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October 29, 1943

REPORT NO. 892

A FISHERIES SURVEY OF AVALON LAKE, MONTMORENCY COUNTY

by

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Introduction

Location and Drainage

Avalon Lake, formerly known as Brush Lake, is located in the northeast part of Montmorency County (T. 31 N., R. 4 E, Sec. 4, 5, 8, 9) about five miles, by road, northwest of Hillman. Ess, Long, Beaver, Horseshoe, Anchor and Dollar Lake lie within a one mile radius of Avalon Lake.

The lake has no inlets. Its water supply is derived from surface runoff from the surrounding terrain and from several boiling springs reported to be present in the lake. It is drained by a small, permanent outlet approximately two feet in width (8/13-20/42) which is located at the southwest end of the lake. This meanders about half a mile to enter Cooper's Pond and thence to Brush Creek which is a tributary to the Thunder Bay River.

The lake can be reached by travelling north from Hillman for two and one-half miles on County Road 451, then west for two miles and finally north for one-fourth mile to the east shore of the lake. Short drives lead from Avalon Lake to Ess, Long and Beaver lakes. The former two are reported to be fine walleye waters, while Beaver Lake is reported to furnish

excellent panfish, especially bluegills. These lakes are all within 35 miles of Alpena.

Acknowledgments

The Civilian Conservation Corps prepared the map (outline and soundings) of this lake in the winter of 1935. Drs. Metzlaar and Langlois made a partial survey of Avalon Lake on July 21, 1925.

Conservation Officer W. J. Cronk of Hillman assisted the survey party in locating a convenient camp site and collected creel census data in the years of 1936, 1938, 1939, and 1940. Mr. Dave Hubert furnished valuable information concerning the past and present fishing in Avalon Lake.

The fisheries inventory[*] was made August 13-20, 1942, and the data collected were used for this report.

Past and Present Use

In past years, Avalon Lake was only used by nearby residents for fishing and picnicking. However, as conditions for automobile travel improved, resorts and cottages were built which attracted many vacationers. At the present time, the resort and tourist business is of prime importance to residents in and around Hillman. Eighty-three cottages and several resorts and boat liveries are present on Avalon Lake and only a very limited frontage is available for future development or public use. The only undeveloped property remaining that would be suitable for public use has from 30 to 40 rods of frontage and is owned by Mrs. Garnet Murphy of Alpena. It is now known as the Alpena Boys Club and is so labelled on the county map.

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[*] The fisheries inventory party included: Hugo Kilpela, leader, R. D. Van Deusen, Pat Galvin, Stanley Lievense, assistants.

Fishing in Avalon Lake has been reported as fair, with the possible exception of several years when stocking with northern pike was maintained. Smallmouth bass fishing was reported to be fair in the past and a few good-sized perch were caught. In general, the fishing at present is considered poor, although an occasional northern pike weighing as much as 20 pounds is caught.

Physical Characteristics

Geological Origin

No information concerning the geological origin of Avalon Lake is available. The formations of the surrounding fragmentary moraines, however, give almost certain evidence that the lake is of glacial origin.

Shape of the Basin and Extent of the Drainage

Avalon Lake has the approximate shape of an elongated bowl with its long axis in a northeast southwest direction. The depth contours are quite regular and grade off gradually to the dropoff. With the exception of the southwest end of the lake, the shores are steep. The surrounding country is gently rolling with sandy and gravelly soil. Less than half of the land is under cultivation; the remainder is covered with second growth woodland and small areas of cedar and tamarack swamp are found. The drainage area of the lake is limited to about one square mile in the immediate vicinity.

Water Fluctuation

The water level in Avalon Lake is very stable. According to Mr. Dave Hubert, one of the early residents of this area, the level of the lake can be raised at least a foot by blocking the little two-foot outlet with a large log. This was done at one time, but the log was removed when it became evident that wave action was undermining pine trees growing close to the edge of the water. It would be possible for enough leaves

and sticks to accumulate and raise the water level nearly as efficiently as it was raised by the log.

