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REPORT NO. 673

A FISHERIES SURVEY OF THE "SHAKEY LAKES" (LONG, BASS, AND BAKER) IN MENOMINEE COUNTY

By

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The lakes included in this report are located in Lake township, Menominee County (T 35 N, R. 28, 29 W., Secs. 13, 18, 19, 24). They are parts of the Shakey River drainage. Long Lake actually constitutes a part of that river, while Bass and Baker lie very close to, and are connected directly with the flowage. They are readily accessible from Stephenson via a good county road, #352, and are about 30 miles from Menominee.

Hydrographic maps used in the survey of these lakes were prepared by the Institute for Fisheries Research during the winter of 1939-40. The mapping party was headed by Mr. Floyd Ames, who reported on the general morphological conditions of lakes in this county during 1939-40 (Institute Report No. 584). Both the winter mapping and summer inventory work on these lakes were made easier by the cooperation and aid of Mr. Clarence Lienna, Conservation Officer; Mr. Stanley Shust, Supervisor of Fisheries Operations in Hatchery District No. 2; Mr. Alex Hillsdale of the Menominee County Road Commission and Mr. Frank Lee at the Whispering Pines Club. These men and others furnished information regarding the history, stocking, and dam specifications on these lakes.

The data included in this report were collected during the period June 18 - July 5, 1940.*/

These lakes, lying in a group on the Shakey River about one mile upstream from the mouth of this river, are parts of the old river basin. Long Lake, which includes the following preexisting lakes within its shoreline: East, West, Resort, and Becker, actually occupies the river channel and its side branches. Bass and Baker Lakes, connected with each other by a broad channel, maintain the same water level as Long because they are actually parts of the latter. A road grade passes between Long Lake and Bass, the lowermost of the Bass-Baker combination. However, the two are joined by a large culvert, six feet in diameter, which is negotiable by boat and through which level changes in one or the other lake are compensated. Long Lake was formed by an old logging dam. This dam was constructed in the Shakey River to furnish water head sufficient to float logs to the Menominee River into which the Shakey flows. Sometime prior to 1926, probably in the first decade of this century, the dam was either destroyed or went out, and the level of Long Lake was lowered about 10 feet. Each of the low portions of Long Lake basin became a separate lake connected with the others by a rather narrow, mucky channel. Dr. John N. Lowe made a reconnoissance survey of these waters during the summers of 1926 - 1927. He reported that the lakes were heavily populated with game fish of most every species common to the area. Forage fish and crayfish were abundant. Fishing was apparently good and the population considered large enough at that time to prompt the statement: "No further planting of fish necessary for years to come." Northern pike, largemouth bass, and perch were the dominant species of game fish. Smallmouth bass, black crappie, bullheads, walleye pike, rock bass, common sunfish, and bluegills were present. The northern pike were quite abundant and "grew to good size". One which was seen weighed 12½ pounds. Walleye pike were introduced

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*/The survey party personnel consisted of Fred E. Locke, Aquatic Biologist I, leader, Irving J. Cantrall and Burton P. Hunt, Fisheries Technicians A, and Pat Galvin, Fish Culturist C, assistants.

in the fall of 1925. Dr. Lowe objected strenuously to this introduction and underlined the words "Keep walleyes out", in all of his notes on these waters.

Vast beds of vegetation, wild rice, lilies, pondweeds, and coontail were noted by him. He also saw many ducks on these waters.

Information obtained from fishermen during the 1940 survey brings out the fact that the catch in these lakes has undergone a decided change in the last 8 - 10 years. Previous to the installation of the present dam in 1932, walleye pike and smallmouth bass were caught. Now, few, if any, of either species are taken. Fishermen agree that the population of largemouth bass has declined since the water level was raised. Some anglers report that northern pike have increased in numbers.

The Shakey Lakes area is a very good recreational center. A county park is located on Long Lake and approximately 15 cottages have been built on the shores of what used to be Resort and West Lakes. Three boat liveries are located on the shores. Few lakes in this area provide good fishing and recreational facilities such as swimming, boating and camping. For this reason these lakes are potentially important as public waters, and their possibilities as recreational centers should be developed.

Physical Characteristics

Long Lake. The basin of this lake is relatively shallow over much of its area. It has a maximum depth of 43 feet and an area of 284 acres. Formation of this basin is generally attributed to the development of Shakey River. Like many river lakes, the basin and shoreline of Long Lake are very irregular. Long Lake has a shoreline development of 3.4, which means that the shoreline is 3.4 times longer than it would be were it the circumference of a circle which enclosed the area of the lake. All other things being equal, the higher the shore development the greater the productivity of the water in question. This factor is an expression of irregularity of shoreline. Irregularities, such as bays, coves and protected indentations are usually the most productive areas of a lake.

