2017 Bullhead Lake Report
Steve Hogler, Steve Surendonk and Derek Apps
WDNR Green Bay Fish Management

ABSTACT

Bullhead Lake is a seepage lake located in western Manitowoc County. The lake has a surface area of 67 acres, a maximum depth of 40 feet and a shoreline development factor of 1.07.

Traditionally, Bullhead Lake has been managed as a bass-panfish lake with the stocking of Muskellunge, Walleye and Yellow Perch to increase angling opportunities. Fish surveys from the 1950's found an unbalanced fish community with numerous large Carp and small panfish. In 1957, Fisheries Management chemically eradicated the fish population of Bullhead Lake with toxaphene to restore a balanced fish community. The restocking program included Largemouth Bass, Muskellunge, Bluegill and Yellow Perch. Surveys from the 1960's and 1970's found continuing issues with the fish community and poor water quality with fish kills and subsequent restocking noted. By the mid 1970's shocking surveys found good numbers of Walleye and Black Crappie along with lower numbers of Largemouth Bass and Yellow Perch. Muskellunge and Bluegill were present, but in low number. Shocking surveys conducted in the 1980's found improved fish populations with good numbers of Largemouth Bass, Black Crappie and Yellow Perch with lower numbers of Walleye and Bluegill. Results from the last three surveys in 1990's and 2000's indicated that Bullhead Lake was dominated by Largemouth Bass and Bluegill with a good mix of other species.

The Bullhead Lake Association has been an active partner with WDNR for many years. Among other activities, the Bullhead Lake Association has contributed to the management of the lake by collecting long-term water quality data, sponsoring alum treatments to control phosphorus and several Aquatic Plant Management (APM) studies.

A comprehensive fisheries was conducted on Bullhead Lake in April and May, 2017 to assess the fish populations of the lake. Two survey gears, fyke nets and a boomshocker was used to collect fish across the spring spawning period. In total, 1,721 fish representing eight species were captured. Overall, Bluegill dominated our catch chiefly because the large number of Bluegill captured in fyke nets. Largemouth Bass, Brown Bullhead and Northern Pike were the next most abundant species. Black Crappie, Yellow Perch, and Walleye were less common. In electroshocking surveys, Largemouth Bass and Bluegill dominated our catch. It is recommended to: regularly conduct fish surveys to assess population numbers, growth rates and the contribution of stocked fish to the fishery, to implement findings from the panfish project, to work with stakeholders

to improve water quality in the lake, and to encourage shoreline owners to improve nearshore fish habitat.

INTRODUCTION

Bullhead Lake is a seepage lake located in western Manitowoc County. The lake has a surface area of 67 acres, a maximum depth of 40 feet and a shoreline development factor of 1.07 (Figure 1). The lake has one basin with an adjoining cattail wetland. The lake bottom consists of muck, sand and gravel and the water is considered hard. Bullhead Lake is surrounded by agricultural land with an increasing number of year-round residences being built along the shoreline and on adjacent lands. A public boat launch is present on the western side of the lake that has a single pier for boat launching and an additional pier for fishing.

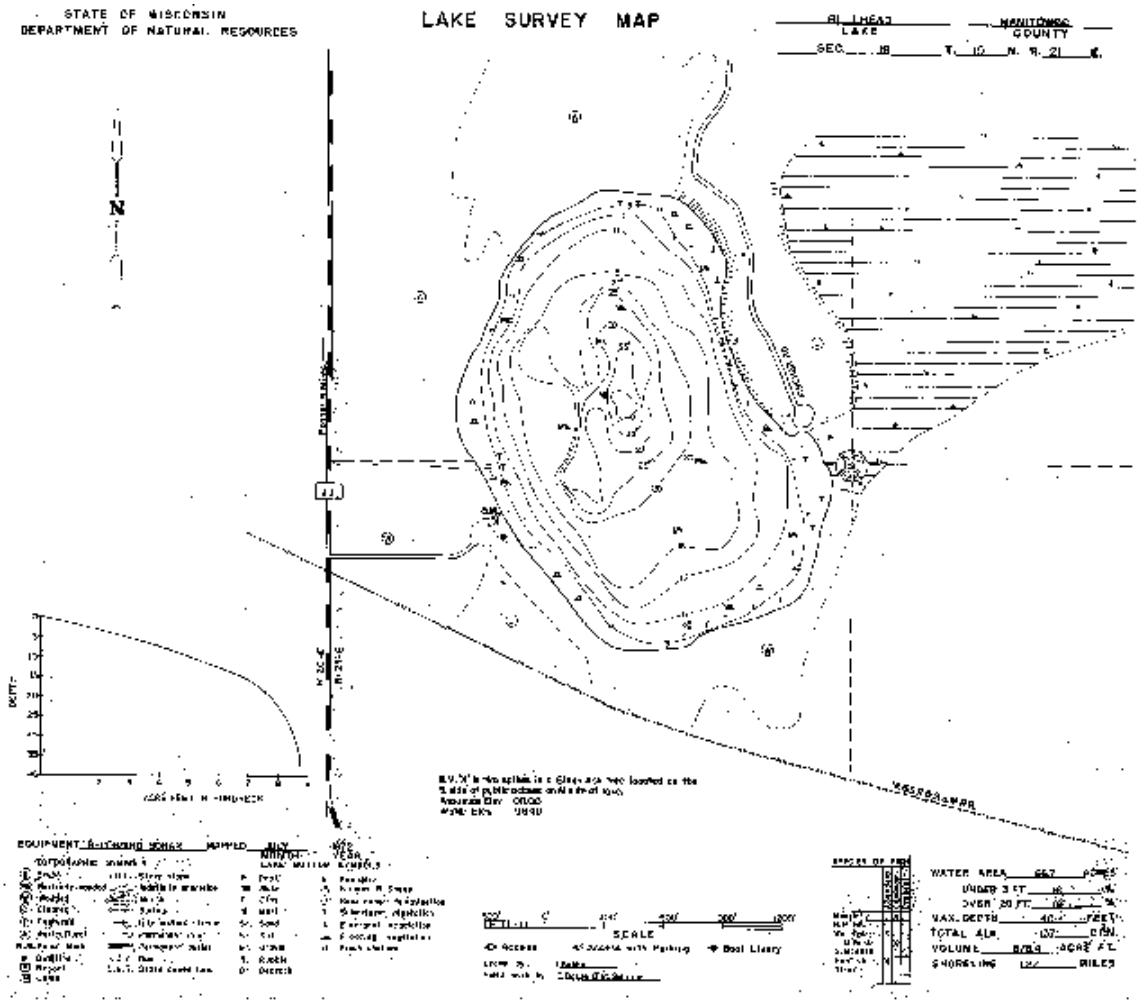

Figure 1. Bathometric map of Bullhead Lake found in western Manitowoc County.

Traditionally, Bullhead Lake has been managed as a bass-panfish lake with WDNR stocking Muskellunge (1970's) and Walleye (1980's to present) to increase angling opportunities (Table 1). The Bullhead Lake Association has stocked Yellow Perch and Fathead Minnow to augment their populations in the lake since 2002.

Table 1. The Bullhead Lake fish stocking record since 1973. Wisconsin DNR stocked the gamefish species, Walleye and Muskellunge and the Bullhead Lake Association stocked the Walleye in 2012 and the other species under a DNR stocking permit.

