PISGAH LAKE

Johnson County

2007 Fish Management Report

Clinton R. Kowalik
Assistant Fisheries Biologist

Larry L. Lehman
Fisheries Biologist

Fisheries Section
Indiana Department of Natural Resources
Division of Fish and Wildlife
I.G.C.-South, Room W273
402 W. Washington Street
Indianapolis, IN 46204

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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; 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 6 and 18, 2007, 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.

- This survey follows a selective gizzard shad eradication conducted on November 6, 2006 to reduce the number of gizzard shad and to fulfill the directives of the work plan. No live gizzard shad were collected or observed during a follow-up survey on November 14, 2006.

- A total of 285 fish, representing 3 species, was collected during this survey. Total weight of the fish sample was approximately 132 lbs. By number and by weight, largemouth bass ranked first, followed by bluegill and then gizzard shad.

- Largemouth bass ranged from 1.3 to 21.5 in TL, averaging 8.9 in TL. Relative abundance by number increased greatly from 2006. The bass proportional stock density (PSD) of 44 is near the lower end of the desired range (40 to 70) for a balanced bass fishery. In the subsample, 8% of bass were legal size (14.0 in or longer), a decrease from 13% in 2006. Growth was slower than 2006, but back-calculated lengths indicate largemouth most likely reached 14.0 in during their 6th year of growth, which is average for southeastern Indiana.

- Bluegill ranged from 1.8 to 7.7 in TL, averaging 5.1 in TL. The electrofishing catch rate decreased greatly from 2006. Due to an insufficient sample size, it was not determined if bluegill represented a balanced population. In the subsample, 40% of the bluegill were 6.0 in or longer (i.e. quality size), a decrease from 57% in 2006. Growth was similar to 2006; back-calculated lengths indicate bluegill reached 6.0 in at the end of their 4th year of growth, which is average for southeastern Indiana.

- Only 15 shad (12.0/h) were collected; the relative abundance of shad by number and by weight decreased greatly from 2006 when it was approximately 50%. One YOY was collected in this survey, however, indicating shad reproduction in 2007.

- The DFW should maintain a 14.0-in minimum size limit on largemouth bass, continue to stock 992 (16/acre) channel catfish every 2 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; 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. In October 2001, a selective gizzard shad eradication was conducted, followed by a stocking of 12,400 largemouth bass fingerlings. Pisgah Lake is currently stocked with 992 (16/acre) channel catfish every odd 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.

This survey follows a gizzard shad selective conducted on November 6, 2006. Few game fish were seen dead after the selective and no live gizzard shad were collected or observed during a follow-up survey on November 14, 2006. To enhance the predator population, the lake received a supplemental stocking of 6,200 (100/acre) largemouth bass fingerlings. An additional 2,369 bass fingerlings and 82 larger bass (5.3 to 10.9 in TL) were later stocked.

METHODS

A survey of largemouth bass, bluegill, and gizzard shad was conducted June 6 and 18, 2007. Fish were collected by pulsed DC electrofishing the shoreline on two nights with two dippers for 1.25 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. A GARMIN GPSmap 76 was used to record the location of the fish collection sites.

All gizzard shad, a subsample of 154 largemouth bass, and a subsample of 48 bluegill were measured to the nearest 0.1 in TL. The remaining largemouth bass were counted but not measured. The bluegill collected at the first station were counted but not measured, since many more bluegill were anticipated to be collected. The length-frequency distributions of 196 largemouth and 74 bluegill were created based on the proportion by number of each half-inch group of the largemouth and bluegill subsamples.

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).

RESULTS

A total of 285 fish, representing 3 species, was collected during this survey. Total weight of the fish sample was approximately 132 lbs. By number and by weight, largemouth bass ranked first, followed by bluegill and then gizzard shad.

A total of 196 largemouth bass was sampled that weighed 115 lbs. They ranged from 1.3 to 21.5 in TL, averaging 8.9 in TL. Relative abundance was 69% by number and 87% by weight. The electrofishing catch rate was 156.8/h compared to 162.5/h in 2006 (Kowalik and Lehman 2008) (Figure 1). In the subsample, 8% of the largemouth were 14.0 in or longer (i.e. legal size), a decrease from 13% in 2006.

