INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

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Report No. 1389

RESULTS OF FISHERY INVESTIGATIONS MADE IN 1953 ON FOURTEEN LAKES IN LAKE COUNTY

by

C. M. Taube and W. R. Crowe

Abstract

From August 31 to September 16, 1953, personnel from the Institute for Fisheries Research investigated 14 Lake County lakes--Big Bass, Big Star, Cool, Idlewild, Little Bass, Loon, Orchard, Paradise, Putman, Sauble (3), Seaman, and Wolf. Fish collections were taken to allow evaluation of the present make-up of the fish populations of these waters; scale samples were obtained from game species for age and growth analysis. Later on, these materials (as well as records from earlier studies) were examined in the laboratory, after which management recommendations were drawn up for the lakes.

Results indicated presence of sizeable populations of game fish in most of the lakes, with growth accruing mostly at average or above-average rates; creel census records show fishing success to range from fair to good. Exceptions are Big Star, Idlewild, Paradise, Seaman, and Wolf lakes. While Big Star contains a large population of fish, the bluegills and crappies are growing slowly. Idlewild, Paradise, and Seaman lakes apparently have small populations. Wolf Lake supports a medium population

of good-sized perch, and the three chief game species (perch, bluegill, and largemouth bass) are well above average in growth, but bluegills are relatively scarce.

Management recommendations for the lakes examined in 1953 include the following:

Some further investigation is proposed for Cool and Paradise lakes to determine their suitability for trout.

Brush shelters are recommended for Idlewild Lake and Sauble Lake No. 1. Introduction of perch is also advised for Idlewild Lake if further investigation verifies the absence of this species.

Suggested for Little Bass Lake is designation for fall spearing and netting for ciscoes, which presently are an unexploited resource.

If further check verifies the absence of northern pike in Seaman Lake, an introductory planting of pike should be made here.

A recommendation to transfer some bluegills to Wolf Lake from Big Star Lake has already been carried out. Checks are to be made on the effectiveness of this transfer in augmenting the bluegill supply. Also planned is continuation of the study (begun in 1951) of the effect of brush shelters on the fish population of Wolf Lake.

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A lake survey crew,[1] representing the Institute for Fisheries Research, worked on Big Bass, Big Star, Cool, Idlewild, Little Bass, Long, Loon, Orchard, Paradise, Putman, Sauble, and Wolf lakes from August 31 to September 16, 1953. This work consisted mainly of collecting fish with gill nets and seines. In addition, another Institute crew[2] collected fish with trap nets on Big Star and Wolf lakes. The primary objects of the investigations were to evaluate the present make-up of the fish populations of these waters, to obtain scale samples from the game species for age and growth studies, and to propose management practices for the lakes with the aid of the results.[3]

Following a summary of the results, fishery management recommendations are listed for each lake. Included in the account of the netting and the findings from the growth studies are resumes of whatever work was done on

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[1] Personnel of this crew were Carroll R. Norden, Leader, and Robert W. Eshenour and Kenneth L. Fitch, Assistants; Clarence M. Taube gave some assistance.

[2] Walter R. Crowe and Robert N. Schafer.

[3] The investigations of these lakes, analysis of data, and preparation of the report were undertaken largely with Federal Aid to Fish Restoration funds under Dingell-Johnson Project Number F-2-R-2.

these lakes in previous years. The gill nets used were 125 feet long and 6 feet deep, with mesh sizes that ranged from 3/4 inch to 2 inches, bar measure. The trap nets each had a single pot 5 feet wide, 8 feet long, and 3 feet deep, and a single heart. The lead was 150 feet long. Mesh sizes were 1 inch in the pot, 1-1/4 inches in the heart, and 1-1/2 inches in the lead, bar measure. Two types of seines were employed--a 30-foot bag seine having 1/4-inch mesh in the bag and 3/8-inch mesh in the wings, and a 20-foot common sense (minnow) seine.

For anyone unfamiliar with the significance of water chemistry tests used in fishery surveys, or interpretation of fish growth data, the following explanatory review is given.

The test for dissolved oxygen in late summer is of most significance for determining whether a lake is suited for trout. Four parts per million of oxygen in water cool enough to support these cold-water fish has been considered the minimum quantity. The maximum temperature regarded allowable for trout is 70° Fahrenheit, and a layer of water at least five feet thick that provides these conditions during the critical summer season has commonly been required before stocking of trout is recommended. Presence of northern pike in a lake disfavors introduction of trout because of the highly predatory nature of the pike.

The methyl orange alkalinity test is a check on water hardness. It evaluates the quantity of dissolved mineral salts present, lime being the main one in Michigan water. One classification breaks down the degree of water hardness, based on methyl orange values in parts per million, as follows: soft, 0-22; medium, 23-98; hard, 99-223. Water of at least medium hardness has been regarded as biologically more productive than soft water. Hence the alkalinity test has been employed to evaluate the fishery potential of lakes. A research worker has pointed out that waters

with alkalinity below 40 parts per million were found to be low in productivity; that those with values above this figure favored good production, but that various degrees of alkalinity above 40 parts per million apparently did not further influence productivity.[4]

Fish age and growth data for lakes that were studied in this investigation are summarized in tables. In these tables, age of the fish in years is shown by Roman numerals. Average lengths (total length in inches) are listed under the age-groups, and the number of fish involved is shown in parentheses. Also given for each age-group is the state-average length which evolved from a study of numerous fish collected over a period of years from various Michigan lakes. For several game species, state averages have not yet been determined. When the growth of fish from any one lake is examined, obviously more weight should be given sizeable samples than those that have only one or few fish. Average lengths of the smaller species of the game-fish group (bluegill, perch, etc.) that fall within 0.5 inch either above or below the state-average figure are considered within the average range; the allowable range for the black basses is 1 inch to either side of the state-average figure.

In fisheries management, consideration of growth rate of fish is of great importance because it provides an index to environmental conditions for fish life in the body of water under consideration. Average or above-average growth indicate that the fish population is in a sound condition and adjusted to the food supply. Conversely, slow growth is usually associated with inadequate food supplies, over-crowding, or other conditions which produce poor fishing.

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[4] Moyle, J. B., Some indices of lake productivity. Trans. Am. Fish. Soc., Vol. 76, 1946, pp. 322-334.

Acknowledgment

The cooperation of local people who assisted directly in the work, permitted access to the lakes over their property, or aided this investigation in other ways, is gratefully acknowledged.

Big Bass Lake, T 19, 20 N, R 14 W, Secs. 3, 4, 27, 33, 34.

Big Bass Lake was examined briefly on September 1 and 2, 1953. Certain basic information that pertains to the lake was available prior to the 1953 survey.

