

**2009 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 2009 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 2009 survey.

The 2009 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.

A total of 1,426 fish were collected during the fisheries surveys of Clark Lake with rock bass, bluegill and walleye the most common species. Other species were captured in much lower numbers.

Fish populations in Clark Lake appear to be in a state of change.

- Walleye numbers are down since 1994 based on population estimates, but walleye relative abundance (CPE) appears to be increasing. Walleye reproduction is evident and length at age is above state averages although there are few large walleye in the lake. Harvest may be impacting the size of walleye in Clark Lake.
- 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 size distribution.

- Panfish are increasing in number. Stocking of yellow perch by the Clark Association may have improved the yellow perch population in the lake. Growth of panfish in Clark Lake appears to be good.
- 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 spatial distributions 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.
- During spring netting we collected fish as part of the statewide surveillance for the viral hemorrhagic septicemia (VHS) virus. For the fish that we submitted all test results were negative for VHS. But since we captured two steelhead in Clark Lake, it demonstrated that Lake Michigan fish can enter the lake over the dam exposing Clark Lake fish populations to VHS. Because of this, the lake is now on the list of waters considered to be VHS positive.

## **RECOMMENDATIONS**

- Investigate changing the walleye size and bag limit to improve the number and size structure of walleye in Clark Lake. Several different regulations could be used to manage walleye in the lake. The lack of large walleye and good numbers of small fish suggests a regulation of no minimum size, a protected slot of 14"-18" (no harvest) and 1 fish over 18" and a daily total bag of 3 walleye. Another regulation that could improve walleye number and size distributions is an 18" minimize size and 3 daily bag. 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.
- As another way to reduce walleye harvest, investigate the public sentiment for eliminating motor trolling on Clark Lake.
- 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.
- Encourage shoreline residents to reestablish natural shorelines. This will also help plant communities as well as many other animal populations.

- 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.

## INTRODUCTION

Clark Lake (WBIC 97700) is the second largest lake in Door County and is impounded by a dam on Whitefish Bay Creek (Figure 1). The lake has a surface area of 864 acres, a maximum depth of 22 feet and an average depth of 7 feet (Door County SWCD 2000). Clark Lake is considered mesotrophic indicating that the lake is moderately productive (WDNR 2001). 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.



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

The fish and aquatic plant communities of Clark Lake have been extensively monitored and managed for decades. Most of the past efforts to manage the fishery of Clark Lake have focused on fish stocking. Records indicate that since 1933 the lake has been stocked with a wide variety of fish including bass, walleye, perch, bluegill, crappie and bullhead (Hogler et al 2005).

Hogler et al (2005) 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 time series (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 1990's smallmouth bass and rock bass began to increase in abundance. By the 2005 survey, dominance in the fish community had once again shifted toward walleye, yellow perch and rock bass.

The most recent aquatic plant surveys conducted in 1992 (Rasman 1992) and 2006 (Hoverson and Turyk 2006) indicate that while plant diversity has remained stable, the abundance of native species has declined overall with the largest declines in shallow water species. Aquatic invasive species (AIS) are present in the lake and include Eurasian Water Milfoil and zebra mussels.

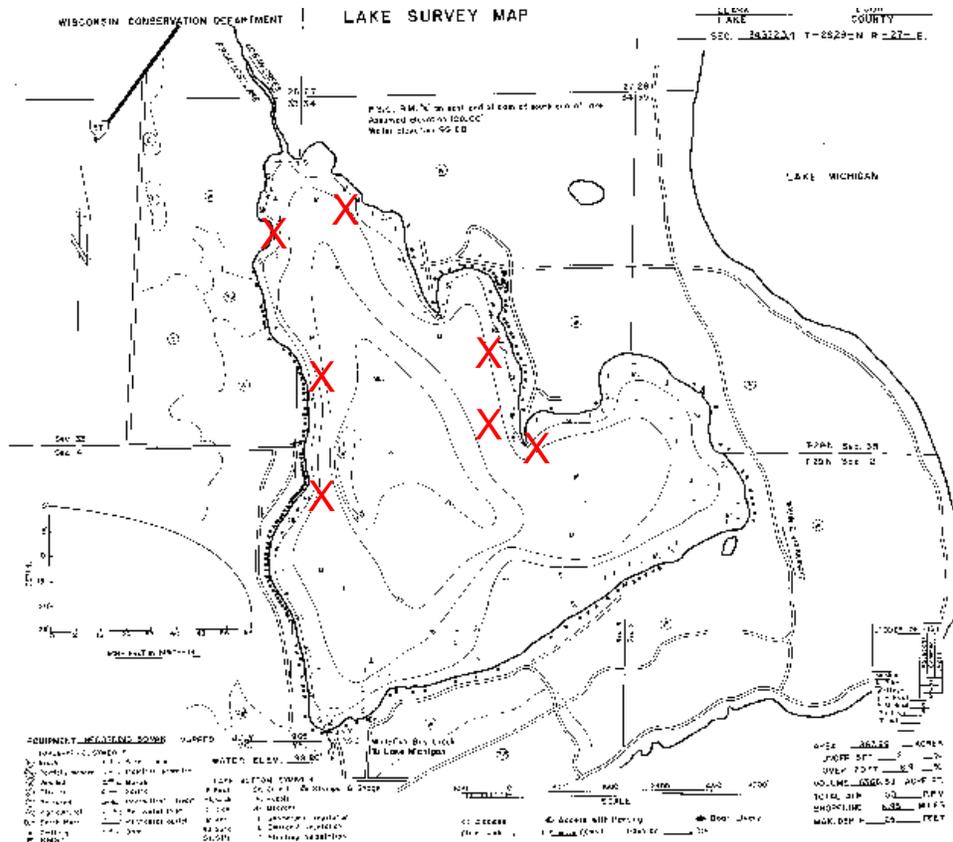
In 2007 several areas in Clark Lake were designated as Sensitive/Critical Habitat Areas as a way to protect plant beds and fish spawning areas (Gansberg 2007). Most of these sites were located on the north end of the lake near Logan Creek, on rocky points located on the east shore and shallow water sections of the southern shoreline.

