

LAKE ECOSUMMARY

Lake Moore

The City of Tallahassee’s Lakes Monitoring group conduct chemical and biological sampling at Lake Moore. Moore Lake is a 60-acre natural lake located in a closed basin south of the Cody escarpment in the Munson Sandhills Physiographic Province. Maximum lake depth is 10 feet at normal pool elevation, and the average depth is estimated to be 5 feet. Impacts to this lake are limited due to its relative isolation within the Apalachicola National Forest and lack of development in the surrounding basin. This is reflected in its water quality and biological diversity, which continue to be good and indicate that the lake meets expectations for a healthy, well-balanced system. The relative absence of anthropogenic influences, including no inflow or outflow streams, has allowed Moore Lake to be utilized as the Lakes Monitoring Program’s reference lake since 1992.

Background

Although healthy, well balanced lake communities may be maintained even with some level of human disturbance, excessive human activities may result in lake degradation. Human stressors include increased inputs of nutrients, sediments and/or pesticides from watershed runoff, undesirable removal of native shoreline and/or upland buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP has methods to evaluate if human activities have resulted in conditions where a particular waterbody has exceeded water quality criteria (Chapter 62-302, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.*, recreation, aquatic life support). Exceedances of these standards impede the designated use. Chlorophyll-*a* is a measure of algal biomass in the water column. In clear, low alkalinity lakes (lakes where color is ≤ 40 PCU and alkalinity is ≤ 20 mg/L CaCO₃), a healthy system is expected to have ≤ 6 $\mu\text{g/L}$ of chlorophyll-*a*. In colored (≥ 40 PCU) lakes or clear, high alkalinity (≥ 20 mg/L CaCO₃) lakes, healthy systems are expected to have ≤ 20 $\mu\text{g/L}$ of chlorophyll-*a*. Chlorophyll-*a* values greater than those referenced may result in unwanted shading of aquatic plants and/or greater potential for harmful algal blooms. The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. These tools are often used in conjunction with one another because it is possible to detect imbalance in the plant community while the algal community appears healthy (and vice versa).

Below is the chart for the FL Department of Environmental Protection’s Numeric Nutrient Criteria for the state’s lakes.

Long Term Geometric Mean Lake Color and Alkalinity	Annual Geometric Mean Chlorophyll <i>a</i>	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units	20 $\mu\text{g/L}$	0.05 mg/L	1.27 mg/L	0.16 mg/L ¹	2.23 mg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO ₃	20 $\mu\text{g/L}$	0.03 mg/L	1.05 mg/L	0.09 mg/L	1.91 mg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO ₃	6 $\mu\text{g/L}$	0.01 mg/L	0.51 mg/L	0.03 mg/L	0.93 mg/L

Methods

This lake is sampled on a quarterly basis each year. Surface water samples are collected for analysis [*e.g.* nutrients, chlorophyll *a*, color, etc.] following [DEP Standard Operating Procedures \(SOPs\) and quality assurance/quality control \(QA/QC\) standards](#).

For the LVI, species lists were developed for four of twelve sections of the lake (**Figure 1**), and the following information was derived from those lists: percent native species, percent invasive exotic species, percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is to disturbance) of the dominant species. According to DEP SOP LT 7000, the LVI score ranges and categories are: (78-100) Exceptional; (43-77) Healthy; and (0- 42) Impaired. DEP’s revised impairment threshold score of 43 and higher fully meet the expectation of a healthy, well balanced community, and scores at and below 42 are considered impaired. The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000.

Figure 1. Map of Lake Moore. Sampling sites are illustrated “North” and “South”, on the map. Water quality samples are collected from each site along with water parameters such as Dissolved Oxygen, Conductivity, pH level, Temperature, Secchi Disk reading and depth.



Results

Water Quality

The water quality samples meet the FLDEP Nutrient Criterion limits, as shown in **Table 1**. The Lakes Monitoring Program has two monitoring stations on this lake, Lake Moore “North” and “South”. The geomeans for the two sampling locations are used for the overall lake assessment. Lake Moore’s nutrient data is assessed against the high color (> 40 PCU) lake criteria. Although the lake oscillates, between being a high color and low color lake, DEP assesses lakes based on the long-term average color, which is >40 PCU. Based on the criteria, TN levels should be <1.05 mg/L of nitrogen, TP levels < 0.03 mg/L of phosphorus and chlorophyll levels are to be < 20 µg/L. The most recent (10-year history) of annual geomeans of data is shown in **Table 1**. These data show no indications of exceeding any of these nutrient limits. The 10-year (2011 – 2020) geomean for chlorophyll-*a*, TN and TP is 2.6 µg/L, 0.51 mg/L and 0.007 mg/L respectively.

