

Coon Creek Embayment Guntersville Reservoir Intensive Basin Survey 2015 & 2018

GUNM-2: Coon Creek approx. 2 miles upstream of lake confluence (Jackson Co 34.75049/-85.83659)

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 Coon 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 Coon Creek embayment (GUNM-2) during the 2015 and 2018 growing seasons (Apr-Oct). This is 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. Coon 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 89 mi² watershed is predominantly forest (52%) and hay/pasture (22%) (Figure 3). As of January 28, 2016, ADEM has issued a total of 43 NPDES permits within the watershed. Two of those permits are located within 10 mi of the station (Figure 2).

SITE DESCRIPTION

The Coon Creek embayment is located just west of Flat Rock, AL, and flows into Guntersville Reservoir near river mile 396. Coon Creek has a mean bottom depth of about 3.1 m (Table 2) at the sampling location.



Figure 1. Coon Creek at GUNM-2.

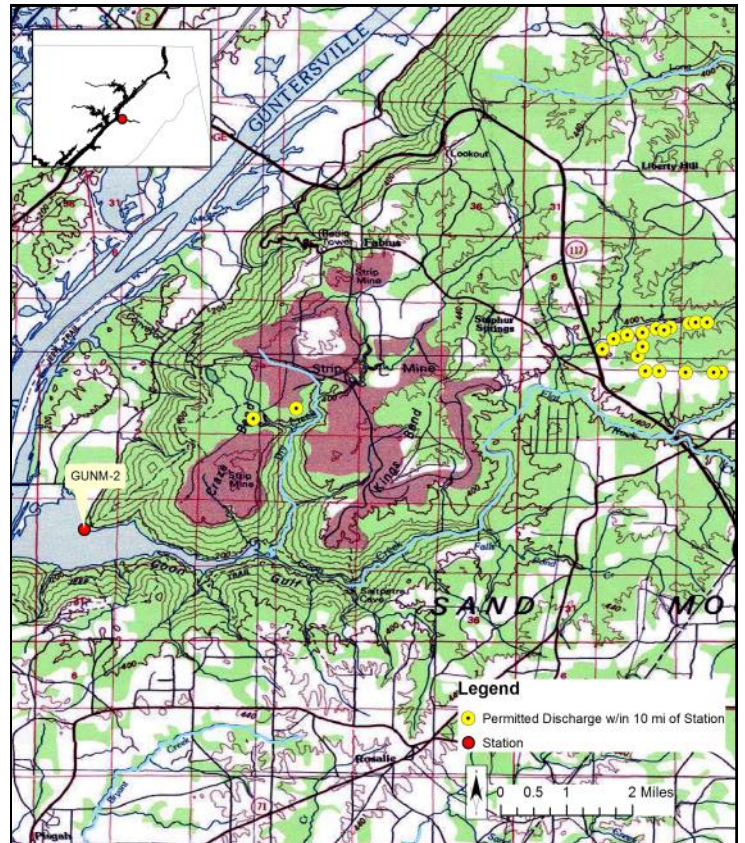


Figure 2. Map of the Coon Creek embayment of Guntersville Reservoir. Though additional discharges may occur in the watershed (Table 1), only permitted discharges within 10 miles of the station are displayed on the map.

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).

Table 1. Summary of Watershed

Summary of Watershed		GUNM-2
Basin		Tennessee R
Drainage Area (mi ²)		89
Ecoregion ^a		68b
Assessment Unit		AL06030001-0403-111
% Landuse		
Open Water		2%
Developed	Open Space	3%
	Low Intensity	<1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	32%
	Evergreen Forest	10%
	Mixed Forest	10%
Shrub/Scrub		11%
Herbaceous		4%
Hay/Pasture		22%
Cultivated Crops		4%
Wetlands	Woody	<1%
	Emergent Herb.	<1%
# NPDES outfalls ^b	TOTAL	43
	Construction Stormwater	1
	Mining	40
	Small Mining	0
	Industrial General	0
	Industrial Individual	0
	No Exposure	0
	Municipal	2
	Underground Injection Control	0

