LITTLE BEAR CREEK RESERVOIR

MANAGEMENT REPORT

2005

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February 21, 2006

Introduction

Little Bear Creek Reservoir (LBCR), a 1,560 acre Tennessee Valley Authority impoundment, is one of four TVA reservoirs in North West Alabama managed by the Bear Creek Development Authority, an agency of the state of Alabama. It is characterized by infertile water with low chlorophyll-a values (Table 1). This nutrient deficient water often suppresses growth and abundance of sport fishes.

Little Bear Creek anglers (Little Bear Millennium Group) have been concerned about the decline in bass catch rates and the loss of aquatic habitat in LBCR. Flooded terrestrial vegetation originally provided favorable nursery habitat for black basses and sunfishes. Over time these habitats have declined. Efforts to restore native aquatic plants in LBCR have been initiated through the Habitat Enhancement and Restoration Team (HEART) – a new program to benefit aquatic organisms in flowing streams and lakes by forming partnerships with bass clubs, environmental interest groups, school clubs, hydropower companies and others interested in improving aquatic habitat.

The reservoir management objective for LBCR is to collect baseline biological data on the important sport and forage species. From these data; age and growth, relative abundance, and relative weights will be obtained. This information will be analyzed and used to make management recommendations to correct current or future problems concerning the fisheries.

LBCR was previously sampled in 2000 (Greene et al. 2000). Greene recommended the implementation of a 13-16 inch slot limit on largemouth bass, which was implemented on October 1, 2001.

Methods

LBCR was sampled in the fall of 2004 and spring of 2005 using the guidelines of the Alabama Reservoir Management Program Manual.

The Bass Anglers Information Team (BAIT) program provides tournament catch information on all participating reservoirs and these data are often used to compliment reservoir management reports. In 2004, only one BAIT report was received for LBCR; therefore, no BAIT data will be represented in this report.

The organization of this report is such that all tables and figures may not be referenced in the text of the discussion. Appendix A includes all the tables and figures.

Results and Discussion

The 2005 sample of largemouth bass consisted of 117 fish. The catch per unit (CPUE) effort of 64.2 fish per hour for largemouth bass was higher than the 2000 rate of 58.0 fish per hour (Table 4). Catch rates for stock and quality size categories fell below the statewide mean, while the catch rates for preferred and memorable categories exceeded the Alabama mean. The CPUE for stock to memorable largemouth bass increased from 45.2 fish per hour in 2000 to 58.2 fish per hour in 2005. This value is near the 75% value of 61.1 reported for Alabama reservoirs. The CPUE for preferred to memorable size bass increased from 9.0 to 23.0 from 2000 to 2005 and exceeds the statewide 75% value of 15.7 fish per hour. Memorable sized fish remained unchanged with a value of 4.0%, equal to the statewide mean.

The proportional stock density (PSD) value was 45 (Table 4). This value falls below the recommended range of 47-68 suggested by Alabama reservoir data and below the range of 50-70 suggested by Anderson and Weithman (1978) for reservoirs where shad are the dominant forage species. This suggests an absence of fish >12 inches, but upon further analysis of these data, it more accurately reflects a poor representation of 12-15 inch fish, while fish >15 inches are represented at statewide averages.

Fifty-five percent of the bass sampled were in the stock size category. This exceeds the statewide 75% value of 53.2%. Relative stock density (RSD) values for

preferred and memorable size groups were equal to the statewide mean, with values of 19 and 4 respectively (Figure 3). This represents an RSD-P increase from 5.0 in 2000 to 19 in 2005. The value for RSD-Q was 23, down from 38 in 2000, and below the 25th percentile for Alabama reservoir data (Table 2). This decline in the RSD-Q category is unexpected, since most of the fish in the quality sized category are protected by the 13-16 inch slot limit, an increase in the RSD-Q value would have been expected. This decrease may be a result of the poor 2002 year class (mean length of 328 mm), which could be affecting the recruitment of bass into the RSD-Q category and the protected slot limit (Table 3). The substock ratio of 10 was just below the statewide 25th percentile value of 10.9, while the RSD-S value of 55 was above the 75th percentile of Alabama reservoirs.

Relative weight values for all RSD size categories were below the 25th percentile mark of statewide reservoir data except for RSD-M, which was equal to the statewide 25th percentile value of 92.

The time it took for largemouth bass to reach lengths of 12, 13, 16 and 20 inches was 2.93, 3.38, 4.94 and 7.67 years respectively. In 2000 it took bass 2.55, 3.06, 5.91 years to reach lengths of 12, 13 and 16 inches (Table 5.). No 20 inch bass were sampled in 2000. Fish 13 inches and under are growing slower, while fish 16 inches and greater are growing faster than they were in 2000, suggesting that the 13-16 inch slot limit may be helping by increasing the percentage of fish in the RSD P-M categories and their growth rates. Fewer but faster growing sub-slot fish (<13 inches) would also indicate that the slot limit is working properly, but this has not been seen, suggesting that bass anglers are reluctant to harvest bass under the slot limit. Faster growing and larger bass could be expected if bass anglers would harvest bass under the slot, rather than practicing catch-and-release of these fish.

Age 1 and age 3 bass were poorly represented in the 2005 sample indicating poor 2004 and 2002 year classes. This could affect the recruitment of largemouth bass

into the fishery for the next 7 years, at current growth and mortality rates. Age 2 bass were well represented in the sample and ideally will negate the effect that the poor year classes may have on the bass fishery (Table 3).

The total annual mortality estimate for largemouth bass, ages 4-8, was 39.0%, with adjusted r^2 of 0.98 (Figure 4). This is much lower than the 54.7% reported on LBCR in 2000 (Greene et al. 2000).

The spotted bass sample consisted of only 39 fish, 29 of which were stock size and larger. These fish fell into the stock and quality size groups, with 59% and 41% respectively (Table 2). Values for RSD-S were above the Alabama mean, while the RSD-Q value exceeded the state-wide 75th percentile (Figure 6). CPUE for all spotted bass was 21.4 fish per hour, one-third the CPUE of largemouth bass, and fell slightly below the state-wide mean for RSD-S and RSD-Q categories. Relative weights for RSD-S were near the 25th percentile, while RSD-Q fell below the 25th percentile of statewide reservoir data.

Bluegill sunfish (N=110) were collected at the rate of 129.4 fish per hour during the spring of 2005. All fish, except for one sub-stock, fell into the stock and quality size categories with 71% and 29% respectively (Table 2). No preferred or memorable sized fish were captured. In the 2000 sample, only 1 RSD-P fish was captured (Greene et al. 2000). The PSD value of 29 exceeds the statewide 75th percentile for Alabama reservoirs. The catch rate for stock size bluegill was near the 75th percentile of Alabama reservoirs, while the catch rate for RSD-Q sized bluegill exceeded the 75th percentile. Relative rate values were down from the 2000 sample but still fell within the 25th and 75th percentile range.

