

# **UPPER BEAR CREEK RESERVOIR**

## **MANAGEMENT REPORT**

**2010**

Prepared by

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October 19, 2010

## Introduction

Upper Bear Creek Reservoir (UBCR) is one of four Tennessee Valley Authority (TVA) reservoirs in the Bear Creek watershed of the Tennessee River. UBCR is a 1,850-acre reservoir located near the junctions of Franklin, Marion, and Winston Counties in northwest Alabama. UBCR historically has been one of Alabama's better "big bass" fisheries and harbors an above average abundance of largemouth bass over five pounds.

Sampling for black bass in the spring of 2010 followed management program guidelines (Alabama Reservoir Management Manual 1999). The purpose of this program is to develop reservoir specific management guidelines designed to improve sport fish population structure and fishing quality. UBCR black bass were previously sampled in 2006 (Ekema et al. 2006) and 2001 (Greene et al. 2001).

## Methods

Spring electrofishing took place during April 12-14, 2010. The 2010 electrofishing protocol was slightly different from the 2006 (Ekema et al. 2006) and 2001 (Greene et al. 2001) samples. Instead of 10 randomly selected sites from the entire reservoir, five randomly selected sites came from each of the two major tributary arms, Bear Creek and Little Bear Creek. Target species were largemouth and spotted bass. We measured and weighed all black bass. Otoliths were removed from 10 bass per 25 mm length group greater than 150 mm; these black bass were also sexed. Otoliths were aged at the District One Fisheries office. Data analysis was conducted with ADWFF Data Analysis and Report Utilities (Slipke 2004) and Fisheries Analysis and Simulation Tools (F.A.S.T.) program (Slipke 2006). Fitting von Bertalanffy growth curves to the

mean length-at-age data provided a prediction of the time it took for black bass to reach lengths of interest.

The Bass Anglers Information Team (B.A.I.T.) program compiles tournament catch information from all participating reservoirs. These data complement the Alabama Reservoir Management Program data. This report utilizes the 2008 B.A.I.T. data (Abernethy 2009). The text of this report does not reference all of the tables and figures included in the Appendix.

### Results and Discussion

The largemouth bass sample consisted of 200 fish, 170 were of stock size and larger. Sixteen percent of the largemouth bass fell into the quality (RSD Q-P) category, 18% in the preferred (RSD P-M) category, and 7% in the memorable (RSD M-T) category, all representing decreases from the 2006 sample and all falling below lake averages (Table 2). The substock ratio of 18% is slightly above the lake's average, yet represents a decrease from 26% in 2006. Stock (RSD S-Q) sized fish made up 59% of the sample, up from 41% in 2006 and exceeding the lake's average value of 43% (Table 2). When comparing RSD values with statewide reservoir data, both the RSD S-Q and RSD M-T values exceeded the 75<sup>th</sup> percentile values, the RSD Q-P value was well below the 25<sup>th</sup> percentile value, and the RSD P-M value was slightly below the mean value, for reservoirs statewide (Figure 3).

The CPUE for largemouth bass (RSD S-T) and (RSD P-T) were 34.0 and 8.6 fish/hour, respectively, both values falling below the mean catch rate for reservoirs statewide. Catch rates for all RSD categories was 40.0 fish/hour, a decline from the rate of 46.2 in 2006, yet was better than the lake's average of 36.3 fish/hour (Table 2).

The largemouth bass proportional stock density (PSD) value of 41 is 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 prey species. PSD values have declined from 70 in 2001, to 59 in 2006, and now to 41 in 2010, a trend indicating that the overall size of largemouth bass is decreasing in UBCR (Table 2).

Relative weights for all RSD categories were similar to those of previous sample years, but below average compared to statewide reservoir data (Table 2.).

The time to reach lengths of 12, 15, and 20 inches in 2010 as calculated by von Bertalanffy growth curves is 3.05, 4.53, and 8.66 years, respectively (Table 5). The Alabama averages for these same lengths are 2.47, 3.79, and 7.45 years, indicating slower than average growth for UBCR largemouth bass, and a decrease in growth rates since 2006 (Table 5, Figure 5).

Weighted catch curve regression calculations indicate a survival rate of 74% ( $r^2=0.8381$ ) for largemouth bass ages 3-12 (Figure 4), reflecting no change from the 2006 value. This survival rate is high and indicates a low angler exploitation rate for largemouth bass.

Modeling with F.A.S.T. utilizing an average conditional mortality of 0.285, revealed that exploitation was low (2.2%) and that natural mortality (28.8%) comprised a high percentage of the total annual mortality. Percentage of largemouth bass reaching RSD P-M and RSD M-T categories under models utilizing a 14" mll, a 13-16" slot, and a 15-20" slot, were all lower than those values actually observed in the 2010 sample.

Sexual examination of one-hundred-twenty-nine (129) largemouth bass revealed that males accounted for 39% of those fish sexed. The largest male was 513 mm (20.2 in.) in length, weighing 2000 grams (4.4 lbs.). Females represented 33% of the sexed sample with the largest

female obtaining a length of 587 mm (23.1 in.) and a weight of 3194 grams (7.0 lbs.). The remaining largemouth bass (28%) were determined to be sexually immature.

Spotted bass are common in UBCR with a CPUE of 35.6 fish per hour, which is slightly lower than the CPUE of 40.0 for largemouth bass (Table 2). Catch rates declined from the 2006 value of 46.4, but still exceed the lake's average of 33.9 fish per hour. The spotted bass sample consisted of 178 fish, with 168 being stock size and larger. Eighty-four percent (84%) of the spotted bass fell into the RSD S-Q (41%) and RSD Q-P (43%) size categories. All categories except RSD S-Q and RSD T exceeded lake averages (Table 2). RSD calculations revealed that values for RSD S-Q, RSD P-M, and RSD M-T size categories fell within recommended ranges, while RSD Q-P values exceeded the statewide 75<sup>th</sup> percentile (Figure 7). The CPUE (RSD S-T) for spotted bass was 33.6 fish per hour, which exceeds the 75<sup>th</sup> percentile value for Alabama reservoirs.

