2017 & 2021 Holt Reservoir Report

Rivers and Reservoirs Monitoring Program

Alabama Department of Environmental Management

Field Operations Division
Rivers and Reservoirs Unit
August 2025

Rivers and Reservoirs Monitoring Program

2021

Holt Reservoir

Black Warrior River Basin

Alabama Department of Environmental Management
Field Operations Division
Rivers and Reservoirs Unit

August 2025

Table of Contents

LIST OF ACRONYMS

A&I	Agricultural and Industrial Water Supply
ADEM	Alabama Department of Environmental Management
AGPT	Algal Growth Potential Test
APCO	Alabama Power Company
BW	Black Warrior
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
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Opened in 1966 by the US Army Corps of Engineers (USACOE), Holt Lock and Dam was constructed on the Black Warrior River in Tuscaloosa County, Alabama. Holt Reservoir encompasses 3,200 surface acres and extends 19 river miles between Bankhead Dam and William Bacon Oliver Lock and Dam. Additionally, the Alabama Power Company owns and operates a hydroelectric generating facility capable of producing 40,000 kilowatts at Holt Lock and Dam.

The Alabama Department of Environmental Management (ADEM) monitored Holt Reservoir as part of the 2017 and 2021 assessments of the Black Warrior River (BWC) basin 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, to 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).

A specific water quality criterion for nutrient management was implemented in 2004 at the dam forebay, or lower end, sampling location (HOLT-1) on Holt Reservoir. This criterion represents a growing season mean (April-October) chlorophyll *a* (chl *a*) concentration that is protective of Holt Reservoir's Swimming/Fish & Wildlife (S/F&W) use classifications.

The purpose of this report is to summarize data collected at three stations in Holt Reservoir during the 2017 and 2021 growing seasons and to evaluate growing season 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 [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

Sampling stations were selected using historical data and previous assessments (Figure 1). Specific location information can be found in Table 1. Holt Reservoir was sampled in the dam forebay, mid reservoir, and upper reservoir.

Water quality sampling was conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2021), Surface Water Quality Assurance Project Plan (ADEM 2023) and Quality Management Plan (ADEM 2018).

Mean growing season TN, TP, chl *a,* and TSS were calculated to evaluate water quality conditions at each site. Monthly concentrations of these parameters were graphed with the closest available flow data and ADEM's previously collected data to help interpret the 2017 and 2021 results.

Figure 1. Holt Reservoir with 2017 and 2021 sampling locations. A description of each sampling location is provided in Table 1.

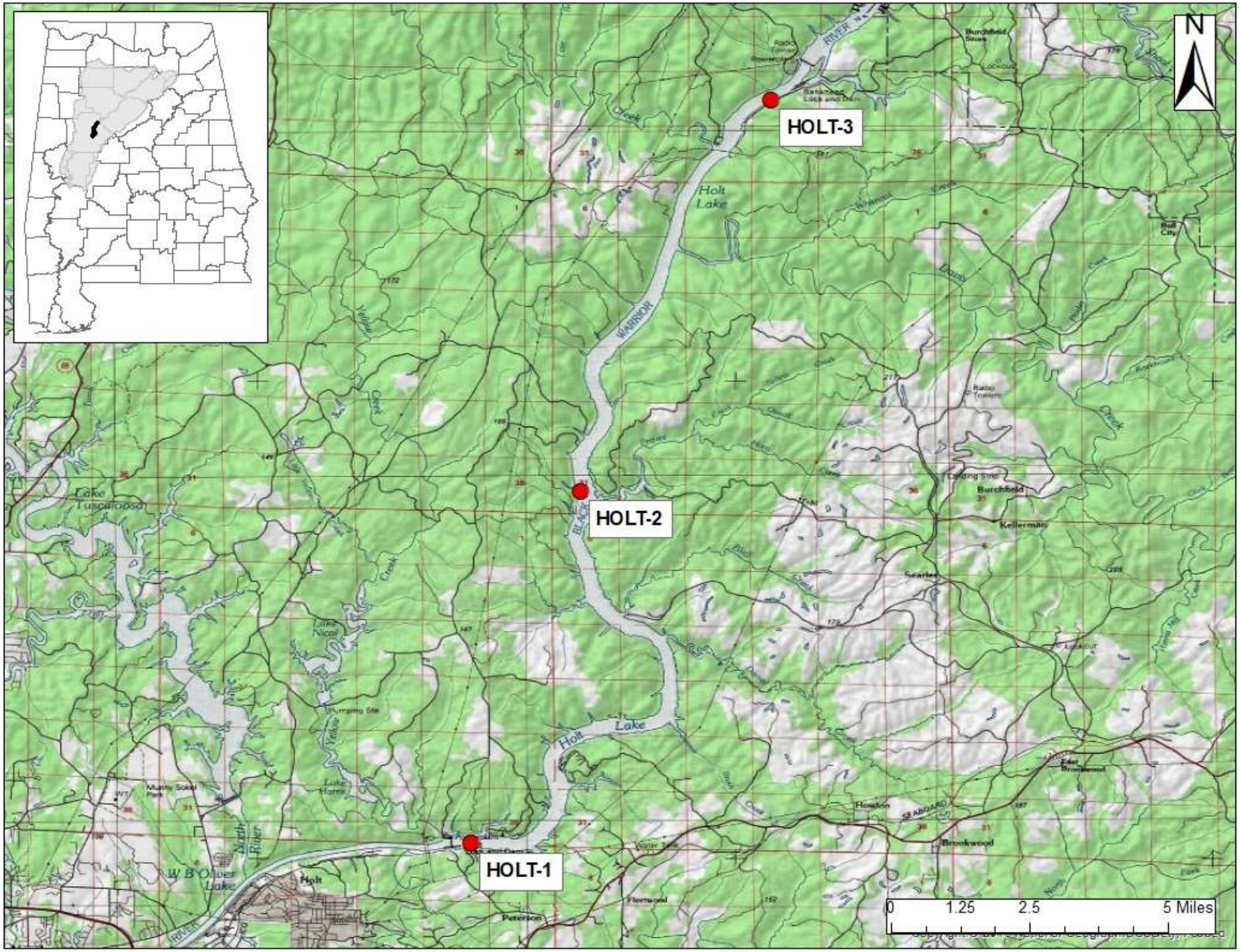


Table 1. Descriptions of the 2017 and 2021 monitoring stations in Holt Reservoir.

HUC	County	Station Number	Report Designation	Waterbody Name	Station Description	Chl *a* Criterion	Latitude	Longitude
Holt Reservoir								
031601120505	Tuscaloosa	HOLT-1*	Lower	Black Warrior R	Forebay area, downstream of Deerlick Ck public access area	16 µg/L	33.25418	-87.44429
031601120306	Tuscaloosa	HOLT-2	Mid	Black Warrior R	Deepest point, main river channel, immediately upstream of Pegues Creek-Black Warrior R confluence		33.34641	-87.41554
031601120306	Tuscaloosa	HOLT-3	Upper	Black Warrior R	Deepest point, main creek channel, approximately 0.5 miles downstream of Big Indian Creek-Black Warrior R confluence		33.44900	-87.36570

*Growing season mean chl *a* criteria implemented at this station in 2004.

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, dissolved oxygen (DO), and TSI are also provided (Figures 4-8 and 13). 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 9-12. Summary statistics of all data collected during 2017 and 2021 are presented in Appendix Table 1 and Appendix Table 2, respectively. The tables contain the minimum, maximum, median, mean, and standard deviation of each parameter analyzed.

Stations with the highest concentrations of nutrients, chl *a,* and TSS are noted in the paragraphs to follow. Though stations with the 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 calculated among Holt Reservoir stations was at the Upper station (Figure 2) while the lowest value was at the Lower station. Mean growing season TN values were similar at all three Holt stations in 2021. Mean TN concentrations measured in 2017 were the highest observed at all three stations since monitoring began. However, values decreased at all stations in 2021. Monthly TN graphs are available in Figure 4.

In 2017, mean growing season TP values among Holt Reservoir stations were similar (Figure 2). In 2021, the highest calculated mean TP value was at the Mid station. At all three Holt Reservoir stations, mean growing season TP concentrations have remained stable since 2007 except for the Mid station in 2021, which showed a slight increase. Monthly TP graphs are available in Figure 5.

The growing season mean chl *a* concentration at the Lower Holt Reservoir station exceeded the established nutrient criterion in 2017 (Figure 3). That growing season, all three stations recorded the highest mean chl *a* value observed since monitoring began. In 2021, all mean chl *a* concentrations were lower than those for the previous sampling year. The Lower station had the

highest mean value, but it was below the nutrient criterion. Monthly chl *a* graphs are available in Figure 6.

