Fish Lake
Marquette County, T47N, R29W, Section 5, 6 & 8
Escanaba River Watershed, last surveyed: 2009

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Environment

Fish Lake is located in west-central Marquette County about 14 miles west of the City of Ishpeming. It has a watershed size of 1,466 acres, a surface area of 156 acres, and a maximum depth of approximately 29 feet (Figure 1). Halfway Creek forms the outlet of Fish Lake and is a tributary to the Middle Branch of the Escanaba River. Lake substrates vary from cobble, boulders, and sand in the nearshore areas to organic material found in the deeper offshore areas (Figure 1). Rooted emergent and sub-emergent aquatic vegetation is scattered throughout the littoral zone and includes cattails, lily pads, bulrush, and pond weed.

The immediate landscape surrounding Fish Lake consists of Precambrian granitic and sandstone bedrock knobs, rocky ground moraine, bedrock lakes, and localized outwash plains. Principle soil associations are mostly sands that are well drained, and the tops of the bedrock knobs have little to no soil coverage. Land cover consists upland mixed forest, northern hardwoods, and lowland coniferous forest while land use surrounding the lake is primarily residential in nature.

The perimeter of Fish Lake has been extensively developed with seasonal and permanent dwellings. A summer survey of the shoreline in 2009 documented 44 dwellings and 38 docks. Recent observations also indicate that natural riparian zone habitat such as downed trees and brush (deadwood) have most likely been removed for several decades to improve swimming, boat dockage, and aesthetics. A gravel-based public-access boat launch is located on the south-eastern shoreline and is maintained by the Department of Natural Resources (DNR).

The trophic state of a lake refers to the total weight of living biological material (biomass) and is a measure of its overall productivity. The concept is based on the fact that changes in nutrient levels (measured by total phosphorus) affect changes in algal biomass (measured by chlorophyll a) which in turn affect changes in lake clarity (measured by Secchi disk transparency). A Secchi disk is commonly used to measure the depth to which it can easily be observed through the water, (i.e. transparency). Secchi disk transparency, chlorophyll a (an indirect measure of phytoplankton), and total phosphorus (an important nutrient) are often used to define the degree of productivity, or trophic status of a lake. Oligotrophic, mesotrophic, and eutrophic lakes are respectively low, medium, and high in productivity.

To determine lake productivity, limnological characteristics were last measured on August 26, 2009. The water was clear with a Secchi disk reading of 6.0 feet. Within the water column, alkalinity was 18 milligrams per liter (mg/L), total phosphorus was 0.0231 mg/L, total nitrogen was 1.122 mg/L, and chlorophyll a was 0.00856 mg/L. Water chemistry values indicate that the trophic state of Fish Lake is mesotrophic (moderately productive).

Temperature and dissolved oxygen profiles were also documented in August 2009 and can be found in Table 1. Water temperatures ranged from 67.7 ºF (surface) to 55.5 ºF (bottom). Dissolved oxygen

ranged from 9.6 parts per million (ppm) at the surface to 0.3 ppm at the bottom. Minimum dissolved oxygen (DO) levels for suitable summer habitat are approximately 3.0 ppm for coldwater and coolwater fish and 2.5 ppm for warmwater fish (Schneider 2002). Dissolved oxygen levels were above the 3.0 ppm threshold from depths 0-17 feet (Table 1). Critical depth is defined as the point at which DO concentrations are less than 0.5 ppm and refers to a maximum depth that will support microorganisms like zooplankton. The critical depth in Fish Lake was measured at 19 feet (Table 1).

History

Fish Lake has a long and varied history of fisheries management. DNR Fisheries Division file records indicate that Fish Lake was stocked with largemouth bass, smallmouth bass, and bluegill from 1936 to 1945. Northern pike were stocked in 1961 and 1962. No further stocking occurred until the implementation of a walleye stocking program in 1988 (Table 2). Previous fisheries assessment surveys were conducted by the DNR in 1986, 1991, 1997, and 2003 to determine the status of the fish community and guide management. A total of 14 species have been captured during all Fisheries Division survey assessments with 9 species captured during the 2009 survey (Table 3).

Survey assessment results in 1986 documented what was perceived to be a highly-abundant population of yellow perch that was comprised of mostly small fish. A corrective action was implemented in 1988 when a manual removal of yellow perch was completed with the goal of reducing competition between yellow perch to increase both growth rates and population size structure. A walleye stocking program was also then implemented as an additional measure to control the abundance of yellow perch. Spring fingerling walleye have been stocked in 1988, 1994, 1996, 1999, 2002, 2004, and 2006 (Table 2).

