2017 Big Creek Reservoir Report

Rivers and Reservoirs Monitoring Program

Alabama Department of Environmental Management

Field Operations Division
Rivers & Reservoirs Unit
April 2021

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Escatawpa River Basin

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LIST OF ACRONYMS

A&I	Agricultural and Industrial Water Supply Use Classification
ADEM	Alabama Department of Environmental Management
AGPT	Algal Growth Potential Test
CHL *a*	Chlorophyll *a*
DO	Dissolved Oxygen
F&W	Fish and Wildlife
MAX	Maximum
MDL	Method Detection Limit
MIN	Minimum
MSC	Mean Standing Crop
NTU	Nephelometric Turbidity Units
OAW	Outstanding Alabama Waters
ONRW	Outstanding National Resource Water
PWS	Public Water Supply
QAPP	Quality Assurance Project Plan
RRMP	Rivers and Reservoirs Monitoring Program
S	Swimming and Other Whole Body Water-Contact Sports
SD	Standard Deviation
SOP	Standard Operating Procedures
TEMP	Temperature
TN	Total Nitrogen
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSI	Trophic State Index
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

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INTRODUCTION

Big Creek Reservoir is a 3,600 acre waterbody located in the western portion of Mobile County. The reservoir was created in 1952 to provide drinking water for people in the City of Mobile and surrounding areas.

In 2007, a consumption advisory was issued by the Alabama Department of Public Health for largemouth bass taken from Big Creek Reservoir due to mercury levels in fish tissue exceeding the EPA action level of 0.33 ppm. All waters within a consumption advisory are placed on Alabama's Clean Water Act (CWA) §303(d) list of impaired waters. In 2008, Big Creek Reservoir was listed on Alabama's §303(d) list of impaired waters for not meeting its Public Water Supply/Fish & Wildlife (PWS/F&W) water use classifications due to impairments caused by atmospheric deposition of metals (mercury).

The Alabama Department of Environmental Management (ADEM) monitored Big Creek Reservoir as part of the 2017 assessment of the Escatawpa, Mobile, and Tombigbee River basins under the Rivers and Reservoirs Monitoring Program (RRMP). ADEM began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program (now known as RRMP) was initiated by ADEM. The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM's 2017 Monitoring Strategy (ADEM 2017).

In 2010, ADEM implemented a specific water quality criterion for nutrient management at one location on Big Creek Reservoir. This criterion a growing season mean (April-October) chlorophyll *a* (chl *a*) concentration that is protective of the reservoir's designated Public Water Supply and Fish & Wildlife (PWS/F&W) use classifications (Table 1).

The purpose of this report is to summarize data collected at five stations in Big Creek Reservoir during the 2017 growing season and to evaluate trends in mean lake trophic status and nutrient concentrations using ADEM's historic dataset. Monthly and mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [chlorophyll *a*

(chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] were compared to ADEM's historical data and established criteria.

METHODS

Sample sites were determined using historical data and previous assessments (Figure 1). Specific station location information is listed in Table 1. Big Creek Reservoir was sampled in the dam forebay, mid reservoir, and upper reservoir. Two tributary embayments, Hamilton Creek and Crooked Creek, were also monitored.

Water quality sampling was conducted at monthly intervals through the growing season, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures #2000 (ADEM 2017), Surface Water Quality Assurance Project Plan (ADEM 2017), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions at each site. For mainstem stations, monthly concentrations of these parameters were graphed with the closest available USGS flow data and ADEM's previously collected data to help interpret the 2017 results.

Figure 1. Big Creek Reservoir with 2017 sampling locations.

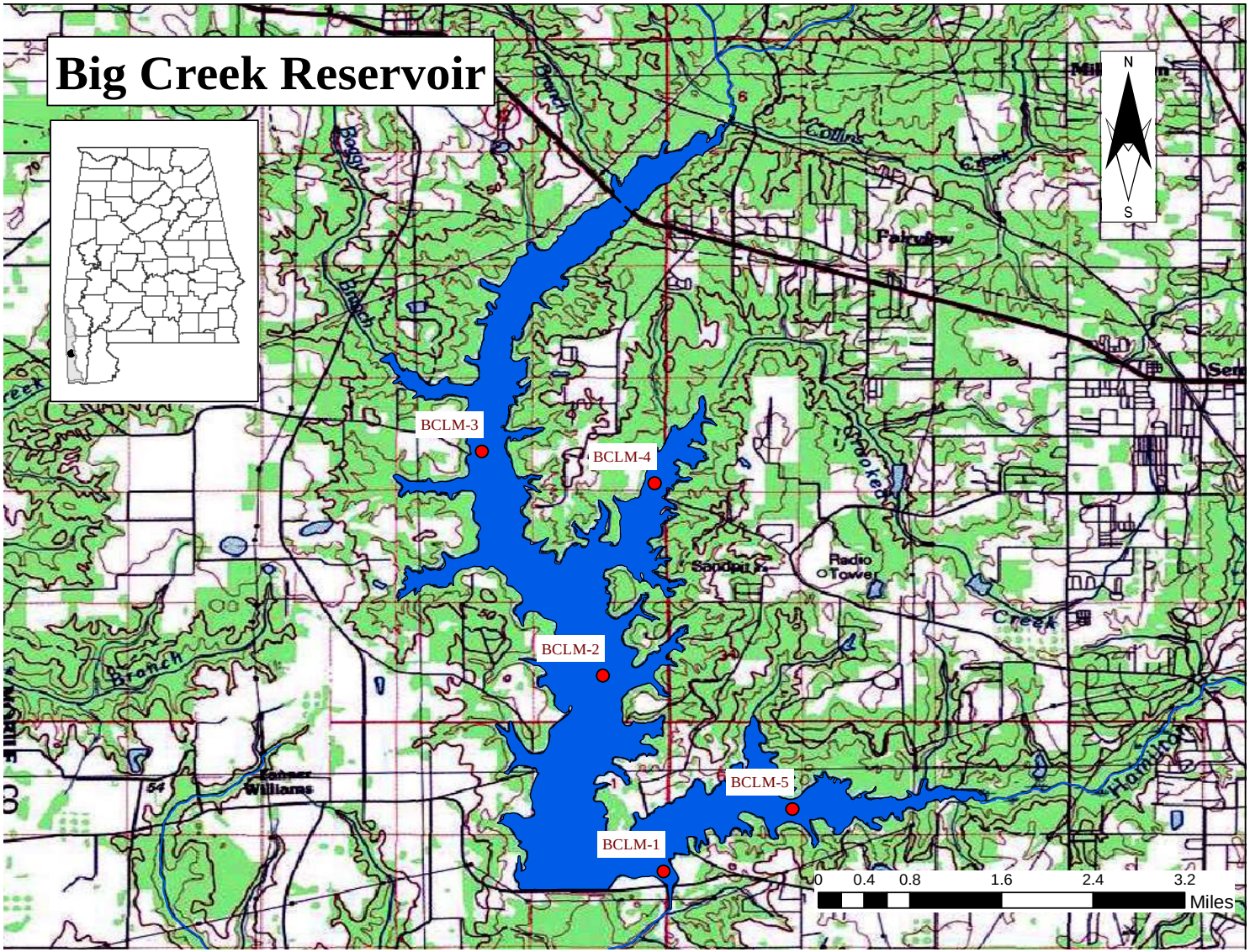


Table 1. Descriptions for the monitoring stations in Big Creek Reservoir.

HUC	County	Station Number	Report Designation	Waterbody Name	Station Description	Chl. *a* Criterion	Latitude	Longitude
Big Creek Reservoir								
031700080402	Mobile	**BCLM-1	Lower	Big Creek	Deepest point, Big Creek channel, dam forebay.	11µg/L	30.7146	-88.3275
031700080402	Mobile	BCLM-2	Mid	Big Creek	Deepest point, Big Creek channel, approximately 0.5 mile downstream of the Crooked Creek confluence.		30.7401	-88.3351
031700080402	Mobile	BCLM-3	Upper	Big Creek	Deepest point, Big Creek channel, approximately one mile downstream of US Hwy. 98.		30.7692	-88.3505
031700080402	Mobile	BCLM-4	Crooked Cr	Big Creek	Deepest point, main creek channel, Crooked Creek embayment, approximately one mile downstream of US Hwy. 98.		30.7650	-88.3286
031700080402	Mobile	BCLM-5	Hamilton Cr	Big Creek	Deepest point, main creek channel, Hamilton Creek embayment, approximately one mile upstream of confluence with Big Creek.		30.7227	-88.3112

** Growing season mean Chl a criterion implemented at this station in 2010

RESULTS

Growing season mean graphs for TN, TP, chl *a* and TSS are provided in this section (Figures 2 and 3). Monthly graphs for TN, TP, chl *a*, TSS, DO, and TSI are also provided (Figures 4-8 and 12). Mean monthly discharge is included in monthly graphs for TN, TP, chl *a*, TSS, and TSI as an indicator of flow and retention time in the months sampled. AGPT results appear in Table 2. Depth profile graphs of temperature, DO, and conductivity appear in Figures 9, 10 and 11. Summary statistics of all data collected during 2017 are presented in Appendix Table 1. The table contains the minimum, maximum, median, mean, and standard deviation of each parameter analyzed.

