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FISHERIES SURVEY OF ROSE LAKE, OSCEOLA COUNTY, MICHIGAN

by
C. J. D. Brown

During the latter part of August, 1938, a fisheries survey party* made a study of Rose Lake (T. 19 N., R. 9 W., Secs. 3, 4, 9, 10). This is a public lake located about 16 miles northeast of Reed City. It can be reached by traveling U. S. highway 131, $2\frac{1}{2}$ miles north of LeRoy, and thence turning 3 miles east on the county road. Rose Lake is in the Manistee River system and is situated near the headwaters of the South Branch (Pine River) of this stream. The outlet from this lake is intermittent and was very inactive at the time of the survey. The inlet is very small and also intermittent.

There were 12 cottages and one boat livery on the shores of the lake in 1938. Fishing was moderate to light, but was reported to be heavy during previous summers. According to reports this lake is one of the most popular in that district and attracts many fishermen and vacationists. A heavy mortality of game fish was reported for the winter of 1937-38. This may have been the result of winter killing (suffocation due to the lack of oxygen under the ice), although this lake is not the type where winter killing would be expected. The very poor fishing during the summer of 1938 is explained by this loss.

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*The survey party had the following personnel: Robert Ball, leader; Paul Eschmeyer, Walter Crowe and Arthur Whitely, assistants.

Rose Lake has a surface area of 370 acres and a maximum depth of 34 feet. The basin is fairly irregular with the largest and deepest depression in the northeast end of the lake and with three smaller depressions in the southwest arm. The lake bottom with its knobs and hollows is not essentially different from the general contour of the surrounding country. The shore line has a development of 1.8. This means that it is nearly twice as long as it would be if the lake were perfectly round. Almost one-half of the shore line is encroaching. The shoals (0-15 ft.) of this lake are composed almost entirely of sand strewn in places with gravel, except in the extreme west end where the bottom is of pulpy peat. They vary in width from 100 to 750 feet and constitute approximately 25 per cent of the total area of the lake. The slope is gradual into deeper water, with no steep drop-off. Out beyond the 15-foot contour, the bottom is composed almost entirely of pulpy peat. The surrounding country has sandy soil and is rather heavily wooded.

The water is colorless, but appeared greenish at the time of the survey. This may be explained by the large quantities of phytoplankton present then. A secchi disc was visible down to $8\frac{1}{4}$ feet, which is another indication of the turbidity, as 12 to 15 feet is about average for other lakes of this size in the region.

A temperature and chemical study was made on the water of Rose Lake on August 31. The data taken are summarized in the following table.

Depth in feet	Water temp. °F.	Oxygen p.p.m.	CO_2 p.p.m.	M. O. Alkalinity	pH
0	72	...	...	...	...
2	72	8.5	0.0	30	7.9
5	72	8.5	0.0	30	7.9
10	72	8.5	0.0	30	7.9
15	72	8.5	0.0	30	7.9
20	72	8.5	0.0	30	7.9
25	72	8.5	0.5	28	7.8
30	72	8.5	1.0	30	7.3
33	71	...	...	...	...

The above analyses were made on a day when the air temperature was 68° F., the sky was cloudy and there was a strong west wind. As can be seen, there is no significant difference in either temperature or chemical conditions from the top to the bottom of this lake. This seems strange, since Rose Lake supposedly has experienced a number of "winter killings." Lakes of this depth, which are subject to oxygen depletion in the winter, would be expected to stratify both thermally and chemically during the summer, i.e. water temperatures at the bottom should be considerably below those of the surface and the oxygen supply near the bottom should be greatly depleted. It is possible that strong winds during the summer, prevent stratification, and since ice cover prevents wind effect, there may be winter stratification. At any rate, the large depression in this lake is probably very suitable for fish from top to bottom during the summer.

The water of Rose Lake is soft (methyl orange alkalinity, 30 p.p.m.), and yet alkaline (pH 7.4-7.9), although not strongly so.

Aquatic vegetation is fairly abundant in Rose Lake, in spite of the sandy shoals. The lake is protected by wooded shores and its long axis is

in a northeast southwest direction. This allows only a short sweep for the prevailing northwest winds and reduces wave action to a minimum. Both submerged and emergent types of plants are common along the shoals (water from 0 to 15 feet in depth). Twenty-two different species were collected from this lake. The various kinds, their abundance, type of bottom and depth at which they grow are shown in the following table.