Threadfin shad and gizzard shad, both important forage species for black bass, were also targeted in the 2005 electrofishing sample. Eighty-one threadfin and 10 gizzard shad were captured. In 2000, 40 threadfin shad and 85 gizzard shad were sampled. Threadfin shad were collected at the rate of 40.5 fish per hour, while gizzard

shad were collected at the rate of 5.0 fish per hour (Table 2). This CPUE for threadfin shad is similar to the CPUE of 35.7 on Upper Bear Creek Reservoir in 2001 (Greene et al. 2001). All threadfin shad fell within the stock and quality sized categories, which allows them to be utilized as forage by age 1 and older black bass. The gizzard shad relative weights were low and indicate slow growth.

During the fall of 2004, white crappie (N=21) were collected from LBCR with trap nets. No black crappie were collected. Crappie were caught at a rate of 0.7 fish per net-night (Table 2). This is similar to the 1998 and 1999 catch rates when 1.8 and 0.8 crappie per net-night were caught respectively (Greene et al. 2000). These values are much lower than those of similar water bodies: Bear Creek Reservoir had a CPUE of 9.3 fish per net-night (Darr et al. 1995), Cedar Creek Reservoir had a CPUE of 4.7 fish per net-night (Floyd et al. 1999), and Bear Creek Reservoir had a CPUE of 18.4 fish per net-night (Ekema et al. 2004). The fall 2004 sample consisted only of young-of-year and age 1+ fish. Mean length-at-age data revealed that LBCR crappie averaged a length of 229.2 mm (9.2 inches) during their second growing season (Tables 6 and 7). This is much faster growth than in Bear Creek Reservoir where crappie averaged 220.7 mm (8.67 inches) in length in their third growing season (Ekema et al. 2004), and Cedar Creek Reservoir where crappie only averaged 205.7 mm (8.1 inches) in length during their second season (Floyd et al. 1999).

Recommendations

The largemouth bass population in LBCR appears to be somewhat instable with poor representation of the 2002 and 2004 year classes. Relative weights for all RSD groups were equal to or below the 25th percentile for Alabama reservoirs, Catch rates for RSD P-M categories exceed the 75th percentile for Alabama reservoirs. A decrease in the RSD-Q category and an increase in the RSD-P category have taken place since the 13-16 inch slot limit was implemented in October 2001. Whether the 13-16 inch slot

limit is responsible for this change in the bass population structure is difficult to ascertain. Participation in the BAIT program remains poor, so an increased effort will be made to encourage bass clubs to submit their tournament results so their catch data can compliment future reports. The affects of the 13-16 inch slot limit should continue to be monitored. No changes in the black bass management strategy are recommended at this time.

Crappie densities remain low, resulting in fast growth rates due to reduced competition within the species. The statewide 9 inch minimum length limit needs to remain in effect on LBCR in order to protect the low numbers of adult crappie. Therefore, no changes in the current management strategy for crappie in LBCR are recommended.

Literature Cited

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APPENDIX A

Tables and Figures

TABLE 1. MORPHOMETRIC, PHYSICAL AND CHEMICAL CHARACTERISTICS OF LITTLE BEAR CREEK RESERVOIR.

Surface area	1560	acres
Drainage area	91	sq. mi.
Full pool elevation	620	feet-msl
Mean annual fluctuation	17	feet
Shoreline distance	45	miles
Mean depth	16	feet
Maximum depth	84	feet
Outlet depth	variable	
Thermocline depth	18	feet
Date of Impoundment	1976	
Chlorophyll a (dam forebay)	7.1	ug/l (2004 mean)
% Florida bass alleles	no data	

TABLE 2. RELATIVE STOCK DENSITY (RSD), CATCH PER HOUR (CPH), RELATIVE WEIGHT (Wr), AND PROPORTIONAL STOCK DENSITY (PSD) OF TARGET SPECIES AT LITTLE BEAR CREEK RESERVOIR.

LARGEMOUTH BASS

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
2000	Electro.	5	32	12.8	28.0	60	24.0	53.0	75	43	17.2	38.0	76	6	2.4	5.0	81	4	1.6	4.0	89	145	58.0	47
2003	TVA	12	55	9.2	37.0	71	11.8	48.0	85	44	7.3	30.0	80	29	4.8	20.0	83	3	0.5	2.0	96	202	33.6	52
2004	TVA	12	72	12.0	31.0	90	15.0	38.0	84	100	16.7	42.0	82	43	7.2	18.0	81	3	0.5	1.0	91	308	51.4	62
2005	Electro.	4	11	6.0	10.0	58	31.8	55.0	79	24	13.2	23.0	81	20	11.0	19.0	84	4	2.2	4.0	92	117	64.2	45
LAKE AVERAGE				10.0	26.5		20.7	48.5	80.8		13.6	33.3	79.8		6.4	15.5	82.3		1.2	2.8	92.0		51.8	51.4

SPOTTED BASS

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
2003	TVA	12	44	7.3	83.0	46	7.7	87.0	86	6	1.0	11.0	87	1	0.2	2.0	104	--	--	--	--	97	16.2	13
2004	TVA	12	10	1.7	21.0	28	4.7	58.0	91	17	2.8	35.0	95	3	0.5	6.0	91	--	--	--	--	58	9.7	42
2005	Electro.	4	10	5.5	34.0	17	9.3	59.0	90	12	6.6	41.0	86	--	--	--	--	--	--	--	--	39	21.4	41
LAKE AVERAGE				4.8	46.0		7.2	68.0	89.0		3.5	29.0	89.3		0.2	2.7	65.0		0.0	0.0	0.0		15.8	32.1

BLUEGILL

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
2000	Electro.	4	--	--	--	99	49.5	77.0	91	29	14.5	22.0	90	1	0.5	1.0	99	--	--	--	--	129	64.5	23
2005	Electro.	3	1	1.2	1.0	77	90.6	71.0	86	32	37.6	29.0	84	--	--	--	--	--	--	--	--	110	129.4	29
LAKE AVERAGE				0.6	0.5		70.1	74.0	88.5		26.1	25.5	87.0		0.3	0.5	49.5		0.0	0.0	0.0		97.0	26

GIZZARD SHAD

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
2000	Electro.	5	--	--	--	33	13.8	39.0	89	52	21.8	61.0	77	--	--	--	--	--	--	--	--	85	35.6	61
2005	Electro.	4	--	--	--	5	2.5	50.0	75	5	2.5	50.0	66	--	--	--	--	--	--	--	--	10	5.0	50
LAKE AVERAGE				0.0	0.0		8.2	44.5	82.0		12.2	55.5	71.5		0.0	0.0	0.0		0.0	0.0	0.0		20.3	--