The fishery of Clark Lake was surveyed in 2009 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 2009 survey.

## **METHODS**

### **Spring Fyke Netting**

A standard Tier 1 fisheries survey on Clark Lake was begun in April and continued through October, 2009. Seven fyke nets were set following ice-out on April 9, fished until April 17 and were used to capture and mark adult spawning walleye and northern pike for the purpose of estimating adult population size (Figure 2). Other species 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 49 net lifts for a total effort of 57 net-nights during the netting period. All fish were identified, measured, marked with a caudal fin clip and scales or spines were removed from a sub-sample for age determination.



**Figure 2.** The locations of the seven fyke nets that were fished in Clark Lake from April 9 through April 17, 2009 are marked by an X on the lake map.

### Spring Electrofishing

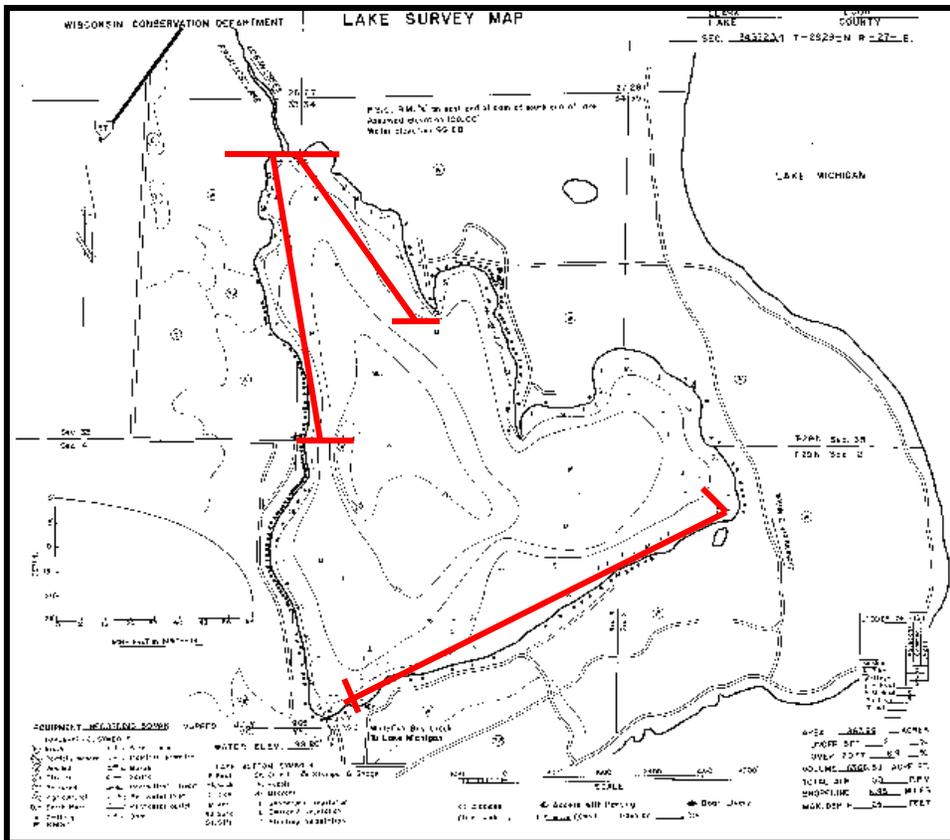
Shortly after the completion of fyke netting, three randomly selected 1 mile sections of the shoreline were electroshocked on the night of April 27 to look for marked fish (Figure 3). All fish were netted, identified, examined for marks, and measured.

