THE SPORT FISHERIES OF THE TWENTY LARGEST INLAND LAKES IN MICHIGAN

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FISHERIES RESEARCH REPORT NO. 1843
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MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

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By Percy W. Laarman

Abstract

The 20 largest inland lakes in Michigan vary in size from 5,652 acres (Long Lake, Alpena and Presque Isle counties) to 20,044 acres (Houghton Lake, Roscommon County). Fisheries surveys which include netting to determine relative abundance of fish and measures of water chemistry and temperatures have been made on all of the lakes except Fletcher Impoundment (Alpena and Montmorency counties) and Portage Lake (Houghton County). Water chemistry data are lacking on these two bodies of water. Since the initial surveys, subsequent nettings to evaluate fish management programs have been done on most lakes. Due to the lack of standardization of gear and establishment of index stations in the past, it is difficult to determine increases or decreases in the fish populations in most of the lakes. Creel censuses have been by Conservation Officers, post-card surveys, and on a few lakes by special census efforts. In general, no trends of decreases in catch or quality of fishing are apparent. Most management efforts in the past have consisted of stocking fish, changing fishing regulations, or installing brush shelters. Usually these management practices have not been adequately evaluated. Present day managers are recommending regular netting schedules at established index stations to determine changes in fish populations, and creel censuses to determine amount of fishing and anglers' success rate. Implementation of these recommendations will enable fisheries managers to properly evaluate management practices.

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[1] Contribution from Dingell-Johnson Project F-35-R, Michigan.

Introduction

Summaries of available fisheries information for Michigan's 20 largest inland lakes were compiled from the files of the Michigan Department of Natural Resources and from personal communication with Natural Resources District field personnel. Most of these lakes have many people who occupy summer homes or permanent residences, and in addition large numbers of other people who visit to fish or carry on some kind of water-oriented recreation.

Although each lake has its own particular fishery characteristics, collectively these lakes present a unique challenge to fish management due to their large size. However a census of angling, or manipulation of habitats or fish populations is difficult because of the large size. Stocking of selective fish species and modification of regulations are feasible on such large lakes, but an evaluation of these procedures takes much effort.

It was decided that these 20 lakes deserved a special management effort which would start with the following:

(1) a summary, lake-by-lake, of fish inventory data in various departmental files (the Institute for Fisheries Research in Ann Arbor; Fisheries Division files in Lansing; and the Regional and District files);
(2) a summary of past management activities on each lake with an evaluation where possible, or District Supervisors' opinions as to the success of these management activities;
(3) a description of the present sport fishery and a comparison of quality and magnitude with that of the past;
(4) an assessment of weaknesses in available data; and
(5) suggestions as to information needed for improved management activities.

The following report is an attempt to reach these goals for each lake. It contains field data through December 31, 1974, with occasional available information from 1975. The common names of fishes follow the American Fisheries Society Special Publication No. 6, "A List of Common and Scientific Names of Fishes from the United States and Canada," (third edition, 1970).

Black Lake, Cheboygan and Presque Isle counties
T. 35, 36 N., R. 1, 2 E., Sec. many

Black Lake is the eighth largest inland lake in Michigan. It has a surface area of 10,130 acres and a maximum depth of 50 feet. About 36% of the lake is less than 20 feet deep. A map showing the shoreline and bottom contours was prepared during the winter of 1936-37. An intensive survey was made in July 1939, to collect information on the physical, chemical and biological characteristics of the lake. Collections of fish have been made of both predator and prey species in 1937, 1939, and 1960, to determine the species present and their relative abundance. Growth rates have been determined for some of the fishes.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed to measure angler success of those fishermen actually interviewed. More recently a mail survey has been used to measure total fishing pressure on the lake.

Currently, investigations are being conducted on the lake sturgeon. This fish has been sampled with large mesh gill nets for the past 4 years. To date, not enough recaptures have been obtained from tagged fish to make reliable population estimates, however, indications are that a substantial sturgeon population exists and that the construction of Kleber Dam has not noticeably reduced year class strength.

At the present time, a good sport fishery exists both summer and winter for walleyes, northern pike, and yellow perch. A good self-sustaining population of Great Lakes muskellunge occurs in the Black Lake system. They are taken by hook-and-line during the open-water season and by spearing in the winter.

A general fish survey with establishment of index stations to measure fish abundance is recommended for Black Lake.

LAKE SURVEYS

Physical and chemical data
Lake survey July 1-21, 1939

Area (acres)	10,130	Temperature (°F)	
Depth (feet)		Surface	70-79
Maximum	50	Bottom	63-65
Mean	23.5	Thermocline	None
Surface		Shore development	1.4
Alkalinity (ppm)	144-164	Bottom type	
pH	8.0-8.2	Shoal	sand, gravel, marl
Secchi disk (feet)	12-15	Depths	muck
Percent shoal		Vegetation	sparse
< 20 feet deep	36		
Oxygen (ppm)			
Surface	8.0-9.1		
Bottom	5.0-5.5		

Tributaries and dams, watershed drainage

Main inlets: Black and Rainy rivers.

Main outlets: Black River into Cheboygan River into Lake Huron.

Dams: Cheboygan Dam constructed in 1868 near mouth of Cheboygan River, equipped with a boat lock.

Alverno Dam constructed in 1903 on the Black River about 6 miles below Black Lake.

Tower Dam constructed in 1922 on Black River about 10 miles upstream from Black Lake.

Kleber Dam constructed in 1949 on Black River about 6 miles upstream from Black Lake.

Watershed drainage area (acres): 36,453

Benthos--July 1939 survey
(18 Ekman dredge samples)

Organism	Number collected
Chironomidae	553
Isopoda	213
Gastropoda	55
Culicidae	53
Amphipoda	56
Pelecypoda	47
Ephemeroptera	21
Hirudinea	19
Trichoptera	17
Oligochaeta	3
Neuroptera	3
Hydracarina	2
Lepidoptera	1
Total	1,043

Mean of 16 samples:

Volume per square foot	0.74 cc
Number per square foot	54.8

Fish collections

Species and numbers

Species	Number of fish collected				
	July 1937[a]	July 1939[b]	July 1960[b]	May 1970[c]	June 1972[d]
Yellow perch	29	807	124	...	5
Rock bass	4	30	138	70	4
Pumpkinseed	...	7	19	29	...
Longear sunfish	...	74	1	...	...
Smallmouth bass	2	5	18	11	...
Largemouth bass	...	...	18	1	...
Walleye	...	14	9	10	86
Northern pike	...	16	34	18	10
Lake sturgeon	...	1	...	...	1
Total	35	954	361	139	106

Species	Number of fish collected				
	July 1937[a]	July 1939[b]	July 1960[b]	May 1970[c]	June 1972[d]
Brook trout	...	...	...	3	1
White sucker	67	445	304	...	199
Redhorse spp.	...	4	1	...	...
Longnose gar	...	2	3	...	1
Bullhead spp.	...	...	15	...	...
Total	67	451	323	...	200
Mimic shiner	217	1815	3	...	...
Common shiner	59	391	57	...	...
Sand shiner	54	77	...	...	...
Spottail shiner	5	8	1070	...	...
Blacknose shiner	...	...	1	...	...
Blackchin shiner	...	9	...	...	...
Bluntnose minnow	1	325	138	...	...
Pearl dace	...	2	...	...	...
Iowa darter	...	81	9	...	...
Johnny darter	2	16	116	...	...
Blackside darter	...	...	1	...	...
Logperch	18	66	56	...	...
Sculpin sp.	1	...	...	...	...
Silver lamprey	1	34	...	...	...
Total	358	2824	1451	...	...
Grand Total	460	4229	2135	142	307

[a] Collected with seine.

[b] Collected with gill net and seine.

[c] Collected with trap net.

[d] Collected with 3 1/4-inch mesh gill net (sturgeon survey).

Catch per unit effort

Species	Catch per 1,000 feet of gill net		Catch per acre with seine
	July 1939[a]	Aug 1960[b]	July 1939[c]
Yellow perch	27.0	15.0	159.0
Rock bass	8.5	18.0	2.2
Pumpkinseed	....	9.6	1.5
Longear sunfish	....	....	16.0
Smallmouth bass	0.4	0.8	0.9
Walleye	6.0	6.4	....
Northern pike	6.8	24.0	....
Lake sturgeon	0.4	....	....
White sucker	23.0	59.0	84.0
Redhorse spp.	1.3	0.8	....
Longnose gar	....	2.4	0.4
Bullhead spp.	....	12.0	....
Mimic shiner	....	....	395.0
Common shiner	....	....	85.0
Sand shiner	....	....	16.0
Spottail shiner	....	....	1.7
Blackchin shiner	....	....	2.0
Bluntnose minnow	....	....	71.0
Pearl dace	....	....	0.4
Iowa darter	....	....	18.0
Johnny darter	....	....	3.5
Logperch	....	....	14.0

[a] Total of 2,350 feet of gill net set.

[b] Total of 1,250 feet of gill net set

[c] Total of 4.6 acres seined.

Age and growth

Species	Mean growth rate index[1] for collections on different dates; number of scale samples in parentheses; age groups represented given in Roman numerals		
	July 1960	May 1970	June 1972
Yellow perch	-0.4 (23) II-IV		
Rock bass	+1.0 (12) III, V	+1.5 (70) IV-VI	
Pumpkinseed	+0.5 (16) II, V	+0.7 (26) IV-VI	
Smallmouth bass	+0.4 (11) I	+0.7 (5) IV	
Walleye		-0.8 (5) IV	-0.2 (80) II-IV
Northern pike	+0.1 (23) I-III		

[1] Deviations in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39	92	345	294	0.85
1940-45	479	1,231	368	0.30
1946-51	1,298	3,191	512	0.16
1952-57	1,298	2,585	416	0.16
1958-64	1,586	2,538	459	0.18

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1946-51	1952-57	1958-64
Yellow perch	27.9	11.4	14.5	36.3	22.4
Rock bass	8.2	23.4	25.4	22.6	19.4
Pumpkinseed	5.4	16.3	0.8	6.0	3.7
Bluegill	5.1	3.0	....	....	0.4
Largemouth bass	1.4	....	0.4	....	0.4
Smallmouth bass	2.0	3.5	3.1	1.9	3.9
Walleye	20.1	30.2	29.7	19.7	42.3
Northern pike	29.2	12.2	23.2	12.5	8.5
Others	0.7[a]	0.4[b]	2.9[c]	1.0[d]	0.9[e]

[a] Includes bullheads.

[b] Includes white sucker.

[c] Includes whitefish, sturgeon, muskellunge, burbot, white sucker, redhorse and bowfin.

[d] Includes white sucker.

[e] Includes black crappie and bowfin.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	40,930
1973	55,350

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked--Few records available from 1911-1932

Species	Dates[1]	Size	Numbers
Walleye	1903-10	fry	1,200,000
	1933-42	fry	10,625,000
	1937-42	adult	784
Northern pike	1939-42	adult	4
Largemouth bass	1903	fry	6,000
Smallmouth bass	1940-42	adult	8
Yellow perch	1921	fingerling	71,750
	1933-39	fingerling	394,000
	1939-42	adult	184
Rock bass	1939-42	adult	277
Rainbow trout	1939	yearling	200
	1941-42	fingerling	58,200
	1942-43	adult	5,000
Brown trout	1938	yearling	500

[1] Plantings not necessarily continuous between dates given.

Walleye transfers

1931-49. Walleyes were transferred above Cheboygan Dam during spawning runs and released in different sections of the inland waterway including Black Lake. Cheboygan Dam transfer was discontinued due to expense involved in relation to the small numbers of fish transferred. Tagged and released walleyes showed the Black Lake walleye population was distinct from the remainder of the inland waterway. Alverno Dam prevents free passage of fish to the Cheboygan River.

Removal of rough fish by commercial trap netting

10/23/39-1/21/40. About 11 tons of rough fish mostly white suckers were removed.

Composition of catch was:

Species	Percent
White sucker	37.4
Rock bass	31.6
Walleye	14.1
Northern pike	3.8
Bullhead spp.	3.8
Redhorse spp.	3.5
Pumpkinseed	2.8
Bowfin	1.6
Yellow perch	0.9
Smallmouth bass	0.3
Others	0.1[a]

[a] Included whitefish, bluegill, largemouth bass, sturgeon, muskellunge, and burbot.

No definite conclusions were reached of the effect on the remaining fish population after removal of rough fish.

Brush shelters

1933-36	Forty-three shelters installed.
1948	Fifty-six shelters installed.
1953	One hundred shelters installed.
1944	Shelters were inspected by diving. Thirteen shelters in 19-28 feet of water were inspected. Rock bass congregated around the shelters to some extent. Vegetation had not become established around the shelters. Many shelters had washed ashore.

Sturgeon fishery

Spearing regulations:

1928	Closed all sturgeon fishing.
1948	Spearing season opened, January-February; limit of 2 fish; minimum size of 36 inches.
1952	Minimum size increased to 42 inches.
1958	Open season February only.
1959	Sturgeon classified as game fish (prohibits sale of sturgeon from inland waters).
1974	Minimum size increased to 50 inches. Fish must be validated at DNR office within 48 hours after capture.

Fishing pressure and harvest:

1948	About 75 sturgeons speared.

Date	Total shanty counts	Shanties on sturgeon grounds	Total hours fished	Fish caught	Hours per fish
1/24/55	118				
2/20/56	153	70	5,076	55	92
2/15/57	148	70	5,177	12	431
2/19/58	181	74	3,700	21	176
2/11/59	151				
/60	161				
2/21/61	224				
2/ /62	208				
2/21/63	167				
2/13&14/64	183				
2/16-19/65	238				

Age and growth:

Available data suggest that sturgeon reach 42 inches at an age of about 15 years and weigh about 12-15 pounds.

1956-1959 Average length of sturgeon speared was 54 inches and ages ranged from 19-36 years.

Reproduction

As of 1958, reproduction of the Black Lake sturgeon population appeared to be relatively successful.

INFORMATION, SOURCES, REPORTS, ETC.

I.F.R. Reports:

Number	
573	Report on Black Lake, Cheboygan County. By James Moffett and C.J.D. Brown. December 26, 1939.
595	Summary of commercial netting operations in Black Lake, Cheboygan County, Mich. Walter R. Crowe. April 1940.
884	Records available of brush shelters and other improvement installations in Michigan lakes. I. A. Rodeheffer. August 24, 1943.
1019	Brush shelter investigations summer 1944. I. A. Rodeheffer. September 27, 1945.
1130	Demonstration netting in Black, Burt, and Mullet lakes, Cheboygan County, Mich. July 25 to August 2, 1947. Walter R. Crowe. September 19, 1947.
1139	A summary of the netting operations during the summer of 1947. William C. Beckman. November 17, 1947.
1175	A list of the lakes in Michigan for which the installation of brush shelters has been recommended. P. H. Eschmeyer. May 28, 1948.
1226	Sucker removal and demonstration netting, 1947-1948. Walter R. Crowe. May 17, 1949.

Number

1297 The lake sturgeon, Michigan's largest fish. By John E. Williams. September 6, 1951.

1529 A questionnaire census of sturgeon spearing, January-February, 1956, on Black, Burt, and Mullett lakes, Cheboygan County. Henry J. Vondett. November 12, 1957.

1534 Walleyes in the Inland Waterway. Walter R. Crowe. January 6, 1958.

1616 The sturgeon fishery of Black, Burt, and Mullett lakes, Cheboygan County, 1957-1958. Henry J. Vondett and John E. Williams. April 5, 1961.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Shouder, Mason F. 1975. A progress report on the lake sturgeon in the Black Lake system, Cheboygan and Presque Isle counties. Mich. Dep. Nat. Resources, Fish. Div. Tech. Rep. 75-8.

Personal communication:
Mason F. Shouder, Fisheries Habitat Biologist, December 1975.

Burt Lake, Cheboygan County
T. 35, 36 N., R. 3 W., Sec. many

Burt Lake is the fourth largest inland lake in Michigan. It has a surface area of 17,120 acres and a maximum depth of 73 feet. Approximately one-fourth of the lake is less than 15 feet deep. The Civilian Conservation Corps (CCC) mapped the lake during the winter of 1940-41. An intensive survey was made in July and August 1955 to collect information on the physical, chemical and biological characteristics of the lake. Collections of fish were made to determine the species present and their relative abundance. Growth rates were determined from scale samples for some of the species of fish.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed to measure angler success of those fishermen actually interviewed. More recently the mail survey has been used to measure total fishing pressure on the lake.

An extensive gill net survey was conducted in 1975. This survey was directed toward all species of fish and included the establishment of index stations to measure relative abundance of fish in future survey work. The current sport fishery is aimed primarily toward walleyes both in summer and winter. During the early 1960's, a large winter fishery existed for cisco but with a decline in this population the fishery has virtually disappeared.

Management goals are to obtain current data on the walleye population and fishery, to maintain rainbow runs in the Sturgeon River, and create anadromous runs of brown trout and rainbows in the Maple River.

LAKE SURVEYS

Physical and chemical data surveyed July-August 1955

Area (acres)	17, 120	Temperature (°F)	
		Surface	74-79
Depth (feet)		Bottom	60-63
Maximum	73		
Mean	23.1	Thermocline	began at 27 feet
Shore development	1.8	Surface	
		Alkalinity (ppm)	142-151
Percent shoal			
<15 feet deep	25	Oxygen (ppm)	
		Surface	6.8-7.7
Secchi disk (feet)	6-12	at 50 feet	0.2-2.9
		Bottom type	
		shoal	organic, sand, marl, clay, gravel, rubble
		depths	mixture of clay, silt and marl
		Vegetation	sparse

Tributaries, dams and watershed drainage

Main inlets:	Sturgeon, Maple, Crooked and Little Carp rivers.
Main outlets:	Indian River into Mullett Lake into Cheboygan River into Lake Huron.
Dams:	Cheboygan Dam constructed in 1868 near mouth of Cheboygan River, equipped with a boat lock.
Watershed drainage area (acres):	19, 604

Fish collections

Species and numbers

October 1887 -- survey reported the presence of northern pike, walleyes, yellow perch, rock bass, lake trout, herring, whitefish, and suckers.

July 1925 -- survey reported the presence of yellow perch, rock bass, sand shiner, spottail shiner, bluntnose minnow, Johnny darter, logperch, stickleback, and suckers.

July-August 1952 -- survey reported the presence of northern pike, yellow perch, rainbow trout, white sucker, brown bullhead, and sea lamprey.

Species	Number of fish collected			
	July, Aug 1955 [a]	May 1969 [b]	Winter 1961 [c]	Winter 1962 [c]
Yellow perch	1,248	6	...	...
Rock bass	212	499	...	...
Pumpkinseed	38	6	...	...
Bluegill	41	...	...	...
Green sunfish	1	...	...	...
Smallmouth bass	39	130	...	...
Largemouth bass	159	23	...	...
Walleye	132	318	...	...
Northern pike	157	49	...	...
Muskellunge	...	1	...	...
Burbot	...	6	...	...
Total	2,027	1,038	0	0
Rainbow trout	3	7	...	...
Brown trout	1	4	...	...
Brook trout	...	14	...	...
Cisco	...	4	101	162
Total	4	29	101	162

(continued, next page)

[a] Collected with gill net and seine.

[b] Collected with trap net.

[c] Collected by angling.

Species	Number of fish collected			
	July, Aug 1955[a]	May 1969[b]	Winter 1961[c]	Winter 1962[c]
White sucker	1,168	...	...	...
Yellow bullhead	102	6	...	...
Brown bullhead	25	5	...	...
Longnose gar	12	5	...	...
Bowfin	7	6	...	...
Carp	...	18	...	...
Total	1,314	40	0	0
Mimic shiner	69	...	...	...
Common shiner	188	...	...	...
Sand shiner	919	...	...	...
Blackchin shiner	1	...	...	...
Emerald shiner	2	...	...	...
Bluntnose minnow	395	...	...	...
Creek chub	4	...	...	...
Johnny darter	48	...	...	...
Iowa darter	2	...	...	...
Logperch	88	...	...	...
Mudminnow	5	...	...	...
Mottled sculpin	1	...	...	...
Total	1,722	0	0	0
Grand total	5,067	1,107	101	162

[a] Collected with gill net and seine.

[b] Collected with trap net.

[c] Collected by angling.

Catch per unit effort

Species	Catch per 1000 feet of gill net July-Aug 1955 [a]	Catch per 100 feet of shoreline seining July-Aug 1955 [b]	Catch per trap net lift May 1969 [c]
Yellow perch	14.9	52.5	<0.1
Rock bass	3.6	5.1	6.6
Pumpkinseed	1.0	1.0	<0.1
Bluegill	0.8	1.4	...
Green sunfish	....	<0.1	...
Smallmouth bass	0.2	1.8	1.7
Largemouth bass	0.2	8.2	0.3
Walleye	5.8	0.5	4.2
Northern pike	6.8	0.2	0.6
Muskellunge	....	....	<0.1
Burbot	....	....	<0.1
Rainbow trout	0.2	....	...
Brown trout	<0.1	....	<0.1
Brook trout	....	....	0.1
Cisco	....	....	<0.1
White sucker	8.0	57.2	18.6
Yellow bullhead	1.2	0.1	<0.1
Brown bullhead	0.4	0.2	<0.1
Longnose gar	0.6	....	<0.1
Bowfin	0.4	....	<0.1
Carp	....	....	0.2
Mimic shiner	....	4.0	...
Common shiner	....	10.8	...
Sand shiner	....	52.8	...
Blackchin shiner	....	<0.1	...
Emerald shiner	....	0.1	...
Bluntnose minnow	....	22.7	...
Creek chub	....	0.2	...
Johnny darter	....	2.8	...
Iowa darter	....	0.1	...
Logperch	....	5.1	...
Mudminnow	....	0.3	...
Mottled sculpin	....	<0.1	...

[a] Total of 20,000 feet of gill net.

[b] Total of 1,740 feet of shoreline seined.

[c] Total of 76 trap net lifts.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals			
	July, Aug 1955	May 1969	Winter 1961	Winter 1962
Yellow perch	+1.2 (369) I-IX	....	....	....
Rock bass	+1.4 (141) II-XI	+1.1 (61) III-XI	....	....
Pumpkinseed	+0.5 (22) II-V	....	....	....
Bluegill	+0.4 (21) II-VI	....	....	....
Largemouth bass	+1.1 (131) 0-III	0 (13) III, V	....	....
Smallmouth bass	+1.7 (5) III	+0.6 (79) III-VIII	....	....
Walleye	-1.1 (120) I-VII	-1.3 (106) II-IX	....	....
Northern pike	-1.8 (153) I-IV	-1.7 (29) II-IV	....	....
Cisco	....	....	+0.2 (93) V-VIII	+0.6 (160) III-VIII

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39	374	1,996	1,583	0.79
1940-45	687	1,826	710	0.39
1946-51	1,403	2,727	868	0.32
1952-57	2,607	5,186	1,468	0.28
1958-64	6,257	14,122	5,219	0.37

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1946-51	1952-57	1958-64
Yellow perch	36.4	37.9	54.1	49.9	36.0
Rock bass	0.8	9.9	3.7	2.7	1.7
Smallmouth bass	0.8	0.1	0.6	0.4	0.3
Largemouth bass	0.1	0.4	....	....	0.1
Walleye	47.8	44.4	33.2	41.3	24.0
Northern pike	8.9	5.9	6.3	2.4	1.1
Rainbow trout	3.9	1.3	1.0	2.4	0.4
Cisco	....	....	....	....	35.9
Others	1.3[a]	0.1[b]	1.1[c]	0.9[d]	0.5[e]

[a] Includes bluegill, pumpkinseed, whitefish, brook trout, white sucker, and bullhead.

[b] White sucker.

[c] Includes bluegill, sturgeon, muskellunge, and white sucker.

[d] Includes bluegill, whitefish, brown trout, and white sucker.

[e] Includes pumpkinseed, muskellunge, brook trout, white sucker, and bullhead.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	73,560
1973	35,910

Ice shanty counts by airplane

Date	Number of shanties	Date	Number of shanties
1/24/55	114	2/13/62	215
2/20/56	129	2/21/63	155
2/15/57	125	2/13-14/64	146
2/19/58	164	2/16-19/65	132
2/11/59	152	1971	174
2/23/60	157	1974	116
2/21/61	175	2/21/75	98

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked: Few records available from 1915-1932

Species	Dates[1]	Size	Numbers
Yellow perch	1914	fry	400,000
	1921	fingerling	3,000
	1939-49	adult	800
Rock bass	1936-47	adult	1,740
Largemouth bass	1908	fry	8,000
	1911-14	fingerling	7,800
Smallmouth bass	1910	fingerling	1,000
	1922	adult	45
	1943-47	adult	56
Walleye	1904-14	fry	4,110,000
	1933-42	fry	8,000,000
	1933-49	adult	6,509
Northern pike	1940-49	adult	21
Whitefish	1887	fry	3,000,000
Lake trout	1897-1914	fry	676,500
Brook trout	1943	fingerling	690
Rainbow trout	1933-49	fingerling	401,128
	1933-43	adult	38,048
	1950-65	fingerling + adult	274,025
	1967-73	fingerling	570,000

[1] Plantings not necessarily continuous between dates given.

Sturgeon fishery

Regulations:

1928 - Closed all sturgeon fishing.
1948 - Spearing season opened January and February; limit of 2 fish, minimum size of 36 inches.
1952 - Minimum size increased to 42 inches.
1958 - Open season February only.
1959 - Sturgeon classified as game fish (prohibits sale of sturgeon from inland waters.
1974 - Minimum size increased to 50 inches. Fish must be validated at a DNR office within 48 hours after capture.

Ice shanty counts by airplane on sturgeon fishing grounds

Date	Shanty counts	Total hours fished	Number of fish caught	Hours per fish
2/20/56	29	1,347	4	337
2/15/57	28	2,133	2	1,066
2/19/58	21	669	0	.....

Walleye transfers

Walleyes were transferred above Cheboygan Dam during spawning runs and released in different sections of the inland waterway including Burt Lake. Cheboygan Dam transfer was not considered profitable due to the expense and insufficient number of fish involved.

Returns on stocked rainbows

1939-40 - Based on voluntary tag returns about 14% of fall planted legal-sized rainbows were caught by anglers.

