Little Lake

Marquette County, T45N, R24W, Sections 19, 20, 29 & 30
Escanaba River Watershed, last surveyed: 2011

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Environment

Little Lake, with a watershed size of 1,732 acres and a surface area of approximately 454 acres, is located within the Escanaba River watershed in central Marquette County near the community of Gwinn. Little Lake consists of 2 basins (Figure 1) each with different bathymetric features. The eastern basin has a maximum depth of approximately 15 feet and contains 2 islands, while the western basin consists of a round basin that drops off quickly to deep water and has a maximum depth of approximately 50 feet. Sawmill Creek forms the outlet of Little Lake and is a tributary to the main branch of the Escanaba River. 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 (Figure 1).

The immediate landscape surrounding Little 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 Little Lake has been heavily developed with permanent and seasonal dwellings, and this was noted in the previous fisheries management plan written in 1981. 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 nearshore areas to improve swimming, boat dockage, and visual aesthetics. A Michigan Department of Natural Resources (DNR) state forest campground and public-access boat launch is located on the east end of Little Lake (Figure 1).

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. The trophic state of a lake refers to the total weight of living biological material (biomass). 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). Oligotrophic, mesotrophic, and eutrophic lakes are respectively low, medium, and high in productivity.

To determine lake productivity, limnological characteristics were last measured during August 2011. 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, and nitrate/nitrite was 0.1 mg/L. Water chemistry values indicate that the trophic state of Little Lake is meso-eutrophic (i.e. medium to high productivity) indicating that it receives relatively high inputs of nutrients. Also, Little Lake has a higher level of nutrient loading compared to other lakes in the Northern Lake Michigan Management

Unit (NLMMU). Most lakes within the NLMMU in the central Upper Peninsula surveyed to date with Status and Trends protocols have trophic states of either oligotrophic or oligo-mesotrophic.

Temperature and dissolved oxygen (DO) profiles also were documented in August 2011 and are listed in Table 1. Water temperatures ranged from 72.5F (surface) to 51.5F (bottom). Dissolved oxygen ranged from 11.2 parts per million (ppm) at the surface to 0.0 ppm at the bottom. Minimum DO levels for suitable summer habitat are approximately 3.0 mg/l 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 0-27 feet (Table 1). The current temperature and DO profiles appear similar to historical records and indicate that deep water zones become deprived of oxygen during the summer when the lake stratifies and therefore are unsuitable for survival of most fish species. Critical depth is defined as the point at which DO concentrations are less than 0.5 mg/l and refers to a maximum depth that will support microorganisms like zooplankton. The critical depth in Little Lake was found to be located between 33-38 feet (Table 1).

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) Little Lake in 1925 and captured a total of 7 species: bluntnose minnow, creek chub, Iowa darter, Johnny darter, largemouth bass, mottled sculpin, and yellow perch.

Bluegill, largemouth bass, smallmouth bass, yellow perch, and walleye were periodically stocked by the Michigan Department of Conservation starting in the mid-1930s and continuing through 1944 (Table 2). Fisheries surveys were conducted in April, June, and August of 1949 and found abundant white sucker and yellow perch populations with walleye as the dominant predator in the fish community. Some limited natural reproduction of smallmouth bass and walleye was also noted. Species captured during the survey included bluegill, common shiner, largemouth bass, northern pike, pumpkinseed sunfish, rock bass, smallmouth bass, walleye, white sucker, and yellow perch. The survey also identified some suitable habitat for rainbow trout in Little Lake, which were subsequently stocked on a trial basis from 1949-1951. Rainbow trout stocking was terminated after 1951 when it was determined that the stocking efforts were not successful due to very low survival of stocked fish.

Smallmouth bass and northern pike populations appeared to increase in abundance slowly through the 1960s and 1970s, while walleyes declined due to decreasing levels of successful natural reproduction. Walleye fry were stocked by the DNR in 1969, and although a fisheries survey in 1975 captured walleyes from the 1969 stocking effort, it was noted that no recent walleye natural reproduction was evident. As a response, walleye fry were stocked in the mid-to late-1970s to bolster the population (Table 2). However, survival of fish from these stocking efforts was determined to be poor.

A fisheries survey conducted in 1980 found the predator fish community dominated by smallmouth bass and northern pike, with only a remnant walleye population present despite the recent stocking efforts in the 1970's. Abundant populations of white suckers and yellow perch were noted, and management recommended manual removals of these species followed by walleye stocking with the

goal to use walleyes as a biological control to maintain those populations at a reduced biomass as compared to the high biomass of the 1970s.

