LAKE ECOSUMMARY

Alligator Lake, WBID 3176, April 20, 2016



Figure 1. Alligator Lake in Osceola County on April 20, 2016.

DEP conducted water quality and biological sampling at Alligator Lake (STORET 26010038) in Osceola County on April 20, 2016 to assess attainment of designated uses (Figure 1). This lake was sampled as part of a strategic monitoring program. 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 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

Alligator Lake is in North Central Osceola County representing part of the Upper Kissimmee River Basin and covering an area of 3,500 acres (Figure 2). Surface water enters Alligator Lake from Lake Lizzie to the northeast, Lakes Buck and Brick to the east and exits south into Lake Gentry to form part of the Alligator Chain of Lakes. This chain of lakes converges with the Lake Tohopekaliga chain to the west at Lake Gentry to form part of the Kissimmee Chain of Lakes ultimately flowing into the Kissimmee River and into Lake Okeechobee. Water movement between these lakes is made up largely of man-made canals and water control structures (Figure 3).

Much of the water entering Alligator Lake via sheetflow is buffered by wetlands. There are approximately 1.3 square miles of wetlands directly adjacent to the lake's shoreline, with the majority being on the east side. This

wetland buffer accounts for 22% of the lake's 25 miles of shoreline. Low intensity commercial and residential zones and non-cultivated natural vegetation surround the rest of the lake. These are key factors in determining the Landscape Development Intensity Index (LDI) of a waterbody. The LDI score is a tool The Florida Department of Environmental Protection (DEP) uses to estimate potential land use impacts on streams, lakes, and wetlands. This score can range from 1 to 10, with higher values indicating greater intensity of human land use. Alligator Lake currently (2017) has an LDI score of 1.003.

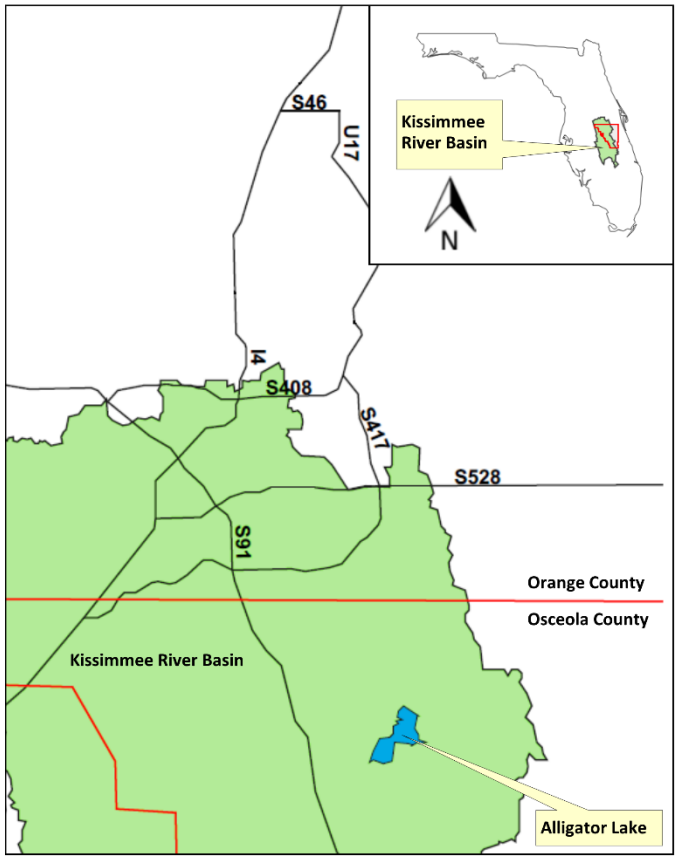


Figure 2. Location of Alligator Lake in Osceola County.

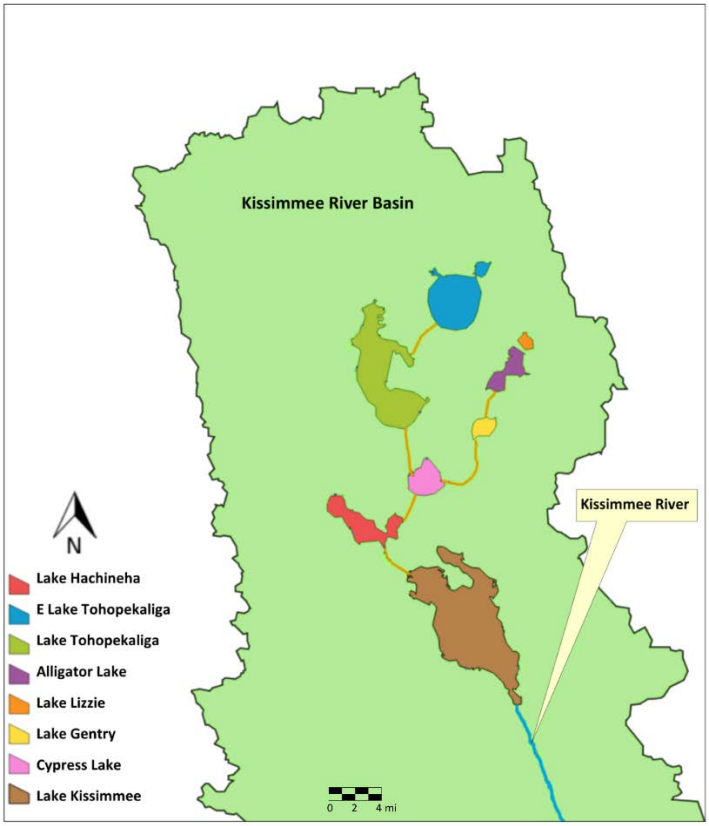


Figure 3. General direction of southerly flow of the major lakes comprising the Kissimmee Chain of Lakes.

