Alabama Department of Environmental Management

Tennessee River Basin

Rivers and Reservoirs Monitoring Program

Long Island Creek Embayment Guntersville Reservoir Intensive Basin Survey 2015 & 2018

GUNM-11: Long Island Creek approx. 0.5 mi upstream of confluence with TN River (Jackson Co 34.89911/-85.70357)

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 2015 and 2018, ADEM monitored the Long Island Creek tributary embayment of Guntersville Reservoir as part of the intensive basin assessment of the Tennessee River under the RRMP (Figure 1). This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Long Island Creek embayment (GUNM-11) during the 2015 and 2018 growing seasons (Apr-Oct). These are the fourth and fifth intensive basin assessment of the Tennessee River since ADEM began sampling on a basin rotation. 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)] were compared to ADEM's historical data and established criteria.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Long Island Creek is classified as a *Public Water Supply/Swimming/Fish & Wildlife (PWS/S/F&W)* stream located in the Sequatchie Valley ecoregion (68b). Based on the 2016 National Land Cover Dataset, land use within the 86 mi^2 watershed is predominantly forest (52%) (Figure 3). As of January 28, 2016, ADEM has issued a total of 111 NPDES permits within the watershed. All of those permits are located within 10 mi of the station (Figure 2).

SITE DESCRIPTION

The Long Island Creek embayment at GUNM-11 is located just south of Bridgeport, AL. It begins with the convergence of Big Spring Branch and Miller Creek before flowing into the Tennessee River near river mile 410. Long Island Creek has a mean bottom depth of approximately 4.5 meters at the sampling location (Table 2).

Figure 1. Long Island Creek at GUNM-11.

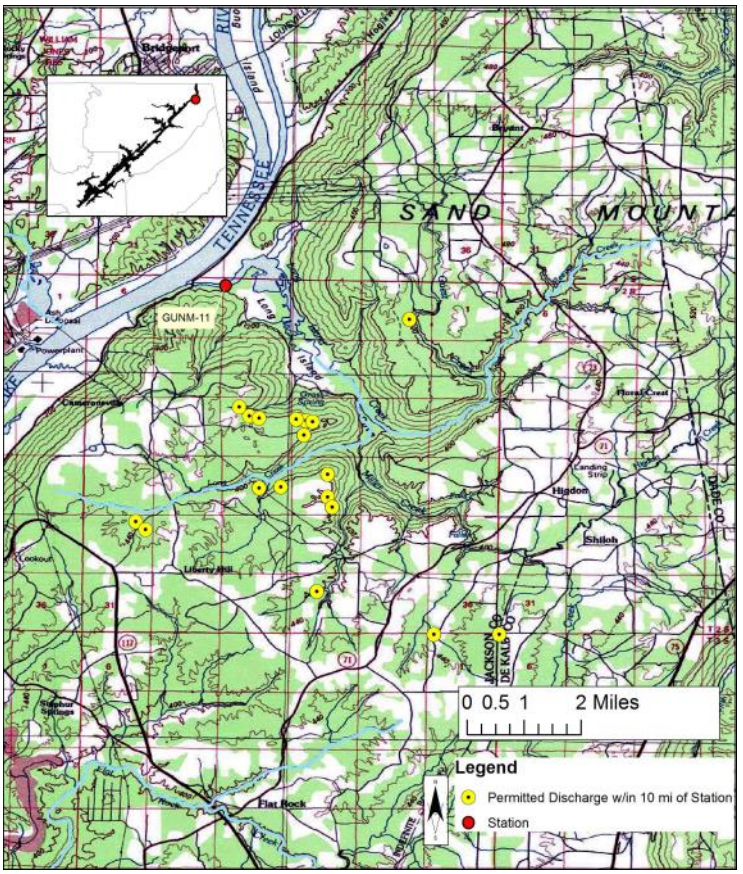


Figure 2. Map of Long Island Creek Embayment of Guntersville Reservoir. Though additional discharges may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

