Original: Fish Division
cc: Education-Game
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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
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June 15, 1942

REPORT NO. 793

A FISHERIES SURVEY OF BOOTH (STANDARD) LAKE, CHARLEVOIX AND OTSEGO COUNTIES

by

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Introduction

Booth Lake is located in T. 32-33 N., R. 3-4 W., Secs. 1, 6, 36. It is less than a half mile northeast of Lake Louise (Thumb Lake), and lies in the inter-drainage zone between the Cheboygan and the smaller rivers draining the Charlevoix area. The nearest town is Vanderbilt, 7 miles to the southeast. The lake is accessible by 2 or 3 poor roads branching off from the Lake Louise road.

The map of Booth Lake was made by the C.C.C. in the winter of 1935-36. A survey party✓ of the Institute for Fisheries Research made the biological inventory of this lake from August 5-7, 1937.

The lake is some distance from population centers and is not known to have been used for any industrial purpose. The surrounding area has been logged, but it is doubtful if Booth Lake was used extensively in logging operations.

✓ The survey party included: David Chandler, leader; E. L. Cheatum and Walter Crowe, assistants.

Fishing was reported to have been good at one time, but the lake became overcrowded with small perch and rock bass and was little used by the public at the time of the survey.

There is one small cottage on the lake, but there are no boat liveries or resorts.

Booth Lake was brought to the attention of the Department of Conservation by Mr. W. C. Garred, of Detroit, in 1935, in a letter asking what might be done for a lake with a stunted population of perch and rock bass.

Physical Characters

Booth Lake has a surface area of 32.5 acres. It is divided into two basins of nearly equal size, each of which has a maximum depth of approximately 34 feet. The shoreline development is 1.87, which means that the shoreline is 1.87 times longer than the circumference of a circle having the same area. Usually the greater the shoreline development, the greater is the productivity because this index is proportionate to the number of bays and shore irregularities.

There is a rapid drop-off around most of the lake. The shoal area (the area potentially able to produce plants) ranges in width from 20 to 60 feet and constitutes about 20 per cent of the lake.

Booth Lake probably occupies a depression left between the moraines as the glacier receded. The surrounding country is very hilly, and is partially wooded.

The lake has no inletnor outlet, and the water level fluctuates very little.

Some of the physical characteristics of the lake are given in the following table:

Area in acres	Maximum depth in feet	Shoreline development	Percentage of shoal	Bottom types		Color of water	Secchi disk
				Shoal	Depths		
32.5	34	1.87	20	Sand, marl, mostly marl, very soft.	Pulpy peat	Clear, color-less	14 ft.

The transparency of the water, as determined by lowering the Secchi disk (a black and white metal disk) until it disappears from sight, was 14 feet. The transparency reading means that light will penetrate at least to a depth of 14 feet. This is somewhat greater than average for small lakes, the average being about 9 feet.

Temperature and Chemical Characters

The temperature and chemical character of the water play an important part in its suitability for the production of plant and animal life. Temperature is a primary factor in the growth of fishes. The so-called warm-water fish, such as bass and bluegills, grow very little if at all in water below 50°F. while brook trout, for example, cannot live in water which is much over 70°F. for any great period of time, whereas bass and bluegills thrive at temperatures of 70°F. and above. Each species has a range of tolerance for temperature and within that range there is an optimum at which the growth rate is most rapid.

Dissolved gases and minerals also affect plant and animal life. Lack of oxygen in the deeper waters will limit the use of these areas by fish, and the lack of certain dissolved minerals will greatly limit plant production. A knowledge of the existing physical, chemical and biological conditions helps the fishery biologist to determine, in a general way, the productivity of a given body of water.

Certain temperature and chemical characteristics of Booth Lake are presented in Table I.

Table I
Temperature and Chemical Conditions in
Booth Lake, August, 1937

Station	1			2		
Location	South Basin			North Basin		
Date	8/6/37			8/6/37		
	Depth in feet	Temp. in °F.	Oxygen in p.p.m.	Depth in feet	Temp. in °F.	Oxygen in p.p.m.
Surface	...	75	8.8	...	75	8.1
Thermocline						
Top	21	70	...	21	71	...
Bottom	27	63	6.2	25	68	7.4
Bottom	27	63	6.2	25	68	7.4
M. O. Alkalinity	117-125			115-123		
pH range	7.9-8.1			8.0-8.2		

Oxygen was present throughout the entire lake, and thus fish can live at all depths. The water is moderately hard and slightly alkaline. The combined chemical factors are about average for productive lakes.

A thermocline (an area of rapid change in temperature, at least 0.5°F. per foot) was present. It extended from 21 feet to the bottom. A thermocline immediately at the bottom such as this has no particular significance because it is probably only a temporary condition and because it does not isolate a layer of water below which oxygen may be absent.

Biological Characters

The vegetation in Booth Lake is not abundant except in the southwest bay of the south basin. This is probably due to the soft nature of the bottom in the shallow areas and along the "drop-off"

The following table gives the species of plants collected in the lake.

