

Harpt Lake 2019 Comprehensive Fish Survey Report  
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ABSTRACT

Harpt Lake (WBIC-84600) is located in Manitowoc County approximately 5 miles southeast of the Village of Denmark. The lake has a surface acreage of 31 acres, a small littoral zone and a maximum depth of 54 feet. Harpt Lake is lightly developed with low-density year-round residences and lies in a 773 acre watershed that is mostly agricultural. Poor water quality, high turbidity and algae blooms have been an issue on the lake since the mid-1960's. Fish Management has been involved on Harpt Lake since 1933 when the first Walleye were stocked. Stockings of various species have continued through 2019 by DNR and the Larrabee Sportsmen's Club.

Fisheries surveys have been conducted on the lake since 1950. Surveys in the 1950's and 1960's found a lake dominated by Walleye and Yellow Perch. Other panfish were less numerous but had good size. In the 1970's, surveys found fewer gamefish and increasing numbers of panfish that were smaller in size than in previous surveys. By the 1980's, small panfish, mainly Yellow Perch and Bluegill so dominated in the lake that removal efforts were undertaken. Since the late 1980's, Walleye numbers had dropped sharply with limited recruitment while Largemouth Bass numbers increased. The trend in a shift in the fish community from Walleye-Yellow Perch to Bass-Bluegill continued in the early 2000's with Bass and Bluegill dominating the survey catch. During that time period, panfish numbers had stabilized, but fish were still small in size.

During 2019 surveys, a total of 2,820 individual fish were captured with use of fyke nets and electroshocking gear. Overall, Largemouth Bass was the dominant gamefish that was captured during the 2019 survey. Walleye were caught in higher frequency in 2019 than during previous surveys and Northern Pike were only captured in low number. Bluegill continue to be the most abundant panfish species in Harpt Lake. Unlike earlier surveys this survey found reduced numbers of Bluegill with a size structure skewed toward larger fish. Black Crappie, Pumpkinseed Sunfish and Yellow Perch were also captured during this survey, but in much lower abundances than Bluegill.

The fish community of Harpt Lake appears to be in good condition. Predators, including stocked Walleye are doing well and panfish numbers have decreased with an improved size structure. It is recommended to: evaluate WDNR Walleye stocking, implement recommendations from the Panfish Study, improve access, continue work with lake residents and sport clubs to improve habitat and implement other recommendations found in the Harpt Lake Management Plan.

## INTRODUCTION

Harpt Lake (WBIC-84600) is located in Manitowoc County approximately 5 miles southeast of the Village of Denmark (Figure 1). The lake has a surface acreage of 31 acres, a small littoral zone and a maximum depth of 54 feet (Figure 2). Most of the bottom is muck, with a few patches of rock mainly on the east side of the lake. Harpt Lake is lightly developed with low-density year-round residences and lies in a 773 acre watershed that is 68.5% agricultural (Manitowoc County Soil and Water Conservation Department 2003). Poor water quality, high turbidity and algae blooms have been an issue on the lake since the mid-1960's.



**Figure 1. Harpt Lake is located about 5 miles southeast of the Village of Denmark.**

The earliest Fish Management activity on Harpt Lake was stocking which commenced in 1933 with the stocking of 10,535 Walleye (Table 1). Early stockings consisted of Walleye or Largemouth Bass with Walleye dominating stocking since 1948. In addition to Walleye, more recent stockings by the Larrabee Sportsmen's Club have included Yellow Perch and Fathead Minnow. Various age fish have been stocked in to the lake including, fry, fingerling and adult transfer stockings. Recent Walleye stockings by DNR have been 2" small fingerling fish, while the club has stocked large fingerling Walleye that averaged 8" in length.

Fish surveys have been conducted on Harpt Lake since the 1950's. Early surveys found substantial Walleye populations that exhibited a good size structure and were self-reproducing (Wirth 1950, Wirth and Schultz 1958). Other gamefish, Largemouth Bass and Northern Pike were less abundant, but also were of good size structure. Panfish, chiefly Bluegill and Yellow Perch dominated the fishery. Although the Yellow Perch were considered small, Bluegill and other centrarchids had a good size structures with many fish larger than 8" encountered. Investigators indicated that water quality was good at the time of the surveys.

**Table 1. Fish stocking records for Harpt Lake since 1933. The ages of stocked fish have included fry, fingerling (F), yearling (Y) and adult transfers. Lengths are reported in inches.**

Lake	Year	Species	Age	Number	Length (in)	Source
Harpt Lake	1933	Walleye	F	10,535		
Harpt Lake	1934	Largemouth Bass	F	392		
Harpt Lake	1935	Largemouth Bass	F	480		
Harpt Lake	1940	Walleye	Fry	1,000,000		
Harpt Lake	1941	Walleye	Fry	800,000		
Harpt Lake	1944	Walleye	Fry	500,000		
Harpt Lake	1948	Largemouth Bass	F	500		
Harpt Lake	1948	Walleye	Fry	1,000,000		
Harpt Lake	1972	Walleye	Y	100	9	FEDERAL HATCHERY
Harpt Lake	1972	Walleye	F	150	9	FEDERAL HATCHERY
Harpt Lake	1975	Walleye	Y	50	-	FEDERAL HATCHERY
Harpt Lake	1975	Walleye	F	1,500	5	DNR COOP PONDS
Harpt Lake	1978	Walleye	F	50	9	FEDERAL HATCHERY
Harpt Lake	1980	Walleye	Fry	50,000	-	DNR HATCHERY
Harpt Lake	1982	Walleye	F	1,500	3	DNR COOP PONDS
Harpt Lake	1984	Walleye	F	1,500	3	DNR COOP PONDS
Harpt Lake	1985	Walleye	F	1,500	4	DNR COOP PONDS
Harpt Lake	1989	Walleye	Fry	1,500	3	DNR COOP PONDS
Harpt Lake	1989	Walleye	Y	512	6	FIELD TRANSFER
Harpt Lake	1992	Walleye	F	1,599	3	DNR COOP PONDS
Harpt Lake	1994	Walleye	F	740	2.5	DNR COOP PONDS
Harpt Lake	1995	Walleye	F	780	2.8	DNR COOP PONDS
Harpt Lake	1997	Walleye	F	775	2.7	DNR PONDS
Harpt Lake	1999	Walleye	Fry	50,000	-	DNR HATCHERY
Harpt Lake	1999	Walleye	Y	1,000	-	PRIVATE HATCHERY
Harpt Lake	1999	Walleye	F	3,100	1.5	DNR HATCHERY
Harpt Lake	2001	Walleye	F	3,100	1.6	DNR PONDS
Harpt Lake	2003	Walleye	Y	1,020	6	PRIVATE HATCHERY
Harpt Lake	2003	Walleye	F	3,100	2.1	DNR PONDS
Harpt Lake	2004	Walleye	F	1,000	6	PRIVATE HATCHERY
Harpt Lake	2005	Walleye	F	1,525	1.4	DNR HATCHERY
Harpt Lake	2006	Walleye	F	1,240	5	PRIVATE HATCHERY
Harpt Lake	2011	Walleye	F	1,192	1.9	DNR HATCHERY
Harpt Lake	2012	Walleye	Y	1,500	7	PRIVATE HATCHERY
Harpt Lake	2013	Walleye	F	1,074	2	DNR PONDS
Harpt Lake	2014	Walleye	F	1,500	7	PRIVATE HATCHERY
Harpt Lake	2015	Yellow Perch	Y	2,800	5	PRIVATE HATCHERY
Harpt Lake	2015	Walleye	F	1,349	1.7	DNR HATCHERY
Harpt Lake	2016	Walleye	Y	1,500	8	PRIVATE HATCHERY
Harpt Lake	2016	Yellow Perch	Y	2,800	4	PRIVATE HATCHERY
Harpt Lake	2016	Fathead Minnow	Adult	-	1.5	PRIVATE HATCHERY
Harpt Lake	2017	Yellow Perch	Y	2,800	4	PRIVATE HATCHERY
Harpt Lake	2017	Walleye	F	1,126	1.7	DNR HATCHERY
Harpt Lake	2018	Fathead Minnow	Adult	-	2	PRIVATE HATCHERY
Harpt Lake	2018	Yellow Perch	Y	2,800	4	PRIVATE HATCHERY
Harpt Lake	2018	Walleye	F	1,500	8	PRIVATE HATCHERY
Harpt Lake	2019	Yellow Perch	Y	2,800	4	PRIVATE HATCHERY
Harpt Lake	2019	Walleye	F	1,995	1.9	DNR HATCHERY