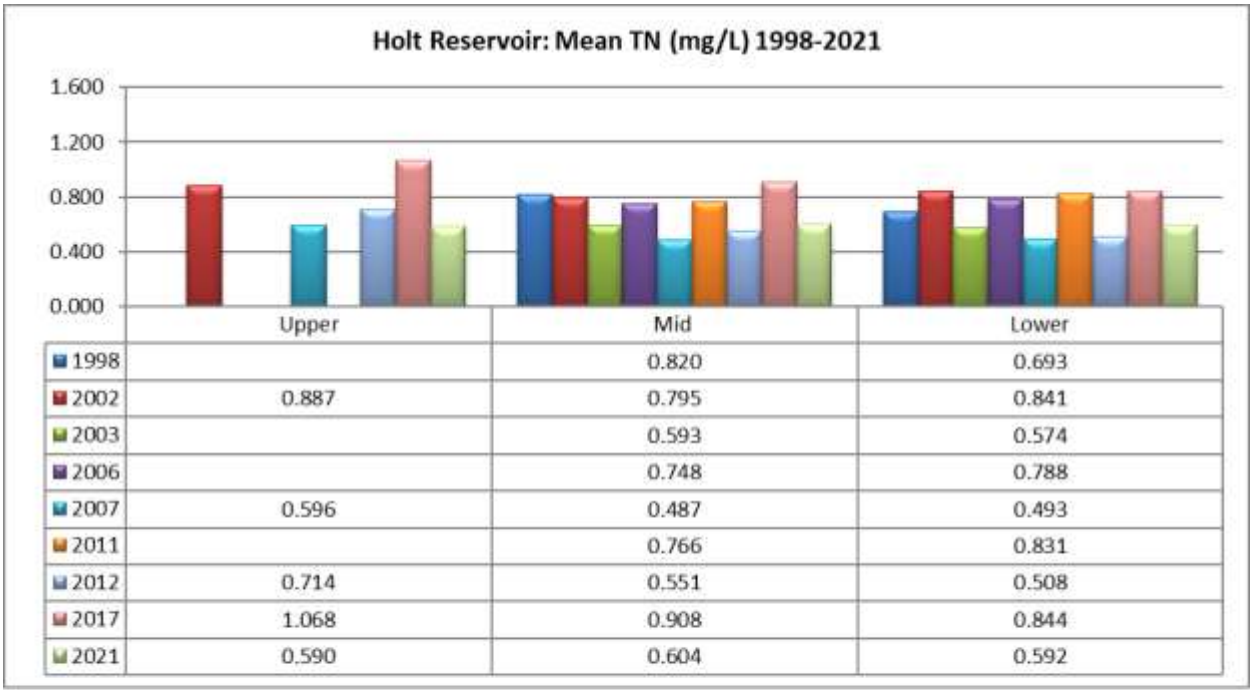
Mean TSS concentrations were similar among all three Holt Reservoir stations in 2017 (Figure 3). The highest mean TSS concentration was calculated for the Upper station in 2021. Mean TSS values at all stations declined steadily from 2003 to 2012 but increased 2012 to 2021. Monthly TSS graphs are available in (Figure 7).

AGPT results for the Mid station indicated phosphorus-limited conditions in 2017 (Table 2). While mean standing crop (MSC) at the Mid station was above 5.0 mg/L, the value that Raschke and Shultz (1987) defined as protective of reservoir and lake systems, it was below 20 mg/L, the value considered protective of flowing streams and rivers. While MSC values at all Holt Reservoir stations were less than 5 mg/L prior to 2012, all values since 2012 have been greater than 5 mg/L. No AGPT samples were collected in 2021.

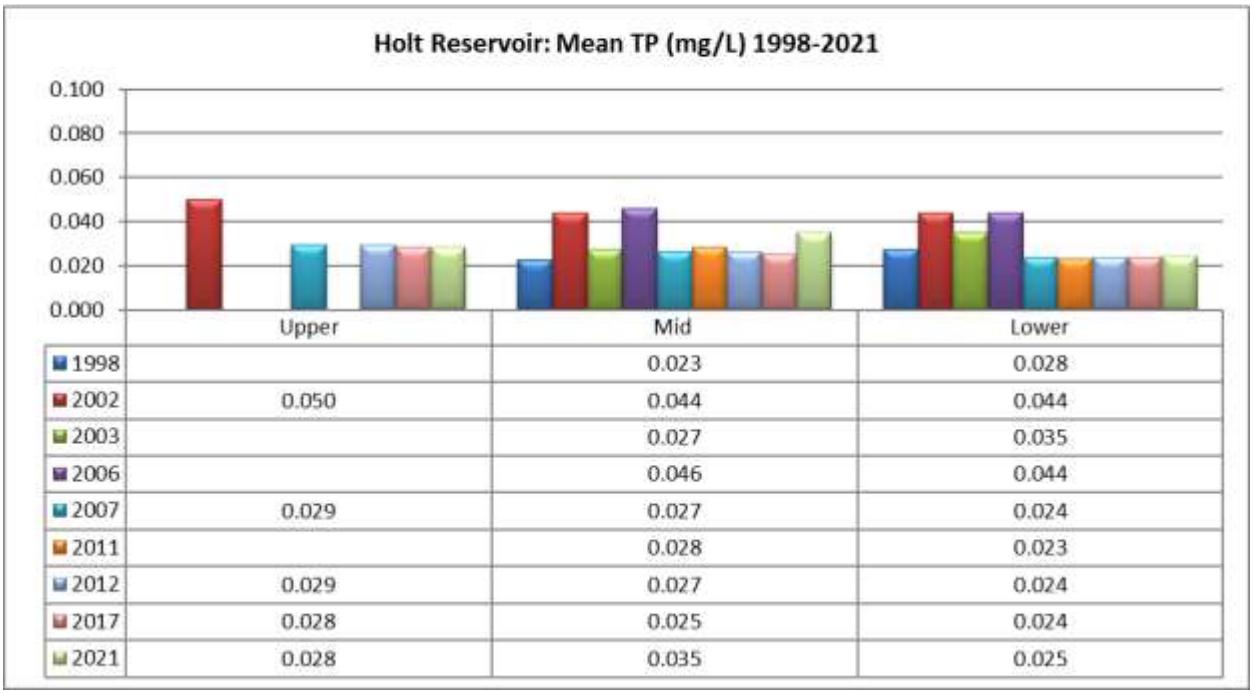
Dissolved oxygen concentrations at all Holt Reservoir stations were above the ADEM criteria limit of 5.0 mg/L at 5 ft (1.5m) throughout the April-October growing season in both 2017 and 2021 (ADEM Admin. Code R. 335-6-10-.09) (Figure 8). Based on monthly profile data, the Upper station was well-mixed April-October in both 2017 and 2021, while the Lower station was stratified May-September of 2017 and in August of 2021 (Figures 9-12). The highest water temperatures were observed in August of both years at both the Upper and Lower stations.

TSI values were calculated using monthly chl *a* concentrations and Carlson's Trophic State Index. In 2017, all three stations were eutrophic throughout the growing season, except for the month of July, at which time the Lower station was mesotrophic and the Upper station was oligotrophic (Figure 13). In 2021, all three stations were eutrophic most months sampled, except for June, July, and October, when some stations dropped to mesotrophic conditions.

Figure 2. Mean growing season TN and TP concentrations measured in Holt Reservoir, April-October, 1998-2021. Stations are illustrated from upstream to downstream as the graph is read from left to right.

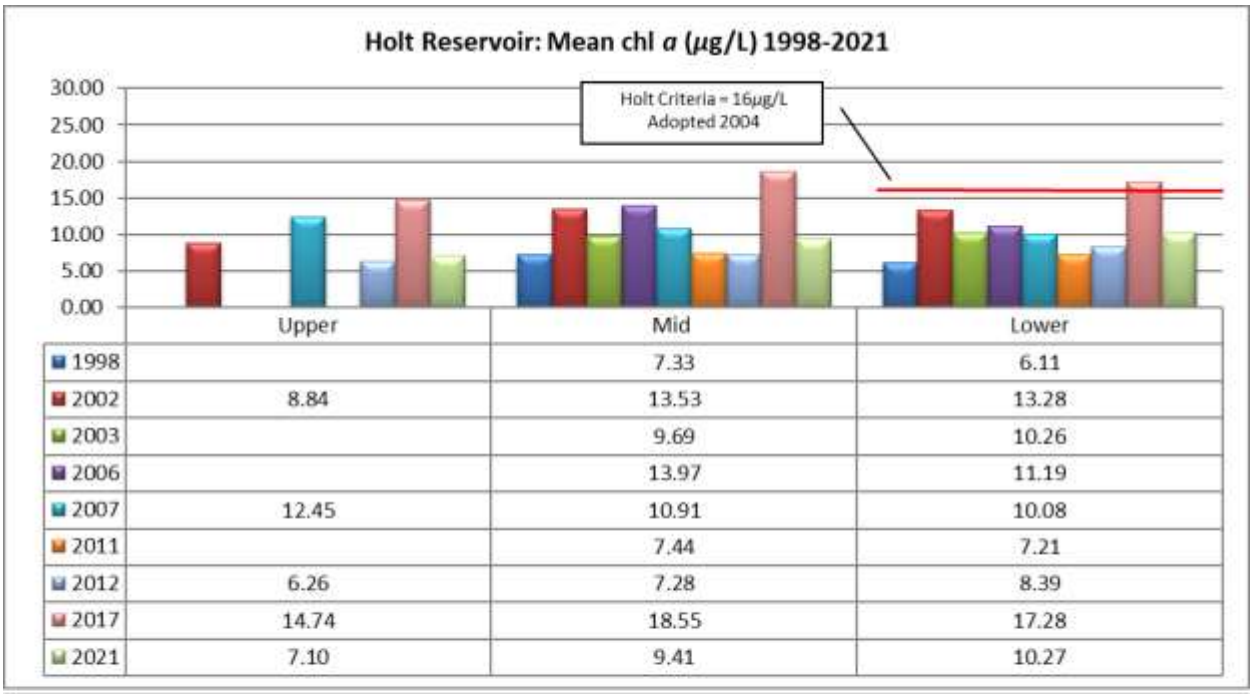


	Upper	Mid	Lower
1998		0.820	0.693
2002	0.887	0.795	0.841
2003		0.593	0.574
2006		0.748	0.788
2007	0.596	0.487	0.493
2011		0.766	0.831
2012	0.714	0.551	0.508
2017	1.068	0.908	0.844
2021	0.590	0.604	0.592

