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A FISHERIES SURVEY OF SIX MILE LAKE,

HOUGHTON AND ONTONAGON COUNTIES

by

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Introduction

Six Mile Lake is located partly in Laird Township, Houghton County, and partly in Bohemia Township, Ontonagon County, in the western portion of the Upper Peninsula of Michigan. In the former county it covers the extreme southwest corner of section 31, T. 51 N., R. 36 W. In the latter it covers a small part of section 36, T. 51 N., R. 37 W., while most of its area lies in section 4, T. 50 N., R. 37 W.

The Village of Nisula is situated $6\frac{1}{2}$ miles east of the lake and the Village of Mass is 8 miles to the west. Highway M-35 skirts its north shore. No large lakes are found in the immediate vicinity of Six Mile Lake. Courtney Lake is one mile south. Both lakes lie within the drainage area of the Firesteel River.

The map of Six Mile Lake, showing the shoreline, shore features, depth contours and bottom types, was made by the C.C.C., under the direction of technicians of the Ottawa National Forest, within the boundaries of which a part of the lake lies. A regular chemical and biological

inventory of the lake was made by an Institute for Fisheries Research survey party* on August 19 and 20, 1937.

Six Mile Lake has never had extensive recreational or other use, and the quality of the fishing is not known to have ever been particularly good. Perch and largemouth bass are said to have been introduced about 1930. They became established, but no good fishing ever developed. There were no cottages, hotels, resorts or boat liveries on Six Mile Lake at the time of the survey, and light fishing was the only use being made of the lake.

Almost all of the shoreline of Six Mile Lake is marshy and encroaching, and dense aquatic vegetation is taking over large areas. It is not expected that the lake will, in the future, occupy a much different place among the fisheries of the Upper Peninsula than it does at the present time. It is not potentially capable of becoming a highly productive lake which will stand up under more than light fishing pressures.

Physical Characters of Six Mile Lake

Six Mile Lake is a relatively small, shallow lake with a roughly circular basin which has an average diameter of about 1,900 feet. The basin is probably of glacial origin and may have been formed by the melting of an ice mass left by the retreating glacier. The area surrounding the lake is rolling, has essentially sandy soils and is rather densely wooded.

Although Six Mile Lake is located within the drainage basin of the Firesteel River, it has no surface connection with the stream. There is a single small inlet stream (probably intermittent) entering the

* Members of the party included: Franklin Bond, leader; Wm. Beckman, John Greenbank and Ted Monti, assistants.

southwest end of the lake. The drainage of the lake itself is limited to direct run off from areas immediately adjacent to the lake. Water fluctuation is minimal, with water level changes being limited to from 2 to 3 feet or less and occurring only during the spring run off or during times of abnormal precipitation.

The surface area of Six Mile Lake is 73 acres and it has a maximum depth of about 13 feet. It has a shoreline of slightly over 7,200 feet in length and has a shoreline development of 1.14. This means that the lake has only 14 per cent (1.14 times) more shoreline than a perfectly circular lake of the same area. Ordinarily, lakes with low shoreline developments (which indicate the absence of extensive shallow bays and coves which provide food, shelter and spawning facilities for many species of fish) are less productive than are lakes with high shoreline developments. This is a less important factor in the case of Six Mile Lake, however, which is shallow enough to be potentially capable of producing plants over its entire area.

Well over 90 per cent of Six Mile Lake has a muck~~*~~ bottom, with sand occurring on only a small area along the south shore.

The water in Six Mile Lake at the time of the survey was colorless. A Secchi disk (white metal disk about 6 inches in diameter), when lowered into the water disappeared from view at a depth of $7\frac{1}{2}$ feet. Transparency of the water is an important factor in determining the depth to which vegetation will grow in a lake. None of the higher plants can survive in the continued absence of light.

Temperature and Chemical Characters of Six Mile Lake

Temperature and chemical data are important in assisting the fisheries

* Probably at least partly peat, according to survey records.

worker to predict the suitability of a given water for various fish species. With respect to temperature as well as dissolved oxygen and other chemical factors, requirements differ among various fish species as well as among fish food organisms, plants, etc. Temperature and chemical data frequently indicate some of the reasons for the presence of existing fish populations and sometimes suggest means for improving the water's production of desirable game fishes.

The water temperature of Six Mile Lake on August 20, 1937, was 71°F. at the surface and 70°F. near the bottom, at a depth of 10 feet. Air temperature at the same time was 68°F. The temperature of water of shallow, exposed lakes such as Six Mile Lake fluctuates rather readily with changes in air temperature. Temperatures at the surface and bottom would normally be nearly identical throughout the year.

Seven parts per million of oxygen was present at a depth of 6 feet. No further oxygen tests were made. In a lake such as Six Mile, the constant circulation of the water by wind action insures a thorough distribution of ample quantities of oxygen throughout the waters of the lake, except during the period of ice cover.

A Methyl Orange Alkalinity test (made to determine the amounts of certain minerals and buffer salts in the water) showed the water of Six Mile Lake to be quite soft. A dissolved mineral and salt content of only 13 parts per million was found. Moderately hard waters (with a Methyl Orange Alkalinity of from 100 to 200 parts per million) are generally more productive than soft waters.

The water of Six Mile Lake was found to be somewhat acid, with a pH (hydrogen ion concentration) of 6.0 (7.0 is neutral). Moderately alkaline lakes are normally more productive than are acid waters.

