Mehl Lake

Marquette County, T45N, R25W, Sections 24 & 25
Escanaba River Watershed, last surveyed: 2011

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Environment

Mehl Lake is located within the Escanaba River watershed in central Marquette County near the community of Gwinn. It has a watershed size of 586 acres and a surface area of approximately 91 acres. The maximum depth is approximately 20 feet and one island is located in the southeastern area of the lake. There are no inlets, and a small outlet forms a connection to Little Lake (Figure 1). Lake substrates vary from mostly sand and organics with scattered patches of gravel in the nearshore areas to predominantly organic material located in the deeper offshore areas.

The immediate landscape surrounding Mehl Lake consists of glacial outwash sand and gravels, post glacial alluvium, peat and muck. Principle soil associations are mostly sands that are moderately- to well- drained. Land cover types consist of northern hardwoods, mixed non-forest wetlands, scattered herbaceous open land, and lowland coniferous forest while land use surrounding the lake is primarily residential and recreational in nature.

The perimeter of Mehl Lake has been heavily developed with permanent and seasonal dwellings. Past and recent observations by fisheries staff also indicated that natural riparian zone habitat such as downed trees and brush (deadwood or submerged wood) may have been extensively removed in some nearshore areas to improve swimming, boat dockage, and aesthetics. Public access to Mehl Lake is gained through a small outlet to Little Lake (Figure 1); a Department of Natural Resources (DNR) state forest campground and public-access boat launch is located on the east end of Little Lake.

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). Secchi disk transparency is defined as the maximum depth at which the disk can easily be observed through the water, (i.e. water clarity). Less productive lakes have greater water transparency, lower chlorophyll a, and lower total phosphorous than lakes with high productivity. Oligotrophic, mesotrophic, and eutrophic lakes are respectively low, medium, and high in productivity.

Recent water samples were not taken from Mehl Lake, but Little Lake can probably be used as a surrogate given the close geographical proximity to Mehl Lake and similarities in geology, soils, and anthropomorphic development along the shoreline. To determine lake productivity, limnological characteristics were last measured in Little Lake during August 2011 as part of a DNR Fisheries Division Status and Trends survey. The water was stained with a Secchi disk reading of 14.0 feet. Within the water column, alkalinity was 43 milligrams per liter (mg/L), total phosphorus was 0.03 mg/L, nitrate/nitrite was 0.1 mg/L. Water chemistry values indicated that the trophic state of Little Lake (and thus Mehl Lake) is meso-eutrophic (i.e. medium to high productivity).

History

John Nicholas Lowe was a general biologist who taught biology at the Northern State Teachers College (now Northern Michigan University) during the early 1900s. After arriving at Marquette in the late 1910s he started assembling random fish collections and expressed a general interest in determining the fish fauna of the Upper Peninsula. J. N. Lowe surveyed (seine only) Mehl Lake in 1928 and captured a total of 5 species: bluntnose minnow, Iowa darter, Johnny darter, mottled sculpin, and yellow perch. He returned for another survey in 1936 and captured the same species complex except for mottled sculpin.

Bluegill, largemouth bass and smallmouth were periodically stocked by the Michigan Department of Conservation starting in the mid-1930s and continuing through 1943 (Table 1). After the mid 1940s, Department policy indicated that bass and panfish would not be stocked for maintenance purposes in lakes where those species were established due to marginal gains from the stocking efforts. In 1948, the Institute for Fisheries Research conducted a fisheries survey with gill net, fyke net and seining gear. A total of nine species were captured during the survey: bluegill, common shiner, largemouth bass, pumpkinseed sunfish, rock bass, smallmouth bass, walleye, white sucker, and yellow perch. Rock bass, white sucker, and yellow perch were noted as most common in the survey catch.

