

BISCHOFF RESERVOIR
Ripley County
2007 Fish Management Report

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EXECUTIVE SUMMARY

- Bischoff Reservoir (also known locally as Batesville Reservoir or Morris Reservoir) is a 190-acre impoundment located approximately 1 mi southwest of the small town of Morris in southeastern Indiana. It is owned by the City of Batesville and managed by the Batesville Water and Gas Utility as a water supply reservoir. An Indiana Department of Natural Resources public access site with a parking lot and concrete boat ramp is present. Electric trolling motors and gasoline outboards (up to 6 horsepower) can be used on the lake.
- A survey of largemouth bass, bluegill, and gizzard shad was conducted on Bischoff Reservoir on June 11 and 20, 2007, as part of a Division of Fish and Wildlife (DFW) work plan, which is titled, "Gizzard shad experimental management strategies." Bischoff will be used as an experimental control to determine natural fluctuations in shad populations and is scheduled to be surveyed annually from early to mid-June through 2009.
- A total of 1,461 fish, representing three species, was collected during this survey. The DC electrofishing catch rate for all three species decreased from 2006. By number, bluegill ranked first, followed by gizzard shad and then largemouth bass. By weight, largemouth bass ranked first, followed by gizzard shad and then bluegill.
- Bluegill ranged from 1.7 to 7.3 in TL, averaging 4.8 in TL. Bluegill represented a balanced population; however, the bluegill proportional stock density (PSD) of 21 is near the lower end of the desired range (20 to 60) for a balanced bluegill fishery. In the subsample, 19% of bluegill were quality-size (6.0 in and longer), a decrease from 26% in 2006. Growth was similar to 2006 and bluegill reached 6.0 in at the end of their 4th year of growth, which is average for southeastern Indiana.
- Largemouth bass ranged from 1.5 to 21.5 in TL, averaging 9.0 in TL. Largemouth bass did not represent a balanced population: their PSD of 26 was below the desired range (40 to 70) for a balanced bass fishery. In the sample, 8% of bass were legal size (14.0 in or longer), a decrease from 12% in 2006. Growth was slower than 2006, but largemouth most likely reached 14.0 in during their 6th year of growth, which is average for southeastern Indiana.
- The DC electrofishing catch rate for gizzard shad was 139.0/h, which is a decrease from 188.0/h in 2006 and also less than in 2005 (404.5/h) and 2004 (304.0/h).
- In Bischoff Reservoir, the DFW should maintain a 14.0-in minimum size limit on largemouth bass, continue to stock 3,040 (16/acre) channel catfish every two years, and continue to monitor the fishery.

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INTRODUCTION

Bischoff Reservoir (also known locally as Batesville Reservoir or Morris Reservoir) is a 190-acre impoundment located approximately 1 mi southwest of the small town of Morris in southeastern Indiana. It is owned by the City of Batesville and managed by the Batesville Water and Gas Utility as a water supply reservoir. Construction was completed in 1960. An Indiana Department of Natural Resources (IDNR) public access site with a parking lot and concrete boat ramp is present. Electric trolling motors and gasoline outboards (up to 6 horsepower) can be used on the lake.

Bischoff Reservoir is one of the few lakes in southern Indiana where the standing crop of fish has been measured. The lake was drained by the utility in the fall of 1966 to improve water quality by removal of rough fish. As the lake drained, IDNR personnel measured and weighed all the fish. Results revealed the standing crop of fish in Bischoff Reservoir was 300 lbs per acre (Barry 1967).

Bischoff Reservoir was restocked early in 1967 with largemouth bass, redear sunfish, channel catfish, and white catfish (Ameiurus catus). Regular stockings of channel catfish were started in 1977 to maintain the channel catfish population, which was not expected to sustain itself through natural reproduction. Prior to this survey, 49,337 catfish had been supplementally stocked by the IDNR's Division of Fish and Wildlife (DFW) from 1977 through 2006.

Gizzard shad, a species that has the potential to ruin sport fisheries in impoundments, had not been collected during any surveys at Bischoff before 1993. In the 1993 survey, however, gizzard shad was found to be the dominant species by number and by weight (Lehman 1995).

Bischoff Reservoir is scheduled to be surveyed from 2005 through 2009 under a DFW work plan which is titled, "Gizzard shad experimental management strategies." The work plan objectives are:

1. Report on how the illegal introductions of gizzard shad have negatively affected sport fish populations and reduced fishing opportunities.
2. Determine the most effective way(s) to control excessive gizzard shad populations.
3. Determine how sport fish populations respond to various gizzard shad management techniques.