At times TN concentrations have unexpectedly increased. This would typically raise concerns, but since the chlorophyll-*a* concentration is well below the criterion limit, Moore’s TN range increases to 2.23 mg/L. Since Lake Moore is an undisturbed waterbody with no real anthropogenic influence, the nitrogen fluctuation is best attributed to natural, biogenic sources such as organic matter decomposing from many of its aquatic macrophytes and settling within the lake bottom sediment, which produces higher organic nitrogen (total Kjeldahl nitrogen, (TKN)) content. This organic nitrogen on the lake bottom is the driving factor for where the “TN” calculation is derived.

Table 1. Water quality results from Lake Moore.

Yearly Geomeans of FLDEP Nutrient Criterion Parameters					
Lake Moore					
Year	Chlorophyll *	Color	Alkalinity	TN *	TP*
2011	5	28	2	0.64	0.008
2012	4	21	3	1.20	0.010
2013	2	39	3	0.58	0.004
2014	4	126	2	1.00	0.009
2015	4	96	2	0.69	0.005
2016	3	53	2	0.29	0.010
2017	1	27	2	0.33	0.010
2018*	2	16	2	0.25	0.005
2019	1	24	2	0.33	0.010
2020	3	17	2	0.45	0.010

*DEP’s Numeric Nutrient Criteria (NNC data is based on annual geometric means calculated on minimum of 4 samples, however in 2018 the forest was closed in the summer due to forest a fire, therefore 3 quarterly samples were collected.

Lake Vegetation Index

**The 2020 Lake Vegetation Survey was not performed due to low water levels during year 2020 and Covid-19 virus scheduling complications. (The 2019 LVI data is kept here in this summary to show typical aquatic macrophyte conditions within Lake Moore.)*

The 2019 LVI score for this lake was 92 out of a possible 100 points, corresponding with an "Exceptional" designation. **Table 2** contains the species list and occurrence information for this sampling event. No invasive exotic plant species were observed in the lake. Again, anthropogenic impacts are limited due to its remote location in the Apalachicola National Forest. Occasional fisherman will use the lake and remote camp sites have been observed but in general the lake is undisturbed.

Table 2. Species list for the 2019 LVI at Lake Moore. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Moore Year 2019		Sections			
Scientific Name	Common Name	2	5	8	11
<i>Cabomba caroliniana</i>	CAROLINA FANWORT		P		P
<i>Cephalanthus occidentalis</i>	COMMON BUTTONBUSH	P		P	P
<i>Clethra alnifolia</i>	COASTAL SWEETPEPPERBUSH	P	P	P	
<i>Cyrilla racemiflora</i>	TITI	P	P	P	P
<i>Eleocharis sp.</i>	SPIKERUSH	P			P
<i>Eriocaulon sp.</i>	PIPEWORT	P			
<i>Hypericum fasciculatum</i>	PEELBARK ST. JOHNSWORT	P	P	P	P
<i>Ludwigia leptocarpa</i>	ANGLESTEM PRIMROSEWILLOW				P
<i>Magnolia virginiana</i>	SWEETBAY		P	P	P
<i>Myriophyllum heterophyllum</i>	TWOLEAF WATERMILFOIL	P	P	P	P
<i>Nuphar sp.</i>	SPATTERDOCK	P		P	P
<i>Nymphaea odorata</i>	AMERICAN WHITE WATERLILY	P	C	C	P
<i>Nymphoides aquatica</i>	BIG FLOATINGHEART			P	
<i>Nyssa sylvatica biflora</i>	WATER TUPELO	P	P	P	P
<i>Sacciolepis striata</i>	AMERICAN CUPSCALE	P	P	P	P
<i>Taxodium</i>	BALD-CYPRESS	P	P	P	P
<i>Utricularia floridana</i>	FLORIDA BLADDERWORT	D	C	C	D
<i>Utricularia purpurea</i>	PURPLE BLADDERWORT	P	P	P	P
<i>Websteria confervoides</i>	ALGAL BULRUSH		P		
<i>Xyris sp.</i>	YELLOW-EYED GRASS				P



Photo of dominant Cypress trees (*Taxodium sp.*) with Lily pads (*Nymphaea odorata*) floating in Lake Moore.

Thank you for your interest in maintaining the water quality of City of Tallahassee area lakes. Visit the web-links below for more information on Florida natural water resources.

DEP publications on Best Management Practices and Environmental Stewardship and Education:

https://ffl.ifas.ufl.edu/media/fflifasufledu/docs/GIBMP_Manual_Web_English.pdf

DEP biological assessment resources:

<https://floridadep.gov/dear/bioassessment/content/bioassessment-training-evaluation-and-quality-assurance#LVI>

FWCC Aquatic Plant Management:

<http://myfwc.com/wildlifehabitats/habitat/invasive-plants/aquatic-plant/>

Freshwater Algal Bloom information:

<https://floridadep.gov/AlgalBloom>