Manual removals of white suckers and yellow perch were conducted in 1982 (May) with a total of 2,663 pounds (lbs) of yellow perch (29.3 lbs/acre) and 192 lbs of white suckers (2.1 lbs/acre) removed. Manual removals of yellow perch and white suckers were again conducted in 1983 (1,165 lbs, 12.8 lbs/acre and 48 lbs, 0.5 lbs/acre, respectively) and walleyes were then stocked in 1983, 1986 and 1996 (Table 1).

A fisheries survey was conducted in 1987 by DNR staff to monitor the success of the manual removals and the stocked walleye spring fingerlings. Good numbers of yellow perch in the 8-11 inch groups were captured as well as walleye ranging from 8-16 inches. Smallmouth bass were also numerous with bass ranging from 2-13 inches in the survey catch.

A total of 18 species of fish have been captured during fisheries surveys that were conducted on Mehl Lake from 1928-2011 (Table 2). Schneider (2002) indicated that the total number of species present in a lake is related to lake size (larger lakes tend to have more species than smaller lakes) and connectivity as well as quality. Mehl Lake provides diverse aquatic habitats and supports a large number of species as compared to many other lakes in the Northern Lake Michigan Management Unit (NLMMU).

Current Status

In June 2011, DNR Fisheries Division conducted a fish community survey on Mehl Lake. Assessment gear included fyke nets, gill nets, mini-fyke nets, a seine, and an electrofishing boat. From June 13-15, 4 fyke nets were fished at 6 locations over 3 nights. Two experimental gill nets were fished at 4 locations over 2 nights. Two mini-fyke nets were fished at 3 locations over 2 nights. Three seine hauls were conducted at 3 locations around the shoreline. On June 20, 3 night electrofishing transects were conducted at 3 separate locations around the shoreline. Captured fish were identified to species, measured for total length, a scale sample was collected from common sportfish for age and growth analysis, and then released back into the lake.

A total of 4,944 fish representing 16 species were collected from the combined June netting and electrofishing efforts (Table 3). In terms of the number captured during the survey, bluntnose minnow were the most abundant comprising 64% of the total catch, bluegill were second at 22%, yellow perch were third at 7% (Table 3). In terms of biomass captured during the survey, northern pike comprised 49% of the survey catch, smallmouth bass and bluegill were second at 8%, and yellow perch were third at 7% (Table 3).

Bluegill (n=1,102) averaged 2.2 inches in total length with 5% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 3). Bluegills ranged from 1-10 inches (Table 4). Age-growth data indicated that bluegills were growing at the statewide average with a mean growth index (MGI) of 0.0 inches (Table 5). A MGI of 0.0 indicates that the sampled population is growing at exactly the state average for the species in question. An index of +1.0 or -1.0 indicates that the sampled population is either growing 1.0 inch faster or 1.0 inch slower than average. A general rule is that satisfactory growth indices for panfish (e.g. bluegill, pumpkinseed sunfish) are in the range of +0.5 to -0.5 while the range for gamefish (e.g. bass, northern pike) is +1.0 to -1.0 (Schneider et. al 2000). The age distribution indicated variable recruitment with representation of bluegill aged 1-6 in the survey catch (Table 5).

Northern pike (n=45) averaged 22.6 inches in total length with 51% of the fish meeting or exceeding minimum harvest length of 24 inches (Table 3). Northern pike ranged from 12-31 inches (Table 4). Age-growth data indicated that northern pike were at the statewide average with a MGI of -0.2 inches (Table 5). The age distribution indicated variable recruitment with representation of northern pike aged 1-9 (Table 5).

Pumpkinseed sunfish (n=59) averaged 6.2 inches in total length with 64% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 3). Pumpkinseed sunfish ranged from 3-8 inches (Table 4). Age-growth data indicated that pumpkinseed sunfish were growing slightly above the statewide average with a MGI of +0.5 inches (Table 5). The age distribution indicated variable recruitment with representation of pumpkinseed sunfish aged 2-6 in the survey catch (Table 5).

