2013 Fish Survey of Clark Lake

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ABSTRACT

Clark Lake is the second largest lake in Door County and is impounded by a dam on Whitefish Bay Creek. The lake has a surface area of 864 acres, a maximum depth of 22 feet and an average depth of 7 feet. Clark Lake is mesotrophic indicating moderately productive water. At times, because the lake is shallow, especially on the south end, lake water can be very turbid due to wind action or from heavy boating use.

A number of fish surveys have been conducted on the lake since the 1950's. Over time the lake has seen shifts in fish populations with walleye and smallmouth bass alternating dominance. Panfish have shown a similar trend with yellow perch, rock bass and bluegill alternating in dominance. The fishery of Clark Lake was surveyed in 2013 as part of Tier 1 Lake monitoring which utilizes a rotating schedule and standardized sampling protocols to monitor lakes on a statewide basis. This paper reports the findings of the 2013 survey and when applicable compares results to previous surveys.

Fish populations in Clark Lake appear to have changed little since the previous survey in 2009. Adult (spawning) walleye numbers continue to be lower than historic numbers based on population estimates, but relative abundance (CPE) appears to be slightly increasing because of increasing numbers of young fish. Smallmouth bass numbers are stable and largemouth bass continue to be part of the fishery. Bass populations appear to be reproducing well. The northern pike population appears to be declining in the lake. Few northern pike are large in size and harvest or poor recruitment may be affecting their abundance and size distribution. Panfish are increasing in number. The growth of panfish in Clark Lake appears to be good at all sizes. Forage minnows are common in the lake near Logan Creek, but lack of suitable habitat in other areas of the lake, limit their abundance. Increased distribution of plants would benefit forage fish as well as other species. Carp although present in the lake, were low in number and do not seem to be a problem at this time.

It is recommended that DNR should

- Continue to monitor the walleye population in Clark Lake.
- Encourage the lake residents to protect natural shorelines and the recolonization of shallow water aquatic plants that will help maintain a healthy, stable and diverse fish community in the lake.
- Monitor the movement and abundance of invasive species in Clark Lake.

INTRODUCTION

Clark Lake (WBIC 97700) is the second largest lake in Door County covering 864 acres and is formed by a dam on Whitefish Bay Creek (Figure 1). This dam is operated within guidelines set by an Administrative Law Judge to allow for seasonal water level adjustments and required that fish barriers be in place to prevent the movement of fish over the dam. The lake is relatively shallow with a maximum depth of 22 feet and an average depth of 7 feet (Door County SWCD 2000). Twenty-one percent of the lake is less than 3 feet in depth and 7% is greater than 20 feet. Since the lake is shallow, especially on the south end, lake water can be very turbid at times due to wind action or from heavy boating use. Clark Lake is considered mesotrophic indicating that the lake is moderately productive (WDNR 2001).

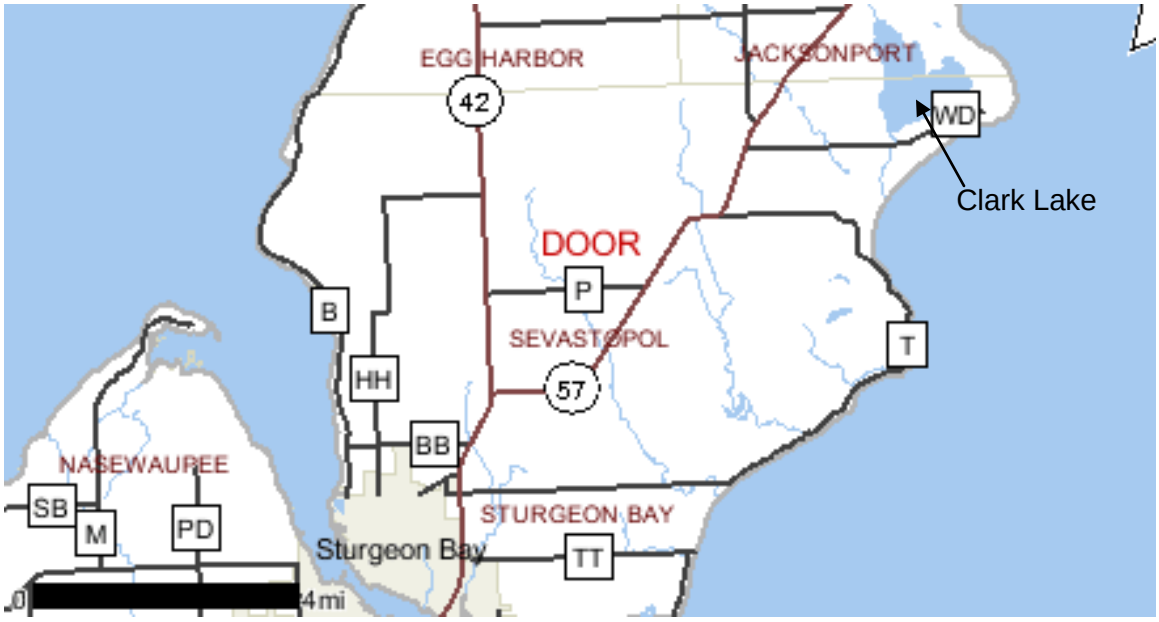

Figure 1. Clark Lake is located in Door County northeast of Sturgeon Bay.

Hogler et al (2005 and 2010) described the findings of fish surveys conducted in Clark Lake since the 1950's. He found that over time the lake has undergone several cycles in which smallmouth bass and walleye have alternated as the dominant predator and panfish community dominance has switched between yellow perch and bluegill or rock bass. Early in the 1950's smallmouth bass, bluegill and yellow perch dominated the fish community. By the 1960's and through the 1970's, walleye and yellow perch dominated the fish community. Early in the 1980's and continuing through the 2000's smallmouth bass and rock bass began to increase in abundance. The fishery of Clark Lake was last surveyed in 2009 as part of Tier 1 Lake monitoring. Results from the 2009 survey indicate that rock bass, bluegill and walleye were the most common species. Other populations such as smallmouth bass and yellow perch were stable with declines noted in the northern pike population. No new management recommendations were made based on the survey findings. Most fish species

have had stable populations and stocking of any species has not been required to augment their number since the mid-1970's when largemouth bass were stocked and for yellow perch that were stocked by the Lake Association from 2002 to 2004.