a. Sequatchie Valley

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

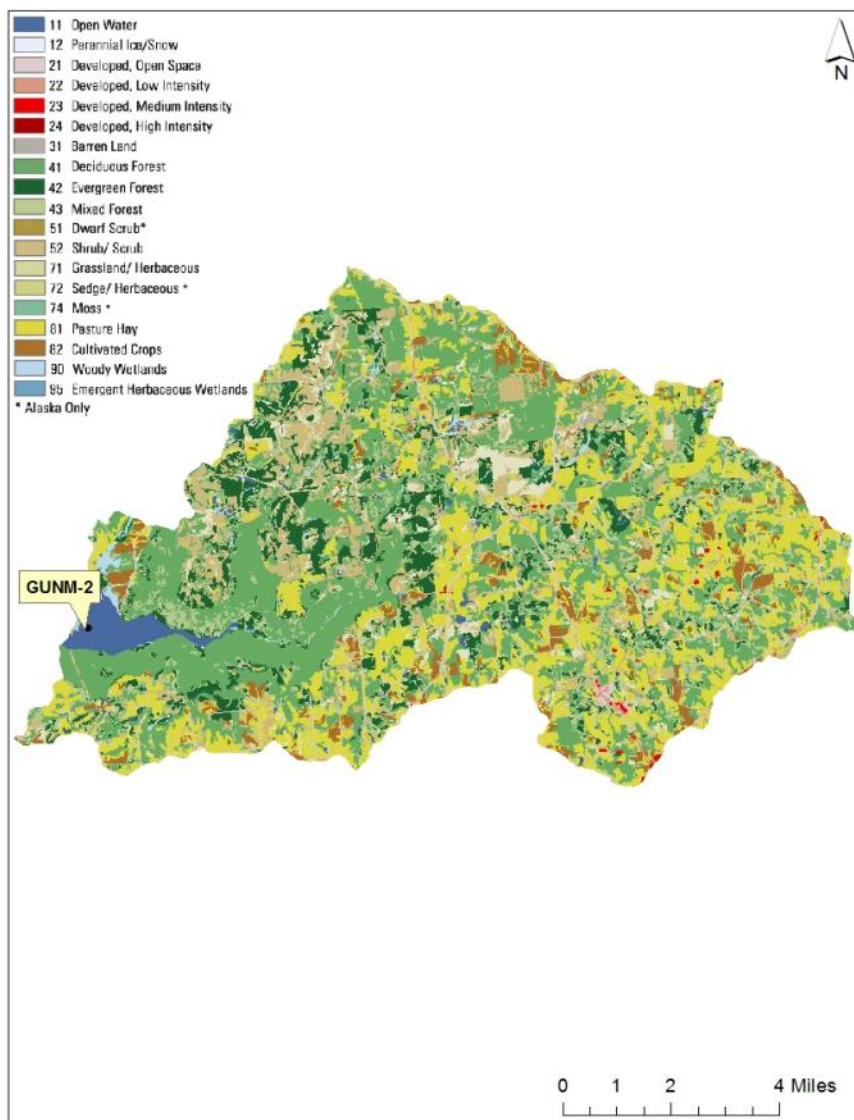


Figure 3. Land use within the Coon Creek watershed at GUNM-2.

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 all embayment reports on the same reservoir could be compared.

The mean growing season TN concentration increased from 2003 to 2013, but it has appeared to remain stable since 2013 (Figure 4). Monthly TN concentrations were highest in August of 2015 and in April of 2018.

Mean growing season TP concentrations have decreased each growing season since 2003 (Figure 5). The highest monthly TP concentration was measured in August of 2015 and in April of 2018.

The mean growing season chl *a* value declined 2003-2015, and then increased in 2018 (Figure 5). In 2015, the highest monthly chl *a* concentration was measured in August. In 2018, the highest monthly chl *a* concentration was measured May.

The mean TSI decreased to mesotrophic conditions in 2015, but returned to eutrophic in 2018 (Figure 5). In 2015, monthly TSI in Coon Creek was oligotrophic April-June, but increased to eutrophic the remainder of the growing season. During 2018, mesotrophic conditions were measured in April, but TSI increased to eutrophic May-October.

