see report 777a

Original: FishDivision
cc: Education-Game
Mr. J. G. Marks 5-8-42

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

ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

April 22, 1942

REPORT NO. 777

FISHERIES SURVEY OF PRAIRIE, MINNEWAUKON, EBERHARD, AND LITTLE FISH LAKES,* ST. JOSEPH COUNTY

by

John Funk

Introduction

Prairie, Minnewaukon, Eberhard, and Little Fish Lakes are in the southeastern part of St. Joseph County. Their specific locations are as follows:

Prairie	Sherman and Bur Oak Townships.	T. 7 S., R. 9-10 W., Sec.13, 18, 19, 24.
Minnewaukon	Sherman Township.	T. 7 S., R. 10 W., Sec.34, 35.
Eberhard	Bur Oak Township	T. 7 S., R. 9 W., Sec.4.
Little Fish	Bur Oak Township	T. 7 S., R. 9 W., Sec.18, 19.

Minnewaukon is a landlocked lake situated about 1.5 miles northwest of Sturgis. Prairie, Little Fish, and Eberhard are all in the drainage of the Prairie River. Prairie and Little Fish are approximately 4 miles and Eberhard about 7 miles north of Sturgis. These lakes are part of a chain extending northeast from Klinger Lake.

* On most of the maps, Little Fish Lake is shown as Fish Lake, but since there is another larger Fish Lake in Sherman Township only 5 miles away, the locally used name is employed here. On some of the older maps, Minnewaukon is called Johnson's Lake, and Prairie, Hog Creek Lake. Prairie is also frequently called Prairie River Lake.

Minnewaukon Lake was mapped and given a regular biological inventory by an Institute party* on July 11-15, 1938. An investigation of the reported stunted bluegill population by Drs. A. S. Hazzard and R. W. Eschmeyer was carried out in April, 1938,** and additional fish collections were made by Dr. W. C. Beckman and the writer on September 29-30, 1941.

Maps showing shoreline, soundings and bottom types were prepared for Prairie, Eberhard, and Little Fish Lakes during the winter of 1941. Later, fish collections were made in the lakes and biological inventories were conducted. The dates of the various investigations were as follows:

	Prairie	Little Fish	Eberhard
Mapped ***	2/21-24/41	2/19/41	2/20/41
Fish collected****	5/23-26/41	5/26-27/41	5/27-28/41
Inventoried *****	6/26-27/41	6/28-7/1/41	6/30-7/1/41

In addition, on November 29-December 1, 1940, Little Fish and Eberhard Lakes were investigated to determine whether ciscoes were present.

Extensive industrial use of these lakes in the past seems improbable. All may have been used to some extent in lumbering operations, although there is no evidence of such. Prairie, Little Fish and Eberhard have all

*Personnel of survey party: R. C. Ball, leader; Walter Crowe, Paul Eschmeyer, and Arthur Whiteley, assistants.

**Institute Report No. 472, "Report on the Bluegills from Minnewaukon Lake, Sturgis, Michigan."

***Personnel of mapping party: Lee Anderson, leader; Royal Howe and Richard Wilson, assistants.

****Personnel of fish party: W. C. Beckman, leader; Lee Anderson, Raymond Buller, and Donald Thomas, assistants.

*****Personnel of inventory party: John Funk, leader; E. M. Roelofs and Stanley Livense, assistants.

been dredged for marl. The amount taken, however, seems to have been limited to that used locally.

Reports vary regarding the early fishing history of the lakes. The usual "general falling off in recent years" is reported for all. Minnewaukon is said to have furnished good fishing for bluegills 20 or 30 years ago. At present, bluegills are plentiful but quite small. Bass fishing is reported to be good. Prairie seems to have always furnished good fishing for bluegills and bass. Little Fish and Eberhard are also reported to furnish good bass and bluegill fishing. In both these lakes the amount of vegetation is said to have been very much reduced in recent years. The appearance of carp coincided with the reported reduction in vegetation, and so naturally the carp is blamed for the plant reduction.

Resort development is most extensive on Prairie Lake. It has about 40 cottages and a large resort and boat livery. Most of the cottages are at the west end where M-78 touches the lake. A gravel road also goes around the east end so that the lake is very accessible. It is heavily fished in the summer and also provides considerable winter fishing. It is of much potential importance as a public fishing water.

Minnewaukon has 26 cottages and 2 boat liveries. A paved road from Sturgis touches the southwest end. Most of the cottages are on the north and east shores. Because of its reputation for small bluegills, the lake is fished mostly for bass and bullheads, and is not much frequented. It is not of much importance as a public fishing water at the present time, although its potential importance is rather high.