This report describes the findings of the 2013 Tier 1 lake monitoring survey of Clark Lake.

METHODS

Spring Fyke Netting

A standard Tier 1 fisheries survey on Clark Lake was begun in April and continued through October, 2013. Eight fyke nets were set following ice-out on April 29, fished until May 6 and were used to capture and mark adult spawning walleye and northern pike for the purpose of estimating adult population size (Figure 2). Other gamefish captured in fyke nets were also marked for potential population size estimation, but nets were set in habitats to target adult spawning walleye. Overall, there were 48 net lifts for a total effort of 56 net-nights during the netting period. All fish were identified, measured or counted, gamefish marked with a caudal fin clip and scales or spines were removed from a sub-sample of gamefish and panfish for age determination.

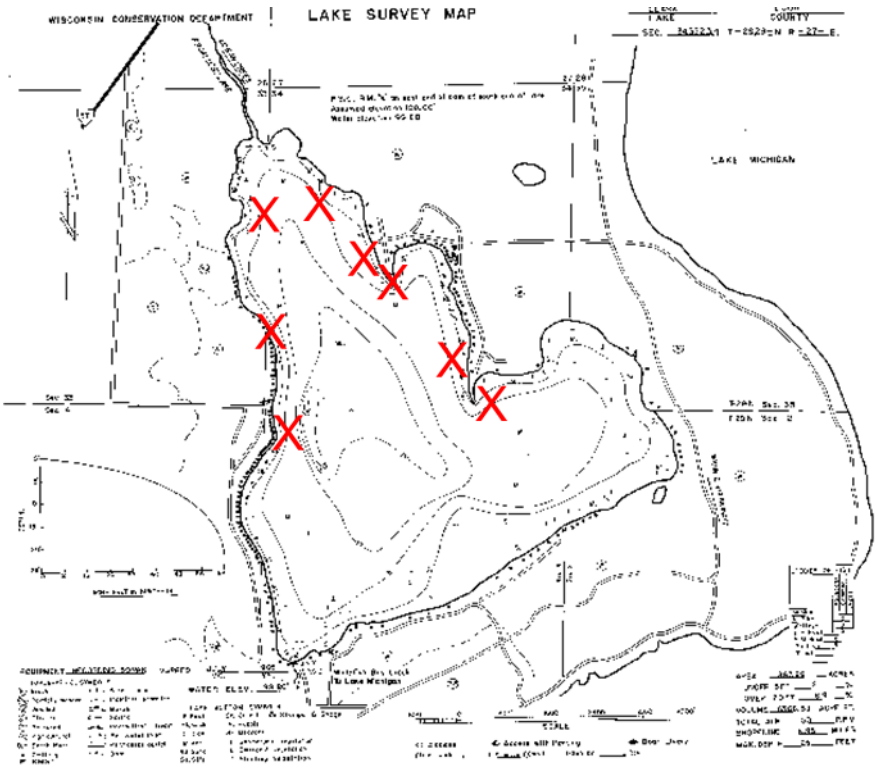

Figure 2. The locations of the eight fyke nets that were fished in Clark Lake from April 29 through May 6, 2013 are marked by an X on the lake map.

Spring Electrofishing
Shortly after the completion of fyke netting, three 1 mile sections of the shoreline were electroshocked on the night of May 7 to look for marked fish (Figure 3). All fish were netted, identified, examined for marks, and measured.

Centrarchid Electrofishing
Centrarchids are the taxonomic family of fish that includes bass and most panfish species. Research has shown that to effectively sample these species, spring electrofishing is the preferred method of capture. The same 3 sections of shoreline were electroshocked on May 28 to estimate adult smallmouth and largemouth bass population size and to estimate panfish relative abundance. All fish were netted, identified and counted. Gamefish were examined for marks, measured, and bass had scales removed for age determination.

Fall Recruitment and Index Sampling
On the night of October 21, three shoreline sections were electroshocked to determine the abundance young-of-year fish and to assess the general fish population (Figure 4). Strong west-northwest winds did not allow us to shock the same three stations that were shocked in May. An alternative section running from the west shore boat ramp to the dam was shocked instead. All fish were netted, identified, and counted or measured.

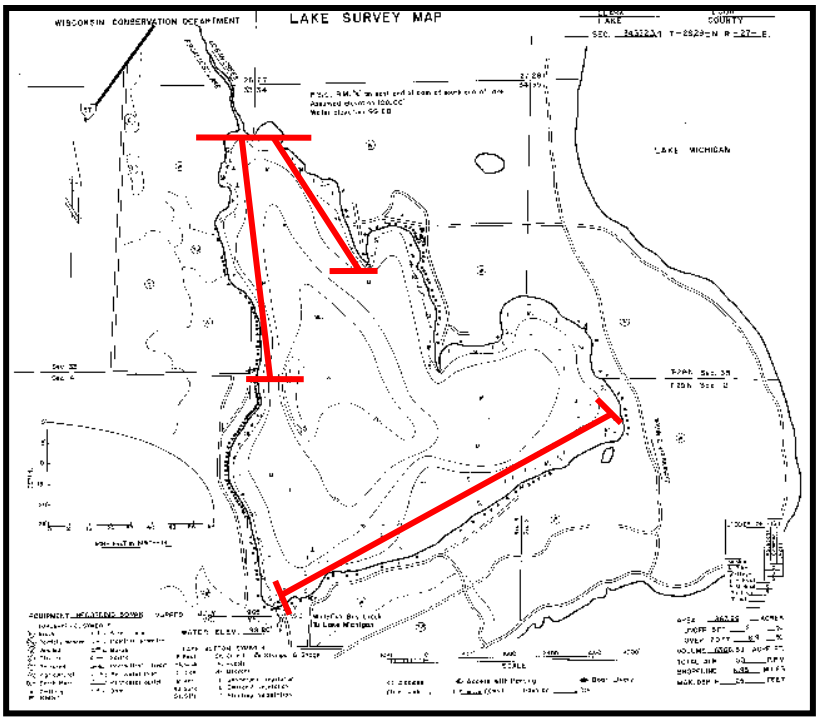

Figure 3. The recapture and centrarchid electroshocking stations are shown by the red lines on the map of Clark Lake.

