

CENTER LAKE
Kosciusko County
2005 Fish Management Report

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EXECUTIVE SUMMARY

- A general lake survey was completed on Center Lake from June 6 to 7, 2005. During this survey, water chemistry data was also collected. Two aquatic vegetation surveys were conducted on May 11 and August 2, 2005.
- The Secchi disk reading was 5 ft on May 11 and August 2 and dissolved oxygen concentration was not adequate for fish survival below 14 ft on June 6. Submersed vegetation was found to a maximum depth of 13 ft on May 11 and 9.5 ft on August 2. A whole-lake fluridone treatment was conducted on Center in May and June. Eurasian watermilfoil dominated the plant population in the spring vegetation survey, but chara, water stargrass, and coontail dominated the vegetation community in late summer.
- A total of 3,257 fish, representing 24 species and 1 hybrid sunfish, was collected during the general survey. Bluegill ranked first by number, followed by redear sunfish and gizzard shad. Gizzard shad ranked first by weight, followed by bluegill and spotted gar. Largemouth bass were ranked fourth by number. Overall, the quality of the largemouth bass fishery was good based on the relatively high PSD (56) and RSD-14 (32). Largemouth bass reached 14.0 in TL between ages 4 and 5. In contrast, the bluegill population was not high quality because PSD was only 8. Bluegill grew slower in 2005 than in 2001 and did not reach 6.0 in TL until ages 4 or 5. In addition, redear sunfish also grew slower in 2005 than in 2001, but the PSD for this population was 31, which was relatively good.
- In Center Lake, the DFW should maintain a 14-in minimum size limit on largemouth bass, continue to track the growth of largemouth bass, bluegill, and redear sunfish in the years following the 2005 whole-lake fluridone treatment, and continue to control Eurasian watermilfoil in order to improve the growth of largemouth bass, bluegill, and redear sunfish.

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
LIST OF FIGURES	v
INTRODUCTION	1
METHODS	2
RESULTS	2
DISCUSSION	4
RECOMMENDATIONS	5
LITERATURE CITED	6
APPENDIX: Lake pages.....	15

LIST OF TABLES

Table	Page
1. Center Lake vegetation survey results by rake score on May 11 and August 2, 2005. A total of 60 sites was sampled during both surveys.....	7
2. Fish species and number of individuals captured in Center Lake general surveys from 1984 through 2005	8
3. Mean length-at-age and its associated variance for largemouth bass and bluegill collected for the general survey on Center Lake in June 2005. The NA denotes where variance could not be calculated because the sample size was too small	9
4. Age-length key for bluegill captured using night electrofishing on Center Lake in June 2005	10
5. Age-length key for largemouth bass captured during the general survey on Center Lake in June 2005	11

LIST OF FIGURES

Figure	Page
1. Comparison of bluegill growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples	12
2. Comparison of largemouth bass growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples.....	13
3. Comparison of redear sunfish growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples.....	14

INTRODUCTION

Center Lake is a 120-acre natural lake located within the city limits of Warsaw, Indiana. Maximum depth is 46 ft and average depth is 20 ft. Until December 31, 1999, the lake was a municipal water supply (H. Gerkin, personal communication 2002). A city park and beach are located on the south shore. A public access site is located at the north end of Buffalo Street, also on the south shore. Previous fisheries surveys were conducted in 1970, 1976, 1984, 1997, and 2001. A watershed diagnostic study was conducted in Center Lake by V3 Companies in order to determine the reason for the decline in water quality in Center Lake (V3 Consultants 2005). They determined that the flow paths of Center Lake have changed dramatically, particularly since Pike and Center Lakes are now connected by a man-made ditch that flows from Lones Ditch into Center Lake. This connection carries additional pollutants and sediment into Center Lake from outside its natural watershed, which has contributed to the degradation of its water quality.

Center Lake has vast shallow areas, especially the north end of the lake, which support extensive aquatic vegetation during summer months, hampering boat traffic. The plant community has been dominated by Eurasian watermilfoil, an exotic plant, for many years. Historically, the Center Lake Conservation Association (CLCA) operated a weed harvester to keep boating lanes open. In October 1996, the SePro Corporation, in cooperation with the City of Warsaw, the water company, the lake association, Department of Natural Resources, Department of Health and Department of Environmental Management, treated Center Lake with Sonar® aquatic herbicide at a concentration of 12 parts per billion (Braun 1997). The treatment reduced Eurasian watermilfoil to a few scattered plants by ice out. Native plants, sago pondweed in particular, were reestablished by late spring. A fisheries survey was conducted by DNR in June 1997 to assess the status of the fishery and look for possible impacts from the change in vegetation (Braun 1997). By 2001, Eurasian watermilfoil had reestablished its dominance. A fish community survey was conducted June 2001 to assess any changes to the fish community as a result of the return of Eurasian watermilfoil. The CLCA used a biological control method in the form of the milfoil-eating weevil *Euhrychiopsis lecontei* in order to control Eurasian watermilfoil. However, this method was unsuccessful; thus, Eurasian watermilfoil was again treated with a whole-lake fluridone treatment funded by a Lake and River Enhancement grant in

May and June 2005. A fisheries survey was also conducted in 2005 to determine the impacts, if any, of the whole-lake fluridone treatment on the fish community in the lake.

METHODS

The Center Lake general survey was conducted from June 6 to 7, 2005 as part of DFW Work Plan 204755 that covers general fisheries surveys of natural lakes. Some physical and chemical characteristics of the water were measured in the deepest area of the lake (Indiana Division of Fish and Wildlife 2001). Submersed aquatic vegetation was sampled on May 11 and August 2, 2005 using guidelines written by Pearson (2004). A global positioning system (GPS) device was used to record the location of the limnological data collection site, aquatic vegetation sample sites, and fish collection sites.

Fish were collected by pulsed D.C. electrofishing the shoreline at night with two dippers for 0.75 h at 3 different locations (15-minute stations). Three trap nets and four experimental-mesh gill nets were also fished overnight. All fish collected were measured to the nearest 0.1 in TL and weighed in the field to the nearest 0.01 lb.