Year	Species	Age Class	Number Fish Stocked	Ave. Length (in)
1973	MUSKELLUNGE	FINGERLING	300	15
1974	Hybrid Muskellunge	FINGERLING	240	9
1976	Hybrid Muskellunge	FINGERLING	300	8
1977	Hybrid Muskellunge	FINGERLING	300	10
1978	Hybrid Muskellunge	FINGERLING	300	9
1979	Hybrid Muskellunge	FINGERLING	300	8.5
1980	Hybrid Muskellunge	FINGERLING	300	11
1983	WALLEYE	FINGERLING	3350	5
1985	WALLEYE	FINGERLING	3500	4
1989	WALLEYE	FRY	3094	3
1992	WALLEYE	FINGERLING	1774	2.5
1994	WALLEYE	FINGERLING	1776	2.5
1995	WALLEYE	FINGERLING	1677	2.8
1997	WALLEYE	LARGE FINGERLING	1675	2.7
1999	WALLEYE	SMALL FINGERLING	6700	1.5
2001	WALLEYE	SMALL FINGERLING	6700	1.6
2002	YELLOW PERCH	ADULT (BROODSTOCK)	600	6
2003	WALLEYE	SMALL FINGERLING	6695	1.5
2004	YELLOW PERCH	LARGE FINGERLING	500	5
2004	FATHEAD MINNOW	ADULT (BROODSTOCK)	200000	3
2005	YELLOW PERCH	LARGE FINGERLING	1000	5
2005	WALLEYE	SMALL FINGERLING	3335	1.4
2005	FATHEAD MINNOW	ADULT (BROODSTOCK)	40000	3
2006	YELLOW PERCH	LARGE FINGERLING	1000	5
2008	YELLOW PERCH	LARGE FINGERLING	541	6
2008	YELLOW PERCH	SMALL FINGERLING	500	3
2009	FATHEAD MINNOW	ADULT	0	2
2009	YELLOW PERCH	YEARLING	500	6
2009	WALLEYE	SMALL FINGERLING	2245	1.8
2010	YELLOW PERCH	YEARLING	850	6
2011	YELLOW PERCH	YEARLING	1100	6
2011	WALLEYE	SMALL FINGERLING	2570	1.9
2012	WALLEYE	YEARLING	397	6
2013	YELLOW PERCH	YEARLING	1200	5
2013	WALLEYE	SMALL FINGERLING	2340	2
2015	YELLOW PERCH	ADULT	500	8
2015	WALLEYE	SMALL FINGERLING	1504	1.7
2017	WALLEYE	SMALL FINGERLING	2432	1.7

Fishery surveys have been conducted on Bullhead Lake since the 1950's with variable fishery conditions described. Cline (1957) conducted a barge seine survey in 1955 on Bullhead Lake and captured nine fish species: Pumpkinseed Sunfish, Green Sunfish, Black Crappie, Yellow Perch, Carp, Bullhead, White

Sucker, Golden Shiner and Northern Pike. Panfish were described as small and thin and Carp as extremely large. Since Largemouth Bass were absent from the catch, the lake was stocked with 3,191 fingerling Largemouth Bass in 1956. In 1957, Fisheries Management chemically eradicated the fish population of Bullhead Lake with toxaphene to restore a balanced fish community. The restocking included Largemouth Bass, Muskellunge, Bluegill and Yellow Perch.

Schultz conducted a barge seine and shocking surveys in 1962 and 1964 (Schultz 1963 and 1965). These surveys found that the species stocked in 1957 were doing well and that all species were reproducing except for Muskellunge. However, following the winter of 1964-65, Schultz (1966) investigated a large winter-kill on Bullhead Lake. He reported finding dead Muskellunge, Largemouth Bass and Bluegill. Schultz restocked the lake with Muskellunge fry and fingerling, Largemouth Bass adult and fingerling and Walleye fry.

Belonger (1976) conducted a shocking survey in 1976 and found good numbers of Walleye and Black Crappie along with modest numbers of Largemouth Bass and Yellow Perch. Muskellunge and Bluegill were present in low numbers. Belonger noted poor over-winter survival of young Largemouth Bass.

Shocking surveys conducted by Peeters (1982, 1985 and 1988) found good numbers of Largemouth Bass, Black Crappie and Yellow Perch with lower numbers of Walleye, Bluegill and other species captured during each survey.

Results from the last three surveys conducted in 1999 (Surendonk and Hogler 2003), 2005 (Hogler and Surendonk 2005) and 2011 (Hogler and Surendonk 2012), indicated that Bullhead Lake was dominated by Largemouth Bass and Bluegill. These surveys found a good mix of gamefish and panfish in the lake with Largemouth Bass the dominant predator and Bluegill the most common panfish. Northern Pike and Walleye were captured during the surveys, but in low number and the other panfish species such as Black Crappie and Yellow Perch were also captured in low abundance. A creel survey that was conducted with the 1999 survey found that sport anglers were fishing the lake at a rate of 190 hours per acre with most anglers targeting Bluegill and Largemouth Bass with few individuals targeting the other species.

The Bullhead Lake Association has been an active partner with WDNR Fisheries and Water Resource staff for many years. Among other activities, the Bullhead Lake Association has contributed to the management of the lake by collecting long-term water quality data, sponsoring alum treatments to control phosphorus that occurred in 1978 and 1988 and several Aquatic Plant Management (APM) studies. Long-term monitoring data that the Association helped to collect indicates that since 2008 the trophic status of the lake has moved from mesotrophic to slightly eutrophic. APM studies have identified the presence of three invasive species: Banded Mystery Snail, Curly Leaf Pondweed and Eurasian Water Milfoil found in the lake since 2003. The APM surveys have also

indicated increasing amounts of filamentous algae that can be found in large mats in the nearshore waters of the lake.

METHODS

Spring Fyke Netting

A standard comprehensive fisheries survey on Bullhead Lake began in April and continued through May 2017. Six fyke nets were set on April 5 and were lifted through April 14 (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 and measured, spines, rays or scales were removed from a sub-sample of all species for age determination and all gamefish were marked with a caudal fin clip for use in calculating a population estimate.

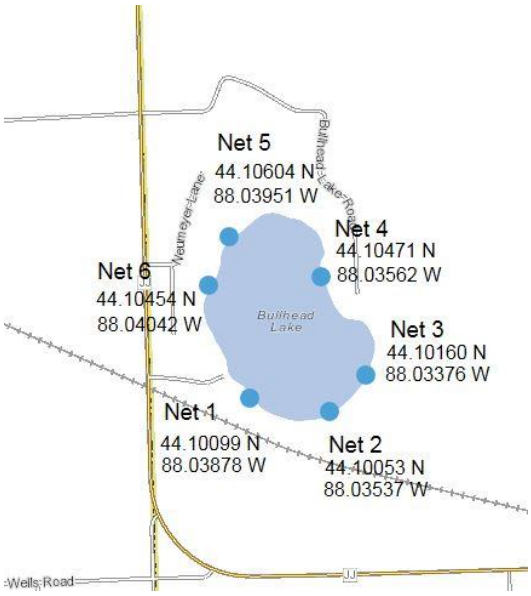

Figure 2. Spring 2017 fyke net locations on Bullhead Lake.

Spring Electrofishing

Recapture Run
Shortly after the completion of fyke netting, on the night of April 25, the entire shoreline of Bullhead 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 24, the entire shoreline was 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.

The Petersen population estimation method was used to estimate community population size when the recapture numbers were large enough to provide an unbiased estimate of population size. For the Petersen method, 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) using the Petersen estimator (Ricker 1975).

RESULTS

Spring Fyke Netting

During the fyke net portion of the survey, a total of 1422 fish were captured during the 54 net nights fished for a Catch per Effort (CPE) of 26.3 fish per net per night. Of the seven species captured, Bluegill, Brown Bullhead and Largemouth Bass dominated the catch, with fewer Northern Pike, Black Crappie, Yellow Perch and Walleye netted (Table 1).

Table 1. The number of each species that were captured with fyke nets fished from April 6 through April 14, 2017 in Bullhead Lake. Catch per unit effort, (CPE) is expressed as the number of fish per net per night. Lengths are reported in mm and in inches () for each species.

Species	Number Caught	CPE	Length Range	Average Length
Walleye	2	0.0	525 mm- 596 mm (20.6"- 23.5")	561 mm (22.1")
Largemouth Bass	100	1.9	87 mm- 525 mm (3.3"- 20.7")	291 mm (11.5")
Northern Pike	94	1.6	410 mm- 791 mm (16.1"- 31.1")	565 mm (22.2")
Bluegill	888	16.4	87 mm- 244 mm (3.3"- 9.6")	163 mm (6.4")
Yellow Perch	58	1.1	120 mm- 268 mm (4.7"- 10.6")	167 mm (6.6")
Black Crappie	86	1.6	115 mm- 289 mm (4.5"- 11.4")	201 mm (7.9")

Brown Bullhead	194	3.6	194 mm- 374 mm (7.6"- 14.7")	295 mm (11.6")
Total	1422	26.3		

Gamefish

Largemouth Bass

Although not an early spring spawning fish, Largemouth Bass were the most abundant gamefish captured during fyke netting (Table 1). The 100 Largemouth Bass that were handled ranged in length from 87 mm to 525 mm (3.3"- 20.7") with an average length of 291 mm (11.5”) (Table 2). Thirty-seven of the 100 Bass (37%) were longer than the 14” (356 mm) minimum size limit for harvest, but only one captured Bass was greater than 18” (457 mm) in length (Figure 3). Total CPE was 1.9 Bass per net per night (Table 1).

