Original: Fish Division
cc: Education-Game
Mr. Claude Lydell 1-30-42
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

January 16, 1942

REPORT NO. 733

FISHERIES SURVEY OF MORRISON LAKE, IONIA COUNTY

by

John Funk

Introduction

Morrison Lake (T. 5, 6 N., R. 8 W., Sec. 1, 2, 35, 36) is located in Boston and Campbell Townships, Ionia County. Its outlet flows into the Grand River. It is about 2 miles from Clarksville and 14 miles from Ionia.

A map of the lake showing shoreline, soundings, and bottom types was prepared by an Institute party* March 15-18, 1940. This was used in charting vegetation beds and locating sampling stations in the subsequent inventory. Fish collections** were made June 17-18, 1941. The biological inventory*** of the lake was completed July 23-24, 1941.

No information concerning possible industrial use of the lake is available. However, its size and the fact that its outlet is a somewhat

---

*Personnel of mapping party: Richard Bohland, leader; Frank Lydell and William Mason, assistants.

**Personnel of fish party: W. C. Beckman, leader; Lee Anderson, Patrick Galvin, Donald Thomas, assistants.

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

navigable stream would make it seem probable that it was used in lumbering operations.

The lake has long had a reputation for its good fishing. In summer it is heavily fished and many bluegills and largemouth bass are caught. It is reported to be fished moderately hard in the winter with black crappies, or calico bass as they are known locally, forming the bulk of the catch.

Resort development on the lake is quite extensive. On the northeast shore a group of well kept cottages cluster about a golf course. The clubhouse is built over the outlet of the lake. Other groups of cottages are scattered along the south shore. Since there is a considerable rise in the land a few feet back from the margin along much of the shore, pleasant cottage sites are numerous. There are two large resorts and at least three boat liveries, and a total of 107 cottages (July, 1941). The lake, therefore, is of great potential importance as a public fishing water.

Physical Characteristics

Morrison Lake is roughly oblong in shape. The chief irregularities are two large points on the north shore and two much smaller opposing points on the south shore. The long axis of the lake runs in an approximately west southwest-east northeast direction. The lake is about $1\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide at the widest point.

The surrounding country is rolling and somewhat irregular. The level of the Grand River is considerably below that of the surrounding country in this locality. Streams which flow into it have cut deep but rather narrow valleys. The outlet of Morrison Lake is one of these.

The deepest part of the basin is in the extreme northeast end. The lake bottom slopes gradually upward toward the southwest. The drop-off

is steep all around the lake except at the west end. The basin is undoubtedly of glacial origin.

For a lake of its size, Morrison has a rather limited drainage basin. Three small streams flow into it and the entire drainage does not exceed 10 or 12 square miles. The soil seems to be moderately fertile. The outlet stream flows into the Grand River at Saranac. The Grand empties into Lake Michigan at Grand Haven.

The water level fluctuates somewhat. At the time of the survey the level seemed to be at least a foot below normal and no water was flowing from the outlet. However, there was apparently some seepage from the lake because there was water flowing in the stream farther down. Conditions at that time may have been somewhat abnormal since there had been very little rainfall the preceding month. Such fluctuation may be expected in a drainage system so limited.

The inlets are all small and relatively unimportant streams. The two larger (No. 1 and 2) flow into the east end and south side respectively. Each is 12-15 feet wide, 1-2 feet deep, with no perceptible current at the time of examination. The third (No. 3) is much smaller and drains a swamp at the southwest end of the lake. In addition to these, several springs enter the lake.

Other physical characteristics not discussed above are given in the following table.

