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SUPPLEMENT TO
REPORT NO. 630

LATE WINTER WATER ANALYSES OF SEVERAL PROPOSED TROUT LAKES OF THE OTTAWA NATIONAL FOREST

by

Paul H. Eschmeyer

(INSTITUTE FOR FISHERIES RESEARCH REPORT NO. 630,
A FISHERIES SURVEY AND MANAGEMENT SUGGESTIONS FOR
SOME LAKES OF THE OTTAWA NATIONAL FOREST, MICHIGAN)

by

James W. Moffett

Chemical and biological analyses of waters conducted by Institute for Fisheries Research Lake Survey Parties are largely restricted to the summer months. Due to the need for covering a number of waters during the period, time spent on any given water is in most cases necessarily limited to a few days. Generally speaking, the data gathered during even this short period is sufficient to permit the drafting of some recommendations for the improvement of the fishery concerned, since past research has enabled workers to predict, to a very considerable degree, the probable chemical and biological nature

of a given water throughout the year, once the necessary data have been gathered during the critical period of the summer. In some instances, however, it is highly desirable to check certain vital chemical or biological factors during the seasons of the year other than that at which the original survey is undertaken, to insure that conditions then do not impose restrictions on fish life which might nullify the value of certain of the recommendations made as a result of the brief summer survey.

The chemical nature of the water under the ice cover in winter, with particular regard to the matter of dissolved oxygen, is among the most important factors which might impose such restrictions on aquatic life. This is particularly true in the case of waters in northern Michigan, where, for a full four months or more, an ice cover bearing a deep layer of snow very greatly limits the amount of light penetrating to the water below, which in turn limits or halts the oxygen-producing photosynthetic action of green plants under the ice. Aquatic life is thus largely dependent for its supply upon the residual oxygen present in the lake at the time of the formation of the ice cover. The rate of deterioration of this supply as a result of use by living aquatic life and the decay of organic materials cannot easily be predicted with certainty as a result of the usual summer survey, particularly in relatively shallow lakes. While the presence of adult fish of various age groups in an isolated inland water might in almost all instances be accepted as suitable evidence that sufficient oxygen is present throughout the year to support these species, a recommendation advising the introduction into a given water of a new species, with an oxygen demand higher than that of the indigenous species, is risking uncertainty of success until the oxygen

is checked under the ice cover, late in the winter, and found to be sufficient to support the proposed new member of the lake fauna.

Within recent years it has become the policy of the Michigan Department of Conservation to introduce various species of trout into suitable lakes in the State, to in some cases replace an undesirable fish population or in other instances to supplement the established lake fauna with an additional much desired game fish. Trout have a somewhat higher oxygen demand than do the species normally inhabiting Michigan lakes (e.g. members of the sunfish, perch, and pike families). A dissolved oxygen content of 4 parts per million has been found to be about their lower limit of toleration, except for short periods, and under conditions of very low water temperatures. During the winter, decreased metabolic rates of fish as a result of very low temperatures would probably lower this limit slightly. Many other species are able to exist in waters with lower oxygen content. It is thus evident that in order to support trout, some part of a given water must have a dissolved oxygen content of about 4 parts per million or over throughout the year, including the period during which the lake is covered with ice. It follows that any lake having an oxygen content which steadily diminishes with the progress of the winter and closely approaches 4 parts per million during the latter part of an average winter might logically be regarded with suspicion insofar as suitability for trout stocking is concerned. An especially severe winter or an increase in oxygen-demanding organic life might further lower the residual oxygen supply below the limits of toleration for the species.

According to Institute for Fisheries Research Report No. 630, of which this is a supplement, data gathered by lake survey parties on 23 lakes of the Ottawa National Forest during the summers of 1937 and 1938

showed that physical and chemical conditions during the summer in 8 of the lakes were such as to indicate a likelihood that they would support trout. Stocking of trout was recommended, but actual work withheld until the dissolved oxygen content of the water beneath the ice in late winter could be checked. This was done in April, 1941, and the results are shown in Table 1.