Electroshocking surveys in the 1960's conducted by Schultz (1963, 1964 and 1967) continued to find healthy populations of Walleye, Largemouth Bass and Bluegill, but declines in the numbers and sizes Northern Pike, Yellow Perch and Black Crappie. He also noted a decline in water quality with increased turbidity, more frequent algal blooms and decreases in dissolved oxygen levels. In 1964, Schultz considered a copper sulfate chemical treatment to improve water quality, but recommended against it, because of the damage it would cause to the quality fishery of the lake.

Several demonstration fyke net surveys in the 1970's (Langhurst 1975 and Dodge 1976) caught very few gamefish of any species and numerous, small panfish. Captured panfish were less than 6" in length and were judged to be thin or having poor body condition.

Peeters conducted three surveys in the 1980's to assess fish populations in Harpt Lake. Electrofishing surveys in 1980 (Peeters 1980) and 1981 (Peeters 1981) found few gamefish, with Largemouth Bass dominating the gamefish community. He noted the lack of Walleye and Northern Pike reproduction during these surveys. Peeters indicated that panfish were numerous and small with Yellow Perch the most common fish species encountered. A fyke net survey in 1986 (Peeters 1986) found better number of Northern Pike and Walleye although small fish were rarely captured. Panfish, mainly Yellow Perch and Bluegill were numerous but small in size. To decrease panfish numbers and to improve size structures he used the fyke nets to capture and remove panfish, bullheads and rough fish. During removals, Peeters transferred 3,000 Yellow Perch to other nearby lakes and harvested 700 pounds of Bullheads, 150 pounds of Black Crappie, 100 pounds of Bluegill and 50 pounds of Carp and Suckers.

Hogler conducted the two most recent surveys of Harpt Lake. The 2003 electroshocking survey found that Largemouth Bass was the dominant gamefish fish captured during the survey (Hogler 2004). Walleye survival appeared to be poor, with very few Walleye caught despite nearly annual stocking by the DNR and the local sport club. Panfish were small, but good growth suggested that angler harvest may be responsible for the distribution of Bluegill lengths. Similarly, the 2012 survey (Hogler 2012) found that Bass dominated the gamefish community with no Walleye captured. Based on the comparison of historical data and the results from the two most recent surveys (2003 and 2012) Harpt Lake appeared to converting from a Walleye-Yellow Perch dominated lake to a Bass-Bluegill dominated lake despite nearly annual stockings of Walleye. Panfish in the lake continued to be small, but unlike past surveys the small size is due to young age, not slow growth. It was recommended to evaluate DNR Walleye Stocking and to encourage the Larrabee Club to focus on habitat projects such as rock reefs and fish sticks rather than solely stocking fish. Finally, Fisheries Staff should support and encourage landowners to follow the recommendations of the Lake Management Plan (Onterra 2012) which seeks to improve water quality in the lake by establishing buffers and reducing nutrient and sediment inputs into the lake.

The Larrabee Sportsmen's Club has been an active partner in managing the lake. Over the past decade the club has been instrumental in rerouting drainage away from the north end of the lake to help water quality, constructed several reefs and tree drops, and has sponsored a Comprehensive Lake Management Plan. The goals of this plan included: (1) Maintain Current Water Quality Conditions by encouraging the use of best management practices (BMP's) in the watershed and (2) monitor Eurasian Water Milfoil distribution in the lake and to prevent new aquatic invasive species (AIS) from entering the lake (Onterra 2012).

Harpt Lake, because of having small panfish with average growth rates was selected to be part of the Statewide Panfish Study. This study is evaluating if the panfish size structure can be improved by reducing panfish harvest bag limits to 5, 10 or 15 fish either yearly or

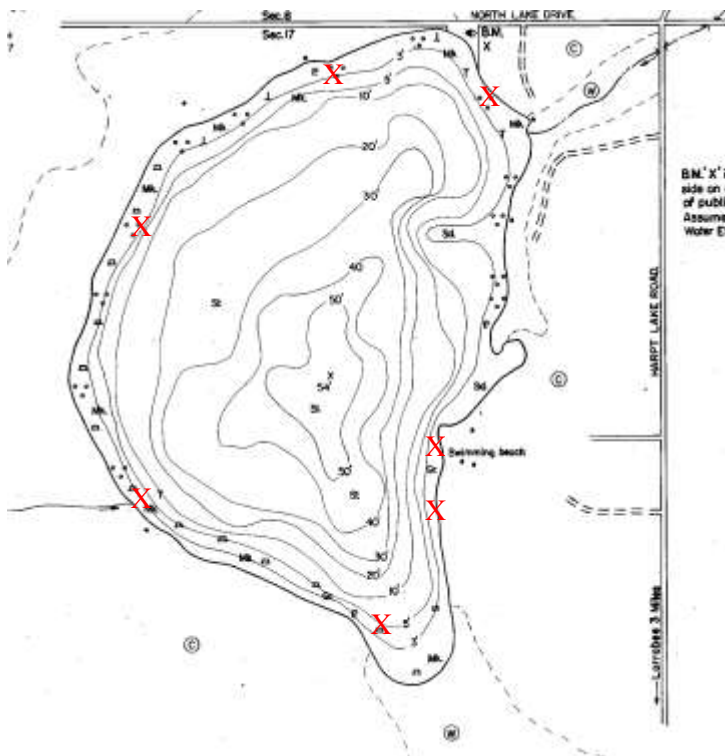
seasonally. For the duration of the study (2016-2024), panfish fishing regulations were temporally changed from the statewide regulation of 25 fish per day to 25 panfish per day but with not more than 10 per species may be kept from Harpt Lake. Commencing in 2019 for the next 3 years lakes in this study will be surveyed with length and age data collected from panfish. Following the data collection on individual lakes, lakes will be grouped by treatment and evaluated. A final report and recommendations on managing small panfish will be made by 2024.

In 2019, a comprehensive fish survey was conducted by DNR starting April. A combination of fyke nets and electroshocking surveys were performed to assess the fish community of Harpt Lake. This fish survey followed Statewide protocols for Tier 1 lake surveys.