An outline map, showing depth contours, bottom soil types, and distribution of aquatic vegetation was prepared by the U. S. Forest Service in 1940. The surface area of the lake is 300 acres. The maximum depth is about 45 feet. The irregular shoreline is about 5.8 miles long. There is an inlet from Little Bass Lake and an intermittent outlet.

A routine water analysis (A. G. Horn, U. S. F. S., August 29, 1939) showed the water to be hard, the methyl orange alkalinity ranging from 93 to 118 parts per million. Dissolved oxygen in sufficient quantity to support fish life extended to an extreme depth somewhere between 20 and 30 feet.

A summary of general creel census records collected from 1947 to 1952 inclusive, and compiled by K. G. Fukano, showed the quality of the fishing in Big Bass Lake to be somewhat better than average for lakes in Lake County, 2.19 fish per hour versus 1.61 fish per hour. The bulk of the catch was composed of bluegills. Also caught were perch, pumpkinseeds, smallmouth bass, northern pike, rock bass, black crappies, and largemouth bass. The quality of the fishing for 1952 (2.41 fish per hour), 1951 (2.38), 1950 (2.27) exceeds the average quality for the 6-year period (2.19 fish per hour).

The investigation in 1953 consisted chiefly of fish collecting by means of seines and gill nets, with some hook-and-line fishing included. Table 13 lists the species of fish present in Big Bass Lake. One point of interest as concerns the fish collection at Big Bass Lake is that only one smallmouth bass was captured by the survey party, while creel census records show the smallmouth to be caught here more frequently than the largemouth. The scarcity of smallmouth in the net collections probably resulted from this species' tendency to avoid gill nets, rather than actual scarcity in the lake.

Table 1 shows the growth rate of the game fish in Big Bass Lake. All species were growing at least at an average rate. The fact that small-sized bluegills have recently predominated in anglers' catches is, at least in part, accounted for by the presence of large numbers of 2-year-old fish. Over 60 percent of the bluegills collected were of this age-class.

Table 1.--Age and growth of Big Bass Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V
Largemouth bass	6.0 (5)	9.9 (2)	...	12.5 (2)	13.3 (1)
State average	6.1	8.7	10.0	12.1	13.7
Bluegill	3.4 (13)	4.4 (51)	5.4 (13)	7.0 (3)	
State average	3.1	4.3	5.4	6.6	
Pumpkinseed	3.6 (22)	4.6 (10)			
State average	2.9	4.1			
Yellow perch	5.6 (3)	7.9 (4)	8.6 (3)	9.7 (10)	11.0 (2)
State average	4.1	5.8	6.4	7.5	8.5
Northern pike	17.2 (6)	21.6 (4)	20.9 (1)		

Big Star Lake, T 17 N, R 14 W, Secs. 23, 24, 25, 26, 34, 35.

Big Star Lake, which is the largest, and supports the most intensive real estate development of any lake in the county, was examined during September, 1953.

A considerable body of information pertaining to Big Star Lake was already available in the Institute files at the time of the 1953 investigation.

The lake was inventoried during June 23-26, 1937. Results of this survey are summarized in Institute Report No. 769, dated April 14, 1942. The more salient features of the report are summarized below.

An outline contour map prepared by the U. S. Forest Service and completed by the 1937 survey party, shows the surface area of the lake to be 912 acres, and the maximum depth about 25 feet. There is neither an inlet stream nor an outlet. Bottom soil to a depth of about 5 feet is sand, with scattered patches of gravel. In the deeper water the soil is predominantly pulpy peat overlying sand. Vegetation covers almost the entire lake bottom and affords much protection for fish.

The lake's considerable area and fairly shallow character prevents thermal and chemical stratification in midsummer, and consequently the whole basin is habitable by fish. The water is moderately hard--methyl orange alkalinity, 58 to 61 p.p.m.

Table 13 lists the species of fish present in Big Star Lake. Note that species collected in 1937 and 1948, but not in 1953, are separated.

Creel census records secured by Conservation officers have been compiled for two different periods, 1928 to 1940 and 1944 to 1953. For the earlier period, a total of 397 anglers, fishing for 1,270 hours caught on the average 1.87 fish per hour. This catch was composed of 2,075 (86 percent) bluegills, 187 perch, 100 largemouth bass, 36 smallmouth bass,

5 bullheads, 2 pumpkinseeds, and 2 crappies. This, of course, represents only a small sample of the fishing over the 13-year period. For the second period, 3,070 anglers fishing for 6,040 hours made an average catch of 1.58 fish per hour. This catch was composed of 6,278 (66 percent) bluegills, 1,985 yellow perch, 488 black crappies, 368 pumpkinseeds, 188 largemouth bass, 184 northern pike, 36 smallmouth bass, 13 rock bass, and 3 walleyes. The sample of fishing secured for the later period is considerably larger and probably is more characteristic of the fishing in the lake at the present time. These figures suggest that there has been a slight decline in fishing quality, 1.58 fish per hour lately, compared to 1.87 fish per hour during the earlier period. Another feature shown by the creel census for the later period is that crappies, pumpkinseeds, and northern pike formed an important part of the catch, while during the earlier period these species either were not represented at all, or else formed only a minor portion of the catch. During the earlier period, both largemouth and smallmouth bass composed a more significant portion of the fish harvest. As judged from netting results, anglers at the present time are catching the various species of game fish in approximately the same ratio as they occur in the lake, with bluegills, perch, crappies, and pumpkinseeds forming the bulk of the take, while bass and pike are caught in far smaller numbers.

Report No. 769 included management recommendations as follows:

1. "Stocking of all species should be discontinued."

2. "A lake of this kind can best be managed by leaving it strictly alone. Plantings of those species already present probably have no effect on the population and the successful introduction of other species such as walleyed pike would very probably disturb the present balance and spoil the good bluegill and bass fishing which now exists."

The 1953 investigation consisted mainly of fish collecting by means of seines, gill nets, and trap nets. The purpose of the study was to assess growth rate of the various game and pan fish in the lake, and to reconsider the management program which was proposed in 1942.

Prior to 1953, information on growth rate of the fish in Big Star Lake was very sketchy. There have been some complaints about abundance of small fish. The 1937 survey party collected scale samples from only a few specimens, and from perch alone was there a sufficient sample to give a reliable index on growth rate. In 1937, scale samples from 36 perch showed this species to be growing at a better than average rate. Information on growth secured in 1937 is summarized below:

Species	Number of fish	Age	Average length	State average
Yellow perch	2	II	7.6	5.8
	3	III	9.1	6.4
	17	IV	10.1	7.5
	8	V	10.5	8.5
	6	VI	10.8	9.5
Largemouth bass	1	IV	11.4	12.1

A few additional scale samples secured in the winter of 1950-51 have also been examined, giving the following results:

Species	Number of fish	Age	Average length	State average
Bluegill	27	III	5.8	5.4
	5	IV	5.9	6.6
Black crappie	5	II	6.9	5.9
	2	III	7.7	8.0
	2	IV	9.3	9.0

In 1953 a much larger series of scale samples from the various species was secured. Results of the growth rate study are presented in Table 2.

