



LAKE ECOSUMMARY

Lake Ola, 2011

DEP conducted water quality and biological sampling at Lake Ola in Orange County on May 11 and November 7, 2011, to assess attainment of designated uses. Overall, the water quality, plant community, and phytoplankton data indicated that the lake met expectations for a healthy, well-balanced lake.

Background

Although healthy, well-balanced lake communities may be maintained with some level of human disturbance, 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 the condition 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), and exceedances of these standards are associated with interference with 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 CaCO₂), a healthy system is expected to have ≤6 µg/L of chlorophyll *a*. In colored (≥40 PCU) lakes or clear, high alkalinity (≥ 20 mg/L CaCO₂) lakes, healthy systems are expected to have ≤20 µg/L of chlorophyll *a*. Chlorophyll *a* values greater than those shown above 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).

Methods

Lake Ola was sampled on May 7, and November 7, 2011, by the DEP Central District Office. Surface water samples were collected for analysis of nutrients, chlorophyll *a*, color, and algal community composition 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>). 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; (38-77) Healthy; and (0-37) Impaired. DEP's new draft F.A.C. Chapter 62.302 requires at least two temporally independent LVIs with an average score of 43 or above in order to meet the expectation of a healthy, well balanced community. The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000.

Site Information

Lake Ola, located in central Florida approximately 25 miles northwest of Orlando, is part of the Upper Ocklawaha River Basin and in the Lake Apopka Watershed. The lake has a surface area of approximately 439 acres and a mean depth of 5 m. Surface water enters the lake via sheet flow from surrounding uplands and leaves the lake under high water condition through a canal to Lake Carlton. Lake Ola's watershed consists primarily of low density residential with scattered agriculture use. Agricultural use once dominated the area.

Lake Ola was listed as potentially impaired for Trophic State Index and was included on the planning list of impaired waters for the Ocklawaha Basin.

Results

Water Quality

The concentrations of total nitrogen, total phosphorus, and chlorophyll *a* in the samples collected May 11 and November 7, 2011, met the proposed state water quality criteria (Table 1, note that compliance with lake numeric nutrient criteria involves an annual geometric mean, and is not based on single samples). The chlorophyll *a* concentration was 2.0 µg/L on 5/11/11 and 1.8 µg/L 11/7/11, well below the proposed annual geometric mean standard of 20 µg/L.

Phytoplankton

The chlorophyll *a* concentration was well within the range of values considered to be healthy for lakes, so the phytoplankton was not of nuisance or unhealthy abundance. The algal community in the water column on May 11 consisted of 28.01% cyanobacteria (blue-green algae), 56.64% green algae, 6.02% diatoms, and 8.01% cryptomonads. The algal community in the water column on November 7 consisted of 17.18% cyanobacteria (blue-green algae), 41.81% green algae, 7.26% diatoms, and 33.39% cryptomonads.

Table 1. Water quality results May 11, 2011 and November 7, 2011 at Lake Ola

Analyte	Results 5/11	Results 11/7	Applicable Class III Water Quality Criteria
Field Water Temperature (°C)	27.7	21.2	
Field pH (SU)	8.4	9.0	
Secchi (m)	3.8	4.0 J	
Field Dissolved Oxygen (mg/L)	8.99	9.98	≥ 5
Field Specific Conductance (µmhos/cm)	260	249	
Alkalinity (mg CaCO ₃ /L)	31	32 A	
Color (PCU)	7.5	5.6 I	
Chlorophyll <i>a</i> (µg/L)	2.0	1.8	*20
Total Phosphorus (mg/L)	0.012	0.008 I	0.03 *

Nitrate+Nitrite (mg/L)	0.004 U	0.004 U	
Ammonia (mg/L)	0.013	0.011 I	
Total Kjeldahl Nitrogen (mg/L)	0.67	0.65	
Total Nitrogen (mg/L)	0.67	0.65	1.05*

*proposed 62-302 thresholds for Annual Geometric Mean values for lakes with alkalinity > 20 mg/L and color < 40 PCU.

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

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.

J - Estimated Value

Lake Vegetation Index

The LVI score for both 2011 sampling events was 52 out of a possible 100 points corresponding with a category II "Healthy" designation. Table 2 and 3 contain the species list and occurrence information for these sampling events. A total of 10 invasive exotic plants were observed in the lake during the May 11 sample event in sections 2, 5, 8, and 11. Only six invasive exotics were observed in November in sections 1, 10, 7, and 4, but *Hydrilla verticillata* was codominant in three of the sections. The LVI scored in the "Healthy" category despite the presence of these exotics due to the high diversity of native vegetation.