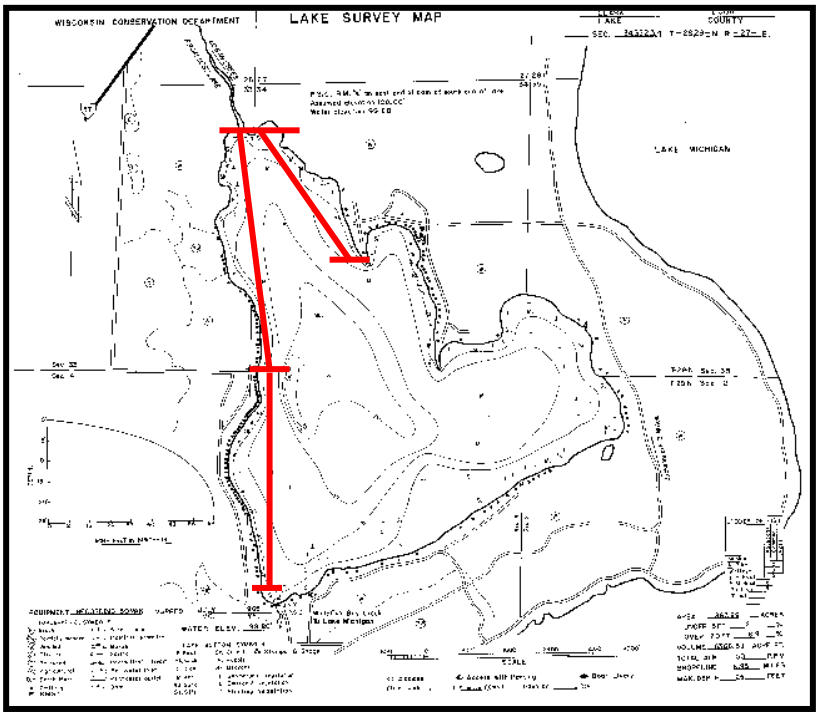

Figure 4. The fall electroshocking stations are shown by the red lines on the map of Clark Lake.

Statistical Analyses

Basic fisheries statistics, such as average length, length frequencies by survey type, age distributions, and population estimates were calculated. 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 806 fish were captured during the 56 net nights of effort resulting in a CPE of 14.39 fish per net per night (Table 1). Of the eleven species captured during fyke netting, rock bass, bluegill,

longnose sucker and walleye dominated the catch, with substantially fewer fish our other species captured.

Table 1. Species captured from Clark Lake with fyke nets fished from April 29 through May 6, 2013.

	Captured	Total Marked	Catch Per Net Night	Ave. Length	Length Range
Bowfin	48		0.86	--	--
Northern Pike	12	12	0.21	624 mm	440- 700 mm
Longnose Sucker	114		2.04	--	--
White Sucker	73		1.30	--	--
Rock Bass	208		3.71	169 mm	95- 299 mm
Pumpkinseed	1		0.02	145 mm	--
Bluegill	199		3.57	159 mm	91- 265 mm
Smallmouth Bass	11	11	0.20	464 mm	426- 504 mm
Largemouth Bass	7	7	0.13	411 mm	256- 515 mm
Yellow Perch	7		0.13	179 mm	149- 195 mm
Walleye	125	125	2.23	411 mm	137- 602 mm
Total	806	155	14.39		

Gamefish

Walleye

Walleye were the most commonly captured gamefish during fyke netting with a CPE of 2.23 (Table 1). The 125 walleye that were captured ranged in length from 137 mm to 602 mm and had an average length of 411 mm (Table 2). Of the walleye we captured, 96 (76.8%) were greater than 381mm minimum size limit.

Age was determined for most of the walleye that were captured using a dorsal spine. Ages ranged from age 1 through age 11 and age 14 (Table 3). Ages 1 through 4 were the most common aged walleye, with few walleye older than age 9 sampled. Young fish (< age 5) were very common in our catch. Growth of walleye in Clark Lake when compared to statewide age at length tables, appears to be at or above state rates for each age (Table 4).

Table 2. The length frequency distribution of gamefish captured by fyke net from Clark Lake from April 29 through May 6, 2013.

Length (mm)	Walleye	Largemouth Bass	Smallmouth Bass	Northern Pike
130	1			
140				
150				
160				
170				
180				
190	1			
200				
210	1			
220				
230				
240	1			
250		1		
260	2			
270	1			
280	3			
290	4			
300	6			
310	4			
320	2			
330		1		
340	2			
350	1			
360				
370				
380	2			
390	11			
400	4	1		
410	10			
420	14	1	1	
430	10		2	
440	5		2	1
450	11			
460	8		1	
470	3	2	1	
480	1		1	
490	3		1	
500	1		2	
510	4	1		
520	1			
530	3			
540				1
550	1			
560	1			
570	2			
580				
590				1
600	1			2
610				
620				
630				
640				
650				2
660				1
670				1
680				2
690				
700				1
Total	125	7	11	12
Average Length	411	411	464	624
S.D.	81.4	91.9	29.3	74.2

Table 3. The age-length distribution of walleye captured with fyke nets during spring surveys of Clark Lake.

