MICHIGAN DEPARTMENT OF NATURAL RESOURCES
Research and Development Report No. 253*

November 29, 1971

ANGLING ON MILL LAKE AFTER A 5-YEAR PERIOD OF NO FISHING [1]

By James C. Schneider

Mill Lake, a 136-acre warmwater lake in Washtenaw County, Michigan, was closed to fishing from October 1, 1964 to August 1, 1969, for a study of fish population dynamics. This is a report on the creel census conducted the first 3 days the lake was reopened to angling, August 1-3, 1969.

As part of the study on fish population dynamics, the number of fish present in Mill Lake was estimated each spring by means of the mark-and-recapture technique (Schneider, 1971). In 1969, the population was unusually large due to a succession of strong year classes. Growth was slow, indicating that the lake was at its carrying capacity. Excellent fishing was anticipated for the special opening day, August 1; and advance publicity to the local newspapers assured a large turnout of anglers. Recognizing that there was a unique opportunity to (1) observe the impact of angling on a known fish population and, (2) to find out if angling quality would be enhanced by the 5-year closure, an intensive creel census was conducted on opening weekend, August 1-3, 1969.

---

* Institute for Fisheries Research Report No. 1783.

1 A contribution from Dingell-Johnson Project F-29-R, Michigan.

The effects of fishing on lightly exploited fish populations in northern Michigan lakes have been reported by Patriarche (1960) and Clady (1970). Patriarche noted that after lakes in the Rifle River Area passed from private to public ownership (and from very light to heavy fishing pressure), the catch in the first year far exceeded that in following years. Clady predicted a similar decline if the harvest of bass from the lakes in the Sylvania Tract was not greatly restricted. Whereas in these northern, relatively unproductive lakes, there is clear evidence that fish can be over-harvested (i.e., a drastic decline occurs in the catch and the fish population), the effect of angling on the fish populations of the southern, more productive lakes is apparently so small that it is difficult to measure. For example, any buildup in the fish population caused by closure of Mill Lake to fishing was obscured by naturally caused fluctuations in recruitment (Schneider, 1971). Bennett (1962, p. 262) cites other evidence that fish populations are not easily decimated by angling.

Methods

Anglers at Mill Lake obtained access mostly at the public fishing site where a census clerk was stationed from early morning until after dark. Therefore the creel census on August 1-3 was a nearly complete one. The only source of error of possible significance was the non-census of bass fishermen who left the lake before 6 AM on

August 1. Based on reports by fishermen and park personnel, these anglers could not have taken a significantly large number of bass.

The census clerk interviewed anglers after they completed their fishing trip. He examined their catch and recorded the number of anglers in each party, the hours fished, the number of fish kept of each species, and the methods and baits which had been used. On the basis of fishing methods and remarks made during the interview, data from anglers who were fishing primarily for game fish (bass and pike) could be tabulated separately from those fishing for only panfish or for both types of fish.

Most fishing was done from boats; only a few anglers fished from shore. The total fishing pressure was estimated from bi-hourly counts of boats and shore anglers. An average hourly boat count was derived from a graph of the bi-hourly boat counts versus time of day. This average was multiplied by 24, and then by the average number of anglers per boat to obtain the number of angling hours by boat fishermen in a day. An estimate of fishing effort by shore anglers was made in a similar way. Total fishing pressure was the sum of boat and shore fishing.

State law imposed a 10.0-inch (total length) minimum size limit on largemouth bass and a 20.0-inch minimum size limit on northern pike. Although there were no size limits on the other species of fish found in Mill Lake, anglers rarely kept bluegill (Lepomis macrochirus), pumpkinseed (Lepomis gibbosus) and rock bass

(Ambloplites rupestris) less than 6.0 inches long or yellow perch (Perca flavescens), black crappie (Pomoxis nigromaculatus) and yellow and brown bullhead (Ictalurus natalis and I. nebulosus) less than 7.0 inches long. Subsequent discussion of the fish population of Mill Lake is restricted to that portion of the population which exceeded these sizes.

In order to compute the stock of fish available to anglers and their exploitation rate, I assumed that the number of large fish present in the lake was the same on August 1, 1969 as in March-May 1969. This would be true if losses to natural mortality between spring and August 1 were balanced by gains from growth of small fish. From what is known about natural mortality and growth of fish in Mill Lake, this is a reasonable assumption.

Results

Fishing pressure

Parks personnel unlocked the entrance to the public access site at midnight, at the start of August 1. There were 18 cars, each with a boat, waiting at that time. By 6 AM, when the census clerk arrived, 48 boats were on the lake. Boating activity peaked at 8 AM when 62 boats (nearly 1 per 2 acres) were counted. Activity diminished during mid-afternoon, then increased again just before sunset when there were 58 boats on the lake. Ten parties were still out at midnight and six at 2 AM, August 2. This intense fishing pressure occurred

despite the fact that the opening day fell on a Friday. Also, many anglers were discouraged by the traffic jam, limited launching and parking facilities, the carnival atmosphere and other congestions at the lake.