A few observations concerning growth of Big Star Lake fish are in order. It is suggested by somewhat limited data that there has been a decline in the growth rate of bluegills and crappies since 1950. Possible reasons for such decline are suggested in the management section. On the

Table 2. --Age and growth of Big Star Lake game fish collected in September, 1953

Age-group	0	I	II	III	IV	V	VI	VII
Largemouth bass	...	...	...	11.0 (1)	10.6 (6)	11.9 (2)	17.4 (2)	
State average	3.3	6.1	8.7	10.0	12.1	13.7	15.1	
Bluegill	2.1 (22)	2.5 (75)	3.6 (2)	5.2 (5)	5.6 (142)	6.5 (53)	7.1 (10)	
State average	1.7	3.1	4.3	5.4	6.6	7.3	7.7	
Pumpkinseed	...	3.6 (3)	4.3 (14)	5.2 (7)	5.7 (26)	7.8 (3)		
State average	2.0	2.9	4.1	4.9	5.7	6.2		
Black crappie	...	...	...	...	7.8 (82)	8.8 (2)		
State average	...	...	5.9	8.0	9.0	9.9		
Yellow perch	...	5.2 (2)	6.4 (8)	7.8 (2)	8.1 (9)	...	11.5 (1)	12.0 (1)
State average	...	4.1	5.8	6.4	7.5	8.5	9.5	10.4
Northern pike	...	17.1 (5)	23.5 (3)	25.7 (2)				

other hand, perch, pumpkinseeds, and northern pike show good growth. Fewer data on largemouth bass indicate that this species is making sub-average growth. Bluegills and crappies are definitely stunted. Unfortunately, the last two species make up the bulk of the catch, particularly in summer, and hence the numerous complaints of small fish.

Cool Lake, T 20 N, R 14 W, Secs. 2, 3.

The area of Cool Lake, as shown by a U. S. Forest Service map prepared in 1940, is 88.6 acres. There are three distinct basins. A large part of the lake exceeds 25 feet in depth, with a maximum of around 50 feet. There is an outlet, but no inlet. Bottom soils are marl and sand on the shoal, and pulpy peat and muck in the deeper areas.

Routine temperature and water analyses were run on Cool Lake in August of 1939 by a U. S. Forest Service biologist. Dissolved oxygen became sharply reduced between 20 and 30 feet. Methyl orange alkalinity values that varied from 141 to 151 p.p.m. showed the water to be quite hard.

One set of four gill nets was made here from September 15 to 16, 1953. A seine collection was also taken. Species of fish that were caught are shown in Table 13. A local resident said that brown trout and rainbow trout were present. Fishing success was reported as good.

Too few specimens of game fish were secured to afford a reliable assessment on growth, although the trend shown by those studied indicate average growth for at least rock bass and perch. The single available bluegill was considerably below average (Table 3).

Table 3.--Age and growth of Cool Lake game fish collected in September, 1953.

Age-group	I	II	III	IV	V	VI	VII	VIII
Largemouth bass			11.2 (1)					
State average			10.0					
Rock bass				5.5 (1)	7.3 (2)	7.9 (2)	7.6 (1)	
State average				6.2	7.3	7.9	8.8	
Bluegill					4.9 (1)			
State average					7.3			
Black crappie		5.8 (2)						
State average		5.9						
Yellow perch			6.2 (1)	8.0 (5)	9.2 (1)	8.3 (1)	...	12.6 (1)
State average			6.4	7.5	8.5	9.5	10.4	10.8
Northern pike	15.0 (2)							

Idlewild Lake, T 17 N, R 12 W, Secs. 5, 6, 7, 8.

Idlewild Lake has an area of 105 acres and a maximum depth of around 22 feet. About 75 percent of the lake consists of shoal (water less than 15 feet deep). There is no inlet or outlet. The bottom soils are sand, marl, and pulpy peat, the latter two types predominating.

This lake was mapped by the Institute for Fisheries Research in March, 1953. District Fisheries Supervisor, Edward H. Andersen, took temperatures and ran chemistry tests on the water on August 18 of this year. Results showed the lake to be unstratified, and dissolved oxygen in quantities adequate for fish life occurred all the way to the bottom. The water was found to be fairly hard, the methyl orange alkalinity range being 122 to 130 parts per million.

The lake survey crew set six gill nets here for one night, over September 8 and 9, and also did some seining. The species of fish taken are listed in Table 13. Cover for fish life was noted as generally sparse.

Age and growth of the game fish taken are shown in Table 4. The limited number of specimens available for study does not permit very definite conclusions on growth. However, the trends of the figures indicate that the black bass of Idlewild Lake are growing at about an average rate, except that 3-year-old largemouths and 1-year-old smallmouths are above average; that bluegills up to four years of age are average, and that 4-year-old bluegills are above average.

Table 4.--Age and growth of Idlewild Lake game fish collected in September, 1953

Age-group	0	I	II	III	IV
Largemouth bass	4.3 (8)	6.9 (3)	9.9 (1)	11.8 (2)	
Stage average	3.3	6.1	8.7	10.0	
Smallmouth bass	4.0 (1)	8.1 (5)			
State average	3.3	5.9			
Bluegill	...	3.4 (1)	4.0 (6)	4.0 (1)	7.7 (3)
State average	1.7	3.1	4.3	5.4	6.6

Little Bass Lake, T 20 N, R 14 W, Secs. 27, 34.

This is a 54-acre lake with a maximum depth of about 45 feet. A considerable part of the lake has depth in excess of 30 feet. There is an inlet stream in addition to springs, and an outlet to Big Bass Lake. Sand and marl are the bottom soils in the shallows, while marl and pulpy peat occur in the deeper places.

The U. S. Forest Service prepared a map of Little Bass Lake in 1940. A Forest Service biologist took a vertical series of water temperatures and ran chemistry tests in August of the same year. A supply of oxygen adequate for fish life extended down beyond 20 feet. The methyl orange alkalinity range was 120 to 171 p.p.m.

In April of 1950, one thousand rainbow trout (6.6 inches, average length), supplied by the U. S. Fish and Wildlife Service, were planted in Little Bass Lake. Apparently few, if any, of these fish were caught by anglers, which indicated poor survival. Stocking of trout was discontinued.

