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REPORT NO. 1044

A FISHERIES SURVEY OF TWIN LAKES, NEAR INDIAN RIVER, CHEBOYGAN COUNTY

by

G. P. Cooper

INTRODUCTION

The Twin Lakes in question are located 3 miles east of the village of Indian River in T 35 N, R 2 W, Sections 21 and 28, Koehler Township, Cheboygan County. The two lakes are not named separately on county maps, but they are completely separate units and should have separate designations. "North" and "South" Twin are listed in the Department's stocking records for 1938; and residents in Indian River, contacted by the survey party, referred to these lakes as North Twin and South Twin. These designations are appropriate from the standpoint of compass direction.

North Twin Lake is located in the southeast quarter of Section 21. South Twin, the larger of the two, is located centrally in Section 28. The two lakes are in the drainage of Burt and Mullett lakes and the Cheboygan River. Both lakes are accessible by automobile.

Mapping and inventory surveys of North and South Twin lakes were done by Mr. Pat Galvin, Mr. I. A. Rodeheffer and the writer during the period of July 3 to 9, 1945. Some information about the lakes was obtained from Conservation Officer Gilbert Lince of Wolverine and from Mr. C. A. Reid of Indian River.

Mapping was done by the Base Line Method, with a 300-foot base line on North Twin Lake and a 1,000-foot base line on South Twin. Shore line definition points were marked by white flags. Twenty-seven such points were established on North Twin and 23 on South Twin. The locations of these points were determined by alidade readings (triangulation) from points on the base line, and frequent back-checks were made to the base line. Sounding was done from a boat rowed on a line between designated shore flags. The locations of soundings were determined by single alidade directions from advantageous and established points on the shore line to the boat at the time of each sounding. Shore line details between flag stations were added to the maps while rowing around the shore. The completed maps are available at the Institute office.

These Twin lakes are now completely state-owned as the result of a purchase, with 40-cent fish license money, approved by the Conservation Commission on April 10, 1945. According to Mr. Reid the local people of Indian River feel that public fishing on the Twin Lakes will be a real asset to this section of the state, because these lakes will provide fishing at times when rough weather makes it impossible to fish on Burt and Mullett lakes.

Access to the lakes is by way of a gravel, county road which connects U.S. 27 at Indian River with U.S. 23 two miles east of Afton. From this county road, unimproved woods roads, suitable for automobiles, run to the

north and south ends of both lakes. North Twin has a good beach and boat-launching site at its north end, and a poor launching site at the south end. South Twin has a fair boat-launching site at its north end, a poor site at its south end, but no sand beach. There are no cottages or resort developments on either lake. We noted one row boat on South Twin, none on North Twin. We did not get any comprehensive summary of the history of fishing from local residents. Fishing records for early summer of 1945, obtained from Mr. C. A. Reid, are cited later.

North and South Twin lakes were examined by Messrs. Jan Metzelaar and T. H. Langlois for the Conservation Department on August 8 and 9, 1925. Their descriptions of depth, vegetation, bottom types, etc. for the two lakes in 1925 (on Lake Survey record forms) are closely in accord with conditions observed by the survey party during 1945. Their fish records will be cited later in this report.

On February 20, 1945, Messrs. D. S. Shetter and Pat Galvin of the Institute examined these Twin Lakes for the purpose of determining potential fishing values. Comments on their observations are contained in a letter by Dr. Shetter to Mr. F. A. Westerman, dated February 21, 1945. Their observations on the physical features of the lakes and their surroundings were generally substantiated by the survey observations during the following summer. Shetter, presumably quoting Mr. Reid, states: "The lakes have been posted in the past by the absentee owner, but the trespass laws have never been invoked by him. A small amount of angling appears to have been done by local residents who understood the situation."

Results of the survey are given for the two lakes separately in the following:

NORTH TWIN LAKE

The drainage basin of North Twin Lake is entirely wooded with a moderately dense stand of "second growth." Poplar is the dominant tree; white birch, maple and jack pine are common types; and, in decreasing frequency, there are cherry, oak, white pine, Norway pine, cedar, tamarack, balsam, and ash. The wooded area extends to within 25 to 50 feet of the lake shore around most of the lake. The shore line is mostly non-encroaching. The drainage area of the lake is very small, probably less than a square mile. The lake has no permanent inlet. There is not a permanent outlet. However, at the south end of the lake, we could detect a faintly defined drainage trough extending toward South Twin Lake, indicating that North Twin would overflow to South Twin during very high water. A rise in lake level of about one foot, above the level as of July 3 to 4, 1945 when the lake was mapped, would cause the lake to overflow. On July 3 to 4 we noted that the lake level was about one foot below a well-defined high-water mark. The lake level was rechecked[†] on October 18, 1945 and found to be 0.4 foot below that of July 3 to 4.