Rock bass (n=149) averaged 4.7 inches in total length with 14% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 3). Rock bass ranged from 1-8 inches (Table 4). Age-growth data indicated that rock bass were growing at the statewide average with a MGI of -0.1 inches (Table 5). The age distribution indicated variable recruitment with representation of rock bass aged 1-6 in the survey catch (Table 5).

Smallmouth bass (n=26) averaged 9.0 inches in total length with 23% of the fish meeting or exceeding the minimum harvest length of 14 inches (Table 3). Smallmouth bass ranged from 2-19 inches (Table 4). Age-growth data indicated that smallmouth bass were growing under the statewide average with a MGI of -1.5 inches (Table 5). The age distribution indicated variable recruitment with representation of rock bass aged 1-8 in the survey catch (Table 5).

Yellow perch (n=325) averaged 4.6 inches in total length with 11% of the fish meeting or exceeding an acceptable harvest length of 7 inches (Table 3). Yellow perch ranged from 1-9 inches (Table 4). Age-growth data indicated that yellow perch were growing slightly under the statewide average with a MGI

of -0.6 inches (Table 5). The age distribution indicated variable recruitment with representation of yellow perch aged 1-5 in the survey catch (Table 5).

Only one, 10-inch white sucker and three large walleyes were captured during the survey (21-, 22-, and 25 inches).

Analysis and Discussion

The current fish community in Mehl Lake can be generally characterized as having the following: 1) a panfish community considered of moderate diversity dominated by bluegill and yellow perch, 2) a predator population of moderate diversity, average growth rates, and average to low mortality which allows fish to attain old ages and some fish to grow to relatively large sizes, 3) a diverse minnow/shiner/darter community of unknown abundance.

Populations of rock bass and pumpkinseed sunfish are not very abundant (as also found in previous surveys), but fish live long enough to attain larger size for the creel and provide some diversity for anglers. Bluegills are growing at the state average, and some fish up to at least 10 inches are present in the population. The yellow perch population is exhibiting good growth and size structure characteristics. Schneider et al. (2007) suggested that healthy, adequately buffered and self-sustaining populations may have some yellow perch over age 7 and 9 inches in length, and the population in Mehl Lake meets the length benchmarks. However, mortality of yellow perch may be high as age 5 was the oldest year class found during the 2011 survey.

Predators in Mehl Lake consist of smallmouth bass and northern pike. The smallmouth bass population appears to be of moderate abundance, but growth was found to be slow at -1.5 inches. However, further analysis of year classes found that age 1 smallmouth bass were growing slowly (which may indicate a large year class and competition for limited forage resources) while most other age classes appeared to have adequate growth trends near the statewide average. Smallmouth bass are reaching sizes at least up to 19 inches, and a total of eight year classes were captured during the survey indicating relatively low mortality for this population. Schneider (2000) proposed that mortality is within the expected range if the maximum aged fish in a good survey sample was age 8. Alternatively, if fish age 10 or older are found, then that suggests mortality is probably low. Northern pike growth is at the statewide average, and the mortality rate for this population appears to be low which (in conjunction with adequate forage resources) allows some pike to grow over 30 inches in length. Spawning habitat for northern pike is limited in Mehl Lake which prevents over population (and subsequent low average size and slow growth rates) as is observed in many other lakes around the NLMMU.

The non-game fish community is very diverse and is dominated in biomass by bluntnose minnow with several other species (e.g. Golden shiner, Johnny darter, Iowa darter) rounding out the community. All of these species probably compete with juveniles of game species for forage resources but are no doubt preyed upon by larger predators. Currently, white sucker abundance appears to be low when compared to previous fish surveys; the 2011 survey captured only one white sucker.

