

Original: Fish Division  
cc: Education-Game  
Mr. Ralph Marks 7-2-42  
Mr. Frank Hoard 7-2-42

W

INSTITUTE FOR FISHERIES RESEARCH

DIVISION OF FISHERIES  
MICHIGAN DEPARTMENT OF CONSERVATION  
COOPERATING WITH THE  
UNIVERSITY OF MICHIGAN

*gall*

ALBERT S. HAZZARD, PH.D.  
DIRECTOR

June 24, 1942

ADDRESS  
UNIVERSITY MUSEUMS ANNEX  
ANN ARBOR, MICHIGAN

REPORT NO. 797

A FISHERIES SURVEY OF ARBUTUS LAKE,

GRAND TRAVERSE COUNTY

by

L. E. Perry

Introduction

Location and Drainage

Arbutus Lake is located in Grand Traverse County (T. 26 N., R. 10 W., Secs. 3, 4, 9, 10, 16) about five miles south of the East Arm of Grand Traverse Bay. It is one of a group of several landlocked lakes, including Spider Lake and Rennie Lake, that lie within the Boardman River drainage basin but have no direct connection with it.

Arbutus Lake is accessible from Traverse City by paved county road No. 611. It is about 10 miles southeast of this town. It may also be reached by township roads from US-31 and M-42.

Acknowledgments

An outline map of this lake was prepared by the Michigan Emergency Conservation Work from aerial photographs. The lake was sounded and given a biological inventory in July, 1936, by a party of the Institute for Fisheries Research.\*

---

\*The party consisted of: D. E. Miller, leader; W. F. Carbine and William Waters, assistants.

### Past and Present Use

Arbutus Lake has been <sup>well</sup> developed as a recreation area. A number of cottages and several camping grounds, resorts and summer camps provide recreation facilities.

Recently the Conservation Department purchased an 11.2 acre site on the north end of the lake, thus making the lake forever accessible to the public. All the shoreline was formerly under private ownership. The Michigan Conservation Magazine of March 1, 1942, describes the site as follows: "Arbutus Lake site consists of 11.2 acres with 800 feet of frontage at the north end of the lake, 10 miles southeast of Traverse City. ----This site has a fine hard beach with a limited provision for parking cars. A heavy growth of birch and Norway pines covers a great deal of the site."

In past years Arbutus Lake has been well known for the very large bluegills it produced; however, the number of exceptional bluegills taken has decreased in more recent times. The lake has been heavily fished and has provided sizable catches of largemouth and smallmouth bass, bluegills and perch. Fishing is of great importance in this lake, and much of the development, no doubt, is there because of the good fishing.

### Physical Characteristics

#### Geological Origin

Little has been written on the geology of Arbutus Lake. It lies north of the Port Huron moraine and probably originated as several pits in the outwash plain.

#### Shape of Basin and Extent of Drainage

There are five distinct basins in Arbutus Lake and the shoreline is of such a nature that each basin is nearly isolated as a lake by itself. These

basins are numbered from south to north and are commonly known by their numbers as Arbutus No. 1, 2, etc. The connections between the basins are rather narrow and shallow, exceeding a five-foot depth only between Lakes No. 2 and No. 3. Together, these basins form a long, simuous lake nearly three miles in length.

The actual area of drainage, approximately three square miles, is confined to the immediately surrounding terrain which is rather high and wooded. It constitutes part of the Fife Lake State Forest.

#### Water Fluctuation

A considerable fluctuation of the water level has occurred in the past several years. The extremes have not been recorded but doubtless are the result of fluctuations in precipitation.

A small stream flows into Arbutus No. 3 from Spring Lake on the east. Two intermittent streams flow into No. 2 and No. 3, and the remaining water supply is derived from seepage and runoff.

There is no outlet, although the Boardman River passes within a mile of the south end of the lake.

A summary of the physical data on this lake is presented in the following table.

