Jordan Reservoir Report 2016 & 2019

Rivers and Reservoirs Monitoring Program

Alabama Department of Environmental Management

Field Operations Division
Rivers and Reservoirs Unit
April 2022

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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
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

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Jordan Reservoir is a 6,800 acre impoundment of the Coosa River located about 20 miles north of Montgomery in central Alabama. The reservoir is created by two dams: Jordan dam, completed in 1928, and Walter Bouldin Dam, completed in 1967 to increase generating capacity. The reservoir is managed by the Alabama Power Company (APCO) for hydroelectric power generation and recreation.

The Alabama Department of Environmental Management (ADEM) monitored Jordan Reservoir as part of the 2016 and 2019 assessments of the Coosa River Basin under the Rivers and Reservoirs Monitoring Program (RRMP). Implemented in 1990, the 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).

In 2010, the ADEM implemented a specific water quality criterion for nutrient management at the lower Jordan Reservoir station, which has been monitored by ADEM since 1990 (ADEM Admin. Code R. 335-6-10-.11). This criterion represents a growing season mean (April-October) chlorophyll *a* (chl *a*) concentration that is protective of Jordan Reservoir's Swimming and Fish & Wildlife (S/F&W) use classifications.

The purpose of this report is to summarize data collected at five stations in Jordan Reservoir during the 2016 and 2019 growing seasons and to evaluate growing season trends in lake trophic status and nutrient concentrations using ADEM's historical dataset. Monthly and/or 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. Jordan Reservoir was sampled in the dam forebay and upper reservoir. Three tributary embayment stations were also monitored: Shoal Creek, Weoka Creek, and Sofkahatchee Creek.

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 2019), Surface Water Quality Assurance Project Plan (ADEM 2018a), and Quality Management Plan (ADEM 2018b).

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 APCO flow data and ADEM's previously collected data to help interpret the 2016 and 2019 results.

Figure 1. Jordan Reservoir with 2016 and 2019 sampling locations.

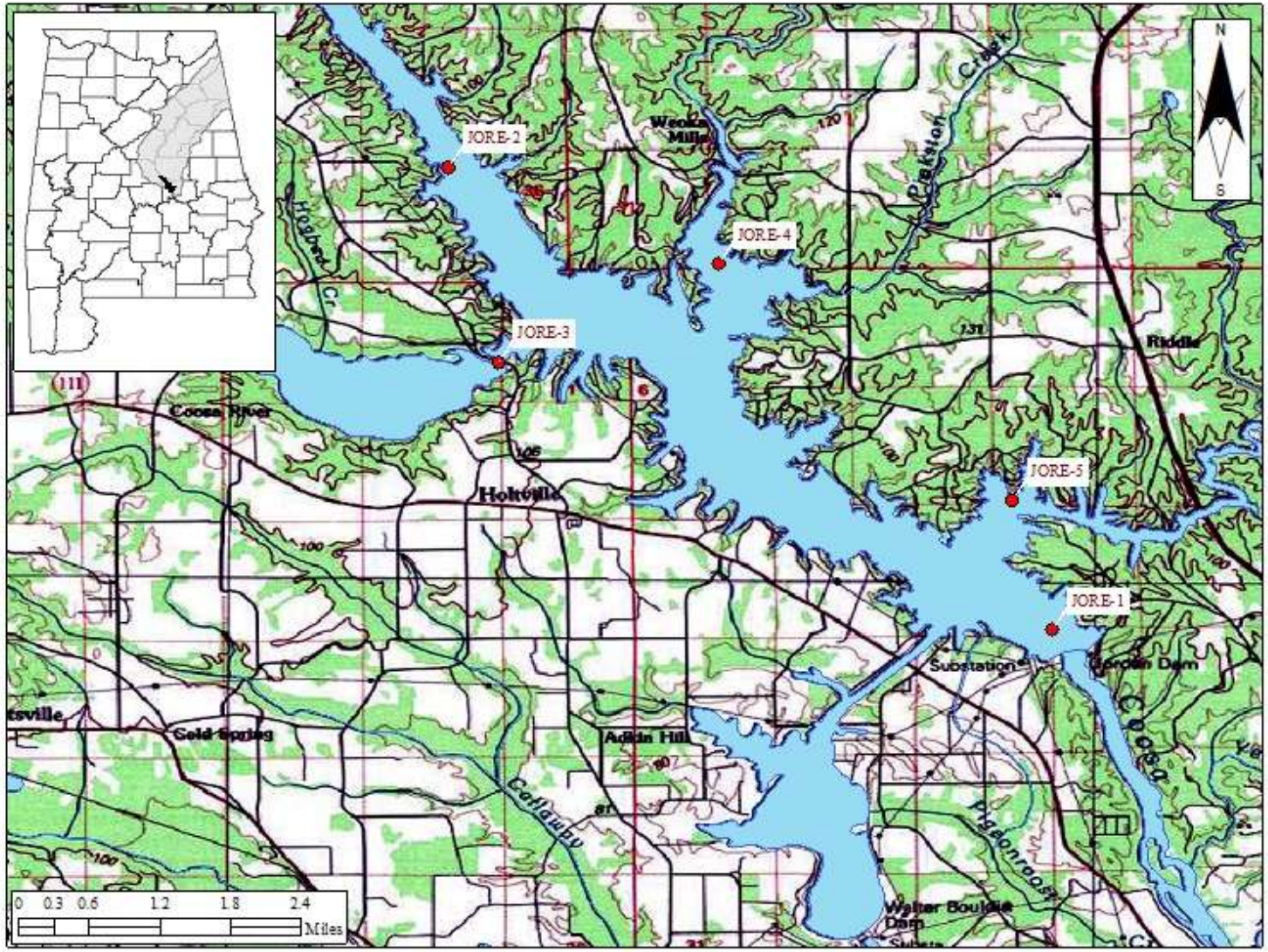


Table 1. Descriptions of the 2016 and 2019 monitoring stations in Jordan Reservoir.

HUC	County	Station Number	Report Designation	Waterbody Name	Station Description	Chl *a* Criteria	Latitude	Longitude
031501070906	Elmore	JORE-1*	Lower	Coosa R	Deepest point, main river channel, dam forebay.	14 µg/L	32.62129	-86.25953
031501070906	Elmore	JORE-2	Upper	Coosa R	Deepest point, main river channel, upstream of Weoka Ck/Coosa River confluence		32.67826	-86.33385
031501070902	Elmore	JORE-3	Shoal Ck	Shoal Ck	Deepest point, main creek channel, Shoal Ck embayment, immediately upstream of Elmore Co. Rd. 23 bridge		32.65421	-86.32768
031501070904	Elmore	JORE-4	Weoka Ck	Weoka Ck	Deepest point, main creek channel, Weoka Ck embayment, approximately 0.5 miles upstream of lake confluence.		32.66634	-86.30060
031501070905	Elmore	JORE-5	Sofkahatchee Ck	Sofkahatchee Ck	Deepest point, main creek channel, Sofkahatchee Ck embayment, approximately 0.5 miles upstream of lake confluence.		32.63716	-86.26449

*Growing season mean chl *a* criteria 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 4-9 and 14-15). 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 10-13. Summary statistics of all data collected during 2016 and 2019 are presented in Appendix Table 1 and Appendix Table 2. The table contains the minimum, maximum, median, mean, and standard deviation of each parameter analyzed.

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

In 2016, the highest mean growing season TN value in Jordan Reservoir mainstem stations was in the upper station (Figure 2). The highest mean TN value among embayment stations was in Shoal Creek. In 2019, the lower station had higher concentrations than the upper station, and Sofkahatchee Creek had the highest mean TN concentration among embayment stations. In general, the mainstem showed an overall increase in TN concentrations 1997-2013. Values decreased in 2016 and 2019. In 2019, Shoal Creek and Sofkahatchee Creek had the lowest mean TN values since 2000, and Weoka Creek has the lowest TN value calculated since monitoring began. In 2016, historic high monthly TN concentrations were measured in July and September at the upper station and in October at the lower station (Figure 4). In 2019, a historic high concentration was measured at the lower station in April.

Mean growing season TP values calculated for Jordan Reservoir stations ranged from 0.016-0.022 mg/L in 2016 and 2019 (Figure 2). Overall, mean TP concentrations decreased in the mainstem stations from 1997-2019. Similarly, mean TP values in the embayment stations decreased 2008-2019. Mean monthly TP concentrations were below historic means in all months sampled in both 2016 and 2019 (Figure 5). Historic low TP values were measured in April, July,

and October at the upper station and in October at the lower station in 2016. Historic lows were also measured in 2019 at the upper station in May and September.

A specific water quality criterion for nutrient management has been established for the lower station in Jordan Reservoir. The growing season mean chl *a* value calculated in the lower station during 2016 and 2019 was below the criteria limit (Figure 3). The 2019 mean growing season chl *a* concentrations at both mainstem stations and embayment stations were the lowest values calculated since monitoring began. With the exception of the 2016 value in the upper station, chl *a* concentrations in the mainstem stations have decreased overall since 1997. Concentrations in the embayment stations have been more variable over time. A historic high monthly chl *a* concentration was measured in 2016 at the upper station in September (Figure 6). Historic low monthly concentrations were measured in September 2016 at the lower station, as well as in 2019 at the upper station in June and at the lower station in May, June, and October.

In general, mean growing season TSS concentrations have been higher in the upper station than in lower station (Figure 3). Mean TSS concentrations in the mainstem stations have decreased since monitoring in the early years and appear to be stabilizing. Mean TSS concentrations in Shoal Creek have increased since 2010, while the 2019 values calculated for Weoka Creek and Sofkahatchee Creek were the lowest recorded since monitoring began in 2000. In 2016, historic low monthly TSS values were measured at the upper station in April and at the lower station in July and August (Figure 7). In 2019, a historic low monthly TSS concentration was measured at the upper station in October.