The country around the lake and Shakey River is rather sandy, flat and covered with second growth pine and scrub oak. The river course is densely wooded and almost impassable. Cedars, tag alder and swamp vegetation line the river banks. There are a few pastured and cultivated tracts within the drainage basin of Shakey River. This basin is approximately 45 square miles in extent. Consequently, Shakey River is a good sized stream where it enters the east side of Long Lake. It maintains the lake level almost constant depending on the control boards in the dam at the outlet of Long Lake. This dam was constructed in 1932 by the County Road Commission and raised the level of Long Lake about 8 - 10 feet, thus consolidating all of the separate basins which had existed since the old logging dam, described above, went out. The dam is concrete and dirt fill construction. Six 6-feet steel culverts in it aid in the control of water level of Long Lake. Five of these culverts are equipped with slash boards. The sixth was so installed as to make it possible to remove water from the lower part of the dam. This latter gate has not been in operation for sometime as a more uniform level can be maintained by use of the slash boards. A fish chute or ladder was installed in one culvert and was in good working order at the time of the survey. From this dam Shakey River courses through low plains and dense woods to the Menominee River, about one-half mile below the lakes.

Bottom types in Long Lake are predominately peaty. Fibrous peat constitutes practically all of the bottom on the shoals. Some sand occurs near shore and extends to depths of 2 - 3 feet in restricted areas. The bottom under deep water is almost exclusively pulpy and fibrous peat. Some marl deposits are found in a small area.

Water in Long lake is quite brown in color. This color and some suspended organic matter make the water turbid enough to obscure a secchi disc at a depth of 5 or 6 feet. It was noted, while taking samples of water for chemical analysis, that the water became increasingly clear with increase in depth below the thermocline. Most of the color and turbidity, then, is believed to be due

to river water which at the time of the survey was running in the surface layers of the lake.

Bass and Baker Lakes. Immediately to the south of and connected by a large culvert to Long Lake, Bass and Baker Lakes form a unit sufficiently different from the Long Lake basin to be considered independently. Actually, these lakes are part of the Shakey Lakes group. Their level is determined by the level of Long Lake. Migration of fish between them and Long Lake is unobstructed. Bass and Baker Lakes, although separate basins, are connected by a channel 300 feet long and from 25 - 100 feet wide. These lakes have had a history similar to that of Long Lake. Their levels were raised by the original dam and lowered when this dam went out. They were restored to their present level with the installation of the dam now functional at the lower end of Long Lake.

The early history of fishing in these lakes is very similar to that of Long Lake in that a decline of largemouth bass followed installation of the dam in Long Lake. It is thought by some fishermen that the bluegill catch has increased in the past five years. No resort or cottage development has been made on the shores of these lakes. They are close enough to the Shakey Lakes county park to be an integral part of that recreational area.

The basins of Bass and Baker Lakes are shallow. Much of their area is shallower than 10 feet. Although the lakes are not in the present river channel, their general location would lead one to believe that they were once a part of the Shakey River. They were probably cut off as an oxbow during the development of the river. The same general topographic features of the country surrounding Long Lake are common to Bass and Baker Lakes. There are no inlets to these lakes other than the occasional inflow of water through the outlet when the level of Long Lake is raised.

Bass and Baker Lakes cover an area of 110.3 acres, 58 per cent of which is considered as shoal. The maximum depth is 16 feet. Shoreline development for the two basins is 2.1 which is 1.3 below that for Long Lake. This difference means

that the shoreline of Bass and Baker Lakes is about 1/3 as irregular as the shoreline of Long Lake. The bottom constituents in both shoal and deep areas of these lakes are predominately marl. Fibrous peat and sand occur sparingly on the shoal regions. Water in Bass and Baker is generally clear, quite colorless and transparent. A secchi disc can be seen at depths of 9 feet. At times, the waters appear to have a greenish hue, due to the marly lake bottom. But, periodically, they become brownish in color especially when water from Long Lake is flowing into Bass Lake.

Considering the physical characteristics of Long, Bass and Baker Lakes, one is impressed by their suitability for high production of fish, fish foods and plants. The lake basins are shallow enough for most of their extent to come within the productive volume. Irregularities of the shoreline forming protected bays and coves encourage plant beds and fish food production. Regulation of water level fluctuation insures, to a certain extent, the proper levels for most efficient spawning of game fish. The inflow of Shakey River adds fertility to the lakes by a rather rapid lake water exchange. The lakes are so shaped and situated that prevailing winds from the west and northwest cause little or no changes to occur on exposed shores. Their long axes run practically northeast-southwest. Such protection accomplishes two purposes. Aquatic plants can grow undisturbed and fibrous peat, the predominant shoal bottom, can become sufficiently consolidated to produce a bottom fauna where otherwise very little would be present. Bottom constituents of these lakes are none too productive. However, they do produce vast plant beds which, as studies have shown, carry most of the invertebrate food utilized by fish.