Little Fish and Eberhard are both small lakes with moderate development. There are nine cottages at Eberhard and six at Little Fish. High ground and shade around a part of these lakes provide a number of pleasant cottage

sites. Both are easily accessible by good gravel roads and both are rather heavily fished in summer and winter. They seem to be of considerable importance as public fishing waters for lakes of their size.

Physical Characteristics

Minnewaukon and Prairie Lakes are both rather long, narrow lakes with their long axes running approximately northeast-southwest. Their dimensions are as follows:

Lake	Maximum length	Maximum width
Prairie	1.0 mile	0.28 mile
Minnewaukon	0.9 mile	0.25 mile

The basin of each is rather uniformly bowl-shaped, sloping quite steeply from the shoal to the central depression. Prairie is considerably deeper than Minnewaukon. Eberhard and Little Fish are irregularly oval in outline and have rather uniform bowl-shaped basins, with fairly steep slopes. All four lakes are undoubtedly of glacial origin. I. D. Scott, in his "Inland Lakes of Michigan" offers the following interesting information:

> "Probably the first part of the Southern Peninsula to be uncovered by the ice is a small triangular area included largely in St. Joseph County. Within this county the glacial formations consist of two morainic tracts, one in the eastern part and the other crossing the northern part of the western boundary, and a large area of outwash which stands between and around the northern borders of the morainic areas. A number of small lakes occupy pits in the outwash and basins in the moraine in this region. The more numerous, however, lie in the morainic basins - - - -.
>
> " Klinger Lake is the largest of a group of small lakes which are aligned in a northeast-southwesterly direction in the south-central part of St. Joseph County. These basins are morainic in character - - - - -."

Minnewaukon Lake has no inlets. Its water supply comes from run-off in the immediate surroundings. It has no outlet but most of the surrounding country is in the drainage of the Fawn River, a tributary of the St. Joseph.

The inlet of Little Fish Lake drains Crotch and Grey Lakes. At its mouth in Little Fish it is 4-5 feet wide and 1-2 feet deep, with a slow current. Little Fish also receives water from several springs and drainage ditches. The outlet is 10 feet wide and about one foot deep. The current is moderate. This stream enters the upper Prairie River about 1/4 mile above Prairie Lake.

The upper Prairie River is the inlet of Prairie Lake. It rises in Branch County from a group of lakes situated on both sides of the Michigan-Indiana boundary. It drains approximately 100 square miles chiefly in Branch County and a small amount of territory in Indiana. At the point where it enters Prairie Lake, it is about 125 feet wide, and at the time of the survey was approximately 2 feet deep. The current was rather slow. A few springs and drainage ditches also enter the lake. At the outlet of the lake, Prairie River was approximately 125 feet wide, with a maximum depth of about four feet. The current was slow. Prairie River flows into the St. Joseph below Three Rivers. The St. Joseph empties into Lake Michigan at St. Joseph.

Eberhard Lake has a very small local drainage area. The only inlet is a drainage ditch from a small marshy area on the north shore. The outlet passes under a road via a 2-foot culvert. At the time of the survey the current was very slow. The outlet stream flows through Bryant Lake and enters the Prairie River about 1½ miles below Prairie Lake.

These lakes lie in a section of Michigan where agriculture is the chief industry and the fertility of the soil is rather high. Most of the land is cleared, although lake and stream margins are frequently wooded.

Minnewaukon is the only one of the lakes in which important fluctuations of water level seem to occur. Since it has no visible outlet, no control is possible. A low, partial dam is formed by the road fill which crosses the outlet of Eberhard Lake. The level is controlled by the culvert under the fill.

Other physical characteristics not discussed above are given in the following table.

Lake	Area in acres	Maximum depths in feet	Shore development	Approx. per cent shoal	Bottom types		Color of water	Secchi disc in feet
					Shoal	Depths		
Prairie	136	57	1.6	25	Marl	Pulpy peat, muck, marl, marl and pulpy peat.	Light brown	8½
Minnewaukon	126	32	1.5	100	Fibrous peat, rubble and sand.	Fibrous peat.	Colorless, clear.	12-14
Eberhard	38	30	1.3	35	Marl, sand, sand and marl.	Marl and pulpy peat, marl	Colorless, clear.	12
Little Fish	31	35	1.2	35	Marl, sand and marl.	Marl, marl and pulpy peat.	Light brown	7

Prairie and Minnewaukon are nearly the same size but Prairie is considerably deeper. Each has a moderate shore development (1.5-1.6). This factor expresses the relationship between the actual length of the shoreline and the circumference of a circle of equal area. A large shore development means a long shoreline for the area and so suggests the presence of numerous bays and coves. Since such protected areas are usually the most productive parts of a lake, this factor is to some extent an index of productivity.