Table I

## Summary of Physical Characteristics

Lake basin	No. 1	No. 2	No. 3	No. 4	No. 5	Entire Lake
Area in acres	39	150	75	100	31	395
Maximum depth in feet	15	44	30+	30+	25	44
Shore development	...	...	...	...	...	3.6
Dominant bottom types Shallows (0'-15')	Marl, peat, sand.	Sand, muck, marl, peat.	Sand, marl, peat.	Marl, sand, peat.	Marl, peat, sand.	...
Depths (over 15')	...	Peat	Peat	Peat	Peat	...
Color of water	...	...	...	...	...	Greenish-blue
Transparency of water (Secchi disc) in feet	12 $\frac{1}{2}$	11 $\frac{1}{2}$	13	13	13	11 $\frac{1}{2}$

Shore development expresses the irregularity of the shoreline in terms of a circle of the same area, i.e., the shoreline of Arbutus Lake is 3.6 times longer than that of a perfectly round lake with the same area. This is indicative of high productivity, since irregularities in a shoreline increase the number of protected areas.

Discussion of Physical Factors in Relation to Fisheries

Arbutus Lake has many features that are conducive to high productivity. It has extensive shallow areas and many protected bays. The bottom is largely peat and marl, which are favorable. While the fluctuation of water level is considerable and undesirable, it is probably not great enough to have disastrous consequences. Since there is no outlet, the level could not be stabilized.

Temperature and Chemical Characteristics

Temperature

At the time observations were made, July 28, 29, 1936, the surface temperature was 74°-77°F. in the five basins. The bottom temperatures

varied to a greater extent. The shallow Basin No. 1 was practically the same temperature throughout (77°F.). Basins No. 3, 4, and 5 showed a more or less gradual cooling of the water toward the bottom (No. 3, 67°F.; No. 4, 57°F.; and No. 5, 66°F.). In Basin No. 2 the warm surface water was found to extend to a depth of about 23 feet. A rather rapid drop in temperature (thermocline) occurred from there to a depth of about 35 feet (76°F. to 55°F.). Little change was noted from 35 feet to the bottom at 42 feet (53°F.). Thus three layers of water may be designated in this basin on the basis of temperature. The thermocline is often of considerable importance in isolating the cold bottom layer of water. However, the quantity of the bottom layer of water in Arbutus Lake is very small and so of little importance to fish.

#### Chemical Conditions

Oxygen was fairly abundant in all five basins, ranging from 8.1 to 9.8 parts per million at the surface and maintaining a high content throughout most of the water. However, next to the bottom, especially in the deeper Basins No. 2, 3, and 4, the oxygen had been greatly depleted by decomposing organic matter. The volume of water thus depleted is small, however, and should have no great significance in the lake's ability to produce fish.

#### Alkalinity and pH

The water in Arbutus Lake is moderately hard. Methyl Orange Alkalinity ranged from 54 parts per million in Basin No. 1 to 143 parts per million in Basin No. 2. Only in Basin No. 1 was the alkalinity considerably below 100. The water was alkaline, having a pH range from 7.2 to 8.2.

#### Pollution

No evidence of pollution was found.

The following table summarizes the temperature and chemical conditions found in the lake at the time of the survey.

Table II  
Summary of Temperature and Chemical Conditions  
in Arbutus Lake

Depth in ft. ✓	Basin No. 1 7/28/36				Basin No. 2 7/28/36				Basin No. 3 7/29/36			
	Temp. °F.	Oxygen p.p.m.	M. O. Alkalinity	pH	Temp. °F.	Oxygen p.p.m.	M. O. Alkalinity	pH	Temp. °F.	Oxygen p.p.m.	M. O. Alkalinity	pH
0	77	9.8	61	8.2	76	9.0	98	8.2	74	8.1	109	8.0
3	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...
10	...	9.6	54	8.2	...	...	...	...	...	...	...	...
12	76	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	76	...	...	...	...	...	...	...
20	...	...	...	...	76	...	...	...	74	...	...	...
23	...	...	...	...	76	...	...	8.1	72	7.1	110	8.0
26	...	...	...	...	69	6.9	110	7.7	69	0.2	135	7.3
29	...	...	...	...	63	4.5	120	7.5	67	...	...	...
33	...	...	...	...	60	0.7	127	7.4	...	...	...	...
36	...	...	...	...	55	...	...	...	...	...	...	...
39	...	...	...	...	53	0.5	143	7.3	...	...	...	...
42	...	...	...	...	53	...	...	...	...	...	...	...