Spotted bass relative weights for all RSD categories were equal to or below the 25<sup>th</sup> percentile for Alabama reservoirs (Table 2). The spotted bass PSD value of 59 exceeds the 2006 value of 55, the 2001 value of 32, and the mean value of 51 for Alabama reservoirs (Table 2). These data indicate that the spotted bass population has shifted towards larger fish since 2001.

The time to reach lengths of 12 and 17 inches as calculated by von Bertalanffy growth curves were 3.87 and 7.05 years, respectively (Table 5). The Alabama averages for these same lengths were 2.61 and 5.20 years, indicating slower than average growth for UBCR spotted bass (Table 5, Figure 9).

Total annual survival estimate for spotted bass was calculated to be 49% ( $r^2=0.9169$ ) (Figure 8). The spotted bass survival value is lower than the largemouth bass value of 74%.

Harvest of spotted bass takes place more frequently than largemouth bass; therefore angling mortality may be responsible for the difference in the survival rate of the two species.

Sexual examination of one-hundred-eleven (111) spotted bass revealed that males accounted for 59% of the sexed sample. The largest male measured 506 mm (19.9 in.) in length, and weighed 1520 grams (3.3 lbs.). Females represented 19% of the sexed sample with the largest female measuring 469 mm (18.5 in.) and weighing 1105 grams (2.4 lbs.). The remaining spotted bass (22%) were determined to be sexually immature.

In 2009 (Abernethy 2010) there were no B.A.I.T. report submissions for UBCR, and only one tournament report was submitted in 2008 (Abernethy 2009). The average weight of 1.13 pounds for black bass in 2008 marks the lowest average weight to date for UBCR and no bass over 5 pounds were recorded. Spotted bass accounted for two-thirds of the tournament catch.

### Recommendations

Although the percentage of memorable sized largemouth bass in UBCR exceeds the 75% value for reservoirs statewide, the RSD M-T value has progressively decreased from 19% in 2001, to 14% in 2006, down to 7% in 2010. Meanwhile, the percentage of stock sized largemouth bass continues to increase. Conversely, the spotted bass population is increasing in its percentage of fish of quality sized and larger, while decreasing in the percentage of stock sized fish. Both species of black bass also had a change in their PSD values. PSD values for largemouth declined from 70 to 59 to 41 for 2001, 2006, and 2010, respectively. PSD values for spotted bass increased from 32 to 55 to 59 for 2001, 2006, and 2010, respectively. This trend indicates that the black bass population may be switching from a largemouth bass fishery to a spotted bass fishery.

F.A.S.T. modeling showed that the percentages predicted for preferred and memorable sized largemouth bass under various size restrictions were lower than that observed in the 2010 sample, indicating that the current black bass management strategy is working well.

Efforts to increase tournament participation in the B.A.I.T. program have been unsuccessful. B.A.I.T. data would complement our electrofishing data and would help identify any changes or trends observed in the bass population. Increasing the participation in the B.A.I.T. program prior to the next scheduled sampling would prove beneficial.

It is recommended that UBCR be re-sampled in 3-4 years, to ascertain any changes in the black bass population. No change in the black bass management strategy for Upper Bear Creek Reservoir is recommended.

### Literature Cited

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- Slipke, J. W. 2004. ADWFF data analysis and report utilities. Version 2.2. Auburn University, Auburn, Alabama.
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# **APPENDIX**

## **TABLES AND FIGURES**

Table 1. Upper Bear Creek Reservoir morphometric, physical and chemical characteristics.

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Surface area	1850 acres
Drainage area	115 sq. mi.
Full pool elevation	797 ft. msl
Mean annual fluctuation	4 feet
Shoreline distance	105 miles
Mean depth	14 feet
Maximum depth	70 feet
Average annual discharge	200 cfs
Outlet depth	variable
Thermocline Depth	13 feet
Oxygen-cline (summer)	13 feet
Year of Impoundment	1978

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Table 2. Relative Stock Density (RSD), Catch Per Hour (CPH), Relative Weight (Wr), and Proportional Stock Density (PSD) of largemouth bass and spotted bass from Upper Bear Creek Reservoir.

LARGEMOUTH BASS																													
Year	Gear	No. of Samples	SUBSTOCK			RSD S-Q				RSD Q-P				RSD P-M				RSD M-T				RSD T				TOTAL		PSD	
			NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH		
2001	Electro.	10	10	2.0	10	31	6.2	30	78	15	3.0	14	84	38	7.6	37	91	20	4.0	19	94	--	--	--	--	114	22.8	70	
2006	Electro.	10	47	9.4	26	75	15.0	41	79	44	8.8	24	83	39	7.8	21	89	26	5.2	14	94	--	--	--	--	231	46.2	59	
<b>2010</b>	<b>Electro.</b>	<b>10</b>	<b>30</b>	<b>6.0</b>	<b>18</b>	<b>100</b>	<b>20.0</b>	<b>59</b>	<b>83</b>	<b>27</b>	<b>5.4</b>	<b>16</b>	<b>89</b>	<b>31</b>	<b>6.2</b>	<b>18</b>	<b>92</b>	<b>12</b>	<b>2.4</b>	<b>7</b>	<b>93</b>	--	--	--	--	<b>200</b>	<b>40.0</b>	<b>41</b>	
LAKE AVERAGE			5.8	18		13.7	43	80		5.7	18	85		7.2	25	91		3.9	13	94	--	--	--	--	36.3	57			
25% TILE			--	3.9	11	--	10.8	33	84	--	8.6	26	85	--	4.5	13	89	--	0.7	2	92	--	--	--	--	28.5	47		
STATEWIDE MEAN			--	11.5	26	--	20.3	43	88	--	15.8	33	91	--	9.9	20	94	--	1.9	4	97	--	--	--	--	59.4	57		
75% TILE			--	15.2	33	--	25.6	53	93	--	20.7	40	95	--	13.0	26	98	--	2.5	5	102	--	--	--	--	77.0	67		