In 1993, local riparian owners voiced concerns over a significant decline in angler success of legal-sized smallmouth bass and northern pike over the previous several years and attributed this decline to over-harvest by anglers. In 1995, in an attempt to reverse this trend, special minimum size limit and creel regulations were put into effect on Fish Lake. Minimum size limits for pike were set at 30 inches and bass (largemouth and smallmouth) were set at 18 inches. Two northern pike and one bass were allowed in daily possession.

Current Status

In June of 2009, DNR Fisheries Division conducted a fish community survey using Status and Trends protocols on Fish Lake. Assessment gear included fyke nets, gill nets, mini-fyke nets and an electrofishing boat. From June 6-11, 4 fyke nets were fished at 12 locations over 3 nights. Two experimental gill nets were fished at 6 locations over 3 nights. Two mini-fyke nets were fished at 5 locations over 3 nights. On June 17, 3 ten-minute night electrofishing transects were conducted at 3 separate locations around the shoreline. All fish captured were measured for length and a sample of scales was collected from common sportfish for age and growth analysis.

A total of 408 fish representing 9 species were collected from the combined June netting and electrofishing efforts (Table 4). Yellow perch, black crappie, and northern pike were the most

numerically abundant, compromising 73% of the total catch. Other fish species collected included bluegill, central mudminnow, pumpkinseed sunfish, slimy sculpin, smallmouth bass, and walleye.

Black crappie (N=75) averaged 8.9 inches in total length and comprised 18% of the total survey catch by number (Table 4). Black crappies ranged from 5 to 13 inches (Table 5) with 99% of the fish meeting or exceeding an acceptable harvest length of 7 inches. Age-growth data indicated that black crappies were growing slightly above state average having a mean growth index of +0.5 inches (Table 6). The age distribution indicated variable recruitment with representation of black crappie aged 3, 4, 7, 8, and 10 in the survey catch (Table 6).

Bluegill (N=27) averaged 5.6 inches in total length and comprised 7% of the total survey catch by number (Table 4). Bluegills ranged from 1 to 9 inches (Table 5) with 48% of the fish meeting or exceeding an acceptable harvest length of 6 inches. Age-growth data indicated that bluegills were growing slightly above state average having a mean growth index of +0.6 inches (Table 6). The age distribution indicated variable recruitment with good representation of bluegill aged 1-6, and 8 in the survey catch (Table 6).

Northern pike (N=45) averaged 25.1 inches in total length and comprised 11% of the total survey catch by number (Table 4). Northern pike ranged from 15 to 38 inches (Table 5) with 13% of the fish meeting or exceeding minimum harvest length of 30 inches. Age-growth data indicated that northern pike were growing at or near state average having a mean growth index of +0.1 inches (Table 6). The age distribution indicated variable recruitment with representation of northern pike aged 2-6, 10 and 11 in the survey catch (Table 6).

Pumpkinseed sunfish (N=12) averaged 5.5 inches in total length and comprised 3% of the total survey catch by number (Table 4). Pumpkinseed sunfish ranged from 1 to 8 inches (Table 5) with 42% of the fish meeting or exceeding the acceptable harvest length of 6 inches. The mean growth index and comparisons to state average growth rates could not be completed due to an insufficient quantity of pumpkinseed sunfish captured during the survey. Ages 1-5 were captured during the survey.

Smallmouth bass (N=36) averaged 13.5 inches in total length and comprised 9% of the total survey catch by number (Table 4). Smallmouth bass ranged from 7 to 19 (Table 5) inches with 11% of the fish meeting or exceeding the minimum harvest length of 18 inches. Age-growth data indicated that smallmouth bass were growing under the state average having a mean growth index of -1.5 inches (Table 6). The age distribution indicated good recruitment and representation of smallmouth aged 2-12 (Table 6).

Walleye (N=31) averaged 13.9 inches in total length and comprised 8% of the total survey catch by number (Table 4). Walleyes ranged from 9 to 21 inches (Table 5) with 35% of the fish meeting or exceeding the minimum harvest length of 15 inches. Age-growth data indicated that walleyes were growing under state average having a mean growth index of -1.6 inches (Table 6). The age distribution indicated variable recruitment with representation of walleyes aged 2-4 and 6-9 in the survey catch (Table 6). Further analysis of the ageing data indicated that naturally reproduced walleyes are contributing to the population (i.e. walleyes are present from non-stocked years).