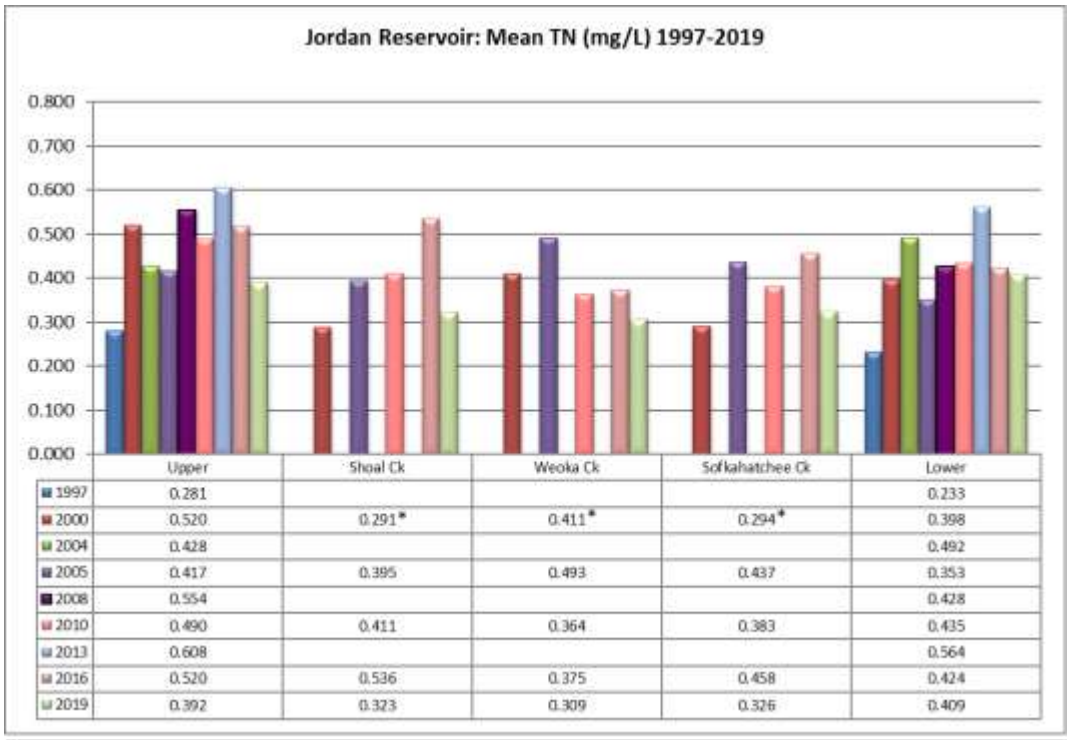
AGPT results for Jordan Reservoir have varied between phosphorus-limited and nitrogen-limited in the years monitored (Table 2). However, all samples collected in 2016 and 2019 indicated the reservoir to be nitrogen-limited. Raschke and Schultz (1987) defined a mean standing crop (MSC) value of 5.0 mg/L as protective of reservoir and lake systems. All MSC values measured in Jordan Reservoir since 1997 have been below 5.0 mg/L.

In September 2016, the lower station had a dissolved oxygen (DO) concentration of 3.0 mg/L and Sofkahatchee Creek had a DO concentration of 4.7 mg/L, both below the ADEM criteria (ADEM Admin. Code R. 335-6-10-.09) limit of 5.0 mg/L at 5.0 ft (1.5 m) (Figure 8). In

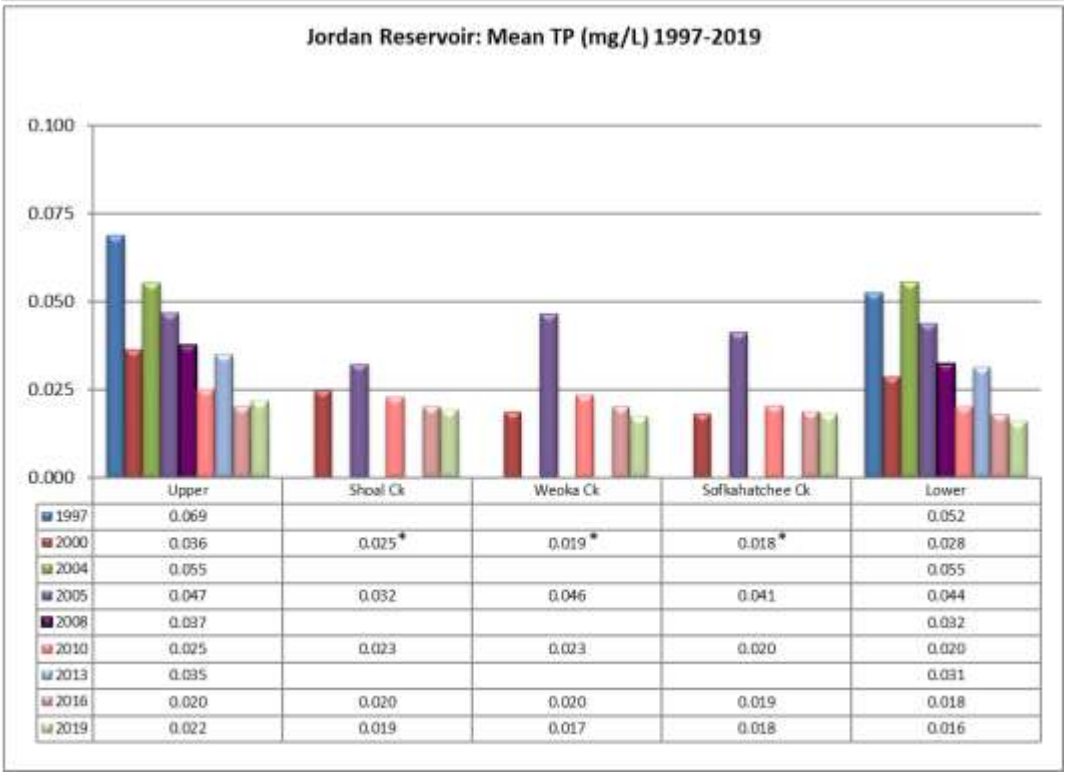
2019, the lower station was below criteria in October (Figure 9). All tributary embayment stations were above the criteria limit in 2019. Based on monthly DO profiles, the upper and lower stations were stratified April-September in 2016 (Figures 10-11). At the lower station, DO concentrations were less than 5.0 mg/L throughout the entire water column in September. There also appeared to be a slight thermocline at the upper station in April and June. In 2019, both the upper and lower reservoir stations appeared to be stratified May-September (Figures 12-13).

Monthly TSI values were calculated using monthly chl *a* concentrations and Carlson's Trophic State Index. In 2016, the upper station was eutrophic April-October, while the lower station was eutrophic in May-July and October (Figure 14). Shoal Creek was eutrophic throughout the growing season, and Weoka and Sofkahatchee Creeks were eutrophic all months, except July, which were mesotrophic. In 2019, the upper station was mesotrophic all months, except June and September, which were eutrophic (Figure 15). The lower station was eutrophic in April, June, August, and September. Shoal Creek was eutrophic in June, August, and September; Weoka Creek was eutrophic in April, September, and October; and Sofkahatchee Creek was eutrophic all months except April, which was oligotrophic, and October, which was mesotrophic.

Figure 2. Mean growing season TN and TP measured in Jordan Reservoir, April-October, 1997-2019. Stations are illustrated from upstream to downstream as the graph is read from left to right.



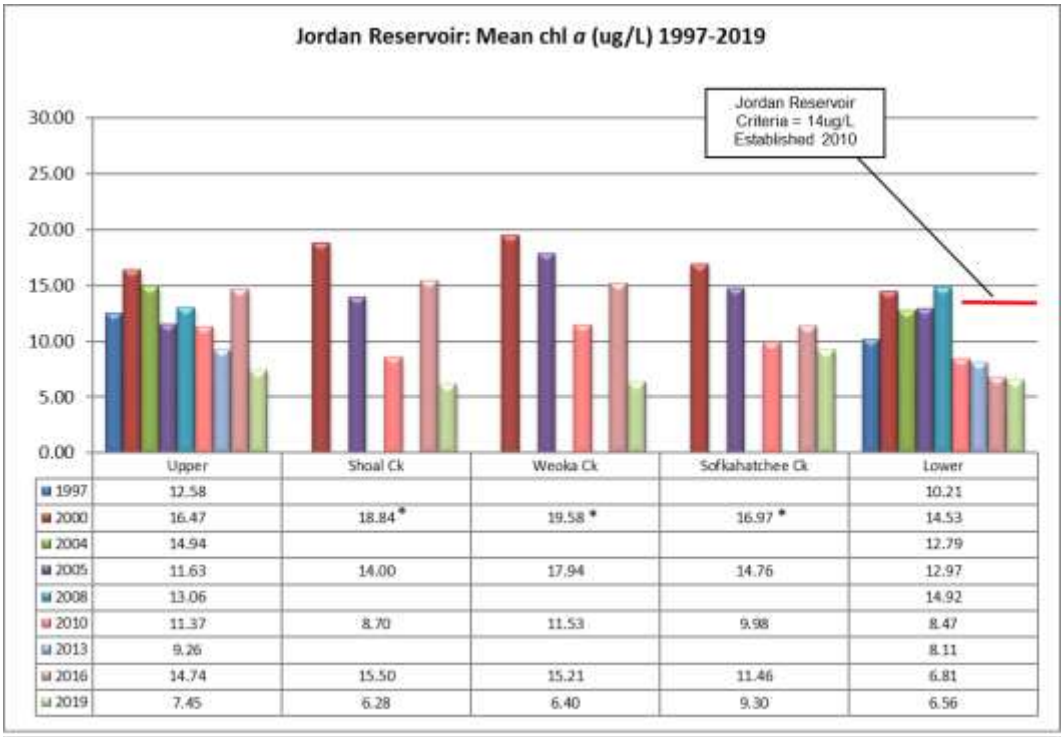
	Upper	Shoal Ck	Weoka Ck	Sofkahatchee Ck	Lower
1997	0.281				0.233
2000	0.520	0.291*	0.411*	0.294*	0.398
2004	0.428				0.492
2005	0.417	0.395	0.493	0.437	0.353
2008	0.554				0.428
2010	0.490	0.411	0.364	0.383	0.435
2013	0.608				0.564
2016	0.520	0.536	0.375	0.458	0.424
2019	0.392	0.323	0.309	0.326	0.409



