LAKE ECOSUMMARY

Star Lake

WBID 2742A

October 29, 2013

DEP conducted water quality and biological sampling at Star Lake in Putnam County on October 29, 2013 to assess attainment of designated uses. The residents living near the lake were concerned about the lake's health and future changes in land use within the watershed, and wanted data to make informed lake management decisions. 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 activities, 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 particular 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.

Methods

Water Quality

This lake was sampled on October 29, 2013 by the DEP Northeast District Office. Surface water samples were collected for analysis of nutrients, chlorophyll *a*, color, fluoride, chloride, biochemical oxygen demand, turbidity, alkalinity, total dissolved solids, total suspended solids, ammonia, total nitrogen, total phosphorus, total organic carbon & orthophosphate following DEP Standard Operating Procedures (SOPs; 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).

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 (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.

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. Percent saturation takes into account 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.

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 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 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 1. Sampling map of Star Lake: Sections 1, 4, 7 & 10 were sampled for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Site Information

Star Lake is a 236-acre, oligotrophic, low alkalinity, high color lake, with approximately 3.24 miles of shoreline (Figure 1 and 2). The landscape development intensity index (LDI), based on land use data within 100 m of the lake shoreline is 5.28. LDI scores range from 1 to 10 with a score of <2 being "minimally disturbed." Further out, the predominant land uses[1] in the lake's watershed are silviculture (47%), residential (19%), pasture (3%), agriculture (1%) and natural (forest and wetlands, 30%). Most of the homes observed good lake Best Management Practices (BMPs: see "A guide for Waterside Living" hyperlinked at the end of this report

[1] Generated using 2009 St Johns River Water Management District Land Use data.

for BMP information and how you can help protect your lake).

Results

Water Quality

The water quality samples complied with state Class III surface water quality standards (Table 2). Based on this sampling event, the lake met the nutrient thresholds for colored 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. Additional data are needed to fully assess compliance with nutrient criteria. Using available LAKEWATCH data from June 2012 to June 2013 for Star Lake, the annual geometric nutrient means were 0.025 mg P/L, TP; 0.62 mg N/L, TN; and 7.51 µ g/L, chlorophyll *a*.

Table 2. Water quality results collected by FDEP from October 29, 2013, at Star Lake.

Analyte	Result	Remark	Applicable Class III Water Quality Criteria
Alkalinity (mg $CaCO_3$/L)	1.2	I	
Ammonia (mg/L)	0	I	
Biochemical oxygen demand, 5-day (mg/L)	0.86	I	
Chloride	13		
Chlorophyll *a* (µg/L)	4.1		20‡
Color (PCU)	65	A	
Field Dissolved Oxygen (% saturation)	80.9		Peninsula: 38%;
Field pH (SU)	6.35		
Field Specific Conductance (µmhos/cm)	69		
Field Temperature (°C)	22.3		
Fluoride	0.36	I	
Nitrate+Nitrite (mg/L)	0.004	U	
Ortho-Phosphate (mg P/L)	0.004	U	
Sulfate	6.3		
Total Dissolved Solids (mg/L)	49		
Total Kjeldahl Nitrogen (mg/L)	0.49		
Total Nitrogen (mg/L)	0.49		2.23‡
Total Organic Carbon (mg C/L)	7.2		
Total Phosphorus (mg/L)	0.03		0.16‡
Total Suspended Solids (mg/L)	4	I	
Turbidity (NTU)	2.7		

‡Annual geometric mean maximum

A - Average of two or more values.

I - The reported value is between the method detection limit and the lab practical quantitative limit.

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

Lake Vegetation Index

The LVI score for this lake was 56 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 7 invasive exotic plants were observed in the lake: alligator weed (P,II), taro (I), water hyacinth (P,I), torpedo grass (I), water spangles (I), purple sesban (II) and anglestem primrosewillow (I).

P= prohibited by the Florida Department of Agriculture and Consumer Affairs.

I= Florida Exotic Pest Plant Council (FLEPPC) Category I

Invasive exotics that are altering native plant communities by displacing native species, changing community structures, ecological functions or hybridizing with natives. *This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.*

II= FLEPPC category II

Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. *These species may become ranked Category I, if ecological damage is demonstrated.*

http://www.fleppc.org/list/11list.html



Figure 2. Photo of Star Lake on 10/29/2013.

Table 3. Species list for the October 29, 2013 LVI at Star Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Star Lake, 10/29/2013		Sections			
Scientific Name	**Common Name**	1	2	3	4
Acer rubrum	RED MAPLE	P	P	P	P
Alternanthera philoxeroides	ALLIGATOR WEED	P	P	P	P
Andropogon glomeratus	BUSHY BLUESTEM	P	P		P
Aster dumosus	BUSHY ASTER	P		P	P
Baccharis glomeruliflora	SILVERLING	P		P	P
Bidens laevis	BURRMARIGOLD; SMOOTH BEGGARTICKS		P		
Cephalanthus occidentalis	COMMON BUTTONBUSH	P			
Ceratophyllum demersum	COONTAIL	P	P	P	P
Cladium jamaicense	JAMAICA SWAMP SAWGRASS	P	P	P	P
Colocasia esculenta	TARO; WILD TARO; DASHEEN; COCO YAM		P	P	
Eichhornia crassipes	WATER HYACINTH	P	P	P	P
Eleocharis vivipara	VIVIPAROUS SPIKERUSH	P	P	P	P
Eupatorium capillifolium	DOGFENNEL	P	P	P	P
Gordonia lasianthus	LOBLOLLY BAY	P	P	P	P
Hydrocotyle	MARSHPENNYWORT	P			
Juncus effusus	SOFT RUSH	P			P
Limnobium spongia	AMERICAN SPONGEPLANT; FROG'S-BIT	P	P	P	P
Ludwigia leptocarpa	ANGLESTEM PRIMROSEWILLOW	P	P	P	P
Ludwigia peruviana	PERUVIAN PRIMROSEWILLOW				P
Ludwigia repens	CREEPING PRIMROSEWILLOW	P			P
Lyonia lucida	FETTERBUSH	P	P	P	
Magnolia virginiana	SWEETBAY	P	P	P	P
Mikania scandens	CLIMBING HEMPVINE	P	P	P	P
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRT	P	P	P	P
Nuphar	SPATTERDOCK			P	
Nymphaea odorata	AMERICAN WHITE WATERLILY	P		P	P
Nyssa sylvatica biflora	SWAMP TUPELO	D	D	C	C
Panicum hemitomon	MAIDENCANE	P	P	P	C
Panicum repens	TORPEDO GRASS		P	P	
Persea palustris	SWAMP BAY	P	P	C	P
Pontederia cordata	PICKERELWEED	P			
Sacciolepis indica	INDIAN CUPSCALE	P	P	P	P
Sacciolepis striata	AMERICAN CUPSCALE	P			
Salix caroliniana	CAROLINA WILLOW; COASTALPL	P	P	P	P
Salvinia minima	WATER SPANGLES	P	P	P	P
Scirpus cubensis	CUBAN BULRUSH	P			
Sesbania punicea	PURPLE SESBAN	P	P		P
Solidago fistulosa	PINEBARREN GOLDENROD	P			P
Taxodium	CYPRESS	P		P	P
Typha	CATTAIL	P	P	P	P
Vitis	GRAPE		P	P	
Xyris	YELLOW-EYED GRASS				P

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

Contact and resources for more information

Eesa Gafoor-Ali 904-256-1628 eesa.ali@dep.state.fl.us

A guide for Waterside Living
http://www.currentproblems.org/links/lotis.pdf

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