

**Pickerel Lake**  
Emmet County  
Cheboygan River Watershed, last surveyed 2021

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**Environment**

Pickerel Lake is a 1,082-acre lake located in eastern Emmet County (Figure 1). It flows into Crooked Lake and is part of the Inland Waterway in the Cheboygan River watershed. Maximum depth is 75 feet (Figure 2). Pickerel Lake has two tributaries, Cedar Creek and Mud Creek. Its outlet is the Pickerel Lake channel which connects it to Crooked Lake and the rest of the Inland Waterway. Public access on the lake is at the end of Artesian Lane/Ellsworth Road on the south-central part of the lake. Boats can also be launched at access sites on Crooked Lake with access to Pickerel Lake via the Pickerel Lake channel.

Pickerel Lake thermally stratifies in the summer. Temperature and dissolved oxygen profiles indicate that a thermocline is established between 24 and 42 feet in depth. Dissolved oxygen levels are above 3 ppm from the surface to 27 feet. However, during stratification, hypolimnetic waters (below the thermocline) at depths 51 feet and below become completely anoxic (Dissolved Oxygen = 0 ppm; Figure 3, Table 1). Dissolved oxygen concentrations of 3 ppm or less are generally considered stressful or lethal to most warmwater fish species.

**History**

Early fisheries management in Pickerel Lake focused on an inventory of the lake and its fish populations. The earliest note in Fisheries Division's files for this lake, dated October 31, 1942, simply states that the lake was mapped and that the lakes in the Crooked River Drainage should be inventoried. The lake was first inventoried in 1960 using seines and gill nets, and documented game fish species of Northern Pike, Walleye, Yellow Perch, Largemouth Bass, Rock Bass, and Bluegill. These species were all noted to be common or abundant, except Bluegill which were noted to be "few" in abundance. Forage fish were listed as Sand Shiner, Common Shiner, Bluntnose Minnow, Pearl Dace, Banded Killifish, Logperch, Johnny Darter, Iowa Darter, and Mottled Sculpin. Other non-game species listed were White Sucker, Brown Bullhead, Yellow Bullhead, Longnose Gar, and Bowfin.

The 1950s and 1960s saw extensive commercial harvest of undesirable species in Pickerel and Crooked lakes. Species such as White Suckers, Burbot, Common Carp, and Bowfin were harvested in the winters using trap nets through the ice.

The Inland Waterway Project, which was completed in 1958, impacted Pickerel and Crooked Lakes. The purpose of the project was to have a five-foot deep navigable channel through the Inland Waterway, allowing boats to travel from the Cheboygan River mouth at Lake Huron all the way up to Crooked and Pickerel Lakes. The dredging of this navigation channel resulted in a 1.5-foot drop in the water levels in Crooked and Pickerel Lakes (Fisheries Division Files). The remedy was to install a lock and dam at the outlet of Crooked Lake to restore pre-1958 average water levels to Crooked and Pickerel Lakes. The Crooked River Lock and Dam were built in 1968.

Two netting surveys and a creel survey were done in the 1970s. A survey was done in early June 1971 using trap nets and gill nets, with a suite of game fish species captured similar to that of the 1961 survey, dominated by Bluegill, Northern Pike, Walleye, and Yellow Perch, along with nongame fish such as suckers, Bowfin, and Longnose Gar. The outstanding population of fish was acknowledged by the biologist, who recommended managing to try to preserve what is already present. Northern Pike and Yellow Perch were growing well below statewide average, with Growth Indexes of -1.4 and -2.0, respectively. Another gillnet survey was done in 1972 with similar results. A creel survey was done of the ice fishery on Pickerel Lake from February 11-28, 1975. The main species in the catch were Yellow Perch, Bluegill, Rock Bass, and White Sucker. A total 774 angler hours were estimated over that 18-day period.

A netting survey of Pickerel Lake was done in May 1989. This is the only recorded survey activity for the 1980s with the exception of Walleye stocking which is discussed below. The 1989 survey consisted of gill nets, large-mesh trap nets, and fine-mesh fyke nets. A similar fish community was found, and survey notes indicate that longnose gar were removed from the lake as part of the effort. Yellow Perch and Walleye were the only species growing below statewide average; indeed, even Northern Pike had a growth index of +0.3 for this survey which is unusual for this lake.

Walleye were stocked in Pickerel Lake from the 1970s through 2012 with the assistance of the Pickerel-Crooked Lakes Association (PCLA) and a cooperative rearing pond (Table 2). The Pickerel-Crooked rearing pond was built in 1974 on land deeded to the Michigan Department of Natural Resources (MDNR) by the PCLA. The rearing pond was renovated in the 1990s and was thereafter referred to as the Reid Berney pond to honor the MDNR heavy equipment operator who performed the work, and subsequently passed away. Stocking of Walleye in Pickerel Lake was discontinued in 2012 due to high catch rates of age-0 fish and good natural reproduction observed in the lake. Continued stocking on top of the naturally produced Walleye would also cause growth rates to be even slower. The Reid Berney walleye pond was used through 2018 with assistance from PCLA to raise walleye for stocking in other area lakes.

