

Horseshoe Lake

Ogemaw County, T23N, R 01E, Section 2
Au Sable River watershed, last surveyed 2009

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Environment

Horseshoe Lake is a 37-acre lake in Foster Township, Ogemaw County. Maximum depth is approximately 20 feet, although about 85% of the lake is less than 15 feet deep. A 1967 hydrological map showed a depth of 32 feet; however, MDNR personnel found depths of only 20 feet in 1990, 1994, and 2016 observations. Horseshoe Lake is spring fed with no inlets or outlets. Organic material/silt composes most of the bottom substrate, with some sand and a small pocket of marl nearshore on the southeast corner of the lake. Aquatic plants are very sparse in Horseshoe Lake, with minimal submerged vegetation. Potamogeton (pondweed), lily pads, bulrush, and Chara (muskgrass) have been observed, but no formal aquatic plant survey has been conducted. Also water chemistry data is lacking, in the fall of 1994 secchi disc depth was 14 feet, dissolved oxygen was 10.0 ppm at the surface and 9.2 ppm at the bottom (17 feet), and pH was 9.1 at the surface. There is one public boat launch on the southeast side of the lake.

Horseshoe Lake is within the Northern Lower Peninsula ecoregion (Eagle et al. 2005). This region was completely glaciated during the Late Wisconsinan period which resulted in diverse topography with extensive outwash plains and large moraines. The majority of soils are sands, loamy sands and sandy loams (Eagle et al. 2005), although there are also deposits of lacustrine clay. Soils of this region are typically well drained to excessively well-drained. Forest types in this ecoregion include northern hardwoods, early successional aspen, pine systems, and lowland conifers. The area immediately surrounding Horseshoe Lake is mainly forested, although there is some wetland habitat. Roughly half of Horseshoe Lake's shoreline is developed. The remainder is pine and maple forest, with some cattails.

History

Fish stocking was the earliest management action recorded for Horseshoe Lake. A variety of fish species were stocked from 1934-1941 including bluegill, yellow perch, walleye, smallmouth bass, and largemouth bass. Walleye failed to establish, likely due to a lack of spawning habitat, and have not been stocked since.

The first recorded fisheries survey occurred in June 1938. Bluegill and pumpkinseed sunfish were captured in gill nets, while bluntnose minnow, central mudminnow, and yellow perch were captured in a seine haul. Reports state that anglers were catching stocked walleye at this time.

A survey was conducted in August 1955 using gill nets which captured largemouth bass and yellow perch. Both were growing at rates better than the state average. Trap and fyke nets were used to survey the lake again in May 1962. Northern pike, largemouth bass, pumpkinseed sunfish, rock bass, and yellow perch were present and all found to have higher growth rates than the state average, aside from largemouth bass.

In June 1967, an electrofishing survey found the fish community to be comprised mostly of small yellow perch and largemouth bass. A 16-inch northern pike was the only fish captured greater than 12 inches and there was only one largemouth bass over 10 inches. No bluegills were sampled. Disappointed in the lack of quality fishing, local residents agreed to pay half the cost of a chemical reclamation of the fish community using rotenone in September 1967. Fisheries managers noted that this treatment was effective and obtained the desired fish kill. Rainbow trout, largemouth bass, and bluegill were stocked after the rotenone treatment was complete.

In August 1970, an electrofishing survey was conducted to assess the recovery of the fish community post-rotenone treatment and subsequent stocking efforts. Largemouth bass were found to be plentiful with the larger ones noted as being in great condition. Bluegills were rather low in abundance, which managers attributed to predation by largemouth bass and a lack of cover. Along with largemouth bass and bluegill, the electrofishing survey also collected smallmouth bass, brown bullhead, and golden shiners.

