

### **Lake Esau**

Presque Isle, T34N, R08E, S28  
Lake Huron watershed, Last surveyed 2014

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### **Environment**

Lake Esau is a 275-acre natural lake located near the Lake Huron shoreline between the Michigan towns of Rogers City and Alpena in Presque Isle County, between Grand Lake and Lake Huron (Figures 1, 2). The lake falls within the Presque Isle Harbor Association and nearly the entire riparian zone is under private management except for a county access site which is provided along the northeast shore (Figure 2). The riparian zone consists mainly of white birch, maples, white cedar and white pines. The littoral zone of the lake is composed mainly of sand, with some gravel, cobble, and boulders present. Cover for fish and invertebrates is limited. Most of the lake is less than 15-feet deep, with a maximum depth of 27-feet. Master Angler awards have been awarded to anglers for rock bass (2001) and yellow perch (2018).

A legal lake level was established at the lake in 1984 as a result of high-water level variation in previous years. Limestone is an important mining mineral in the region around Lake Esau. Presque Isle Corporation, an adjacent landowner, has mined this mineral from nearby quarries. To help maintain Lake Esau's water levels, the corporation previously discharged up to 6 million gallons of water from the mine daily. Settling basins help to filter out the sediments from the clear, clean water. This was done in accordance with NPDES permitting (NEMCOG 2007).

### **History**

Fish community surveys have been conducted on Lake Esau since at least 1943 when early lake examiners found its waters did not stratify thermally in the summer, which would be key to fisheries management in the following decades. Fish stocking began in the 1940s with Smallmouth Bass and Bluegill and shifted to Rainbow Trout, Splake, and Brown Trout from 1960-1990. Since 1992, only Walleye have been stocked in Lake Esau (Table 1).

Another fisheries survey was conducted in 1953 by the Michigan Department of Conservation (MDOC) but little data was gathered. Some panfish were captured, but no Walleye were collected despite reports from local residents that Walleye were present. An extensive fisheries survey was conducted by MDOC in 1962 with the use of 28 trap net lifts, 18 fyke net lifts, and 4 experimental gill net lifts. Captured predators included Largemouth and Smallmouth Bass, and Walleye. Smallmouth Bass dominated the predator catch. Panfish catches included small Yellow Perch and Rock Bass, as well as good growing Bluegill and Pumpkinseed. Large numbers of White Suckers were also collected.

A follow-up survey occurred in 1966 to evaluate the recent Rainbow Trout stocking efforts (Table 1). The traditional species were still present but only two Rainbow Trout were collected. It was once again determined that Lake Esau did not thermally stratify creating an impediment to providing a coldwater trout fishery. A proposal to chemically treat the lake with a fish toxicant and restock with Rainbow Trout and Smallmouth Bass was rejected by the lake property owners in 1967, but trout stocking efforts continued in the following years. In 1970, a fisheries survey using gill nets was conducted. Small Yellow

Perch (under 8 inches) dominated the catch while only one Brown Trout was collected. Angler reports were poor at this time and thus the trout stocking efforts were discontinued.

Michigan Department of Natural Resources (MDNR) personnel conducted fish community surveys at Lake Esau in 1986 and 1987. Species such as Yellow Perch, Rock Bass, and Pumpkinseed were abundant along with good growing Smallmouth Bass and Northern Pike. Yellow Perch were the dominant game fish captured and were still found to be small. This was the first-time Northern Pike had been collected in a Lake Esau fisheries survey and they were found in high numbers. Northern Pike and Smallmouth Bass were also found to be growing at rates above the state average and the survey reports noted that the lake was a potential Walleye fishery, though Walleye were not available for stocking at the time. Splake and Brown Trout were then stocked in the lake again in attempt to create a regional trout-type fishery, and in hopes of increasing the Yellow Perch size structure through predation by another predator. Simultaneous removals of White Sucker and Yellow Perch also occurred at this time. A survey with gill nets was initiated in 1990 to evaluate these salmonid stocking efforts and their effectiveness. No Splake and very few Brown Trout were collected, so stocking was discontinued.

Fish stocking as a tool of fish management had changed by the early 1990's in northern Michigan and Walleye had become a popular fish. Based on the availability of suitable habitat and the abundant Yellow Perch population, it was decided that the lake could support a Walleye population. As a result, Lake Esau started receiving alternate year stocking of this species (Table 1). It was believed that Walleye would create a popular fishery while controlling the size structure of Yellow Perch, something the trout and Splake stocking efforts had not accomplished.