Manual removals of white suckers and yellow perch were conducted in May 1982 with a total of 8,354 pounds (lbs) of yellow perch (18.4 lbs/acre) and 1,126 lbs of white suckers (2.5 lbs/acre) removed from Little Lake. In 1983, walleye fry and spring fingerlings were stocked (Table 2). Manual removals of yellow perch and white suckers were again conducted in 1984 (8,857 lbs, 19.5 lbs/acre and 3,023 lbs, 6.7 lbs/acre, respectively), 1985 (961 lbs, 2.1 lbs/acre and 1,628 lbs, 3.6 lbs/acre, respectively), and walleyes were then stocked biennially through the 1980's at rates ranging from 48-120/acre (Table 2).

Two fisheries surveys (1987 and 1989) were conducted 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 walleyes ranging from 6-23 inches with several year classes present. Some anglers reported many sublegal walleyes captured for every legal fish.

In the early 1990s anglers reported a poor yellow perch fishery in Little Lake that consisted of low numbers of larger fish. In response, DNR staff transferred 22,172 yellow perch (49/acre) from a nearby manual removal that was conducted on Sporley Lake. A subsequent fisheries survey in 1994 found the yellow perch population high in abundance with year classes 1-11 present. Also at that time, walleyes ranged from 7-21 inches and growth was acceptable at -0.6 inches under the statewide average. Management recommended continued walleye stocking, and from 1994-2000 spring fingerling walleyes were stocked at a rate ranging from 88-111/acre (Table 2).

In 2002, DNR staff completed a fish community survey on Little Lake. Abundance of predators, such as walleyes, northern pike, and smallmouth bass, appeared to have increased since the 1994 survey, although growth rates of predators were acceptable. Natural reproduction of walleyes was suspected due to the presence of walleyes corresponding to non-stocked years. However, some walleyes in the sample may have been incorrectly aged since the sample size of walleye was small. The total catch and average size of yellow perch had declined more than threefold between the 1994 and 2002 surveys, and the number of larger fish had also declined. In 1994, approximately 12% of the yellow perch catch was greater than 7.0 inches in length, while in 2002 only 1% was greater than 7.0 inches.

A cause for concern was that predators such as walleyes, pike, and bass accounted for a relatively high percentage of the survey catch biomass (~76%) in 2002, while the yellow perch and white sucker populations appeared to be substantially smaller in abundance compared to the 1980's and 1990's. Subsequent recommendations included a reduction in the rate of walleye stocking to reduce the number of walleyes in the population and thus reduce predation on the forage base. Previous walleye stocking rates had remained relatively consistent for quite some time and may not have considered the addition of any naturally reproduced fish to the overall population. Additionally, no adjustment was made to the walleye stocking rate after the transfer of yellow perch in 1993 as walleye stocking rates averaged 100/acre from 1994-2004 (versus 88/acre from 1983-1992). The occurrence of viral hemorrhagic septicemia in Michigan precluded the stocking of walleyes in most inland waters around the State (including Little Lake) from 2007-2010.

A total of 23 species of fish have been captured during fisheries surveys that were conducted on Little Lake from 1925-2011 (Table 3). 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. Little Lake provides diverse aquatic habitats and supports a large number of species as compared to many other lakes in the NLMMU.

Current Status

In June of 2011, DNR Fisheries Division conducted a fish community survey using Status and Trends protocols on Little Lake. Assessment gear included fyke nets, gill nets, mini-fyke nets, a seine, and an electrofishing boat. From June 6-9, 5 fyke nets were fished at 12 locations over 3 nights. Two experimental gill nets were fished at 4 locations over 2 nights. Two mini-fyke nets were fished at 5 locations over 3 nights. Four seine hauls were conducted at 4 locations around the shoreline. Two minifyke nets were fished at 3 locations over 2 nights. On June 21, 4 night electrofishing transects were conducted at 4 separate locations around the shoreline. Captured fish were identified to species and measured for length, a sample of scales was collected from common sportfish for age and growth analysis, and then fish were released back into the lake. In addition to the collection of biological data, staff also surveyed habitat features around the shoreline of Little Lake; the number of dwellings, docks, and submerged logs (greater than 6" in diameter) were counted and length of armored shoreline (i.e. riprap, sheet piling, etc.) was measured.