SPOTTED BASS																													
Year	Gear	No. of Samples	SUBSTOCK			RSD S-Q				RSD Q-P				RSD P-M				RSD M-T				RSD T				TOTAL		PSD	
			NO.	CPH	SSR	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH	PCT.	Wr	NO.	CPH		
2001	Electro.	10	7	1.4	8	63	12.6	68	78	22	4.4	24	87	5	1.0	5	91	2	0.4	2	100	--	--	--	--	99	19.8	32	
2006	Electro.	10	93	18.6	67	63	12.6	45	83	53	10.6	38	90	17	3.4	12	95	5	1.0	4	100	1	0.2	1	110	232	46.4	55	
<b>2010</b>	<b>Electro.</b>	<b>10</b>	<b>10</b>	<b>2.0</b>	<b>6</b>	<b>69</b>	<b>13.8</b>	<b>41</b>	<b>85</b>	<b>72</b>	<b>14.4</b>	<b>43</b>	<b>89</b>	<b>18</b>	<b>3.6</b>	<b>11</b>	<b>92</b>	<b>9</b>	<b>1.8</b>	<b>5</b>	<b>91</b>	--	--	--	--	<b>178</b>	<b>35.6</b>	<b>59</b>	
LAKE AVERAGE			7.3	27		13.0	51	82		9.8	35	89		2.7	9	93		1.1	4	97		0.2	1	110	33.9	48			
25% TILE			--	2.3	11	--	6.4	36	87	--	3.4	21	91	--	1.4	8	92	--	0.2	1	97	--	--	--	--	13.7	36		
STATEWIDE MEAN			--	6.0	32	--	11.9	49	94	--	7.7	30	98	--	4.4	16	100	--	1.2	5	105	--	--	--	--	31.2	51		
75% TILE			--	8.7	40	--	16.5	64	101	--	11.7	37	103	--	5.5	23	107	--	1.6	7	115	--	--	--	--	44.0	65		

Table 3. Age composition and mean length of largemouth bass from Upper Bear Creek Reservoir, Spring 2010.

Annulus	Year Class	Number	Percent	CPE	Mean Length	Standard Error
1	2009	26	13.0	5.2	159.1	5.1
2	2008	86	43.0	17.2	242.9	3.1
3	2007	32	16.0	6.4	306.1	5.0
4	2006	15	7.5	3.0	343.5	12.7
5	2005	8	4.0	1.6	370.9	26.5
6	2004	11	5.5	2.2	444.9	11.2
7	2003	6	3.0	1.2	480.5	22.9
8	2002	9	4.5	1.8	498.7	14.9
9	2001	3	1.5	0.6	527.7	17.0
10	2000	2	1.0	0.4	554.5	18.5
11	1999	0	0.0	0.0	--	--
12	1998	2	1.0	0.4	527.5	59.5
<b>Total</b>		200	100.0	40.0		

Table 4. Length at age for largemouth bass from Upper Bear Creek Reservoir, Spring 2010.

Length (mm)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total
100	2												2
125	7												7
150	10												10
175	7	4											11
200		19											19
225		28											28
250		23	3		2								28
275		10	12	3									25
300		2	13	4									19
325			1	2									3
350			2	1	1								4
375			1	3	2								6
400				1	2	6	1	1					11
425				1		1	2						4
450								2				1	3
475					1	3		1	1				6
500						1	1	3					5
525							2	1	2	1			6
550										1			1
575								1				1	2
<b>Total</b>	26	86	32	15	8	11	6	9	3	2	0	2	200

Table 5. Time to reach Lengths of Interest (L.O.I.) for largemouth bass and spotted bass from Upper Bear Creek Reservoir in 2001, 2006, and 2010.

<b>LARGEMOUTH BASS</b>						
<b>Length of Interest (L.O.I.)</b>		<b>Time to Reach L.O.I. (years)</b>			<b>Alabama Average</b>	
<b>(inches)</b>	<b>(mm)</b>	<b>2001</b>	<b>2006</b>	<b>2010</b>	<b>(years)</b>	
12	305	3.03	2.68	3.05	2.47	
13	330	3.45	3.05	3.49	--	
14	356	3.91	3.47	3.99	--	
15	381	4.41	3.91	4.53	3.79	
16	406	4.95	4.41	5.12	--	
17	432	5.58	5.01	5.82	--	
18	457	6.27	5.67	6.60	--	
19	483	7.09	6.48	7.55	--	
20	508	8.03	7.46	8.66	7.45	
21	533	9.18	8.72	10.06	--	
22	559	10.72	10.62	12.08	--	
23	584	12.81	13.96	15.21	--	

<b>SPOTTED BASS</b>						
<b>Length of Interest (L.O.I.)</b>		<b>Time to Reach L.O.I. (years)</b>			<b>Alabama Average</b>	
<b>(inches)</b>	<b>(mm)</b>	<b>2001</b>	<b>2006</b>	<b>2010</b>	<b>(years)</b>	
12	305	3.65	3.58	3.87	2.61	
13	330	4.18	4.03	4.37	--	
14	356	4.83	4.53	4.94	--	
15	381	5.61	5.07	5.56	--	
16	406	6.61	5.66	6.24	--	
17	432	8.09	6.34	7.05	5.20	
18	457	10.58	7.09	7.96	--	
19	483	--	7.99	9.09	--	
20	508	--	9.03	10.44	--	
21	533	--	10.27	12.20	--	

Table 6. Age composition and mean length of spotted bass from Upper Bear Creek Reservoir, Spring 2010.

Annulus	Year Class	Number	Percent	CPE	Mean Length	Standard Error
1	2009	5	2.8	1.0	108.0	7.2
2	2008	21	11.8	4.2	192.9	4.6
3	2007	63	35.4	12.6	271.8	2.5
4	2006	46	25.8	9.2	299.7	3.8
5	2005	26	14.6	5.2	339.1	7.4
6	2004	12	6.7	2.4	402.4	12.6
7	2003	2	1.1	0.4	449.0	15.0
8	2002	1	0.6	0.2	466.0	--
9	2001	1	0.6	0.2	461.0	--
10	2000	1	0.6	0.2	506.0	--
<b>Total</b>		178	100.0	35.6		

Table 7. Length at age for spotted bass from Upper Bear Creek Reservoir, Spring 2010.