### Centrarchid Electrofishing

Similarly, 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 13, the three shoreline sections were electroshocked to determine the abundance young-of-year fish and to assess the general fish population (Figure 3). All fish were netted, identified, and counted or measured.



**Figure 3.** The three 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 1,159 fish were captured with a CPE of 20.33 fish per net per night (Table 1). Of the ten species captured during fyke netting, rock bass, bluegill and walleye dominated the catch, with substantially fewer smallmouth bass, northern pike and white sucker captured.

**Table 1. Species captured from Clark Lake with fyke nets fished April 9-17, 2009. Petersen Population Estimates (PE) were calculated using fyke nets to mark fish and the April 27 electroshocking survey as the recapture run.**

Species	Fyke Net									Shocking Number	Recapture Number	Petersen PE	PE Range
	10-Apr	11-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr	Total	CPE				
Walleye	34	41	80	29	22	13	16	235	4.12	15	4	881	347-3,540
Northern Pike	7	7	8	1	1	1	4	29	0.51	0	0		
Smallmouth Bass	1	0	0	0	0	2	6	9	0.16	9	2	41	11-405
Largemouth Bass	0	1	1	0	0	0	0	2	0.04	1	0		
Steelhead	0	0	1	0	0	1	0	2	0.04	0	0		
Rock Bass	57	54	128	46	62	46	119	512	8.98	6	1	3,072	549-30,720
Bluegill	57	55	58	26	50	25	31	302	5.30	12	0		
Yellow Perch	16	8	13	4	4	4	5	54	0.95	5	0		
Bowfin	0	0	0	0	0	1	0	1	0.02	0	0		
White Sucker	0	2	2	2	0	4	3	13	0.23	2	0		
Common Carp								0	0.00	16	0		
Bluntnose Minnow								0	0.00	4	0		
Common Shiner								0	0.00	6	0		
Mimic Shiner								0	0.00	2	0		
<b>Total</b>	<b>172</b>	<b>168</b>	<b>291</b>	<b>108</b>	<b>139</b>	<b>97</b>	<b>184</b>	<b>1,159</b>	<b>20.33</b>	<b>78</b>	<b>7</b>		

### Gamefish

#### Walleye

Walleye were the most commonly captured gamefish during fyke netting with a CPE of 4.12 (Table 1). Walleye capture number increased from the onset of netting, peaked on April 13 when the water temperature reached 43F and declined thereafter. The 235 walleye that were captured ranged in length from 272 mm to 557 mm and had an average length of 369 mm (Table 2). Of the walleye we captured, 109 (46.4%) were greater than 381mm size limit.

Using mark and recapture during spring surveys and the Petersen method to estimate population size, the walleye population in Clark Lake is likely between 347 and 3,540 individual walleye or 0.4 to 4.1 walleye per surface acre (Table 1).

Age was determined for most of the walleye that were captured using a dorsal spine. Ages ranged from age 1 through age 7 and age 9 (Table 3). Age 4 was the most common age walleye followed by ages 3 and 2. Age 4 walleye averaged 411 mm in length.

From this data it appears that in Clark Lake, walleye begin to spawn at age 3 and most spawn by age 4 or 5. Young fish appear to be present in the lake, but numbers decline steadily after age 6. Growth of walleye in Clark Lake when compared to statewide age at length tables, appears to be above state rates at each age (Table 4).

#### Northern Pike

We captured 29 northern pike during fyke netting with a CPE of 0.51 fish per net-night (Table 1). Since most of the pike were captured during the first three days of netting, it is likely that we missed most of the spawning period thus reducing our catch of adult northern pike. The captured northern pike ranged in length from 292 mm to 763 mm and averaged 480 mm in length (Table 2). Only 5 of the 29 pike we captured or 17.2% were greater than 660 mm in length.

Ages 1 through 7 were noted from the scale samples that were collected during fyke netting (Table 5). Age 2 northern pike were the most abundant age class followed by age 3 and age 5 fish. Age 2 northern pike had an average length of 367 mm. Very few northern pike older than age 5 were captured.

Based on the size at which sex could be determined, male northern pike in Clark Lake begin to spawn at age 2 or 3 and females spawn by age 4 or 5. Growth of northern pike in Clark Lake when compared to statewide age at length tables, appear to grow at or slightly above state rates (Table 4).

