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FISHERIES SURVEY OF ORCHARD LAKE, OAKLAND COUNTY, MICHIGAN

BY

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Orchard Lake lies in the southcentral part of Oakland county, in West Bloomfield township (T. 2 N., R. 9 E., Sec. 9, 10, 11, 14, 15). It is only about three miles directly southwest of Pontiac and may be reached via the Orchard Lake road from this city. The village of Orchard Lake completely surrounds the lake. There are no substantial inlets and no permanent outlet to Orchard Lake. It is reported that during high water it may drain into Cass Lake to the north. The divide between the Huron and Clinton drainages probably runs immediately west of Orchard Lake, which would place the lake in the Clinton River drainage. It lies almost directly on the divide. Upper Straits Lake, less than 1/4 mile to the west, is the eastern headwater of the Huron River, and Cass Lake (1/4 mile to the north) lies directly in the Clinton River drainage.

A map of this lake was prepared during March of 1940 by an Institute* mapping party.* This was used as a base for plotting certain information taken by the Fisheries survey party** which made the biological studies September 9 - 12 of the same year.

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* The personnel of the mapping party was as follows: Floyd Ames, leader; Si Moody and Nicholas Murphy assistants.

**The Fisheries survey party included: Fred Locke, leader; Burton Hunt and Irving Cantrall assistants.

Fishing during the past 20 years is reported as good for smallmouth bass and perch. The lake has also produced a large number of bluegills, largemouth bass and northern pike, although this last named species is reported as greatly reduced in recent years. The lake has not been heavily fished since public access has been restricted to one or two commercial resorts. It is expected that the fishing intensity will increase, now that the Department of Conservation has purchased frontage on the southeast side of the lake.

No industrial establishments are present in the immediate vicinity of the lake. The surrounding land is rather thickly occupied by many fine homes and cottages. No hotels and only one boat livery are reported. Fishing, swimming and boating make this lake one of the most important recreational lakes in this region.

Orchard Lake, like most of the lakes in Michigan, is of glacial origin.* It lies in the interlobate region which stretches southwestward from the thumb into Oakland County. It is situated in a rather large moranic basin which was formed from glacial accumulation of two ice fronts. The lake once stood at a higher level and was part of a large area of water which included Pine, Cass, Otter, Sylvan, and possibly Elizabeth Lakes.

Only one small inlet (a ten inch pipe) presumed to have its source in artesian wells or springs, was observed by the survey party. This was located on the northwest side of the lake. The adjacent shore is comparatively low except on the southeast side where rather high moranic banks are found. The surrounding country is partly wooded. The soil consists mostly of sand and gravel, and has no high agricultural value.

The lake basin is very irregular, characteristic of lakes formed near the front of glacial lobes. There are three major depressions of over

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* Information from "Inland Lakes of Michigan", by I. D. Scott.

60 feet in depth. The largest occupying the south 1/3 of the lake is divided into two sub-depressions, the most southernly one having a depth of about 90 feet and the other a depth of 111 feet. This is the deepest point in the lake, and lies approximately 1500 feet west of the point of public access. The east depression (located directly east of Apple Island) has a maximum depth of about 80 feet and the west depression, found on the opposite side of the island, has a maximum depth of about 60 feet. The water between the depressions, around Apple Island and in the whole north end of the lake, is very shallow in contrast to the depressions.

The lake has a surface area of 788 acres. The slope of the bottom is irregular and the sides of the depressions very steep. About 60% of Orchard Lake is shoal (less than 20 feet in depth). This shallow zone has a bottom composed of sand and marl. Sand predominates the very shallow area (less than five feet) and marl is the main bottom constituent down to the 30 foot contour. The lake bottom in the depressions is composed of muck (finely divided organic material).

The shore line development of Orchard Lake is 1.64. This means that the shore line is 1.64 times longer than it would be if the lake were perfectly round and of the same area. Ordinarily, lakes with a high shore line development are more productive, because this development is indicative of bays and side waters protected and abounding with vegetation and fish food.