## .METHODS

### Spring Fyke Netting

A standard comprehensive fisheries survey on Harpt Lake began in April and continued through May 2019. Seven fyke nets were set on April 15 and were lifted through April 23 (Figure 2). Fyke nets were set to capture and mark adult spring spawning Northern Pike, Walleye and Yellow Perch. Biological data was also collected from the other species that were captured in the nets. All fish were identified, measured, had spines, rays or scales removed from a sub-sample of fish for age determination and all gamefish and some panfish were marked with a caudal fin clip for use in calculating a population estimate.



**Figure 2. A morphometric map of Harpt Lake showing depth contours of the lake and the location of the public boat access on North Lake Drive. The red X's indicate the locations where fyke nets were set.**

## **Spring Electrofishing**

### **Recapture Run**

After the completion of fyke netting, on the night of April 29, the entire shoreline of Harpt Lake was electroshocked to look for marked fish. All fish were netted, identified, checked for marks and measured.

### **Centrarchid Electrofishing**

On the night of May 21, the entire shoreline was again electroshocked to estimate adult Largemouth Bass and panfish relative abundance. All fish were netted, identified, checked for marks and measured.

## **Statistical Analyses**

Basic fisheries statistics, such as average length, length frequencies by survey type, age distributions, and population estimates were calculated when possible. Mean length at age was determined first by using an age length key to extrapolate length age distributions from the sub-sample of fish that were aged to the full sample length frequency, then second calculating the arithmetic mean of the length for a given age from the estimated full sample age distribution.

Two methods were used to estimate population size, the Schnabel method that used data collected during a single survey to estimate population number and the Petersen method that uses results from two surveys to estimate population size. For both methods, population size was estimated as the ratio between the number of fish initially marked and released during the marking period (M), times the number of fish captured and examined for marks (C) during the recapture period, divided by the number of fish that were found to have marks during the recapture period (R) (Ricker 1975).

## **RESULTS**

### **Spring Fyke Netting**

Seven fyke nets were set in Harpt Lake on April 15<sup>rd</sup>, 2019 and fished until April 23<sup>rd</sup> when they were removed. The nets were lifted and emptied seven times during the eight days they were deployed for a total effort of 56 net nights. 2,475 individual fish were captured representing twelve species (Table 2). Total catch per effort (CPE) was 44.2 fish per net per night. Yellow Bullhead and Bluegill were the most abundant species caught, with lower numbers of other species captured. Largemouth Bass and Walleye were the most abundant gamefish species captured. CPE (fish/net/night) ranged from a high of 19.1 for Yellow Bullhead to 0.02 for Golden Shiner.

**Table 2. The fyke net catch summary for Harpt Lake. Seven nets were set and lifted between April 15 and April 23, 2019 with a total effort of 56 net-nights.**

Species	Number	CPE (fish/net-night)	Average Length	Length Range	Schnabel PE	PE Range
Northern Pike	68	1.2	479 mm (18.9")	246 mm-874 mm (9.7"- 34.4")	75	60-101
Common Carp	23	0.4	--	--		
Golden Shiner	1	0.02	--	--		
White Sucker	4	0.07	--	--		
Black Bullhead	11	0.2	236 mm (9.3")	161 mm-275 mm (6.3"-10.8")		
Yellow Bullhead	1,067	19.1	256 mm (10.1")	128 mm-367 mm (5.0-14.4")		
Pumpkinseed Sunfish	48	0.9	165 mm (6.5")	115 mm-194mm (4.5"-7.6")	73	48-117
Bluegill	903	16.1	188 mm (7.4")	92 mm-264 mm (3.6"-10.4")	3155	2,599-4,013
Largemouth Bass	140	2.5	330 mm (13.0")	180 mm-486 mm (7.1"-19.1")	546	339-929
Black Crappie	48	0.9	234 mm (9.2")	155 mm-307 mm (6.1"-9.2")		
Yellow Perch	31	0.6	188 mm (7.4")	134 mm-265 mm (5.3"-10.4")	46	28-82
Walleye	133	2.3	409 mm (16.1")	213 mm-562 mm (8.4"-22.1")	136	117-162
Total	2,475	44.2				

## Gamefish

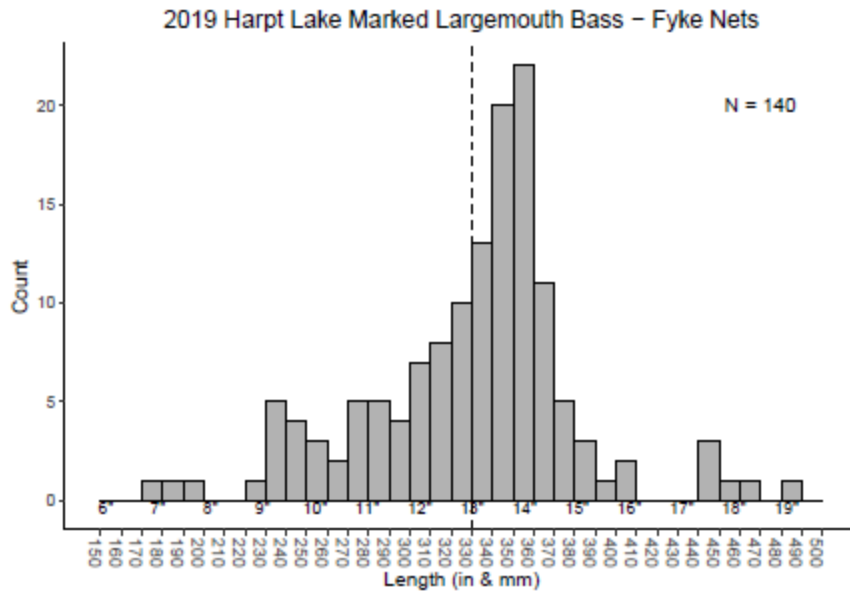
### Largemouth Bass

Largemouth Bass were the most common gamefish captured by fyke net. The 140 Bass ranged in length from 180 mm to 486 mm (7.1" to 19.1") and had an average length of 330 mm (13.0") (Table 2). Most of the captured Bass were between 250 mm (10") and 360 mm (14.2") with few small or larger Bass captured (Table 3). 37 of the 140 (26.4%) captured Bass were greater than the 14" (356 mm) minimum size limit for harvest, with 5.7% greater than 400 mm (16") and 2.1% greater than 450 mm (18") (Figure 3). The Schnabel population estimate for Bass was 546 or 17.6 adults per surface acre (Table 2). The 95% confidence interval range was 339 to 929.

**Table 3. The length distribution of gamefish captured by fyke net from Harpt Lake in April, 2019. Note the length scale breaks between 700 mm and 870 mm (28" and 34").**

Length (in) mm	Northern Pike	Largemouth Bass	Walleye
180		2	
190		1	
(8") 200			
210			2
220			
230		6	
240	1	4	
(10") 250		3	
260		2	1
270		4	
280		6	
290	1	3	
(12") 300	1	8	
310	2	6	
320		9	3
330	1	14	3
340	1	20	3
(14") 350	2	22	4
360		13	6
370		3	4
380	1	5	8
390		1	15
(16") 400	2	2	17
410			17
420	1		7
430	1		10
440	2	3	7
(18") 450	9	1	9
460	5	1	4
470	4		1
480	7	1	3
490	3		4
(20") 500	5		1
510	1		1
520	3		
530	4		
540			1
(22") 550	2		
560			1
570	1		
580	2		
590			
(24") 600			
610			
620			
630	1		
640	1		
(26") 650	1		
660			
670			
680			
690	1		
(28") 700			
870	1		
Total	67	140	133
Ave. Length	479 mm (18.9")	330 mm (13.0")	409 mm (16.1")
S.D.	98.1 mm (3.9")	51.9 mm (2.0")	51.5 mm (2.0")





**Figure 3. The length distribution of captured Largemouth Bass with fyke nets on Harpt Lake, April 2019. The vertical dashed line at 13 inches indicates average length.**

The second dorsal spine was removed from captured Bass for aging. The spine was cross-sectioned, mounted on a glass slide and viewed under a microscope to count annular rings. In our collected sample, Largemouth Bass ranged in age from age 1 through age 10 (Table 4). Age 4 Bass were the most common with other ages less common although ages 3 through 8 were all well represented. Few young or old Bass were captured during the survey.