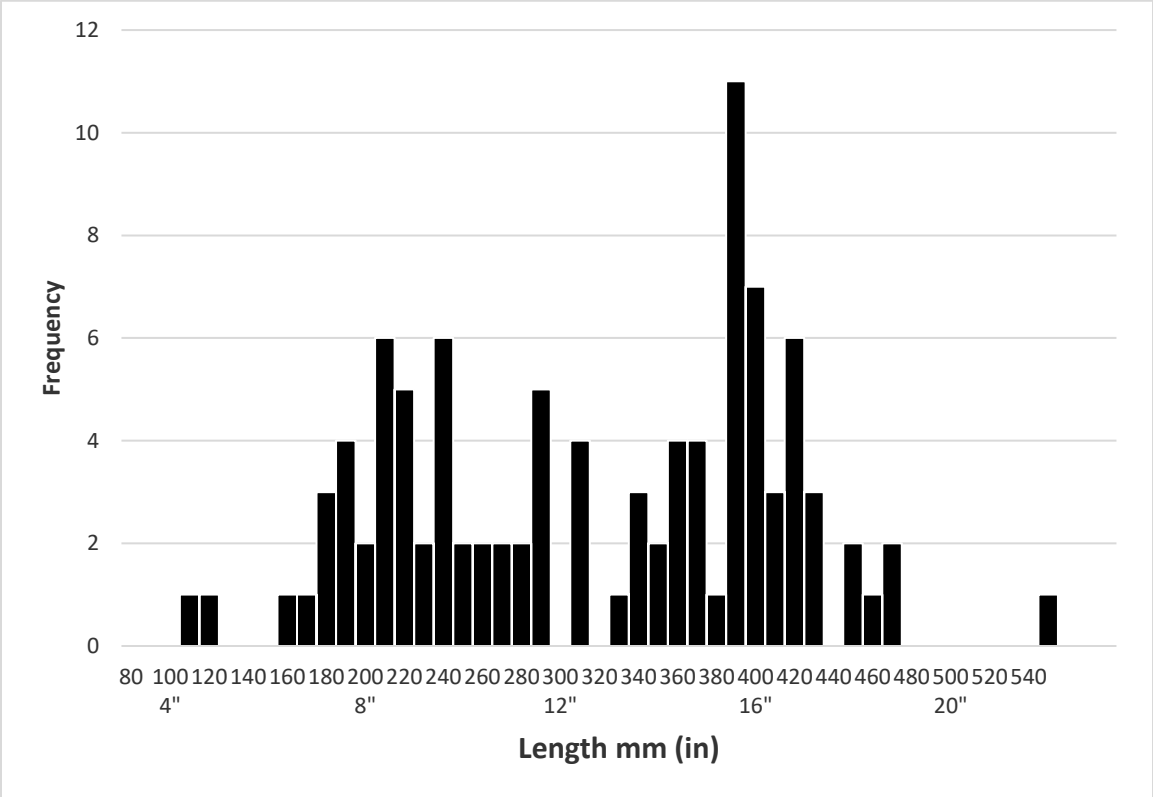

Figure 3. The length frequency distribution of Largemouth Bass captured during fyke netting on Bullhead Lake, April, 2017.

Age was determined from 96 of the captured Largemouth Bass using sectioned dorsal spines. Ages ranged from Age 2 through age 13, with age 2 the most common age followed by ages 3 and 8 (Table 3). Growth, as shown by average

length at age is below State Averages, but is similar to values from the last full survey conducted in 1999 (Table 4).

Table 2. The length distribution of fish species caught on Bullhead Lake during the spring 2017 fyke net survey.

Length (in)	mm	Largemouth Bass	Walleye	Bluegill	Yellow Perch	Black Crappie	Brown Bullhead
	80	1		1			
	90	1		2			
(4")	100			30			
	110			76		1	
	120			54	3	7	
	130	1		46	10	4	
	140	1		63	7	7	
(6")	150	3		93	3	3	
	160	4		107	10	3	
	170	2		104	6		
	180	6		82	7		
	190	5		41	5	6	1
(8")	200	2		42	1	19	1
	210	6		34	4	12	4
	220	2		27		2	8
	230	2		15		1	5
	240	2		2	1	1	8
(10")	250	2				7	8
	260	5			1	7	11
	270					3	10
	280	4				2	14
	290						12
(12")	300	1					17
	310	3					17
	320	2					9
	330	4					9
	340	4					22
(14")	350	1					7
	360	11					2
	370	7					1
	380	3					
	390	6					
(16")	400	3					
	410						
	420	2					
	430	1					
	440	2					
(18")	450						
	460						
	470						
	480						
	490						
(20")	500						
	510						
	520	1	1				
	530						
	540						
(22")	550						
	560						
	570						
	580						
	590		1				
(24")	600						
	Total	100	2	819	58	85	166
	Ave. Length	291 (11.5")	561 (22.1")	163 (6.4")	167 (6.6")	201 (7.9")	295 (11.6")

SD	94.7 (3.7")	50.2 (2.0")	32.9 (1.3")	30.9 (1.2")	47.3 (1.9")	40.7 (1.6")

Table 3. The length at age distribution of Largemouth Bass caught on Bullhead Lake during the spring 2017 fyke net survey.

Length	AGE											
(in) mm	2	3	4	5	6	7	8	9	10	11	12	13
130	1											
140	1											
(6") 150	3											
160	4											
170	2											
180	6											
190	5											
(8") 200	1	1										
210	1	5										
220		2										
230		2										
240		1										
(10") 250		1		1								
260		1	3	1								
270												
280				3	1							
290												
(12") 300				1								
310				2	1							
320				2								
330					3		1					
340					1	1		1				
(14") 350							1					
360					2	4	4		1			
370						3	1	1	2			
380							2	1				
390							3	2		1		
(16") 400						1		2				
410												
420									1			1
430											1	
440								1	1			
(18") 450												
460												
470												
480												
490												
(20") 500												
510												
520												1
Total	24	13	3	10	8	9	12	8	5	1	1	2
Ave. Length	177 (7")	224 (8.5")	265 (10.4")	295 (11.6")	341 (13.4")	368 (14.5")	372 (14.6")	393 (15.5")	399 (15.7")	391 (15.4")	430 (16.9")	475 (18.7")
S.D.	20 (0.8")	20 (0.8")	2.9 (0.1")	25.1 (1.0")	25.4 (1.0")	16.6 (0.7")	18.1 (0.7")	28 (1.1")	37.1 (1.5")	--	--	70.7 (2.8")

Table 4. Average length at age for fish collected during the 2017 Bullhead Lake Survey. Largemouth Bass were aged in 2017 using dorsal spines, Northern Pike were aged using anal rays and scales were used for all other species. Before the 2017 survey all fish were aged using scales. All lengths are in millimeters and inches (in).