The water is colorless and moderately clear. A white (secchi) disc was visible to a depth of 14 feet.

Most of the physical factors operating in Orchard Lake are favorable to high productivity. Only a small portion of the shallow water is without weed beds. This is along the southwest beach where the movement of the sand due to wind action has prevented the establishment of aquatic vegetation. The presence of a large island near the center in this lake is undoubtedly important in controlling the wave action, since the sweep is reduced to a com-

paratively short distance. The extensive shoal areas and spawning grounds, fertile bottom deposits and protection from strong wind and wave action allows this lake to produce much fish food and, consequently, fish.

Temperature and chemical studies were made during the survey (9/9-11/40). A summary of this is given in the following table:

Depth in Feet		Temp. °F		Oxygen ppm.		Methyl Orange Alkalinity ppm.		pH	
I*	II**	I	II	I	II	I	II	I	II
0	0	72	66	7.4	8.5	93	94	8.4	8.4
3	3	72	66	...	...	...	...	...	...
6	6	71	66	...	...	...	...	...	...
9	9	70	66	...	...	...	...	...	...
12	12	69	66	...	...	...	...	...	...
15	15	67	66	...	...	...	...	...	...
18	18	66	66	...	...	...	...	...	...
21	21	66	66	...	...	...	...	...	...
24	24	65	65	...	...	...	...	...	...
27	27	65	65	8.7	...	94	...	8.4	...
30	30	63	64	...	6.5	...	96	...	8.4
33	33	58	62	...	...	...	...	...	...
36	36	51	58	6.8	...	109	...	8.0	...
39	39	47	54	...	2.8	...	108	...	7.6
42	42	46	50	...	...	...	...	...	...
45	45	46	49	...	...	...	...	...	...
48	48	46	47	...	...	...	...	...	...
51	51	46	47	...	...	...	...	...	...
54	54	46	47	...	...	...	...	...	...
57	57	46	47	...	...	...	...	...	...
60	60	45	46	...	...	...	...	...	...
63	63	45	46	...	...	...	...	...	...
66	66	45	46	...	...	...	...	...	...
69	69	45	46	...	...	...	...	...	...
72	72	45	46	...	0.1	...	115	...	7.4
75	...	45	...	...	...	...	...	...	...
78	...	45	...	...	...	...	...	...	...
81	...	45	...	...	...	...	...	...	...
84	...	44	...	...	...	...	...	...	...
87	...	44	...	...	...	...	...	...	...
91	...	44	...	...	...	...	...	...	...
93	...	44	...	...	...	...	...	...	...
96	...	44	...	...	...	...	...	...	...
99	...	44	...	0.5	...	114	...	7.3	...

* Sta. 1 - South Depression
** Sta. 2 - East Depression

As the above table indicates there is a great deal of difference in temperature from the top to the bottom in Orchard Lake. The thermocline (zone of rapid change in temperature) occurs between 30 and 39 feet in the south depression and

between 30 and 42 feet in the east depression. It is very probable that temperature conditions are similar in the west depression, although no data were taken. This difference in temperature is of significance because the water of the thermocline is suitable for cold water fish, not only because of the colder temperatures maintained during the height of the summer period, but because the oxygen supply is adequate there for fish. Dissolved oxygen varied from 7.4 to 8.5 p.p.m. at the surface, from 6.5 to 87 at 30 feet, and from 2.8 (39 feet) to 6.8 (36 feet) at the bottom of the thermocline. With a water temperature of 46°F at 72 feet (bottom) in the east depression, the oxygen was 0.1 p.p.m. In the bottom of the south depression (99 feet) the oxygen was 0.5 p.p.m.

The zone of water between 25 and 40 feet has suitable temperatures and sufficient oxygen throughout the year to support cisco and possibly trout, and of course during spring and fall the entire lake would be suitable for these fish.

