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A SURVEY OF LAKE MEDORA, KEWEENAW COUNTY, WITH SPECIAL EMPHASIS ON THE ENDANGERED SPECIES OF MEDORA WHITEFISH

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ABSTRACT

The fish management program for Lake Medora in Keweenaw County, Michigan, has been of special concern to local anglers for some time. During the fall of 1974, a survey of Lake Medora was conducted to evaluate past management practices and to assess the status of the Medora Lake whitefish. It is important now to decide whether the management of this unique and rare species warrants special efforts to preserve it, and to what extent it should receive priority over other game fishes. Data on water temperatures, dissolved oxygen, water transparency, plankton, and fish were collected and compared with data collected during the past 35 years. There was little difference in the summer water temperature and dissolved oxygen content, between 1938 and 1974. However, the volume and species diversity of plankton were much greater in 1974 than in 1938. The zooplankton is a primary source of fish food. Trap nets, fyke nets and experimental gill nets were used to collect fish during the fall spawning activity of the whitefish. The predominant species collected were rainbow trout, whitefish, and yellow perch; the rainbow trout was the most abundant. Net collections indicated that a sizable population of the Medora whitefish still exists in this lake. The nets took several walleyes which were survivors from a 1971 planting of fingerlings. No minnows or other prey species were collected, nor have they been reported to be present in the lake. Crayfish were abundant, judging from the catch in gill nets.

The fish population in Lake Medora currently is in fair balance with its food supply, judging from the numerical abundance, growth, and size-frequency distribution of the predominant fishes, and from the abundance of zooplankton and crayfish. Therefore it is recommended that continued fish plantings be limited to rainbow trout, and not include further plants of walleyes. The lake is not rich enough to support a much greater fish population. Furthermore, as a precautionary measure to avoid overstocking and poor production, the stocking of rainbow trout should be on an every-other-year schedule. Because Lake Medora is one of the few inland lakes in Michigan which contains a self-sustaining population of whitefish, and because this whitefish is currently being considered as an endangered race, the lake should be managed with special consideration for maintaining this stock of whitefish. Periodic netting should be done at least once every 5 years to assess the condition of the fish stocks in the lake.

Introduction

The fish management program for Lake Medora, T. 58 N., R. 29 W., Sections 3, 4, 9, 10, Keweenaw County, has been of special concern to local anglers for some time; recently their interests have been renewed. During the summer of 1956, Mr. T. B. Durling, then Fish Area Biologist responsible for managing Lake Medora, conducted a fish survey of the lake. The results of this survey and his recommendations were presented in a mimeographed report entitled, "A Fish Management Program for Lake Medora." Since that time, only one fisheries survey (July 1968) has been conducted for the express purpose of assessing the fish population in the lake.

During the fall of 1974, another survey of Lake Medora was conducted to evaluate past management practices and to assess the status of the Lake Medora whitefish. There is an important question of deciding whether the management of this supposedly unique whitefish warrants special efforts to preserve it, and to what extent the whitefish should receive priority over the game species.

Physical, chemical and biological characteristics

The physical and chemical parameters of Lake Medora were adequately described by T. B. Durling in his 1956 report. Except for the addition of a few cottages, very little change, both in and around the lake, has occurred since the summer of 1938, when the initial biological survey was made. The following table compares water temperatures, dissolved oxygen, and total alkalinity (methyl orange) from the original survey (7/30/38) with those from the most recent survey (7/26/74):

Depth (feet)	Temperature (° F)		Dissolved oxygen (ppm)		Total alkalinity (ppm)	
	1938	1974	1938	1974	1938	1974
Surface	72.0	74.0	...	...	...	...
18	67.6	71.4	...	...	...	...
21	67.3	69.9	...	...	...	...
24	66.6	68.0	...	...	...	...
25	....	....	...	3.2	26	24
26	64.0	65.0	4.3	...	...	...

The lake has a surface area of 695 acres and a maximum depth of 26 feet. Bottom soils are primarily sand and rocky rubble; the deep water is underlaid by peat. The amount of dissolved oxygen present near the bottom of the deepest basin of the lake was slightly higher in July 1938 than it was in July 1974.