Depth in ft. ✓	Basin No. 4 7/28/36				Basin No. 5 7/28/36			
	Temp. °F.	Oxygen p.p.m.	M. O. Alkalinity	pH	Temp. °F.	Oxygen p.p.m.	M. O. Alkalinity	pH
0	75	8.4	110	8.1	75	8.3	110	7.9
3	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...
10	75	...	...	...	...	...	...	...
13	75	...	...	...	...	8.6	...	7.9
16	73	...	...	...	74	8.5	...	7.9
20	69	7.0	110	7.9	72	5.6	...	7.6
23	64	4.2	121	7.6	67	0.4	140	7.2
24	...	...	...	...	66	...	...	...
26	60	0.3	134	7.3	...	...	...	...
28	59	0.0	142	7.2	...	...	...	...
29	57	...	...	...	...	...	...	...

✓ Depths were measured in meters and later converted to nearest foot.

Discussion of Temperature and Chemical Factors in Relation to Fisheries

The water in Arbutus Lake becomes fairly warm in late summer and maintains a satisfactory supply of oxygen. There is only a small volume of deep water which remains cold and it probably becomes deficient in oxygen. This means that the lake is suitable only to warm water fishes. The hardness and alkalinity are favorable to high productivity. In general it may be said that the chemical factors of Arbutus Lake compare favorably with the more productive southern Michigan lakes.

Biological Characteristics

Vegetation

The plants collected from Arbutus Lake are rated in the following table according to their relative abundance in the different basins.

Table III  
The Aquatic Plants and Their Relative Abundance  
in Arbutus Lake

Name	Basin Number				
	1	2	3	4	5
Waterweed ( <u>Anacharis canadensis</u> )	...	...	...	...	R
Coontail ( <u>Ceratophyllum demersum</u> )	...	...	...	...	F
Horsetail ( <u>Equisetum fluviatile</u> )	...	...	R	...	R
Bushy pondweed ( <u>Najas flexilis</u> )	C	F	F	F	F
Yellow water lily ( <u>Nuphar advena</u> )	...	R	R	R	F
White water lily ( <u>Nymphaea odorata</u> )	F	...	R	F	R
Smartweed ( <u>Polygonum amphibium</u> )	F	...	...	...	R
Large-leaf pondweed ( <u>Potamogeton amplifolius</u> )	F	F	F	F	R
Pondweed ( <u>Potamogeton angustifolius</u> )	C	C	A	C	C
Pondweed ( <u>Potamogeton filiformis</u> )	...	...	...	R	...
Leafy pondweed ( <u>Potamogeton foliosus</u> )	...	...	...	...	F
Floating-leaf pondweed ( <u>Potamogeton natans</u> )	...	...	F	...	R
Sago pondweed ( <u>Potamogeton pectinatus</u> )	...	...	...	...	F
Whitestem pondweed ( <u>Potamogeton praelongus</u> )	...	...	R	R	R
Pondweed ( <u>Potamogeton pusillus</u> )	...	R	R	...	R
Flat-stemmed pondweed ( <u>Potamogeton zosteriformis</u> )	...	...	F	F	F
Arrowhead ( <u>Sagittaria</u> sp.)	R	...	...	...	...
Bulrush ( <u>Scirpus</u> sp.)	F	R	F	F	F
Cattail ( <u>Typha</u> sp.)	R	...	...	...	...
Wild celery ( <u>Vallisneria americana</u> )	F	...	...	...	R
Musk grass ( <u>Chara</u> sp. or <u>Nitella</u> sp.)	A	A	A	A	A

A - Abundant; C - Common; F - Few; R - Rare.

Arbutus Lake has an abundance of aquatic plants. About 60 per cent of the entire lake bottom supports plant growths. The approximate percentage of vegetated bottom in each of the basins is as follows: No. 1, 100 per cent; No. 2, 50 per cent; No. 3, 40 per cent; No. 4, 65 per cent; No. 5, 55 per cent. Plant growth is generally very important in maintaining high productivity in a lake by supporting many fish organisms and by providing shelter and spawning facilities for certain fish.