1958 - About 1.6% of spring planted legal-sized rainbows were caught by anglers within 1.5 years after stocking. Most were caught in the Sturgeon River.

Removal of rough fish by commercial trap netting

1947 - Removed 7,367 white suckers, 83% of catch was suckers.

1948 - Removed 22.5 tons of white suckers, 66% of catch was suckers.

1949 - Removed 16.2 tons of white suckers, 87% of catch was suckers.

1939-56- Summary of intermittent netting: white suckers 74%, walleyes 13%, rock bass 4%, bullhead 3.5%, and northern pike 1.4%.

Netting appeared to have little overall effect on the sucker population.

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1218	Applegate, V. C. March 29, 1949. Sea lamprey investigations. An inventory of spawning streams of the sea lamprey, Petromyzon marinus, in Michigan. (Summary for 1947 and 1948).
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No.

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1297 Williams, J. E. September 6, 1951. The lake sturgeon, Michigan's largest fish.

1529 Vondett, H. J. November 12, 1957. A questionnaire census of sturgeon spearing, January-February, 1956, on Black, Burt, and Mullett lakes, Cheboygan County.

1573 Wagner, W. C. June 9, 1959. Distribution and abundance of sea lamprey ammocoetes in tributaries of Michigan Inland Waterway, 1958.

1607 Hansen, M. J. September 1960. Recoveries by anglers of hatchery-reared rainbow trout stocked near the mouths of Great Lakes tributaries, 1955-1958.

1616 Vondett, H. J., and J. E. Williams. April 5, 1961. The sturgeon fishery of Black, Burt, and Mullett lakes, Cheboygan County, 1957-1958.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Mason F. Shouder, Fisheries Habitat Biologist, December 1975.

Charlevoix Lake (includes south arm of lake),
Charlevoix County
T. 32, 33, 34 N., R. 6, 7, 8 W., Sec. many

Charlevoix Lake is the third largest inland lake in Michigan. It consists of a main basin with a maximum depth of 122 feet and a south arm with a maximum depth of 52 feet. About 55% of the total lake area is over 50 feet deep and 15% is less than 15 feet deep. The lake was mapped by the U.S. Army Corps of Engineers. An intensive survey was made in July and August 1959 to determine the species of fish present and their relative abundance. Growth rates of the fish are available mainly from the collections made in 1959.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure angler success of those fishermen actually interviewed. More recently the mail survey has been used to measure total fishing pressure on the lake.

The present sport fishery is quite diversified. Rainbow trout are caught off the mouths of virtually all the tributary streams. Smallmouth bass are taken around the old docks at Boyne City and Ironton. Lake trout, coho, and some brown trout are taken by trolling the open water areas. In the winter the most important fishery is for yellow perch at Ironton. Past fisheries management has consisted primarily of stocking fish.

The future management should include an extensive survey and establishment of index stations to measure relative abundance of fish.

LAKE SURVEYS

Physical and chemical data surveyed July-August 1959

Area (acres)	17,260	Thermocline	began at 35 feet
Depth (feet)			
Maximum	122	Surface	
Mean	49.9	Alkalinity (ppm)	131-147
		pH	8.2
Shore development	3.2		
		Oxygen (ppm)	
Percent shoal		Surface	8.1-9.1
< 15 feet deep	15	Below thermo-	
>50 feet deep	55	cline	5.9-7.6
Secchi disk (feet)	10-12	Bottom type	
		Shoal	sand, gravel, rubble
Temperature (°F)			
Surface	71-75	Depths	marl, clay
Bottom	49-50		
		Vegetation	sparse

Tributaries and dams, watershed drainage

Main inlets	Boyne and Jordan rivers, Horton, Loeb, Monroe, Price, and Stover creeks.
Main outlets:	Round Lake to Lake Michigan.
Dams:	None
Watershed drainage area (acres):	55,149

Plankton
July, September and October survey 1955

Common phytoplankton were Ceratium sp., Lyngbya sp., Microcystis sp., and Anabena sp. Common zooplankton were Daphnia sp., Bosmina sp., Diaptomus sp., Limnocalamus sp., and Pontoporeia sp.

Fish collections

1926 - survey revealed the presence of lake trout, cisco, smallmouth bass, largemouth bass, pumpkinseed, rock bass, yellow perch, white sucker, fine scale sucker, topminnow, longnose dace, blacknose dace, bluntnose minnow, sand shiner, emerald shiner, spottail shiner, logperch, Johnny darter, Iowa darter, common shiner, and bullhead.

Species and numbers

Species	Number of fish collected			
	Feb 1947	July, Oct. 1955[a]	July, Aug 1959[b]	Feb 1962[c]
Yellow perch	...	244	1,649	190
Rock bass	...	...	1,169	...
Pumpkinseed	...	...	38	...
Bluegill	...	...	24	...
Black crappie	...	...	19	...
Longear sunfish	...	...	23	...
Smallmouth bass	...	...	101	...
Largemouth bass	...	...	9	...
Northern pike	...	...	31	...
Walleye	...	...	60	1
Total	0	244	3,123	191
Brook trout	...	...	1	...
Lake trout	...	...	...	14
Cisco	4	...	...	...
Rainbow smelt	32	122	14	5
White bass	...	...	2	...
Total	36	122	17	19
Alewife	...	9	...	1
Total	0	9	...	1
Sand shiner	...	...	20	...
Mimic shiner	...	...	15	...
Spottail shiner	...	...	192	...
Common shiner	...	...	184	...
Golden shiner	...	...	1	...

(continued, next page)

Fish collections, continued

Species	Number of fish collected			
	Feb 1947	July, Oct 1955[a]	July, Aug 1959[b]	Feb 1962[c]
Blacknose shiner	...	...	1	...
Bluntnose minnow	...	...	222	...
Creek chub	...	...	25	...
Longnose dace	...	...	4	...
Redbelly dace	...	...	1	...
Johnny darter	...	11	51	...
Iowa darter	...	...	16	...
Logperch	...	3	6	...
Trout-perch	...	...	1	...
Mottled sculpin	...	1	72	...
Banded killifish	...	...	2	...
Ninespine stickleback	...	...	...	2
Total	0	15	813	2
Grand total	36	390	3,953	213

[a] Collected with gill net and deep water trawl.

[b] Collected with gill net and seine.

[c] Collected with gill net.

Fish collections, continued

Species	Number of fish collected			
	July 1969[a]	March 1970[b]	Oct 1970[c]	May 1972[d]
Yellow perch	201	...	20	...
Rock bass	...	...	4	...
Smallmouth bass	1	...	...	2
Northern pike	...	254	...	1
Walleye	...	10	...	...
Total	202	264	24	3
Brook trout	2	...	...	...
Brown trout	8	...	...	...
Rainbow trout	8	6	...	7
Lake trout	3	...	...	...
Coho salmon	1	...	8	...
Atlantic salmon	2	...	...	2
Rainbow smelt	12	...	...	...
Total	36	6	8	9
White sucker	118	...	...	...
Carp	...	...	...	8
Alewife	23	...	...	2
Gizzard shad	...	...	...	7
Total	141	0	0	17
Grand total	379	270	32	29

[a] Collected with gill net.

[b] Collected with trap net.

[c] Collected with gill net for purpose of sampling coho salmon.

[d] Collected with boom shocker for purpose of sampling rainbow trout.

Catch per unit effort

Species	Catch per 1000 feet of gill net				Catch per 1000 feet of shoreline seining
	Oct 1955[a]	July, Aug 1959[b]	Feb 1962[c]	July 1969[d]	July, Aug 1959[e]
Yellow perch	95.0	214.0	47.5	78.8	13.7
Rock bass	....	115.0	....	....	17.0
Pumpkinseed	....	0.7	....	....	1.0
Bluegill	....	0.5	....	....	0.6
Black crappie	....	0.2	....	....	0.6
Longear sunfish	....	....	....	....	0.7
Smallmouth bass	....	11.9	....	0.4	0.7
Largemouth bass	....	....	....	....	0.2
Northern pike	....	4.8	....	....	0.1
Walleye	....	5.4	0.2	....	0.9
Rainbow trout	....	....	....	3.1	....
Brown trout	....	....	....	3.1	....
Lake trout	....	....	3.5	1.2	....
Brook trout	....	0.2	....	0.8	....
Coho salmon	....	....	....	0.4	....
Rainbow smelt	11.7	1.5	1.2	4.7	....
White bass	....	0.3	....	....	....
White sucker	....	23.8	....	46.3	3.6
Brown bullhead	....	0.7	....	....	<0.1
Longnose gar	....	0.3	....	....	<0.1
Carp	....	....	....	....	<0.1
Alewife	15.0	62.8	0.2	9.0	0.6
Sand shiner	....	....	....	....	0.7
Mimic shiner	....	....	....	....	0.3
Spottail shiner	....	....	....	....	6.8
Common shiner	....	....	....	....	5.5
Blacknose shiner	....	....	....	....	<0.1
Bluntnose minnow	....	....	....	....	7.0
Creek chub	....	....	....	....	0.2
Johnny darter	....	....	....	....	1.1
Iowa darter	....	....	....	....	0.4
Longnose dace	....	....	....	....	<0.1
Logperch	....	....	....	....	0.1
Trout-perch	....	....	....	....	<0.1
Mottled sculpin	....	....	....	....	1.8
Banded killifish	....	....	....	....	<0.1

[a] Total of 600 feet of 2-inch-mesh gill net.
[b] Total of 5,875 feet of gill net.
[c] Total of 4,000 feet of 2.5-inch-mesh gill net.
[d] Total of 2,550 feet of gill net.
[e] Total of 2,830 feet of shoreline seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	Feb 1947	July, Aug 1959	Feb 1962	July 1969	Oct 1970
Yellow perch	....	-0.3 (77) VI-VIII	+0.1 (209) II-VII	-1.3 (7) VI	-0.3 (14) III
Rock bass	....	-0.4 (212) II-VII	....	....	....
Pumpkinseed	....	-0.5 (27) II	....	....	....
Bluegill	....	-0.3 (18) II-III	....	....	....
Black crappie	....	-0.9 (8) II	....	....	....
Smallmouth bass	....	-0.9 (76) II-V	....	....	....
Northern pike	....	+1.3 (26) I-III	....	....	....
Walleye	....	+0.6 (58) I-IV	....	....	....
Rainbow smelt	-0.6 (28) II	....	....	....	....

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39	.....	881	2,130	2.42
1940-45	583	1,763	2,771	1.57
1946-51	1,705	4,814	5,461	1.13
1952-57	2,974	6,290	10,096	1.61
1958-64	5,115	10,332	18,103	1.75

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1946-51	1952-57	1958-64
Yellow perch	81.5	40.9	71.2	63.0	78.0
Rock bass	....	4.3	2.5	7.5	3.8
Bluegill	....	1.3	<0.1	0.1	0.3
Black crappie	....	2.0	....	0.1	....
Smallmouth bass	0.3	6.2	5.0	5.3	3.0
Northern pike	....	0.2	<0.1	0.1	0.9
Walleye	....	....	<0.1	<0.1	0.6
Whitefish	3.8	1.8	2.5	....	....
Cisco	3.5	2.2	2.0	....	....
Rainbow smelt	10.8	40.0	16.1	23.2	12.7
Others	0.1[a]	1.1[b]	0.6[c]	0.7[d]	0.7[e]

[a] Largemouth bass.

[b] Includes pumpkinseed, rainbow trout, lake trout, and white sucker.

[c] Includes largemouth bass, pumpkinseed, rainbow trout, white bass, white sucker, and bullhead.

[d] Includes largemouth bass, pumpkinseed, white bass, and bullhead.

[e] Includes largemouth bass, pumpkinseed, rainbow trout, brown trout, lake trout, white bass, white sucker, and bullhead.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	40,860
1971	53,340
1972	53,380
1973	33,840

Ice shanty counts by airplane

Date	Number of shanties
2/15/57	379
2/19/58	371
2/11/59	285
2/23/60	97
2/21/61	109
2/13/62	56 (main basin only)
2/21/63	41 (main basin only)
2/13-14/64	27 (main basin only)
2/16, 19/65	51 (south arm only)
1971	14
	32 (south arm)
1974	27
	35 (south arm)
1975	28
	42 (south arm)

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Whitefish	1887-97	fry	11,471,400
Carp	1894	fry	200
Smallmouth bass	1906-14	fry + fingerling	11,300
Largemouth bass	1906-14	fry + fingerling	33,400
Walleye	1905-10	fry	1,090,000
	1925	fry	90,000
	1937	fry	125,000
	1955-58	fingerling	84,000
Brook trout	1934	fingerling	6,000
Rainbow trout	1933-43	fingerling + adult	63,050
	1948-51	fingerling	95,345
	1965-67	fingerling + legals	95,397
	1968-73	fingerling + yearlings	281,053
Steelhead	1959	fingerling + legals	3,183
	1969	yearlings	38,650
Brown trout	1937	adult	1,500
	1970-73	yearlings	79,011
Lake trout	1907-11	fry	130,000
	1939-43	fingerling	108,000
	1972	yearlings	100,000

[1] Plantings not necessarily continuous between dates given.

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Number

4 Hubbs, C. L. March 19, 1930. Provisional report on the smelt situation in Lake Charlevoix.

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394 Shetter, D. S. November 10, 1936. Fin clipping of rainbow trout fingerlings (Salmo gairdnerii irideus) planted in south arm of Lake Charlevoix, Charlevoix County, Michigan.

512 Shetter, D. S. February 13, 1939. Success of plantings of fingerling trout in Michigan waters as demonstrated by marking experiments and creel census.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Mason F. Shouder, Fisheries Habitat Biologist, December 1975.

Crystal Lake, Benzie County
T. 26, 27 N., R. 15, 16 W., Sec. many

Crystal Lake is the ninth largest inland lake in Michigan. It has a surface area of 9,711 acres and a maximum depth of 162 feet. Approximately 36% of the lake is less than 20 feet deep. A hydrographic map showing the lake outline and soundings was prepared by R. L. McNamee (consulting engineer) and copyrighted in 1935. Permission to use this map was obtained in June 1940, when a biological inventory was conducted. Lake temperatures and oxygen conditions were checked in August 1940 as part of the inventory. Since 1940 no extensive inventory of the fish populations has been made.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure angler success of those fishermen actually interviewed. More recently a mail survey has been used to measure total fishing pressure on the lake.

Past management has consisted of planting since 1892 eleven different species of fish. The plantings have not been adequately evaluated. Between 1937 and 1973, lake trout were planted every year except four, and at a rate of two fish per acre or less. These plantings provided only a limited fishery, but proportional to the number planted. In 1974 and 1975, the planting rate was increased to ten per acre which is expected to improve the fishery significantly. Rainbow trout have been planted regularly since 1956, generally at the rate of two per acre or less. They have provided only a fair fishery and it is assumed that many of the fish migrate to Lake Michigan.

Currently yellow perch provide a good year-around fishery. Rainbow trout and lake trout fishing is fair throughout the year and smelt provide a good fishery through the ice. Whitefish furnish a fair ice fishery, a limited troll fishery in the spring and fall, plus an open-water spear fishery during November and December. The spearing is enjoyed only by approximately 100 local people.

The fishing appears to have changed little in the past 20 years except for the winter smelt fishery which has improved. This improvement may be related to the closing of Cold Creek to smelt dipping and to the washing of spawning gravel; an operation conducted prior to the spawning run on an annual basis since 1966.

Existing data are not adequate for determining management recommendations. The lake should be re-surveyed to evaluate stocking programs and to obtain current data on the existing fish population. Permanent index stations, sampling periods and sampling methods should be established and evaluation gear standardized to monitor abundance of fish.

LAKE SURVEYS

Physical and chemical data
surveyed June 1940

Area (acres)	9,711	Thermocline	none
Depth (feet)		Surface	
Maximum	162	Alkalinity (ppm)	112-117
Mean	66	pH	8.0
Shore development	1.5	Oxygen (ppm)	
		Surface	9.4-10.4
Percent shoal		Bottom	10.7
<20 feet deep	36		
		Bottom type	
Secchi disk (feet)	19	Shoal	sand, rubble
		Depths	muck, marl, sand
Temperature (°F)			
Surface	58-61		
Bottom	43	Vegetation	sparse

Tributaries and dams, watershed drainage

Main inlet: Cold Creek.

Main outlet: Betsie River into Lake Michigan.

Dams: Concrete dam about 50 yards from the lake controls water level. About 6 miles by stream from the outlet of Crystal Lake to Lake Michigan.

Watershed drainage area (acres): 13,921

Benthos--June 1940 survey
(14 Ekman dredge samples)

Organism	Number collected
Ephemeroptera	178
Amphipoda	166
Chironomidae	140
Oligochaeta	43
Trichoptera	21
Gastropoda	20
Odonata	6
Hirudinea	6
Pelecypoda	5
Plecoptera	1

Mean number per square foot 54.8

Fish collections

Species and numbers

Species	Number of fish collected				
	June 1940[a]	Aug 1948[b]	Nov 1956[b]	Winter 1955-56[c]	Jan, Feb 1962[c]
Yellow perch	7,651	158	24	...	95
Rock bass	6	36	...	...	...
Bluegill	1	...	...	...	...
Smallmouth bass	3	1	...	...	...
Northern pike	1	...	...	...	...
Burbot	1	...	3	...	...
Total	7,663	195	27	0	95
Lake trout	1	...	4	...	...
Whitefish	3	...	1	18	...
Cisco	2	...	...	...	...
Rainbow smelt	55	...	1	...	...
Total	61	0	6	18	0
White sucker	107	3	7	...	...
Total	107	3	7	0	0
Spottail shiner	691	...	...	...	...
Sand shiner	531	...	...	...	...
Emerald shiner	931	...	...	...	...
Bluntnose minnow	125	...	...	...	...
Johnny darter	77	...	...	...	...
Iowa darter	9	...	...	...	...
Logperch	15	...	...	...	...
Total	2,379	0	0	0	0
Grand total	10,210	198	40	18	95

[a] Collected with gill net and seine.

[b] Collected with gill net.

[c] Collected by angling.

Catch per unit effort

Species	Catch per 1000 feet of gill net				Catch per acre with seine
	June 1940[a]	June 1940[b]	Aug 1948[c]	Nov 1956[d]	June 1940[e]
Yellow perch	5,901	5.0	115.0	9.6	33.1
Rock bass	1.6	0.7	26.2	...	0.3
Bluegill	.....	...	....	...	0.1
Smallmouth bass	.....	...	0.7	...	....
Northern pike	.....	0.4	....	...	....
Burbot	.....	0.4	....	1.2	....
Lake trout	.....	0.4	....	1.6	....
Whitefish	.....	1.1	....	0.4	....
Cisco	1.6	...	....	...	....
Rainbow smelt	0.8	2.7	....	0.4	5.9
White sucker	.....	32.1	2.2	2.8	0.6
Sand shiner	.....	...	....	...	67.0
Spottail shiner	.....	...	....	...	79.0
Emerald shiner	.....	...	....	...	124.0
Bluntnose minnow	.....	...	....	...	15.7
Johnny darter	.....	...	....	...	9.7
Iowa darter	.....	...	....	...	1.1
Logperch	.....	...	....	...	1.9

[a] Total of 1,250 feet of experimental gill net.

[b] Total of 2,800 feet of 4-inch-mesh gill net.

[c] Total of 1,375 feet of 1-, 1.5-, 2.25-inch-mesh and experimental gill net.

[d] Total of 2,500 feet of experimental gill net.

[e] Total of 7.97 acres seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals	
	June 1940	Jan, Feb 1962
Yellow perch	-0.9 (100) I, II, IV-VIII	-1.4 (95) III-IV
Rainbow smelt	0.0 (31) I-III	...

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39	.....	5,276	17,044	3.23
1940-45	1,802	7,607	23,643	3.11
1947-51	569	1,552	6,324	4.07
1952-57	913	2,778	7,522	2.71
1958-64	3,468	8,280	15,194	1.84

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1947-51	1952-57	1958-64
Yellow perch	19.0	12.2	1.9	7.8	21.7
Lake trout	....	1.2	1.7	2.1	3.2
Rainbow smelt	80.4	86.1	95.9	88.2	72.8
Others	0.6[a]	0.5[b]	0.5[c]	1.9[d]	2.3[e]

[a] Includes bluegill, crappie, whitefish, white sucker, redhorse, and bullhead.

[b] Includes bluegill, smallmouth bass, largemouth bass, rock bass, cisco, whitefish, and white sucker.

[c] Includes bluegill, rock bass, cisco, brown trout, white sucker, and northern pike.

[d] Includes crappie, rock bass, smallmouth bass, largemouth bass, whitefish, cisco, and rainbow trout.

[e] Includes rock bass, smallmouth bass, largemouth bass, whitefish, cisco, rainbow trout, burbot, and white sucker.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	24,880
1973	10,800

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Date[1]	Size	Numbers
Yellow perch	1910	fingerling	500
	1938-39	fingerling	210,000
Bluegill	1913	fingerling	1,200
	1934-37	fingerling	31,400
Warmouth	1907-10	fingerling	1,800
Smallmouth bass	1904-14	fry + fingerling	18,900
	1935-44	fingerling	11,395
Largemouth bass	1904-14	fry + fingerling	22,400
	1936	yearling	200
Walleye	1892-1914	fry	2,000,000
Whitefish	1896	fry	1,200,000
Rainbow smelt	1912	eggs	16,400,000
Lake trout	1895-1907	fry	320,000
	1935-40	fry, yearlings + fingerling	50,000
	1941-47	adult	28,135
	1948-53	adult	38,023
	1955-65	legal	85,500
	1967-68	adult	11,561
	1970-72	yearling + adult	40,085
Rainbow trout	1903-14	fry	87,000
	1941-42	yearling + adult	14,990
	1957-68	fingerling + adult	284,448
	1967-73	yearling	144,135
Steelhead	1967-72	yearling + adult	31,893
Splake	1966	fingerling	50,000
	1973	fingerling	100,000

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1948. Installed 75 shelters.
1949. Installed 110 shelters.
1950. Installed 60 shelters.
1952. Installed 25 shelters.

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Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Bernard R. Ylkanen, District Fisheries Biologist, January 1976.

Elk Lake, Antrim and Grand Traverse counties
T. 28, 29 N., R. 8, 9 W., Sec. many

Elk Lake with an area of 7,730 acres ranks number sixteen in size of the inland lakes in Michigan. It has a maximum depth of 192 feet. About 15% of the lake is less than 15 feet deep. Inventories of all the fish species were made when the lake was mapped in 1931, and again in 1956.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure angler success of those fishermen actually interviewed. More recently the mail survey has been used to measure total fishing pressure on the lake.

Past management has been limited to fish stocking, installation of artificial reefs (brush shelters and car bodies) and special regulations allowing spearing of cisco, whitefish, carp and suckers from November 1 through December 31.

Most of the fishing in Elk Lake is for rock bass or yellow perch. Some smallmouth bass are taken especially early in the season. Few trout are caught. Currently, an excellent fishery exists for whitefish during the winter. Spearing for trophy-size Great Lakes muskellunge is concentrated near the narrows between Elk and Round lakes. Some spearing for whitefish is done in the fall but this activity is apparently declining.

Available information is not suitable for accurate management of the fisheries. An intensive creel census is needed to determine angler use, species and size of the catch. Stocked trout should be marked to help evaluate the success of stocking, the amount of natural reproduction, and movement of fish between the lakes. Investigation of the habitat requirements of the Great Lakes muskellunge should be conducted, in order to determine why this fish is native to these waters. Index stations have been established in an effort to standardize the fish collection system on all the large inland lakes.

LAKE SURVEYS

Physical and chemical data surveyed August 1931

Temperature (°F)		Secchi disk (feet)	9.6
Surface	74	pH	8.0
Bottom	45		
Thermocline	began at 40 feet		

Surveyed August 1956

Area (acres)	7,730	Thermocline	began at 39 feet
Depth (feet)		Surface	
Maximum	192	Alkalinity (ppm)	128-137
Mean	54.3		
Shore development	2.1	Oxygen (ppm)	
		Surface	8.5-8.8
Percent shoal		Bottom	8.8-9.4
<15 feet deep	15		
		Bottom type	
Secchi disk (feet)	10-14	Shoal	sand, gravel, rubble
Temperature (°F)		Depths	marl, organic
Surface	68-71		
Bottom	44-45	Vegetation	sparse

Tributaries and dams, watershed drainage

Main inlets:	Round Lake, Battle and Williamsburg creeks.
Main outlets:	Elk River into Grand Traverse Bay.
Dams:	On Elk River constructed in 1891; another constructed in 1915 about 2 miles from lake; controls lake level.
Watershed drainage area (acres):	20,003

Fish collections

Survey in July 1891: reported presence of trout sp. (?), burbot, herring, rock bass, northern pike, yellow perch, whitefish and white sucker.

Survey in 1923: reported presence of lake trout, yellow perch, rock bass, and smallmouth bass.

Species and numbers

Species	Number of fish collected			
	July, Aug 1931[a]	Aug 1956[b]	Sep, Oct 1971[c]	Oct 1975[c]
Yellow perch	57	148	24	75
Rock bass	234	53	30	248
Pumpkinseed	...	2	...	...
Bluegill	...	3	...	...
Longear sunfish	...	46	...	...
Smallmouth bass	...	9	...	3
Largemouth bass	1	...	...	...
Northern pike	11	8	...	...
Muskellunge	1	3	...	...
Burbot	...	1	7	10
Catfish sp.	1	...	...	...
Total	305	273	61	336
Lake trout	...	...	3	30
Rainbow trout	...	17	...	...
Brown trout	...	...	1	...
Splake	...	...	70	...
Whitefish	31	...	60	93
Cisco	28	28	66	54
Total	59	45	200	177
White sucker	303	76	23	54
Bullhead spp.	63	7	...	...
Longnose gar	...	1	...	...
Total	366	84	23	54

(continued, next page)

Fish collections, continued

Species	Number of fish collected			
	July, Aug 1931[a]	Aug 1956[b]	Sep, Oct 1971[c]	Oct 1975[c]
Sand shiner	651	345	...	...
Common shiner	109	36	...	...
Blacknose shiner	1	3	...	...
Rosyface shiner	4	2	...	...
Bluntnose minnow	629	238	...	...
Creek chub	...	1	...	...
Longnose dace	33	...	...	...
Redbelly dace	...	2	...	...
Johnny darter	28	16	...	...
Iowa darter	13	3	...	...
Logperch	14	36	...	...
Mudminnow	1	1	...	...
Sculpin sp.	...	2	...	...
Total	1,483	685	0	0
Grand total	2,213	1,087	284	567

[a] Collected with gill net, trap net and seine.