Largemouth represented a balanced population; the bass PSD was 44, which was identical to 2006. 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 2).

A total of 74 bluegill was sampled that weighed 9 lbs. They ranged from 1.8 to 7.7 in TL, averaging 5.1 in TL. Relative abundance was 26% by number and 7% by weight. The electrofishing catch rate was 59.2/h, decreasing from 511.7/h in 2006 (Kowalik and Lehman 2008) (Figure 1). Bluegill PSD was not determined due to an insufficient sample size (Anderson and Neumann 1996). In 2005, the bluegill PSD was 60. In the subsample, 40% of the bluegill were 6.0 in or longer (i.e. quality size), a decrease from 57% in 2006. Growth was similar to 2006; 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 3).

A total of 15 gizzard shad, including one YOY, was sampled that weighed 9 lbs. Excluding YOY shad, shad ranged from 11.0 to 13.4 in TL, averaging 12.1 in TL. Relative abundance was 5% by number and 7% by weight. The electrofishing catch rate was 12.0/h, decreasing from 662.5/h in 2006 (Kowalik and Lehman 2008) (Figures 1 and 4). Gizzard shad were not aged.

DISCUSSION

In spite of the attempt to selectively exterminate gizzard shad in 2001 at Pisgah Lake, shad were very abundant in the 2004 survey and ranked first by number in the 2005 and 2006 surveys. Post-selective electrofishing catch rates for shad were greater in 2004, 2005, and 2006 than the catch rate observed in 1998 before the selective. As previously mentioned, a selective gizzard shad eradication was conducted in November 2006. This selective was determined to be successful, as no shad were collected in the follow-up survey 8 d later. In 2007, only 15 shad (12.0/h) were collected; the relative abundance of shad by number and by weight greatly declined from 2006 when it was approximately 50%. One YOY was collected in this survey, however, indicating shad reproduction in 2007.

As previously mentioned, the lake received a supplemental stocking of largemouth bass fingerlings to enhance the predator population after the selective; however, more bass were stocked than the recommended 6,200 (100/acre). Although the largemouth electrofishing catch rate was similar to 2006, the relative abundance by number and by weight greatly increased. The

bass PSD did not change from 2006, but fewer legal bass were collected in this survey. Growth at all ages was slower than in 2006 and the district average. The 14.0-in minimum size limit should remain in effect since largemouth bass are the primary source of predation on Pisgah Lake's gizzard shad population.

The 2006 survey report stated that Pisgah Lake provides good fishing opportunities for bluegill despite the abundance of gizzard shad. The abundance and density of submersed vegetation made sampling conditions difficult and may have played a role in the decline of the bluegill catch rate. In 2007, the relative abundance by number and weight as well as the percentage of quality-size bluegill decreased from 2006 whereas they each increased in 2006 from the previous survey in 2005. The bluegill PSD in 2006 was near the upper limit (60) for a balanced fishery. As in the past three surveys, no bluegill over 8.0 in were collected. This lack of large bluegill may be the result of angler harvest and/or correlated with the presence of gizzard shad.

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 2 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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Submitted by: Clinton R. Kowalik, Assistant Fisheries Biologist
Date: March 27, 2008