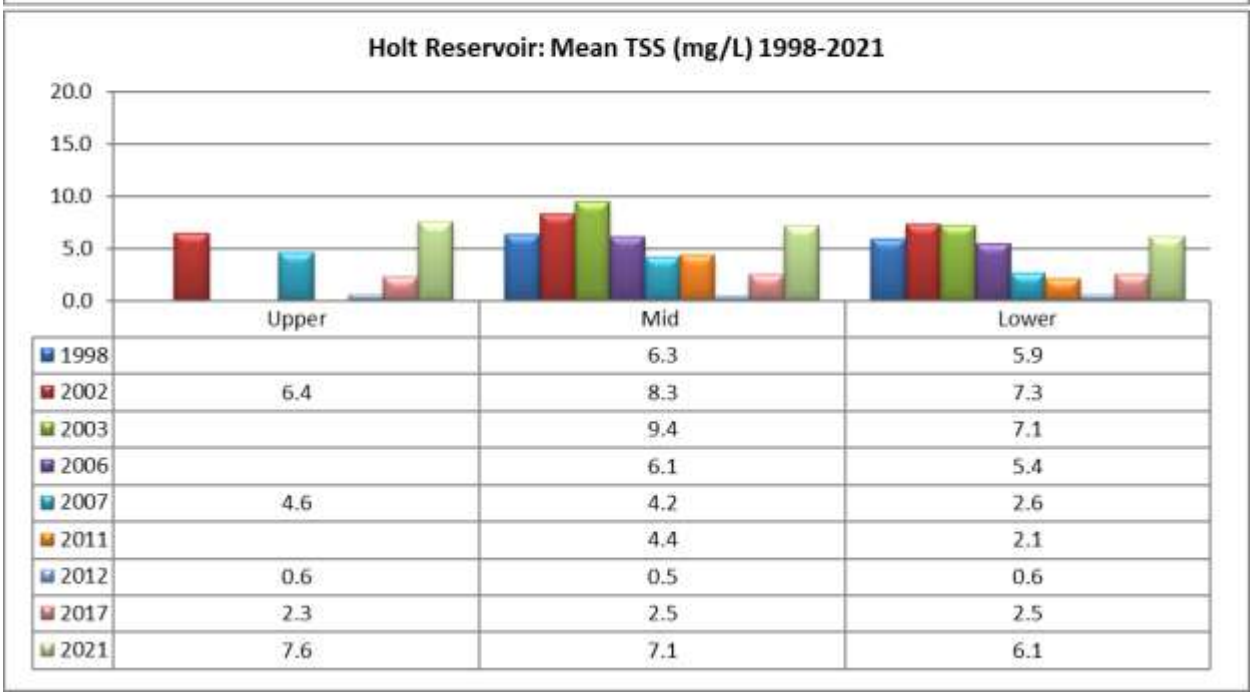


	Upper	Mid	Lower
1998		0.023	0.028
2002	0.050	0.044	0.044
2003		0.027	0.035
2006		0.046	0.044
2007	0.029	0.027	0.024
2011		0.028	0.023
2012	0.029	0.027	0.024
2017	0.028	0.025	0.024
2021	0.028	0.035	0.025

Figure 3. Mean growing season chl *a* and TSS concentrations measured in Holt Reservoir, April-October, 1998-2021. Stations are illustrated from upstream to downstream as the graph is read from left to right. Chl *a* criterion applies to the growing season mean of the Lower station only.



	Upper	Mid	Lower
1998		7.33	6.11
2002	8.84	13.53	13.28
2003		9.69	10.26
2006		13.97	11.19
2007	12.45	10.91	10.08
2011		7.44	7.21
2012	6.26	7.28	8.39
2017	14.74	18.55	17.28
2021	7.10	9.41	10.27



	Upper	Mid	Lower
1998		6.3	5.9
2002	6.4	8.3	7.3
2003		9.4	7.1
2006		6.1	5.4
2007	4.6	4.2	2.6
2011		4.4	2.1
2012	0.6	0.5	0.6
2017	2.3	2.5	2.5
2021	7.6	7.1	6.1

Figure 4. Monthly TN concentrations measured in Holt Reservoir, April-October 2017 and 2021. Each bar graph depicts monthly changes in each station. The historic mean (1992-2021) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations. TN was plotted vs. the closest discharge (Holt Lock & Dam, provided by APCO.

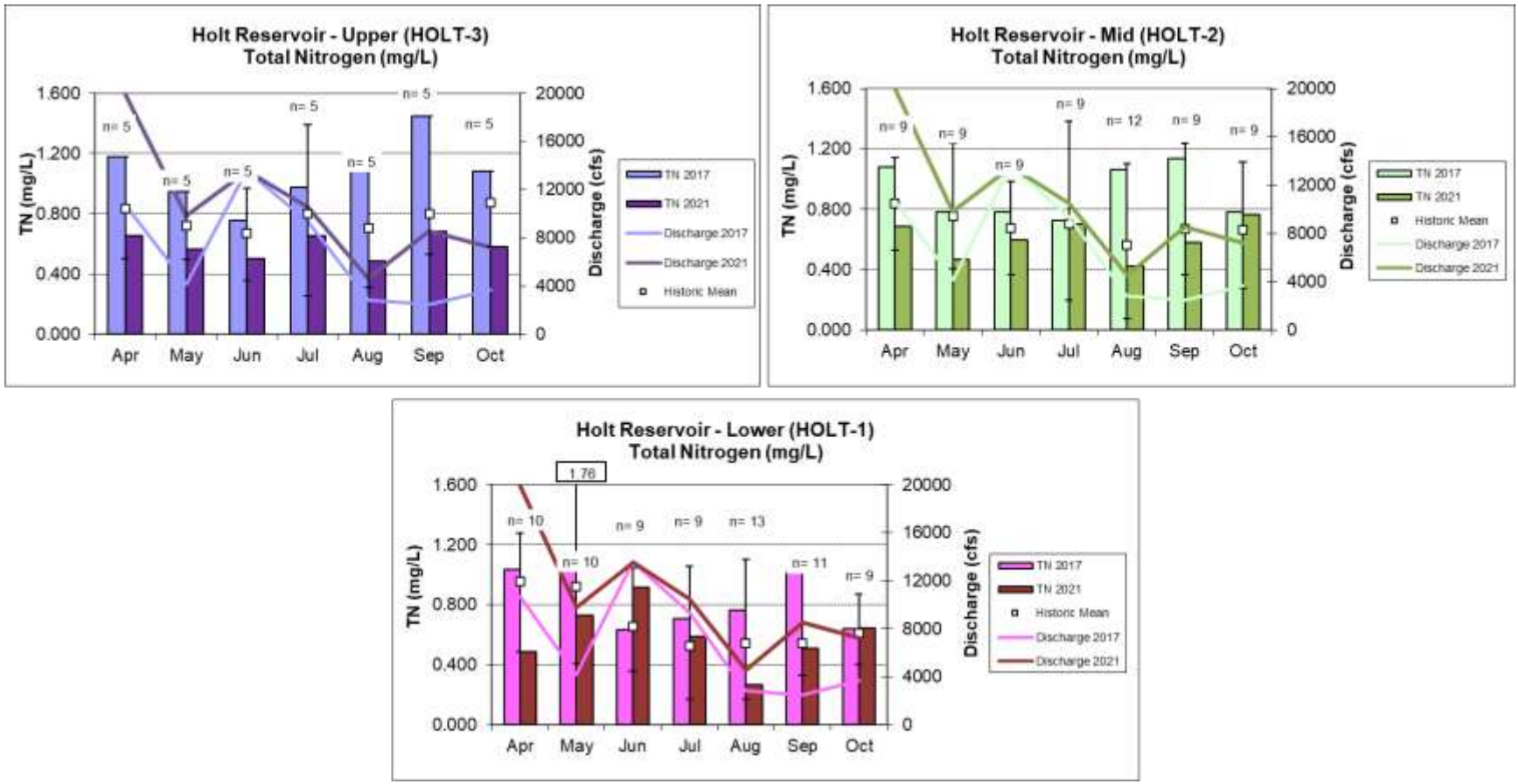


Figure 5. Monthly TP concentrations measured in Holt Reservoir, April-October 2017 and 2021. Each bar graph depicts monthly changes in each station. The historic mean (1992-2021) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations. TP was plotted vs. the closest discharge (Holt Lock & Dam, provided by APCO.