Mehl Lake currently supports a mixed and diverse fish community. This species complex is common in the central Upper Peninsula lakes, and walleyes are also often present in the community either through natural reproduction, supplemental stocking, or a combination thereof. Mehl Lake riparians

had requested that walleyes be stocked in Mehl Lake to increase and diversify angling opportunities. The preliminary 2011 survey results were discussed at the 2011 lake association meeting in Gwinn and there was wide-ranging support to begin an experimental walleye stocking program. Given that nearby Little Lake supports a similar fish community (which includes walleyes) it is expected that Mehl Lake could also support a modest walleye population without negatively affecting the overall integrity of the fish community; if walleye densities become too high, their predation can significantly reduce the abundance of both small and large panfish (MDNR 2004). The typical stocking range for most lakes in the NLMMU has been from 25-50/acre. The NLMMU will experimentally stock Bay de Noc spring fingerling walleye (n=2,275) at a rate of 25/acre for 3 consecutive years and then on an alternate year schedule. Surveys will be planned to determine the success of the experimental management program and monitor future trends in fish community dynamics. Based on previous walleye stocking efforts and lack of suitable spawning habitat in Mehl Lake, little to no natural reproduction is expected.

Although shoreline development was not quantified, visual observations from the 2011 survey indicated that Mehl Lake is more developed (i.e. dwellings and docks) than Little Lake and most other lakes surveyed in the NLMMU. Many other lakes in the central and eastern NLMMU with high levels of shoreline development tend to have low abundance of submerged logs in the nearshore areas. This is most likely due to efforts by riparians to "clean-up" the littoral zone in front of their upland properties by removing woody material. Submerged logs, or coarse woody habitat (CWH), is a vital component of a healthy and diverse habitat in the littoral zone.

Most fish utilize CWH in a variety of ways to meet needs during their lifetime. Many species spawn adjacent to or under trees that provide cover which helps them protect their incubating brood. For smallmouth bass and other centrarchids (i.e. bluegills, pumpkinseed sunfish), nests adjacent to or under submerged trees reduce the nest perimeter that needs to be defended against predators. Fathead minnows can spawn on the underside of wood in cavities. Juveniles of many species of fish can find refuge and protection from predators throughout the branches while predators, such as northern pike, can utilize the same trees for ambushing forage.

Because CWH provides vital habitat for a multitude of animals including invertebrates, reptiles, birds, mammals, and fish, rehabilitation programs designed to compensate for loss of CWH should be considered. Sass et. al (2006) demonstrated dramatic declines in both fish abundance and growth rates, in addition to changes in food habits following an experimental removal of CWH from a lake thus demonstrating the critical role of CWH in supporting healthy functioning fish communities. On lakes that have highly developed riparian areas (such as Mehl Lake), these effects also likely occur but are not readily evident because lake shorelines are typically developed with dwellings (and the CWH subsequently removed) in small lots over relatively long time periods (i.e. cumulative effect may take years).

Christensen et al. (1996) found that humans greatly influenced the abundance of downed trees in the littoral zones of lakes. In a study of lakes in northern Wisconsin and the Upper Peninsula of Michigan, they found that in lakes with no development, forested shorelines averaged 555 logs/km (i.e. 345 logs/mile) in the littoral zone. On developed lakes, undeveloped shorelines contained an average of 379 logs/km (i.e. 235 logs/mile) of littoral zone versus just 57 logs/km (i.e. 35 logs/mile) along shorelines where dwellings had been built. Jennings et al. (1999) showed that levels of wood in littoral zones of lakes that had more advanced shoreline perturbations (i.e., having seawalls and rip-rap) was

reduced, apparently due to direct removal by riparian landowners interested in having an uncluttered or manicured shoreline. O'Neal and Soulliere (2006) reported that natural lakes in Michigan can have CWH (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 this type of critical habitat for over 100 years.

Management Direction

1) Stock Bay de Noc strain spring fingerling walleye (N=2,275) at a rate of 25/acre for 3 consecutive years and then on an alternate year schedule. A successful walleye management program will maintain a balanced fish community, support adequate walleye growth rates, and provide an acceptable fishery for anglers. Survey assessments will be planned to help determine the success of the experimental management program and monitor future trends in fish community dynamics.