Length (mm)	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
75	1									✓	1
100	3									✓	3
125	1									✓	1
150		4								✓	4
175		10								✓	10
200		7	2							✓	9
225			6							✓	6
250			26	6						✓	32
275			27	20	4					✓	51
300			2	14	6					✓	22
325				3	7	2				✓	12
350				3	4	1				✓	8
375					4	2				✓	6
400						3				✓	3
425					1	2	1			✓	4
450						2	1	1	1	✓	5
475										✓	0
500										1 ✓	1
<b>Total</b>	<b>5</b>	<b>21</b>	<b>63</b>	<b>46</b>	<b>26</b>	<b>12</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>178</b>

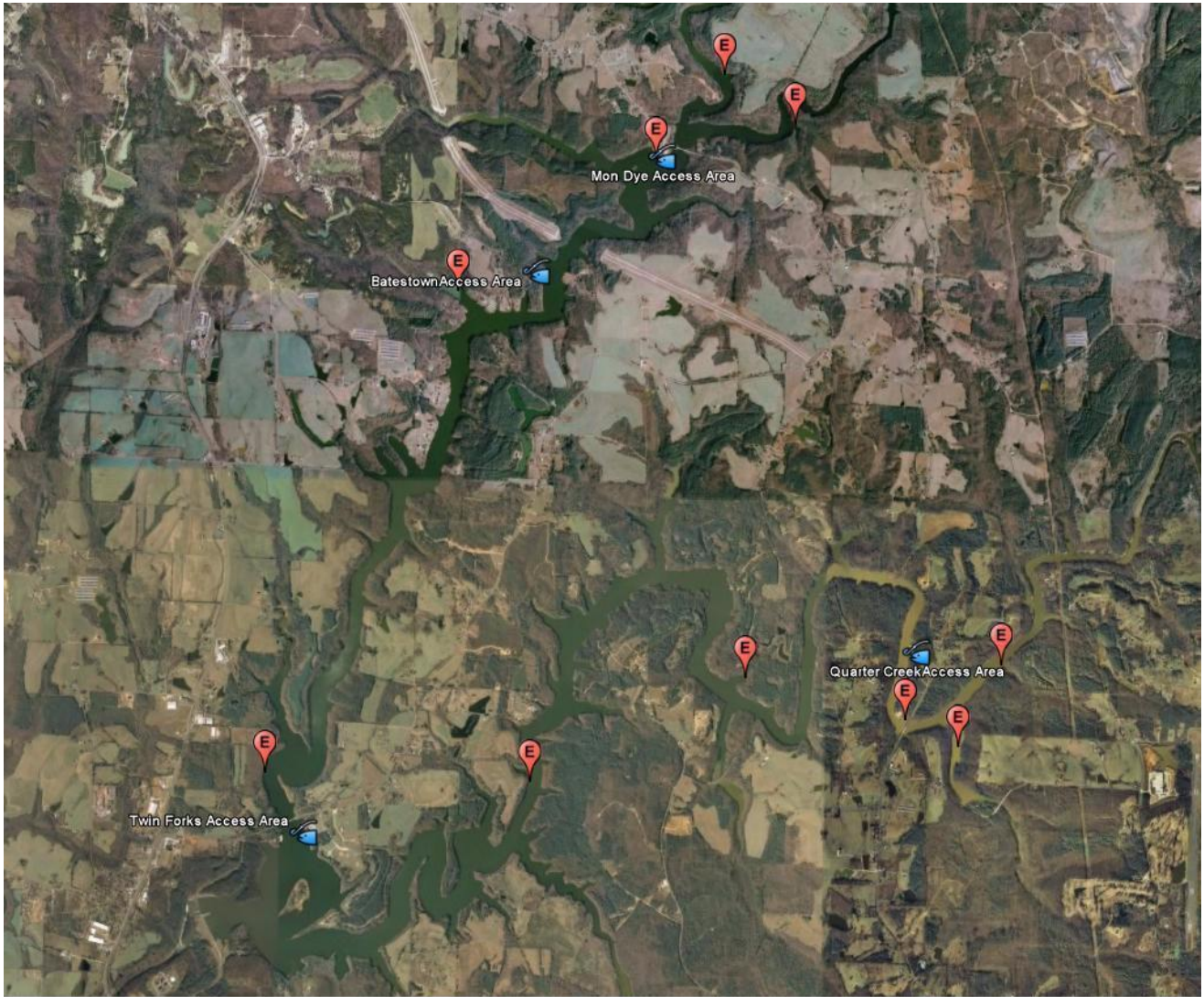


Figure 1. Upper Bear Creek Reservoir 2010 electrofishing (E) sites and public access areas.

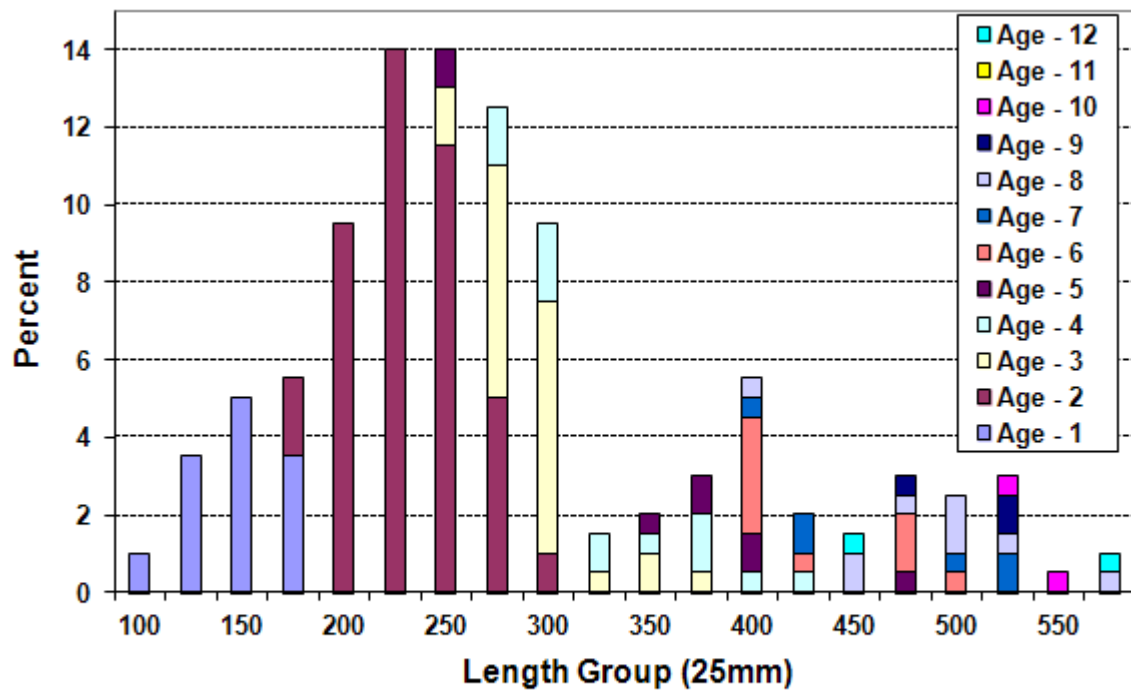


Figure 2. Length at age frequency of largemouth bass (N=200) from Upper Bear Creek Reservoir, Spring 2010.