Water transparency, as judged by Secchi disk readings, was slightly higher in 1938 than in 1974; 9 feet as compared to 7 feet. Some of the difference might have been attributable to the high winds which preceded the survey in 1974, which probably stirred up the bottom sediments considerably. Because Lake Medora is exposed to heavy wind action and because it is a relatively shallow lake, it does not stratify strongly. Therefore its water temperature can be expected to reflect the prevailing seasonal air temperatures. Thus a comparison of water temperatures between years has little significance without knowing the air temperatures which immediately preceded the surveys. For comparable depths, however, Lake Medora was about 1 degree warmer in 1974 than it was in 1938--a very insignificant difference. In July 1974, it was 74 F (23.3 C) at the surface and 65 F (18.3 C) at the bottom; thus it is a rather warm lake, by Upper Peninsula standards.

Plankton samples were collected during 1974 at approximately the same time of year, and in the same manner, as in 1938. The plankton samples collected in 1974 contained about three times the bulk of the 1938 samples (0.31 ml compared to 0.10 ml). This difference in

volume is very minimal in view of two differences in experimental procedure: (1) the net used in 1974 had larger mesh (160 microns) than that used in 1938 (76 microns) and (2) volume of the 1974 samples was determined by centrifugation which produces a more compact sample than does the 24-hour settling method which was used on the 1938 samples. The general conclusion, based on these July samples, is that Lake Medora had a much richer supply of plankton in 1974 than it had back in 1938. In 1938 the plankton consisted almost entirely of blue-green algae (Rivularia sp.), whereas in 1974 it was comprised mostly of zooplankton. The predominant plankters in 1974 were copepods, Chydorus, and daphnids (Daphnia galeata mendota and D. retrocurva); the other less abundant zooplankters present were Ceriodaphnia sp., Latonopsis sp., and Holopedium gibberum. An occasional Leptodora, Chaoborus and ostracod were also present in the plankton. Most of the zooplankton consisted of small individuals (less than 1.4 mm in length) and these may serve mostly as a food supply for small fish (fingerlings). The 1974 samples contained an average of 121 daphnids, 1.4 mm or larger; the average volume of these daphnids was 0.05 ml. Numbers of large-size zooplankters in Lake Medora are relatively low as compared to other Michigan trout lakes.

In previous fish collecting in Lake Medora, trap nets and fyke nets were not so effective in catching whitefish as were gill nets. In our 1974 survey we [1] used all three types of nets; these included two 4-foot trap nets (1-inch mesh), one fyke net, and two experimental nylon gill nets (125-foot and 250-foot). The nets were set over two nights on October 23 and 24, 1974, and lifted daily. The total catch was:

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[1] The survey party included A. D. Sutton, J. W. Merna, R. P. Juetten and M. G. Galbraith.

Species	Number	Size range (inches)
Whitefish	49	10.6-14.0
Rainbow trout	65	8.6-14.7
Yellow perch	43	6.0-10.4
Walleye	7	13.9-16.4
Brown trout	1	18.3
Common sucker	1	17.8

Thus the predominant species were rainbow trout, whitefish, and yellow perch. All of the whitefish were from sets of gill nets. For comparison, a tabulation of Medora Whitefish in gill net collections made by various field parties of the Fisheries Division since 1938 is presented in the following table:

Date	Number of white-fish	Catch per effort [1]	Average length (inches)
July 26-28, 1938	66	11	....*
July 31-Aug. 1, 1947	3	1	....*
Oct. 30-31, 1952	128	13	12.0
Oct. 26, 1955	415	104	10.4
Aug. 6-8, 1956	45	4	10.9
July 10-11, 1968	65	5	12.7
Oct. 22-24, 1974	49	8	12.9

[1] Catch per effort is expressed as the number of fish caught per standard unit of net per night.

* Not measured.

The numbers of whitefish caught per unit of effort are not all subject to direct comparison. The October collections were by nets set on spawning grounds during the spawning season--where and when fish are congregated--and this would explain the especially high catch in 1955. We know that even

on spawning grounds the netting might miss the very peak of the spawning run, which might explain the lower catches of 1952 and 1974. Even though some of the October netting may not have been precisely on the spawning grounds, this is the season when mature fish move about considerably and when they would be more vulnerable to capture by gill nets. Suffice it to say that in 1974 there was still a fairly good population of whitefish in Lake Medora, when three experimental gill nets set for two nights caught 49 fish. The population, however, may be down considerably from 1952.