2) Fall Sern's index surveys should be scheduled in the future to track and monitor trends in walleye natural reproduction and guide future management efforts for walleye.

3) Survey Mehl Lake "development variables" such as number of dwellings and docks, total length of armored shoreline, and submerged wood (≥3 inches" in diameter) in the nearshore areas to determine the amount of development as compared to other lakes in the NLMMU. At this time, it is assumed that nearshore woody habitat is lacking in some areas as this is the trend in nearby Little Lake and (East) Bass Lake. Habitat rehabilitation and enhancement programs designed to compensate for loss or lack of CWH in the near shore area of Mehl Lake should be considered to maintain and restore critical habitat for the fish community. Staff from the NLMMU area are available to work with riparian landowners in a cooperative program to implement a habitat rehabilitation and enhancement program on Mehl Lake.

4) Anglers are encouraged to report sport catches of all species to the NLMMU. Reports are useful to track population trends over time and aid further management of the fishery for current and future mangers.

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Figure 1. –Bathymetric contour map for Mehl Lake, Marquette County.

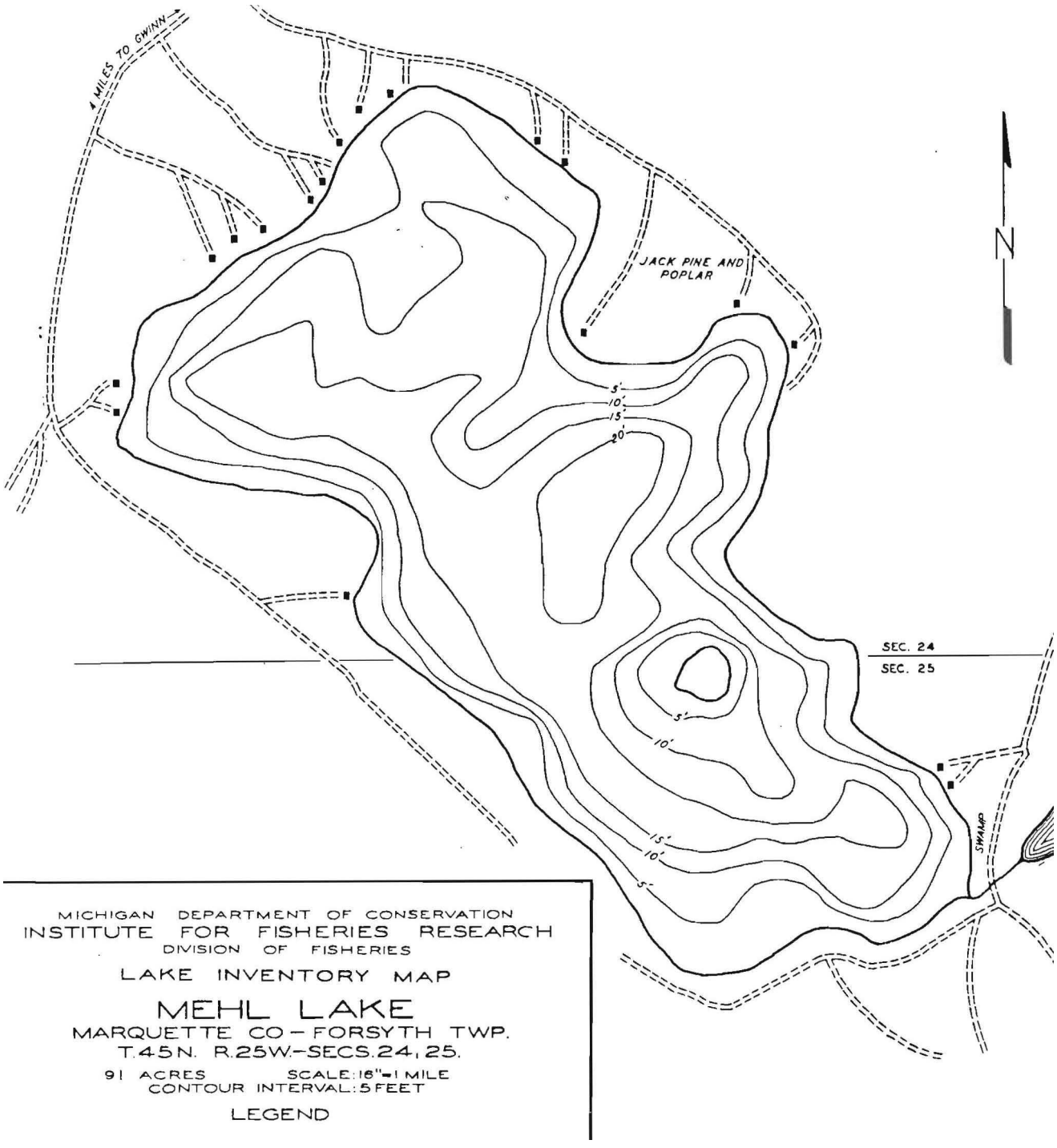

Table 1.-Fish stocked into Mehl Lake, Marquette County (1934 to 1996). Data from DNR, Fisheries Division records.

Year	Species	Number	Rate (#/acre)	Size (inches) or Age
1934	Bluegill	1,000	11	4 months