An early spring survey of Pickerel Lake, along with neighboring Crooked Lake, was done in 2001. The survey focused on Walleye and Northern Pike populations and was intended to estimate abundance for those two species. Effort was substantial for the two lakes, consisting of 63 large-mesh trap-net lifts, 49 large-mesh fyke-net lifts, and 2 electrofishing runs. The survey results estimated that there were 2.1 legal-sized Walleye per acre in Crooked and Pickerel Lakes, which is slightly above the mean of 1.9 per acre for large lakes in Michigan ( $n=23$ ; Hanchin et al. 2005, Hanchin 2017). Legal-sized Northern Pike abundance could not be estimated due to mostly sub-legal Northern Pike being captured. The size structure of both the Walleye and Northern Pike populations were proportionally dominated by small individuals (47% sublegal Walleye, 97% sublegal Northern Pike).

In 2011, a study of the larger Inland Waterway was initiated as a collaboration between MDNR, Michigan State University, and Little Traverse Bay Bands of Odawa Indians (LTBB). The study had multiple aspects, including Walleye population estimates and movement dynamics (Herbst et al. 2016b and Herbst et al. 2017); Walleye foraging ecology (Herbst et al. 2016a); and an examination of limitations on larval Walleye production and survival (MacWilliams 2013). Walleye abundance in Pickerel Lake in spring 2011 was estimated to be 4,442 adults, but decreased post-spawn by about 35%

in summer due to movement (Herbst et al. 2017). Almost 60% of out-migrating Walleye moved from Pickerel Lake to Crooked Lake after spawning, while about 31% of the out-migrating fish moved to Burt Lake (Herbst et al. 2017). Yellow Perch was the most abundant forage fish captured in forage gill nets, followed by Spottail Shiners.

Pickerel Lake Walleye production and growth are likely affected by the available prey base. Crayfish were the primary diet item of Walleyes in Pickerel Lake based on stomach content analysis (Herbst et al. 2016a). MacWilliams (2013) reported that the average density of large-bodied zooplankton taxa in Pickerel Lake was in the mid-range of the four Inland Waterway lakes studied (Pickerel Lake, Crooked Lake, Burt Lake, and Mullett Lake) as measured during spring/early summer when larval walleye most need zooplankton. However, zooplankton availability at critical times during Walleye early life history helped determine Walleye year-class strength in Pickerel Lake (MacWilliams 2013). Following early life stages, crayfish were the primary diet item of Walleyes in Pickerel Lake based on stomach content analysis (Herbst et al. 2016a). The dietary prevalence of crayfish, which possess low energy density relative to forage fishes, contributes to the poor growth rates observed for Pickerel Lake.

Tip of Mitt Watershed Council (TOMWC) did a comprehensive plant survey of Crooked and Pickerel Lakes in 2015. The survey found that the most common species found in Crooked and Pickerel Lakes were muskgrass, variable-leaf watermilfoil, slender naiad, and common bladderwort. Approximately 50% of the sites sampled in Pickerel Lake had little or no vegetation, while 14% of the sampled sites had moderate to heavy densities of vegetation (Cronk et al. 2015).

Surveys to evaluate the juvenile Walleye population were done in 2000, 2001, 2009-2014, and 2021 in the fall (Figure 3) by MDNR and LTBB. Catch rates were variable (0.4 - 11.1 per hour), with an average of 3.5 age-0 walleye per hour. This indicates that the walleye population is likely driven by periodic strong year classes.

### **Current Status**

A fish community survey was done on Pickerel Lake in June 2021 by the MDNR Fisheries Division's Northern Lake Huron Management Unit and Tribal Coordination Unit. A variety of net types and sizes were deployed consistent with the Status and Trends protocol. A Status and Trends survey uses a methodology developed by Fisheries Division in which the gear types are standardized throughout the state and survey effort is based on lake size (Wehrly et al. in press). The various gear types and mesh sizes are intended to sample different sizes of fish, species, and life stages to give a more complete view of the overall fish community and allow for spatial and temporal comparisons. Unless otherwise noted, a lift is equal to one net night. Survey effort consisted of 12 large-mesh fyke-net lifts, 12 large-mesh trap-net lifts, 6 small-mesh fyke-net lifts, 9 gill-net lifts, 6 seine hauls, and three 10-minute boat electrofishing transects.

A total of 3,996 fish representing 25 species were collected during the survey (Table 3). This includes five panfish species and seven predator species. Bluegill were by far the most abundant fish in the catch, followed by Sand Shiner, Rock Bass, Yellow Perch, Pumpkinseed, and Largemouth Bass. Other species had less than 100 individuals each in the catch.

The panfish community of Pickerel Lake is comprised of Black Crappie, Bluegill, Pumpkinseed, Rock Bass, and Yellow Perch. These five species made up about 71% of the numerical catch and almost 60%

of the catch by weight for this survey. Bluegill and Pumpkinseed populations had a good size distribution, with fish up to 10 inches present for each species. (Table 4, Figure 5), although Bluegill were much more abundant. Yellow Perch also had fish among various sizes up to the 11-inch group, but most of the catch for this species was in very small fish, three inches or less in length (Table 4, Figure 6). Rock bass were an important part of the panfish community, comprising over 15% of the numerical catch and almost 26% of the catch by weight for the overall survey (Table 3). Growth for these species was below statewide average, but generally considered acceptable as the growth index was within 0.5 inch of statewide average.