Chemical and Thermal Characteristics

The importance of a knowledge of thermal and chemical attributes in a lake under management cannot be overemphasized. Fish and fish foods have maximum, minimum, and optimum ranges in their reactions to every factor in their environment. Some of these toleration ranges are broad while others are quite narrow.

For example, trout are killed by temperatures over 80°F if exposed to them for any length of time. Their optimum temperature range is 60 - 70°F while their minimum is probably near or directly at freezing. Still, they do not thrive in waters which remain colder than 55°F. Warm water species of fish have an optimum range somewhere between 75 and 85°F and can tolerate temperatures in the nineties, and also temperatures below 75°, although growth is slowed down considerably. Oxygen requirements of fish also vary over a wide range, each species requiring a somewhat different set of conditions. Fish foods and plants react quite definitely to acid or alkaline water conditions. Excess or lack of certain chemical salts in solution determine the ecological assemblage of organisms inhabiting a given water. The seasonal history of each of these environmental factors is of definite significance.

As water warms up and cools down it changes density, being lightest when warm and heaviest when around 39°Fahrenheit. From this point of maximum density it becomes lighter as it approaches freezing. In lakes sufficiently deep to minimize the mixing effect of wave action, stratification of the water results from temperature changes. Melting of winter ice and warming the surface water to 39°F causes the heavier water at the surface to sink through the colder layers immediately beneath the surface bringing all the water in the lake to a common temperature, usually, 39°F. Surface waters continue to warm up and become lighter. They remain in the upper portion of the lake. At a point where they join the heavier, colder waters of the depth, there is a zone of rapid temperature drop. When this drop is 1.8°F or more for every 3 feet increase in depth, it is called a thermocline. For convenience, the three zones thus formed are called: epilimnion, the zone between surface and thermocline; thermocline, zone of rapid temperature change; and hypolimnion, the zone from thermocline to lake bottom. This stratified condition remains in a lake throughout the summer and since water in the hypolimnion is isolated from surface oxygen supplies, it very

often stagnates, i.e., loses its oxygen and accumulates carbon dioxide. When such a condition exists, the lake is said to be chemically stratified. Fish cannot live in these deeper waters and fish food production is reduced to a minimum. It very often happens that organic matter is so sparse in the hypolimnion that oxygen in the water is not consumed. Very little if any chemical stratification occurs under such conditions and these cold depths are habitable by fish and their food organisms. Such a lake could be stocked with trout because it would offer them a place of retreat when the surface waters became too warm during summer. A lake which loses its oxygen in and below the thermocline could accomodate warm water fish only. Following the summer period of stratification, surface waters are cooled by the atmosphere of autumn. As they reach the point of maximum density, they settle through the warmer layers beneath. This process goes on until once again the lake has a temperature near 39°F, common to all depths. Cooling of surface waters to the freezing point makes them lighter and they remain at the surface where ice of winter is formed. The two periods of universal temperature and density of the water in a lake are called "turnovers", because, actually, surface water has traded places or become thoroughly mixed with bottom water. These mixings or turnovers oxygenate water at all depths. Carbon dioxide accumulations are released to the atmosphere. Acidity, caused by this gas, is eliminated and very often dissolved alkaline salts restore the bottom water to an alkaline condition.

Chemical and thermal attributes of Long, Bass, and Baker Lakes as found during the survey are given in Table I. Long Lake is thermally stratified, in its deeper portions as is shown by results at stations 2, 3, and 5. The top of the thermocline ranged between depths of 9 - 15 feet, the bottom between depths of 15 - 30 feet. Temperature drops in this zone, which varied in thickness from 6 - 8 feet ranged between 9° and 13°F. Surface temperatures were comparatively low. It is believed they were lower than they would be during the same period of an average year, as the survey was made during a spell of abnormally cool weather.