Prairie and Minnewaukon differ markedly in the amount of the bottom able to produce plants. Plants are reported to grow all over the bottom of Minnewaukon but in Prairie only the more shallow water is suitable for plant growth. The fact is that there is much more deep water in the latter. The Secchi disc reading is the depth in feet at which an eight-inch black and white disc disappears from view when lowered into the water. This gives an index of the transparency. Since plants require light for growth, the more transparent the water the deeper vegetation should be able to grow. As might be expected from the greater depth of plant growth, the water in Minnewaukon is more transparent than in Prairie. The more turbid condition of the water in Prairie may be due to abundant suspended material or to the presence of more microscopic, free swimming organisms (plankton).

In general, the physical characteristics of these two lakes are quite similar to those of productive lakes in southern Michigan.

Eberhard and Little Fish are quite similar in size, depth, shoreline development, and per cent of shoal. Eberhard has clearer, more transparent water. Most of these physical characteristics would indicate lakes of moderate productivity.

Temperature and Chemical Characteristics

Water temperature directly affects all types of fish. Trout and ciscoes, for instance, cannot survive in water which becomes much warmer than 70°F. for prolonged periods. Warm-water fish such as bass and bluegills, on the other hand, grow best when the water temperature is above 70°F. Fish and most other living things require oxygen. Three or four parts per million of dissolved oxygen is generally considered the minimum essential for most fish, although some species may be able to

survive on less for short periods. Dissolved minerals are necessary for the growth of aquatic plants. Moderately hard water (water with a moderate amount of dissolved minerals) is usually most productive. Extremes of acidity or alkalinity may have detrimental effects on fish and other organisms. Productive waters are usually slightly alkaline.

The temperature and chemical characteristics of the lakes are given in the following table.

Lake	Station location	Date	M. O. alkalinity range (p.p.m.)	pH range		Surface	Thermocline Top	Thermocline Bottom	Bottom
Prairie	Central depression	6-26-41	207-223	7.4-8.3*	Depth in ft.	...	10	30	50
					Temp. in °F.	78	70	48	45
					O_2 in p.p.m.	7.8	9.1	1.1	0.0
	Inlet (Prairie River)	6-26-41	217	7.8*	Depth in ft.	...	...	...	...
					Temp. in °F.	77	...	...	...
					O_2 in p.p.m.	5.9	...	...	...
	Outlet (Prairie River)	6-26-41	200	8.2*	Depth in ft.	...	...	...	...
					Temp. in °F.	83	...	...	...
					O_2 in p.p.m.	8.0	...	...	...
Minnewaukon	Deepest part of lake	7-15-38	73-105	...	Depth in ft.	3	12	**	27
					Temp. in °F.	81	79	...	66
					O_2 in p.p.m.	8.5	8.7	...	0.9
	Near north shore	7-15-38	78	...	Depth in ft.	5	...	...	...
					Temp. in °F.	81	...	...	...
					O_2 in p.p.m.	8.8	...	...	...
Eberhard	Deepest part of lake	7-1-41	112-161	7.2-8.4*	Depth in ft.	...	12	**	30
					Temp. in °F.	80	74	...	56
					O_2 in p.p.m.	8.0	12.8	...	0.6
Little Fish	Deepest part of lake	7-1-41	173-202	7.2-8.4*	Depth in ft.	...	10	27	34
					Temp. in °F.	80	76	51	49
					O_2 in p.p.m.	7.8	8.0	2.7	1.6
	Outlet (Stream to Prairie R.)	7-1-41	171	8.1	Depth in ft.	...	...	...	...
					Temp. in °F.	87	...	...	...
					O_2 in p.p.m.	8.2	...	...	...
	Inlet (Stream from Grey Lake)	7-1-41	176	8.2	Depth in ft.	...	...	...	...
					Temp. in °F.	87	...	...	...
					O_2 in p.p.m.	8.2	...	...	...

* pH taken 7-6-41

**Thermocline extended to bottom.

In all of the lakes, the surface water was warm enough to promote good growth of warm-water fish. Conditions suitable for cold-water fish were found in none. The surface water in all the lakes contained an abundance of dissolved oxygen.

All of the lakes showed marked thermal and chemical stratification. A thermocline was present in each. This is a zone of rapid change of temperature ($\frac{1}{2}$°F. or more per foot of depth) which forms in many lakes in the summer. The thermocline is significant for it divides the lake into two layers and acts as an insulating layer between the water above and below it. Circulation due to wind action, etc., is limited to the warmer water above the thermocline. The colder water below stagnates while the thermocline is present. During this stagnation period the supply of dissolved oxygen may be used up by the respiration of organisms and the decay of organic matter in the bottom.