Rainbow trout were first stocked in 1967 and 1970. These stocking efforts were designed to provide an interim fishery while the warmwater fishery recovered. Retired rainbow trout broodstock from a hatchery were stocked in 1969 with hopes of thinning out the largemouth bass population; this was unsuccessful, as anglers harvested most of these fish before they were able to consume many small bass (MDNR Files, 1970). Local anglers targeted and harvested many rainbow trout and the stocking efforts continued from 1973-1978 (Table 1). Minimal, if any carryover from stocking events was seen from year to year. In 1979, no stocking occurred due to a hatchery shortage of rainbow trout. Angler demand for these rainbow trout was high, and stocking continued from 1980 through 1990 with the exception of 1989 (Table 1). After 1990, rainbow trout stocking was terminated on Horseshoe Lake because of low survival rates which were attributed to a lack of thermal habitat and the presence of large northern pike.

After complaints of poor fishing, an electrofishing survey was conducted in June 1979. The results of the survey supported what local anglers had reported: high numbers of small fish (Table 7). Hoping to improve the fishery, managers decided to perform a removal of undesirable fish. In 1981, fyke nets were used to remove all captured bluegill less than 6.5 inches and all pumpkinseed sunfish, rock bass, and white suckers. Crews removed over 1,400 bluegills, over 1,600 pumpkinseed, 121 rock bass, and 4 white suckers. The removal was done to reduce both inter- and intra-specific competition, with the intent of increasing growth rates of bluegill and other desired species.

A fisheries survey was completed in August 1990, using fyke and gill nets. Rainbow trout, northern pike, largemouth bass, yellow perch, bluegill, pumpkinseed sunfish, rock bass, and brown bullhead were sampled. Yellow perch were the most common species and exhibited a high size structure (Table 6). Bluegill and largemouth bass were also fairly common, though only one bluegill over 6 inches was sampled. Yellow perch, largemouth bass, and bluegill all had growth rates above the statewide average.

Since 1990, bluegills are the only fish that have been stocked. Recently, 350 spring fingerlings were stocked in July 2008 and 300 adults were stocked in July 2009 (Table 2). These fish were stocked by a private hatchery and the stocking event was privately funded, presumably by lakeshore residents.

Current Status

Horseshoe Lake was last sampled May 25-28, 2009 using gill nets, trap nets, fyke nets, and a minnow seine. This survey was completed as part of the MDNR's Status and Trends Program. Sampling effort consisted of 2 experimental gill-net lifts, 9 fyke-net lifts, 3 trap-net lifts, and 2 shoreline seine hauls. Surface water temperature during the survey was 61 degrees Fahrenheit.

In total, 211 fish were sampled during the 2009 survey. Species sampled were black crappie, bluegill, largemouth bass, northern pike, pumpkinseed sunfish, rock bass, and yellow perch. The 2009 survey was the first time any black crappies had been sampled in Horseshoe Lake. These fish were likely introduced into Horseshoe Lake by unapproved citizen stocking. The crappie population had poor size structure (Table 6), with 96% of fish sampled being 7.5 inches or smaller, although one large (13.8 inch) individual was sampled. Bluegills were the second most common panfish species, but remain small in Horseshoe Lake. No bluegills sampled were greater than 6.1 inches and 98% were less than 6 inches (Table 6). No bluegills sampled were older than age 4. Private stocking efforts have not seemed to improve bluegill abundance or size structure. Pumpkinseed sunfish were the most common panfish species and had a better size structure than bluegill, with fish ranging from 2.8 to 8.9 inches. Recruitment seems consistent as sampled pumpkinseed represented all age-classes from age 1 through age 10 (Table 5). Rock bass were also sampled, ranging from 4.2-7.5 inches. Both rock bass and pumpkinseed sunfish were found to be growing at rates below the state average.

