LAKE ECOSUMMARY

Otter Lake

Wakulla County, WBID 1165A

August 14, 2019 and September 21, 2021



Figure 1. Otter Lake in Wakulla County during 2019.

DEP conducted water quality and biological sampling at Otter Lake (STORET 22020090, SBIO OtterRef) in Wakulla County on August 14, 2019 and September 21, 2021 to assess attainment of designated uses. This lake was sampled as part of the DEP Reference Lake Sampling Project. Overall, the water quality and plant community data indicated that the lake met expectations for a healthy, well-balanced lake.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance 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 a specific waterbody exceeding water quality criteria (Chapter 62-302, Florida Administrative Code [F.A.C.]), 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), and exceedances of these standards are associated with interference with the designated use. DEP assesses the health of plant communities in Florida lakes, as one indication of whether adverse impacts to biological communities have occurred.

Site Description

Otter Lake (Figures 1 and 2) is in southwest Wakulla County and is a part of the Otter Lake watershed in the Ochlocknee – St. Marks Basin. It is in the Gulf Coast Lowlands Lake Region, which consists of xeric coastal strand and pine scrub vegetation. Dark-water, acidic, soft-water lakes with low to moderate nutrients are characteristic of this region. Otter Lake has a surface area of approximately 138 acres.

The predominant land uses surrounding Otter Lake are cypress wetlands, gum swamps, and pine flatwoods. This lake is not currently listed on the Impaired Waters Verified List. Additional information about this WBID is available in the Water Quality Assessments, TMDLs, and BMAPs map application (https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77).

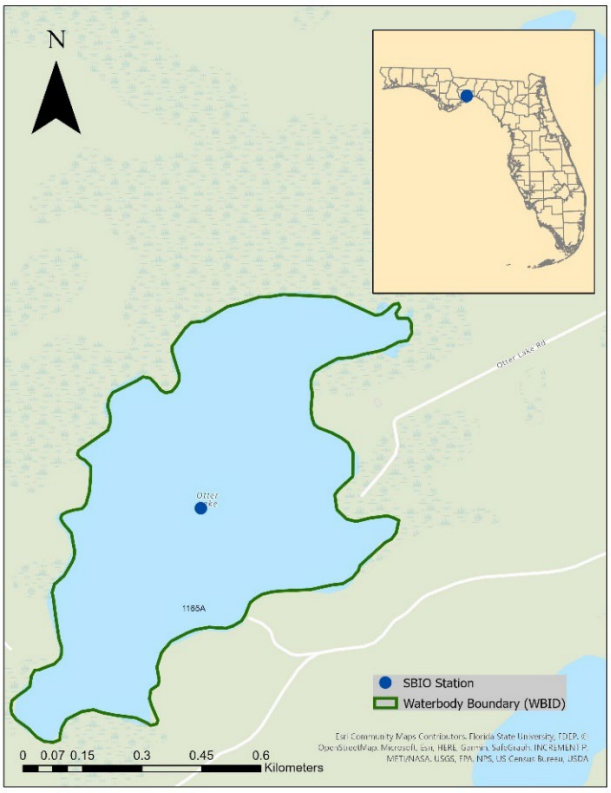


Figure 2. Location of Otter Lake in Wakulla County.

Methods

Water Quality

This lake was sampled on August 14, 2019 and September 21, 2021 by the members of the Aquatic Ecology and Quality Assurance Section of the DEP Tallahassee Office. Surface water samples were collected from the center of the lake for analysis of total phosphorus, ortho-phosphate, total Kjeldahl nitrogen, nitrite-nitrate, ammonia, metals, phytoplankton, alkalinity, color, and chlorophyll *a* following DEP Standard Operating Procedures (SOPs; see https://floridadep.gov/dear/quality-assurance/content/dep-sops). Sampling and analyses met DEP quality assurance/quality control standards. Results were compared with applicable Class III water quality criteria contained in 62-302, F.A.C., including nutrients, dissolved oxygen, and other indicators.