THREADFIN SHAD

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
2000	Electro.	5	--	--	--	1	0.4	3.0	--	39	15.6	98.0	--	--	--	--	--	--	--	--	--	40	16.0	98
2005	Electro.	4	--	--	--	32	16.0	39.5	--	49	24.5	60.5	--	--	--	--	--	--	--	--	--	81	40.5	60
LAKE AVERAGE				0.0	0.0		8.2	21.3	0.0		20.1	79.3	0.0		0.0	0.0	0.0		0.0	0.0	0.0		28.3	79.0

WHITE CRAPPIE

		No. of	SUBSTOCK			RSD-S				RSD-Q				RSD-P				RSD-M				TOTAL		
Year	Gear	Samples	NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PSD
1998	Trap Net	40	7	0.2	11.0	7	0.2	11.0	73	23	0.6	35.0	76	35	0.9	53.0	79	1	0.0	2.0	75	73	1.8	89
1999	Trap Net	40	--	--	--	1	0.0	3.0	91	11	0.3	37.0	77	15	0.4	50.0	79	3	0.1	10.0	85	30	0.8	97
2004	Trap Net	30	7	0.02	50	2	0.1	14.0	84	9	0.3	64.0	83	1	0.0	7.0	84	2	0.1	14.0	88	21	0.5	86
LAKE AVERAGE				0.1	20.3		0.1	9.3	82.7		0.4	45.3	78.7		0.4	36.7	80.7		0.1	8.7	82.7		1.0	90.6

TABLE 3. AGE COMPOSITION AND MEAN LENGTH OF LARGEMOUTH BASS FROM LITTLE BEAR CREEK RESERVOIR, SPRING 2005.

Annulus	Year Class	Number	Percent	CPE	Mean Length	(SE)
1	2004	10	8.5	5.5	156.9	10.6
2	2003	62	53.0	34.0	265.2	3.5
3	2002	8	6.8	4.4	328.0	11.2
4	2001	15	12.8	8.2	374.0	8.9
5	2000	10	8.5	5.5	398.8	14.0
6	1999	5	4.3	2.7	414.4	5.9
7	1998	4	3.4	2.2	465.8	19.0
8	1997	2	1.7	1.1	552.5	7.5
9	1996	0	--	--	--	--
10	1995	0	--	--	--	--
11	1994	0	--	--	--	--
12	1993	0	--	--	--	--
13	1992	0	--	--	--	--
14	1991	1	0.9	0.5	515.0	--
Total		117	100.0	64.1		

TABLE 4. LENGTH AT AGE OF LARGEMOUTH BASS FROM LITTLE BEAR CREEK RESERVOIR, SPRING 2005.

Length (mm)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	TOTAL
75	1														1
100	1														1
125	1														1
150	5														5
175	1	2													3
200	1	4													5
225		12													12
250		19	1												20
275		20		1											21
300		5	2												7
325			4	2	2										8
350			1	3	1										5
375				6	2										8
400				3	3	3									9
425					1	2	2								5
450					1										1
475							1								1
500							1							1	2
525								1							1
550								1							1
Total	10	62	8	15	10	5	4	2	0	0	0	0	0	1	117

TABLE 5. TIME IT TOOK LARGEMOUTH BASS IN LITTLE BEAR CREEK RESERVOIR TO REACH DESIGNATED LENGTHS IN 2000 AND 2005.

SAMPLE YEAR	LENGTHS			
	305mm (12in.)	330mm (13in.)	406mm (16in.)	508mm (20in.)
2000	2.55 years	3.06 years	5.91years	NA
2005	2.93 years	3.38 years	4.94 years	7.67 years

TABLE 6. AGE COMPOSITION AND MEAN LENGTH OF WHITE CRAPPIE FROM LITTLE BEAR CREEK RESERVOIR, FALL 2004.

Annulus	Year Class	Number	Percent	CPE	Mean Length	(SE)
0	2004	7	33.3	3.8	76.7	2.9
1	2003	14	66.7	7.7	229.2	9.9
Total		21	100.0	11.5		

TABLE 7. LENGTH AT AGE OF WHITE CRAPPIE FROM LITTLE BEAR CREEK RESERVOIR, FALL 2004.

Length (mm)	0+	I+	TOTAL
60	2		2
70	3		3
80	2		2
90			0
100			0
110			0
120			0
130			0
140			0
150			0
160			0
170			0
180		1	1
190		1	1
200		4	4
210		1	1
220		1	1
230		2	2
240		1	1
250		1	1
260			
270			
280			
290			
300		2	2
Total	7	14	21