According to the work plan, Bischoff will be surveyed from early to mid-June each year. Only largemouth bass, bluegill, and gizzard shad will be collected. Bischoff will be used as an experimental control to determine natural fluctuations in shad populations.

METHODS

A survey of largemouth bass, bluegill, and gizzard shad was conducted June 11 and 20, 2007. Fish were collected by pulsed DC electrofishing along the shoreline on two nights with two dippers for 2.0 h. Four 15-min electrofishing stations in the southeast arm of the lake were sampled the first night. Three 15-min electrofishing stations in the north arm of the lake and one 15-min station along the dam were sampled the second night. A GPS unit, GARMIN GPSmap 76, was used to record the location of the fish collection sites.

All largemouth bass collected and subsamples of 161 bluegill and 140 gizzard shad were measured to the nearest 0.1 in TL. The remaining bluegill and shad were counted but not measured. The length-frequency distributions for 952 bluegill and 278 gizzard shad were created based on the proportion by number of each half-inch group of the bluegill and shad subsamples.

Most fish were not weighed. Average weights for fish by half-inch groups for Fish Management District 8 were used to estimate the weight of the fish sample except for largemouth bass that were longer than 17.5 in TL. Bass over 17.5 in TL were weighed in the field to the nearest 0.01 lb. Fish scale samples were taken from largemouth bass, bluegill, and gizzard shad for age and growth analysis. The proportional stock density (PSD) was calculated for largemouth bass and bluegill (Anderson and Neumann 1996). The bluegill PSD was calculated using only the bluegill subsample. The Bluegill Fishing Potential (BGFP) index was used to assess bluegill fishing quality (Ball and Tousignant 1996).

RESULTS

A total of 1,461 fish, representing three species, was collected during this survey. Total weight of the fish sample was approximately 297 lbs. By number, bluegill ranked first, followed by gizzard shad and then largemouth bass. By weight, largemouth bass ranked first, followed by gizzard shad and then bluegill.

A total of 952 bluegill was sampled that weighed 82 lbs. They ranged from 1.7 to 7.3 in TL, averaging 4.8 in TL. Relative abundance was 65% by number and 28% by weight. The

electrofishing catch rate was 476.0/h, decreasing from 823.5/h in 2006 (Kowalik and Lehman 2008). Bluegill represented a balanced population; the bluegill PSD was 21, however, this is a decrease from 28 in 2006. In the subsample, 19% of the bluegill were 6.0 in or longer (i.e. quality size) compared to 26% in 2006. The 2007 BGFP index was 13, which is in the fair category, compared to 20 (i.e. good) in 2006. Growth was similar to 2006 and back-calculated lengths indicate bluegill reached 6.0 in at the end of their 4th year of growth, which is average for southeastern Indiana (Figure 1).

A total of 278 gizzard shad was sampled that weighed 90 lbs. They ranged from 8.0 to 11.3 in TL, averaging 9.8 in TL. Relative abundance was 19% by number and 30% by weight. The electrofishing catch rate was 139.0/h compared to 188.0/h in 2006 (Kowalik and Lehman 2008) (Figure 2). Gizzard shad were not aged.

A total of 231 largemouth bass was sampled that weighed 125 lbs. They ranged from 1.5 to 21.5 in TL, averaging 9.0 in TL. Relative abundance was 16% by number and 42% by weight. The electrofishing catch rate was 115.5/h, decreasing from 124.0/h in 2006 (Kowalik and Lehman 2008). Largemouth did not represent a balanced population; the largemouth PSD was 26, a decrease from 29 in 2006. In the sample, 8% of the bass were 14.0 in or longer (i.e. legal size), a decrease from 12% in 2006. Growth was slower than 2006, but back-calculated lengths indicate largemouth bass most likely reached 14.0 in during their 6th year of growth, which is average for southeastern Indiana (Figure 3).