There is no dam at the immediate outlet of Avalon Lake. However, through the effort of Mr. Hubert and a number of conservation-minded men, a dam was constructed in 1941 approximately one-half mile downstream from the lake for the purpose of making a pond in which to rear fish for stocking Avalon Lake. The dam is a sand dike with a five-foot concrete sluice way which impounds approximately a five-foot head of water. Iron bars are set about one inch apart in the sluice way to prevent the escape downstream of large fish in the pond. The pond formed by this dam is about one-quarter mile long and varies from five to ten feet in depth. Bluegills and largemouth bass were planted in the pond. According to Mr. Hubert, it is believed that some of the northern pike which had been transferred to Avalon Lake from Fletcher Pond on the Turtle Lake property have moved into the pond.

Most of the length of the outlet stream is too narrow and log choked to permit free movement of fishes between the pond and the lake.

Other Physical Data

Avalon Lake has a surface area of 372 acres and a maximum depth of 74 feet. About one-third of the lake is less than 20 feet in depth and two-thirds of this portion supports plant growth. In terms of the entire lake, approximately 20 per cent is vegetated. Plant beds were found as deep as 35 feet. From the shore to a depth of about 20 feet, the bottom is sandy; beyond 15 feet, the bottom grades into marl and finally to pulpy peat in depths over 60 feet.

The shoreline development is 1.15, which means the shoreline is only 1.15 times as long as it would be if the lake were round and had the same area. In general, the greater the shoreline development, the greater the plant beds and feeding grounds for fish.

The water in Avalon Lake is colorless and quite clear. The Secchi disk reading was 12 feet (average of all lakes studied is 10.6). Light penetration is sufficient to allow vegetation in deeper water than the average inland lake in Michigan, other factors being favorable.

Wave and Ice Action

Disturbances to the biology of Avalon Lake by wave and ice action are reported to be slight at the present level of the lake. In the past when the level was raised about a foot by blocking the outlet with a log, wave action undermined pine trees growing at the edge of the water.

Discussion of Physical Factors in Relation to Fisheries

The predominant trees in this area, pines, poplars, and white birches, are trees that normally grow in poor sandy soils and the land is said to be unproductive for farming. The lake reflects this condition; the bottom in shallow water is composed principally of clear, white sand which supports only a meager growth of vegetation, thus indicating poor fish productivity.

Temperature and Chemical Characteristics

Temperature and chemical analyses were made on Avalon Lake during the third week in August 1942 by the survey party. The information collected is summarized in the following table.

Chemical and Temperature Data on Avalon Lake,

Montmorency County

Date	Depth in feet	Temperature °F.	Oxygen p.p.m.	Methyl Orange Alkalinity, p.p.m.	pH
8-13-42	0	70	8.4	118	8.0
	3	70	...	...	...
	12	70	...	...	...
	21	70	...	...	...
	30	69	8.2	...	...
	39	59	...	...	...
	45	54	8.4	...	...
	54	50	3.1	...	7.6
	60	49	1.0	...	...
	68	49	0.0	148	7.4

The temperature at the surface was 70°F and at the bottom (68 feet) was 49°F on August 13, 1942. The lake had definite thermal stratification, a thermocline (zone of rapid change in temperature) was present between depths of 36 and 45 feet in the 68 foot depression. This thermal stratification would provide a considerable volume of cool water for those fish which require lower water temperatures.

Due to the thermocline, oxygen and temperature throughout the summer would vary only slightly from the surface of the lake to the thermocline. Wind action keeps this layer of water well mixed. Beginning at the bottom of the thermocline, the oxygen content of the water decreases as the depth increases, and in late summer very little oxygen, if any, is found in the water near the bottom of the lake. Wind action does not have much effect on the water below the thermocline and very little mixing occurs in summer. As may be seen from the table above, water down to 50 feet is suitable both as to temperature and oxygen for species of fish that prefer cold water (it is 70°F or less in temperature and contains eight or more parts per million of oxygen down to 45 feet.)

The water of Avalon Lake is moderately hard (methyl orange alkalinity 118-148 p.p.m.) and distinctly alkaline (pH 7.4-8.0). Since moderately alkaline waters are usually the more productive, this lake is suitable in respect to these properties.

No pollution of any kind was found or reported in Avalon Lake.

Biological Characteristics

Vegetation

The aquatic vegetation was studied and the following table lists species and estimated abundance of each.

