by Dr. Metzelaar in 1925 and so are no doubt authentic records although those species may not now be present.

Scale samples were taken and age determined for all game fish collected. From this data the growth rate of the various species has been worked out. The results of this study are given in the following table.

Growth-rate Table

Species	Age Group*	Number of specimens	Length in inches
Perch	I	4	3.3
	II	7	4.8
	III	49	6.5
	IV	28	8.2
	V	21	8.8
	VII	3	9.7
Smallmouth bass	IV	6	13.6
Largemouth bass	II	1	10.2
Bluegill	III	1	6.4
	IV	5	7.1
Pumpkinseed	II	5	3.9
	III	8	5.4
	IV	7	5.8
Rock bass	II	1	4.0
	III	8	5.5
	VII	1	8.0

* Age determinations by W. C. Beckman

The perch in this lake are growing slower than average. An average Michigan perch is 6 inches long by the end of its second summer but the perch here in their fourth summer (age group III) are only 6.5 inches long. The series for smallmouth bass is not large but should be fairly representative. Better than average growth is indicated since most bass in Michigan reach 10 inches in length in their fourth summer. The single largemouth taken also shows very good growth. The bluegill series is also small but shows good growth since the average Michigan bluegill reaches legal length in its fourth summer. The pumpkinseeds did not reach legal size until their fifth summer. They are growing slower than average for the state. Rock bass probably reach legal size in their fourth or fifth summer. This is near average growth for this species.

Spawning facilities are probably adequate for most species now present in the lake. There is an abundance of sand and marl shoal for the smallmouth bass and bluegills which utilize this type of bottom. Weed beds are adequate for perch spawning. Facilities for pike are certainly limited and pike will probably never be very abundant. Cold springs and inlet streams which might be utilized by trout are lacking.

VI. Management Suggestions

Louise Lake is now in the "all other lakes" classification and for the present it is suggested that it be left in this category. It may be desirable to change the designation later.

Since some trout are present and since the temperature and chemical characteristics of the lake show it to be suitable for cold water fish, it is suggested that these fish be encouraged. The following experimental stocking program may build up a trout population which may or may not be self maintaining.

It is suggested that 3,000 yearling brook trout and 3,000 yearling rainbow trout be planted in the lake late in the fall each year for the next three years. It is important that the planted fish be at least yearlings and of good size since the large population of perch would make short work of ordinary fingerlings. At the end of the three year period a careful check should be made to determine whether the trout are reproducing in the lake and are able to maintain themselves. If not, plantings of sufficient numbers to maintain the fishing should be continued if the trout thrive and furnish good sport.

The perch in the lake are growing rather slowly, probably because they are overcrowded. Since natural propagation is undoubtedly adequate to maintain the population and stocking will only aggravate the overcrowding, it is

recommended that the stocking of perch be stopped.

Large- and smallmouth bass and bluegills are doing well in the lake. Since spawning facilities for these species would seem to be ideal, it can be assumed that natural propagation is adequate to maintain the population. It is therefore suggested that the stocking of largemouth, pumpkinseeds and bluegills be discontinued. Some encouragement of smallmouth bass by stocking might be justified since the adult smallmouth in Louise Lake are at least partially sterilized by the bass tapeworm, and natural reproduction may not be adequate. It is recommended that 5,000 marked smallmouth bass fingerlings be stocked each year for a 3 year period. A different fin should be clipped each year.

Although over a million walleyes were stocked between 1934 and 1936, none have been taken in the lake. It seems apparent that conditions are not suited for this species. It is suggested that no more walleyes be planted in Louise Lake.

Herons and terns were observed on the lake but the number of these predators was not numerous enough to warrant any attempts at control. Fish parasites were not numerous except that the smallmouth bass were rather heavily infected with bass tapeworm. This parasite is harmless to man. Infected fish are safe to use as food. Most fish parasites seem to cause the fish little inconvenience. Severe infestations of the bass tapeworm, however, are known to impair the reproductive ability. No practical method of control of fish parasites is known.

Cover is abundant in the lake. Besides the vegetation, which is rather dense in some places, the deadheads are numerous on the shoal all around the lake. The water level seems to fluctuate somewhat, but since there is no outlet above ground, control is impossible. Spawning facilities, as was pointed out above, are probably adequate.

The only additional investigation apparently needed is the check to be made after the experimental plantings of trout have been made for three years. It is suggested that this be made by members of the Institute staff.

INSTITUTE FOR FISHERIES RESEARCH

By John Funk
Junior Aquatic Biologist

Report approved by A. S. Hazzard

Report typed by: R. Bauch