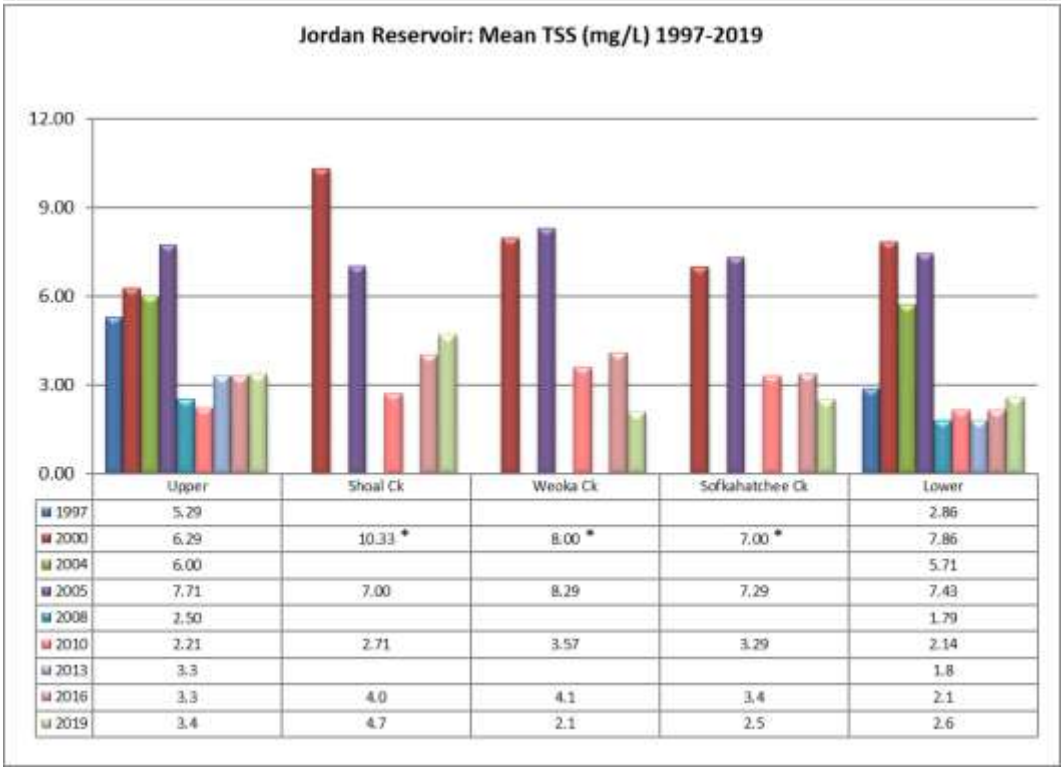
	Upper	Shoal Ck	Weoka Ck	Sofkahatchee Ck	Lower
1997	0.069				0.052
2000	0.036	0.025*	0.019*	0.018*	0.028
2004	0.055				0.055
2005	0.047	0.032	0.046	0.041	0.044
2008	0.037				0.032
2010	0.025	0.023	0.023	0.020	0.020
2013	0.035				0.031
2016	0.020	0.020	0.020	0.019	0.018
2019	0.022	0.019	0.017	0.018	0.016

*Mean of April/June/August only.

Figure 3. Mean growing season chl *a* and TSS measured in Jordan Reservoir, April-October, 1997-2019. Stations are illustrated from upstream to downstream as the graph is read from left to right. Chl *a* criteria applies to the growing season mean of the lower station.



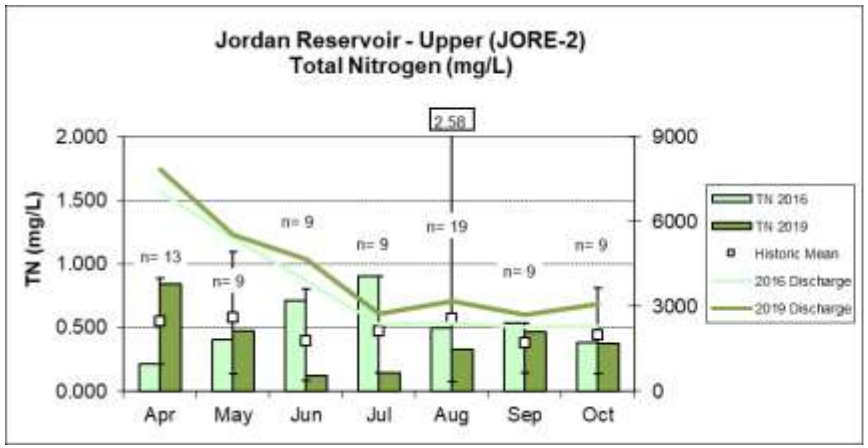
	Upper	Shoal Ck	Weoka Ck	Sofkahatchee Ck	Lower
1997	12.58				10.21
2000	16.47	18.84 *	19.58 *	16.97 *	14.53
2004	14.94				12.79
2005	11.63	14.00	17.94	14.76	12.97
2008	13.06				14.92
2010	11.37	8.70	11.53	9.98	8.47
2013	9.26				8.11
2016	14.74	15.50	15.21	11.46	6.81
2019	7.45	6.28	6.40	9.30	6.56



	Upper	Shoal Ck	Weoka Ck	Sofkahatchee Ck	Lower
1997	5.29				2.86
2000	6.29	10.33 *	8.00 *	7.00 *	7.86
2004	6.00				5.71
2005	7.71	7.00	8.29	7.29	7.43
2008	2.50				1.79
2010	2.21	2.71	3.57	3.29	2.14
2013	3.3				1.8
2016	3.3	4.0	4.1	3.4	2.1
2019	3.4	4.7	2.1	2.5	2.6

*Mean of April/June/August only.

Figure 4. Monthly TN concentrations measured in Jordan Reservoir, April-October 2016 and 2019 vs. average monthly discharge. Discharge provided by APCO. Each bar graph depicts monthly changes in each station. The historic mean (1990-2019) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations.



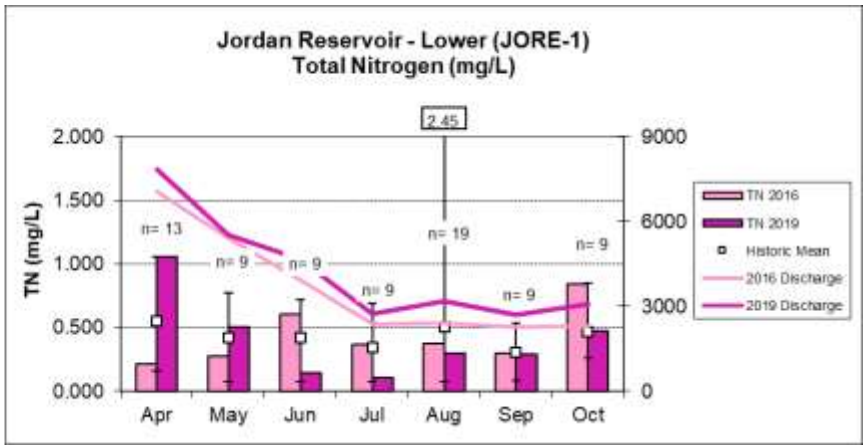
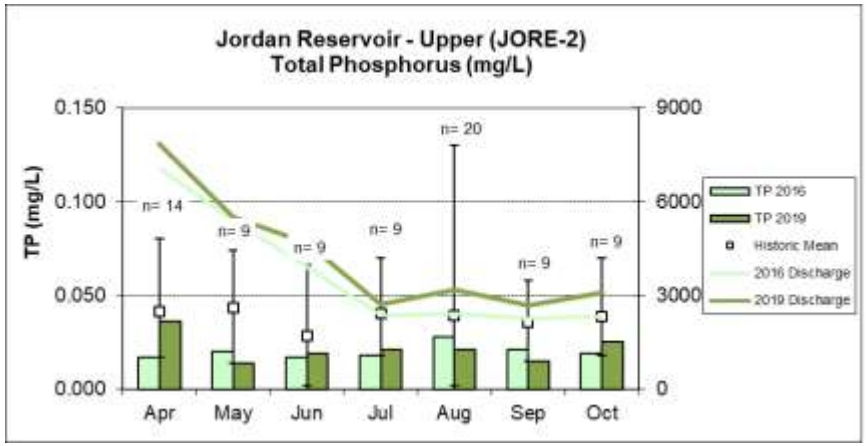


Figure 5. Monthly TP concentrations measured in Jordan Reservoir, April-October 2016 and 2019 vs. average monthly discharge. Discharge provided by APCO. Each bar graph depicts monthly changes in each station. The historic mean (1990-2019) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations.



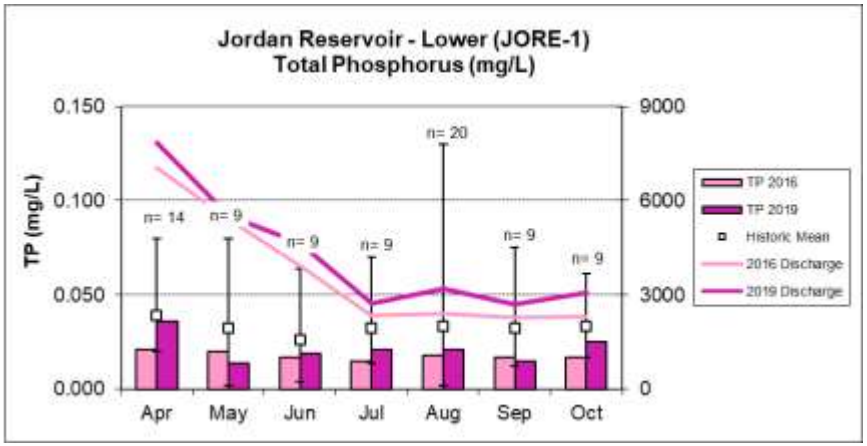


Figure 6. Monthly chl a concentrations measured in Jordan Reservoir, April-October 2016 and 2019 vs. average monthly discharge. Discharge provided by APCO**.** Each bar graph depicts monthly changes in each station. The historic mean (1990-2019) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations.

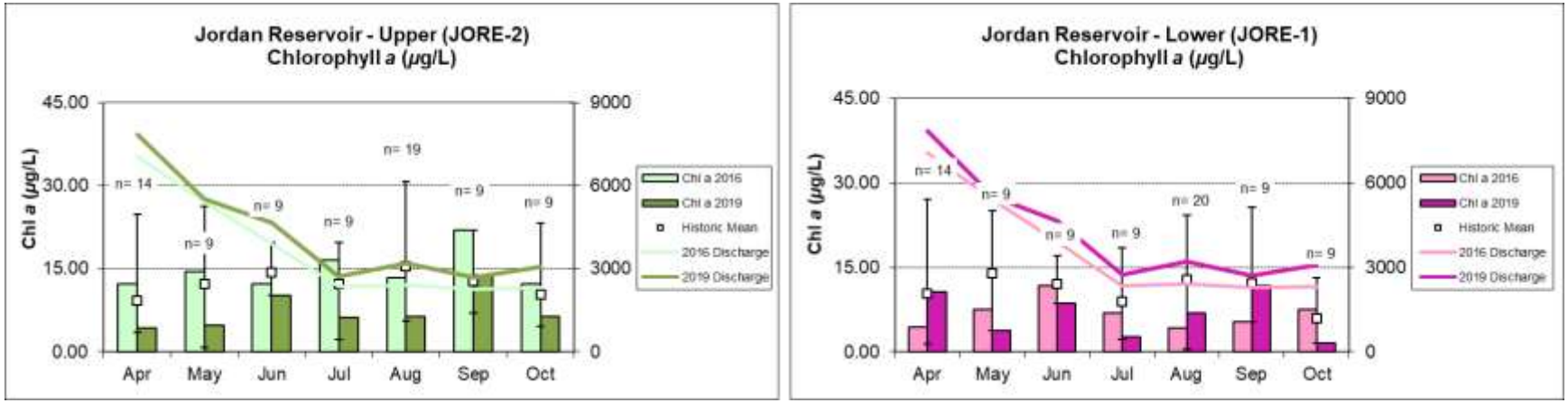


Figure 7. Monthly TSS concentrations measured in Jordan Reservoir, April-October 2016 and 2019 vs. average monthly discharge. Discharge provided by APCO. Each bar graph depicts monthly changes in each station. The historic mean (1990-2019) and min/max range are also displayed for comparison. The "n" value equals the number of datapoints included in the monthly historic calculations.