Stations with the highest concentrations of nutrients, chlorophyll, and TSS are noted in the paragraphs to follow. Though stations with lowest concentrations may not always be mentioned, review of the graphs included in this report will indicate these stations that may be potential candidates for reference waterbodies and watersheds.

In 2017, the highest mean growing season TN value was measured in the upper station (Figure 2). Mean TN concentrations appear to be declining overall from 2006 to 2017. Monthly TN concentrations were near or below historic means much of the growing season, with one historic high measured in June at the mid station (Figure 4).

The highest mean growing season TP values measured in 2017 were in the upper and Crooked Creek stations, though concentrations were similar throughout the reservoir (Figure 2). Mean growing season TP values appeared to decrease overall 2001-2011. Historic high monthly TP concentrations were measured in the upper station in July and October and in the mid station in July (Figure 5). One historic low was measured in April at the upper station.

A specific water quality criterion for nutrient management has been established for the lower station on Big Creek Reservoir. The mean growing season chl *a* value for the lower station was below the criteria limit in 2017 (Figure 3). The highest 2017 growing season mean chl *a* value was measured at the upper station. Mean chl *a* concentrations decreased at all stations between 2006 and 2017. Monthly chl *a* concentrations were below historic means the entire growing

season at all mainstem stations, with historic low concentrations measured in the upper and mid stations in September and in the lower station in June and September (Figure 6).

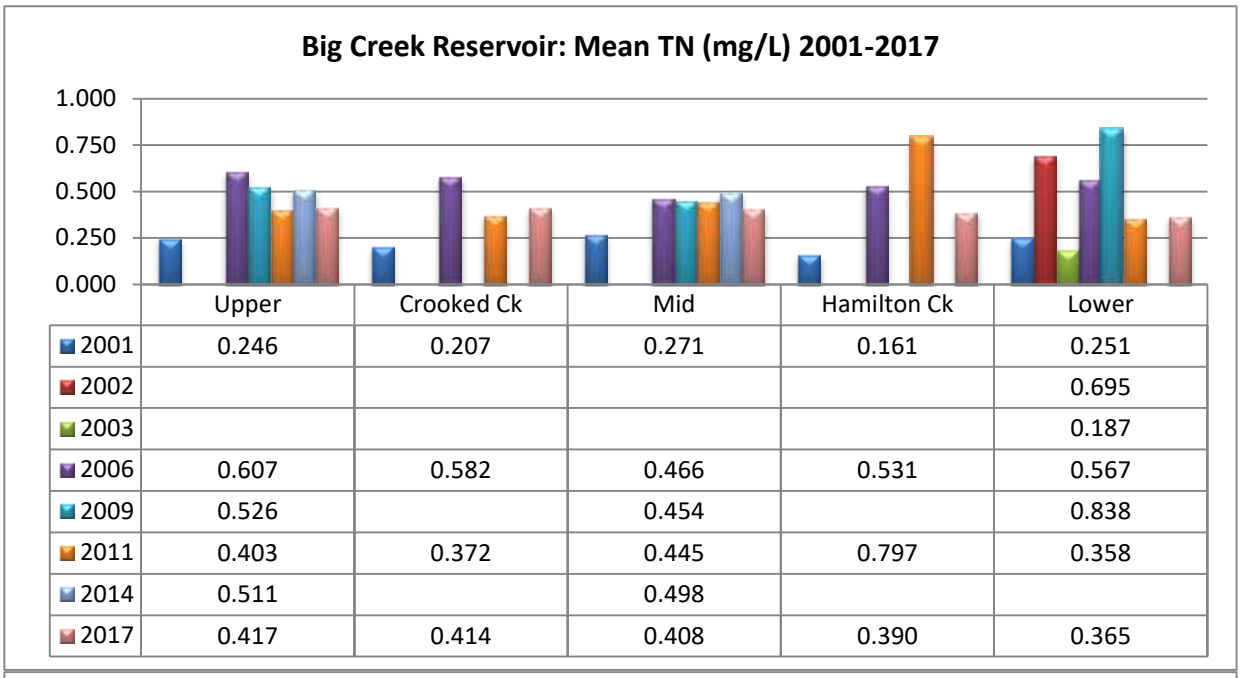
In 2017, the highest mean growing season TSS value was measured at the upper station (Figure 3). Mean TSS concentrations have generally decreased at all locations since 2006, though 2017 values in the upper and mid stations were slightly higher. Monthly TSS concentrations were at or below historical means the entire growing season in the mid and lower stations (Figure 7). Concentrations reached historic highs in July and October in the upper station. Historic lows were observed in the upper station in August and September, in the mid station in April, July, August, and October, and in the lower station in April.

With the exception of nitrogen limiting conditions measured in the upper station in August 2011, AGPT results have been co-limiting at all stations in all years monitored (Table 2). The mean standing crop (MSC) value at the upper station was below 5 mg/L in 2017, the value that Raschke et al. (1987) defined as protective of reservoir and lake systems.

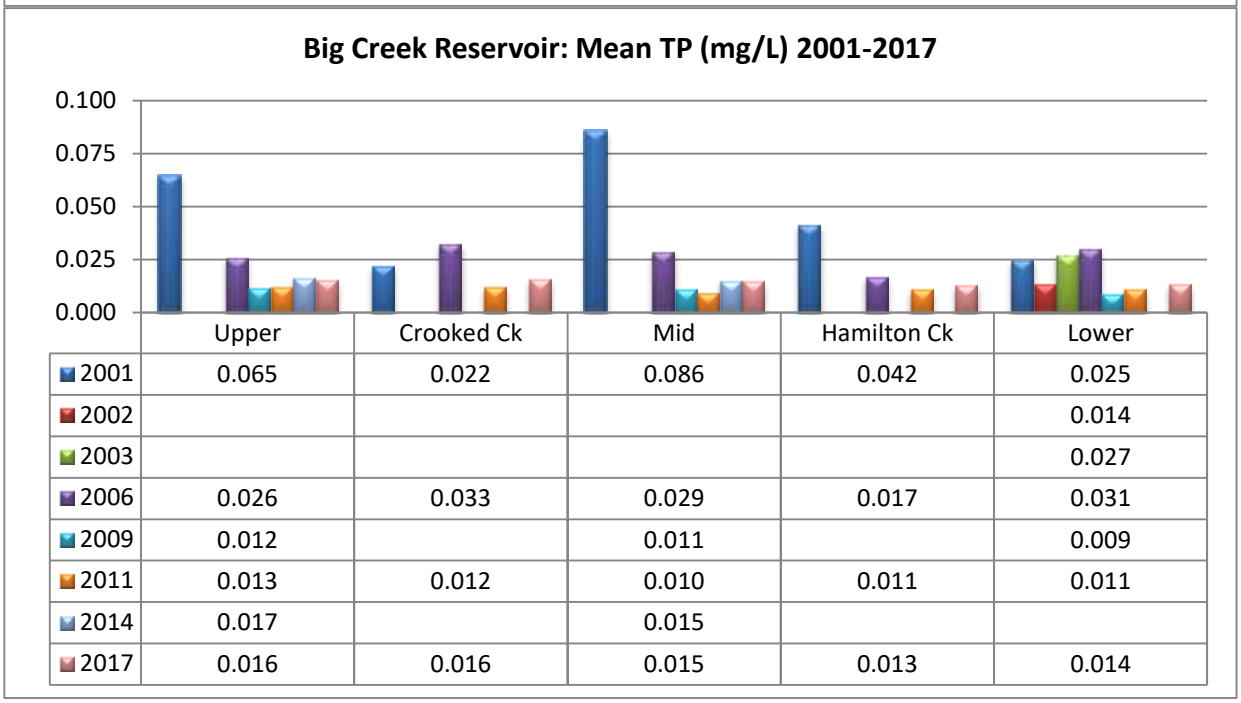
All dissolved oxygen (DO) measurements in the Big Creek Reservoir mainstem and tributary stations met the ADEM criteria (ADEM Admin. Code R. 335-6-10-.09) limit of 5.0 mg/L at 5.0 ft (1.5 m) during the 2017 growing season (Figure 8). Based on monthly DO profiles, anoxic conditions existed in July and August at depths greater than 3.0m in the lower station (Figure 9). Monthly DO profiles of the mid and upper stations indicated stratification from June-September 2017 (Figures 10 & 11). Conductivity profiles of the mid station also indicated the presence of a chemocline June-August 2017.

TSI values were calculated using monthly chl *a* concentrations and Carlson's Trophic State Index. TSI values for all mainstem stations were oligotrophic for most of the growing season (Figure 12). While the lower station was consistently oligotrophic, the upper station was mesotrophic or borderline mesotrophic in June and October, and the mid station was mesotrophic or borderline mesotrophic in August and October. TSI values in Hamilton Creek and Crooked Creek also indicated oligotrophic conditions for most of the growing season. Hamilton Creek was borderline mesotrophic in September, and Crooked Creek was mesotrophic in October.