When comparing growth, represented by length at age, Largemouth Bass in Harpt Lake were longer at each age through age 5 with older fish shorter than Bass from other lakes across the state (Table 5). Generally, based on age at length data, growth of Bass in Harpt Lake had growth rates similar to average Bass across the State.

**Table 4. The age distribution of age for Largemouth Bass in Harpt Lake that were collected throughout the survey using Bass captured during fyke netting and the two electroshocking runs during April and May, 2019.**

Length (in) mm	Sum	Age									
		1	2	3	4	5	6	7	8	9	10
(4") 100											
110	1	1									
120	1	1									
130											
140											
(6") 150	1			1							
160											
170	1		1								
180	4		3	1							
190	1		1								
(8") 200	2			2							
210	3			2	1						
220	3			3							
230	12			11	1						
240	10			8	2						
(10") 250	4			2	2						
260	6				6						
270	5				5						
280	9				9						
290	6				6						
(12") 300	16				8	8					
310	13				6	7					
320	15				5	5	4	1			
330	18					7	7	4			
340	23					3	7	10	3		
(14") 350	29					4	11	7	5	2	
360	14					2	3	4	5		
370	10						3	4	3		
380	6					1	2	1	2		
390	3						1		2		
(16") 400	4						1	3			
410											
420											
430											
440	2						1		1		
(18") 450	1									1	
460	1						1				
470											
480	1										1
490											
(20") 500											
Total	225	2	5	30	51	37	41	34	21	3	1
Ave. Length	316 mm (12.4")	116 mm (4.6")	185 mm (7.3")	231 mm (9.1")	287 mm (11.3")	328 mm (12.9")	357 mm (14.1")	357 mm (14.1")	367 mm (14.4")	387 mm (15.2")	486 mm (19.1")
SD.	59.3 mm (2.3")	7.8 mm (0.3")	7.7 mm (0.3")	20.0 mm (0.8")	25.9 mm (1.0")	20.6 mm (0.8")	29.5 mm (1.2")	21.0 mm (0.8")	23.1 mm (0.8")	55.2 mm (2.2")	--

**Table 5. Length at age for Largemouth Bass, Bluegill, Northern Pike and Walleye captured by fyke nets from Harpt Lake in 2019 compared to Statewide averages. Lengths are in mm and inches (). Age samples were collected from the fyke nets and the Largemouth Bass age samples were collected during spring netting and electroshocking.**

Largemouth Bass

Age	2019	Statewide Average
0		
1	116 mm (4.6")	97 mm (3.8")
2	185 mm (7.3")	165 mm (6.5")
3	231 mm (9.1")	229 mm (9.0")
4	287 mm (11.3")	290 mm (11.4")
5	328 mm (12.9")	338 mm (13.3")
6	357 mm (14.1")	384 mm (15.1")
7	357 mm (14.1")	414 mm (16.3")
8	368 mm (14.5")	447 mm (17.6")
9	387 mm (15.2")	470 mm (18.5")
10	486 mm (19.1")	485 mm (19.1")

Bluegill

Age	2019	Statewide Average
0		
1		64 mm (2.6")
2	88 mm (3.5")	97 mm (3.8")
3	132 mm (5.2")	122 mm (4.8")
4	179 mm (7.0")	147 mm (5.9")
5	214 mm (8.4")	167 mm (6.6")
6	235 mm (9.3")	183 mm (7.2")
7	242 mm (9.5")	196 mm (7.8")
8	252 mm (9.9")	208 mm (8.2")
9		

Northern Pike

Age	2019	Statewide Average
0		
1	327 mm (12.9")	356 mm (14.0")
2	429 mm (16.9")	406 mm (16.0")
3	490 mm (19.3")	470 mm (21.5")
4	532 mm (20.9")	546 mm (24.0")
5	532 mm (20.9")	610 mm (24.0")
6		650 mm (25.6")
7		706 mm (27.8")
8	874 mm (34.4")	762 mm (30.0")
9		787 mm (30.9")
10		
11		

Walleye

Age	2019	Statewide Average
1	215 mm (8.5")	152 mm (6")
2	265 mm (10.4")	254 mm (10")
3	347 mm (13.7")	324 mm (12.8")
4	390 mm (15.4")	381 mm (15.2")
5	418 mm (16.5")	432 mm (17")
6		457 mm (18")
7	461 mm (18.1")	497 mm (19.6")
8		526 mm (20.7")
9		551 mm (21.7")
10		
11		

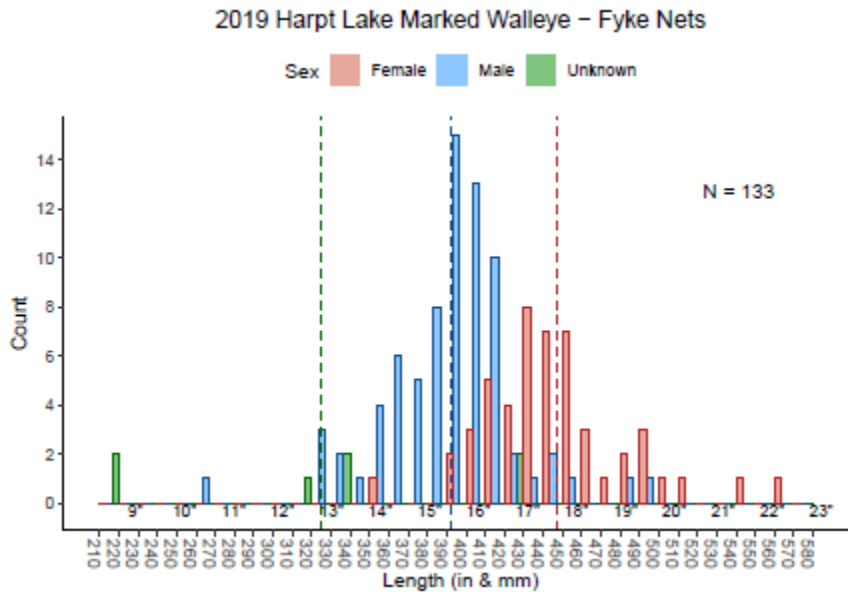
### Walleye

The 133 Walleye that were captured by fyke net ranged in length from 213 mm to 562 mm (8.4" to 22.1") and had an average length of 409 mm (16.1") (Table 2). 106 of 133 (80.9%) of the captured Walleye were greater in length than the minimum harvest limit of 15" (381 mm), with 13.0% greater than 457 mm (18") (Table 3 and Figure 4). The Schnabel PE was

136 for Walleye greater than 300 mm (12”) in length or 4.4 per lake surface acre with a 95% confidence range of 117 to 162 (Table 2).