A total of 18,621 fish representing 18 species were collected from the combined June netting and electrofishing efforts (Table 4). In terms of the number captured during the survey, bluntnose minnow were the most abundant comprising 88% of the total catch, yellow perch were second at 5%, creek chub (2%), common shiner and rock bass (1%), and all of the other species were each less than 1% (Table 4). In terms of biomass captured during the survey, northern pike comprised 20% of the survey catch, then bluntnose minnow (15%), brown bullhead (14%), walleye and white sucker (13%), yellow perch (10%), smallmouth bass (6%), rock bass (4%), pumpkinseed sunfish and creek chub (1%), and the rest of the species were each less than 1% (Table 4).

Bluegill (n=93) averaged 2.3 inches in total length with 5% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 4). Bluegills ranged from 1-8 inches (Table 5). Age-growth data indicated that bluegills were growing slightly below the statewide average with a mean growth index of -0.5 inches (Table 6). To explain the mean growth index (MGI), 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 6).

Northern pike (n=66) averaged 25.6 inches in total length with 73% of the fish meeting or exceeding minimum harvest length of 24 inches (Table 4). Northern pike ranged from 15-37 inches (Table 5). Age-growth data indicated that northern pike were growing above the statewide average with a mean growth index of +0.9 inches (Table 6). The age distribution indicated variable recruitment with representation of northern pike aged 2-8 (Table 6).

Pumpkinseed sunfish (n=50) averaged 4.2 inches in total length with 38% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 4). Pumpkinseed sunfish ranged from 1-8 inches (Table 5). Age-growth data indicated that pumpkinseed sunfish were growing at about the statewide average with a mean growth index of +0.4 inches (Table 6). The age distribution indicated variable recruitment with representation of pumpkinseed sunfish aged 1, 2 and 4-6 in the survey catch (Table 6).

Rock bass (n=95) averaged 6.1 inches in total length with 58% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 4). Rock bass ranged from 2-9 inches (Table 5). Age-growth data indicated that rock bass were growing above the statewide average with a mean growth index of +0.6 inches (Table 6). The age distribution indicated variable recruitment with representation of rock bass aged 3-8 in the survey catch (Table 6).

Walleye (n=42) averaged 15.4 inches in total length with 60% of the fish meeting or exceeding the minimum harvest length of 15 inches (Table 4). Walleyes ranged from 6-23 inches (Table 5). Age-growth data indicated that walleyes were growing at about the statewide average with a mean growth index of +0.4 inches (Table 6). There is a regional difference in growth rates, and walleye in the Upper Peninsula tend to grow on average approximately 1 inch slower than the current average calculated for walleye in Michigan (K. Wehrly, personal communication). Therefore, the walleye in Little Lake are actually growing rather quickly as compared to the state average. The age distribution indicated variable recruitment with representation of walleye aged 1-8 and 11 (Table 6).

White sucker (n=33) averaged 16.6 inches in total length (Table 4) and ranged from 5-23 inches (Table 5). Fish were not aged.

Yellow perch (n=907) averaged 4.5 inches in total length and with 10% of the fish meeting or exceeding an acceptable harvest length of 7 inches (Table 4). Yellow perch ranged from 2-13 inches (Table 5). Age-growth data indicated that yellow perch were growing slightly above the statewide average with a mean growth index of +0.5 inches (Table 6). The age distribution indicated variable recruitment with representation of yellow perch aged 1-7 in the survey catch (Table 6).

Little Lake was found to have approximately 19.0 dwellings/mile, 15.9 docks/mile, 227.7 submerged logs/mile (greater than 6" in diameter), and 7.3% of the shoreline was armored (Table 7).

Analysis and Discussion

The current fish community in Little Lake can be generally characterized as having the following: 1) a panfish community considered of moderate diversity but low abundance except for yellow perch, 2) a predator population of moderate diversity, good growth rates, and average to low mortality which allows fish to attain old ages and some fish to grow to relatively large sizes, 4) a diverse minnow/shiner/darter community but of unknown abundance.