Species	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7	AGE 8	AGE 9	AGE 10
Northern Pike										
2017		478 (18.8")	571 (22.5")	553 (21.8")	588 (23.1")	598 23.5")	612 (24.1")	584 (23.0")	581 (22.9")	532 (22.9")
State Average	356 (14.0")	406 (16")	470 (18.5")	546 (21.5")	610 (24.0")	650 (25.6")	706 (27.8")	762 (30.0")	787 (30.9")	
Largemouth Bass										
2017		177 (7.0")	224 (8.5")	265 (10.4")	295 (11.6")	341 (13.4")	368 (14.5")	372 (14.6")	393 (15.5")	399 (15.7")
2011	121 (4.8")	177 (7.0")	260 (10.2")	313 (12.3")	337 (13.3")	338 (13.3")	--	--		
2005	94 (3.7")	155 (6.1")	228 (9.0")	288 (11.3")	329 (13.0")	380 (15.0")	--	--		
1999		154 (6.1")	217 (8.5")	279 (11.0")	307 (12.0")	376 (14.8")	406 (16.0")	463 (18.2")		
State Average	97 (3.8")	165 (6.5")	229 (9.0")	290 (11.4")	338 (13.3")	383 (15.1")	414 (16.3")	447 (17.6")	470 (18.5")	500 (19.2")
Bluegill										
2017		93 (3.7")	123 (4.8")	164 (6.5")	183 (7.2")	203 (8.0")	213 (8.4")	214 (8.4")	226 (8.9")	240 (9.4")
2011	65 (2.6")	105 (4.1")	141 (5.6")	211 (8.3")	--	--	--	--		
2005	50 (2.0")	110 (4.3")	139 (5.5")	158 (6.2")	193 (7.6")	205 (8.2")	--	--		
1999	43 (1.7")	74 (2.9")	100 (3.9")	129 (5.1")	155 (6.1")	168 (6.6")	182 (7.2")	192 (7.6")		
State Average	64 (2.6")	97 (3.8")	122 (4.8")	147 (5.9")	167 (6.6")	183 (7.2")	196 (7.8")	208 (8.2")		
Black Crappie										
2017		140 (5.5")	207 (8.1")	259 (10.2")	280 (11.0")					
State Average	79 (3.1")	137 (5.4")	183 (7.2")	218 (8.6")	241 (9.5")	267 (10.5")	274 (10.8")			
Yellow Perch										
2017		136 (5.4")	164 (6.5")	198 (7.8")	234 (9.2")		268 (10.6")			
State Average	74 (2.9")	119 (4.7")	152 (6.0")	180 (7.1")	208 (8.2")					

Northern Pike

The 94 northern Pike that were captured during netting ranged in length from 410 mm to 791 mm (16.1" to 31.1") and had an average length of 565 mm (22.2") (Table 1). Most captured pike were less than 600 mm (24") in length with only four (4.3%) greater than the 26" (660 mm) minimum harvest length and none were greater than 800 mm (32") in length (Table 5 and Figure 4). Of the 94 captured Pike, 24 (25.5%) were female, 69 (73.4%) were male and 1 (1.1%) was unknown sex. The average length for female and male Northern Pike was 587

mm (23.1”) and 559 (22.0”) respectively. Pike CPE was 1.6 fish per net each night (Table 1).

Anal rays from 92 Northern Pike were sectioned for aging with age 2 through age 10 and age 12 in the sample. To increase our sample size, all Pike regardless of sex were pooled for age analysis. Age 3 Pike were the most common followed by age 2 and age 4 Pike. Growth, as shown by the average length at age for Northern Pike from Bullhead Lake had mixed results. Through age 5 growth was at or above the Statewide value but from age 6 and older growth decreased to be below the State average (Table 4).

Table 5. The length frequency distribution of Northern Pike by sex for Pike captured by netting in Bullhead Lake during April 2017.

Length mm (in)	Total	Female	Male	Unknown
400 (16")				
410	1		1	
420				
430	1		1	
440				
450 (18")	2	1	1	
460	3	1	2	
470	2		1	1
480	6	1	5	
490	2	1	1	
500 (20")	1		1	
510	2		2	
520	6	2	4	
530	1		1	
540	5	2	3	
550 (22")	9	1	8	
560	6	1	5	
570	7		7	
580	12		12	
590	3	1	2	
600 (24")	4	3	1	
610	5	2	3	
620	6	5	1	
630	3		3	
640	2		2	
650 (26")	1		1	
660				
670	1	1		
680				
690	1	1		
700 (28")				
710	1		1	
720				
730				
740				
750 (30")				
760				
770				
780				
790	1	1		
800 (32")				
Total	94	24	69	1

Ave. Length	565 (22.2")	587 (23.1")	559 (22.0")	475 (18.7")
S.D.	63.2 (2.5")	79.0 (3.1")	55.4 (2.2")	--

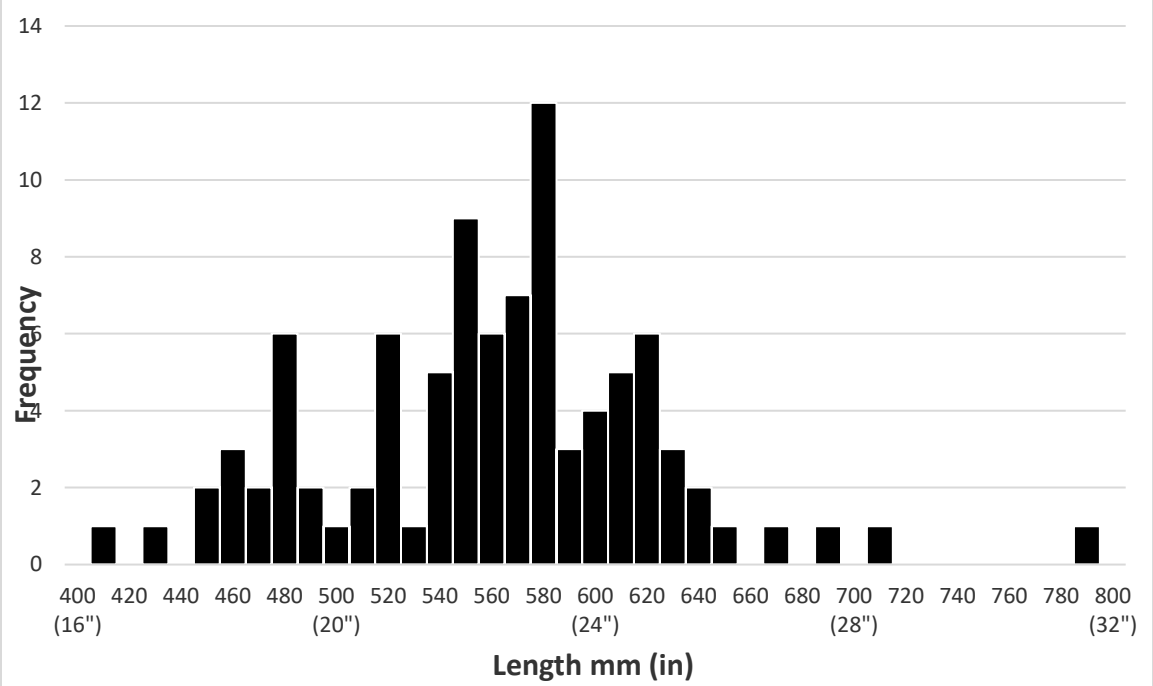

Figure 4. The length distribution of Northern Pike captured during spring netting on Bullhead Lake in April 2017. Length are in mm and inches.

Table 6. The length at age distribution of Northern Pike, sexes combined from spring netting in April 2017 on Bullhead Lake.

Length	Age										
mm (in)	2	3	4	5	6	7	8	9	10	11	12
410 (16")	1										
420											
430	1										
440											
450 (18")	2										
460	2	1									
470	1	1									
480	3	1	1						1		
490	2										
500 (20")			1								
510		2									
520	2	1	1				2				
530			1								
540	1	2	2								
550 (22")		1	1	2	1	1	2	1			
560		1	2		2	1					
570		1		2	1	1	1		1		
580		1	1	1	4	1	1	2			1
590		1				1		1			
600 (24")		1	1	1		1					
610		1				1	1				
620		3	1	1		1					
630				1			2				
640						1	1				
650 (26")						1					
660											
670		1									
680											
690		1									
700 (28")											
710						1					
720											
730											
740											
750 (30")											
760											
770											
780											
790 (31")					1						
Total	15	20	12	8	9	11	10	4	2	0	1
Ave. Length	478 (18.8")	571 (22.5")	553 (21.8")	588 (23.1")	598 (23.5")	612 (24.1")	584 (23.0")	581 (22.9")	532 (20.9")	--	582 (22.9")
S.D.	34 (1.4")	63.2 (2.5")	41.0 (1.6")	31.2 (1.2")	73.3 (2.9")	44.4 (1.7")	45.4 (1.8")	15.1 (0.6")	60.8 (2.4")	--	--

During the fyke net survey we captured two Walleye (Table 1). These Walleye ranged in length from 525 mm to 596 mm (20.6” to 23.5”) and had an average length of 561 mm (22.1”) (Table 2).