A fisheries survey was conducted in 1997 with various gear types to assess the recent Walleye stocking efforts. Based on catches, it was determined that the 1992 and 1996 Walleye stocking had failed or at best done poorly. Survival of the 1994 stocked cohort was good, however growth of age-3 fish (size range: 11-14 inches) was slower than the statewide average. Walleye stocking continued in attempt to stabilize survival and the overall population. Other species such as rock bass, Yellow Perch, Smallmouth Bass, and White Suckers continued to thrive in Lake Esau. Only a few Northern Pike were collected in the 1997 survey. By the late 1990's, angler reports for Walleye were favorable and a fishery had been created. Round Goby are present in Lake Esau and were reported to be widespread by anglers in 2011 (Tim Cwalinski Department of Natural Resources Fisheries Biologist, personal communication). Zebra mussels are also present.

### **Current Status**

The most recent fish community survey at Lake Esau was conducted by MDNR in mid-June 2003. However, there have also been three fall Walleye index surveys completed since 2003, in 2005 and 2014. The purpose of the 2003 survey was to examine the entire fisheries community and to assess the Walleye stocking efforts. Sampling effort consisted of 4 large-mesh fyke net lifts, 8 large-mesh trap net lifts, 10 experimental gill net lifts, and 1 large seine haul. Sampling procedures followed the Status and Trends sampling design where effort is standardized based on lake size (Wehrly, et al., 2009). Water temperature ranged from 65-69F during the survey.

A total of 249 fish, not including Sand Shiners, were collected during the 2003 survey (Table 2). Sand shiners and White Suckers continued to comprise the fish forage base at Lake Esau. Rock bass and Yellow Perch dominated the panfish catch, while only one Bluegill was collected. Rock bass grew

slightly below the statewide average, but some large individuals were collected (Schneider, 2000; Table 3). Yellow Perch growth was slightly more favorable, but the catch of this species was dominated by small fish under 6 inches (Table 3).

The major predators in Lake Esau continued to be Smallmouth Bass and Walleye. No Northern Pike were collected. Smallmouth Bass were thriving and growing slightly better than the statewide average for the species and reaching lengths up to 19 inches (Table 3; Table 4). This species was represented by ages 1-8, with dominant year classes in 1998 and 2001. Many 14-17-inch Smallmouth Bass were available to anglers. Yellow Perch were also growing slightly above the statewide average and a range of age classes were represented in the 2003 survey (Table 4).

Walleye collected during the 2003 netting survey ranged in length from 14-19 inches (ages 5-7) and are growing below the statewide average (Table 4). Stocking events of this species occurred in several of the years prior to the 2003 survey, but no age-3 fish were collected at the time. This may indicate poor survival of a year class or low vulnerability of these smaller Walleye to the sampling gear. Survival of the 1998 year class (age-5) appeared strong based on age and growth analysis with these fish ranging from 14-18 inches in length. Some older (Age-7) fish were even collected during the survey (Table 4). Growth, however, remained very poor for Lake Esau Walleye and may be a result of higher densities of age-5 Walleye or limited food availability (Table 4). Regardless, legal size Walleye were available to anglers at Lake Esau in 2003 (Table 3).

The 2005 and 2014 surveys were conducted to evaluate the success of Walleye stocking efforts and the possibility of Walleye natural reproduction in Lake Esau. The entire shoreline of the lake was surveyed in 2005 and 2014 using an electrofishing boat at night. Catch was quite different between the two surveys (Table 6) despite stocking in both years (Table 1). A total of 103 Walleye were captured in 2005 and all but one individual were young of year (age-0) fish ranging from 5-9 inches in length. Walleye stocked in 2005 were marked with oxytetracycline (OTC) to indicate they were of stocked origin and 100% of the subsample of Walleye checked were marked with OTC. The high catch rate in 2005 combined with the OTC mark check indicated good survival of Walleye stocked from the spring stocking event and that stocking contributes significantly to the population. The growth rates of Walleye in 2005 were poor compared to the statewide average, but reports indicated that a fair number of Walleye grow past legal size. In 2014, only 9 Walleye were captured, and OTC marks indicated they were stocked. A total of 6 adult Walleye were also captured, ranging from 19-20 inches which indicates Walleye do survey to larger sizes in Lake Esau. Walleye angler reports at the time suggested a small fishery for legal size fish existed.