The Little Lake panfish community (bluegill, pumpkinseed sunfish, rock bass, and yellow perch) is moderately diverse. Populations of bluegill 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. Rock bass are growing above the state average, and fish up to at least 9 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 Little Lake almost meets these benchmarks. Previously, anglers had reported that large yellow perch had become scarce in the fishery during the late 1990's and early 2000's which corresponded to the period when spring fingerling walleye stocking rates were relatively high in Little Lake. If walleye densities become too high, their predation can significantly reduced the abundance of both small and large panfish (MDNR 2004).

Predators in Little Lake consist of smallmouth bass, northern pike, and walleye. The smallmouth bass population appears to be of moderate abundance and is similar in size structure and growth as found from the 1994 and 2002 surveys. Smallmouth bass are reaching sizes up to 18 inches, growth is good, and a total of 10 year classes were captured during the survey, indicating relatively low mortality for this population. Schneider (2000) proposed that if the maximum age collected in a survey sample is age 8, then that indicates a typical mortality rate probably exists in the population. Alternatively, if fish age 10 or older are found, then that suggests mortality is probably low. Northern pike growth is well above the state average, and the mortality rate for this population appears to be low which, in conjunction with adequate forage resources, allows some pike to grow to large sizes. Spawning habitat for northern pike is limited in Little Lake, which prevents overpopulation and subsequent low average size and slow growth rates as is observed in many other lakes around the NLMMU. Walleyes are growing fast, indicating a population that is not limited by forage resources at this time. Some natural reproduction is occurring as there were walleyes captured in the 2011 survey from years where there was no supplemental stocking (ages 1-6, 8 and 9). Walleye abundance appears to be down as compared to the 2002 survey, and this is expected given the assumed low levels of natural reproduction that occur and the stocking suspension during 2007-2010. Mortality of walleyes appears to be average or perhaps relatively low as walleyes up to age 11 were captured during the survey.

The non-game fish community is very diverse and is dominated in biomass by bluntnose minnow and white suckers. All of these species probably compete with game species for forage resources but are no doubt preyed upon by larger predators. Currently, the white sucker population abundance appears to be lower when compared to previous fish surveys; the 2011 survey captured fish from only the 17-22 inch groups whereas previous surveys captured large, adult fish as well as younger fish in the 3-10 inch groups.

Little Lake is more developed (i.e. dwellings and docks) than most other lakes surveyed in the NLMMU using the Status and Trends protocol (Table 7). Surprisingly, the amount of submerged logs is well above the NLMMU median and approaches the 75th percentile. 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. Riparian owners from Little Lake and Mehl Lake have formed the Little Lake Watershed Conservancy to promote healthy environmental stewardship practices and this may have had a positive effect in retaining fish habitat. Submerged logs, or coarse woody habitat (CWH), is a vital component of 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.

Since 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 to support healthy functioning fish communities. On lakes that have highly developed riparian areas (such as Little Lake), these effects also likely occur but are not readily evident since lake shorelines are typically developed with dwellings (and the CWH subsequently removed) over relatively long time periods (i.e. cumulative effects may take years).

Christensen et al. (1996) found that humans greatly influenced the abundance of downed trees in 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.

The shoreline survey of Little Lake in 2011 found that submerged logs (CWH) were generally abundant. Submerged logs were found to be above the median in the NLMMU (Table 7), but recent recruitment of this critical habitat type from the riparian area into the littoral zone appears to be limited, and new recruitment of CWH was observed to be scarce. Thus, as old CWH naturally decays in the environment, it appears that it is not being regularly replaced by new material. Future management should focus on maintaining and improving areas of physical habitat deficiencies (i.e. varying levels of CWH) that can have a negative effect(s) upon the fish community in Little Lake.

Management Direction

1) Continue to stock spring fingerling walleyes on a biennial schedule. Spring fingerling stocking can be used to bolster walleye population abundance to enhance the recreational fishery, while also providing a biological control to keep the abundance of yellow perch and white sucker populations below levels observed during the late 1970's and early 1980's. Walleye stocking rates in Little Lake have been fairly aggressive as compared to other lakes in the central Upper Peninsula. In recent years, walleye spring fingerling stocking rates in Little Lake have ranged from 88-100/acre, while the typical range for most lakes in the NLMMU is 25-50/acre. The stocking rate should be reduced to 40/acre with a goal of seeking a balance between predator control on forage and avoiding over-cropping the yellow perch population to the extent that it compromises the recreational fishery.

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) A fish community survey should be scheduled within 10 years to monitor the forage and predator populations. Additionally, Little Lake would be an appropriate candidate for a walleye population estimate to start gathering abundance information on this species in small lakes in the NLMMU.