Oxygen, in Parts per Million, Beneath Ice Cover in 7 Lakes of the Ottawa National Forest, April, 1941

Lake	Golden	Pickerel (Otto)	Crooked		Beatons	Imp	Pilot	Smoky
Date	4-7-41	4-2-41	4-1-41	4-7-41	4-7-41	4-3-41	4-3-41	4-2-41
Station*	1	1	3	5	1	1	1	1
Depth in feet								
5	12.2	10.8	...	5.0	11.5	13.6	11.4	9.2
10	...	...	3.5	...	...	...	...	...
15	...	10.3	...	1.1	...	10.6	...	9.8
20	...	...	1.8	...	...	...	6.8	...
25	9.6	...	...	...	8.7	...	...	9.0
30	...	7.6	...	...	...	...	...	...
40	...	...	...	...	...	7.9	...	...

* Station numbers refer to chemical stations on Institute for Fisheries Research Inventory maps.

A permanent ice cover had formed on the lakes in question during late November, 1940, and a rapid break-up occurred about April 10 to 15, 1941. The dissolved oxygen was determined during a period extending from April 1 to 7. In general, analyses were made of water samples taken at a depth of 5 feet below the surface and at one or two greater depths. No analyses were undertaken at Markey Lake, which was inaccessible during the late spring period. A brief discussion of the results follows.

Golden Lake was sampled at depths of 5 and 25 feet, near the geographical center of the lake. Ample oxygen for trout was found even at the lower depth, as shown by the table. This might have been expected in view of the fact that lake trout have been present in the lake for the past several years. A number of lake trout, as well as some rainbow trout were reliably reported taken by anglers during the summer of 1940. Since 12 brook trout

were entered on creel census records in 1933, apparently all 3 species of trout are or have been present in Golden Lake.

Pickerel Lake showed 7.6 ppm. of oxygen at a depth of 30 feet, with still more of the dissolved gas above this depth. Water samples were taken near the center of the lake. Although 34,500 lake trout were planted in the lake from 1934 - 1939, no catch of lake trout has yet been reported. Other species of trout have likewise not been reported.

Crooked Lake could support trout in only about the upper 6 or 7 feet of water below the ice cover at the points examined (the northeast and northwest bays) and a slight change in conditions such as a longer period of ice-cover might lower the oxygen content of the water to the lethal point for trout. It has been reported that brook trout have been taken in each of the two bays in which the winter oxygen tests were made. However, it is possible that any trout spending a portion of the summer in the lake might retreat to the more or less open and better aerated Ontonagon River, flowing from the northwest bay of the lake, during other seasons of the year. Any trout stocking done in Crooked Lake should be restricted in amount and the results of the plantings carefully followed for several years before larger scale plantings are undertaken.

Beatons Lake possessed ample oxygen for all species of trout, as shown in the table. Examination was made near the southwest end of the lake. Lake trout in considerable numbers, as well as rainbow trout, have been taken from the lake in the past, and occasional landlocked salmon are persistently reported as appearing in anglers' catches.

Imp Lake is chemically suitable for trout during the winter months, as shown by the presence of almost 8 ppm. of oxygen at a depth of 40 feet. The water sample tested was collected near the center of the lake. Lake

trout ranging from 1 to 5 pounds were taken in considerable numbers during the first 3 months of 1941. Eight specimens collected by a party including Mr. Roy Johnston, Supervisor of Hatchery District No. 1, in late March, 1941, ranged from 1 1/4 to 2 3/4 pounds in weight and were in excellent condition. Stomachs of the fish were crammed with fingerling smallmouth bass and bluegills. The fish had completed 5 summers of growth.

Pilot Lake has sufficient oxygen under the ice cover to support trout. The water was sampled near the center of the lake. A number of fine catches of lake trout were reported from Pilot Lake about 1935, but no trout have been taken in recent years. The lake is decidedly too small to support lake trout in any numbers, and the recommendation that brook trout be introduced into the lake is a logical one.

Smoky Lake is capable of supporting trout, as judged by analyses made in the south-central portion of the lake, where 9 ppm. of oxygen were found at a depth of 25 feet. Previous plantings of lake trout in this water have apparently not proven successful, since no catches of trout have been reported there.

Conclusion: All of the lakes examined, with the possible exception of Crooked Lake, have more than ample oxygen to maintain a trout population throughout the winter months.

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