Figure 2. Mean growing season TN and TP measured in Big Creek Reservoir, April-October, 2001-2017. Bar graphs consist of mainstem and embayment stations, illustrated from upstream to downstream as the graph is read from left to right.

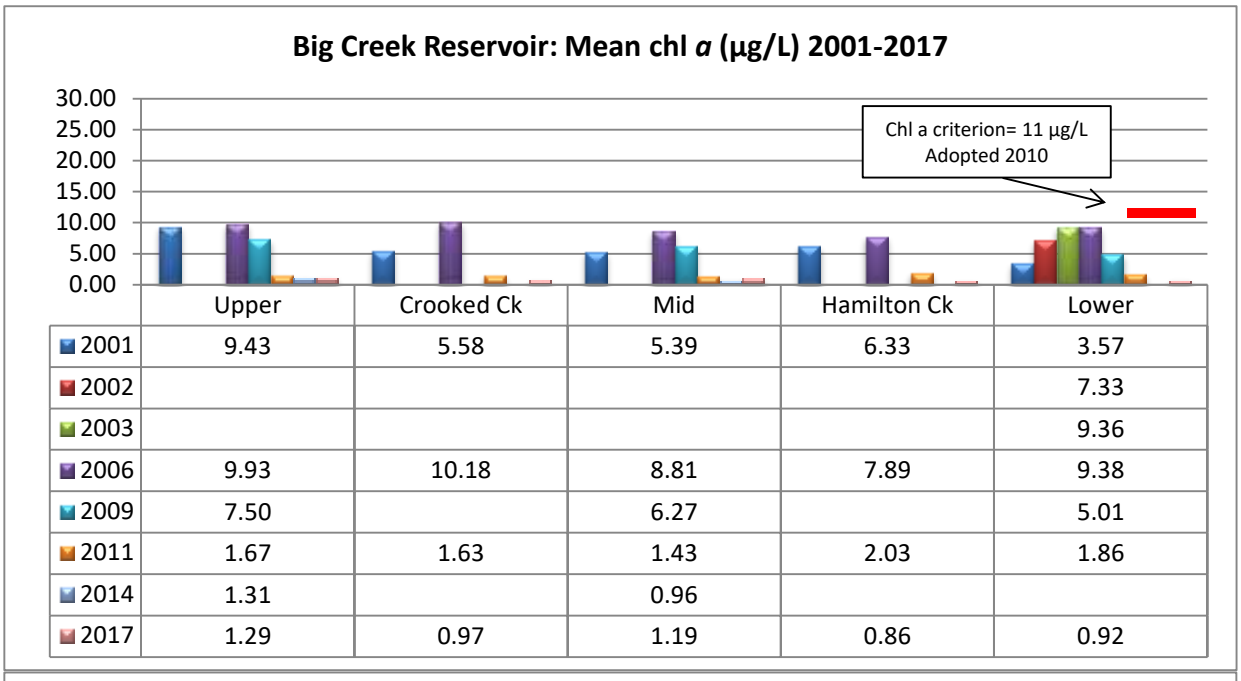


	Upper	Crooked Ck	Mid	Hamilton Ck	Lower
2001	0.246	0.207	0.271	0.161	0.251
2002					0.695
2003					0.187
2006	0.607	0.582	0.466	0.531	0.567
2009	0.526		0.454		0.838
2011	0.403	0.372	0.445	0.797	0.358
2014	0.511		0.498		
2017	0.417	0.414	0.408	0.390	0.365

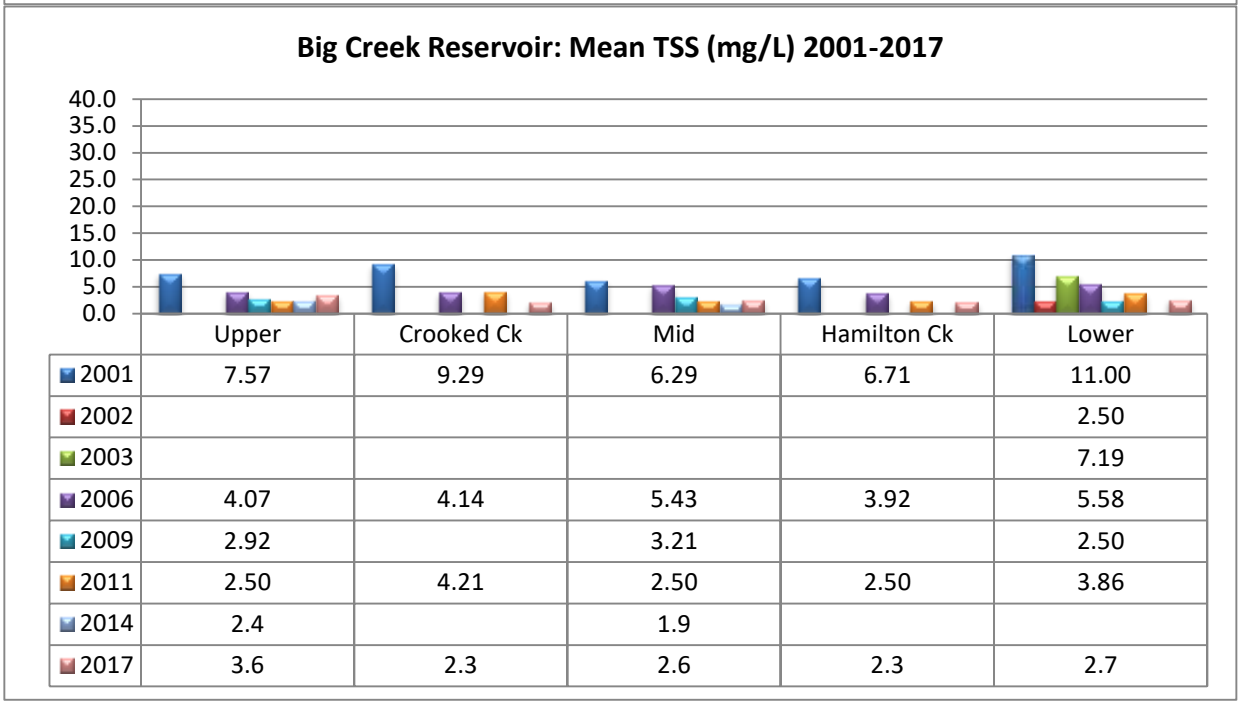


	Upper	Crooked Ck	Mid	Hamilton Ck	Lower
2001	0.065	0.022	0.086	0.042	0.025
2002					0.014
2003					0.027
2006	0.026	0.033	0.029	0.017	0.031
2009	0.012		0.011		0.009
2011	0.013	0.012	0.010	0.011	0.011
2014	0.017		0.015		
2017	0.016	0.016	0.015	0.013	0.014

Figure 3. Mean growing season chl *a* and TSS measured in Big Creek Reservoir, April-October, 2001-2017. Bar graphs consist of mainstem and embayment stations, illustrated from upstream to downstream as the graph is read from left to right.



	Upper	Crooked Ck	Mid	Hamilton Ck	Lower
2001	9.43	5.58	5.39	6.33	3.57
2002					7.33
2003					9.36
2006	9.93	10.18	8.81	7.89	9.38
2009	7.50		6.27		5.01
2011	1.67	1.63	1.43	2.03	1.86
2014	1.31		0.96		
2017	1.29	0.97	1.19	0.86	0.92



	Upper	Crooked Ck	Mid	Hamilton Ck	Lower
2001	7.57	9.29	6.29	6.71	11.00
2002					2.50
2003					7.19
2006	4.07	4.14	5.43	3.92	5.58
2009	2.92		3.21		2.50
2011	2.50	4.21	2.50	2.50	3.86
2014	2.4		1.9		
2017	3.6	2.3	2.6	2.3	2.7

Figure 4. Monthly TN of the mainstem stations in Big Creek Reservoir, April-October 2017. Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. TN was plotted vs. the closest discharge (USGS 02479945 Big Creek near Wilmer, AL).