In addition to the fish collections, limnological parameters were measured on August 12, 2003 (Figure 3) and August 2009 (United States Geological Survey data; Figure 3). In 2003, Lake Esau had not stratified thermally so no thermocline or layer of very cold water was present during the summer months, which was consistent with past limnological data. As a result, temperature and dissolved oxygen are nearly uniform from top to bottom (Figure 3). Secchi disk reading was 10 feet indicating high water clarity. In 2009, a slight thermocline was observed in Lake Esau for the first time with a temperature change of 5F between the top and bottom (Figure 4). Dissolved oxygen was only measured at 27 ft and was 9.8 ppm.

Various other parameters such as nitrogen, phosphorus, and alkalinity were also collected in both years at Lake Esau (Table 5). All values were lower in 2009 than in 2003. The lake has low alkalinity values and is classified as moderately hard. Total phosphorus levels are low (0.007 mg/L in 2009, 0.016 mg/L in 2003) at Lake Esau and Chlorophyll (amount of algae present) was measured at 2.2 µg/L in 2003. Based on these values alone, Lake Esau appears to be an oligotrophic lake, meaning it has low productivity (Fuller and Taricska, 2012). However, much of the lake is less than 15-ft deep and more recent data on phosphorus and Chlorophyll are not available, so more routine measurement of water quality parameters would help with determining actual productivity of the system.

### **Analysis and Discussion**

The management of Lake Esau has changed considerably since the 1940s and the current fish community can be characterized as having the following 1) a predator population dominated by Smallmouth Bass and Walleye, 2) abundant Yellow Perch that exhibit average growth rates, 3) a Walleye population that currently appears to rely on routine stocking. The shift in management from a coldwater trout fishery to a Walleye fishery appears to be suitable for Lake Esau. Though it is a relatively unproductive northern Michigan lake, there are a variety of species present and several are growing at rates comparable to the statewide averages.

Smallmouth Bass have consistently been abundant in Lake Esau and at least several age classes have been documented in most surveys. This population appears to be thriving and growth is slightly above the statewide average for the species and the 2003 survey indicated that good numbers of 14-17 inch bass were available for anglers. Yellow Perch have also remained abundant, though size structure appears to have improved somewhat since the 1960s with growth near the state average in 2003.

The 2003 survey indicated that Walleye growth was below average, and they comprised 10% of the total catch. Since only Walleye over 14 inches were captured the survey gear may not have been suitable for catching smaller Walleye. Future surveys with a variety of gear types may give a better indication of Walleye population status. Age-0 Walleye catch is variable, and stocking appears to contribute significantly to the population. It is possible that there is a barrier to natural reproduction or survival to fingerling size, but further fall index surveys would be needed to determine if there is natural reproduction of Walleye in the lake.

Overall, Lake Esau's fish community currently appears stable but requires Walleye stocking to maintain that component of the fishery. There are a variety of game fish available for the size of the lake and growth rates are average. Smallmouth Bass and Yellow Perch represent a significant portion of the fish community and appear to be present in size ranges desirable for anglers. Walleye stocking is needed not only to maintain the fishery but also will help maintain Yellow Perch size structure.

### **Management Direction**

- 1) Lake Esau's fish community has not been surveyed in many years, so a general fish community survey would help provide an update on the population status of many species.
- 2) Stocking of OTC marked spring fingerling Walleye should continue every other year in Lake Esau at the current levels (73 fish/acre). Since catch was variable in the last two fall Walleye index surveys it is not entirely clear how much, if any, natural reproduction occurs. With the little data we have available,

it is likely that the Walleye population and fishery is totally reliant on stocking. Future fall nighttime electrofishing can help better answers this question.

3) Smallmouth Bass are abundant in Lake Esau and the most recent survey indicated a range of legal-size fish were available for anglers. This species is also likely to help at some level with controlling Yellow Perch size structure, as well as Round Goby invasion.

### **References**

Fuller, L.M., and Taricska, C.K., 2012, Water-quality characteristics of Michigan's inland lakes, 2001-10:  
U.S. Geological Survey Scientific Investigations Report 2011-5233, 53 p.

Northeast Michigan Council of Governments. 2007. Grand Lake and coastal watersheds management plan. NEMCOG, Gaylord, MI.

Schneider, James C. (ed). 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

Wehrly, K.E., G.S. Carter, and J.E. Breck. 2009. Standardized Sampling Methods for the Inland Lakes Status and Trends Program in DRAFT. Michigan Department of Resources and Environment, Fisheries Division. Lansing, MI.



Figure 1. Location of Lake Esau, Presque Isle County.

