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INSTITUTE FOR FISHERIES RESEARCH

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A FISHERIES SURVEY OF MOLLS LAKE,

ONTONAGON COUNTY

by

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Introduction

Molls (Moll, Maul, Dr. Maul) Lake covers a portion of sections 2 and 3, T. 46 N., R. 38 W., and part of sections 34 and 35, T. 47 N., (R. 38 W.). The 4 section corners meet in the south-central portion of the lake. This water is located about $1\frac{1}{2}$ miles south of the Village of Trout Creek (through which highway M-28 passes), and about 5 miles east of Bond Falls, on the Ontonagon River. Trout Creek, a tributary of the Middle Branch of the Ontonagon River, passes about $\frac{1}{2}$ mile east of Molls Lake, but the latter water, being without inlets or outlets, forms no connection with the stream.

Molls Lake is reached by following an unmarked, gravel road west and south from Trout Creek (village) for a distance of about 4 miles, at which point a poor dirt road heads to the east and south for 2 miles and terminates at the north end of the lake.

The map of Molls Lake was made by the United States Forest Service, the physical survey having been completed by the C.C.C., under supervision

of technicians of the Ottawa National Forest, within the boundaries of which the lake lies. Depth contours, bottom types and shore features were mapped, in addition to the shoreline.

A regular biological survey of Molls Lake was made by Dr. A. S. Hazzard and the writer, of the Institute Staff, on August 27, 1941. Mr. Roy Johnston, District Supervisor of Fisheries Operations, accompanied the survey party and assisted in the field work.

Molls Lake has apparently been little frequented by fishermen, and not much is known concerning its past history. Fishing has never been considered particularly good. Fair catches of largemouth bass are occasionally reported, but these have been very infrequent in recent years.

Molls Lake is either inaccessible or can be reached only with great difficulty during much of the year, due to the poor condition of the road leading to it during wet weather. The lake has undergone very little recreational development. A single cottage (probably used as a hunting shack) is situated on its north shore. There are no boat liveries, hotels, or resorts. The lake is fished lightly in summer and not at all in winter. It is insufficiently large and insufficiently productive to support a very heavy volume of fishing, and it will probably continue in the future to be a much less important body of water than some of the larger, more productive lakes in the vicinity.

Physical Characters of Molls Lake

Molls Lake has a small, deep basin, with a total area of 6 acres and a maximum depth of 40 feet. The lake is oblong in shape, and has a very regular shoreline with no bays or coves. It has a shoreline development of only 1.12, which means that it has a shoreline only 1.12 times, or 12 per cent, longer than a perfectly circular lake of the same area would have.

The country surrounding Molls Lake has rolling, glaciated topography. The nature of the basin and its surroundings make it seem highly probable that the lake is of the "pot-hole" type, formed by glacial action. The area surrounding the lake has sandy soils and is rather densely wooded, mostly with second-growth timber.

Since Molls Lake has no inlet or outlet, its drainage is restricted to the hills immediately adjacent to the lake, and fluctuations in the water level are, by and large, limited to that of the water table itself. Evidence along the shores of the lake appears to indicate repeated fluctuations in water level in the past, not all of which have been seasonal. Along the west shore, low levels persisted long enough for a growth of woody plants, of several years in age, to become well established. Subsequent higher levels drowned out the young trees and shrubs. At the present time, the water has again receded to the previous lower level.

Not a great deal of shoal is present in Molls Lake, particularly during periods of low water level. A relatively restricted shoal area at the north end of the lake extends out into the water about 100 feet, but most of the shoal areas are not over 25 feet wide. About 10 per cent of the area of the lake may be considered as shoal.

Pulpy peat, muck, and sand, with very small amounts of fine gravel, are present at Molls Lake. The first two soils named are restricted to the deeper waters and the latter covers much of the narrow shoal area surrounding the greater part of the lake.

The water in Molls Lake is colorless. A Secchi disk (white metal disk about 6 inches in diameter) when lowered into the water disappeared from view at a depth of 8 feet. This represents about average transparency for similar lakes of the vicinity. Clearness of the water is important in

helping to determine the depth to which aquatic plants will grow, since all of the higher aquatic plants require light to survive.

Temperature and Chemical Character of Molls Lake

As a part of the survey conducted at Molls Lake, various physical and chemical data concerning the lake water itself were collected. Temperature of the water at various depths was observed, and pertinent information concerning the dissolved gases and minerals in the water was obtained. Such data are very important in assisting to determine the degree of adaptability of a lake to the various fish species. All fish have certain ranges of temperature and dissolved gas content (specific for each gas) which they will tolerate, and within these ranges are optima. Not only the ranges, but particularly the optima, vary among the different fish species, as well as among food organisms and other organic life in the waters.

