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A FISHERY SURVEY OF LONG LAKE, BRANCH COUNTY

by

L. Edward Perry

Introduction

Location and drainage

Long Lake, in Ovid Township, Branch County (T. 7 S., R. 6 W., Secs. 13, 14, 23, 24), is part of a chain of lakes in the upper Coldwater River (St. Joseph drainage), including Coldwater, Mud, Bartholemew, Middle and Marble Lakes. It is nearly 7 miles south of the city of Coldwater and may easily be reached from U. S. Highway No. 27 by county roads. The shore is accessible by road only in one place and nowhere does the road follow the shore line. Because of marshy shores there is no resort development on the lake.

Acknowledgments

Long Lake was mapped and bottom-typed by an Institute party on January 11-13, 1941.\* The following summer the lake was given a biological inventory.\*\* Fish collections were made on May 19-21, 1941, and other biological and chemical information was obtained on June 18-19, 1941.

Past and present use

Long Lake has been of little importance in the past for anything but fishing and its present value is somewhat the same. At the time of the survey there were only five cottages near the lake shore and no resorts, hotels or recreation centers of any kind. Swimming was not popular because of the lack of a good swimming beach. Boats were obtainable at one livery and were used principally by fishermen. Because of the proximity to other

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\*Personnel of mapping party: Lee Anderson, leader; Royal Howe and Richard Wilson, assistants.

\*\*Personnel of fish party: W. C. Beckman, leader; Lee Anderson, Raymond Buller and Donald Thomas, assistants.

Personnel of biological inventory party: J. L. Funk, leader; E. W. Roelofs and Stanley Lievense, assistants.

more accessible lakes, Long Lake is probably not as important as it might be. Fishing, however, is reported to be rather heavy in summer and moderate in winter, which is some indication of its potential value. The lake is open to public fishing.

### Physical characteristics

#### Geological origin

Dr. I. D. Scott in "Inland Lakes of Michigan" describes the origin of Long Lake and the others of this chain as pits in the glacial outwash plain.

#### Shape of basin and extent of drainage

As the name implies, this lake is long and narrow. Its long axis extends a little over a mile in a northeast-southwest direction. The width varies from 400 to 1,600 feet. The lake basin is divided into three depressions. The deepest is near the northeast end with a maximum depth of 45 feet. The middle depression was 42 feet deep and the one on the southwest end was 35 feet. The lake is more or less constricted between these depressions so that they are well defined and provide areas that are protected from strong wave action. The shore line is 2.2 times longer than that of a round lake of the same area. Shallow water is limited to a narrow strip near shore. The "drop-off" begins at the five-foot contour which in most places is about fifty feet from shore.

The bottom soil is marl and fibrous peat in the shallow areas and pulpy peat in the depths. The water has a brownish color and is only moderately transparent. A black and white Secchi disk was visible to a depth of seven feet.

Practically all of the immediate shore of Long Lake is low and marshy. The surrounding terrain is partly wooded but gives way to good rolling farm land in the distance. Long Lake drains an area of approximately 37 square miles under normal conditions, however, a dam at Marble Lake may at times cause the drainage of Marble, Bartholemew and Middle Lakes to be included also.

#### Water fluctuation

The level of Long Lake fluctuates little. Its water supply is derived from seepage, drainage ditches and more directly from Mud Lake with which it is connected by a narrow channel on the northeast end. A broad outlet, about 125 feet wide and 4 feet deep flows into Coldwater Lake on the southwest end. At the time of the survey little current was visible through either inlet or outlet.

Before the canal was constructed between Mud and Bartholemew Lakes, Mud, Long and Coldwater Lakes were connected by one branch of Coldwater River and Bartholemew, Middle and Marble Lakes by another branch. The construction of this canal some fifty years ago joined these lakes and thus made a complete

circuit of water. The direction of flow through this chain of lakes now depends largely on a dam in the outlet of Marble Lake. Marble Lake is a few inches higher than Coldwater Lake at the other end and when the dam at Marble Lake is closed the water flows through all the lakes toward Coldwater Lake. When the dam is open the direction of flow is more nearly as existed before the canal was built and is divided some place in the chain. The canal is not over a foot deep in some places but permits the passage of small boats.

#### Discussion of physical factors in relation to fisheries

The shore line of Long Lake is relatively long and sinuous forming many protected bays, however, the limited amount of shallow water and the rapid "drop-off" prevent these protected bays from adding much to the productivity of the lake. The presence of pulpy peat in the deeper zones is an indication of decomposition and probably depletion of oxygen in these regions. Marl in the shallow areas is often valuable in increasing productivity. The low transparency and brownish color are at times indications of biologically productive waters.

Since Long Lake is openly connected with the other lakes in this chain its fishery is influenced by the other lakes, but since the other lakes have not yet been surveyed the nature and extent of this influence is not known.