Fish scale samples were taken from bluegill, largemouth bass, yellow perch, reard sunfish, black crappie, and northern pike for age and growth analysis. Proportional stock density (PSD) and relative stock density (RSD) were calculated for bluegill, largemouth bass, and reard sunfish (Anderson and Neumann 1996). Additionally, age-length keys and mean lengths-at-age were created and calculated for bluegill and largemouth bass captured during this general survey.

RESULTS

Center Lake was at normal pool. On June 6, dissolved oxygen concentrations were not adequate for fish survival below 14 ft and Secchi depth was 4 ft, 1 in. The thermocline was located between 12 and 16 ft.

The Secchi disk reading was 5 ft on May 11 and 5 ft on August 2. Submersed vegetation was found to a maximum depth of 13 ft on May 11 and 9.5 ft on August 2 (Table 1). In 61 sites sampled, Eurasian watermilfoil (80%) dominated the vegetation population on May 11. Coontail (38%), largeleaf pondweed (7%), chara (8%), flatstem pondweed (2%), eel grass (13%), and slender naiad (2%) were also present in the lake. Eurasian watermilfoil was treated with fluridone in May and June. On the August 2 vegetation survey, in 60 sampled sites, coontail

(20%), water stargrass (28%), and chara (35%) dominated the plant community. Other species present included creeping bladderwort (7%), largeleaf pondweed (10%), sago pondweed (15%), curly leaf pondweed (2%), small pondweed (2%), Illinois pondweed (3%), and Eurasian watermilfoil (8%).

A total of 3,257 fish, representing 24 species and 1 hybrid sunfish, was collected during this survey. Total weight of the fish sample was approximately 558 lbs. Species collected in past surveys, but not in this survey, include lake chubsucker, shorthead redhorse, rock bass, hybrid walleye, river redhorse, green sunfish, black bullhead, northern hogsucker, and white bass (Table 2). By number, bluegill ranked first, redear sunfish ranked second, and gizzard shad ranked third in the survey sample. By weight, gizzard shad ranked first followed by bluegill and spotted gar.

A total of 1,999 bluegill was sampled that weighed 76.13 lbs. They ranged in length from 1.8 to 7.6 in TL. Relative abundance by number and weight were 61.4% and 13.6%, respectively. The electrofishing, gill net, and trap net catch rates were 1,010.7 fish/h, 78.7 fish/lift, and 38.5 fish/lift, respectively. The bluegill PSD was 8. The bluegill RSD-8 was 0. Growth of bluegill collected during this survey appeared to be slower for all ages than that of bluegill captured in the 2001 survey for all ages (Figure 1). Overall mean length of bluegill was 4.6 in (Table 3). Mean length-at-age data from the age-length key indicated bluegill reached 6 in (i.e. quality size) between their 4th and 5th year of growth (Table 4).

A total of 65 largemouth bass was sampled that weighed 53.78 lbs. They ranged in length from 4.0 to 19.7 in TL. Relative abundance by number and weight were 2.0% and 9.6%, respectively. The electrofishing, gill net, and trap net catch rates were 78.7 fish/h, 2 fish/lift, 0 fish/lift, respectively. The largemouth bass PSD was 56 and RSD-14 was 32. This indicates that the quality of the largemouth bass fishery is good based on the relatively high PSD and RSD-14. Growth of largemouth bass ages 1 through 4 collected during this survey was similar to that of bass captured in the 2001 survey for the same ages, but bass ages 5 and 6 grew slower than those in the 2001 survey (Figure 2). Overall mean length of bass was 10.9 in (Table 3). Mean length-at-age data from the age-length key indicated bass reached 14 in (i.e. harvestable size) between their 4th and 5th year of growth (Table 5).

A total of 577 redear sunfish was sampled that weighed 24.54 lbs. They ranged in length from 3.9 to 8.5 in TL. Relative abundance by number and weight were 17.7% and 4.4%,

respectively. The electrofishing, gill net, and trap net catch rates were 52 fish/h, 30.7 fish/lift, 2 fish/lift. The redear sunfish PSD was 31. For all ages, redear growth was slower in 2005 than 2001 (Figure 3). Back-calculated lengths indicated redear sunfish reached 7 in (i.e. quality size) between their 5th and 6th year of growth.

A total of 43 yellow perch was sampled that weighed 4.06 lbs. They ranged in length from 3.7 to 8.7 in TL. Relative abundance by number and weight were 1.3% and 0.7%, respectively. The electrofishing, gill net, and trap net catch rates were 25.3 fish/h, 7 fish/lift, 0.8 fish/lift. The yellow perch PSD was 8. Back-calculated lengths indicated yellow perch reached 8 in (i.e. quality size) between their 5th and 6th year of growth.

A total of 33 black crappie was sampled that weighed 7.05 lbs. They ranged in length from 5.2 to 10.6 in TL. Relative abundance by number and weight were 1.0% and 1.3%, respectively. The electrofishing, gill net, and trap net catch rates were 0 fish/h, 10 fish/lift, 0.8 fish/lift. The black crappie PSD was not calculated since none were captured during electrofishing. Crappie ranged in age from 2 to 5. Back-calculated lengths indicated black crappie reached 8 in (i.e. quality size) between ages 4 and 5.

Gizzard shad, northern pike, and carp were also captured during the general survey. Shad ranked third by number (N = 79) and second by weight (66.94 lbs). Gizzard shad have typically been ranked as either the second, third, or fourth most abundant species in previous surveys. Seven northern pike were captured, ranging in TL from 26.9 to 32.4 in and age from 3 to 7. Five carp were captured, ranging in size from 23.8 to 26.3 in TL and tied for fifth by weight with northern pike.

DISCUSSION

Water quality in Center Lake has declined since the previous survey in 2001. During the 2001 survey, dissolved oxygen was high enough to support fish up to a depth of 20 ft. In this 2005 survey, dissolved oxygen was only high enough to support fish up to a depth of 14 ft. This lake was classified as eutrophic in 2004 based on the Indiana Trophic Status Index (Indiana Department of Environmental Management (IDEM), 2004). However, in the 1990's, this lake was mesotrophic to oligotrophic. Based on the diagnostic study conducted in 2005, nutrient runoff from the man-made ditch connecting Center Lake to Lones Ditch, which flows from Pike

Lake, provided additional pollutants and sediment into Center Lake from outside its natural watershed, degrading its water quality (V3 Consultants 2005).