DISCUSSION

In this 2007 survey of Bischoff Reservoir, the electrofishing catch rate for all three species decreased from 2006. The abundance and density of submersed vegetation in certain stations made sampling conditions difficult. The bluegill catch rate decreased by the greatest percentage, but bluegill remained the most abundant fish in the sample, unlike the 2005 survey when gizzard shad ranked first. The bluegill PSD decreased from 2006 (barely remaining within the desired range) and less quality-size bluegill were collected than in 2004, 2005, and 2006. The BGFP index returned to the fair category (as it was in 2004 and 2005) from the good category in 2006. According to the index, this negative effect was due mostly to a *less than good* density. No bluegill 8.0 in or longer have been collected in the last four surveys. The lack of

large bluegill may be the result of angler harvest and/or correlated with the presence of gizzard shad. Bluegill growth remains average for southeastern Indiana.

In 2007 (as in 2006), gizzard shad ranked second behind bluegill in relative abundance. In 2005, gizzard shad ranked first by number and weight in the sample as in 1993 when the species first appeared in a DFW survey at Bischoff (Lehman 1995). The 2007 electrofishing catch rate was less than the last three surveys. The 2007 length range of shad was smaller than 2006, but the average length was similar to 2005 and 2006. Gizzard shad directly compete with bluegill and young bass for zooplankton, which can lead to a decline in fishing.

In 2007, a lesser percentage of legal largemouth bass was collected than in 2004, 2005, and 2006. The bass length range and average size, however, was very similar to 2006. The bass PSD (below the desired range for a balanced population as in 2006) was less than in the previous three surveys. The bass catch rate decreased from 2006 and was similar to the 2004 catch rate. Bass most likely reached 14.0 in during their 6th year of growth, which is average for southeastern Indiana. In 2006, bass growth at all ages was as fast as or faster than in 2005 and the district average. In 2007, bass growth was slower than 2006 and more similar to 2005 and the district average.

Although the bass PSD has declined and less legal bass were collected, an abundance of age-2, 3, and 4 bass should keep supplying 14.0-in bass into the fishery. It does not appear that largemouth have a shortage of prey. The 14.0-in minimum size limit should remain in effect to prevent over-harvest of largemouth bass, the primary source of predation on Bischoff's small panfish and gizzard shad population.

According to the work plan, Bischoff will be surveyed from early to mid-June each year. Only largemouth bass, bluegill, and gizzard shad will be collected. Bischoff will be used as an experimental control to determine natural fluctuations in shad populations.

RECOMMENDATIONS

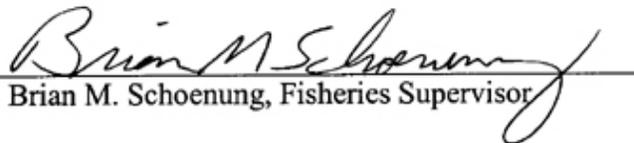
- The DFW should maintain the 14.0-in minimum size limit on largemouth bass at Bischoff Reservoir.
- The DFW should continue to stock 3,040 (16/acre) channel catfish fingerlings every two years as long as it is felt channel catfish should be managed in this manner. These channel catfish should average at least 8 in long to reduce mortality from bass predation.

LITERATURE CITED

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Date: March 27, 2008

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Approved by: 
Brian M. Schoenung, Fisheries Supervisor

Date: August 11, 2008

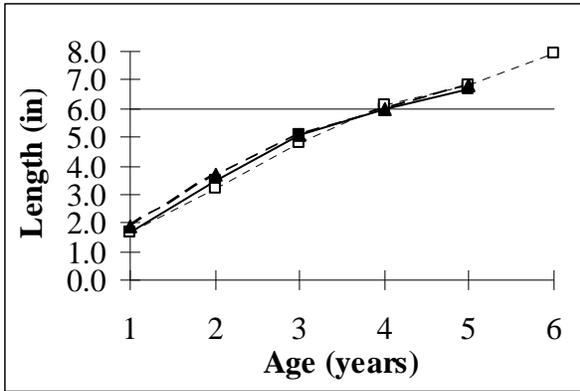


Figure 1. Bischoff Reservoir bluegill growth from 2007 survey (solid line) compared to 2006 survey (dashed line) and to average bluegill growth observed in Fish Management District 8 impoundments (dotted line).