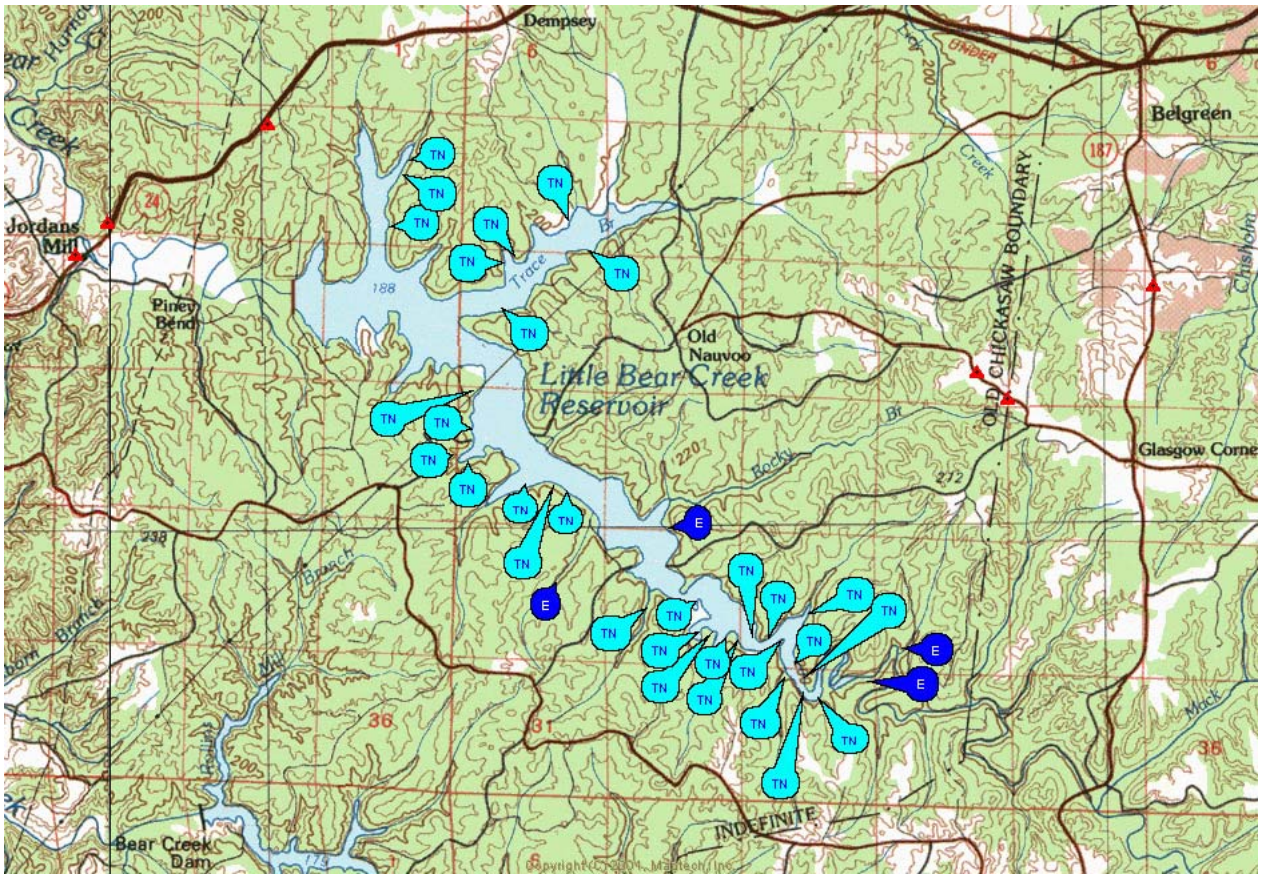

Figure 1. Fall 2004 Trap netting (TN) sites and spring 2005 Electrofishing (E) sites on Little Bear Creek Reservoir.

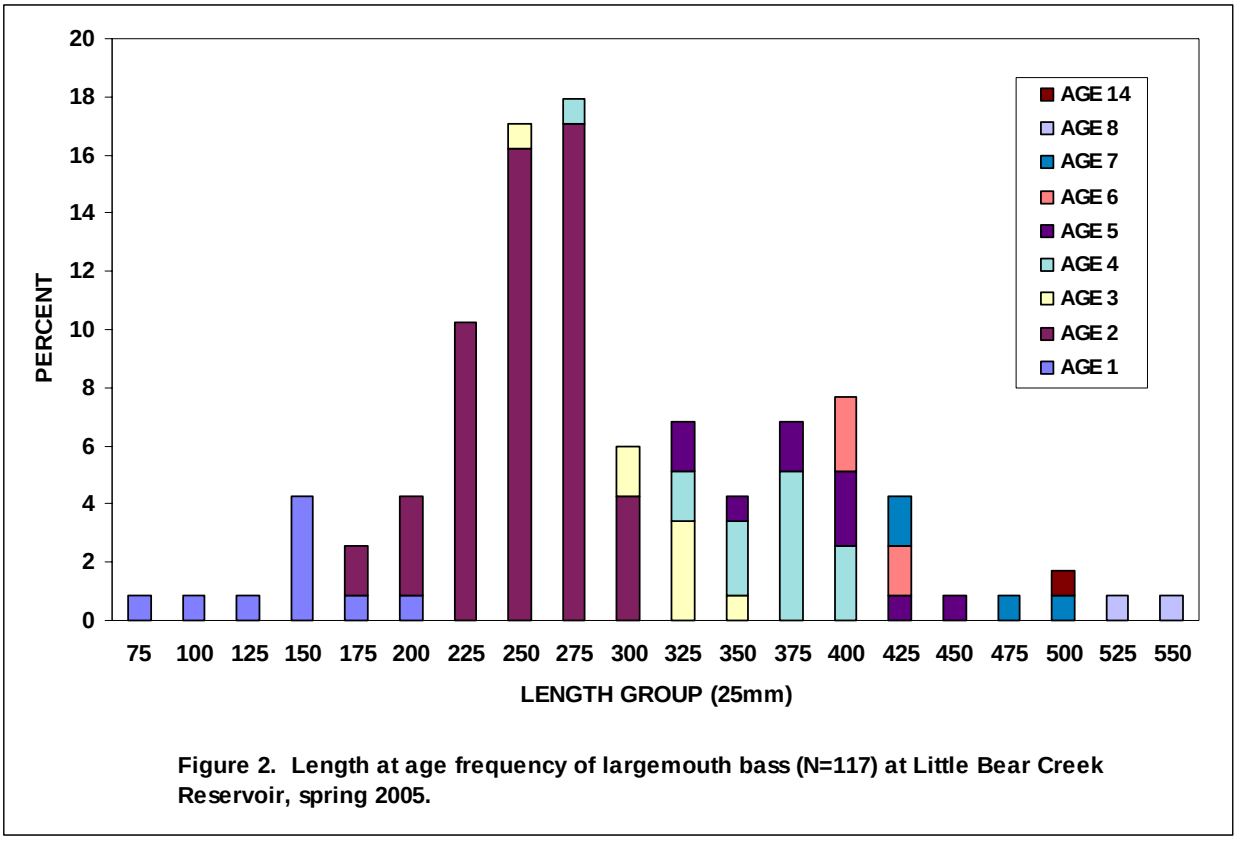

Figure 2. Length at age frequency of largemouth bass (N=117) at Little Bear Creek Reservoir, spring 2005.