The submersed aquatic vegetation community of Center Lake was dominated by Eurasian watermilfoil, which was the reason that a whole-lake fluridone treatment was conducted on this lake. Studies have shown that fish biomass in exotic vegetation such as Eurasian watermilfoil is significantly lower than in native vegetation (Keast 1984; Weaver et al. 1997). After the previous whole-lake treatment, more native vegetation returned to the lake since it didn't have to compete with Eurasian watermilfoil, so it was assumed that we would see the same result after this year's fluridone treatment. This year's data will be used to compare pre-treatment conditions of the fish community (i.e., fish growth) with post-treatment conditions within the next one or two years.

Bluegill, redear sunfish, and gizzard shad continue to dominate the fishery at Center Lake similar to what was observed during the 2001 survey. Largemouth bass and yellow perch are also present in fairly large numbers similar to previous surveys. However, growth of bluegill, redear sunfish, and largemouth bass has decreased since the 2001 survey. This is probably a direct result of an abundance of Eurasian watermilfoil in the lake. In the years following the 2005 whole-lake fluridone treatment, we should see an increase in growth for these species as was observed in previous years following a whole-lake fluridone treatment (Kittaka 2001). As a result, the DFW should conduct general surveys on this lake at least every other year in order to monitor the effects of Eurasian watermilfoil depression on the growth of the important game species, i.e., largemouth bass, bluegill, and redear sunfish.

RECOMMENDATIONS

- The DFW should maintain the 14-inch minimum size limit on largemouth bass at Center Lake.
- The DFW should continue to track the growth of largemouth bass, bluegill, and redear sunfish in the years following the 2005 whole-lake fluridone treatment.
- Eurasian watermilfoil should continue to be aggressively controlled and depressed as necessary in order to promote the growth of the popular game fish in this lake, i.e., largemouth bass, bluegill, and redear sunfish.

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Date: February 1, 2006

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Stu Shipman, Fisheries Supervisor
Date: February 1, 2006

Table 1. Center Lake vegetation survey results by rake score on May 11 and August 2, 2005. A total of 60 sites was sampled during both surveys.

Center Lake, Kosciusko County

Date 5/11/2005

Secchi depth (ft) 5

Max plant depth (ft) 13

Species	Rake score					# sites w/ vegetation	% sites w/ vegetation
	1	2	3	4	5		
Overall	35	5	8	0	7	55	90
Eurasian watermilfoil	32	4	6	0	7	49	80
Coontail	23	0	0	0	0	23	38
Largeleaf pondweed	4	0	0	0	0	4	7
Chara	4	0	1	0	0	5	8
Flat-stem pondweed	1	0	0	0	0	1	2
Eel grass	8	0	0	0	0	8	13
Slender naiad	1	0	0	0	0	1	2

Date 8/2/2005

Secchi depth (ft) 5

Max plant depth (ft) 9.5

Species	Rake score					# sites w/ vegetation	% sites w/ vegetation
	1	2	3	4	5		
Overall	30	9	3	3	6	51	85
Coontail	12	0	0	0	0	12	20
Creeping bladderwort	2	2	0	0	0	4	7
Largeleaf pondweed	4	1	0	0	1	6	10
Water stargrass	9	5	1	1	1	17	28
Sago pondweed	9	0	0	0	0	9	15
Chara	14	2	2	0	3	21	35
Curly-leaf pondweed	1	0	0	0	0	1	2
Eurasian watermilfoil	3	1	1	0	0	5	8
Small pondweed	1	0	0	0	0	1	2
Illinois pondweed	2	0	0	0	0	2	3

Table 2. Fish species and number of individuals captured in Center Lake general surveys from 1984 through 2005.

Species	1984	1997	2001	2005
Bluegill	239	1051	1990	1,999
Redear sunfish	43	430	154	577
Gizzard shad	223	76	294	390
Largemouth bass	26	49	72	65
Yellow perch	10	135	109	43
Spotted gar	12	35	25	35
Black crappie	38	48	36	33
Brown bullhead	10	24	20	29
Bowfin	4	2	9	15
Warmouth	35	42	25	13
Longear sunfish	14	22	24	8
Northern pike	11	26	11	7
Hybrid sunfish		1	10	7
Golden shiner	11	13	6	6
Golden redhorse		2	4	6
Yellow bullhead	3	4	7	5
Common carp	4	17	9	5
White sucker	5	5		4
Pumpkinseed	90	22	10	2
Channel catfish	2			2
Grass pickerel				2
Spotted sucker	13	26	14	1
Brook silverside		23	3	1
Bluntnose minnow				1
Walleye				1
Green sunfish		2	2	
White bass		2		
Shorthead redhorse		2		
Rock bass		2		
Northern hog sucker		1		
Hybrid walleye		1		
Lake chubsucker		1		
River redhorse	4			
Black bullhead	3			
Total	890	2064	2834	3,257

1984 effort: gill net = 6 lifts, trap nets = 6 lifts; DC electrofishing = 1 h

1997 effort: gill net = 6 lifts, trap net = 6 lifts, DC electrofishing = 1 h

2001 effort: gill net = 5 lifts, trap net = 6 lifts, DC electrofishing = 1 h

2005 effort: gill net = 4 lifts, trap net = 3 lifts, DC electrofishing = 0.75 h

Table 3. Mean length-at-age and its associated variance for largemouth bass and bluegill collected for the general survey on Center Lake in June 2005. The NA denotes where variance could not be calculated because the sample size was too small.

Largemouth bass		
Age	Mean length (in)	Variance
1	4.5	0.500
2	7.2	0.673
3	10.3	0.614
4	12.1	1.674
5	14.5	0.706
6	15.0	0.414
7	16.5	NA
8	19.5	NA

Bluegill		
Age	Mean length (in)	Variance
1	2.0	NA
2	3.0	0.022
3	4.0	0.223
4	5.1	0.231
5	6.3	0.110
6	6.7	0.130
7	7.0	NA

Table 4. Age-length key for bluegill captured using night electrofishing on Center Lake in June 2005.