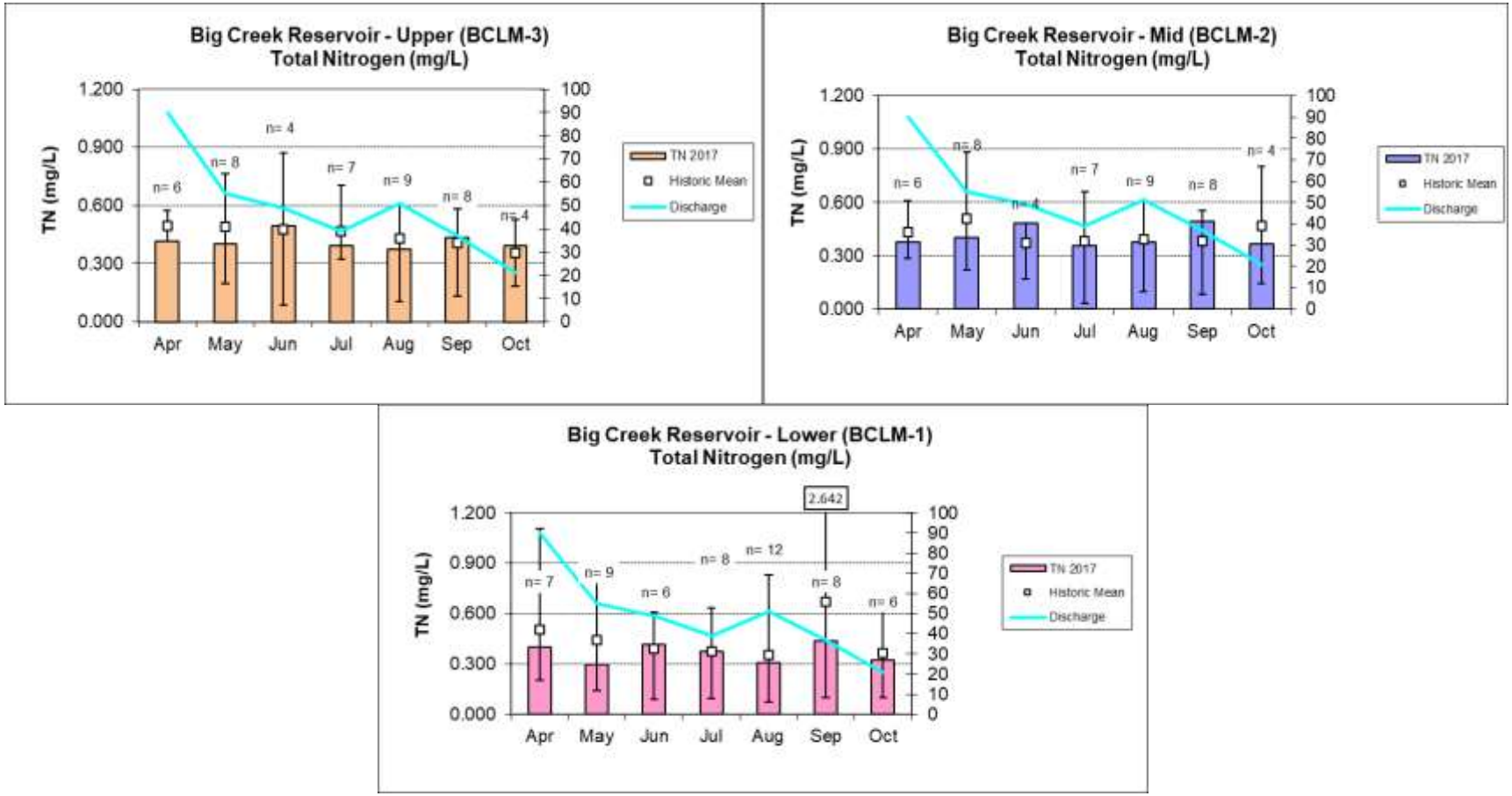


Figure 5. Monthly TP of the mainstem stations in Big Creek Reservoir, April-October 2017. Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. TP was plotted vs. the closest discharge (USGS 02479945 Big Creek near Wilmer, AL).

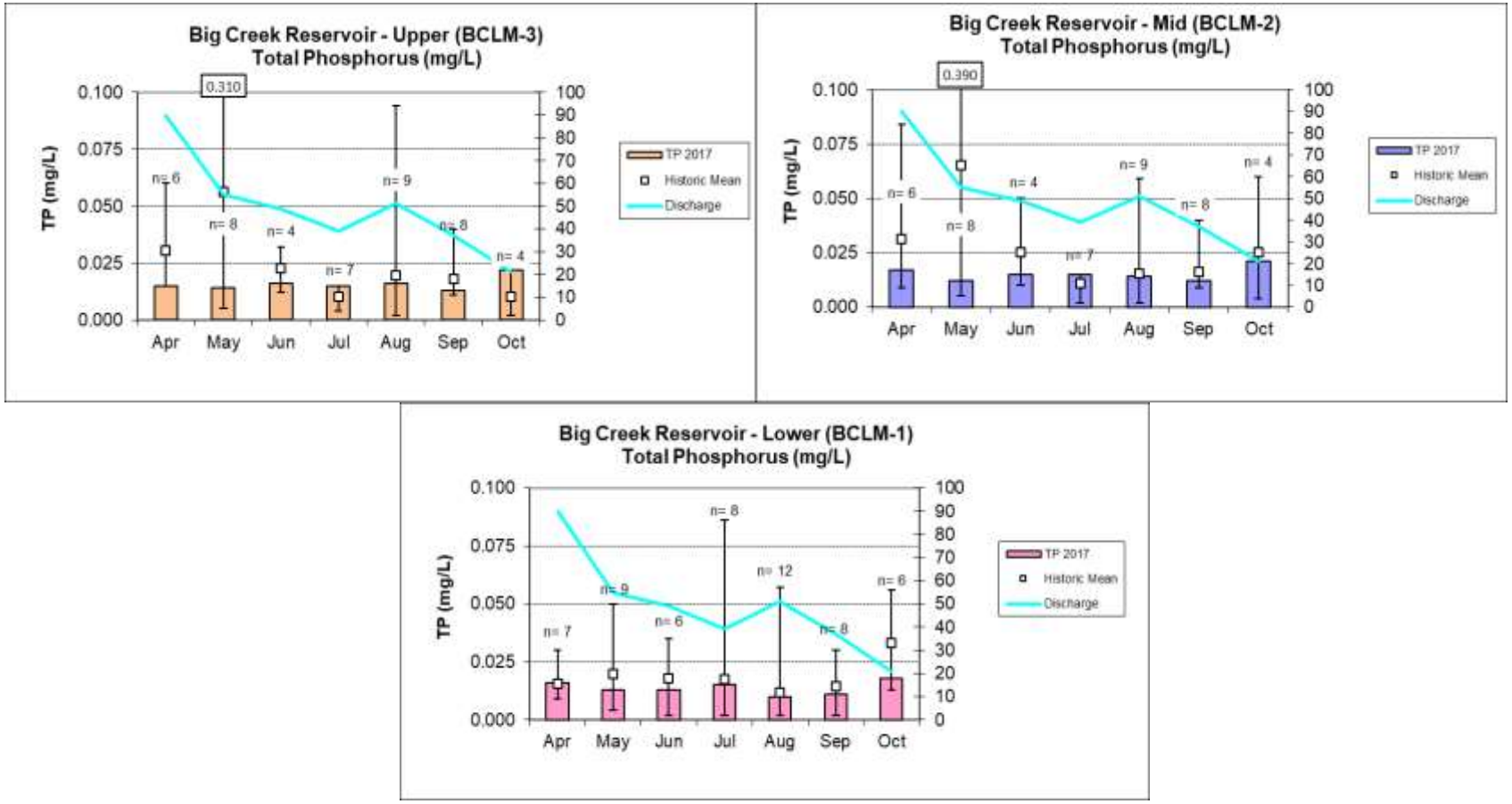


Figure 6. Monthly chl *a* of the mainstem stations in Big Creek Reservoir, April-October 2017. Each bar graph depicts monthly changes in each station**.** The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. Chl ***a*** was plotted vs. the closest discharge (USGS 02479945 Big Creek near Wilmer, AL).