Table 2. Summary of water quality data collected April-October, 2015 and 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-2 2015	N	Min	Max	Med	Avg	SD
Physical						
Turbidity (NTU)	7	7.2	11.4	8.4	8.7	1.3
Total Dissolved Solids (mg/L) ^d	7	66.0	121.0	103.0	101.7	18.6
Total Suspended Solids (mg/L)	7	4.0	10.0	7.0	6.6	2.3
Hardness (mg/L)	4	20.8	77.4	74.2	61.6	27.3
Alkalinity (mg/L)	7	36.6	58.3	47.4	47.6	9.1
Photic Zone (m)	7	2.07	3.21	2.53	2.54	0.38
Secchi (m)	7	0.69	1.20	1.06	1.00	0.19
Bottom Depth (m)	7	2.6	4.0	2.7	3.1	0.6
Chemical						
Ammonia Nitrogen (mg/L) ^d	7	< 0.007	0.077	0.005	0.018	0.027
Nitrate+Nitrite Nitrogen (mg/L) ^d	7	< 0.002	0.266	0.036	0.070	0.097
Total Kjeldahl Nitrogen (mg/L)	7	0.314	0.659	0.404	0.445	0.130
Total Nitrogen (mg/L) ^d	7	< 0.998	2.013	0.566	0.515	0.154
Dis Reactive Phosphorus (mg/L) ^d	7	< 0.004	0.009	0.004	0.004	0.002
Total Phosphorus (mg/L)	7	0.014	0.026	0.018	0.019	0.004
CBOD-5 (mg/L) ^d	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	3.5	6.5	5.4	5.2	1.1
Biological						
Chlorophyll a (mg/m ³)	7	< 1.00	16.00	7.48	6.39	6.10
E. coli (MPN/DL) ^d	3	< 1	1	1	1	0
GUNM-2 2018	N	Min	Max	Med	Avg	SD
Physical						
Turbidity (NTU)	7	7.4	12.5	11.1	10.5	1.9
Total Dissolved Solids (mg/L) ^d	7	57.0	94.0	87.0	83.9	13.2
Total Suspended Solids (mg/L) ^d	7	11.0	17.0	12.0	12.9	2.3
Hardness (mg/L)	4	56.4	63.6	60.4	60.2	3.0
Alkalinity (mg/L)	7	30.0	57.5	53.5	50.3	9.3
Photic Zone (m)	7	1.69	2.53	2.09	2.10	0.32
Secchi (m)	7	0.75	1.26	0.82	0.91	0.19
Bottom Depth (m)	7	2.2	3.8	3.4	3.2	0.5
Chemical						
Ammonia Nitrogen (mg/L) ^d	7	< 0.015	0.042	0.008	0.014	0.013
Nitrate+Nitrite Nitrogen (mg/L) ^d	7	< 0.007	0.379	0.004	0.067	0.139
Total Kjeldahl Nitrogen (mg/L)	7	0.386	0.618	0.481	0.484	0.099
Total Nitrogen (mg/L) ^d	7	< 1.168	2.991	0.484	0.551	0.211
Dis Reactive Phosphorus (mg/L) ^d	7	< 0.004	0.004	0.002	0.002	0.001
Total Phosphorus (mg/L) ^d	7	0.007	0.028	0.017	0.017	0.008
CBOD-5 (mg/L)	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L) ^d	7	2.4	5.2	4.3	4.0	1.0
Biological						
Chlorophyll a (mg/m ³)	7	5.87	24.00	15.00	14.56	6.31
E. coli (MPN/DL) ^d	4	< 1	1	1	1	0

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

RESULTS (con't)

The mean growing season TSS concentration decreased 2003-2015 but increased in 2018 (Figure 5). Monthly TSS concentrations were highest in August for both the 2015 and 2018 sampling seasons.

AGPT results show that Coon Creek was phosphorus limited in 2003 and co-limiting in 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 MSC measured in 2013 was 3.15 mg/L. The mean MSC in 2003 was also <5.0 mg/L. AGPT samples were not collected at Coon Creek during the 2015 or 2018 sampling seasons.