[b] Collected with gill net, seine and hook and line.

[c] Collected with gill net.

Catch per unit effort

Species	Catch per 1000 feet of gill net		
	Aug 1931[a]	Aug 1956[b]	Sep, Oct 1971[c]
Yellow perch	39.4	10.7	3.0
Rock bass	....	3.4	3.8
Smallmouth bass	0.7	0.5	...
Northern pike	0.7	0.6	...
Muskellunge	....	0.2	...
Burbot	....	<0.1	0.9
Whitefish	23.9	...	7.5
Cisco	24.6	2.1	8.2
Rainbow trout	....	<0.1	...
Brown trout	....	...	0.1
Lake trout	....	0.2	0.4
Splake	....	...	8.8
White sucker	4.9	2.5	2.9

[a] Total of 1,420 feet of experimental gill net set.

[b] Total of 13,250 feet of experimental gill net set.

[c] Total of 8,000 feet of gill net set.

Catch per unit effort

Species	Catch per trap net Aug 1931[a]	Catch per acre seine Aug 1931[b]	Catch per 100 feet of shore line with seine Aug 1956[c]
Yellow perch	<0.1	....	1.4
Rock bass	6.4	9.1	1.9
Bluegill	....	....	0.7
Longear sunfish	....	....	9.4
Pumpkinseed	....	....	0.5
Smallmouth bass	6.2	7.8	0.7
Largemouth bass	....	0.4	....
Northern pike	0.2	....	....
Muskellunge	....	0.4	....
White sucker	1.4	81.6	10.1
Bullhead spp.	0.2	....	1.6
Longnose gar	....	....	0.2
Sand shiner	....	268.0	81.2
Common shiner	....	54.8	8.5
Rosyface shiner	....	20.2	0.5
Blacknose shiner	....	0.4	0.7
Bluntnose minnow	....	259.0	56.0
Longnose dace	....	7.8	....
Creek chub	....	....	0.2
Redbelly dace	....	....	0.5
Johnny darter	....	11.1	3.8
Iowa darter	....	4.9	0.7
Logperch	....	5.8	8.2
Mudminnow	....	0.4	0.2
Sculpin sp.	....	....	0.5

[a] Total of 12 trap net days.

[b] Total of 2.43 acres seined.

[c] Total of 425 feet of shore line seined.

Age and growth

Species	Mean growth rate index[1] for collections on different dates; number of scale samples in parentheses; age groups represented given in Roman numerals	
	Aug 1956	Sep, Oct 1971
Yellow perch	-0.6 (136) IV-VII, IX	-0.5 (13) III
Rock bass	-0.4 (42) III-VI	0.0 (13) III, VII
Smallmouth bass	0.0 (5) II	
Northern pike	+1.3 (5) III	
Cisco	-0.8 (22) I, III	+1.1 (58) V-IX

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Age and growth of whitefish and splake

Date	Species	Number of fish	Age group	Mean length (inches)
Sep, Oct 1971	Splake	17	I	9.3
		26	II	13.6
		22	III	16.8
		3	IV	19.8
	Whitefish	17	II	13.1
		16	III	15.5
		5	IV	17.0
		16	V	18.7
		4	VI	19.6
		1	VII	21.3

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39[a]	...	411	328	0.80
1940-45	...	563	214	0.38
1946-51[b]	124	397	102	0.26
1952-57[c]	185	561	200	0.36
1958-64	461	1,314	235	0.18

[a] Years of 1930, 1932, 1933, 1935, and 1936 not included.

[b] Year of 1949 not included.

[c] Years of 1953 and 1954 not included.

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1946-51	1952-57	1958-64
Yellow perch	49.7	29.0	41.2	67.5	31.9
Rock bass	28.0	38.8	15.7	8.5	21.3
Pumpkinseed	1.2	0.5	....	0.5	....
Bluegill	....	....	4.9	....	....
Smallmouth bass	15.5	18.2	....	4.5	3.4
Muskellunge	0.3	0.5	6.9	....	0.4
Northern pike	1.2	1.4	2.0	1.5	0.4
Lake trout	2.1	10.3	27.5	16.0	26.8
Rainbow trout	....	....	1.0	....	8.1
Whitefish	....	0.5	....	....	6.8
Others	2.0[a]	0.8[b]	0.8[c]	1.5[d]	0.9[e]

[a] Includes largemouth bass, cisco and bullhead.

[b] Largemouth bass.

[c] Brook trout.

[d] White sucker.

[e] Includes brown trout and carp.

Estimated angler effort, from mail survey (includes Skegemog Lake)

Year	Number of angler days
1970	8,120
1973	22,770

Shanty counts by airplane

Date	Number
2/15/57	46
2/19/58	131
2/11/59	71
2/18/60	103
2/20/61	97

Muskellunge harvest

Harvest by spearing from questionnaire survey

1953: Estimated 16 muskellunge
1954: Estimated 24 muskellunge
1954: Estimated 163 hours required to spear one muskellunge

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Date[1]	Size	Numbers
Yellow perch	1920-21	fry, fingerling	2,106,000
	1935-41	fingerling	6,871,000
Smallmouth bass	1934-38	adults	5,858
Largemouth bass	1909	fingerling	4,000
Walleye	1904-10	fry	875,000
	1934-38	fry	2,515,000
Lake trout	1894-1914	fry	553,000
	1933-40	fry, fingerling	226,250
	1942-47	fingerling	155,000
	1957-65	sublegal, legal	88,704
Rainbow trout	1938	adult	257
	1949-52	fingerling	30,528
	1956-66	fingerling	211,000
	1968-69	yearlings	33,550
	1971-73	fingerling	52,192
	1972-73	yearlings	75,024
Steelhead	1972	yearlings	10,012
Splake	1966	fingerling	80,000
	1968-71	yearlings	155,897

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1948. Two hundred seventeen shelters installed.
1951. One hundred shelters installed.
1952. One hundred shelters installed.
1953. Fifty shelters installed.
1954. Fifty shelters installed.

About 1959: Fifteen old car bodies were put in 26 feet of water.
1963. Car bodies were checked by diving. Rock bass, smallmouth bass and white suckers were using the shelters.

Recommendations from observations: Car bodies should be lowered in an upright position, windows, doors, hoods, and trunks should be open. Car bodies with everything closed were used very little by fish.

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Warren Alward, Fisheries Habitat Biologist, December 1975.

Fletcher Impoundment, Alpena and Montmorency counties
T. 30 N., R. 4, 5 E., Sec. many

Fletcher Impoundment was formed by a dam placed on the South Branch of the Thunder Bay River. The dam, completed in 1930, is owned by the Alpena Light and Power Company. Purpose of the dam is production of electrical power. The impoundment covers 8,970 acres with a maximum depth of 10 feet.

General creel census, special creel census, and mail surveys have been used to measure fishing pressure and success of anglers. The general creel census was conducted by Conservation Officers while performing their other duties at the lake during the years 1935-1964 (1936 and 1937 excluded). Special creel censuses were conducted in 1948, 1956, and 1961-1965. Data from mail surveys are available for 1970 and 1973.

Management of these waters has been directed primarily toward northern pike by manipulation of regulations on minimum sizes, creel limits, and spearing. The present sport fishery has normal state-wide regulations on all species except no minimum size limit on northern pike and spearing is prohibited. Species included in the anglers creel are northern pike, largemouth and smallmouth bass, yellow perch, rock bass, pumpkinseed, black crappies, bluegill, bullhead and suckers.

Fishing is concentrated at the north end of the lake where most of the access sites are located; however, the entire impoundment is fished during the open water season. The old stream channels are popular places for trolling for pike. The irregular bottom along a flooded railroad grade has the reputation as a good area to fish.

Currently Fletcher Impoundment provides a productive fishery. The present regulations appear to be sustaining a good yield and are acceptable to the anglers. The uplands and watershed are in large private ownership and overdevelopment does not appear to be a problem at this time.

Periodic checks on fishing pressure, angler harvest, and the fish populations including prey species should be made. Data on water chemistry are lacking and should be obtained at index stations.

LAKE SURVEYS

Physical data

Area (acres)	8,973	Shore development	1.9
Depth (feet)			
Mean	5.8		

Dam: Constructed in 1930 on Upper South Branch of the Thunder Bay River. Owned by Alpena Light and Power Company.

Water levels:
Legal limits--Maximum, 12 feet, 7 inches above floor of dam.
Minimum, 7 feet, 5 inches above floor of dam.

Fish collections

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	1948	1954	1955	1956	1959
Northern pike	+0.3 (224) I-VII	-1.6 (85) I-IV	-1.8 (995) I-V	-2.6 (580) I-IV	-1.4 (19) I-II
Largemouth bass	....	....	....	+0.5 (63) II, IV-VII	....
Pumpkinseed	....	....	....	+0.6 (64) III-VI	....
Rock bass	....	....	....	-0.8 (18) V-VI	....
Yellow perch	....	....	....	-0.5 (49) III-VIII, X	....

[1] Deviations in inches from statewide growth rate averages, only age groups with at least five samples are included.

Age and growth, continued

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	1961	1962	1963	1964	1965
Northern pike	-2.3 (97) I-V	-5.1 (88) I-III	-4.9 (311) II-V	-5.2 (200) I-V	-5.4 (330) II-VI
Pumpkinseed	....	+1.2 (70) III-VI	+1.5 (46) III-V	....	+1.0 (99) II-IV
Bluegill	....	+3.0 (23) III-IV	....	....	....
Yellow perch	....	....	+0.9 (202) III-VIII	+1.9 (19) III-V	+1.6 (41) II-V
Largemouth bass	....	....	+0.1 (5) VIII	....	....

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals			
	1966	1967	1968	1972
Northern pike	-3.3 (112) II-IV	-3.0 (93) I-IV	-2.0 (119) II-III	+0.2 (6) III
Yellow perch	....	+0.2 (5) III	....	....

[1] Deviations in inches from statewide growth rate averages, only age groups with at least five samples are included.

Population estimate of northern pike

Spring of 1956, northern pike netted, marked and released. Creel census during summer gave ratio of marked to unmarked pike in harvest.

Estimated population size = 97,000.
Exploitation rate = 38%.

Diet of northern pike

Food item	Percent of food items in stomachs of northern pike (W = winter; S = summer)						
	1963		1964	1965	1966	1967	1968
	W	S	W	S	W	W	W
Percidae	48	8	45	10	8	11	26
Centrarchidae	22	2	0	5	51	15	11
Cyprinidae	4	0	6	0	8	2	29
Catostomidae	3	0	0	0	1	<1	5
Ictaluridae	<1	1	0	0	1	3	0
Umbridae	0	1	0	<1	0	0	0
Esocidae	<1	1	5	0	1	<1	2
Fish remains	21	4	32	30	21	14	20
Total fish items	98	17	88	45	91	45	93
Crayfish	2	53	13	40	10	7	5
Frog	0	0	0	0	0	<1	2
Insect	<1	9	0	13	<1	47	0
Leech	0	21	0	<1	0	0	0
Total non-fish items	2	83	13	53	10	54	7

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1935-40[a]	93	413	536	1.30
1941-50	5,754	20,381	9,120	0.45
1951-59	17,317	59,822	31,176	0.52
1960-64	5,270	16,131	7,158	0.44

[a] Years of 1936 and 1937 not included.

Species composition of catch from general creel census

Species	Percent of total catch			
	1935-40	1941-50	1951-59	1960-64
Yellow perch	....	15.2	4.4	16.0
Rock bass	1.3	2.3	2.3	1.0
Bluegill	....	0.6	1.9	11.1
Pumpkinseed	3.0	2.2	18.7	21.5
Black crappie	....	0.4	0.2	0.1
Largemouth bass	....	1.4	6.9	3.7
Smallmouth bass	0.4	0.6	1.3	0.5
Walleye	....	0.2	<0.1	....
Northern pike	17.0	62.3	63.1	35.7
Rainbow trout	....	<0.1	<0.1	....
Bullhead spp.	78.4	14.6	1.1	10.3
Sucker spp.	....	0.1	0.2	0.1

Special creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1948	47,600	258,540	83,910	0.32
1955	49,100	245,700	147,760	0.60
1956	48,850	196,530	129,380	0.66
1961[a]	21,940	77,950	37,400	0.48
1962	25,729	99,008	14,959	0.15

[a] Open water season only.

Species composition of catch from special creel census

Species	Percent of total catch				
	1948	1955	1956	1961	1962
Yellow perch	22.9	4.2	4.3	69.2	27.5
Rock bass	2.4	2.0	2.9	1.5	0.5
Bluegill	....	....	<0.1	1.6	4.5
Pumpkinseed	1.4	56.7	51.6	15.7	42.0
Largemouth bass	0.8	5.2	6.6	2.9	2.3
Northern pike	57.8	26.2	28.9	5.6	12.3
Bullhead spp.	14.7	5.7	5.5	3.4	10.9

Estimated harvest of northern pike

Year	Winter	Summer	Special regulations
1948	14,000	34,500	14-inch minimum size, spearing allowed, creel limit of 5
1956	19,500	17,900	14-inch minimum size, spearing allowed, creel limit of 5
1961	1,200	980	20-inch minimum size, spearing allowed, creel limit of 5
1962	1,210	581	20-inch minimum size, spearing allowed, creel limit of 5
1963	18,400	43,500	14-inch minimum size, spearing prohibited, creel limit of 10
1964	10,300	18,800	14-inch minimum size, spearing prohibited, creel limit of 10
1965	10,400	114,600	14-inch minimum size, spearing prohibited, creel limit of 10
1966	No census		14-inch minimum size, spearing prohibited, creel limit of 10
1967-68	No census		20-inch minimum size, spearing prohibited, creel limit of 5
1969-75	No census		No size limit, spearing prohibited, creel limit of 5

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	30,200
1973	60,210

Fish shanty counts
by airplane

Date	Shanty count
1-24-55	606
1-17-56	620
2-15-57	557
2-19-58	490
2-11-59	560
2-23-60	332
2-21-61	388
2-13-62	365
2-11-63	164
2-13, 14-64	219
2-16-65	287
1971	266
1974	206
2-21-75	228

RECORDS OF FISH MANAGEMENT

Stocking - none

Fishing regulations

See estimated harvest of northern pike.

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1205 Shetter, D. S., and H. J. Vondett. September 23, 1948. Creel census results from the 1948 winter spearing season on the Fletcher Floodwater, Alpena and Montmorency counties.

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Warren Alward, Fisheries Habitat Biologist, August 1975.

Glen Lake, Leelanau County
T. 28, 29 N., R. 13, 14 W., Sec. many

Glen Lake has two distinct basins. The larger east basin (Big Glen) has a surface area of 4,865 acres with a maximum depth of 130 feet. This basin contains suitable habitat for both cold-and warm-water species of fish. The smaller west basin (Little Glen) has a surface area of 1,400 acres and a maximum depth of 13 feet. Little Glen is best suited for warm-water species of fish. Both basins were mapped during the winter of 1949 and a biological survey was made in August 1949.

Fishing pressure and angler success have been measured with the general creel census (1928-1962) and a mail survey in 1970. The general creel census was designed to measure only success of anglers actually interviewed while the mail survey measured total fishing pressure. Yellow perch have been the predominant species in the angler's creel.

Past management has consisted of planting ten different species of fish since 1912. Except for the splake introductions of 1972 and 1973, none of the plantings have been adequately evaluated. The degree of success has been largely a matter of individual opinion. Plantings of lake trout at a rate of two or less per acre have provided only a limited fishery. Introductions of steelhead and rainbow trout made between 1956 and 1973 have also resulted in only a limited fishery, but it is assumed that many of these fish migrated to Lake Michigan. Plantings of splake at the rate of seven and ten per acre have been successful and are beginning to contribute significantly to the fishery.

In Little Glen Lake, yellow perch provide a good year-around fishery while largemouth and smallmouth bass furnish good fishing during the summer months. Big Glen Lake provides a good year-around fishery for both yellow perch and splake. Fishing quality probably has not changed much from that of 20 years ago, except for the splake fishery which has been established since 1972.

For future evaluation work, permanent index stations, and standard sampling periods and methods should be established.

LAKE SURVEYS

Physical and chemical data
surveyed August 1949

Big Glen

Area (acres)	4,865	Thermocline	yes
Depth (feet)		Surface	
Maximum	130	Alkalinity (ppm)	135
Mean	68.8	pH	8.0
Shore development	1.1	Oxygen (ppm)	
Percent shoal		Surface	7.6
<15 feet deep	18	Bottom	2.6
Secchi disk (feet)	20	Bottom type	
Temperature (°F)		Shoal	sand, gravel, marl
Surface	76	Depths	marl
Bottom	43	Vegetation	sparse

Little Glen

Area (acres)	1,400	Thermocline	none
Depth (feet)		Surface	
Maximum	13	Alkalinity (ppm)	109
Mean	5.4	pH	8.2
Shore development	1.2	Oxygen (ppm)	
Percent shoal		Surface	7.3
<15 feet deep	100	Bottom	8.3
Secchi disk (feet)	11	Bottom type	sand, gravel, marl
Temperature (°F)		Vegetation	medium
Surface	76		
Bottom	76		

Tributaries and dams, watershed drainage

Main inlets:	No large inlets. Stream from Brooks Lake, Hadlem Creek, many springs.
Main outlets:	Canal to Fisher Lake to Crystal River to Lake Michigan. About 6 miles by stream to Lake Michigan.
Dams:	Dam on Crystal River controls water level.
Watershed drainage area (acres):	12,415

Fish collections

Species and numbers

Species	Number of fish collected		
	August 1949[a]		April 1955[b]
	Big Glen	Little Glen[c]	Big Glen
Yellow perch	4,970	196	66
Rock bass	118	82	4
Longear sunfish	3	...	...
Smallmouth bass	20	42	...
Largemouth bass	15	103	...
Northern pike	11	9	...
Total	5,137	432	70
Lake trout	1	...	...
Cisco	12	...	2
Total	13	0	2
White sucker	28	4	33
Bullhead spp.	...	3	...
Total	28	7	33
Sand shiner	4	4	...
Mimic shiner	1	16	...
Spottail shiner	6	8	...
Blacknose shiner	...	20	...
Common shiner	...	1	...
Bluntnose minnow	258	202	...
Hornyhead chub	1	...	...
Johnny darter	4	111	...
Iowa darter	...	20	...
Logperch	29	...	...
Mudminnow	...	7	...
Total	303	389	0
Grand total	5,481	828	105

[a] Collected with gill nets and seine.

[b] Collected with gill nets.

[c] An estimated 5,000 more small fish taken with seine were not sorted to species.

Species	Number of fish collected		
	Big Glen		Little Glen
	Nov 1965[a]	Aug 1973[a]	June 1965[b]
Yellow perch	153	192	37
Rock bass	...	12	24
Bluegill	...	...	11
Smallmouth bass	...	1	37
Largemouth bass	...	...	17
Northern pike	...	...	1
Total	153	205	127
Rainbow trout	1	...	1
Lake trout	...	7	...
Splake	...	43	...
Cisco	15	276	...
Total	16	326	1
Suckers spp.	33	71	59
Grand total	202	602	187

[a] Collected with gill nets.

[b] Collected with trap and fyke nets.

Catch per unit effort

Species	Catch per 1,000 feet of gill net			Catch per 100 feet of shoreline with seine	
	August 1949		April 1955	August 1949	
	Big Glen[1]	Little Glen[2]	Big Glen[3]	Big Glen[4]	Little Glen[5]
Yellow perch	161.0	73.0	132.0	788.0	10.7
Rock bass	15.3	32.0	8.0	15.8	4.4
Longear sunfish	....	....	....	0.5	....
Smallmouth bass	2.0	10.0	....	2.8	2.8
Largemouth bass	....	1.0	....	2.5	8.9
Northern pike	7.3	9.0	....	....	....
Lake trout	0.7	....	....	....	....
Cisco	8.0	....	2.0	....	....
White sucker	6.0	....	33.0	3.2	0.3
Bullhead spp.	....	....	....	....	0.3
Mimic shiner	....	....	....	0.2	1.4
Sand shiner	....	....	....	0.7	0.3
Spottail shiner	....	....	....	1.0	0.7
Blacknose shiner	....	....	....	....	1.7
Common shiner	....	....	....	....	0.1
Bluntnose minnow	....	....	....	43.0	17.6
Hornyhead chub	....	....	....	0.2	....
Johnny darter	....	....	....	0.7	9.7
Iowa darter	....	....	....	....	1.7
Logperch	....	....	....	4.8	....
Mudminnow	....	....	....	....	0.6

[1] Total of 1,500 feet of gill net.

[2] Total of 1,000 feet of gill net.

[3] Total of 500 feet of gill net.

[4] Total of 600 feet of shoreline seined.

[5] Total of 1,145 feet of shoreline seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals			
	August 1949		Nov 1965	June 1965
	Big Glen	Little Glen	Big Glen	Little Glen
Yellow perch	0.0 (153) I-VII	+0.6 (95) I-V	+0.4 (27) III-V	-0.1 (26) II-VI
Rock bass	+0.2 (45) II-III	+0.8 (25) II-III	....	....
Smallmouth bass	....	+1.6 (13) I	....	-0.7 (15) II
Largemouth bass	....	....	....	-0.5 (9) III

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
		Big and Little Glen lakes combined		
1928-39[a]	...	2,292	5,347	2.33
1940-46	756	1,841	5,684	3.09
		Big Glen Lake only		
1947-51	294	798	1,638	2.05
1952-57	698	1,626	4,179	2.57
1958-63	715	1,766	1,109	0.63
		Little Glen Lake only		
1947-51	212	436	1,922	4.41
1952-57	325	648	2,711	4.18
1958-62	171	309	344	1.11

[a] The year 1933 not included.

Species composition of catch from general creel census

Big and Little Glen lakes combined

Species	Percent of total catch	
	1928-39	1940-46
Yellow perch	85.7	91.8
Rock bass	5.3	2.8
Bluegill	0.3	0.5
Smallmouth bass	2.9	1.4
Northern pike	0.3	0.4
Lake trout	0.3	0.3
Cisco	5.1	1.8
Others	0.1[a]	1.0[b]

[a] Includes pumpkinseed, largemouth bass, and white sucker.

[b] Includes pumpkinseed, crappie, largemouth bass, walleye, and white sucker.

Big Glen Lake only

Species	Percent of total catch		
	1947-51	1952-57	1958-63
Yellow perch	90.9	96.9	87.5
Rock bass	1.9	1.0	5.0
Bluegill	...	0.2	0.5
Smallmouth bass	4.3	0.5	3.0
Northern pike	0.7	0.4	...
Lake trout	1.6	0.7	2.3
Cisco	...	...	1.2
Others	0.6[a]	0.3[b]	0.5[a]

[a] Largemouth bass.

[b] Includes pumpkinseed, largemouth bass and brown trout.

Little Glen Lake only			
Species	Percent of total catch		
	1947-51	1952-57	1958-62
Yellow perch	97.4	98.6	88.7
Rock bass	0.4	0.3	4.4
Smallmouth bass	2.1	0.8	3.8
Largemouth bass	...	...	2.0
Others	0.1[a]	...	1.1[b]

[a] Includes northern pike and lake trout.

[b] Includes bluegill, northern pike and white sucker.

Estimated angler effort,
from mail surveys
(big and little lakes combined)

Year	Number of angler days
1970	7,880

RECORDS OF FISH MANAGEMENT

Introductions and stockings

Fish stocked: Few records available from 1915-32

Species	Dates[1]	Size	Numbers
Yellow perch	1912	fingerling	1,000
	1921	fingerling	36,000
	1934	fingerling	10,000
Bluegill	1933-44	fingerling	168,200
Smallmouth bass	1908-14	fry + fingerling	14,050
	1934-44	fingerling	20,468
Largemouth bass	1903-13	fry + fingerling	14,800
	1934-44	fingerling	9,500
Walleye	1894-1906	fry	1,350,000
	1933-42	fry	2,020,000
Lake trout	1894-1911	fry	416,000
	1933-40	fingerling	89,000
	1941-50	yearling + 2-yr-old	59,300
	1952-55	6-8 inch	20,000
	1956-64	legal	55,383
	1965	sublegal	3,000
	1970-72	fingerling + yearling	38,575
Whitefish	1956	fry	1,000
	1959	fry	4,000
Rainbow trout	1956	sublegal	5,000
	1967-73	yearling	87,998
Steelhead	1973	yearling	20,196
Brook trout	1960-62	fingerling	20,000
Splake	1966	fingerling	50,000
	1972	yearling	35,280
	1973	fingerling	50,000

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1951. Installed 225 shelters in Big Glen Lake.

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Gogebic Lake, Gogebic and Ontonagon counties
T. 46, 47, 48 N., R. 42, 43 W., Sec. many

Gogebic Lake is the sixth largest inland lake in Michigan. It has a surface area of 13,380 acres and a maximum depth of 35 feet. Approximately 20% of the lake is less than 15 feet deep. A biological inventory was made in June 1938. For the inventory an outline map was provided by the U.S. Forest Service, and depth contours and bottom types were determined by a C.C.C. crew under U.S. Forest Service supervision. At the time of the inventory, forage fish were reported as extremely scarce.

General creel census (1928-63), special creel census (summers of 1940 and 1941), and mail surveys have been used to measure fishing pressure and success of anglers. The general creel census and special census were designed only to measure angler success of those fishermen actually interviewed. The mail survey measures total fishing pressure.

The walleye has been and still is the most important sport fish in Gogebic Lake. An intensive investigation of the reproduction of walleyes in this lake was conducted in the 1940's. For several years walleyes from Gogebic Lake have been used as a source of eggs for the hatcheries. The studies and surveys indicate a large population of walleyes, but from the angler's point of view, there has been dissatisfaction, continuously since the 1930's, with the size of the walleye catch. Their claim has been based on low catches of walleyes which they feel indicate a low population. Because of the low catches, anglers have raised objections to the annual walleye spawn collection, but after 4 years of observing and assisting in the work, some anglers are beginning to accept the spawn-taking operation.