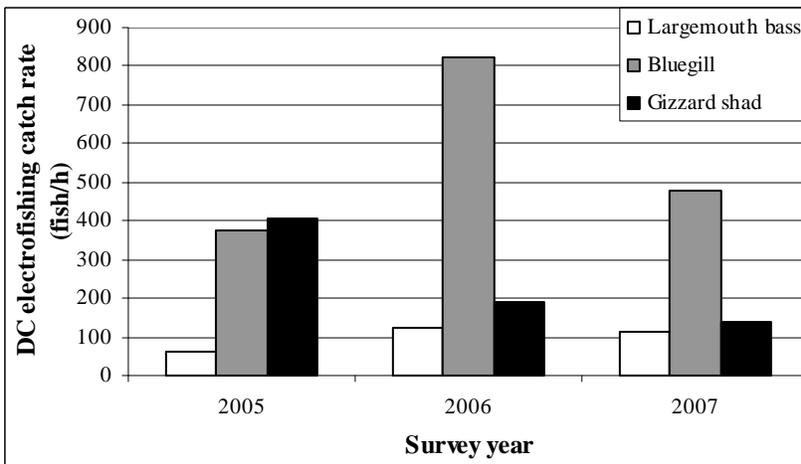


Figure 2. DC electrofishing catch rates for largemouth bass, bluegill, and gizzard shad in Bischoff Reservoir in June 2005, 2006, and 2007.

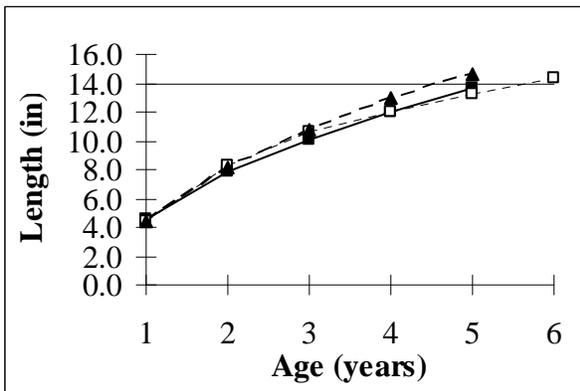


Figure 3. Bischoff Reservoir largemouth bass from 2007 survey (solid line) compared to 2006 survey (dashed line) and to average largemouth bass growth observed in Fish Management District 8 impoundments (dotted line).

LAKE SURVEY REPORT

Type of Survey	<input type="checkbox"/> Initial Survey	<input checked="" type="checkbox"/> Re-Survey
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Lake Name Bischoff Reservoir	County Ripley	Date of survey (Month, day, year) June 11 and 20, 2007
Biologist's name Larry L. Lehman		Date of Approval (Month, day, year) August 11, 2008

LOCATION		
Quadrangle Name Batesville, IND. 1961. Photorevised 1980	Range 12E	Sections 27, 28, 33, and 34
Township 10N	Nearest Town Morris	

ACCESSIBILITY					
State owned public access site Two-lane IDNR concrete boat ramp with parking		Privately owned public access site One private boat ramp is present		Other access site City of Batesville owns impoundment	
Surface acres 190*	Maximum depth (ft) 27**	Average depth (ft) 8.1*	Volume (acre feet) 1,541*	Water level (feet MSL) 959	Extreme fluctuations 953.0-959.5 feet MSL
Location of benchmark Along State Road 46 in town of Morris					

INLETS		
Name	Location	Origin
Several unnamed intermittent inlets enter impoundment along its shoreline		

OUTLETS			
Name Bobs Creek	Location Below principal spillway in dam		
Water level control Grass emergency spillway around south end of dam. Principal spillway is 5-ft square concrete drop inlet. Ten-inch drawdown tube is present.			
POOL	ELEVATION (feet MSL)	ACRES	Bottom type
TOP OF DAM			<input type="checkbox"/> Boulder
TOP OF FLOOD CONTROL POOL			<input checked="" type="checkbox"/> Gravel
NORMAL POOL	959	190	<input checked="" type="checkbox"/> Sand
TOP OF MINIMUM POOL			<input type="checkbox"/> Silt loam
STREAMBED			<input type="checkbox"/> Clay loam
			<input type="checkbox"/> Marl

Watershed use: Watershed covers approximately 3,000 acres. Approximately 1% is commercial and 4% is residential. The remainder is forest (~10%), agriculture (~38%), and grass/pasture (~41%). (source is <http://pasture.ecn.purdue.edu>)

Development of shoreline
Public access site with a concrete boat ramp, a courtesy dock, and parking lot is present. Twenty-six residences and some private docks sit along the shoreline. Housing development (Hillindale Commons) with a private boat ramp is located on the north arm of the lake.

Previous surveys and investigations
Hydrographic survey 1963. Fishery survey 1963. Creel census 1965, 1966. Evaluation of survey methods 1966.