#### Fish Foods

Plankton, small organisms that float freely in the water, is a very common source of food for most young fish and some adults. In Arbutus Lake it was collected in moderately abundant amounts. This, however, may not be representative of the year-around conditions since plankton is known to vary greatly from day to day and place to place in lakes.

On the submerged plants were found several kinds of insect larvae in considerable abundance, and in the bottom soil, snails, mussels, and midge larvae were collected.

There apparently is also a good supply of forage fish.

These facts point to an abundant supply of food in Arbutus Lake to meet the needs of a fairly large population of game fish.

#### Fish Present

A list of the fishes collected, their relative abundance and the extent of stocking for the period 1933-1940 is given in Table IV.



Table IV

Fish Collected or Reported for Arbutus Lake

Species	Abundance	Stocking 1933-1940
<b>GAME FISH</b>		
Walleye	Few	...
Perch	Few	20,000 fingerlings
Smallmouth bass	Common	3,000 fingerlings
Largemouth bass	Common	3,000 fingerlings
Green sunfish	Common	...
Bluegill	Abundant	26,700 fingerlings
Pumpkinseed	Common	...
Northern pike	Reported	...
Rock bass	Reported	...
Brown trout	Reported	...
<b>FORAGE FISH</b>		
Straw-colored shiner	Few	...
Blunt-nosed minnow	Abundant	...
Menona killifish	Common	...
<b>COARSE FISH</b>		
Common sucker	Few	...
Bullhead (species?)	Reported	...

Bluegills are the most common fish in Arbutus Lake, making up at least half of the entire catch as shown by creel census reports for the past twelve years (Table V), and to add to their significance they have been reported up to two pounds in weight. In recent years, however, reports indicate that large bluegills are less numerous and that the average size is smaller. Largemouth bass are also fairly abundant and make up an important part of the catch. Smallmouth bass, pumpkinseed, perch, and walleye are other species that are commonly caught.

Table V

## Creel Census Summary 1928-1940 on Arbutus Lake

Year	Number of fishermen	Number taking no fish	Number of hours fished	Number of legal fish caught	Catch per hour	Catch per fisherman	Number of illegal fish caught	Av. no. of hours per fisherman per day
1928	...	...	27.50	7	0.25	...	5	...
1929	...	20	207.00	131	0.63	...	261	...
1930	74	8	154.00	99	0.64	1.3	62	2.1
1931	18	2	51.50	18	0.35	1.0	5	3.0
1932	6	0	300.00	138	0.46	23.0	0	50.0 ↓
1934	83	14	273.00	493	1.80	5.9	143	3.3
1935	52	13	217.00	189	0.87	3.6	63	4.2
1936	11	1	...	52	...	4.5	15	...
1937	33	8	231.50	308	1.33	9.3	233	7.0
1938	57	3	218.00	259	1.19	4.6	18	3.8
1939	70	13	248.25	296	1.19	4.2	0	3.5
1940	70	17	182.00	147	0.81	2.1	0	2.6

↓ This figure is for a period of several days fishing by one party.

Year	Smallmouth bass	Largemouth bass	Bluegill	Pumpkin-seed	Perch	Walleye	Rock bass	Northern pike	Bullhead	Brown trout
1928	1	...	4	...	...	2	...	...	...	...
1929	...	7	47	4	49	11	11	1	1	...
1930	...	1	53	10	20	15	...	...	...	...
1931	...	1	13	...	4	...	...	...	...	...
1932	36	12	82	...	8	...	...	...	...	...
1934	11	19	363	56	31	...	12	...	...	1
1935	4	44	140	...	...	1	...	...	...	...
1936	1	49	...	...	...	...	...	2	...	...
1937	11	119	163	1	7	7	...	...	...	...
1938	13	40	174	4	26	12	...	...	...	...
1939	34	8	234	1	16	3	...	...	...	...
1940	6	22	88	15	11	...	5	...	...	...