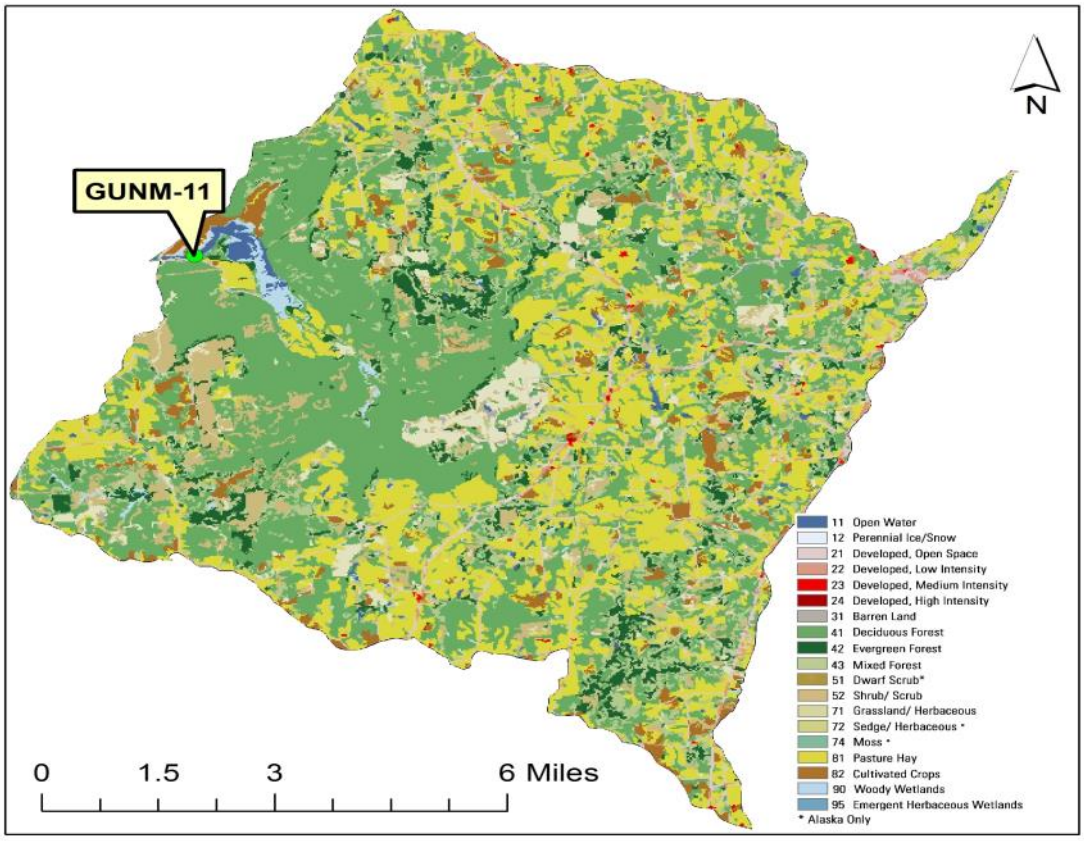


Figure 3. Land use within the Long Island Creek watershed at GUNM-11.

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

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with discharge data, if available, and ADEM's previously collected data to help interpret the results. Carlson's TSI was calculated from the corrected chl *a* concentrations (1977).

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 axis ranges of the graphs in Figures 4-6 were set to maximum values reservoir-wide so that all embayment reports on the same reservoir could be compared.

The mean growing season TN concentration decreased from 2013-2018 (Figure 4). Monthly TN concentrations were highest in April of 2015 and 2018.

The mean growing season TP concentration decreased 2009-2018 (Figure 5). The highest monthly TP concentration was measured in August of 2015 and in May of 2018.

The mean growing season chl *a* value calculated for 2018 was the highest mean recorded at Long Island Creek (Figure 5). The highest monthly chl *a* concentration was measured in July of 2015 and in September of 2018.

The mean TSI declined 2009-2013 and then increased from 2013-2018 (Figure 5). Mean TSI has remained mesotrophic or oligotrophic over the years, but conditions increased to eutrophic for the first time in 2018. Monthly TSI conditions in Long Island Creek were oligotrophic or mesotrophic each month during 2015. During 2018, eutrophic conditions were measured during May, June, August, and September.

Table 1. Summary of Watershed — **GUNM-11**

Basin		Tennessee R
Drainage Area (mi^2)		86
Ecoregion[a]		68b
Assessment Unit		AL06030001-0203-101
% Landuse		
Open Water		1%
Developed	Open Space	4%
	Low Intensity	1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	37%
	Evergreen Forest	5%
	Mixed Forest	10%
Shrub/Scrub		7%
Herbaceous		4%
Hay/Pasture		26%
Cultivated Crops		4%
Wetlands	Woody	1%
	Emergent Herb.	<1%
# NPDES outfalls[b]	TOTAL	111
Construction Stormwater		0
Mining		105
Industrial General		3
Underground Injection Control		3

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

Table 2. Summary of water quality data collected (April-October, 2015-2018). 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.