Panfish

Bluegill

Bluegill dominated our fyke net catch and accounted for more than 60% of the fish handled during netting (Table 1). The 819 measured Bluegill ranged in length from 87 mm to 244 mm (3.3” to 9.6”) and had an average length of 163 mm (6.4”) (Table 2). Of the measured Bluegill, 61.1% (500 of 819) were greater than 150 mm (6”) in length and 14.7% were greater than 200 mm (8”) in length (Figure 5). Most Bluegill were between 150 mm and 180 mm in length (6”-7”). Total Bluegill CPE was 16.4 Bluegill per net per night.

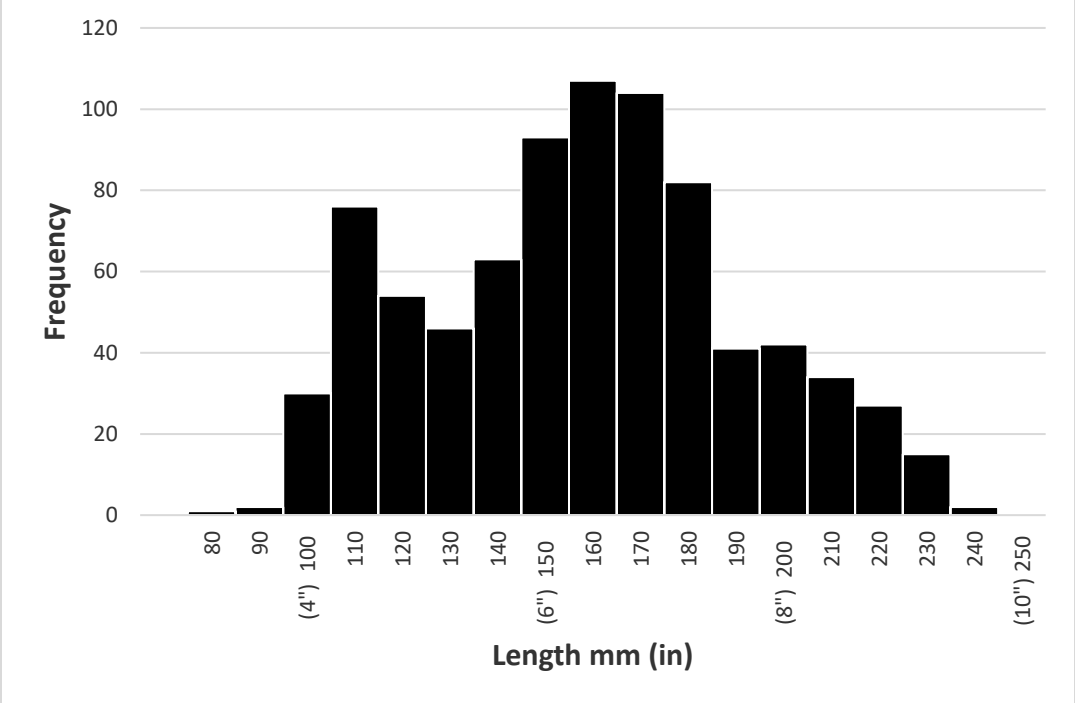

Figure 5. The Bluegill length frequency distribution for fish captured during April 2017 fyke netting on Bullhead Lake.

Scales were collected from a subsample of the captured Bluegill for analysis of age. 174 Bluegill were aged yielding an age distribution that ranged from age 2 through age 11. Age 4 and age 3 were the most common ages in our sample with other ages occurring at a lower frequency (Table 7). Growth as measured by the average length at age was above Statewide averages for all ages (Table 4).

However, growth in 2017 was slightly less than measured during previous surveys.

Table 7. Bluegill length frequency and age distribution for fish that were captured with fyke nets during the 2017 survey. The age distribution of the entire measured catch was a projection based on the distribution of ages from scale samples. Lengths are reported in mm and in inches ().

Length	Total	Age									
(in) mm	Measured	2	3	4	5	6	7	8	9	10	11
80	1	1									
90	2	2									
(4") 100	30		30								
110	76		76								
120	54		54								
130	46		28	18							
140	63		26	32	5						
(6") 150	93		9	84							
160	107		6	95	6						
170	104			83	21						
180	82			64	12	6					
190	41				15	11	11	4			
(8") 200	42				3	10	19	10			
210	34					6	10	14	4		
220	27					2	9	5	11		
230	15						5	1	3	1	5
240	2									1	1
Total	819	3	229	376	62	35	54	34	18	2	6
Ave. Length	163 (6.4")	93 (3.7")	123 (4.8")	164 (6.5")	183 (7.2")	203 (8.0")	213 (8.4")	214 (8.4")	226 (8.9")	240 (9.4")	238 (9.4")
S.D.	40 (1.6")	7.8 (0.3")	14.0 (0.6")	14.7 (0.6")	16.5 (0.6")	10.7 (0.4")	12.0 (0.5")	9.5 (0.3")	7.3 (0.3")	2.1 (0.1")	4.4 (0.2")

Black Crappie

Black Crappie were the second most common panfish that were captured during spring netting (Table 1). The 86 Crappie ranged in length from 115 mm to 289 mm (4.5” to 11.4”) and had an average length of 201 mm (7.9”) (Table 2). The distribution of Crappie was tri-modal with peaks around 130 mm (5.1”), 200 mm (8”) and 255 mm (10”) (Figure 6). CPE for Black Crappie was 1.6 fish per net per night (Table 1).

Scales were collected from 48 of the 86 measured Black Crappie. Ages ranged from age 2 through age 5, with ages 2, 3 and 4 occurring at similar frequency (Table 8). Age 5 Crappie were captured at a lower frequency. Growth, as measured as average length at age, was at, or above Statewide averages at each age indicating good growth for Black Crappie in Bullhead Lake (Table 4).

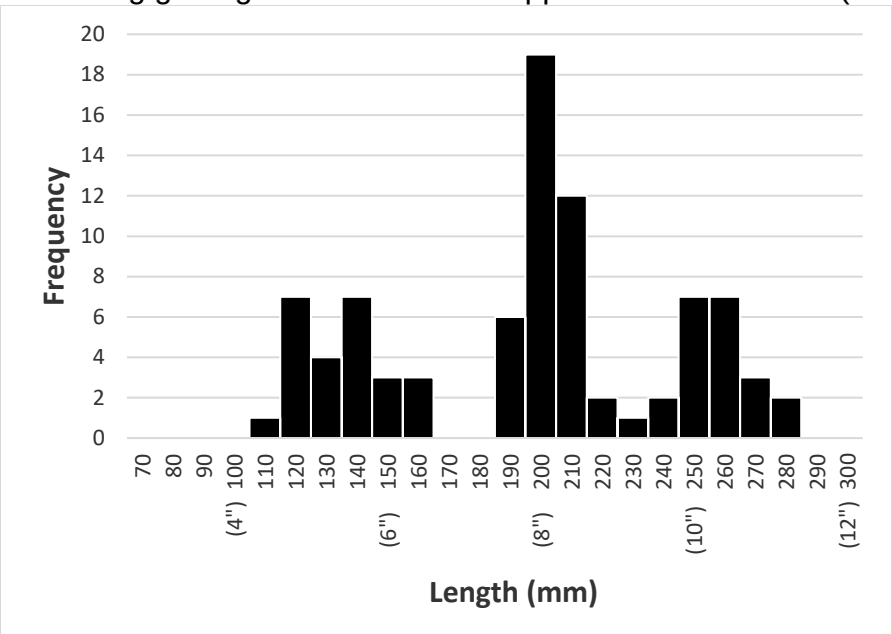

Figure 6. The Black Crappie length frequency distribution for fish captured during April 2017 fyke netting on Bullhead Lake.

Table 8. Black Crappie length frequency and age distribution for fish that were captured with fyke nets during the 2017 survey. The age distribution of the entire measured catch was a projection based on the distribution of ages from scale samples. Lengths are reported in mm and in inches ().