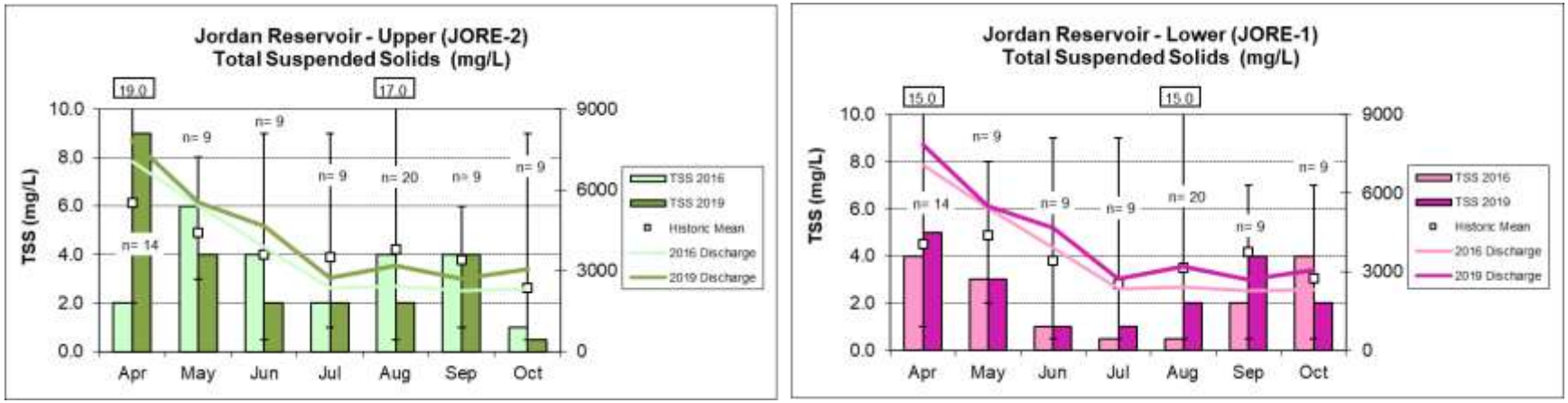


Table 2. Algal growth potential test results, Jordan Reservoir, 1997-2019 (expressed as mean Maximum Standing Crop (MSC) dry weights of Selenastrum capricornutum in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes; values below 20 mg/L MSC are considered protective of flowing streams and rivers. (Raschke and Schultz 1987).

Station	**Upper (JORE-2)**		**Lower (JORE-1)**	
	MSC	**Limiting Nutrient**	**MSC**	**Limiting Nutrient**
1997	6.80	NITROGEN	6.28	PHOSPHORUS
2000	1.79	PHOSPHORUS	2.41	PHOSPHORUS
2005	2.86	CO-LIMITING	2.74	NITROGEN
2010	2.53	PHOSPHORUS	---	---
2016	3.21	NITROGEN	---	---
2019	3.26	NITROGEN	2.92	NITROGEN

Figure 8. Monthly DO concentrations at 1.5 m (5 ft) for Jordan Reservoir stations collected April-October 2016. ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth (ADEM Admin. Code R. 335-6-10-.09).

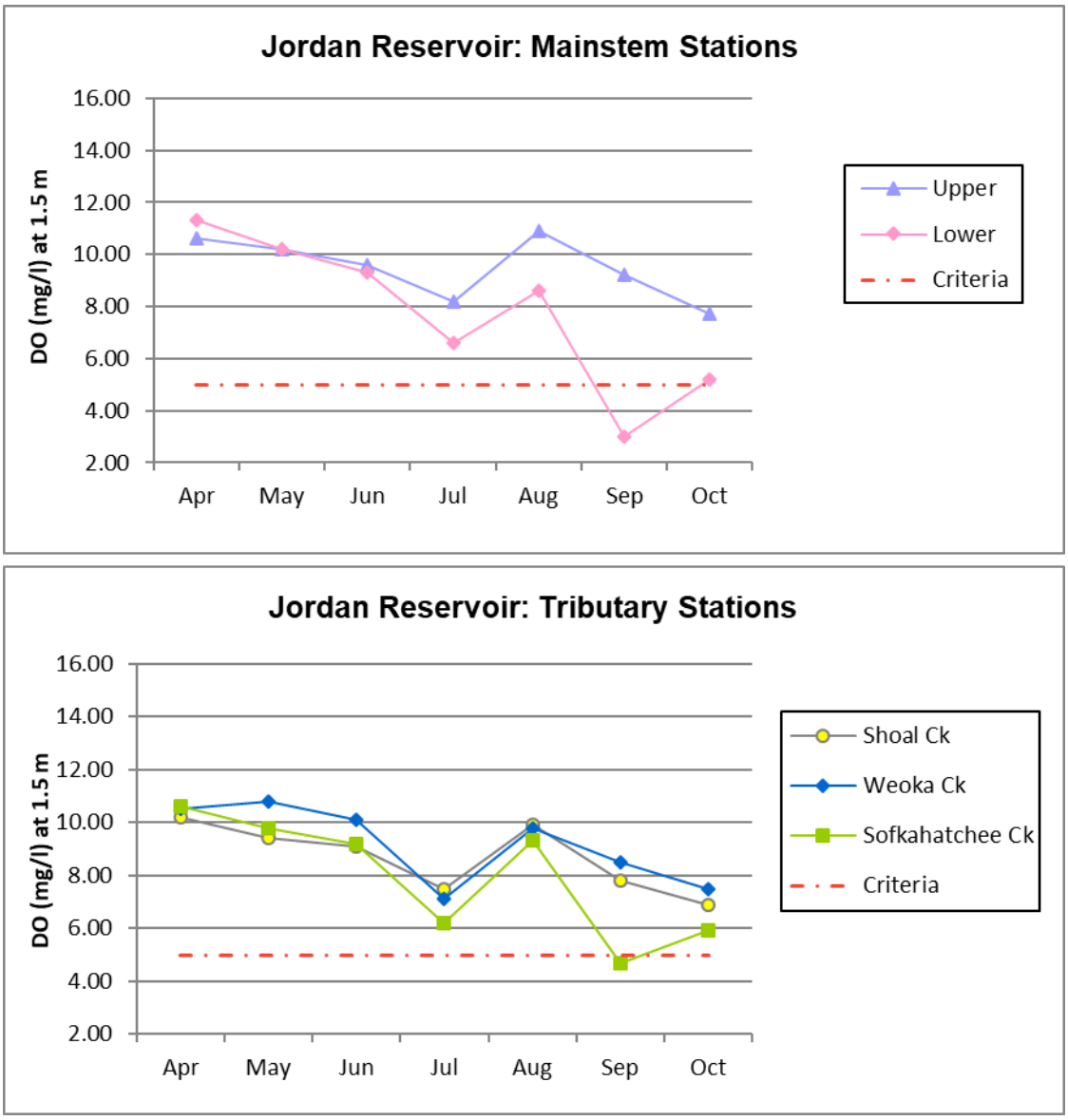


Figure 9. Monthly DO concentrations at 1.5 m (5 ft) for Jordan Reservoir stations collected April-October 2019. ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth (ADEM Admin. Code R. 335-6-10-.09).

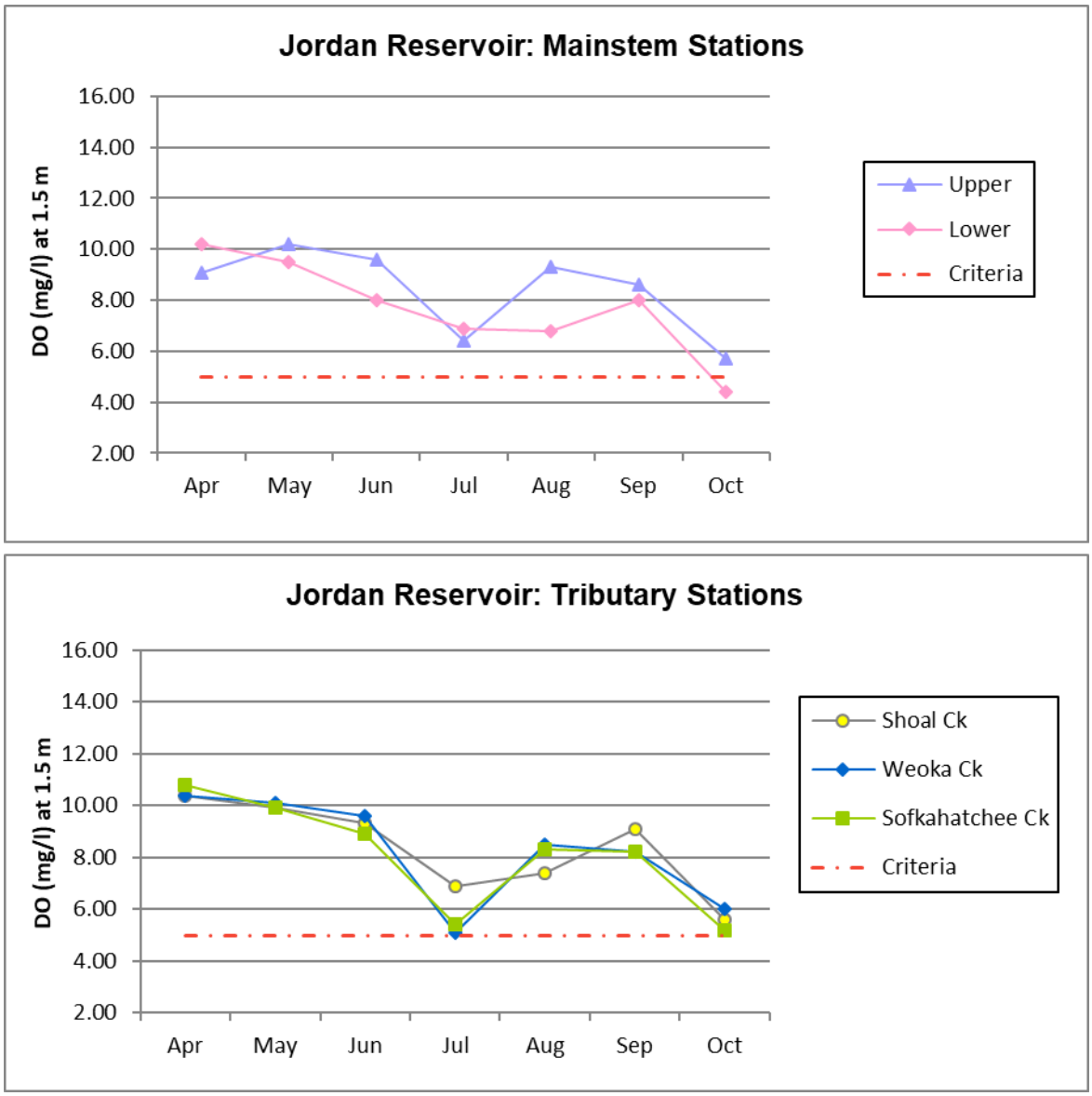


Figure 10. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the lower Jordan Reservoir station, April-October 2016.