The second dorsal spine was collected from Walleye for aging. The spine was cross-sectioned and mounted on a glass slide and viewed under a microscope to count annular rings. In our collected sample, Walleye ranged in age from age 1 through age 5 and age 7 in our aged sample (Table 6). Most of the aged Walleye were aged at age 5, with fewer fish of other ages captured.

When compared to average age at length for Walleye from lakes across Wisconsin, Walleye from Harpt Lake grew near the State average (Table 5). Because some age bins had few fish, grow rates for Walleye should be viewed with caution.



**Figure 4. The length distribution of Walleye by sex from Harpt Lake, April 2019. The dashed lines represent the average length for that sex.**

**Table 6. The age distribution of 132 Walleye that were collected and aged from spring fyke netting on Harpt Lake.**

Length (in) mm	Sum	Age						
		1	2	3	4	5	6	7
(8") 200								
210	2	2						
220								
230								
240								
(10") 250								
260	1		1					
270								
280								
290								
(12") 300								
310								
320	3			3				
330	3			3				
340	3			2		1		
(14") 350	4			3		1		
360	6			3		3		
370	4			2		2		
380	8					7		1
390	15				1	14		
(16") 400	17					15		2
410	17					16		1
420	7					6		1
430	10					9		1
440	7					6		1
(18") 450	9					9		
460	4					4		
470	1					1		
480	3					2		1
490	4					1		3
(20") 500	1					1		
510	1					1		
520								
530								
540	1							1
(22") 550								
560	1							1
Total	132	2	1	16	1	99	0	13
Ave. Length	409 mm (16.1")	215 mm (8.5")	265 mm (10.4")	347 mm (13.7")	390 mm (15.3")	418 mm (16.5")	-	461 mm (18.1")
SD.	51.0 mm (2.0")	2.8 mm (0.1")	--	17.5 mm (0.7")	--	31.8 mm (1.3")	-	56.1 mm (2.2")

## Northern Pike

During fyke netting, 68 Northern Pike were captured. The Pike ranged in length from 246 mm to 874 mm (9.7" to 34.4") and had an average length of 479 mm (18.9") (Table 2). Most of the captured Pike were between 300 mm and 600 mm (12" and 24") with few fish shorter or longer in length captured (Table 3). Only 2 Pike were greater than 26" (660 mm) in length which is the minimum size for harvest in Harpt Lake. Using the Schnabel method, the Pike population was estimated at 75 or 2.4 Pike per acre with a 95% confidence range of 60 to 101 (Table 2).

The second anal ray was removed from captured Northern Pike. The ray was cross-sectioned and mounted on a glass slide and viewed under a microscope to count annular rings. In our collected sample, Northern Pike ranged in age from age 1 through age 5 and age 8 (Table 7). Age 3 Pike dominated the catch, with fewer pike of other ages in the sample. Only a single Northern Pike was older than age 5 in the sample.

When ages at length for Pike from Harpt Lake are compared to fish across the state, it appears that Pike in Harpt Lake are growing at Statewide averages for fish through age 3. Northern Pike older than age 3 are growing slightly slower than an average Pike from other lakes across the State.

**Table 7. Northern Pike age distribution of fish captured during fyke netting from Harpt Lake. Note the length scale is discontinuous between 700 mm and 840 mm (28"- 34").**

Length (in)	mm	Number	Age									
			1	2	3	4	5	6	7	8		
	240	1	1									
(10")	250											
	260											
	270											
	280											
	290	1	1									
(12")	300	1	1									
	310	2	1	1								
	320											
	330	1	1									
	340	1	1									
(14")	350	2	2									
	360											
	370											
	380	1		1								
	390											
(16")	400	2		1	1							
	410											
	420	1		1								
	430	1		1								
	440	2		1	1							
(18")	450	9			6	2	1					
	460	5			4	1						
	470	4			3	1						
	480	7			4	2	1					
	490	3		1	1	1						
(20")	500	5			4	1						
	510	1			1							
	520	3			2	1						
	530	4		1	2	1						
	540											
(22")	550	2			1	1						
	560											
	570	1			1							
	580	2			1	1						
	590											
(24")	600											
	610											
	620											
	630	1					1					
	640	1					1					
(26")	650	1						1				
	660											
	670											
	680											
	690	1					1					
(28")	700											
(34")	870	1										1
Total		67	8	8	32	15	3					1
Ave. Length		479 mm (18.9")	327 mm (12.9")	429 mm (16.9")	490 mm (19.3")	532 mm (20.9")	532 mm (20.9")					874 mm (34.4")
SD.		98.1 mm (3.9")	24.5 mm (1.0")	65.6 mm (2.6")	42.8 mm (1.7")	74.7 mm (2.9")	110.0 mm (4.3")					--

Panfish

Bluegill

Bluegill dominated the panfish catch with 903 captured. Length ranged from 92 mm to 264 mm (3.6" to 10.4") and Bluegill had an average length of 188 mm (7.4") (Table 2). Bluegill length distribution was skewed toward larger fish with 85.4% of the fish greater than 150 mm (6") in length (Table 8, Figure 5 and Figure 6). Additionally, 42.6% of the Bluegill were greater than 200 mm (8") in length with 1.1% greater than 254 mm (10") in length. Using the Schnabel method, the PE for bluegill in Harpt Lake was 3,155 with a 95% confidence range of 2,599 to 4,013 (Table 2).

Several scales were removed from a subsample of Bluegill for aging. Scales were dried, cleaned and viewed under a microscope to count annular rings. In our collected sample, Bluegill ranged in age from age 1 through age 8 (Table 8). The most commonly aged Bluegill in decreasing frequency were ages 4, 5 and 3. Other ages were less common. When compared to Statewide length at age statistics, Bluegill in Harpt Lake were longer at each age than Bluegill from other lakes across the State (Table 5).

**Table 8. The age distribution of measured Bluegill captured during fyke netting on Harpt Lake, with the exception of the eight Bluegill less than 90 mm (3.5") which were captured during the recapture electroshocking run. A length-age table based on 171 aged Bluegill was used to expand the age distribution to the entire measured sample as reflected in this table.**

Length (in) mm	Sum	Age						
		2	3	4	5	6	7	8
(2") 50								
60	1	1						
70	4	3	1					
80	3	2	1					
90	2	1	1					
(4") 100	4	2	2					
110	22	2	20					
120	31		31					
130	33		33					
140	40		40					
(6") 150	54		27	27				
160	77		49	28				
170	100			100				
180	78			78				
190	78			55	23			
(8") 200	105			21	74		10	
210	109				98	11		
220	74				45	22	7	
230	70				7	56	7	
240	16					5	8	3
(10") 250	8					1	3	4
260	2						1	1
270								
Total	911	11	205	309	247	95	36	8
Ave. Length	188 mm (7.4")	88 mm (3.5")	132 mm (5.2")	179 mm (7.0")	214 mm (8.4")	235 mm (9.3")	242 mm (9.5")	252 mm (9.9")



SD.	50.3 mm (2.0")	17.2 mm (0.7")	20.1 mm (0.8")	13.8 mm (0.5")	10.2 mm (0.4")	10.7 mm (0.4")	13.8 mm (0.5")	7.3 mm (0.3")
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### Other Panfish

Pumpkinseed Sunfish, Black Crappie and Yellow Perch were also captured during fyke netting but in much lower abundances than Bluegill (Table 2). Average lengths were 165 mm (6.5"), 234 mm (9.2") and 188 mm (7.4") for Sunfish, Crappie and Perch (Table 8). Schnabel PE estimates were calculated for Pumpkinseed Sunfish and Yellow Perch at 73 and 46 respectively but are likely underestimates their true population number because of low sample sizes.