One overnight set of four gill nets was made in the lake on September 9 to 10, 1953. This gear caught three northern pike (19.0 to 29.0 inches in length), one 12.6-inch perch, one 8.0-inch rock bass, and 55 ciscoes that ranged from 8.2 to 11.9 inches. It is probable that the small

catch of warm-water fish can be largely accounted for by the fact that the nets fished mostly in deep water.

Age and growth information are given in Table 5. Because of the very small number of samples available, the data afford little more than a hint that the warm-water species of Little Bass Lake are growing at better than an average rate.

General creel census figures for this lake show that bluegills and perch appear in the catch of anglers most often, with a considerable number of bluegills taken. There are fewer records for largemouth and smallmouth bass, pumpkinseeds, rock bass, and bullheads. General creel census records are continuous for Little Bass Lake fishing for the years of 1949 through 1952. These show a catch-per-hour of 1.66 fish as compared to the general average of 1.74 for Lake County lakes.

Table 5.--Age and growth of Little Bass Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V	VI	VII
Rock bass				8.0 (1)			
State average				6.2			
Yellow perch					12.6 (1)		
State average					8.5		
Northern pike		19.0 (1)	24.0 (1)	...	...	...	29.0 (1)
Cisco	8.4 (5)	9.8 (10)	10.7 (10)	10.9 (26)	11.1 (3)	11.3 (1)	

Loon Lake, T 19 N, R 14 W, Sec. 3.

This lake was examined by the survey party during September 8-9, 1953. Information available prior to the 1953 investigation consisted of a routine water analysis record, by a U. S. Forest Service biologist, general creel census records, and a Forest Service map prepared in 1941.

The surface area of the lake is shown on the map to be 94.5 acres and maximum depth is about 35 feet. The lake has neither inlet nor outlet. Bottom soils are sand, gravel, and marl near shore, and pulpy peat in deeper water. The water analysis showed the water in the lake to be hard (methyl) orange alkalinity, 95 to 115 p.p.m.). The lake was thermally stratified in August of 1941, when the epilimnion extended to a depth of about 23 feet. Dissolved oxygen was sharply reduced at the upper limit of the thermocline.

The 1953 investigation consisted of fish collecting with gill nets and seine. Species of fish collected are shown in Table 13. Results of the growth analysis are shown in Table 6. Additional scale samples from bass and bluegills would have been desirable. Information at hand suggests that bass may be growing rather slowly. From correspondence in the files, it appears that the lake has a history of producing small, slow-growing largemouth bass. Rather limited information indicates that bluegills and pumpkinseeds make at least average growth. Perch, the only species from which a satisfactory series of scales was secured, make better than average growth.

General creel census records for this lake, secured during the period from 1933 to 1952, show that the bulk of the catch has always been composed of bluegills, with perch (particularly in winter), pumpkinseeds, and largemouth bass also contributing substantially to the harvest. Smallmouth bass and rock bass appear less frequently, while crappies and northern pike have been recorded.

Table 6.--Age and growth of Loon Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V	VI
Largemouth bass	4.6 (12)	7.0 (1)				
State average	6.1	8.7				
Bluegill	3.3 (9)	3.9 (1)	6.5 (1)			
State average	3.1	4.3	5.4			
Pumpkinseed	4.2 (34)	5.0 (1)				
State average	2.9	4.1				
Yellow perch	6.4 (1)	8.2 (8)	9.1 (30)	10.2 (17)	10.5 (2)	10.9 (1)
State average	4.1	5.8	6.4	7.5	8.5	9.5

Orchard Lake, T 17 N, R 14 W, Sec. 21

This lake was examined briefly by the lake survey party on September 14 and 15, 1953. P. H. Eschmeyer and Floyd Simonis also made a brief check on September 4 and 5, 1948.

A map of the lake prepared by the U. S. Forest Service in 1937 shows the surface area to be 46 acres, and maximum depth, 15 feet. There is no permanent inlet or outlet, but during high water there is drainage into Rainbow Lake. Bottom soils consist of sand at the margin and pulpy peat underlying the deeper water. Vegetation is distributed sparsely over most of the lake basin. A routine water analysis made by a biologist from the U. S. Forest Service in August of 1940 showed the lake to be unstratified. The water was found to be moderately hard (methyl orange alkalinity, 59 p.p.m.). Dissolved oxygen was 8.0 p.p.m. at the surface and 7.6 p.p.m. at 10 feet.

General creel census records show the bulk of the catch to be composed of bluegills. Perch are caught in fair numbers, and largemouth bass infrequently--pumpkinseeds are recorded in creel census records, but were not collected either by the 1948 or 1953 parties.

The 1953 investigation consisted of fish collecting by means of seines and gill nets. Species of fish collected from Orchard Lake are listed in Table 13. Results of age and growth analysis are given in Table 7. No very conclusive statements concerning growth rates of the various species can be made, except that perch are doubtless making better than average growth, while bluegills and largemouth bass appear to be growing at average rates.

Table 7.--Age and growth of Orchard Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V	VI	VII
Largemouth bass	7.6 (1)	9.9 (1)	11.9 (1)	11.4 (5)			
State avg.	6.1	8.7	10.0	12.1			
Bluegill	3.7 (33)	...	6.5 (2)	...	...	7.4 (1)	7.3 (1)
State avg.	3.1	4.3	5.4	6.6	7.3	7.7	8.2
Yellow perch	6.7 (1)	9.3 (2)	9.5 (11)	10.5 (22)			
State avg.	4.1	5.8	6.4	7.5			

Paradise (Mill) Lake, T 17 N, R 12 W, Sec. 6.

There is some confusion as to the correct name for this body of water. Apparently, local usage favors Paradise, but official master plan maps show it as Mill Lake. We have no record of an official name change. A winter mapping party mapped it as Paradise Lake.

Until the investigation in September of 1953, the only information on the lake consisted of a map prepared in March, 1953. This map, which shows depth contours, bottom types, and shore features, gives the surface area as 39 acres, and the maximum depth as 33 feet. The lake is land-locked. Bottom soils are sand, muck, and marl in the shallow parts, with pulpy peat underlying the deeper water. Cover, in the form of aquatic vegetation, is present in quantity.

The 1953 investigation consisted of fish collecting by means of gill nets and seines. Species of fish collected from Paradise Lake are listed in Table 13. As judged from netting results, the fish population is not large, as few fish were captured. The fishing quality, judging from a very few general creel census records, appears to be poor. Growth rates of different species are shown in Table 8. The sample is far too small to permit valid conclusions, but bluegills appear to be growing at a normal rate, while largemouth bass may be growing rather slowly, and perch quite fast.