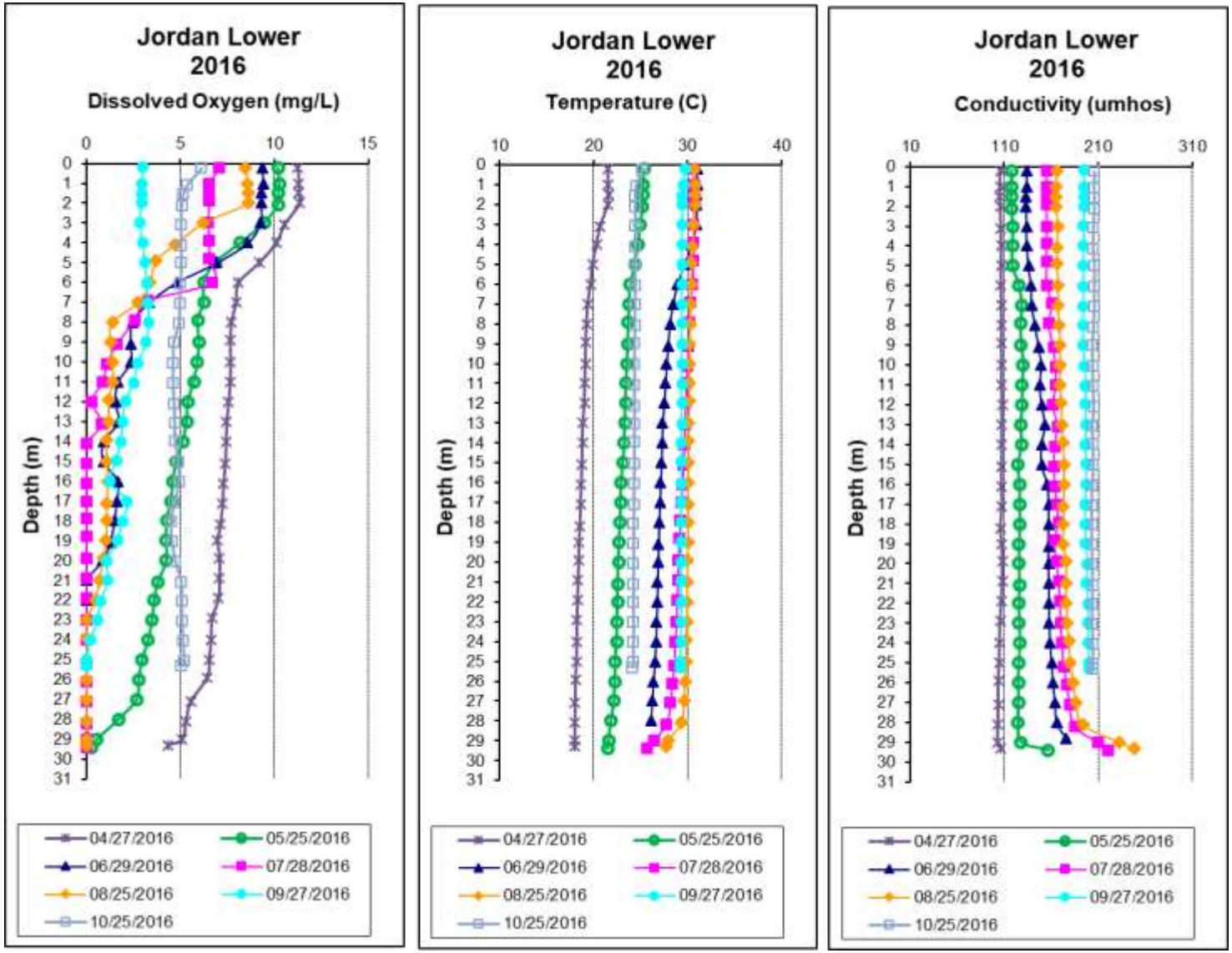


Figure 11. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the upper Jordan Reservoir station, April-October 2016.

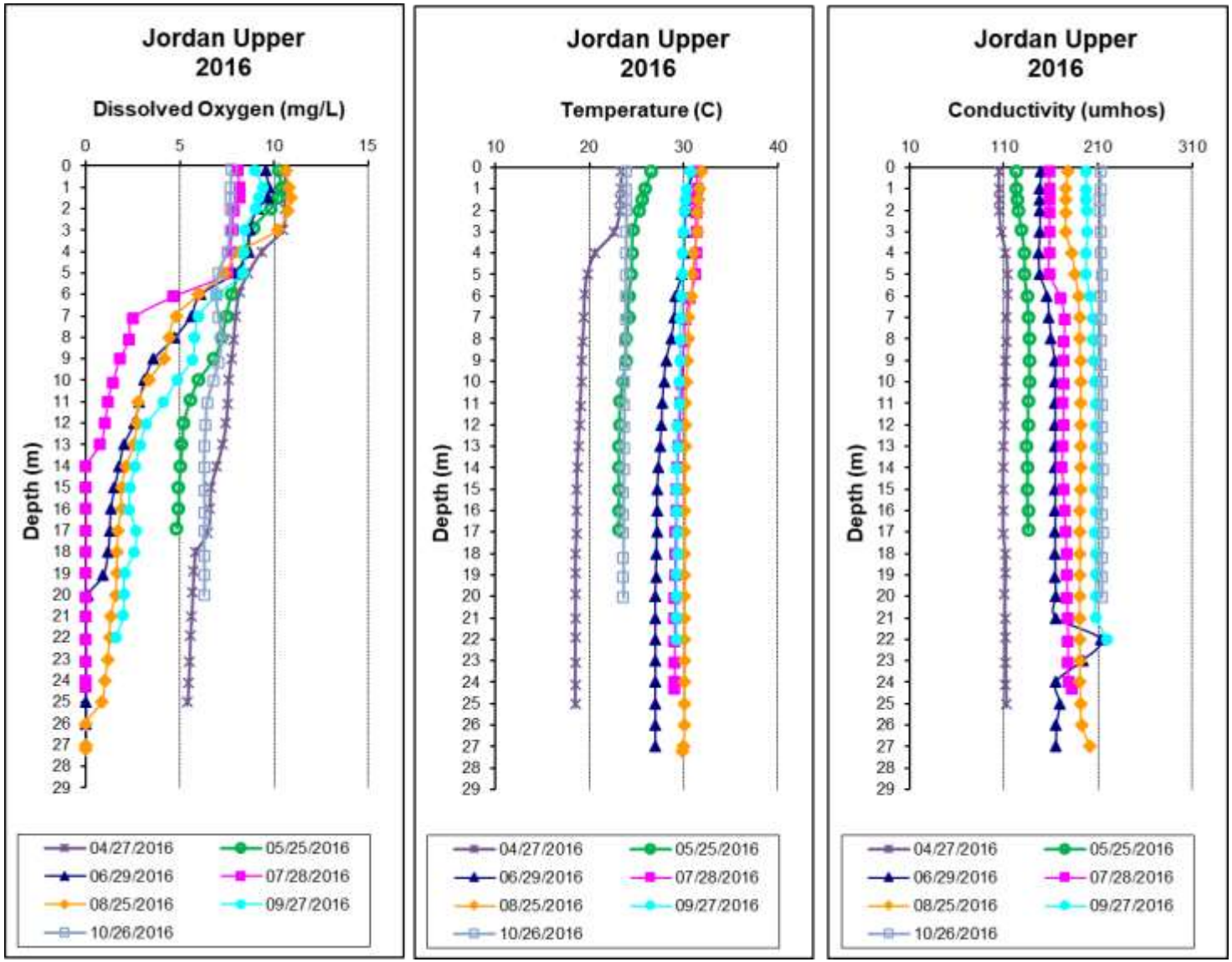


Figure 12. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the lower Jordan Reservoir station, April-October 2019.

