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FISHERIES SURVEY OF GOODRICH AND HAVEN LAKES, BRANCH AND ST. JOSEPH COUNTIES

by

John Funk

Goodrich and Haven Lakes are broadly connected and for all practical purposes each is part of the same lake and will be treated as such in this report. They are located in Sherwood Township, Branch County (T. 5 S., R. 8 W., Sec. 31, 32) and in Leonidas Township, St. Joseph County (T. 5 S., R. 9 W., Sec. 25, 36). Haven Lake is entirely in St. Joseph County and most of Goodrich Lake is in Branch County. These lakes are part of a chain which includes Adams and Blossom Lakes, and which empties into the St. Joseph River. They are about three miles northeast from the village of Colon and 3 miles west of Sherwood, and about 25 miles south of Battle Creek.

A map of the lakes showing shoreline, soundings and bottom types was prepared by an Institute party January 14-15, 1941.* This map was used to locate sampling stations and vegetation beds in the biological inventory. Fish collections were made in the lakes May 21-23, 1941.** The inventory was conducted June 23-24, and July 6, 1941.***

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

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

*** Personnel of inventory party: John Funk, leader; Eugene Roelofs, Stanley Lievense, assistants.

Acknowledgement is here made for the cooperation of R. C. Wells of Athens who allowed the survey party to use his cottage while they were at the lake.

General Information

Extensive industrial use of Goodrich and Haven Lakes in the past seems unlikely. It is possible that the chain of lakes may have been utilized for lumbering operations but there is no evidence of more recent use. As in most Michigan lakes, fishing is reported to have been very good in Goodrich Lake 15-20 years ago and no doubt the same was true of Haven. In recent years catches have declined in both quantity and quality. This has been blamed by some people upon the winter fishing which is particularly heavy in Haven Lake.

There is a comparatively small amount of real estate development on these lakes. There are 15-20 cottages on Goodrich, and none on Haven. There are no boat liveries or resorts on either lake. Goodrich Lake is somewhat private in that cottages occupy the only part of the shore by which it is convenient to enter the lake and few of the cottage owners will allow fishermen to cross their property. Access may be obtained from Haven Lake which is open to the public at least in winter when some property owners allow fishermen to cross their land to reach the lake. However, the nearest road is almost a half mile from the shore of Haven. In spite of this, the location of the lakes in a populous district makes them of considerable potential importance as public fishing waters.

Physical Characteristics

The area of the combined lakes is 90 acres (Goodrich 61, Haven 29). The basin of Goodrich is rather regularly oval or egg-shaped. The channel to Haven is near the smaller end of the oval. The maximum depth of the basin is 37 feet. The channel between the two lakes is over 200 feet wide,

3-6 feet deep, and about 400 feet long. The Haven basin is roughly square in shape. The channel from Goodrich enters at one corner and the outlet flows from the corner diagonally opposite. The maximum depth is 20 feet.

The basins of the lakes appear to have been much larger in the earlier stages of their development and to have been reduced to their present size by filling in and possibly by falling water levels. The original depressions were undoubtedly of glacial origin.

Most of the margin of the lakes is encroaching. The immediate shores are low and marshy. This marshy area is quite extensive except on the south side where high banks rise 100-200 feet back from the shore. These banks are wooded with some small trees and brush in the marshy areas below.

Drainage and Water Fluctuation

This chain of small lakes drains an area of approximately 10 square miles. About 75 per cent of the run-off passes through Goodrich and Haven Lakes. Blossom Lake, Dean Lake, and a small unnamed lake upstream from Blossom form the headwaters of the system and drain into Goodrich. The outlet of Haven Lake flows into Adams Lake. The Adams Lake outlet enters Sturgeon Lake, an impoundment of the St. Joseph River. The St. Joseph flows into Lake Michigan at St. Joseph.

The soil in the drainage area is either marshy or sandy and of rather low fertility. That which is suitable for farming produces only fair crops.

The water level of the lakes is reported to fluctuate only slightly. Goodrich Lake has two inlets, one from Blossom Lake (20 feet wide, one foot deep, moderate flow), and one from Dean Lake (20 feet wide, ½ foot deep, very little flow). Both are more or less completely choked with weeds. The outlet is a stream about 40 feet wide, 2-3 feet deep, with no perceptible current.

Additional Physical Characteristics

The shore development of the combined lakes is 1.72. This indicates that the shoreline of the two lakes is 1.72 times as long as that of a perfectly round lake of equal area. A high shore development suggests the presence of numerous protected bays and coves. Such a lake would be likely to be more productive than one with a low shore development since the protected portions of a lake are usually most productive. A shore development of 1.72 is moderate.