The water of Orchard Lake is moderately hard (methyl orange alkalinity 93 - 115 p.p.m.) and distinctly alkaline (pH 7.3 - 8.4). It is a known fact that moderately hard water lakes are more productive than those containing soft water. Aquatic plants, which are fundamental to good fish food production, find conditions in lakes of this kind more suitable for growth.

In conclusion, it might be said that Orchard Lake has very favorable temperature and chemical conditions for the growth and reproduction of fish. These conditions are not only favorable to the production of warm water fish, such as bass and bluegills, but to a limited population of coldwater fish, such as cisco and trout.

No pollution of any kind was reported for this lake.

Aquatic vegetation is reported as extensive and fairly abundant in Orchard Lake. A list of fifteen species collected during the survey is given in the following table. Several other species are probably present but were not collected due to their disappearance before the survey was made in September.

Common Name	Scientific Name	Abundance
Waterweed	Anacharis canadensis	abundant - common
Hornwort; Coontail	Ceratophyllum demersum	abundant
Bushy Pondweed	Najas flexilis	abundant
Large-leaf Pondweed	Potamogeton amplifolius	common
Pondweed	Potamogeton angustifolius	common
Variable Pondweed	Potamogeton gramineus	rare
Pondweed	Potamogeton gramineus, graminifolius myriophyllus	abundant
Sago Pondweed	Potamogeton pectinatus	abundant
Clasping-leaf Pondweed	Potamogeton Richardsonii	common
Robbins' Pondweed	Potamogeton Robbinsii	common
Pondweed	Potamogeton sp.	rare
Hardstem Bulrush	Scirpus acutus	abundant
Three-square	Scirpus americanus	common
Common Cattail	Typha latifolia	abundant
Wild Celery	Vallisneria spiralis	common
	Chara	abundant

Submerged vegetation, consisting mostly of pondweed and coontail, is abundant in the partly protected areas but is either thinly scattered or completely lacking in the most exposed region. Emergent beds were reported near the protected shore and around Apple Island. Floating species were found only in the two west bays.

There seems to be an adequate supply of aquatic vegetation in Orchard Lake. It is not extremely abundant, but sufficient to supply the requirements for a good fish population. Fish abundance in this lake is evidence of adequate aquatic vegetation.

A study was made of the fish-foods present in Orchard Lake in connection with the survey. Plankton (small microscopical, free floating plants and animals) samples showed that the animal forms were most abundant. There was an average of approximately 3.2 cc of organisms per cubic meter of water. A rich plankton population is essential to high fish productivity because it occupies a fundamental link in the food chain. Plankton is food of many fish food

organisms as well as the food of many young fish.

On the shoals, clams, snails, scuds, and mayflies were abundant. Vegetation supported many of these same forms, particularly mayflies and scuds, and in addition, many caddis nymphs, midge larvae, and water mites. The deep, mucky bottom samples showed comparatively small numbers of worms and midges.

On the whole, the food conditions in Orchard Lake seem to be favorable to high fish production and entirely satisfactory.

Fish studies were made in order to determine the abundance of each species and the growth rate of game species. The kinds and abundance of fish are summarized in the following table. Stocking during the past five years (1935 - 1939) is also included in this table.

Game Fish	Abundance	Previous Stocking (1935-39)
Walleye pike	None taken or reported	706,000 fry
Northern pike	Few	None
Yellow perch	Common	37,200 (7 mo.)
Large-mouth bass	Abundant	3,375 (4 mo.)
Small-mouth bass	Common	1,050 (3 mo.)
Rock bass	Common	None
Bluegill	Very abundant	85,500 (3-6 mo.)
Pumpkinseed	Common	None
Long-eared sunfish	Few	None
Green sunfish	Few	None
Crappie	Reported	None
Cisco	Common	None
Forage Fish		
Black-nosed shiner	Few	
Black-chin shiner	Common	
Mimic shiner	Common	
Straw-colored shiner	Common	
Blunt-nosed minnow	Abundant	
Minona killifish	Few	
Johnny darter	Common	
Silversides	Abundant	
Fantail darter	Rare	
Coarse Fish		
Yellow bullhead	Common	
Brown bullhead	Few	
"Obnoxious Fish"		
Long-nosed gar	Common	

Bluegills appear to be by far the most abundant game fish present, with largemouth bass, perch, and sunfish being common to abundant. Forage fish are abundant with the blunt-nose minnow, straw-colored shiner, and silverside being the most common species. The yellow bullhead is the most common coarse fish, and the long-nosed gar was the only predaceous non-game fish taken.