Large predators in Pickerel Lake include Brown Trout, Bowfin, Largemouth Bass, Longnose Gar, Northern Pike, Smallmouth Bass, and Walleye. These seven predator species comprised 7.5% of the survey catch by number and over 33% of the catch by weight (Table 3). Largemouth bass were the most abundant predator species, followed by Northern Pike, Longnose Gar, Smallmouth Bass, Walleye, Brown Trout, and Bowfin. All the predators were slow growing, except for Smallmouth Bass and Largemouth Bass, which had growth indexes of +0.8 and +0.2, respectively (Figure 7). This means that on average, bass in Pickerel Lake were larger than the statewide average lengths at age. Surveyed Smallmouth Bass ranged in size from 3-22 inches and Largemouth bass ranged in size from 2-16 inches (Figure 7). Walleye and Northern Pike, however, were growing very slowly, with Growth Indexes of -3.9 and -5.3 respectively. Walleye ranged in size from 11-24 inches (mode = 14 inches; Figure 8). Likewise, Northern Pike had a size range of 22-33 inches (mode = 17 inches) and averaged 5.3 inches smaller than the statewide average lengths at age (Figure 9).

The non-game fish community of Pickerel Lake was diverse and comprised of numerous prey and larger bodied fish species. Small-bodied species such as Blacknose Dace, Bluntnose Minnow, Fathead Minnow, Longnose Dace, Johnny Darter, Sand Shiners, and Spottail Shiners formed the prey fish assemblage (Table 3). Other larger-bodied non-game fish species encountered include Longnose Gar, Black Bullhead, Brown Bullhead, White Sucker, and Horneyhead Chub (Table 3). The aquatic invasive species Round Goby was also captured during the survey, but their true abundance is likely much higher than the catch indicates due to their difficulty to capture using traditional gear types (Diana et al. 2006).

### **Analysis and Discussion**

The predator fish community of Pickerel Lake is comprised of warmwater species like Largemouth Bass and Smallmouth Bass, and coolwater species like Northern Pike and Walleye. The warmwater predator species were growing above statewide averages, and habitat and forage for these species was abundant. The coolwater predators, Northern Pike and Walleye, were growing very poorly in Pickerel Lake. Although water temperatures at or below the thermocline in pickerel Lake should provide ample coolwater habitat to Northern Pike and Walleye, hypoxia (low dissolved oxygen) and anoxia at these depth strata preclude habitation by coolwater species. Therefore, lack of oxygen in the cooler parts of the lake would force Walleye and Northern Pike to spend much of the summer in the warmer upper layer, outside of their optimal thermal preferences. This likely results in greater metabolic energy expenditure and subsequently slower growth.

Northern Pike have very slow growth rates and limited growth potential in Pickerel Lake, similar to Crooked Lake. Hanchin et al. (2005) found that growth potential (derived from the  $L_{\infty}$  term of the Von Bertalanffy growth equation) for male Northern Pike was 22.4 inches and 22.5 inches for female

Northern Pike. This confirms that most Northern Pike here do not reach legal size (24"), and those that do are likely females.

The panfish community in Pickerel Lake is diverse but dominated by Bluegill. Overall the panfish community was exceptional in regards to density, and has one of the most robust (abundant) Bluegill populations in the Northern Lake Huron Management Unit. In recent years, we have received complaints about the number of Rock Bass, but this species is a natural component of the panfish community and provides diversity to the fishery. Bluegill were still the most abundant species in the catch by numbers and by weight.

Overall, Pickerel Lake has a very diverse fish community and provides abundant recreational fishing opportunities. The panfish community is robust and supports an outstanding bluegill fishery.

This is the latest in the Status and Trends surveys and Status of the Fishery Resource Reports for the large lakes in the Inland Waterway. Burt Lake, Mullett Lake, and Crooked Lake have all been surveyed using the Status and Trends protocols and have Status of the Fishery Resource reports written for them as well. These large lakes support important fish communities and abundant recreational fishing opportunities.

### **Management Direction**

1. Consider putting a no minimum size limit (5 fish daily possession limit, 1 fish >24") regulation for Northern Pike on Pickerel Lake. This would allow more harvest of smaller Northern Pike, would reduce the abundance of smaller pike thereby increasing growth rates of larger fish through competitive-release, and would be more protective of the generally larger female Northern Pike which could help shape a better size structure for the fish community. It would also make the pike regulations in Pickerel Lake consistent with those in Crooked Lake and provide greater harvest opportunities.
2. For other species, maintain statewide fishing regulations, which are adequate for the protection of this fishery.
3. Continue to work with the Pickerel-Crooked Lakes Association and the Northern Inland Lakes Citizen Fisheries Advisory Committee on issues related to Pickerel Lake and the Inland Waterway.
4. Continue to periodically monitor the contribution of natural production of Walleye to the population to determine if the stocking hiatus is appropriate. At this time, stocking of Walleye in Pickerel Lake is not recommended, as growth of coolwater predators like Walleye is very slow; stocking additional Walleye would only further slow that growth.
5. Monitor the contribution of other fish species in Pickerel Lake to other lakes in the Inland Waterway to determine if it serves as a nursery/production area for other lakes.

### **References**

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Table 1. Temperature (°F), dissolved oxygen (ppm), and pH measured along a profile of Pickerel Lake August 12, 2021.

Depth (ft)	Temperature (°F)	Dissolved Oxygen (ppm)	pH
-	76.3		
0	76.2	8.19	8.05
3	76.2	8.19	8.14
6	76.2	8.22	8.16
9	76.2	8.17	8.18
12	75.1	7.54	8.11
15	73	6.77	8.01
18	71.7	6.36	7.93
21	70.8	5.71	7.85
24	69.6	4.52	6.96
27	68.1	3.49	7.64
30	66.5	2.30	7.52
33	65.6	2.01	7.5
36	64.5	1.59	7.46
39	63.4	1.43	7.44
42	59.9	1.47	7.39
45	58.2	1.54	7.38
48	56.6	1.27	7.34
51	55	0.00	7.3
54	54.3	0.00	7.3
57	53.8	0.00	7.29
60	53.7	0.00	7.27
63	53.6	0.00	7.27
66	53.6	0.00	7.27
69	53.6	0.00	7.27

Table 2. Number of Walleye stocked in Pickerel Lake by species and year, 1979-2021.