In Prairie Lake, the amount of dissolved oxygen was greatly reduced at the bottom of the thermocline and was absent at the bottom of the lake. Fish and most other forms of life would be able to inhabit only the upper waters of this lake during the summer. The water was hard (M. O. Alkalinity 200-223) and alkaline (pH 7.4-8.3). Temperature and chemical conditions in this lake compare favorably with those of the more productive warm-water lakes.

The thermocline in Minnewaukon Lake extended from twelve feet in depth to the bottom. Dissolved oxygen was not entirely absent at the bottom but was reduced below the requirements for fish. The water was moderately soft (M. O. Alkalinity 73-105), although to judge by the luxuriance of the vegetation, enough dissolved minerals were present to allow near maximum production of plants. The chemical characteristics are not far from average for productive lakes in Southern Michigan.

In Eberhard and Little Fish Lakes, temperature and chemical conditions were quite similar. In both, oxygen was present within the thermocline, and, while not entirely exhausted at the bottom, was reduced far below the requirements of fish. It seems quite certain that ciscoes or other cold-water fish would be unable to survive in these lakes. The survey was made in July and the extremes of temperature and oxygen depletion do not usually occur in southern Michigan until later in the season. In both lakes the water was moderately hard (M. O. Alkalinity 112-202) and alkaline (pH 7.2-8.4). These conditions are favorable for the production of warm-water fish.

Biological Characteristics

The close relationship between vegetation and fish production is evident to every fisherman. The best fishing lakes have an abundance of plants, and the best fishing spots are near weed beds. The plants benefit fisheries in a number of ways. Perhaps the most important are that they support many of the most used fish food organisms and that they provide cover and concealment for fish.

The following table gives the relative abundance of the various species of plants found in the lakes under consideration.

Species*	Prairie	Minnewaukon	Eberhard	Little Fish
Water shield (Brasenia Schreberi)	...	Common	...	Few
Sedge (Carex lasciocarpa)	...	...	...	Rare
Sedge (Carex comosa)	...	Few	Few	...
Sedge (Carex lanuginosa)	...	Few	...	...
Sedge (Carex sp.)	...	Rare	...	...
Sedge (Carex sp.)	...	Rare	...	...
Sedge (Carex sp.)	...	Rare	...	...
Coontail (Ceratophyllum demersum)	Common	Abundant	...	Rare
Swamp loosestrife (Decodon verticillatus)	Common	Few**	...	Rare
Three-way sedge (Dulichium arundinaceum)	...	Rare	...	...
Spike rush (Eleocharis calva)	...	...	...	Few
Triangle spike rush (Eleocharis Robbinsii)	...	Rare	...	...
Spike rush (Eleocharis Smallii)	...	Rare	...	...
Horsetail (Equisetum fluviatile)	...	...	Rare	Rare
Mud plantain (Heteranthera dubia)	Few	...	...	...
Water pennywort (Hydrocotyle umbellata)	...	Few	...	...
Blue flag (Iris versicolor)	...	Rare	...	...
Rice cutgrass (Leersis oryzoides)	...	Few	...	...
Lesser duckweed (Lemna minor)	Common	Few	...	...
Water milfoil (Myriophyllum sp.)	Few	Common	...	Rare
Bushy pondweed (Najas flexilis)	Few	Common	Common	Few
White water lily (Nymphaea odorata)	Common	Common	Rare	Common
Yellow water lily (Nuphar advena)	Common	Abundant	Rare	...
Arrow arum (Peltandra virginica)	Abundant	...	...	Common
Smartweed (Polygonum coccineum)	...	Few	...	...
Smartweed (Polygonum natans)	...	Rare	...	...
Pickerel weed (Pontederia cordata)	Abundant	Common	Few	Common
Pondweed (Potamogeton americanus)	Common	...	...	...
Large-leaf pondweed (Potamogeton amplifolius)	Few	Abundant	...	...
Pondweed (Potamogeton angustifolius)	Common	...	Few	Few
Pondweed (Potamogeton foliosus var. marcellus)	Few	Few	Rare	...
Pondweed (Potamogeton gramineus var. graminifolius)	...	...	...	Rare
--forma myriophyllus)	...	Common	Rare	...
--forma terrestris)	...	...	Rare	...
Pondweed (Potamogeton illinoensis)	...	Few	...	...
Floating-leaf pondweed (Potamogeton natans)	...	Abundant	...	Rare
Pondweed (Potamogeton panormitanus var. major)	...	...	...	Rare
Sago pondweed (Potamogeton pectinatus)	Few	...	...	Rare
Flat-stemmed pondweed (Potamogeton zosteriformis)	Rare	Common	Rare	Rare
Stiff water crowfoot (Ranunculus longirostris)	Rare	...	...	...
Water dock (Rumex verticillatus)	Rare	...	...	...
Wapato (Sagittaria latifolia)	...	...	...	Rare
Big bulrush (Scirpus acutus)	Few	...	Common	Common
Three-square bulrush (Scirpus americanus)	Rare	Common	...	Few
Water bulrush (Scirpus subterminalis)	...	...	...	Rare
Great bulrush (Scirpus validus)	Few	Few	...	...
Bur reed (Sparganium eurycarpum)	Rare	...	...	...
Big duckweed (Spirodela polyrhiza)	Few	Few	...	...
Common cattail (Typha latifolia)	Few	...	Few	Common
Bladderwort (Utricularia vulgaris var. americana)	...	Few	...	Rare
Musk grass (Chara sp.)	Abundant	Abundant	Common	Common