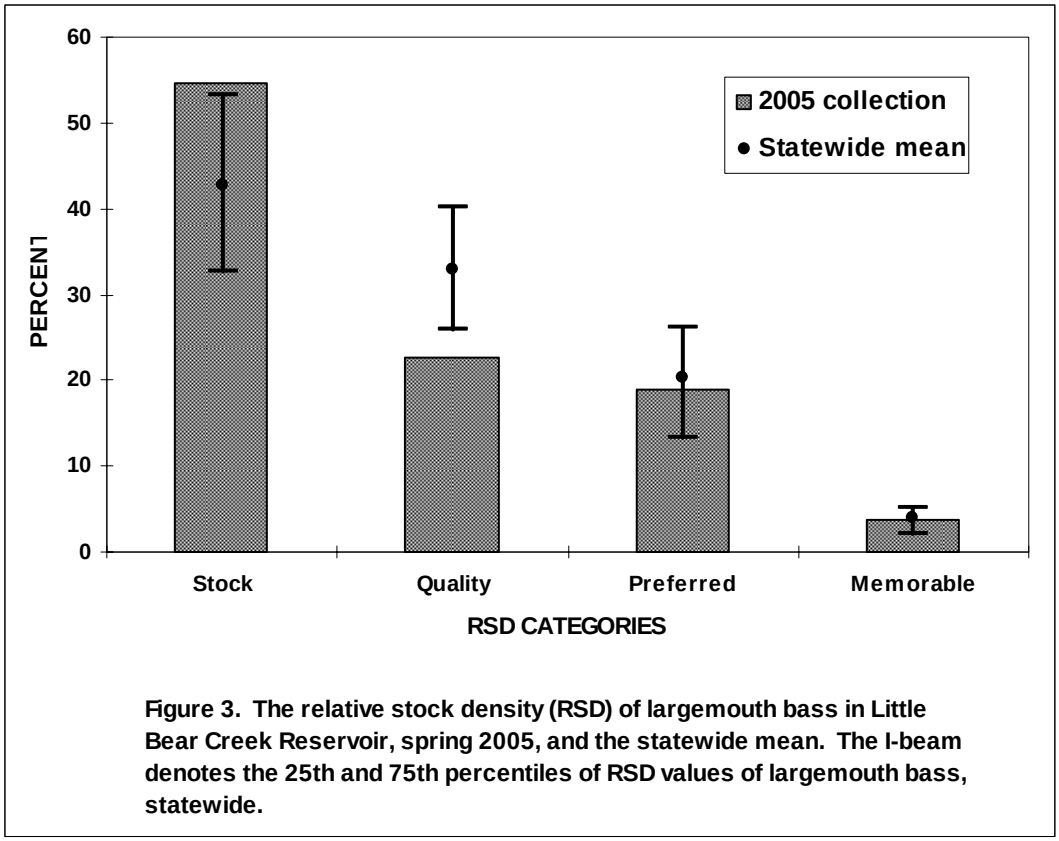

Figure 3. The relative stock density (RSD) of largemouth bass in Little Bear Creek Reservoir, spring 2005, and the statewide mean. The I-beam denotes the 25th and 75th percentiles of RSD values of largemouth bass, statewide.

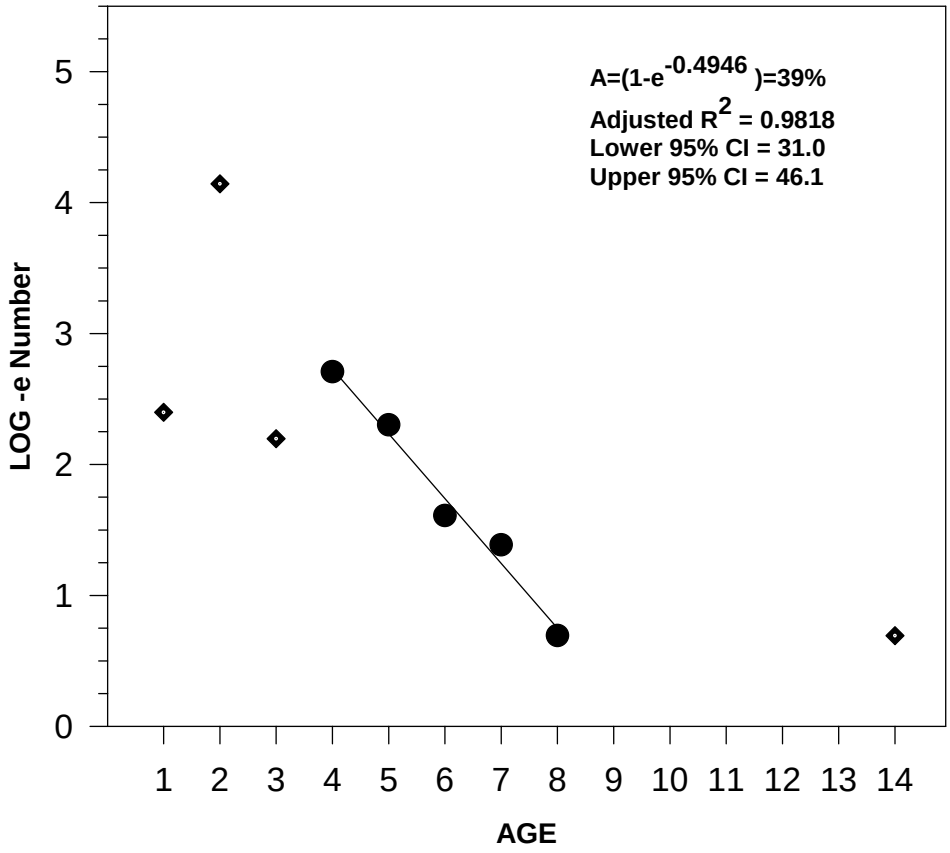

Figure 4. Total annual mortality (A) for largemouth bass (ages 4-8) collected from Little Bear Creek Reservoir, spring 2005.

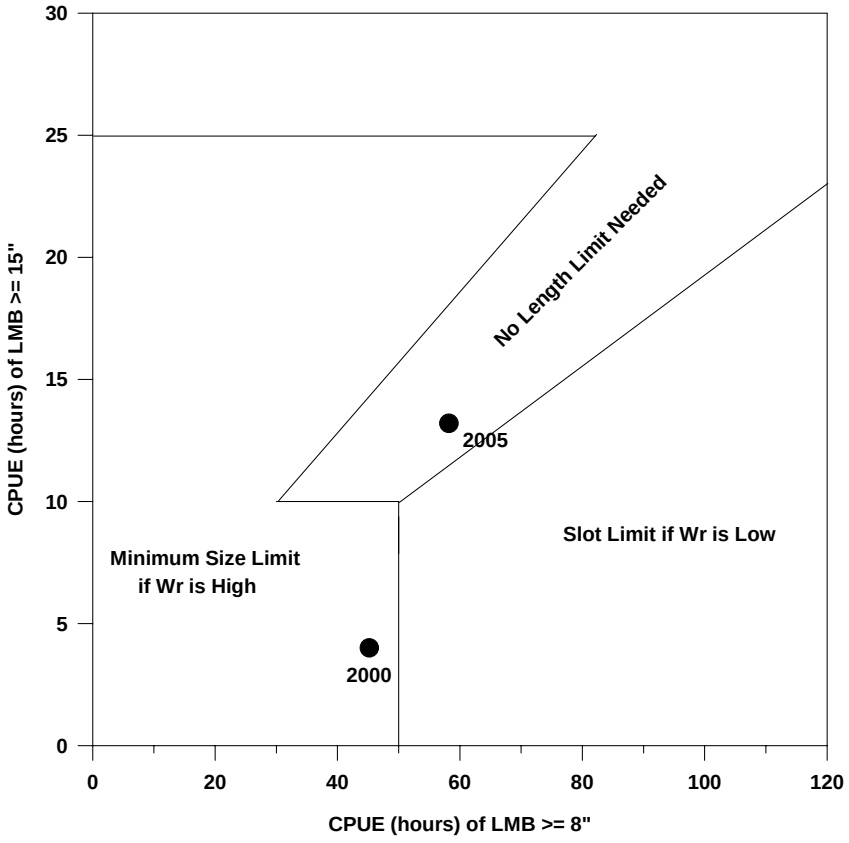

Figure 5. Little Bear Creek Reservoir largemouth bass electrofishing catch per unit of effort (CPUE) for fish greater than or equal to 8 inches total length plotted against CPUE for fish greater than or equal to 15 inches total length (Dean and Wright 1992) for 2000 and 2005.