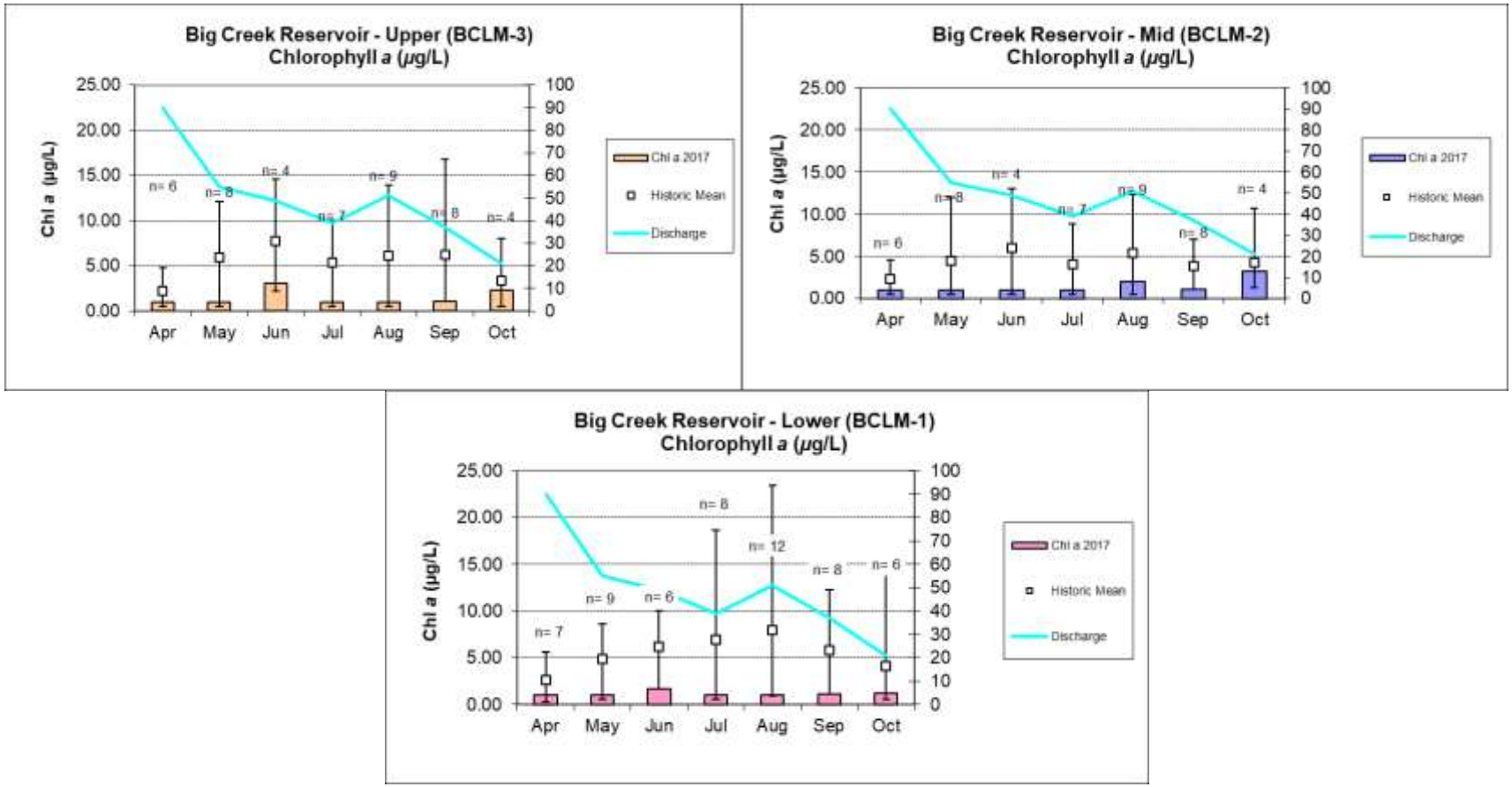


Figure 7. Monthly TSS of the mainstem stations in Big Creek Reservoir, April-October 2017**.** Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. TSS was plotted vs. the closest discharge (USGS 02479945 Big Creek near Wilmer, AL).

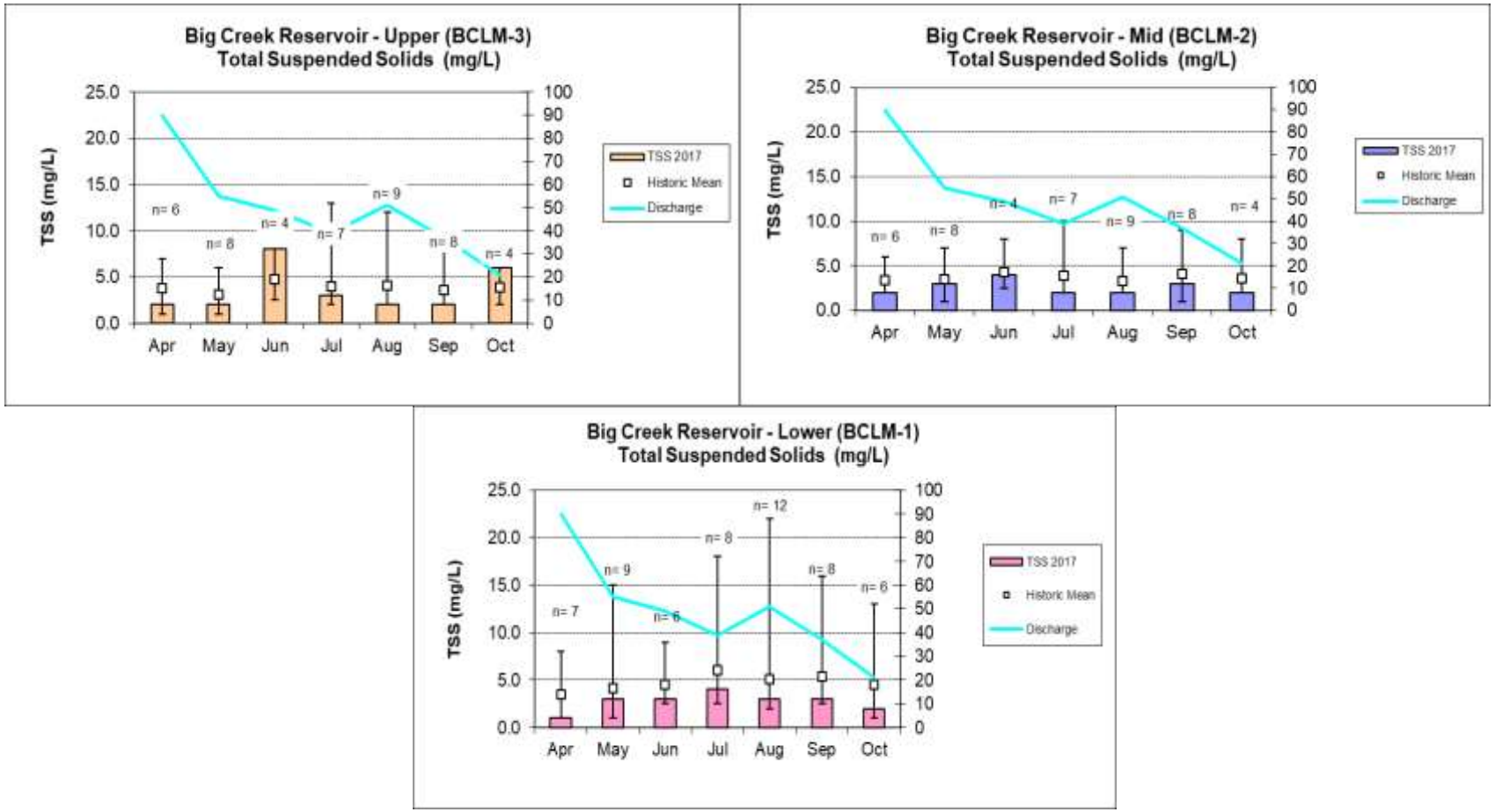


Table 2. Algal growth potential test results, Big Creek Reservoir, 2011-2017 (expressed as mean Maximum Standing Crop (MSC) dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes; values below 20 mg/L MSC are considered protective of flowing streams and rivers. (Raschke and Schultz 1987).

Station	**Upper**		**Mid**		**Lower**	
	MSC	Limiting Nutrient	MSC	Limiting Nutrient	MSC	Limiting Nutrient
August 2011	2.87	Nitrogen	2.28	Co-limiting	2.4	Co-limiting
August 2014	*	*	*	*	*	*
August 2017	3.79	Co-limiting	*	*	*	*

*No AGPT sample collected at this location.

Figure 8. Monthly DO concentrations at 1.5 m (5 ft) for Big Creek Reservoir stations collected April-October 2017. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth (ADEM 2011). In tributaries, when total depth was less than 3 m, criteria apply to the mid-depth reading.