Drained 1966. Restocked 1967. Fishery survey 1970. Research project 1973-1977. Fishery survey 1984.

Lake enhancement feasibility study 1989-1991. Fishery surveys 1993, 2004. Gizzard shad study 2005, 2006.

*According to lake enhancement feasibility study (1989-1991). **According to hydrographic survey 1963.

SAMPLING EFFORT					
ELECTROFISHING	Day hours		Night hours		Total hours
	0		2.00**		2.00**
TRAP NETS	Number of traps		Number of Lifts		Total effort
	0				
GILL NETS	Number of nets		Number of Lifts		Total effort
	0				
ROTENONE	Gallons	ppm	Acre Feet Treated	SHORELINE SEINING	Number of 100-Foot Seine Hauls
	0				

PHYSICAL AND CHEMICAL CHARACTERISTICS					
Color			Turbidity		
			Feet	Inches (SECCHI DISK)	
Alkalinity (ppm)*			pH		
Surface:		Bottom:	Surface:		Bottom:
Conductivity: _____			Air temperature		°F
Conductivity: _____					
Water chemistry GPS coordinates:					
N			W		

TEMPERATURE AND DISSOLVED OXYGEN (D.O.)								
DEPTH (FEET)	Degrees (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)
SURFACE	***		36			72		
2			38			74		
4			40			76		
6			42			78		
8			44			80		
10			46			82		
12			48			84		
14			50			86		
16			52			88		
18			54			90		
20			56			92		
22			58			94		
24			60			96		
26			62			98		
28			64			100		
30			66					
32			68					
34			70					

COMMENTS
**6/11/07 electrofisher settings: 707 volts DC, output mode 60 pps DC, pulse width 3.75 ms (4 amps)
**6/20/07 electrofisher settings: 530 volts DC, output mode 60 pps DC, pulse width 3.75 ms (3-4 amps)
***Surface water temperatures: 78°F on 6/11/07 and 80°F on 6/20/07

*ppm-parts per million

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Bluegill Bischoff Reservoir 6/11/07 and 6/20/07

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	5	0.5	<0.01	1	19.5				
2.0	6	0.6	<0.01	1	20.0				
2.5	30	3.2	0.01	1	20.5				
3.0	41	4.3	0.02	1	21.0				
3.5	41	4.3	0.03	1, 2	21.5				
4.0	154	16.2	0.04	2	22.0				
4.5	237	24.9	0.06	2	22.5				
5.0	112	11.8	0.08	2, 3, 4	23.0				
5.5	95	10.0	0.11	2, 3, 4	23.5				
6.0	136	14.3	0.15	3, 4	24.0				
6.5	71	7.5	0.19	4, 5	24.5				
7.0	18	1.9	0.24	4, 5	25.0				
7.5	6	0.6	0.30	5	25.5				
8.0					26.0				
8.5					TOTAL	952			
9.0									
9.5					Subsample: PSD = 31/150(100) = 20.7				
10.0									
10.5					Subsample: % ≥ 6.0 inches = 31/161(100) = 19.3				
11.0									
11.5					Bluegill Fishing Potential Index = 13 (fair)				
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	476.0/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Gizzard shad Bischoff Reservoir 6/11/07 and 6/20/07

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					23.0				
5.5					23.5				
6.0					24.0				
6.5					24.5				
7.0					25.0				
7.5					25.5				
8.0	10	3.6	0.17	Not aged	26.0				
8.5	28	10.1	0.20		TOTAL	278			
9.0	14	5.0	0.25						
9.5	56	20.1	0.28						
10.0	97	34.9	0.34						
10.5	48	17.3	0.40						
11.0	22	7.9	0.46						
11.5	3	1.1	0.51						
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	139.0/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Largemouth bass Bischoff Reservoir 6/11/07 and 6/20/07