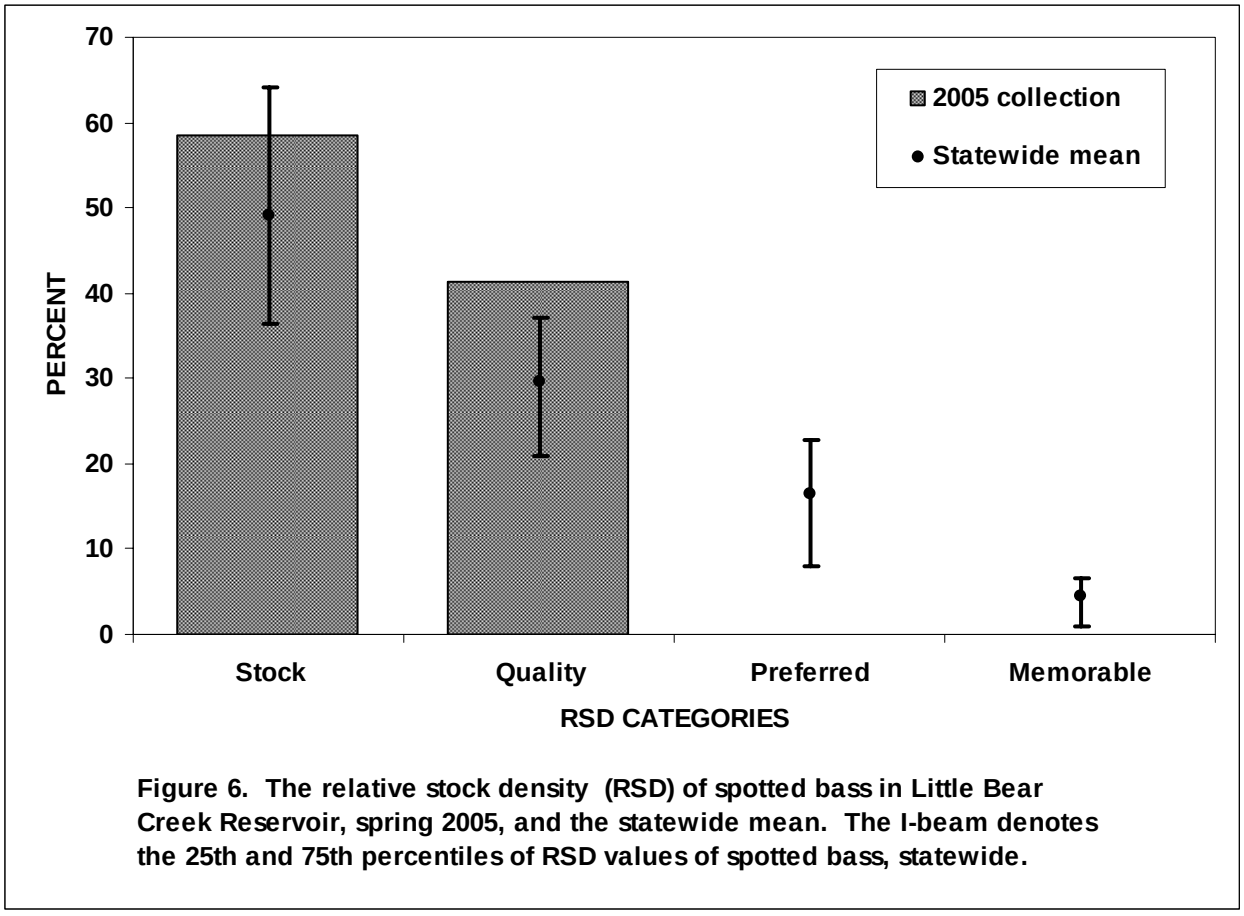

Figure 6. The relative stock density (RSD) of spotted bass in Little Bear Creek Reservoir, spring 2005, and the statewide mean. The I-beam denotes the 25th and 75th percentiles of RSD values of spotted bass, statewide.

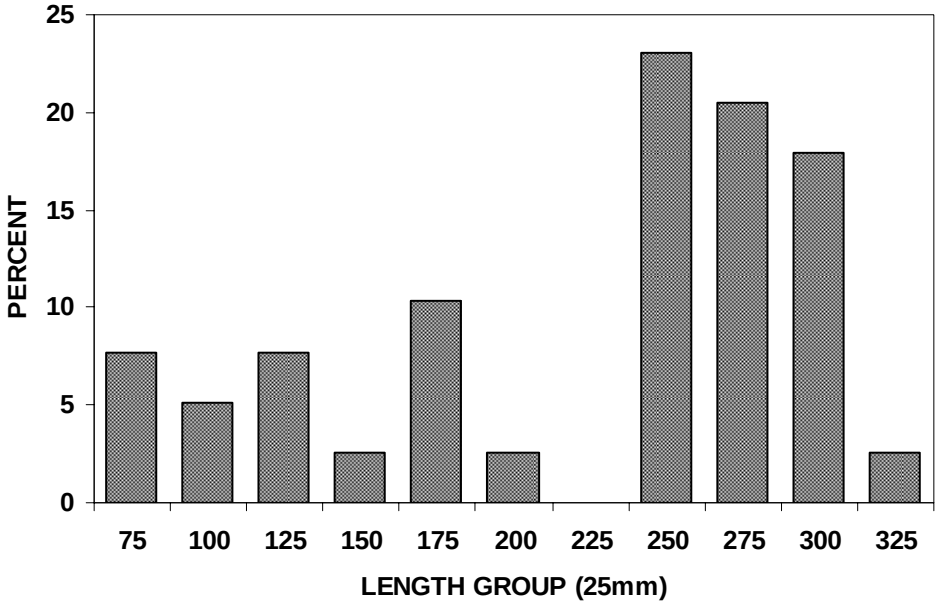

Figure 7. Length frequency of spotted bass (N=39) from Little Bear Creek Reservoir, spring 2005.