Length (mm)	Total Captured	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
130	1	1													
140															
150															
160															
170	2	2													
180	8	8													
190	10	10													
200	3	3													
210	3	3													
220															
230															
240	1		1												
250															
260	3		3												
270	1		1												
280	3		3												
290	6		6												
300	6		6												
310	4		1	3											
320	3		3												
330															
340	2			2											
350	1			1											
360															
370															
380	2				1	1									
390	11			4	6	1									
400	4			2	1		1								
410	10			6	1	3									
420	15			5	4		4	1	1						
430	10			2	3	2	2			1					
440	5			2	1		1		1						
450	11			1	1		3	4	2						
460	11				4		2	1	1	2					1
470	3				2					1					
480	1						1								
490	4						2	2							
500	1						1								
510	4						1	1		1	1				
520	1						1								
530	3						1	1	1						
540															
550	1											1			
560	1								1						
570	2								2						
580															
590															
600	1									1					
Total	158	27	24	28	24	7	20	10	9	6	1	1	0	0	1
Ave. Length	376	193	287	398	425	412	462	471	497	492	510	552	--	--	467
S.D.	108.5	10.1	37.3	39.9	29.1	17.8	37.2	34.3	61.2	59.6	--	--	--	--	--

Table 4. Average length (mm) at age as determined by spines or scales for fish captured during surveys in 2005 (Hogler 2005 and 2009) and 2013 as compared to state averages.

Species	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7	AGE 8	AGE 9	AGE 10+
Northern Pike (2013)			440	604	652	660				
2009	292	367	468	533	616	698	747			--
2005	--	335	476	511	573	725	890	--	--	1,010
(State Average)	356	406	470	546	610	650	706	762	787	
Rock Bass (2013)	--	114	131	167	201	257	--	295		
2009	--	101	147	190	224	231	275	--	277	--
2005	--	90	129	171	212	239	255	269	273	285
(State Average)	53	91	127	155	175	193	213	226	239	244
Bluegill (2013)	--	107	147	187	219	237	255	261		
2009	--	--	125	188	198	250	255			
2005	--	131	182	217	--	--	--			
(State Average)	64	97	122	147	167	183	196			
Smallmouth Bass (2013)	158	272	--	432	446	458	490	490	504	
2009	135	198	342	393	399	440	475	520	--	--
2005	--	150	232	293	353	409	429	452	480	490
(State Average)	97	168	236	292	343	381	432	457	472	
Yellow Perch (2013)										
2009			174	210	270					
2005	--	130	164	220	250					
(State Average)	74	119	152	180	208					
Walleye (2013)	193	287	398	425	412	462	471	497	492	510
2009	187	276	357	411	465	492	513	--	550	--
2005	--		356	396	421	454	479	529	568	590
(State Average)	152	254	324	381	432	457	497	526	551	

Northern Pike

During netting, 12 northern pike were captured with a CPE of 0.21 fish per net-night (Table 1). The captured northern pike ranged in length from 440 mm to 700 mm and averaged 624 mm in length (Table 2). Most pike were greater than 600 mm in length with 5 of the 12 pike (41.6%) greater than 660 mm in length.

Ages 3 through 6 were noted from the scale samples that were collected during fyke netting (Table 5). Age 5 northern pike was the most abundant age class followed by age 4 and age 6 fish.

Growth of northern pike in Clark Lake when compared to statewide age at length tables, appear to be at or slightly above state average growth rates for pike (Table 4). Very few northern pike were captured during netting so age and growth data should be viewed cautiously.

Table 5. The length and age frequency of northern pike captured with fyke nets from Clark. Note the discontinuity of the table between 710 and 990 mm and above 1000mm. No pike were captured that had a length between 710 mm and 990 mm and only a single fish had a length greater than 1000 mm at 1025 mm but it was not aged.

Length (mm)	Number	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
400								
410								
420								
430								
440	1			1				
450								
460								
470								
480								
490								
500								
510								
520								
530								
540	1				1			
550								
560								
570								
580								
590	1					1		
600	2				1		1	
610								
620								
630								
640								
650	2					2		
660	2				1	1		
670	1					1		
680	1						1	
690								
700	1						1	
710-990								
1000+	1							
Total	13			1	3	5	3	
Ave. Length	655			440	604	652	660	
S.D.	131.9			--	60.0	34.7	53.1	

Bass

We captured eleven smallmouth bass and seven largemouth bass during fyke netting (Table 1). The CPE for smallmouth and largemouth bass CPE was 0.20 and 0.13 respectively. Smallmouth bass ranged in length from 426 mm to 504 mm with an average length of 464 mm (Table 2). All the captured smallmouth bass were greater than the 356 mm minimum size limit. The largemouth bass that we captured ranged in length from 256 mm to 515 mm and had an average length 411 mm (Table 2). Five of the six largemouth bass that we captured were greater than the 356 mm minimum size limit for bass on Clark Lake.

During fyke netting we collected dorsal spines for aging from smallmouth and largemouth bass. We also collected spines from these fish during the recapture

and centrarchid electroshocking runs. Since most of the samples were collected during fyke netting, I will report the combined results in this section.

A total of 18 spines were collected from smallmouth bass for aging. Ages of sampled smallmouth bass ranged from age 1 through age 9 (Table 6). Age 5 was the most common age in our sample followed by ages 4 and 8.

When compared to state average lengths at age, smallmouth bass in Clark Lake were larger at all ages than bass from other lakes indicating very good growth (Table 4).

Table 6. The length and age frequency of smallmouth bass captured from Clark Lake during spring netting and spring shocking.