Length group	# in sample	# (age) in subsample	age 1	age 2	age 3	age 4	age 5	age 6	age 7
2.0	1	1 (1)	1						
2.5	5	2 (2)		5					
3.0	52	9 (2), 1 (3)		47	5				
3.5	144	10 (3)			144				
4.0	239	10 (3)			239				
4.5	212	5 (3), 7 (4)			88	124			
5.0	239	1 (3), 11 (4)			20	219			
5.5	133	10 (4)			0	133			
6.0	72	1 (3), 5 (4), 4 (5)			7	36	29		
6.5	40	3 (4), 4 (5), 3 (6)				12	16	12	
7.0	9	3 (5), 1 (6), 2 (7)					5	2	3
7.5	2	1 (6)						2	
Total	1148		1	52	504	524	49	16	3

Table 5. Age-length key for largemouth bass captured during the general survey on Center Lake in June 2005.

Length group	# in sample	# (age) in subsample	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8
4.0	1	1 (1)	1							
5.0	1	1 (1)	1							
5.5	1	1 (2)		1						
6.0	2	2 (2)		2						
6.5	2	2 (2)		2						
7.0	4	4 (2)		4						
7.5	6	6 (2)		6						
8.0	2	2 (2)		2						
8.5	2	2 (2)		2						
9.5	5	4 (3), 1 (4)			4	1				
10.0	1	1 (3)			1					
10.5	6	3 (3), 3 (4)			3	3				
11.0	1	1 (3)			1					
11.5	3	2 (3), 1 (4)			2	1				
12.0	3	2 (4)				3				
12.5	2	2 (4)				2				
13.0	3	2 (4)				3				
13.5	4	2 (4), 2 (5)				2	2			
14.0	3	1 (4), 2 (5)				1	2			
14.5	5	2 (5), 2 (6)					2.5	2.5		
15.0	2	1 (5), 1 (6)					1	1		
15.5	2	1 (5), 1 (6)					1	1		
16.0	2	1 (5), 1 (6)					1	1		
16.5	1	1 (7)							1	
19.5	1	1 (8)								1
Total	65		2	19	11	16	10	6	1	1

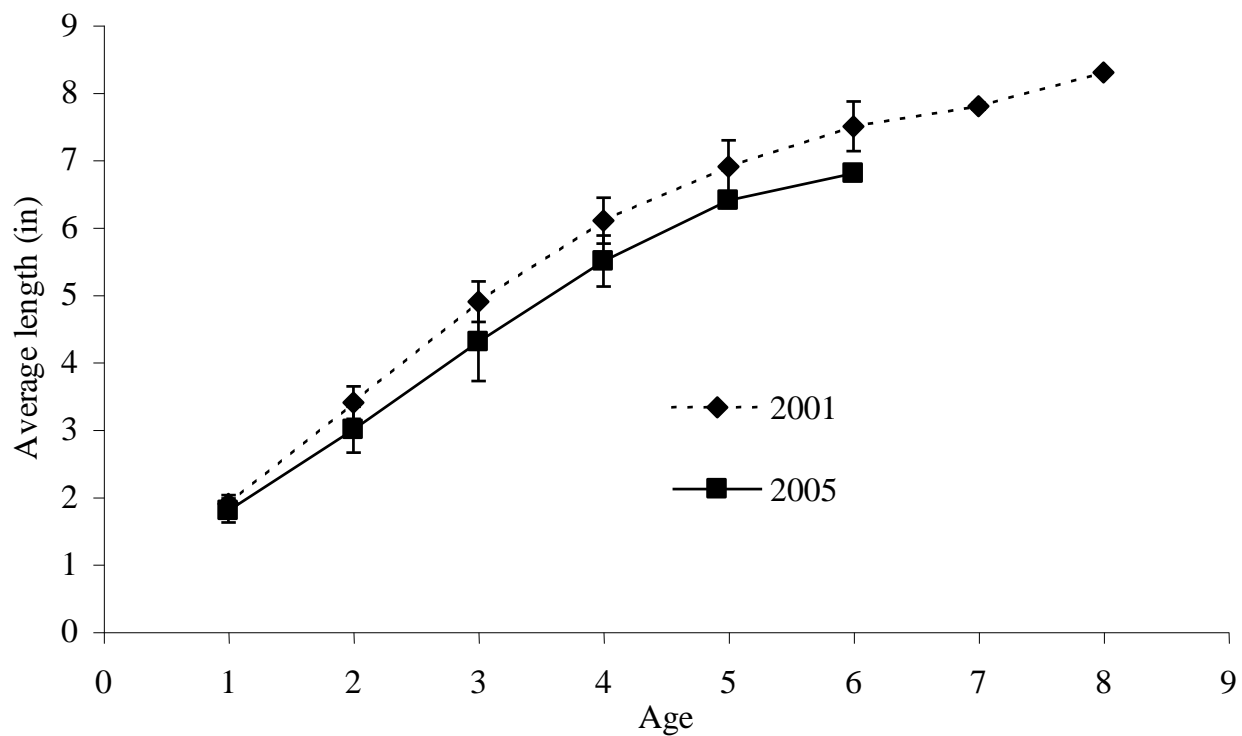


Figure 1. Comparison of bluegill growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples.