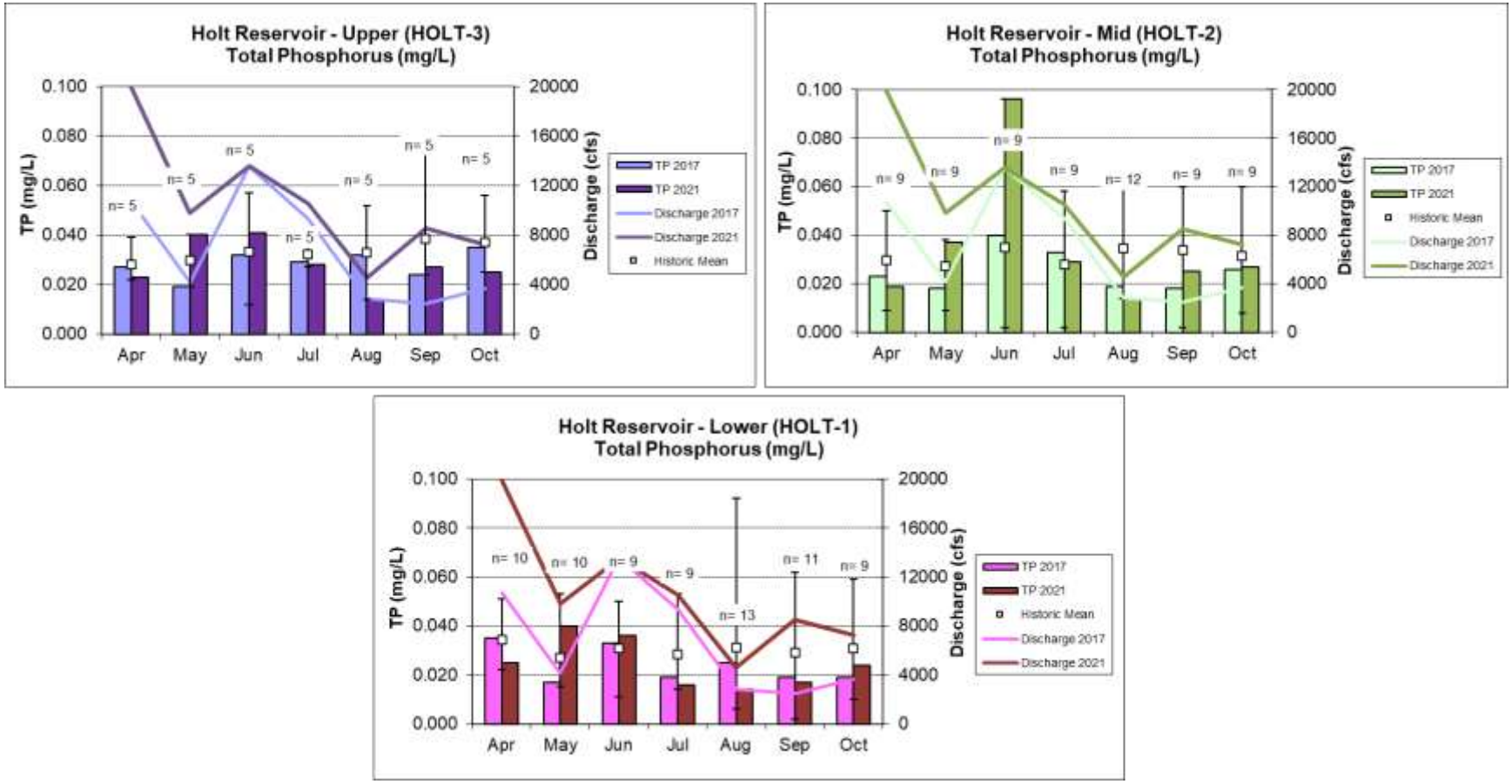


Figure 6. Monthly chl *a* concentrations measured in Holt Reservoir, April-October 2017 and 2021. Each bar graph depicts monthly changes in each station. The historic mean (1992-2021) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations. Chl *a* was plotted vs. the closest discharge (Holt Lock & Dam, provided by APCO.

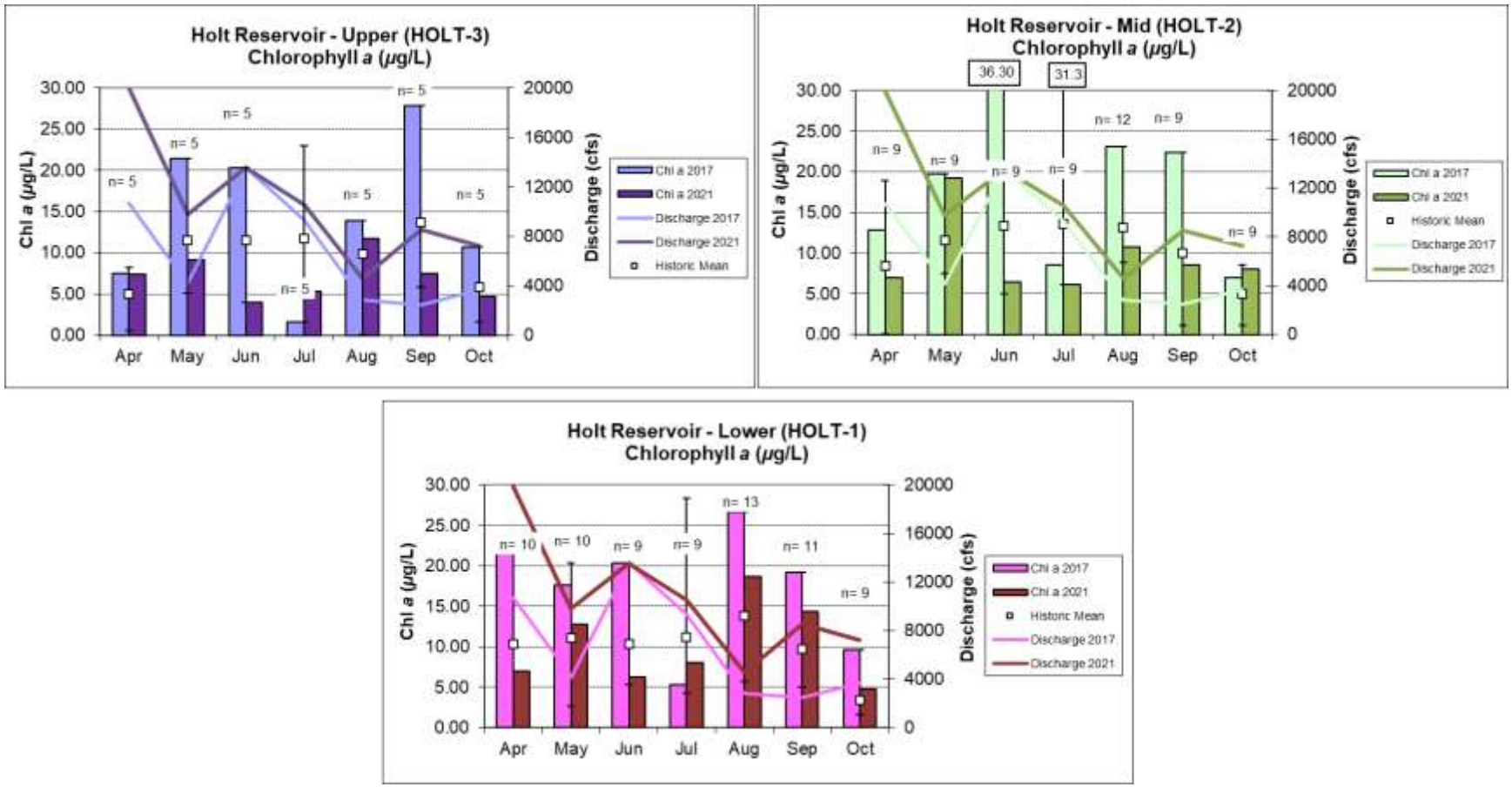


Figure 7. Monthly TSS concentrations measured in Holt Reservoir, April-October 2017 and 2021. Each bar graph depicts monthly changes in each station. The historic mean (1992-2021) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations. TSS was plotted vs. the closest discharge (Holt Lock & Dam, provided by APCO.