GUNM-11 2015	N		Min	Max	Med	Avg	SD
Physical							
Turbidity (NTU)	7		3.1	11.5	4.1	4.1	2.9
Total Dissolved Solids (mg/L)J	7		61.0	127.0	109.0	103.3	21.8
Total Suspended Solids (mg/L)	7		1.0	6.0	5.0	4.3	1.8
Hardness (mg/L)	4		12.0	96.5	80.4	67.3	37.6
Alkalinity (mg/L)	7		26.9	73.0	61.9	59.3	15.3
Photic Zone (m)	7		3.01	4.81	4.23	3.90	0.72
Secchi (m)	7		1.00	2.67	1.78	1.86	0.51
Bottom Depth (m)	7		3.0	4.8	4.4	4.3	0.6
Chemical							
Ammonia Nitrogen (mg/L)J	7	<	0.007	0.099	0.005	0.028	0.039
Nitrate+Nitrite Nitrogen (mg/L)J	7		0.056	0.424	0.152	0.211	0.135
Total Kjeldahl Nitrogen (mg/L)	7		0.174	0.516	0.383	0.350	0.110
Total Nitrogen (mg/L)J	7		0.927	2.247	0.616	0.560	0.144
Dis Reactive Phosphorus (mg/L)J	7	<	0.007	0.015	0.009	0.009	0.005
Total Phosphorus (mg/L)	7		0.018	0.030	0.019	0.022	0.005
CBOD-5 (mg/L)J	7	<	2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)J	7		1.8	8.1	6.5	5.7	2.1
Biological							
Chlorophyll a (mg/m³)	7	<	1.00	6.14	2.14	2.81	2.20
E. coli (MPN/DL)J	3		2	19	2	8	10
GUNM-11 2018	**N**		**Min**	**Max**	**Med**	**Avg**	**SD**
Physical							
Turbidity (NTU)	7		3.2	7.8	4.7	4.8	1.6
Total Dissolved Solids (mg/L)J	7		63.0	99.0	91.0	87.9	12.0
Total Suspended Solids (mg/L)J	7		3.0	10.0	5.0	5.0	2.4
Hardness (mg/L)	4		60.2	66.6	64.4	63.9	2.7
Alkalinity (mg/L)	7		37.0	68.0	58.9	57.3	9.8
Photic Zone (m)	7		3.48	5.04	3.92	4.04	0.54
Secchi (m)	7		1.19	2.23	1.52	1.61	0.38
Bottom Depth (m)	8		3.0	5.2	5.0	4.7	0.7
Chemical							
Ammonia Nitrogen (mg/L)J	7	<	0.015	0.028	0.008	0.013	0.010
Nitrate+Nitrite Nitrogen (mg/L)J	7		0.042	0.345	0.168	0.183	0.098
Total Kjeldahl Nitrogen (mg/L)	7		0.185	0.422	0.303	0.305	0.084
Total Nitrogen (mg/L)J	7		1.026	1.944	0.434	0.488	0.134
Dis Reactive Phosphorus (mg/L)J	7	<	0.004	0.010	0.004	0.005	0.003
Total Phosphorus (mg/L)J	7		0.006	0.021	0.016	0.016	0.005
CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)J	7		2.4	5.4	5.2	4.7	1.1
Biological							
Chlorophyll a (mg/m³)	7	<	1.00	47.00	8.01	13.88	15.50
E. coli (MPN/DL)J	4		1	13	4	6	6

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

RESULTS (con't)

Mean growing season TSS concentrations have remained stable across sampling years (Figure 5). Monthly TSS concentrations were highest in April and September of 2015 and in May of 2018.

AGPT results show that GUNM-11 was phosphorus limited in both 2009 and 2013 (Table 3). Raschke and Schultz (1987) found that maximum standing crop (MSC) values below 5.0 mg/L are considered to be protective of reservoir and lake systems. The mean MSC value was greater than 5.0 mg/L both years sampled. AGPT samples were not collected at Long Island Creek during the 2015 or 2018 sampling seasons.

The DO concentration at the Long Island Creek station was above the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) for all months sampled in 2015. However, DO did drop to 4.1 mg/L in September of 2018 (ADEM Admin. Code R. 335-6-10-.09) (Figure 6).