1936	Bluegill	2,000	22	5 months
	Smallmouth Bass	200	2	4 months
1937	Bluegill	4,800	53	4 months
	Smallmouth Bass	300	3	3 months
1939	Bluegill	2,000	22	4 months
	Largemouth Bass	300	3	4 months
1940	Bluegill	4,250	47	4 months
1941	Bluegill	5,000	55	4 months
1942	Bluegill	1,000	11	4 months
	Smallmouth Bass	200	2	4 months
1943	Bluegill	100	1	Adult
1983	Walleye	250,000	2,747	Fry
		10,850	119	1.5
1986	Walleye	14,128	155	2.3
1996	Walleye	5,000	55	2.0

Table 2.-List of fishes captured during surveys (1928 to 2011) of Mehl Lake, Marquette County. Origin: Native=N, I=Introduced. Status: P (present)=recent observations. Data from DNR, Fisheries Division records.

Common Name	Scientific Name	Origin	Status
Black bullhead	*Ameiurus melas*	N	
Bluegill	*Lepomis machrochirus*	I	P
Bluntnose minnow	*Pimephales notatus*	N	P
Brook stickleback	*Culaea inconstans*	N	P
Brown bullhead	*Ameiurus nebulosus*	N	P
Common shiner	*Luxilus cornutus*	N	P
Golden shiner	*Notemigonus crysoleucas*	N	P
Iowa darter	*Etheostoma exile*	N	P
Johnny darter	*Etheostoma nigrum*	N	P
Largemouth bass	*Micropterus salmoides*	I	P
Mottled sculpin	*Cottus bairdi*	N	
Northern pike	*Esox lucius*	I	P
Pumpkinseed sunfish	*Lepomis machrochirus*	N	P
Rock bass	*Ambloplites rupestris*	N	P
Smallmouth bass	*Micropterus dolomieu*	N	P
Walleye	*Sander vitreus*	I	P
White sucker	*Catostomus commersoni*	N	P
Yellow perch	*Perca flavescens*	N	P

Table 3.-Number, weight, length, and percentages of fishes collected from Mehl Lake, Marquette County, in June 2011. Data from DNR, Fisheries Division records.

