PISGAH LAKE

Johnson County

2006 Fish Management Report

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EXECUTIVE SUMMARY

- Pisgah Lake is a 62-acre impoundment located on Atterbury Fish and Wildlife Area (FWA) near Edinburgh in southeastern Indiana. It is one of nine small lakes and marshes on the property managed for fishing by the Department of Natural Resources. Access includes two boat ramps and only electric motors are allowed. A brochure of the property is available by writing to Atterbury FWA, 7970 South Rowe Street, Edinburgh, IN 46124.

- A survey of largemouth bass, bluegill, and gizzard shad was conducted on Pisgah Lake on June 8 and 19, 2006, as part of a Division of Fish and Wildlife (DFW) work plan, which is titled, "Gizzard shad experimental management strategies." As part of this work plan, Pisgah Lake is scheduled to be surveyed annually through 2009.

- A total of 1,604 fish, representing 3 species, was collected during this survey. By number, gizzard shad ranked first, followed by bluegill and then largemouth bass. By weight, gizzard shad ranked first, followed by largemouth bass and then bluegill.

- The electrofishing catch rate for gizzard shad was 662.5/h, which is an increase from 2005 (556.0/h).

- The bluegill fishery of 2006 was in good condition and represented a balanced population. More than half of the bluegill collected were 6.0 in or longer (quality size) and the majority of these were 7-in fish. They are reaching 6.0 in TL at the end of their 4^{th} year of growth, which is average for southeastern Indiana.

- Bass represented a balanced population and are reaching 14.0 in TL in their 5^{th} year of growth, which is above average for southeastern Indiana.

- A selective gizzard shad eradication was conducted on November 6, 2006 to reduce the number of gizzard shad and to fulfill the directives of the work plan.

- Pisgah Lake received a supplemental stocking of 6,200 (100/acre) largemouth bass fingerlings November 15 to enhance the predator population following the shad selective. An additional 2,369 bass fingerlings and 82 larger bass (5.3 to 10.9 in TL) were also stocked 2 weeks later.

- The DFW should maintain a 14.0-in minimum size limit on largemouth bass, continue to stock 992 (16/acre) channel catfish every two years, and continue to control submersed vegetation in Pisgah Lake.

FIGURES

Figure Page

INTRODUCTION

Pisgah Lake is a 62-acre impoundment located on Atterbury Fish and Wildlife Area (FWA) near Edinburgh in southeastern Indiana. It is one of nine small lakes and marshes on the property managed for fishing by the Department of Natural Resources. Construction was completed in 1977. Access includes two boat ramps and only electric motors are allowed. A brochure of the property is available by writing to Atterbury FWA, 7970 South Rowe Street, Edinburgh, IN 46124.

Pisgah Lake has a 14.0-in minimum size limit on largemouth bass. Prior fish management activities include a selective gizzard shad eradication in October, 2001 followed by a stocking of 12,400 largemouth bass fingerlings. Pisgah Lake is currently stocked with 992 (16/acre) channel catfish every other year.

Pisgah Lake is scheduled to be surveyed from 2005 through 2009 under a Division of Fish and Wildlife (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.

Pisgah will be surveyed from early to mid-June each year. Only largemouth bass, bluegill, and gizzard shad will be collected. The management activity being tested at Pisgah is a selective gizzard shad eradication every 2 to 3 years followed by a supplemental stocking of bass fingerlings.

The 2005 survey report recommended that a selective gizzard shad eradication be conducted in the fall of 2006 to fulfill the directives of the work plan (Kowalik and Lehman 2006). It was also recommended that, following the selective, the lake should receive a supplemental stocking of 6,200 (100/acre) largemouth bass fingerlings to enhance the predator population.

METHODS

A survey of largemouth bass, bluegill, and gizzard shad was conducted June 8 and 19, 2006. A GARMIN GPSmap 76 was used to record the location of the fish collection sites.