#### Bass

We captured nine smallmouth bass and two largemouth bass during fyke netting (Table 1). Smallmouth and largemouth bass CPE was 0.16 and 0.04 respectively. Smallmouth bass ranged in length from 132 mm to 423 mm with an average length of 323 mm (Table 2). Six of the nine smallmouth bass that we captured were greater than the 356 mm size limit. The two largemouth bass captured were 425 mm and 483 mm in length had an average length of 454 mm.

Using the Petersen method for estimating population size, it was estimated that the smallmouth population ranged between 11 and 405 individuals (Table 1). Because the number of captured and recaptured smallmouth bass was low, estimates of population size likely under represents the total number of smallmouth bass in Clark Lake.

**Table 2. Gamefish length frequency distribution of the fish captured on Clark Lake with fyke nets during April 2009.**

Length (mm)	Walleye	Smallmouth Bass	Largemouth Bass	Northern Pike
170	1	1		
180	3	2		
190	8			
200	1			
210				
220				
230				
240	2			
250	3			
260	7			
270	14			
280	11			
290	11			1
300	7			
310	3			
320	1			1
330	4			
340	11			1
350	13			1
360	9			3
370	12	1		3
380	10			1
390	11	1		2
400	11	2		
410	8	1		1
420	14	1	1	
430	7			1
440	17			
450	10			
460	3			
470	3			2
480	4		1	
490	5			1
500	1			1
510	2			
520	1			
530	1			1
540	2			1
550	2			
560	1			1
570				
580	1			
590				
600				1
610				
620				
630				
640				
650				1
660				2
670				
680				
690				1
700				
710				
720				
730				1
740				
750				
760				1
Number	235	9	2	29
Ave. Length	369	323	454	480
S.D.	84.52	119.72	41.01	136.09

**Table 3. Length and age distribution of walleye captured during fyke netting on Clark Lake.**

Length (mm)	Walleye	Age									
		1	2	3	4	5	6	7	8	9	10
170	1	1									
180	3	3									
190	8	8									
200	1	1									
210											
220											
230											
240	2		2								
250	3		3								
260	7		7								
270	14		14								
280	11		11								
290	11		11								
300	7		6	1							
310	3			3							
320	1			1							
330	4			4							
340	11			11							
350	13			13							
360	9				9						
370	12			10	2						
380	10			6	4						
390	11			7	4						
400	11			1	10						
410	8			1	7						
420	14				12	2					
430	7				6	1					
440	17				9	7	1				
450	10				3	5	1	1			
460	3				1		2				
470	3					1	2				
480	4				3	1					
490	5					4	1				
500	1					1					
510	2					2					
520	1					1					
530	1					1					
540	2						1	1			
550	2							1		1	
560	1						1				
570											
580	1						1				
590											
600											
Number	235	13	54	58	70	26	10	3	0	1	0
Ave. Length	369	187	276	357	411	465	492	513	--	550	--
S.D.	84.52	7.51	15.48	24.82	30.82	32.28	49.62	55.08	--	--	--

**Table 4. Average length (mm) at age as determined by spines or scales for fish captured during surveys in 2005 (Hogler 2005) and 2009 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 (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 (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 (2009)	--	--	125	188	198	250	255			
(2005)	--	131	182	217	--	--	--			
(State Average)	(64)	(97)	(122)	(147)	(167)	(183)	(196)			
Smallmouth Bass (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 (2009)			174	210	270					
(2005)	--	130	164	220	250					
(State Average)	(74)	(119)	(152)	(180)	(208)					
Walleye (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)	

**Table 5. The northern pike length frequency and age distribution of fish captured on Clark Lake with fyke nets, April 2009.**

Length (mm)	Northern Pike	Age						
		1	2	3	4	5	6	7
250								
260								
270								
280								
290	1	1						
300								
310								
320	1		1					
330								
340	1		1					
350	1		1					
360	3		3					
370	3		3					
380	1		1					
390	2		2					
400								
410	1			1				
420								
430	1			1				
440								
450								
460								
470	2			2				
480								
490	1			1				
500	1			1				
510								
520								
530	1				1			
540	1					1		
550								
560	1					1		
570								
580								
590								
600	1					1		
610								
620								
630								
640								
650	1					1		
660	2					2		
670								
680								
690	1						1	
700								
710								
720								
730	1							1
740								
750								
760	1							1
Number	29	1	12	6	1	6	1	2
Ave. Length	480	292	367	468	533	616	698	747
S.D.	136.09	--	20.01	35.85	--	50.83	--	23.33

## Panfish

### Rock Bass

Rock bass were the most commonly captured panfish during spring fyke netting with 512 handled, yielding a CPE of 8.98 fish per net per night (Table 1). Captured rock bass ranged in length from 85 mm to 277 mm and had an average length of 147 mm (Table 6). 44.1% and 9.4% of the captured rock bass were greater than 150 mm or 200 mm in length respectively.