4) Habitat rehabilitation and enhancement programs designed to compensate for loss or lack of CWH in the near shore area of Little Lake should be considered to maintain and restore critical habitat for the fish community. Staff from the NLMMU are available to work with riparian landowners in a cooperative program to implement a habitat rehabilitation and enhancement program in Little Lake.

5) 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 Little Lake, Marquette County.

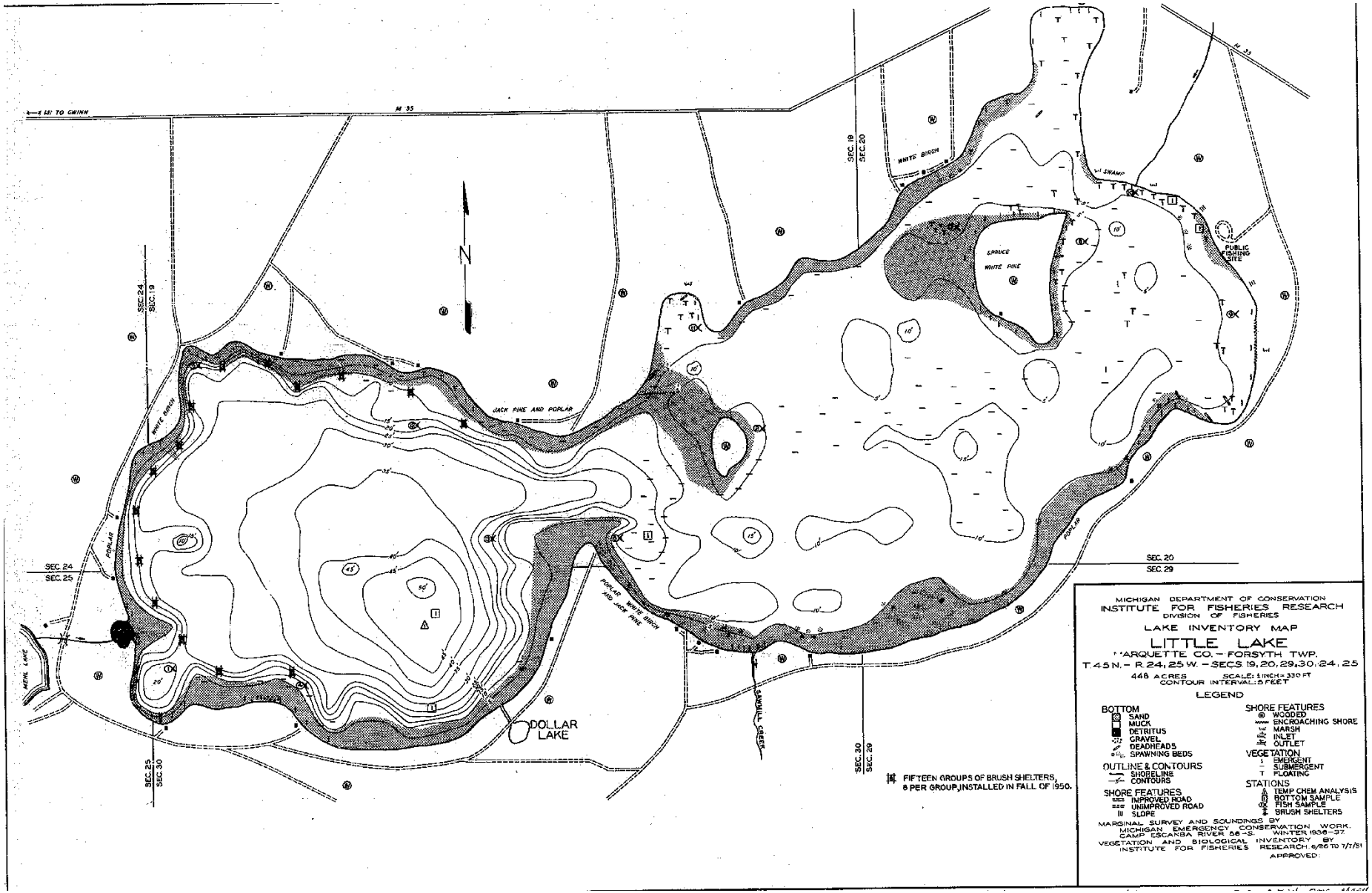

Table 1.-Temperature and dissolved oxygen profiles collected on August 22, 2011 from Little Lake, Marquette County. Data from DNR, Fisheries Division records.