Largemouth bass were the most common fish, with 51 sampled during this survey. Largemouth bass ranged in size from 2.7-18.4 inches, with about 12% being above the legal harvest length of 14 inches. The number of harvestable largemouth bass may be biased low, as larger bass are often net-shy and no electrofishing was conducted for this survey. Recruitment seems consistent, as fish from all year classes age 2 through age 11 were found, along with two age-13 largemouth as well (Table 5). Largemouth bass are growing at a rate much slower than the state average. As largemouth bass increase in size, their diet shifts mainly to other fishes (Keast 1979). This could explain why largemouth bass growth rates drop further below state average as length increases in Horseshoe Lake. Although low in numbers, the northern pike population in Horseshoe Lake has a high size structure. Of 8 fish sampled, 2 were over 30 inches and 4 were above the legal harvest length of 24 inches.

Yellow perch made up a smaller proportion of the total catch than what has historically been found in this lake. Only three were found, making up less than 2% of the catch compared to the 216 perch that made up about 55% of the total catch in the 1990 survey.

Analysis and Discussion

The Horseshoe Lake fish community currently consists mainly of largemouth bass, bluegill, and pumpkinseed sunfish, with some black crappie, northern pike, and yellow perch. The forage base in Horseshoe Lake consists of bluntnose minnows, central mudminnows, and white suckers, along with limited numbers of younger black crappie, yellow perch, and bluegill.

Largemouth bass are currently the most common species and the main predator in Horseshoe Lake. Largemouth bass are abundant but have poor size structure, with growth rates that are much slower than the state average. Density-dependent growth seems to be evident and the overabundance of

largemouth bass is likely the reason for the low abundance in bluegill, resulting in a lack of forage and extremely slow growth rates in bass.

Northern pike are the second most abundant predator in Horseshoe Lake. Although their abundance is still relatively low, northern pike appear to be more abundant than in historical records. Northern pike size structure is good, with 50% of the sampled fish being greater than the legal harvest length of 24 inches. Similar to largemouth bass, northern pike growth rates were slower than the state average, likely due to a lack of an ample forage base.

The Horseshoe Lake panfish community is fairly diverse, with pumpkinseed sunfish being the most common, followed by bluegill, rock bass, black crappie, and yellow perch. Bluegill and yellow perch numbers are down from historical records and both are growing at rates below the state average. The 2009 survey was the only time that black crappie have been found in Horseshoe Lake, so future surveys will indicate how (if at all) this population will persist. Yellow perch densities have decreased dramatically from past records (Table 6). No yellow perch younger than age 4 were sampled, indicating a possible lack of recruitment. Yellow perch generally spawn on macrophytes and submerged brush (Robillard and Marsden, 1999), which are sparse in Horseshoe Lake. Possible reasons for a decline in recruitment could be removal of macrophytes, removal of submerged timber, high predation on juveniles, and/or poor abiotic conditions.

Management Direction

Overall, Horseshoe Lake currently has abundant predators and inadequate forage. This imbalance is likely a product of sparse aquatic vegetation and woody debris, but low productivity is also a factor. What little vegetation and submerged brush/timber exists in Horseshoe Lake should be protected, as habitat complexity is minimal and it is habitat for both fish and invertebrates. Aquatic plant and woody debris removal leaves the forage community with reduced cover and yellow perch spawning habitat. Along with protecting the existing vegetation and brush, habitat additions may be beneficial for Horseshoe Lake, providing cover and spawning habitat.

Currently, Horseshoe Lake is governed by state-wide fishing regulations. While the 14-inch minimum length limit on largemouth bass is appropriate for most lakes, this allows for minimal harvest on Horseshoe Lake. Largemouth bass are highly abundant and are likely limiting bluegill abundance and recruitment. A regulation change allowing for an increased harvest of smaller largemouth bass may be beneficial for this lake. In order for such a regulation to work, anglers must be willing to harvest smaller largemouth bass. Ideally, this would decrease the density of largemouth bass, balance the predator to prey ratio, increase largemouth bass growth rates, and allow for an increase in panfish recruitment and abundance.