Table 8.--Age and growth of Paradise Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V	VI	VII	VIII
Largemouth bass			9.3 (1)	11.1 (3)				
State avg.			10.0	12.1				
Bluegill				6.4 (5)	6.9 (2)	8.3 (1)	8.2 (2)	7.8 (1)
State avg.				6.6	7.3	7.7	8.2	8.4
Yellow perch				9.2 (2)				
State avg.				7.5				

Putman Lake, T 18 N, R 13 W, Secs. 26, 27, 34, 35.

A. U. S. Forest Service map is on hand for this lake. It is incorrectly named Putnam on the map. The area is 17.5 acres and the maximum depth is around 25 feet. There is no inlet or outlet. Bottom soils are sand on the shoal and pulpy peat in the depths.

The general creel census shows that bluegills appear in the catch most often on this lake; taken in fewer numbers have been largemouth and smallmouth bass, pumpkinseeds, and perch. Rock bass and green sunfish were taken by seine at the time of the investigation in September of 1953.

Significant numbers of census records are available for only four years; for 1935, 1936, and 1937 combined, the catch-per-hour figure was 1.65, while in 1948 it was 0.91.

Considering the limited amount of gill netting done in 1953 (four nets), goodly numbers of largemouth bass (11) and large perch (12) were captured. Only one bluegill was taken with this gear, which is not so surprising because more often than not few of this species are taken with gill nets even in lakes that contain numerous bluegills. Bluegills in anglers' catches run to good size.

As indicated by Table 9, largemouth bass and bluegills of Putman Lake have made average growth, while perch are considerably above average.

Table 9.--Age and growth of Putman Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V
Largemouth bass	...	...	10.7 (5)	11.2 (5)	10.7 (1)
State average	6.1	8.7	10.0	12.1	13.7
Bluegill	3.1(7)	...	7.7 (1)		
State average	3.1	4.3	5.4		
Yellow perch	...	...	11.7 (1)	10.9 (1)	11.9 (10)
State average	4.1	5.8	6.4	7.5	8.5

Sauble Lakes, T 19 N, R 14 W, Secs. 2, 3, 11.

There are four Sauble lakes, connected to one another, and they are locally referred to as No. 1, 2, 3, and 4. Number 1 is the lowest, most southern lake in the chain, the others above it being numbered consecutively. A map of Sauble No. 1 was provided by the U. S. Forest Service in 1937; the other lakes of this group have not been mapped. No. 1 has an inlet from No. 2, and its outlet enters the Sauble River near the headwaters of the latter. No. 1 has a fair amount of water that is over 30

feet deep. Bottom soils are sand with some gravel, marl, and pulpy peat. The surface area of this lake is 64 acres.

Sauble Lake No. 1 was inventoried by the Institute for Fisheries Research during the summer of 1936. In August of that year, 4 p.p.m. of oxygen were found at 24 feet, which was near mid-point of the thermocline; there was only 0.3 p.p.m. at 39 feet. When the water chemistry was repeated the following year, the methyl orange alkalinity ranged from 116 to 140 p.p.m.

Creel censuses were run on the lake during June, July, and August in 1935 and 1936, covering 332 hours and 824 hours of fishing, respectively. Bluegills appeared in the catches most frequently. Appreciable numbers of largemouth and smallmouth bass, rock bass, pumpkinseeds, and perch were taken; caught in fewer numbers were crappies, bullheads, walleyes, northern pike, and dogfish.

Brush shelters and spawning boxes had been placed in the lake by the CCC prior to 1936. The brush shelters numbered 47. Observations made on 10 gravel spawning boxes selected at random at the time of the inventory indicated that these were being used but little.

One setting of five gill nets was made in Sauble Lake No. 1 from September 2 to 3, 1953. The catch taken by these nets, including the size range in inches for each species, was as follows: 1 brook trout (14.0), 15 brown trout (10.3 - 22.0), 3 yellow perch (5.8 - 11.4), 7 largemouth bass (5.6 - 10.7), 2 bluegill (5.6 plus one large fish partly eaten by turtle), 7 white sucker, and 3 yellow bullhead. Some collecting was also done with seine and hook and line. Fishes found in the lake during this study are listed in Table 13.

The surprising aspect of the netting results was the large number of trout caught. Fishermen have taken trout here now and then, but probably

very few people have suspected that the lake contained more than a few. There seems to be no record of the lake ever having been stocked with trout. The population, no doubt, developed from fish that migrated in from the Sauble River. It appears quite certain that adult trout from the lake move into the stream to spawn. It is just as probable that progeny from these fish and those that live in the river come to make the lake their home.

As in earlier years, the bluegill has continued to provide the bulk of the fishing in Sauble No. 1. Although small bluegills are plentiful, anglers also take good-sized fish. For example, six bluegills that a fisherman took on August 28, 1953, were from 6.9 to 9.1 inches long. Largemouth and smallmouth bass furnish a substantial amount of sport, too, but according to local report and general creel census records, smallmouth fishing has declined somewhat within recent years. There is some spearing for northern pike during the winter season.

The Sauble lakes are not differentiated in the general creel census records, so the figures on these data refer to the group as a whole. But it seems likely that the records are mainly for Lake No. 1, since it is the most accessible lake of the group, and probably is fished the most. From 1945 through 1951, the catch-per-hour on these lakes varied from 0.40 fish in 1948 to 2.73 fish in 1950. The average for this 7-year period is 2.38 fish per hour, as compared to 1.57 fish per hour on Lake County lakes as a whole during the same time.

Except for 3-year-old bluegills, which were below average, warm-water game fish collected from Sauble Lake No. 1 in 1953 showed normal growth. Growth of the brown trout was good, and appreciably better than that experienced by this species in streams. Growth data are summarized in Table 10.

Sauble Lake No. 2 is the smallest and most secluded of the four; its area is estimated as about 15 acres. It is rather shallow, with the greatest depth probably around 15 feet. In contrast to Lake No. 1, in which vegetation is generally sparse, No. 2 has a luxuriant growth of aquatic plants. There is a short inlet channel from Lake No. 3, and a lengthy outlet channel to No. 1. Means of access at present is mostly limited to these channels by boat.

A single gill net was set in Lake No. 2 during the period of study of the Sauble lakes in September, 1953. This net caught two perch, one bluegill, one pumpkinseed, and one crappie.

Sauble Lake No. 3 is estimated to have an area of around 35 acres. It has a considerable amount of deep water, which goes down so far as 30 feet. There is a wide, shallow inlet channel from Lake No. 4. The lake supports a dense growth of vegetation on the shoals.

Three gill nets set here from September 2 to 3, 1953, took three brown trout, one bluegill, and five white suckers. Lengths of the trout were 13.9, 14.7, and 19.5 inches.

Lack of time prevented study of Lake No. 4. Local people reported that this lake is fished relatively little.