Fishing pressure diminished slightly on Saturday and Sunday. Anglers spent 2,078 hours fishing Mill Lake during August 1; 1,767 hours on August 2; and 1,401 hours on August 3. The total for the 3 days was 5,246 hours (39 hours per acre). About one-fourth of the anglers were seeking only game fish, a few were fishing strictly for panfish, but most were fishing for both types of fish.

Catch

The census clerk recorded 5,818 fish during the first 3 days (Table 1). Undoubtedly a few fish were not counted, so that the actual harvest likely was close to 6,000 fish. Bluegills were the most abundant fish in the catch; a total of 3,745 (28 per acre) were removed. The catches of pumpkinseeds and largemouth bass were of secondary importance, averaging 6.7 and 5.0 per acre, respectively. Black crappies and yellow perch were harvested at the rate of 1-2 fish per acre. Catches of bullheads, rock bass and northern pike were small. Only one warmouth was taken.

Exploitation

Slightly less than 16% of the fish in Mill Lake were harvested during the first 3 days of fishing (Table 2). Yellow perch (61%),

Table 1. --Number of fish caught by anglers on August 1-3, 1969

Species	Aug 1	Aug 2	Aug 3	Total
Bluegill	1,483	1,423	839	3,745
Yellow perch	75	45	36	156
Pumpkinseed	397	372	147	916
Black crappie	106	79	40	225
Rock bass	19	7	5	31
Largemouth bass	481[a]	155	49	685
Northern pike	9	2	1	12
Bullheads	25	15	8	48
Total	2,595	2,098	1,125	5,818

[a] Up to 70 additional bass may have been taken before the census began at 6 AM, August 1.

largemouth bass (35%), and pumpkinseed (29%) were the most highly exploited species. Bullheads (4%), northern pike (8%), and rock bass (10%) were lightly exploited. Only 13% of the bluegills were caught.

Exploitation of bass was high because many anglers were fishing for them. Perch and pumpkinseeds, on the other hand, were taken incidentally by bluegill fishermen. Perhaps they inhabited areas of the lake which were fished more intensively, or perhaps they just bit more readily. The small catch of pike, occurring despite a large amount of fishing effort, is attributed to their lack of activity in mid-summer. Exploitation of bullheads was low because few anglers fished for them.

Success

Dividing catch of all species by fishing pressure in hours gives the following catch-per-hour statistics: August 1--1.25 fish per hour; August 2--1.19; and August 3--0.80. The average for August 1-3 was 1.10.

Note that the catch rate steadily declined during the first 3 days. The decline may have been due to depletion of the fish population or to a reduction in catchability (i.e., fraction of the residual fish stock caught per unit time) of the survivors. Another possible, but unlikely, explanation is that anglers on August 1 were more skillful than those on succeeding days.

The effect of diminishing population size on the catch rate was eliminated by dividing the catch per hour during each day by the estimated number of fish available to anglers at the beginning of each day (spring population estimate minus catch) and multiplying by 10^6 (Table 2). The resulting index expresses the catch per hour from a population of a million fish and provides a way of measuring changes in the catchability of a species from day to day. I will assume that other factors which affect catch rate did not vary significantly during the period of August 1-3.

There was no trend of change in the index of catchability for bluegills during the 3 days (Table 2). This indicates that the decline in catch rate of bluegills from 0.71 per hour on August 1 to 0.60 per hour on August 3 was strictly due to a decline in the bluegill population. For most of the other species there was likewise no clear indication that the survivors were getting harder to catch. However the catchability of largemouth bass decreased greatly between opening day and the third day. Compared to August 1, bass were twice as hard to catch on August 2 and four times harder to catch on August 3. Thus the drop in catch of bass was largely due to a decrease in catchability.

The decline in the quality of bass fishing was evident from other data as well. On opening day, 83% of the fishing parties seeking game species were successful in catching at least one bass on opening day, 57% were successful on the second day, and 46% on the third day. On the opening day 20 anglers took their limit of 5 bass each. In total catch,

Table 2.--Estimated number of fish present in Mill Lake on August 1, 1969, exploitation rate on August 1-3, and an index of catchability

Species	Estimated population	Exploitation (%)	Catchability [1]		
			Aug 1	Aug 2	Aug 3
Bluegill	28,267	13	25	30	24
Yellow perch	254	61	157	140	194
Pumpkinseed	3,189	29	60	75	41
Black crappie	1,625	14	31	26	20
Rock bass	319	10	31	10	14
Largemouth bass	1,958	35	118	63	28
Northern pike	148	8	27	7	7
Bullheads	1,180	4	8	7	5
Total	36,940	16	-	-	-

[1] This is an index of fishing success, with the effects of fishing pressure and size of the fish stock removed (see text).

at least 481 bass were caught on opening day, compared to 155 and 49 on succeeding days. A total of 35% of the bass population was exploited. If catchability had not declined, exploitation would have been extremely high.

Discussion

Fishing on Mill Lake was good on August 1-3. The average catch per hour was 1.1. For other southern Michigan lakes the average is 1.0 (Christensen, 1953). Although this difference appears to be slight, the latter average includes the months of June, July and September which are better times to fish than is August.