Year	Number of Walleye	Avg. Length (in)	Life stage
1981	20,000		Spring fingerling
1982	600		Spring fingerling
1983	125		Spring fingerling
1984	2,500	1.52	Spring fingerling
1985	5,500	1.52	Spring fingerling
1989	750	1.52	Spring fingerling
1994	50,000	1.92	Spring fingerling
1996	25,000	1.24	Spring fingerling
1998	28,000	1.2	Spring fingerling
2000	12,500	1.2	Spring fingerling
2004	24,450	1.36	Spring fingerling
2006	12,500	1.44	Spring fingerling
2006	6,500	1.44	Spring fingerling
2012	7,343	1.52	Spring fingerling

Table 3. Number, weight, and length of fish species captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County. \*Growth Index is a comparison to statewide lengths at age for that species.

<b>Species</b>	<b>Number</b>	<b>Percent by Number</b>	<b>Weight (lbs.)</b>	<b>Percent by Weight</b>	<b>Length Range (in.)</b>	<b>Growth Index*</b>
Bluegill	1,751	43.9	376.4	28.1	1-10	-0.5
Sand Shiner	737	18.5	3	0.2	1-3.7	--
Rock Bass	617	15.5	342.2	25.6	1-11	--
Yellow Perch	263	6.6	7.6	0.6	1-11	-0.7
Pumpkinseed	193	4.8	70.7	5.3	3-10	-0.3
Largemouth Bass	103	2.6	90.2	6.7	2-17	+0.2
Northern Pike	69	1.7	115.9	8.7	12-33	-5.3
Brown Bullhead	44	1.1	37.6	2.8	7-14	--
Longnose Gar	38	1	58.3	4.4	15-32	--
Smallmouth Bass	35	0.9	61.7	4.6	3-22	+0.8
Spottail Shiner	29	0.7	0.1	0	1-3	--
Walleye	26	0.7	41.4	3.1	11-24	-3.9
Yellow Bullhead	18	0.5	11.4	0.9	8-12	--
Bluntnose Minnow	17	0.4	0.1	0	2-2	--
White Sucker	17	0.4	45	3.4	13-21	--
Brown Trout	14	0.4	56.9	4.3	12-25	-1.8
Bowfin	6	0.2	19.1	1.4	14-23	--
Round Goby	6	0.2	0	0	1-2	--
Black Bullhead	2	0.1	1.3	0.1	6-13	--
Blacknose Dace	2	0.1	0	0	2-3	--
Fathead Minnow	2	0.1	0	0	2-2	--
Black Crappie	1	0	0.2	0	7-7	--
Hornyhead Chub	1	0	0	0	3-3	--
Johnny Darter	1	0	0	0	1-1	--
Longnose Dace	1	0	0	0	2-2	--



Table 4. Length-frequency of sport fish species captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County.

<b>Inch Group</b>	<b>Northern Pike</b>	<b>Bluegill</b>	<b>Largemouth Bass</b>	<b>Pumpkinseed</b>	<b>Smallmouth Bass</b>	<b>Walleye</b>	<b>Yellow Perch</b>
<b>1</b>		50					1
<b>2</b>		118	1				126
<b>3</b>		136	10	1	1		85
<b>4</b>		78	5	14			32
<b>5</b>		138	2	15			6
<b>6</b>		429		42	1		4
<b>7</b>		372	7	63	1		1
<b>8</b>		210	2	43	3		2
<b>9</b>		76	9	10	1		3
<b>10</b>		18	13	5	1		1
<b>11</b>			1		3	1	2
<b>12</b>	1		11		2		
<b>13</b>	1		19		4	1	
<b>14</b>	3		17		4	7	
<b>15</b>	7		3		5	6	
<b>16</b>	7		2		1	4	
<b>17</b>	16				1	2	
<b>18</b>	9				1		
<b>19</b>	4				4	1	
<b>20</b>	5				1	2	
<b>21</b>	5						
<b>22</b>	4				1	1	
<b>23</b>	2						
<b>24</b>						1	
<b>25</b>							
<b>26</b>	1						
<b>27</b>	1						
<b>28</b>							
<b>29</b>	2						
<b>30</b>							
<b>31</b>							
<b>32</b>							
<b>33</b>	1						

Table 5. Water chemistry parameters for Pickerel Lake, Emmet County, collected August 12, 2021.  
MDL refers to Method Detection Limit.

