

## CORRESPONDENCE/MEMORANDUM

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TO: Mike Donofrio  
Horseshoe Lake File

FROM: Steve Hogler  
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SUBJECT: 2014 Horseshoe lake Spring Electroshocking Survey

**Lake Background:**

Horseshoe Lake is a 22 acre, 54 feet deep hard water seepage lake located in southeastern Manitowoc County. The lake has a narrow littoral zone that drops off sharply and a muck bottom. Water clarity is good and the lake rates as mesotrophic using most standard metrics. Past issues include algae blooms and major fish kills as recently as the mid-1960's caused by polluted runoff. Stocking has been utilized since 1934 to manage the fishery. Most of the early stocking history (1934-1950) included stocking Largemouth Bass, Bluegill and Black Crappie. Since 1950, the lake has been managed as a two story lake with Brown or Rainbow Trout stocking although after the last major fish kill in 1964. Largemouth Bass and Bluegill were stocked for several years to rebuild the warm water community. Today, the lake continues to be managed as a two story lake with annual Trout stocking that produces a very popular ice fishery. During open water months, anglers target Largemouth Bass and Bluegill.

**Fish Survey History:**

Fish surveys have been conducted on the lake since the early 1960's. Surveys from the 1960's found good survival of stocked Trout and excellent populations of Largemouth Bass and Bluegill. Other species found in these surveys included Black Crappie, Pumpkinseed, White Sucker and a diverse mixture of forage minnows. Surveys in the 1970's had similar results with Bass, Bluegill and Trout dominating the catch. Some change was observed in the 1980's when surveys noted declines in Bass numbers and increasing numbers of Bluegill and Black Crappie. In 2003, Horseshoe Lake had a limited fish kill of Bluegill caused by Columnaris, a bacterium found in the soil. Since many Bass and Bluegill were observed swimming during this investigation, it was believed the kill was minor. The last fish survey of Horseshoe Lake was a fall electroshocking survey in 1981.

**2014 Survey Results:**

The entire 1.27 mile shoreline of Horseshoe Lake was electroshocked in 62 minutes on the night of June 2 using pulsed DC current. An attempt to net all fish was made and all captured fish were measured to the nearest 1 mm. Scales were collected from Bluegill and a dorsal spine and scales were collected from Largemouth Bass at the rate of 10 per centimeter group for age analysis.

During the 62 minutes of shocking, 230 individual fish representing eight species were captured (Table 1). Total catch per effort (CPE) was 223.3 fish per hour shocked or 181.1 per mile shocked. Bluegill and Largemouth Bass dominated the catch with substantially fewer individuals of other species captured. CPE for Largemouth Bass was 52.4/hour or 42.5/mile shocked. Bluegill, the most abundant species, had a CPE of 141.7 per hour or 114.9 per mile shocked.

**Table 1. The species captured and Catch per Effort (CPE) for fish captured by electroshocking on June 2, 2014 from Horseshoe Lake.**

Species	Number	CPE (Fish/Mile)	CPE (Fish/Hour)
Northern Pike	1	0.8	1.0
Golden Shiner	2	1.6	1.9
White Sucker	4	3.1	3.9
Yellow Bullhead	4	3.1	3.9
Green Sunfish	1	0.8	1.0
Bluegill	146	114.9	141.7
Largemouth Bass	54	42.5	52.4
Black Crappie	18	14.2	17.5
Total	230	181.1	223.3

**Gamefish:**

Largemouth Bass were the dominant gamefish captured during electroshocking. During the 62 minutes of shocking, we captured 54 Largemouth Bass that ranged in length from 130 mm to 524 mm and had an average length of 156 mm (Table 2). Only three (5.6%) of the Bass captured were greater than the 356 mm (14”) minimum size limit for angler harvest and two (3.7%) were greater than 457 mm (18”) in length.