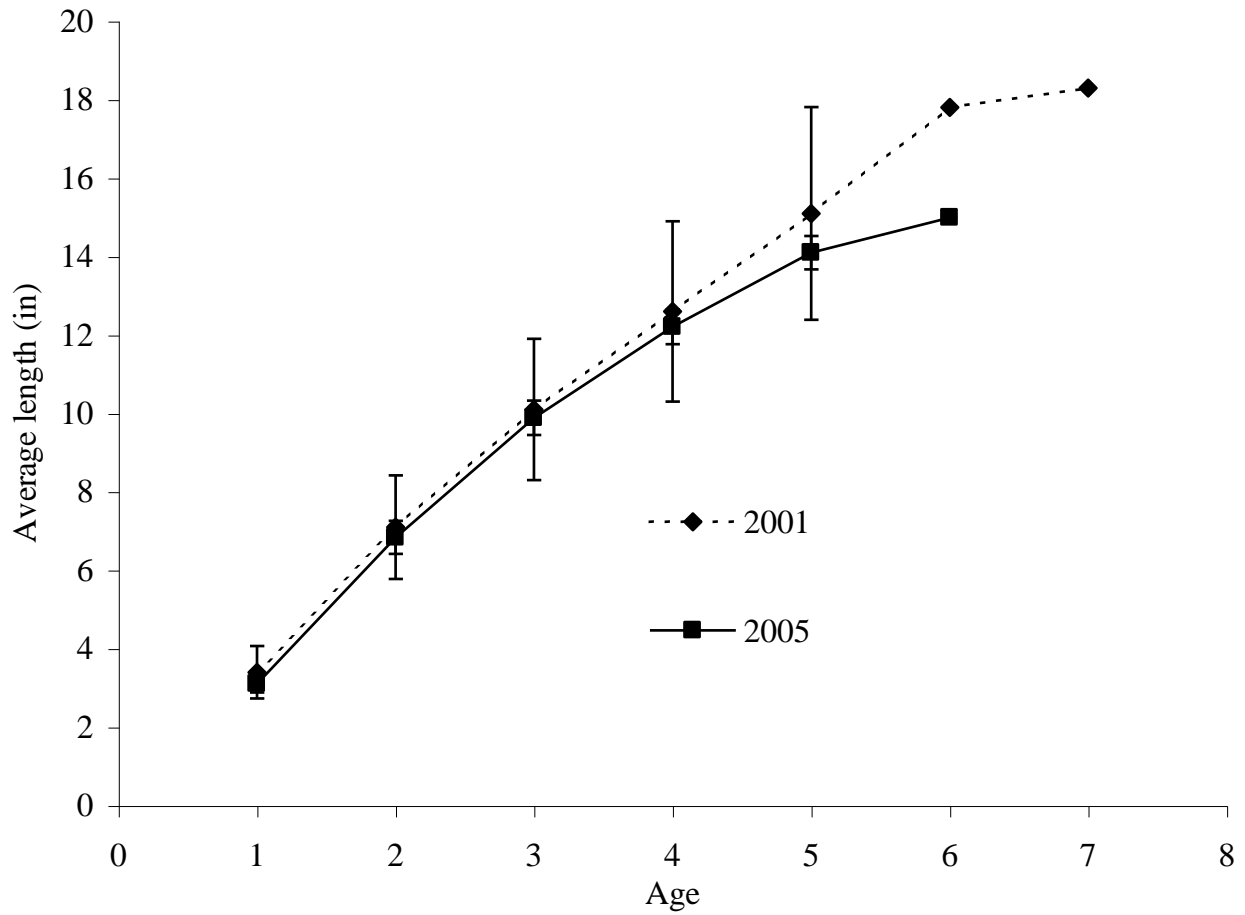


Figure 2. Comparison of largemouth bass growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples.

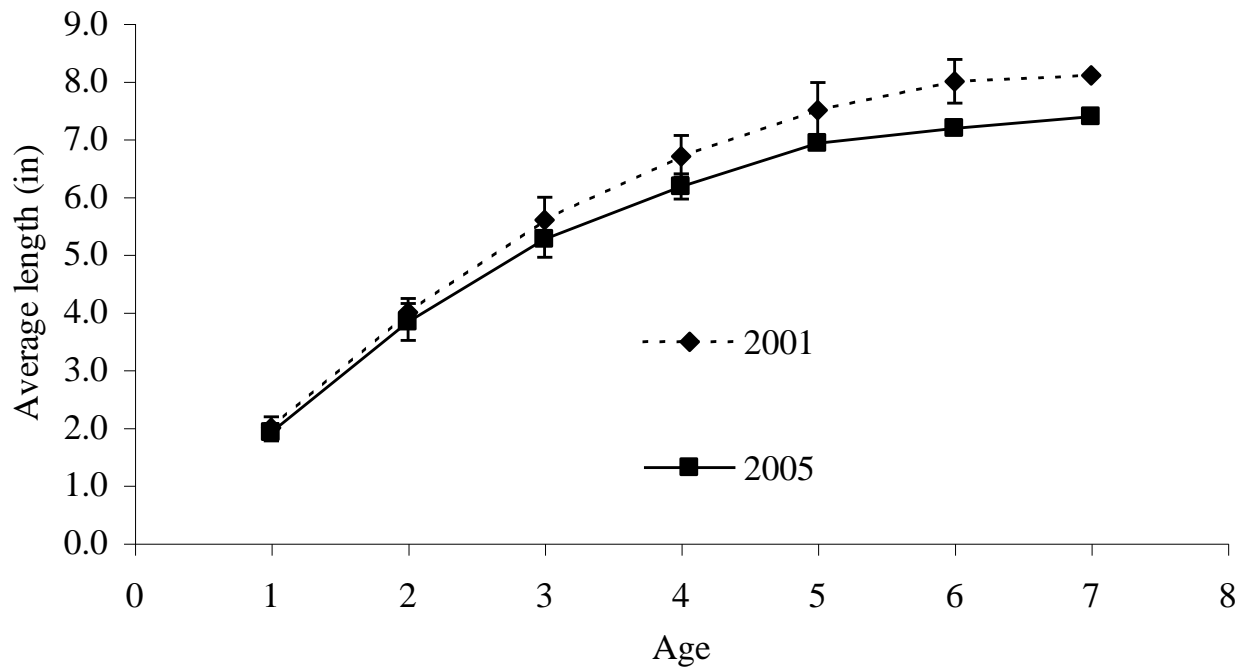


Figure 3. Comparison of redear sunfish growth in 2001 and 2005. The Y-error bars represent the standard deviation around each average length. Average length and standard deviation were not calculated for age groups with less than three samples.