In the past, local residents have inquired about ways to help their lake. One possibility would be a citizen-run or postcard creel survey. This information would help fisheries managers gauge harvest and know how the regulations are affecting the fish community. For example, it would be beneficial to know if angler harvest is contributing to poor size structure of bluegill. Additionally, residents could be encouraged to construct habitat structures. These structures could potentially increase panfish recruitment and survival as coarse woody habitat has been shown to provide refuge and decrease the encounter rate between predators and prey. (Anderson 1984). Regardless of any possible regulation changes, Horseshoe Lake should be sampled by 2025 to monitor any changes in the fish community,

especially regarding the introduction of black crappie and the recent decrease in yellow perch abundance. Also, a limnological survey should be conducted, as there is minimal information on the dissolved oxygen, hardness, alkalinity, and other limnological features of the lake. An aquatic plant inventory should be taken, as this has not been conducted on this lake. Fish stocking is not recommended for Horseshoe Lake at this time.

References

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Table 1. Rainbow trout stocking history in Horseshoe Lake (Ogemaw County).

Year	Strain	Number	Avg. Size (in)
1967	-	4000	Adult
1968	-	0	
1969	-	0	
1970	-	690	Adult
1971	-	0	
1972	-	0	
1973	-	1010	Yearling
1974	-	1000	Yearling
1975	-	1050	Yearling
1976	-	1000	Yearling
1977	-	1100	Yearling
1978	-	1000	Yearling
1979	-	0	
1980	-	1000	9.21
1981	Harrietta	1000	7.76
1982	Harrietta	1000	6.77
1983	Harrietta	1000	7.09
1984	Shasta	750	7.05
1985	Shasta	1000	7.17
1986	Shasta	1000	7.48
1987	Shasta	1100	7.32
1988	Shasta	1000	5.87
1989	-		
1990	Shasta	1000	6.73

Table 2. Private bluegill stocking in Horseshoe Lake (Ogemaw County).

Year	Number	Avg. Size (in)
2008	351	3.50
2009	300	6.00

Table 3. Water temperature profile from Horseshoe Lake (Ogemaw County), August 29, 1990.

Depth (ft)	Temp (F)
S	72
3	70
5	70
7	70
9	70
11	67
13	67
15	67
17	65

Table 4. Total catch from May, 2009 Status and Trends Survey on Horseshoe Lake (Ogemaw County). Growth is relative to state of Michigan average.

Species	Number	Length Range (in)	Weight (lbs)	Growth
Black Crappie	23	5-13.8	5	-
Bluegill	41	2.2-6.1	38.8	Below Average
Largemouth Bass	51	2.7-18.4	44.4	Below Average
Northern Pike	8	19.8-35.5	37.7	-
Yellow Perch	3	7.2-9.4	0.9	-
Pumpkinseed Sunfish	55	2.8-8.9	16.1	Below Average
Rock Bass	30	4.2-7.5	6.9	Below Average
TOTAL	211		149.8	

Table 5. Mean length at age of various fishes sampled from 1967-2009. Number in parenthesis is number of fish aged.

Species	Age	1967 (June)	1979 (July)	1981 (May)	1990 (August)	2009 (May)
Pumpkinseed Sunfish	I	2.9 (1)	2.3 (10)		3.6 (4)	2.8 (1)
	II	4.2 (2)	3.7 (5)	3.5 (19)	5.2 (3)	3.26 (9)
	III	4.8 (2)	4.8 (17)	5.1 (12)	5.9 (3)	4.65 (16)
	IV	6.1 (3)	5.9 (14)	6.0 (5)	7.0 (3)	5.33 (7)
	V	7.1 (1)		6.7 (15)	7.1 (4)	6.14 (5)
	VI	7.9 (1)		7.0 (1)		6.14 (2)
	VII	7.7 (2)				7.23 (3)
	VIII					7.68 (4)
	IX					7.85 (6)
	X					8.65 (2)
Yellow Perch	I	2.9 (1)	3.7 (7)			
	II	3.1 (3)	5.2 (1)	5.7 (2)		
	III			7.6 (33)	9.2 (5)	
	IV	5.3 (2)		10.5 (15)	9.4 (2)	7.2 (1)
	V	6.2 (3)			10.1 (12)	
	VI		11.2 (1)		11.2 (14)	9.2 (1)
	VII				12.0 (5)	9.4 (1)
	VIII					
Largemouth Bass	I	4.3 (2)	3.8 (8)	4.0 (3)		
	II	6.6 (3)	7.5 (3)	6.2 (29)	11.4 (18)	5.7 (4)
	III	9.0 (5)	9.5 (3)	8.7 (23)	11.5 (7)	7.40 (4)
	IV	10.6 (2)	13.7 (1)	11.0 (16)	13.0 (1)	8.38 (6)
	V			13.0 (1)	15.4 (2)	10.11 (7)
	VI		14.6 (1)	15.5 (2)	16.2 (2)	11.5 (12)
	VII			17.5 (2)		12.25 (4)
	VIII				19.2 (1)	13.3 (2)
	IX					13.46 (5)
	X					14.6 (2)
	XI					16.05 (2)
	XII					
	XIII					18.35 (2)
Bluegill	I		2.4 (3)		4.1 (16)	2.9 (1)
	II		3.5 (11)	3.5 (26)	5.8 (2)	