Parameter	Value	Note
Alkalinity, total (mg/L)	146	
Chlorophyll a (mg/L)	0.00128	
Nitrogen, ammonia (mg/L)	0.0843	
Nitrogen, nitrate + nitrite (mg/L)	<0.004	MDL = 0.004
Nitrogen, total Kjeldahl (mg/L)	1.102	
Phosphorus, total (mg/L)	0.0091	

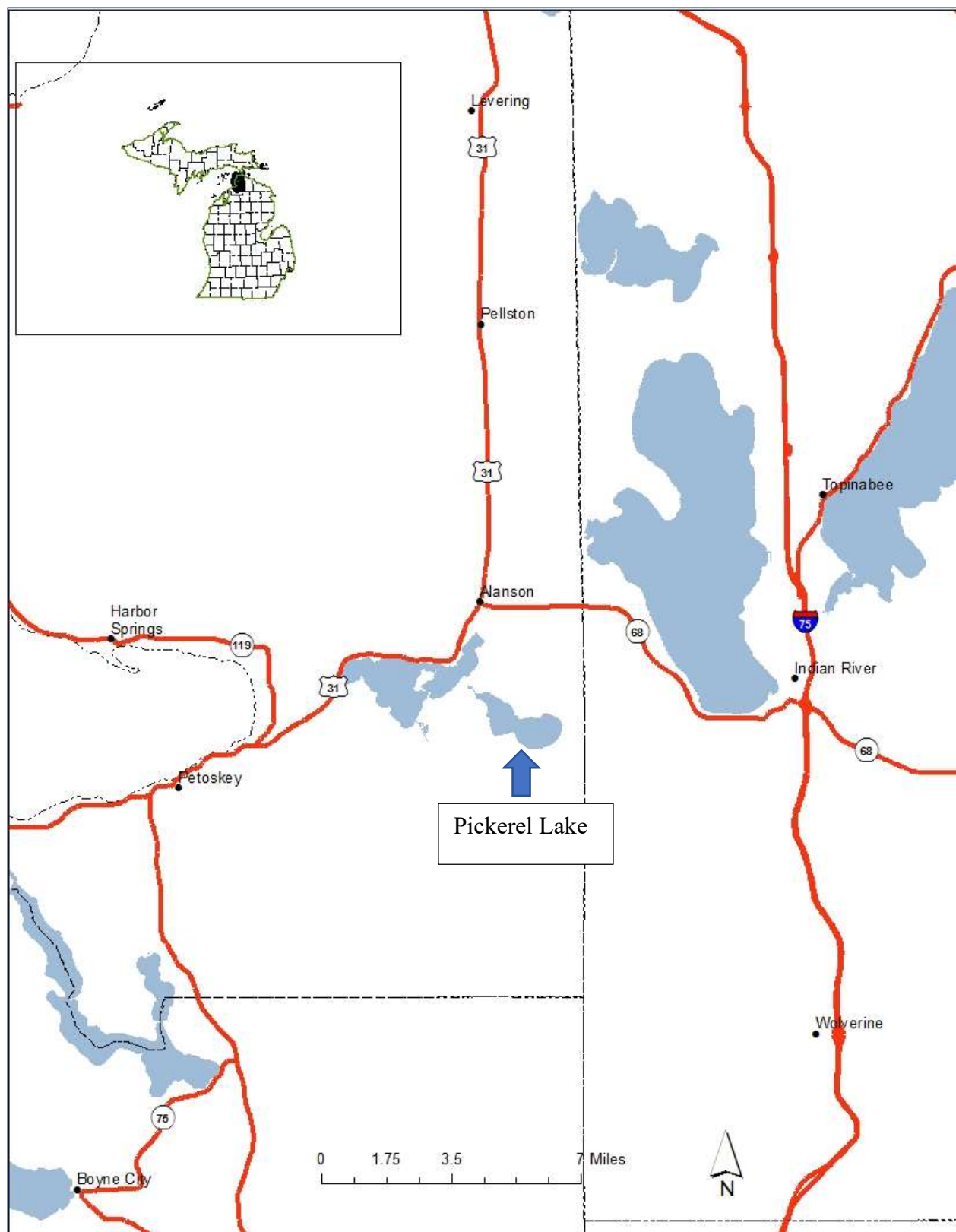


Figure 1. Location Map for Pickerel Lake (Emmet County).

