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A FISHERIES SURVEY OF ACKERMAN LAKE, ALGER COUNTY

by

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Introduction

Ackerman Lake is located in Section 3 of T. 45 N., R. 20 W., Au Train Township, Alger County, in the north-central portion of the Upper Peninsula of Michigan. The City of Munising is situated 13 miles northeast of the lake and the Village of Forest Lake is 2 1/4 miles west. The water is 4½ miles south of Au Train Lake and 2½ miles northeast of Sixteen Mile Lake. The Au Train River and The Basin (Forest Lake) are 2 1/4 miles west of Ackerman Lake. The latter has no surface connections with other waters of the vicinity. The headwaters of Buck Bay Creek (a tributary of Au Train Lake) rise about ½ mile north of the lake.

Highway M-94 (formerly M-28) skirts the north boundary of the lake. A short dirt road (private) permits access to the east shore.

The map of Ackerman Lake, including the shoreline, shore features, and depth contours, was made by the United States Forest Service in 1937, the work having been done by the C.C.C., under the supervision of technicians of the Hiawatha National Forest, within the boundaries of which the water lies. A regular biological inventory of the lake was made by Dr. A. S. Hazzard and the writer, of the Institute Staff, during the period from August 5 to 7, 1941.

Ackerman Lake, at one time the site of a logging camp, is at present a lightly fished lake with a minimum of recreational or industrial development. Landlocked salmon were at one time planted and caught there, but did not reproduce. Fishing has apparently never been good, and in recent years only warm-water species have been caught. The lake has never been much frequented and is isolated from population centers. There are only 2 cottages on its shores and there are no resorts, hotels, or boat liveries. No good beach is present and it has little to offer the recreationist, except fishing. It seems probable that the lake will continue in the future in its present status of a lightly to moderately fished water unless a decided improvement of the fishing adds to its attractiveness for anglers.

Physical Characters of Ackerman Lake

The basin of Ackerman Lake is roughly circular in outline, with an average diameter of about 800 feet, an area of 14 acres and a maximum depth of 41 feet. It has a shoreline development of 1.06, which means that it has only 6 per cent (1.06 times) more shoreline than a perfectly circular lake of the same area would have. Ordinarily, the greater the shoreline development of a lake, the greater its productivity. Low shoreline development indicates an absence of shallow, productive bays and coves, and a high percentage of deep, open water.

The area surrounding Ackerman Lake is rolling, moderately to densely wooded, and has largely sandy soils. The lake basin has many characteristics of the "pot hole" type of lake, and is very probably of glacial origin.

Except for a very small, short, intermittent inlet in the southwest end of the lake, there is no inlet or outlet. The drainage is thus restricted to direct runoff from the areas immediately adjacent to the lake. Most of the area is hilly, densely wooded, and has sandy soils.

The shoal areas in Ackerman Lake are very restricted, being limited to a narrow strip along the shore which at no point exceeds about 100 feet in width, and at most places the shoal is much narrower than this. Only about 10 per cent of the area of the lake is shoal. The declivity from shoal to the depths is quite steep. Shoal areas have a sandy soil along the south and east shores and a fibrous peat substratum in other parts of the lake. The bottom type in the deeper waters is pulpy peat, which at some parts of the lake is mixed with limited amounts of fibrous peat.

The water in Ackerman Lake is colorless and quite clear. During the survey, a Secchi disk (white metal disk about 6 inches in diameter) would disappear from view after being lowered to a depth of 15 feet. This is well above average for lakes in the vicinity. The degree of clearness of the water is in many cases an important factor in determining the depth to which aquatic vegetation will grow in a lake. No higher aquatic plants can survive in the continued absence of light. In Ackerman Lake the infertile or soft bottom soils and the acidity of the water are, no doubt, more responsible for the sparsity of vegetation than the transparency factor.

Temperature and Chemical Characters of Ackerman Lake

As a part of the survey conducted at Ackerman Lake, various physical and chemical data concerning the lake water itself were collected. Temperature of the water at various depths was observed, and the nature and amounts of dissolved oxygen and minerals in the water was obtained. Such data are very important in determining the degree of suitability of a lake to the various fish species. All fish require certain ranges of temperature and certain quantities of dissolved oxygen, and within these ranges are optima. Not only the ranges, but particularly the optima, are

different for the various fish species, as well as for food organisms and other organic life in the water.

Chemical analyses were made and a series of temperatures were taken on August 6. The lake was found to have temperatures ranging from 79°F. at the surface to 43°F. at the bottom. Air temperature at 2 P.M. was 83°F. It was found that a thermocline (area of rapid change in temperature, e.g., at least 1°C. per meter of depth) was present in the lake, extending from a depth of 10 to 25 feet. The temperature at the top of this zone was 75°F., while at 25 feet the reading was 47°F.