North Twin Lake is generally oval in shape, with no islands, and with a non-meandering shore line resulting in a low shore line development of 1.1. From our map, the lake area was calculated to be 27.5 acres, the shore line to be 4,325 feet. The lake basin is a simple bowl in shape. The maximum depth recorded by our sounding line, and shown on our map, was 15 feet; but at this point of sounding there was a very soft bottom through which the sounding lead sunk. At a nearby station the sounding line indicated a depth of 14 feet, while the water sampler brought up very soft pulpy peat from a depth of 11 feet. Allowing for a 3-foot layer of this soft pulpy peat in

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[†] By W. F. Carbine and the writer.

the deeper part of the lake, the maximum depth of clear water was approximately 12 feet. The lake bottom is almost entirely pulpy peat, with a narrow (10- to 30-foot) margin of sand around all of the shore line except at the north and south ends where there are narrow shoals of fibrous peat. Wave action has little effect on the shore because of the small size of the lake and the protection afforded by woods.

Water analyses (see Table 1) on North Twin were made on July 8, 12:30-2:30 P.M., near the center of the lake, over the deeper water (clear water depth of 11 feet). The air temperature was 77° F., wind disturbance was light, and the preceding weather had been fair and cool. Water temperatures ranged from 73.0° F. at the surface to 71.4° F. at 10 feet; for respective depths the dissolved oxygen ranged from 8.3 to 8.4 p.p.m.; carbon dioxide, from 0.0 to 0.0 p.p.m.; pH, 8.0 to 8.0; and the methyl orange alkalinity, from 54.5 to 60.5 to 58.5 p.p.m. The water was colorless. Judging from the analyses, the lake has no thermocline during the summer. Since preceding weather had been only moderately warm, it must follow that the lake water would get considerably warmer at all depths, during occasional hot spells, than it was on July 8. Therefore the lake cannot be considered as potential trout water. The alkalinity values of 55 to 60 indicate that the lake water is quite soft. (Less than 50 is considered as soft, 50 to 100 as moderately soft, 150 to 250 as hard, etc.; and soft-water lakes in general as less productive than hard-water lakes.)

Aquatic vegetation was very sparse in North Twin Lake. Submergent types were common over about 5 per cent of the lake area, and mostly absent over the remainder; floating types were even more limited in occurrence; and emergent types were sparsely scattered on a few areas near shore. The

more common species[+] included Potamogeton natans, P. amplifolius, Nymphaea odorata, and Chara sp. The vegetation is not of sufficient abundance to afford good cover for fish.

Plankton in North Twin was measured by a single net haul from 10 feet to the surface at 3 P.M. on July 8. The volume of plankton was computed to be 24.1 c.c. per cubic meter. The dominant organisms were Dinobryon, Cyclops, and species of Cladocera.[++]

Our fish collecting consisted of an overnight set of four experimental gill nets on July 7 to 8, and some seining on July 9. The gill net catch was 15 yellow perch, 2 smallmouth bass, 1 bluegill, 10 pumpkinseeds, and 40 yellow bullheads. Many of the fish while in the nets were partially eaten, presumably by painted turtles (Chrysemys) which we observed to be abundant in the lake. The yellow perch were 6 to 9 inches, averaging small. The pumpkinseeds also were small (3.7-4.7 inches), and almost all of the bullheads were less than 7 inches. The single bluegill was 9.3 inches, and the bass were 15.7 and 19.8 inches. Except for the two fine specimens of the smallmouth, the collection would not excite much interest by fishermen because of the small size of the fish. The seining operations were very limited, and the results were not very conclusive. There was very little cover for small fish in shallow water. Furthermore, the very soft bottom made seining difficult. No fish at all were taken by the seining; and during the several days which we spent on the lake, we saw no small fish in shallow water, except for about 50 nest-guarding pumpkinseeds on a spawning area at the south end of the lake. The apparently complete absence of young fish on the lake shallows may have been to some extent

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[+] Identification checked by E. W. Roelofs.