A few Black Crappie were aged using a combination of scales and spines that were read under a microscope to estimate age. In the aged sample ages 3 through 7 were identified, with age 3 the most common. Other aged Black Crappie were much less common.

### Other Species

During fyke netting, five additional fish species were captured. Yellow Bullhead were caught in large numbers and dominated the overall fyke net catch (Table 2). Of the 1067 Yellow Bullhead, 663 were measured. The measured Yellow Bullhead ranged in length from 128 mm to 367 mm (5" to 14.4") and had an average length of 256 mm (10.1") (Table 8). Additionally, 11 Black Bullhead were caught, and they had an average length of 236 mm (9.3") (Table 2 and Table 8).

Three species, Common Carp, White Sucker and Golden Shiner were also caught in low abundance and are listed in decreasing order of abundance (Table 2). None of these fish were measured.

**Table 8. Panfish and Bullhead length frequency for fish caught by fyke nets from Harpt Lake, April 2019.**

Length (in) mm	Black Bullhead	Yellow Bullhead	Pumpkinseed Sunfish	Bluegill	Black Crappie	Yellow Perch
90				2		
(4") 100				4		
110			1	22		
120		1		31		
130			2	33		2
140		1	1	40		1
(6") 150		1	10	54	2	5
160	1	2	17	77	8	3
170		2	11	100	4	5
180		2	4	78	2	3
190		9	2	78	2	2
(8") 200		21		105	1	2
210	1	25		109	1	2
220	1	47		74	1	2
230	1	80		70	1	1
240	1	93		16	1	
(10") 250	2	102		8	5	2
260		78		2	3	1
270	2	55			2	
280		53			4	
290		31			8	
(12") 300		16			3	
310		13				
320		9				
330		10				
340		10				
(14") 350		1				
360		1				
Total	8	663	48	903	48	31
Ave. Length	236 mm (9.3")	256 mm (10.1")	165 mm (6.5")	188 mm (7.4")	234 mm (9.2")	188 mm (7.4")
S.D.	34.0 mm (1.3")	32.5 mm (1.3")	14.4 mm (0.6")	33.9 mm (1.3")	54.1 mm (2.1")	33.8 mm (1.3")

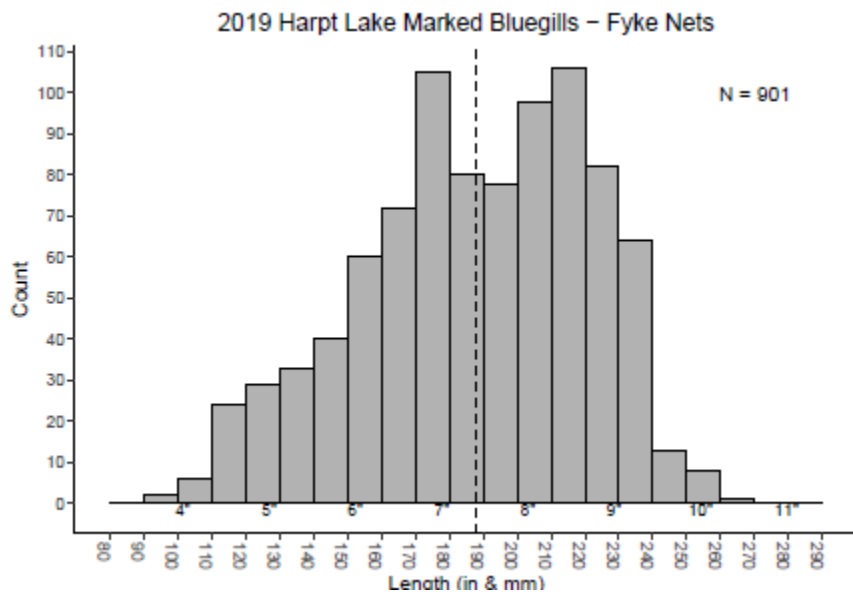


Figure 5. The length distribution of Harpt Lake Bluegill caught by fyke nets in April 2019. The dashed line represents Bluegill average length.



**Figure 6. A photograph of a 255 (10") Bluegill captured in a fyke net set in Harpt Lake in April 2019.**

## Spring Electroshocking

### Recapture Run

Just after dark on April 29, 2019 the entire shoreline was electroshocked to look for fish marked during fyke netting. In the 40 minutes of shocking 148 individual fish representing seven species were captured (Table 9). Total CPE was 164.4 fish per mile or 220.9 fish per hour captured. Largemouth Bass dominated the catch with fewer Bluegill, Yellow Bullhead and other species handled. We recaptured 7 marked Largemouth Bass, 11 Walleye, 4 Bluegill and 1 Pumpkinseed Sunfish which allowed for a Peterson Population Estimate to be calculated for those species.

**Table 9. The April 29, 2019 Harpt Lake recapture run electroshocking summary.**

Species	Number	CPE (#/mile)	CPE (#/hour)	Average Length	Length Range mm (in)	Peterson PE	PE Range
Yellow Bullhead	23	25.6	34.3	--	--		
White Sucker	1	1.1	1.5	--	--		
Pumpkinseed Sunfish	4	4.4	6	150 mm (5.9")	100 mm-188 mm (3.9"-7.4")	192	69-1063
Bluegill	38	42.2	56.7	130 mm (5.1")	48 mm-204 mm (1.9"-8.1")	4,048	3,734-21,605
Largemouth Bass	68	75.6	101.5	308 mm (12.1")	121 mm-405 mm (4.8"-15.9")	1360	709-2,758
Yellow Perch	3	3.3	4.5	92 mm (3.6")	75 mm-105 mm (2.9"-4.1")		
Walleye	11	12.2	16.4	409 mm (16.1")	361mm-467 mm (14.2"-18.4")	133	133-179
Total	148	164.4	220.9				

## Gamefish

### Largemouth Bass

Largemouth Bass dominated the catch during the electroshocking run. Bass ranged in length from 121 mm to 405 mm (4.8" to 15.9") and had an average length of 308 mm (12.1") (Table 9). Most Bass were between 200 mm (8") and 350 mm (13.8") in length, with only two Bass (2.9%) less than 200 mm (8") and seven (10.3%) greater than 355 mm (14") in length captured (Table 10). Seven Bass were recaptured that were marked during fyke netting yielding a Peterson PE of 1360 (range 709 to 2,758) or 43.9 Bass per lake surface area.