In recent years winter and spring perch fishing has declined, however, there are few complaints about the winter walleye fishery. Walleye fishing is very good in May and early June, but during the warm summer months (the tourist season) it is poor. In October and November, after the tourist season, the walleye fishing improves and success is good for the few anglers who fish.

The abundance of perch in the lake should be determined. Netting to collect spawn yields primarily walleyes and the abundance of

other fish species cannot be evaluated in this way. Closer surveillance of the fishery through an intensive creel census would determine whether the complaints of anglers are justified. The effects on year class strength of the annual walleye spawn collection needs to be evaluated.

Growth rates of the walleye are slow. Currently, a 13-inch minimum size length is in effect in place of the state-wide minimum length of 15 inches.

LAKE SURVEYS

Physical and chemical data
surveyed June 1938

Area (acres)	13,380	Thermocline	none
Depth (feet)		Surface	
Maximum	35	Alkalinity (ppm)	20-28
Mean	17.5	pH	7.6-7.8
Shore development	2.3	Oxygen (ppm)	
		Surface	8.0
Percent shoal		Bottom	7.8
<15 feet deep	20		
		Bottom type	
Secchi disk (feet)	2-9	Shoal	sand, gravel
		Depths	muck
Temperature (°F)			
Surface	60-74	Vegetation	sparse to medium
Bottom	61		

Tributaries and dams, watershed drainage

Main inlets:	Slate River, Merriweather River, Fern Creek, Trout Creek, Meri-ma-she Creek, Spring Creek and four unnamed streams.
Main outlet:	West Branch of Ontonagon River into Ontonagon River into Lake Superior.
Dam:	Located about 0.5 mile from lake in West Branch of Ontonagon River; controls water level of lake.
Watershed drainage area (acres):	89,297

Fish collections

Species and numbers

Species	Number of fish collected			
	Sep 1928[a]	June 1938[a]	April 1942[b]	Sep 1946[b]
Yellow perch	138	105	9	35
Rock bass	2	...	...	...
Black crappie	10	...	...	...
Smallmouth bass	1	...	...	...
Northern pike	1	14	3	3
Walleye	16	28	...	3
Total	168	147	12	41
Brook trout	1	...	...	...
Cisco	...	1	3	...
Total	1	1	3	0
White sucker	26	40	5	...
Total	26	40	5	0
Johnny darter	...	1	....	...
Common shiner	...	...	...	2
Total	0	1	0	2
Grand total	195	189	29	78

[a] Collected with gill net and seine.

[b] Collected with gill net.

Species	Number of fish collected		
	May 1947[a]	Aug 1955[a]	Aug 1957[a]
Yellow perch	17	46	99
Rock bass	1	4	...
Black crappie	1	...	...
Smallmouth bass	2	15	42
Northern pike	8	9	4
Walleye	7,771	517	688
Burbot	2	...	...
Total	7,802	591	833
White sucker	25	68	97
Grand total	7,827	659	930

[a] Collected with trap net.

Catch per unit effort

Species	Catch per 1,000 feet of gill net		
	June 1938[a]	April 1942[b]	Sep 1946[c]
Yellow perch	20.4	14.4	70.0
Northern pike	4.2	4.8	6.0
Walleye	1.2	...	6.0
Cisco	0.4	4.8	...
White sucker	11.2	8.0	...

[a] Total of 2,600 feet of gill net.

[b] Total of 625 feet of gill net.

[c] Total of 500 feet of gill net.

Species	Catch per trap net lift		Catch per 100 feet of shoreline with seine
	Aug 1955[a]	Aug 1957[b]	June 1938[c]
Yellow perch	3.1	9.9	8.1
Rock bass	0.3	...	...
Smallmouth bass	1.0	4.2	...
Northern pike	0.6	0.4	0.5
Walleye	34.5	68.8	3.9
White sucker	4.5	9.7	1.7

[a] Total of 15 trap net lifts.

[b] Total of 10 trap net lifts.

[c] Total of 640 feet of shoreline seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals					
	1929	1940	1947	Aug 1955	Aug 1957	May 1967[2]
Yellow perch	+2.2 (92) III-VII	+3.6 (5) IV	....	....	....	....
Walleye	-3.5 (193) II-VII	-1.5 (47) IV-VI	-1.3 (519) 0-IX	-2.8 (24) II-IV	-0.9 (90) I-VI	-3.0 (56) I-XI
Northern pike	....	-0.7 (12) I-II	....	....	....	....

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

[2] Age group averages were from back calculations of 56 fish.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39	.....	6,232	2,108	0.34
1940-45	2,881	10,878	4,671	0.43
1946-51	854	2,860	1,081	0.38
1952-57	876	2,589	1,185	0.46
1958-63	1,127	2,618	1,605	0.61

Species composition of catch from general creel census

Species	Percent of total catch				
	1928-39	1940-45	1946-51	1952-57	1958-63
Yellow perch	7.0	0.8	5.2	4.6	11.3
Bluegill	...	0.1	5.6	...	...
Walleye	81.7	91.7	80.9	87.6	84.9
Northern pike	9.5	6.2	8.1	6.6	2.3
Others	1.8[a]	1.2[b]	0.2[c]	1.2[d]	1.5[e]

[a] Includes crappie and smallmouth bass.
[b] Includes crappie, pumpkinseed, largemouth bass, and smallmouth bass.
[c] Includes crappie and smallmouth bass.
[d] Includes largemouth bass and burbot.
[e] Includes rock bass and smallmouth bass.

Special creel census during summers of 1940 and 1941

Date	Number of anglers [1]	Total hours fished [1]	Number of fish caught [1]	Catch per hour
1940	2,276	8,051	2,917	0.36
1941	5,323	16,923	5,414	0.32

[1] Empirical data, not expanded estimates.

Species composition of catch from special creel census during summers of 1940 and 1941

Species	Percent of total catch 1940	1941
Yellow perch	2.4	2.0
Black crappie	1.1	0.6
Smallmouth bass	2.4	1.1
Walleye	80.8	89.2
Northern pike	12.6	6.9
Burbot	0.6	0.1
Others	0.1[a]	0.1[b]

[a] Includes rock bass, largemouth bass, and white sucker.

[b] Includes rock bass and largemouth bass.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	26,480
1973	42,300

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked:

Species	Dates[1]	Size	Numbers
Walleye	1904-07	fry	1,200,000
	1933-40	fry	27,250,000
	1972-75	fry	4,100,000
Northern pike	1898	adult	84
Muskellunge	1898	adult	18
Lake trout	1892-1897	fry	400,000
	1905-14	fry	380,000
Smallmouth bass	1910-14	fingerling	9,250
	1937	fingerling	1,000
Largemouth bass	1914	fingerling	4,500
	1933	fingerling	500
Yellow perch	1934-37	fingerling	34,400
Black crappie	1940	fingerling	5,250
Bluegill	1941	fingerling	45,000
	1943-45	yearling	54,000

[1] Plantings not necessarily continuous between dates given.

Tagged walleyes

In 1947, 4,400 walleyes were tagged and released. From 1947 to 1960, 300 tags were returned.

Rainbow trout release

In 1967, the Lake Gogebic Improvement Association released under DNR permit, 6,000 rainbow trout 5-7 inches long. An additional 5,000 trout were released in 1969. Results were not evaluated, however, riparians claimed the catch success was good.

Brush shelters

About 700 shelters were installed prior to 1940.

1948: Installed 56 shelters.

1949: Installed 24 shelters.

Weir across outlet

1934-1935: A Barr fishway was installed at the outlet because residents claimed that fish migrating out of the lake could not return. Fishway did not work as expected.

The Lake Gogebic Development Association and Board of Supervisors requested that a screen be placed across the outlet to prevent migration of walleyes out of the lake. A weir containing an upstream and downstream trap was operated from April 10, 1940, to September 14, 1941, to determine movement of fish into and out of the lake.

Results:

Species	Number of fish captured	
	Upstream trap	Downstream trap
White sucker	124	402
Walleye	52	56
Northern pike	11	14
Black crappie	2	7
Yellow perch	6	2
Rock bass	55	13
Smallmouth bass	2	4
Largemouth bass	0	1

Conclusion: Loss of fish from the lake was negligible and did not merit placing a screen in the outlet of the lake.

Walleye egg collections

1971: 41 quarts of eggs.
1972: 153 quarts of eggs.
1974: 125 quarts of eggs.
1975: 106 quarts of eggs.

Legal lake levels

The following legal lake levels were accepted by the U.P. Power Company and County Boards in 1961.

Dates	Inches above Barthels Spike
March 1 - April 1	Maintain no higher than 12 inches to avoid ice damage during spring break-up.
April 1 - May 1	Fill to 24 inches.
May 1 - June 10	Maintain at 24 inches insofar as runoff and outlet capacity will permit. If lake exceeds 24-inch level because of heavy runoff, maintain lake at peak level but not in excess of 30 inches. If lake exceeds 30 inches, lower to 30 inches as soon as possible.
June 30 - Sep 15	Raise to 30 inches if Power Company anticipates future need for additional water. Preferably maintain at 18-24 inches.
Sep 15 - March 1	Store and withdraw water as needed by Power Company, levels not to exceed 24 inches and no higher than 12 inches when possible. Lake to be lowered to 12 inches by March 1.

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Personal communication:

Raymond P. Juetten, Fisheries Biologist, August 1975.

Grand Lake, Presque Isle County
T. 33, 34 N., R. 7, 8 E., Sec. many

Grand Lake has a surface area of 5,660 acres and a maximum depth of 25 feet. About 80% of the lake is less than 15 feet deep. The lake was mapped during the winter of 1949-50 and was followed by an intensive fisheries survey in June and July 1950.

Measures of angling pressure and success have been obtained from a special creel census during the winter of 1935, general creel census records, and mail surveys. The general creel census was conducted from 1939-1964 by Conservation Officers while performing their other duties at the lake. This census was designed only to measure success of those anglers actually interviewed. The mail survey measures total fishing pressure.

Past management has consisted of planting several species of fish, installation of 250 brush shelters, removal of rough fish by commercial trap netting, and development of a pike rearing area. The brush shelters have been popular areas to fish but are now in poor condition. The pike rearing area has been successful in rearing fingerling pike but no evaluation of the contribution to the fishery has been made.

The lake is under state-wide fishing regulations. Species normally taken are yellow perch, rock bass, smallmouth bass, walleye and northern pike. The best northern pike fishing occurs in Black Bass Bay, just after the first ice forms. Popular areas for walleye are between Three Sisters and Appelgate Islands, between Grand and Macombers Island and off Warren Creek and Whiskey Bay in the spring. Perch and rock bass are caught all over the lake but a popular area is Whiskey Bay.

Two changes in the fishery have occurred. About 20 years ago there was an active fishery for cisco. This is completely gone now. Yellow perch fishing has been getting better the last 3 years, 1973-75. "Jumbo" perch are taken fairly consistently in Whiskey Bay.

Creel census is needed to determine angler use, species caught and size of fish in the catch. Other information needed includes relative abundance or population estimates of sport and forage species, studies on

fish movements in and out of the lake, determination of spawning areas, age, growth and mortality of major species and an estimate of the impact of fishing on the stocks. The contribution of northern pike from the rearing area to the fishery should be measured.

LAKE SURVEYS

Physical and chemical data surveyed 28 June-17 July, 1950

Area (acres)	5,660	Thermocline	none
Depth (feet)		Surface	
Maximum	25	Alkalinity (ppm)	126-127
Mean	8.4	pH	8.2
Shore development	3.6	Oxygen (ppm)	
Percent shoal		Surface	7.8-7.9
<15 feet deep	80	Bottom	7.8-7.9
Secchi disk (feet)	8	Bottom type	
Temperature (°F)		shoal	rocks, sand, gravel, marl
Surface	70	depths	marl
Bottom	70	Vegetation	sparse to medium

Tributaries and dams, watershed drainage

Main inlets: Warren Creek and Schalks Creek.

Main outlets: Outlet about 2 miles long; drains directly into Lake Huron, not part of a major river system. Nineteen islands in the lake.

Watershed drainage area (acres): 21,650

Fish collections

Species and numbers

Species	Number of fish collected				
	June July 1950[a]	Sep 1959[b]	June 1961[c]	June 1962[d]	April 1966[e]
Yellow perch	220	16	129	119	...
Rock bass	149	15	41	1,647	...
Pumpkinseed	411	1	...	52	...
Longear sunfish	7	...	...	...	...
Smallmouth bass	9	3	15	314	...
Largemouth bass	...	...	...	2	...
Northern pike	62	...	5	3	11
Walleye	19	6	197	223	...
Total	877	41	387	2,360	11
Cisco	12	...	...	...	...
White sucker	143	8	248	1,040	...
Bullhead spp.	1	...	...	5	...
Bowfin	83	...	...	1	...
Longnose gar	13	...	1	12	...
Carp	...	...	...	1	...
Total	240	8	249	1,059	0
Mimic shiner	40	...	...	...	...
Sand shiner	43	...	...	...	...
Common shiner	47	...	...	...	...
Blacknose shiner	8	...	...	...	...
Bluntnose minnow	121	...	...	...	...
Creek chub	11	...	...	...	...
Hornyhead chub	2	...	...	...	...
Johnny darter	20	...	...	...	...
Logperch	6	...	...	...	...
Mudminnow	3	...	...	...	...
Banded killifish	1	...	...	...	...
Total	302	0	0	0	0
Grand total	1,431	49	636	3,419	11

[a] Collected with gill net and seine.
[b] Collected with gill net.
[c] Collected with large seine.
[d] Collected with trap and fyke nets.
[e] Collected with trap at pike marsh.

Species	Number of fish collected				
	March 1968[a]	June 1970[b]	April 1971[a]	April 1972[a]	March 1973[a]
Yellow perch	...	22	...	...	...
Rock bass	...	27	...	...	...
Smallmouth bass	...	15	...	...	...
Northern pike	106	5	279	213	186
Walleye	...	16	...	...	...
Total	106	85	279	213	186
White sucker	...	8	...	...	...
Bullhead sp.	...	1	...	...	...
Carp	...	1	...	...	...
Total	0	10	0	0	0
Grand total	106	95	279	213	186

[a] Collected with trap at pike marsh.
[b] Collected with trap at pike marsh and electrofishing.

Catch per unit effort

Species	Catch per 1000 feet of gill net		Catch per 100 feet of shoreline seining	Catch per acre with large seine	Catch per trap net lift
	June July 1950[a]	Sep 1959[b]	June July 1950[c]	June 1961[d]	June 1962[e]
Yellow perch	21.7	21.3	6.9	3.1	2.1
Rock bass	12.8	20.0	6.8	1.0	29.4
Pumpkinseed	2.4	1.3	55.2	...	0.9
Longear sunfish	...	...	1.0	...	...
Northern pike	7.6	...	0.3	0.1	<0.1
Walleye	2.4	8.0	...	4.7	4.0
Smallmouth bass	0.8	4.0	0.4	0.4	5.6
Largemouth bass	...	...	...	...	<0.1
Cisco	1.5	...	...	...	...
White sucker	3.8	10.7	15.9	5.9	18.6
Bullhead sp.	0.1	...	...	...	<0.1
Longnose gar	1.7	...	...	<0.1	0.2
Bowfin	...	...	11.7	...	<0.1

Catch per unit effort, continued

Species	Catch per 1000 feet of gill net		Catch per 100 feet of shoreline seining	Catch per acre with large seine	Catch per trap net lift
	June July 1950[a]	Sep 1959[b]	June July 1950[c]	June 1961[d]	June 1962[e]
Carp	...	...	...	...	<0.1
Mimic shiner	...	...	5.6	...	...
Sand shiner	...	...	6.1	...	...
Common shiner	...	...	6.6	...	...
Blacknose shiner	...	...	1.1	...	...
Bluntnose minnow	...	...	17.0	...	...
Creek chub	...	...	1.5	...	...
Hornyhead chub	...	...	0.3	...	...
Johnny darter	...	...	2.8	...	...
Logperch	...	...	0.8	...	...
Mudminnow	...	...	0.4	...	...
Banded killifish	...	...	0.1	...	...

a Total of 7,875 feet of experimental gill net.
b Total of 750 feet of experimental gill net.
c Total of 710 feet of shoreline seined.
d Total of 42.2 acres seined.
e Total of 56 trap net lifts.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	July 1950	Sep 1959	June 1961	June 1962	
Yellow perch	-1.2 (116) III-VII	-0.3 (5) IV	-0.8 (99) II-V	+0.1 (73) II-VI	
Rock bass	+0.4 (35) IV-VI	+0.9 (6) IV	....	....	
Pumpkinseed	+0.6 (18) III	....	....	....	
Smallmouth bass	....	....	-2.1 (15) II, IV	-0.9 (156) II, VIII	
Northern pike	+1.7 (58) I-IV	....	....	....	
Walleye	-2.2 (6) III	....	-1.8 (128) I-IV	-2.3 (92) II-VI	
	March 1968	April 1970	April 1971	April 1972	April 1973
Yellow perch	....	-1.4 (16) I, V	....	....	....
Rock bass	....	-0.1 (11) IV	....	....	....
Smallmouth bass	....	-2.6 (11) IV	....	....	....
Northern pike	+1.0 (101) I-V	+0.5 (174) I-VI	-0.6 (277) I-VII	-0.6 (203) II-V	-1.4 (181) I-V
Walleye	....	-6.8 (14) III-IV	....	....	....

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1939-50	1,634	5,406	3,242	0.60
1951-64	2,717	4,824	2,940	0.61

Species composition of catch from general creel census

Species	Percent of catch	
	1939-50	1951-64
Bluegill	0.7	0.3
Sunfish spp.	0.7	2.1
Rock bass	4.8	18.4
Yellow perch	85.2	66.6
Largemouth bass	0.2	0.2
Smallmouth bass	2.8	4.7
Walleye	3.0	6.4
Northern pike	2.1	1.1
Cisco	0.4	...
Others	...	0.2[a]

[a] Includes brook trout, white sucker and bullhead.

Special creel census 7 January to 20 March, 1935

Number of anglers	Total hours fished	Number of fish caught	Catch per hour
98	480	211	0.44

Species composition of catch from special creel census
7 January to 20 March, 1935

Species	Percent of total catch
Yellow perch	81.5
Northern pike	18.0
Walleye	0.5

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	19,940
1973	24,750

Shanty counts by air

Date	Count
1960-1970	60 (mean)
1971	62
1974	88
1975	92

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked:
Few records available from 1915-1932

Species	Dates[1]	Size	Numbers
Yellow perch	1910-14	fingerling	8,750
	1921	fingerling	15,750
	1933-39	fingerling	208,950
Bluegill	1933-45	fingerling	340,700
Sunfish spp.	1944	fingerling	5,160
Warmouth	1910	yearling	450
Largemouth bass	1906-14	fry + fingerling	89,325
	1933	fingerling	1,800
	1938-45	fingerling	22,250
Smallmouth bass	1911-14	fingerling	1,900
	1933-34	adult	972
	1936-45	fingerling + adult	15,622
Walleye	1913	fry	285,000
	1933-42	fry	4,320,000
Northern pike	1972-73	fingerling (from pike marsh)	30,000

[1] Plantings not necessarily continuous between dates given.

Removal of rough fish by commercial trap netting

Species	Number of fish caught		Percent of total catch	
	April 1944	Dec-April 1945-46	April 1944	Dec-April 1945-46
White sucker	1,009	4,919	64.9	70.4
Walleye	303	1,151	19.5	16.5
Northern pike	33	107	2.1	1.5
Rock bass	189	563	12.2	8.1
Smallmouth bass	10	62	0.6	0.9
Largemouth bass	1	...	<0.1	....
Yellow perch	4	160	0.3	2.3
Others	5[a]	21[b]	0.3	0.3

[a] Includes bowfin and bullhead.

[b] Includes cisco, sunfish, bluegill, bowfin, and bullhead.

Brush shelters

1949. Installed 89 shelters.
1950. Installed 111 shelters.
1951. Installed 50 shelters.

Pike spawning area

1962. Completed pike spawning area.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. Reports

Number

369 Eschmeyer, R. W. June 19, 1936. Creel census on 12 northern Michigan lakes, winter of 1935-36.

1045 Crowe, W. R. May 21, 1946. Coarse fish removal, Grand Lake, Presque Isle County, 1945-46.

1324 Rodeheffer, I. A., and Jason Day. March 24, 1952. A fisheries survey report of Grand Lake, Presque Isle County, Michigan.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Warren Alward, Fisheries Habitat Biologist, December 1975.

Higgins Lake, Roscommon and Crawford counties
T. 24, 25 N., R. 3, 4 W., Sec. many

Higgins Lake has a surface area of 9,600 acres and a maximum depth of 135 feet. About one-third of the lake is less than 20 feet deep. A bottom-contour map of the lake was prepared during the winter of 1936-37.

A measure of fishing pressure and success of anglers has been obtained from general creel census (1928-1964), a special creel census during the winter of 1936, and mail surveys in 1970 and 1973. The general creel census was designed only to measure success of those anglers actually interviewed. The mail survey was designed to measure total fishing pressure.

During the 1950's and early 1960's, the lake held the reputation as having a good lake trout fishery. This fishery was sustained by annual plantings. Because of slow growth, 2 to 3 years in the lake was necessary for the planted fish to enter the fishery. Exploitation of the relatively small lake trout was high. In 1966 lake trout plantings were replaced with splake. The potential faster growth of the hybrid made it seem a logical choice to offset the tendency to harvest small fish as the anglers were doing with lake trout. Unfortunately, heavy angling pressure continued to lead to the cropping of the splake at a small size. Still with hopes of establishing a population of larger sized fish, lake trout plantings were resumed in 1971 along with the splake.

Rainbow trout have been planted on an annual basis from 1950 to 1973 except for the period of 1966-68. There is no evidence that rainbows have made more than a token contribution to the fishery. Apparently the only specific fishery for rainbows has taken place through the ice, near the mouths of the two creeks in the northwest part of the lake. Currently, brown trout are being planted in place of rainbows in an effort to establish a brown trout fishery.

Reports are that whitefish were abundant in the past. Currently "chumming" for this species through the ice results in high harvests from localized areas. The whitefish is a highly desirable fish to sport

anglers and possibilities for increasing the population should be explored. Cisco appear to be abundant and initial efforts to catch them through the ice have indicated that there may be an undeveloped fishery for this species.

Northern pike are present in the lake and provide a very sporadic fishery. In view of the potential for producing a salmonid-coregonid type fishery, enhancement of that fishery should take precedence over trying to develop a pike fishery.

Probably the most needed information is a comprehensive index station type survey to give baseline data on the fish population and an evaluation of the current stocking program.

LAKE SURVEYS

Physical and chemical data
surveyed August 1939

Area (acres)	9,600	Thermocline	yes
Depth (feet)		Surface	
Maximum	135	Alkalinity	103-110
Mean	49	pH	8.0-8.2
Shore development	1.7	Oxygen (ppm)	
Percent shoal		Surface	8.4-9.6
<20 feet deep	33	Bottom	6.6
Secchi disk (feet)	22-27	Bottom type	
Temperature (°F)		shoal	sand, gravel, boulders
Surface	71-73	depths	marl, muck, clay
Bottom	48-50	Vegetation	sparse

Tributaries and dams, watershed drainage

Main inlets:	Big Creek, Little Creek (intermittent), numerous springs.
Main outlets:	"The Cut," (dredged during the lumbering era for floating logs into Houghton Lake).
Dams:	In outlet, regulates lake level.
Watershed drainage area (acres):	21,953

Benthos
August 1939 survey
(24 Ekman dredge samples)

Organism	Number collected
Chironomidae	317
Amphipoda	285
Trichoptera	189
Pelecypoda	94
Gastropoda	91
Ephemeroptera	81
Hirudinea	48
Oligochaeta	31
Others [1]	25

[1] Includes Turbellaria, Amisoptera, Zygoptera, Neuroptera, Lepidoptera, Coleoptera, and crayfish.

Mean of 24 samples: Number per square foot 77.4

Zooplankton
August 1939 survey
(10 samples)

Population composed mainly of Cladocera and Copepoda with a mean of 0.84 cubic centimeter of organisms per cubic meter of water.

Fish collections

Species and numbers

Species	Number of fish collected			
	July Oct 1935[a]	Sep 1938[a]	Aug 1939[b]	Sep 1941[a]
Yellow perch	28	1	148	1
Rock bass	16	...	96	...
Smallmouth bass	8	2	24	...
Longear sunfish	...	...	...	1
Walleye	...	...	3	...
Whitefish	...	...	23	...
Total	52	3	294	2
Sand shiner	761	198	384	97
Mimic shiner	1	6	4	...
Spottail shiner	11	29	11	27
Rosyface shiner	19	...	3	11
Satinfin shiner	1	...	...	...
Common shiner	4	...	2	1
Golden shiner	...	...	...	1
Spotfin shiner	...	3	80	82
Emerald shiner	3	...	...	...
Bluntnose minnow	52	24	197	19
Pearl dace	5	...	...	...
Johnny darter	79	3	97	...
Sculpin spp.	3	...	...	...
Total	939	263	778	238
Grand total	991	266	1,072	240

[a] Collected with seine.

[b] Collected with gill net and seine.

Species	Number of fish collected		
	Oct, Dec 1952[a]	Oct-Dec 1954[b]	Winter 1970-71[c]
Yellow perch	6	569	...
Rock bass	...	1,777	...
Smallmouth bass	1	50	...
Largemouth bass	...	5	...
Walleye	1	1	...
Northern pike	8	8	9
Total	16	2,410	9
Whitefish	14	29	33
Lake trout	9	8	1
Rainbow trout	...	10	2
Cisco	97	...	...
Splake	...	...	119
Total	120	47	155
White sucker	1	68	...
Bullhead sp.	...	1	...
Bowfin	...	11	...
Total	1	80	0
Grand total	137	2,537	164

[a] Collected with gill net.

[b] Collected with gill net and trap net.

[c] Collected by angling.