Table 10.--Age and growth of Sauble Lake No. 1 game fish collected in September, 1953

Age-group	I	II	III	IV	V	VI	VII
Largemouth bass	6.2 (4)	9.2 (1)	...	12.0 (4)	10.7 (1)	...	18.3 (1)
State avg.	6.1	8.7	10.0	12.1	13.7	15.1	16.1
Rock bass	...	4.3 (2)	5.1 (4)	6.0 (1)			
State avg.	3.2	4.3	5.2	6.2			
Bluegill	...	4.0 (14)	4.7 (4)	6.5 (13)	7.8 (7)	9.1 (2)	9.9 (1)
State avg.	3.1	4.3	5.4	6.6	7.3	7.7	8.2
Yellow perch	4.3 (1)	5.9 (3)	...	...	...	...	11.4 (1)
State avg.	4.1	5.8	6.4	7.5	8.5	9.5	10.4
Brown trout	12.0 (1)	13.1 (9)	17.6 (4)	22.0 (1)			

Seaman (Long) Lake, T 19 N, R 14 W, Sec. 4, 9.

The name of this lake, still commonly referred to as Long was officially changed to Seaman by the U. S. Board on Geographic Names in April, 1950.

The lake was examined by the survey party during the period of September 14-16, 1953.

A map of the lake was prepared by the U. S. Forest Service in 1942. The surface area is 23 acres, and the maximum depth is about 25 feet. The lake is landlocked. Bottom soils are sand and pulpy peat in the shallow areas, and pulpy peat under the deeper water. Aquatic vegetation is distributed in a band around the whole lake to a depth of about 10 feet.

A routine chemical water analysis made by a biologist from the U. S. Forest Service in August, 1941, showed the water in this lake to be on the borderline between the soft and hard classifications (methyl orange, 22-66 p.p.m.). A vertical temperature series showed the lake to be stratified, and dissolved oxygen was sharply reduced below 10 feet. The slightly brown color of the water, its chemical characteristics, and the physical appearance of the lake with its surrounding marsh indicate that the lake is approaching senescence.

General creel census records, which are very few in number, indicate that perch and bluegills make up the bulk of the anglers' catch, and that largemouth and smallmouth bass are caught infrequently.

The 1953 investigation consisted of fish collecting by means of gill nets and seines. The species of fish collected by the survey party are shown in Table 13. Few species and few individuals were captured. A summary of growth rates for the game fish collected is presented in Table 11. With the exception of bluegills, too few specimens were available to permit valid conclusions. Bluegills are definitely making slow

growth, and the data suggest that perch and largemouth bass may be growing normally.

Table 11.--Age and growth of Seaman Lake game fish collected in September, 1953

Age-group	I	II	III	IV	V
Largemouth bass			10.7 (1)		
State average			10.0		
Bluegill		3.3 (25)	3.8 (7)	4.5 (1)	10.9 (1)
State average		4.3	5.4	6.6	7.3
Yellow perch		6.3 (1)	...	...	10.9 (1)
State average		5.8	6.4	7.5	8.5

Wolf Lake, T 19 N, R 13 W, Secs. 26, 27, 34, 35.

The area of Wolf Lake is 418 acres. The maximum depth is 13 feet, with about 90 percent of the lake being less than 10 feet deep. There is neither an inlet nor an outlet. The bottom soils are sand on most of the area near shore to a depth of 5 feet, with some fibrous peat in the southwest corner, and pulpy peat in the other places. It seems likely that the peat comprises a relatively shallow layer over sand.

The Institute for Fisheries Research mapped Wolf Lake in January of 1946 and made a biological inventory in the summer of 1950. Rooted aquatic vegetation was scarce; a filamentous alga was the most common plant. The water was found to be exceptionally soft, showing a methyl orange alkalinity value of only 4 parts per million of dissolved mineral salts. The chemical analysis of the water was repeated in 1953 to verify the results of 1950. No appreciable difference was found, although somewhat lower alkalinity values were obtained--2 p.p.m. at the surface and 3 p.p.m. at 8 feet. Wolf Lake is unique in the extreme softness of its water; most lakes of the vicinity are of the hard-water type.

Gill netting and seining in 1950 produced only three species of game fish from Wolf Lake--yellow perch, bluegills, and largemouth bass. The mudminnow was the only forage species found. Perch were plentiful, but bluegills of any size and largemouth bass other than young were few in number. The game fish attained large size and were well above the state average in growth rate. Sixteen gill net sets took 116 perch that ranged from 6.3 to 14.5 inches in length; 51 of these fish were at least 10 inches long. The perch were feeding chiefly on crayfish.

Following inventory, brush shelters were recommended for Wolf Lake in view of the scarcity of natural cover. Also proposed was additional study for evaluating the effect of the shelters on fish life. Before introduction of these structures late in the fall of 1951, intensive seining was done in September of 1951 at designated stations. The only game fish taken were young-of-the-year largemouth bass and perch, which were individually measured and counted. The Lake and Stream Improvement Section of the Fish Division installed 340 brush shelters in 68 groups of 5.

In September of 1953, seining was repeated at the stations checked in 1951, some of which had also been covered during the routine inventory in 1950. Effort was made to maintain uniformity with previous procedures. The most noticeable difference in the results was the far smaller catch of perch in 1953. This year only 13 perch were taken at the six seining stations, as against 315 in 1951. More largemouth bass were caught in 1953-276 as compared to 169 in 1951. No bluegills were captured.

The significance of the reduced number of young-of-the-year perch in 1953 cannot be explained at this time. One of several possibilities may hold the answer:

(1) Young perch may now be frequenting the brush shelters rather than near-shore areas where cover is extremely scarce.

(2) The shelters may have encouraged predation on perch eggs and/or fry, resulting in poor production in 1953.

(3) Reproduction of perch may have been low this year for a reason or reasons other than the presence of brush shelters in the lake. Weak age-classes of this species for previous years in Wolf Lake (as indicated by age and growth studies) strongly suggest that reproduction and survival have been appreciably better some years than others.

Further study on Wolf Lake should cast some light on the apparent fluctuation in abundance of perch.

Trap netting and gill netting were also done at Wolf Lake in September, 1953. Fish caught in the trap nets were released after length measurements and scale samples were obtained. Fish in seine collections also were released. The fish taken in gill nets were not returned to the lake.

Three trap nets were set for three nights, from August 31 to September 3. The catch in these nets was as follows (size ranges--total lengths in inches--in parentheses): 4 northern pike (20.0 - 26.1), 18 yellow perch (7.6 - 13.9), 12 largemouth bass (7.6 - 19.0), 31 bluegill (4.6 - 11.5), and 2 bluegill x pumpkinseed hybrids (4.3 - 4.4).