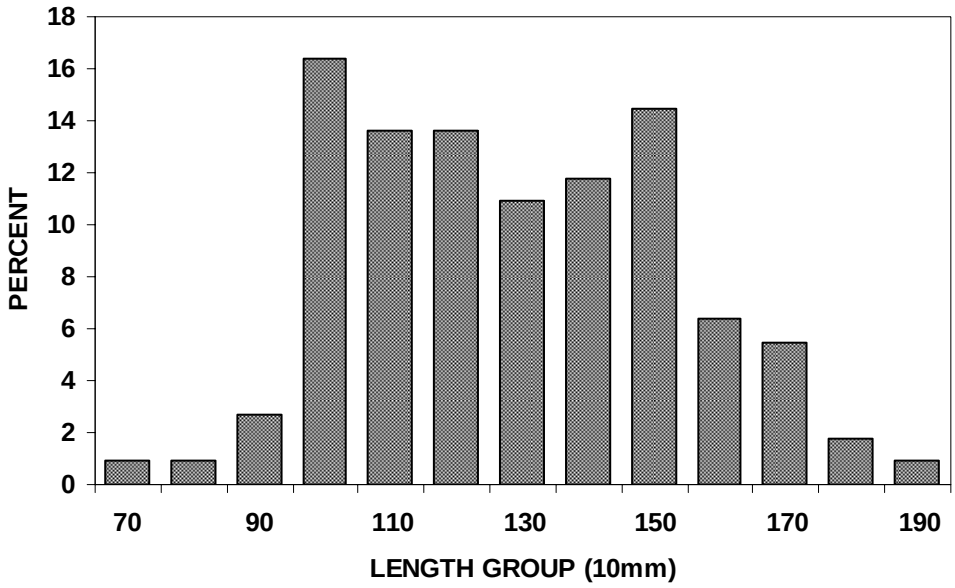

Figure 8. Length frequency of bluegill sunfish (N=110) from Little Bear Creek Reservoir, spring 2005.

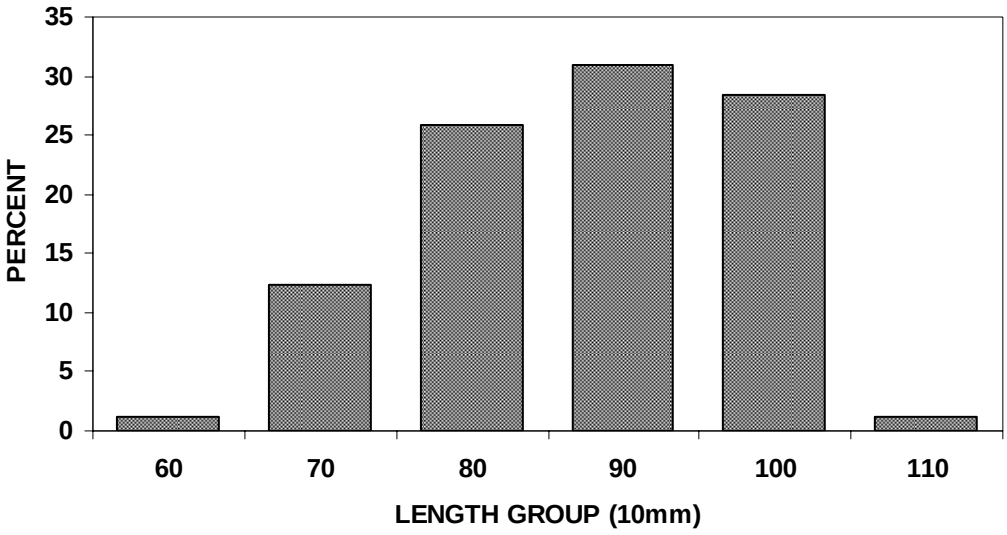

Figure 9. Length frequency of threadfin shad (N=81) from Little Bear Creek Reservoir, spring 2005.

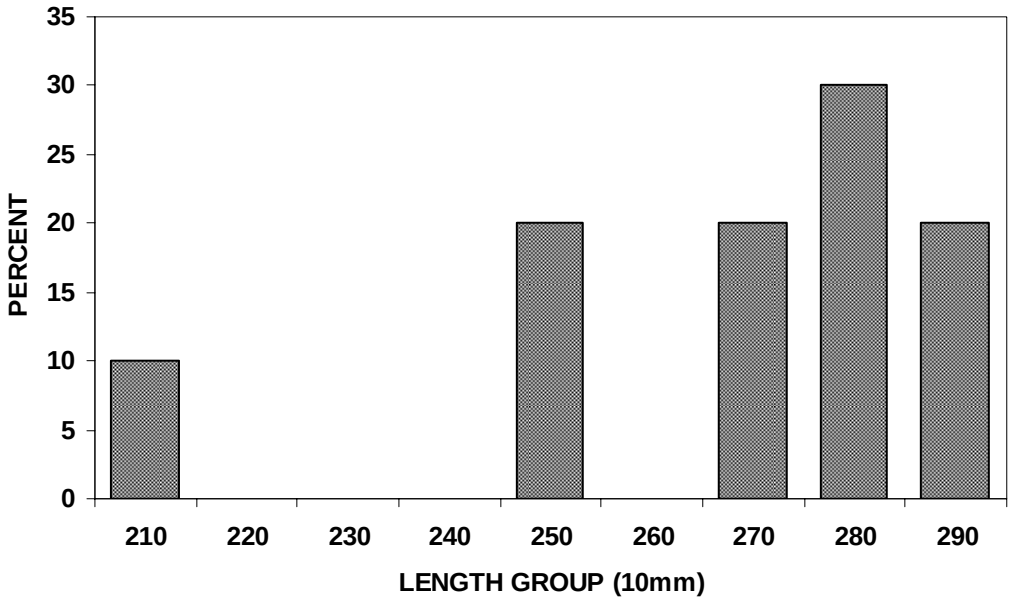

Figure 10. Length frequency of gizzard shad (N=10) from Little Bear Creek Reservoir, spring 2005.

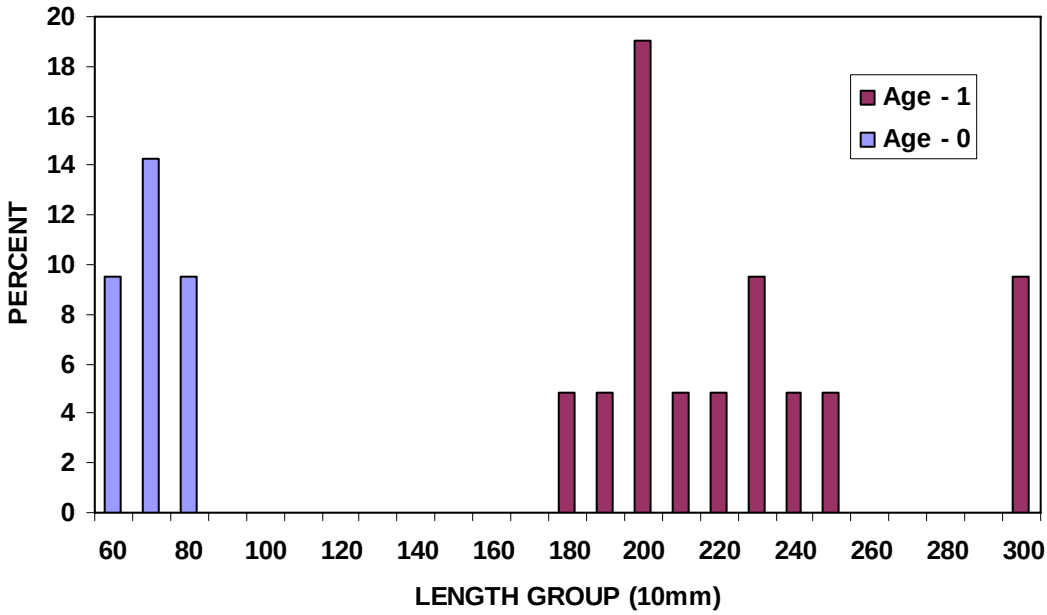

Figure 11. Length at age frequency of white crappie (N=21) at Little Bear Creek Reservoir, fall 2004.