TABLE I

Summary of Temperature and Chemical Conditions in Long, Bass and Baker Lakes

	Date	Surface Temp. (F)	Surface O_2 p.p.m.	Surface CO_2 p.p.m.	Bottom Depth	Bottom Temp. (F)	Bottom O_2 p.p.m.	Bottom CO_2 p.p.m.	Depth
Long Lake									
Sta. 1 - In west arm near outlet.	6/25/40	63°	6.0 5.6	2.0	- - - - - - - - - - -		S t a t i o n		r u n
Sta. 2 - In 40' depression in west arm about midway between north and south shores where arm is widest.	6/27/40	66°	6.0	0.0	41'	41°	0.0	13.0	12'
Sta. 3 - In 40' hole in north arm S8E of point at Whispering Pines Resort about 1/3 of the way across the lake.	6/27/40	70°	6.95	0.0	36'	50°	0.6	5.5	15'
Sta. 4 - In Baker Lake, about 1/3 of the way across the lake on a line running from NE point to the center of the bay at NW end.	6/29/40	68°	6.8	0.0	8'	66°	...	...	- - -
Sta. 5 - In 20' depression in south bay of east arm.	7/1/40	69°	6.6	0.0	24'	49°	1.5	9.0	9'
Bass and Baker Lakes									
Sta. 1 - In 10' hole in Bass Lake just east of a point on the north shore and but a short distance from the bridge at lower end of lake where County road no. 352 crosses.	6/27/40	68°	...	...	9'	67°	- - - - - - - -		- - -
Sta. 2 - In 10' depression in approximately the center of Baker Lake.	6/29/40	72°	8.9	0.0	14'	66°	8.6	0.0	- - -

	Thermocline								Range M. O. Alkalinity p.p.m.	Range pH, top to Bottom
	Top				Bottom					
CO_2 p.p.m.	Depth	Temp.	O_2 p.p.m.	CO_2 p.p.m.	Depth	Temp.	O_2 p.p.m.	CO_2 p.p.m.		
i o n	r u n a t suu r f a c e o n l y.- -								Surf. 97	Surf. 7.6
13.0	12'	62°	3.7	1.0	30'	42°	0.9	8.0	110 - 180	8.3 - 7.2
5.5	15'	62°	...	...	21'	53°	3.2	4.0	139 - 143	8.0 - 7.2
...	- - - - - - - - - - - - - - - - - No Thermocline - - - - - - - - - - - - - - - - - -								Surf. 147	Surf. 8.2
9.0	9'	69°	5.6	0.0	15'	56°	3.05	2.0	131 - 146	8.0 - 7.3
- - - -	- - - - - - - - - - - - - - - - - No Thermocline - - - - - - - - - - - - - - - - -								117 at 6'	8.4 at 6'
- - - -	- - - - - 9.3 p.p.m. O_2 at 6'- -									
	0.0 p.p.m. CO_2 at 6'									
0.0	- - - - - - - - - - - - - - - - - No Thermocline - - - - - - - - - - - - - - - - -								86 - 87	8.3 - 8.3

Oxygen concentrations ranged from 5.6 to 6.95 parts per million at the surface. At the top of the thermocline, they were 3.7 and 5.6 p.p.m. in the two stations where tests were made. Oxygen at the lower limit of this zone was present, but in amounts varying from 0.9 to 3.05 p.p.m. Directly above the bottom in the deep stations, oxygen was practically absent. Carbon dioxide content of the water progressed from none at the surface to 13.0 p.p.m. at the bottom. Long Lake was found to be chemically stratified, although the oxygen concentration at the bottom of the thermocline was great enough at two stations to maintain fish life. Based on extensive seasonal studies of similar lakes, it is believed that the chemical stratification in Long Lake will become more pronounced as the season progresses, thus eliminating any likelihood of successful trout or other cold water fish maintenance. The water in Long Lake is moderately hard. It is also alkaline in reaction. Both these attributes are conducive to productivity. Some plants and fish foods thrive only in alkaline waters. It has also been found that moderately hard water usually contains the salts, physiologically essential for both plants and animals.

No thermal or chemical stratification was found in Bass and Baker Lakes. Water temperatures were comparable with those in Long Lake. These lakes are kept in circulation by wind and wave action. They are so shallow that they are mixed from top to bottom by any heavy winds. Such mixing replenishes the oxygen supply and eliminates accumulations of other gases in the water. Oxygen concentrations in these lakes were somewhat higher than those in Long Lake. Carbon dioxide was not present. The water was slightly softer, but had a higher alkaline reaction than that in Long Lake. Thermal and chemical attributes of both lakes are conducive to productivity. Oxygen was abundant at all depths, thus assuring utilization of all the lake's volume by fish and food organisms.

Biological Characteristics

Aquatic plants are very abundant in Long Lake. Pondweeds predominate there but it is difficult to determine which plants are most abundant. In Bass

and Baker Lakes, vegetation is much more restricted both in species and distribution. Very little marl deposition occurs in Long Lake, while in Bass and Baker the plants are often covered by a thin coating of marl. Such coatings retard plant growth and, in severe cases, exterminate the beds. Marly lake bottoms are generally poor substrata for plants. The accompanying table (Table 2) lists the plants found by the survey party in these lakes. The differences in abundance are apparent. Those forms usually found in marly lakes occur in Bass and Baker. Most of them occur in Long Lake in company with many other species. Vegetation in these lakes is considered adequate.