Length (in) mm	Total Measured	Age			
		2	3	4	5
(4") 100					
110	1	1			
120	7	7			
130	4	4			
140	7	7			
(6") 150	3	3			
160	3	3			
170					
180					
190	6		6		
(8") 200	19		19		
210	12		8	4	
220	2			2	
230	1			1	
240	2			2	
(10") 250	7			7	
260	7			6	1
270	3			3	
280	2				2
290					
(12") 300					

Total	86	25	33	25	3
Ave. Length	201 (7.9")	140 (5.5")	207 (8.1")	259 (10.2")	280 (11.0")
S.D.	54.3 (2.1")	15.2 (0.6")	7.4 (0.3")	16.5 (0.6")	10.6 (0.4")

Yellow Perch

A total of 58 Yellow Perch were captured by fyke net during this survey (Table 1). The Perch ranged in length from 120 mm to 268 mm (4.7" to 10.6") and had an average length of 167 mm (6.6") (Table 2). 50% of the captured Perch were greater than 150 mm (6") in length, but only 10.3% were greater than 200 mm (8") in length (Figure 7)

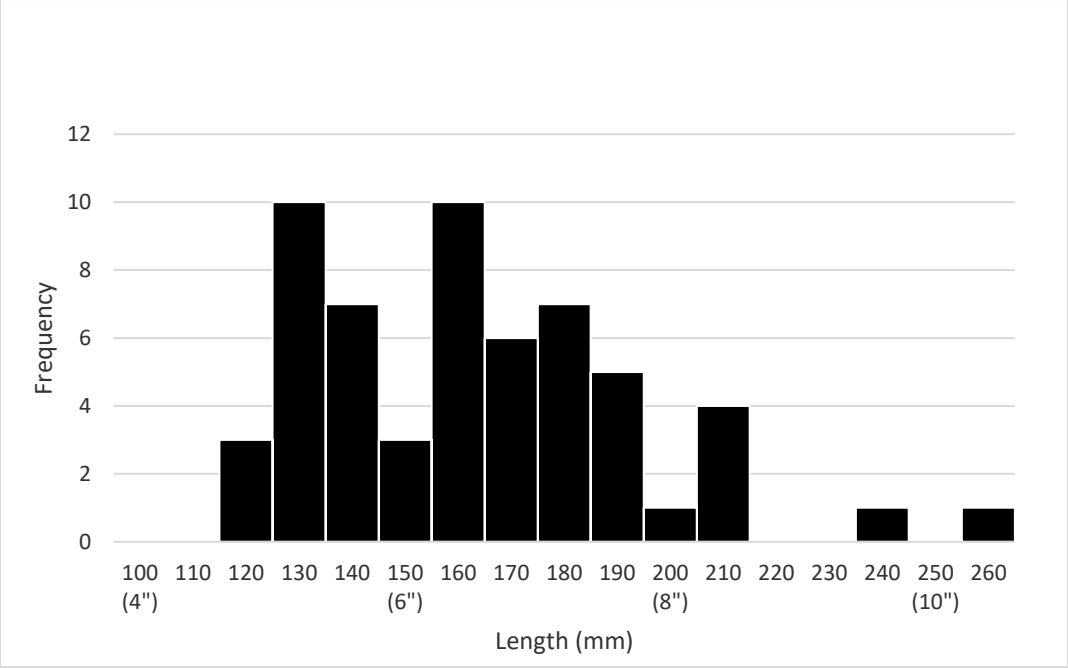

Figure 7. The length frequency distribution for Yellow Perch captured by fyke net from Bullhead Lake during April, 2017.

Spines were collected from captured Yellow Perch for age analysis. From the samples age 2 through age 5 and age 7 Perch were identified with age 3 Perch the most abundant (Table 9). Age 2 and age 4 were also present in good numbers. When average length at each age for Yellow Perch from Bullhead Lake is compared to Statewide values, Perch in Bullhead Lake are longer at each age (Table 4).

Table 9. Yellow Perch length frequency and age distribution for fish that were captured with fyke nets during the 2017 survey. Lengths are in mm and inches (in).

Length	Age					
(in) mm	2	3	4	5	6	7
120	3					
130	9	1				
140	3	4				
(6") 150	2	1				
160		10				
170		6				
180		4	3			
190			5			
(8") 200			1			
210			3	1		
220						
230						
240				1		
(10") 250						
260						1
Total	17	26	12	2	0	1
Ave. Length	136 (5.4")	164 (6.5")	198 (7.8")	234 (9.2")		268 (10.6")
S.D.	9.6 (0.4")	14.3 (0.6")	14.7 (0.6")	21.2 (0.8")		--

Other Species

Fyke nets also captured 194 Brown Bullhead (Table 1). These Bullhead ranged in length from 194 mm to 374 mm (7.6” to 14.7”) and had an average length of 295 mm (11.6”) (Table 2). Many of the captured Bullhead were greater than 280 mm (11”) in length (Figure 8).

A small number of Bullhead had a pectoral spine removed for aging. The ages from this sample ranged from age 3 through age 13, with ages 7, 8 and 9 the most common.

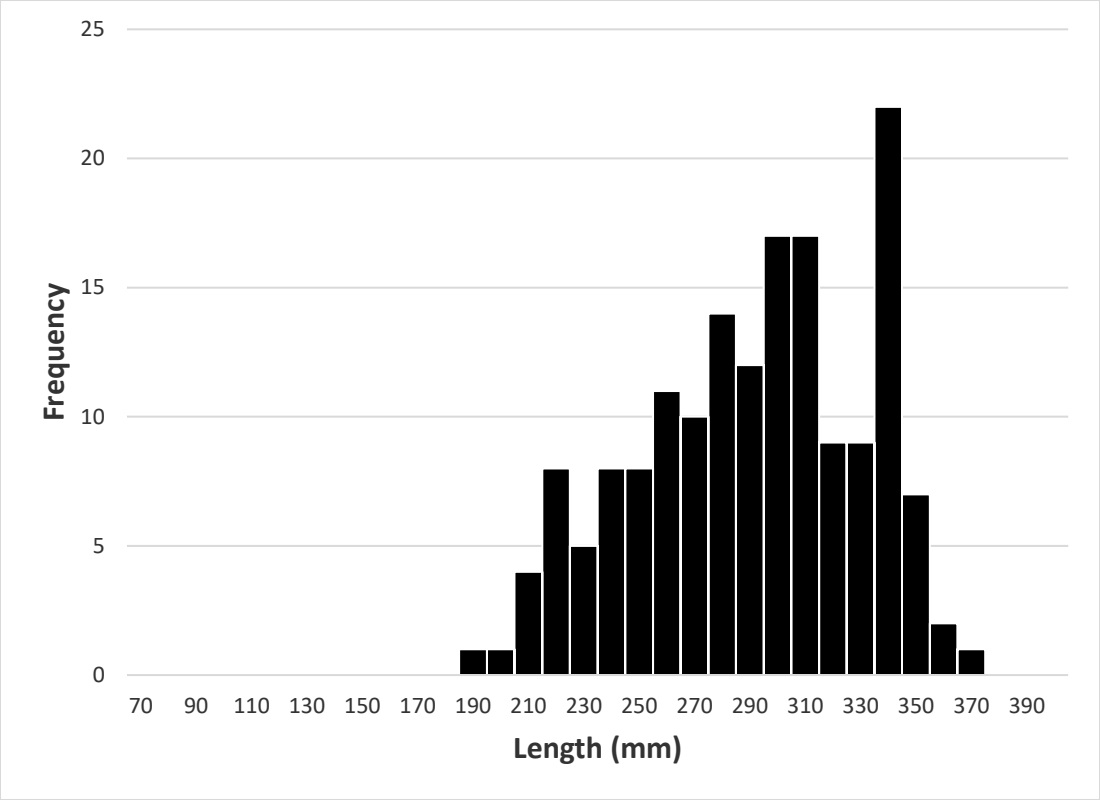

Figure 8. The length frequency distribution for Brown Bullhead captured by fyke net from Bullhead Lake during April, 2017.

Spring Electroshocking

Recapture Run

On the night of April 25, 2017, the entire 1.23 mile shoreline was electroshocked to look for fish marked during fyke netting to allow Peterson Population Estimates to be made. During the 48 minutes of electroshocking, 108 fish of four species were netted. Total CPE was 139 fish per hour shocked or 84 fish per mile shocked (Table 10). The most common fish netted were Largemouth Bass, with substantially fewer Northern Pike or Black Crappie netted. No Walleye were observed during shocking.