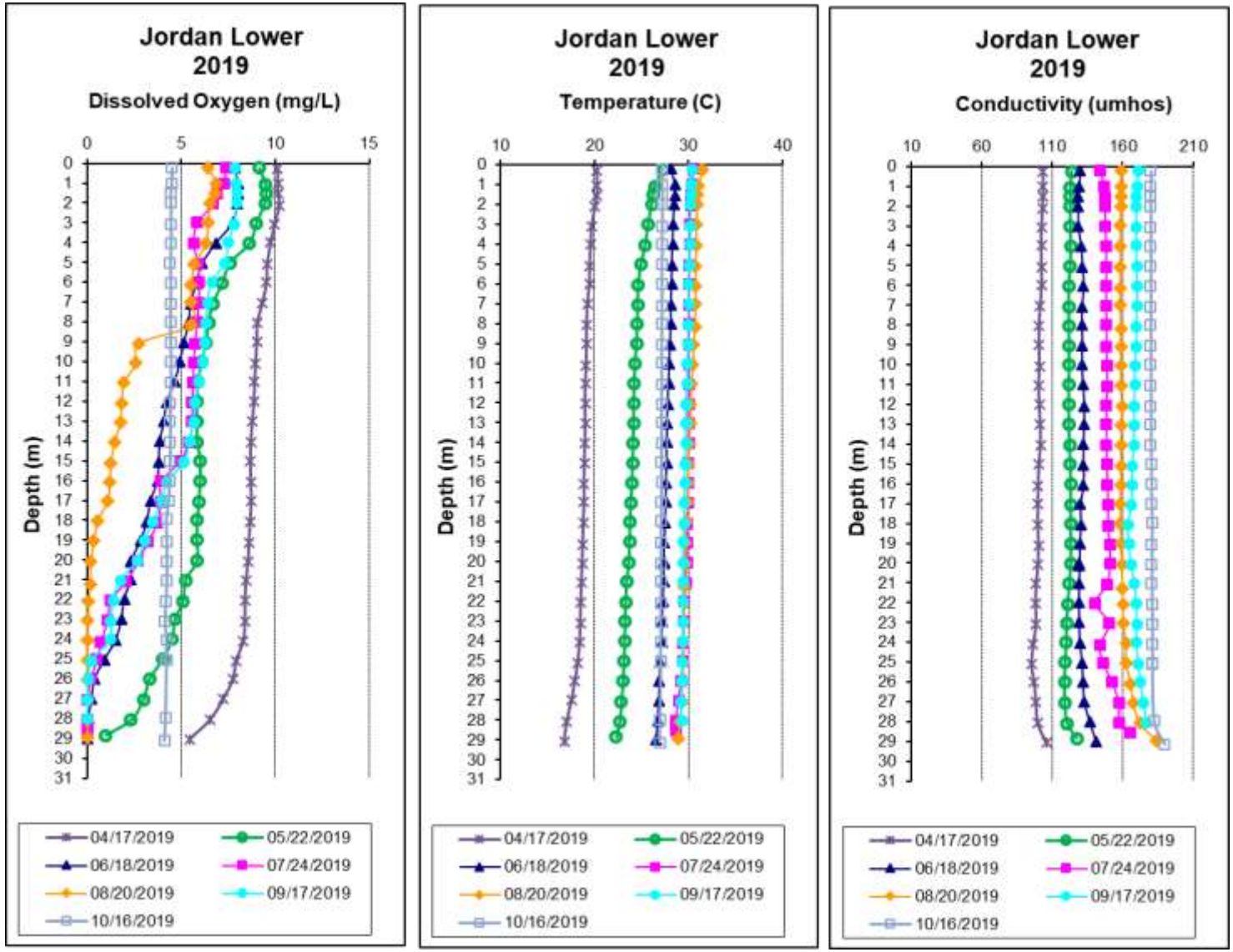


Figure 13. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the lower Jordan Reservoir station, April-October 2019.

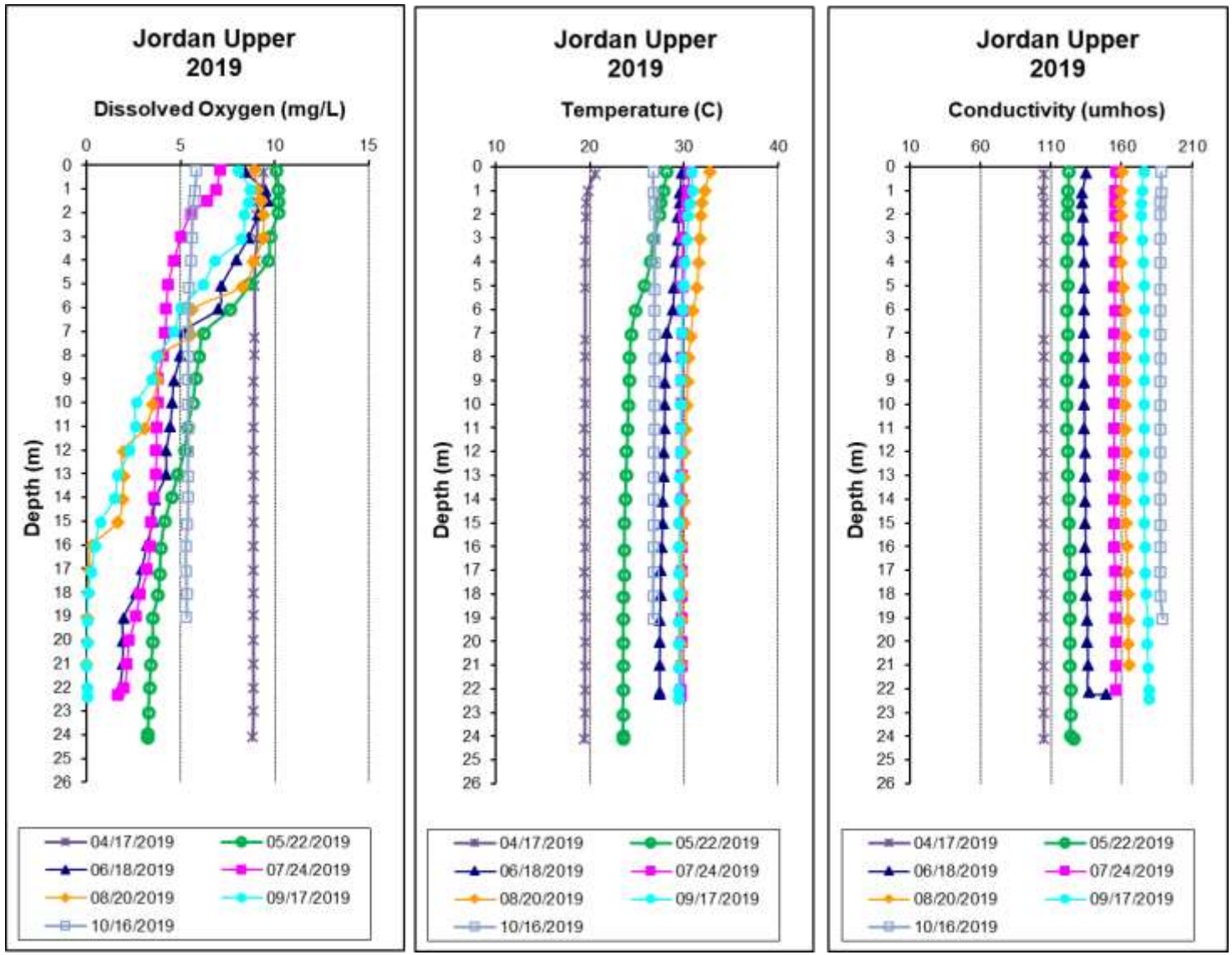


Figure 14. Monthly TSI values calculated for mainstem and tributary Jordan Reservoir stations in 2016 using chl *a* concentrations and Carlson's Trophic State Index calculation (Carlson 1977). Monthly discharge provided by APCO.