Eight gill nets with mesh of identical sizes of eight nets used in 1950 were set for nearly equal lengths of time in locations approximating the locations of 1950. This gear caught 68 perch as compared to 60 in 1950. Size range of these fish in 1950 was 5.9 to 13.3 inches, and 5.9 to 15.0 inches in 1953. The average lengths of the two lots were 9.3 inches and 8.6 inches, respectively. Twenty-eight (47 percent) of the 60 perch taken in 1950 were 10 inches or over in length, whereas 21 (31 percent) of the 68 gill-netted perch of 1953 fell within this size group.

These results indicate that the number of large perch in the lake is smaller at present than in 1950. Heavier cropping of the perch population during the past two years is a plausible explanation for this reduction. It has been reliably reported that large catches of big perch were taken in recent winters by ice fishermen using the Russian hook. Apparently fishing pressure during the open-water seasons has also increased since 1950.

Besides perch, only one bluegill (9.5 inches) was taken in the eight nets in 1950, and only two largemouth bass (7.8 - 10.3 inches) in the comparable net sets of 1953.

Growth rates of largemouth bass, bluegill, and perch of Wolf Lake were found to be well above state average. Growth data on the fish taken with the gill nets and trap nets in 1953 are summarized in Table 12.

Comparison of growth of perch captured in 8 gill nets in 1950 with that of perch taken by the comparable gill netting of 1953 shows an appreciable increase in rate of growth since 1950. The growth index for the fish caught in 1950 was 41.13, while that for the 1953 collection was 42.17.

Following the check in 1953, an experimental transfer of bluegills to Wolf Lake from another lake was recommended. From September 30 through October 1, 1953, approximately 2,500 small bluegills were seined from Big Star Lake and stocked in Wolf. The fish were marked for future identification by clipping the dorsal fin. Of these bluegills, about 75 percent were yearlings that ranged from 1.8 to 3.1 inches in length, 20 percent were young-of-the-year, from 1.3 to 2.8 inches long, and 5 percent were 2 or more years old, ranging from 3.7 to 6.0 inches long. Actually, 2,900 bluegills were planted, but because of mortality attending the marking and sorting operation, the number of live bluegills planted in the lake probably did not exceed 2,500. The result that is hoped for from this experiment

Table 12.--Age and growth of Wolf Lake game fish collected in September, 1953.

Age-group	I	II	III	IV	V	VI	VII	VIII
Largemouth bass	8.6 (8)	...	15.0 (1)	...	...	17.2 (3)	...	19.0 (1)
State average	6.1	8.7	10.0	12.1	13.7	15.1	16.1	17.7
Bluegill	4.8 (7)	...	...	7.7 (2)	9.6 (9)	9.9 (7)	9.8 (5)	11.5 (1)
State average	3.1	4.3	5.4	6.6	7.3	7.7	8.2	8.4
Yellow perch	...	6.7 (14)	7.0 (37)	11.1 (4)	12.7 (12)	13.1 (13)	13.4 (5)	12.0 (1)
State average	4.1	5.8	6.4	7.5	8.5	9.5	10.4	10.8

Table 13.--Species of fish collected by lake survey crews in various lakes in Lake County, September, 1953.

	Big Bass	Big Star	Cool	Idle-wild	Little Bass	Long	Loon	Orchard	Para-dise	Put-man	Sauble No. 1	Sauble No. 2	Sauble No. 3	Wolf
Game fish:														
Northern pike	x	x	x		x									x
Largemouth bass	x	x	x	x		x	x	x	x	x	x			x
Smallmouth bass	x	x		x										
Brown trout											x		x	
Brook trout											x			
Cisco					x									
Yellow perch	x	x	x		x	x	x	x	x	x	x	x		x
Bluegill	x	x	x	x		x	x	x	x	x	x		x	x
Pumpkinseed	x	x					x		x		x			
Black crappie	x	x	x								x			
Rock bass	x		x		x		x			x	x			
Green sunfish	x						x			x	x			
Longear sunfish											x			
B'gillxP'seed hyb.		x												x
Coarse fish:														
White sucker		x	x	x					x		x		x	
Yellow bullhead		x	x			x			x		x			
Brown bullhead		x												
Forage fish:														
Bluntnose minnow		✓*	x	x			x	x	x	x	x			
Blacknose shiner		✓*	x						x					
Blackchin shiner			x				x							
Sand shiner		x												
Creek chub		✓*				x								
Mudminnow			x			x	x		x					x
Banded killifish	x	✓*					x	x	x	x	x			
Johnny darter		x									x			
Iowa darter			x						x	x	x			
Least darter											x			
Brook silversides	x													
Sculpin			x											
Brook stickleback			x											
Tadpole madtom		✓*												
Mimic shiner		✓*						✓*						

✓ These species collected by 1937 survey crew.
✓* Collected by P. H. Eschmeyer, 1948.

is that the transferred fish will augment the supply of brood fish already present to the extent that the bluegill population of the lake will be materially increased by natural reproduction.

Management Program

No particular management procedures are suggested for Big Bass Lake. Results of the survey and general creel census records indicate that it supports a varied population of game fish. All species grow at least at an average rate. Shore seining for young fish produced fair numbers of most resident game species, indicating a continuous recruitment to the population of adult fish. Cover and spawning areas are adequate so the lake may be regarded as a self-supporting unit.

Big Star Lake

During the 1953 investigation, no information came to light which would substantially alter the management recommendations made in 1942. There are certain observations concerning the sport fishing in this lake which should be recorded.

Correspondence in our files (February 14, 1951) indicates that northern pike first appeared in the anglers' catch at Big Star Lake during the summer of 1949. During the winter of 1949-50, large numbers of pike were caught by ice fishermen. Since that time pike fishing has declined. The rather sudden appearance of pike in the lake (and in the fishermen's catch) possibly resulted from casual stocking by some angler, followed by a year or two of successful spawning, or from a small population of pike already resident in the lake. Since that time the pike harvest has been declining, and annual production is thought to have been low. Good spawning areas for pike at Big Star Lake are not numerous. Pike will probably continue to exist here in rather limited numbers, unless a period

of high water again encourages a good hatch. If the latter situation develops, good pike fishing will naturally again follow for a few years.

The decline in growth rate of bluegills, perch, and crappies since the period 1937-1950 is possibly explained by the appearance of pike during the period 1949-51. Prior to 1948 or 1949, perch, crappies, and largemouth bass were the chief predatory species in this lake. Of the three, perch is considered the most efficient predator. Before 1948, the perch was acting as the main controlling species. With the appearance of pike in considerable numbers, the perch population probably suffered some reduction through predation by pike, and thus could no longer act as an effective control on the bluegills. In other words, the pike's contribution was to temporarily upset the existing balance. In the meantime, bluegills and crappies have become abundant. Perch of smaller size are forced to compete with bluegills and crappies for food, so there has also been a decline in the growth rate of perch.