Area in acres	Maximum depths in feet	Shore development	Approximate per cent of shoal	Bottom types		Color of water	Secchi disk in feet
				Shoal	Depths		
317	36	1.68	15	Marl, some sand, gravel and rubble	Marl, pulpy peat, marl and pulpy peat	Light brown	5½

Morrison Lake is not large, but its shape and orientation with regard to the direction of the prevailing wind is such as to allow considerable wave action. The area of deep water is small; most of the lake is less than 20 feet in depth. The shore development of 1.68 means that the shoreline of the lake is 1.68 times as long as that of a perfectly round lake of the same area. The most productive areas of a lake are usually along shore. A high shore development means a long shoreline, therefore a high shore development indicates a high productivity if other factors are favorable. A high per cent of shoal also indicates high productivity, other things being equal, since shoal is the area of a lake capable of producing plants. The shoal of Morrison Lake is of limited extent, due to the steep drop-off. The Secchi disk reading of 5½ feet indicates the approximate depth to which light penetrates. This is important in two ways. First, the relatively small amount of light penetration may limit plant growth to the upper few feet of water. Second, such high turbidity may indicate the presence of large concentrations of plankton.

Temperature and Chemical Characteristics

The following table presents the temperature and chemical characteristics of the lake.

Station	Location	M. O. Alkalinity range	pH range	Depth Temperature Oxygen	Surface	Thermocline Top	Thermocline Bottom	Bottom
1	Deepest part of lake	176-247	7.0-8.5	Depth in feet	...	15	27.5	33
				Temp. in °F.	79	71	57	55
				Oxygen in p.p.m.	8.2	5.5	0.0	0.0
2	Inlet no. 1	145.0	8.2	Temp. in °F.	86	...	...	...
				Oxygen in p.p.m.	13.0	...	...	...
3	Inlet no. 2	180.0	8.2	Temp. in °F.	84	...	...	...
				Oxygen in p.p.m.	7.4	...	...	...

There is a close relationship between temperature and the growth rate of fish. Since fish are "cold blooded" they feed most actively when the water is warm, within the toleration range of the fish, of course, and so make their best growth in warm water. The water temperature in Morrison Lake is high enough to permit good growth of warm-water fish such as bass and bluegills. Cold-water fish such as trout probably could not survive the high summer temperature.

In the deep water a thermocline is present. This is a zone of rapid change of temperature (approximately $\frac{1}{2}$°F. or more per foot). The thermocline layer divides the lake into two parts. All circulation due to wind, etc., is limited to the upper part; the water below the thermocline stagnates, i.e. the oxygen supply is used up. This condition of low oxygen lasts through most of the summer and is found in some lakes during the winter after long periods of ice cover.

Oxygen is necessary for fish and most other forms of aquatic life, and so these animals are restricted to the surface water where there is a continuous oxygen supply. The absence of oxygen in the deeper waters in Morrison Lake is probably due to the decomposition of organic matter. This decomposition process also produces carbon dioxide. The change in pH from 8.5 at the surface to 7.0 at the bottom suggests the presence of

considerable quantities of carbon dioxide in the lower water. The presence of large quantities of carbon dioxide is also detrimental to fish and fish foods, although this condition seldom occurs in natural, unpolluted waters.

It was observed that brass instruments were blackened when lowered into the deeper water of Morrison Lake. This suggests the presence of hydrogen sulfide, another product of decomposition. While concentrations of this substance are undoubtedly harmful to aquatic life, it is probably doing little harm here. The zone in which it is present would be practically uninhabited anyway, due to the absence of oxygen. Furthermore, the area involved is only a small fraction of the lake.

Other chemical factors indicate that the lake should be fairly productive. The Methyl Orange Alkalinity range of 145-247 shows that the water is hard, i.e., it contains a large amount of dissolved minerals. These are known to be necessary for the growth of aquatic plants. The water is, perhaps, harder than that of the most productive lakes, but this condition is to be expected in lakes containing much marl. The water is somewhat alkaline in reaction (pH 7.0-8.5). This is about average for productive lakes.

Biological Characteristics

The following table shows the species of plants and their relative abundance in Morrison Lake.

Species*	Abundance
Coontail (Ceratophyllum demersum)	Few
Musk grass (Chara sp.)	Abundant
Swamp loosestrife (Decodon verticillatus)	Common
Spike rush (Eleocharis sp.)	Rare
Spike rush (Eleocharis quadrangulata)	Rare
Mud plantain (Heteranthera dubia)	Rare
Yellow water lily (Nuphar advena)	Common
White water lily (Nymphaea odorata)	Common
Water milfoil (Myriophyllum exalbescens)	Few
Arrow arum (Peltandra virginica)	Rare
Floating-leaf pondweed (Potamogeton natans)	Rare
Sago pondweed (Potamogeton pectinatus)	Common
Clasping-leaf pondweed (Potamogeton Richardsonii)	Rare
Smartweed (Polygonum sp.)	Rare
Big bulrush (Scirpus acutus)	Common
Three-square (Scirpus americanus)	Common
Great bulrush (Scirpus validus)	Rare
Cattail (Typha latifolia)	Rare

*Identifications by Miss B. M. Robertson.