Summary of Vegetation from Rose Lake

Common Name	Scientific Name	Station	Abundance	Depth ft.	Bottom Types
Watershield	Brasenia schreberi	1,2	medium	1-5	Fibrous peat, sand
Sedge	Dulchium arundinaceum	1	sparse	0-1	Sand
Needle rush	Eleocharis sp.	2	medium	0-1	Sand
Pipewort	Eriocaulon septangulare	1,2,3,4	medium	0-4	Sand
Quillwort	Isotes Braunii	3	sparse	4-8	Sand
Bushy pondweed	Najas flexilis	1,2,3,4	medium	1-8	Sand, fibrous peat
White waterlily	Nymphaea odorata	1,2,4	medium	1-5	Sand, fibrous peat
Yellow waterlily	Nuphar variegatum	1,2,4	dense	1-4	Sand, fibrous peat
Pickerel weed	Pontederia cordata	1,2,4	sparse	0.5-3	...
Pondweed	Potamogeton amplifolius	2,3	sparse	3-8	Sand
"	" graminifoliatus	1,2,4	sparse	0.5-4	Sand
"	" natans	2	medium	2-5	Sand
"	" Robinsii	1,2	dense	1-11	Sand, pulpy peat
"	" praelongus	1	sparse	3-4	Sand
"	" pusillus	1,2,3	medium	2-11	Sand, pulpy peat
"	" zosteriformis	1,2	medium	1-11	Sand
Arrowhead	Sagittaria sp.	1,2	dense	2-4	Sand, fibrous peat
Bulrush	Scirpus acutus	1,3,4	medium	0-2	Sand
"	" americanus	3	medium	0-1	Sand
Cattail	Typha latifolia	1	medium	0-1	Sand
Bladderwort	Utricularia vulgaris	1	medium	1-3	Sand
Wild celery	Valisnaria spiralis	1,2,3	medium	1-5	Sand

The extreme southwest bay of the lake is choked with weeds of many kinds. Conditions, on the whole, seem to be very favorable for the growth of plants and this greatly influences the quantity of food organisms produced as well as the fish. Weed beds are known to harbor much more fish food than equal areas

without plants. They also act as cover for both large and small fish, and provide a place for the successful spawning of several species.

Fish food organisms occupy various niches in each lake habitat. The plankton, which was very abundant in Rose Lake, is composed of the extremely small free-floating animals and plants which may at times be so numerous as to make the water turbid. Populations of these small forms fluctuate greatly from day to day and from place to place in a lake. It is not possible, therefore, to give much significance to one set of samples which may or may not represent a cross-section of conditions throughout the year. Plankters are primarily important because they occupy a fundamental link in the fish food chain. While they are not used directly by most of the larger fishes, they are an important part of the diet of young game fish and forage fishes. Their greatest significance, however, is that they are the important food of most fish food organisms. Rose Lake seems to be unusually well suited for plankton production.

Mayflies, dragonflies, snails and water mites were the most common food organisms found along the shoals, while midges were the most abundant in the pulpy peat bottom of the deeper areas. A summary of the quantitative samples taken is given below. Each sample represents an area of $\frac{1}{2}$ sq. foot taken on August 31, 1938, with an Ekman dredge.

Station number	Depth ft.	Bottom type	Number of Organisms							
			Aquatic worms	Snails	Clams	Mites	Mayflies	Dragonflies Damselflies	Caddis	Midges
1	12	sand	1	.	.	3	14	.	.	1
2	33	pulpy peat	.	.	.	1	..	.	.	30
3	16	sand	1	4	.	23	..	4	.	18
4	12	pulpy peat	.	.	.	3	..	.	.	21
5	5	detritus	.	1	18	2	3	15	8	2
6	5	...	.	2	3	4	7	2	.	2

Because no plant samples were examined for food organisms, we feel certain that the above table is not very representative. Caddis flies and snails were very probably numerous on the submerged vegetation.

On the whole, food conditions appear to be very good in Rose Lake, possibly as good or better than the average for lakes of its size in the region.