[++] Analysis of the plankton sample by E. W. Roelofs.

misleading in its significance, for during the daytime even the young fish might be expected to have been in the deeper water where vegetation afforded some cover. Season of the year also may have been a contributing factor, for by early July young perch and bass would be large enough to be independent of the lake shallows as a habitat. But even after allowing for these contingencies, the results of seining and direct observation indicated that young fish were not very abundant in the lake. We concluded from our netting that the lake had a sparse population of adult game and pan fishes, and that small fish of any kind were not very abundant.

The fish records by Metzelaar and Langlois in 1925 are of interest at this point. They found (presumably by seining) a considerable number of fingerling game fish, including smallmouth and largemouth bass, perch, pumpkinseeds, and yellow bullheads. They listed northern pike, with no comment as to numbers. Referring to fingerling smallmouth bass, they stated "lots of them." They listed minnows as present, and recorded many Iowa darters. They concluded that the lake needed "no plantings whatever," which conclusion presumably was based on their finding a considerable number of young game fish already present.

It seems quite obvious that young fish were much more abundant in the lake during the summer of 1925 than during the summer of 1945. The spring of 1945 was characterized by unusual weather: an early warm spell followed by a protracted cold spell. It has been observed that such weather reversals are destructive to eggs of centrarchids which spawn early (e.g., smallmouth bass at the Lydell Hatchery during 1945). This might have happened on North Twin during 1945, though this is pure conjecture based on coincidence.

Records of fish plantings in the Twin Lakes since 1921 are cited in a letter of February 9, 1945 from Mr. Westerman, as follows:

Year	Twin Lakes (undifferentiated)	North Twin	South Twin
1921	30,750 perch fry	....	....
1922	3,000 smallmouth bass fry	....	....
1936	66 smallmouth bass adults	....	....
1938	1,000 bluegills (5 mos. old)	51 smallmouth adults	57 smallmouth adults

According to records at the Institute no plantings were made in either lake from 1939 to 1945, inclusive.

The few game fish in our collections which were not mutilated by turtles were studied for age and growth (see Table 3). The smaller of the two bass was in its seventh summer, the other one was about 8 years old. The bluegill was 6, the perch 4, and the pumpkinseeds 4 and 5. Compared to Beckman's data[1] on average (state-wide) age at the attainment of legal size, growth of the 2 smallmouth bass, 1 bluegill, and 1 yellow perch from North Twin had been good, but growth of the 4 pumpkinseeds had been poor.

Examinations for parasites were made on the two smallmouth and on one of the larger perch. None of the important, objectionable parasites (Proteocephalus, Clinostomum or Neascus) were found.

Favorable spawning grounds for centrarchids in North Twin are limited to a narrow (10- to 30-foot) strip along the shore line around most of the lake. This strip is of sand bottom with a small amount of gravel in places, and is limited to water less than a foot deep. The 40-50 occupied nests of pumpkinseeds which we observed were confined to this shallow water zone

[1] I.F.R. Report No. 786, Fig. 7.

with sand and gravel bottom. The spawning smallmouth is known to prefer a hard bottom at depths of more than one foot, and this combination is generally lacking in North Twin where the bottom is almost exclusively pulpy peat at depths of over one foot. However, judging from the observed and reported presence of smallmouth during 1945, it is obvious that there has been some natural reproduction of the species in this lake during recent years, for fish in the most recent plantings (adults in 1938 and 1936) could not be the seven- and eight-year-olds collected (seven to nine years later) in 1945.

Conservation Officer Gilbert Lince reported seeing no signs of a winterkill on this lake during the winter of 1944-45.

Our general creel census data on North Twin are very meager. There is one entry for two fishermen on an August 13 (year not recorded) fishing for four hours and taking no fish. During the time our survey crew was at the lake (July 3-9), one party of four fishermen set up camp on North Twin, fished one day, caught nothing, and left. Mr. C. A. Reid of Indian River told us that the lake has good bass fishing. However, the creel records which, on his own initiative, he had kept for the Twin Lakes during 1945 were all of fish from South Twin. Judging from our netting records, and from the emphasis on South Twin in Mr. Reid's reports, it is clear that North Twin is by far the least productive of the two lakes to the angler.