Catch per unit effort

Species	Catch per 1000 feet of shoreline	Catch per acre with seine		
	July, Oct 1935[a]	Sep 1938[b]	Aug 1939[c]	Sep 1941[d]
Yellow perch	13.7	1.0	44.4	0.4
Rock bass	7.8	...	4.6	...
Longear sunfish	...	...	...	0.9
Smallmouth bass	3.9	2.0	11.1	...
White sucker	1.0	...	5.2	...
Sand shiner	371.2	196.0	251.0	42.2
Mimic shiner	0.5	5.9	2.6	...
Spottail shiner	5.4	28.7	7.2	11.7
Rosyface shiner	9.3	...	2.0	4.8
Satinfin shiner	0.5	...	...	...
Common shiner	2.0	...	1.3	0.4
Golden shiner	...	...	...	0.4
Spotfin shiner	...	3.0	52.3	35.7
Bluntnose minnow	25.4	23.8	128.8	8.3
Northern pearl dace	2.4	...	...	...
Johnny darter	38.5	3.0	63.4	...
Sculpin spp.	1.5	...	...	...

[a] Total of 2,050 feet of shoreline seined.
[b] Total of 1.01 acres seined.
[c] Total of 1.53 acres seined.
[d] Total of 2.3 acres seined.

Species	Catch per 1000 feet of gill net		
	Aug 1939[a]	Oct, Dec. 1952[b]	Nov, Dec 1954[c]
Yellow perch	21.9	0.9	...
Rock bass	24.4	...	...
Smallmouth bass	1.9	0.2	...
Walleye	0.8	0.2	0.3
Northern pike	...	1.2	1.0
Whitefish	6.3	2.2	9.7
Lake trout	...	1.4	0.7
Rainbow trout	...	...	1.3
Cisco	...	14.9	...
White sucker	1.6	0.2	1.3

[a] Total of 3,650 feet of gill net set.
[b] Total of 6,500 feet of gill net set.
[c] Total of 3,000 feet of gill net set.

Age and growth

Species	Mean growth rate index[1]; number of scale samples in parentheses; age groups represented given in Roman numerals	
	Aug 1939	Nov 1962
Yellow perch	+0.2 (47) III-V	+0.1 (63) III-VI
Rock bass	+0.4 (62) III, IV, VI-IX	...
Smallmouth bass	-0.1 (12) I, II	...

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-1939	...	67	299	4.46
1941-1950	763	1,002	1,134	1.13
1951-1964	4,030	8,455	6,379	0.78

Species composition of catch
from general creel census

Species	Percent of total catch		
	1928-39	1941-50	1951-64
Yellow perch	100.0	73.2	79.3
Rock bass	...	22.8	12.1
Pumpkinseed	...	0.9	0.2
Smallmouth bass	...	1.8	0.5
Walleye	...	0.5	0.1
Northern pike	...	...	1.0
Lake trout	...	...	4.3
Rainbow trout	...	...	1.9
Others	...	0.8[a]	0.6[b]

[a] Includes bluegill, largemouth bass, northern pike, rainbow trout, lake trout, and white sucker.

[b] Includes bluegill, pumpkinseed, crappie, largemouth bass, whitefish, brook trout, and white sucker.

Special creel census
January 13 to April 4, 1936

Number of anglers	Total hours fished	Number of fish caught	Catch per hour
365	1,397	785	0.6

Species composition of catch
from special creel census
January 13 to April 4, 1936

Species	Percent of total catch
Yellow perch	76.8
Northern pike	1.9
Whitefish	4.3
Cisco	2.4
White sucker	14.3
Bullhead spp.	0.2

Estimated angler effort,
from mail surveys

Year	Number of angler days
1970	48,680
1973	53,550

Ice shanty counts by airplane

Date	Number of shanties
2/18/54	89
3/3/55	67
2/1/56	176
2/14/57	194
2/23/60	198
2/20/61	218
2/13/62	174
2/21/63	184
2/13-14/64	132
2/16, 19/65	130
2/25/72	221
1/28/74	194

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked:

Species	Dates[1]	Size	Numbers
Walleye	1909	fry	400,000
	1913-21	fry	2,150,000
	1925-28	fry	1,750,000
	1931-39	fry	12,900,000
Largemouth bass	1910-14	fingerling + fry	28,600
	1924-25	fingerling + adult	6,750
Smallmouth bass	1916-23	fingerling + fry	26,200
	1944	fingerling + yearling	800
Yellow perch	1914-21	fingerling + fry	629,500
	1924-41	fingerling + fry	2,488,500
Bluegill	1913	fingerling	6,500
	1921-23	fingerling	9,000
	1927-30	fingerling	7,750
Atlantic salmon	1874	eggs	7,000
Land-locked salmon	1874	fry	6,500
Whitefish	1879	fry	200,000
	1927	fry	750,000

(continued, next page)

Species	Dates[1]	Size	Numbers
Arctic grayling	1926-28	fry	173,000
Lake trout	1903-27	fry	545,000
	1931-36	fingerling	41,500
	1941-43	2-yr-old + adult	17,165
	1947-49	2-yr-old + fingerling	19,600
	1950-59	fingerling + legal	105,000
	1960-66	sub-legal + legal	85,609
	1971-75	fingerling + yearling	150,490
Rainbow trout	1930-37	fingerling	31,500
	1941-46	fingerling, yearling, 2-yr-old	14,030
	1950-59	fingerling + legal	271,000
	1960-65	sub-legal + legal	75,000
	1969-73	fingerling + yearling	104,830
Steelhead	1973	fingerling	13,630
Kokanee	1965-67	fry	1,906,816
	1970	fry	36,624
Splake	1966	fingerling	92,720
	1968-75	yearling	499,402
Brown trout	1974-75	yearling	60,000

[1] Plantings not necessarily continuous between dates given.

Introductions

January 1934. 250,000 lake emerald shiners were introduced in an attempt to increase the supply of forage fish.

July 1935. Seining produced 3 specimens (2 from stocking and 1 from reproduction).

October 1935. Seining produced 43 specimens (1 from original stocking and 42 from reproduction).

1939. No specimens were found. Introduction was determined as unsuccessful.

Brush shelters

1933. Forty-five shelters installed.
1949. Three hundred eight shelters installed.
1950. Twenty-six shelters installed.

Artificial spawning reef

In 1962, rocks and broken concrete were used to build a spawning reef about 1800 square yards and 1.5 feet thick. Later observation showed that lake trout successfully reproduced on the reef.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. Reports

Number

264 Cooper, G. P. November 30, 1934. Initial examination of inland lakes in which plantings of the Great Lakes shiner Notropis atherinoides have been made.

323A Cooper, G. P. November 18, 1935. Further examinations of those Michigan inland lakes in which plantings of Great Lakes shiner Notropis atherinoides have been made.

369 Eschmeyer, R. W. June 19, 1936. Creel census on 12 northern Michigan lakes, winter of 1935-36.

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Gary T. Schnicke, District Fisheries Biologist, March 1976.

Houghton Lake, Roscommon County
T. 22, 23 N., R. 3, 4 W., Sec. many

Houghton Lake is the largest inland lake in Michigan. It has a surface area of 20,044 acres and is relatively shallow with a maximum depth of 20 feet. Fishing pressure is high and in general the lake is considered to be productive and provide good fishing.

A measure of angler pressure and success has been obtained from the general creel census, the special creel census and the mail surveys. The general creel census (1928-64), and the special census during the winters of 1935-37 were designed only to measure success of those anglers actually interviewed. The special census during 1956-59 measured total fishing pressure and total catch, and the mail surveys in 1970 and 1973 measured total fishing pressure.

Past management has consisted of stocking fish, manipulation of regulations, and construction of two large pike spawning areas. Many special studies of the northern pike have been conducted at Houghton Lake.

During the 1920's and early 1930's, northern pike and walleyes were the predominant species in the fishery. In the mid-1930's, the catch of pike declined drastically while the catch of panfish increased proportionally. Bluegill fishing improved over the years and probably reached a peak in the late 1940's or early 1950's. Fishing pressure for bluegills followed about the same trend, however, the peak of fishing pressure did not occur until the mid or even the late 1950's. By this time complaints were being received that bluegill fishing was on the decline. Complaints about the large number of small perch in the lake began to appear some time during the mid 1950's and these complaints have continued to the present time. In general, growth rates of yellow perch, northern pike, and walleye have been below average while growth rates of other species have been at or above average.

Fishing pressure and harvest are high for northern pike. Operation of the spawning marshes is necessary to maintain the present pike fishery. The walleye population is self-sustaining and appears to be quite stable. Apparently the walleye fishery is as good today as it has been in modern times.

A limited population of rather large, fast-growing bluegills is present in the lake. Even though heavy fishing pressure occurs for bluegills, success is sporadic.

The over-abundant, slow-growing perch are considered to be the major problem in the fish population. Management of the fishery centers around efforts to increase predator numbers in an attempt to reduce numbers of small perch.

Rock bass are quite abundant, of large size, and relatively unexploited. Smallmouth bass are present but lightly exploited. Largemouth bass are uncommon.

Bullheads are abundant and offer an opportunity for greater harvest. Carp, bowfin, gar and suckers are present but not abundant enough to affect other species of fish in the lake.

The most important single factor which will preserve the water quality of Houghton Lake and its fishery is probably the construction of sewage treatment facilities for the homes around the lake.

LAKE SURVEYS

Physical and chemical data 1971-1973

Area (acres)	20,044	Thermocline	none
Depth (feet)		Surface	
Maximum	20	Alkalinity (ppm)	63-129
Mean	8.5	pH	7.5-8.7
Shore development	1.5	Oxygen (ppm)	
Water retention time		Ice-free period	>9.0
in lake basin (years)	1.2	Bottom type	sand
Percent shoal			silty-sand
<16 feet deep	94.6		organic
Secchi disk (feet)	4.5-10.0	Vegetation	medium
Temperature (°F)			
(21 Aug 1972)			
Surface	74		
Bottom	71		

Tributaries and dams, watershed drainage

Main inlets:	"The Cut," Denton Creek, Knappen Creek and Spring Brook.
Main outlet:	Muskegon River.
Dams:	Houghton Lake Dam, controls water level. Reedsburg Dam on Muskegon River about 12 miles downstream from Houghton Lake.
Watershed drainage area (acres):	31,361

Benthos
October 1971
(20 stations, 6 samples per station, Ponar bottom sampler)

Organism	Mean number per square foot
Oligochaeta	48
Hirudinea	9
Gastropoda	21
Pelecypoda	86
Amphipoda	383
Ephemeroptera	13
Trichoptera	10
Chironomidae	185
Others	33
Total organisms per square foot	
Range	190-3613
Mean	788

Zooplankton
Samples collected on 33 dates from 6/23/71-6/13/73 at four stations

Station number	Mean number of organisms per liter
11	1418
12	1336
19	1300
20	1522

Rotifers comprised 89.8% of total with 19 genera identified (Keratella sp. and Polyarthra sp. dominant).

Copepoda comprised 7.0% of total with Cyclops sp. and Diaptomus sp. dominant.

Cladocera comprised 3.2% of total with 8 genera identified (Bosmina sp. was dominant).

Fish collections

Species and numbers

Species	Number of fish collected with seine				
	Oct 1935	Sep 1938	Sep 1941	Sep-Oct 1956	Sep 1960
Yellow perch	882	64	2	539	1203
Rock bass	6	10	...	1	82
Bluegill	8	137	...	46	1049
Pumpkinseed	...	10	...	...	89
Longear sunfish	...	3	...	...	...
Black crappie	...	1	...	2	1161
Smallmouth bass	8	2	...	3	8
Largemouth bass	...	1	...	5	104
Walleye	4	...	3	...	137
Northern pike	...	...	...	...	102
Total	908	228	5	596	3935
White sucker	...	...	...	...	53
Brown bullhead	1	...	1	...	20
Black bullhead	...	1	...	...	...
Bowfin	...	...	1	...	21
Total	1	1	2	0	94
Mimic shiner	341	31	397	...	...
Common shiner	51	5	...	...	256
Sand shiner	1	26	35	...	...
Spottail shiner	391	3	9	...	...
Blacknose shiner	7	2	1	...	...
Blackchin shiner	4	...	12	...	...
Rosyface shiner	288	9	81	...	...
Golden shiner	9	2	2	...	...
Spotfin shiner	...	23	74	...	...
Bluntnose minnow	291	76	53	...	...

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Species	Number of fish collected with seine				
	Oct 1935	Sep 1938	Sep 1941	Sep-Oct 1956	Sep 1960
Johnny darter	13	22	13	...	...
Blackside darter	1	...	2	...	...
Iowa darter	...	...	1	...	...
Logperch	9	23	6	...	10
Killifish spp.	...	3	2	...	...
Mudminnow	...	...	3	...	...
Total	1406	225	691	0	266
Grand total	2315	454	698	596	4295

Species	Number of fish collected with trap and fyke nets				
	July 1948	May June 1955	May 1962	Spring summer 1967	June 1972
Yellow perch	5	35	27	45	1
Rock bass	32	1679	212	135	146
Bluegill	64	2992	460	329	146
Pumpkinseed	71	1779	169	138	151
Black crappie	12	459	89	4	20
Smallmouth bass	14	135	1	...	5
Largemouth bass	15	193	8	13	6
Walleye	54	1651	172	...	31
Northern pike	...	122	36	55	17
Catfish spp.	...	5	...	...	...
Total	267	9050	1174	719	523
White sucker	12	75	11	...	10
Redhorse spp.	...	2	2	...	...
Brown bullhead	12	1455	125	...	283
Black bullhead	...	...	1	...	...
Yellow bullhead	...	18	...	...	...
Bowfin	15	90	2	...	6
Longnose gar	1	43	1	...	2
Carp	...	7	15	...	7
Total	40	1690	157	0	308
Grand total	307	10,740	1331	719	831

Catch per unit effort

Species	Catch per acre with seine				
	Oct 1935[a]	Sep 1938[b]	Sep 1941[c]	Sep-Oct 1956[d]	Sep 1960[e]
Yellow perch	639.0	111.5	1.2	128.0	62.4
Rock bass	4.3	17.4	...	0.2	4.3
Bluegill	5.8	239.0	...	10.9	54.4
Pumpkinseed	...	17.4	...	...	4.6
Longear sunfish	...	5.2	...	...	...
Black crappie	...	1.7	...	0.5	60.2
Smallmouth bass	5.8	3.5	...	0.7	0.4
Largemouth bass	...	1.7	...	1.2	5.4
Walleye	2.9	...	1.9	...	7.1
Northern pike	...	...	...	...	5.3
White sucker	...	...	...	...	2.7
Bullhead spp.	0.7	1.7	0.6	...	1.0
Bowfin	...	...	0.6	...	1.1
Mimic shiner	247.0	54.0	247.0	...	...
Common shiner	37.0	8.7	...	...	13.3
Sand shiner	0.7	45.3	21.7	...	...
Spottail shiner	283.0	5.2	5.6	...	...
Blacknose shiner	5.1	3.5	0.6	...	...
Blackchin shiner	2.9	...	7.5	...	...
Rosyface shiner	209.0	15.7	50.3	...	...
Golden shiner	6.5	5.2	1.2	...	...
Spotfin shiner	...	40.1	46.0	...	...
Bluntnose minnow	211.0	103.0	32.9	...	...
Johnny darter	9.4	38.3	8.1	...	...
Blackside darter	0.7	...	1.2	...	...
Iowa darter	...	...	0.6	...	...
Logperch	6.5	40.1	3.7	...	0.5
Killifish spp.	...	5.2	1.2	...	...
Mudminnow	...	...	1.9	...	...

[a] Total of 1.38 acres seined.

[b] Total of 0.57 acre seined.

[c] Total of 1.61 acres seined.

[d] Total of 4.21 acres seined for game fish only.

[e] Total of 19.28 acres seined with a 1600-foot seine.

Species	Catch per trap net lift	
	May-June 1955[a]	June 1972[b]
Yellow perch	0.2	0.1
Rock bass	9.1	7.3
Bluegill	16.2	7.3
Pumpkinseed	9.6	7.6
Black crappie	2.5	1.0
Smallmouth bass	0.7	0.2
Largemouth bass	1.0	0.3
Walleye	8.9	1.6
Northern pike	0.7	0.8
White sucker	0.4	0.5
Bullhead spp.	8.0	14.1
Bowfin	0.5	0.3
Longnose gar	0.2	0.1
Carp	...	0.4

[a] Total of 185 net lifts. [b] Total of 20 net lifts.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals					
	July-Aug 1922	Feb 1939	Feb 1943	Feb 1947	July 1948	Jan 1954
Yellow perch	...	-2.2 (51) II, III	...	...	...	...
Rock bass	+0.4 (115) I-IV	...	...	...	+0.8 (28) IV, V	...
Bluegill	+0.6 (23) I, III	+1.2 (5) VI	+1.4 (22) V, VII	+1.9 (13) VI	+1.1 (55) III-VII	-0.3 (29) V
Pumpkinseed	-0.2 (79) I-III	...	...	...	+1.2 (71) III-VI	...
Black crappie	...	...	...	...	+0.1 (5) III	...
Smallmouth bass	...	...	...	...	+0.2 (5) II	...

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Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals					
	July-Aug 1922	Feb 1939	Feb 1943	Feb 1947	July 1948	Jan 1954
Largemouth bass	...	...	...	...	+2.2 (8) III	...
Northern pike	...	...	...	...	...	+1.1 (5) II

	May-June 1955	Oct 1956	Dec 1957	Jan-Mar 1958	Sep 1960
Yellow perch	...	-0.9 (44) I, II	...	-2.1 (30) II-IV	-0.2 (20) I
Rock bass	+0.6 (72) III-VIII	...	...	...	...
Bluegill	+0.2 (78) III, IV, VI, VIII	...	+0.8 (7) III	+0.2 (38) IV, V	+0.6 (88) I-IV
Pumpkinseed	+0.8 (80) III, IV, VI, VIII	...	...	+0.7 (13) IV, V	+0.8 (25) I-III
Black crappie	+0.7 (40) III-VI	...	...	-0.3 (12) IV	+1.1 (23) I, III
Smallmouth bass	+0.2 (27) III, VI, VII	...	...	...	...
Largemouth bass	0.0 (37) III, V, VII	...	...	...	+1.7 (25) I
Walleye	-2.9 (52) III-VI, VIII	...	...	...	-0.4 (42) 0, I, III
Northern pike	...	...	+0.1 (22) II, III	-1.7 (5) III	-1.0 (71) 0-IV

[1] Deviations in inches from statewide growth rate averages, only age groups with at least five samples are included.

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals					
	May 1962	June-July 1967	Apr 1970	Apr 1971	July 1971	June 1972
Yellow perch	-0.7 (14) III, IV	-1.5 (43) I-V	...	-0.4 (14) IV-VI	...	...
Rock bass	+0.6 (50) III, IV	+1.6 (131) III-VI	...	+0.4 (17) V, VI	...	+0.5 (85) III-VIII
Bluegill	+0.7 (59) III, V, VII	+0.4 (327) II-VI	...	...	...	+0.6 (108) III-VIII
Pumpkinseed	+0.3 (18) III, V	+0.6 (134) III-V	...	+0.4 (19) V, VI	...	+0.6 (104) III-VI
Black crappie	+0.6 (5) IV	...	...	...	...	+0.5 (13) III, IV
Smallmouth bass	...	+1.6 (5) IV	...	...	...	...
Largemouth bass	...	+0.2 (8) III	...	...	...	...
Walleye	-1.1 (45) III-V, VII	...	...	...	-2.0 (15) III, IV	...
Northern pike	-1.8 (29) II, III	-1.5 (53) I-III	-1.2 (34) II-IV	-2.9 (25) II-IV	...	-1.4 (14) II, III

[1] Deviations in inches from statewide growth rate averages, only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39[a]	...	90,718	53,626	0.59
1940-50	36,163	105,128	57,797	0.55
1951-64	20,641	43,906	30,093	0.69

[a] Year of 1936 not included.

Species composition of catch from general creel census

Species	Percent of total catch		
	1928-39	1940-50	1951-64
Yellow perch	18.3	17.1	23.6
Rock bass	17.9	13.0	9.5
Bluegill	14.5	41.3	40.0
Pumpkinseed	14.9	16.1	9.4
Black crappie	0.1	0.7	1.1
Smallmouth bass	0.3	0.4	0.5
Largemouth bass	<0.1	<0.1	0.4
Walleye	7.1	7.0	4.7
Northern pike	24.6	3.7	10.5
Bullhead spp.	2.0	0.5	0.1
Others	0.3[a]	0.1[b]	0.2[c]

[a] Includes white sucker, bowfin, redhorse, carp, longnose gar, catfish, and grass pickerel.

[b] Includes white sucker, bowfin, redhorse and longnose gar.

[c] Includes white sucker and bowfin.

Special creel census

Date [1]	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
12/18/35-3/24/36	5,520	31,627	5,630	0.18
12/31/36-2/28/37	4,153	21,649	15,374	0.71
12/18/56-3/16/57	...	344,000	250,000	0.73
6/8/57-9/24/57	...	443,000	233,000	0.53
Winter 1957-58	...	314,000	208,000	0.66
Summer 1958	...	630,000	402,000	0.64
Winter 1958-59	...	274,000	238,000	0.87
Summer 1959	...	622,000	379,000	0.61

[1] From 1956-59, the hours fished and total catch are expanded estimates from the data collected.

Species composition of catch from special creel census

Species	Percent of total catch			
	Winter 1935-36	Winter 1936-37	Winter 1956-57	Summer 1957
Yellow perch	46.2	86.1	25.3	20.9
Rock bass	0.4	...	3.8	18.4
Bluegill	0.9	0.1	51.4	24.0
Pumpkinseed	0.2	...	2.1	17.6
Black crappie	...	<0.1	2.9	1.6
Smallmouth bass	...	...	...	0.9
Largemouth bass	...	...	...	1.7
Walleye	12.8	2.0	1.7	5.3
Northern pike	39.4	11.5	12.8	8.3
White sucker	<0.1	0.2	...	...
Bullhead spp.	0.1	<0.1	...	1.1
Bowfin	<0.1	<0.1	...	0.2
Longnose gar	<0.1	<0.1	...	...

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	181,700
1973	210,240

Ice shanty counts by airplane

Date	Number of shanties	Date	Number of shanties
2/18/54	459	2/21/63	568
3/3/55	483	2/13-14/64	598
2/1/56	646	2/16, 19/65	548
1/26/57	710	1966	443
2/21/58	648	2/3/67	348
2/11/59	609	2/25/72	423
2/23/60	442	2/28/73	353
2/20/61	536	1/28/74	504
2/13/62	556	2/9/76	530

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked--
Few records available from 1914-1932

Species	Dates[1]	Size	Numbers
Lake trout	1904-05	fry	48,000
Yellow perch	1921	fingerling	3,000
	1933-38	fingerling	220,000
	1941	fingerling	25,000
Largemouth bass	1913-14	fingerling	2,800
Walleye	1908	fry	400,000
	1933-44	fry	30,060,100
Northern pike	1969-73	fry and fingerlings from marsh	898,444

[1] Plantings not necessarily continuous between dates given.

Introductions.--In January 1934, 250,000 lake emerald shiners Notropis atherinoides were stocked in an effort to increase the supply of forage fish. The introduction was not successful in establishing a population of lake emerald shiners.

Fishing regulations

1936. Number of ice lines per angler reduced from five to two.
1940. Winter spearing prohibited.
Winter 1956-57. Creel limit on yellow perch was removed. Removal of an estimated 3.2 perch per acre was far short of the goal.
January 1, 1960. Creel limit on perch was removed for entire year.
December 1, 1957. Minimum size limit on northern pike was increased to 20 inches.

Northern pike spawning areas

1965. Large marsh area for pike spawning was developed.
1968. Another marsh area was developed.

Control of swimmers' itch

1944-1973. About 1,000,000 pounds of copper sulfate have been applied for control of schistosome dermatitis (swimmers' itch). No detrimental effect on fish populations has been detected.

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Personal communication:

Gary T. Schnicke, District Fisheries Biologist, March 1976.

Hubbard Lake, Alcona County
T. 27, 28 N., R. 7, 8 E., Sec. many

Hubbard Lake has a surface area of 8,850 acres and a maximum depth of 85 feet. About 44% of the lake is less than 20 feet deep. A bottom-contour map of the lake was made during the winter of 1936-37.

A measure of fishing pressure and angler success has been obtained from the general creel census records (1940-64) and from mail surveys in 1970 and 1973. The general creel census was designed only to measure success of those anglers actually interviewed. The mail survey measured total fishing pressure.

Past management of the lake has consisted of stocking fish, installation of brush shelters, and removal of rough fish by netting in 1947 and 1948. A pike spawning marsh was developed in 1962, abandoned after 2 or 3 years and then rebuilt and used again in 1972.

Fishing in the lake appears to have changed little during the past 20 years. Perch are and have been the mainstay of the fishery. The abundance of pike has been sporadic in East and South bays. Since the advent of the new spawning area off East Bay (Holcomb Creek), reports are that pike fishing success and fishing pressure have increased in East Bay. Data are not available to support or refute these reports.

Yellow perch tend to run small but occasionally good catches of large fish are made. Walleyes might have a chance in the lake but it would require the stocking of large numbers of fish. Local groups are pursuing the development of walleye rearing facilities. Smallmouth bass are locally abundant in areas of the lake but fishing pressure for them is light.

The rainbow trout plants of 1968-69 should have been more successful but apparently were planted into an abundant year class of pike. The lake contains a remnant population of whitefish which are reputed to spawn over weed beds and are pursued by a small group of spearers. Reports are that whitefish were more abundant 20 years ago than they are now.

Current data on fishing pressure and catch would be valuable on this lake.

LAKE SURVEYS

A survey in 1925 reported the presence of smallmouth bass, largemouth bass, rock bass, yellow perch, whitefish, ciscoes, and bullheads.