No very adequate fish samples were obtained, not so much for the lack of effort as for the scarcity of fish. Perch, northern pike and black crappie were the only game fish taken. The common sucker, as well as both the black and yellow bullheads, were also found. The sucker seemed to be the only fish abundant in the lake. The common shiner was the only forage fish found. This very poor sample of fish was undoubtedly due to the heavy kill reported the previous winter. General creel census records show smallmouth bass, bluegills and rock bass in addition to the above named game fish.

Rather large plantings of fish have been made in Rose Lake during the past six years (1934-1939 inclusive). A summary of the planting records is given below.

1934 -	150	four-month largemouth bass
	4,000	adult bluegills
1935 -	20,000	eight-month perch
1936 -	500	year largemouth bass
1937 -	450,000	pike perch fry
	10,000	five-month bluegills
	45,000	four-month bluegills
1938 -	440,000	pike perch fry
	14,000	three-month bluegills
1939 -	440,000	pike perch fry
	500	three-month largemouth bass
	7,500	seven-month perch
	14,000	three-month bluegills

It is very difficult to say what effect these plantings have had on the total fish population. Of course, plantings prior to the winter of 1937-38 may all have been nullified by the heavy winter kill at that time. No subsequent studies have been made since August, 1938, and we are not certain, therefore, what the present conditions are.

Only eight fish were studied for their growth rate. As can be seen from the following table, the growth of fish in this lake seemed to be good. Northern pike reached legal length by the middle of their second year, and black crappie at about the same age.

Species	Age group*	No. specimens	Average total length in inches	Av. weight in ounces
Northern pike	I	1	16	13.1
	II	2	18	18.4
	III	1	23	36.8
Crappie	III	1	8.8	4.8
Pumpkinseed	II	2	4.3	0.9
Warmouth bass	II	1	5.1	1.5

The rate of growth shown by these data is probably not average, due to the inadequate samples of fish and the effect of the reduced population due to winter mortality.

All of the fish collected during the survey were young, which may mean that the older fish are more vulnerable to conditions producing winter mortality, than are younger individuals.

The means for natural propagation seem to be adequate for largemouth and possibly smallmouth bass, bluegills, crappie, northern pike and perch.

*Age determinations by W. C. Beckman.

Walleye pike may also find conditions suitable here, but we are not yet certain what their spawning requirements are.

Management Suggestions

Rose Lake has been in the "pike lake" classification during the last several years. However, by action of the Conservation Commission at the October meeting this year, the lake has been changed to the "all other lakes" class. This seems logical, since bass and bluegills have shown their ability to become established here. We note that, contrary to policy, this lake was stocked regularly with bass and bluegills while in the pike lake classification.

From the information obtained during the survey, we believe that largemouth bass and bluegills should be encouraged. No stocking should be necessary after these species are well established, except as future mortalities destroy the fish population. Northern pike and perch will undoubtedly maintain themselves without stocking unless the winter mortality includes the entire population of these species.

It might be advisable to stock some forage fish in this lake for a few years, since they were very scarce when the survey was made. Only a few common shiners were found. Plantings of the common shiner, golden shiner and blunt nose minnow might well improve the forage fish situation; however, very little is known about the effectiveness of such plantings. Crappies seem to have done well in Rose Lake. Future plantings of this species seem unwise, however, in view of the scarcity of adequate forage fish. This

same reason makes us question the advisability of planting walleye pike. If forage fish become abundant, then there is no serious objection to the planting of both these species.

No predators or parasites of consequence have been reported and as a result no control measures are suggested.

Cover seems to be fairly good in that there are good aquatic plant beds. The lake is quite free from deadheads and permanent natural objects which would serve as cover, however, and we believe the addition of brush shelters around much of the shoal in water between 6 and 18 feet in depth would be very beneficial. One thing is certain, however: the devices constructed for this purpose should be well scattered over the shoal and not concentrated in one or two areas. Minnow spawning slabs might also improve conditions for forage fish.

The water level at the time of the fisheries survey was too low to make any damming of the intermittent outlet stream effective. Previous suggestions have indicated that a dam placed in the outlet just south of the townline road would turn certain springs back into the lake. There is serious doubt that such a dam would maintain or improve the lake level. However, since the lake was only seen during the lowest water period (late August), we are not in a position to make a definite recommendation on this point.

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