SOUTH TWIN LAKE

The basin of South Twin is completely wooded with a moderately dense stand of "second growth." The dominant trees are white birch, poplar, jack pine, Norway pine, white pine, and tamarack. Cedar, cherry and maple

are few. The drainage area of South Twin was estimated to be about one square mile, possibly a little more. There are no permanent inlets. At the south end of the lake there is a permanent outlet, Twin Lakes Creek, a tributary of Crumley Creek which drains to Burt Lake and the Indian River. The outlet flow on July 6 was estimated at 300-400 g.p.m. At the outlet we found the remains of a wooden dam, consisting of hand-driven stakes and one splash board. The dam was not functioning, and could be pulled out by hand. Apparently, in the past, it could not have raised the lake level by as much as one foot. From the permanent appearance of the outlet and the character of the shoreline we concluded that the lake level fluctuates very little, probably not more than one foot.

South Twin is about 3/4 mile long and 600 to 800 feet wide, generally finger-like in shape, and tapered to a narrow channel at the south (outlet) end. From the Institute map, the lake area was computed to be 53.5 acres. It has a maximum depth of 4 feet over a small area in the north-central part, and about 50% of the lake is less than 2 feet deep. The shore line is 8,550 feet, and a shore line development of 1.58 reflects the long and narrow shape of the lake. The east and west shores are quite straight. The west and north shores are entirely encroaching and are bordered by a 30- to 100-foot strip of quaking, shrub bog. Along the transition line between bog and woods are tamarack, pines and cedar. About two-thirds of the east shore is encroaching, but the bog mat here is very narrow. The northern third of the east shore is stable in character and is wooded to the lake margin.

The bottom soil over most of the lake is pulpy peat. Over an area of about 8 acres the bottom is marl. There is a 20- to 30-foot strip of sand bottom along the east shore, and a corresponding strip of fibrous peat along the encroaching west shore. Wave action has only slight effect

on the east shore where it is maintaining the sandy shoal, and has no apparent effect on the remainder of the shore line. The water was colorless, and clear to the bottom at 4 feet.

Water analyses made on July 9 on surface samples (Table 2) gave the following: temperature, 73° F.; oxygen, 9.9 p.p.m.; carbon dioxide, 0.0 p.p.m.; ph-th alkalinity, 6.0; M.O. alkalinity, 90.0; and pH, 8.8. The lake is too shallow to have an important thermal stratification, and too warm to have possibilities as trout water. It is a warm-water fish lake. The alkalinity value of 90 is approaching moderately hard water. South Twin is significantly harder than North Twin.

South Twin has dense beds of Chara over about 40% of its area, dense beds of other submerged types (mostly Potamogeton) over an additional 10% of its area, and very sparse to no vegetation over the remaining 50%. Chara sp., Najas flexilis, Potamogeton amplifolius, and P. foliosus were identified[+] specifically. The abundant vegetation, and the encroaching and overhanging bog mat along the shore, together, offer good cover for young fish.

Plankton analyses[++] are based on five vertical, net hauls through the surface foot of water, made at 4 P.M. on July 9. The quantity of plankton was computed to be 8.03 c.c. per cu. meter. It was nearly 100% Bosmina (one of the micro-crustacea).

Our fish records for South Twin are from an overnight (July 6-7) set of four experimental gill nets, and one hour seining on July 9. The gill nets took 3 northern pike, 12 yellow perch, 6 largemouth bass, 9 bluegills, 17 pumpkinseeds, and 3 yellow bullheads. Most of the fish were of a sufficiently large size to be attractive to anglers. Seining took 14 young

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[+] Identifications checked by E. W. Roelofs.

[++] Analysis of the plankton samples by E. W. Roelofs.

largemouth bass, 1 bluegill, 3 pumpkinseeds, and many forage fishes (blacknose shiners, bluntnose minnows, banded killifish, and Iowa darters). The young game fish were seined from cover afforded by the overhanging bog mat along the shore line.

Metzelaar and Langlois, from their examination of South Twin on August 9, 1925, record yellow bullhead, brown bullhead, and pumpkinseeds. It is presumed (from examining their record sheet) that their examination of South Twin was limited to hook and line fishing.

Stocking records for South Twin are cited above under North Twin. The 1921, 1922 and 1936 plantings in Twin Lakes (undifferentiated) of perch, smallmouth bass and bluegills presumably were partly in South Twin. In 1938 South Twin received 57 adult smallmouth bass. No plantings were made from 1939 to 1945, inclusive.

