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FISHERIES SURVEY OF MILLER AND COPLEY LAKES

CASS COUNTY

by

John Funk

I. Introduction

Miller Lake (T. 5 S., R. 13 W., Sec. 35, 36) is located in Marcellus Township and Copley Lake (T. 5 S., R. 14 W., Sec. 25)in Violinia Township of Cass County. They are 4.2 and 6 miles respectively from the town of Marcellus. Neither lake has an outlet and so is not directly referable to any drainage but they are located near the headwaters of the Rocky River which flows into the St. Joseph at Three Rivers.

The lakes were mapped and the biological survey made by an Institute party* in July, 1938. We wish to thank Mr. Goodenough of Marcellus for the use of his cabin and boats while the party was at Copley Lake. Such cooperation is greatly appreciated.

Since these lakes are small, have no inlets or outlets, and are largely surrounded by marsh, it is improbable that they ever had any important industrial use. Fishing in both lakes is reported to have formerly been good. All game fish were winter killed in Copley in 1936.

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* Personnel of survey party: R. C. Ball, leader; W. Crowe, P. Eschmeyer, and Arthur Whiteley, Assistants.

Bluegill fishing in Miller was formerly good but the fish caught now are mostly small.

Copley is a semiprivate lake, the owner allows anyone to fish who cares to. Conditions at Miller were formerly similar but the main entrance has recently been posted so that it is difficult, if not impossible, to gain access. There is little resort development on either lake.

Copley has one cottage; all there is on Miller is a camp ground and two boat houses. Few boats are kept on either lake. A resident reports that no one was fishing on Copley during the summer of 1941. It would seem that the potential importance of these lakes as public fishing waters is very slight.

II. Physical Characteristics

In many respects the two lakes are similar in their physical characteristics. Both are somewhat oval in shape, the margins are low and marshy, and are apparently in an advanced stage of development. From the character of the surrounding country it may be assumed that the lakes occupy basins of glacial origin. Most of the land in the vicinity is rolling, the soil is sandy and of rather low productivity.

The water level of the lakes is reported to fluctuate considerably. This is serious, since extensive shoal areas are exposed with only small drops in the water level. However, in lakes with no inlets or outlet no practical method of control suggests itself.

Copley Lake is roughly oval in shape with its long axis (.3 mile) running approximately north-northwest. It is about a quarter of a mile wide. The margin most of the way around is floating bog. The maximum length of Miller Lake is slightly less than ½ mile and the maximum width about 1/4 mile. The long axis runs almost directly east and west. The entire margin is swampy.

Lakes are known to go through a cycle of development beginning with a water-filled depression in the earth which gradually fills in to become a swamp or marsh and ends up as dry land. In isolated lakes the greatest factor in the filling-in process is vegetation. Plant remains settle to the bottom and form the peat which eventually fills the basin. As the lake becomes smaller the process becomes more rapid because wind action, which retards the plant growth, is reduced. When plants have taken over the lake to such an extent that they cover the entire bottom the filling becomes very rapid. In the space of 20 or 30 years the open water may disappear entirely and only a marsh be left.

The lakes under discussion have the following combination of physical characteristics.

Lake	Area in Acres	Maximum Depths	Shore development	Approximate per cent Shoal	Bottom types		Color of Water	Secchi disc
					Shoal	Depths		
Miller	56.7	24 feet	1.2	100	Fibrous peat	Fibrous peat	slightly dark	10 feet
Copley	31.8	10+ feet	1.18	100	Pulpy peat	Pulpy peat	dark brown	1½ feet

Each has a shore development of approximately 1.2. This means that the shore line is 1.2 times as long as if they were perfectly round lakes. In general a large shore development is desirable since the shore area of a lake is usually most productive.

From a study of the other factors it will become apparent that these lakes are well along in their cycle of development. They have been completely taken over by plants (100 per cent shoal). They are small so that wind action is minimal. The margins are already encroaching on the lakes. Copley is at a more advanced stage of development than Miller. This is

shown by the shallower water, smaller size, and the bottom of very soft, more completely decomposed peat.

Such lakes begin to lose their value as fishing lakes when filling has progressed to the stage where the water is only a few feet in depth as in Copley. Then winter kill (usually caused by the depletion of the oxygen in the water under the ice by the decomposition of organic matter) may be expected. This occurred in Copley in 1936. In Miller, with a greater depth of water, it is not so likely to occur. This does not mean that there will not be some good fishing in the lake in the future but simply indicates the general trend which may be expected in the next 20 or 30 years.