Fish were collected by pulsed DC electrofishing the shoreline on two nights with two dippers for 1.20 h. The lake's shoreline was divided into five 15-min electrofishing stations. The odd-numbered stations were sampled the first night and the even-numbered stations were sampled the second night. All largemouth bass collected and subsamples of bluegill and 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 of 795 gizzard shad and of 614 bluegills were created based on the proportion by number of each half-inch group of the subsample of 145 shad and 239 bluegill.

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 17.0 in TL. These bass were weighed in the field to the nearest 0.01 lb. Scale samples were taken from largemouth bass, bluegill, and gizzard shad for age and growth analysis. Proportional stock density (PSD) was calculated for largemouth bass and bluegill (Anderson and Neumann 1996). The Bluegill Fishing Potential (BGFP) index was used to assess bluegill fishing quality (Ball and Tousignant 1996).

A light dose of rotenone was applied to the lake November 6, 2006 to selectively eradicate gizzard shad. A follow-up survey was conducted on November 14, 2006 to determine the success of the selective. Sampling effort consisted of DC electrofishing along the entire shoreline south of the railroad bridge at night with two dippers for 1.33 h. Access to the small area north of the railroad bridge was blocked by a beaver dam at the bridge.

RESULTS

A total of 1,604 fish, representing 3 species, was collected during this survey. Total weight of the fish sample was approximately 570 lbs. By number, gizzard shad ranked first, followed by bluegill and then largemouth bass. By weight, gizzard shad ranked first, followed by largemouth bass and then bluegill.

A total of 795 gizzard shad was sampled that weighed 302 lbs. They ranged in length from 5.3 to 15.3 in TL, averaging 9.9 in TL (compared to 11.1 in observed in 2005) (Kowalik and Lehman 2006). Relative abundance was 50% by number and 53% by weight. The electrofishing catch rate was 662.5/h, which is an increase from 2005 (556.0/h) (Figure 1). Gizzard shad were not aged.

A total of 614 bluegill was sampled that weighed 97 lbs. They ranged in length from 1.8 to 7.9 in TL, averaging 5.8 in TL. Relative abundance was 38% by number and 17% by weight. The electrofishing catch rate was 511.7/h compared to 168.8/h in 2005 (Kowalik and Lehman 2006). Bluegill represented a balanced population as the bluegill PSD was 60, which is an increase from 36 observed in 2005. More bluegill were 6.0 in or longer (quality size) in 2006 (57%) than in 2005 (35%). The 2006 BGFP index was 21, which is in the good category. The 2005 BGFP index was in the fair category. Growth was similar to 2005 and back-calculated lengths indicated bluegill reached 6.0 in at the end of their 4th year of growth, which is average for southeastern Indiana (Figure 2).

A total of 195 largemouth bass was sampled that weighed 172 lbs. They ranged in length from 1.2 to 20.8 in TL, averaging 10.7 in TL. Relative abundance was 12% by number and 30% by weight. The electrofishing catch rate was higher this year (162.5/h) than in 2005 (92.0/h) (Kowalik and Lehman 2006). Largemouth represented a balanced population as the bass PSD was 44 compared to only 21 in 2005. Back-calculated lengths indicated largemouth bass reached 14.0 in during their 5th year of growth, which is above average for southeastern Indiana (Figure 3). As in 2005, largemouth bass growth is slightly below average for age-2 and age-3 fish, but is above average for age 4 and age 5.

The selective gizzard shad eradication on November 6 was a success. Few game fish were killed by the rotenone. Dead shad collected during the selective ranged from 4.0 to 15.4 in TL, which is similar to that observed for shad collected in the June survey.

No live gizzard shad were collected or observed during the follow-up electrofishing survey on November 14. On November 15, 6,200 largemouth bass fingerlings (average 3.60 in TL) were stocked. On November 30, an additional 2,369 bass fingerlings (average 3 in TL) and 82 larger bass (5.3 to 10.9 in TL) were stocked.