The presence of a thermocline in a lake indicates that during the summer months the water is divided into 3 different strata: an epilimnion (area of warm, circulating water above the thermocline, in this case extending from a depth of 1 to 10 feet), a thermocline, and a hypolimnion (area of cold, non-circulating water below the thermocline, in this case extending from a depth of 25 feet to the bottom of the lake). If a thermocline is absent, or if there are less than 4 parts per million of oxygen in the thermocline or hypolimnion, a given water is ordinarily only suitable for warm-water species of fish, since the water is either too warm or has insufficient oxygen to support cold-water species, such as trout. If a thermocline is present, however, and there is sufficient oxygen present in this zone or in the hypolimnion, the lake will generally support trout.

In Ackerman Lake, at a depth of 36 feet, only 1/4 part per million of oxygen was found. At a depth of 25 feet, near the bottom of the thermocline, 3.9 parts per million were found. At a depth of 15 feet (still well within the thermocline) 11.9 parts per million were present.

It is thus seen that Ackerman Lake has adequate oxygen in the thermocline to support trout.

Methyl Orange Alkalinity tests (designed to determine the amounts of dissolved minerals and buffer salts in the water) showed the water in Ackerman Lake to be very soft. The dissolved minerals and salt content ranged from 11 to 17 parts per million. Ordinarily a Methyl Orange Alkalinity of 100-200 parts per million is present in lakes with a high productivity.

The pH (hydrogen ion concentration) of Ackerman Lake was found to range from 5.6 to 6.4, indicating moderate acidity (7.0 is neutral). Ordinarily slightly to moderately alkaline waters are more productive than acid waters, particularly when the management of warm-water species of fish is being considered.

No pollution was found in Ackerman Lake. This would be expected in view of the water's far removal from sources of industrial or significant amounts of domestic wastes.

Biological Characters of Ackerman Lake

As a part of the survey of Ackerman Lake, several kinds of biological data were gathered. Collections of aquatic plants were made and identified, samples of plankton (free swimming and floating microscopic plant and animal life) were obtained, and fish of various species and sizes were collected and their rate of growth, condition, parasitism, etc., determined. Frequently the biological attributes of a given water, as revealed by such data, offer more important clues to its proper management than do the physical or chemical characters.

Vegetation in Ackerman Lake is very sparse. This would be expected in view of the rather high acidity of the water and the unproductive nature

of the bottom soils. The amounts of vegetation are probably hardly adequate to meet the needs of the fish population now in the lake, although considerable additional cover is provided by large numbers of deadheads, trees, branches, etc., in the lake. The species of plants found, and also an estimate of their abundance, are shown in Table I.

Table I
Vegetation Collected in Ackerman Lake*

Species	Abundance
Leatherleaf (Charnaedaphne calyculata)	(Abundant on bog mat)
Bog rosemary (Andromeda glaceopleylla)	"
Creeping spike rush (Eleocharis palustris)	Sparse
Quillwort (Isoetes sp.)	Sparse
Yellow water lily (Nuphar variegatum)	Common

* Identifications by B. M. Robertson, Department of Botany, University of Michigan.

Plankton appeared to be of about average abundance at Ackerman Lake at the time of the survey, with water fleas being the dominant organisms. The one sample taken at the time of the survey does not constitute sufficient data to permit an estimate of plankton abundance throughout the year.

Bottom food in Ackerman Lake was found to be very sparse. In two of three bottom samples taken, organisms were found, while the third, taken in 18 feet of water, produced only 3 midge larvae and a few empty caddis cases. The sparse vegetation near the lakeshore shelters limited amounts of invertebrate food. Some midge larvae and plant lice were observed clinging to a yellow water lily examined. In general, fish food organisms in Ackerman Lake appeared to be rare as compared with other lakes having similar conditions. Fish appeared to be feeding on insects at the surface at the time of the survey.

A record of the species of fish collected during the survey, together with an estimate of their abundance and a report of artificial stocking from 1936 to 1940, is shown in Table II.

Table II
Fish Collected in Ackerman Lake

Species	Estimated abundance	Stocking
GAME FISH		
Yellow perch	Abundant	2,000
Bluegill	Common	2,000
Smallmouth bass	Common	126 (adults)
Largemouth bass	Rare or absent	500
FORAGE FISH		
Golden shiner	Abundant	...
COARSE FISH		
Common sucker	Rare	...

The perch collected during the survey ranged from 5½ to 7 inches in length and the bluegills from 4½ to 6½ inches. No adult smallmouth bass were taken during the survey, although several were seen. Only one sucker (12 inches in total length) was collected.

The growth rates of fish taken in Ackerman Lake are shown in Table III.

Table III
Growth Rate of Fish of Ackerman Lake*

Species and age	Number of specimens	Average length in inches
Perch		
II	9	6
III	20	6 1/8
IV	5	6 1/2
V	1	6 5/8
Bluegill		
IV	13	5 5/8
Smallmouth bass		
II	1	5 1/4
Golden shiner		
II	1	5 1/4

* Age determinations by W. C. Beckman.