At present, no specific management recommendations are offered. Fish populations are not static. In any lake the relative abundance of the various species is constantly shifting. At the present time, Big Star Lake appears to be overpopulated with bluegills and crappies. Following the decline of pike, it is quite possible that perch will again assume a dominant position, resulting in improved growth by bluegills and crappies. A second possibility is that pike will increase, particularly if they should have a year or two of good spawning conditions.

Cool Lake

At the present time, no definite management recommendations can be made. Information at hand is insufficiently conclusive to permit a clear-cut program. The lake appears to have possibilities for trout, but before an experimental introduction is made three steps should be taken:

1. Repeat the water analysis during the critical summer period to definitely determine whether there is a stratum of water suitable for trout.
2. Learn something more of the abundance of northern pike. Present evidence indicates that the pike limits success of trout in lakes.
3. Determine definitely whether trout and ciscoes are already present.

The district fisheries supervisor should make this further study of Cool Lake, and then make definite recommendations for a management program.

Idlewild Lake

The small catch taken by netting in September of 1953 indicated that Idlewild Lake supports only a small population of fish. What feature or features are responsible for the low productivity were not determined by the brief study. Low productivity frequently is a characteristic of marl-bottomed lakes; the presence of marl soil on the bottom, together with surrounding low-grade land, may well be the basis for the poorness of Idlewild Lake. Experiments are now under way to find means of improving the fertility of marl lakes.

This lake is also characterized by a scarcity of plant life. To furnish additional protective cover for small fish, as well as to concentrate fish of larger size for the benefit of anglers, introduction of brush shelters is recommended.

No perch were taken by netting nor have any been recorded by the general creel census. Some further investigation should be made by the district fisheries supervisor to verify apparent absence of perch, and, if verified, an introductory planting of this species should be made.

Spearing of carp should continue to be permitted.

Little Bass Lake

General creel census records show a degree of fishing success on Little Bass Lake that is only slightly below that for other Lake County lakes. Rainbow trout planted here in 1950 did not provide satisfactory fishing for this species. It is possible that predation by northern pike was responsible for poor survival of the trout. Presence of an abundant population of pike does not augur well for the success of trout, and we usually do not recommend stocking of trout where pike are numerous.

The netting results indicated the presence of a large population of ciscoes in Little Bass Lake. Since this species is being utilized very little, if at all, it is recommended that gill netting and spearing of ciscoes be permitted here in the fall season as it is in a number of lakes in the southern part of the state. Included in these provisions is a netting season that extends from November 15 to December 10, under a special license costing $1.00, and use of gill nets with mesh sizes of not less than 2-1/4 inches nor more than 4 inches, stretch measure.

Loon Lake

No particular recommendations for management of this lake are suggested. The present fish population is in good condition, as indicated by the growth rates. Largemouth bass may be growing slowly, but creel census records show that both large- and smallmouth bass are caught to some extent. Cover and spawning areas are adequate. The lake is not suited for cold-water species such as trout.

Orchard Lake

From information on hand, the fish population of Orchard Lake appears to be in a healthy condition, and no recommendations are offered, other than to leave the lake alone. Cover and spawning areas are adequate for

the species present. The food supply is probably sufficient, as judged from the satisfactory growth rates. Introduction of other species probably would not make a substantial contribution, and could disturb the present balance.

Paradise (Mill) Lake

No concrete management proposals for Paradise Lake can be offered at this time. The lake appears to be rather unproductive and offers no better than fair fishing at present. More netting, and a water analysis in midsummer would be desirable. With the sketchy information available at the present time, no soundly conceived recommendations can be made. The suggested midsummer water analysis may reveal trout possibilities.

Putman Lake

No management recommendations are made for Putman Lake at this time. This lake presently provides good fishing.

Sauble Lakes

Sauble Lake No. 1

Since cover is generally sparse in Sauble Lake No. 1, installation of some brush shelters is recommended. The shelters installed by the CCC have deteriorated, although the broken-down remains are still visible. It is suggested that a conservative number of new structures be introduced, off the east and west shores. There is a considerable amount of vegetation in the shallow bay at the north end of the lake, so this area does not need additional cover. The south and southwest sides should also be kept free of brush shelters because these areas are used for bathing.

No other management recommendation is made at this time. Goodly numbers of fish and a wide variety of species make this an attractive lake for fishing. More fishing should be done for the trout, and it is

very likely that trout will in the future get more attention from anglers now that it is known a sizeable population of these fish is present.

Purchasing land, either on Lake No. 1 or one of the others in the chain, to assure continued public access, would be desirable.

Sauble Lakes No. 2 and No. 3

No new management recommendations are proposed for these waters which appear to be quite productive. As suggested for Lake No. 1, fishing for trout in Lake No. 3 ought to be given some attention. These lakes, as well as No. 4, should be mapped.

Seaman Lake

As indicated in the discussion section, this lake is approaching a senescent condition. From all data at hand, it appears to be rather unproductive, and no genuinely hopeful management suggestions can be offered. At present, the lake offers fair pan fishing, particularly for perch, which reach desirable size. Introduction of a few northern pike might offer further variety to the fishing, particularly if there are suitable spawning areas for pike. The pike is a tolerant species and frequently does well in bog lakes.

If the introduction of northern pike is considered, absence of pike should be verified; for if they are already present in very limited numbers, it suggests that spawning areas for pike are scarce. Stocking pike on a maintenance basis is not recommended. However, if they are not present, an introduction of 500 fingerling northerns, or 50 adults could be tried.

Wolf Lake

The current management program at Wolf Lake has included provision of brush shelters. In the fall of 1951, 340 shelters in 68 groups of 5 were installed. These were added to provide protection for small fish.

The second step in the management procedure has been to try to evaluate the effect of the shelters through seining and netting operations. This evaluation is to continue.

Thirdly, in 1953, about 2,500 bluegills from Big Star Lake were stocked in Wolf Lake. As pointed out earlier, the hoped-for result is that natural reproduction of bluegills will be increased by added cover (brush shelters) and more brood stock (transferred fish). Additional plantings of bluegills are not contemplated at present. The success of the 1953 introduction should be observed first.

In order to follow results from the above program, additional fish collecting during 1954 or 1955 is planned. Such checking will help to determine if natural reproduction has increased and whether the transferred bluegills have survived. Continual checking of results from the management practices is of considerable importance, and fishermen on Wolf Lake can be of great assistance by reporting any capture of marked bluegills.

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