**Table 10. The length frequency of fish collected during the recapture electroshocking on April 29, 2019 from Harpt Lake.**

Length (in) mm	Pumpkinseed Sunfish	Bluegill	Largemouth Bass	Yellow Perch	Walleye
40		1			
(2") 50					
60		3			
70		3		1	
80					
90				1	
(4") 100	1	2		1	
110		3			
120		8	1		
130		4			
140					
(6") 150	1	3			
160	1	5	1		
170		3			
180	1	1			
190		1			
(8") 200		1	1		
210			1		
220			3		
230			2		
240			6		
(10") 250			1		
260			2		
270					
280					
290			1		
(12") 300			7		
310			8		
320			6		
330			5		
340			6		
(14") 350			10		
360			1		1
370			4		
380					1
390			1		1
(16") 400			1		5
410					
420					
430					2
440					
(18") 450					
460					1
Total	4	38	68	3	11
Ave. Length	150 mm (5.9")	130 mm (5.1")	308 mm (12.1")	92 mm (3.6")	409 mm (16.1")
S.D.	36.8 mm (1.5")	39.1 mm (1.6")	56.5 mm (2.2")	15.3 mm (0.6")	28.4 mm (1.1")

### Walleye

During electroshocking, 11 Walleye were captured that had an average length of 409 mm (16.1") (Table 9 and Table 10). All Walleye captured during this electroshocking run had been marked during fyke netting. The Peterson PE for Walleye was estimated to be 133 (range 133 to 179) or 4.3 per surface acre (Table 9).

## Panfish

### Bluegill

Bluegill were the most common panfish that were captured during this portion of the survey. The 38 Bluegill ranged in length from 48 mm to 204 mm (1.9" to 8.1") with an average length of 130 mm (5.1") (Table 9). Most Bluegill had lengths clustered between 100 mm (4") and 170 mm (6.7") with few smaller or larger fish captured (Table 10). The Peterson PE was 4048 (range 3,734 to 21,605) for Bluegill.

### Other Panfish

Four Pumpkinseed and three Yellow Perch were also captured during shocking. Pumpkinseed had an average length of 150 mm (5.9") and the Yellow Perch averaged 92 mm (3.6") in length (Table 9 and Table 10). A single marked Pumpkinseed was recaptured, and the Peterson PE was calculated at 192 (range 69-1,063). This estimate should be viewed with caution because of the low number of Pumpkinseed Sunfish marked and recaptured.

### Other Species

Twenty-three Yellow Bullhead and one White Sucker were captured during shocking (Table 9). None of these fish were measured.

## Centrarchid Electrofishing

During the evening of May 21, 2019, the entire shoreline of Harpt Lake was shocked to assess Bass and panfish. In 32 minutes of shocking, a 197 individual fish representing eight species were captured (Table 11). Total CPE was 218.9 fish per mile or 371.7 fish per hour shocked. Largemouth Bass and Bluegill dominated the catch, with other species caught in lower number.

## Gamefish

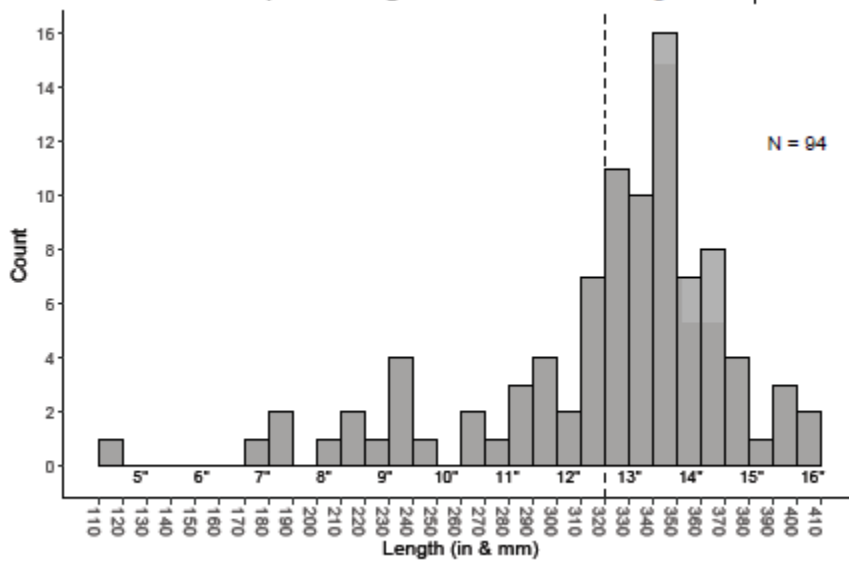
### Largemouth Bass

The 94 captured Largemouth Bass ranged in length from 110 mm to 408 mm (4.3" to 16.1") and had an average length of 320 mm (12.6") (Table 11). Most of the captured Bass were greater than 250 mm (10") in length, with few Bass under 200 mm (8") captured (Table 12 and Figure 7).

Nineteen of the 94 captured Bass were recaptured fish marked in previous surveys allowing for a Peterson PE to be calculated. The Peterson estimate was 994 (32.1 per acre) with a range of 663 to 1507 based on the catch of this survey (Table 11).

**Table 11. The May 21, 2019 Centrarchid shocking survey of Harpt Lake.**

Species	Number	CPE (#/mile)	CPE (#/hour)	Average Length	Length Range mm (in)	Peterson PE	PE Range
Common Carp	8	8.9	15.1				
Yellow Bullhead	5	5.6	9.4	262 mm (10.3")	212 mm-309 mm (8.3"-12.2")		
Brown Bullhead	1	1.1	1.9	255 mm (10")	--		
Pumpkinseed Sunfish	1	1.1	1.9	181 mm (7.1")	--		
Bluegill	66	73.3	124.5	147 mm (5.8")	68 mm-224 mm (2.7"-8.8")	11893	5,096-36,629
Largemouth Bass	94	104.4	177.4	320 mm (12.6")	110 mm-408 mm (4.3"-16.1")	994	683-1,507
Yellow Perch	6	6.7	11.3	132 mm (5.2")	117 mm-151 mm (4.6"-5.9")		
Walleye	16	17.8	30.2	374 mm (13.7")	211 mm-415 mm (8.3"-16.3")	152	138-208
Total	197	218.9	371.7				



**Figure 7. Largemouth Bass length frequency histogram for Bass collected during the May 21, 2019 shocking survey. The dashed line represents Largemouth Bass average length.**

## Walleye

A total of 16 Walleye were captured during shocking. They ranged in length from 211mm to 415 mm (8.3” to 16.3”) and had an average length of 374 mm (13.7”) (Table 11 and Table 12). The Peterson PE for Walleye was 152 (4.9 per acre) with a range of 138 to 208 (Table 11).

**Table 12. The length frequency of fish captured during the May 21, 2019 electroshocking survey on Harpt Lake.**

Length (in) mm	Yellow Bullhead	Bluegill	Largemouth Bass	Yellow Perch	Walleye
(2") 50					
60		1			
70		3			
80		6			
90					
(4") 100		2			
110		5	1	1	
120		4		2	
130		6		1	
140		5		1	
(6") 150		7		1	
160		5			
170		9	1		
180		3	2		
190		3			
(8") 200		4	1		
210	1	1	2		1
220		2	1		
230			4		
240	1		1		
(10") 250	1				
260			2		
270			1		
280			3		
290	1		4		
(12") 300	1		2		
310			6		
320			11		1
330			10		
340			17		1
(14") 350			7		
360			8		1
370			4		1
380			1		5
390			3		1
(16") 400			2		2
410					3
420					
Total	5	66	94	6	16
Average Length	262 mm (10.3")	147 mm (5.8")	320 mm (12.6")	132 mm (5.2")	374 mm (13.7")