Length (mm)	Total Caught	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9
130										
140										
150	1	1								
160										
170										
180										
190										
200										
210										
220										
230										
240										
250										
260										
270	1		1							
280										
290										
300										
310										
320										
330										
340										
350										
360										
370										
380										
390										
400										
410										
420	1				1					
430	3				2	1				
440	3					3				
450	1						1			
460	1					1				
470	1							1		
480	2								2	
490	1								1	
500	2							1		1
510	1									1
520										
Total	18	1	1	0	3	5	1	2	3	2
Ave. Length	438	158	272	--	432	446	458	490	490	504
S.D.	87.8	--	--	--	7.8	11.2	--	20.5	10.6	6.4

We also collected dorsal spines from largemouth bass during netting and shocking surveys of Clark Lake. A total of 23 spines were evaluated for age. In our sample we encountered largemouth bass that ranged in age from age 1 to age 5 and ages 7 and 8 (Table 7). Age 2 and age 5 were the most common aged bass in our sample.

Table 7. The length and age frequency of largemouth bass captured from Clark Lake during spring netting and spring shocking.

Length (mm)	Total Caught	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
100									
110									
120									
130	1	1							
140	1	1							
150									
160									
170									
180									
190									
200	1		1						
210									
220									
230	2		2						
240	1		1						
250	1		1						
260	1		1						
270									
280									
290									
300									
310									
320	1								
330	2			2					
340	2			2					
350									
360					1				
370									
380									
390									
400	3					3			
410									
420	1					1			
430									
440	1					1			
450									
460									
470	3							3	
480									
490	1								1
500									
510	1								1
Total	23	2	6	4	1	5	0	3	2
Ave. Length	343	140	240	337	336	418	--	476	515
S.D.	113.5	2.1	23.3	6.4	--	19.9	--	4.4	14.1

Panfish

Rock Bass

Rock bass were the most commonly captured panfish during spring fyke netting. We caught 208 rock bass with a CPE of 3.71 fish per net per night (Table 1). Captured rock bass ranged in length from 95 mm to 299 mm and had an average length of 169 mm (Table 8). 72.1% and 16.8% of the captured rock bass were greater than 150 mm or 200 mm in length respectively.

Table 8. The panfish length frequency for fish captured with fyke nets during the spring netting survey of Clark Lake.

Length (mm)	Rock Bass	Bluegill	Pumpkinseed	Yellow Perch
50				
60				
70				
80				
90	1	11		
100	1	12		
110	2	7		
120	12	9		
130	18	24		
140	24	27	1	1
150	36	25		
160	26	18		1
170	20	15		1
180	18	7		2
190	15	6		2
200	15	11		
210	8	7		
220	3	7		
230	1	4		
240	1	3		
250		3		
260	1	3		
270	2			
280				
290	4			
300				
Total	208	199	1	7
Average Length	169	159	145	179
S.D.	34.5	40.4	--	16.4

Age was determined by scales for a sub-sample of rock bass that were captured during fyke netting and spring electroshocking. Rock bass ages ranged from age 2 through age 6 and age 8 (Table 9). Age 4 was the most common age rock bass followed by ages 3 and 5. Age 4 rock bass averaged 167 mm in length. Growth of rock bass in Clark Lake when compared to statewide age at length at age tables, show that in Clark Lake rock bass are larger than state averages at each age indicating good growth (Table 4).

Table 9. Rock bass length frequency and age distribution for fish captured with fyke nets and electroshocking on Clark Lake during 2013. 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.

Length (mm)	Number Caught	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
50									
60									
70									
80									
90	1		1						
100	3		3						
110	2		1		1				
120	12		2	10					
130	19			15	4				
140	25			2	23				
150	37			2	35				
160	26				24	2			
170	23				21	2			
180	18				14	4			
190	15				6	9			
200	16				4	12			
210	9				2	7			
220	4					3	1		
230	1					1			
240	1						1		
250									
260	1						1		
270	2						2		
280									
290	4								4
300									
Total	219	0	7	29	134	40	5	0	4
Ave. Length	169	--	114	131	167	201	257	--	295
S.D.	34.7	--	13.7	7.5	19.8	14.1	20.4	--	4.5

Bluegill

During fyke netting, we captured 199 bluegill with a CPE of 3.57 fish per net-night (Table 1). Captured bluegill ranged in length from 91 mm to 265 mm and had an average length of 159 mm (Table 8). 54.8%% of the captured bluegill were greater than 150 mm in length and 19.1% were greater than 200 mm in length.

Similar to rock bass, age was determined by scales for a sub-sample of bluegill that were captured during fyke netting and spring electroshocking. Age of captured bluegill ranged from age 2 through age 8 (Table 10). Age 3 bluegill were the most common followed by age 2 and age 4 bluegill. Few bluegill were older than age 6. Length at age for bluegill in Clark Lake was greater than statewide averages for each age indicating good bluegill growth in the lake (Table 4).

Table 10. Bluegill length frequency and age distribution for fish captured with fyke nets and electroshocking on Clark Lake during 2013. 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.

Length (mm)	Total Caught	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
50									
60									
70	2		2						
80	3		3						
90	14		14						
100	14		14						
110	7		6	1					
120	9		6	3					
130	24		2	22					
140	28			28					
150	26			26					
160	18			14	4				
170	16			3	13				
180	7				7				
190	6				6				
200	11				7	4			
210	7				3	3	1		
220	7					6	1		
230	4					1	3		
240	3					1	1	1	
250	3						2		1
260	3							2	1
270									
280									
290									
300									
Total	212	0	47	97	40	15	8	3	2
Ave. Length	156	--	107	147	187	219	237	255	261
S.D.	41.9	--	11.6	13.4	14.8	11.8	13.7	9.0	6.4

Other Panfish

In addition to rock bass and panfish, we captured yellow perch and pumpkinseed sunfish in our nets. The seven captured yellow perch ranged in size from 149 mm to 195 mm and had an average length of 179 mm (Table 1). The single pumpkinseed sunfish was 145 mm in length (Table 1).