	III		4.6 (14)	5.0 (6)	6.6 (3)	
	IV		5.7 (26)	6.0 (6)	7.5 (1)	4.2 (10)
	V		7.0 (1)	7.1 (29)		
	VI					
	VII					
	VIII					
Northern Pike	I	16.2 (1)				
	II					
	III					19.8 (1)
	IV					
	V				27.0 (1)	22.75 (2)
	VI				33.5 (1)	23.2 (1)
	VII					28.3 (1)
	VIII					29.7 (1)
	IX					30.3 (1)
	X					
	XI					35.5 (1)
	XII					
Rock Bass	I		3.8 (1)	1.9 (1)	3.8 (8)	
	II	4.1 (3)		3.7 (18)	5.9 (7)	
	III	6.3 (2)	6.1 (3)	6.3 (15)	6.9 (5)	4.5 (4)
	IV		6.9 (1)		7.4 (7)	5.25 (9)
	V				7.9 (3)	5.81 (8)
	VI					6.37 (6)
	VII					7.07 (3)
Black Crappie	I					
	II					5.67 (9)
	III					6.59 (11)
	IV					7.3 (2)
	V					
	VI					
	VII					
	VIII					
	IX					
	X					
	XI					13.8 (1)

Table 6. Size structure of largemouth bass, bluegill, yellow perch, and black crappie sampled in Horseshoe Lake (Ogemaw County) in 1990 and 2009.

Length (in)	Largemouth Bass		Bluegill		Yellow Perch		Northern Pike		Black Crappie
	1990	2009	1990	2009	1990	2009	1990	2009	2009
1	1								
2	1	1	57	10	11				
3			21	9	2				
4			12	10					
5		2	1	11					7
6		3	4	1					11
7		4	1			1			4
8		3			3				
9	2	5			54	2			
10	2	6			97				
11	15	6			45				1
12	6	8			4				
13	2	7							
14		2							
15	2								
16	2	2							
17									
18		2							
19	1							1	
20									
21									
22								1	
23								2	
24									
25							1		
26									
27									
28								1	
29								1	
30								1	
31							1		
32									
33									
34									
35								1	
Sum	34	51	96	41	216	3	2	8	23

Table 7. Size structure of bluegill, largemouth bass, pumpkinseed sunfish, yellow perch, and rock bass as sampled in 1979 electrofishing survey on Horseshoe Lake (Ogemaw County). *Inch classes are 2-inch length bins. The 2-inch length bin indicates fish from 1-2.9 inches.