#### Temperature and chemical characteristics

##### Temperature

At the time of the survey (June 18 and 19) the surface water of Long Lake was fairly warm (75° F.) and only slightly cooler at a depth of 12.5 feet (67° F.). From 12.5 to 22.5 feet the temperature dropped rapidly (67° to 51° F.). There was little change from there to the bottom (45° at 45 feet). The middle layer of rapidly changing temperature is known as the thermocline. It separates the bottom water from the surface and prevents it mixing during the summer period. Later in the summer the bottom temperature probably becomes slightly warmer and the thermocline more distinct and even perhaps a little deeper. The surface would warm up easily with the warm atmosphere but the general nature of this stratification of the water would persist throughout the summer.

##### Chemical conditions

Oxygen was found in abundance above the thermocline, but was depleted below. Down to 12.5 feet there were 8.4-8.9 parts per million. At 22.5 feet there was only 0.7 part per million and at the bottom, none. The supply was exhausted someplace between 12.5 and 22.5 feet. Later in the summer the volume of oxygenless water would probably become greater but would not extend above the thermocline.

The water of Long Lake was hard (methyl orange alkalinity 171 to 234 parts per million) and alkaline (pH 7.1 to 8.4). Moderately hard, alkaline waters are usually the most productive. The conditions in Long Lake are reasonably favorable for fish production.

Pollution

No pollution has been reported in this lake and no polluted areas were observed by the survey party.

The chemical and temperature observations on Long Lake are summarized in Table I.

Table I

Temperature and chemical observations on Long Lake, June 18, 19, 1941

Depth (feet)	Northeast depression				Middle depression			
	Temper- ature (°F.)	Oxygen (parts per million)	Methyl orange alkalinity (parts per million)	pH*	Temper- ature (°F.)	Oxygen (parts per million)	Methyl orange alkalinity (parts per million)	pH*
0	75	8.9	177	8.4	74	...	171	8.4
7.5	69	...	...	...	69	...	...	...
10	68	...	...	...	68	8.9	176	...
12.5	67	8.4	174	8.2	...	...	...	8.4
15	62	...	...	...	...	...	...	...
20	53	...	...	...	53	...	...	...
22.5	51	0.7	213	...	51	...	...	...
25	50	...	...	7.2	50	0.0	213	7.2
30	47	...	...	...	...	...	...	...
35	46	...	...	...	...	...	...	...
39	...	...	...	...	46	0.0	226	7.1
45	45	0.0	234	7.1	...	...	...	...

\*pH readings were made on July 5, 1941.

Discussion of temperature and chemical factors in relation to fisheries

Only the surface water in Long Lake is suitable to fish life during the summer and since this water is warm, only warm-water species such as bass, sunfish and pike can inhabit it. Although there is cold water at the bottom of the lake, there is not enough oxygen to support fish life. Analyses showed similar conditions to exist in all of the three main basins.

Biological characteristics

Vegetation

The abundance of vegetation in Long Lake is restricted by the limited amount of shallow water. Plants are found only in a narrow band around the lake extending from the shore to a depth of about ten feet. There are few

broad shallow areas where extensive plant beds can grow. A general cross-section of the plant zone would show water willow and cattail at the margin of the lake, muskgrass scattered over the shallows and pondweeds at the deeper edge. Other common forms were coontail, water milfoil, yellow water lily, arrow arum and bulrushes.

Many features of plants, including the fact that they harbor fish food organisms and provide shelter and spawning facilities for fish, make them a very important factor in the productivity of lakes.

Table II

List of plants and their relative abundance in Long Lake

Common name	Scientific name	Relative abundance
Water weed	<i>Anacharis canadensis</i>	Rare
Sedge	<i>Carex comosa</i>	Few
Coontail	<i>Ceratophyllum demersum</i>	Common
Water willow	<i>Decodon verticillatus</i>	Abundant
Water star grass	<i>Heteranthera dubia</i>	Rare
Lesser duckweed	<i>Lemna minor</i>	Rare
Star duckweed	<i>Lemna trisulca</i>	Rare
Water milfoil	<i>Myriophyllum exalbescens</i>	Common
White water lily	<i>Nymphaea odorata</i>	Few
Yellow water lily	<i>Nuphar variegatum</i>	Common
Arrow arum	<i>Peltandra virginica</i>	Common
Reed canary grass	<i>Phalaris arundinacea</i>	Few
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	Few
Pondweed	<i>P. angustifolius</i>	Few
Pondweed	<i>P. Friesii</i>	Common
Pondweed	<i>P. panormitanus var. major</i>	Few
Sago pondweed	<i>P. pectinatus</i>	Common
Flat-stemmed pondweed	<i>P. zosteriformis</i>	Few
Hardstem bulrush	<i>Scirpus acutus</i>	Common
Big duckweed	<i>Spirodela polyrhiza</i>	Few
Common cattail	<i>Typha latifolia</i>	Common
Bladderwort	<i>Utricularia vulgaris var. americana</i>	Rare
Muskgrass	<i>Chara sp.</i>	Abundant

Identifications by Betty Robertson Clarke.

Fish foods

Small free-floating organisms (plankton) were not very abundant in Long Lake, however, they are expected to vary considerably from time to time in all lakes and a few samples are not indicative of their abundance throughout the year. Animal organisms (Zooplankton) were dominant.