Aquatic Plants From Avalon Lake and Their Abundance

Common Name	Scientific Name*	Abundance
Pondweed	Potamogeton angustifolius	Common
Sago pondweed	Potamogeton pectinatus	Few
Bushy pondweed	Najas flexilis	Common
Stonewort	Chara fragilis	Common

*Determinations by Betty R. Clarke

The aquatic vegetation in Avalon Lake is exceptionally poor both as to species and abundance. Only four species of plants occur, whereas the average inland lake supports considerably more. It will also be noted that none of the four species of plants found are listed as "abundant."

Fish Foods

Plankton samples taken over deep water were predominantly animal (zooplankton). They were fairly abundant. Copepods constituted most of the sample, the principal genera in order of abundance being Diaptomus, Epischura and Cyclops. Zooplankton no doubt aids considerably in maintaining the rather large cisco population now present. It should be mentioned, however, that plankton varies greatly from day to day and place to place in a lake and that the samples considered may not represent average conditions for the lake.

The bottom organisms were, in general, not very abundant. Mayflies (Hexagenia) were most abundant and were found over most of the bottom. Midge larvae were common but not abundant. Other organisms found include aquatic sow-bugs, alder flies, stoneflies, caddisflies and snails, all in fair abundance. Freshwater earth worms, dragonfly nymphs, leaches, planarians and crayfish occurred only rarely.

The bluntnosed minnow was the only minnow taken by the survey party. It appeared to be abundant. Smallmouth bass were feeding on these minnows as evidenced by the fact that bluntnosed minnows were regurgitated as soon as the bass were caught by rod and line.

A large population of ciscoes is present in Avalon Lake. J. W. Leonard and L. N. Allison visited this lake on the night of December 1, 1942, and collected 108 ciscoes which were spawning along the east shore. At this time, they were reported to have been spawning for about ten days. The fish could be heard a distance of nearly 100 feet from the lake splashing in the water as they engaged in spawning activity. Many ciscoes were observed spawning in water less than two feet deep along the 300 yards of shore examined. The fish collected varied from 7 3/4 to 8 1/2 inches in length, some in their third and some in their fourth year of life. Ciscoes are seldom seen during the summer months because they seek the deeper and colder waters. They are rarely caught by fishermen.

Fish Present

Fish collected or reported from Avalon Lake, Montmorency County

Species	Abundance
Game fish:	
Rock bass	Common
Yellow perch	Common
Smallmouth bass	Common
Pumpkinseed sunfish	Common
Bluegill	Few
Northern pike	Few
Largemouth bass	Few
Walleyed pike	Reported
Brook trout	Reported
Cisco	Abundant

Species	Abundance
Forage fish:	
Bluntnose minnow	Abundant
Coarse fish:	
Common sucker	Abundant
Obnoxious fish:	
None seen or reported	
Other fish:	
None	

Twelve species of fish are present in the lake. Rock bass, perch and smallmouth bass are the most abundant game fish and considerable numbers of common suckers, bluntnose minnows and ciscoes are present. No walleyed pike or brook trout were seen by the survey party. The bluntnose minnow was the only forage fish observed in Avalon Lake. This minnow was abundant and being utilized as food by smallmouth bass. Although classed as a game fish, the ciscoes, which are abundant in this lake, probably serve as food for the northern pike and are undoubtedly an important food item in the diet of the brook trout.

The following table gives the stocking records for the past five years.

Stocking Report for

Avalon Lake, Montmorency County

	1937	1938	1939	1940	1941
Walleyed pike	90,000 F	200,000 F	920,000 F	...	...
Largemouth bass	1,000 5M	2,700 5M	...	1,000 4M	...
Smallmouth bass	213 A	101 A	2,000 4M	1,000 4M	1,000 4M
			251 A	296 A	153 A
			1,750 ✱		
Bluegills	10,000 3M	25,000 5M	25,000 5M	15,000 3M	20,000 3M
	11,800 4M				
Perch	...	23,890 5M	30,000 7M	...	8,000 7M
		10,000 6M			

✱ 3-inch fingerlings stocked by U. S. Fish and Wildlife Service.
F - fry
A - Adults
M - Months