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).

Year	Mean MSC	Limiting Nutrient
2009	8.12	PHOSPHORUS
2013	9.43	PHOSPHORUS

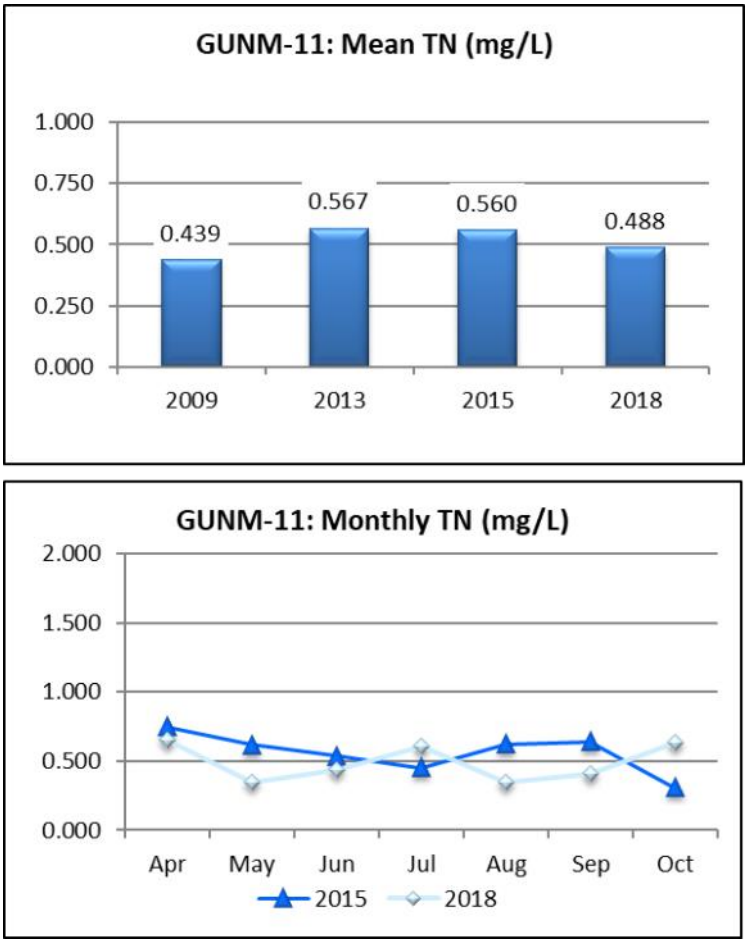
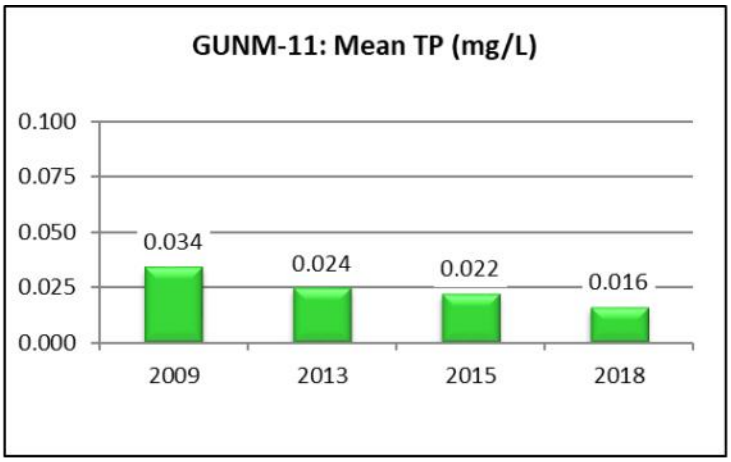
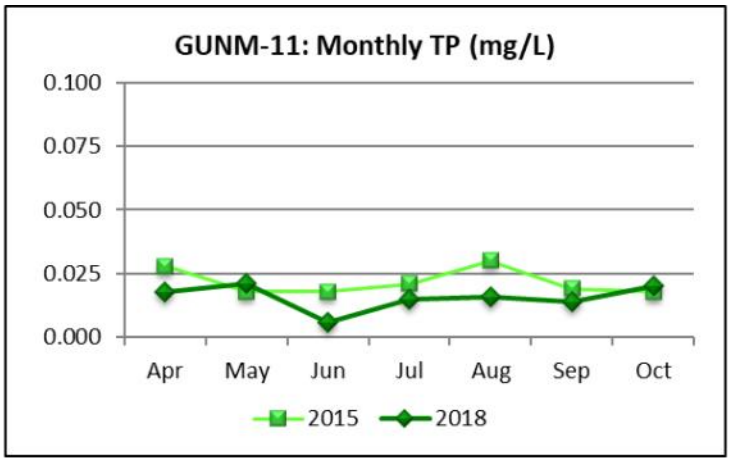
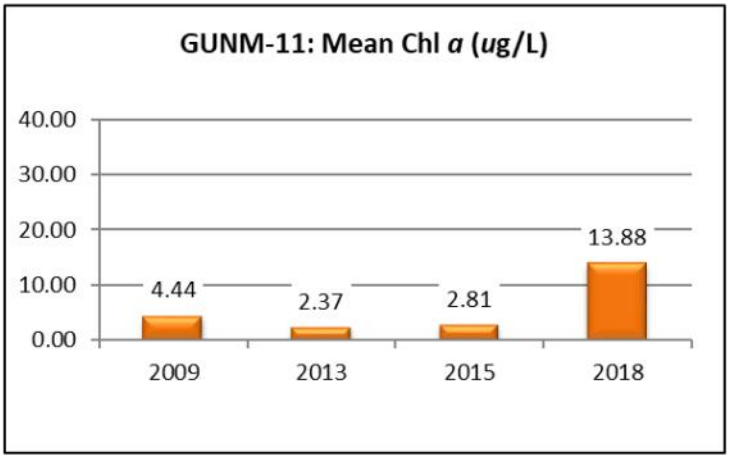
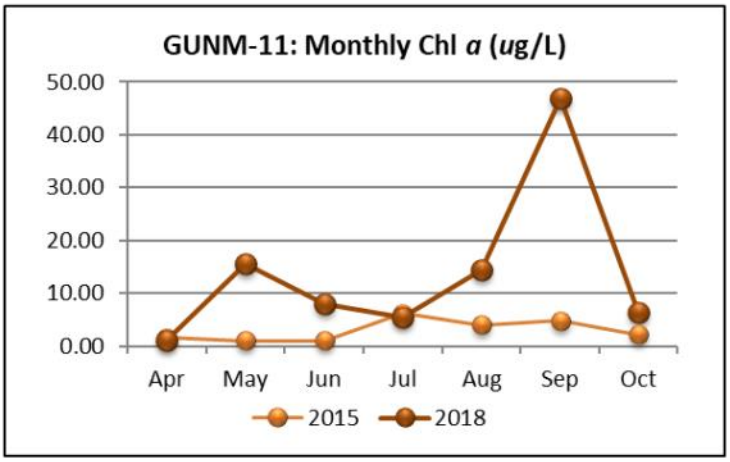