The analyses made at Molls Lake on August 27 showed a surface temperature of 64.6°F . Bottom temperature, at a depth of 36 feet, was 44.4°F . A thermocline (area of rapid change in temperature, e.g., one degree centigrade per meter of depth) was found to be present, extending from a depth of 15 to 24 feet, with a temperature at the top of this stratum of 62.2° and a 24-foot reading of 46.4° . The presence of a thermocline in a lake indicates the division of the lake into 3 different horizontal strata during the summer months. The uppermost of these is the epilimnion, which is a warm, circulating surface layer of water above the thermocline. The hypolimnion is a layer of cold, non-circulating water below the thermocline. If oxygen is adequate in the hypolimnion or thermocline, a lake will ordinarily support cold-water species, such as trout. If a given lake has no thermocline, or if the thermocline or hypolimnion has less than 4 parts per million of oxygen, the lower strata of water are either not suitable for

fish or are too warm for cold-water species, and the lake can ordinarily be managed for only warm-water varieties. Although the surface temperature taken at Molls Lake at the time of the survey (about 65°F.) was well below the toleration limit of brook trout (about 70°F.), the observation was preceded by an extended span of continued cool weather, and probably there are some periods during the summer when waters above the thermocline are too warm to permit the survival of trout.

Molls Lake was found to have inadequate oxygen in the hypolimnion or the thermocline to support trout. These are among the most important data gathered in the field, since the principal reason for conducting the survey was to determine whether Molls Lake could be made into a trout lake.

Near the bottom of Molls Lake, at a depth of 35 feet, only 0.1 part per million of oxygen was found. At the bottom of the thermocline (at a depth of 24 feet) only 1.3 parts per million showed up in the analysis. A third check revealed the presence of 3.8 parts per million at a depth of 16 $\frac{1}{2}$ feet, near the top of the thermocline. Water of shallower depth would doubtless have sufficient oxygen, but, as has been mentioned, would probably have insufficiently low temperatures throughout the summer to permit the existence of trout.

Only very small amounts of carbon dioxide were found in Molls Lake. This gas is not present in sufficient amounts to require consideration in the management of the fishery there.

Methyl Orange Alkalinity tests (designed to determine the amounts of certain minerals and buffer salts in the water) showed the water in Molls Lake to be extremely soft. A Methyl Orange Alkalinity ranging from 5 to 11 parts per million was found. This is well below the average for even the softer waters of the vicinity. Ordinarily, waters with a considerably

higher Methyl Orange Alkalinity (from about 100 to 200 p.p.m.) are more productive than are soft waters such as Molls Lake, particularly when the management of warm-water fishes is being considered.

The pH (hydrogen ion concentration) of the water in Molls Lake ranges from 5.8 to 6.8, or from quite acid to slightly acid (7.0 is the neutral point). Ordinarily lakes which are slightly to moderately alkaline are more productive than are the neutral or acid waters.

No pollution was found to exist in Molls Lake. This would be expected, in view of the absence of sources of domestic or industrial wastes.

Biological Characters

Vegetation is very sparse in Molls Lake. This sparsity may be due very largely to the fluctuating water levels, but may also be related to the high acidity of the water and perhaps in part to the nature of the bottom soils. No extensive beds of vegetation are present in the lake, and only 3 species of water plants were collected. These include waterwort (Elatine minima), smartweed (Polygonum natans f. genuinum), and leafy pondweed (Potamogeton epihydrus). (Identifications were made by B. M. Robertson, Department of Botany, University of Michigan). There is, no doubt, insufficient vegetation in Molls Lake to provide a proper biotic balance, but until more is learned concerning the nature of the fluctuations in the water level of the lake, no means of relieving this shortcoming can be foreseen.

Plankton (free-floating microscopic plants and animals) is of about average abundance in the lake. Crustaceans are the dominant organisms. Phantom midge larvae also appeared in the plankton sample collected.

Bottom foods are relatively scarce in Molls Lake. Phantom midge and other midge larvae are present in soils beneath the deeper waters of the

lake, with occasional dragonfly nymphs occurring in the shoal areas. The food is probably not adequate for the present large, stunted perch population, but would probably support a balanced, normal (though not large) fish population.

Only 2 fish species were found in Molls Lake, yellow perch and golden shiners. Both are very abundant (thirty-three perch and 43 shiners were taken in a single overnight gill net set). Table I is a record of the growth rate of yellow perch in Molls Lake.

Table I
Growth Rate of Yellow Perch in Molls Lake*

Growing seasons completed	Number of specimens	Average length in inches	Average weight in ounces
IV	2	6 $\frac{3}{4}$	1.5
V	17	6 $\frac{5}{8}$	1.5
VI	11	7 $\frac{1}{2}$	1.9
VII	1	7 $\frac{3}{4}$	2.9

*Growth determinations made by W. C. Beckman.