Chlorophyll *a* is a measure of algal biomass in the water column. Chapter 62-302.531, F.A.C., provides numeric criteria for chlorophyll *a*, total nitrogen (TN), and total phosphorus (TP) in lakes, and is dependent upon the long term mean color and alkalinity of the lake (Table 1). If the annual geometric mean chlorophyll *a* (calculated with at least four samples, representing seasonal variability) does not exceed the chlorophyll *a* value for the lake type in Table 1, then the TN and TP criteria for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in Table 1. If there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in Table 1 for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1. Based on the color and alkalinity results presented in this report, Otter Lake is a high color, low alkalinity lake.

Table 1. Numeric nutrient criteria in lakes, 62-302.531 (2)(b)(1), F.A.C. AGM = annual geometric mean

Long Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a*	AGM TP Range	AGM TN Range
> 40 Platinum Cobalt Units	**20 µg/L**	**0.05 to 0.16[1] mg/L**	**1.27 to 2.23 mg/L**
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$	**20 µg/L**	**0.03 to 0.09 mg/L**	**1.05 to 1.91 mg/L**
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$	**6 µg/L**	**0.01 to 0.03 mg/L**	**0.51 to 0.93 mg/L**

[1] For lakes with color > 40 PCU in the West Central Region, the maximum TP limit is 0.49 mg/L

Dissolved Oxygen

Rule 62-302.533 (1), F.A.C., states that no more than 10 percent of the daily average percent dissolved oxygen (DO) saturation values shall be below 67 percent in the Panhandle West bioregion, 38 percent in the Peninsula and Everglades bioregions, or 34 percent in the Northeast and Big Bend bioregions. This site is in the Big Bend region for DO criteria assessment. Percent saturation considers temperature, atmospheric

pressure, and salinity. For lakes, the daily average DO level shall be calculated as the average of measurements collected in the upper two meters of the water column at the same location on the same day.

The daily average freshwater DO criteria is preferentially assessed using daily average values calculated from full days of diel (collected over a 24 hour period) monitoring data. If diel monitoring data are not available instantaneous samples are used to assess the DO criterion by comparing the instantaeous value with a time-of-day-specific translation of the daily average criterion (62-303.420(9), F.A.C.), and a spreadsheet calculator for this purpose is available at: https://floridadep.gov/dear/water-quality-standards-program/documents/do-saturation-calculator%C2%A0

Lake Vegetation Index

The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. The LVI was sampled and calculated per DEP SOP LVI 1000 and calculated per DEP SOP LVI 2000. Species lists were developed for four of twelve sections of the lake (Figure 3), and the following information was derived from those lists: percent native species, percent Category 1 invasive exotic species as identified by the Florida Exotic Pest Plant Council, percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is of disturbance) of the dominant or co-dominant species. Chapter 62-303.330 and 62-303.430, F.A.C., provide that a LVI score of 43 or greater meets the expectation of a healthy, well balanced community, and scores below 43 are considered impaired.

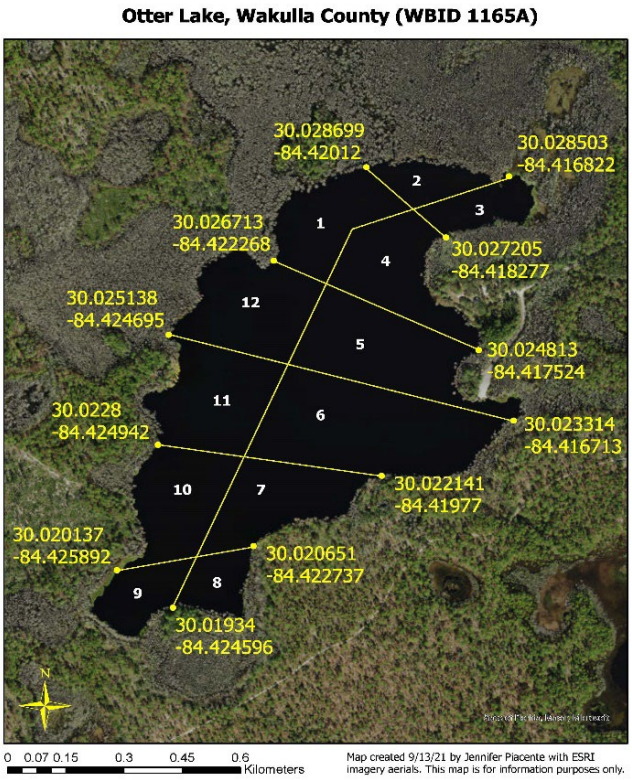


Figure 3. LVI sampling map of Otter Lake. Sections 2, 5, 8, 11 were sampled for the Lake Vegetation Index. The water quality samples were collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2.