Other Species

Three additional species were captured during fyke netting and in decreasing order of abundance included longnose sucker, white sucker, and bowfin (Table 1).

Spring Electroshocking

On the night of May 7, the three shoreline stations on Clark Lake were electroshocked for 1.53 hours to look for fish marked during fyke netting. A total of 44 fish representing four species were captured (Table 11). CPE was 35.3 fish per hour shocked or 16.9 fish per mile of shoreline shocked. Walleye was the most common species captured with other species captured in lower abundance. Of the fish captured, one walleye and three smallmouth bass had marks given during fyke netting. This allowed us to calculate Petersen population estimates for these species. The walleye estimate was calculated for all walleye and for those greater than age 1.

The population estimates (PE) for both walleye and smallmouth bass should be viewed cautiously because of the low number of fish marked and the low number of recaptured fish. The population estimate for all walleye was 3625 which likely underestimates the total number of walleye in Clark Lake (Table 11). PE for smallmouth bass was 22 which under estimates the total number of bass in the lake (Table 11).

Captured walleye ranged in length from 173 mm to 492 mm and had an average length of 262 mm (Table 12). Most of the captured walleye (19 of 29) were judged to be age 1 fish. Few captured walleye were greater than 450 mm in length. The smallmouth bass that were handled ranged in length from 272 mm to 514 mm and had an average length of 435 mm. The eight largemouth bass that we captured ranged in length from 232 mm to 492 mm and had an average length of 370 mm.

Table 11. The number of fish caught during recapture electroshocking on Clark Lake in May 7, 2013. The table also includes the number of marked fish recaptured during electroshocking, the number of fish marked during fyke netting, the Peterson Population Estimate and Catch Per Effort (CPE).

Species	Total Captured (Electro-shocking)	Re-Captured (Electro-shocking)	Total Marked (Fyke Net)	Peterson Population Estimate	CPE per Hour	CPE Per Mile
Bowfin						
Northern Pike	1	0	12	--	0.7	0.4
Longnose Sucker						
White Sucker						
Rock Bass						
Pumpkinseed						
Bluegill						
Smallmouth Bass	6	3	11	22	3.9	2.3
Largemouth Bass	8	0	7	--	5.2	3.1
Yellow Perch						
Walleye > Age 1	10	1	123	1230	6.5	3.8
Walleye (all)	29	1	125	3625	19.0	11.1
Total	44	5	125		35.3	16.9

Table 12. The length frequency of gamefish captured during the recapture electroshocking of Clark Lake conducted the night of May 7, 2013.

Length (mm)	Walleye	Largemouth Bass	Smallmouth Bass
150			
160			
170	2		
180	7		
190	7		
200	1		
210	2		
220			
230		1	
240		1	
250			
260	1		
270			1
280			
290	2		
300			
310			
320	1	1	
330			
340		1	
350			
360			
370			
380			
390			
400		1	
410			
420	1		
430			1
440	1	1	1
450			1
460	3		
470		1	
480			1
490	1	1	
500			
510			1
Total	29	8	6
Ave. Length	262	370	435
S.D.	109.9	100.4	85.3

Centrarchid Electroshocking

On the night of May 28 Clark Lake was electroshocked to assess centrarchid populations. The same three shoreline segments that were shocked in early May were used for this portion of the survey (Figure 3). We shocked the three segments with a total effort of 2.1 hours.

We captured 99 individual fish representing nine species during shocking (Table 13). Yellow perch, bluegill and rock bass were the most commonly caught species with the other species captured in lower number. Total CPE was 37.9 fish per mile or 48.3 fish per hour shocked. Largemouth bass and walleye were the most common gamefish captured the survey. Forage minnows were seen, but rarely captured as they passed through the mesh of the nets.

Table 13. Fish species captured from Clark Lake during centrarchid electroshocking during the night of May 28, 2013.

Species	Captured	CPE(Per Hour)	CPE(per Mile)	Ave. Length	Length Range
Common Shiner	1	0.5	0.4		
Bluntnose Minnow	2	1.0	0.8		
White Sucker	1	0.5	0.4		
Rock Bass	11	5.4	4.2	165 mm	102 mm- 224 mm
Bluegill	13	6.3	5.0	106 mm	75 mm- 179 mm
Smallmouth Bass	1	0.5	0.4	158 mm	--
Largemouth Bass	8	3.9	3.1	258 mm	138 mm- 404 mm
Yellow Perch	57	27.8	21.8	158 mm	123 mm- 203 mm
Walleye	5	2.4	1.9	196 mm	183-202 mm
Total	99	48.3	37.9		

The five captured walleye ranged in length from 183 mm to 202 mm and had an average length of 196 mm (Table 14). Largemouth bass ranged in length from 138 mm to 404 mm and had an average length of 258 mm. The single smallmouth bass was 158 mm in length. The average length of panfish was 165 mm, 106 and 158 mm for rock bass, bluegill and yellow perch respectively.

Table 14. Length frequency of fish captured during centrarchid electroshocking on May 28, 2013.

Length (mm)	Walleye	Largemouth Bass	Smallmouth Bass	Rock Bass	Bluegill	Yellow Perch
50						
60						
70					2	
80					3	
90					3	
100				2	2	
110						
120						3
130		1		1		3
140		1		1	1	16
150			1	1	1	8
160						15
170				3	1	2
180	1					8
190	2					
200	2	1		1		2
210				1		
220				1		
230		1				
240						
250						
260		1				
270						
280						
290						
300						
310						
320						
330		1				
340		1				
350						
360						
370						
380						
390						
400		1				
Total	5	8	1	11	13	57
Ave. Length	196	258	158	165	106	158
S.D.	7.8	97.0	--	41.1	32.6	18.7

Fall Recruitment and Index Sampling

We anticipated shocking the same three shoreline stations that were shocked during previous shocking runs again on the night of October 21 to assess young-of-year abundances and the general condition of the fish community but strong west-northwest winds prevented us from shocking the transect along the south shore of the lake. Instead, we shocked two of the three standard transects and from the boat launch to the dam on the west side of the lake (Figure 4). In 1.4 hours of effort, a total of 82 individual fish representing eight species were captured with a CPE of 33.1 fish per mile or 58.2 fish per hour shocked (Table 15).