APPENDIX

Lake Pages

LAKE SURVEY REPORT

Type of Survey	<input type="checkbox"/> Initial Survey	<input checked="" type="checkbox"/> Re-Survey
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Lake Name Center Lake	County Kosciusko	Date of survey (Month, day, year) 6/6-7/2005
Biologist's name Edward R. Braun, Angela C. Benson		Date of survey (Month, day, year) 6/6-7/2005

LOCATION		
Quadrangle Name Warsaw	Range 6E	Section 8
Township Name 32N	Nearest Town Warsaw	

ACCESSIBILITY					
State owned public access site South end of lake at Buffalo Street		Privately owned public access site		Other access site	
Surface acres 120	Maximum depth 46 ft	Average depth 20 ft	Acre feet 2,400	Water level 804 ft	Extreme fluctuations 1-2 ft
Location of benchmark A gage is located on the south shore. A brass marker is located on the outlet structure.					

INLETS		
Name None	Location	Origin

OUTLETS			
Name Unnamed	Location Southwest side of lake		
Water level control A concrete structure with three graded openings.			
POOL	ELEVATION (Feet MSL)	ACRES	Bottom type <input type="checkbox"/> Boulder <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Muck <input type="checkbox"/> Clay <input checked="" type="checkbox"/> Marl
TOP OF DAM			
TOP OF FLOOD CONTROL POOL			
TOP OF CONSERVATION POOL	804		
TOP OF MINIMUM POOL			
STREAMBED			

Watershed use Municipal; within Warsaw city limits, residential and industrial areas
Development of shoreline City park on south shore; about 5% natural shoreline, remainder is residential and industrial.
Previous surveys and investigations 2001, 1997, 1984, 1970 - general surveys

SAMPLING EFFORT						
ELECTROFISHING	Day hours			Night hours		Total hours
	0			0.75 h		0.75 h
TRAP NETS	Number of traps			Number of Lifts		Total effort
	3			1		3
GILL NETS	Number of nets			Number of Lifts		Total effort
	4			1		4
ROTENONE	Gallons	ppm	Acre Feet Treated		SHORELINE SEINING	Number of 100 Foot Seine Hauls

Center Lake 6/6-7/2005

PHYSICAL AND CHEMICAL CHARACTERISTICS			
Color	Turbidity		Air temperature:
Green	4 Feet	1 Inches (SECCHI DISK)	F
Water chemistry GPS coordinates:		N 41.24508440	W 85.85658261

WATER QUALITY PARAMETERS																
DEPTH (Feet)	Degrees (F)	D.O.	SpC	pH	TDS	D.O.%	Turb.	DEPTH	Degrees (F)	D.O.	SpC	pH	TDS	D.O.%	Turb.	
SURFACE	73.5	9.02	0.504	8.72	0.3	108.3	5.4	52								
2	73.4	8.79	0.504	8.49	0.3	105.4	5.5	54								
4	73.2	8.70	0.504	8.50	0.3	104.1	5.2	56								
6	73.0	8.64	0.504	8.49	0.3	103.2	5.1	58								
8	72.8	8.64	0.504	8.47	0.3	103.2	5.5	60								
10	67.1	9.78	0.512	8.46	0.3	109.5	18.0	62								
12	64.0	9.99	0.518	8.43	0.3	108.1	19.8	64								
14	60.3	8.54	0.526	8.17	0.3	88.5	26.9	66								
16	55.3	1.02	0.537	7.56	0.3	9.4	39.3	68								
18	51.9	0.03	0.543	7.46	0.4	0.3	35.9	70								
20	49.8	0.00	0.544	7.37	0.4	0.0	32.8	72								
22	49.2	0.00	0.542	7.31	0.4	0.0	31.7	74								
24	48.8	0.00	0.544	7.25	0.4	0.0	30.9	76								
26	48.5	0.00	0.545	7.20	0.4	0.0	29.4	78								
28	48.0	0.00	0.547	7.17	0.4	0.0	26.2	80								
30	47.5	0.00	0.550	7.14	0.4	0.0	24.5	82								
32	47.2	0.00	0.554	7.10	0.4	0.0	23.9	84								
34	47.1	0.00	0.555	7.09	0.4	0.0	22.3	86								
36	47.0	0.00	0.557	7.08	0.4	0.0	20.7	88								
38	46.4	0.00	0.565	7.03	0.4	0.0	19.7	90								
40	46.1	0.00	0.565	6.90	0.4	0.0	5999.0	92								
42								94								
44								96								
46								98								
48								100								
50																

COMMENTS

One GN vandalized a few hours after setting, but prior to EF, we reset it.

Occurrence and Abundance of Submersed Aquatic Plants in Center Lake

Date: 5/11/05	Littoral sites with plants: 55	Species diversity: 0.64
Littoral depth (ft): 13.0	Number of species: 7	Native diversity: 0.65
Littoral sites: 60	Maximum species/site: 3	Rake diversity: 1.53
Total sites: 60	Mean number species/site: 0.18	Native rake diversity: 0.72
Secchi: 5.0	Mean native species/site: 0.09	*Mean rake score: 1.70

Common Name	Site frequency	Relative density	Mean density	Dominance
Eurasian watermilfoil	81.67	1.55	1.90	31.00
Coontail	38.33	0.38	1.00	7.67
Large-leaf pondweed	8.33	0.08	1.00	1.67
Chara	8.33	0.12	1.40	2.33
Flat-stem pondweed	1.67	0.02	1.00	0.33
Wild celery	13.33	0.13	1.00	2.67
Slender naiad	1.67	0.02	1.00	0.33
Filamentous Algae	5.0			

Other Observed Plants: white water lily, spatterdock

Occurrence and Abundance of Submersed Aquatic Plants in Center Lake

Date:	8/2/2005	Littoral sites with plants:	50	Species diversity:	0.829
Littoral depth (ft):	9.5	Number of species:	10	Native diversity:	0.805
Littoral sites:	60	Maximum species/site:	3	Rake diversity:	1.3
Total sites:	60	Mean number species/site:	0.156	Native rake diversity:	1.2
Secchi:	5	Mean native species/site:	0.144	*Mean rake score:	1.65