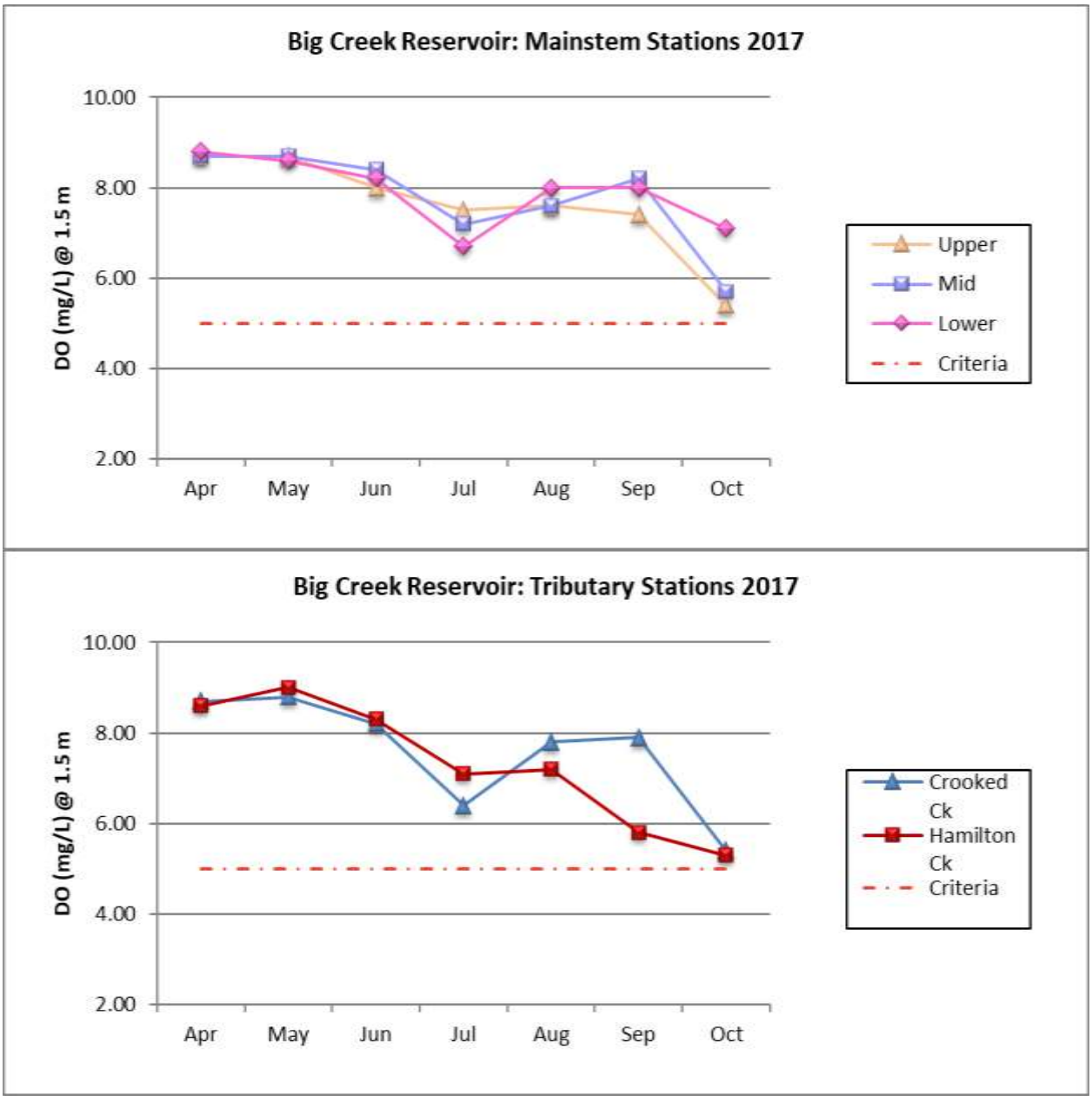


Figure 9. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in lower Big Creek Reservoir, April-October 2017.

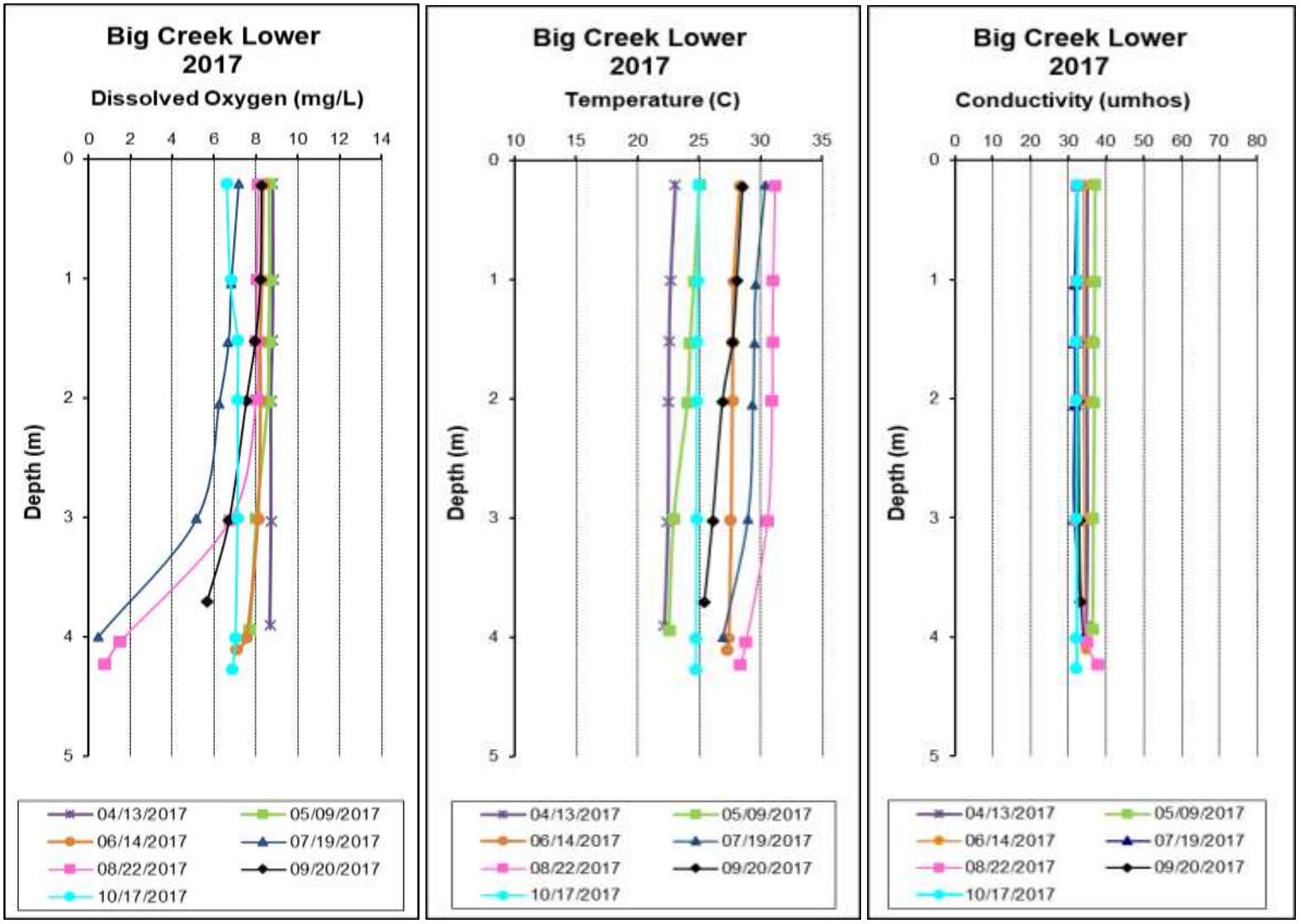


Figure 10. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in mid Big Creek Reservoir, April-October 2017.

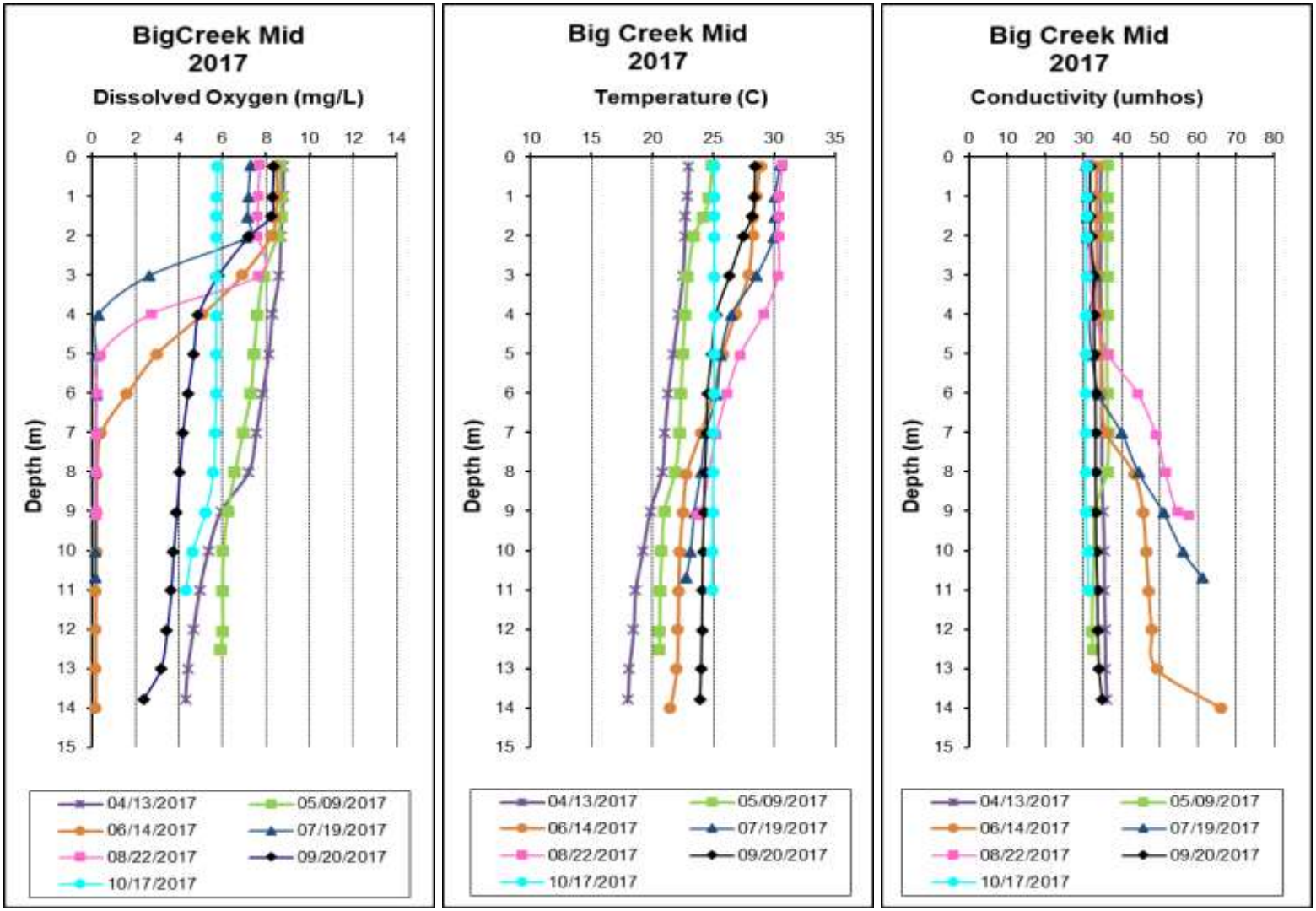


Figure 11. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in upper Big Creek Reservoir, April-October 2017.