Yellow perch (N=180) averaged 3.1 inches in total length and comprised 44% of the total survey catch by number (Table 4). Yellow perch ranged from 2 to 7 inches (Table 5) with 1% of the fish meeting or exceeding the acceptable harvest length of 7 inches. Age-growth data indicated that yellow perch were growing below state average having a mean growth index of -1.7 inches (Table 6). The age distribution indicated variable representation of yellow perch aged 1 through 5 (Table 6).

Analysis and Discussion

The 30-inch minimum size limit on northern pike appears to have been effective as the average length of northern pike captured during fisheries surveys has increased since the regulation was implemented during the mid-1990s (fyke net data only): 1997=20.5 inches; 2003=22.1 inches; 2009=25.7 inches. Additionally, 6 northern pike over 30+ inches were also captured in 2009. Northern pike growth rates during this same time period have remained acceptable at about state average. Current growth trends for northern pike are perhaps a bit surprising since the fish community lacks an abundant population of large-bodied forage fish such as white suckers.

The 18-inch minimum size limit on smallmouth bass appears to have been effective as the average length of bass captured has increased since the regulation was implemented during the mid-1990s (fyke net data only): 1997=14.7 inches; 2003=16.5 inches, 2009=17.8 inches. Growth rates during this same time period have either been at approximately state average (2003= -0.1 inches) or below state average (1997= -0.9 inches; 2009= -1.5 inches). Smallmouth bass are growing slowly with older and larger individuals exhibiting slightly better growth than younger and smaller fish. Larger adult bass can target a larger size range of forage resources which may buffer their growth rates versus smaller juvenile bass which can only target smaller sizes of forage.

Walleye abundance has declined since the 2003 survey but is similar to the catch from the 1997 survey. Growth rates of walleye have fallen from the 2003 survey (+2.3 inches) to the 2009 survey (-1.5 inches). Growth rates from the 1997 survey could not be calculated as insufficient numbers of walleye were captured. A total of seven year classes (2-4 and 6-9) were captured during the 2009 survey. Walleye were stocked in 2006 (age 3), 2004 (age 5), and 2002 (age 7), and walleye present in non-stocked years indicates that there is some natural reproduction occurring in Fish Lake. Growth rates of walleye are currently under the state average, but when considering that walleye in the Upper Peninsula tend to grow slower as compared to the rest of the state, current growth is not as poor as it may appear. Walleye stocking rates in Fish Lake are fairly aggressive as compared to other lakes in the central Upper Peninsula; walleye spring fingerling stocking rates in Fish Lake have recently ranged from 60-100/acre while the typical rates for most lakes in the Northern Lake Michigan Management Unit (NLMMU) have ranged from 25-50/acre.

Yellow perch abundance has varied over time and has declined since the 2003 survey assessment. Few yellow perch are of acceptable size (?7-inches) to anglers, and large yellow perch may be increasingly targeted by large northern pike, especially given that large white suckers are not present in the fish community. The mean growth rate of yellow perch has declined from 2003 (-0.3 inches) to 2009 (-1.7 inches).

Panfish such as bluegill have never been very abundant in Fish Lake, and the catch sampled in 2009 indicated little change in the population as compared to previous surveys. Age classes 1-6 and 8 were

captured during the survey indicating limited natural reproduction on an annual basis. Catch rates for black crappie are up about threefold from the 2003 survey and fish up to 13 inches are available to the angler.

Management Direction

Northern pike and smallmouth bass populations appear to still be adjusting to the increased minimum size limits implemented in 1995 as average lengths for each species have increased over the last two surveys. This is not surprising given that either species are fairly long-lived in Fish Lake. The high minimum size limits currently in place also appear to have been successful as larger and older fish constitute a greater proportion of each population as compared to before the regulations were in effect. Over time, growth rates for northern pike have been acceptable while smallmouth bass growth has trended downward since 2003. Given the current success of high minimum size limits to increase the size structures of both northern pike and smallmouth bass, it is recommended that these regulations remain in effect.

Walleye have been aggressively stocked in Fish Lake and at generally much higher rates that what has been demonstrated to be sustainable in most other lakes in the NLMMU. Growth rates have trended downward since 2003 but still remain acceptable. It also appears that some natural reproduction may be occurring although it is unknown if there is enough to support a walleye population without stocking. Given that fishing regulations in Fish Lake have been implemented to create predators of large body size (i.e. northern pike, smallmouth bass) there is some concern that continued walleye stocking at previous rates of 60-100 fingerlings per acre may be too aggressive and unbalance the predator to forage base ratio. It is recommended that walleye stocking be reduced to a rate of 30/acre (down from 60-100/acre). Fall Sern's index surveys should be scheduled in the future to track and monitor trends in walleye stocking and natural reproduction and guide future stocking efforts for walleye.