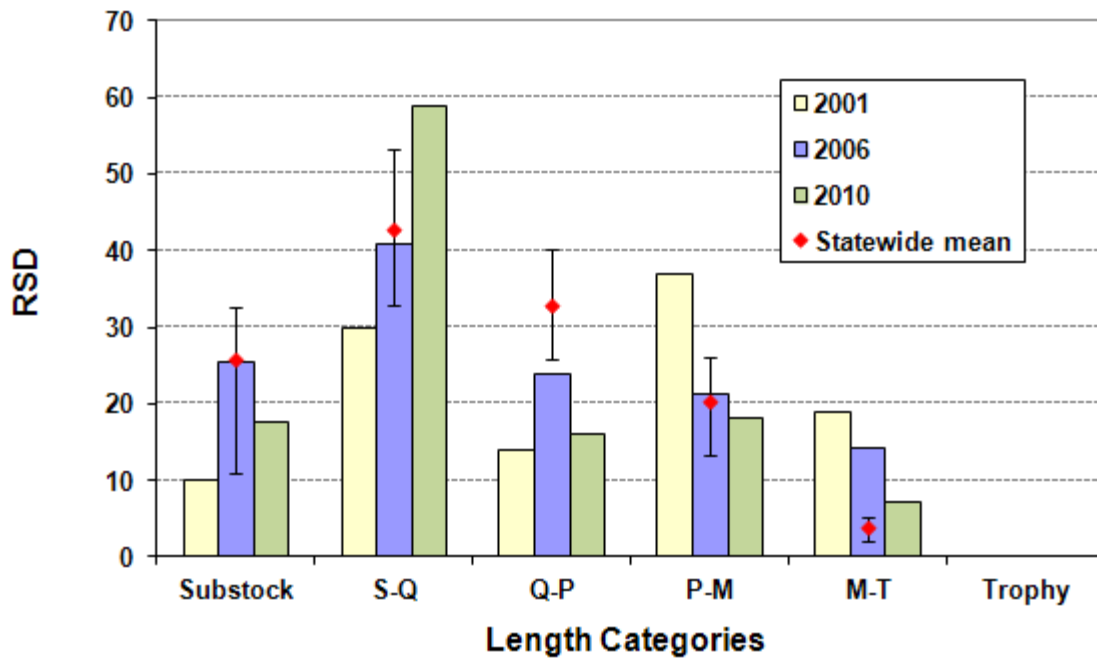
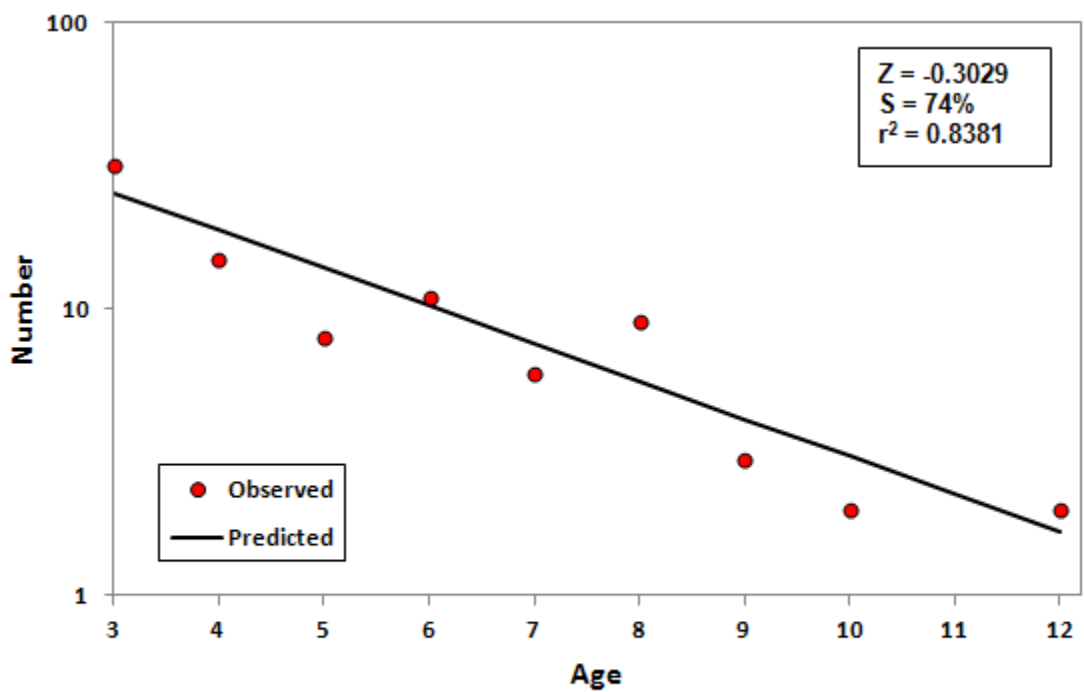


Figure 3. Relative stock density (RSD) of largemouth bass in Upper Bear Creek Reservoir, spring 2001, 2006, and 2010 and the statewide mean. The I-beams denote the 25th and 75th percentiles of RSD values of largemouth bass, statewide.