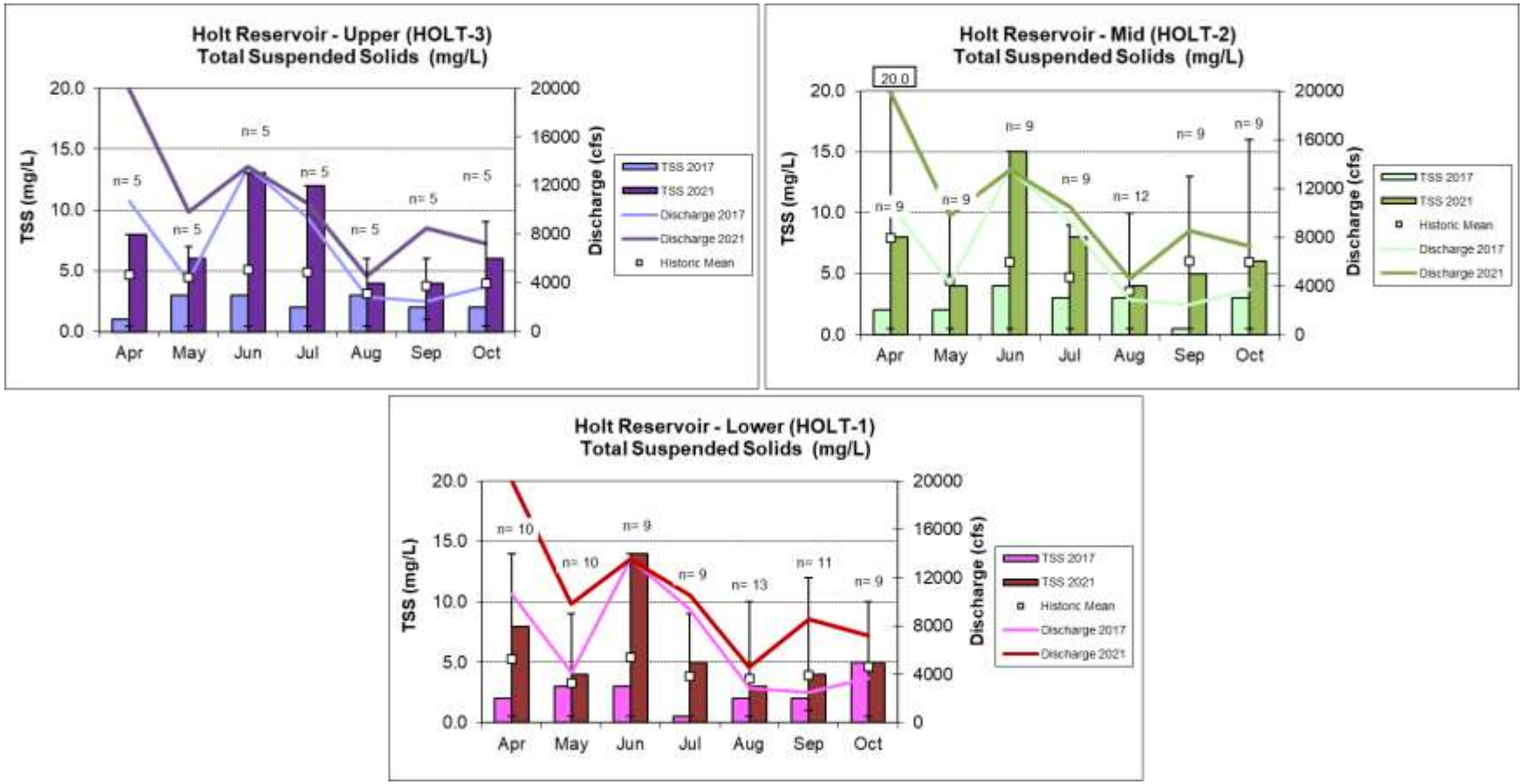
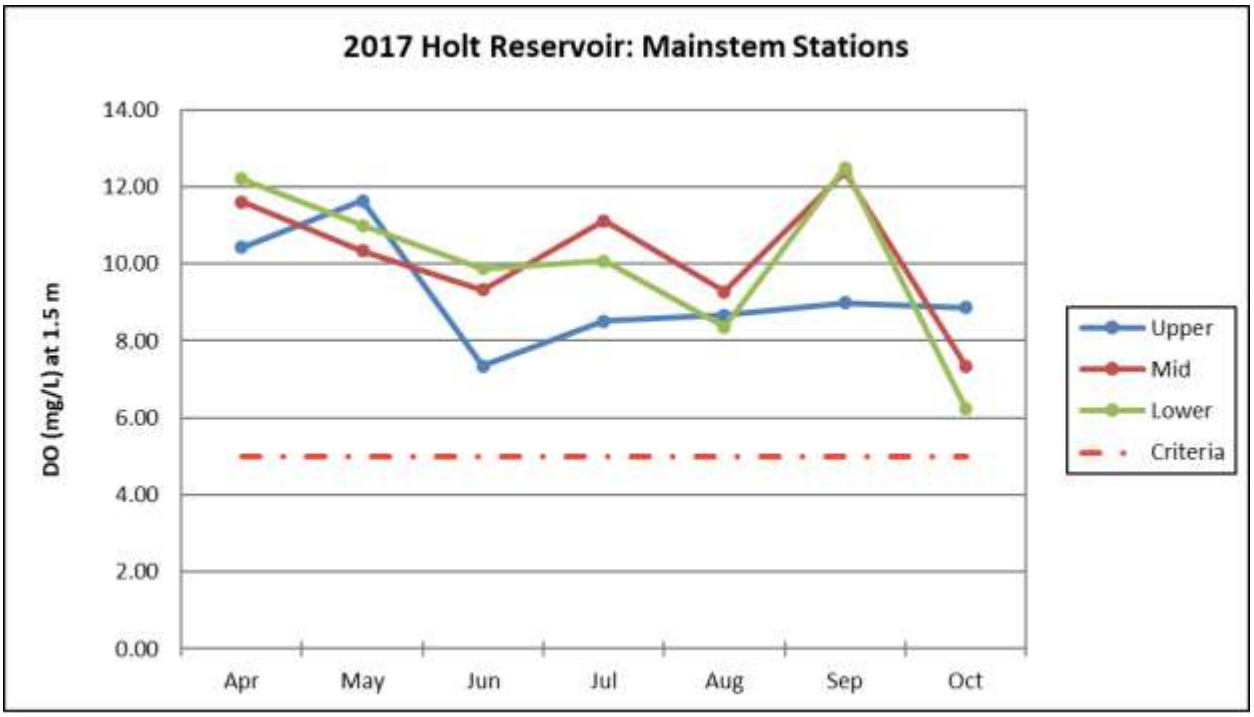


Table 2. Algal growth potential test results, Holt Reservoir, 1998-2017, (expressed as mean Maximum Standing Crop (MSC) dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes; values below 20 mg/L 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 1998	---	---	2.66	Phosphorus	2.60	Phosphorus
August 2002	3.76	Phosphorus	4.52	Phosphorus	4.06	Phosphorus
June 2007	---	---	3.71	Phosphorus	3.74	Phosphorus
July 2007	---	---	4.01	Phosphorus	4.02	Co-Limiting
August 2007	---	---	2.37	Co-Limiting	2.34	Phosphorus
August 2012	28.35	Non-Limiting	23.97	Non-limiting	6.78	Nitrogen
August 2017	---	---	8.41	Phosphorus	---	---

Figure 8. Monthly DO concentrations at 1.5 m (5 ft) for Holt Reservoir stations collected April-October, 2017 and 2021. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth (ADEM Admin. Code R. 335-6-10-.09).



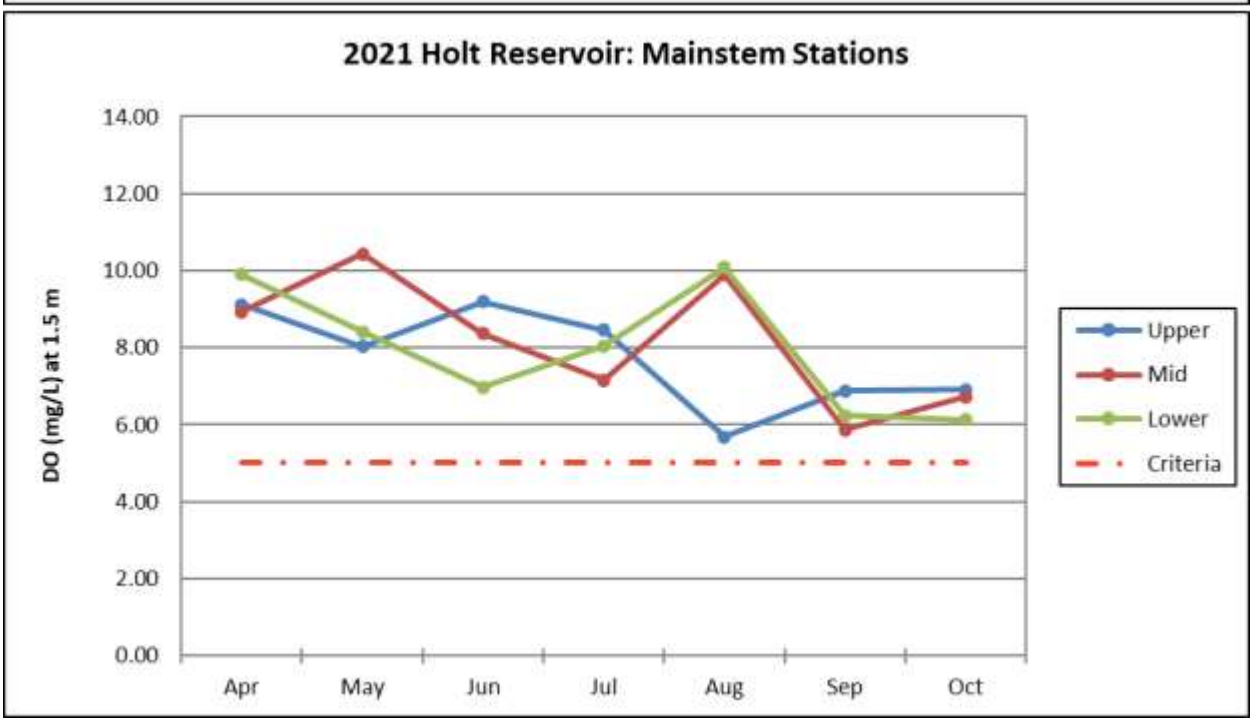


Figure 9. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the Lower Holt Reservoir station, April-October, 2017.