Future management should also focus on improving physical habitat deficiencies that are potentially having a negative effect upon the fish community. Natural lakes can have deadwood (2-inch and larger) abundances of 470 to 1,545 pieces per mile, but aggressive logging practices and development of lake shorelines have reduced inputs of deadwood to Michigan lakes for over 100 years (O'Neal and Soulliere 2006). Deadwood is a vital component of a healthy and diverse habitat in the littoral zone. Deadwood provides habitat for a multitude of animals including invertebrates, reptiles, birds, mammals, and fish, and rehabilitation programs designed to compensate for loss of deadwood should be considered. Rehabilitation programs designed to compensate for loss of deadwood in Fish Lake should be considered as Fish Lake has below average abundance of deadwood as compared to other Upper Peninsula lakes surveyed with the Status and Trends survey protocol. Staff from the DNR and riparian landowners should work cooperatively to implement a habitat rehabilitation program for the littoral zone surrounding Fish Lake.

References

O'Neal, R. P., and G. J. Soulliere. 2006. Conservation guidelines for Michigan lakes and associated natural resources. Michigan Department of Natural Resources, Fisheries Special Report 38, Ann Arbor.

Schneider, J. C. 2002. Fish as indicators of lake habitat quality and a proposed application. Michigan Department of Natural Resources, Fisheries Research Report 2016, Ann Arbor.

Figure 1. Hydrographic contour map of Fish Lake, Marquette County.