DISCUSSION

The October 2001 selective did not completely eliminate gizzard shad in Pisgah Lake. Electrofishing catch rates for shad have steadily increased since 2002 and surpassed the pre-selective catch rate of 421 shad/h by 2005 (Figure 1). In the 2006 sample, approximately half the fish by number and weight were gizzard shad which are of little use to anglers. Gizzard shad directly compete with bluegill and young bass for zooplankton, which can lead to a decline in fishing.

Despite the abundance of gizzard shad, Pisgah Lake provides good fishing opportunities for bluegill. The 2006 BGFP index increased from 2005 due to *good* density and an *excellent* PSD. The electrofishing catch rate, relative abundance by number and weight, PSD, and percentage of quality size bluegill increased from 2005. As in 2004 and 2005, no bluegill over 8.0 in was collected. This lack of large bluegill may be the result of angler harvest and/or correlated with the presence of gizzard shad.

The majority of the largemouth bass in Pisgah Lake are sublegal fish, so most bass fishing will be catch-and-release; however, bass reached the legal-size limit of 14.0 in faster than the average bass in southeastern Indiana. The bass electrofishing catch rate, bass relative abundance by number and weight, and bass PSD increased from 2005. The 14.0-in minimum size limit should remain in effect to prevent over-harvest of largemouth bass, the primary source of predation on Pisgah Lake's gizzard shad population.

As previously mentioned, a selective gizzard shad eradication and a follow-up survey were conducted in November. The selective was determined to be successful and the lake received a supplemental stocking of largemouth bass fingerlings to enhance the predator population.

RECOMMENDATIONS

- The DFW should maintain the 14.0-in minimum size limit on largemouth bass at Pisgah Lake.

- The DFW should continue to stock 992 (16/acre) channel catfish 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.

- Submersed vegetation should continue to be controlled as needed to accommodate angler access and fish management.

LITERATURE CITED

Anderson, R. O. and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-481 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Ball, R. L. and J. N. Tousignant. 1996. The development of an objective rating system to assess bluegill fishing in lakes and ponds. Research report. Indiana Department of Natural Resources. Indianapolis, Indiana. 18 pp.

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Date: June 19, 2007

Approved by: Larry L. Lehman, Fisheries Biologist

Approved by: Brian M. Schoenung, Fisheries Supervisor

Date: March 28, 2008

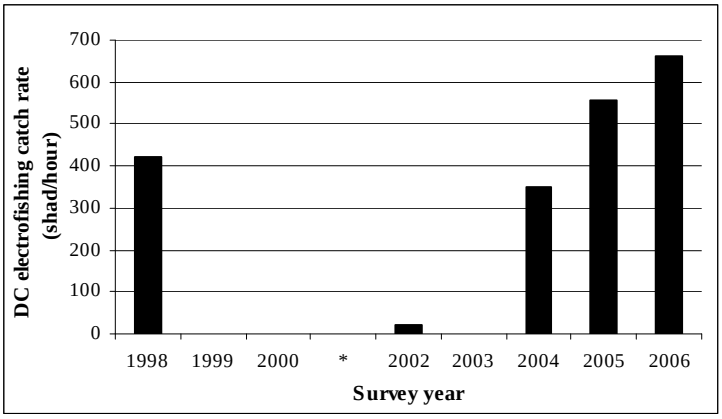

Figure 1. Electrofishing catch rates for gizzard shad in Pisgah Lake (June sampling except for 2002 which was in October). *A shad selective was conducted October 2001.

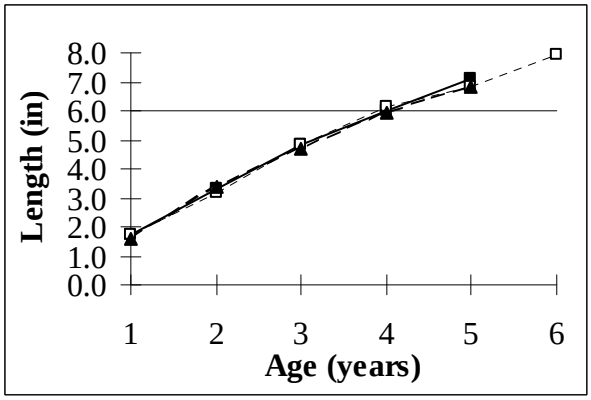

Figure 2. Pisgah Lake bluegill growth from 2006 survey (solid line) compared to 2005 survey (dashed line) and to average bluegill growth observed in Fish Management District 8 impoundments (dotted line).