**Table 6. Panfish length frequency for fish captured on Clark Lake with fyke nets, April 2009.**

Length (mm)	Rock Bass	Bluegill	Yellow Perch
80	5	1	
90	42	2	
100	31	21	
110	16	49	
120	24	60	
130	69	38	1
140	97	18	
150	94	11	2
160	42	13	4
170	9	18	9
180	16	25	8
190	15	20	5
200	17	10	6
210	12	10	4
220	11	2	7
230	2	1	3
240	3	1	3
250	1	2	
260			
270	2		
280			1
290			
300			
310			1
Number	512	302	54
Ave. Length	147	146	200
S.D.	34.01	34.68	32.48

Using the Petersen method to estimate population number, it was estimated that between 549 and 30,720 rock bass inhabit the lake (Table 1). This estimate should be viewed cautiously because centrarchids are generally not well represented in fyke nets and it is likely the estimate may substantially underestimate their true number.

Age was determined from scales for a subsample of rock bass that were captured. Rock bass ages ranged from Age 2 through Age 9 (Table 7). Age 3 was the most common age rock bass followed by ages 2 and 4. Age 3 rock bass averaged 147 mm in length. Growth of rock bass in Clark Lake when compared

to statewide age at length tables, show that in Clark Lake rock bass are growing near state rates through age 3 and then much above state rates at older ages (Table 4).

**Table 7. Rock bass length frequency and age distribution for fish captured with fyke nets on Clark Lake during April 2009.**

Length (mm)	Rock Bass	Age									
		1	2	3	4	5	6	7	8	9	10
80	5		5								
90	42		39	3							
100	31		28	3							
110	16		14	2							
120	24			24							
130	69			66	3						
140	97			92	5						
150	94			94							
160	42			42							
170	9			8	1						
180	16			1	15						
190	15				15						
200	17				15	2					
210	12				5	5	2				
220	11				1	9	1				
230	2					2					
240	3					2	1				
250	1						1				
260											
270	2							1		1	
280											
290											
300											
310											
Number	508	0	86	335	60	20	5	1	0	1	0
Ave. Length	147		101	147	190	224	231	275		277	
S.D.	34.01		8.31	13.8	21.8	10.9	18.2	--		--	

### Bluegill

During fyke netting we captured 302 bluegill with a CPE of 5.30 fish per net-night (Table 1). Captured bluegill ranged in length from 87 mm to 256 mm and had an average length of 146 mm (Table 6). 37.4% of the captured bluegill were greater than 150 mm in length and 8.6% were greater than 200 mm in length.

Age of captured bluegill ranged from age 3 through age 7, with ages 3 and 4 the most common (Table 8). Substantially fewer bluegills were older than age 4. Age 3 bluegill averaged 125 mm in length while age 4 bluegill averaged 188 mm in length. Length at age for bluegill in Clark Lake was much greater than statewide averages indicating good bluegill growth in the lake (Table 4).

**Table 8. Bluegill length frequency and age distribution for fish captured with fyke nets on Clark Lake during April 2009.**

Length (mm)	Bluegill	Age									
		1	2	3	4	5	6	7	8	9	10
80	1			1							
90	2			2							
100	21			21							
110	49			49							
120	60			60							
130	38			38							
140	18			18							
150	11			10	1						
160	13				12	1					
170	18				18						
180	25				23	2					
190	20				18	2					
200	10				10						
210	10				10						
220	2				1	1					
230	1					1					
240	1						1				
250	2						1	1			
260											
270											
280											
290											
300											
310											
Number	302	0	0	199	93	7	2	1	0	0	0
Ave. Length	146			125	188	198	250	255			
S.D.	34.68			13.6	15.9	24.3	7.07	--			

### Yellow Perch

Fifty-four yellow perch were captured during fyke netting with a CPE of 0.95 perch per net-night (Table 1). Yellow perch ranged in length from 138 mm to 310 mm and had an average length of 200 mm (Table 6). All but one of the captured perch were greater than 150 mm in length and 20 of 54 (30%) were greater than 200 mm in length.

The age of captured yellow perch was determined by the use of scales. Yellow perch age ranged from age 3 through age 6 (Table 9). Age 3 and age 4 perch dominated the age sample. Age 3 yellow perch had an average length of 174 mm and age 4 perch had an average length of 210 mm.

Growth of yellow perch in Clark Lake when compared to statewide age at length tables, indicates that in Clark Lake, yellow perch are growing above state rates at all ages (Table 4).