Food organisms did not appear to be as abundant as in neighboring lakes. The greatest number was found on the plants but even here they were not as numerous as expected. The principal forms in order of abundance were midge larvae and other immature insects, snails, scuds and leeches.

The principal forage fishes were brook silversides, golden shiners, topminnows and mud minnows.

Fish present

A list of the fish found in Long Lake is given in Table III. Bluegills were, by far, the most common game fish. Others which were common included perch, largemouth bass, northern pike, black crappies, pumpkinseed sunfish and ciscoes.

Gars and dogfish were found in the lake but their effect on game fish is not considered harmful.

Table III

List of fish, their relative abundance and stocking in Long Lake

Name	Relative abundance	Stocking (1937-1941)
<b>Game species:</b>		
Northern pike	Few	
Perch	Common	10,000 fingerlings
Largemouth bass	Few	500 fingerlings
Bluegill	Abundant	55,000 fingerlings
Black crappie	Few	
Pumpkinseed sunfish	Few	
Cisco	Few	
<b>Coarse species:</b>		
Lake chub sucker	Few	
Brown bullhead	Few	
Yellow bullhead	Few	
Green sunfish	Few	
Warmouth bass	Common	
<b>Obnoxious species:</b>		
Gar	Reported	
Dogfish	Few	
Mud pickerel	Few	
<b>Forage species:</b>		
Golden shiner	Common	
Pugnose shiner	Few	
Northern starhead topminnow	Few	
Western pirate perch	Few	
Mud minnow	Few	
Silversides	Common	

The few creel census reports on Long Lake obtained from conservation officers are not adequate to give any definite trends in the fishing.

Growth rate of game species

Growth rate data of the most common game fishes collected in Long Lake are presented in Table IV.

Table IV  
Growth of fish in Long Lake

Name	Age*	Number	Average total length (inches)	Average weight (pounds) (ounces)	Michigan average length* (inches)	
Northern pike	II	3	20.7	2	2.7	...
	IV	1	23.4	3	0.0	...
	V	2	27.6	4	15.3	...
Perch	II	29	5.9	...	1.3	6.2
	III	6	6.2	...	1.6	7.1
	IV	1	9.0	...	4.9	7.8
Largemouth bass	I	4	3.1	...	0.3	5.5
	II	4	7.1	...	2.4	8.4
	IV	2	12.3	1	0.2	12.1
	V	1	18.5	3	2.0	13.3
	VIII	1	18.8	3	6.0	...
Bluegill	II	6	3.3	...	0.4	4.3
	III	13	5.2	...	1.5	5.6
	IV	5	7.2	...	4.7	6.7
	V	50	7.8	...	6.0	7.4
	VI	24	8.3	...	7.3	7.8
	VII	5	8.5	...	7.1	7.9
	VIII	2	8.7	...	8.8	8.3
Pumpkinseed sunfish	II	2	4.0	...	0.9	4.4
	III	9	5.6	...	2.4	5.8
Green sunfish	III	3	5.4	...	1.9	...
Warmouth bass	II	2	3.8	...	0.7	...
	III	2	4.6	...	1.2	...
	IV	2	5.6	...	2.4	...
	V	2	6.3	...	3.1	...
	VI	6	6.2	...	3.3	...
	VII	5	6.8	...	4.6	...
	VIII	3	7.1	...	4.9	...
Cisco	VI	1	14.6	...	...	...

\*Age determinations by W. C. Beckman.

A comparison with the state averages given in the last column shows the growth of the bluegills and largemouth bass to be a little below average during the first two or three years but above average later in life. The growth of perch and pumpkinseeds was about average or a little below. State averages are not available for the other species, but their growth is considered about normal.

#### Natural propagation

Spawning facilities for bluegills and other centrarchids (sunfishes and basses) were abundant in several places around the lake. The marshy areas near the inlet and the outlet and around the large bay at the southwest end provide the necessary requirements for pike spawning. Perch will spawn on the vegetation almost any place around the lake.

### Management Proposals

#### Designation of lake

Long Lake is in the "all other lakes" category. This is in agreement with the findings of the present investigation.

#### Stocking

Spawning facilities are adequate in Long Lake to enable all fish present to keep the lake well stocked by natural propagation, therefore, no future stocking of the species present is recommended. The lake does not appear suitable for the introduction of any other species.

#### Predators and parasites

No serious predation was observed in Long Lake, but parasites were found in most of the game fish. Yellow grub and black spot were found on perch. Yellow grub was more common. The bass tapeworm occurred in the largemouth bass and unidentified cysts and tapeworms were found in the bluegills, pumpkinseeds and black crappies. Unidentified tapeworms and black spot were found in the pike. The infestations of none of these was considered serious and no satisfactory control methods are known. None of these is harmful to man.

#### Shelter

The plants in Long Lake provide abundant and satisfactory shelter for the present fish population.

#### Regulation of water level

The fluctuation of the lake level at the present time is not great enough to require any special means of control.



Improvement of spawning facilities

No improvement of spawning facilities is necessary.

INSTITUTE FOR FISHERIES RESEARCH

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