

Frank Jackson Lake Intensive Basin Survey 2017

Yellow River Basin

FJAC-1: Frank Jackson Lake deepest point, dam forebay, Covington County (31.30180/-86.28040)

BACKGROUND

The Alabama Department of Environmental Management (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 the Rivers and Reservoirs Monitoring Program (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).

In 2017, ADEM monitored Frank Jackson Lake as part of the intensive basin assessment of the Yellow River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in Frank Jackson Lake (FJAC-1) during the 2017 growing season (Apr-Oct). Monthly and/or 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)] from 2017 were compared to ADEM's historical data and established criteria.

A consumption advisory was issued by the Alabama Department of Public Health in 2008 for mercury in fish collected from Frank Jackson Lake. As a result, Frank Jackson Lake was first listed on Alabama's 2010 Clean Water Act (CWA) §303(d) list of impaired waters for not meeting its water use classification.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Frank Jackson Lake is classified as a *Fish & Wildlife (F&W)* waterbody located in the Southern Pine Plains and Hills ecoregion (65f). Based on the 2006 National Land Cover Dataset, land use within the 75 mi² watershed is predominantly forest (47%) (Figure 3). As of January 28, 2016, ADEM has issued a total of 4 NPDES permits within the watershed. Two of those permits are located within 10 mi upstream of the station (Figure 2).

SITE DESCRIPTION

Frank Jackson Lake at FJAC-1 is a fairly small impoundment of Lightwood Knot Creek, which flows into the Yellow River. Frank Jackson Lake has a mean bottom depth of 6.4 m (Table 2) at the sampling location.



Figure 1. Frank Jackson Lake at FJAC-1.

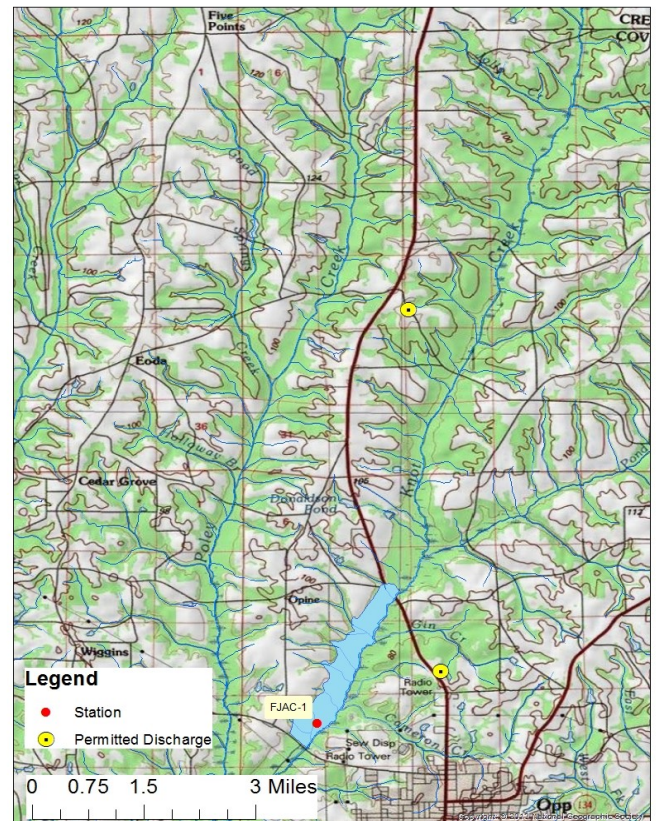


Figure 2. Map of Frank Jackson Lake. Though additional permits may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

Table 1: Summary of Watershed FJAC-1

Basin	Yellow R	
Drainage Area (mi ²)	75	
Ecoregion ^a	65f	
% Land use		
Open Water	2%	
Developed	Open Space	5%
	Low Intensity	1%
	Medium Intensity	0%
	High Intensity	0%
Barren Land	0%	
Forest	Deciduous Forest	15%
	Evergreen Forest	22%
	Mixed Forest	10%
Shrub/Scrub	14%	
Herbaceous	2%	
Hay/Pasture	17%	
Cultivated Crops	10%	
Wetlands	Woody	3%
	Emergent Herb.	0%
# NPDES outfalls ^b TOTAL		4
Construction Stormwater	1	
Mining	0	
Small Mining	1	
Industrial General	2	
Industrial Individual	0	
No Exposure	0	
Municipal	0	
Underground Injection Control	0	