As shown in the table above, perch reach legal size (6 inches) during their third summer of life, and bluegills probably do not reach keeper size (6 inches) until early in their 6th summer. (Bluegills with 4 annuli were in their 5th summer of growth at the time of the survey). Insufficient material is available to determine when smallmouth bass could be expected to reach legal size. In the inland lakes of Michigan, the average perch reaches legal size during its second summer of life, and bluegills during their 4th. Indications are that both these species are stunted in Ackerman Lake. Intense competition for the available food in the lake is probably the big factor retarding growth. The one smallmouth bass taken, if growing at an average rate, should reach a length of over 8 inches by the end of the third growing season. Slow growth of this species also seems indicated, although a single specimen offers no safe criterion upon which to judge the entire bass population of the lake.

Spawning facilities in Ackerman Lake are apparently adequate for the Centrarchid species, and the perch appear to have adequate space on the brush and vegetation. Gravel is limited, being restricted to the southwest corner of the lake. The adult smallmouth bass planted in 1939 appear to have spawned successfully, since young-of-the-year of this species were observed during the course of the survey, also since one fish in its second year was taken. Apparently these are offspring of the 126 adults planted in the lake in 1939. Since the lake has no permanent inlet or outlet, trout would find unsuitable conditions for spawning in the lake.

Management Suggestions

Ackerman Lake offers three distinct possibilities with regard to the management of the fishery there. The water might be used either to

encourage warm-water species, such as smallmouth bass and bluegills, or cold-water species such as brook or rainbow trout, or possibly both.

The adult smallmouth bass planted in 1939 appear to have spawned successfully, since young-of-the-year fish were seen by the survey party, and a two-year-old fish was collected. Bass are not known to have been previously established there. Since conditions in the lake appear to be somewhat favorable for the development of a balanced smallmouth bass and bluegill population, it is recommended that no change in management procedure (except for discontinuation of stocking) be initiated for a period of 3 years. Periodic checks should be made during this interval to determine what results are being achieved. It is entirely possible that the smallmouth bass will grow at an average rate and will reproduce in sufficient numbers to sustain a good population of this species, as well as to control the bluegill population (reducing its numbers and thus encouraging faster growth).

If, during the course of the next three years, periodic checks by the District Fisheries Biologist reveal that the bass are showing poor growth, or that the bass-bluegill relationship is not working out so as to provide good fishing in the lake, it is recommended that proper steps be taken to convert the lake into a trout lake. To do this, it will first become necessary to gain permanent public access to the water. Although the public is permitted free use of the lake at the present time, this privilege might be withdrawn at any time, since all land adjacent to the lake is privately owned. The lake should then be poisoned, and the present fish population removed. This should be followed by a relatively heavy stocking of adult and fingerling brook trout. The use of minnows for bait should be prohibited in the lake and the creel limit

reduced to 5 trout per day. These procedures are not recommended until after sufficient time has elapsed to determine whether or not the smallmouth bass seem likely to become established, and to provide good fishing.

A third procedure, which more or less combines portions of the above management plans, would be to stock a limited number of legal-size trout in the lake, leaving the present population intact. If smallmouth bass become established, but in limited numbers, during the next three years, and if further tests show that the bluegill and perch populations have not become even more abnormally stunted or large in numbers, such a management procedure might succeed. It would be less costly than poisoning, and would have the advantage of retaining the bass and bluegill fishery. In short, it would add a highly desirable game fish to those already existing in the lake. If the perch are as numerous as they now appear to be, however, or if the bluegills become more numerous, these may offer too much competition for the trout, and this procedure is not likely to be successful. Only if the smallmouth bass becomes sufficiently numerous to at least partially control the bluegills and perch, and insufficiently numerous in and of themselves to furnish good fishing should this management procedure be followed.

The management procedure to be used in the case of Ackerman Lake depends almost entirely on the degree of success achieved by the recently introduced smallmouth bass, during the course of the next three years.

Ackerman Lake is at the present time in the "all others" classification. It should retain this classification unless the lake is poisoned and only trout are stocked at some future time. <u>All stocking should be discontinued for the next three years, until it is determined whether or not trout should be planted.</u>

A loon and a few kingfishers were the only fish predators seen at Ackerman Lake. Neither these nor any other predators which would be likely to occur at Ackerman Lake would cause significant damage to the fishery there. No control measures are recommended.

None of the fish collected at Ackerman Lake were observed to have parasites.

The limited amounts of vegetation, together with large numbers of logs, deadheads, brush, etc., furnishes adequate shelter in the lake, and no improvements seem advisable. No further regulation of the water level would materially benefit the fish population, either present or proposed, in the lake. No regulation of the level is recommended.

In the event that future investigation shows the smallmouth bass to be growing well, but not reproducing sufficiently to retain adequate numbers to control the bluegill and perch populations, it will become advisable to add gravel to some portions of the sandy shoreline to promote smallmouth bass spawning. Areas suitable for smallmouth spawning are at the present time somewhat restricted, but may be adequate.

INSTITUTE FOR FISHERIES RESEARCH

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