As can be seen, heavy plantings of largemouthed bass, bluegills, perch, and walleye pike have been made in this lake. The present population of fish may be a justification for these plantings except in the instance of Walleye pike, which were neither taken or reported even though approximately 3/4 of a million have been stocked during the past five years (1934-39).

There are other things to be considered besides the abundance of gamefish in a lake. The growth rate and general conditions of the species present is just as important to good fishing as the number of available fish. In cases where heavy populations of small fish occur, there is often a scarcity of legal sized ones. Size has obvious significance in such an instance and most fishermen will admit that fewer large fish are to be preferred to numerous small individuals. In Orchard Lake the rate of growth and condition of the fish are good. A summary of the age and size of fish taken is given in the following table.*

Yellow perch reach legal length early in their third year of life, while largemouth bass reach 10 inches just about a year later. Bluegills grow rather slowly in that they do not reach legal length until late in their fourth summer, while sunfish take five to six years to reach this size. The one northern pike showed unusual growth, i.e., 17.2 inches total length late in its second year.

On the whole, this growth rate for the game fish is above average for pike and perch, and slightly below average for bluegills and sunfish. This can be explained on the basis of an exceptionally large population of the last named two species, and a comparatively small population of the first two. An increase in the relative abundance of the "fish eating" to the "bug eating" species will

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* Age determination by William C. Beckman.

Species	Age Group	No. of Specimens	Av. Total Length in Inches	Av. Weight in Ounces
Perch	II	3	6.5	1.6
	III	1	7.8	3.1
	IV	1	11.3	10.3
	V	2	11.1	10.1
	VII	3	10.8	10.6
Northern pike	I	1	17.2	20.0
Large-mouth bass	II	4	8.6	4.5
	III	3	13.5	5.0
Rock bass	II	2	3.8	0.6
	III ?	1	4.7	1.0
	IV	1	7.3	3.8
Bluegill	I	18	2.3	0.1
	II	19	3.7	0.4
	III	8	5.7	1.7
	VI	1	8.8	7.5
	VII	1	9.0	8.1
	VIII	1	9.1	8.1
Pumpkinseed	I	1	2.5	0.1
	II	8	3.5	0.5
	III	2	5.3	1.9
	IV	1	6.4	3.5
	V	1	7.5	5.3
	VI	1	7.1	4.7
Cisco	IV	1	12.8	11.2
	VII	2	12.5	11.6
	VIII	1	13.3	11.0

undoubtedly effect the growth rate of the latter. The purchase of public frontage on this lake, making it more readily accessible to the public, may increase the fishing pressure a great deal. Just how this may effect the present fish population cannot be predicted.

Creel census records taken by Conservation Officers on Orchard Lake since 1928 are summarized in the following table. On the basis of 95 fishermen scattered over the years between 1928 and 1940, the catch of legal fish per hour is 3.7. This is rather high when compared to the state average of the general creel census of 1.1. During 1940 when 37 records were taken, the catch per hour was 6.5 fish which is far above what might be considered good fishing. Blue gills

Date	Number of Fishermen	Number Taking No Fish	Number of Hours Fished	Number of Legal Fish Caught	Catch per Hour	Catch per Fisherman	Number of Illegal Fish Caught	Av. No. of Hours per Fisherman/Day
1928	14	0	93.0	251	2.7	17.9	51	6.6
1929	4	0	27.0	98	3.6	24.5	10	6.8
1932	6	0	28.0	103	3.7	17.2	..	4.7
1933	3	0	13.0	60	4.6	20.0	..	4.3
1934	2	0	10.0	21	2.1	10.5	..	5.0
1935	4	0	22.0	78	3.5	19.5	..	5.5
1936	4	0	18.0	45	2.5	11.3	..	4.5
1938	1	0	7.0	14	2.0	14.0	12	7.0
1939	20	0	65.0	132	2.0	6.6	6	3.3
1940	37	0	95.0	615	6.5	16.6	..	2.6
Tot. or Av.	95	0	378.0	1417	3.7	14.9	79	4.0