Based on these two sampling events, the lake met the nutrient thresholds for high color, low alkalinity lakes; however, the thresholds represent annual geometric mean concentrations (minimum of four samples) not to be exceeded more than once in any three-calendar year period. DEP's Watershed Assessment Section will evaluate the complete dataset for this lake to assess compliance with nutrient criteria.

Table 2. Water quality results from August 14, 2019 and September 21, 2021 at Otter Lake.

Analyte	Result 8/14/ 2019	Result 9/21/ 2021	Applicable Class III Water Quality Criteria
Field Temperature (°C)	32.2	28.5	N/A
Field pH (SU)	5.24	4.6 J	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	71.1	70.2	*30.65
Field Specific Conductance (µmhos/cm)	311.6	99.9	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	2.7	0.65 U	Shall not be depressed below 20 [or if natural alkalinity is low, shall not be reduced by more than 25%]
Color (PCU)	260	400	N/A
Chlorophyll a (µg/L)	2.0 I	1.7 I	≤ 20 for colored and alkaline clear lakes
Total Phosphorus (mg/L) as P	0.02	0.022	0.16 mg/L
Nitrate+Nitrite (mg/L) as N	0.018	0.013	N/A
Ammonia (mg/L) as N	0.023	0.023	**2.42 mg/L and 3.08 mg/L
Total Kjeldahl Nitrogen (mg/L) as N	0.63	0.73	N/A
Total Nitrogen (mg/L) as N	0.648	0.743	2.23 mg/L

* Instantaneous DO criterion calculated per DO Saturation Calculator

** Total ammonia criterion calculated per https://floridadep.gov/dear/water-quality-standards-program/documents/total-ammonia-nitrogen-calculator%C2%A0

I – The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

J – Indicates that the reported value was estimated.

U – Indicates that the compound was analyzed for but not detected.

Phytoplankton

The algal community in the water column consisted of 0% cyanobacteria (blue-green algae), 30.3% green algae, and 69.6% diatoms in the August 14, 2019 sample. Algal sample results for 2021 contained twenty-two species. Of the 22 species, three species accounted for 85% of the total counted specimens in the sample. The dominant species were *Eunotia*, *Eunotia incisa*, and *Aulacoseira herzogii*. Dominance in algal groups varies naturally throughout the year, but prolonged dominance of cyanobacteria may be associated with a higher risk for harmful algal blooms.

Lake Vegetation Index

The LVI score for this lake was 75 out of a possible 100 points in 2019, and 71 in 2021, both corresponding with a "Healthy" (43-77) designation. Tables 3 and 4 contain the species list and occurrence information for these sampling events. Two invasive exotic plants, *Alternanthera philoxeroides* and *Salvinia minima* were observed in all four sampled sections of the lake in both 2019 and 2021. The LVI scores for Otter Lake have been in the 70s for the past 5 years, except in 2018, when the LVI score was 64, which is still a "Healthy" designation. Water quality results from preceding trips indicate that a few parameters made significant jumps from 2017 to 2018. chloride, sodium, and sulfate were three times greater in 2018 than they were in 2017. Chlorophyll-a, magnesium, and calcium were two times greater in 2018 than they were in 2017. It is key to note the system rebounded to a 75 and 71 in the 2019 and 2021 visits, respectively.