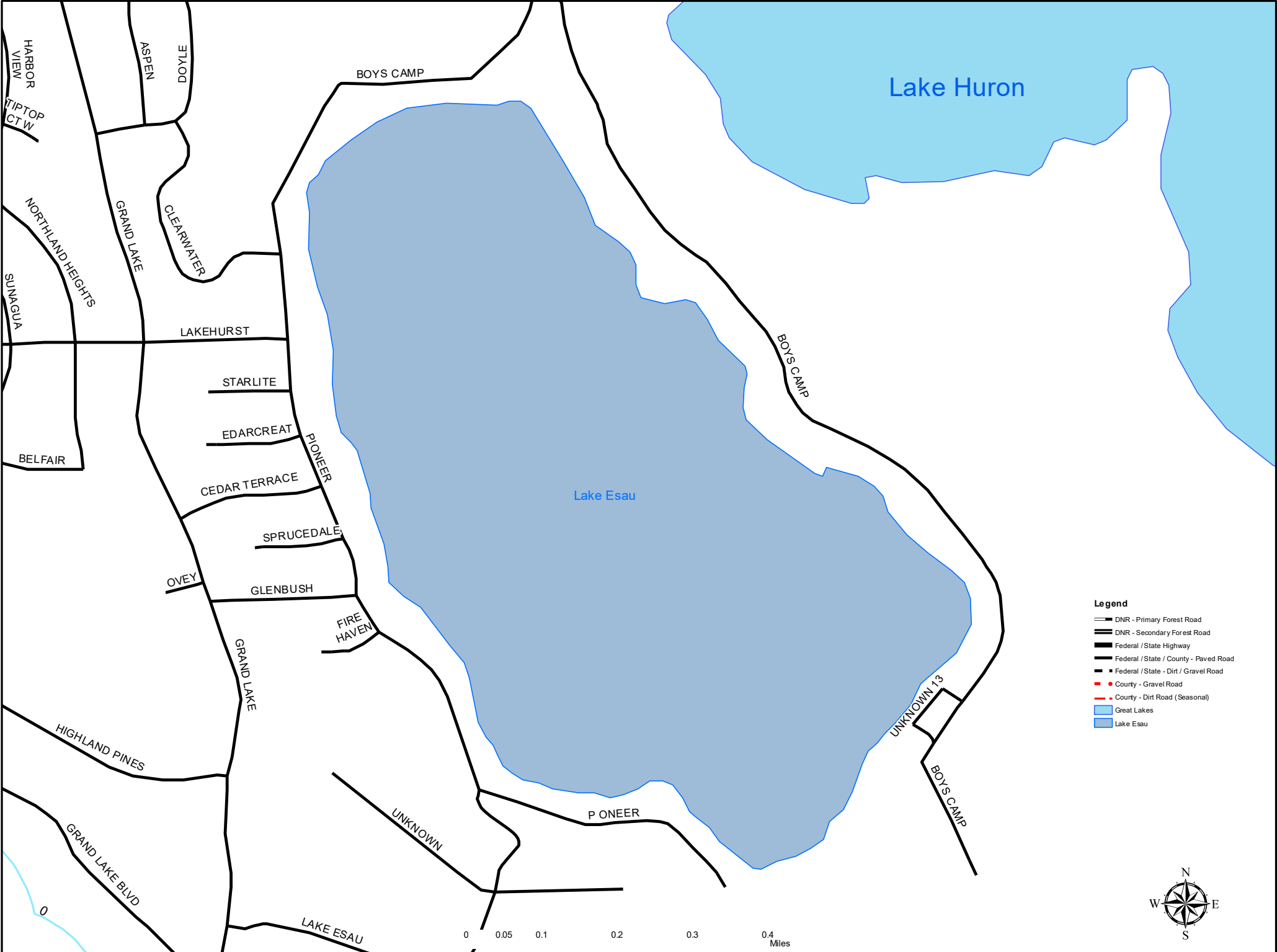


Figure 2. Lake Esau, Presque Isle County.