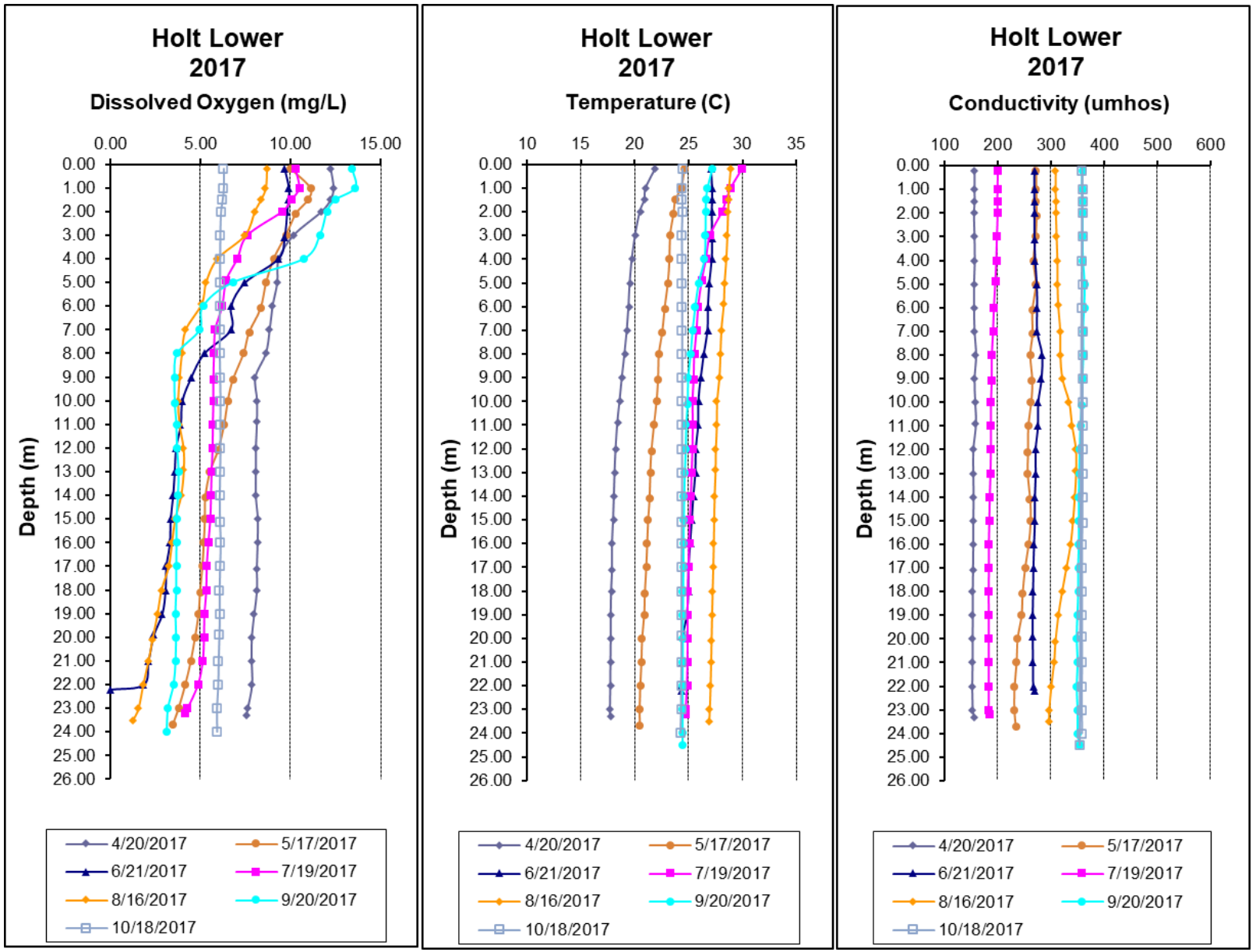


Figure 10. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the Upper Holt Reservoir station, April-October, 2017.

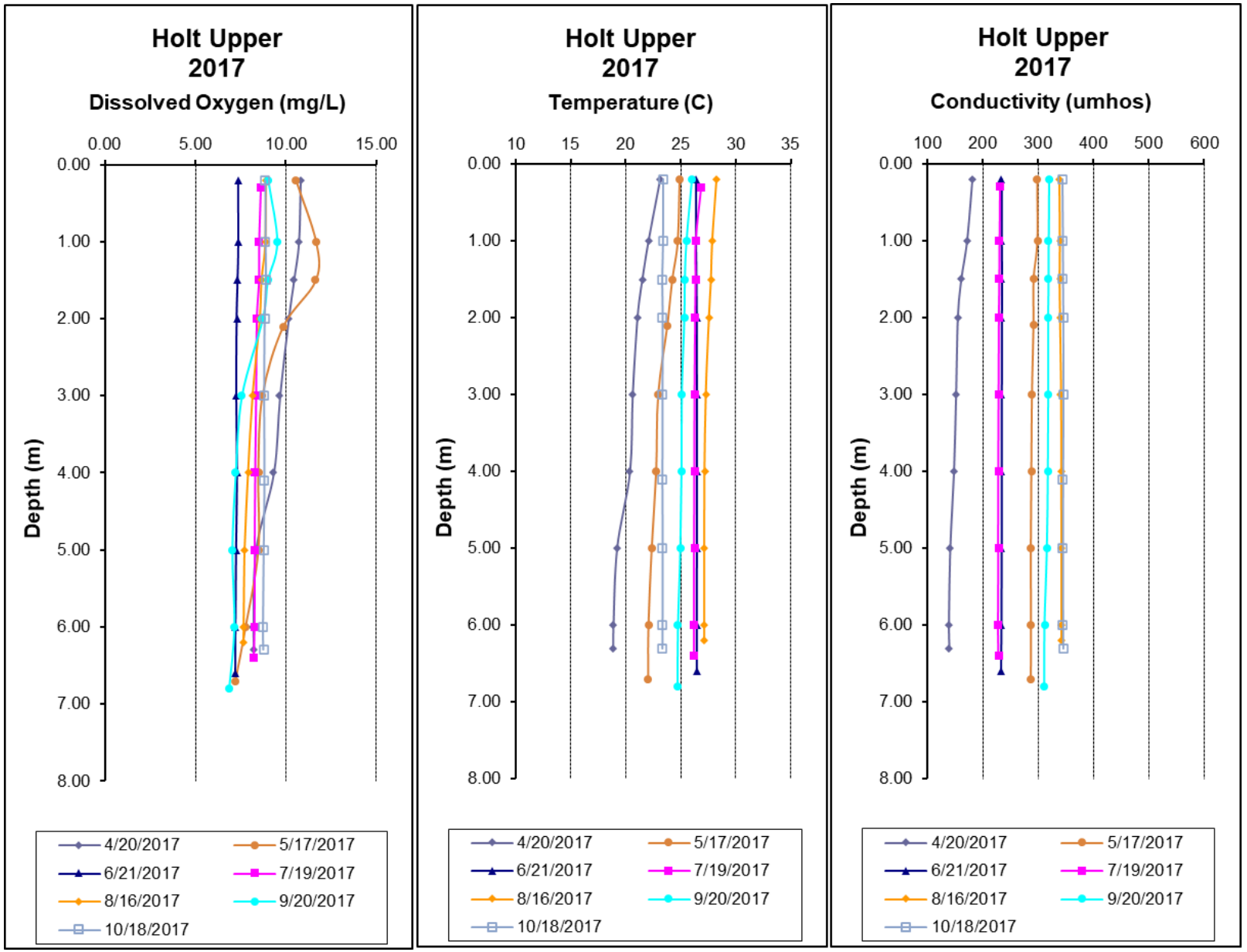


Figure 11. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the Lower Holt Reservoir station, April-October, 2021.

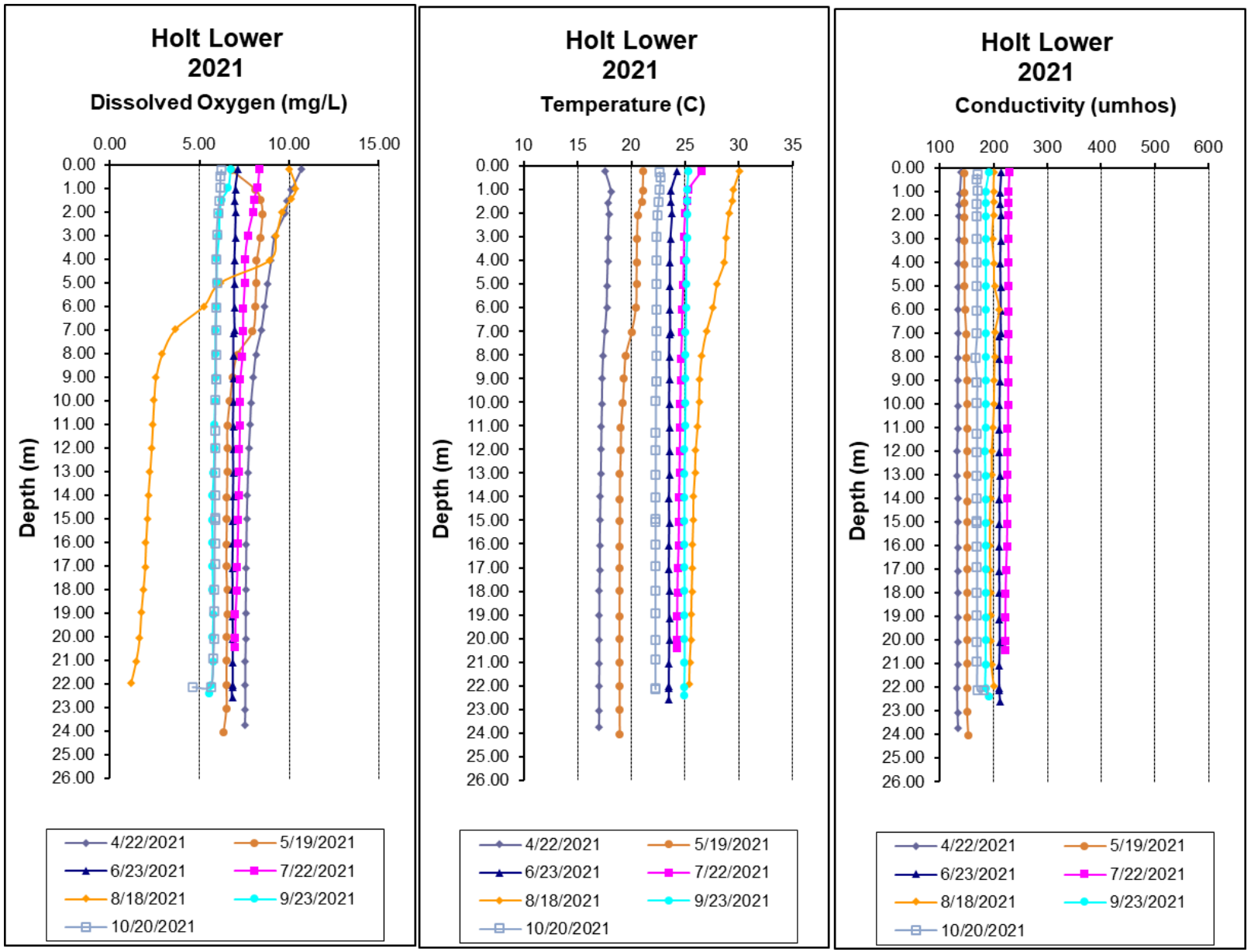


Figure 12. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the Upper Holt Reservoir station, April-October, 2021.