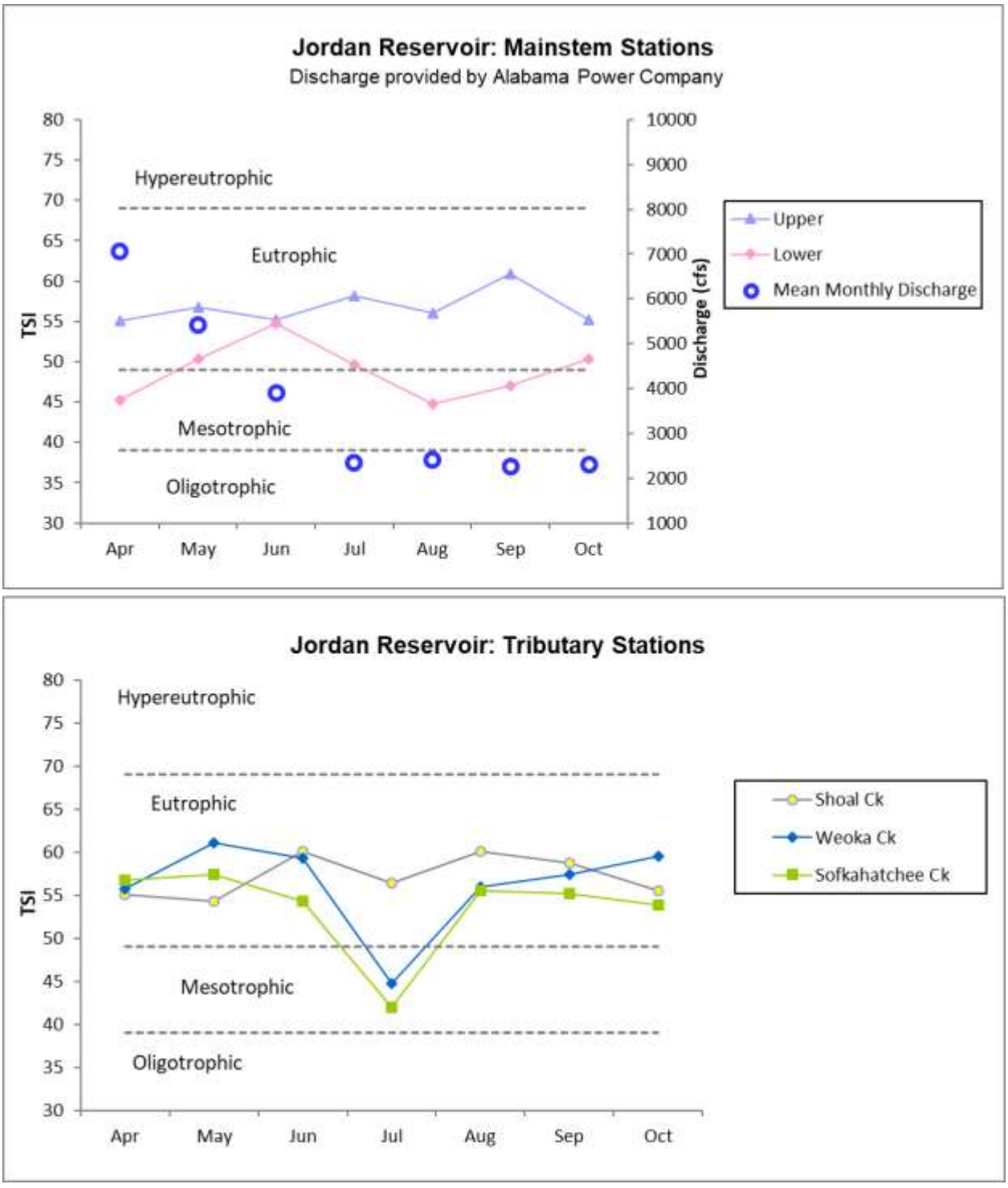
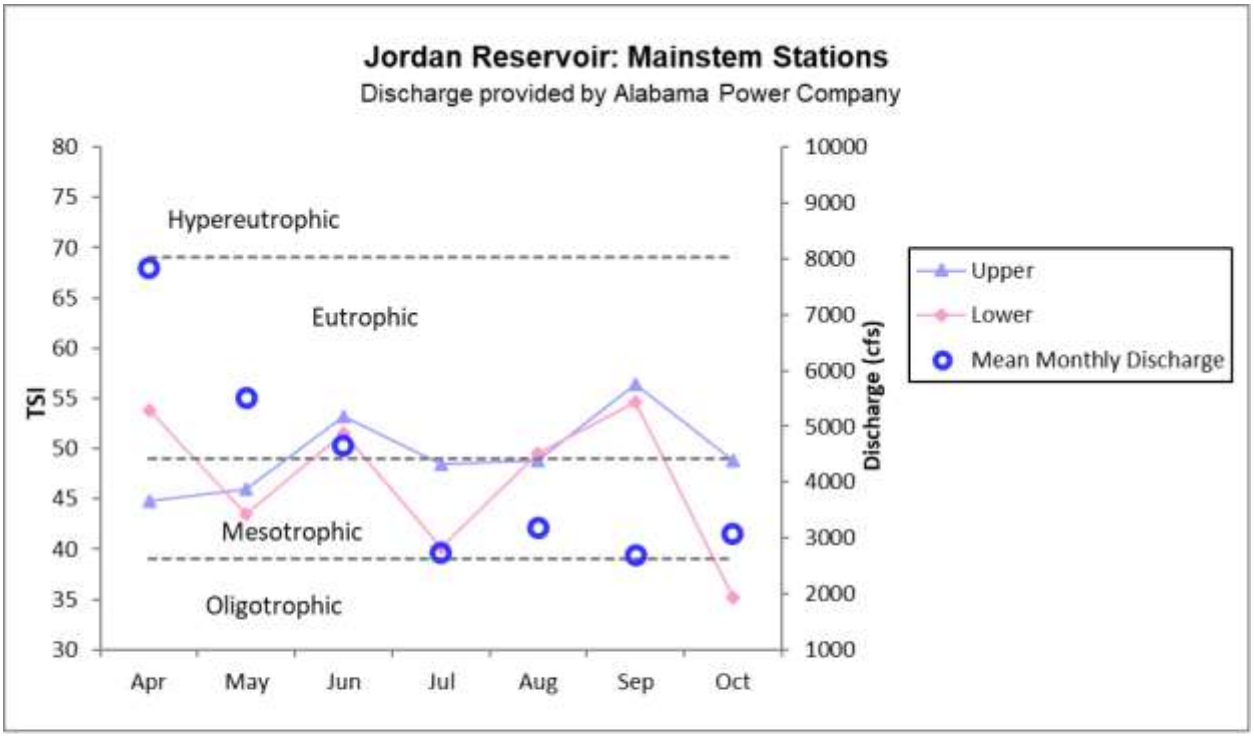
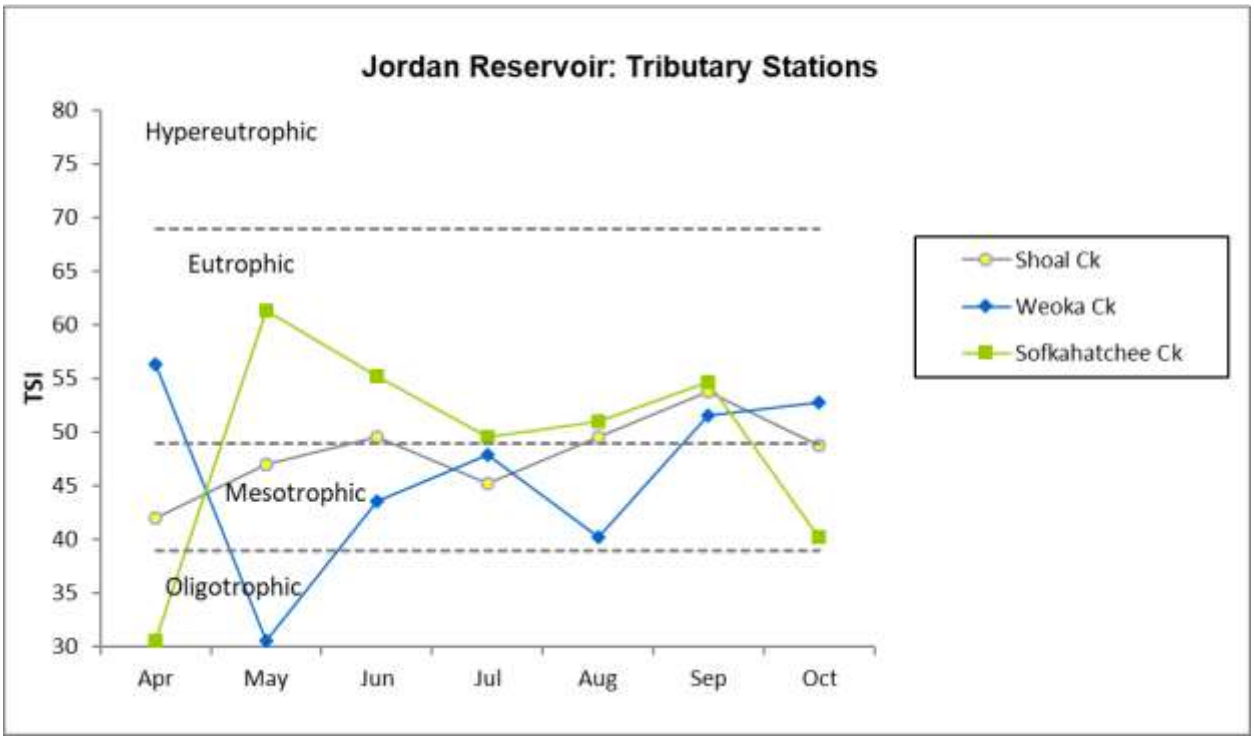


Figure 15. Monthly TSI values calculated for mainstem and tributary Jordan Reservoir stations in 2019 using chl *a* concentrations and Carlson's Trophic State Index calculation (Carlson 1977). Monthly discharge provided by APCO.





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APPENDIX

Appendix Table 1. Summary of Jordan Reservoir water quality data collected April-October, 2016. 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
JORE-1	**Physical**							
	Turbidity (NTU)	7		1.6	3.5	2.3	2.4	0.6
	Total Dissolved Solids (mg/L)	7		48.0	116.0	86.0	86.1	23.4
	Total Suspended Solids (mg/L)	7	<	1.0	4.0	2.0	2.1	1.6
	Hardness (mg/L)	4		58.3	75.4	67.2	67.0	7.4
	Alkalinity (mg/L)	7		46.8	86.7	68.8	67.1	14.6
	Photic Zone (m)	7		4.19	7.50	6.95	6.47	1.18
	Secchi (m)	7		1.55	3.08	1.93	2.12	0.56
	Bottom Depth (m)	7		25.3	29.4	29.3	28.1	1.9
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.043	0.004	0.011	0.015
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.002	0.141	0.007	0.037	0.055
	Total Kjeldahl Nitrogen (mg/L)	7		0.186	0.699	0.365	0.386	0.194
	Total Nitrogen (mg/L)[J]	7	<	0.627	2.520	0.366	0.424	0.221
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.004	0.003	0.003	0.001
	Total Phosphorus (mg/L)	7		0.015	0.021	0.017	0.018	0.002
	CBOD-5 (mg/L)	7	<	2.0	3.6	1.0	1.6	1.0
	Chlorides (mg/L)	7		3.5	8.5	4.9	5.4	2.0
	Biological							
	Chlorophyll a (mg/m³)	7		4.27	11.70	6.94	6.81	2.55
	E. coli (MPN/DL)[J]	4	<	1	1	1	1	0
JORE-2	**Physical**							
	Turbidity (NTU)	7		2.3	6.0	2.7	3.1	1.3
	Total Dissolved Solids (mg/L)	7		57.0	110.0	90.0	87.0	18.7
	Total Suspended Solids (mg/L)	7		1.0	6.0	4.0	3.3	1.7
	Hardness (mg/L)	4		63.5	77.2	70.0	70.2	6.7
	Alkalinity (mg/L)	7		46.7	90.1	70.5	70.1	15.3
	Photic Zone (m)	7		5.05	6.14	5.54	5.51	0.42
	Secchi (m)	7		1.70	2.24	1.86	1.87	0.18
	Bottom Depth (m)	7		16.9	27.2	24.3	23.2	3.8
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.007	0.030	0.004	0.008	0.006
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.002	0.052	0.002	0.009	0.019
	Total Kjeldahl Nitrogen (mg/L)	7		0.202	0.905	0.493	0.510	0.237
	Total Nitrogen (mg/L)[J]	7	<	0.627	2.718	0.494	0.520	0.230
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.003	0.002	0.002	0.001
	Total Phosphorus (mg/L)	7		0.017	0.028	0.019	0.020	0.004
	CBOD-5 (mg/L)	7	<	2.0	4.0	1.0	1.6	1.1
	Chlorides (mg/L)	7		3.3	8.9	5.1	5.7	2.1
	Biological							
	Chlorophyll a (mg/m³)	7		12.20	22.00	13.40	14.74	3.57
	E. coli (MPN/DL)[J]	4	<	1	3	1	1	1

Station	Parameter	N		Min	Max	Med	Avg	SD
JORE-3	**Physical**							
	Turbidity (NTU)	7		2.4	4.7	3.4	3.6	0.8
	Total Dissolved Solids (mg/L)	7		34.0	119.0	83.0	80.6	28.8
	Total Suspended Solids (mg/L)	7		2.0	9.0	4.0	4.0	2.4
	Hardness (mg/L)	4		56.4	74.7	65.3	65.4	9.0
	Alkalinity (mg/L)	7		35.6	88.6	64.1	64.3	18.8
	Photic Zone (m)	7		4.33	5.10	4.74	4.74	0.26
	Secchi (m)	7		1.02	2.20	1.65	1.60	0.38
	Bottom Depth (m)	7		6.0	12.5	11.0	10.2	2.5
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.055	0.004	0.017	0.020
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.002	0.039	0.002	0.009	0.014
	Total Kjeldahl Nitrogen (mg/L)	7		0.307	0.782	0.446	0.527	0.182
	Total Nitrogen (mg/L)[J]	7	<	0.969	2.349	0.485	0.536	0.177
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.003	0.002	0.002	0.001
	Total Phosphorus (mg/L)	7		0.017	0.028	0.019	0.020	0.004
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		3.0	8.7	4.7	5.4	2.2
	Biological							
	Chlorophyll a (mg/m³)	7		11.20	20.30	13.90	15.50	3.89
	E. coli (MPN/DL)[J]	4	<	1	2	1	1	1
JORE-4	**Physical**							
	Turbidity (NTU)	7		2.8	6.1	3.4	3.8	1.2
	Total Dissolved Solids (mg/L)	7		50.0	114.0	77.0	81.3	23.9
	Total Suspended Solids (mg/L)	7	<	1.0	8.0	4.0	4.1	2.5
	Hardness (mg/L)	4		50.4	73.5	60.1	61.0	9.8
	Alkalinity (mg/L)	7		34.2	87.1	62.3	61.9	18.0
	Photic Zone (m)	7		3.78	6.52	5.00	5.06	1.05
	Secchi (m)	7		1.30	2.23	1.60	1.65	0.29
	Bottom Depth (m)	7		13.0	15.0	13.9	13.9	0.6
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.040	0.004	0.011	0.014
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.002	0.036	0.002	0.007	0.013
	Total Kjeldahl Nitrogen (mg/L)	7		0.115	0.610	0.390	0.369	0.148
	Total Nitrogen (mg/L)[J]	7	<	0.351	1.938	0.392	0.375	0.157
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.003	0.002	0.002	0.001
	Total Phosphorus (mg/L)	7		0.018	0.024	0.020	0.020	0.002
	CBOD-5 (mg/L)	7	<	2.0	2.3	1.0	1.3	0.6
	Chlorides (mg/L)	7		2.8	8.4	4.4	5.1	2.1
	Biological							
	Chlorophyll a (mg/m³)	7		4.27	22.40	15.50	15.21	5.88
	E. coli (MPN/DL)[J]	4	<	1	6	4	4	3