No pollution was found in Six Mile Lake. None would be expected in view of the lake's far removal from sources of domestic or industrial wastes.

Biological Characters of Six Mile Lake

Toward determining the biological nature of Six Mile Lake, various kinds of data were collected. Representatives of the various species of vegetation in the lake were gathered and identified and samples of plankton (microscopic free swimming and floating plant and animal life) were collected. Bottom foods were studied and seining and netting was done in an attempt to determine the nature of the existing fish population. The biological attributes of a lake require careful consideration in the molding of suggestions for the improvement of its fishery.

Vegetation was found to be abundant in Six Mile Lake, particularly if the soft, acid water of the lake is taken into consideration. Aquatic plants were concentrated on the protected west and southwest shores, although a fringe of vegetation skirted the entire shoreline. A summary of the species of vegetation found in the lake, together with an estimate of their abundance, is shown in Table I.

Table I
Aquatic Vegetation Found in Six Mile Lake*

Species	Estimated abundance
Yellow water lily (<u>Nuphar advena</u>)	Abundant
White water lily (<u>Nymphaea odorata</u>)	Abundant
Coontail (<u>Ceratophyllum demersum</u>)	Common
Bur reed (<u>Sparganium</u> sp.)	Common
Spike rush (<u>Eleocharis palustris</u>)	Sparse
Pipewort (<u>Eriocaulon septangulare</u>)	Sparse
Large-leaf pondweed (<u>Potamogeton amplifolius</u>)	Sparse
Leafy pondweed (<u>Potamogeton epihydrus</u>)	Sparse
Floating-leaf pondweed (<u>Potamogeton natans</u>)	Sparse
Bulrush (<u>Scirpus subterminalis</u>)	Sparse
Bladderwort (<u>Utricularia intermedia</u>)	Sparse
Bladderwort (<u>Utricularia vulgaris</u> var. <u>americana</u>)	Sparse

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

Plankton (small, free floating plants and animals) was fairly abundant in Six Mile Lake at the time of the survey. However, individual samples taken during the short survey period provide insufficient data upon which to base an estimate of plankton abundance throughout the year. Large quantities of suspended materials were noted as being present in the water at the time of the survey.

Invertebrate bottom foods were found by the survey party to be very scarce in Six Mile Lake. A sample taken near the middle of the lake yielded only one midge larva. A general scarcity of invertebrate food in other parts of the lake was noted by the survey party. Minnows and crayfish appeared to be about as scarce.

The fish sample taken from Six Mile Lake by the survey party was inadequate to permit an acceptable estimation of the nature of the fish population. Loss by theft of two experimental gill nets just previous to the survey left the party with inadequate equipment to take a good fish sample in the soft-bottomed lake. An area of 12,000 square feet was seined with a common seine and yielded about 20 young-of-the-year largemouth bass, 38 young-of-the-year perch, and one fine-scaled dace. An overnight set with 300 feet of 2-inch mesh gill netting yielded no fish.

Little further information concerning the fish of Six Mile Lake is available. During 1940, according to creel census records, 54 hours of fishing in late June and early July yielded 28 perch averaging about $7\frac{1}{2}$ inches in length. In the same period, 35 undersized fish (presumably perch) were returned to the water. Thirty of the 54 hours were spent fishing with artificial bait (presumably for bass) without any fish being taken.

Piecing together the available information, it seems that perch were more or less established in the lake in 1937, with largemouth bass also well represented. The failure of the gill nets to take any fish suggests that there may have been few good-sized adult bass in the lake at the time of the survey. The absence of bass in the few available creel census records gives weight to this suggestion. The fact that undersized perch were caught, and that the legal fish taken were uniformly small, might permit one to suppose that the lake has become overpopulated with this species.

Stocking in Six Mile Lake in recent years has been confined to 900 smallmouth bass and 7,000 bluegills, all of which were planted in 1939 (2 years after the survey). No data have been collected to show whether or not either of these species survived or became established. Smallmouth bass would not be expected to reproduce in the lake. Roots and vegetation present in the lake provide spawning facilities for the largemouth bass and perch. Bluegills might spawn on the rather limited sandy shoal on the southeast end of the lake.

Management Suggestions for Six Mile Lake

The drafting of proper management proposals for Six Mile Lake is very difficult, if not impossible, in the absence of more data concerning the nature of the fish population and the rate of growth of the game fish present there. If, as some of the very incomplete data tend to show, the perch have become dominant and are stunted in the lake, and if largemouth bass have been reduced to the point where they are not effective predators of the perch, some form of population control should be undertaken. (The introduction of adult northern pike, for example, might balance up the present population).

Since the data on hand at present is very inconclusive, it is recommended that further observations and collections of fish be made at Six Mile Lake before definite management proposals are drawn up. A summary of the findings and the resulting recommendations should be made the subject of a supplementary report. The growth rate of perch and largemouth bass in the lake should be studied; the degree of success of the planting of smallmouth bass and bluegills in 1939 should be determined; parasitism of the fish in the lake should be observed (since no adult fish were collected by the survey party, upon which such observations might be made); and additional bottom samples should be taken to determine whether the principal bottom type is muck or pulpy peat (survey reports and the map conflict). Until these necessary observations have been made, it is recommended that artificial stocking in Six Mile Lake be discontinued, and that no other management procedures be undertaken.

INSTITUTE FOR FISHERIES RESEARCH

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