Table II
Vegetation present in Booth Lake*

Species
Bushy pondweed (Najas flexilis)
White water lily (Nymphaea odorata)
Water smartweed (Polygonum amphibium)
Large-leaf pondweed (Potamogeton amplifolius)
Variable pondweed (P. gramineus)
Floating-leaf pondweed (P. natans)
Pondweed (P. pusillus)
Big bulrush (Scirpus acutus)
Narrow-leaved cattail (Typha angustifolia)
Bladderwort (Utricularia vulgaris var. americana)
Musk grass (Chara fragilis)

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

The bulrush is the most abundant plant in the lake, extending around the entire lake. Plants are not only beneficial for cover, but also harbor a large number of insects and other fish foods.

Fish Foods

The plankton (microscopic and nearly microscopic plants and animals which are free-floating in the water) was not abundant at the time of the survey. However, the abundance of plankton varies greatly, even from day to day and place to place in a lake, and a sample taken at one time and at one place may not be representative of average conditions.

Midge larvae were the dominant organisms in the bottom foods. Aquatic worms, dragon- and damselfly nymphs and water mites were also present. The abundance of bottom organisms was about average for this type of lake.

The species of fish present at the time of the survey, together with the estimated abundance and stocking records are presented in Table III.

Table III
Species of fish present in Booth Lake, at the time of the survey, with abundance and stocking records.

Species	Abundance	Stocking 1932-36
GAME FISH		None
Rock bass	Abundant	
Yellow perch	Abundant	
FORAGE FISH		
Black-nosed shiner	Few	
Golden shiner	Few	
Blunt-nosed minnow	Abundant	
Iowa darter	Common	
COARSE FISH		
Common sucker	Common	
OBNOXIOUS FISH		
None taken, seen or reported.		

The scale samples taken at the time of the survey indicated a stunted condition for rock bass. From samples taken later (at the time of the poisoning) perch and rock bass were found to be stunted.

Rock bass grew very slowly; the largest had a length of 5.6 inches in six years (7 summers). Rock bass, on the average, reach legal size (6 inches) during their 5th summer of life, while those in Booth Lake averaged 4.5 inches near the end of their 5th summer. Yellow perch were also slow-growing; the largest had a length of 7 1/8 inches in six years (7 summers). Yellow perch, on the average, reach 7 1/8 inches during their 4th summer of life. (For further information, see Report No. 461 by Dr. R. W. Eschmeyer.)

Spawning facilities are adequate for perch, rock bass and minnows.

Management Suggestions

Survey data indicated an overpopulation of small rock bass and yellow perch. In order to determine the effect of a reduction in the density of the population, the south basin of Booth Lake was blocked off and the fish killed by the use of chemicals on September 7, 1937. Of the 20,192

fish recovered, 14,054 were minnows, 4,827 yellow perch, 1,233 rock bass, and 78 suckers. The total weight was 398.7 pounds. Of the 6,060 game fish, only 42 were legal-sized, less than two limit catches. There were 37 perch and 5 rock bass of legal size.

Following the poisoning, several checkups were made to determine the effect of this reduction on the remaining fish, i.e. those in the north basin. After the poison had dissipated, the sand bags blocking the channel between the two basins were removed and the fish in the north basin were given free access to the entire lake. The growth rate increased in all age groups. This increase was too great to be accounted for by any normal growth fluctuation. (For more detailed growth rate data, see Report No. 612, or published report from Vol. 70 (1940) 1941 of the American Fisheries Society, pp. 143-148).

Booth Lake is designated as an "all others" lake, and there is no reason in the light of our present knowledge to change this classification.

A planting of 25 adult smallmouth bass was made in the fall of 1937, after the poisoning. These fish have successfully spawned and their offspring are now furnishing good bass fishing. In 1938, 200 largemouth bass fingerlings (3 months), 1,500 perch (6 months) and 5,000 bluegills (5 months) were stocked. The stocking with yellow perch was a sad mistake, as the lake already had an adequate, if not more than adequate, supply of perch.

Two pumpkinseeds were caught in October, 1939. These fish may have been planted with the bluegills or bass, or possibly some fishermen planted them with the hope of improving the fishing in Booth Lake. If these pumpkinseeds were planted with the bluegills, they were holdovers in the ponds, because they were one year older than the bluegills which

were planted. It is also a possibility that a small number of pumpkinseeds lived in the basin not poisoned and in insufficient numbers to be readily taken, and thus were overlooked at the time of the poisoning.

No future stocking is recommended.

One largemouth bass was taken in June, 1940. This bass was from the planting made in 1938.

Painted turtles, snapping turtles and great blue herons were seen at the time of the survey. No predator control is advisable since these predaceans may be valuable in keeping fish populations under control. This is particularly true where there is a stunted condition of the fish.

The rock bass were infected with "black spot" parasite and some of the perch were infected with the yellow grub. The parasite problem is not great and no practical method of control is known.

The cover in Booth Lake is primarily vegetation, with a few logs and windfalls. A few brush shelters might aid in providing cover for some fish and also harbor fish food organisms.

Spawning facilities for smallmouth bass might be improved by gravel spawning boxes.

A continued periodic check should be made on this lake to determine whether or not the rock bass and perch continue to maintain an improved growth rate, or whether they again become stunted. These checkups will also determine whether the smallmouth bass can maintain good fishing by natural reproduction, and whether or not the largemouth bass have established themselves from the plantings of 1938.

INSTITUTE FOR FISHERIES RESEARCH

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