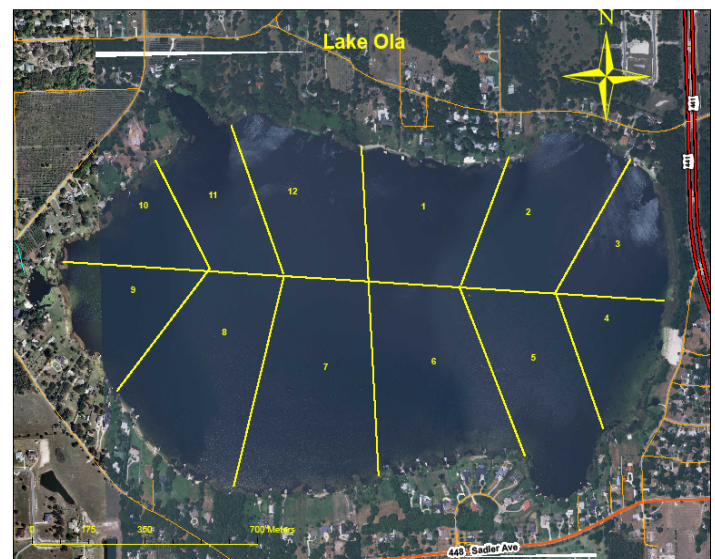


Figure 1. Sampling map of Lake Ola. Sections 2,5,8,11 were sampled for the LVI on May 11, 2011. Sections 1,10,7,4 were sampled on November 7, 2011. The water quality sample was collected from the lake center.

Table 2. Species list for the May 11, 2011, LVI at Lake Ola.
An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Species	Common Name	Section:	2	5	8	11
<i>Acer rubrum</i>	RED MAPLE		P	P	P	P
<i>Alternanthera philoxeroides</i> *	ALLIGATOR WEED			P		
<i>Andropogon</i>	BROOM GRASS		P			
<i>Aster carolinianus</i>	CAROLINA ASTER					P
<i>Baccharis</i>	SALT MYRTLE			P		P
<i>Bacopa caroliniana</i>	LEMON BACOPA		P	P	P	P
<i>Bidens alba</i>	HAIRY BEGGAR TICKS					P
<i>Cephalanthus occidentalis</i>	BOTTON BUSH					P
<i>Ceratophyllum demersum</i>	COONTAIL		P			P
<i>Chara</i>	CHARA		P	P	P	P
<i>Cicuta mexicana</i>	WATER HEMLOCK			P		
<i>Cinnamomum camphora</i>	CAMFOR TREE			P		P
<i>Cladium jamaicense</i>	JAMAICA SWAMP SAWGRASS			P		P
<i>Colocasia esculenta</i> *	TARO; WILD TARO		P	P	P	P
<i>Cyperus odoratus</i>	RUSTY FLAT SEDGE		P			
<i>Eichhornia crassipes</i> *	WATER HYACINTH		P	P	P	P
<i>Eleocharis baldwinii</i>	BALDWIN'S SPIKERUSH			P	P	P
<i>Eriocaulon compressum</i>	HAT PIN			P		
<i>Eupatorium capillifolium</i>	DOGFENNEL		P			P
<i>Fuirena scirpoidea</i>	RUSH FUIRENA		P	P	P	P
<i>Hydrilla verticillata</i> *	HYDRILLA		P	P		P
<i>Hydrocotyle</i>	MARSHPENNYWORT		P	P	P	P
<i>Ilex cassine</i>	DAHOON			P	P	
<i>Juncus effusus</i>	SOFT RUSH				P	
<i>Juncus marginatus</i>	SHORE RUSH			P		
<i>Liquidambar styraciflua</i>	SWEET GUM					P
<i>Ludwigia</i>	PRIMROSE WILLOW			P		
<i>Ludwigia arcuata</i>	CREEPING PRIMROSE		P			
<i>Ludwigia peruviana</i> *	PERUVIAN PRIMROSEWILLOW		P	P		P
<i>Melaleuca quinquenervia</i> *	MELALEUCA				P	
<i>Mikania scandens</i>	CLIMBING HEMPVINE			P		P
<i>Myrica cerifera</i>	WAX MYRTLE		P	P		P
<i>Najas guadalupensis</i>	SOUTHERN WATERNYMPH		C	P	P	C
<i>Nitella</i>	NITELLA		C	D	D	C
<i>Nuphar</i>	COW LILY					P
<i>Nymphaea odorata</i>	WHITE WATERLILY		P	P	P	P
<i>Panicum hemitomon</i>	MAIDENCANE			P	P	P
<i>Panicum repens</i> *	TORPEDO GRASS		P	P	P	P
<i>Paspalum urvillei</i>	VASEY GRASS		P	P		
<i>Polygonum hydropiperoides</i>	SMARTWEED		P	P		
<i>Pontederia cordata</i>	PICKERELWEED		P	P	P	P
<i>Ptilimnium capillaceum</i>	MOCK BISHOP'S WEED		P			P
<i>Sabal palmetto</i>	CABBAGE PALM			P		
<i>Sagittaria isoetiformis</i>	THREADLEAF ARROWHEAD		P		P	
<i>Sagittaria lancifolia</i>	BULLTONGUE ARROWHEAD		P	P		P
<i>Salix caroliniana</i>	CAROLINA WILLOW		P			P
<i>Salvinia minima</i> *	WATER SPANGLES		P	P		P
<i>Sambucus canadensis</i>	ELDERBERRY		P	P		P
<i>Sapium sebiferum</i> *	CHINEESE TALLOW		P			
<i>Schinus terebinthifolius</i> *	BRAZILIAN PEPPER		P		P	
<i>Scirpus cubensis</i>	CUBAN BULRUSH					P
<i>Sesbania punicea</i>	RATTLE BOX					P
<i>Taxodium</i>	CYPRESS		P	P	P	P
<i>Thelypteris</i>	FERN					P
<i>Typha</i>	CAT TAIL		P	P	P	P
<i>Utricularia gibba</i>	TANGLED BLADDER WORT			P		
<i>Utricularia radiata</i>	FLOATING BLADDERWORT		P			P
<i>Vallisneria americana</i>	EEL GRASS, TAPE GRASS		P	P	P	P
<i>Vigna luteola</i>	COW PEA					P
<i>Vitis</i>	GRAPE VINE			P		P