The rainbow trout was the most abundant species caught in the nets. Lake Medora has been planted with rainbow trout almost every year since 1939. As might be expected of a lake this size, and with fairly low productivity, frequent trout plantings do not always guarantee good fishing. Poor survival some years was blamed on the emigration of trout via the outlet. To rectify this, a barrier dam was constructed across the outlet during the fall of 1956. In 1962, management personnel decided that fingerling plantings were not providing good fishing, and so the program was changed to planting yearlings. Even these plantings did not consistently provide good fishing. In 1968, results of a fish survey by electric boom shocker, to evaluate fish stocks in the lake, led to the conclusion that there had been good survival from a 1967 planting of fingerling rainbow trout. This is not too surprising, since the lake had not been stocked during the 2 years prior to 1967. Since then, yearlings have been planted every year except in 1969.

Compared with previous fish collections, the catch of rainbow trout in Lake Medora in the fall of 1974 was the largest ever. Excellent survival from the 1973 and 1974 plants of large (6.3 inches) yearlings accounted for the abundance in 1974.

The catch of yellow perch in 1974 was low, but it compared favorably with previous October collections. Judging from the long-time netting record, perch are caught more readily in Lake Medora during summer than during fall, which fact should be considered in judging perch abundance.

Few other species of fish were collected in Lake Medora in 1974. Seven walleyes, collected mostly in gill nets, were all survivors from a single planting of 15,495 fingerlings made in September 1971. Only one common sucker was collected, even though previous netting had indicated a greater abundance. No smallmouth bass were collected, despite reports by local anglers that some good catches are made every year. Although no shoreline seining was attempted in 1974, observations along the shoreline by boat, and reports by local cottage owners, indicated that minnows as well as other small "prey species" of fish were very rare. Since 1938, there has been only a single record of a "prey species" collected in Lake Medora; this was a single sculpin taken in 1972 by a boom shocker.

Age and growth of fish

The Medora Whitefish might reasonably be regarded as a dwarf form of the common whitefish which lives in the Great Lakes. It matures earlier, grows more slowly, and seems to have a much shorter life span than the Great Lakes "form." The maximum recorded age for whitefish in Lake Medora is 8 years (see tabulation below). Its slow growth rate is more like that of whitefish in some of the much colder lakes of northern Canada such as Lac la Ronge (Saskatchewan), Great Slave Lake (Northwest Territories), and Lake Opeongo (Ontario). In Medora it does not live long enough to attain as large a size as in these other lakes. Whitefish have faster growth near the southern limit of its distribution, and conversely slower growth toward its northern limit. Since Lake Medora is near the southern limit, one might expect better growth here. However whitefish prefer cold water and, as mentioned above, Medora is not a cold lake. The inherently warm, summer water temperatures could be a major cause of slow growth of Medora Whitefish.

Judging from scale-growth pattern and empirical lengths of fish collected in 1974, the Medora Whitefish grows quite rapidly during

its first 3 years; thereafter growth slackens abruptly. This change in growth rate was apparent for all whitefish collected since 1952. No whitefish over 14.0 inches were collected in 1974, and very few this size have been collected since 1952. Whitefish collected in 1974 were mostly older (ages V and VI) than those collected in 1952 (ages III to V). Age and length (inches) of fish in Lake Medora samples are summarized in the following un-numbered table; figures in parentheses are number of fish:

Species, month and year of collection	Age group							
	I	II	III	IV	V	VI	VII	VIII
Whitefish								
July 1938	7.1 (1)	8.0 (1)	9.8 (6)	10.9 (2)	12.2 (6)	16.7 (6)	18.1 (2)	....
Oct 1952[a]	...	...	9.7 (14)	11.7 (18)	12.7 (21)	13.8 (2)	15.2 (2)	....
July 1968[b]	...	...	8.6	10.3	11.4	11.7	12.5	....
Oct 1974[a]	...	...	10.6 (1)	12.4 (1)	12.8 (15)	13.0 (7)	13.2 (4)	14.0 (1)
Yellow perch								
July 1938	...	5.7 (2)	6.5 (9)	7.0 (8)	9.0 (7)	....	....	....
July 1968[b]	1.8	3.1	4.3	5.2	6.4	7.5	8.6	9.8
Oct 1974[a]	...	...	...	6.4 (10)	7.6 (9)	8.6 (6)	9.4 (4)	10.3 (2)
Walleye								
Oct 1974	...	...	...	15.5 (7)	....	....	....	....
Rainbow trout								
Oct 1974[a]	...	10.7	13.1	....	....	....	....	....