Table 2

Aquatic Plants✓ of Long, Bass, and Baker Lakes

Common Name	Scientific Name	Long	Bass	Baker
Water Weed	Anacharis canadensis	C	-	C
Water Shield	Brasenia Schreberi	C	F	F
Sedge	Carex comosa	A	-	-
Sedge	Carex diandra	C	-	-
Sedge	Carex lasciocarpa	-	-	surrounds lake
Coontail	Ceratophyllum demersum	A	-	-
Spike Rush	Eleocharis calva	C	-	-
Horsetail	Equisetum fluviatile	F	-	-
Iris	Iris versicolor	F	F	R
Water Milfoil	Myriophyllum sp.	A	C	F
Sweet Gale	Myrica gale	A	C	surrounds lake
Bushy Pondweed	Najas flexilis	-	-	C
White Water Lily	Nymphaea tuberosa	F	-	-
Yellow Water Lily	Nuphar variegatum	C	-	C
Smartweed	Polygonum natans f. genuinum	C	-	C
Pondweed	Potamogeton angustifolius	C	-	-
Variable Pondweed	Potamogeton gramineus	C	-	-
Floating Pondweed	Potamogeton natans	A	-	F
Whitestem Pondweed	Potamogeton praelongus	-	F	C
Pondweed	Potamogeton strictifolius	A	F	C
Flat-stemmed Pondweed	Potamogeton zosteriformis	A	-	C
Pondweed	Potamogeton temuifolius	C	-	-
Cinquefoil	Potentilla palustris	F	-	-
Wapato	Sagittaria latifolia f. gracilis	C	-	-
Hardstem Bulrush	Scirpus acutus	-	C	A
Softstem Bulrush	Scirpus validus	C	-	-
Cattail	Typha latifolia	-	F	C
Bladderwort	Utricularia vulgaris var. amer.	A	C	C
Muskgrass	Chara	A	A	A

✓ Plants identified by Miss Betty Robertson, University of Michigan.

Plankton (microscopic plants and animals living free in the water) in Long Lake averaged approximately 10.8 cubic centimeters per cubic meter of water. The preponderant organisms were animal forms which should afford young fish plenty of forage. In Bass and Baker Lakes, animal plankton was predominant and of sufficient volume to meet requirements of young fish. It should be pointed out that the plankton crop is not constant and fluctuates quite rapidly. Samples taken at the time of the survey are probably not representative of the average annual crop but, since the plankton was quite abundant in mid-summer, it is possible to state that it would be plentiful during spring and fall. More extensive studies of the seasonal fluctuation of plankton populations usually show that plankton is more abundant in spring and fall than in summer.

Bottom and plant inhabiting fauna in Long Lake was quite abundant. The bottom areas were not as productive as the plants. An average of 1.2 cubic centimeters of fish food organisms was found on the bottom, while 1,573 organisms constituting a volume of 11.1 cubic centimeters were taken from a 5 pound sample of plants, chiefly pondweeds, bladderwort and coontail. Snails, fresh water shrimps, fingernail clams, caddis and midge larvae, and mayfly nymphs were the common forms found on the shoals and plants. Deeper waters produced little animal life. Midge larvae, phantom midge larvae, and aquatic earthworms were the only forms found, and these were taken only occasionally. Although the organisms inhabiting the floor of Long Lake are not present in sufficient numbers and volume for them to be considered abundant, the extent to which they occur on the submerged plant beds far offsets any paucity which might otherwise result.

Fish food organisms in Bass and Baker lakes are not so abundant as in Long Lake. Snails, fingernail clams, midge larvae, and mayfly nymphs were taken on the shoals. Few organisms were found in the deeper waters. Occasional snails and midge larvae were collected. The fauna on vegetation was about 10 times scarcer than in Long Lake. Because of this lack of production in plant beds, the food in Bass and Baker Lakes is not considered adequate. The flocculent marl

bottom and active marl deposition on the plants in these lakes are believed responsible for the scarcity of invertebrate fish food. Plants coated by a thin layer of marl are not as attractive to food organisms as plants covered only by biotic coatings.

Fish taken by the survey party are listed in Table 3. Eight species of game fish were taken in Long Lake while only 6 of these were found in Bass and Baker. It is quite possible that the game fish of Long Lake also occur in Bass and Baker because of their connections with each other. The most abundant species was the bluegill. Northern pike are listed as abundant in the table but in actual numbers, they were probably less numerous than perch, largemouth bass, and black crappie. Northern pike were rare in Bass and Baker Lakes. Although a decline in the numbers of largemouth bass has been reported during the past few years, 12 adults and 219 young were taken by the survey party. Bass fry were abundant around the shores.