a. Southern Pine Plains and Hills

b. # NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

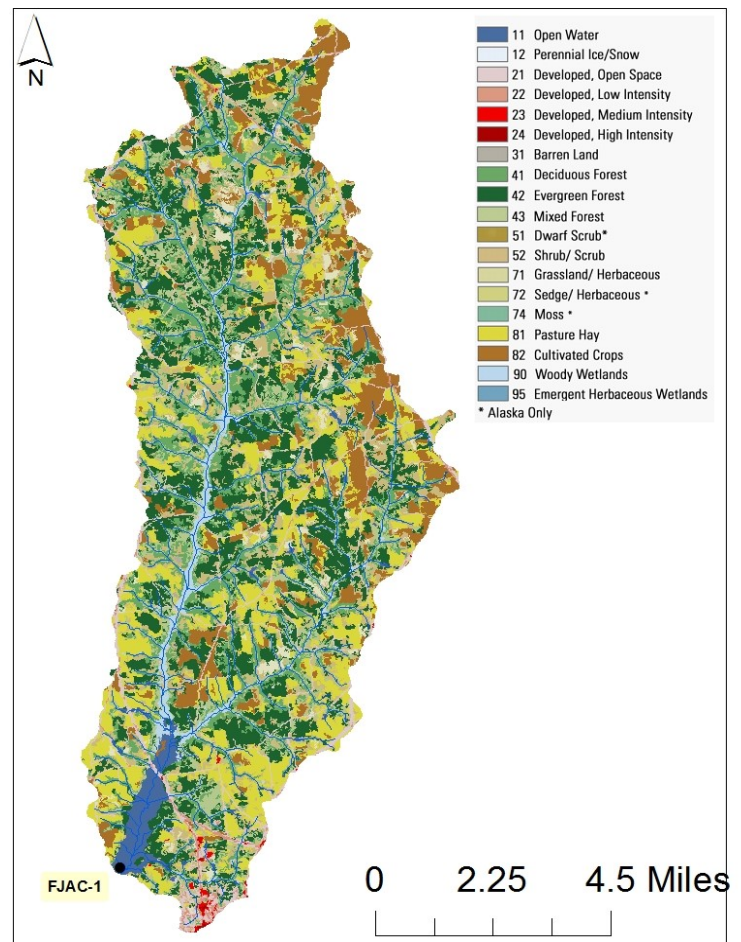


Figure 3. Land use within Frank Jackson Lake at FJAC-1.

METHODS

Water quality assessments were 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 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. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2017 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. A summary of all water chemistry analyses are presented in Table 2.

The mean growing season TN value decreased in 2017 from the 2014 sampling season. (Figure 4). Monthly TN concentrations were highest in June and July.

The mean growing season TP concentration decreased slightly in 2017 (Figure 4). Monthly TP concentrations were fairly consistent throughout the growing season with values peaking in June and July.

In 2017, the growing season mean chl *a* value was lower than 2014 (Figure 4). Monthly chl *a* concentrations were higher early in the growing season, with highest concentrations measured in May.

Mean TSI remained eutrophic in 2017, though closer to mesotrophic conditions than in 2014. Monthly TSI declined throughout the growing season. The reservoir was eutrophic April-June, decreased to borderline eutrophic July-September, and reached oligotrophic conditions in October (Figure 4).

The mean growing season TSS value was lower in 2017 than 2014 (Figure 5). Monthly TSS concentrations were highest in April and June.

AGPT results show that Frank Jackson Lake continues to be phosphorus limited in 2017 (Table 3). Raschke and Schultz (1987) found that maximum standing crop (MSC) values below 5.0 mL are considered to be protective of reservoir and lake systems. The mean (MSC) value in 2017 was 1.42 mg/L.

DO concentrations were above the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) during every station visit in 2017 (ADEM Admin. Code R. 335-6-10-.09) (Figure 6).



Figure 4. Mean growing season (2007-2017) and monthly (April-October, 2017) TN, TP, chl *a* and TSI measured in Frank Jackson Lake. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