III. Temperature and Chemical Characteristics

Temperature and chemical conditions of the lakes are summarized below.

Lake	Miller			Copley								
Station #	1			1			2			3		
Location	Deepest part			Deepest part			North end			South end		
	Depth in feet	Temperature in °F.	Oxygen in p.p.m.	Depth in feet	Temperature in °F.	Oxygen in p.p.m.	Depth in feet	Temperature in °F.	Oxygen in p.p.m.	Depth in feet	Temperature in °F.	Oxygen in p.p.m.
Surface	3	78	7.3	3	88	6.2	4	84	4.4	4	84	4.3
Bottom	15	72	5.9	6	76	4.5	...	...	...	...	...	...
Thermocline												
Top	12	75	6.7	...	...	...	...	...	...	...	...	...
Bottom	15	72	5.9	...	...	...	...	...	...	...	...	...
Carbon dioxide range	0.0			2.0 - 4.0			4.0			25.0		
M. O. alkalinity range	45 - 51			7.0 - 8.0			7.0			1.0		
pH range	8.1 - 8.2			6.6 - 7.4			6.9			6.8		

In both, the water is quite warm and probably is warm for several months each season. This encourages maximum growth of all living things in the lakes.

The slight degree of thermal and chemical stratification in both lakes can be ignored as insignificant. In their other chemical characteristics they differ considerably. Miller has an abundance of oxygen (5.9 - 7.3 p.p.m.) from top to bottom, carbon dioxide is absent, and it is somewhat alkaline (pH 8.1 - 8.2). All of these factors are considered favorable for productivity and are near average for productive lakes. The water is fairly soft (M. O. alkalinity 45 - 51 p.p.m.). Hardness in water is due chiefly to salts of calcium, magnesium, and phosphorus in solution. These are necessary for a good growth of plants (and indirectly of other organisms) so that moderately hard water lakes are usually most productive. The abundance of plants in Miller Lake would seem to indicate, however, that this factor is not having any serious limiting effect.

In Copley there is enough oxygen for fish (over 4 p.p.m.). Carbon dioxide is present in amounts up to 25.0 p.p.m. Carbon dioxide is usually produced by the decomposition of organic matter in the bottom and its presence in the surface water indicates the extent that the bottom deposit is effecting the lake. The water is near neutrality in reaction (pH 7.4 - 6.6) and is quite soft (M. O. alkalinity 1.0 - 8.0). Generally soft water lakes which are acid or neutral in reaction are less productive than those with harder, more alkaline water.

To summarize, the temperature-chemical factors would seem to indicate that Miller is a moderately productive lake while in Copley productivity is rather low.

IV. Biological Characteristics

The aquatic vegetation in the two lakes is summarized in the following table.

Species*	Abundance	
	Miller	Copley
Waterweed (Anacharis canadensis)	Abundant	...
Water Shield (Brasenia Schreberi)	Rare	Common
Bluejoint (Calamagrostis canadensis)	Few	...
Sedge (Carex atherodes)	Rare	...
Sedge (Carex sp.)	Common	...
Coontail (Ceratophyllum demersum)	Common	...
Water Willow (Decodon verticillatus)	Few	Rare
Three-way Sedge (Dulichium arundinaceum)	Rare	Rare
Needle Rush (Eleocharis acicularis)	Rare	...
Spike Rush (E. Robbinsii)	...	Rare
Spike Rush (E. sp.)	Common	...
Pipewort (Eriocaulon septangulare)	...	Rare
Water Pennywort (Hydrocotyle umbellata)	Rare	Rare
Water Milfoil (Myriophyllum sp.)	Common	...
Bushy Pondweed (Najas flexilis)	Few	...
White Water Lily (Nymphaea odorata)	Few	Common
Yellow Water Lily (Nuphar advenum)	Common	Common
Smartweed (Polygonum sp.)	Rare	...
Pickerel Weed (Pontederia cordata)	Common	Common
Pickerel Weed (P. cordata f. taenia)	...	Rare
Large-leaf Pondweed (Potamogeton amplifolius)	Few	Rare
Pondweed (P. augustifolius)	Few	...
Leafy Pondweed (P. foliosus var. marcellus)	Few	...
Variable Pondweed (P. gramineus)	Rare	...
Variable Pondweed (P. g. var. graminifolius f. myriophyllus)	Common	...
Floating-leaf Pondweed (P. natans)	Rare	Rare
Flat-stemmed Pondweed (P. zosteriformis)	Common	...
Bulrush (Scirpus sp.)	Few	...
Common Cattail (Typha latifolia)	Few	Rare
Narrow-leaf Cattail (T. augustifolia)	Rare	...
Bladderwort (Utricularia vulgaris var. americana)	Rare	Common
Unknown (Probably Sagittaria sp.)	Rare	...