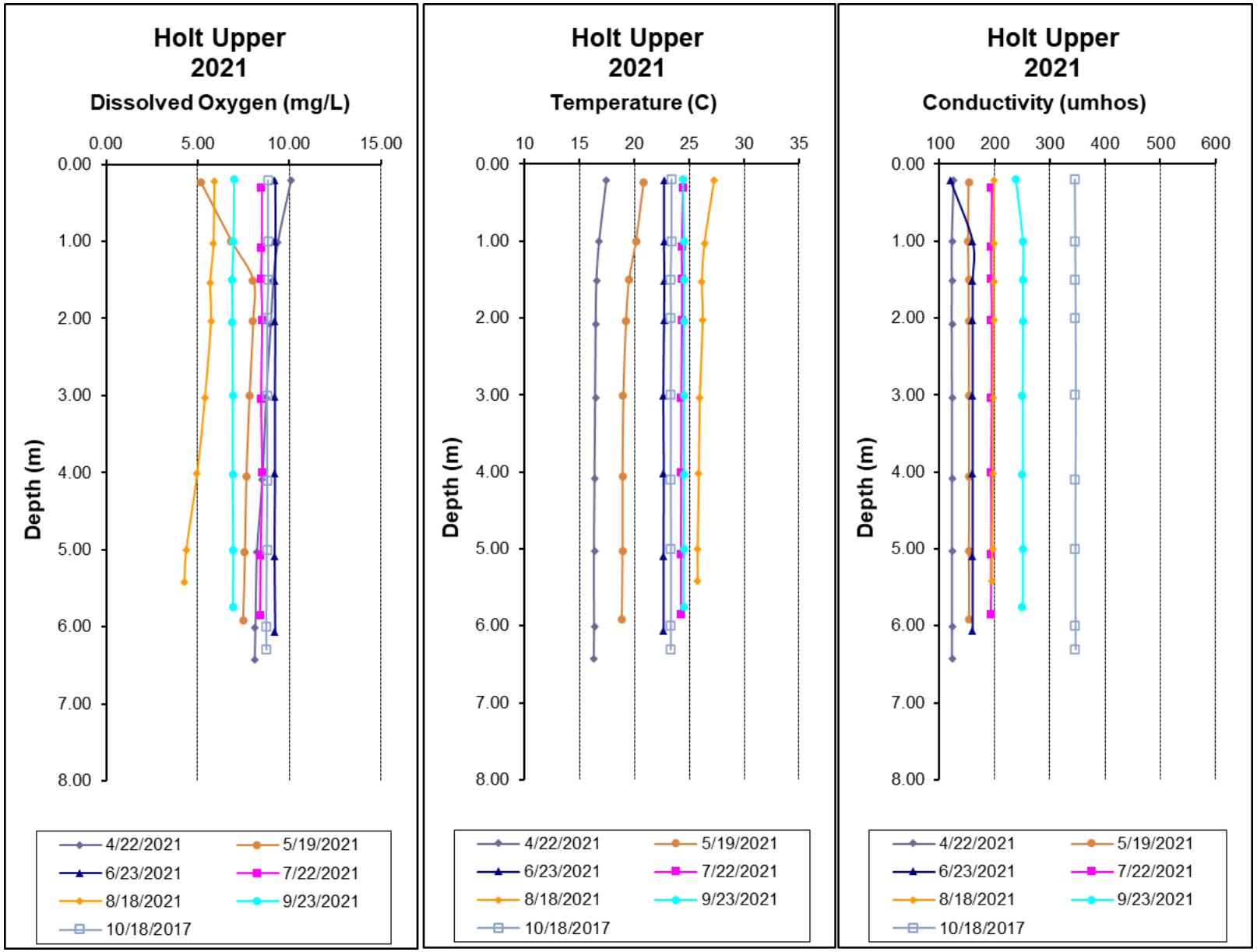
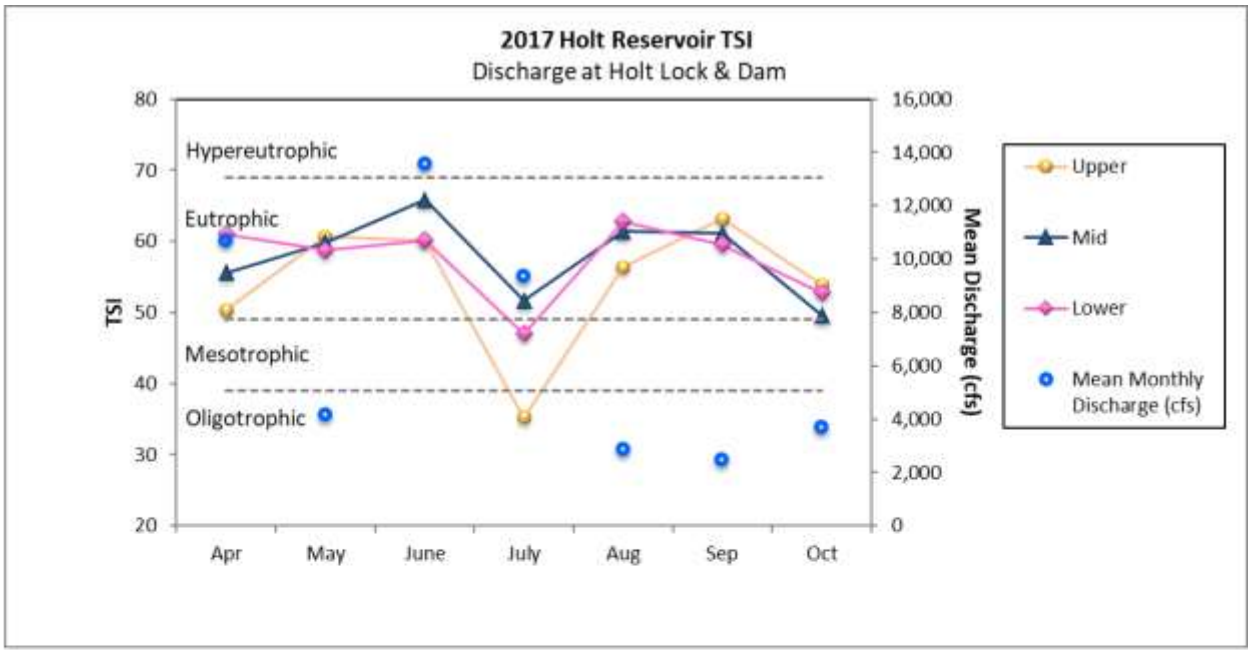
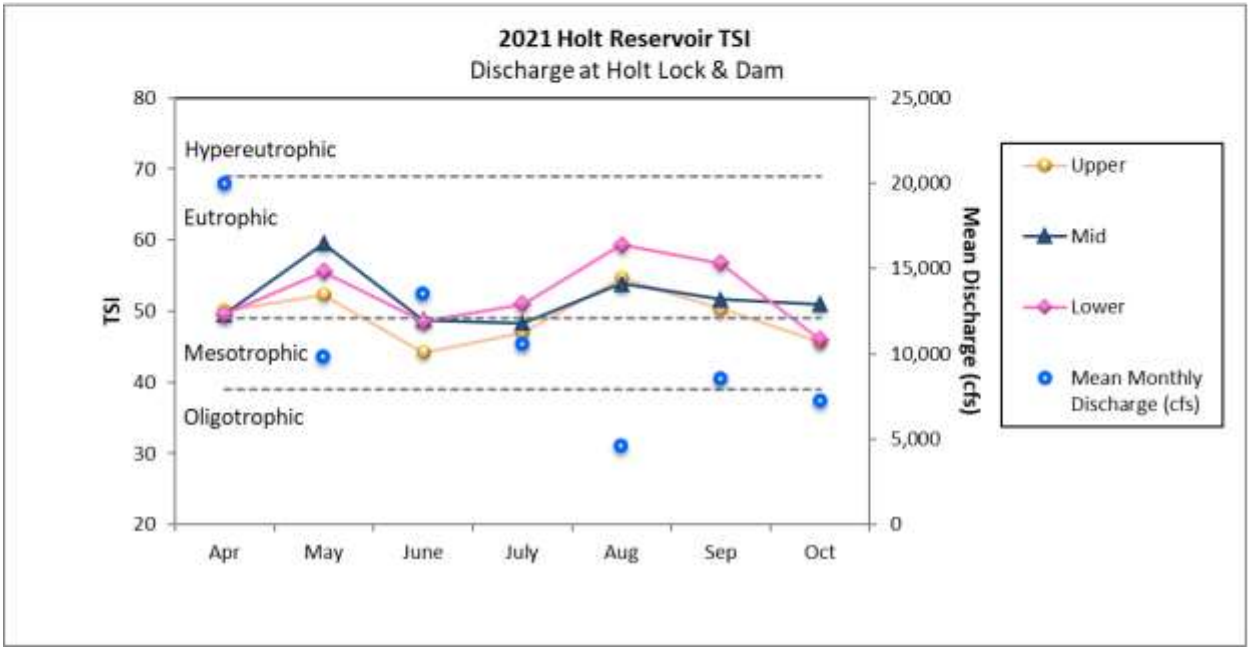


Figure 13. Monthly growing season TSI values calculated for Holt Reservoir stations, April-October, 2017 and 2021, using chl *a* concentrations and Carlson's Trophic State Index calculation (Carlson 1977). Discharge for Holt Reservoir measured at Holt Lock & Dam, provided by APCO.





REFERENCES

ADEM. 2017. State of Alabama Water Quality Monitoring Strategy. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 108 pp.

ADEM. 2018. Quality Management Plan (QMP) for the Alabama Department of Environmental Management (ADEM) Rev 5.0, Montgomery, AL. 72 pp.

ADEM. 2021. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.

ADEM. 2023. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama Rev 2. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 159 pp.