When spine and scale samples were examined to estimate age, age classes from age 2 through age 6, age 11 and age 12 were detected in our collected sample (Table 3). Age 3 was the most common age class in our aged sample followed by age 2 and age 4. In Horseshoe Lake based on our age sample, it takes a Largemouth Bass six years to reach the 356 mm (14”) minimum size limit at which an angler could harvest a bass.

The growth of Largemouth Bass in Horseshoe Lake appears to be average based on our sample with younger bass having a length at each age close to state average length at age through age 5 (Table 4). However, length at age for bass greater than age 5 indicate slower than state average growth, but should be viewed cautiously because of small sample sizes of older bass.

During this survey, we also caught one Northern Pike that was 540 mm in length.

**Panfish:**

Bluegill were the dominant panfish and the most abundant species that we captured during this survey. The 146 Bluegill that we captured ranged in length from 56 mm to 227 mm and had an average length of 156 mm (Table 2). Most of the Bluegill were clustered in length from 160 mm to 210 mm with 89 of 146 (61.0%) greater than 152 mm (6”) in length and 23 of 146 (15.8%) greater than 203 mm (8”) in length.

When scales were aged, ages 1 through 6 and age 8 were detected in our sample (Table 5). Age 3 was the most common age for Bluegill followed by age 4 and age 2 fish. On average in Horseshoe Lake, it takes a bluegill three years to reach 152 mm (6”) and five years to reach 203 mm (8”).

In Horseshoe Lake, based on this sample, Bluegill are longer at each age than an average Bluegill from across the state. This is indicative of good growth for Bluegill in Horseshoe Lake.

**Table 2. The length distribution and number of fish captured during June 2, 2014 electroshocking on Horseshoe Lake.**

Length (mm)	Bluegill	Black Crappie	Largemouth Bass	Northern Pike
50	1			
60	3			
70	4			
80	4			
90	5			
100	8			
110	13			
120	5			
130	6	1	2	
140	8		1	
150	5		3	
160	15	1	1	
170	16			
180	16		2	
190	14	3	4	
200	10	6	5	
210	10	7	6	
220	3		2	
230			2	
240			3	
250			2	
260			2	
270			4	
280				
290			3	
300			1	
310			2	
320				
330			2	
340			2	
350			2	
360				
370			1	
380				
390				
400				
410				
420				
430				
440				
450				
460				
470				
480				
490				
500			1	
510				
520			1	
530				
540				1
550				
Number	146	18	54	1
Ave. Length	156	200	251	540
S.D.	42.6	20.2	79.9	--

**Table 3. The age distribution of Largemouth Bass captured from Horseshoe Lake in 2014 during June electroshocking.**

Length (mm)	Number	Age											
		Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
100													
110													
120													
130	2		2										
140	1		1										
150	3		3										
160	1		1										
170													
180	2		2										
190	4		1	3									
200	5		1	4									
210	6		1	5									
220	2			2									
230	2			2									
240	3			3									
250	2			2									
260	2			2									
270	4				4								
280													
290	3				3								
300	1				1								
310	2				1	1							
320													
330	2					2							
340	2					2							
350	2						2						
360													
370	1						1						
380													
390													
400													
410													
420													
430													
440													
450													
460													
470													
480													
490													
500	1											1	
510													
520	1												1
530													
540													
550													
Sum	54	0	12	23	9	5	3	0	0	0	0	1	1
Ave. Length	251		169	224	288	334	360					500	524
S.D.	79.9		26.5	21.5	16.7	11.9	13.7					--	--

**Table 4. The average length at age for Largemouth Bass and Bluegill captured in Horseshoe Lake during spring electroshocking in 2014 as compared to statewide average length ( ) at age for each species.**

Age	Largemouth Bass	Bluegill
1	-- (97)	63 (64)
2	169 (165)	105 (97)
3	224 (229)	159 (122)
4	288 (290)	183 (147)
5	334 (338)	207 (167)
6	360 (383)	205 (183)
7	-- (414)	-- (196)
8	-- (447)	225 (208)
9	-- (470)	--