Methods

Water Quality

Alligator Lake was sampled on April 20, 2016, by the DEP Central Regional Operating Center. Surface water samples were collected from the center of the lake for analysis of nutrients, metals, chlorophyll *a*, color, alkalinity, fluoride, ammonia, nitrogen, phosphate, chloride, and sulfate following DEP Standard Operating Procedures (SOPs; see http://www.dep.state.fl.us/water/sas/qa/sops.htm). Sampling and analyses met DEP quality assurance/quality control standards (see http://www.dep.state.fl.us/water /sas/qa/index.htm). 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. Alligator Lake has a color value of 110 Platinum Cobalt Units and alkalinity of 3.3 mg $CaCO_3$/L. These values place Alligator Lake in the first category of Table 1.

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 Peninsula region for DO criteria assessment. Percent saturation considers factors such as 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 criterion 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 (as was the case for this report), 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. The equations to calculate the time-of-day-specific translation of the daily average criterion are cited in 62-303.420(9), F.A.C., and a spreadsheet calculator for this purpose is available at: http://www.dep.state.fl.us/water/wqssp/dissoxy.htm.



Figure 4. Representative vegetation community on the eastern shoreline looking west from a canal on April 20, 2017.

Lake Vegetation Index

The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community (Figure 4). 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 5), 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 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.

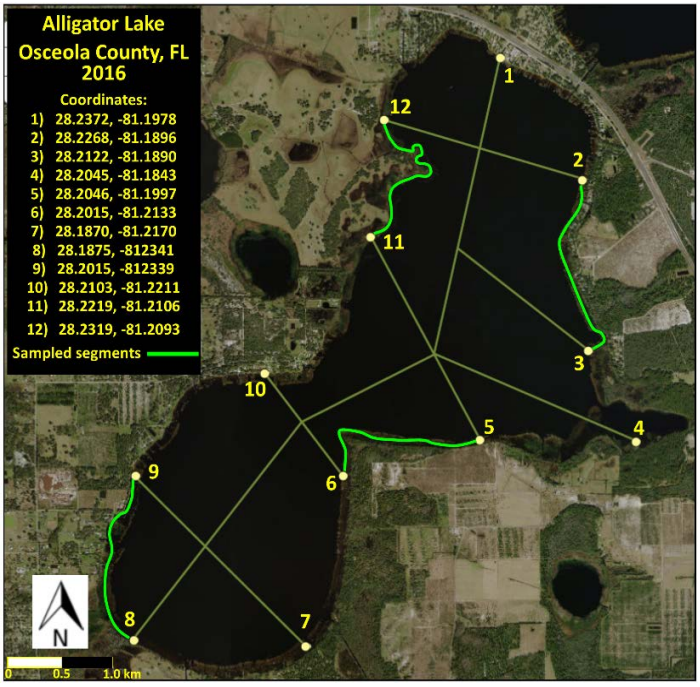


Figure 5. LVI Sampling map of Alligator Lake. Sections 2, 5, 8 and 11 were sampled for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Results

Water Quality

According to Florida's Nutrient Numerical Criteria (NNC), Chapter 62-302, lakes with a color value of > 40 Platinum Cobalt Units (PCU) must have a maximum chlorophyll *a* concentration of 20 µg/L, < 0.16 mg/L total phosphorus (TP) and < 2.23 mg/L total nitrogen (TN). On April 20, 2016, Alligator Lake's chlorophyll *a* was 2.7 µg/L, TP was 0.027 mg/L and TN was 0.75 mg/L. These values were all well below the NNC thresholds (Table 2). All other parameters met their applicable limits. Alligator Lake is not on the Impaired Waters Verified List**.** However, it should be noted that compliance with lake numeric nutrient criteria cannot be determined with a single sample; all criteria limits are based on annual geometric means not to be surpassed more than once in a three-year period.

Table 2. Water quality results from surface water samples collected on 4/20/2016 at Alligator Lake, STORET station 26010038 by FDEP. Water quality criteria from Chapter 62-302, F.A.C.