Aquatic plants are an important factor in the productivity of lakes. The value of weed beds as fishing spots is well known. The plants increase production in a number of ways. One of the most important, from a fisheries standpoint, is that they support great numbers of fish food organisms. Another is that they provide shelter for fish of all sizes. Morrison Lake has a fairly wide variety of plant species, some of which are quite abundant.

Plankton, the microscopic or near-microscopic plants and animals floating free in the water, was quite abundant at the time of the survey. Plant organisms were predominant. Since plankton populations are known to vary considerably from day to day and from place to place in a lake, this information is of only general value. These organisms have an important place in the food chain of game fish and are the main source of food for young fish of all types.

A summary of the types and abundance of bottom food organisms is given in the following table.

Location	Shoal		Depths
	Vegetation	Bottom	
Depth range	3-6 ft.	½-1 ft.	10-32 ft.
Average size of sample	4 lb. 4 oz. plants	1 sq. ft.	½ sq. ft.
Number of samples	5	2	3
Bottom type	Marl, marl and pulpy peat	Rubble, sand, marl	Marl and pulpy peat
Flatworms (Turbellaria)	Rare	Common	...
Aquatic earthworms (Oligochoeta)	Rare	...	...
Leeches (Hirudinea)	Few	...	...
Snails (Gastropoda)	Common	...	...
Scuds (Amphipoda)	Abundant	Few	...
Water mites (Hydracarina)	Common	Few	...
Mayflies (Ephemeroptera)	Common	Rare	...
Dragonflies (Anisoptera)	Few-common	...	...
Damselflies (Zygoptera)	Common	...	...
Caddisflies (Trichoptera)	Few	Rare	...
Beetles (Coleoptera)	Few	Rare	Rare
Phantom midges (Corethra)	...	...	Few
Midges (Chironomidae)	Abundant	Abundant	Few-common
Crayfish	Rare	...	...
Bullheads (Ameiurus)	Rare	...	...

The three samples from deep water showed few kinds although one, the midge larvae (Chironomidae), was fairly common. In shallow water, two samples from bottom composed of rubble mixed with sand and marl were rather productive. Seven different kinds were collected, of which midge larvae were the most abundant and planarians (Turbellaria) were common. Collections made by washing all the animals from weighed samples of aquatic vegetation were, by far, the most productive. Five such samples, averaging 4½ pounds in weight, yielded 14 kinds of animals. Midge larvae and scuds (Amphipods) were abundant and water mites (Hydracarina), mayflies (Ephemeroptera), damselflies (Zygoptera) and snails (Gastropoda) were common. Food conditions certainly seem to be good in this lake.

The following table shows the kinds and abundance of fish taken in the lake. Stocking records are also included.

Species	Relative abundance	Stocking 1933-40
GAME FISH		
Northern pike (Esox lucius)	Rare	...
Perch (Perca flavescens)	Common-abundant	44,400
Largemouth bass (Huro salmoides)	Common	20,450
Bluegills (Lepomis macrochirus)	Abundant	52,140
Pumpkinseed (Lepomis gibbosus)	Rare	...
Black crappie (Pomoxis nigro-maculatus)	Few	...
COARSE FISH		
Common sucker (Catostomus commersonnii)	Few	...
Mullet (Moxostoma erythrurum)	Rare	...
Yellow bullhead (Ameiurus natalis)	Rare	...
FORAGE FISH		
Straw-colored shiner (Notropis deliciosus)	Few	...
Common shiner (Notropis cornutus)	Few	...
Golden shiner (Notemigonus crysoleucas)	Abundant	...
Blunt-nosed minnow (Hyborhynchus notatus)	Abundant	...
Johnny darter (Boleosoma nigrum)	Few	...
OBNOXIOUS FISH		
Carp (Cyprinus carpio)	Rare	...