**Table 5. The age distribution of Bluegill captured from Horseshoe Lake in 2014 during June electroshocking.**

Length (mm)	Number	Age							
		1	2	3	4	5	6	7	8
50	1	1							
60	3	3							
70	4		4						
80	4		4						
90	5		5						
100	8		8						
110	13		9	4					
120	5		1	4					
130	6			6					
140	8			6	2				
150	5			3	2				
160	15			13	2				
170	16			10	6				
180	16			5	10		1		
190	14			3	8	3			
200	10				4	6			
210	10				1	7	2		
220	3					1			2
230									
240									
250									
Total	146	4	31	54	35	17	3	0	2
Ave. Length	156	63	105	159	183	207	205		225
S.D.	42.6	5.5	12.5	21.5	17.2	7.0	18.2		3.5

Other species captured during this survey included Black Crappie, Green Sunfish, Golden Shiner, Yellow Bullhead and White Sucker (Table 1). We captured eighteen Black Crappie averaging 200 mm in length (Table 2). Scale samples were collected from these fish and ages 2 through 4 were in the analyzed sample. Most of the fish were age 3. Based on the limited number of scale samples we collected, growth of Black Crappie in Horseshoe Lake was average.

## Discussion and Conclusions:

### Gamefish

Similar to surveys conducted since the 1960's, results from the June 2014 survey indicate that Largemouth Bass continue to be the dominant warm water gamefish in Horseshoe Lake. The size structure of bass in the lake continues to decline with fewer legal size (14") Bass captured in 2014 than in previous surveys. Age samples indicate that most Bass are less than five years old (Table 3) and growth is only average for young fish and declines with age (Table 4). The lack of older fish greater than the minimum size limit for harvest may indicate substantial harvest by anglers. Slower growth of the remaining larger fish may be indicative of limited forage of preferred sizes for larger Bass in the lake.

As in past surveys, other species of gamefish were captured in low abundance in 2014. We captured only one Northern Pike and did not observe either stocked Rainbow Trout or walleye which had been captured infrequently in the past. Since Rainbow Trout are stocked in late fall and there is likely substantial winter harvest based on angler reports, it appears that most Trout are harvested within six months of stocking with few carryovers to the next fishing season. Other gamefish are likely limited by the lack of appropriate spawning habitat.

### **Panfish**

Bluegill have been the most common panfish captured in surveys of Horseshoe Lake since the 1960's. In 2014, they were the most common fish captured which was similar to surveys conducted in the 1980's. Bluegill size distribution and age distribution was very good compared to other Manitowoc County lakes with more than 60% of Bluegill lengths greater than 150 mm (6") and year classes through age 6 and age 8 represented in our sample. Growth of Bluegill at all ages was at or above the state averages and likely indicates that forage levels are sufficient for the number of Bluegill in the lake (Table 4). Black Crappie are still present in the lake but appear to have declined in abundance over time and have average growth. Their age distribution indicates that a single strong year class dominates their population which is typical for Crappie in Manitowoc County lakes.

### **Other Species**

The capture of a few Yellow Bullhead and White Sucker is typical for surveys conducted on Horseshoe Lake (Table 1). Most likely many more of these species are present in the lake, but not vulnerable to our electroshocking gear.

In general, there has been little change to the fish community of Horseshoe Lake since the late 1960's following the major winter kill in the winter of 1964-65. Surveys have documented that Largemouth Bass continues to be the dominant gamefish and Bluegill is the most common panfish. Two story lake management continues to be successful with stocked Rainbow Trout providing a popular winter fishing opportunity for anglers. Despite the apparent stability of the fish community, the decline in abundance of Largemouth Bass since the 1980's despite the more conservative harvest regulations instituted in the 1990's and the slowing growth rates may indicate harvest and forage issues for Bass in Horseshoe Lake. I do not recommend any changes to the fishing regulations for this lake but upcoming surveys should continue to monitor Bass population trends.