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	1	0.4	<0.01	0	19.5	1	0.4	4.63	—
2.0	1	0.4	<0.01	0	20.0				
2.5					20.5	1	0.4	4.81	—
3.0					21.0	1	0.4	6.00	—
3.5					21.5	2	0.9	5.76	—
4.0					22.0				
4.5	1	0.4	0.04	1	22.5				
5.0	5	2.2	0.05	1	23.0				
5.5	14	6.1	0.07	1	23.5				
6.0	26	11.3	0.10	1	24.0				
6.5	8	3.5	0.12	1, 2	24.5				
7.0	6	2.6	0.16	1, 2	25.0				
7.5	14	6.1	0.19	2	25.5				
8.0	35	15.2	0.24	2	26.0				
8.5	29	12.6	0.28	2	TOTAL	231			
9.0	17	7.4	0.34	2					
9.5	18	7.8	0.41	2, 3		PSD = 37/143(100) = 25.9			
10.0	5	2.2	0.48	2, 3					
10.5	6	2.6	0.57	3, 4		% _≥ 14.0 inches = 18/231(100) = 7.8			
11.0	5	2.2	0.64	3, 4					
11.5	1	0.4	0.74	4					
12.0	7	3.0	0.84	3, 4, 5					
12.5	5	2.2	0.97	3, 4					
13.0	3	1.3	1.09	4					
13.5	5	2.2	1.24	4					
14.0	3	1.3	1.39	4, 5					
14.5	2	0.9	1.59	5					
15.0	1	0.4	1.72	5					
15.5	1	0.4	1.93	5					
16.0	2	0.9	2.06	5					
16.5									
17.0	1	0.4	2.40	—					
17.5	3	1.3	2.85	—					
18.0									
18.5	1	0.4	3.63	—					

ELECTROFISHING CATCH	115.5/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A
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Species Bluegill	YEAR CLASS	Number of fish aged	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE								
				1	2	3	4	5	6	7	8	
Intercept= 0.8"	2006	14	1.7-3.5	1.9								
	2005	17	3.4-5.5	1.6	3.4							
	2004	12	5.0-6.2	1.6	3.5	5.0						
	2003	8	5.2-7.2	1.7	3.4	4.9	5.9					
	2002	3	6.4-7.3	1.6	3.7	5.2	6.1	6.7				
			AVERAGE LENGTH	1.7	3.5	5.1	6.0	6.7				
			NUMBER AGED	54	40	23	11	3				

Species Largemouth bass	YEAR CLASS	Number of fish aged	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE								
				1	2	3	4	5	6	7	8	
Intercept= 0.8"	2006	23	4.7-7.2	5.3								
	2005	36	6.3-9.9	4.5	7.8							
	2004	15	9.4-12.4	4.5	8.0	10.1						
	2003	19	10.4-14.1	3.8	7.3	9.8	11.7					
	2002	6	12.2-16.0	4.6	8.4	10.5	12.3	13.7				
			AVERAGE LENGTH	4.5	7.9	10.1	12.0	13.7				
			NUMBER AGED	99	76	40	25	6				

*Not included in average length calculations.

GPS LOCATION OF SAMPLING EQUIPMENT Bischoff Reservoir 6/11/07 and 6/20/07

GILL NETS			TRAP NETS			ELECTROFISHING				
1	N	W	1	N	W	1	N 39.27236	W -85.17973		
	N	W	2	N	W		N 39.27404	W -85.18168		
2	N	W	3	N	W					
	N	W	4	N	W					
3	N	W	5	N	W	2	N 39.27059	W -85.18559		
	N	W	6	N	W		N 39.26752	W -85.18416		
4	N	W	7	N	W					
	N	W	8	N	W					
5	N	W	9	N	W	3	N 39.27069	W -85.18980		
	N	W	10	N	W		N 39.26972	W -85.18720		
6	N	W	11	N	W					
	N	W	12	N	W					
7	N	W	13	N	W	4	N 39.27184	W -85.18671		
	N	W	14	N	W		N 39.27265	W -85.18954		
8	N	W	15	N	W					
	N	W	16	N	W					
9	N	W	17	N	W	5	N 39.28254	W -85.18799		
	N	W	18	N	W		N 39.28327	W -85.18770		
10	N	W	19	N	W					
	N	W	20	N	W					
11	N	W				6	N 39.28056	W -85.19268		
	N	W					N 39.27889	W -85.19536		
12	N	W								
	N	W								
13	N	W						7	N 39.27540	W -85.19944
	N	W							N 39.27435	W -85.19670
14	N	W								
	N	W								
15	N	W						8	N 39.27602	W -85.19405
	N	W							N 39.27735	W -85.19054
16	N	W							N	W
	N	W							N	W
17	N	W							N	W
	N	W							N	W
18	N	W								
	N	W								
19	N	W							N	W
	N	W							N	W
20	N	W							N	W
	N	W							N	W