Scales were read for age and growth for almost all of the game fish in our collections from South Twin (Table 3). Compared to Beckman's data on state-wide average age of fish at the attainment of legal size, the South Twin largemouth bass were about one years growth slower than the average, the bluegills had considerably better than average growth, while the yellow perch, northern pike, and pumpkinseeds had about average growth. The conclusion is that growth of the game species in South Twin was generally satisfactory.

The six largemouth bass from South Twin were examined for parasites; no important parasites were found. Ten of the pumpkinseeds were examined, all of them containing Clinostomum (about 2 to 5 per fish) in the muscles, and heavy infestations of Neascus (van cleavi ?) in the liver. In addition, most of the pumpkinseeds had light infestations of Neascus in the skin. The other species of game fishes were generally free of parasites

on the surface, and internal examinations were not made.

During the survey, no spawning activity of bass, bluegills, or sunfish was observed. This is of little significance because of the dates of the survey (July 5 to 9) being late in the season. About a dozen abandoned spawning beds were seen which, judging from their large size, were presumed to be bass nests. The young largemouth bass taken by seine were from good cover at scattered locations along the overhanging shore, and we were convinced from the results of this seining that a considerable number of the young largemouth bass were present. We took no smallmouth bass by gill net or seine. Even though the smallmouth was introduced here from 1922 to 1938 and some were reported by Mr. C. A. Reid in the anglers' catch for 1945, it appears from our netting records that the smallmouth is not so well established as the largemouth. In physical character (shallow, weedy, peat and marl bottom) the lake is typically a largemouth type, not a smallmouth type. The character of the lake bottom is better adapted for spawning of the largemouth.

Conservation Officer Gilbert Lince reported that he examined the lake at "ice-out" in the spring of 1945, finding no evidence of a winterkill. South Twin is the extreme shallow type which might be expected to winterkill in a peculiarly unfavorable winter (as 1944-45), and this report by Mr. Lince should allay some of the future anxiety on this account.

The general creel census records for South Twin are as follows:

July 20, 1942 - 2 fishermen, 4 hrs. each, 1 largemouth (13")

June 27, 1943 - 5 fishermen, 18 hrs. (total), 7 smallmouth (11" av.)

Aug. 20, 1943 - 3 fishermen, 9 hrs. (total), 4 pumpkinseeds (6" av.)

In addition, Mr. C. A. Reid of Indian River voluntarily gave us the following records of fish taken by anglers on South Twin from June 25 to

July 4, 1945. He had not attempted to get a complete census, but merely kept records of fish caught by guests at his camp and reports which came to him.

23 bass (largemouth and smallmouth) on opening day
(15 by one party in 50 minutes, average about 2 lbs.)
(8 on opening day by another party)

5 fish on July 3 by 2 fishermen, 4 of them pike, one 4 lbs.

Known total of 28 fish taken; conservative estimate (by Reid) that a total of 50-100 were taken.

All caught with artificial bait.

Mr. Reid described the bass fishing as "good."

During the four days (July 5-9) which the survey party spent at the lake, we saw no fishermen. There was one row boat present. The fewness of the general creel census records would suggest that past fishing on South Twin has been light, probably attributable to the semi-public status of the lake.

SUMMARY AND RECOMMENDATIONS

Since these Twin Lakes are now state-owned and open to the public, they offer opportunities for special management studies, either (1) as one designated experimental lake or (2) for intensive studies on certain management procedures. Since there are so few creel census data for them, neither lake would be a good selection, at the present time, for a designated experimental lake. But each of the lakes affords a good opportunity for an intensive study on a particular problem, namely: the effects of artificial fertilization in increasing food, cover (aquatic plants), and fish production in North Twin; and the effect of raising the lake water level on production and growth of fish in South Twin.

From our survey of North Twin it is concluded that the lake water is quite soft and therefore low in potential productivity. There is a scarcity of rooted vegetation. There is a poor crop of game fishes, i.e., relatively few adults and apparently very few young. In view of this appraisal of the lake as a low producer, the lake offers a good opportunity for an experimental attempt to increase fish production by artificial fertilization. The small size of the lake and the absence of an outlet are favorable factors in the consideration of such an experiment. Results of experiments in the artificial fertilization of natural waters are badly needed to know whether or not the method is effective and practical. Considerable fertilization of natural waters has been done in regions comparable to Michigan, but in few if any instances have the results in terms of fish production been adequately evaluated. It is planned that the Institute will be conducting fertilization experiments on natural lakes in the near future, and it is here recommended that North Twin be included on the list of lakes for such experiments.