Alabama Department of Environmental Management Water Division (ADEM Admin. Code r. 335-6-10-.09). 2021. 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). 2021. 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 Holt Reservoir 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	Avg	SD
HOLT-1	**Physical**						
	Turbidity (NTU)	7	3.4	5.2	4.0	4.2	0.6
	Total Dissolved Solids (mg/L)	7	92.0	233.0	147.0	152.4	48.8
	Total Suspended Solids (mg/L)	7	< 1.0	5.0	2.0	2.5	1.4
	Hardness (mg/L)	4	68.5	122.0	107.3	101.3	24.2
	Alkalinity (mg/L)	7	33.6	82.6	62.7	60.8	17.9
	Photic Zone (m)	7	3.27	4.82	4.14	4.10	0.58
	Secchi (m)	7	0.90	2.00	1.32	1.39	0.38
	Bottom Depth (m)	7	22.2	24.5	23.5	23.5	0.7
	Chemical						
	Ammonia Nitrogen (mg/L)	7	< 0.004	0.007	0.002	0.003	0.001
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	0.016	0.574	0.254	0.295	0.180
	Total Kjeldahl Nitrogen (mg/L)	7	0.355	1.000	0.461	0.549	0.224
	Total Nitrogen (mg/L)[J]	7	1.899	3.348	0.762	0.844	0.205
	Dis Reactive Phosphorus (mg/L)[J]	7	< 0.002	0.005	0.002	0.002	0.001
	Total Phosphorus (mg/L)	7	0.017	0.035	0.019	0.024	0.007
	CBOD-5 (mg/L)[J]	6	< 2.0	3.6	1.0	1.4	1.1
	Chlorides (mg/L)	7	3.4	9.1	6.3	6.4	2.1
	Biological						
	Chlorophyll a (mg/m³)	7	5.34	26.70	19.20	17.28	7.38
	E. coli (MPN/DL)[J]	4	< 1	< 1	1	1	0
HOLT-2	**Physical**						
	Turbidity (NTU)	7	3.1	5.0	4.4	4.4	0.6
	Total Dissolved Solids (mg/L)	7	78.0	198.0	165.0	149.3	40.6
	Total Suspended Solids (mg/L)	7	< 1.0	4.0	3.0	2.5	1.1
	Hardness (mg/L)	4	75.5	122.0	105.2	102.0	19.9
	Alkalinity (mg/L)	7	34.0	77.1	65.5	62.7	16.6
	Photic Zone (m)	7	3.65	5.25	4.35	4.39	0.62
	Secchi (m)	7	0.80	1.54	1.32	1.32	0.26
	Bottom Depth (m)	7	16.8	20.5	20.1	19.7	1.3
	Chemical						
	Ammonia Nitrogen (mg/L)[J]	7	< 0.004	0.065	0.004	0.016	0.023
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.068	0.515	0.353	0.323	0.144
	Total Kjeldahl Nitrogen (mg/L)	7	0.359	1.070	0.528	0.585	0.263
	Total Nitrogen (mg/L)	7	2.178	3.414	0.784	0.908	0.176
	Dis Reactive Phosphorus (mg/L)[J]	7	< 0.002	0.007	0.002	0.003	0.002
	Total Phosphorus (mg/L)	7	0.018	0.040	0.023	0.025	0.008
	CBOD-5 (mg/L)[J]	6	< 2.0	2.9	1.0	1.3	0.8
	Chlorides (mg/L)	7	3.9	7.4	6.4	5.9	1.3
	Biological						
	Chlorophyll a (mg/m³)	7	6.94	36.30	19.80	18.55	10.17
	E. coli (MPN/DL)[J]	4	< 1	< 1	1	1	0

Station	Parameter	N		Min	Max	Med	Avg	SD
HOLT-3	**Physical**							
	Turbidity (NTU)	7		2.8	7.0	3.6	4.3	1.5
	Total Dissolved Solids (mg/L)	7		87.0	214.0	163.0	161.1	46.4
	Total Suspended Solids (mg/L)[J]	7		1.0	3.0	2.0	2.3	0.8
	Hardness (mg/L)	4		82.5	134.0	102.0	105.2	23.4
	Alkalinity (mg/L)	7		33.4	80.5	66.1	63.9	17.0
	Photic Zone (m)	7		3.27	5.23	4.47	4.33	0.78
	Secchi (m)	7		0.98	1.99	1.42	1.48	0.33
	Bottom Depth (m)	7		6.2	6.8	6.4	6.5	0.2
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.007	0.002	0.003	0.001
	Nitrate+Nitrite Nitrogen (mg/L)	7		0.228	0.615	0.498	0.478	0.149
	Total Kjeldahl Nitrogen (mg/L)	7		0.381	1.220	0.481	0.591	0.292
	Total Nitrogen (mg/L)	7		2.271	4.344	1.081	1.068	0.215
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.012	0.002	0.003	0.004
	Total Phosphorus (mg/L)	7		0.019	0.035	0.029	0.028	0.006
	CBOD-5 (mg/L)[J]	6	<	2.0	3.1	1.0	1.4	0.9
	Chlorides (mg/L)	7		3.5	6.8	5.3	4.1	1.2
	Biological							
	Chlorophyll a (mg/m³)	7		1.60	27.80	13.90	14.74	9.02
	E. coli (MPN/DL)[J]	4	<	1	5	2	2	1

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

Appendix Table 2. Summary of Holt Reservoir water quality data collected April-October, 2021. 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	Avg	SD
HOLT-1	**Physical**						
	Turbidity (NTU)	7	3.7	14.4	6.0	6.9	3.6
	Total Dissolved Solids (mg/L)[J]	7	71.0	128.0	104.0	101.0	20.9
	Total Suspended Solids (mg/L)[J]	7	3.0	14.0	5.0	6.1	3.8
	Hardness (mg/L)	4	66.8	87.1	77.6	77.3	9.4
	Alkalinity (mg/L)	7	29.9	50.5	43.9	41.4	7.7
	Photic Zone (m)	7	2.38	4.12	3.73	3.51	0.58
	Secchi (m)	7	0.75	1.58	1.25	1.23	0.30
	Bottom Depth (m)	7	20.4	24.0	22.4	22.5	1.2
	Chemical						
	Ammonia Nitrogen (mg/L)	7	< 0.016	0.046	0.023	0.021	0.006
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.105	0.485	0.364	0.355	0.124
	Total Kjeldahl Nitrogen (mg/L)[J]	7	< 0.324	0.479	0.162	0.237	0.132
	Total Nitrogen (mg/L)[J]	7	< 0.801	2.745	0.586	0.592	0.204
	Dis Reactive Phosphorus (mg/L)[J]	7	< 0.004	0.012	0.005	0.006	0.004
	Total Phosphorus (mg/L)	7	0.014	0.040	0.024	0.025	0.010
	CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7	2.6	4.2	3.7	3.5	0.6
	Biological						
	Chlorophyll a (mg/m³)	7	4.81	18.70	8.01	10.27	5.11
	E. coli (MPN/DL)	4	1	26	5	10	12
HOLT-2	**Physical**						
	Turbidity (NTU)	7	2.9	24.3	6.8	9.6	7.5
	Total Dissolved Solids (mg/L)[J]	7	69.0	137.0	103.0	104.4	25.1
	Total Suspended Solids (mg/L)[J]	7	4.0	15.0	6.0	7.1	3.8
	Hardness (mg/L)	4	75.4	81.3	77.8	78.1	2.6
	Alkalinity (mg/L)	7	29.4	50.1	43.2	41.7	8.2
	Photic Zone (m)	7	1.74	4.66	3.37	3.35	1.00
	Secchi (m)	7	0.50	1.56	1.14	1.12	0.37
	Bottom Depth (m)	7	18.0	20.4	19.9	19.6	0.9
	Chemical						
	Ammonia Nitrogen (mg/L)	7	< 0.016	0.046	0.023	0.021	0.006
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.259	0.542	0.395	0.386	0.093
	Total Kjeldahl Nitrogen (mg/L)[J]	7	< 0.324	0.372	0.162	0.217	0.095
	Total Nitrogen (mg/L)[J]	7	< 1.263	2.301	0.599	0.604	0.126
	Dis Reactive Phosphorus (mg/L)[J]	7	< 0.004	0.012	0.007	0.007	0.004
	Total Phosphorus (mg/L)	7	0.014	0.096	0.027	0.035	0.028
	CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7	2.4	4.9	3.2	3.5	0.8
	Biological						
	Chlorophyll a (mg/m³)	7	6.10	19.20	8.01	9.41	4.59
	E. coli (MPN/DL)[J]	4	< 1	70	28	32	34

Station	Parameter	N	Min	Max	Med	Avg	SD
HOLT-3	**Physical**						
	Turbidity (NTU)	7	4.0	24.1	7.9	10.6	7.6
	Total Dissolved Solids (mg/L)[J]	7	63.0	149.0	106.0	101.0	28.7
	Total Suspended Solids (mg/L)[J]	7	4.0	13.0	6.0	7.6	3.6
	Hardness (mg/L)	4	66.0	92.0	75.0	77.0	10.9
	Alkalinity (mg/L)	7	28.8	55.9	38.2	41.2	9.4
	Photic Zone (m)	7	1.32	4.05	2.86	2.91	1.00
	Secchi (m)	7	0.40	1.46	0.89	1.00	0.42
	Bottom Depth (m)	7	5.2	6.4	5.8	5.8	0.4
	Chemical						
	Ammonia Nitrogen (mg/L)	7	< 0.016	0.056	0.023	0.026	0.014
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.324	0.521	0.404	0.404	0.079
	Total Kjeldahl Nitrogen (mg/L)[J]	7	< 0.324	0.328	0.162	0.186	0.063
	Total Nitrogen (mg/L)[J]	7	< 1.458	2.049	0.583	0.590	0.077
	Dis Reactive Phosphorus (mg/L)[J]	7	< 0.004	0.014	0.007	0.007	0.005
	Total Phosphorus (mg/L)	7	0.014	0.041	0.027	0.028	0.010
	CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7	2.2	4.4	2.6	3.0	0.8
	Biological						
	Chlorophyll a (mg/m³)	7	4.00	11.70	7.34	7.10	2.71
	E. coli (MPN/DL)	4	1	111	35	45	53

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