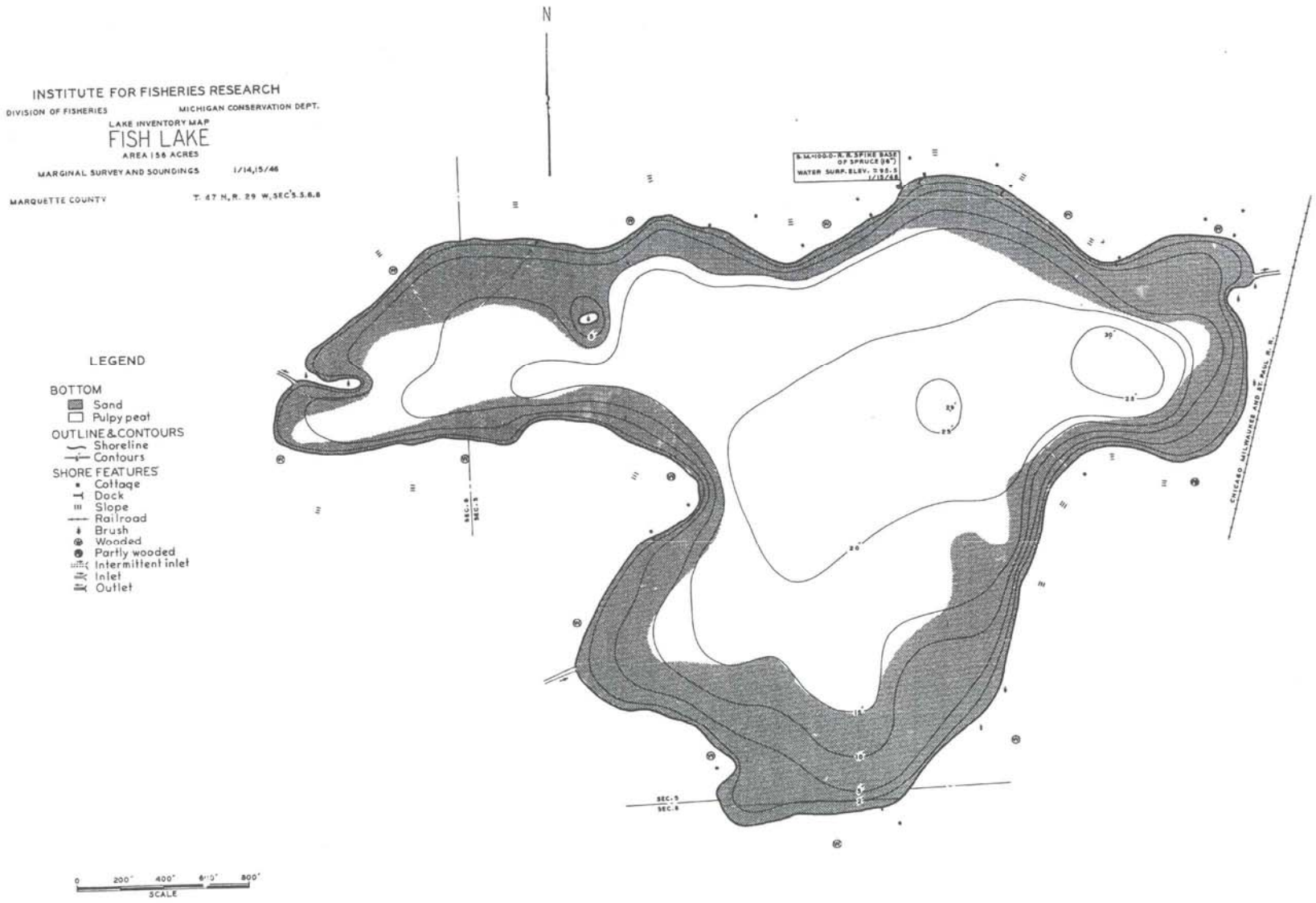

Table 1.-Temperature and dissolved oxygen profiles collected on August 26, 2009 from Fish Lake, Marquette County. Data from DNR, Fisheries Division records.

Depth (feet)	Temperature (ºF)	Dissolved Oxygen (ppm)
0	67.7	9.6
1	67.0	9.5
2	66.8	9.5
3	66.5	9.5
4	66.4	9.4
5	66.3	9.3
6	66.2	9.0
7	66.1	9.1
8	66.0	8.8
9	66.0	8.5
10	65.9	8.6
11	65.6	7.9
12	65.3	7.7
13	65.1	7.5
14	64.8	7.1
15	64.6	7.0
16	64.2	6.6
17	63.8	5.3
18	63.1	2.8
19	60.8	0.5
20	59.1	0.3
21	58.0	0.3
22	56.7	0.3
23	55.8	0.3
24	55.5	0.3

Table 2.-Fish stocked into Fish Lake, Marquette County (1936 to 2006). Data from DNR, Fisheries Division records.

Year	Species	Number	Rate (#/acre)	Size (in.) or Age
1936	smallmouth bass	300	2	4 months
	bluegill	3,000	19	5 months
1937	smallmouth bass	300	2	3 months
	bluegill	7,200	46	4 months
1938	bluegill	6,000	38	5 months
1939	largemouth bass	300	2	4months
	smallmouth bass	50	<1	adults
	bluegill	6,000	38	4 months
1940	bluegill	10,200	65	4 months
1941	bluegill	10,000	64	4 months
1942	smallmouth bass	130	<1	adults
1944	bluegill	250	2	15 months
1945	bluegill	500	3	15 months
1961	northern pike	100	<1	sub-legal
1962	northern pike	145	1	legal
1988	walleye	4,512	29	2.6
1990	walleye	9,000	58	2.0
1992	walleye	10,900	70	1.9
1994	walleye	19,000	122	1.9
	yellow perch	5,437	35	4.1
1996	walleye	17,860	114	2.5
1999	walleye	10,040	64	2.0
2002	walleye	15,600	100	2.0
2004	walleye	9,360	60	1.6
2006	walleye	9,643	61	1.4

Table 3.-List of fishes captured during DNR survey assessments (1986 to 2009) in Fish Lake, Marquette County. Origin: Native=N, I=Introduced. Status: Present=P (recent observations). Data from DNR, Fisheries Division records.

Common Name	Scientific Name	Origin	Status
Bluegill	*Lepomis machrochirus*	I	P
Black crappie	*Pomoxis nigromaculatus*	N	P
Central mudminnow	*Umbra limi*	N	P
Common shiner	*Luxilus cornutus*	N	
Largemouth bass	*Micropterus salmoides*	I	
Northern pike	*Esox lucius*	N	P
Northern redbelly dace	*Phoxinus eos*	N	
Northern pearl dace	*Margariscus nachtriebi*	N	
Pumpkinseed sunfish	*Lepomis machrochirus*	N	P
Rainbow trout	*Oncorhynchus mykiss*	I	
Slimy sculpin	*Cottus cognatus*	N	P
Smallmouth bass	*Micropterus dolomieu*	I	P
Walleye	*Sander viterius*	I	P
White sucker	*Catostomus commersoni*	N	
Yellow perch	*Perca flavescens*	N	P

Table 4.-Number, weight, length, and percentage of total catches for fishes collected with fyke net, gill net, and electrofishing gear from Fish Lake, Marquette County in June 2009. Data from DNR, Fisheries Division records.