Black-chin shiners were the most abundant forage fish in all of these lakes. Seven species of forage fish were taken by the party. Common shiners, and golden shiners were taken in Bass and Baker Lakes, but not in Long Lake. Tadpole cats and mud minnows were secured from Long, but not from Bass and Baker. Blunt-nose minnows were common in all lakes, and ranked second in numbers present. Other species found were uncommon enough to be classed as rare. It is believed that the forage fish supply in these lakes is adequate to fill the needs of a fair population of predatory species.

Yellow bullheads, brown bullheads and common suckers constituted the catch of "rough" or "coarse" fish taken. The yellow bullheads were common, but the other two species were quite rare in occurrence. Dogfish were abundant in Long Lake but only common in Bass and Baker Lakes.

Table 3

Fish Taken from Long, Bass, and Baker Lakes

Lake	Game Fish								Forage Fishes								Coarse Fish				Obnoxious		
	Northern pike	Perch	Large m. bass	Sunfish	Bluegill	Pumpkinseed	Rock bass	Crappie		Black-chin shiner	Blunt-nose minnow	Tadpole cat	Mud minnow	Iowa Darter	Common shiner	Golden shiner		Yellow bullhead	Brown bullhead	Common sucker		Dogfish	
Long Lake	A	C	R*	R	A	R	R	C		A	R	R	C	R	-	-		C	R	-		A	
Bass and Baker Lakes	R	C	C	-	C	C	R	-		A	C	-	-	R	R	C		C	-	R		C	

*Bass declined in late years; fry common, however.

Stocking records, as compiled by the Conservation Department, for the years 1936 - 1939 inclusive, are given in Table 4. The table is self-explanatory. Attention should be called to the 680,000 pike perch or walleye pike fry stocked. None of these fish were taken by the party and no records of any having been caught could be found.

Table 4

Stocking Record - 1936-39 Inclusive

Stocking Record for Long Lake			
Species	Year Planted	No. Planted	Age of Fish
Bluegill	1936	10,000	5 mo.
"	1937	18,000	3 mo.
"	1938	22,680	4 mo.
"	1939	43,000	4 mo.
Total		93,680	
Pike Perch	1937	680,000	fry
Total		680,000	
S.M. Bass	1938	200	5 mo.
"	1939	1,900	4 mo.
Total		2,100	
L.M. Bass	1938	400	5 mo.
Total		400	
Perch	1939	11,000	7 mo.
Total		11,000	

Stocking Record for Bass and Baker Lake			
Species	Year Planted	No. Planted	Age of Fish
Bluegill	1937	12,000	3 mo.
"	1938	17,640	4 mo.
"	1939	10,000	4 mo.
Total		39,640	
S.M. Bass	1937	1,250	5 mo.
Total		1,250	

Growth rate studies made from scale samples taken by the survey party are summarized in Table 5. These scale samples were taken early in the summer. Consequently, their last year mark or annulus had just formed or was forming at the time.* Very little or no growth for the 1940 season had been made by any of the fish taken. Their lengths were reached at the close of the 1939 growing season. In specimens not bearing the 1940 annulus, one year was added to the number of annuli found on the scales, because the fish were actually a year older than the year marks on the scales would indicate. Bluegills in Long Lake reached legal length (6 inches) late in their fourth summer. This growth is near the state average for that region. Little growth is made during the following years. Seventeen specimens beginning their ninth summer averaged 7.7 inches in length and 5.3 ounces in weight. Five specimens, in their tenth year, averaged 7.9 inches in length and 5.9 ounces in weight. Bluegills from Bass and Baker Lakes grew at about the same rate. Pumpkinseed sunfish grew somewhat slower than the bluegills in Long Lake. Seven specimens averaged 6 inches in length and 2.8 ounces in weight at the end of their fifth year. In Bass and Baker Lakes growth of this species was more rapid. Two specimens at the end of their fifth year of life were 8 inches long and weighed 7.3 ounces. However, the average length of five fish which were four years old was 5.7 inches; 0.3 of an inch less than legal size. The data on rock bass from the lakes under discussion are too meagre to show trends but it appears that this species grows fairly well. Large mouth bass attain the 10 inch legal size limit sometime between their third and fourth years in both lakes. Such growth is considered slightly better than average. A seven year old specimen from Long Lake was 15.3 inches long. One of the same age group from Bass Lake was 17 inches long and weighed 2 pounds, 11 ounces. Black crappies were caught from Long Lake only. They probably

*The time of annulus formation on the scales of certain Michigan Game Fishes, Institute for Fisheries Research Report #632 by W. C. Beckman.