The results of the survey show the bluegill to be abundant and the largemouth bass common. Creel census data and reports indicate the same thing. Creel census figures show that in winter many black crappies (calico bass) are caught. Perhaps they are somewhat more numerous than is indicated by the survey results. In general, the lake seems to have the fish species best adapted to it.

Growth rate studies were made on the game fish taken. The results are presented in the following table.

Species	Age* Group	Number of specimens	Average length in inches
Perch	I	2	4.1
	II	27	5.6
	III	4	6.5
	V	1	9.1 ?
	VII	1	10.8
Northern pike	II	1	14.2
Largemouth bass	I	6	4.9
	II	11	8.8
	III	6	11.1
	IV	2	12.1
	V	1	11.8
Bluegill	II	21	4.0
	III	13	5.4
	IV	22	6.7
	V	20	7.2
	VI	6	7.3
	VII	1	8.0
Pumpkinseed	II	2	4.1
	III	4	5.0
	IV	2	5.4
Black crappie	II	14	5.5
	III	2	6.8

*Age determinations by W. C. Beckman

Most of the species in the lake seem to be growing at about an average rate. The average Michigan perch reaches legal length at the end of its second or the beginning of its third summer. The perch here are growing nearly as fast. The single northern pike taken was growing well, having reached legal length some time in its third summer. The largemouth bass may be doing a little better than average since they seem to reach legal length early in the fourth season.

The average Michigan bluegill is in its fourth summer when it becomes a "keeper". The bluegills in Morrison seem to be growing at almost that rate. The pumpkinseed may be growing more slowly although the series studied is small. The black crappies seem to be making about average growth.

Spawning facilities are probably adequate for all species present. Weed beds which might be utilized by perch and largemouth bass are abundant. There are small amounts of sand, gravel, and rubble shoal along the north and east shores, and considerable solid marl shoal. These are the types of bottom generally utilized by bluegills, although they are known to use soft bottoms at times. The weedy swamp area at the southwest end is probably utilized by pike. It seems certain that natural propagation of all species present is sufficient to maintain the population against any ordinary pressure of fishing.

Management Suggestions

The survey results show no reason why Morrison Lake should be changed from its present designation of "all other lakes".

In the past the lake has been rather heavily stocked with perch, largemouth bass and bluegills. These are the important game species in the lake. Spawning facilities for all of them are adequate, as was pointed out above. In the past, the potentialities of natural propagation have been greatly underestimated. Mr. Carbine, of the Institute Staff, has shown that an average bluegill spawning bed produces about 18,000 fry.* Multiply this by the large number of beds which are often found on even small lakes, and the number of the resulting fry produced is astounding. Even allowing for a great mortality among the young, the number of fish in generous plantings dwindles into insignificance in comparison. It is, therefore, suggested that all stocking of perch, bluegills, and largemouth bass in Morrison Lake be discontinued.

---

*Carbine, W. F., Observations on the Spawning Habits of Centrarchid Fishes in Deep Lake, Oakland County, Michigan. Trans. 4th N. Am. Wildlife Conf., 1939.

Some predatory animals (herons, mergansers, kingfishers, and turtles) were observed on the lake, but they were not numerous. Since there is doubt as to the extent to which these predators are harmful to fish, no attempts at control are suggested. Some fish parasites were noted. These "grubs" are harmless to man and apparently do little damage to the fish. No practical methods of control are known.

Dense beds of vegetation form the main cover, but some snags and deadheads are present. No additional structures are suggested. Water level fluctuation on the lake is of considerable importance. Because of the steep drop-off, the shoal is already limited. A small drop in water level might so decrease the amount of shoal as to seriously reduce the feeding ground for fish. However, with such a small drainage basin, no practical control measures seem possible. Spawning facilities seem to be adequate and no attempts at improvement are suggested.

INSTITUTE FOR FISHERIES RESEARCH

By John Funk

Report approved by: A. S. Hazzard

Report typed by: R. Bauch