Common name	Number	Total weight (lbs.)	Average length (in.)	Length range (in.)	Percent by Number	Percent by weight	Percent legal or acceptable size
Black crappie	75	32	8.9	5-13	18	10	99 (≥7”)
Bluegill	27	5	5.6	1-9	7	2	48 (≥6”)
Central mudminnow	1	<1	2.5	-	<1	<1	-
Northern pike	45	179	25.1	15-38	11	58	13 (≥30”)
Pumpkinseed sunfish	12	2	5.5	1-8	3	<1	42 (≥6”)
Smallmouth bass	36	54	13.5	7-19	9	17	11 (≥18”)
Slimy sculpin	1	<1	2.5	-	<1	<1	-
Walleye	31	34	13.9	9-21	8	11	35 (≥15”)
Yellow Perch	180	3	3.1	2-7	44	<1	1 (≥7”)

Table 5.-Length range of select fishes collected with fyke net, gill net, and electrofishing gear from Fish Lake, Marquette County, June 2009. Data from DNR, Fisheries Division records.

Inch group	Black crappie	Bluegill	Northern pike	Pumpkinseed	Smallmouth bass	Walleye	Yellow perch
0	-	-	-	-	-	-	-
1	-	2	-	1	-	-	-
2	-	2	-	1	-	-	123
3	-	4	-	1	-	-	25
4	-	-	-	1	-	-	24
5	1	6	-	3	-	-	3
6	-	7	-	1	-	-	3
7	14	2	-	3	1	-	2
8	39	2	-	1	3	-	-
9	9	2	-	-	3	3	-
10	5	-	-	-	2	8	-
11	-	-	-	-	4	6	-
12	5	-	-	-	2	1	-
13	2	-	-	-	3	-	-
14	-	-	-	-	3	2	-
15	-	-	1	-	8	2	-
16	-	-	1	-	2	1	-
17	-	-	-	-	1	-	-
18	-	-	2	-	3	2	-
19	-	-	2	-	1	1	-
20	-	-	1	-	-	4	-
21	-	-	1	-	-	1	-
22	-	-	6	-	-	-	-
23	-	-	6	-	-	-	-
24	-	-	6	-	-	-	-
25	-	-	5	-	-	-	-
26	-	-	5	-	-	-	-
27	-	-	1	-	-	-	-
28	-	-	1	-	-	-	-
29	-	-	1	-	-	-	-
30	-	-	1	-	-	-	-
31	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-
33	-	-	1	-	-	-	-
34	-	-	-	-	-	-	-
35	-	-	1	-	-	-	-
36	-	-	2	-	-	-	-
37	-	-	-	-	-	-	-
38	-	-	1	-	-	-	-

Table 6.-Weighted mean length (inches) at age, and growth relative to the state average for selected species of fish sampled from Fish Lake with fyke nets, gill nets, and electrofishing gear, June 2009. Number of fish aged is in parentheses. Data from DNR, Fisheries Division records.

	Age/Length												
Species	1	2	3	4	5	6	7	8	9	10	11	12	Mean growth index[1]
Black crappie			8.2 (32)	9.5 (14)			12.3 (3)	12.6 (2)		13.9 (1)			+0.5
Bluegill	2.4 (5)	3.5 (4)	5.9 (9)	6.4 (4)	7.8 (2)	8.5 (3)		9.8 (1)					+0.6
Northern pike		18.0 (6)	22.4 (9)	24.4 (13)	26.1 (7)	28.3 (5)				36.0 (3)	38.4 (1)		+0.1
Smallmouth bass		8.3 (1)	9.5 (7)	9.6 (2)	12.6 (5)	14.6 (9)	15.4 (2)	16.9 (3)	17.8 (3)	18.4 (1)	19.0 (1)	18.8 (1)	-1.5
Walleye		10.4 (14)	11.3 (5)	15.5 (6)		18.8 (1)	20.4 (3)	20.3 (2)	20.7 (1)				-1.6
Yellow perch	2.5 (15)	3.9 (15)	5.7 (4)	6.5 (3)	7.3 (1)								-1.7

[1]Mean growth index is the average deviation from the state average length at age.