All DO concentrations at Coon Creek were above the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) throughout the sampling seasons in both 2015 and 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
2003	2.89	PHOSPHORUS
2013	3.15	CO-LIMITING

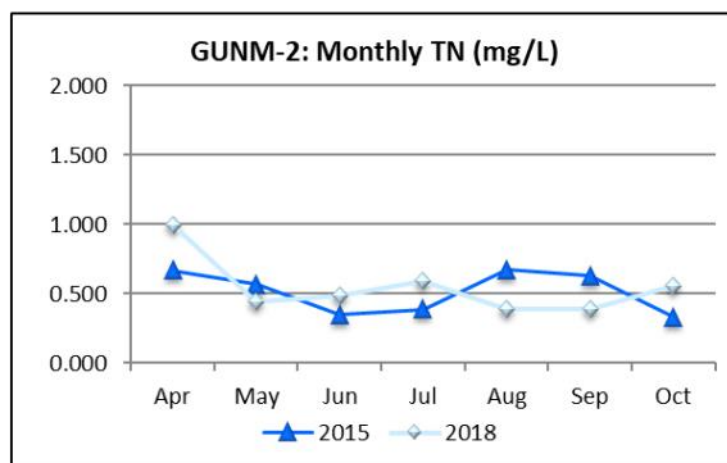
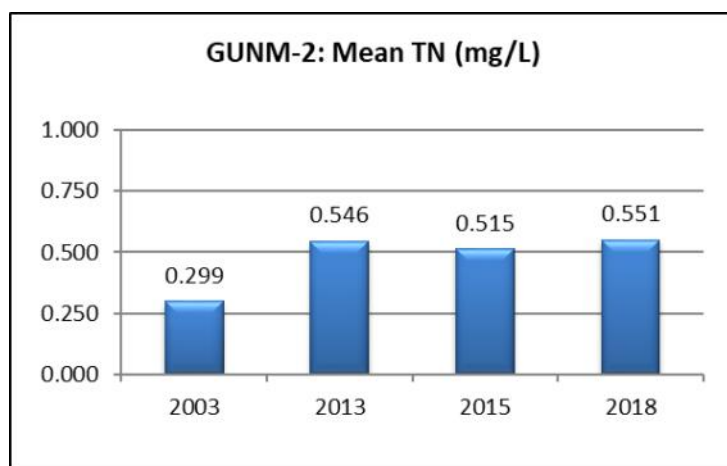


Figure 4. Mean growing season (2003-2018) and monthly (April-October, 2015 and 2018) TN, measured in the Coon Creek embayment (GUNM-2) of Guntersville Reservoir.