It was noted that most fish were captured at the north end of the lake near Logan Creek. Additionally, the catch was much more diverse near Logan Creek than in other locations of the lake. Yellow perch dominated the catch with substantially fewer walleye, bluegill and bass (Table 15).

Table 15. Fish species captured from Clark Lake on October 21, 2013 during fall electroshocking.

Species	Number	CPE (per Hour)	CPE (per Mile)	Average Length	Length Range
Common Carp	3	2.1	1.2		
White Sucker	1	0.7	0.4		
Rock Bass	8	5.6	3.2		
Bluegill	13	9.2	5.2		
Smallmouth Bass	2	1.4	0.8	199	183- 215 mm
Largemouth Bass	1	0.7	0.4	210	--
Yellow Perch	36	25.4	14.5		
Walleye	18	12.7	7.3	292	188- 445 mm
Total	82	58.2	33.1		

The 18 captured walleye ranged in length from 188 mm to 445 mm and had an average length of 292 mm (Table 15). Based on age determinations from earlier portions of this survey and from previous surveys, it is likely that most of the walleye less than 200 mm were young-of-year fish.

The two smallmouth bass and the one largemouth bass that we captured had average lengths of 199 mm and 210 mm respectively.

Of the fish we captured but did not measure yellow perch was the dominant species followed by bluegill. During this survey we captured three common carp which had not been captured during other portions of this survey.

Table 16. The length frequency of gamefish captured during fall electroshocking on Clark Lake during the night of October 21, 2013.

Length (mm)	Walleye	Largemouth Bass	Smallmouth Bass
150			
160			
170			
180	1		1
190	1		
200			
210		1	1
220			
230			
240			
250			
260	1		
270	5		
280	4		
290	1		
300	2		
310			
320			
330			
340			
350			
360	1		
370			
380			
390			
400	1		
410			
420			
430			
440	1		
450			
Total	18	1	2
Ave. Length	292	210	199
S.D.	61.2	--	22.6

DISCUSSION

The 2013 fisheries survey on Clark Lake characterized the fish populations of the lake using multiple fisheries assessment gear during multiple seasons. Each gear type was efficient in capturing certain fish species and fish sizes. The use of multiple gears during different sampling seasons provided a clearer picture of the entire fish community and fish population characteristics of individual species within the lake. However, in 2013 the late spring likely caused our spring surveys to miss most of the spring spawning species that we usually capture with fyke nets or electroshocking gear thus skewing our survey results.

A total of 1,031 fish were collected during the fisheries surveys of Clark Lake with rock bass, bluegill, suckers and walleye the most common species (Tables 1, 11, 13 and 15). Other species were captured in much lower numbers. Our total catch across all surveys was only 2/3 of what we captured in 2009 due to a very low fyke net catch.

Gamefish

In 2013 walleye were the most abundant gamefish captured during surveys since the 1969 survey. However, in 2013 the walleye catch number and CPE were the lowest measured since the beginning of our time series (Table 17). It is likely that the late spring in 2013 caused walleye to spawn under the ice or as the ice left the lake before our nets were deployed. Since our catch was dominated by small males, spent females and unknown sex fish, it is very likely that the majority of spawning occurred before our survey started. Overall since 1969, there have been variations in catch and CPE which may be due to variations in walleye year class strength (good or bad spawning years) or by other factors such as poor weather or by fyke net placement which may influence our walleye catch. However sufficient walleye recruitment has occurred in the lake to maintain a stable, natural self-sustaining population so stocking or adjustments to statewide regulations have not been required.

Table 17. Summary of fyke net surveys, numbers of fish and catch per net night (CPE) from Clark Lake 1969-2013 (Hogler et al 2005 and 2010). The 1969-1994 data is after Lychwick (1995).

Species	1969	1976	1981	1984	1994	2005	2009	2013
Walleye	142 (2.84)	458 (6.94)	388 (6.06)	393 (3.97)	209 (2.79)	225 (3.21)	235 (4.12)	125 (2.23)
Northern Pike	23 (0.46)	114 (1.73)	97 (1.51)	51 (0.52)	86 (1.15)	66 (0.94)	29 (0.51)	12 (0.21)
Smallmouth Bass	12 (0.24)	13 (0.20)	19 (0.30)	6 (0.06)	13 (0.17)	72 (1.03)	9 (0.16)	11 (0.20)
Largemouth Bass	3 (0.06)	2 (0.03)	5 (0.08)	1 (0.01)	3 (0.04)	0 (0.0)	2 (0.04)	7 (0.13)
Rock Bass	38 (0.76)	86 (1.30)	318 (4.97)	88 (0.99)	201 (2.68)	182 (2.6)	512 (8.98)	208 (3.71)
Yellow Perch	328 (6.56)	46 (0.70)	22 (0.34)	17 (0.17)	9 (0.12)	37 (0.53)	54 (0.95)	7 (0.13)
Bluegill	10 (0.03)	34 (0.52)	112 (1.75)	132 (1.33)	13 (0.17)	20 (0.29)	302 (5.3)	199 (3.57)
Bullhead sp.	7 (0.14)	6 (0.10)	5 (0.08)	28 (0.28)	118 (1.58)	6 (0.09)	0 (0.0)	0 (0.0)
Carp	1 (0.02)	6 (0.09)	50 (0.78)	5 (0.05)	18 (0.24)	4 (0.06)	0 (0.0)	0 (0.0)
Sucker sp.	69 (1.38)	159 (2.41)	216 (3.38)	70 (0.71)	204 (2.71)	82 (1.17)	13 (0.23)	187 (3.34)
Bowfin	2 (0.04)	5 (0.08)	20 (0.31)	2 (0.02)	7 (0.09)	5 (0.07)	1 (0.02)	48 (0.86)