Table 10. The number of each species that were captured by electroshocking during the night of April 25, 2017 in Bullhead Lake. Catch per unit effort, (CPE) is expressed as the number of fish per hour shocked or mile shocked. Lengths are reported in mm and in inches () for each species.

Species	Number	CPE (Fish Per Hour)	CPE (Fish Per Mile)	Length Range	Average Length	Peterson P.E.	P.E Range
Walleye	0	--	--	--	--	--	--
Largemouth Bass	100	125	81.3	143 mm- 423 mm (5.6"- 16.7")	332 mm (13.0")	3333	1220-8333
Northern Pike	4	5	3.3	462 mm- 650 mm (18.2"- 25.6")	566 mm (22.3")	--	--
Black Crappie	4	5	3.3	197- 247 mm (7.8"-9.7")	214 mm (8.4")		
Total	108	139	84.6				

Largemouth Bass dominated our catch. The 100 captured Bass ranged in length from 143 mm to 423 mm (5.6” to16.7”) and had an average length of 332 mm (13”) (Table 10). 38% of the captured Bass were greater in length than the 14” (356 mm) minimum size for harvest, but none were greater than 457 mm (18”) in length (Table 11).

Of the 100 Bass that were captured, 97 were greater than 200 mm (8”) in length and 2 were recaptures that were marked during fyke netting. This allowed a Peterson Population Estimate to be made. Using this method, it is estimated that 3,333 Largemouth Bass greater than 200 mm (8”) with a range of 1,220 to 8,333 are in Bullhead Lake (Table 10). Since there was a low number of recaptures, estimates should be viewed with caution.

All unmarked Bass had a dorsal spine removed for aging. Age 2 through age 9, age 11 and age 13 were found in our sample. Age 5 was the most common aged Bass followed by age 7 and age 6 (Table 12). Other ages occurred less commonly. When the average length at age reported in Table 11 from electroshocking are compared to values in Table 4 for 2017 Largemouth Bass average length at age from the fyke net survey, they indicate nearly identical lengths at age. When compared to Statewide values, Bass in Bullhead Lake show good growth as young fish, but as they age, growth slows to below average.

The 4 captured Northern Pike ranged in length from 262 mm to 650 mm (18.2” to 25.6”) and had an average length of 566 mm (22.3”) (Tables 10 and 11).

The 4 Black Crappie ranged in length from 197 mm to 247 mm (7.8” to 9.7”) and had an average length of 214 mm (8.4”) (Tables 10 and 11).

Table 11. The length distribution of fish captured by electroshocking from Bullhead Lake on April 25, 2017.

Length (in) mm	Largemouth Bass	Northern Pike	Black Crappie
140	1		
(6") 150	1		
160	0		
170	1		
180	0		
190	0		1
(8") 200	1		1
210	0		1
220	1		
230	0		
240	1		1
(10") 250	1		
260	0		
270	1		
280	4		
290	14		
(12") 300	7		
310	6		
320	7		
330	4		
340	3		
(14") 350	9		
360	13		
370	11		
380	5		
390	6		
(16") 400	1		
410	1		
420	1		
430			
440			
(18") 450			
460		1	
470			
480			
490			
(20") 500			
510		1	
520			
530			
540			
(22") 550			
560			
570			
580			
590			
(24") 600			
610			
620			
630		1	
640			
(26") 650		1	
Total	100	4	4
Ave. Length	332 (13.0")	566 (22.3")	214 (8.4")
S.D.	52.2 (2.1")	93.1 (3.7")	22.9 (0.9")

Table 12. The age distribution by length for Largemouth Bass collected by electroshocking on April, 25, 2017 on Bullhead Lake.

Length		Age											
(in)	mm	2	3	4	5	6	7	8	9	10	11	12	13
	140	1											
(6")	150	1											
	160												
	170	1											
	180												
	190												
(8")	200	1											
	210												
	220			1									
	230												
	240			1									
(10")	250		1										
	260												
	270				1								
	280			1	2	1							
	290			1	13								
(12")	300				5	2							
	310				4	1		1					
	320				4	2	1						
	330				1	2	1						
	340					2		1					
(14")	350				1	5	3						
	360						9	2	1		1		
	370					3	2	2	2				
	380						5						
	390						3	2	1				
916")	400								1				
	410										1		
	420												1
Total		4	1	4	31	18	24	8	5	0	2	0	1
Ave. Length		169 (6.7")	254 (10.0")	260 (10.2")	305 (12.0")	340 (13.4")	370 (14.6")	364 (14.3")	382 (15.0")		389 (15.3")		423 (16.7")
S.D.		25 (1.0")	--	33.1 (1.3")	16.5 (0.6")	25.8 (1.0")	18.4 (0.7")	25.5 (1.0")	15.6 (0.6")		30.4 (1.2")		--

Centrarchid Electrofishing

On the night of May 24, 2017 the entire shoreline was electroshocked to assess bass and panfish populations. During the 57 minutes of shocking, 191 individual fish of seven species were captured (Table 13). Total CPE was 210.1 fish per

hour shocked or 155.3 per mile shocked. Largemouth Bass and Bluegill dominated our catch with fewer fish of other species collected.

Table 13. The number of each species that were captured by electroshocking during the night of May 24, 2017 in Bullhead Lake. Catch per unit effort, (CPE) is expressed as the number of fish per hour shocked or mile shocked. Lengths are reported in mm and in inches () for each species.

Species	Number	CPE (Fish Per Hour)	CPE (Fish Per Mile)	Length Range	Average Length	Peterson P.E.	P.E Range
Walleye	0	0	0	--	--		
Largemouth Bass	130	143.0	105.7	142 mm- 445 mm (5.6"- 17.5")	307 mm (12.1")	4333	1585-10833
Northern Pike	4	4.4	3.3	549 mm- 678 mm (21.6"- 26.7")	595 mm (23.4")	125	46-313
Bluegill	47	51.7	38.2	67 mm- 220 mm (2.6"- 8.3")	153 mm (6.0")		
Yellow perch	2	2.2	1.6	112 mm- 119 mm (4.4"- 4.7")	116 mm (4.6")		
Black Crappie	5	5.5	4.1	75 mm- 228 mm (3"- 9")	155 mm (6.1")		
Brown Bullhead	2	2.2	1.6	280 mm- 338 mm (11"- 13.3")	309 mm (12.2")		
Common Carp	1	1.1	0.8	--	--		
Total	191	210.1	155.3				

Gamefish

Largemouth Bass dominated the catch, with the 130 captured Bass ranging in length from 142 mm to 445 mm (5.6” to 17.5”) with an average length of 307 mm (12.1”) (Tables 13 and 14). 27.7% of the Bass were greater than the 14” (356 mm) size limit with no fish greater than 457 mm (18”) captured (Table 14). Two Bass were recaptured with marks from either fyke netting or the recapture electroshocking survey. Using the Peterson Population Estimate method, it was estimated that 4,333 Bass greater than 200 mm (8”) (range 1,585 to 10,833) were in the lake. Since the estimate is based on only two recaptures this estimate should be view with caution.

Four Northern Pike were captured during this electroshocking run (Table 13). The Pike ranged in length from 549 mm to 678 mm (21.6” to 26.7”) with an average length of 595 mm (23.4”). Two of the captured Pike were recaptures. The Peterson Population Estimate was 125 with a range of 46 to 313 (Table 13). Since the estimate is based on only two recaptures this estimate should be view with caution.

Panfish

Bluegill dominated the panfish catch. The 47 Bluegill ranged in length from 67 mm to 220 mm (2.6” to 8.3”) with an average length of 153 mm (6”) (Table 13 and 14). The average length for other panfish was 116 mm (4.6”) for Yellow Perch and 155 mm (6.1”) for Black Crappie (Tables 13 and 14).

Other species that were captured included Brown Bullhead and Common Carp. Both were captured in low number (Table 13).

Table 14. The length frequency distribution of captured fish from electroshocking on Bullhead Lake on May 24, 2017.