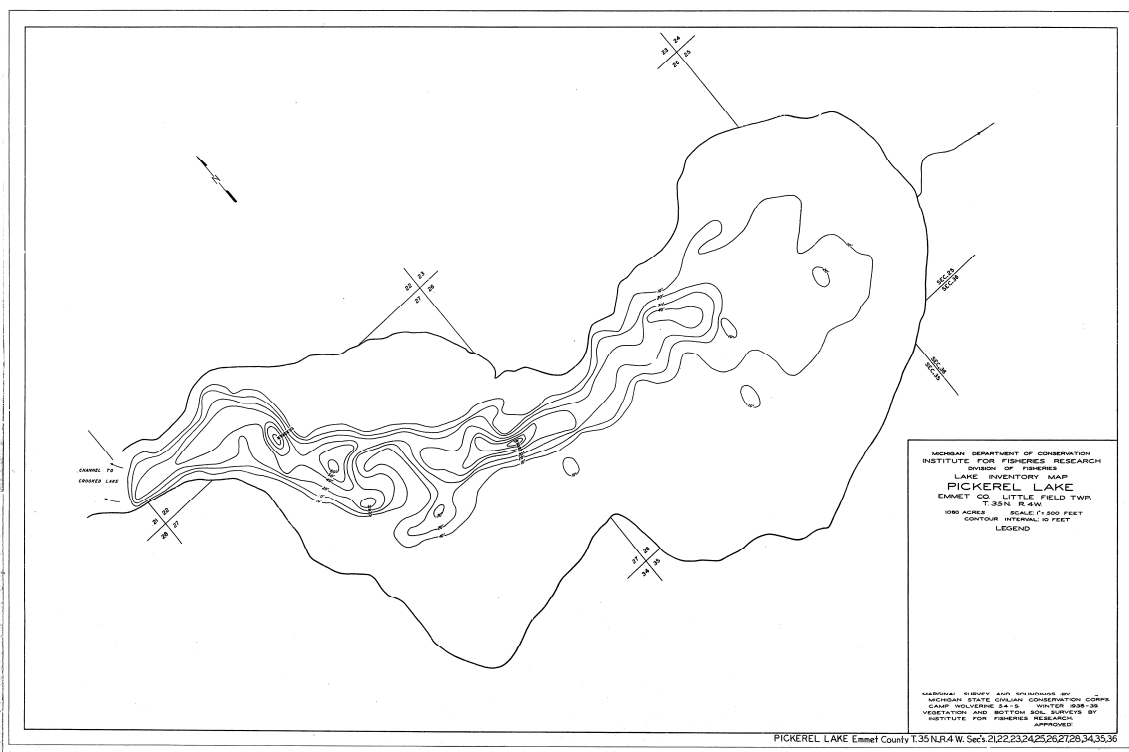


Figure 2. Depth contour map for Pickerel Lake (Emmet County). Depth contour intervals are 10 feet.

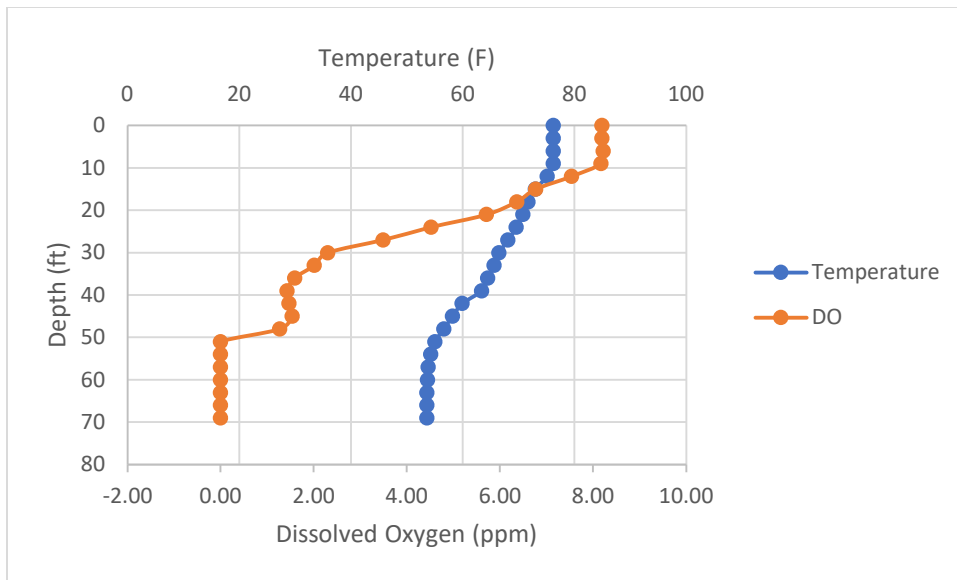


Figure 3. Temperature (°F) and dissolved oxygen (ppm) measured along a profile of Pickerel Lake, August 12, 2021.