Physical and chemical data surveyed August-September 1942

Area (acres)	8,850	Thermocline	began at 43 feet
Depth (feet)		Surface	
Maximum	85	Alkalinity (ppm)	158
Mean	32.6	pH	8.1
Shore development	3.2	Oxygen (ppm)	
Percent shoal		Surface	8.2
<20 feet deep	44	Bottom	0.5
Secchi disk (feet)	7	Bottom type	
Temperature (°F)		Shoal	sand, gravel, marl, rubble
Surface	68.2	Depths	marl, pulpy peat
Bottom	56.7	Vegetation	medium

Tributaries and dams, watershed drainage

Main inlets:	Holcomb Creek, Sucker Creek, West Branch River, Stevens Creek, and Shafer Creek.
Main outlet:	Lower South Branch of Thunder Bay River.
Dam:	Dam in outlet controls water level and prevents upstream passage of fish.
Watershed drainage area (acres):	18,469

Fish collections

Species and numbers

Species	Number of fish collected			
	Aug-Sep 1942[a]	Aug 1946[b]	Apr-May 1947[c]	Nov-Dec-Apr 1947-48[c]
Yellow perch	540	323	311	1,670
Rock bass	58	...	52	120
Bluegill	10	...	...	...
Pumpkinseed	3	...	2	42
Largemouth bass	1	...	...	...
Smallmouth bass	22	...	17	15
Northern pike	4	2	90	621
Walleye	...	...	66	38
Total	638	325	538	2,506
Whitefish	...	...	50	126
Cisco	...	8	...	34
Rainbow trout	...	...	9	31
Brook trout	...	...	1	...
Burbot	...	...	...	3
Catfish sp.	...	...	1	...
Total	0	8	61	194
White sucker	247	...	5,468	5,347
Bullhead spp.	160	...	55	224
Longnose gar	...	...	1	...
Total	407	0	5,524	5,571
Spottail shiner	134	...	...	...
Common shiner	127	...	...	...
Golden shiner	5	...	...	...
Blacknose shiner	1	...	...	...
Sand shiner	31	...	...	...
Bluntnose minnow	5	...	...	...
Johnny darter	49	...	...	...
Iowa darter	23	...	...	...
Blackside darter	4	...	...	...
Hornyhead chub	5	...	...	...
Mudminnow	3	...	...	...
Logperch	13	...	...	...
Sculpin spp.	13	...	...	...
Total	413	0	0	0
Grand total	1,458	333	6,123	8,271

[a] Collected with fyke, gill nets, and seine.

[b] Collected with gill nets and seine.

[c] Collected with trap net by commercial fishermen for rough fish removal.

Species	Number of fish collected		
	June-Oct 1962[a]	April 1969[a]	Jan 1970[a]
Yellow perch	294	83	44
Rock bass	84	8	...
Bluegill	1	...	...
Pumpkinseed	8	1	...
Largemouth bass	5	...	...
Smallmouth bass	29	...	...
Northern pike	23	43	5
Total	444	135	49
Cisco	...	3	...
Rainbow trout	...	3	...
Rainbow smelt	1	...	...
White sucker	24	11	6
Bullhead spp.	134	1	...
Longnose gar	19	...	...
Common shiner	6	...	...
Total	184	18	6
Grand total	628	153	55

a. Collected with gill nets.

Catch per unit effort

Species	Catch per trap net		Catch per 1000 feet of gill net		Catch per acre with seine
	April, May 1947[a]	Nov, Dec, April 1947-48[b]	Oct 1962[c]	Aug 1946[d]	Aug 1946[e]
Yellow perch	6.5	28.8	73.1	373.0	430.0
Rock bass	1.1	2.1	15.4	...	...
Bluegill	...	...	0.6	...	...
Pumpkinseed	<0.1	0.7	0.6	...	...
Largemouth bass	...	...	1.7	...	...
Smallmouth bass	0.4	0.3	2.9	...	...
Northern pike	1.9	10.7	9.7	...	20.0
Walleye	1.4	0.7	...	...	...
Whitefish	1.0	2.2	...	...	...
Rainbow trout	1.9	0.5	...	...	...
Brook trout	<0.1	...	...	...	...
Rainbow smelt	...	...	0.6	...	...
Catfish sp.	<0.1	...	...	...	...
White sucker	114.0	92.3	5.1	...	...
Bullhead spp.	1.1	...	1.7	...	...
Longnose gar	<0.1	...	...	...	...
Burbot	...	0.5	...	...	...
Cisco	...	0.6	...	10.7	...
Common shiner	...	...	3.4	...	...

[a] Total of 48 trap net lifts.

[b] Total of 58 trap net lifts.

[c] Total of 1,750 feet of gill net.

[d] Total of 750 feet of gill net.

[e] Total of 0.1 acre seined.

Age and growth

	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	Aug-Sep 1942	Aug 1946	June 1962	Sep 1967	April 1969
Yellow perch	-1.6 (46) III, V-VIII	+0.1 (8) II	-1.0 (59) IV-VII	-0.7 (6) I	-1.2 (19) IV, V
Rock bass	+0.8 (30) II-V	...	+0.7 (30) III-V	...	...
Northern pike	+3.7 (7) I	...	...	...	0.0 (11) III
Pumpkinseed	+1.5 (5) II	...	...	...	...
Cisco	-2.4 (7) II	-1.2 (7) I	...	...	...
Smallmouth bass	...	...	-0.9 (17) II-III	-2.2 (6) III	...
Largemouth bass	...	...	...	-2.5 (6) III	...

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1940-50	4,163	9,483	9,340	0.98
1951-64	7,880	14,091	21,145	1.50

Species composition of catch from general creel census

Species	Percent of total catch	
	1940-50	1951-64
Yellow perch	93.5	95.1
Rock bass	1.7	1.3
Pumpkinseed	0.2	0.7
Smallmouth bass	0.7	0.8
Northern pike	2.5	1.2
Bullhead spp.	1.2	0.6
Others	0.2[a]	0.3[b]

[a] Includes largemouth bass, bluegill, walleye, rainbow trout, and whitefish.

[b] Includes largemouth bass, bluegill, crappie, walleye, rainbow trout, whitefish, brook trout, smelt, white sucker, lake trout, cisco, and longnose gar.

Special creel census winter of 1935-36

Total hours fished	Number of fish caught	Catch per hour
894	262	0.3

Species composition of catch from special creel census

Species	Number caught
Yellow perch	210
Northern pike	32
Walleye	7
Whitefish	12
White sucker	1

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	28,180
1973	35,550

Ice shanty counts by airplane

Date	Number of shanties
2/11/59	248
2/23/65	172

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Yellow perch	1912-14	fry + fingerlings	122,000
	1933-39	fingerling + adult	198,394
	1942	fingerling	17,500
Smallmouth bass	1914	fry + fingerling	8,000
Largemouth bass	1905-14	fry + fingerling	49,400
Northern pike	1938	adult	17
Walleye	1904-09	fry	2,725,000
	1933-42	fry + fingerling	6,415,250
Lake trout	1895-1914	fry	310,000
	1933-34	fingerling	81,660
	1935-42	fry	592,400
	1944-45	fingerling	13,500
	1954	fingerling	5,000
	1955-57	legal	15,000
Rainbow trout	1944-58	sublegal + legal	99,600
	1968-69	yearling	129,890
Catfish sp.	1938	adult	17
Emerald shiner	1938	adult	31,200

[1] Plantings not necessarily continuous between dates given.

January 1934. About 90,000 lake emerald shiners were introduced on an experimental basis. Seining in November 1934 failed to take any lake emerald shiners.

Brush shelters

1947. Installed 25 shelters.

Pike spawning area

1962. A cooperative pike spawning area was developed.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. reports:

Number

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369 Eschmeyer, R. W. June 19, 1936. Creel census on 12 northern Michigan lakes, winter of 1935-36.

836 Perry, L. E., and R. D. Van Deusen. December 8, 1942. Fisheries survey of Hubbard Lake, Alcona County.

1095 Carbine, W. F. February 28, 1947. Demonstration netting of Hubbard Lake, Alcona County.

1119 Crowe, W. R. July 1, 1947. Sucker removal and demonstration netting on certain larger lakes in Michigan, winter of 1947.

1139 Beckman, William C. November 17, 1947. A summary of the netting operations during the summer of 1947.

1175 Eschmeyer, P. H. May 28, 1948. A list of the lakes in Michigan for which the installation of brush shelters has been recommended.

1226 Crowe, W. R. May 17, 1949. Sucker removal and demonstration netting, 1947-1948.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Gary T. Schnicke, District Fisheries Biologist, March 1976.

Indian Lake, Schoolcraft County
T. 41, 42 N., R. 16, 17 W., Sec. many

Indian Lake is a relatively shallow lake with a maximum depth of 15 feet and a surface area of 8,000 acres. Approximately 90% of the lake is less than 15 feet deep. The Civilian Conservation Corps (CCC) mapped the lake during the winter of 1935-36. A biological survey of the lake was conducted during June and July 1937.

A measure of fishing pressure and angler success has been obtained from a special creel census during the winter of 1937, general creel census from 1939-64, and a mail survey in 1970. The general creel census was conducted by Conservation Officers while performing their other duties at the lake and was designed to measure success of those anglers actually interviewed. The mail survey was designed to measure total fishing pressure on the lake.

Management has been directed mainly toward walleye, yellow perch, and northern pike. An attempt was made to transfer walleye, and northern pike from the lower Manistique River to satisfy riparian whims that dams were obstructing recruitment. The transferred fish soon returned to the Manistique River. An attempt was made in 1967 to establish northern muskellunge brood stock but no follow-up plants were made.

Currently, fishing success rises and falls considerably but the general trend is for a drop in production of northern pike and walleye. The perch population remains good with several year classes in the catch. Bass fishing has not changed much. Rock bass is the predominant species of sunfish. Bluegills have all but disappeared from the lake. Total fishing pressure appears to be on the increase although spearing pressure is falling off due to a lack of large pike.

LAKE SURVEYS

Physical and chemical data surveyed June-July 1937

Area (acres)	8,000	Thermocline	none
Depth (feet)		Surface	
Maximum	15	Alkalinity (ppm)	74-82
Mean	6.8	pH	8.2-8.4
Shore development	1.4	Oxygen (ppm)	
Percent shoal		Surface	6.4-7.5
<15 feet	90	Bottom	6.8-7.2
Secchi disk (feet)	4-12	Bottom type	
Temperature (°F)		Shoal	sand, pulpy peat
Surface	70-77	Depths	pulpy peat
Bottom	68-70	Vegetation	medium

Tributaries and dams, watershed drainage

Main inlets: Indian River, Big Spring, Smith's Creek, Dead Creek, Silver Creek, Dufour Creek.

Main outlet: Indian River.

Dam: At Manistique.

Watershed drainage area (acres): 59,838

Fish collections

Species and numbers

Species	Number of fish collected			
	July 1928[a]	June-July 1937[b]	July 1952[b]	Aug 1962[c]
Yellow perch	21	324	200	24
Rock bass	...	51	8	81
Pumpkinseed	...	3	...	...
Bluegill	...	14	...	1
Walleye	...	128	15	75
Northern pike	...	31	51	19
Smallmouth bass	...	12	1	24
Cisco	...	1	1	...
Total	21	564	276	224
White sucker	9	855	92	87
Redhorse spp.	...	6	4	30
Bullhead spp.	...	37	3	2
Total	9	898	99	119
Mimic shiner	15	1051	16	...
Sand shiner	3	866	8	...
Spottail shiner	144	478	...	...
Common shiner	...	103	8	...
Bluntnose minnow	3	815	23	...
Johnny darter	2	150	18	...
Iowa darter	...	38	...	...
Fantail darter	...	3	...	...
Blacknose shiner	...	4	...	...
Blackchin shiner	...	53	...	...
Golden shiner	...	22	...	...
Redbelly dace	...	1	...	...
Sculpin spp.	...	3	1	...
Mudminnow	...	4	...	...
Brook stickleback	...	6	...	...
Blackside darter	1	...	...	...
Logperch	...	26	10	...
Killifish spp.	...	4	...	...
Total	168	3627	84	0
Grand total	198	5089	459	343

[a] Collected with seine.

[b] Collected with gill net and seine.

[c] Collected with trap net.

Species	Number of fish collected				
	April 1966[a]	April 1967[a]	Aug 1968[b]	April 1971[a]	May 1972[a]
Yellow perch	...	...	150	...	...
Rock bass	2	2	...	14	...
Pumpkinseed	...	12	...	...	...
Bluegill	...	2	...	...	...
Walleye	242	515	1	232	1
Northern pike	30	60	...	43	9
Smallmouth bass	...	3	...	6	...
Cisco	3	...	...	70	1
Total	277	594	151	365	11
White sucker	35	125	...	243	24
Redhorse spp.	15	11	...	...	2
Bullhead spp.	...	...	...	1	1
Total	50	136	0	244	27
Spottail shiner	...	...	100	...	...
Johnny darter	...	...	50	...	...
Logperch	...	...	5	...	...
Total	0	0	155	0	0
Grand total	327	730	306	609	38

[a] Collected with trap net for collecting walleye eggs.

[b] Collected with seine.

Catch per unit effort

Species	Catch per acre with seine		Catch per 100 feet of shoreline seined
	June-July 1937[a]	Aug 1968[b]	July 1952[c]
Yellow perch	62.6	100	2.8
Rock bass	3.7	...	0.7
Bluegill	1.2	...	...
Pumpkinseed	0.2	...	...
Walleye	...	0.7	0.2
Northern pike	0.7	...	...
Smallmouth bass	2.3	...	0.2
White sucker	169.0	...	7.7
Bullhead spp.	0.5	...	...
Mimic shiner	244.0	...	2.7
Sand shiner	201.0	...	1.3
Spottail shiner	111.0	66.7	...
Common shiner	23.9	...	1.3
Bluntnose minnow	189.0	...	3.8
Johnny darter	34.8	33.3	3.0
Iowa darter	8.8	...	...
Fantail darter	0.7	...	...
Blacknose shiner	0.9	...	...
Blackchin shiner	12.3	...	...
Golden shiner	5.1	...	...
Redbelly dace	0.2	...	...
Sculpin spp.	0.7	...	0.2
Mudminnow	0.9	...	...
Brook stickleback	1.4	...	...
Logperch	6.0	3.3	1.7
Killifish spp.	0.9	...	...

[a] Total of 4.31 acres seined.

[b] Total of 1.5 acres seined.

[c] Total of 600 feet of shoreline seined.

Species	Catch per 1000 feet of gill net		Catch per trap net
	June-July 1937[a]	July 1952[b]	Aug 1962[c]
Yellow perch	20.4	66.5	4.0
Rock bass	13.2	1.5	13.5
Bluegill	3.4	...	0.2
Pumpkinseed	0.8	...	...
Walleye	48.3	5.1	12.5
Northern pike	10.6	18.5	3.2
Smallmouth bass	0.8	...	4.0
Cisco	0.4	0.4	...
White sucker	47.5	16.7	14.5
Redhorse spp.	2.3	1.5	5.0
Bullhead spp.	13.2	1.1	0.3

[a] Total of 2,650 feet of gill net.
[b] Total of 2,750 feet of gill net.
[c] Total of six trap net lifts.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	June-July 1937	July 1952	Aug 1962	Jan-Feb 1967	Aug 1968
Yellow perch	...	-0.2 (142) II-VI	...	0.0 (22) III-V	-1.5 (150) 0
Walleye	-2.4 (7) VI	-1.6 (12) II, III	...	...	...
Northern pike	-2.8 (20) III-V	-0.3 (52) I-III	+0.1 (5) II	...	...
White sucker	...	-0.6 (40) IV, V	+1.0 (5) IV	...	...

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1939-50 [a]	955	2,121	4,678	2.2
1951-64	3,970	11,021	13,909	1.3

[a] Years of 1946 and 1947 excluded

Species composition of catch from general creel census

Species	Percent of total catch	
	1939-50 [a]	1951-64
Yellow perch	80.9	75.0
Northern pike	8.3	8.1
Walleye	7.2	11.5
Bluegill	1.9	1.2
Rock bass	0.9	2.9
Pumpkinseed	0.4	0.1
Bullhead spp.	0.2	0.7
Smallmouth bass	0.1	0.2
Others	0.1 [b]	0.3 [c]

[a] Years of 1946 and 1947 excluded.

[b] Largemouth bass.

[c] Includes largemouth bass, cisco, white sucker, black crappie, and sturgeon.

Special creel census January 16 to March 31, 1937

Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1,409	6,279	5,073	0.8

Species composition of catch
from special creel census
January 16 to March 31, 1937

Species	Percent of total catch
Yellow perch	88.1
Walleyes	6.4
Northern pike	5.5

Estimated angler effort,
from mail survey

Year	Number of angler days
1970	21,690

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Yellow perch	1921	fingerling	4,500
	1933-35	fingerling	57,000
	1936-39	yearling + adult	47,000
Walleye	1905-06	fry	275,000
	1933-41	fry	6,870,000
	1965	fry	600,000
	1965	eggs	250,000
Smallmouth bass	1910-13	fingerling	3,000
Lake trout	1905-06	fry	30,000
	1910	fingerling	1,750
Northern pike	1941	adult	360
	1969	adult	52
Muskellunge	1967	fingerling	2,200

[1] Plantings not necessarily continuous between dates given.

Fishing regulations

Closed to fishing during winter of 1936, 1937 and 1938.
Closed to spearing 1936 to 1949.

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750 Roelofs, E. W. February 23, 1942. Fisheries survey of Indian Lake, Schoolcraft County.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Leland R. Anderson, District Fisheries Biologist, August 1975.

Lake Leelanau, Leelanau County
T. 28, 29, 30, 31 N., R. 11, 12 W., Sec. many

Lake Leelanau consists of two distinct basins. The South Basin has a surface area of 5,370 acres and a maximum depth of 62 feet. Approximately 44% of the water is less than 20 feet deep. The North Basin has an area of 2,950 acres with a maximum depth of 121 feet. About 37% of the basin is less than 20 feet deep. Both basins are suitable for cold-water species of fish.

The South Basin was mapped during the winters of 1946, 1947 and 1948. Unfavorable ice conditions caused considerable delay in mapping. The North Basin was mapped during the winter of 1948. During July and August 1948, a biological survey was conducted on both basins.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928 to 1963, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure angler success of those fishermen actually interviewed. The mail survey was used in 1970 and 1973 to measure total fishing pressure.

Management in the South Basin has consisted of planting brown trout of various sizes. Planted adult and yearling trout have provided a good fishery; plants of fall fingerlings have resulted in poor survival. Currently, brown trout provide a very good fishery in the spring and fall along with a limited ice fishery. Yellow perch and panfish provide good year-around fishing. Smallmouth and largemouth bass fishing is good during spring and summer. Northern pike catches are incidental to fishing for other species. Fishing quality probably has not changed much in the last 20 years except for the addition of the brown trout fishery which was established during this period.

Management efforts in the North Basin have centered around planting lake trout and rainbow trout at rates usually less than two per acre. These plants have provided only a limited fishery, but proportional to the number planted. Plants of yearling brown trout at the rate of seven per acre were started in 1974.

Currently in the North Basin, smallmouth bass provide a good summer fishery. Yellow perch and panfish angling is fair to good both summer and winter. Rainbow smelt provide a good fishery through the ice. Northern pike catches are incidental to fishing for other species. Lake trout and rainbow trout are caught occasionally. The smallmouth bass fishery has reportedly declined in the last 25 years. The rainbow trout and lake trout fisheries are dependent upon stocking and probably have not changed significantly during the last 20 years.

Both basins should be inventoried again to evaluate stocking programs and to obtain current population data on all species. Permanent index stations, sampling periods and sampling methods should be established. Gear used for sampling fish populations should be standardized.

LAKE SURVEYS

Physical and chemical data surveyed July-August 1949

South Basin:

Area (acres)	5,370
Depth (feet)	
Maximum	62
Mean	21.4
Shore development	4.4
Percent shoal	
<20 feet deep	44
Secchi disk (feet)	9
Temperature (°F)	
Surface	83
Bottom	49
Thermocline	began at 27 feet
Surface	
Alkalinity (ppm)	142
pH	8.2
Oxygen (ppm)	
Surface	8.0
Bottom	1.6
Bottom type	
Shoal	sand, marl
Depths	marl
Vegetation	medium

North Basin:

Area (acres)	2,950
Depth (feet)	
Maximum	121
Mean	37.8
Shore development	6.1
Percent shoal	
<20 feet deep	37
Secchi disk (feet)	11
Temperature (°F)	
Surface	83
Bottom	51
Thermocline	began at 30 feet
Surface	
Alkalinity (ppm)	146
pH	8.2
Oxygen (ppm)	
Surface	8.1
Bottom	3.5
Bottom type	
Shoal	sand, marl
Depths	marl
Vegetation	medium

Tributaries and dams, watershed drainage

South Basin

Main inlets:	Cedar Creek, Belnap Creek, and Merbex Creek.
Main outlet:	Flows into North Basin.

North Basin

Main inlets:	Channel from South Basin, and Houdels Creek.
Main outlet:	Flows into Lake Michigan.
Dam:	In outlet, prevents upstream passage of fish.
Watershed drainage area (acres):	58,524

Fish collections

Species and numbers

Species	Number of fish collected July-Aug 1949[a]	Number of fish collected May 1967[b]
Yellow perch	240	273
Rock bass	243	8
Pumpkinseed	49	2
Longear sunfish	5	...
Bluegill	65	...
Northern pike	111	4
Largemouth bass	100	...
Smallmouth bass	38	...
Total	851	287
Rainbow trout	1	...
Brown trout	...	8
Brook trout	...	1
Lake trout	1	5
Cisco	12	19
Total	14	33
White sucker	8	6
Bullhead spp.	12	...
Longnose gar	98	...
Bowfin	4	...
Total	122	6
Mimic shiner	46	...
Sand shiner	550	...
Spottail shiner	3	...
Common shiner	312	...
Golden shiner	44	...
Bluntnose minnow	175	...
Blackchin shiner	77	...
Blacknose shiner	11	...
Pugnose shiner	1	...
Johnny darter	15	...
Iowa darter	5	...
Logperch	29	...
Total	1,268	0
Grand total	2,255	326

[a] Collected with gill net and seine.

[b] Collected with gill net.

Catch per unit effort

Species	Catch per 1000 feet of gill net	
	July-Aug 1949[a]	May 1967[b]
Yellow perch	32.5	168.0
Rock bass	42.9	4.9
Pumpkinseed	8.9	1.2
Longear sunfish	0.5	...
Bluegill	11.8	...
Northern pike	20.2	2.5
Largemouth bass	9.6	...
Smallmouth bass	4.4	...
Rainbow trout	0.2	...
Brown trout	...	4.9
Brook trout	...	0.6
Lake trout	0.2	3.1
Cisco	2.2	11.7
White sucker	1.1	3.7
Bullhead spp.	2.2	...
Longnose gar	17.5	...
Bowfin	0.7	...

[a] Total of 5,500 feet of gill net.
[b] Total of 1,625 feet of gill net.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals July-Aug 1949
Yellow perch	-1.4 (203) I-VI
Rock bass	-0.6 (230) III-IX
Pumpkinseed	-0.1 (47) II-IV
Bluegill	-0.6 (58) IV-VI
Largemouth bass	+0.7 (53) I-IV
Smallmouth bass	-0.6 (20) I-IV
Cisco	-3.9 (9) III

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39[a]	...	7,943	9,197	1.16
1940-50	2,274	4,768	6,342	1.33
1951-63	4,005	8,926	6,560	0.73

[a] Year 1933 not included.

Species composition of catch from general creel census

Species	Percent of total catch		
	1928-39	1940-50	1951-63
Yellow perch	32.3	35.0	32.3
Rock bass	35.1	27.0	25.0
Bluegill	12.3	21.5	23.7
Pumpkinseed	2.5	3.0	2.7
Smallmouth bass	10.4	8.9	5.3
Largemouth bass	2.0	1.5	4.1
Northern pike	4.6	2.3	3.0
Lake trout	0.2	0.7	0.3
Brown trout	...	...	3.0
Others	0.6[a]	0.1[b]	0.6[c]

[a] Includes walleye, bullhead, bowfin, white sucker, and carp.
[b] Includes crappie, walleye, bullhead, and white sucker.
[c] Includes crappie, walleye, bullhead, bowfin, rainbow trout, brook trout, longnose gar, and cisco.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	29,420
1973	29,790

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Walleye	1903-13	fry	1,420,000
	1933-42	fry	3,240,000
Largemouth bass	1905-13	fingerling	18,750
	1914	fry	10,000
	1937-44	fry + fingerling	42,500
Smallmouth bass	1911-14	fry + fingerling	14,000
	1935-44	fry + fingerling	83,359
Yellow perch	1912-14	fry + fingerling	161,800
	1921	fingerling	11,150
	1939-41	fingerling	80,000
Warmouth	1913	fingerling	900
Bluegill	1934-44	fingerling	203,300
Lake trout	1904-14	fry	356,000
	1933-42	fingerling + adults	176,250
	1944-57	sublegal + legal	47,600
	1964-65	sublegal + legal	5,000
	1970-72	fingerling + yearling	40,000
Rainbow trout	1949-52	sublegal + legal	25,000
	1964-73	sublegal + legal	100,355
Brown trout	1955-65	sublegal + legal	95,000
	1968-73	sublegal + legal	81,000
Splake	1966	fingerling	30,000

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1951. Installed 126 shelters.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. report
No. 1309 Rodeheffer, I. A., and Jason Day. November 27, 1951. A fisheries survey report on Lake Leelanau, Leelanau County, Michigan.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:
Bernhard R. Ylkanen, District Fisheries Biologist, January 1976.

Long Lake, Alpena and Presque Isle counties
T. 32, 33 N., R. 7, 8 E., Sec. many

Long Lake has a surface area of 5,652 acres and a maximum depth of 25 feet. About 58% of the lake is less than 15 feet deep. The lake was mapped by the Civilian Conservation Corps (CCC) during the winter of 1935-36. An intensive survey of all species of fish was conducted in June 1939.

A special creel census (1936), general creel census (1938-64), and mail surveys (1970 and 1973) have been used to measure fishing pressure and success of anglers. The general creel census was designed only to measure angler success of those fishermen actually interviewed and was conducted by Conservation Officers while performing their other duties at the lake. The mail survey was designed to measure total fishing pressure on the lake.

There has been little evaluation of the stocking in Long Lake. Brush shelters were installed prior to 1959 and apparently these locations are popular areas to fish. The pike spawning area developed in 1964 was discontinued after one year of use. However, two new pike rearing areas were developed in 1975 and will be used for the first time in 1976. A creel census of the ice fishing was conducted in 1975 and the data are in the process of being analyzed.