Station	Parameter	N		Min	Max	Med	Avg	SD
JORE-5	**Physical**							
	Turbidity (NTU)	7		2.2	4.9	2.5	2.9	0.9
	Total Dissolved Solids (mg/L)	7		41.0	116.0	83.0	75.9	26.3
	Total Suspended Solids (mg/L)[J]	7	<	1.0	7.0	3.0	3.4	2.2
	Hardness (mg/L)	4		53.9	73.8	63.8	63.8	8.8
	Alkalinity (mg/L)	7		33.9	86.7	64.0	62.7	18.4
	Photic Zone (m)	7		4.22	6.99	4.98	5.37	1.07
	Secchi (m)	7		1.46	2.56	1.80	1.89	0.40
	Bottom Depth (m)	7		14.8	18.2	17.2	16.9	1.2
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.042	0.004	0.011	0.014
	Nitrate+Nitrite Nitrogen (mg/L)	7	<	0.002	0.113	0.002	0.020	0.042
	Total Kjeldahl Nitrogen (mg/L)	7		0.259	0.674	0.390	0.438	0.144
	Total Nitrogen (mg/L)	7	<	0.840	2.037	0.392	0.458	0.162
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.003	0.002	0.002	0.000
	Total Phosphorus (mg/L)	7		0.016	0.027	0.017	0.019	0.004
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		2.9	8.5	4.6	5.1	2.1
	Biological							
	Chlorophyll a (mg/m³)	7		3.20	15.50	12.30	11.46	4.02
	E. coli (MPN/DL)[J]	4	<	1	3	1	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 Jordan Reservoir water quality data collected April-October, 2019. 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
JORE-1	**Physical**							
	Turbidity (NTU)	7		1.6	5.3	2.0	2.7	1.3
	Total Dissolved Solids (mg/L)	7		41.0	106.0	89.0	76.4	26.8
	Total Suspended Solids (mg/L)	7		1.0	5.0	2.0	2.6	1.5
	Hardness (mg/L)	4		53.7	65.6	60.2	60.0	5.0
	Alkalinity (mg/L)	7		43.7	71.7	58.6	58.3	10.8
	Photic Zone (m)	7		4.38	8.29	7.06	6.67	1.37
	Secchi (m)	7		1.40	3.20	2.25	2.36	0.64
	Bottom Depth (m)	7		28.0	29.1	29.0	28.8	0.4
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.016	0.008	0.005	0.003
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.003	0.181	0.047	0.064	0.069
	Total Kjeldahl Nitrogen (mg/L)	7	<	0.200	0.872	0.296	0.346	0.260
	Total Nitrogen (mg/L)[J]	7	<	0.318	3.159	0.298	0.409	0.320
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.005	0.008	0.002	0.003	0.002
	Total Phosphorus (mg/L)	7		0.012	0.021	0.014	0.016	0.004
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		3.2	6.6	4.9	4.7	1.2
	Biological							
	Chlorophyll a (mg/m³)	7		1.60	11.70	6.94	6.56	3.99
	E. coli (MPN/DL)[J]	4		1	1	1	1	0
JORE-2	**Physical**							
	Turbidity (NTU)	7		1.9	7.4	2.9	3.3	2.0
	Total Dissolved Solids (mg/L)[J]	7		44.0	103.0	79.0	76.9	22.0
	Total Suspended Solids (mg/L)[J]	7	<	1.0	9.0	2.0	3.4	2.8
	Hardness (mg/L)	4		54.1	66.5	61.6	61.0	5.1
	Alkalinity (mg/L)	7		44.5	75.0	61.6	60.1	11.0
	Photic Zone (m)	7		3.47	6.67	6.04	5.47	1.28
	Secchi (m)	7		1.39	2.55	2.07	2.00	0.37
	Bottom Depth (m)	7		19.1	24.1	22.3	22.2	1.8
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.016	0.008	0.005	0.003
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7		0.003	0.196	0.044	0.061	0.068
	Total Kjeldahl Nitrogen (mg/L)	7	<	0.200	0.645	0.323	0.332	0.195
	Total Nitrogen (mg/L)[J]	7	<	0.354	2.523	0.373	0.392	0.243
	Dis Reactive Phosphorus (mg/L)	7	<	0.005	0.011	0.002	0.004	0.003
	Total Phosphorus (mg/L)	7		0.014	0.036	0.021	0.022	0.007
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		3.2	7.2	5.1	4.9	1.4
	Biological							
	Chlorophyll a (mg/m³)	7		4.27	13.90	6.41	7.45	3.40
	E. coli (MPN/DL)[J]	4		1	2	1	1	1

Station	Parameter	N		Min	Max	Med	Avg	SD
JORE-3	**Physical**							
	Turbidity (NTU)	7		3.0	5.0	3.5	3.7	0.7
	Total Dissolved Solids (mg/L)[J]	7	<	1.0	74.0	59.0	53.9	25.2
	Total Suspended Solids (mg/L)	7		2.0	11.9	3.0	4.7	3.4
	Hardness (mg/L)	4		49.9	63.3	57.5	57.0	5.9
	Alkalinity (mg/L)	7		39.4	73.2	55.8	56.5	12.1
	Photic Zone (m)	7		4.43	6.12	5.14	5.20	0.64
	Secchi (m)	7		1.53	2.30	1.86	1.87	0.25
	Bottom Depth (m)	7		9.7	12.6	11.3	11.3	1.1
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.016	0.008	0.005	0.003
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.003	0.147	0.003	0.039	0.055
	Total Kjeldahl Nitrogen (mg/L)	7	<	0.200	0.437	0.361	0.285	0.143
	Total Nitrogen (mg/L)[J]	7	<	0.304	1.524	0.378	0.323	0.165
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.005	0.008	0.002	0.003	0.002
	Total Phosphorus (mg/L)	7		0.013	0.023	0.020	0.019	0.004
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		3.1	7.0	4.7	4.7	1.4
	Biological							
	Chlorophyll a (mg/m³)	7		3.20	10.70	6.41	6.28	2.38
	E. coli (MPN/DL)[J]	4		1	12	3	5	5
JORE-4	**Physical**							
	Turbidity (NTU)	7		1.9	5.6	2.4	3.2	1.4
	Total Dissolved Solids (mg/L)	7		22.0	88.0	76.0	67.7	23.5
	Total Suspended Solids (mg/L)[J]	7	<	1.0	5.0	2.0	2.1	1.5
	Hardness (mg/L)	4		47.9	68.3	58.0	58.1	9.5
	Alkalinity (mg/L)	7		37.5	72.0	55.1	55.7	12.8
	Photic Zone (m)	7		3.88	6.57	5.96	5.73	0.92
	Secchi (m)	7		1.08	2.38	1.79	1.87	0.45
	Bottom Depth (m)	7		13.2	14.8	14.2	14.0	0.7
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.016	0.008	0.005	0.003
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.003	0.125	0.010	0.030	0.045
	Total Kjeldahl Nitrogen (mg/L)	7	<	0.200	0.557	0.259	0.279	0.163
	Total Nitrogen (mg/L)[J]	7	<	0.304	2.046	0.283	0.309	0.198
	Dis Reactive Phosphorus (mg/L)	7	<	0.005	0.005	0.002	0.002	0.000
	Total Phosphorus (mg/L)	7		0.012	0.020	0.018	0.017	0.003
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		2.9	6.6	4.6	4.6	1.4
	Biological							
	Chlorophyll a (mg/m³)	7	<	1.00	13.90	5.87	6.40	4.60
	E. coli (MPN/DL)[J]	4		4	6	5	5	1

Station	Parameter	N		Min	Max	Med	Avg	SD
JORE-5	**Physical**							
	Turbidity (NTU)	7		1.5	4.6	2.1	2.4	1.1
	Total Dissolved Solids (mg/L)	7		19.0	108.0	80.0	72.0	27.7
	Total Suspended Solids (mg/L)	7	<	1.0	5.0	3.0	2.5	1.7
	Hardness (mg/L)	4		51.1	68.3	60.0	59.9	7.8
	Alkalinity (mg/L)	7		37.5	72.4	58.5	57.0	12.2
	Photic Zone (m)	7		3.84	7.91	6.34	6.34	1.32
	Secchi (m)	7		1.20	2.70	2.30	2.19	0.50
	Bottom Depth (m)	7		13.6	18.3	17.5	16.9	1.6
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.004	0.016	0.008	0.005	0.003
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7	<	0.003	0.128	0.035	0.050	0.052
	Total Kjeldahl Nitrogen (mg/L)	7	<	0.200	0.481	0.298	0.276	0.139
	Total Nitrogen (mg/L)[J]	7	<	0.318	1.827	0.356	0.326	0.170
	Dis Reactive Phosphorus (mg/L)[J]	7	<	0.005	0.006	0.002	0.003	0.001
	Total Phosphorus (mg/L)	7		0.014	0.021	0.018	0.018	0.002
	CBOD-5 (mg/L)[J]	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		2.9	6.6	4.8	4.6	1.3
	Biological							
	Chlorophyll a (mg/m³)	7	<	1.00	23.00	8.01	9.30	7.43
	E. coli (MPN/DL)[J]	4		1	1	1	1	0

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