The question might be raised as to the need and value of future plantings of warm-water species in North Twin. The question should be considered in the light of our present knowledge of the reproductive capacity of the warm-water species, and the general success of natural reproduction in our waters.[+] In general, fishes have a tremendous reproductive capacity and when established in a lake to which they are well adapted they produce a great surplus of young above what the lake can support to an adult size. In the case of North Twin the smallmouth bass, yellow perch, pumpkinseed, and bluegill are established. The survey netting in July, 1945 took no young of these species, but the seining operations were not adequate for a close appraisal. In the writer's opinion this seining was a reliable

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[+] See "For Better Fishing" by F. A. Westerman and A. S. Hazzard, Mich. Dept. of Conservation, 1945.

indication only that the young were not very abundant. There may have been a fair number present (in the deeper water), or there may have been almost none. Any real scarcity could have been caused by a failure in natural reproduction due to the unusual weather of the spring of 1945, or to the generally unfavorable spawning grounds in the lake for the bass and bluegills, or to poor survival due to absence of cover. These are problems left unanswered by the survey, but they deserve attention in a consideration of the desirability of future plantings. If the scarcity in 1945 was seasonal, then another years reproduction may fill the gap. If it is due to inadequate spawning grounds, the addition of spawning gravel for bass and bluegills would be a more economical procedure than fish plantings. If spawning grounds or cover are the limiting factors, these should be more accurately evaluated in connection with future fertilization experiments on the lake. It might develop that fertilization plus the installation of brush shelters and gravel spawning beds would represent the best management plan for the lake. Until these apparently limiting factors (fertility, cover, reproduction) are more accurately evaluated than could be done in the short time allotted for the present survey, there is little point in planting young fish. Furthermore, the proposed experiments on fertilization would give more significant results if plantings were not made. Therefore, it is recommended that no future plantings be made in North Twin until the need for such plantings is demonstrated by further study.

South Twin is appraised as being a productive type of lake on the basis of the following survey results: uniformly shallow water, mostly peat bottom, fairly abundant aquatic vegetation, alkalinity approaching moderate hardness, and a good variety of fast-growing game fish. Judging

from abundance of vegetation, water hardness, our fish collections, and reports by anglers, South Twin is at present a much more productive lake than North Twin.

An outstanding feature of South Twin is that it is uniformly very shallow--mostly less than 3 feet deep with a maximum depth of 4 feet. There is the possibility of constructing a low-head dam at the outlet and raising the lake level 2 to 3 feet. Mr. C. A. Reid informed the survey party that fishermen of Indian River were anxious to have a dam installed and the lake level raised. One's immediate reaction might be that raising the level would be entirely beneficial, since the lake is now so shallow, but there are arguments pro and con. Some considerations which occur to the writer are as follows: The present shallow water must be rather poor cover for large game fish in the extensive areas with no vegetation or with Chara densely matted on the bottom. In the shallow water the larger game fish must be more wary, more difficult for fishermen to approach in a boat, and therefore more difficult for which to fish. Raising the lake level would be expected to add materially to the fertility of the lake, at least for a few years. Also, the present shallowness must be approaching that limit which during very severe winters may leave very little water under 2 feet of ice. The above may be valid reasons in favor of a raised lake level. Adverse effects of a raised level might be as follows: The present shallowness may be the most favorable condition in production of fish food and the growth of vegetation. A raised lake level might cause future winterkills, and a raised level might cause an unsightly condition of shoreline.

In the writer's opinion the advantages to fishing in raising the lake level probably will outweigh the bad effects which might develop. The

possibility of winterkill is minimized in view of the infrequency of this phenomenon in lakes of northern Michigan. There is a possibility that the shrub bog-mat along most of the west shore would rise with an increase in water level, or this area might be cut and burned before flooding.

Raising the water level on South Twin would give a much-needed opportunity for a study of the effect of this procedure on game fish populations.

It is recommended that a Fish Division engineer examine the outlet and the lake basin of South Twin, to determine the feasibility of constructing a dam, to run levels to determine the extent of flooding which would result from a 2-foot and a 3-foot rise in water level, and to determine the amount of brush clearing necessary on the area to be flooded. Assuming that the cost would be reasonable, it is recommended that a dam, with a two to three-foot head, be constructed at the foot of South Twin Lake, and that the Institute make a study of the effect of this impoundment on the fish population of the lake.