Depth (feet)	Temperature (ºF)	Dissolved Oxygen (ppm)
0	72.5	11.2
6	72.2	-
12	72.1	-
18	71.6	-
21	70.9	10.9
24	67.5	8.3
27	60.1	3.0
30	56.5	1.2
33	53.7	0.9
38	52.3	0.4
43	51.5	0.0

Table 2.-Fish stocked into Little Lake, Marquette County (1934 to 2011). Data from DNR, Fisheries Division records.

Year	Species	Number	Rate (#/acre)	Size (inches) or Age
1934	Bluegill	2,000	4	4 months
	Largemouth bass	200	<1	4 months
	Walleye	180,000		fry
1936	Bluegill	8,000	18	4 months
	Smallmouth bass	400	<1	4 months
	Yellow perch	5,000	11	adult
	Walleye	180,000	396	fry
1937	Bluegill	9,600	21	4 months
	Smallmouth bass	350	<1	3 months
	Walleye	350,000	771	fry
1938	Bluegill	13,000	29	5 months
	Largemouth bass	400	<1	5 months
	Smallmouth bass	111	<1	adults
	Walleye	858,000	1,890	fry
1939	Bluegill	10,000	22	4 months
	Largemouth bass	300	<1	4 months
	Smallmouth bass	200	<1	4 months
	Walleye	450,000	991	fry
1940	Bluegill	10,000	22	4 months
	Largemouth bass	300	<1	3 months
	Smallmouth bass	300	<1	3 months
	Walleye	600,000	1,322	fry
1941	Bluegill	15,000	33	4 months
1942	Walleye	750,000	1,652	Fry
1943	Bluegill	100	<1	Adult
	Largemouth bass	200	<1	4 months
	Smallmouth bass	200	<1	4 months
1944	Bluegill	350	<1	4.0
1949	Rainbow trout	500	1	7.5
1950	Rainbow trout	500	1	9.7
1951	Rainbow trout	500	1	7.9
1969	Walleye	200,000	440	fry

Table 2.-Continued.

Year	Species	Number	Rate (#/acre)	Size (inches) or Age
1976	Walleye	900,000	1,982	fry
1977	Walleye	900,000	1,982	fry
1978	Walleye	900,000	1,982	fry
1983	Walleye	900,000	1,982	fry
		30,375	67	fingerling
1984	Walleye	54,346	120	fingerling
1986	Walleye	37,424	82	2.3
1988	Walleye	22,000	48	2.6
1990	Walleye	54,381	120	2.2
1992	Walleye	41,892	92	2.0
1993	Yellow Perch	22,172	49	4.8
1994	Walleye	50,242	111	2.0
1996	Walleye	40,050	88	2.0
1998	Walleye	45,403	100	1.6
2000	Walleye	45,000	99	2.0
2002	Walleye	43,800	96	2.2
2004	Walleye	47,665	105	1.4
2011	Walleye	13,496	30	2.4

Table 3.-List of fishes captured during surveys (1925-2011) from Little 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 macrochirus*	I	P
Bluntnose minnow	*Pimephales notatus*	N	P
Brown bullhead	*Ameiurus nebulosus*	N	P
Common shiner	*Luxilus cornutus*	N	P
Creek chub	*Semotilus atromaculatus*	N	P
Fathead minnow	*Pimephales promelas*	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	
Mottled sculpin	*Cottus bairdii*	N	
Northern pike	*Esox lucius*	N	P
Northern pearl dace	*Margariscus nachtriebi*	N	P
Northern redbelly dace	*Phonixus eos*	N	P
Pumpkinseed sunfish	*Lepomis gibbosus*	N	P
Rainbow trout	*Oncorhynchus mykiss*	I	
Rainbow smelt	*Osmerus mordax*	I	
Rock bass	*Ambloplites rupestris*	N	P
Smallmouth bass	*Micropterus dolomieu*	N	P
Walleye	*Sander vitreius*	I	P
White sucker	*Catostomus commersoni*	N	P
Yellow perch	*Perca flavescens*	N	P