**Figure 4. Weighted catch curve regression and annual survival (S) for largemouth bass (ages 3-12) from Upper Bear Creek Reservoir, spring 2010.**

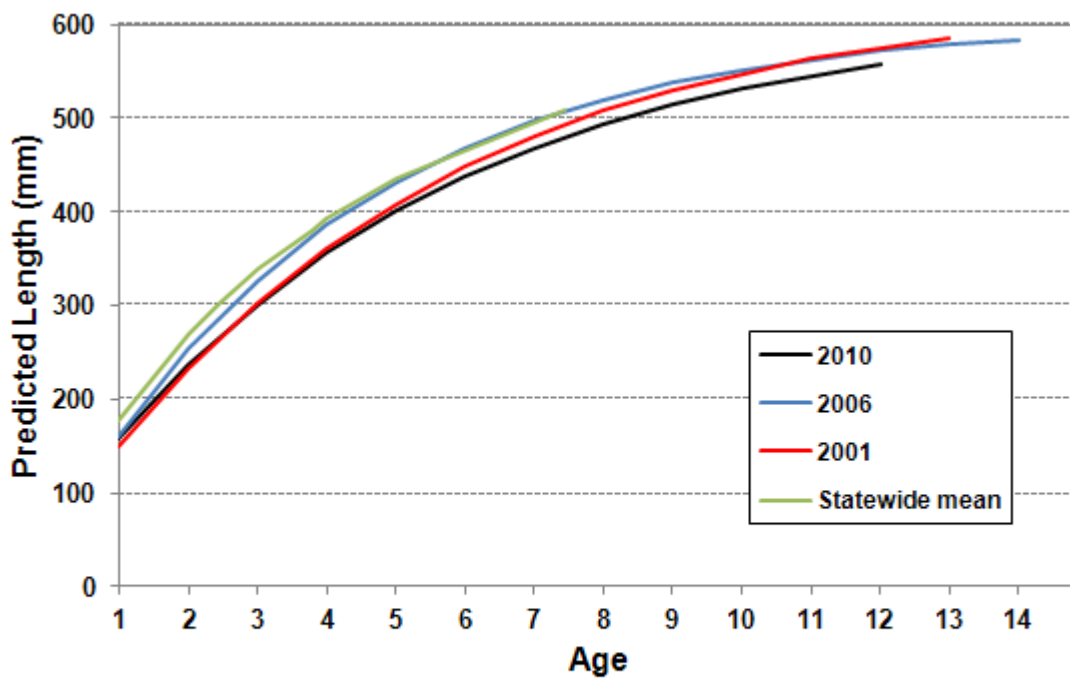


Figure 5. Predicted total length-at-age from von Bertalanffy growth equation for largemouth bass collected from Upper Bear Creek Reservoir.

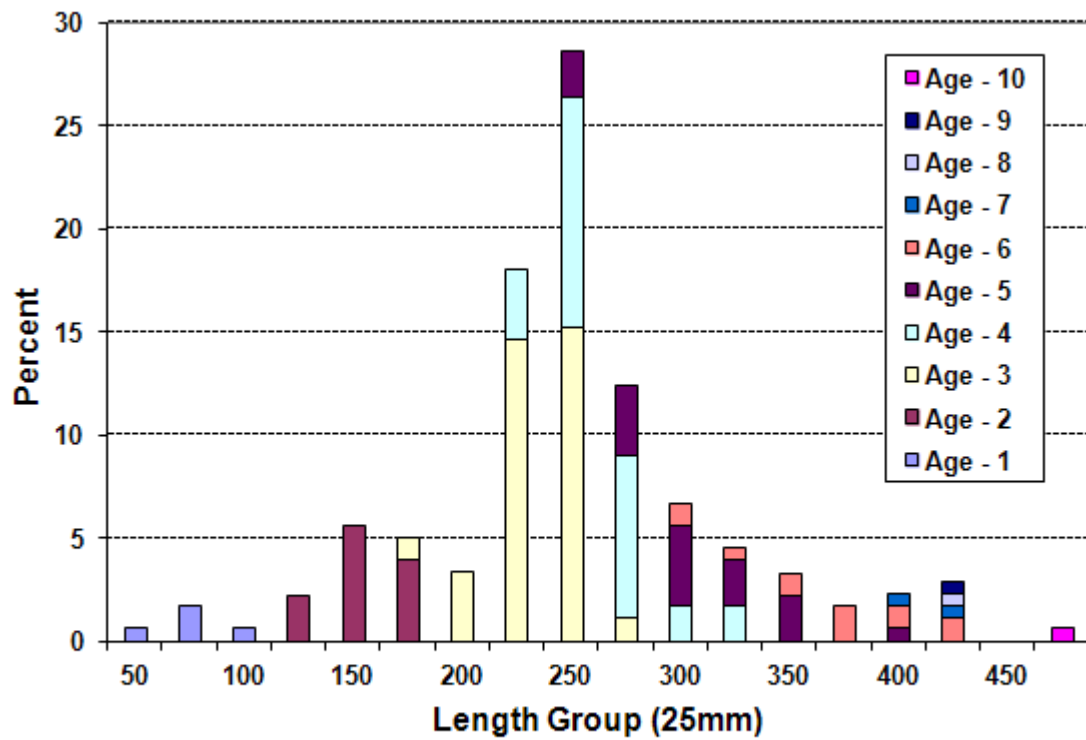


Figure 6. Length at age frequency of spotted bass (N=178) from Upper Bear Creek Reservoir, Spring 2006.