Common Name	Site frequency	Relative density	Mean density	Dominance
Chara	35.00	0.65	1.86	13.00
Water stargrass	28.33	0.52	1.82	10.33
Coontail	20.00	0.20	1.00	4.00
Sago	15.00	0.15	1.00	3.00
Largeleaf pondweed	10.00	0.18	1.83	3.67
Eurasian watermilfoil	8.33	0.13	1.60	2.67
Creeping bladderwort	6.67	0.10	1.50	2.00
Illinois pondweed	3.33	0.03	1.00	0.67
Small pondweed	1.67	0.02	1.00	0.33
Curly-leaf pondweed	1.67	0.02	1.00	0.33
Filamentous Algae	11.7			

Other Observed Plants: white water lily, spatterdock, chairmaker's rush, cattails, hibiscus, loostrife, waterwillow, spike rush, pickerel weed, long-leaf pondweed

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	1,999	61.4	1.8 - 7.6	76.13	13.6
Redear sunfish	577	17.7	3.9 - 8.5	24.54	4.4
Gizzard shad	390	12.0	6.0 - 15.8	148.22	26.6
Largemouth bass	65	2.0	4.0 - 19.7	53.78	9.6
Yellow perch	43	1.3	3.7 - 8.7	4.06	0.7
Spotted gar	35	1.1	17.0 - 33.7	57.28	10.3
Black crappie	33	1.0	5.2 - 10.6	7.05	1.3
Brown bullhead	29	0.9	9.2 - 14.0	24.84	4.5
Bowfin	15	0.5	13.3 - 24.3	40.33	7.2
Warmouth	13	0.4	2.6 - 8.1	1.71	0.3
Longear sunfish	8	0.2	3.1 - 4.4	0.33	0.1
Northern pike	7	0.2	26.9 - 32.4	41.24	7.4
Hybrid sunfish	7	0.2	5.1 - 7.7	1.66	0.3
Golden shiner	6	0.2	6.8 - 8.4	1.03	0.2
Golden redhorse	6	0.2	7.8 - 17.7	9.55	1.7
Yellow bullhead	5	0.2	8.0 - 10.8	2.74	0.5
Common carp	5	0.2	23.8 - 26.3	41.25	7.4
White sucker	4	0.1	14.4 - 18.2	5.96	1.1
Pumpkinseed	2	0.1	3.6 - 4.0	0.06	0.0
Channel catfish	2	0.1	21.2 - 23.2	7.96	1.4
Grass pickerel	2	0.1	2.9 - 11.0	0.29	0.1
Spotted sucker	1	0.0	17.0	2.10	0.4
Silverside	1	0.0	3.6	0.00	0.0
Bluntnose minnow	1	0.0	2.4	0.00	0.0
Walleye	1	0.0	26.1	5.79	1.0
Total (24 Species, 1 Hybrid)	3,257	100.0		557.90	100.0

*Common names of fishes recognized by the American Fisheries Society.

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLUEGILL									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0	1	0.1	0.00	1	20.0				
2.5	5	0.4	0.01	2	20.5				
3.0	52	4.5	0.02	2, 3	21.0				
3.5	144	12.5	0.02	3	21.5				
4.0	239	20.8	0.04	3	22.0				
4.5	212	18.5	0.05	3, 4	22.5				
5.0	239	20.8	0.08	3, 4	23.0				
5.5	133	11.6	0.10	4	23.5				
6.0	72	6.3	0.14	3, 4, 5	24.0				
6.5	40	3.5	0.17	4, 5, 6	24.5				
7.0	9	0.8	0.22	5, 6, 7	25.0				
7.5	2	0.2	0.26	6	25.5				
8.0					26.0				
8.5					TOTAL	1148	100.0		
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	1,010.7 fish/h	GILL NET CATCH	59 fish/lift	TRAP NET CATCH	51.3 fish/lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF LARGEMOUTH BASS									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5	1	1.5	4.24	8
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0	1	1.5	0.03	1	22.0				
4.5					22.5				
5.0	1	1.5	0.06	1	23.0				
5.5	1	1.5	0.06	2	23.5				
6.0	2	3.1	0.09	2	24.0				
6.5	2	3.1	0.12	2	24.5				
7.0	4	6.2	0.13	2	25.0				
7.5	6	9.2	0.21	2	25.5				
8.0	2	3.1	0.21	2	26.0				
8.5	2	3.1	0.25	2	TOTAL	65	100.0		
9.0									
9.5	5	7.7	0.35	3, 4					
10.0	1	1.5	0.48	3					
10.5	6	9.2	0.54	3, 4					
11.0	1	1.5	0.69	3					
11.5	3	4.6	0.74	3, 4					
12.0	3	4.6	0.89	4					
12.5	2	3.1	0.91	4					
13.0	3	4.6	1.02	4					
13.5	4	6.2	1.20	4, 5					
14.0	3	4.6	1.41	4, 5					
14.5	5	7.7	1.55	5, 6					
15.0	2	3.1	1.64	5, 6					
15.5	2	3.1	1.98	5, 6					
16.0	2	3.1	2.09	5, 6					
16.5	1	1.5	2.13	7					
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	78.7 fish/h	GILL NET CATCH	1.5 fish/lift	TRAP NET CATCH	0 fish/lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF REDEAR SUNFISH									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0	3	2.2	0.04	2	22.0				
4.5	4	2.9	0.05	2, 3, 4	22.5				
5.0	13	9.4	0.09	2, 3, 4	23.0				
5.5	13	9.4	0.11	3, 4	23.5				
6.0	18	12.9	0.15	3, 4	24.0				
6.5	49	35.3	0.19	4, 5, 6	24.5				
7.0	25	18.0	0.22	4, 5, 6, 7	25.0				
7.5	9	6.5	0.30	6, 7	25.5				
8.0	4	2.9	0.32	5, 6, 7	26.0				
8.5	1	0.7	0.37	8	TOTAL	139	100		
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	52 fish/h	GILL NET CATCH	23 fish/lift	TRAP NET CATCH	2.7 fish/lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLACK CRAPPIE									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0	1	3.0	0.07	2	23.0				
5.5	3	9.1	0.08	2	23.5				
6.0	2	6.1	0.10	2	24.0				
6.5					24.5				
7.0	1	3.0	0.18	3	25.0				
7.5	11	33.3	0.20	3	25.5				
8.0	11	33.3	0.23	3, 4	26.0				
8.5	1	3.0	0.33	4	TOTAL	33	100		
9.0	2	6.1	0.35	4					
9.5									
10.0									
10.5	1	3.0	0.63	5					
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	0 fish/lift	GILL NET CATCH	10 fish/lift	TRAP NET CATCH	0.8 fish/lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF YELLOW PERCH									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5	1	2.3	0.02	1	21.5				
4.0	6	14.0	0.03	1	22.0				
4.5	0				22.5				
5.0	1	2.3	0.04	4	23.0				
5.5	4	9.3	0.06	4	23.5				
6.0	12	27.9	0.08	4, 5	24.0				
6.5	4	9.3	0.10	4	24.5				
7.0	8	18.6	0.11	4, 5, 6, 7	25.0				
7.5	0				25.5				
8.0	5	11.6	0.18	4, 5, 6	26.0				
8.5	2	4.7	0.24	5, 7	TOTAL	43	100		
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									
ELECTROFISHING CATCH		25.3 fish/lift		GILL NET CATCH	5.3 fish/lift		TRAP NET CATCH		1 fish/ lift