During these 3 days, Mill Lake received a fishing pressure of 39 hours per acre. Fishing pressure under normal circumstances has not been measured; however it is probably very similar to nearby Sugarloaf Lake which had an annual fishing pressure of 107 hours per acre (Christensen, 1953). Thus in 3 days Mill Lake received about one-third the fishing it normally gets in a full year.

Exploitation of game fish in the lake was disproportionately high. Using Sugarloaf Lake as a standard (Cooper and Latta, 1954), the presumed annual quota (35%) of largemouth bass was harvested from Mill Lake with one-third the expected effort. Exploitation of pumpkinseed sunfish and perch was, likewise, very high for the amount of effort expended. About one-half of the usual annual quota of bluegills and black crappies was taken during the 3 days.

However, there appears to be little danger of a serious depletion of the fish population. As fishing quality drops, due to a decline in stock and to a decrease in catchability, fishing pressure also declines (Byrd, 1959). Largemouth bass in particular were in little danger of extinction because their vulnerability decreased markedly. There were still eight legal bass per acre left after the first 3 days of fishing. On the other hand, the average fisherman would feel that the bass population in Mill Lake was "fished out" on opening day because of the very large decline in his catch rate. In another southern Michigan lake, Loch Alpine, anglers considered the bass "fished out" when the legal-sized population had been reduced to six fish per acre, and the catch rate was 0.04 fish per hour (Lagler and DeRoth, 1953).

Bennett (1962, p. 330) and Anderson and Heman (1969) cite other largemouth bass fisheries in which decelerating rates of catch have been observed. The study of Anderson and Heman showed that bass which had been fished over before were more difficult to catch than bass from unexploited ponds. It was not clear, however, if avoidance had been learned or if the surviving bass had always been less vulnerable, or both.

Westers (1963) gave convincing proof that bass learn to avoid fishing baits. Largemouth bass in two previously unexploited ponds were caught by various angling methods, fin clipped and returned to the ponds at the end of the day. A catch curve similar to that for

exploitative fisheries (fisheries in which the bass are killed) was obtained: 102 bass were caught the first day, 39 the second day, and 19 the third day. Westers concluded that "hook resistance" was displayed both by bass which had been caught before and by those which had never been hooked.

In addition to learning, decreasing catchability of exploited bass populations may also be the result of removal of the faster growing, more aggressive bass by anglers. Selection for fast growers occurs in the brook trout (Cooper, 1953; McFadden, 1961) and it quite likely occurs in warmwater fish as well--particularly among those year classes just growing into the fishery. Perhaps the effect of angling selectivity on the catch rate of Mill Lake fish (species other than bass) would have become evident if the creel census at Mill Lake had continued longer.

Literature cited

Anderson, Richard O., and M. LeRoy Heman. 1969. Angling as a factor influencing catchability of largemouth bass. Trans. Amer. Fish. Soc., 98: 317-320.

Bennett, George W. 1962. Management of artificial lakes and ponds. 2nd ed. Reinhold Publ. Co., New York, 375 p.

Byrd, I. B. 1959. Angling success and seasonal distribution of catch in Alabama's state-owned public fishing lakes. N. Amer. Wildl. Conf., Proc. 24: 225-237.

Christensen, Kenneth E. 1953. Fishing in twelve Michigan lakes under experimental regulations. Mich. Dep. Conserv., Inst. Fish. Res., Misc. Publ. No. 7, 46 p.

Clady, Michael D. 1970. Regulation of fish populations in three lightly exploited lakes in northern Michigan. PhD thesis, Univ. of Mich., 86 p.

Cooper, Edwin L. 1953. Growth of brook trout (Salvelinus fontinalis) and brown trout (Salmo trutta) in the Pigeon River, Otsego County, Michigan. Pap. Mich. Acad. Sci., 38: 151-162.

Cooper, Gerald P., and William C. Latta. 1954. Further studies on the fish population and exploitation by angling in Sugarloaf Lake, Washtenaw County, Michigan. Pap. Mich. Acad. Sci., 39(1953): 209-223.

Lagler, Karl F., and Gerardus C. DeRoth. 1953. Populations and yield to anglers in a fishery for largemouth bass, Micropterus salmoides (Lacépède). Pap. Mich. Acad. Sci., 38(1952): 235-253.

McFadden, James T. 1961. A population study of the brook trout, Salvelinus fontinalis. Wildl. Monogr. No. 7, 73 p.

Patriarche, Mercer H. 1960. A twelve-year history of fishing in the lakes of the Rifle River Area, Ogemaw County, Michigan, 1945-1956. Mich. Dep. Conserv., Inst. Fish. Res., Misc. Publ. No. 13, 45 p.

Schneider, James C. 1971. Characteristics of a population of warm-water fish in a southern Michigan lake, 1964-1969. Mich. Dep. Nat. Resources, Res. Devel. Rep. No. 236, 158 p.

Westers, Harmannus. 1963. An evaluation of population estimate procedures in two ponds, containing only largemouth bass (Micropterus salmoides). MS thesis, Dept. Fish., Univ. Mich., 55 p.

INSTITUTE FOR FISHERIES RESEARCH

James C. Schneider

Report approved by G. P. Cooper

Typed by M. S. McClure