Table 3. Species list for the November 7, 2011, LVI at Lake Ola. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Species	Common Name	Sections:	1	10	7	4
Acer rubrum	RED MAPLE		P	P	P	P
Andropogon	BROOM GRASS			P		
Baccharis	SALT MYRTLE			P		
Bacopa caroliniana	LEMON BACOPA		P			P
Ceratophyllum demersum	COONTAIL			P		
Chara	CHARA			P		
Cladium jamaicense	JAMAICA SWAMP SAWGRASS		P			P
Colocasia esculenta*	TARO; WILD TARO			P		
Cyperus polystachyos	MANYSPIKE FLATSEDGE		P			
Echinochloa	BARNYARD GRASS		P			
Eclipta prostrata	FALSE DAISY		P			
Eleocharis baldwinii	BALDWIN'S SPIKERUSH		P			
Eleocharis interstincta	KNOTTED SPIKERUSH				P	
Eupatorium capillifolium	DOGFENNEL			P		P
Fuirena	RUSH FUIRENA					P
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE		P	P	P	P
Gordonia lasianthus	LOBLOLLY BAY			P		
Hydrilla verticillata*	HYDRILLA		C	C	C	P
Hydrocotyle	MARSHPENNYWORT		P	P		P
Ilex cassine	DAHOO				P	
Ludwigia leptocarpa	ANGLESTEM PRIMROSEWILLOW		P	P	P	
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW		P	P	P	P
Melaleuca quinquenervia*	MELALEUCA				P	
Mikania scandens	CLIMBING HEMPVINE					P
Myrica cerifera	WAX MYRTLE		P			P
Najas guadalupensis	SOUTHERN WATERNYMPH		P	P		
Nitella	NITELLA		C	C	C	D
Nymphaea odorata	AMERICAN WHITE WATERLILY		P	P	P	P
Panicum hemitomon	MAIDENCANE			P	P	
Panicum repens*	TORPEDO GRASS		P	P	P	P
Pontederia cordata	PICKERELWEED		P	P	P	P
Sabal palmetto	CABBAGE PALM				P	
Sagittaria filiformis	THREADLEAF ARROWHEAD		P			
Sagittaria lancifolia	BULLTONGUE ARROWHEAD		P	P		P
Salix caroliniana	CAROLINA WILLOW		P		P	P
Sambucus canadensis	ELDERBERRY			P		
Schinus terebinthifolius*	BRAZILIAN PEPPER				P	
Scirpus cubensis	CUBAN BULRUSH				P	
Sesbania	RATTLE BOX			P		
Taxodium	CYPRESS		P		P	
Typha	CAT TAIL		P	P	P	P
Vallisneria americana	EEL GRASS, TAPE GRASS		P	P	P	P

Summary

Lake Ola's water quality, plant community, and phytoplankton data, sampled once on May 11 and again on November 7, 2011, indicated that the lake met expectations for a healthy, well-balanced lake. Total nitrogen, total phosphorus and chlorophyll *a* concentrations were well below applicable state water quality criteria. Two independent LVIs scored 52 out of 100, corresponding with a category II "Healthy"

designation. Phytoplankton data indicated a balance in the algal community and little potential for a harmful algal bloom.

Lake Ola's condition has the potential for change. A large mass of *Hydrilla verticillata* occupies the entire middle of the lake. Lake Ola's LAKEWATCH volunteer of many years estimates as much as 200 acres of dense *Hydrilla*. This observation corresponds with the November 7, 2011 LVI, when *Hydrilla* was co-dominant in three sections. *Hydrilla* has the potential to displace native submersed plants and can trigger changes in the algal community as it is managed.

Lake Ola would benefit from a management plan to prevent increases in nutrient loads from its watershed, promote native submersed and littoral vegetation and upland buffers, and control submersed and emergent exotic vegetation.

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

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Basin Management Action Plan for Upper Ocklawaha River basin;
<http://www.dep.state.fl.us/water/watersheds/docs/bmap/AdoptedUpOcklawahaBMAP.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>