Common name	Number	Total weight (lbs.)	Average length (in.)	Length range (in.)	Percent of catch by number	Percent of catch by weight	Percent legal or acceptable size
Bluegill	1,102	21	2.2	1-10	22	8	5 (≥6”)
Bluntnose minnow	3,173	16	2.3	1-4	64	6	-
Brook stickleback	1	<1	1.0	-	<1	<1	-
Brown bullhead	19	8	9.6	7-11	<1	3	-
Common shiner	1	<1	2.5	-	<1	<1	-
Golden shiner	1	<1	3.5	-	<1	<1	-
Iowa darter	21	<1	2.4	1-2	<1	<1	-
Johnny darter	14	<1	2.5	-	<1	<1	-
Largemouth bass	4	13	17.5	11-19	<1	5	75 (≥14”)
Northern pike	45	133	22.6	12-31	1	49	51 (≥24”)
Pumpkinseed sunfish	59	13	6.2	3-8	1	5	64 (≥6”)
Rock bass	149	16	4.7	1-8	3	6	14 (≥6”)
Smallmouth bass	26	22	9.0	2-19	<1	8	23 (≥14”)
Walleye	3	12	23.2	21-25	<1	5	100 (≥15”)
White sucker	1	<1	10.5	-	<1	<1	-
Yellow perch	325	18	4.6	1-9	7	7	11 (≥7”)

Table 4.-Total catch by length range of select fishes collected from Mehl Lake, Marquette County in June 2011. Data from DNR, Fisheries Division records.

	Species							
Inch group	Bluegill	Northern Pike	Pumpkinseed	Rock bass	Smallmouth bass	Walleye	White sucker	Yellow perch
0	-	-	-	-	-	-	-	-
1	714	-	-	19	-	-	-	1
2	300	-	-	16	1	-	-	33
3	8	-	1	7	6	-	-	142
4	6	-	10	23	4	-	-	40
5	16	-	10	63	3	-	-	37
6	25	-	23	9	-	-	-	36
7	32	-	13	9	-	-	-	18
8	-	-	2	3	-	-	-	14
9	-	-	-	-	-	-	-	4
10	1	-	-	-	1	-	1	-
11	-	-	-	-	1	-	-	-
12	-	2	-		1	-	-	-
13	-	2	-	-	3	-	-	-
14	-		-	-	1	-	-	-
15	-	4	-	-	2	-	-	-
16	-	2	-	-	-	-	-	-
17	-	1	-	-	1	-	-	-
18	-		-	-	1	-	-	-
19	-	3	-	-	1	-	-	-
20	-	3	-	-	-	-	-	-
21	-		-	-	-	1	-	-
22	-	4	-	-	-	1	-	-
23	-	1	-	-	-	-	-	-
24	-	3	-	-	-	-	-	-
25	-	7	-	-	-	1	-	-
26	-	4	-	-	-		-	-
27	-	4	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-
29	-	3	-	-	-	-	-	-
30	-	1	-	-	-	-	-	-
31	-	1	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-

Table 5.-Weighted mean length (inches) at age and growth relative to the state average for select species of fish sampled from Mehl Lake, Marquette County, in June 2011. Number of fish aged is in parentheses. Data from DNR, Fisheries Division records.

	Age/Length											
Species	0	1	2	3	4	5	6	7	8	9	10	Mean growth index[1]
Bluegill		1.9 (20)	3.6 (7)	5.6 (15)	6.5 (9)	7.2 (7)	7.4 (3)				10.5 (1)	0.0
Northern pike		15.3 (12)	21.0 (9)	25.2 (2)	25.7 (2)	24.0 (1)	25.5 (3)	26.5 (5)	27.6 (6)	30.3 (3)		-0.2
Pumpkinseed			4.3 (9)	5.7 (11)	6.6 (3)	7.1 (12)	8.0 (4)				`	+0.5
Rock bass		2.0 (18)	4.1 (16)	5.6 (27)	6.3 (11)	7.6 (4)	8.0 (4)					-0.1
Smallmouth bass		4.0 (12)	10.1 (1)	11.9 (1)	13.3 (4)	15.1 (2)	16.2 (2)	18.8 (1)	19.1 (1)			-1.5
Yellow perch		3.3 (15)	5.6 (3)	6.1 (11)	7.1 (16)	8.5 (11)						-0.6

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