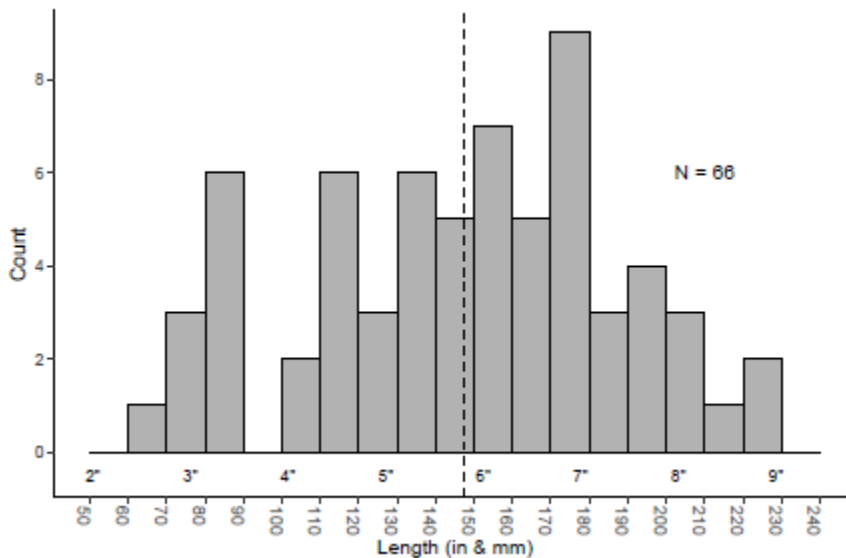


S.D.	39.4 mm (1.6")	40.1 mm (1.6")	54.6 mm (2.1")	13.3 mm (0.5")	50.4 mm (2.0")
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## Panfish

### Bluegill

A total of 66 Bluegill were captured during this survey (Table 11). Bluegill ranged in length from 68 mm to 224 mm (2.7" to 8.8") and had an average length of 147 mm (5.8"). Bluegill length in this survey was skewed toward smaller Bluegill although several Bluegill greater than 200 mm (8") were captured (Table 12 and Figure 8).



**Figure 8. The Bluegill length histogram from fish collected during the May 21, 2019 survey. The dashed line is the average length of Bluegill captured during shocking.**

### Other Panfish

Pumpkinseed Sunfish and Yellow Perch were caught during this survey but in low abundance (Table 11). Pumpkinseed Sunfish had an average length of 181 mm (7.1") and Yellow Perch had an average length of 132 mm (5.2").

### Other Species

In decreasing order of abundance Common Carp, Yellow Bullhead and Brown Bullhead were captured during electroshocking (Table 11). Yellow Bullhead had an average length of 262 mm (10.3”) and the Brown Bullhead was 255 mm (10”) in length.

## **DISCUSSION and RECOMMENDATIONS**

During the course of this survey year, 2,820 individual fish were captured with use of fyke nets and electroshocking gear. This was the first fish survey since 1986 that used nets to assess the fish population of the lake, with most of the previous surveys using only electroshocking to describe fish populations. Since these gears target different species and sizes of fish, direct comparisons will be limited to electroshocking runs, however netting results are informative as well.

### Gamefish

Overall, Largemouth Bass was the dominant gamefish that was captured during the 2019 survey. Similar to past surveys, Bass ranged in length from 110 mm to 400 mm (4” to 16”), although during previous electroshocking surveys (Hogler 2004 and 2012), fewer small Bass were captured and more larger Bass were collected during shocking (Table 12). Pooled growth (length at age) data was similar to what was found in past electroshocking surveys (Table 5). Recruitment appears to be good although few juvenile Bass were collected. Finally, similar to past electroshocking surveys, Bass numbers decreased rapidly above 356 mm (14”) which is the minimize size for anglers to harvest. Fyke nets collected a large number of Largemouth Bass that showed a size distribution more similar to previous electroshocking surveys (Table 2). Population Estimates indicate that the Bass population is likely between 546 to 1,360 Bass (1.6 to 43.9 per acre) in Harpt Lake (Tables 2, 9 and 11).

Walleye were caught in higher frequency in 2019 than during previous surveys. Population Estimates (Tables 2, 9 and 11) gave consistent estimates of between 136 and 152 Walleye (4.4 to 4.9 per acre) in the lake indicating fair survival of stocked Walleye. Length at age analysis indicate Walleye growth in Harpt Lake to be at or above Statewide averages. The age frequency indicates Walleye stocked in 2016 and 2014 appeared to have high survival (Tables 1 and 5). These fish were stocked as large fingerlings by the Sportsmen Club. DNR small fingerling (2”) stockings were rarely identified in the age sample. Since Walleye are stocked nearly every year by DNR or Larrabee Sportsmen Club it is difficult to determine if natural reproduction is occurring, however, the lack of small Walleye in our surveys seems to indicate little or no natural reproduction is happening in the lake. Continued

stocking of large fingerlings will be likely needed to maintain a Walleye population in the lake.

Northern Pike were only captured with fyke nets. Based on length at age data, Pike exhibit good growth in Harpt Lake with above Statewide average growth (Table 5). Recruitment appears to be sufficient with small Pike present, however, the lack of abundant habitat will likely keep Pike number modest.

### Panfish

Bluegill continue to be the most abundant panfish species in Harpt Lake. Unlike earlier surveys by Peeters (1980, 1981 and 1986) and Hogler (2004 and 2012) that found abundant, small Bluegill, surveys in 2019 found reduced numbers of Bluegill with a size structure skewed toward 200 mm (8") fish (Table 8, Figure 9). Bluegill at all ages were on average, longer at each age than Statewide average Bluegill. Improvement in size structure may be due to increased predation on Bluegill by increasing numbers of gamefish and reduced angler harvest because of temporary panfish regulations.

Black Crappie, Pumpkinseed Sunfish and Yellow Perch were also captured during this survey, but in much lower abundances than Bluegill. The presence of young Crappie and few older Crappie is indicative of their typical cyclic boom and bust population and will likely provide good angling during the next several years (Table 8). Pumpkinseed lengths were clustered around 150 mm (6") although several captured fish were near 200 mm (8"). Yellow Perch were the least commonly captured panfish despite several stockings since 2015 (Table 1, 2, 9 and 11). Perch were able to obtain good size (>200 mm (8")) but either anglers or poor survival limited the number of large Perch in the population (Table 8).

### Other Species

Yellow Bullhead, Brown Bullhead, White Sucker and Common Carp were captured during this survey. None of these species appear to be an issue in Harpt Lake currently. Abundant Yellow Bullhead greater than 250 mm (10") are available to anglers to utilize but likely have not been a major part of angler creels.

The fish community of Harpt Lake appears to be in good condition. Predators, including stocked Walleye are doing well and panfish numbers have decreased with an improved size structure. It is recommended that:

- **Halt DNR small fingerling Walleye stocking based on poor survival and either DNR will stock extended growth Lake Michigan strain Walleye fingerlings or allow the Sportsmen's Club to do all stocking of Lake Michigan strain Walleye extended growth into Harpt Lake.**
- **Implement the recommendations from the ongoing Panfish Study when available to maintain a desirable panfish size distribution.**

- **Encourage DNR, Manitowoc County and the Sportsmen’s Club to collectively find an alternate location for the public boat ramp or develop an off-road parking lot.**
- **Continue to work with the local club to continue habitat projects on the lake including rock reefs and fish sticks.**
- **Encourage land owners to implement recommendations found in their management plan to improve water quality by controlling runoff and exploring methods to reduce internal cycling of phosphorus.**

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