Analyte	Result 4/20/2016	Comment	Applicable Class III Water Quality Criteria
Water Temperature (°C)	24.3		
Field pH (SU)	6.9		
Field Dissolved Oxygen (% saturation)	105		≥ 38
Field Specific Conductance (µmhos/cm)	133		"Not to exceed 50% of background or 1275 µmhos/cm"
Salinity (ppt)	0.06		
Alkalinity (mg $CaCO_3$/L)	3.3		
Total Dissolved Solids (mg/L)	93		
Total Suspended Solids (mg/L)	2	I	
Fluoride (mg F/L)	0.046	I	≤ 10
True Color (PCU)	110		
Sulfate (mg SO_4/L)	9.1	A	
Chloride (mg Cl/L)	27	A	
Turbidity (NTU)	2.2		
Chlorophyll a	2.7		20 µg/L*

(µg/L)			
Total Phosphorus (TP) (mg/L)	0.027		< 0.16 mg/L*
Nitrate + Nitrite (mg/L)	0.055		
Ammonia-N (mg N/L)	0.007		3.70
Total Kjeldahl Nitrogen (mg/L)	0.69		
Total Nitrogen (TN) mg/L	0.75		< 2.23 mg/L*
Ortho Phosphate (mg P/L)	0.004	U	
Organic Carbon (mg C/L)	14		
Secchi disk depth (m)	1.2		

*Numeric nutrient criteria in lakes (NNC), 62-302.531, with lake color > 40 PCU

A - Value reported is the mean of two or more determinations

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

U - Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed

Lake Vegetation Index

The LVI score for this lake was 69 out of a possible 100 points, corresponding with a "Healthy" designation. Table 3 contains the species list and occurrence information for this sampling event. A total of 3 invasive exotic plants were observed in the lake. They were: *Alternanthera philoxeroides* (Alligatorweed), *Panicum repens* (Torpedo Grass) and *Salvinia minima* (Common Salvinia). Although the exotic *Panicum repens* was dominant in sections 2 and 5 it shared co-dominance with the favorable submersed plant *Mayaca fluviatilis* (Bogmoss) in section 8. The beneficial native grass *Sacciolepis striata* (American Cupscale Grass) dominated section 11.

Table 3. Species list for the FDEP conducted LVI event on April 20, 2016 at Alligator Lake, FL. P = present, D = dominant, C = codominant

Scientific Name	Common Name :	Sections			
		2	5	8	11
Acer rubrum	Red Maple	P	P	P	P
Alternanthera philoxeroides	Alligatorweed			P	
Andropogon	Broom Grass				P
Bacopa caroliniana	Lemon Bacopa				P
Bidens laevis	Burmarigold				P
Blechnum serrulatum	Swamp Fern				P
Cephalanthus occidentalis	Button Bush	P	P		P
Cladium jamaicense	Saw Grass	P			
Eleocharis submersed viviparous	Spikerush			P	
Eriocaulon compressum	Hat Pin				P
Fuirena scirpoidea	Rush Fuirena	P	P	P	P
Hibiscus grandiflorus	Swamp Rosemallow	P			P
Hydrocotyle	Pennywort		P		P
Liquidambar styraciflua	Sweetgum	P			
Ludwigia (native)	Water Primrose	P		P	P
Ludwigia repens	Creeping Primrose Willow			P	
Mayaca fluviatilis	Bog Moss	C	P	P	P
Myrica cerifera	Wax Myrtle	P	P	P	P
Najas guadalupensis	Southern Naiad	P	P	P	P
Nuphar	Cow Lily	P	P	P	P
Nymphaea odorata	Fragrant Water Lily	P	P	P	P
Nymphoides aquatica	Banana Lily	P	P	P	P
Panicum repens	Torpedo Grass	C	D	D	P

Pontederia cordata	Pickerelweed	P	P	P	P
Sacciolepis striata	American Cupscale Grass	P	P	P	D
Sagittaria lancifolia	Duck Potato	P	P	P	P
Salix caroliniana	Carolina Willow	P	P	P	P
Salvinia minima	Common Salvinia				P
Schoenoplectus californicus	California Bulrush	P	P		
Spartina bakeri	Sand cordgrass	P	P		P
Taxodium	Cypress	P	P	P	P
Typha	Cattail	P		P	P
Utricularia foliosa	Leafy Bladderwort			P	
Websteria confervoides	Algal Bulrush	P		P	

Summary

Alligator Lake is of special concern because it is part of the Kissimmee Chain of Lakes and can ultimately have an impact on the water quality of the Kissimmee River Basin. The productivity of a lake (abundance of plants and/or algae) is determined in large part by sunlight and nutrient levels within the lake. The plant community and water quality results indicate that Alligator Lake represents an intermediate level of productivity and nutrients. Most of the lakes in the Alligator Chain exhibit a similar pattern.

Water quality results were well within acceptable limits for chlorophyll *a*, total nitrogen and total phosphorus on April 20, 2016. The Lake Vegetation Index score, 69 out of a possible 100, corresponded with a "healthy" designation.

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 publications on Best Management Practices and Environmental Stewardship and Education:
http://www.dep.state.fl.us/water/nonpoint/pubs.htm

DEP biological assessment resources:
http://www.dep.state.fl.us/water/bioassess/index.htm

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

Freshwater Algal Bloom information:
http://www.dep.state.fl.us/labs/biology/hab/index.htm