Approved by: Larry L. Lehman, Fisheries Biologist

Approved by: Brian M. Schoenung, Fisheries Supervisor

Date: August 11, 2008

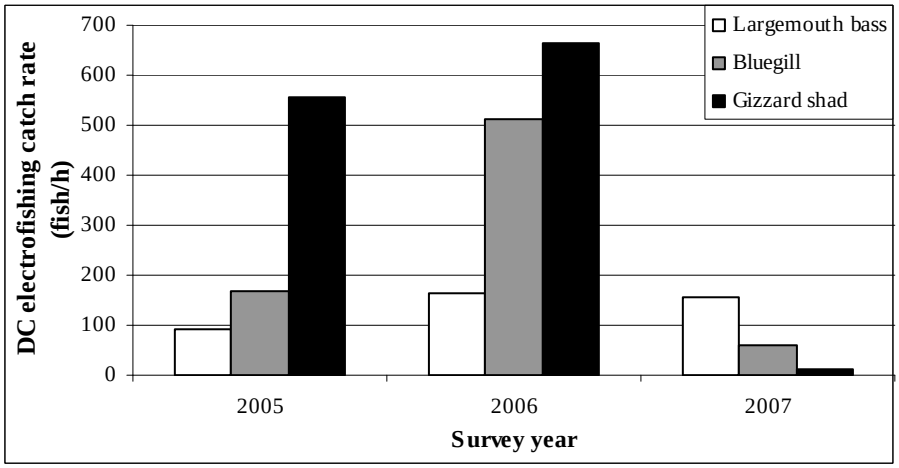

Figure 1. DC electrofishing catch rates for largemouth bass, bluegill, and gizzard shad in Pisgah Lake in June 2005, 2006, and 2007.

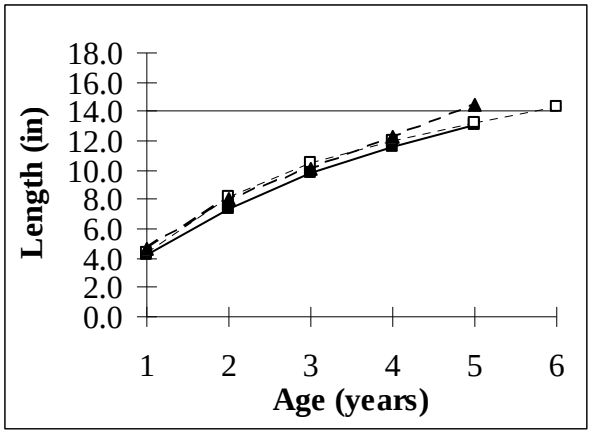

Figure 2. Pisgah Lake largemouth bass from 2007 survey (solid line) compared to 2006 survey (dashed line) and to average largemouth bass growth observed in Fish Management District 8 impoundments (dotted line).

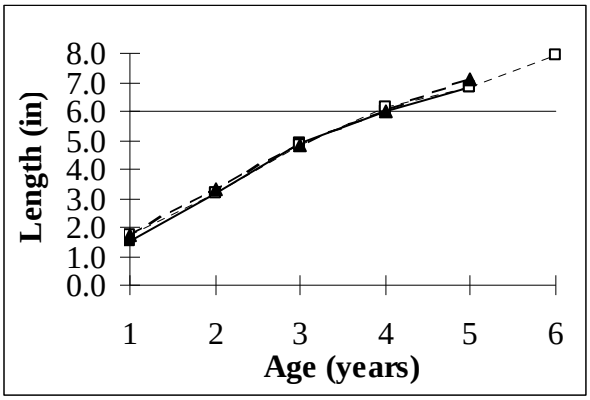

Figure 3. Pisgah Lake bluegill growth from 2007 survey (solid line) compared to 2006 survey (dashed line) and to average bluegill growth observed in Fish Management District 8 impoundments (dotted line).

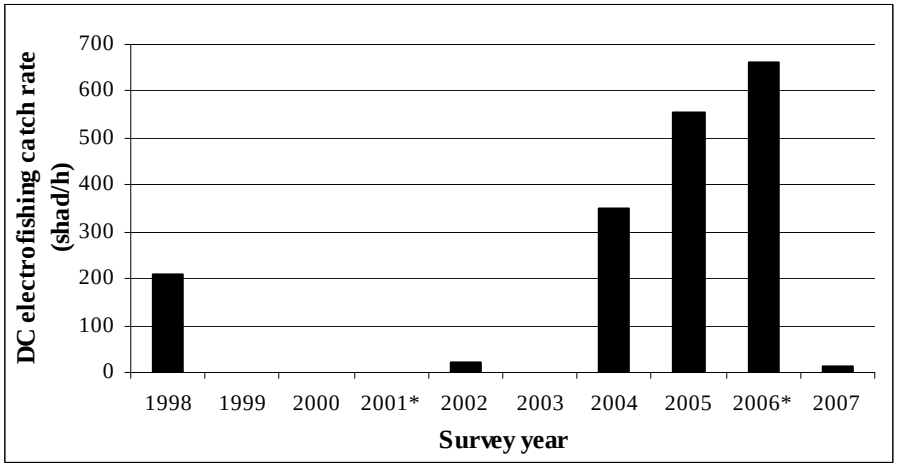

Figure 4. June DC electrofishing catch rates for gizzard shad in Pisgah Lake except for 2002, which was in October. *A shad selective was conducted in October 2001 and in November 2006.