* Plant determinations by B. M. Robertson

It will be seen that plants are quite abundant in Miller (29 species) while in Copley they are relatively scarce (14 species). There is a significant difference in the type of vegetation in the two lakes. The

most abundant forms in Copley are Water Shield (Brasenia), Water Lilies (Nuphar Nymphea), Pickerel Weed (Pontederia), and Bladderwort (Utricularia). These are what might well be expected in a protected, shallow lake with a soft peat bottom. The presence of Pipewort (Eriocaulon) is also significant since it usually grows only in acid waters. The more common submergent forms such as Waterweed (Anacharis), Coontail (Ceratophyllum), and Water Milfoil (Myriophyllum), are common in Miller but are entirely lacking in Copley. Musk Grass (Chara), the most common submergent plant in most hard water lakes, is conspicuous by its absence in both of these. Miller is also characterized by a good variety of marginal plants (sedges, bulrushes, etc.) and of pondweeds. These are few or lacking in Copley.

Plankton (microscopic or near-microscopic plants and animals floating free in the water) was quite abundant in Miller Lake (4.6 - 13.5 cc. per cu. M.) at the time of the survey. It was less abundant in Copley (2.7 cc. per cu. M.) but apparently adequate. Phytoplankton was dominant in Miller while one haul in Copley was made up chiefly of Daphnia. Since plankton populations are known to vary from day to day and place to place in a lake, one sample taken at one time is not of much significance.

Bottom samples taken with the Ekman dredge did not show very large numbers of organisms. In Miller, the organisms most numerous in most samples were amphipods and midge larvae. Mites, mayflies, damselflies, and dragonflies were also found. In Copley, midge larvae were dominant, with a few aquatic worms, leeches, clams, and mayflies present. From experience in similar lakes it is quite certain that the vegetation in the lakes supports a much greater population of food organisms than the bottom samples would indicate. The food is probably adequate for the fish present.

The fish collected on the lakes are given in the following table.

Species	Miller Abundance	Miller Stocking 1934-37	Copley Abundance	Copley Stocking 1934-40
GAME FISH				
Mud pickerel (Esox vermiculatus)	Rare	...	...	...
Yellow perch (Perca flavescens)	Few - Common	...	...	...
Largemouth bass (Huro salmoides)	Few	...	...	...
Warmouth bass (Chaenobryttus gulosus)	Rare	...	...	...
Bluegill (Lepomis macrochirus)	Abundant	...	...	35,000
FORAGE FISH				
Golden shiner (Notemigonus chrysoleucas auratus)	Abundant	...	Abundant	...
Mud minnow (Umbra limi)	...	...	Rare	...
COARSE FISH				
Yellow bullhead (Ameiurus natalis)	Rare -Few	...	...	...
Lake chub sucker (Erimyzon sucetta kermerlii)	Few	...	...	...
OBNOXIOUS FISH				
None taken				

No game fish were taken in Copley Lake since they all winter killed in 1936. The golden shiners apparently survived the winter kill since both young and adults were found. In Miller, the bluegill seems to be by far the most abundant game fish, although perch and largemouth bass might be caught occasionally. Minnows are scarce in the lake, golden shiners being the only ones which were taken.

Since no game fish were taken in Copley, no idea of the growth rate in that lake can be obtained. The following table summarizes the growth rate of game species in Miller Lake. Included in this table are fish taken by members of the Institute staff other than the survey party in visits made to the lake on October 16, 1936, and August 10, 1939.

Since a good part of these fish were collected late in the season they actually have completed most of one growing season more than their age shows.