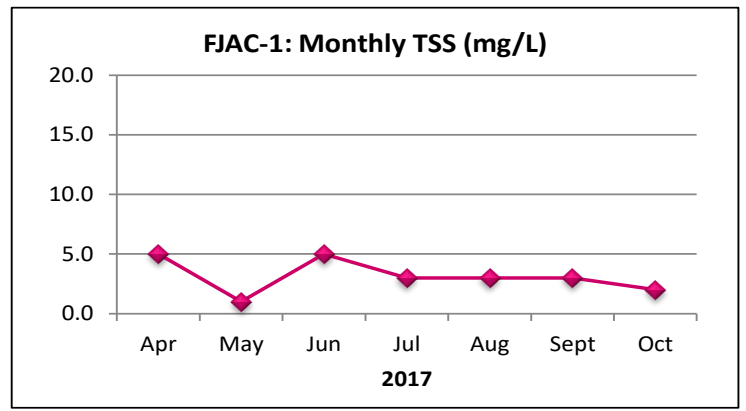
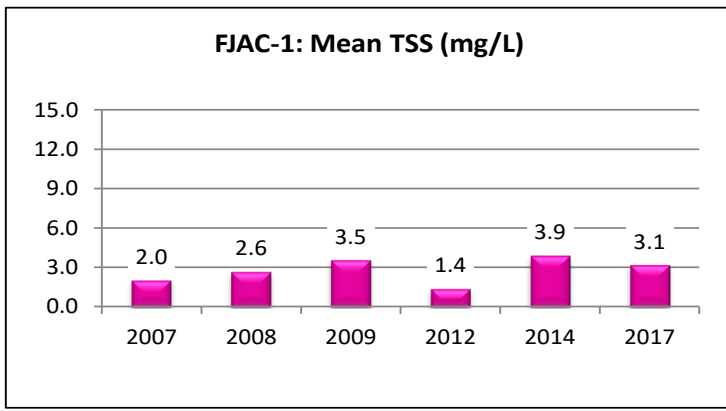


Figure 5. Mean growing season and monthly TSS measured in Frank Jackson Lake.

Table 2. Summary of water quality data collected April-October, 2017. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

FJAC-1	N	Min	Max	Med	Avg	SD
Physical						
Turbidity (NTU)	7	3.8	14.5	6.6	7.6	4.0
Total Dissolved Solids (mg/L) ^J	7	17.0	44.0	24.0	28.3	9.8
Total Suspended Solids (mg/L)	7	1.0	5.0	3.0	3.1	1.5
Hardness (mg/L)	4	9.7	12.5	11.5	11.3	1.4
Alkalinity (mg/L)	7	7.5	10.2	9.4	9.1	1.1
Photic Zone (m)	7	2.03	3.35	2.28	2.53	0.52
Secchi (m)	7	0.49	1.52	1.22	1.15	0.36
Bottom Depth (m)	7	6.3	6.5	6.4	6.4	0.1
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.004	0.066	0.004	0.021	0.025
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	< 0.002	0.052	0.018	0.020	0.021
Total Kjeldahl Nitrogen (mg/L)	7	< 0.077	0.509	0.376	0.347	0.165
Total Nitrogen (mg/L) ^J	7	< 0.040	0.529	0.377	0.367	0.171
Dis Reactive Phosphorus (mg/L) ^J	7	0.002	0.005	0.002	0.003	0.001
Total Phosphorus (mg/L)	7	0.010	0.016	0.012	0.013	0.003
CBOD-5 (mg/L)	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	2.7	4.0	3.5	3.4	0.4
Biological						
Chlorophyll a (mg/m ³)	7	< 0.10	13.40	7.48	7.87	4.22
E. coli (MPN/DL) ^J	4	1	10	3	3	4

J= one or more of the values is an estimate; N= # samples.

Table 3. Algal growth potential test results 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 (Raschke and Schultz 1987).

FJAC-1	MSC	Limiting Nutrient
6/28/2007	1.76	Phosphorus
8/1/2007	1.42	Phosphorus
8/29/2007	1.63	Phosphorus
9/3/2008	2.65	Phosphorus
8/20/2009	0.98	Phosphorus
8/27/2014	2.82	Phosphorus
8/22/2017	1.42	Phosphorus

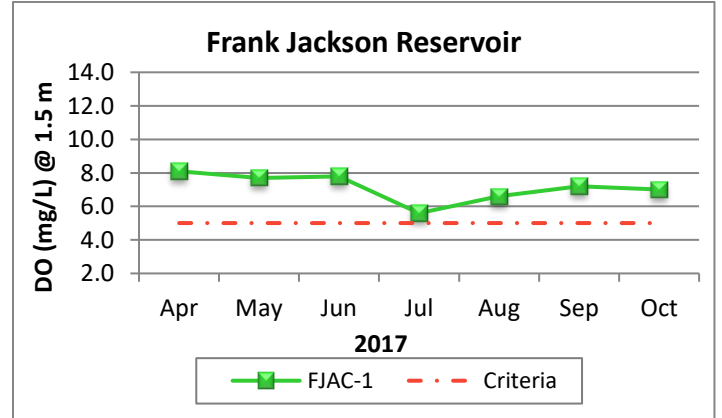


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Frank Jackson Lake, collected April-October 2017. ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth.

REFERENCES

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