LAKE SURVEY REPORT

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

Lake Name	County	Date of survey (Month, day, year)
Pisgah Lake	Johnson	June 6 and 18, 2007
Biologist's name		**Date of Approval (Month, day, year)**
Larry L. Lehman		March 27, 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-ft 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, 2006. Gizzard shad selective 2006.

Supplemental largemouth bass stocking 2006.

SAMPLING EFFORT

ELECTROFISHING	Day hours: 0		Night hours: 1.25**		Total hours: 1.25**
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: Conductivity:	Air temperature: °F
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 (6/6/07): 707 volts DC, output mode = 60 pps, and pulse width = 3.75 ms (5 amps)

**Electrofisher settings (6/18/07): volts DC varied, output mode = 60 pps, and pulse width = ~5 ms (3-5 amps)

***Surface water temperature: 78°F on 6/6/07

*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
Largemouth bass	196	68.8	1.3-21.5	114.54	86.9
Bluegill	74	26.0	1.8-7.7	8.77	6.7
Gizzard shad	15	5.3	1.3-13.4	8.56	6.5
Totals (3 species)	285	100.0		131.87	100.0

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

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Largemouth bass Pisgah Lake 6/6/07 and 6/18/07									
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	16	8.2	<0.01	0	19.5	1	0.5	4.00	—
2.0	3	1.5	<0.01	0	20.0				
2.5					20.5				
3.0					21.0	1	0.5	5.50	—
3.5					21.5	1	0.5	6.19	—
4.0					22.0				
4.5	3	1.5	0.04	1	22.5				
5.0	24	12.2	0.05	1	23.0				
5.5	16	8.2	0.07	1	23.5				
6.0	1	0.5	0.10	1	24.0				
6.5					24.5				
7.0					25.0				
7.5	1	0.5	0.19	2	25.5				
8.0	15	7.7	0.24	2	26.0				
8.5	22	11.2	0.28	2	TOTAL	196			
9.0	18	9.2	0.34	2					
9.5	1	0.5	0.41	1*	Subsample: PSD = 44/99(100) = 44.4				
10.0	4	2.0	0.48	1*, 2					
10.5	2	1.0	0.57	2	Subsample: %≥ 14.0 inches = 13/154(100) = 8.4				
11.0	4	2.0	0.64	3					
11.5	8	4.1	0.74	2, 3	*3 age-1 cannibals were stocked in 2006;				
12.0	8	4.1	0.84	4	these 3 fish were excluded from the calculations				
12.5	10	5.1	0.97	3, 4, 5	for back calculated length at each age				
13.0	14	7.1	1.09	4, 5					
13.5	9	4.6	1.24	4, 5, 6					
14.0	3	1.5	1.39	4, 5					
14.5	5	2.6	1.59	4, 5					
15.0	3	1.5	1.72	5					
15.5									
16.0									
16.5	1	0.5	2.29	—					
17.0	1	0.5	2.75	—					
17.5	1	0.5	3.13	—					
18.0									
18.5									