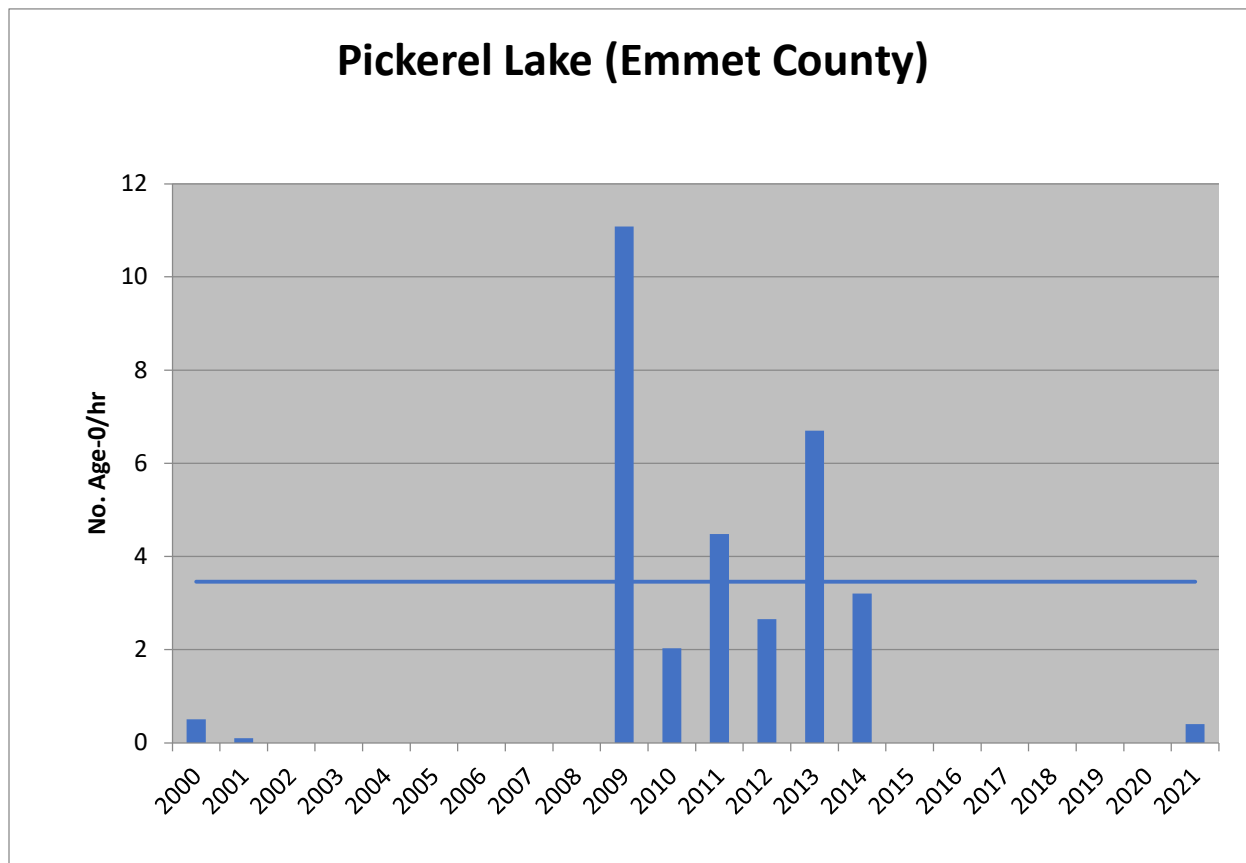


Figure 4. Summary of catch per unit effort for fall walleye evaluations in Pickerel Lake (Emmet County). Note that surveys did not occur in all years.

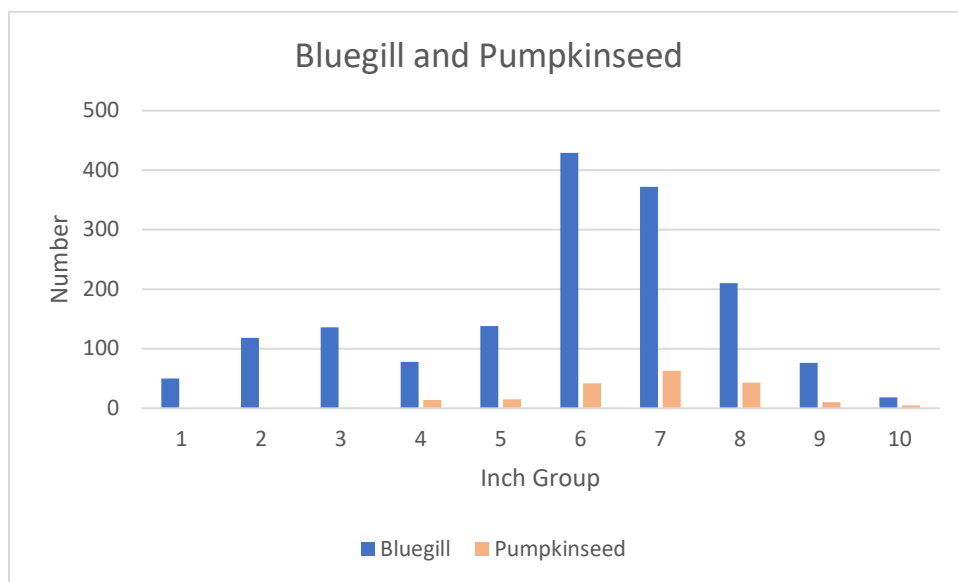


Figure 5. Length-frequency distribution of Bluegill and Pumpkinseed Sunfish captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County.

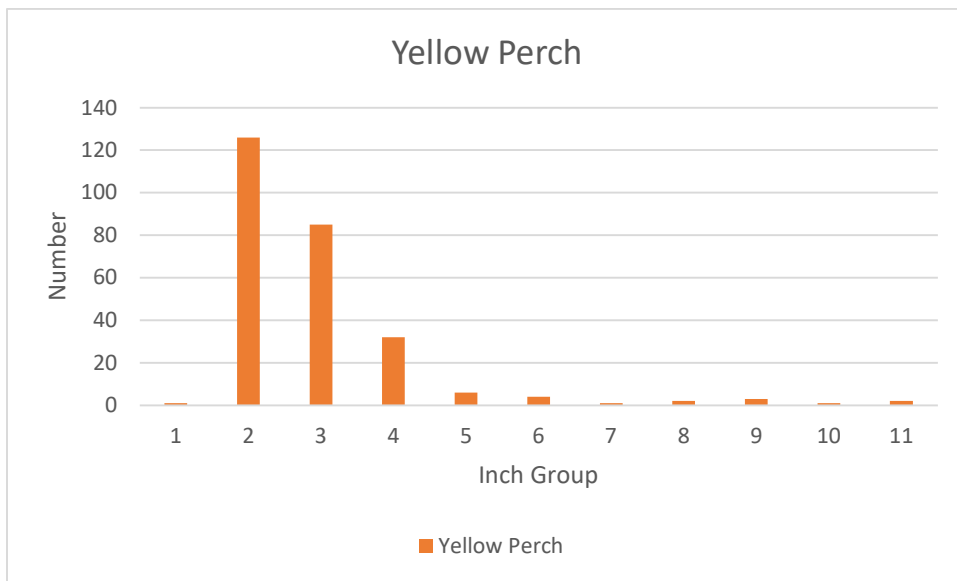


Figure 6. Length-frequency distribution of Yellow Perch captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County.