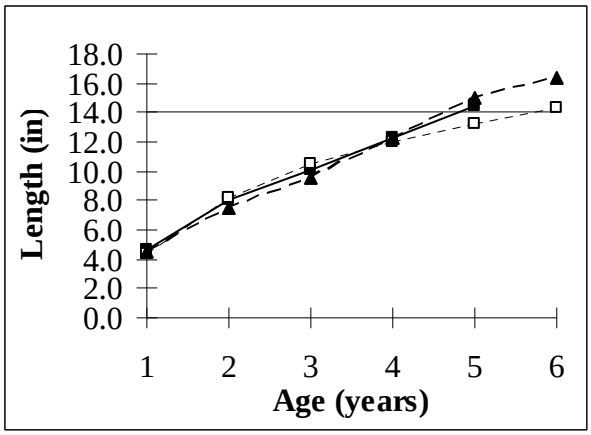

Figure 3. Pisgah Lake largemouth bass from 2006 survey (solid line) compared to 2005 survey (dashed line) and to average largemouth bass growth observed in Fish Management District 8 impoundments (dotted line).

LAKE SURVEY REPORT

Type of Survey: [ ] Initial Survey [X] Re-Survey

Lake Name	County	Date of survey (Month, day, year)
Pisgah Lake	Johnson	June 8 and 19, 2006
Biologist's name		**Date of Approval (Month, day, year)**
Larry L. Lehman		March 28, 2008

LOCATION

Quadrangle Name	Range	Section
Franklin, IND. 1961. Photorevised 1980	5E	19
Township	**Nearest Town**	
11N	Edinburgh	

ACCESSIBILITY

State owned public access site	Privately owned public access site	Other access site
Two concrete boat ramps	Not applicable	Limited shoreline access

Surface acres	Maximum depth (ft)	Average depth (ft)	Volume (acre feet)	Water level (feet MSL)	Extreme fluctuations
62	15	7	434	685	684-689 feet MSL

Location of benchmark

Approximately 0.6 mile northeast of dam where US Government railroad crosses Sugar Creek

INLETS

Name	Location	Origin
Herriott Creek	Northwest end of lake	Farmland

OUTLETS

Name: Herriott Creek (a tributary of Sugar Creek)

Location: East end of lake at principal spillway

Water level control: Principal spillway is a single-stage 5.5-foot diameter concrete drop inlet.

Emergency spillway at north end of dam is grass. Lake has an 18-inch drawdown tube.

POOL	ELEVATION (feet MSL)	ACRES
TOP OF DAM	700.25	235
AT EMERGENCY SPILLWAY	693	155
NORMAL POOL	685	62
TOP OF MINIMUM POOL		
STREAMBED		

Bottom type

- [ ] Boulder
- [X] Gravel
- [ ] Sand
- [ ] Muck
- [X] Clay
- [ ] Marl

Watershed use: Watershed covers approximately 5,360 acres. Approximately 10% of the watershed is forested. Most of the remainder (~86%) is agriculture and grass/pasture (source: http://pasture.ecn.purdue.edu). Six Atterbury impoundments also drain into Pisgah Lake.

Development of shoreline

Concrete boat ramps are located on the north shore and on the south shore where Mauxferry Road enters Pisgah Lake. Parking lots and one pit toilet are located nearby.

Previous surveys and investigations

Pre-impoundment study of Herriott Creek 1976. Fishery surveys 1979, 1982, 1990, 1998.

Gizzard shad selective and supplemental largemouth bass stocking 2001. Gizzard shad spot-check surveys 2002.

Fishery survey 2004. Gizzard shad study 2005.