We noted few large walleye in any of our 2013 surveys but good numbers of small fish including young of year walleye in our fall survey unlike previous surveys conducted in the 1960's through the 1980's. The number of small size fish (under 400 mm) captured in 2013 indicates that some level of reproduction is occurring and that walleye are recruiting into the population but perhaps not to historic levels (Table 2). 2011 and 2012 appear to have produced good year classes and 2013 looks fair. The population estimate of spawning age walleye increased to 1230 in 2013 from the 2009 value of 881 (Table 11), However, the 2013 population estimate is still less than previous PE's that varied between 1,500 and 3,000 (Hogler et al 2005 and 2010). The presence of few large walleye in our surveys and declining spawning PE's suggest that total annual mortality

(natural and angler) is probably high. Based on the walleye spring length frequency it appears that harvest is removing fish larger than 500 mm and that much of the harvest is likely focused on female walleye. Growth (length at age) is above statewide averages at all ages indicating sufficient forage levels for the current walleye population in the lake (Table 4).

In 2013, the relative abundance (CPE) of smallmouth bass was at the 1969-2009 average level although much below the 2005 peak level (Table 17). Electroshocking surveys caught a number of small fish indicating that smallmouth bass have been successful in spawning. Growth appears to be good for smallmouth bass (Table 4).

Although largemouth bass were rarely captured during spring surveys in 2013, they continue to persist in low, but stable numbers in Clark Lake.

The number of northern pike that we capture during our surveys continued to decline in 2013 and was the lowest number captured during fyke netting since 1969 (Table 17). The lack of large pike during spring surveys could indicate that pike do not spawn in the lake but spawn elsewhere or may indicate a decline in the northern pike population of the lake. A decline in the overall abundance could indicate that harvest of large adult pike is occurring and/or pike have had variable spawning success which is not unusual for northern pike. From our analysis of pike age, it appears that several year classes are present but Clark Lake lacks younger and older age pike which may be an indication of variable spawning success and harvest (Table 5). Length at age indicates northern pike in Clark Lake are growing slightly slower than statewide average growth (Table 4).

Panfish

Panfish populations in Clark Lake appear to be increasing although poor fyke net catches in 2013 reversed the increasing trend noted during the past several surveys (Table 17). Although CPE for rock bass and bluegill declined in 2013, they are still near the highest levels noted over the past four decades. Yellow perch CPE declined in 2013 following several surveys in which CPE increased. The sharp increase in panfish number may be due to sampling (fyke net locations) or to actual increases in panfish numbers due to environmental changes such as the increasing size of offshore plant beds. These environmental changes appear to favor centrarchids but not yellow perch.

Other Species

Several other species were captured that are worth noting. The sucker (white and longnose) catches in the lake were up sharply in 2013 and were similar to catches in the late 1970's and early 1980's (Table 17). This may be due to increased immigration into the lake by suckers running up Whitefish Bay Creek

from Lake Michigan. In addition to the increase in sucker number, we captured many bowfin in 2013. Our 2013 catch was the highest throughout the 1969-2013 time period (Table 17). Bowfin can be aggressive predators and may compete for forage with the other predators of the lake.

Forage minnows were abundant near the outlet of Logan Creek, but were scarce in other parts of the lake. It is likely the aquatic plant beds and Logan Creek provide excellent habitat for minnows while limited plant cover in other parts of the lake limit their abundance.

Carp were seen in low number but not captured during all electrofishing surveys and appear to be similar in number to earlier surveys. Carp do not appear to be a problem in the lake.

CONCLUSIONS

Fish populations in Clark Lake appear to have changed little since the previous survey in 2009. Adult (spawning) walleye numbers continue to be lower than historic numbers based on population estimates, but relative abundance (CPE) appears to be slightly increasing because of increasing numbers of young fish. Walleye reproduction is evident and length at age is above state averages although there are few large walleye in the lake. High harvest levels may be impacting the ultimate size of walleye in Clark Lake by removing fish before they grow to older, larger sizes.

Smallmouth bass numbers are stable and largemouth bass continue to be part of the fishery. Bass populations appear to be reproducing well.

The northern pike population appears to be declining in the lake. Few northern pike are large in size and harvest or poor recruitment may be affecting their abundance and size distribution.

Centrarchid panfish are increasing in number in Clark Lake, however, yellow perch numbers are decreasing. Lake conditions currently favor centrarchids over perch. The growth of panfish in Clark Lake appears to be good at all sizes.

Forage minnows are common in the lake near Logan Creek, but lack of suitable habitat in other areas of the lake, limit their abundance. Increased distribution of plants would benefit forage fish as well as other species.

Carp although present in the lake, were low in number and do not seem to be a problem at this time.

RECOMMENDATIONS

- Continue to monitor the walleye population if Clark Lake. If future surveys indicate that the lack large walleye is impacting the population, evaluate regulation changes that would allow more walleye to reach a larger size. Since it is not clear if anglers would support any regulation change, any future rule proposal would need to be discussed with local anglers to gather local support before rule submittal.

- Conduct a one year creel survey to determine exploitation rates of several fish species. It's unclear about the significance of harvest that could explain shifts in populations noticed between the 2013 survey and previous surveys.

- Encourage the recolonization of shallow water aquatic plants by establishing no wake areas or by temporary placement of wave and turbidity barriers to get plants started. Reestablishment of aquatic plants is necessary to have a healthy stable fish community in the lake.

- Monitor the movement and abundance of invasive species in Clark Lake. If these species get firmly established in the lake, more changes in the fish community are likely.

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