About 40 per cent of the lakes' surface area is of a depth suitable for the growth of aquatic plants. This is somewhat of an index to productivity since the vegetation beds are usually the most productive parts of the lake. The most abundant type of bottom material in both deep and shallow water is marl. In the deeper water it is mixed with pulpy peat. In the shallower water of the Haven basin considerable fibrous peat occurs, either independently or mixed with the marl. All of these bottom types are fairly productive of vegetation, especially the mixtures of peat and marl.

The water was clear and practically colorless at the time of the survey. A Secchi disc (a black and white disc 8 inches in diameter) could be lowered into the water 8-9 feet before it disappeared from view. This is encouraging to plant growth since it permits moderately deep penetration of light.

Temperature

Water temperatures are of great importance in fisheries investigations. Each species of fish has a definite range of temperature toleration and also a more restricted range of temperature in which it grows best. The temperatures (Table I) of Goodrich and Haven Lakes are well suited to

warm-water fishes such as bass, bluegills, etc. They would not be suitable for trout or other cold-water fish.

Thermocline

In summer, thermoclines form in many of our lakes. The thermocline is a zone of rapid change of temperature ($\frac{1}{2}^{o}$F. or more per foot). When the thermocline is present the water of the lake is divided into three horizontal layers. The upper layer is warm and is kept pretty much the same throughout by circulation due to wind, etc. The middle layer is the thermocline where the temperature rapidly decreases progressively from top to bottom and the effects of surface circulation decrease. In the bottom layer, the water is cold and there is no circulation. Important chemical changes which take place in this stagnant layer will be discussed later.

In the Goodrich depression a thermocline was present between the depths of 15 and 25 feet at the time of the inventory. Haven Lake was all thermocline; that is, the temperature declined rapidly from surface to bottom. When this condition is found it is usually of a temporary nature. Of course, the arrangement of layers described above would not hold true in this case.

Chemical Characteristics

The chemical characteristics of water which are of most interest to fisheries biologists are the amount of dissolved oxygen, the amount of dissolved minerals (hardness), and the acidity or alkalinity. Oxygen is necessary to most forms of life and fish and most aquatic organisms obtain their supply from that which is dissolved in the water. The requirements of fish vary somewhat, but 3 or 4 parts per million are considered necessary for the survival of most species. A good supply

of dissolved solids seems to be essential for maximum production of aquatic plants. Waters which are moderately hard are generally most productive. Extremes of acidity or alkalinity may have a limiting effect on the population of fish and other organisms. Slightly alkaline water is usually most productive.

Temperature and chemical characteristics of the lakes are given in Table 1.

Table 1

Station	Location	M.O.Alkalinity range	pH range		Surface	Thermocline Top	Thermocline Bottom	Bottom
1	Deepest part of Goodrich L.	154-192	7.2-8.3	Depth in ft.	...	15	25	32
				Temp. in °F.	77	68	55	51
				O_2 in p.p.m.	8.4	9.4	1.7	0.0
2	Deepest part of Haven L.	139-184	7.2-8.4	Depth in ft.	...	...	...	20
				Temp. in °F.	81	...	...	51
				O_2 in p.p.m.	10.3	...	...	2.5
3	Inlet from Dean Lake	150	...	Temp. in °F.	82	...	...	...
				O_2 in p.p.m.	8.0	...	...	...
4	Outlet	134	7.6	Temp. in °F.	85	...	...	...
				O_2 in p.p.m.	14.9	...	...	...
5	Inlet from Blossom L.	149	8.3	Temp. in °F.	78	...	...	...
				O_2 in p.p.m.	8.3	...	...	...

Dissolved Oxygen

The surface waters of the lakes contained an abundance of oxygen at the time of the inventory. In the deeper water of the Haven depression the oxygen supply was greatly reduced and in the depths of the Goodrich depression it was absent. This is due primarily to the presence of the thermocline. The oxygen supply is received chiefly by diffusion from the air at the surface. When the thermocline is present, the lower layer of water is cut off from circulation and contact with the air. Respiration of organisms and decomposition of organic matter in the bottom gradually use up the available oxygen. The region is then uninhabitable for fish and most other organisms.

Hardness and pH

The water was hard (M. O. Alkalinity 134-192 p.p.m.). This is about average for the waters of the region and to be expected of lakes containing much marl. The water ranged from slightly to strongly alkaline (pH 7.2-8.4; 7 is neutrality). This is also to be expected of marl lakes, although the most productive lakes are usually somewhat less alkaline.