**Table 9. Yellow perch length frequency and age distribution of fish captured with fyke nets on Clark Lake in April 2009.**

Length (mm)	Yellow Perch	Age					
		1	2	3	4	5	6
80							
90							
100							
110							
120							
130	1			1			
140							
150	2			2			
160	4			4			
170	9			9			
180	8			4	4		
190	5				5		
200	6			2	3	1	
210	4				2	2	
220	7				2	4	1
230	3				2	1	
240	3				3		
250							
260							
270							
280	1					1	
290							
300							
310	1						1
Number	54	0	0	22	21	9	2
Ave. Length	200			174	210	228	270
S.D.	32.48			16.1	21.4	22.9	63.6

### Other Species

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

### Spring Electroshocking

On the night of April 27, Clark Lake was electroshocked for 86 minutes to look for fish marked during fyke netting. A total of 78 fish representing eleven species were captured (Table 1). CPE was 54.5 fish per hour shocked or 25.2 fish per mile of shoreline shocked. Common carp, walleye and bluegill were the most common species captured with others captured in lower abundance. Of the fish captured, four walleye, two smallmouth bass and one rock bass had marks given during fyke netting. This allowed us to calculate Petersen population estimates for these three species.

Captured walleye ranged in length from 188 mm to 491 mm and had an average length of 324 mm (Table 10). The smallmouth bass that were handled ranged in length from 347 mm to 494 mm and had an average length of 431 mm. Rock

bass, bluegill, yellow perch and white sucker had average lengths of 84 mm, 84 mm 132 mm and 271 mm respectively (Table 10).

**Table 10. Length frequency of fish captured during recapture electroshocking on April 27, 2009.**

Length (mm)	Walleye	Smallmouth Bass	Largemouth Bass	Rock Bass	Bluegill	Yellow Perch	White Sucker
40					2		
50				1	3		
60					1		
70				1	1		
80							
90				1	1		
100						1	1
110					1	2	
120					1	1	
130				1	1		
140				1			
150				1			
160							
170					1		
180	1						
190	3						
200						1	
210							
220			1				
230							
240							
250							
260							
270							
280	2						
290							
300	2						
310							
320							
330							
340	1	1					
350							
360							
370	1						
380	1	2					
390							
400		1					
410							
420	1						1
430							
440	1	1					
450	1	1					
460		1					
470							
480							
490	1	2					
500							
Number	15	9	1	6	12	5	2
Ave. Length	324	431	224	84	84	132	271
S.D.	103.66	51.88	--	41.68	41.68	42.49	227.69

### 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 late April were used for this portion of the survey (Figure 3). We shocked the three segments with a total effort of 93 minutes.

We captured 113 individual fish representing thirteen species during shocking (Table 11). Rock bass, common carp and smallmouth bass were the most commonly caught species with the other species captured in lower number. Total CPE was 36.45 fish per mile shocked or 72.9 fish per hour. Smallmouth 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 11. Fish species captured from Clark Lake during centrarchid electroshocking.**

Species	Number Caught	CPE (# / Mile)	CPE (# / Hr)
Walleye	9	2.90	5.81
Northern Pike	2	0.65	1.29
Smallmouth Bass	17	5.48	10.97
Rock Bass	28	9.03	18.06
Bluegill	4	1.29	2.58
Yellow Perch	7	2.26	4.52
Bowfin	1	0.32	0.65
White Sucker	1	0.32	0.65
Common Carp	21	6.77	13.55
Bluntnose Minnow	5	1.61	3.23
Common Shiner	10	3.23	6.45
Mimic Shiner	7	2.26	4.52
Central Mudminnow	1	0.32	0.65
Total	113	36.45	72.90

The nine captured walleye ranged in length from 160 mm to 479 mm and had an average length of 198 mm (Table 12). Smallmouth bass ranged in length from 130 mm to 524 mm and had an average length of 384 mm. The two northern pike averaged 550 mm in length while the average length of panfish was 175 mm, 146 and 127 mm for rock bass, bluegill and yellow perch respectively.

**Table 12. Length frequency of fish captured during centrarchid electroshocking on May 28, 2009.**

Length (mm)	Walleye	Smallmouth Bass	Northern Pike	Rock Bass	Bluegill	Yellow Perch
80				2		1
90				1		
100				3		
110				1	1	1
120					1	1
130		1		2		2
140				1	1	2
150				2		
160	1			1		
170				2		
180	1			1		
190	1			1		
200	1			3	1	
210				2		
220		1		2		
230						
240				1		
250						
260				1		
270				1		
280						
290				1		
300		1				
310						
320						
330						
340		1				
350						
360	1					
370	1	1				
380		3				
390		2				
400						
410						
420		1				
430	1	1				
440	1	1				
450		1				
460		1				
470	1					
480		1				
490						
500						
510						
520		1	1			
530						
540						
550						
560						
570						
580			1			
Number	9	17	2	28	4	7
Ave. Length	313	384	550	175	146	127
S.D.	132.51	96.75	40.31	60.03	38.96	21.33

Scales were collected from all smallmouth bass during this survey to augment those collected during fyke netting and those from the recapture shocking run to determine the age distribution of smallmouth bass in Clark Lake.