Species normally taken in the fishery are yellow perch, walleye, largemouth and smallmouth bass, and rock bass. A few whitefish are taken through the ice using wigglers. The lake freezes over early and winter fishing is popular. Yellow perch are normally caught from Cookstove Reef (T. 33 N., R. 8 E., Sec. 30), Silver Weed (T. 33 N., R. 7 E., Sec. 36), and Round Top Reef (T. 32 N., R. 8 E., Sec. 4 and 9). Walleyes are usually fished on the north east shore off Big and Little Gravelly reefs (T. 33.N., R. 8 E., Sec. 29, 32, 33). Bass fishing is generally best in the south part of the lake.

Fishing pressure apparently has declined in the last few years possibly because the excellent fishing in Lake Huron is competing for the anglers' time. Many anglers feel that the catch of walleye, yellow perch, and northern pike is declining.

A creel census is needed to determine angler use and harvest. Biological information needed includes relative abundance or population estimates of sport and forage species, and studies of fish movements in and out of the lake, spawning areas, and age and growth of fish in the lake. The contribution of the new pike rearing areas should be evaluated.

LAKE SURVEYS

Physical and chemical data surveyed June 1939 and 1966

Area (acres)	5,652	Thermocline	none
Depth (feet)		Surface	
Maximum	25	Alkalinity (ppm)	110-141
Mean	10.4	pH	8.0-8.2
Shore development	2.7	Oxygen (ppm)	
Percent shoal		Surface	6.6-8.1
<15 feet deep	58	Bottom	8.0-8.1
Secchi disk (feet)	18	Bottom type	
Temperature (°F)		Shoal	sand, gravel, muck
Surface	74	Depths	muck, sand, gravel
Bottom	68	Vegetation	medium

Tributaries and dams, watershed drainage

Main inlets:	Six small streams; two with names, Silver and Fitzgerald creeks.
Main outlet:	Long Lake Creek called the "narrows"; drains into Lake Huron, about 5.5 miles long.
Dams:	Dam reported in outlet in 1939 survey, none reported in 1966 survey.
Watershed drainage area (acres):	14,085

Benthos
June 1939 survey
Ekman dredge

Organism	Number collected
Chironomidae	343
Amphipoda	275
Ephemeroptera	231
Pelecypoda	69
Lepidoptera	56
Trichoptera	49
Odonata	25
Oligochaeta	17
Coleoptera	21
Gastropoda	31
Neuroptera	10
Hirudinea	9
Turbellaria	6
Hydracarina	4

Mean of 99.7 organisms per square foot

Fish collections

Species and number

Species	Number of fish collected	
	Sep 1925	June 1939[a]
Yellow perch	111	372
Rock bass	9	19
Pumpkinseed	...	29
Smallmouth bass	10	5
Walleye	6	21
Northern pike	...	63
Whitefish	...	1
Total	136	510
White sucker	26	322
Total	26	322

(continued, next page)

Species	Number of fish collected	
	Sep 1925	June 1939[a]
Bluntnose minnow	126	1056
Blackchin shiner	...	94
Blacknose shiner	12	6
Sand shiner	...	76
Mimic shiner	...	1
Common shiner	49	56
Spotfin shiner	...	22
Spottail shiner	...	3
Rosyface shiner	...	3
Emerald shiner	...	2
Johnny darter	...	49
Iowa darter	11	18
Rainbow darter	1	...
Killifish spp.	14	15
Logperch	11	7
Mudminnow	...	1
Redbelly dace	...	2
Longear sunfish	...	1
Total	224	1412
Grand total	386	2244

[a] Collected with gill nets and seine.

Species	Number of fish collected			
	Aug 1946[a]	Aug 1948[b]	Aug 1957[a]	June 1966[a]
Yellow perch	39	64	83	221
Rock bass	1	187	21	33
Pumpkinseed	...	78	1	...
Smallmouth bass	...	19	15	23
Walleye	4	6	6	52
Northern pike	3	10	7	2
White sucker	15	2	3	66
Grand total	62	366	136	397

[a] Collected with gill nets.
[b] Collected with trap nets.

Catch per unit effort

Species	Catch per 1000 feet of gill net			Catch per trap net	Catch per acre seined
	June 1939[a]	Aug 1946[b]	Aug 1957[c]	Aug 1948[d]	June 1939[e]
Yellow perch	15.3	44.8	79.0	3.2	63.6
Rock bass	2.6	1.1	20.0	9.4	2.2
Pumpkinseed	1.0	...	1.0	3.9	5.1
Smallmouth bass	1.0	...	14.3	1.0	0.4
Northern pike	18.5	3.4	6.7	0.5	1.2
Walleye	3.9	4.6	5.7	0.3	1.8
Whitefish	0.3	...	...	...	...
White sucker	2.9	17.2	2.9	0.1	61.2
Bluntnose minnow	...	...	...	...	207.0
Blackchin shiner	...	...	...	...	18.4
Blacknose shiner	...	...	...	...	1.1
Sand shiner	...	...	...	...	14.9
Mimic shiner	...	...	...	...	0.2
Common shiner	...	...	...	...	11.0
Spotfin shiner	...	...	...	...	4.3
Spottail shiner	...	...	...	...	0.6
Rosyface shiner	...	...	...	...	0.6
Emerald shiner	...	...	...	...	0.4
Johnny darter	...	...	...	...	9.6
Iowa darter	...	...	...	...	3.5
Killifish spp.	...	...	...	...	2.9
Logperch	...	...	...	...	1.4
Mudminnow	...	...	...	...	0.2
Redbelly dace	...	...	...	...	0.4
Longear sunfish	...	...	...	...	0.2

[a] Total of 3,075 feet of gill net.

[b] Total of 870 feet of gill net.

[c] Total of 1,050 feet of gill net.

[d] Total of 20 trap net lifts.

[e] Total of 5.11 acres seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals	
	June 1939	Aug 1957
Yellow perch	+0.2 (22) II-III	+0.4 (73) II
Rock bass	-0.7 (5) IV	-0.5 (11) V
Walleye	-0.9 (5) VII	...
Northern pike	+0.4 (48) II-IV	...
Smallmouth bass	...	-1.2 (9) II

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1938-50	1,401	4,106	2,256	0.55
1951-64	6,481	13,030	6,175	0.47

Species composition of catch from general creel census

Species	Percent of total catch	
	1938-50	1951-64
Yellow perch	69.1	69.0
Rock bass	5.3	11.8
Pumpkinseed	1.2	2.0
Bluegill	0.7	...
Smallmouth bass	5.7	6.8
Largemouth bass	0.4	0.4
Northern pike	14.1	2.4
Walleye	3.5	6.6
Whitefish	<0.1	0.5
Others	...	0.5[a]

[a] Includes crappie, cisco, white sucker and redhorse.

Special creel census

Species	Percent of total catch	
	Winter 1936	Summer 1936
Yellow perch	86	69
Rock bass	...	6
Pumpkinseed	...	5
Bluegill	...	3
Northern pike	10	9
Walleye	4	3
Smallmouth bass	...	3
Largemouth bass	...	2

Estimated angler effort, from mail survey

Year	Number of angler days
1970	33,340
1973	26,910

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Largemouth bass	1905-14	fry + fingerling	102,575
	1938-44	fingerling	25,250
Walleye	1910-14	fry	1,200,000
	1933-40	fry + fingerling	3,429,050
Smallmouth bass	1933-45	fingerling + adult	28,510
Yellow perch	1921	fingerling	17,650
	1933-43	fingerling + adult	442,586
	1953	adult	2,000
Bluegill	1934-43	fingerling	358,500
Rock bass	1938	yearling	200
Crappie	1938	yearling	180
Pumpkinseed	1938	yearling	220
Lake trout	1910	fry	24,000

[1] Plantings not necessarily continuous between dates given.

Brush shelters

Prior to 1959, 427 shelters had been installed.

Pike marsh

1964. Pike marsh developed by Lake Association.

Tagged smallmouth bass

In August 1940, 200 adult smallmouth bass were tagged and released. About 25% were harvested by anglers within 1 year.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. reports:

Number

369 Eschmeyer, R. W. June 19, 1936. Creel census on 12 northern Michigan lakes, winter of 1935-36.

579 Brown, C. J. D., and J. W. Moffett. February 20, 1940. Fisheries survey report on Long Lake, Alpena and Presque Isle counties.

723 Shetter, D. S. January 5, 1942. Results from the tagging of smallmouth black bass transferred from Lake Huron to Long Lake, Alpena and Presque Isle counties.

1096 Carbine, W. F. February 28, 1947. Demonstration netting of Long Lake, Alpena and Presque Isle counties.

1137 Crowe, W. R. October 23, 1947. Examination of the outlet of Long Lake, Alpena County.

1175 Eschmeyer, P. H. May 28, 1948. A list of the lakes in Michigan for which the installation of brush shelters has been recommended.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:

Warren Alward, Fisheries Habitat Biologist, December 1975.

Manistique (Big) Lake, Luce and Mackinac counties
T. 44, 45 N., R. 11, 12 W., Sec. many

Big Manistique Lake is the seventh largest inland lake in Michigan. The lake has a surface area of 10,130 acres and is relatively shallow with a maximum depth of 20 feet. A map showing the outline and bottom contours was prepared during the winter of 1935-36 by personnel from the Michigan Emergency Conservation Work Program. An intensive biological survey of the lake was conducted in August 1936.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure angler success of those anglers actually interviewed. In 1970 and 1973, the mail survey was designed to measure total fishing pressure on the lake.

For the past 11 years, the lake has been the source of eggs for hatchery production of walleyes. Most of the netting in the last 10 years has been either to check problems or to gather spawn. These samples have provided incidental data on fish sizes, year class strength, etc.

Walleye and northern pike populations are considered to be down from 20 years ago. Bass, not a major species, remain about the same in the catch. The perch population remains large. The cisco population appears to have declined in numbers, but the fish are larger than in the past. Brook trout have been reported in the catch more often in recent years although numbers are low.

An inventory of the fish population is needed. A creel census would be desirable to obtain data on fishing pressure and catch.

LAKE SURVEYS

Physical and chemical data surveyed August 1936

Area (acres)	10,130	Bottom types	sand, pulpy peat
Depth (feet)			
Maximum	20	Thermocline	none
Mean	9.1	Surface	
Shore development	1.9	Alkalinity (ppm)	87
Secchi disk (feet)	8	pH	8.1
Temperature (°F)		Oxygen (ppm)	
Surface	72	Surface	8.5
Bottom	69	Bottom	9.1
		Vegetation	medium

Tributaries and dams

Main inlets: Helmer Creek and Portage Creek.

Main outlet: Headwaters of Manistique River.

Dam: New dam built in 1948 on outlet to control water level.

Fish collections

Species and numbers

Species	Number of fish collected		
	July-Aug 1936[a]	July 1952[a]	Sep 1955[b]
Yellow perch	462	165	15
Rock bass	39	2	14
Pumpkinseed	1	6	2
Smallmouth bass	21	...	11
Largemouth bass	...	...	3
Northern pike	7	23	13
Walleye	35	46	411
Green sunfish	3	...	...
Cisco	14	5	5
Total	582	247	474

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Species	Number of fish collected		
	July-Aug 1936[a]	July 1952[a]	Sep 1955[b]
White sucker	97	40	178
Bullhead spp.	37	...	2
Redhorse spp.	...	1	26
Total	134	41	206
Mimic shiner	301	44	...
Sand shiner	174	2	...
Spottail shiner	73	25	...
Common shiner	35	1	...
Golden shiner	1	...	...
Bluntnose minnow	508	12	...
Johnny darter	85	5	...
Iowa darter	2	...	...
Sculpin	1	4	...
Mudminnow	1	...	...
Logperch	...	1	...
Emerald shiner	...	1	...
Total	1181	95	0
Grand total	1897	383	680

[a] Collected with gill nets and seine.
[b] Collected with trap nets.

Numbers of fish collected by trap and fyke nets when collecting walleye spawn

Species	Number of fish collected				
	Apr-May 1964	May 1965	Apr 1966	Apr 1967	Apr 1968
Walleye	608	314	729	2,760	3,500
White sucker	1,532	1,308	574	1,078	2,249
Yellow perch	39	3	1	1	17
Rock bass	49	67	2	2	106
Smallmouth bass	...	...	...	...	3
Largemouth bass	...	...	...	1	1
Bluegill	...	...	1	...	...
Pumpkinseed	17	1	...	...	7
Northern pike	36	27	12	26	53
Cisco	7	6	1	10	28
Brook trout	...	1	...	...	2
Lake sturgeon	...	...	1	...	...
Redhorse spp.	116	46	41	52	90
Bullhead spp.	47	3	...	...	2
Total	2,451	1,776	1,362	3,930	6,058

Species	Number of fish collected				
	Apr 1969	Apr-May 1970	Apr-May 1971	May 1972	Apr-May 1974
Walleye	1,209	1,887	3,014	2,080	1,497
White sucker	3,492	3,114	5,781	5,171	1,044
Yellow perch	6	54	17	18	4
Rock bass	7	104	87	61	22
Bluegill	1	7	...	...	...
Pumpkinseed	...	3	12	4	3
Northern pike	16	49	126	167	55
Cisco	61	17	36	17	22
Brook trout	...	...	3	4	4
Largemouth bass	...	1	...	...	2
Smallmouth bass	...	17	9	8	5
Sturgeon	...	...	...	...	1
Redhorse spp.	85	118	211	282	69
Bullhead spp.	...	7	4	9	14
Burbot	...	1	...	...	...
Total	4,877	5,379	9,300	7,821	2,658

Catch per unit effort

Species	Catch per 1000 feet of gill net		Catch per trap net
	July-Aug 1936[a]	July 1952[b]	Sep 1955[c]
Yellow perch	68.0	84.3	1.2
Rock bass	....	1.2	1.2
Pumpkinseed	....	3.7	0.2
Walleye	35.0	27.1	34.2
Northern pike	7.0	14.2	1.1
Smallmouth bass	....	....	0.9
Largemouth bass	....	....	0.2
Cisco	14.0	3.1	0.4
White sucker	22.0	23.4	14.8
Bullhead spp.	....	....	0.2
Redhorse spp.	....	....	2.2

[a] Total of 1000 feet of gill net.

[b] Total of 1625 feet of gill net.

[c] Total of 12 trap net lifts.

Species	Catch per acre with seine	Catch per 100 yards of shoreline with seine
	July-Aug 1936[a]	July 1952[b]
Yellow perch	651.0	14.0
Rock bass	64.5	....
Pumpkinseed	1.7	....
Walleye	....	1.0
Smallmouth bass	34.7	....
White sucker	124.0	1.0
Redhorse spp.	....	0.5
Bullhead spp.	61.2	....
Green sunfish	5.0	....
Mimic shiner	498.0	22.0
Sand shiner	288.0	1.0
Bluntnose minnow	840.0	6.0
Spottail shiner	121.0	12.5
Common shiner	57.9	0.5
Johnny darter	140.0	2.5
Sculpin	1.7	2.0
Golden shiner	1.7	....
Mudminnow	1.7	....
Iowa darter	3.3	....
Logperch	....	0.5
Emerald shiner	....	0.5

[a] Total of 0.6 acre seined.
[b] Total of 200 yards of shoreline seined.

Age and growth

Species	Mean growth rate index; number of scale samples in parentheses; age groups represented given in Roman numerals				
	Aug 1936	Sep 1955	Mar 1964	Dec 1966	Apr 1967
Yellow perch	-0.2 (32) II, III, V, VI	....	....	-0.8 (18) III, IV	....
Walleye	-3.2 (15) IV, V	+1.0 (23) I-III	....	....	-1.0 (28) II, IV, VI
Cisco	....	....	+1.9 (18) IV, V	....	....

(continued, next page)

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals				
	Apr 1968	Apr 1969	Apr-May 1970	Nov 1970	Mar 1973
Yellow perch	....	....	....	+1.0 (23) II, III	....
Walleye	-1.3 (28) IV-VI	-1.8 (17) III, V	-0.2 (9) II	-0.4 (7) II	-2.4 (38) V-IX
Northern pike	....	+0.2 (13) II, III	....	....	....
Smallmouth bass	....	-0.6 (7) IV	....	....	....

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-39[a]	...	1,499	2,224	1.48
1940-50	1,113	3,756	4,292	1.14
1951-64	5,821	12,359	12,888	1.04

[a] The years of 1931 and 1933 not included.

Species composition of catch from general creel census

Species	Percent of total catch		
	1928-39	1940-50	1951-64
Yellow perch	74.7	55.7	78.7
Rock bass	1.2	11.7	3.4
Pumpkinseed	0.4	0.1	0.2
Bluegill	1.3	<0.1	<0.1
Smallmouth bass	1.2	0.3	0.2
Largemouth bass	<0.1	<0.1	<0.1
Walleye	14.7	15.1	10.8
Northern pike	6.4	14.0	4.5
Cisco	0.3	0.8	1.8
White sucker	0.1	0.4	0.1
Bullhead spp.	....	1.8	0.2

Estimated angler effort from mail surveys

Year	Number of angler days
1970	55,780
1973	48,780

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked: No records available from 1914-1932

Species	Dates[1]	Size	Numbers
Walleye	1907	fry	60,000
	1933-41	fry	4,210,000
	1970-73	fry	1,700,000
	1971-73	fingerling	27,466
Largemouth bass	1910	fingerling	2,500
Smallmouth bass	1913	fingerling	2,000
Yellow perch	1933-39	fingerling	50,600
Northern pike	1940	adult	516
Northern pike	1971	fingerling	4,350

[1] Plantings not necessarily continuous between dates given.

Fish migration, 1947

A weir was placed in the inlet to Big Manistique Lake from South Manistique Lake to determine whether fish migrated from South Manistique into Big Manistique and stayed there. Vandalism prevented completion of the study.

INFORMATION SOURCES, REPORTS, ETC.

I.F.R. reports:

Number

702 Roelofs, E. W. November 11, 1941. A fisheries survey of the Manistique lakes, Luce and Mackinac counties.

1159 Reynolds, D. B., Jr. February 19, 1948. Observation on the movements of yellow pikeperch (Stizostedion v. vitreum), northern pike (Esox lucius) and other species in South and Big Manistique lakes, Luce and Mackinac counties.

Personal communication:

Leland R. Anderson, District Fisheries Biologist, August 1975.

Michigamme (Way) Reservoir, Iron County
T. 43, 44 N., R. 31, 32 W., Sec. many

Michigamme Reservoir was created by a dam constructed in 1940 on the Michigamme River. The dam, owned by the Wisconsin-Michigan Power Company, floods a wide shallow basin of about 7,000 acres including several natural lakes. Maximum depth is about 42 feet, located at the dam site.

Some indication of the success of anglers has been obtained from general creel census records (1943-64), and a mail survey in 1970. The general creel census was designed only to measure success of those anglers actually interviewed. The mail survey was designed to measure total fishing pressure.

The only fish management to date has been the elimination of the minimum size limit on northern pike. This change in regulation has not been evaluated.

The majority of fishing effort is for walleyes. The walleye fishery peaked about 10 years ago and was followed by a gradual decline to the level of the past 4 or 5 years where it seems to be holding steady. Walleye catches of the past 3 to 4 years have been characterized by large numbers of sublegal fish, but few larger fish. The initial fishery on the reservoir was for northern pike, and as the northern pike declined, the walleye fishery developed.

The best open-water walleye fishery occurs in the spring and fall. The early spring fishing is best in areas of the spawning streams. Ice fishing for walleyes and northern pike is best toward the end of the season when the water level is low and fish are concentrated in old lake basins and the river beds. Good catches of perch are taken occasionally during the summer and fall. Black crappies have declined considerably. Smallmouth bass and bluegills periodically show up in the catches but are rarely fished for specifically.

Michigamme Reservoir has not been given attention commensurate to its size. A netting survey is needed and a creel census would be valuable. An investigation should be made of the paucity of larger walleyes in the fishery even though large numbers of sublegals are present.

LAKE SURVEYS

Physical and chemical data
Chemical survey August 1959 300 yards above dam

Area (acres)	about 7,000	Shore development	6.6
Temperature (°F)		Oxygen (ppm)	
Surface	75	Surface	6.9
At 22 feet	69	Bottom	3.1
Surface		Secchi disk (feet)	4.5
Alkalinity (ppm)	52		
pH	7.2		

Tributaries and dams

Dam: Constructed in 1940 and owned by Wisconsin-Michigan Power Company. Dam constructed in Michigamme River at T. 43 N., R. 31 W., Sec. 6. Floods wide shallow basin (approximately 7000 acres) including several natural lakes. Purpose is for storage to feed the Peavy Falls Reservoir below for hydro-electric power. Reservoir is filled during spring run-off and drawn down in the summer, fall and winter. Result is considerable fluctuation in water level, at times down to stream bed.

Fish collections

Species and number

Species	Number of fish collected	
	June 1969[a]	May-June 1969[b]
Yellow perch	2	20
Rock bass	...	22
Bluegill	...	37
Black crappie	1	12
Walleye	1	49
Northern pike	...	53
White sucker	4	421
Sturgeon sucker	3	...
Total	11	614

[a] Collected with gill net.

[b] Collected with trap and fyke nets.

Catch per unit effort

Species	Catch per trap and fyke net May-June 1969[a]
Yellow perch	0.3
Rock bass	0.4
Bluegill	0.6
Black crappie	0.2
Walleye	0.8
Northern pike	0.9
White sucker	7.3

[a] Total of 58 net lifts.

Age and growth

Species	Mean growth rate index;[1] number of samples in parentheses; age groups represented given in Roman numerals March 1957
Northern pike	-2.4 (24) II, III

[1] Deviation in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1943-49	1,813	10,595	4,366	0.41
1951-64	3,023	10,738	6,377	0.59

Species composition of catch from general creel census

Species	Percent of total catch	
	1943-49	1951-64
Yellow perch	37.6	15.7
Bluegill	....	2.3
Black crappie	28.6	16.8
Largemouth bass	3.2	0.3
Smallmouth bass	0.7	0.2
Northern pike	22.7	27.4
Walleye	6.8	37.1
Others	....	0.2[a]

[a] Includes pumpkinseed, rock bass, burbot and sucker.

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	8,120

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1420 Cooper, G. P., and K. G. Fukano. May 6, 1954. Fishing values in impoundments with special reference to shallow water flooding projects.

Personal communications:

Dell Siler, Fisheries Habitat Biologist, July 1975.

Mullett Lake, Cheboygan County
T. 35-37 N., R. 1, 2 W., Sec. many

Mullett Lake is the fifth largest inland lake in Michigan. It has a surface area of 16,630 acres and a maximum depth of 148 feet. Approximately 15% of the lake is less than 15 feet deep. The Civilian Conservation Corps (CCC) mapped the lake during the winter of 1940-41. An intensive biological survey was made in July 1956.

General creel census and mail surveys have been used to measure fishing pressure and success of anglers. From 1928-1964, the general creel census was conducted by Conservation Officers while performing their other duties at the lake. The general creel census was designed only to measure the success of those anglers actually interviewed. The mail survey was designed to measure total fishing pressure on the lake.

Past management has consisted mainly of planting fish, mostly salmonids. Since 1970, the plantings have been lake trout fingerlings with the objective of creating a sport fishery by utilizing the alewife population as a forage base. From a recent survey in 1975, it appears this approach is successful providing the fingerlings are stocked at a large enough size.

Past history indicates that the cisco fishery is a recent development, but there was a sport fishery for lake trout and a spear fishery for whitefish in the fall at the mouth of the Indian River.

Currently, the open water fishery is primarily for walleyes and northern pike. The winter fishery is about 80% for cisco and the remaining 20% for sturgeon, yellow perch, northern pike, and walleye. The present cisco fishery appears to be limited to fluctuating strong year classes and is now on a downward trend.

Two new fish species have been confirmed in Mullett Lake. Coho salmon, presumably from the Wolverine Hatchery ponds, have been taken by anglers and at least one was taken in nets in 1975. White bass were identified a few years ago in the anglers' creel and several were taken in nets in 1975.

The survey conducted in 1975 consisted of gill netting for all species and included the establishment of index stations for future work.

LAKE SURVEYS

Physical and chemical data surveyed July 1956

Area (acres)	16,630
Shore development	2.3
Depth (feet)	
Maximum	148
Mean	35.8
Percent shoal	
<15 feet deep	15
Secchi disk (feet)	10-12
Temperature (°F)	
Surface	66-74
Bottom	48-49
Thermocline	began at 30-45 feet
Surface	
Alkalinity (ppm)	144-148
pH	8.3
Oxygen (ppm)	
Surface	7.6-8.7
Bottom	7.6-8.5
Bottom type	
Shoal	sand, gravel
Depths	mostly clay
Vegetation	sparse

Tributaries, dams and watershed drainage

Main inlets:	Indian, Pigeon and Little Pigeon rivers, Nigger Creek.
Main outlets:	Cheboygan River into Lake Huron.
Dams:	Cheboygan Dam constructed in 1868 near mouth of Cheboygan River, equipped with a boat lock.
Watershed drainage area (acres):	60,256

Fish collections

Species and numbers

Survey 1887: Reported presence of sunfish, burbot, whitefish, herring, walleye, rock bass, northern pike, yellow perch, suckers, and lake trout.

Species	Number of fish collected		
	July 1956[a]	June 1967[b]	July 1972[b]
Yellow perch	173	1475	...
Rock bass	105	68	...
Pumpkinseed	45	...	...
Longear sunfish	1	...	...
Smallmouth bass	6	3	...
Largemouth bass	18	...	...
Walleye	30	60	9
Northern pike	100	71	5
Muskellunge	8	2	...
Total	486	1679	14
Rainbow trout	...	...	2
Brown trout	...	...	1
Cisco	25	155	114
Splake	...	4	...
Rainbow smelt	...	2	...
Coho salmon	...	2	...
Total	25	163	117
White sucker	420	117	...
Brown bullhead	36	...	...
Yellow bullhead	7	3	...
Bowfin	5	...	...
Longnose gar	27	...	...
Alewife	1	16	...
Carp	1	...	...
Total	497	136	0
Mimic shiner	44	...	...
Sand shiner	93	...	...
Common shiner	32	60	...
Golden shiner	1	...	...
Blacknose shiner	7	...	...
Blackchin shiner	3	...	...
Bluntnose minnow	536	...	...
Creek chub	12	...	...
Johnny darter	73	...	...
Iowa darter	26	...	...
Logperch	16	...	...
Trout-perch	...	13	...
Sculpin sp.	1	...	...
Killifish spp.	5	...	...
Total	849	73	0
Grand total	1857	2051	131

[a] Collected with gill net and seine.
[b] Collected with gill net.