Growth Rate Table

Species	Age * group	Number of specimens measured	Average total length in inches	Average weight in ounces	Number weighed
Yellow perch	III	6	6.1	1.5	5
	IV	8	6.5	1.6	8
	V	9	7.3	2.3	9
	VI	5 (♀)	10.5	7.7	5
	VIII	2	10.9	8.6	2
	IX	1	12.3	11.6	1
Largemouth bass	II	5	6.9	3.3	2
	III	4	10.7	7.6	4
	IV	2	11.2	9.2	2
	V	1	14.5	21.9	1
	VII	1	16.5	34.3	1
	VIII	1	19.5	54.0	1
Bluegills	I	1	2.2	0.1	1
	II	20	3.8	0.5	20
	III	43	4.5	0.8	42
	IV	52	5.1	1.2	50
	V	25	5.6	1.6	24
	VI	4	6.2	2.2	4
Warmouth bass	I	1	2.1	0.1	1
	IV	1	5.3	2.0	1
	V	1	4.4	1.0	1
	VI	1	4.7	1.0	1
Mud pickerel	II	1	7.7	1.5	1
	V	2	8.4	3.6	2

* Age determinations by W. C. Beckman.

Yellow perch and largemouth bass reached legal length in their fourth summer; bluegills in their seventh summer of life. No legal length warmouth were taken.

While the series of yellow perch and largemouth examined are not large we believe they are representative of conditions in the lake. The growth rate of the perch seems to be somewhat below average for southern Michigan lakes. The apparently large increase between age groups V (7.3 inches) and VI (10.5 inches) may be explained by the fact that the five specimens of group VI studied were all females which are generally considerably

larger than males of the same age. The largemouth bass are growing at about average rate for similar lakes.

The bluegill series is large enough to give unquestionable evidence that these fish are growing very slowly. It is taking them almost twice as long to reach legal size as it does the average Michigan bluegill which becomes a "keeper" in its fourth summer. The series of warmouth bass is too small to warrant any definite conclusions although they seem to be growing very slowly.

Spawning grounds on the two lakes are apparently rather limited. In Miller, the bottom is all fibrous peat. This supports a dense growth of vegetation and might provide fair facilities for largemouth bass. Such facilities are not good for perch. Bluegills apparently find conditions quite satisfactory. Approximately the same conditions exist on Copley except that there are two small patches of sand that might be utilized.

V. Management Suggestions

At present these lakes are in the "all other lakes" classification and nothing in the results of this survey would indicate that a change is desirable.

Largemouth bass seem to be doing moderately well in Miller Lake and should be encouraged. Under no conditions should bluegills be planted. The cause of stunting or slow growth, such as the bluegills in this lake show, is not fully understood. It is believed to be due to an over-population in which the numbers of insect-eating species get out of balance with the fish-eating species. It would probably correct itself in time, but the length of time required and even whether the above is the true explanation is not definitely known. Anything done would be experimental in nature and no assurance can be given that the desired results would be obtained.

One experiment might be the introduction of large numbers (1000) of yearling largemouth bass in hopes that they would reduce the bluegill population by predation. If this method should seem impractical the numbers of the bluegills might be reduced by application of derris root to the spawning area at spawning time. Prevention of reproduction for one year might give the remaining bluegills the opportunity they need.

It should be pointed out that if the public is denied access to Miller Lake, it is considered a private lake and the Conservation Department can do nothing in the way of stocking or other improvement.

Copley Lake seems to be of so little importance as a public fishing water that the best management policy would be to stop stocking and improvement attempts. Bluegills have been planted quite regularly (1937 - 5,000, 1939 - 15,000, 1940 - 5,000) but as mentioned above the lake was not fished in 1941 and probably little or no fishing was done in the preceding years. If the planted fish were taking hold and doing well it seems certain that someone would have found it out before this. At best, stocking here seems to be a rather wasteful procedure. There is also the problem of winter kill on this lake. While no reports could be obtained of kills subsequent to 1936 (or "5 or 6 years ago") this might well be due to the fact that the lake is so little frequented. The physical characteristics of the lake are exactly those of a lake in which regular kills might be expected. If they do occur, it would be wasted effort to attempt to restore the lake to production.

A few predators were observed on the lakes but these were not numerous enough to warrant any attempts at control. At least in Miller their effect would be distinctly beneficial in reducing the population of bluegills..

The fish taken showed very few parasites. It is certain that any which may exist are in no way harmful to man. While the fluctuation of water level may be harmful on these lakes, as pointed out above, control would be impossible. The lakes are probably not of sufficient importance to warrant any attempts to improve cover or spawning facilities. If one of the experimental procedures for Miller Lake is adopted, periodic checks to determine the results would of course be made.

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