[a] Because these fish were collected late in the fall it was assumed that their annual growth had already been completed; thus they were assigned to the succeeding age group. As an example, fish aged as III's were assigned to age-group IV, etc.

[b] Information on number of fish is not available.

In his Lake Medora fish management report of 1956, Mr. Durling stated that the whitefish were maturing at 8 inches. No whitefish smaller than 10.6 inches were collected in the 1974 survey; but most of the whitefish assigned to age-group IV and older were mature, and many were already spent. Hence the Medora Whitefish appears to mature earlier than does the whitefish in the Great Lakes and the large Canadian lakes.

Rainbow trout

Rainbow trout from only age groups II and III were present in Lake Medora. The rainbows planted at 6.3 inches during the spring of 1974 reached an average of 10.7 inches in one growing season. Those planted in 1973 at the same size and time of year grew to an average of 13.1 inches in two growing seasons. The growth pattern on the scales of fish planted in 1973 indicated slower growth during their first year in the lake than for those planted in 1974. Although the rainbow trout in Medora grew at a rate comparable to that which I have found in other Upper Peninsula lakes, most of the trout in Medora were white-meated and racy in appearance. It appears that the rainbow trout in Medora Lake is about on the borderline of fast growth and good condition, which needs to be recognized in management proposals for the lake.

Yellow perch

The growth of yellow perch is below the state average, but it is acceptable, considering that Lake Medora is located in the very northernmost and coldest area of Michigan. The size-frequency distribution is very broad, and there is a fairly even numerical distribution among the various age groups. Growth of perch in 1974 was intermediate between better growth back in 1938 and much poorer growth in 1968.

Management recommendations

Currently most biological productivity of Lake Medora apparently goes into the production of game fishes because there are few non-game and forage species. The lake is probably at its maximum carrying capacity, and therefore should not be managed for any additional fish species. Rainbow trout, whitefish, and yellow perch are the major species present. Their relative abundance can be expected to fluctuate annually, depending on year-class survival of each species and on the severity of interspecific competition for food. Currently there seems to be a fair balance between these three major species and their food supply.

The whitefish population appears to be quite large and holding its own. Furthermore, the growth of whitefish in 1974 was good, as compared to fish collected in earlier years, and despite the high population of rainbow trout present during 1973 and 1974.

Comparing available data on plankton and its species composition in 1938 versus 1974, there appears to have been a substantial increase in species diversity and in relative abundance of desirable food types. Especially noteworthy was an increase in the number of species of larger zooplankters (cladocerans and copepods). There may have been some increase in basic fertility of the lake due to cultural enrichment, which fact would help to explain the increase in plankton. Most of the surrounding cottages are built on rock, and are very close to the lake shoreline; so there is a minimum of filtering action for septic tank effluent.

If basic fertility of the lake has increased since 1938, one would expect an increase in benthic fish food organisms. One indication of this is that previous surveys of the lake did not record the presence of crayfish, whereas the 1974 survey party reported an abundant crayfish population.

Since Lake Medora appears to be in fair balance now, albeit the growth rate of fish could stand improvement, it is recommended that no further plantings be made of walleyes or other warmwater fish. Continued

planting of walleyes might reduce the survival of both the Medora Whitefish and rainbow trout through competition for food and by predation on small trout and whitefish.