Inch Class*	Bluegill	Largemouth Bass	Pumpkinseed Sunfish	Yellow Perch	Rock Bass
2	3		15	4	
4	94	8	36	5	
6	52	1	46	1	5
8	1	2			
10		2			
12				1	
14		2			

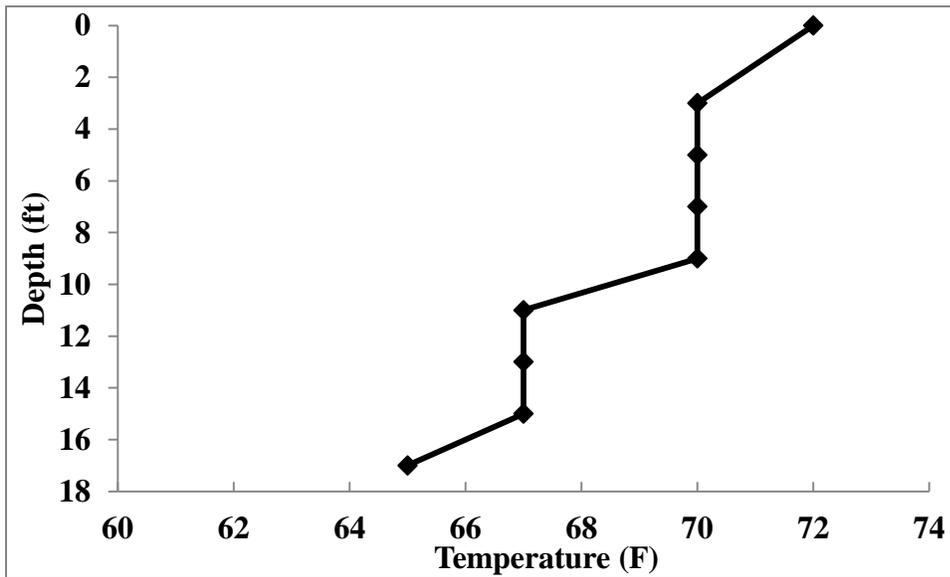


Figure 1. Temperature profile of Horseshoe Lake (Ogemaw County) taken on August 29, 1990.

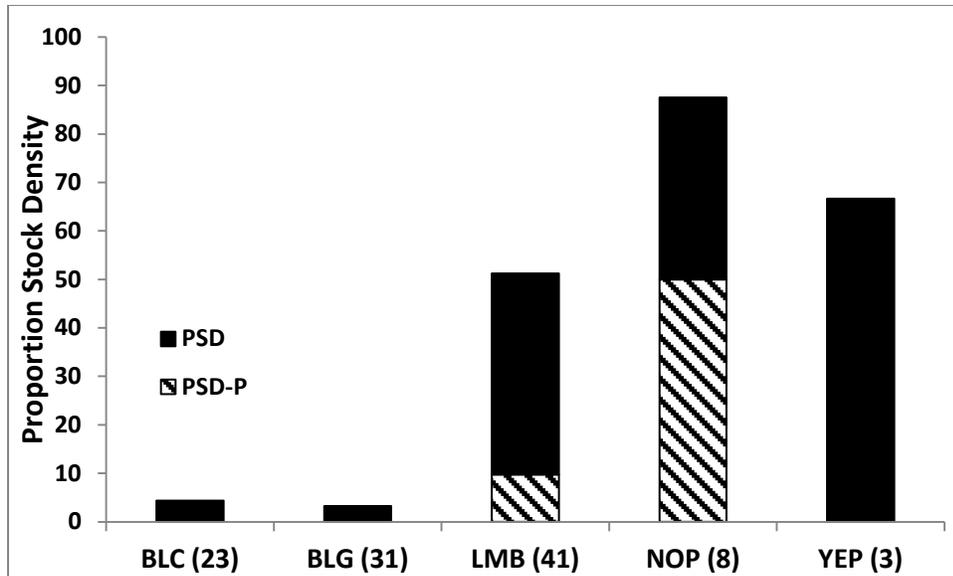


Figure 2. Percent size distribution of black crappie, bluegill, largemouth bass, northern pike, and yellow perch sampled in May 2009 survey of Horseshoe Lake, Ogemaw County. Number in parenthesis is number of stock-length fish.