Catch per unit effort

Species	Catch per 1000 feet of gill net		Catch per 100 feet of shoreline
	July 1956[a]	June 1967[b]	July 1956[c]
Yellow perch	8.9	220.1	1.2
Rock bass	4.4	10.1	1.3
Longear sunfish	...	...	<0.1
Pumpkinseed	0.3	...	1.5
Smallmouth bass	0.3	0.3	<0.1
Largemouth bass	0.1	...	0.6
Walleye	1.9	9.0	...
Northern pike	6.0	10.6	0.2
Muskellunge	0.5	0.3	...
Cisco	1.6	23.1	...
Coho salmon	...	0.3	...
Splake	...	0.6	...
Rainbow smelt	...	0.3	...
White sucker	11.6	17.5	8.8
Brown bullhead	2.3	...	...
Yellow bullhead	0.4	0.4	...
Longnose gar	1.7	...	...
Bowfin	0.3	...	...
Carp	<0.1	...	...
Alewife	<0.1	2.4	...
Mimic shiner	...	...	1.6
Sand shiner	...	...	3.4
Blacknose shiner	...	...	0.3
Blackchin shiner	...	...	0.1
Common shiner	...	9.0	1.2
Golden shiner	...	...	<0.1
Bluntnose minnow	...	...	19.9
Creek chub	...	...	0.4
Johnny darter	...	...	2.7
Iowa darter	...	...	1.0
Logperch	...	...	0.6
Trout-perch	...	1.9	...
Sculpin sp.	...	...	<0.1
Killifish spp.	...	...	0.2

[a] Total of 15,725 feet of gill net set.

[b] Total of 6,700 feet of gill net set.

[c] Total of 2,700 feet of shoreline seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses, age groups represented given in Roman numerals		
	July 1956	June 1967	July 1972
Yellow perch	-0.8 (133) III-VII	-1.0 (38) II, IV, V, VII	....
Rock bass	-0.1 (93) III-V	....	....
Pumpkinseed	-0.2 (28) III-IV	....	....
Walleye	-1.7 (26) II-V	....	....
Northern pike	+0.5 (94) I-VII	+0.6 (25) II-V	....
Muskellunge	-4.1 (6) II-III	....	....
Cisco	-0.8 (21) IV-VI	-1.2 (32) II-VI	-0.1 (106) IV-VII

[1] Deviations in inches from statewide growth rate averages; only age groups with at least five samples are included.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1928-38[a]	...	380	272	0.72
1940-50	1,774	3,504	1,219	0.35
1951-64	3,833	6,111	1,883	0.31

[a] No data available for 1939.

Species composition of catch from general creel census

Species	Percent of total catch		
	1928-38	1940-50	1951-64
Yellow perch	4.0	63.4	64.6
Rock bass	2.9	7.2	10.4
Bluegill	...	1.5	0.1
Sunfish spp.	...	2.1	0.5
Smallmouth bass	0.7	2.2	2.6
Largemouth bass	...	0.3	0.6
Walleye	24.3	9.4	11.6
Northern pike	20.6	9.0	6.9
Muskellunge	...	0.2	0.3
Lake sturgeon	...	...	0.1
Whitefish	1.1	0.2	...
Cisco	37.9	2.1	0.2
Burbot	5.1	...	...
White sucker	1.1	0.1	1.5
Bullhead spp.	1.8	0.2	0.7
Bowfin	0.4	0.3	...

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	65,350
1973	32,130

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked--few records available from 1914 to 1932.

Species	Dates[1]	Size	Numbers
Walleye	1891-1949	fry	17,685,000
	1933-49	adult	4,973
Northern pike	1939-49	adult	47
Largemouth bass	1908-11	fry	8,800
Smallmouth bass	1913-14	fingerling	9,700
	1921-22	adult	370
	1940-46	adult	57
Yellow perch	1921-22	fingerling	3,000
	1939-49	adult	1,013
Rock bass	1939-49	adult	528
Warmouth	1914	fingerling	1,000
Whitefish	1887	fry	3,250,000
Lake trout	1892-1913	fry	641,000
	1937	fry	30,000
	1950-51	fingerling	9,400
	1965	fry	250,000
	1970-73	fingerling	238,000
Rainbow trout	1938	fingerling	19,000
	1971	fingerling	1,500
Brook trout	1961	fingerling	8,000
Splake	1965-73	3 to 7+ inches	412,498

[1] Plantings not necessarily continuous between dates given.

Survey indicated that splake survival was good when fish were stocked at 7+ inches.

Walleye transfer

1931-49: Walleyes were transferred above Cheboygan Dam during spawning runs and released in different sections of the inland waterway including Mullett Lake. Cheboygan Dam transfer was discontinued due to expense involved in relation to the small numbers of fish transferred.

Removal of rough fish by commercial trap netting

1939-56: Percentage of catch by species from intermittent netting was: suckers 21, walleyes 56 (high percentage due to catching spawning run in 1947), rock bass 8, bullhead 7, and northern pike 2.4.

Brush shelters

1953-54: Five hundred sixty-one shelters were installed. No evaluation on effects of brush shelters.

Sturgeon fishery

Regulations

1928	All sturgeon fishing was closed.
1948	Spearing season opened January and February; limit of 2 fish; minimum size of 36 inches.
1952	Minimum size increased to 42 inches.
1958	Open season February only.
1959	Sturgeon classified as game fish (prohibits sale of sturgeon from inland waters).
1974	Minimum size increased to 50 inches. Fish must be validated at DNR office within 48 hours after capture.

Fishing pressure and harvest

Date	Total shanty counts	Shanties on sturgeon grounds	Total hours fished	Fish caught	Hours per fish
1/24/55	200	..	...	..	...
2/20/56	191	57	3,207	11	300
2/15/57	177	44	3,318	3	1,036
2/19/58	159	29	1,742	4	458
2/11/59	161	..	...	..	...
2/13/60	137	..	...	..	...
2/21/61	162	..	...	..	...
2/13/62	212	..	...	..	...
2/21/63	183	..	...	..	...
2/13-14/64	193	..	...	..	...
2/16-19/65	224	..	...	..	...
1971	266	..	...	..	...
1974	223	..	...	..	...
2/21/75	275	..	...	..	...

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1139 Beckman, William C. November 17, 1947. A summary of the netting operations during the summer of 1947.

1218 Applegate, V. C. March 29, 1949. Sea lamprey investigations. An inventory of spawning streams of the sea lamprey, Petromyzon marinus, in Michigan. (Summary for 1947 and 1948)

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1616 Vondett, H. J., and J. E. Williams. April 5, 1961. The sturgeon fishery of Black, Burt, and Mullett lakes, Cheboygan County, 1957-1958.

Marsh, William M., and Thomas E. Borton. 1974. Michigan inland lakes and their watersheds--an atlas. Mich. Dep. Nat. Resources, Water Resources Commission, 166 pp.

Personal communication:
Mason F. Shouder, Fisheries Habitat Biologist, December 1975.

Portage Lake, Houghton County
T. 53, 54, 55 N., R. 32, 33 W., Sec. many

Portage Lake, located in the Keweenaw Peninsula, is part of the Keweenaw Waterway System. The lake is unusual because it is connected with Lake Superior on the southeast by a natural channel and on the northwest by a ship canal.

Data on fishing pressure and angler success have been obtained from general creel census records (1951-64) and mail surveys in 1970 and 1973. The general creel census was designed only to measure success of those anglers actually interviewed. The mail survey was designed to measure total fishing pressure. Data from the mail surveys include Torch Lake, Houghton County, also part of the Keweenaw Waterway System.

Portage Lake has been managed through statewide fishing regulations, inventory netting surveys and limited fish plantings. Surveillance of the fishery has been adequate as the status of the catch appears to have changed little since the 1955 survey. In 1973, a graduate student from Michigan Technological University studied saugers. A copy of his thesis may be obtained from Dr. Thomas Wright of the MTU Biological Science Department. Currently, Dr. Wright is writing an Environmental Analysis for the U.S. Corps of Engineers to determine the effects of channel maintenance dredging at the north entry.

In 1955-56, the Michigan Department of Conservation constructed three public fishing sites. Currently there are seven sites, four maintained by local governmental agencies and three by the DNR Waterways Division. Sauger fishing in Portage Lake was known throughout the midwest during the 1950's. It was not until 1960 that a 20-fish creel limit was put on saugers, and in 1968, a 13-inch minimum size and five possession limit was established.

The present sport fishery is utilized primarily by tourists as most local anglers prefer to fish for lake trout in Lake Superior. The best fishing for panfish is in Chassell Bay during June. Northern pike fishing is best in June, but many pike in the 20-pound class are caught in

July in North Portage Canal. Sauger and walleye fishing is good in June, July, late September, and October. Winter fishing is limited to spearing for pike on Chassell Bay.

This lake has been subject to innumerable environmental stresses caused by mining (reclaiming of copper from bottom stamp sand), industrial and domestic pollution and a lack of shoreline zoning. Water quality data are not available, and if the fishery declines due to any one of these stresses, it would be difficult to determine the specific reason for the decline.

Available data are relatively comparative but future inventories should be aligned to the methods utilized in the 1971 survey when the entire lake and adjoining waters were surveyed. Future surveys should be every 5 years.

For any management surveys or recommendations, Portage Lake should be treated as part of the Keweenaw Waterway System and not as a separate lake.

LAKE SURVEYS

Data from Corps of Engineers map

Area (acres)	9,641	Shore development	4.9
Depth (feet) Maximum	54		

Tributaries and dams

Main inlets:	Sturgeon, Snake and Pike rivers.
Main outlets:	The lake is connected with Lake Superior on the southeast by a natural channel and on the northwest by a ship canal. The level of the lake is the same as Lake Superior; flow of water depends on wind direction.
Dams:	None

Fish collections

Species and numbers

Species	Number of fish collected			
	July 1955[a]	Aug 1955[b]	June 1963[a]	Aug 1966[a]
Yellow perch	56	23	124	19
Rock bass	...	29	6	4
Black crappie	...	194	...	1
Largemouth bass	...	...	...	2
Walleye	4	79	5	4
Sauger	19	24	23	...
Northern pike	...	4	10	6
Total	79	353	168	36
Whitefish	...	...	...	2
Rainbow smelt	2	...	9	...
White sucker	4	45	61	...
Longnose sucker	...	...	20	...
Bullhead spp.	...	14	...	...
Redhorse spp.	...	9	...	...
Carp	...	1	...	...
Alewife	...	...	1	1
Total	6	69	91	3
Grand total	85	422	259	39

	Aug 1969[c]	Aug 1970[a]	July-Aug 1971[d]
Yellow perch	11	273	636
Rock bass	16	...	98
Pumpkinseed	5	...	63
Crappie spp.	50	1	52
Smallmouth bass	...	...	1
Walleye	12	11	10
Sauger	5	3	72
Northern pike	11	9	84
Total	110	297	1016
Whitefish	...	22	...
Rainbow trout	...	...	3
Brown trout	...	...	4
Rainbow smelt	...	15	83
Total	0	37	90

(continued, next page)

Species	Number of fish collected		
	Aug 1969[c]	Aug 1970[a]	July-Aug 1971[d]
White sucker	63	...	207
Longnose sucker	...	...	16
Bullhead spp.	577	...	175
Redhorse spp.	...	...	7
Carp	...	...	2
Alewife	...	...	3
Golden shiner	...	...	3
Total	640	0	413
Grand total	750	334	1519

[a] Collected with gill nets.
[b] Collected with gill and trap nets.
[c] Collected with fyke and trap nets.
[d] Collected with gill, fyke and trap nets.

Collections by Fish and Wildlife Service vessel "Cisco." Collections were made by dragging an otter trawl along the lake bottom. Most fish were caught in nets 35 feet wide at the wings and 36 feet long. Mesh sizes ranged from 1.5-2.5 inches (extension measure) at the forward end to 0.5 inch at the cod end. A trawl of somewhat larger size and mesh was used for 10 minutes of the July 9-10 fishing.

	Dates (1953)				Total
	May 22	July 9-10	Sep 4	Sep 27	
Number of hauls	1	5	2	2	10
Total minutes trawled	15	50	16	20	101
Depth (fathoms)	8	5-8	5.9	7-10	5-10
Species	Number				
Sauger	44	62	28	16	150
Yellow perch	...	22	6	44	72
Rainbow smelt	13	4	43	20	80
Cisco spp.	...	2	...	6	5
Bluegill	...	...	...	8	8
Crappie spp.	...	...	...	8	8
Longnose sucker	7	1	...	...	8
White sucker	...	5	...	...	5
Trout-perch	18	211	314	567	1110
Sculpin spp.	...	3	...	1	4
Johnny darter	...	...	6	21	27
Spottail shiner	...	...	2	11	13
Ninespine stickleback	...	...	...	1	1

Catch per unit effort

Species	Catch per 1000 feet of gill net				Catch per trap net
	July 1955[a]	Aug 1955[a]	June 1963[b]	Aug 1970[c]	Aug 1955[d]
Yellow perch	149.0	61.3	165.0	243.0	....
Rock bass	....	5.3	8.0	....	5.4
Black crappie	....	2.7	....	0.9	38.6
Walleye	10.7	10.7	6.7	9.8	15.0
Sauger	50.7	50.7	30.7	2.7	1.0
Northern pike	....	2.7	13.3	8.0	0.6
Rainbow smelt	5.3	....	12.0	13.3	....
Whitefish	....	....	1.3	....	....
Burbot	....	....	4.0	....	....
White sucker	10.7	18.7	81.3	19.6	7.6
Redhorse spp.	....	5.3	....	....	1.4
Carp	....	2.7	....	....	....
Bullhead spp.	....	....	....	....	2.8
Longnose sucker	....	....	26.7	....	....
Alewife	....	....	1.3	44.4	....

[a] Total of 375 feet of gill net.
[b] Total of 750 feet of gill net.
[c] Total of 1125 feet of gill net.
[d] Total of five trap nets.

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1951-57	933	1,764	1,179	0.67
1958-64	949	1,602	845	0.53

Species composition of catch from general creel census

Species	Percent of total catch	
	1951-57	1958-64
Yellow perch	59.2	69.1
Rock bass	2.6	1.8
Black crappie	0.2	2.1
Smallmouth bass	<0.1	1.1
Walleye	1.4	2.6
Sauger	27.3	10.2
Northern pike	7.8	10.7
Bullhead spp.	0.3	0.9
Others	0.2[a]	1.5[b]

[a] Includes largemouth bass, bluegill, pumpkinseed, and rainbow trout.
[b] Includes largemouth bass, bluegill, pumpkinseed, and channel catfish.

Estimated angler effort,
from mail surveys
(Includes Torch Lake, Houghton County)

Year	Number of angler days
1970	10,990
1973	29,700

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Species	Dates[1]	Size	Numbers
Walleye	1904-06	fry	370,000
	1935	fry	250,000
	1942	fry	1,000,000
Rainbow trout	1943	yearling	200

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1933. Installed 169 shelters.

Tagged rainbows

In April 1943, 200 7- to 9-inch rainbow were jaw tagged and released. No evaluation on returns.

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I.F.R. reports:

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Notes on the planting of jaw-tagged rainbow trout in Portage Lake, Houghton County, Michigan.

Juetten, Raymond P. December 1971. Fisheries survey, Keweenaw Waterway System, Houghton County. Mich. Dep. Nat. Resources, Fisheries Div., mimeograph report.

Personal communication:
John M. Robertson, District Fisheries Biologist, August 1975.

Torch Lake, Antrim County
T. 28, 29, 30, 31 N., R. 8, 9 W., Sec. many

Torch Lake is the second largest inland lake in Michigan with a total surface area of 18,770 acres and a maximum depth of 285 feet. About 10% of the lake is less than 15 feet deep. The lake was mapped in 1953 and inventories of all species of fish were made in 1931 and 1958.

A measure of fishing pressure and angler success has been obtained from general creel census records and from mail surveys. The general creel census was designed only to measure success of those anglers actually interviewed. The mail surveys were designed to obtain information on total fishing pressure.

Past management has been limited to stocking fish, installation of brush shelters and special fishing regulations. A special regulation allows spearing of ciscoes, whitefish, carp and suckers from November 1 through December 31. Other than this the lake is under the state-wide regulations. The introduction of kokanee salmon fingerlings in 1965-66 was not successful.

The present fishery concentrates on lake trout and is best in early summer. Lake trout are also taken through the ice, usually in 50 to 75 feet of water. An excellent winter fishery for whitefish exists. These are fished by chumming and are usually found near the 30-foot depth. The open-water season provides good fishing for rock bass. Some smallmouth bass and perch are caught. A popular area for panfish is near the wooden cribs off Torch village. In the past some spearing for whitefish was done in the fall but this fishery has apparently declined.

An intensive survey with gill nets was conducted during 1975 and included the establishment of netting index stations. A creel census would be valuable to determine fishing pressure and harvest of fish. Stocked lake trout should be marked to aid in evaluating the success of stocking and to determine the amount of natural reproduction. Great Lakes muskellunge are native to this system and their life history requirements should be investigated to help in management of the species.

LAKE SURVEYS

Physical and chemical data
surveyed August 1931 and July, August 1958

Area (acres)	18,770	Thermocline	began at 25 feet
Depth (feet)		Surface	
Maximum	285	Alkalinity (ppm)	141-142
Mean	111	pH	8.0
Shore development	2.2	Oxygen (ppm)	
Percent shoal		Surface	7.4-7.6
<15 feet deep	10	Bottom	8.4-8.7
Secchi disk (feet)	23	Bottom type	
Temperature (°F)		Shoal	sand, gravel, rubble, marl
Surface	65	Depths	clay, marl, pulpy peat
Bottom	41		
		Vegetation	sparse

Tributaries and dams, watershed drainage

Main inlets: Clam River, Spencer Creek, Wilkinsin Creek, and Eastport Creek.

Main outlet: Torch River into Round Lake into Elk Lake into Lake Michigan.

Dam: At Elk Rapids about 10 miles from Torch Lake. Little if any effect on water level of Torch Lake.

Watershed drainage area (acres): 26,853

Fish collections

Year of 1888: Fish species collected were lake trout, burbot, whitefish, herring, yellow perch, white sucker, horned dace, bluntnose minnow, logperch, Johnny darter, sculpin, and lake shiner. Other species reported were largemouth bass, smallmouth bass, rock bass, and brook trout.

Year of 1923: Fish collected were lake trout, burbot, whitefish, herring, yellow perch, white sucker, largemouth bass, smallmouth bass, rock bass, sand shiner, bluntnose minnow, trout-perch, logperch, Johnny darter, lake shiner, longnose dace, and sculpin.

Species and numbers

Species	Number of fish collected				
	Aug 1931[a]	July-Aug 1958[a]	Nov 1970[b]	Oct 1972[b]	Oct 1975[b]
Yellow perch	163	185	2	229	32
Rock bass	1	42	...	4	10
Largemouth bass	...	2	...	...	...
Smallmouth bass	10	4	...	...	...
Northern pike	...	1	...	...	...
Total	174	234	2	233	42
Lake trout	5	8	10	51	203
Cisco	22	64	7	69	187
Brown trout	...	2	24	2	1
Rainbow trout	...	2	9	1	...
Whitefish	...	9	...	63	164
Burbot	2	11	...	8	1
Total	29	96	50	194	556
White sucker	44	291	1	15	7
Longnose gar	...	1	1	...	...
Total	44	292	2	15	7
Sand shiner	1,371	1,208	...	...	...
Common shiner	2	1	...	...	...
Rosyface shiner	209	24	...	...	...
Bluntnose minnow	21	106	...	...	...
Creek chub	6	...	...	...	...
Longnose dace	27	7	...	...	...
Blacknose dace	15	...	...	...	...
Redbelly dace	...	1	...	...	...
Johnny darter	3	64	...	...	...
Logperch	26	8	...	...	...
Sculpin spp.	1	4	...	...	...
Mudminnow	7	...	...	...	...
Brook stickleback	...	4	...	...	...
Total	1,688	1,427	0	0	0
Grand total	1,935	2,049	54	442	605

[a] Collected with gill net and seine.

[b] Collected with gill net.

Catch per unit effort

Species	Catch per 1000 feet of gill net				Catch per acre with seine
	Aug 1931[a]	July-Aug 1958[b]	Nov 1970[c]	Oct 1972[d]	Aug 1931[e]
Yellow perch	14.3	16.3	4.0	36.3	25.8
Rock bass	0.3	3.1	...	0.6	...
Smallmouth bass	...	0.3	...	...	2.4
Northern pike	...	0.1	...	...	...
Lake trout	1.5	0.7	20.0	8.1	...
Brown trout	...	0.2	48.0	0.3	...
Rainbow trout	...	0.2	18.0	0.2	...
Whitefish	...	0.8	...	10.0	...
Burbot	0.6	1.0	...	1.3	...
Cisco	6.4	6.0	14.0	11.0	...
White sucker	0.6	4.4	2.0	2.4	9.5
Longnose gar	...	...	2.0	...	...
Sand shiner	...	...	...	...	210.0
Common shiner	...	...	...	...	0.5
Rosyface shiner	...	...	...	...	47.3
Bluntnose minnow	...	...	...	...	4.8
Creek chub	...	...	...	...	1.4
Longnose dace	...	...	...	...	6.1
Blacknose dace	...	...	...	...	3.4
Johnny darter	...	...	...	...	0.7
Logperch	...	...	...	...	5.9
Sculpin spp.	...	...	...	...	0.2
Mudminnow	...	...	...	...	0.2

a/ Total of 3,420 feet of gill net set.

b/ Total of 10,750 feet of gill net set.

c/ Total of 500 feet of gill net set.

d/ Total of 6,300 feet of gill net set.

e/ Total of 4.42 acres seined.

Age and growth

Species	Mean growth rate index;[1] number of scale samples in parentheses; age groups represented given in Roman numerals		
	July-Aug 1958	April 1966	Oct 1972
Yellow perch	-0.2 (140) II-VII	...	-0.2 (65) III-VI
Rock bass	-1.1 (57) III-V	...	...
Cisco	-0.4 (69) III-VI	-1.8 (7) V	0.0 (46) IV-VI

[1] Deviations in inches from statewide growth rate averages; only age groups with at least five samples are included.

Age and growth of lake trout

Age group	Date of collection; mean length in inches; number of fish in parentheses			
	July Aug 1958	Oct 1958	Fall 1964, Spring 1965	Oct 1972
II	9.9 (2)	10.2 (2)	12.5 (1)	12.1 (16)
III	13.2 (4)	13.5 (3)	...	15.9 (13)
IV	...	...	11.0 (3)	19.9 (4)
V	19.5 (3)	20.5 (1)	18.8 (10)	25.5 (12)
VI	22.4 (3)	23.9 (7)	24.0 (6)	27.0 (2)
VII	26.4 (1)	25.9 (4)	25.2 (19)	31.7 (3)

(continued, next page)

Age group	Date of collection; mean length in inches; number of fish in parentheses			
	July Aug 1958	Oct 1958	Fall 1964, Spring 1965	Oct 1972
VIII	...	29.4 (3)	27.8 (22)	...
IX	...	31.9 (1)	29.0 (6)	...
X	...	...	30.5 (5)	...
XI	...	...	30.2 (5)	...

Age and growth of whitefish

Age group	Date of collection; mean length in inches; number of fish in parentheses	
	Fall 1964 Spring 1964	Oct 1972
I	7.0 (1)	...
II	...	11.4 (4)
III	...	12.5 (11)
IV	11.0 (6)	14.4 (15)
V	11.9 (13)	15.8 (18)
VI	17.0 (1)	17.5 (14)
VII	...	...
VIII	22.5 (1)	
IX	19.5 (1)	...
X	21.5 (1)	...
XI	21.5 (1)	...
XII	22.9 (5)	...

Census of angling

General creel census

Date	Number of anglers	Total hours fished	Number of fish caught	Catch per hour
1935-1945	240	992	133	0.13
1947-1952	168	554	144	0.26
1956-1964	773	2,187	353	0.16

Species composition of catch from general creel census

Species	Percent of total catch		
	1935-45	1947-52	1956-64
Yellow perch	...	51.5	12.7
Rock bass	7.5	13.4	2.8
Crappie	...	1.0	...
Smallmouth bass	4.5	...	1.1
Northern pike	0.8	2.1	...
Muskellunge	1.5	...	...
Lake trout	74.4	27.8	39.1
Rainbow trout	0.8	...	0.3
Brook trout	1.5	...	...
Brown trout	...	...	0.3
Whitefish	8.3	4.1	41.4
Cisco	...	...	2.3
White sucker	0.8	...	...

Estimated angler effort, from mail surveys

Year	Number of angler days
1970	9,800
1973	13,140

Ice shanty counts by airplane

Date	Number of shanties
2/15/57	198
2/19/58	174
2/11/59	185
2/18/60	no ice
2/20/61	270
2/13/62	214
2/21/63	194
2/13, 14/64	no ice
2/16, 19/65	35
1971	89
1974	53
2/21/75	35 (some open water)

RECORDS OF FISH MANAGEMENT

Introductions and stocking

Fish stocked

Species	Dates[1]	Size	Numbers
Atlantic salmon	1882-88	fry	88,100
Whitefish	1887-92	fry	6,250,000
	1927-28	fry	2,125,000
Lake trout	1895-1914	fry	68,000
	1924-32	fry	342,000
	1927-53	fingerling	772,250
	1955-67	sublegal + legal	105,992
	1969-73	yearling	279,500
Walleye	1907	fry	240,000
	1934-39	fry	5,545,000
Smallmouth bass	1911-13	fry + fingerling	10,000
Yellow perch	1933-39	fingerling	978,000
Bluegill	1934	fingerling	15,000
Rainbow smelt	1912	eggs	6,000,000
Rainbow trout	1933-41	fingerling + adult	46,030
	1971	fingerling	82,616
Kokanee	1965-66	fingerling	2,238,920

[1] Plantings not necessarily continuous between dates given.

Brush shelters

1953: Fifty shelters were installed.

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