The level of abundance of yellow perch in any given year probably governs the success of the trout planted in that year. Currently the perch population is judged to be low, and the rainbow trout population is high. Lake Medora is not very productive, especially of the larger zooplankters which smaller rainbow trout need at certain times of year for good growth. Compared with other rainbow trout lakes in northern Michigan, the number and average size of the large daphnids (over 1.3 mm long) now present in Lake Medora indicate that the lake currently has only mediocre potential for trout survival and good fishing. Since the legal limit for rainbow trout is 10.0 inches, and because it takes about 1 1/2 years for fingerlings to attain legal size in relatively unproductive lakes, such as Medora, plantings of fingerling trout should be avoided because they might be too much of a drain on the already limited supply of large zooplankters. The 1974 netting showed that a large number of legal-size rainbows were present, and further that angler harvest was not high during 1974. In order to continually provide a sizable population of legal-size rainbows for anglers, and at the same time protect the food supply for use by whitefish and other game fishes, it is proposed that only yearling rainbows be planted. These plants should be made no more frequently than every other spring, and at the present rate of 15 fish per acre. It is recommended that further stocking be deferred until 1976.

Lake Medora is unique in that it contains a very sizable population of inland lake whitefish which have been successful in self-propagation. Not many Michigan lakes can boast the presence of whitefish, let alone such a thriving population. Especially noteworthy is the fact that the whitefish native to Medora is regarded by some authorities as a distinctive race, or at least as a population especially adapted to conditions in this small inland lake. The Medora Whitefish has been recommended to the Endangered Species Technical Advisory Committee of the Michigan

Department of Natural Resources as a valuable stock worthy of protection under the new program for threatened or endangered species. Since the Medora Whitefish has maintained itself so well in this lake, and because there has been very little recent cottage development as compared to other inland lakes, it is recommended that special care be taken to insure the continuation of this population at least at its present level of abundance. To this end, Lake Medora should be managed in part as a sanctuary for its whitefish, and this can be done without sacrificing present fishing for rainbow trout, perch, and smallmouth bass. Angling for these species will not jeopardize the whitefish, because of differences in angling methods involved. To keep track of the whitefish population, the lake should be netted about every 5 years. The same types of nets as used in 1974 should be set at the same locations during the fall spawning season.

Efforts to protect the Medora Whitefish will be helped along by local pride and public interest in the project. To solicit this public support I suggest that a sign be erected at the public fishing site on the lake in view from highway M-41. This public road is traveled each year by many tourists who visit Fort Wilkins State Park. The sign might contain an artist's drawing of the whitefish, along with details about its life history. Or, at less expense, the sign might simply carry the notation: "Home of the Medora Whitefish."

Conclusions

1. Lake Medora has changed very little since 1938 in dissolved oxygen content and water temperature.
2. Zooplankton (fish food) has improved considerably since 1938, in both quantity and quality.
3. A sizable population of whitefish exists in Lake Medora.
4. Rainbow trout are abundant and have fairly good growth; but they tend to be racy in condition which suggests a moderate degree of overstocking.

5. A small population of walleyes has been successfully established from a single plant of fingerlings in 1971. Their average size is about 15 inches.
6. Although no smallmouth bass were collected by nets in 1974, reports from local anglers indicate a fair population still exists.
7. Minnows and other small "prey species" of fishes are apparently still rare.
8. The three predominant species are rainbow trout, yellow perch, and whitefish. Viewed collectively, they are abundant, have fairly good growth, have broad age and size distribution, and are in fair balance with their food supply.

Recommendations

1. Because the carrying capacity of game fish in Lake Medora is probably at its maximum at the present time, no other fish species should be introduced. No further plantings of walleye should be made, because walleyes may jeopardize the survival of both the Medora Whitefish and the rainbow trout.
2. In view of the limited number of large plankters present, and the racy condition of the rainbow trout, it is recommended that trout be planted only every other year, but still in the spring and at the present rate of 15 yearling fish per acre (first again in 1976). It would not be advisable to return to the earlier practice of planting fingerlings.
3. Because Lake Medora is one of the few inland lakes in Michigan which contain a self-sustaining population of whitefish, this fish should receive the special protection of no open season by angling. Such a provision would

make little difference to anglers on Lake Medora, because the whitefish is rarely caught on lures used for other species.

4. To allow periodic evaluation of the whitefish stock, the fish population of Medora Lake should be monitored by netting approximately every 5 years.

Report approved by G. P. Cooper

Typed by M. S. McClure