Table 5

Growth Rates of Fish* from Long, Bass, and Baker Lakes

Lake	Species	Age Group	No. of Specimens	Av. Tot. Length in Inches	Average Weight in Ounces
Long	Bluegill	IV	8	6.2	2.2
	"	V	17	6.2	3.2
	"	VI	9	7.3	4.8
	"	VII	27	7.2	5.4
	"	VIII	17	7.7	5.3
	"	IX	5	7.9	5.9
	Pumpkinseed	III	5	3.3	0.36
	"	IV	2	4.9	1.4
	"	V	7	6.0	2.8
	"	VI	2	7.1	4.8
	Rock Bass	VII	1	9.3	8.7
	" "	VIII	2	9.5	11.0
	L.M. Bass	III	2	8.6	5.3
	" "	IV	1	15.8	32.0
	" "	V	1	13.0	18.0
	" "	VII	1	15.3	32.0
	Black Crappie	II	1	4.2	0.6
	" "	III	1	6.8	2.4
	" "	IV	2	6.4	2.1
	" "	V	3	7.8	3.4
	" "	VI	2	9.0	6.1
	" "	VII	4	10.1	8.2
	" "	VIII	1	10.5	11.0
	Yellow Perch	II	3	4.2	0.5
	" "	III	3	4.8	0.7
Long	Yellow Perch	V	3	6.8	2.2
	" "	VIII	1	8.7	4.0
	" "	IX	1	8.6	4.4
	Great N. Pike	II	1	13.8	7.5
	" " "	III	2	16.3	12.6
	" " "	IV	10	20.7	30.2
	" " "	V	2	22.0	33.0
	" " "	VI	1	21.2	?
	" " "	VII	1	26.2	60.0
Bass and Baker	Bluegill	I	4	2.1	0.09
	"	III	1	4.2	0.8
	"	V	1	6.5	3.0
	Pumpkinseed	IV	5	5.7	2.9
	"	V	2	8.0	7.3
	"	VII	2	8.7	9.2
	"	VIII	1	8.8	8.7
	Rock Bass	V	1	8.3	6.2
	L.M. Bass	VI	1	13.3	17.0
	" "	VII	1	17.0	43.0
	Yellow Perch	I	5	3.0	0.16
	" "	II	6	3.3	0.23
	" "	V	1	7.7	3.4
	" "	VI	1	7.3	2.9
	Great N. Pike	IV	1	22.5	?
	" " "	VI	1	21.2	24.0

*Age determination by W. C. Beckman.

become legal sized fish during their third summer. They grow about an inch per year following their fourth birthday until they are seven or eight. Four 7-year olds averaged 10.1 inches in length and weighed 8.2 ounces. One, 8-year old was 10.5 inches long and weighed 11.0 ounces. Yellow perch in these lakes, grow slowly and never reach a size comparable to that attained by perch in some of our better perch lakes. They reach legal length during their fifth year. By the time they are 8 or 9, they have become 8.5 inches long, which probably represents the maximum size for perch in these lakes. A fair series of scales from northern pike indicates that these fish probably reach legal size (14 inches) during their second or early in their third year of life. Growth is comparatively slow from then on. One fish, seven years old, was 26.2 inches long and weighed three pounds, 12 ounces. Pike of this age from other lakes are often much larger (1 from Long Lake, Alpena County, was 40.5 inches long and weighed 16 pounds.). None of the game fish in Long or Bass-Baker Lakes grow rapidly. The slowness may be due to a combination of factors such as overpopulation, short growing season, lack of available food supply, adverse physical characteristics, and poor chemical nature. However, studies already discussed show that the food supply is adequate and that physical and chemical characteristics are conducive to productivity. The length of growing season may be somewhat short, but fish in other lakes at the same latitude grow more satisfactorily. Some unknown factor may be responsible for the slow growth of fish in Long, Bass and Baker Lakes, but it is almost a certainty that overpopulation plays an important role in the economics of these waters. Too many trees in a forest will cause slow growth. Sugar beets, too close together are always small. Such dwarfing occurs despite the productivity of the soil.