Back-calculated lengths-at-age for bluegill, largemouth bass, redear sunfish, black crappie, and yellow perch.

Species: Bluegill Intercept = 0.8	Year	Number	Back Calculated Length (in) at Each Age						
	Class	Aged	I	II	III	IV	V	VI	VII
	2004	1	1.7						
	2003	11	1.7	2.7					
	2002	28	1.7	2.7	3.6				
	2001	36	1.8	2.9	4.2	5.1			
	2000	11	1.9	3.2	4.5	5.6	6.3		
	1999	5	2.1	3.5	5.0	5.8	6.4	6.8	
	1998	2	1.8	3.0	4.3	5.0	5.8	6.6	6.9
	Average Length		1.8	3.0	4.3	5.5	6.4	6.8	0
	Standard Deviation		0.18	0.34	0.58	0.38	0.11	0	0
	Yr. Classes Averaged		5	5	4	3	2	1	0

Species: Largemouth bass Intercept = 0.8	Year	Number	Back Calculated Length (in) at Each Age							
	Class	Aged	I	II	III	IV	V	VI	VII	VIII
	2004	2	4.3							
	2003	19	3.3	7.1						
	2002	11	3.1	6.5	10.0					
	2001	14	2.9	6.3	9.3	11.8				
	2000	9	2.9	7.2	10.3	12.7	14.4			
	1999	5	3.4	7.1	10.0	12.2	13.8	15.0		
	1998	1	2.7	7.0	11.7	13.7	15.0	16.0	16.3	
	1997	1	4.8	9.8	12.5	14.7	17.5	18.5	19.3	19.6
	Average Length		3.1	6.8	9.9	12.2	14.1	15.0	0	0
	Standard Deviation		0.23	0.42	0.44	0.45	0.43	0	0	0
	Yr. Classes Averaged		5	5	4	3	2	1	0	0

Species: Redear
Intercept = 0.6

Year Class	Number Aged	Back Calculated Length (in) at Each Age							
		I	II	III	IV	V	VI	VII	VIII
2003	5	1.8	3.9						
2002	13	1.8	3.6	5.0					
2001	25	1.8	3.4	5.0	5.9				
2000	3	2.1	4.0	5.6	6.4	7.0			
1999	9	1.9	3.8	5.2	6.1	7.0	7.2		
1998	3	2.1	4.3	5.6	6.3	6.8	7.2	7.4	
1997	1	1.7	3.3	4.5	5.7	6.7	7.9	8.1	8.3
Average Length		1.9	3.8	5.3	6.2	6.9	7.2	7.4	0
Standard Deviation		0.15	0.32	0.31	0.22	0.07	0.03	0	0
Yr. Classes Averaged		6	6	5	4	3	2	1	0

Species: Black crappie
Intercept = 1.4

Year Class	Number Aged	Back Calculated Length (in) at Each Age				
		I	II	III	IV	V
0	0					
2003	6	2.9	4.8			
2002	13	2.6	4.9	6.7		
2001	6	2.8	4.7	6.5	7.8	
2000	1	2.9	5.1	6.6	9.1	10.3
Average Length		2.8	4.8	6.6	7.8	0
Standard Deviation		0.13	0.07	0.18	0	0
Yr. Classes Averaged		3	3	2	1	0

Species: Yellow perch
 Intercept = 1.2

Year Class	Number Aged	Back Calculated Length (in) at Each Age						
		I	II	III	IV	V	VI	VII
2004	7	3.5						
2003	0							
2002	0							
2001	18	3.1	4.5	5.5	6.0			
2000	7	3.5	4.8	5.9	6.6	7.0		
1999	1	4.0	5.4	6.3	7.0	7.8	8.0	
1998	2	3.2	4.5	5.2	5.9	6.5	7.1	7.6
Average Length		3.4	4.6	5.7	6.3	7.0	0	0
Standard Deviation		0.21	0.19	0.27	0.42	0	0	0
Yr. Classes Averaged		3	2	2	2	1	0	0

Locations of gear types in Center Lake given in decimal degrees.

GILL NETS				TRAP NETS				ELECTROFISHING			
1 N	41.24291182	W	-85.85817584	1 N	41.25107646	W	-85.85468897	1 N	41.24485910	W	-85.85341224
2 N	41.24604464	W	-85.86158224	2 N	41.24697804	W	-85.86005875	N	41.24935985	W	-85.85396477
3 N	41.24684393	W	-85.85375556	3 N	41.24460697	W	-85.85321912	2 N	41.25105500	W	-85.85483917
4 N	41.24927938	W	-85.85615345					N	41.24909699	W	-85.85884103
								3 N	41.24649525	W	-85.86083123
								N	41.24399006	W	-85.85982808