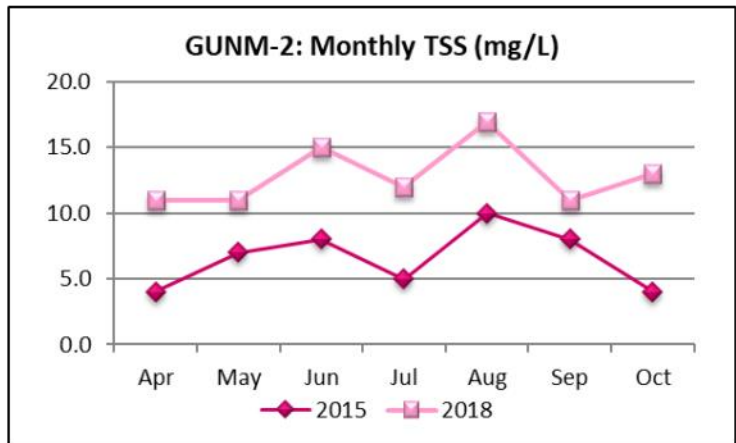
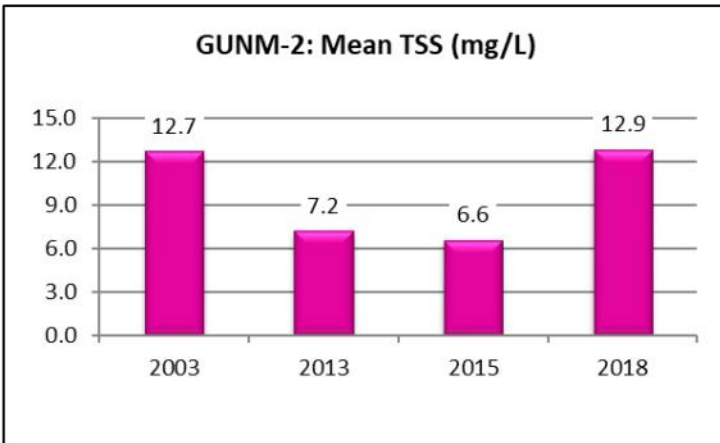
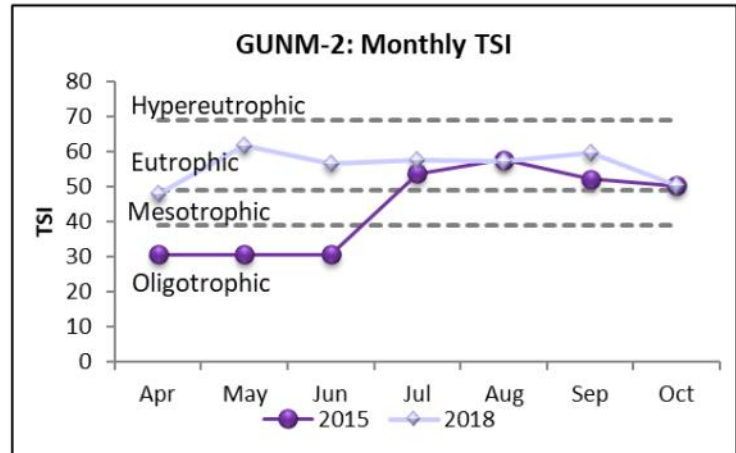
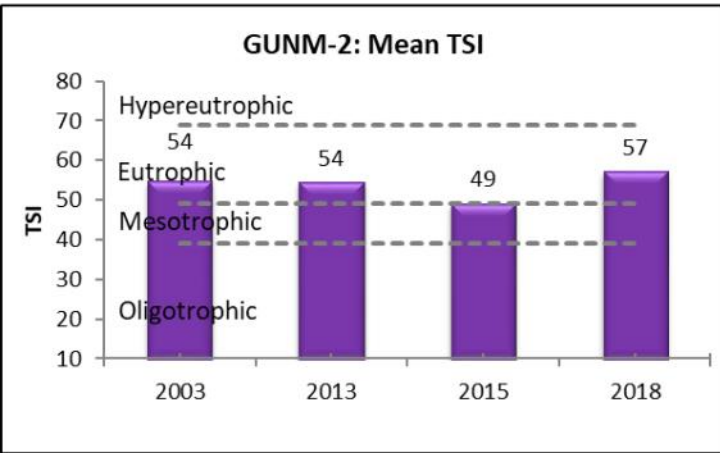
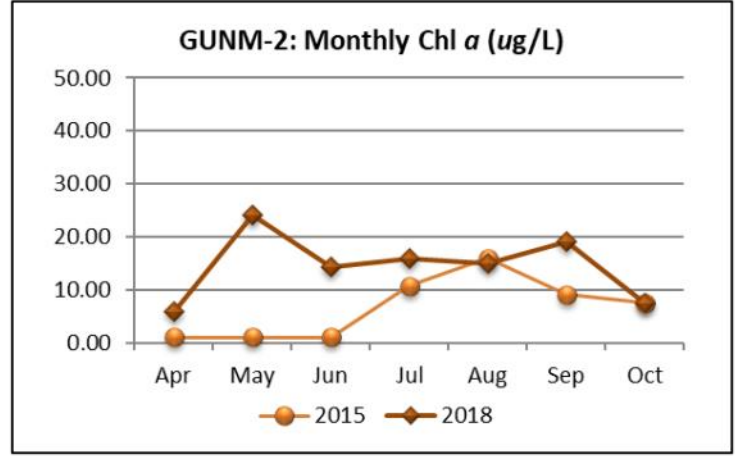
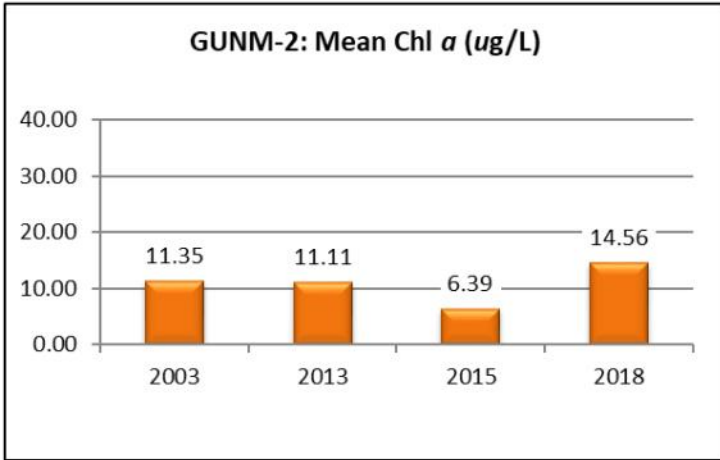
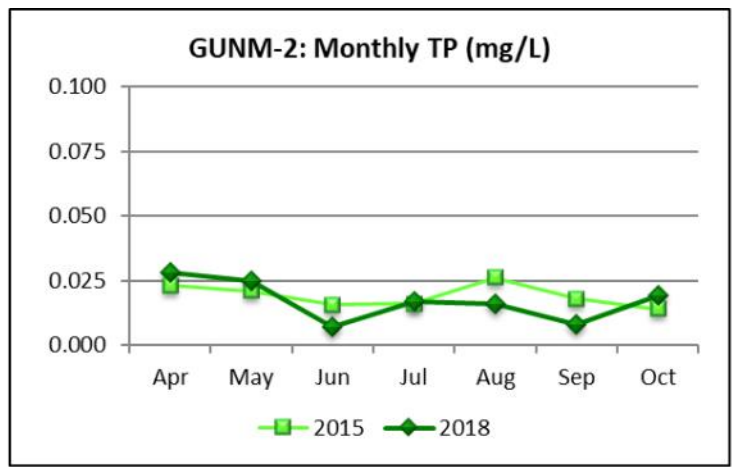
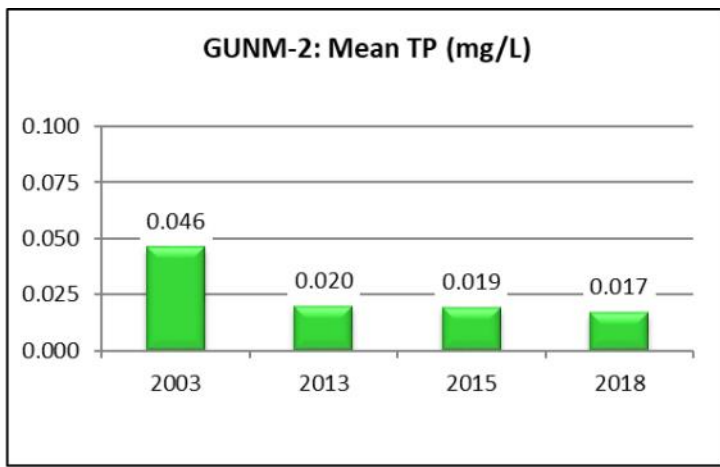