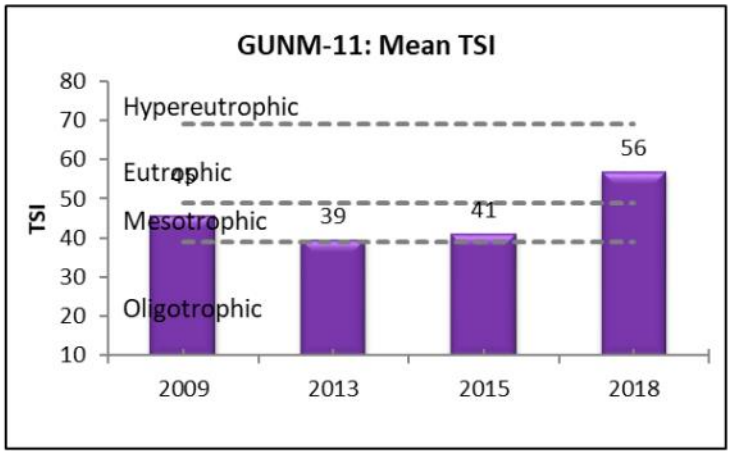
Figure 4. Mean growing season (2009-2015) and monthly (April-October, 2015 and 2018) TN measured in the Long Island Creek embayment (GUNM-11) of Guntersville Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