Length (in)	mm	Largemouth Bass	Bluegill	Black Crappie	Yellow Perch	Brown Bullhead
	60		1			
	70			1		
	80		2			
	90		1			
(4")	100		2			
	110		6		2	
	120		6			
	130		2	1		
	140	2		1		
(6")	150	5	5			
	160	1	2			
	170	3	4			
	180	4	8	1		
	190	3	3			
(8")	200		1			
	210	2	3			
	220	1	1	1		
	230	3				
	240	3				
(10")	250	3				
	260	3				
	270	3				
	280	5				1
	290	8				
(12")	300	9				
	310	8				
	320	5				
	330	7				1
	340	8				
(14")	350	10				
	360	9				
	370	6				
	380	8				
	390	5				
(16")	400	3				
	410					
	420					
	430	1				

440	2				
(18") 450					
Total	130	47	5	2	2
Ave. Length	307 (12.1")	153 (6.0")	155 (6.1")	116 (4.6")	309 (12.2")
SD	72.3 (2.8")	39.5 (1.6")	57.6 (2.3")	4.9 (0.2")	41.0 (1.6")

During fyke netting and electroshocking surveys, fisheries staff noted abundant rooted vegetation and algae at several locations around Bullhead Lake and in addition, that water clarity on some survey dates appeared to be low. Before starting electroshocking on May 24, 2017 staff measured temperature, conductance and dissolved oxygen (DO) with an YSI Meter (Table 15).

Table 15. Temperature, conductance and dissolved oxygen valves measured on May 24, 2017 on Bullhead Lake. Readings were taken starting at 8:10 pm.

Depth (m)	Temperature (C)	Dissolved Oxygen (mg/l)	Percent Oxygen Saturation	Conductance
Surface	**15.4**	**9.2**	**96.0**	**0.3823**
1	**15.5**	**9.0**	**95.0**	**0.5833**
2	**15.5**	**9.0**	**94.0**	
3	**15.5**	**8.8**	**93.0**	
4	**15.5**	**8.8**	**93.0**	
5	**13.1**	**4.0**	**40.0**	**0.3900**
6	**11.0**	**3.0**	**29.0**	**0.3906**
7	**10.3**	**0.6**	**0.6**	
8	**9.8**	**0.2**	**0.2**	**0.3937**
8.5	**9.7**	**0.1**	**0.1**	**0.3949**

The thermocline was found between 4 and 5 meters (12’ to 16’) of depth with DO and temperature dropped quickly below the thermocline (Table 15). Conductance was fairly uniform throughout the water column except at 1 meter (3”) of depth where conductance was highest.

DISCUSSION

A comprehensive fisheries was conducted on Bullhead Lake in April and May, 2017 to assess the fish populations of the lake. Two survey gears, fyke nets and a boomshocker was used to collect fish across the spring spawning seasons. In total, 1,721 fish representing eight species were captured. Overall, Bluegill dominated our catch chiefly because the large number of Bluegill captured by fyke nets. Largemouth Bass, Brown Bullhead and Northern Pike were the next most abundant species with other species caught in lower number. In electroshocking surveys, Largemouth Bass and Bluegill dominated our catch.

Gamefish

Largemouth Bass were the most abundant gamefish captured during the overall survey and in each phase of the survey. Growth as measured by average length at each age was below Statewide averages indicating slow growth. This result is similar to past surveys where slow growth and the stacking of Bass just below the 14” (356 mm) minimum size limit for harvest was noted (Hogler and Surendonk 2012, Surendonk and Hogler 2003). However, in 2017 length frequencies indicate that fewer fish were stacked just below the size limit as shown by an increase in the percentage of fish greater than 14” (356 mm) in that in 2017 that ranged from 27% to 37% compared to less than 20% in previous surveys. Recruitment of Bass appears to be consistent, with many year classes present in our age sample collected in 2017. Past surveys indicated poor survival past age 5 with few older fish. The increased number of year classes and the survival to older may be due to changing our aging structure from scales to dorsal spines.

Northern Pike were commonly captured during spring netting in 2017. Past surveys captured fewer Pike than did the 2017 survey (Hogler and Surendonk 205, Surendonk and Hogler 2003). It is not clear why the Pike population appears to be increasing. Although there appears to be more Northern Pike in the lake, captured fish were generally small, with few fish greater than 660 mm (26”) in length. Growth was at or above average through age 6 and decreased thereafter.

Walleye were infrequently captured during this survey despite ongoing stocking efforts. Survival of stocked Walleye appears to be low although anecdotal reports of sporadic angler catches are received each year.

Panfish

Bluegill were the most common fish and panfish that were captured during this survey. The large catch of Bluegill (888) during fyke netting was unexpected. Previous surveys caught modest numbers of Bluegill that were mostly small in size although a few very large Bluegill were captured in each survey (Hogler and Surendonk 2012, Surendonk and Hogler 2003). The 2017 survey caught greater numbers of Bluegill than did previous surveys although the average size was similar to past surveys. Fewer large, greater than 225 mm (9”) Bluegill, were captured in 2017 compared to earlier surveys perhaps indicating angler harvest of these large Bluegill. Since the growth of Bluegill in Bullhead Lake is at or above Statewide averages, this could indicate that angler harvest may be cropping off large fish.

Black Crappie and Yellow Perch were also captured in 2017 surveys. Similar to past surveys, they are present but not in high abundances. Growth for each species was above Statewide averages.

Other Species

Brown Bullhead were commonly captured in fyke netting. Captured Bullhead were large in size with an average length of 295 mm (11.6”). It is likely that the current population of Bullhead in the lake is not causing negative impacts on other species.

A single Common Carp was captured in the May electroshocking survey. It is very unusual for Bullhead Lake to have carp in it. No Common Carp were captured during the past three surveys.

Very few forage fish were seen and none were netted during the 2017 survey. Past surveys captured small numbers of forage species and the lack of forage in 2017 is concerning and may account for the slow growth seen in some species.

Water Quality and Habitat

Possible declines in water quality since the last survey as indicated by increased algal growth and rooted plant growth is a fisheries concern. Thick mats of algae can cover spawning beds or recently deposited eggs reducing recruitment. Large diel swings in oxygen can also negatively impact fisheries as algae bloom and die. Improving water quality can improve the level and consistency of year classes that are produced improving gamefish, panfish and forage fish populations.

It was also noted during surveys that in water woody habitat was lacking in many areas of the lake. Studies have shown that with increasing amounts of wood in the lake, fish populations respond in a positive manner.

RECOMMENDATIONS

- Conduct a full comprehensive fish survey every ten years, with a Bass/Panfish survey between the comprehensive surveys to monitor the fish populations of the lake. Each survey should focus on:
    - The growth rates of Largemouth Bass, Northern Pike and Bluegill.
    - The contribution of stocked Walleye to the fishery.
    - The abundance of forage fish.
- Evaluate the results from the Panfish Study and make appropriate recommendations based on the findings of the study.
- Work with other DNR staff, the Manitowoc County Soil and Water Department, the Manitowoc Lakes Association, the Bullhead Lake Association and local residents to monitor water quality in the lake and to make changes in the watershed designed to improve water quality.

- Encourage the Bullhead Lake Association and shoreline owners to improve nearshore fish habitat by incorporating woody debris in their landscape.

REFERENCES

Belonger, B. 1976 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 2 Pages.

Cline, C. 1957 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 3 Pages.

Hogler, S. and S. Surendonk. 2005. Fall 2005 Bullhead Lake Electroshocking Survey. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 7 pages.

Hogler, S. and S. Surendonk. 2012. Fall 2011 Bullhead Lake Electroshocking Survey. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 5 pages.

Peeters, P. 1982 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 2 Pages.

Peeters, P. 1985 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 3 Pages.

Peeters, P. 1988 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 2 Pages.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada. Bulletin 191. Ottawa, Ontario, Canada.

Schultz, PT. 1963 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 2 Pages.

Schultz, PT. 1965 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 3 Pages.

Schultz, PT. 1966 Survey of Bullhead Lake, Manitowoc County. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 3 Pages.

Surendonk, S. and S. Hogler. 2003. Comprehensive Survey of Bullhead Lake, Manitowoc County. Unpublished. WDNR. Madison, WI. 37 pages.