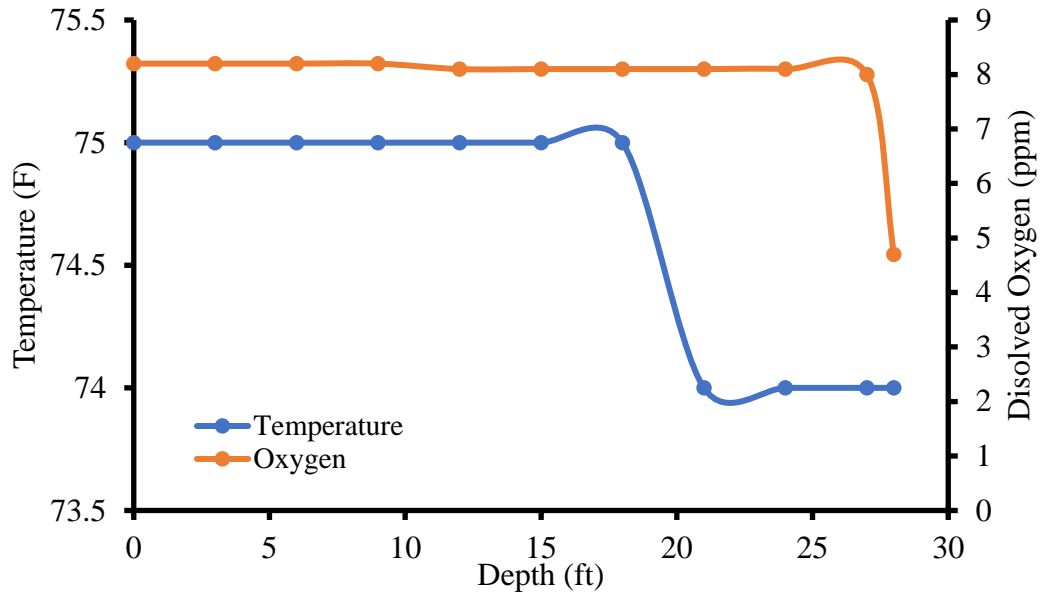


Figure 3. Lake Esau temperature and dissolved oxygen profile from the 2003 survey.

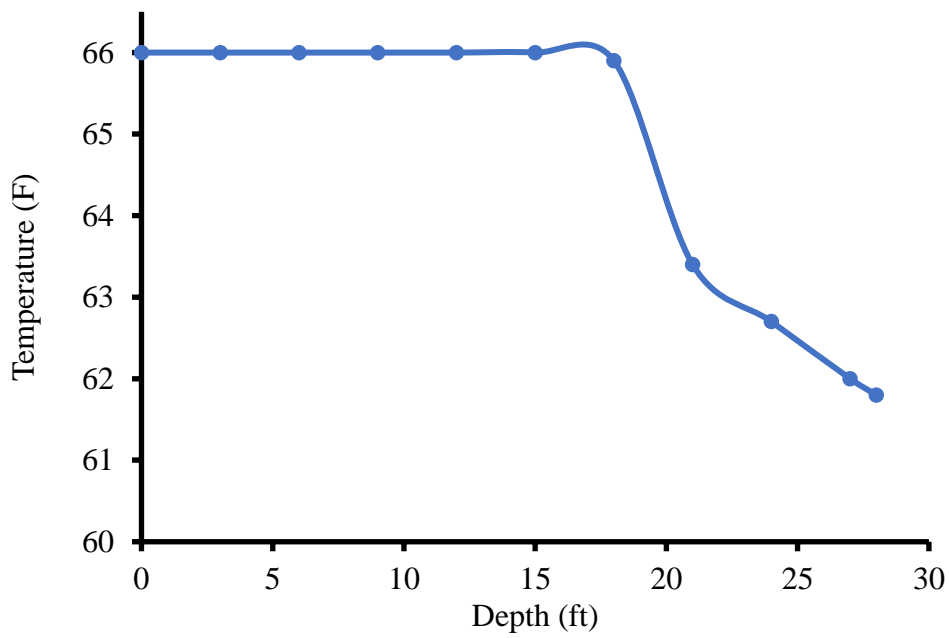


Figure 4. Lake Esau temperature profile from the 2009 survey.



Table 1. Stocking history of Lake Esau, Presque Isle County.