Occasional creel census records, taken by the Conservation Officer, have been summarized in Table 6. These records cover the years from 1928 - 1938. From this table it is noted that of 82 fishermen contacted 16% or 13 caught no fish. Fishermen spent 335 hours on the lake, an average of 4.1 hours per

Table 6

General Creel Census Data of Shakey Lake Area

Year	Number of Fishermen	Taking no fish		Total Hours Fished	Legal Fish Caught	Catch per Hour	Catch per fisherman	No. of Illegal Fish	Av. Hours per fisherman per day
		No.	%						
1928	1	...	...	4.00	2	0.50	2.0	1	4.0
1929	1	1	100	1.00	...	...	...	...	1.0
1930	12	3	25	113.00	22	0.19	1.8	19	9.4
1931	1	...	...	0.50	1	2.00	1.0	...	0.5
1932	5	1	20	13.00	18	1.38	3.6	2	2.6
1933	12	1	8	24.50	42	1.71	3.5	14	2.0
1934	5	...	...	9.00	16	1.78	3.2	...	1.8
1935	16	3	19	44.25	62	1.40	3.9	...	2.8
1936	19	2	11	85.00	123	1.45	6.5	...	4.5
1938	10	2	20	41.00	90	2.20	9.0	...	4.1
Tot. or Av.	82	13	16	335.25	376	1.12	4.6	36	4.1

Number of Each Species

Year	L.M. Bass	S.M. Bass	Blue-gill	Sun-fish	Yellow Perch	Rock Bass	Wall-eye	N. Pike	Bull-head	Sucker	Total
1928	...	...	...	...	...	...	...	...	...	2	2
1929	...	...	...	...	...	...	...	...	...	...	...
1930	1	...	...	...	...	5	...	16	...	...	22
1931	...	...	...	...	...	...	...	1	...	...	1
1932	...	1	...	4	...	7	...	2	4	...	18
1933	3	...	4	24	4	...	1	5	1	...	42
1934	4	...	9	...	...	...	...	3	...	...	16
1935	6	...	28	20	2	1	...	5	...	...	62
1936	5	...	29	69	...	...	...	20	...	...	123
1938	2	...	32	46	...	...	2	8	...	...	90
Total	21	1	102	163	6	13	3	60	5	2	376

fisherman day. 376 legal sized fish were caught at the rate of 1.12 fish per hour. This catch compares favorably with the state average for catch per hour. Sunfish and bluegills were caught most often. Northern pike and largemouth bass were next, with the northern pike totaling 60 individuals. Twenty-one largemouth bass were taken.

Spawning facilities for the various game fishes in Long, Bass and Baker Lakes are abundant. Shoal areas of gravelly sand and even coarse fibrous peat suffice for bluegills and pumpkinseed sunfish. Largemouth bass and crappies utilize the roots of emergent vegetation and brush accumulations in the fibrous peat.

Yellow perch requiring vegetation on which to spawn are amply supplied with these facilities. Northern pike can run the Shakey River or seek marshy, grassy areas in small tributaries to the lake. The relative abundance of most game species in these lakes supports the assertion that spawning facilities are adequate.

Management Suggestions

These lakes are now classified among the "all others" group. From the data presented above it is believed that this status should be retained. More intensive fishing of these lakes would be a good thing. Especially is it necessary in the case of the northern pike. Intensive pike fishing would have a tendency to reduce the now rather large pike population. However, a balance between predatory and pan fish species should be reached eventually. It would be better to allow 5 years for this to come about before any further action regarding a change in status is taken. Erection of the present dam in 1932 raised the water level sufficiently to require an ecological readjustment which, it is believed, has not yet been completed. Revamping of the control regulations before this change is completed is not sound management.

Stocking: Because of the slow growth, apparent abundance and successful spawning activities of game fish in these lakes, NO stocking is recommended. Present stocking policies should be halted. The lakes are apparently maintaining maximum populations of practically every game fish species found there with the possible exception of walleye pike and smallmouth bass. Attempts to establish a thriving population of these species have met with only mediocre success. Further attempts to establish them should be discouraged since there are species enough now in the lakes.

Predators and Parasites are not abundant in Long and Bass-Baker Lakes. No control measures are necessary.

Cover, afforded by aquatic plant beds and submerged debris, roots, and logs, is abundant in these lakes. There is no need for artificial cover or shelter installations.

Water level regulation in Long Lake, and thereby, in Bass and Baker Lakes depends on the level maintained at the dam on the lower end of Long Lake. As constant a level as possible should be maintained during spring and early summer to insure successful spawning of game fishes and survival of their young. If possible, the level should be maintained until July 15 each year. A slight increase in level during the spring would probably do no damage, but a lowering of the level 1 or 2 feet might endanger broods of young fish and also nests of certain species. It is recommended that the Menominee County Road Commission attempt to maintain a constant level in these lakes. Manipulation of the gates in the dam should make this possible.

Further study of these waters is strongly urged, not necessarily at present but within the next 5 or 10 years. More knowledge concerning the fish population and its fluctuations is necessary before a definite management plan can be formulated. Until such study is possible, further stocking and other management attempts should be curtailed. The lakes must be allowed time to stabilize themselves in accord with the new set of conditions which were imposed by the rise of 10 feet in the water level.

INSTITUTE FOR FISHERIES RESEARCH

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