Table 3. Species list for the August 14, 2019 LVI at Otter Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Otter Lake August 14, 2019		Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
*Alternanthera philoxeroides**	Alligator Weed	P	P	P	P
Cephalanthus occidentalis	Buttonbush	P	P	P	P
Cladium jamaicense	Saw grass	P		P	P
Cyrila racemiflora	Swamp titi	P	P	P	P
Decodon verticillatus	Swamp loosestrife			P	
Echinochloa walteri	Cockspur grass	P			
Eleocharis spp.	Spikerushes	P	P	P	P
Hydrocotle spp.	Water Pennywort	P	P	P	P
Lemna spp.	Duckweeds	P	P		P
Leucothoe racemosa	Swamp sweetbells	P			
Ludwigia spp.	Primrose-Willow	P	P	P	
Magnolia virginica	Sweet bay magnolia	P			
Myrica cerifera	Southern wax myrtle		P		
Carex verrucosa	Watery sedge	P			
Nuphar spp.	Water-lily	P	P	P	P
Nyssa sylvatica var. biflora	Swamp tupelo				P
Osmunda regalis	Royal fern	P			P
Sacciolepis striata	Cupscale grass	P		P	P
Polygonum punctatum	Dotted smartweed	P	P	P	P
Pontedaria cordata	Pickerel weed	P	P	P	P
Sagittaria lancifolia	Duck potato	P	P	P	P
Salix caroliniana	Coastal plain willow		P		
*Salvinia minima**	Water spangles	P	P	P	P
Scirpus cyperinus	Wool grass	P			
Spartina bakeri	Marsh grass	P	P	P	P
Taxodium spp.	Cypress	**D**	**D**	**D**	**D**
Typha spp.	Cat tail	P	P	P	P

Table 4. Species list for the September 21, 2021 LVI at Otter Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Otter Lake September 21, 2021		2021 Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
*Alternanthera philoxeroides**	Alligator weed	P	P	P	P
Cephalanthus occidentalis	Buttonbush	P	P	P	P
Cladium jamaicense	Saw grass	P		P	
Cyperus surinamensis	Tropical flatsedge		P		
Cyrilla racemiflora	Swamp titi	P	P	P	P
Decodon verticilatus	Swamp loosestrife	P			
Eleocharis baldwinii	Road grass			P	
Eleocharis sub. viviparus	Spikerush			P	P
Hydrocotyle spp.	Water Penywort	P	P	P	P
Ilex cassine	Dahoon holly			P	P
Lemna spp.	Duckweeds	P	P	P	P
Ludwigia leptocarpa	Water willow	P	P	P	P
Magnolia virginiana	Sweet bay magnolia	P			
Mikania scandens	Climbing hempvine	P			
Myrica cerifera	Southern wax myrtle			P	P
Nuphar spp.	Water-lily	P		P	P
Nymphaea odorata	American White Water-lily			P	
Osmunda regalis	Royal fern			P	P
Panicum hemitomon	Maidencane		P		
Pinus elliottii	Slash pine				P
Polygonum puncatam	Dotted smartweed	P	P	P	P
Pontedaria cordata	Pickerel weed	P	P	P	P
Sacciolepis striata	Cupscale grass	P	P	P	P
Saggitaria lancifolia	Duck Potato	P	P	P	P
Salix carolinia	Coastal plain willow		P		
*Salvinia minima**	water spangles	P	P	P	P
Spartini bakeri	Marsh grass	P	P	P	P
Taxodium spp.	Cypress	**D**	**D**	**D**	**D**
Typha spp.	Cat tail	P		P	P
Utricularia gibba	Floating bladderwort			P	P

Conclusions

Sampling at Otter Lake indicates that the lake met applicable State Water Quality Criteria.

Water quality results were well within acceptable limits for chlorophyll *a*, total nitrogen and total phosphorus on August 14, 2019 and September 21, 2021. The Lake Vegetation Index indicated plant communities that are consistent with expectations for a healthy, well-balanced lake.

Thank you for your interest in maintaining the water quality of Florida's lakes. Please contact us if you have any questions.

Contact and resources for more information

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DEP biological assessment resources:
https://floridadep.gov/dear/bioassessment

FWCC Aquatic Plant Management:
http://myfwc.com/wildlifehabitats/invasive-plants/

Freshwater Algal Bloom information:
https://floridadep.gov/dear/algal-bloom