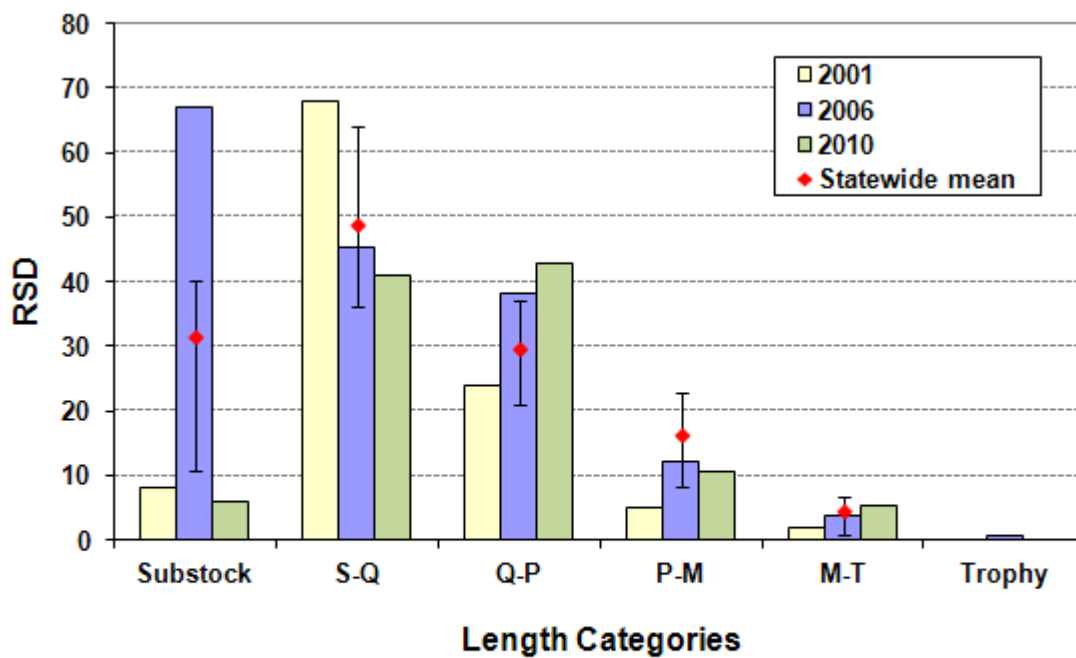
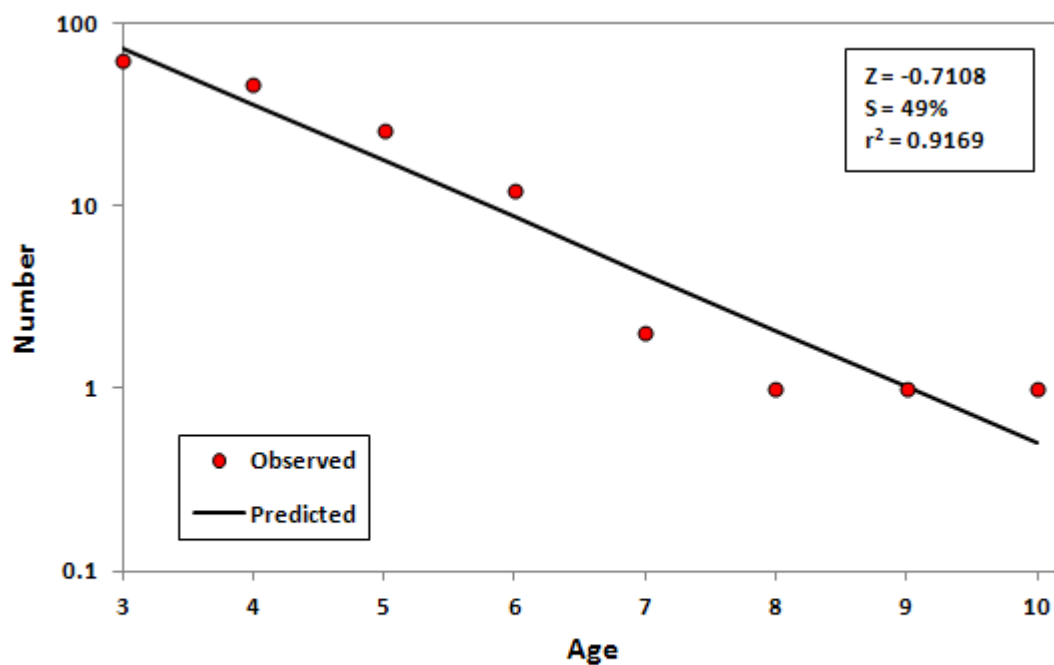
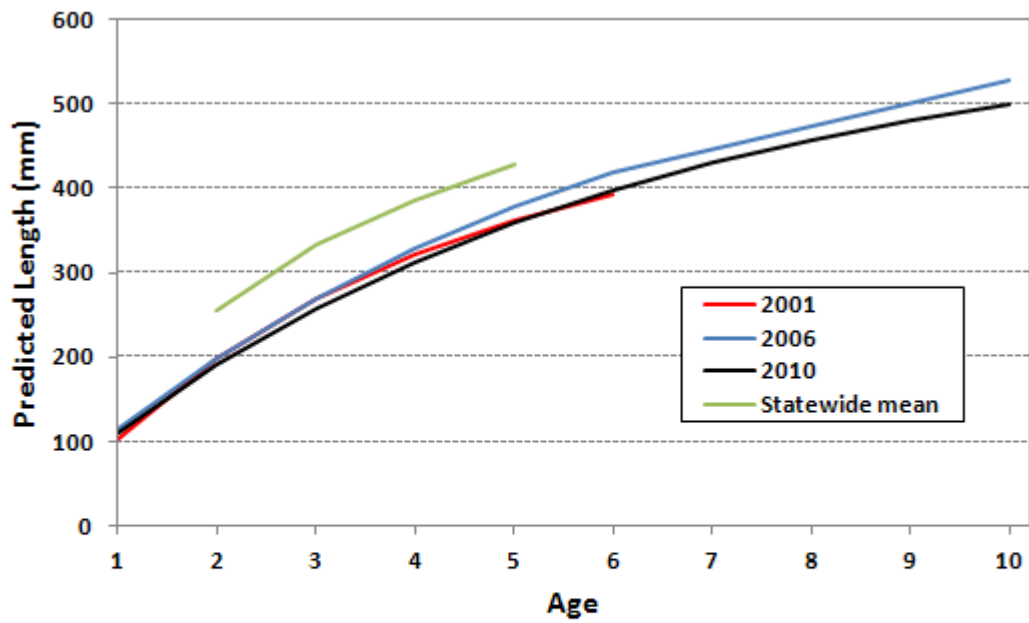


Figure 7. Relative stock density (RSD) of spotted bass in Upper Bear Creek Reservoir, spring 2001, 2006, 2010, and the statewide mean. The I-beams denote the 25th and 75th percentiles of RSD values of spotted bass, statewide.