Previous to the above stocking, between 1927 and 1937 an undetermined number of northern pike were transferred by local sportsmen to Avalon Lake from the Turtle Lake property on Fletcher Floodwater of the South Branch Thunder Bay River. The northern pike in Fletcher Floodwater develop lesions on the skin that appear first as small areas denuded of scales, finally becoming swollen and full of pus and blood. The lesions were reported to have affected only a small number of pike in 1941, but spread rapidly in 1942. The cause has not been determined, although they have been subject to examination. Conservation Officer W. J. Cronk has reported that northern pike with similar lesions have been recently taken from Avalon Lake. It is unfortunate that pike transferred to Avalon Lake were taken from an infected area. More care in transferring fish must be exercised in the future to prevent the spread of infected fish to waters not infected.

Creel Census

		Fish Per Hour							
Year	No. of Hours	S.M. Bass	L.M. Bass	Rock Bass	Blue-gills	Sun-fish	Perch	Northern Pike	Walleye
1934	14	...	...	...	...	...	...	1.07	...
1936	982.5	0.07	0.006	...	...	...	0.02	0.04	...
1938	89.25	...	...	0.01	...	...	0.02	0.35	...
1939	34	0.06	0.03	0.09	0.24	0.29	...	0.15	0.06
1940	98	...	...	...	...	...	0.38	0.03	...
1941	16	...	...	...	...	...	1.56	...	...

The creel census taken in 1936 (July 4th to 7th) revealed that the predominant catch was smallmouth bass. Sixty-seven were taken ranging from 10 1/2 to 14 inches. In the same period, six largemouth bass were taken, three of which averaged 10 inches in length, one 14 inches in length, and two 16 1/2 inches. Twenty-three perch ranging from 7 1/2 to 8 1/2 inches and 35 northern pike ranging in total length from 18 to 36 inches were recorded. There is a record of a 40-inch pike speared in 1939 and Conservation Officer Cronk reported that a northern pike weighing 24 pounds was caught

on hook and line in the summer of 1942. A census for one day (June 29, 1938) recorded 32 northern pike ranging from 17 to 24 inches in total length. Two perch six inches long and one rockbass six inches long were reported during the same period. In 1939 a record of winter spearing reports a total of three northern pike with lengths of 22 ½, 24 and 39 inches. In the same year a one-day census (July 23, 1939) records two smallmouth bass (10 inches), one largemouth bass (12 inches), eight bluegills (6 inches), 10 sunfish (6 inches), three rock bass (7 inches), two walleyed pike (16 inches), and two northern pike (20 inches). A winter fishing record for 1940 (January 1 to March 2) recorded a take of three northern pike (33 to 38 inches) and 37 perch (7 to 11 inches) in 98 hours of fishing.

A brief study of the foregoing records reveals that the take of largemouth bass, bluegills, sunfish and rock bass is very poor as to number and size; perch are relatively few in numbers, although some are quite large. Plantings of walleyed pike fry are not yielding results commensurate with the time and expense involved. Smallmouth bass apparently are established but tend to remain small. According to Mr. Hubert, the present fishing for northern pike is poor because plantings were discontinued after 1937. Since Avalon Lake is not suited for spawning of northern pike, the numbers have been greatly reduced by fishing.

Growth Rate of Fish Collected in Avalon Lake*

Species	Age**	Number of Specimens	Average Total Length (in.)	Average Total Weight (oz.)
Northern pike	I	2	18.0	23.5
Largemouth bass	I	4	7.4	3.41
Walleyed pike	II	1	13.13	9.8
	V	3	20.7	46.3
Bluegill	III	1	7.0	4.3
	IV	2	7.1	3.7
Pumpkinseed	IV	1	4.88	1.1
Yellow perch	V	1	9.38	5.3
Rock bass	III	1	4.13	9.75
	IV	5	4.3	1.3
	V	5	5.8	2.5
	VI	4	6.5	3.4
Cisco	III	2	13.2	11.3
	IV	6	13.0	13.0
	V	1	12.63	12.2

*Age analysis by L. E. Perry

**Add one year to the above to determine the actual number of growing seasons.

The number of specimens studied is too small to be of any great significance. However, compared to the average growth rate for fish from inland lakes in Michigan, the bluegills are slightly above average; the yellow perch about average; the largemouth bass, pumpkinseed and rock bass are below average. No data is available for comparison with the growth of the walleyed pike, cisco, and northern pike.