Biological Characteristics

The biological characteristics of a lake of interest from a fisheries standpoint are the type and abundance of aquatic vegetation, fish food organisms, and fishes. The vegetation is important because it usually supports great numbers of fish food organisms, it furnishes shelter for the fish, and its photosynthetic activity adds oxygen to the water. Fish food organisms include plankton and insects, and other invertebrates eaten by fish. Plankton is made up of the microscopic or nearly microscopic plants and animals which float free in the water. It is the chief food of all very young fish, most larger fish food organisms, and is utilized by some game fish at times. The most important of the larger fish food organisms are the aquatic nymphs and larvae of insects, as well as scuds, snails, clams, leeches, and crayfish. The minnows and other forage fish are considered with the rest of the fish population. In addition to the type and abundance of all fish present, it is also important to know the growth rate of the game species since this is the best index of their success in the lake.

Vegetation

The relative abundance of the various species of plants in the lakes is givenin Table 2.

Table 2

Species	Relative abundance
Coontail (Ceratophyllum demersum)	Common
Sedge (Carex lasciocarpa)	Few
Sedge (Carex substricta)	Few
Sedge (Carex hystericina)	Rare
Swamp loosestrife (Decodon verticillatus)	Few
Spike rush (Eleocharis calva)	Rare
Water milfoil (Myriophyllum heterophyllum)	Common
Bushy pondweed (Najas flexilis)	Rare
Yellow water lily (Nuphar variegatum)	Abundant
White water lily (Nymphaea odorata)	Rare
Arrow arum (Peltandra virginica)	Rare
Pickerel weed (Pontederia cordata)	Rare
Large-leaf pondweed (Potamogeton amplifolius)	Abundant
Pondweed (Potamogeton angustifolius)	Rare
Pondweed (Potamogeton gramineus var. graminifolius f. terrestris)	Few
Floating-leaf pondweed (Potamogeton natans)	Few
Sago pondweed (Potamogeton pectinatus)	Common
Whitestem pondweed (Potamogeton praelongus)	Rare
Robbins' pondweed (Potamogeton Robbinsii)	Common
Flat-stemmed pondweed (Potamogeton zosteriformis)	Abundant
Stiff water crowfoot (Ranunculus longirostris)	Rare
Big bulrush (Scirpus acutus)	Few
Three-square bulrush (Scirpus americanus)	Rare
Water bulrush (Scirpus subterminalis)	Rare
Common cattail (Typha latifolia)	Rare
Musk grass (Chara sp.)	Abundant

Twenty-six species of aquatic plants were found in the two lakes. Of these, eight are common or abundant. This population is quite representative and near average for productive lakes in the southern part of the state.

Fish Foods

Plankton was found to be quite abundant at the time of the inventory, especially in Haven Lake. Plant organisms predominate in the samples. Since plankton populations are known to vary greatly from time to time and from place to place in a lake, a few samples taken at one time give only a general idea of plankton conditions.

Bottom food organisms were found to be moderately abundant. On the vegetation, scuds (Amphipoda) and midge larvae(Chironomidae) were common. Thirteen other kinds of organisms were found in smaller numbers. Relatively few organisms were found in the bottom material either in deep or shallow water.

Fishes

The relative abundance of each species of fish found or reported in the lake is given in Table 3. The number of game species planted since 1933 is also given.

Table 3

Species		Relative abundance	Stocking 1933-40
GAME FISH			
Northern pike (Esox lucius)	7	Rare	...
Perch (Perca flavescens)	5	Few	...
Largemouth bass (Huro salmoides)	2	Common	...
Warmouth bass (Chaenobryttus gulosus)	4	Few-common	...
Green sunfish (Lepomis cyanellus)		Rare	...
Bluegill (Lepomis macrochirus)	1	Very abundant	90,000
Pumpkinseed (Lepomis gibbosus)	3	Few-common	...
Black crappie (Pomoxis nigro-maculatus)	6	Rare-few	...
COARSE FISH			
Common sucker (Catostomus commersonnii)		Rare	...
Mullet (Moxostoma sp.)		Rare	...
Brown bullhead (Ameiurus nebulosus)		Few	...
Yellow bullhead (Ameiurus natalis)		Few	...
OBNOXIOUS FISH			
Short-nosed gar (Lepisosteus productus)		Rare	...
Long-nosed gar (Lepisosteus osseus)		Few	...
Dogfish (Amia calva)		Rare	...
Carp (Cyprinus carpio)		Few	...
FORAGE FISH			
Black-nosed shiner (Notropis heterolepis)		Few	...
Blunt-nosed minnow (Hyborhynchus notatus)		Common	...
Silversides (Labidesthes sicculus)		Few	...