**Figure 8. Unweighted catch curve regression and annual survival (S) for spotted bass (ages 3-10) from Upper Bear Creek Reservoir, spring 2010.**



**Figure 9. Predicted total length-at-age from von Bertalanffy growth equation for spotted bass collected from Upper Bear Creek Reservoir.**

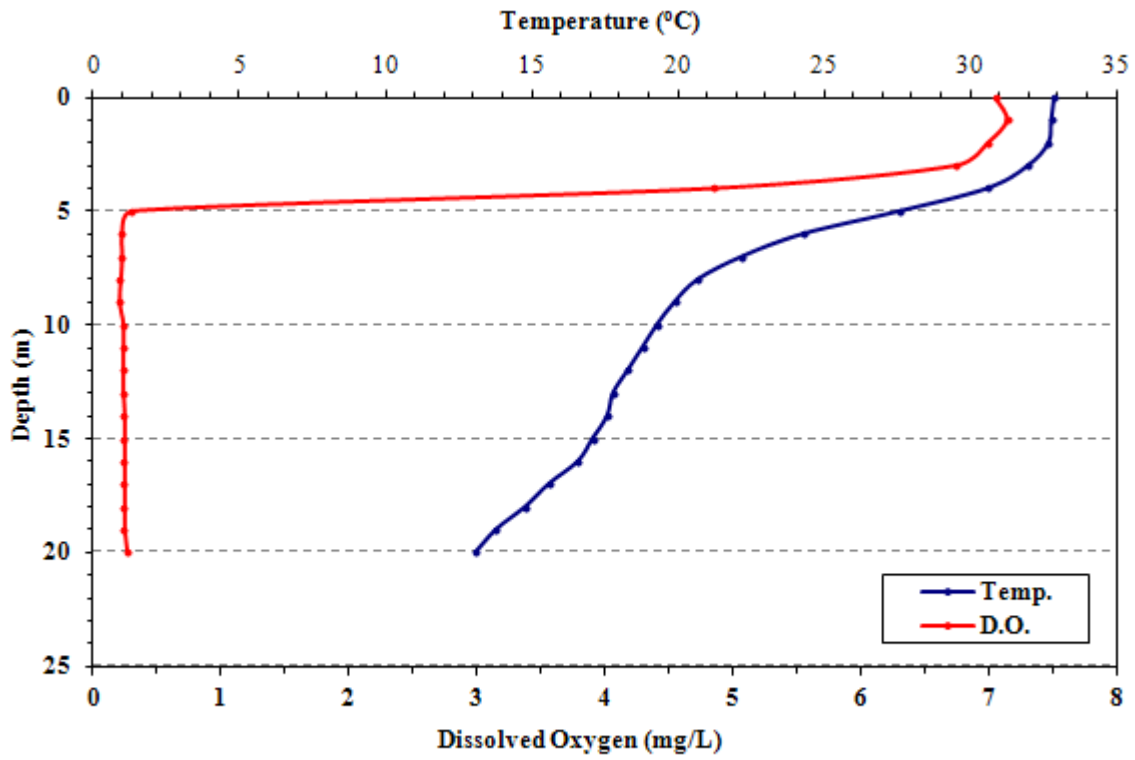


Figure 10a. Temperature and dissolved oxygen profiles at the dam forebay in Upper Bear Creek Reservoir on August 5, 2010.

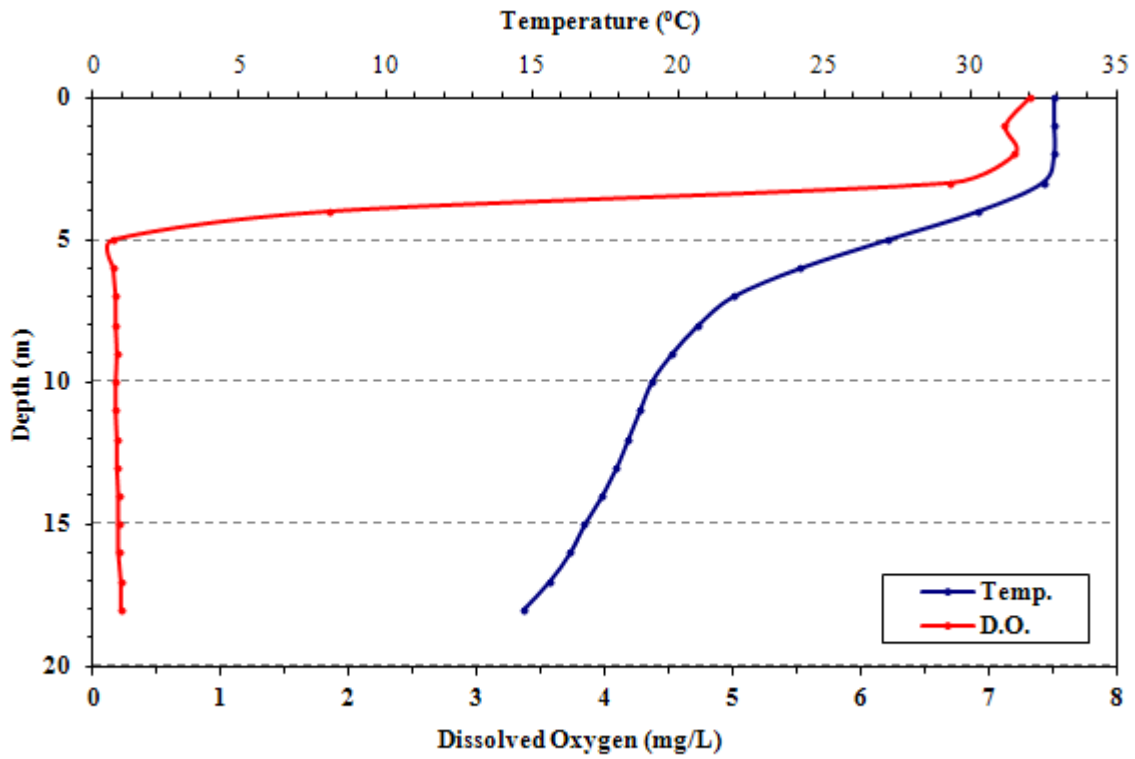


Figure 10b. Temperature and dissolved oxygen profiles at the County Road 79 bridge crossing in Upper Bear Creek Reservoir on August 5, 2010.