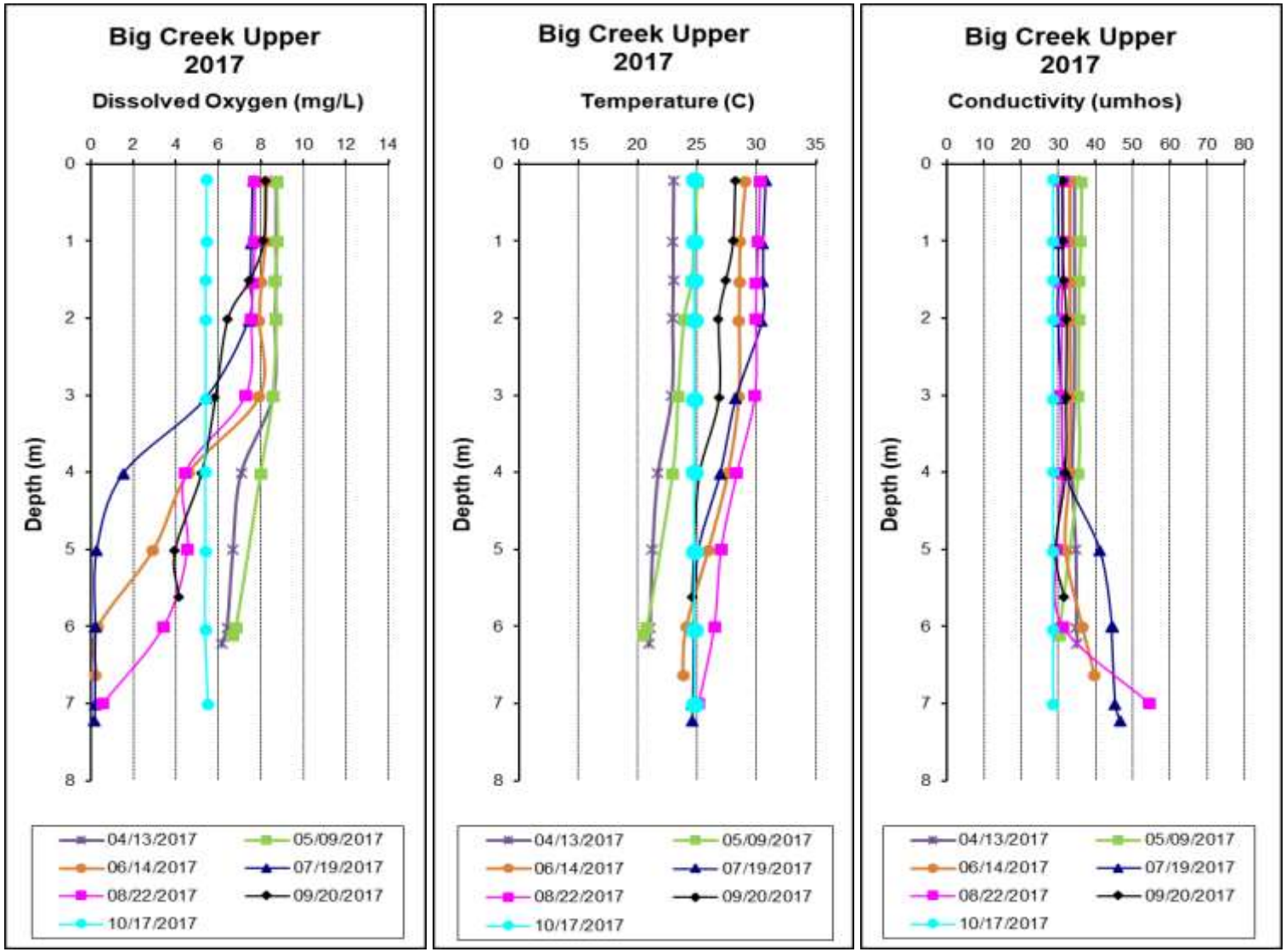
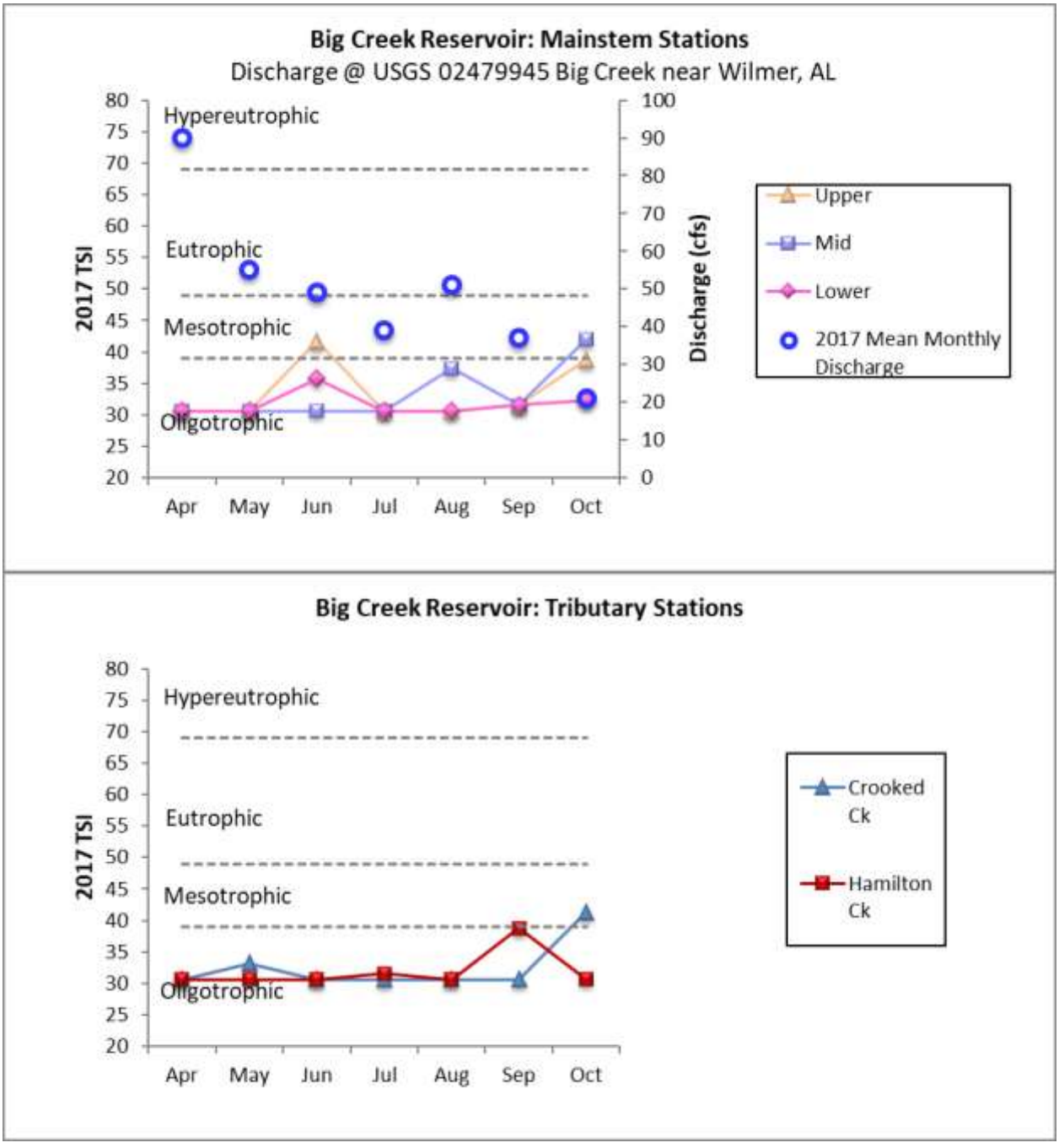


Figure 12. 2017 monthly TSI values calculated for mainstem and tributary Big Creek Reservoir stations using chl *a* concentrations and Carlson's Trophic State Index calculation. Monthly discharge acquired from USGS gage 02479945 at Big Creek near Wilmer, AL.



REFERENCES

ADEM. 2017 (as amended). Standard operating procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.