Data from creel census reports secured by conservation officers over a period of years (Table V) show better fishing in the last half of the past decade than in the first half. Little change is noted in the proportion of species making up the catch. There is little evidence from the creel census that bluegill fishing has declined or that walleye catches have increased, both of which have been reported. Although this census has not been complete enough to permit definite conclusions, it is believed these figures are sufficient to show marked trends in the fishing.

Growth Rate of Game Species

A reasonably accurate picture of the growth of game fish in Arbutus Lake may be had from the data in the following table. This is compiled from information collected by the survey party. Ages were determined from the scales.

Table VI

Age and Size of Game Fish from Arbutus Lake

Species	Age <sup>✧</sup>	Number of individuals	Total length (inches)
Largemouth bass	I	1	4.8
	II	4	6.2
	III	1	6.3
	IV	5	9.1
	V	2	11.8
Smallmouth bass	0	3	1.8
	IV	1	11.1
Perch	0	1	2.4
	II	4	5.9
	III	1	8.0
Bluegill	I	1	1.6
	II	4	2.1
	III	9	3.4
	IV	4	5.2
	V	23	7.3
	VI	23	7.5
Green sunfish	I	3	1.7
	II	3	2.1
	III	3	2.8
	IV	4	3.4
	V	2	3.5
	VII	1	4.3
	Pumpkinseed	I	4
II		3	2.6
III		6	3.3
IV		4	4.8
V		2	6.3
VI		1	5.4
VII		1	8.1
Walleye	VII+	1	26.6

✧ Determined by W. C. Beckman.

The growth of the largemouth bass, bluegill, and pumpkinseed is below the tentative average of these species determined by W. C. Beckman for the State of Michigan. The largemouth bass required over four years to reach legal length. The state average is three years. The bluegills

and pumpkinseeds required about five years to reach six inches in length. The state average is four years. The growth rate of the smallmouth bass and the perch are probably near average, while the walleyes should reach legal size in two or three years.

#### Natural Propagation

Spawning facilities are probably adequate for all species of fish collected, except possibly the walleye. Various combinations of bottom types and plant growth provide the necessary conditions for most species in the lake. The reported occurrence of northern pike and brown trout is doubtful or these species are at least very limited and need not be considered. Ideal conditions for walleye spawning are probably not available; however, they seem to have maintained a fairly large population in the lake since the last stocking in 1932. It is not known whether the walleyes now in the lake are from natural spawning or if they remain from former plantings. The most recent investigations (Institute for Fisheries Research Report No. 695) describe the walleye as seeking wind-swept shallows with a coarse rubble bottom. Here they scatter their spawn freely over the large rubble. However, it is possible that further studies may show that other bottom types or locations can be used successfully.

#### Management Proposals

##### Designation of Lake

Arbutus Lake is classified in the "all other lakes" group. The present survey substantiates this designation.

##### Stocking

The lake seems to be well suited to the bluegill, large- and smallmouth bass and perch which are present in considerable numbers, and have sufficient facilities for natural propagation and maintenance. Therefore,

no further plantings of these species should be made. The walleye is a favorable fish for this lake if an investigation shows their spawning requirements to be sufficient for self-maintenance. No stocking is recommended until this point can be determined.

#### Predators and Parasites

Great blue herons and turtles were found on the lake shores; however, no control is believed necessary for these or other predators that may be present. No serious parasitism was found.

#### Shelter

Sufficient shelter is provided in Arbutus Lake by the vegetation to give the necessary protection to the fish.

#### Regulation of Water Level

There is, at present, no feasible way of maintaining a fixed water level, although this would be desirable.

#### Improvement of Spawning Facilities

No improvement is necessary at present.

#### Other Suggestions

A more detailed investigation of the spawning facilities of walleyed pike is advisable, in view of the recent studies made by Eschmeyer on Gogebic Lake (Institute for Fisheries Research Report No. 695).

INSTITUTE FOR FISHERIES RESEARCH

By L. E. Perry

Report approved by: A. S. Hazzard

Report typed by: R. Bauch