Ages 2 through 8 were present in the aged sample of fish (Table 13). Age 4 bass were the most common, followed by age 5 and age 6 although none of the age classes were abundant. Age 4 smallmouth bass averaged 393 mm in length. On Clark Lake it appears that smallmouth bass spawn by age 4, although some male fish may begin at an earlier age.

**Table 13. Smallmouth bass length frequency and age distribution for fish captured during fyke netting, recapture shocking and centrarchid shocking on Clark Lake in 2009.**

Length (mm)	Smallmouth Bass	Age							
		1	2	3	4	5	6	7	8
130	2	2							
140									
150									
160									
170									
180	2		2						
190									
200									
210									
220	1		1						
230									
240									
250									
260									
270									
280									
290									
300	1			1					
310									
320									
330									
340	1			1					
350									
360									
370	2			1	1				
380	3				2	1			
390	3				1	2			
400	2				1	1			
410	1				1				
420	2					1	1		
430	1						1		
440	1						1		
450	1						1		
460	1							1	
470									
480	1							1	
490									
500									
510									
520	1								1
Number	26	2	3	3	6	5	4	2	1
Ave. Length	384	135	198	342	393	399	440	475	522
S.D.	96.75	--	23.09	35.12	14.72	11.40	12.91	14.14	--

The length at age comparison between smallmouth bass in Clark Lake to statewide averages can be made with the data we collected to determine how bass are growing in the lake. Our data indicates that bass in Clark Lake at all ages are growing above statewide rates (Table 4).

### Fall Recruitment and Index Sampling

The same three shoreline stations were shocked again on the night of October 13 to assess young-of-year abundances and the general condition of the fish community (Figure 3). In 86 minutes of effort, a total of 76 individual fish representing seven species were captured with a CPE of 24.52 fish per mile or 53.15 fish per hour shocked (Table 14).

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 the sand flats on the south end of the lake.

**Table 14. Fish species captured from Clark Lake on October 13, 2009 during fall electroshocking.**

Species	Number Caught	CPE (# / Mile)	CPE (# / Hr)
Walleye	9	2.90	6.29
Northern Pike	2	0.65	1.40
Smallmouth Bass	1	0.32	0.70
Rock Bass	18	5.81	12.59
Bluegill	30	9.68	20.98
Yellow Perch	15	4.84	10.49
White Sucker	1	0.32	0.70
Total	76	24.52	53.15

Panfish dominated the catch with substantially fewer walleye, northern pike and smallmouth bass captured (Table 14). In addition to the fish handled, three young of year walleye and five young of year yellow perch, small bluegill and many additional shiners (common and mimic shiners) were observed but not netted.

The nine captured walleye ranged in length from 194 mm to 521 mm and had an average length of 358 mm (Table 15). Based on age determinations from earlier portions of this survey and from previous surveys, it is likely most of the walleye less than 210 mm were young-of-year fish.

**Table 15. Length frequency of fish captured during fall electroshocking on Clark Lake.**

Length (mm)	Walleye	Smallmouth Bass	Northern Pike	Rock Bass	Bluegill	Yellow Perch
50					1	
60					1	1
70				1	4	
80				2	6	1
90					6	1
100					2	4
110					3	2
120				2	2	
130				3		
140				4	1	1
150				1		1
160				1	2	1
170					1	1
180					1	1
190	1					1
200	1			2		
210				1		
220		1				
230						
240						
250						
260						
270						
280			1			
290				1		
300						
310						
320	2					
330						
340			1			
350						
360						
370						
380						
390	1					
400	1					
410	1					
420						
430						
440						
450	1					
460						
470						
480						
490						
500						
510						
520	1					
Number	9	1	2	18	30	15
Ave. Length	358	222	282	151	104	127
S.D.	109.10	--	342.00	53.18	32.69	39.38

Bluegill were the most common panfish captured (Table 14). Bluegill ranged in length from 54 mm to 180 mm and had an average length of 104 mm (Table 15). Captured rock bass had an average length of 151 mm and yellow perch averaged 127 mm in length.

## DISCUSSION

The 2009 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.

A total of 1,426 fish were collected during the fisheries surveys of Clark Lake with rock bass, bluegill and walleye the most common species (Tables 1, 11 and 14). Other species were captured in much lower numbers.