* Determinations by B. M. Robertson, University of Michigan.

**Observed - 9/29/41.

Minnewaukon had the most plants with 33 species, thirteen of which were common or abundant. Prairie had 25 species, with ten given as common or abundant. Both lakes have a good variety of plants. Little Fish also has a varied plant population with 24 species, six of which were common. Eberhard, with only three common species out of a total of fourteen, is considerably below average. In both Eberhard and Little Fish the vegetation was reported to have been much more abundant before carp found their way into the lakes. Carp are destructive to vegetation in lakes.

Fish Foods

Plankton is composed of the microscopic plants and animals which are free-swimming in the water. These organisms are the chief food of very young fish, larger fish food organisms, and most of the forage fishes. They are also important in the diet of certain of the game fish, at least at times.

Plankton conditions in the various lakes at the time of the survey are shown in the following table:

Lake	Prairie	Minnewaukon	Eberhard	Little Fish
Average volume (cc/M^3)	5.09	0.21	2.76	2.36
Dominant organisms	Plants	Animals	Animals	Animals

Since plankton populations are known to vary from place to place in a lake and from week to week, information such as the above has only general significance.

Fish food organisms were collected from the bottom and from the vegetation in the four lakes. The following table shows the relative abundance of the various types of organisms. The source of the sample, type, and area of bottom or weight of plants examined are also shown.

Lake	Prairie			Minnewaukon		Eberhard			Little Fish		
	Shoal			Shoal✓		Shoal			Shoal		
Type of sample	Bottom	Vegetation	Depths	Bottom	Depths	Bottom	Vegetation	Depths	Bottom	Vegetation	Depths
Number of samples	1	5	1	5	1	1	2	1	1	2	1
Bottom types	Marl and sand	Marl	Muck	Fibrous peat	Fibrous peat	Marl	Marl	Marl and pulpy peat	Marl	Marl	Marl and pulpy peat
Average area or weight	½ sq. ft.	4 lb.	½ sq. ft.	½ sq. ft.	½ sq. ft.	½ sq. ft.	3 1/4 lb.	½ sq. ft.	½ sq. ft.	4 1/4 lb.	½ sq. ft.
Planarians (Turbellaria)	...	Rare	...	...	...	...	Rare	...	...	...	...
Aquatic earthworms (Oligochaeta)	Rare	Few	Common	...	...	Rare	Few	Common	Rare	Few	Rare
Leeches (Hirudinea)	...	Few	...	Rare	Rare	Rare	Few	...	...	Few	...
Snails (Gastropoda)	...	Common	...	Rare	Rare	...	Common	...	...	Few	...
Clams (Pelecypoda)	...	Rare	...	...	...	...	...	...	...	...	...
Scuds (Amphipoda)	...	Abundant	...	Common	Rare	Few	Common	...	...	Common	...
Water mites (Hydracarina)	...	Common	...	Few	Rare	...	Few	...	Rare	Common	...
Mayflies (Ephemeroptera)	Rare	Few	...	Few	...	Rare	Few	...	Rare	Few	...
Dragonflies (Anisoptera)	...	Few	...	Rare	...	Rare	Rare	...	...	Few	...
Damselflies (Zygoptera)	...	Few	...	...	...	...	Few	...	...	Few	...
Fish flies (Neuroptera)	...	Rare	...	...	...	Rare	...	...	...	...	...
Caddis flies (Trichoptera)	...	Rare	...	Rare	Rare	Rare	Few	...	...	Rare	...
Beetles (Coleoptera)	...	Few	...	...	...	...	...	...	Rare	Few	...
Phantom midges (Corethra)	...	...	Common	...	...	...	Few	Few	...	...	Common
Midges (Chironomidae)	Rare	Common	Rare	Few	Few	Abundant	Abundant	Few	Rare	Common	Few
Other flies (Diptera)	...	Rare	...	...	...	...	...	...	...	...	...
Crayfish	...	...	...	...	...	...	...	...	...	Rare	...
Bullheads	...	...	...	...	...	...	...	...	...	Rare	...