Figure 5. Mean growing season (2003-2018) and monthly (April-October, 2015 and 2018) TP, chl *a*, TSI, and TSS measured in the Coon Creek embayment (GUNM-2) of Guntersville Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

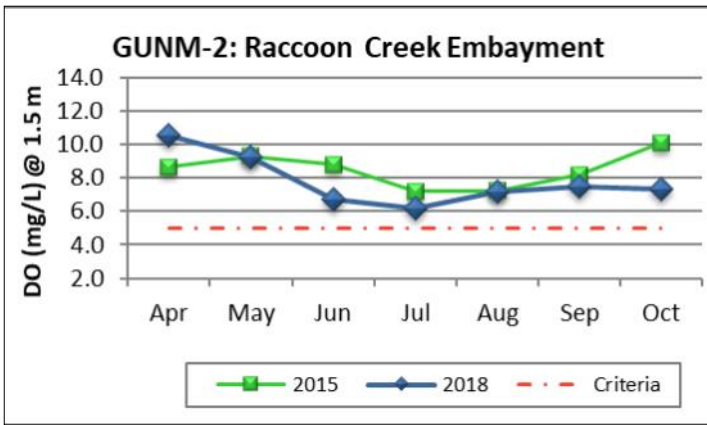


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Coon Creek embayment station (GUNM-2) of Guntersville Reservoir collected (April-October, 2015 and 2018). ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth.

REFERENCES

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