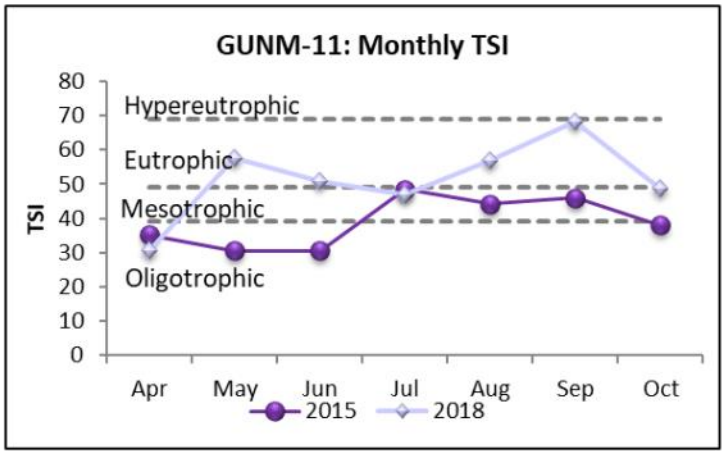


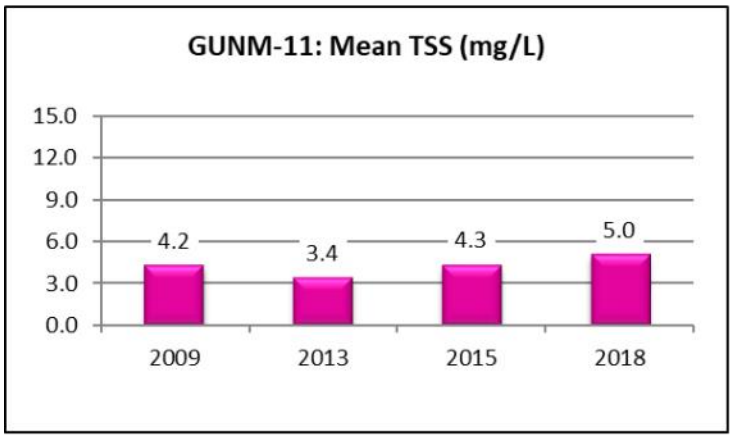












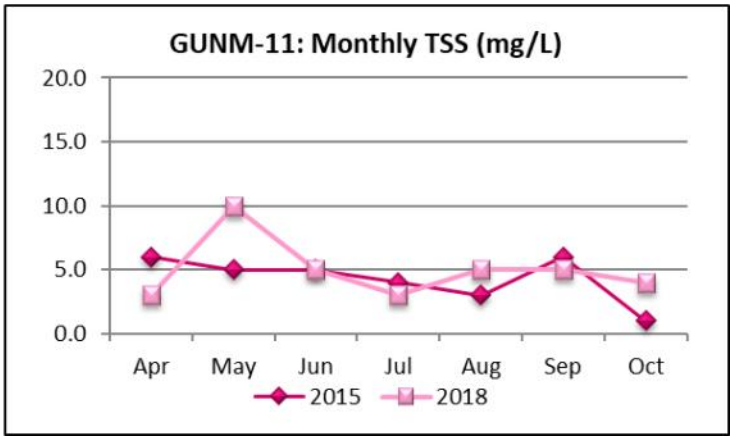


Figure 5. Mean growing season (2009-2015) and monthly (April-October, 2015 and 2018) TP, chl *a,* TSI, and TSS measured in the Long Island Creek embayment (GUNM-11) of Guntersville Reservoir**.** Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

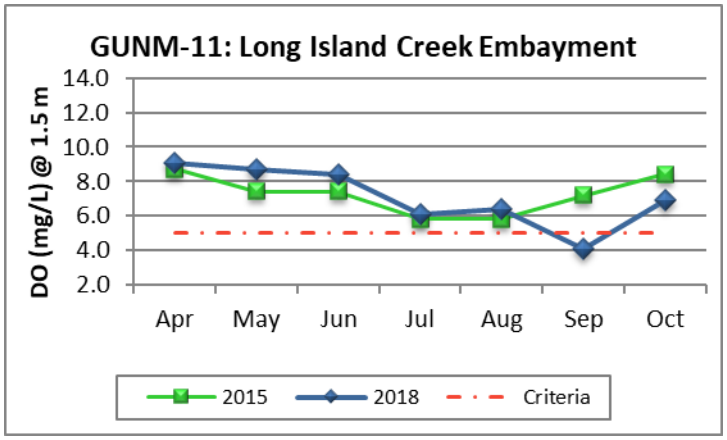


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for the Long Island Creek embayment station (GUNM-11) of Guntersville Reservoir collected (April-October, 2015-2018). ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth.

REFERENCES

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