Spawning Facilities

The spawning facilities for smallmouth bass, largemouth bass, rock bass, bluegills, and sunfish in Avalon Lake are believed to be good, but poor for northern pike and walleyed pike. The abundance of bluntnose minnows

and ciscoes indicates that spawning facilities for these fish are good.

There are no streams connected with the lake suitable for the spawning of trout.

Management Proposals

Designation of Lake

Avalon Lake is designated in the "all other lakes" classification. The "pike" classification cannot be properly recommended (although we believe it would be most suitable) since neither northern pike nor walleyes are dominant species. The results of this study indicate that the lake is suited to fish preferring cold water and if experimental stocking with legal-sized rainbow trout is successful, the lake should be opened by the legislature to fall fishing for rainbow.

Stocking

Since the information secured by the present survey of Avalon Lake indicates suitability to fish preferring cold waters, experimental plantings of 3,000 legal-sized rainbow trout should be made for each of the three following years, and thereafter as conditions may warrant it. Plantings should be made in late fall just before ice forms.

Stocking with smallmouth bass should be discontinued because they appear to be adequately maintaining themselves at the present time and because of the danger of bringing the bass tapeworm into Avalon Lake by planting infected fish. The bass tapeworm has not been reported from this lake, although numbers of smallmouth bass have been examined for it.

The stocking of largemouth bass, sunfish and bluegills should be discontinued because they grow and reproduce best in warm-water, muddy bottomed, weedy lakes and Avalon Lake is a cold-water lake. Northern pike stocking should also be discontinued because no spawning grounds are available to them and because they would prey on and compete with the trout for food.

Predators and Parasites

No evidence of damage caused by parasites or predation were found. The smallmouth bass were free of the bass tapeworm, and Clinostomum grubs were not found in any fish. A small number of the black-spot parasites and liver cysts (Neascus) were found in some panfish. No control methods are suggested. These parasites are not particularly harmful to fish and will not attack man.

Shelter

Aquatic vegetation offers very limited areas of shelter in this lake and about 17 brush shelters have been placed near the shores to provide additional cover. The brush shelters are in two groups, one of 11 shelters located along about half of the northwest shore and one of 6 shelters located along about one fourthof the southeast shore. Since the natural shelter in Avalon Lake is so limited, 25 additional brush shelters should be placed around the lake between the two groups already there. They should be placed in from four to ten feet of water and spaced as evenly as possible.

Regulation of Water Level

The level of this lake remains fairly constant except when the small outlet becomes plugged with debris. At such times, the water level may be raised about a foot. These occurrences are rare, however, and the outlet should be permitted to operate normally.

The outlet stream should not be cleaned out and ditched as suggested by Mr. Hubert and the local conservation club, to encourage pike to travel to and from the lake and pond. The ditching might result in an increase of the pike population, which would be undesirable at this time because pike, being a fish-eater, would compete with the trout for food and might prey on the trout to some extent.

A channel connecting the pond in the outlet stream of Avalon Lake with Beaver Lake, as suggested by the local conservation group, would not be feasible because this survey indicates that Avalon Lake is a cold-water lake and therefore unsuited to warm-water fish. Attempts to improve fishing in this lake by planting sunfish, bluegills and largemouth bass would be futile. Conditions predisposing warm water fish and competing species of fish should not be imposed on waters in which trout are to be encouraged. It is recommended therefore the projects for the ditching of the outlet stream and the channel to Beaver Lake be abandoned.

Improvement of Spawning Facilities

The spawning facilities in Avalon Lake are considered to be adequate for those species which should be encouraged. Since no inlet streams are available for the spawning of rainbow trout, this species must be stocked as conditions warrant it.

Other Suggestions

The only undeveloped frontage on Avalon Lake is owned by Mrs. Garnet Murphy of Alpena, and known as the Alpena Boys Club. This property should be investigated while it is still available as a possible location for a public fishing site.

INSTITUTE FOR FISHERIES RESEARCH

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