✓ No vegetation samples taken.

No samples of vegetation were examined from Minnewaukon Lake but experience has shown that plants generally harbor large numbers of organisms and there is no reason why this lake should be an exception.

In general, food conditions in these lakes seem to be good. They are certainly average or better for lakes of the Lower Peninsula.

Fish

The relative abundance of the fish taken in the various lakes is shown in the following table. Stocking for the past four years is included.

Species	Prairie		Minnewaukon		Eberhard		Little Fish	
	Relative abundance	Stocking 1937-40	Relative abundance	Stocking 1937-40	Relative abundance	Stocking 1937-40	Relative abundance	Stocking 1937-40
GAME FISH								
Northern pike	Rare	...	Rare	...	...	...	Rare	...
Yellow perch	Few	5,000	Few	...	Few	...	Rare	...
Smallmouth bass	Rare	...	...	...	...	...	...	...
Largemouth bass	Common	500	Abundant	6,500	Few	...	Few	...
Warmouth bass	Rare	...	...	...	Few	...	Rare	...
Green sunfish	Rare	...	Few	...	...	...	Rare	...
Bluegill	Common - abundant	100,000	Abundant	40,500	Abundant	65,000	Abundant	85,000
Pumpkinseed	Rare	...	Common	...	Rare	...	Rare	...
Rock bass	Rare	...	...	...	...	...	Rare	...
Black crappie	Abundant	...	...	...	Rare	...	Rare	...
Bluegill x Pumpkinseed	...	...	Rare	...	...	...	...	...
COARSE FISH								
Mud pickerel	...	...	Rare	...	...	...	...	...
Common sucker	Rare	...	...	...	...	...	Rare	...
Lake chub-sucker	...	...	Reported	...	Rare	...	...	...
Redhorse	Rare	...	...	...	...	...	Few	...
Hog molly	Rare	...	...	...	...	...	...	...
Brown bullhead	Rare	...	Few*	...	Rare	...	...	...
Yellow bullhead	...	...	Rare	...	Rare	...	...	...
OBNOXIOUS FISH								
Short-nosed gar	Rare	...	...	...	...	...	Rare	...
Long-nosed gar	Rare	...	...	...	...	...	Rare	...
Dogfish	Rare	...	...	...	Rare	...	Rare	...
Carp	Reported	...	...	...	Reported	...	Reported	...
FORAGE FISH								
Black-nosed shiner	Abundant	...	Abundant	...	Common	...	Abundant	...
Black-chinned shiner	...	...	Abundant	...	...	...	...	...
Mimic shiner	...	...	...	...	Few	...	...	...
Straw-colored shiner	Rare	...	...	...	Common	...	...	...
Common shiner	Rare	...	Rare	...	...	...	...	...
Golden shiner	...	...	Rare	...	...	...	...	...
Blunt-nosed minnow	Few	...	Abundant	...	Abundant	...	Abundant	...
Menona killifish	...	...	Rare	...	...	...	...	...
Log-perch	...	...	...	...	...	...	Rare	...
Johnny darter	...	...	...	...	...	...	Rare	...
Silversides	Few	...	...	...	Rare	...	Abundant	...

* Common, 9-29-41

In all of the lakes, bluegills seem to be the predominant game fish. In addition, largemouth bass are quite common in Prairie and Minnewaukon. Prairie also has a large population of black crappies, and pumpkinseeds are numerous in Minnewaukon. In view of the chemical and physical characteristics discussed above, the combinations of species present are well suited to the lakes. Forage fish are abundant in all the lakes. In spite of reports of their abundance, no carp were taken.

Scale samples were taken from the game fish collected and these scales were examined in order to determine the age of the fish. The following table gives the average total length for each age group of each game species in the lakes. Tentative state average total lengths for each species and age are also given for purposes of comparison. Fish from collections made at several different times are included in the material from Minnewaukon.