Bluegills predominate in the game fish population with largemouth bass second in abundance. There is a rather large variety of coarse and obnoxious fish although no one species is very abundant. The most abundant forage fish is the blunt-nosed minnow. Stocking has been limited to moderate annual plantings of bluegills.

Growth Rate

The average total length and average weight for the year classes of each game species is given in Table 4. The tentative state average total length is also given for the sake of comparison.

Table 4

Species	Age* group	Summer of life	Number of specimens	Average weight in ounces	Average total length in inches	Tentative** state average total length in inches
Northern pike	V	6	2	65	26.9	...
Perch	I	2	2	...	3.3	4.7
	II	3	3	1	4.8	6.2
	III	4	6	2	6.7	7.1
Largemouth bass	I	2	8	...	3.8	5.5
	II	3	7	2	6.1	8.4
	III	4	2	6	9.4	10.8
	IV	5	1	9	11.1	12.1
	V	6	...	...	...	13.3
	VI	7	2	19	15.0	14.4
Warmouth bass	III	4	3	1	4.0	...
	IV	5	1	2	5.1	...
	V	6	...	...	...	...
	VI	7	...	...	...	...
	VII	8	2	5	7.1	...
	VIII	9	1	5	7.2	...
Green sunfish	II	3	4	1	4.2	...
	III	4	...	...	...	...
	IV	5	1	1	4.7	...
Bluegill	II	3	17	...	2.8	4.3
	III	4	37	...	3.8	5.6
	IV	5	13	2	5.8	6.7
	V	6	26	3	6.6	7.4
	VI	7	9	5	7.7	7.8
	VII	8	5	7	8.4	7.9
	VIII	9	6	7	8.5	8.3
Pumpkinseed	II	3	2	...	3.1	4.4
	III	4	11	...	3.9	5.8
	IV	5	1	3	6.1	6.4
Black crappie	III	4	1	3	6.9	8.7
	IV	5	...	...	...	9.2
	V	6	1	9	10.2	9.7
	VI	7	2	11	10.6	10.1

*Age determinations by W. C. Beckman

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

In some cases, too few specimens were studied to make dependable comparisons possible. However, in most cases the series is believed to be quite representative of conditions in the lake. The perch studied were almost a whole year behind the state average. The older largemouth bass seem to have about average growth but the younger ones were somewhat slower. The same is true of the bluegills; they are below the average for the first 3 or 4 years but the older fish equal or even exceed the state average. The few pumpkinseeds seem to indicate the same tendency. State average figures have not been worked out for northern pike, warmouth bass and green sunfish. In any case, these species are poorly represented in the population. The few black crappies taken were making about average growth.

Spawning Facilities

These lakes undoubtedly furnish adequate spawning facilities for all species present. There is an abundance of reasonably solid marl shoal suitable for bluegills and most other Centrarchids. The weed beds should certainly be adequate for the perch and largemouth bass, while marshy areas suitable for pike are abundant around the margin and in the outlet and inlet streams.

Management Suggestions

At present the lakes are designated as "all other lakes" and the inventory results show this to be the proper designation.

All stocking should be discontinued in the lakes. Spawning facilities are adequate for all species present. Natural propagation should be adequate to maintain the population against any expected fishing pressure. It seems probable that it has been more than adequate against the relatively light pressure in the past, since several species show evidence

of becoming overcrowded. Exception to the above blanket suggestion might be made if it is found that the largemouth bass are decreasing in numbers. Severe infestations of bass tapeworm were found in some of these fish. Since this parasite impairs the reproductive function, it might not be possible to maintain the population by natural propagation alone. Moderate numbers of largemouth might be stocked, but only if future observation proves this to be necessary.

In addition to the largemouth bass, most of the other species were infested with parasites to some degree. Most of them are not serious, since they apparently cause the fish little trouble and are all harmless to man. A few herons, turtles, and snakes were observed. These, along with the predator gars and dogfish, were certainly not numerous enough to warrant any control measures.

The dense beds of vegetation and the few snags and deadheads present probably furnish sufficient shelter for fish. No additional structures are suggested. The water level does not seem to fluctuate unduly and no regulation is necessary. Spawning facilities are adequate for all species present.

As was mentioned earlier in this report, it is rather difficult to get access to these lakes. A gravel road passes near the south shore of Goodrich. Part of this shore is suitable for landing boats, etc., but all the most favorable locations are privately owned. The rest of the shoreline of Goodrich and most of that of Haven is marshy. Haven is also a considerable distance from any road. Since these lakes are located in a populous district and are of considerable potential importance as fishing water, they might be considered when purchases of public fishing sites are being made.

INSTITUTE FOR FISHERIES RESEARCH

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