ADEM. 2013. Quality Management Plan (QMP) for the Alabama Department of Environmental Management (ADEM) Rev 4, Montgomery, AL. 58 pp.

ADEM. 2017. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama Rev 1.3. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 2/6/2017

ADEM. 2017 (draft). State of Alabama Water Quality Monitoring Strategy June 19, 2012. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 108 pp. http://www.adem.state.al.us/programs/water/wqsurvey/WQMonitoringStrategy.pdf

Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.09). 2017. Specific Water Quality Criteria. Water Quality Program. Chapter 10. Volume 1. Division 335-6.

Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.11). 2017. Water Quality Criteria Applicable to Specific Lakes. Water Quality Program. Chapter 10. Volume 1. Division 335-6.

Carlson, R.E. 1977. A trophic state index. Limnology and Oceanography. 22(2):361-369.

Raschke, R.L. and D.A. Schultz. 1987. The use of the algal growth potential test for data assessment. Journal of Water Pollution Control Federation 59(4):222-227.

APPENDIX

Appendix Table 1. Summary of water quality data collected April-October, 2017. Minimum (min) and maximum (max) values calculated using minimum detection limits when results were less than this value. Median (med), mean, and standard deviation (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Station	Parameter	N		Min	Max	Med	Mean	SD
BCLM-1	**Physical**							
	Turbidity (NTU)	7		3.1	5.5	4.6	4.3	0.1
	Total Dissolved Solids (mg/L)	7		19.0	47.0	31.0	32.7	9.0
	Total Suspended Solids (mg/L)[J]	7		1.0	4.0	3.0	2.7	1.0
	Hardness (mg/L)	4		7.4	8.2	7.8	7.8	0.3
	Alkalinity (mg/L)[J]	7	<	0.6	6.0	5.0	3.1	2.6
	Photic Zone (m)	7		3.48	4.20	3.61	3.75	0.30
	Secchi (m)	7		1.79	3.47	2.08	2.25	0.62
	Bottom Depth (m)	7		3.8	4.3	4.1	4.1	0.2
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.013	0.052	0.006	0.017	0.017
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.010	0.120	0.005	0.032	0.048
	Total Kjeldahl Nitrogen (mg/L)	7		0.220	0.430	0.320	0.333	0.075
	Total Nitrogen (mg/L)[J]	7	<	0.299	0.435	0.375	0.365	0.055
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.003	0.007	0.004	0.004	0.002
	Total Phosphorus (mg/L)	7		0.010	0.018	0.013	0.014	0.003
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)[J]	7		3.7	5.0	3.9	4.1	0.5
	Biological							
	Chlorophyll a (mg/m³)	7	<	0.94	1.70	0.94	0.92	0.46
	E. coli (MPN/DL)[J]	4		1	3	2	2	0
BCLM-2	**Physical**							
	Turbidity (NTU)	7		3.3	6.7	4.6	4.6	1.2
	Total Dissolved Solids (mg/L)	7		20.0	48.0	31.0	31.1	9.7
	Total Suspended Solids (mg/L)[J]	7		2.0	4.0	2.0	2.6	0.8
	Hardness (mg/L)	4		7.1	88.2	7.8	27.7	40.3
	Alkalinity (mg/L)[J]	7	<	0.6	6.0	5.0	4.5	1.9
	Photic Zone (m)	7		2.55	6.79	3.90	4.25	1.51
	Secchi (m)	7		1.46	4.09	1.96	2.22	0.89
	Bottom Depth (m)	7		9.2	14.1	12.6	12.2	1.9
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.013	0.043	0.006	0.014	0.014
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.010	0.125	0.005	0.032	0.048
	Total Kjeldahl Nitrogen (mg/L)	7		0.250	0.490	0.360	0.376	0.084
	Total Nitrogen (mg/L)[J]	7	<	0.355	0.495	0.375	0.408	0.058
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.003	0.005	0.003	0.003	0.001
	Total Phosphorus (mg/L)	7		0.012	0.021	0.015	0.015	0.003
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)[J]	7		3.6	4.6	3.9	3.9	0.3
	Biological							
	Chlorophyll a (mg/m³)	7	<	1.00	3.20	0.50	1.19	1.05
	E. coli (MPN/DL)[J]	4	<	1	1	1	1	0

Station	Parameter	N		Min	Max	Med	Mean	SD
BCLM-3	**Physical**							
	Turbidity (NTU)	7		2.6	6.1	4.3	4.4	1.3
	Total Dissolved Solids (mg/L)	7		24.0	47.0	34.0	34.3	8.2
	Total Suspended Solids (mg/L)[J]	7		2.0	8.0	2.0	3.6	2.4
	Hardness (mg/L)	4		6.9	7.8	7.5	7.4	0.4
	Alkalinity (mg/L)[J]	7	<	0.6	5.0	5.0	3.5	2.2
	Photic Zone (m)	7		2.26	4.85	3.50	3.60	0.83
	Secchi (m)	7		1.35	3.45	1.70	2.02	0.71
	Bottom Depth (m)	7		5.7	7.3	6.7	6.6	0.6
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.013	0.040	0.006	0.015	0.015
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.010	0.107	0.005	0.027	0.040
	Total Kjeldahl Nitrogen (mg/L)	7		0.310	0.490	0.390	0.390	0.058
	Total Nitrogen (mg/L)[J]	7	<	0.375	0.495	0.404	0.417	0.039
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.003	0.006	0.004	0.004	0.001
	Total Phosphorus (mg/L)	7		0.013	0.022	0.015	0.016	0.003
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)[J]	7		3.4	4.7	4.0	4.0	0.4
	Biological							
	Chlorophyll a (mg/m^3)	7	<	1.00	3.10	1.00	1.29	1.02
	E. coli (MPN/DL)[J]	4		2	7	5	5	2
BCLM-4	**Physical**							
	Turbidity (NTU)	7		1.6	5.9	2.5	3.2	1.5
	Total Dissolved Solids (mg/L)	7		23.0	49.0	29.0	32.4	9.8
	Total Suspended Solids (mg/L)[J]	7		1.0	4.0	2.0	2.3	1.1
	Hardness (mg/L)	4		8.1	8.9	8.6	8.5	0.4
	Alkalinity (mg/L)[J]	7	<	0.6	7.0	6.0	5.2	2.2
	Photic Zone (m)	7		2.20	3.80	3.50	3.24	0.58
	Secchi (m)	7		1.25	3.60	1.73	1.93	0.77
	Bottom Depth (m)	7		3.5	4.1	3.8	3.7	0.2
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.013	0.044	0.006	0.014	0.014
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.010	0.101	0.005	0.022	0.036
	Total Kjeldahl Nitrogen (mg/L)	7		0.350	0.430	0.390	0.391	0.030
	Total Nitrogen (mg/L)[J]	7	<	0.365	0.451	0.425	0.414	0.032
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.003	0.006	0.004	0.004	0.002
	Total Phosphorus (mg/L)	7	<	0.004	0.023	0.017	0.016	0.007
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)[J]	7		3.8	4.6	4.1	4.1	0.4
	Biological							
	Chlorophyll a (mg/m^3)	7	<	1.00	3.00	0.50	0.97	0.94
	E. coli (MPN/DL)[J]	4		1	23	8	10	10

Station	Parameter	N		Min	Max	Med	Mean	SD
BCLM-5	**Physical**							
	Turbidity (NTU)	7		3.7	5.5	4.5	4.5	0.7
	Total Dissolved Solids (mg/L)	8	<	1.0	59.0	31.5	31.3	16.0
	Total Suspended Solids (mg/L)[J]	8	<	1.0	6.0	2.0	2.3	1.7
	Hardness (mg/L)	5	<	0.4	8.6	7.6	6.4	3.5
	Alkalinity (mg/L)[J]	8	<	0.6	6.0	5.5	4.3	2.5
	Photic Zone (m)	7		2.75	5.20	3.90	3.92	0.97
	Secchi (m)	7		1.65	3.58	1.93	2.22	0.65
	Bottom Depth (m)	7		4.9	7.0	5.2	5.5	0.7
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	8	<	0.013	0.080	0.006	0.016	0.026
	Nitrate+Nitrite Nitrogen (mg/L)[J]	8	<	0.010	0.122	0.005	0.028	0.045
	Total Kjeldahl Nitrogen (mg/L)	8		0.150	0.570	0.360	0.361	0.120
	Total Nitrogen (mg/L)[J]	8	<	0.155	0.575	0.405	0.390	0.117
	Dis Reactive Phosphorus (mg/L)[J]	8	<	0.003	0.005	0.004	0.003	0.001
	Total Phosphorus (mg/L)[J]	8		0.007	0.019	0.013	0.013	0.004
	CBOD-5 (mg/L)[J]	8	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)[J]	8		0.4	4.8	4.0	3.6	1.4
	Biological							
	Chlorophyll a (mg/m³)	8	<	1.00	2.30	0.50	0.86	0.63
	E. coli (MPN/DL)[J]	4	<	1	5	2	2	2

J=one or more of the values provided are estimated; < = Actual value is less than the detection limit