SAMPLING EFFORT					
ELECTROFISHING	Day hours 0		Night hours 1.20**		Total hours 1.20
TRAP NETS	Number of traps 0		Number of Lifts 0		Total effort 0
GILL NETS	Number of nets 0		Number of Lifts 0		Total effort 0
ROTENONE	Gallons 0	ppm	Acre Feet Treated	SHORELINE SEINING	Number of 100 Foot Seine Hauls none

PHYSICAL AND CHEMICAL CHARACTERISTICS			
Color		Turbidity Feet	Inches (SECCHI DISK)
Alkalinity (ppm)* Surface:	Bottom:	pH Surface:	Bottom:
Conductivity: 6/8/06 330 micromhos/cm		Air temperature:	°F
Conductivity: 6/19/06 335 micromhos/cm			
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
**Electrofisher settings (6/8/06): 707 volts DC, output mode = 60 pps, and pulse width = 2.75 ms (5 amps)
**Electrofisher settings (6/19/06): 530 volts DC, output mode = 60 pps, and pulse width = 2.75 ms (4 to 5 amps)
***Surface water temperatures: 75.2 °F on 6/8/06 and 78.8 °F on 6/19/06

*ppm-parts per million

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Gizzard shad	795	49.6	5.3-15.3	301.55	52.9
Bluegill	614	38.3	1.8-7.9	96.87	17.0
Largemouth bass	195	12.2	1.2-20.8	172.02	30.2
Totals (3 species)	1,604	100.0		570.44	100.0

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

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Gizzard shad Pisgah Lake 6/8/06 and 6/19/06									
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	5	0.6	0.05	Not aged	23.5				
6.0					24.0				
6.5	6	0.8	0.09		24.5				
7.0	38	4.8	0.12		25.0				
7.5	126	15.8	0.14		25.5				
8.0	93	11.7	0.17		26.0				
8.5	71	8.9	0.20		TOTAL	795			
9.0	11	1.4	0.25						
9.5	17	2.1	0.28						
10.0	82	10.3	0.34						
10.5	39	4.9	0.40						
11.0	39	4.9	0.46						
11.5	82	10.3	0.51						
12.0	71	8.9	0.60						
12.5	55	6.9	0.67						
13.0	11	1.4	0.79						
13.5	22	2.8	0.87						
14.0	6	0.8	0.94						
14.5	11	1.4	1.08						
15.0	5	0.6	1.19						
15.5	5	0.6	1.41						
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	662.5/hr	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Bluegill Pisgah Lake 6/8/06 and 6/19/06									
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	18	2.9	<0.01	1	20.0				
2.5	8	1.3	0.01	1	20.5				
3.0	10	1.6	0.02	1, 2	21.0				
3.5	28	4.6	0.03	1, 2	21.5				
4.0	57	9.3	0.04	2	22.0				
4.5	31	5.0	0.06	2, 3	22.5				
5.0	41	6.7	0.08	2, 3, 4	23.0				
5.5	49	8.0	0.11	3, 4	23.5				
6.0	62	10.1	0.15	4	24.0				
6.5	92	15.0	0.19	4, 5	24.5				
7.0	162	26.4	0.24	4, 5	25.0				
7.5	51	8.3	0.30	5	25.5				
8.0	5	0.8	0.38	5	26.0				
8.5					TOTAL	614			
9.0									
9.5					Subsample: PSD = 136/228(100) = 59.6				
10.0									
10.5					Subsample: %≥ 6.0 inches = 136/239(100) = 56.9				
11.0									
11.5					Bluegill Fishing Potential Index = 21 (good)				
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	511.7/hr	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Largemouth bass Pisgah Lake 6/8/06 and 6/19/06									
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	1	0.5	<0.01	0	19.0	3	1.5	3.96	—
1.5					19.5	3	1.5	4.13	—
2.0					20.0	1	0.5	4.31	—
2.5					20.5	2	1.0	4.88	—
3.0					21.0	1	0.5	4.81	—
3.5					21.5				
4.0	2	1.0	0.03	1	22.0				
4.5	4	2.1	0.04	1	22.5				
5.0	9	4.6	0.05	1	23.0				
5.5	9	4.6	0.07	1	23.5				
6.0	10	5.1	0.10	1	24.0				
6.5	12	6.2	0.12	1	24.5				
7.0	4	2.1	0.16	1, 2	25.0				
7.5					25.5				
8.0					26.0				
8.5					TOTAL	195			
9.0	2	1.0	0.34	2					
9.5	8	4.1	0.41	2		PSD = 64/144(100) = 44.4			
10.0	11	5.6	0.48	2					
10.5	13	6.7	0.57	2, 3		%≥ 14 inches = 24/195(100) = 12.8			
11.0	10	5.1	0.64	3					
11.5	21	10.8	0.74	3, 4					
12.0	32	16.4	0.84	3, 4					
12.5	14	7.2	0.97	4					
13.0	5	2.6	1.09	4					
13.5	2	1.0	1.24	4					
14.0	2	1.0	1.39	4					
14.5	4	2.1	1.59	4, 5					
15.0	1	0.5	1.72	5					
15.5	3	1.5	1.93	5					
16.0									
16.5									
17.0									
17.5	2	1.0	2.79	—					
18.0	3	1.5	3.94	—					
18.5	1	0.5	3.50	—					