A case of a severely stunted perch population is revealed in the table. The average perch in Michigan waters reaches legal size (6 inches) during its second growing season. In Molls Lake, although no 2-year-old fish were taken, 4-summer-old fish are only 6 $\frac{3}{4}$ inches long, and 3 additional seasons are required to add a single inch in length. This is very slow growth for fish of these age groups. The perch have apparently reproduced in great abundance and, in the absence of effective predation by other fish, have arrived at a point where the small amount of food available in the lake is insufficient to support the population. This phenomenon occurs very commonly in small, cold Michigan lakes under conditions where perch are present and no piscivorous species exist to keep down their numbers. The fish in Molls Lake are very thin. The absence of 2 and 3-summer-old fish in the collection is unusual and cannot be readily

explained in the absence of more data. Possibly the younger fish are so thin that even the smallest mesh of a graduated gill net ($3/4$ -inch mesh) is too large to capture them. A second possibility is that the population of adults is large enough so that all, or nearly all, of the young-of-the-year fish are devoured before reaching a size large enough to prevent their use as forage by their parents.

No stocking has been done in Molls Lake since 1934, when 400 fingerling brown trout were planted. At the time of the stocking, it was believed that the lake was suitable for trout. In the light of facts now known, it may be stated that the stocked fish very probably did not survive their first summer in the lake.

The large population of perch provides ample evidence that the spawning facilities are entirely adequate to promote extensive natural propagation. Much of the shoal area of the lake has a sandy bottom type, and very small amounts of fine gravel are also present. This would make it very probable that spawning facilities would be adequate for any of the Centrarchid species, with the possible exception of smallmouth bass and rock bass.

Management Suggestions

Molls Lake is at present in the "all others" group of lakes, and there seems no need to change this classification. The fact that the perch is, at the present time, the dominant game fish would make the "pike lake" designation fit the water more closely, but if the management procedures suggested below are followed, the lake's present classification will be most nearly correct.

The fact that Molls Lake will not support trout makes a tremendous difference in the management procedure which should be followed, the expenditure and effort which can be justified in attempts to improve the

fishing there, and in the degree to which the lake will be fished in the future. There are very few trout lakes in the western part of the Upper Peninsula of Michigan. If the survey findings had verified the belief that the lake would support trout, the expense of poisoning the present population and re-stocking with trout would certainly have been justified. The lake would probably be quite heavily fished, if such procedure could be followed. In view of the facts revealed in the survey, however, the lake is an ordinary, small, warm-water lake, with below-average productivity, a fluctuating water level, and a poorly balanced population of almost nothing but stunted perch. Besides this, as has been mentioned, the lake is inaccessible during much of the year. Furthermore, at least some of the lake's shoreline is on private ground. Lastly, there are considerable numbers of better, more productive, and more readily accessible lakes which produce good fishing for warm-water species, which are the only kinds for which Molls Lake is suited. As a result, when taken as a part of the whole fisheries picture in the western Upper Peninsula, Molls Lake becomes relatively unimportant. Costly management methods, such as fertilization, for example (which might reduce the acidity and increase the productivity of the lake) cannot be justified under existing fishing pressures or any which can be foreseen in the near future, except possibly as an experiment. Poisoning of the present population of fish could likewise hardly be justified, since the unproductive nature of the lake, as described earlier in this report, gives no assurance that the introduction of a new species would ever provide good fishing. Since, in the case of Molls Lake, a management program could not succeed which did not take into account the removal or control of the perch population, it seems logical to here recommend the introduction of a predator species of fish, with the hope that the predator

will reduce the number of perch to the point where normal or near normal growth can be obtained. If a predator is introduced for which the spawning facilities are adequate, it may be hoped that once a balance between predator and prey is established, it will continue for an indefinite period, and provide good fishing for both species. It is therefore recommended that from 15 to 25 adult largemouth bass be stocked in Molls Lake. The fish should be of large size, if possible, so that they can feed without difficulty on 6 to 7-inch perch.

Such bird and mammal predators as may occur at Molls Lake have little or no bearing on the fishery there, and no control measures are recommended. The common "black spot" and yellow grub parasites are present to some degree in the skin and musculature of perch of Molls Lake, but no control measures are recommended.

As has been mentioned, very little cover and almost no vegetation is present in Molls Lake, and the fluctuations in water level, as well as the acidity of the water and bottom soils, make it difficult to predict success for any attempt to establish waterweeds. Establishment of vegetation or other cover (e.g., brush shelters) is not recommended until such time as the bass have become dominant in the lake or have achieved a balance with the perch population. Vegetation or other cover might then become desirable to provide an increased survival of yellow perch.

Regulation of the water level of Molls Lake would be costly, if not impossible, since no inlets or outlets are present. No regulation is recommended.

Spawning facilities in the lake are adequate for both perch and largemouth bass, and no improvements are necessary.

Molls Lake should be checked in 3 to 4 years after the introduction of adult bass to determine whether or not the desired results have been

attained and to provide information upon which the further management of the lake might be based.

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