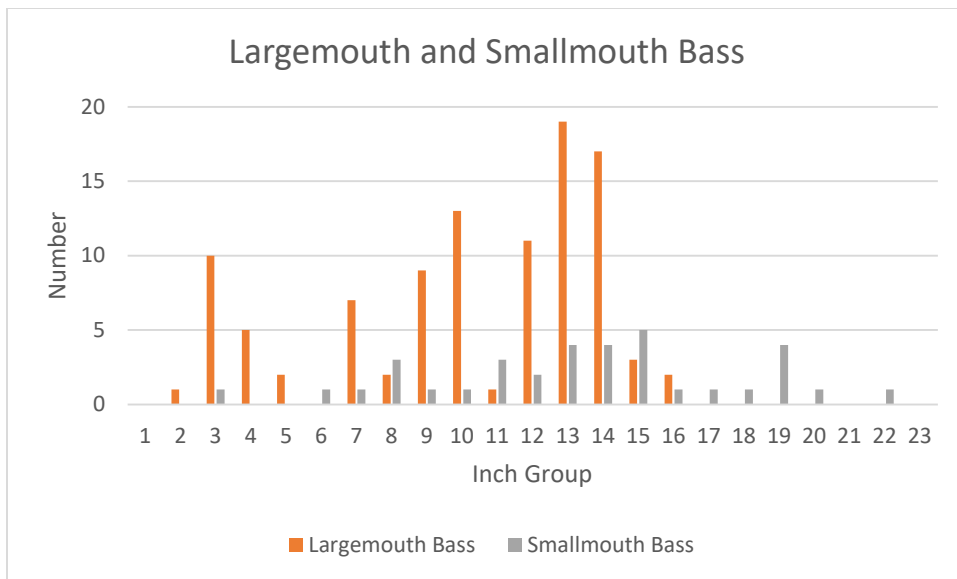


Figure 7. Length-frequency distribution of Largemouth and Smallmouth Bass captured during the June 2021 survey of Pickerel Lake, Emmet County.

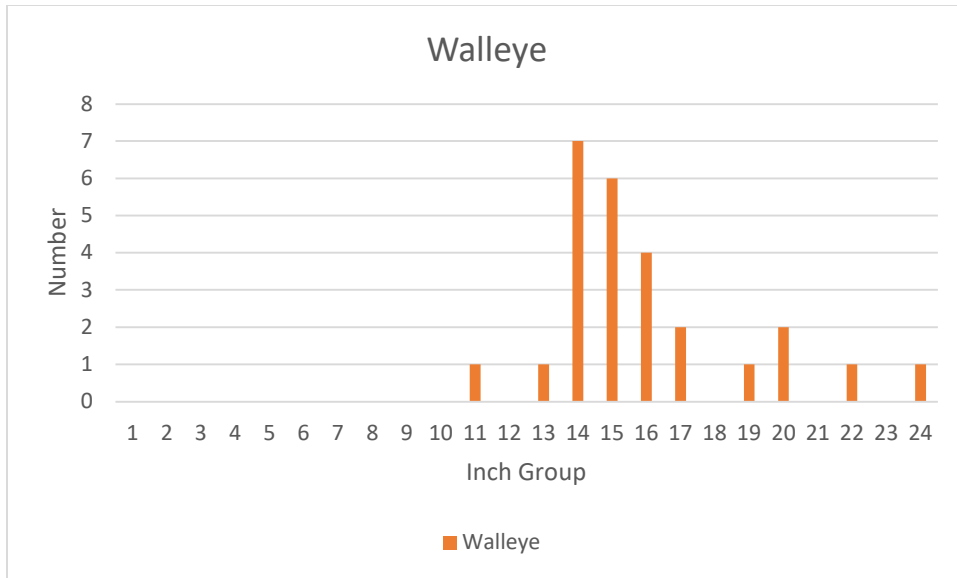


Figure 8. Length-frequency distribution of Walleye captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County.

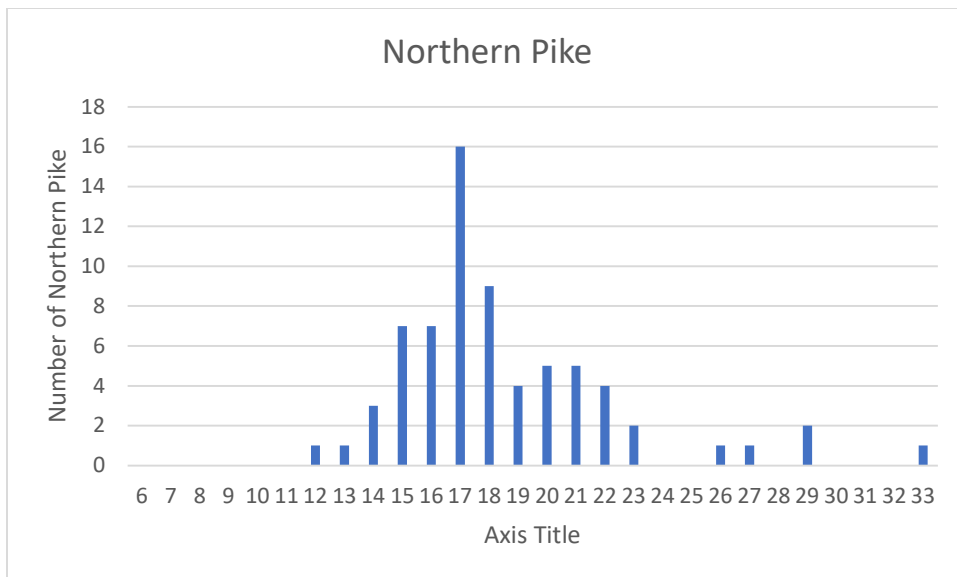


Figure 9. Length-frequency distribution of Northern Pike captured during the June 2021 Status and Trends survey of Pickerel Lake, Emmet County.



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