INSTITUTE FOR FISHERIES RESEARCH

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Report approved by A. S. Hazzard

Report typed by E. F. Livingston

TABLE 1

RESULTS OF WATER ANALYSES ON NORTH TWIN LAKE,

CHEBOYGAN COUNTY

July 8, 1945. 12:30-2:30 P.M.

Depth:ft.	Temp.:°F.	O_2:p.p.m.	CO_2:p.p.m.	ph-th alkalinity p.p.m.	M.O. alkalinity p.p.m.	pH
Surface	73.0	8.5	0.0	0.0	54.5	8.0
5	72.9	8.5	0.0	0.0	60.5	8.0
10	71.4	8.6	0.0	0.0	58.5	8.0

Water depth: 11 feet.

TABLE 2

RESULTS OF WATER ANALYSES ON SOUTH TWIN LAKE,

CHEBOYGAN COUNTY

Depth:ft.	Temp.:°F.	O_2:p.p.m.	CO_2:p.p.m.	ph-th alkalinity p.p.m.	M.O. alkalinity p.p.m.	pH
Surface	73	9.9	0.0	6.0	90.0	8.8

Water depth: 3 feet.

TABLE 3

INDIVIDUAL LENGTHS, AGE✓, ETC. OF SOME OF THE GAME FISHES IN SURVEY COLLECTIONS FROM THE TWIN LAKES. (Collected July 6 to 8, 1945)

Lake	Species	Sex	Length: inches	Weight: ounces	Age: Summers of life (including 1945)
N. Twin	Smallmouth bass	Female	15.7	...	7
"	Smallmouth bass	Male	19.8	...	8 (?)
"	Bluegill	Female	9.3	8.4	6
"	Yellow perch	Female	8.8	2.6	4
"	Pumpkinseed	Female	3.7	0.6	4
"	Pumpkinseed	Female	3.8	0.6	4
"	Pumpkinseed	Female	3.9	0.6	4
"	Pumpkinseed	Female	4.7	1.2	5
S. Twin	Largemouth bass	Female	9.7	...	4
"	Largemouth bass	Female	9.8	...	4
"	Largemouth bass	Male	10.8	...	5
"	Largemouth bass	?	11.8	...	6
"	Largemouth bass	Female	13.7	...	7
"	Largemouth bass	Male	14.8	...	8
"	Bluegill	Female	6.0	...	3
"	Bluegill	Male	6.6	...	3
"	Bluegill	Female	7.8	...	4
"	Bluegill	Male	8.8	...	5
"	Bluegill	Female	8.8	...	5
"	Bluegill	Female	8.8	...	5
"	Bluegill	Female	8.9	...	5
"	Bluegill	Female	9.1	...	6
"	Bluegill	Male	9.3	...	6
"	Yellow perch	Female	5.8	...	3
"	Yellow perch	Female	6.6	...	3
"	Yellow perch	Female	6.7	...	3
"	Yellow perch	Female	7.7	...	4
"	Yellow perch	Female	7.9	...	4
"	Yellow perch	Female	8.8	...	4
"	Yellow perch	Female	8.9	...	4
"	Yellow perch	Female	10.1	...	5
"	Yellow perch	Female	12.2	...	7
"	Northern pike	Male	17.3	...	3
"	Northern pike	Female	20.7	...	3
"	Northern pike	Female	26.5	...	5 (?)
"	Pumpkinseed	Male	5.3	...	4
"	Pumpkinseed	Male	6.9	...	6
"	Pumpkinseed	Male	8.2	...	6
"	Pumpkinseed	Female	8.0	...	6
"	Pumpkinseed	Female	8.0	...	6
"	Pumpkinseed	Female	8.1	...	6
"	Pumpkinseed	Female	8.2	...	6
"	Pumpkinseed	Female	9.6	...	6
"	Pumpkinseed	Male	8.1	...	7
"	Pumpkinseed	Male	8.1	...	7
"	Pumpkinseed	Male	8.1	...	7 (?)
"	Pumpkinseed	Male	8.3	...	7
"	Pumpkinseed	Female	8.1	...	7 (?)
"	Pumpkinseed	Female	8.2	...	7
"	Pumpkinseed	Female	8.4	...	7
"	Pumpkinseed	Female	8.4	...	7
"	Pumpkinseed	Female	8.5	...	7 (?)

✓ Scale readings of age by the writer.