Species	Age group*	Tentative** state average total lengths in inches	Prairie		Minnewaukon		Eberhard		Little Fish	
			Number of specimens	Average length in inches	Number of specimens	Average length in inches	Number of specimens	Average length in inches	Number of specimens	Average length in inches
Northern pike	II	...	1	14.6	...	...	...	...	...	...
	VIII	...	...	...	1	30.0	...	...	1	37.1
Yellow perch	I	4.7	10	3.2	8	3.9	...	...	...	...
	II	6.2	3	4.8	3	5.7	1	3.9	3	5.9
	III	7.1	1	7.6	2	6.3	7	8.5	...	...
	IV	7.8	...	...	5	7.3	6	9.5	...	...
	V	9.4	...	...	5	7.4	2	10.7	...	...
	VI	10.2	...	...	1	10.5	2	10.6	...	...
	VII	10.4	...	...	1	10.8	2	14.0	...	...
	X	...	...	...	...	...	1	11.0	...	...
Largemouth bass	I	5.5	12	5.1	10	4.0	...	...	12	4.1
	II	8.4	9	8.7	6	8.8	10	6.9	3	6.7
	III	10.8	4	10.5	3	11.4	7	9.3	4	8.8
	IV	12.1	1	11.2	...	...	1	11.0	...	...
	V	13.3	3	12.5	...	...	...	...	...	...
	VI	14.4	1	16.4	...	...	...	...	1	14.2
Warmouth bass	III	...	1	4.8	...	...	1	3.8	...	...
	IV	...	...	...	...	...	3	5.4	...	...
	V	...	...	...	...	...	2	5.3	...	...
	VI	...	1	8.4	...	...	4	5.8	1	6.9
	VII	...	...	...	...	...	2	5.5	...	...
	VIII	...	...	...	...	...	1	6.8	...	...
Green sunfish	II	...	...	...	2	3.8	...	...	...	...
	III	...	1	5.6	5	4.0	...	...	1	4.3
	IV	...	...	...	2	4.7	...	...	...	...
	V	...	...	...	...	...	...	...	2	5.2
Bluegill	I	3.0	...	...	3	2.3	...	...	5	2.1
	II	4.3	6	3.6	...	...	...	...	27	3.3
	III	5.6	18	6.3	4	4.2	5	5.6	38	5.0
	IV	6.7	6	8.0	19	4.7	9	7.0	10	6.5
	V	7.4	7	8.9	2	4.5	25	7.8	3	8.0
	VI	7.8	1	9.1	8	5.6	6	8.4	...	...
	VII	7.9	...	...	12	6.2	1	8.5	3	8.5
	VIII	8.3	...	...	1	7.2	...	...	...	...
	IX	8.5	...	...	...	...	...	...	1	9.1
Pumpkinseed	I	2.7	...	...	5	2.6	...	...	...	...
	II	4.4	...	...	15	3.7	...	...	...	...
	III	5.8	2	5.1	5	3.9	6	6.0	2	5.7
	IV	6.4	...	...	7	5.1	...	...	1	5.6
	V	6.8	...	...	2	5.7	...	...	...	...
	VII	7.8	1	7.4	...	...	...	...	...	...
Rock bass	III	4.9	3	7.0	...	...	...	...	1	8.1
Black crappie	II	5.9	37	5.8	...	...	...	...	1	6.1
	III	8.7	1	5.7	...	...	2	8.0	...	...
	V	9.7	...	...	...	...	1	10.4	...	...
	VI	10.1	...	...	...	...	2	10.9	...	...
Bluegill x Pumpkinseed	II	...	...	...	1	3.9	...	...	...	...
	III	...	...	...	1	4.2	...	...	...	...

* Age determinations by W. C. Beckman.

** Report No. 741, Growth rate of some Michigan game fishes.

In some age groups the series of fish is too small to give reliable age-growth relationship. However, we believe that for the more important species, representative samples have been obtained.

The bluegills of Prairie Lake are making very good growth. Those of Eberhard and Little Fish are growing better than average for the state. In Minnewaukon the bluegills are definitely stunted since they do not reach legal length until their seventh or eighth summer. This condition has obtained in Minnewaukon Lake at least since 1938, when the growth study was made.

Largemouth bass are growing at about an average rate in Prairie, average or a little better in Minnewaukon, but are somewhat behind in Little Fish and Eberhard.

Like the bluegills, the pumpkinseeds in Minnewaukon are stunted. None was of legal size, even though some were 6 years old. The small series from the other lakes show them to be near average. Most of the black crappies taken from Prairie Lake were in Age Group II. These fish were making average growth.

Perch in Eberhard were growing very well, but in Prairie and Minnewaukon the growth was somewhat below average. Warmouth bass and green sunfish are not of much importance as game fish in Michigan, since they seldom attain worth while size. Those taken from these lakes were all growing quite slowly. The few pike taken seemed to be making fairly good growth, as were the rock bass. The bluegill x sunfish hybrids in Minnewaukon, like the parent species, were stunted.

Three collections of bluegills were made in Minnewaukon from 1938-1941 to determine if the stunted condition was temporary. However, when these data were analyzed, no significant difference was found in the rate of growth each year. The results are given in the table below.

Age group	4/27/38 Number of specimens	4/27/38 Average total length	7/12-15/38 Number of specimens	7/12-15/38 Average total length	9/30/41 Number of specimens	9/30/41 Average total length
I	...	...	3	2.2	...	...
II	...	...	2	4.1	2	4.4
IV	...	...	9	4.3	10	5.1
V	...	...	2	4.5	...	...
VI	3	4.9	3	6.5	1	5.9
VII	11	5.9	3	6.7	...	...
VIII	10	5.8	1	7.2	...	...
IX	1	5.9	...	...	...	...