ELECTROFISHING CATCH	162.5/hr	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

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"	2005	12	1.8-3.4	1.8							
	2004	15	3.2-5.0	1.5	3.3						
	2003	12	4.4-5.7	1.5	3.1	4.7					
	2002	15	5.1-7.0	1.9	3.5	4.9	5.8				
	2001	11	6.7-7.8	1.7	3.4	5.0	6.2	7.1			
	AVERAGE LENGTH			1.7	3.3	4.8	6.0	7.1			
	NUMBER AGED			65	53	38	26	11			

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"	2005	31	3.9-7.1	5.2							
	2004	16	6.8-10.7	5.4	9.0						
	2003	12	10.4-12.1	4.6	7.8	10.2					
	2002	20	11.6-14.6	4.2	7.4	9.7	12.0				
	2001	5	14.5-15.5	3.9	8.3	10.5	12.6	14.4			
	AVERAGE LENGTH			4.7	8.1	10.1	12.3	14.4			
	NUMBER AGED			84	53	37	25	5			

*Not included in average length calculations.

GPS LOCATION OF SAMPLING EQUIPMENT Pisgah Lake June 8 and 19, 2006								
GILL NETS			TRAP NETS			ELECTROFISHING		
1	N	W	1	N	W	1	N 39.38588	W -86.02063
	N	W	2	N	W		N 39.38536	W -86.01690
2	N	W	3	N	W	2	N 39.38597	W -86.01674
	N	W	4	N	W		N 39.38751	W -86.02057
3	N	W	5	N	W	3	N 39.38725	W -86.02114
	N	W	6	N	W		N 39.38928	W -86.02522
4	N	W	7	N	W	4	N 39.38919	W -86.02537
	N	W	8	N	W		N 39.38667	W -86.02474
5	N	W	9	N	W	5	N 39.38698	W -86.02459
	N	W	10	N	W		N 39.38537	W -86.02117
6	N	W	11	N	W	6	N	W
	N	W	12	N	W		N	W
7	N	W	13	N	W	7	N	W
	N	W	14	N	W		N	W
8	N	W	15	N	W	8	N	W
	N	W	16	N	W		N	W
9	N	W	17	N	W	9	N	W
	N	W	18	N	W		N	W
10	N	W	19	N	W	10	N	W
	N	W	20	N	W		N	W
11	N	W				11	N	W
	N	W					N	W
12	N	W				12	N	W
	N	W					N	W
13	N	W				13	N	W
	N	W					N	W
14	N	W				14	N	W
	N	W					N	W
15	N	W				15	N	W
	N	W					N	W
16	N	W				16	N	W
	N	W					N	W
17	N	W				17	N	W
	N	W					N	W
18	N	W				18	N	W
	N	W					N	W
19	N	W				19	N	W
	N	W					N	W
20	N	W				20	N	W
	N	W					N	W