ELECTROFISHING CATCH	156.8/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Bluegill Pisgah Lake 6/6/07 and 6/18/07									
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	6	8.1	<0.01	1	20.0				
2.5	5	6.8	0.01	1	20.5				
3.0	3	4.1	0.02	1, 2	21.0				
3.5	3	4.1	0.03	2	21.5				
4.0	6	8.1	0.04	2	22.0				
4.5	6	8.1	0.06	2	22.5				
5.0	3	4.1	0.08	2	23.0				
5.5	13	17.6	0.11	2, 3	23.5				
6.0	8	10.8	0.15	3, 4	24.0				
6.5	6	8.1	0.19	3, 4	24.5				
7.0	9	12.2	0.24	4, 5, 6	25.0				
7.5	6	8.1	0.30	4, 5	25.5				
8.0					26.0				
8.5					TOTAL	74			
9.0									
9.5					Subsample: PSD = 19/40(100) = 47.5*				
10.0									
10.5					Subsample: %≥ 6.0 inches = 19/48(100) = 39.6				
11.0									
11.5					Bluegill Fishing Potential Index = 11 (marginal)*				
12.0									
12.5					*The bluegill PSD is unreliable due to an insufficient				
13.0					sample size, and thus, the BGFP index is estimated.				
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	59.2/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Gizzard shad Pisgah Lake 6/6/07 and 6/18/07									
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	6.7	<0.01	0	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					26.0				
8.5					TOTAL	15			
9.0									
9.5									
10.0									
10.5									
11.0	2	13.3	0.46	Not aged					
11.5	2	13.3	0.51						
12.0	4	26.7	0.60						
12.5	5	33.3	0.67						
13.0									
13.5	1	6.7	0.87						
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	12.0/h	GILL NET CATCH	N/A	TRAP NET CATCH	N/A

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	18	4.6-6.1	3.4							
	2005	20	7.6-11.3	5.1	8.0						
	2004	8	10.8-12.3	4.1	7.1	10.4					
	2003	13	11.6-14.3	4.2	7.5	10.1	11.8				
	2002	11	12.4-15.0	4.0	7.1	9.1	11.5	13.1			
	2001	**1***	13.3	3.6	6.7	8.7	10.2	12.0	12.7		
	AVERAGE LENGTH			4.2	7.4	9.8	11.6	13.1			
	NUMBER AGED			70	52	32	24	11			

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	8	1.8-2.9	1.4							
	2005	14	3.0-5.5	1.4	3.0						
	2004	11	5.3-6.6	1.4	3.1	4.8					
	2003	7	6.1-7.6	1.6	3.1	4.7	5.9				
	2002	5	7.1-7.7	1.7	3.5	5.4	6.1	6.8			
	2001	**1***	7.1	1.5	2.8	4.1	5.1	5.9	6.6		
	AVERAGE LENGTH			1.5	3.2	4.9	6.0	6.8			
	NUMBER AGED			45	37	23	12	5			

***Not included in average length calculations.**

GPS LOCATION OF SAMPLING EQUIPMENT Pisgah Lake June 6 and 18, 2007								
GILL NETS			TRAP NETS			**ELECTROFISHING**		
1	N	W	1	N	W	1	N 39.38588	W -86.02065
	N	W	2	N	W		N 39.38631	W -86.01661
2	N	W	3	N	W			
	N	W	4	N	W			
3	N	W	5	N	W	2	N 39.38657	W -86.01670
	N	W	6	N	W		N 39.38736	W -86.02109
4	N	W	7	N	W			
	N	W	8	N	W			
5	N	W	9	N	W	3	N 39.38738	W -86.02121
	N	W	10	N	W		N 39.38928	W -86.02524
6	N	W	11	N	W			
	N	W	12	N	W			
7	N	W	13	N	W	4	N 39.38930	W -86.02523
	N	W	14	N	W		N 39.38712	W -86.02466
8	N	W	15	N	W			
	N	W	16	N	W			
9	N	W	17	N	W	5	N 39.38720	W -86.02479
	N	W	18	N	W		N 39.38578	W -86.02095
10	N	W	19	N	W		N	W
	N	W	20	N	W		N	W
11	N	W					N	W
	N	W					N	W
12	N	W					N	W
	N	W					N	W
13	N	W					N	W
	N	W					N	W
14	N	W					N	W
	N	W					N	W
15	N	W					N	W
	N	W					N	W
16	N	W					N	W
	N	W					N	W
17	N	W					N	W
	N	W					N	W
18	N	W					N	W
	N	W					N	W
19	N	W					N	W
	N	W					N	W
20	N	W					N	W
	N	W					N	W