Year	Species/ <i>Strain</i>	Number	Number/Acre	Avg. Length (inches) or Life stage
Pre 1943	Bluegill	40,000	--	Fingerlings
Pre 1943	Smallmouth Bass	1,000	--	Fingerlings
Pre 1943	Smallmouth Bass	289	--	Adults
1961	Brook Trout	5,000	18	--
1962	Rainbow Trout	5,000	18	--
1963	Rainbow Trout	5,000	18	--
1964	Rainbow Trout	7,500	27	--
1965	Rainbow Trout	5,000	18	Sublegals
1968	Brown Trout	15,000	55	Yearlings
1969	Brown Trout	15,000	55	Yearlings
1987	Splake	15,000	55	8.7
1988	Splake	14,500	53	8.5
1989	Brown trout/ <i>Plymouth Rock</i>	14,955	54	6.7
1990	Splake	15,000	55	6.7
1992	Walleye/ <i>Bay De Noc</i>	20,000	73	2.0
1994	Walleye/ <i>Muskegon</i>	20,000	73	1.4
1996	Walleye/ <i>Muskegon</i>	19,400	71	1.7
1998	Walleye/ <i>Tittabawassee</i>	20,000	73	1.7
2000	Walleye/ <i>Tittabawassee</i>	23,000	84	1.2
2003	Walleye/ <i>Tittabawassee</i>	20,000	73	1.1
2005	Walleye/ <i>Muskegon</i>	20,000	73	1.5
2008	Walleye/ <i>Muskegon</i>	17,706	64	2.2
2009	Walleye/ <i>Muskegon</i>	33,089	120	1.6
2012	Walleye/ <i>Muskegon</i>	14,400	52	1.5
2014	Walleye/ <i>Muskegon</i>	17,877	65	1.5
2016	Walleye/ <i>Muskegon</i>	13,750	50	1.4
2018	Walleye/ <i>Muskegon</i>	25,119	91	1.2

Table 2. Species and relative abundance of fishes collected with survey gear at Lake Esau, Presque Isle County in 2003.

Common Name	Number	Percent by number	Length Range (inches)	Weight*	Growth**
Sand Shiners	Abundant		--	--	--
Rock Bass	106	42.6	3-10	17.6	-0.6
Smallmouth Bass	78	31.3	5-18	100.6	+0.5
Yellow Perch	38	15.3	5-10	4.3	+0.4
Walleye	23	9.2	14-19	32.6	-2.2
White Sucker	3	1.2	18-21	10.3	--
Bluegill	1	0.4	8	0.4	--

\*weight calculated based on length-weight relationships

\*\* the average deviation in inches from the statewide average for this species

Table 3. Length frequency distributions of common gamefish collected during the 2003 fish community survey on Lake Esau.

Length (in)	Rock Bass	Smallmouth Bass	Walleye	Yellow Perch
1				
2				
3	5			
4	12			
5	40	4		12
6	45	1		22
7	1			2
8		16		1
9	1	15		
10	2			1
11				
12		3		
13		2		
14		4	3	
15		10	11	
16		17	2	
17		3	4	
18		3	2	
19			1	

Table 4. Mean length (inches) at age for various fish species of Lake Esau in 2003. Number in parentheses represents number of fish aged. The growth comparison is across all ages for each species.

Species	Age group	2003 Average length (in.)	Growth compared to state average
Smallmouth Bass	I	5.3 (4)	+0.5
	II	8.9 (27)	
	III	12.1 (2)	
	IV	14.2 (4)	
	V	15.5 (15)	
	VI	16.1 (7)	
	VII	16.6 (4)	
	VII	17.9 (4)	
Walleye	V	15.9 (20)	-2.1
	VII	18.5 (3)	
Yellow Perch	I	5.2 (1)	+0.4
	II	6.1 (28)	
	IV	7.9 (2)	
	VI	10.4 (1)	

Table 5. Additional water chemistry results for Lake Esau in 2003 and 2009.

<b>Parameter</b>	<b>2003</b>	<b>2009</b>
Alkalinity, Total (mg/L)	91	170
Phosphorus, Total (mg/L)	0.016	0.007
Nitrogen, Total Kjeldahl (mg/L)	0.798	0.340
Nitrogen, Ammonia (mg/L)	0.127	0.018
Nitrogen, Nitrate + Nitrite (mg/L)	0.075	0.015
Secchi Depth (ft)	10	13.5
Chlorophyll ( $\mu\text{g/L}$ )	2.2	--

Table 6. Fall Walleye index survey results from the 2005 and 2014 surveys in Lake Esau. The entire shoreline was surveyed in 2005 and stocking occurred in both years. YOY= age 0.

	<b>2005</b>	<b>2014</b>
Water Temperature (F)	66	63
Effort (hours)	1.41	1.45
Effort (miles)	--	3.31
Total Walleye caught	103	9
CPUE (YOY/hr.)	72.3	2.1
CPUE (YOY/mile)	--	0.9
Average size (inches) - YOY	7.3	7.4
OTC analysis sample size	20	2
Percent of YOY stocked	100	100