Number of Each Species for Each Year

Date	L.M. Bass	S.M. Bass	Bluegill	Sunfish	Y. Perch	Calico Bass	Rock Bass	N. Pike	Bullhead	Total
1928	12	14	101	28	15	..	40	25	16	251
1929	10	12	33	10	13	..	15	5	..	98
1932	4	9	90	..	..	..	..	..	..	103
1933	1	6	48	5	..	..	..	..	..	60
1934	4	2	..	..	15	..	..	..	..	21
1935	12	..	63	..	3	..	..	..	..	78
1936	22	..	8	5	10	..	..	..	..	45
1938	..	..	10	..	4	..	..	..	..	14
1939	..	14	104	12	..	1	1	..	..	132
1940	12	3	590	..	10	..	..	..	..	615
Total	77	60	1047	60	70	1	56	30	16	1417

made up 94% of the catch during 1940 and approximately 74% of the catch for the entire period of the census. Although these figures are based on a comparatively few records, and may be open to question, they probably give some indication of the trends in fishing on this lake. It is obvious that fishing has been unusually good for bass and bluegills during this period. The number of pike seems to have materially decreased during the past few years.

The spawning facilities for bluegills and large-mouth bass are certainly adequate in Orchard Lake. There may also be sufficient gravel patches to supply the needs of small-mouth bass, but observations by the survey party did not support

this view. The almost complete lack of good spawning grounds for northern pike is most surely the answer to the reduction in this species. The development for cottage sites along the shores, breakwaters, and bank protectors has undoubtedly destroyed most of the favorable places for pike spawning, since they very probably used the marshy borders of the lake in earlier times.

letter to A. T. Stewart 7-10-41 in Drayton Plains hatchery file re this

Management Suggestions

The present status of Orchard Lake in the "all other lakes" classification should be maintained, and the main species to be encouraged should be largemouth bass and bluegills. No stocking of either of these species should be made. The bluegill population is especially large at present and additional planting could do nothing more than aggravate the already rather slow rate of growth. If smallmouth bass are desired, some planting of this species might be necessary, although it is probable that this species may also find spawning conditions adequate in Orchard Lake.

Northern pike will have to be considered more or less out of the picture unless suitable spawning places can be developed. At the present time this would seem almost impossible with the extreme shore development for cottage sites.

Perch should find conditions adequate for natural propagation in this lake, and will probably maintain a reasonable population without artificial propagation and introduction.

It is suggested that an experimental planting of about 1000 legal sized rainbow trout be made in Orchard Lake in order to determine the suitableness of this lake for trout. A limited amount of trout fishing might be afforded here by regular plantings of legal sized fish without greatly affecting the status of the other species. The trout should be stocked in the fall just before the ice appears, as the predatory fish such as garpike, bass, etc., are least active then.

All Walleye pike plantings should be discontinued. The futility of such plantings is already obvious, and should a planting of this species be successful, we seriously doubt the advisability of encouraging it. Past experience has shown that the success of walleye pike is almost certain to greatly reduce the bass and bluegill fishing in lakes of this kind.

No predator control is recommended. The effect of predaceous fish and birds on the gamefish population is probably just as beneficial, if not more so than it is detrimental.

Examination of game fish for parasites have shown no serious incidence in the fish from Orchard Lake. A limited number of perch and bass had light infestations of black spot (Neascus) but no other serious forms. No control of parasitic worms is practicable.

Vegetation beds offer adequate cover and no improvement devices are recommended at this time.

INSTITUTE FOR FISHERIES RESEARCH

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