Solid shoal areas suitable for the spawning of bluegills, etc., and weed beds which are utilized by perch and largemouth bass are abundant in all four lakes. Marshy areas thought to be suitable for pike spawning are quite common in Minnewaukon, especially at the southwest end. In 1938 it was reported that in past years during higher water levels, pike were quite common in this lake and that during this time bluegills and sunfish were not stunted. It is doubtful if there is any place for pike to spawn in the other lakes. Of course, they undoubtedly use the inlet and outlet streams of Prairie and Little Fish, and the marshy areas connected with these streams.

Management Suggestions

All of the lakes are at present in the "all other lakes" classification. The results of the survey indicate that this is the proper designation. Although some local residents have desired to have Prairie Lake made a pike lake, the preponderance of other species in the population and the success they are enjoying would not be in keeping with the present law designating pike lakes.

Since spawning facilities for all game species are adequate, it seems certain that natural propagation will be able to maintain the populations

against any expected fishing pressure. It is therefore suggested that, except for the specific cases mentioned later, all stocking in these lakes be discontinued.

Predators were not especially numerous on the lakes. Some herons, turtles, snakes, dogfish and gars were collected or observed. However, since the amount of damage done to fish populations by such predators is questionable, no control measures are suggested.

The fish of the lakes were found to be parasitized to some extent. None of the "grubs" present are harmful to man. Most of them seem to cause the fish little inconvenience, with the possible exception of the bass tapeworm which was found to infest part of the largemouth bass in all the lakes. This parasite frequently attacks the gonads, and may cause complete loss of the reproductive function. If the infestation in these lakes becomes severe enough, it may become necessary to supplement natural reproduction with artificial stocking.

Vegetation and some snags, etc. probably furnish sufficient shelter. No structures are suggested. The water level in the lakes seems to be fairly constant, and to need no regulation. Spawning facilities are apparently adequate. No improvements are suggested.

Minnewaukon is the only one of the lakes which presents a serious problem. The stunting of fish populations such as has occurred there has also been observed in other lakes in the state. Its exact cause is unknown. Apparently the reproduction of a species (the bluegills and pumpkinseeds in this case) is so successful, or their enemies are so few, that too many of the young fish survive. The competition for food and living room becomes so keen that none of them can get enough to make proper growth. Additional stocking only aggravates the condition. Since

a lake, like a corn field, can produce only so much, it is not practical to attempt to improve the food supply. Two courses of action then suggest themselves: (1) Prevent or reduce the success of spawning for a few years, or (2) introduce a predatory species to reduce the number of small fish.

The first method of attack was suggested by the Institute in 1938 (Report No. 472). It was suggested that spawning bluegills be removed by seining the spawning grounds and that spawning beds be destroyed with rakes, etc. Inquiry as to whether the recommendations of this report had been followed resulted in the following letter:

Wolf Lake Hatchery
Mattawan, Michigan
April 4, 1942

Mr. M. J. DeBoer
Asst. in Chg. Fish Div.
Lansing, Mich.

Dear Sir:

In reply to your letter of April 1st, regarding Minnewauken Lake, the Institute for Fisheries Research advised destroying the bluegill beds and seining out the adult fish.

In June of 1938 Mr. Marks and two men and myself seined the lake with 100' of 1/4 mesh and 200' of 1" mesh net. After a day's work we secured about 75 adult and fingerling bluegills and covered a very small amount of the usable shoreline. As you know, weed beds, rocks and other obstructions make this a difficult job and the results are certainly not commensurate with the costs involved.

As to destroying the beds, that would require two men residing at the lake for the duration of the spawning season. Also this would not begin to kill all the eggs.

Furthermore this work would entail a large amount of driving of our equipment and come right at the time of our rush stocking the hatchery and outlying ponds.

I have had considerable experience on salvage operations and the results have never justified the expense.

Hoping that this explains the situation I beg to remain,

Very truly yours,

/s/ Henry Hatt

Henry Hatt
Foreman, Wolf Lake
Hatchery

While the methods proposed in Report No. 472 may be impracticable, it is possible that better results in seining might be secured if a bag seine were used and if the seining were done somewhat earlier in the season. However, local applications of poison might be easier and more effective since most of the fish killed would probably be of no value anyway. It is suggested that this report ammend the recommendations of Report No. 472 as follows: Experiments in the control of the bluegill and sunfish population should be undertaken as soon as practicable by the Institute.

INSTITUTE FOR FISHERIES RESEARCH

By John Funk

Report approved by: A. S. Hazzard

Report typed by: R. Bauch