### Gamefish

In 2009 walleye were the most abundant gamefish captured during surveys as they have been since the 1969 survey. However, during this time period walleye CPE as measured by fyke catch has been variable (Table 16). These variations in CPE may be due to variations in walleye year class strength (good or bad spawning years) or caused by fyke net placement which may influence our walleye catch (Table 16). CPE in 2009 was the highest measured since the 1981 survey and continues the trend of increasing walleye CPE since 1984.

We noted few large walleye in any of our 2009 surveys and few young of year walleye in our fall survey unlike previous surveys conducted in the 1960's and 1970's that found abundant large walleye and the 1994 and 2005 surveys that captured many young of year in the fall (Tables 1, 11 and 14) . The number of small size fish (under 400 mm) captured in 2009 indicates that some level of reproduction is occurring and that walleye are recruiting into the population but perhaps not to historic levels (Table 2). Population estimates of spawning age fish continues to decline. The 2009 population estimate (PE) of 881 for spawning walleye (Table 1) is much less than previous PE's that varied between 1,500 and 3,000 (Hogler et al 2005). 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).

**Table 16. Summary of fyke net surveys, numbers of fish and catch per net night (CPE) from Clark Lake 1969-2009. The 1969-1994 data is after Lychwick (1995).**

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

In 2009, the relative abundance (CPE) of smallmouth bass declined from the 2005 level (Table 16). The decline was from the highest smallmouth bass CPE measured for Clark Lake (since 1969) to a level consistent to those measured before 2005 and likely represents the average population level for bass in Clark Lake given the current abundance of walleye. Smallmouth bass and walleye abundances may be linked because they compete for food resources and adult fish of one species may prey on the young of the other species. 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 2009, 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 2009 and was the lowest number captured during fyke netting since 1969 (Table 16). The lack of large pike during spring surveys could indicate that our nets are set in poor locations to capture spawning pike or may indicate a decline in the northern pike population of the lake. Since large pike were rarely captured during electrofishing surveys and young of year pike were not captured in fall surveys it is likely that the northern pike population has declined in the lake (Tables 12 and 15). The decline may be due to a combination of harvest of large adult pike and variable spawning success which is not unusual for northern pike. From our analysis of pike age, it appears that several year classes (ages 4, 6 and 7) appear to under-represented which is an indication of variable spawning success (Table 5). Since many northern pike may spawn in Logan Creek, low water in the creek caused by several years of low rainfall may have negatively impacted pike spawning success. Increased rain and snowfall the past several

years may have lead to improved spawning conditions which may result in better spawning success and increased numbers of northern pike in the future. 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 (Tables 1, 11 and 14). CPE for rock bass and bluegill are at the highest level of the past four decades (Table 16). Yellow perch CPE although still lower than 1969 CPE continues to improve. 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, likely due to increases in the size of offshore plant beds. Likely both contributed to the increases in panfish numbers we captured during 2009.

Increasing yellow perch numbers are likely due to survival of perch stocked by the Clark Lake Association and from progeny produced by fish from these stockings. It is unknown if current levels of recruitment will sustain the perch population in the face of angler harvest and nearshore habitat disturbance.

### Other Species

Several other species were captured that are worth noting. The white sucker population in the lake has declined since 1994 and sucker relative abundance (CPE) was the lowest measured since 1969 (Table 16).

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.

The bullhead and bowfin populations appear to be lower in the lake in 2009 than in previous years (Table 16). Carp were captured in low number 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 be in a state of change. Adult (spawning) walleye numbers are down since 1994 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 size distribution.

Panfish are increasing in number. Stocking of yellow perch by the Clark Association may have improved the yellow perch population in the lake. Growth of panfish in Clark Lake appears to be good.

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.

During spring netting we collected fish as part of the statewide surveillance for the viral hemorrhagic septicemia (VHS) virus. For the fish that we submitted all test results were negative for VHS. But since we captured two steelhead in Clark Lake, it demonstrated that Lake Michigan fish can enter the lake over the dam exposing Clark Lake fish populations to VHS. Because of this, the lake is now on the list of waters considered to be VHS positive.

## **RECOMMENDATIONS**

- Investigate changing the walleye size and bag limit to improve the number and size structure of walleye in Clark Lake. Several different regulations could be used to manage walleye in the lake. The lack of large walleye and good numbers of small fish suggests a regulation of no minimum size, a protected slot of 14"-18" (no harvest) and 1 fish over 18" and a daily total bag of 3 walleye. Another regulation that could improve walleye number and size distributions is an 18" minimize size and 3 daily bag. 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.
- As another way to reduce walleye harvest, investigate the public sentiment for eliminating motor trolling on Clark Lake.
- 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.
- Encourage shoreline residents to reestablish natural shorelines. This will also help plant communities as well as many other animal populations.
  - 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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