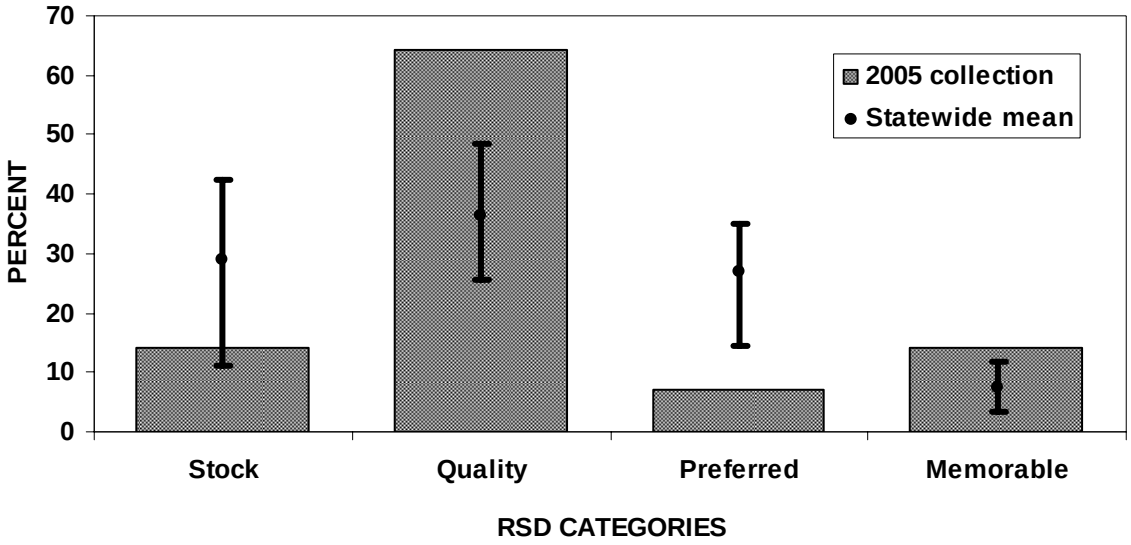

Figure 12. The relative stock density (RSD) of white crappie in Little Bear Creek Reservoir, fall 2004, and the stewide mean. The I-beams denote the 25th and 75th percentiles of RSD values of white crappie, statewide.

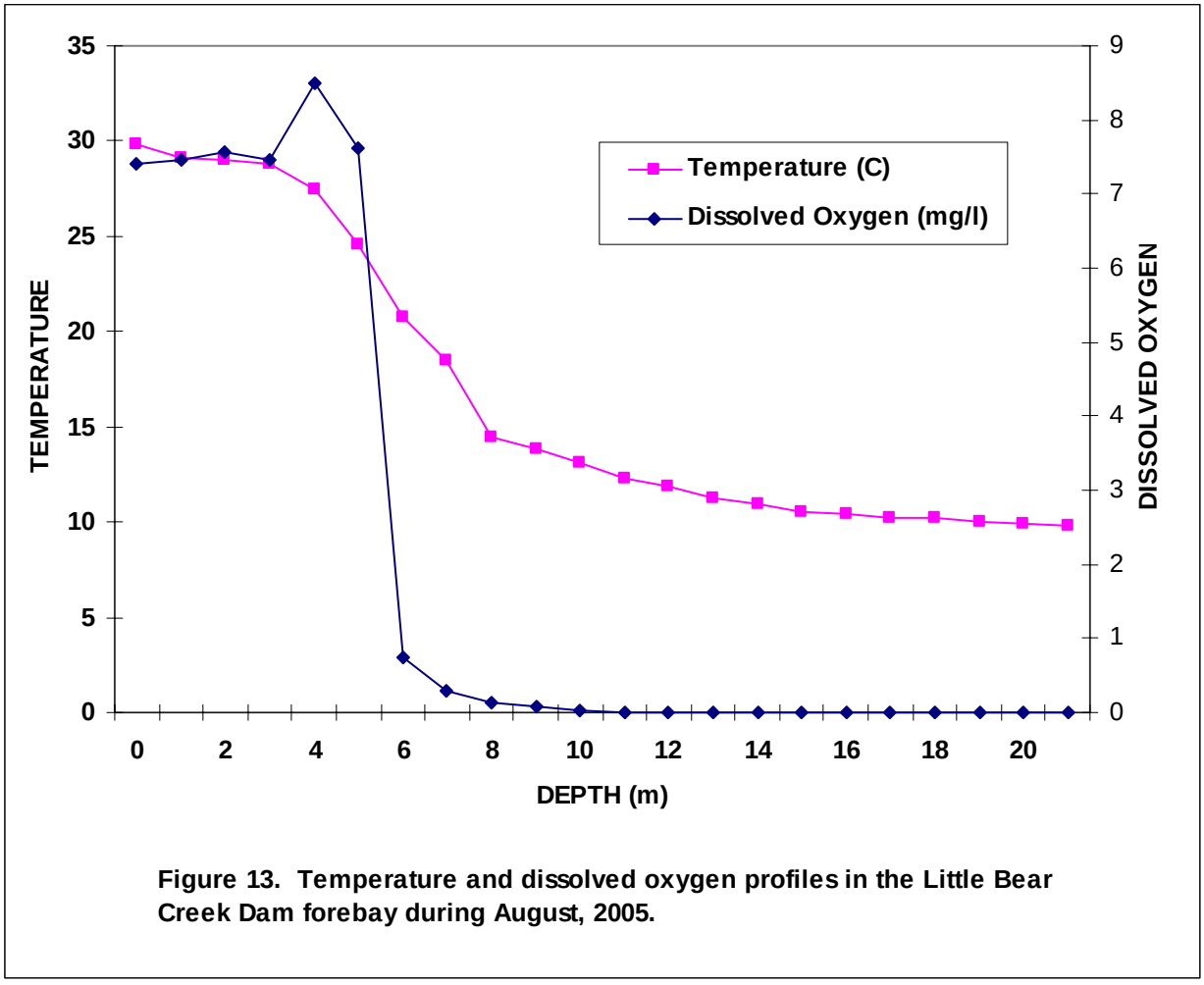

Figure 13. Temperature and dissolved oxygen profiles in the Little Bear Creek Dam forebay during August, 2005.