Table 4.-Number, weight, length, and percentages of fishes collected with fyke, gill, and mini-fyke nets, seine and electrofishing gear from Little 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	93	2.5	2.3	1-8	<1	<1	5 (≥6”)
Bluntnose minnow	16,405	76.4	2.1	1-3	88	15	-
Brown bullhead	156	71.6	9.8	5-11	<1	14	-
Common shiner	229	3.0	3.2	2-4	<1	<1	-
Creek chub	288	4.3	3.4	2-3	2	1	-
Fathead minnow	114	1.8	3.1	2-3	1	<1	-
Golden shiner	18	<1	3.6	2-4	<1	<1	-
Iowa darter	45	<1	2.7	2-3	<1	<1	-
Johnny darter	66	<1	3.0	2-3	<1	<1	-
Northern Pike	26	105.5	25.6	15-37	<1	20	73 (≥24”)
Northern redbelly dace	20	<1	3.0	2-3	<1	<1	-
Pearl dace	18	<1	2.7	2-3	<1	<1	-
Pumpkinseed sunfish	50	6.3	4.2	1-8	<1	1	38 (≥6”)
Rock bass	95	20.3	6.1	2-9	1	4	58 (≥6”)
Smallmouth bass	16	31.9	14.7	5-18	<1	6	75 (≥14”)
Walleye	42	68.1	15.4	6-23	<1	13	60 (≥15”)
White sucker	33	68.6	16.6	5-23	<1	13	-
Yellow perch	907	53.9	4.5	2-13	5	10	10 (≥7”)

Table 5.-Length range of selected species of fish collected with fyke, gill, mini-fyke nets, seine and electrofishing gear from Little 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	56		6					
2	22		21	14				192
3	7		2	1				290
4			2					67
5	3			25	1		1	174
6	1		10	30	1	1		90
7	2		7	8	1	2	1	50
8	2		2	13		7		28
9				4		4		7
10							1	4
11								3
12					1	3		1
13							5	1
14							4	
15		1			3	1	3	
16					4	3	2	
17					2	2	2	
18					3	2	5	
19		1				7	2	
20		1				4	2	
21		3				2	3	
22		1				3	1	
23						1	1	
24		3						
25		4						

Table 5.-Continued.

Inch group	Species							
	Bluegill	Northern pike	Pumpkinseed	Rock bass	Smallmouth bass	Walleye	White sucker	Yellow Perch
26		4						
27								
28		4						
29		2						
30		1						
31								
32								
33								
34								
35								
36								
37		1						
38								
39								
40								

Table 6.-Weighted mean length (inches) at age and growth relative to the state average for selected species of fish sampled with fyke, gill, mini-fyke nets, seine and electrofishing gear from Little 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	11	Mean growth index[1]
Bluegill		1.9 (20)	3.4 (1)	5.9 (2)	7.2 (1)	8.0 (2)	8.8 (1)						-0.5
Northern pike			20.3 (7)	24.3 (2)	25.7 (3)	26.6 (5)	27.4 (4)	27.3 (3)	29.9 (2)				+0.9
Pumpkinseed		2.1 (13)	4.0 (4)		6.6 (8)	7.0 (5)	8.1 (3)						+0.4
Rock bass				5.9 (27)	6.9 (11)	8.3 (4)	8.7 (4)	9.4 (3)	9.5 (1)				+0.6
Smallmouth bass		4.2 (3)	6.9 (2)	12.7 (1)		15.5 (5)	16.2 (3)	17.5 (1)	18.4 (2)	18.0 (1)	18.3 (1)		+0.8
Walleye		8.4 (20)	12.7 (4)	16.8 (5)	17.3 (1)	18.8 (7)	18.9 (5)	20.5 (8)	22.1 (2)			22.3 (2)	+0.4
Yellow perch		3.1 (20)	5.6 (36)	7.4 (14)	8.7 (11)	10.1 (4)	11.8 (5)	11.5 (2)					+0.5

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

Table 7.-Number of dwellings, docks, submerged logs and percent of armored shoreline Little Lake, Marquette County, as compared to NLMMU 25th percentile, median, and 75th percentile data (Status and Trends data collected from 2003-2008).

Development Variable	NLMMU			Little Lake (2011)
	25th	Median	75th	
Dwellings/mile	1.6	5.8	12.0	19.0
Docks/mile	1.0	5.8	4.5	15.9
Submerged Wood logs/mile	8.8	76.7	238.3	227.7
Armored shoreline(%)	0.0%	5.0%	12.4%	7.3%