LAKE ECOSUMMARY

Machine Gun Lake
WBID 3224A2, Martin County
September 19, 2016 & September 20, 2021



Figure 1. Machine Gun Lake in Martin County.

DEP conducted water quality and biological sampling at Machine Gun Lake (WIN: 49879 / 59093; Z6-SL-10001/ Z6-SL-15002) in Martin County on 09/19/2016 and 09/20/2021 to assess attainment of designated uses. This lake was sampled as part of a Status Monitoring Network, specifically as a small lake resource. The Status Network is an annual assessment of the entire state's resources. The network is divided into 6 reporting units or zones. Overall, the water quality indicated that the lake **did not meet** expectations for a healthy, well-balanced lake, however, the plant community did meet expectations

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

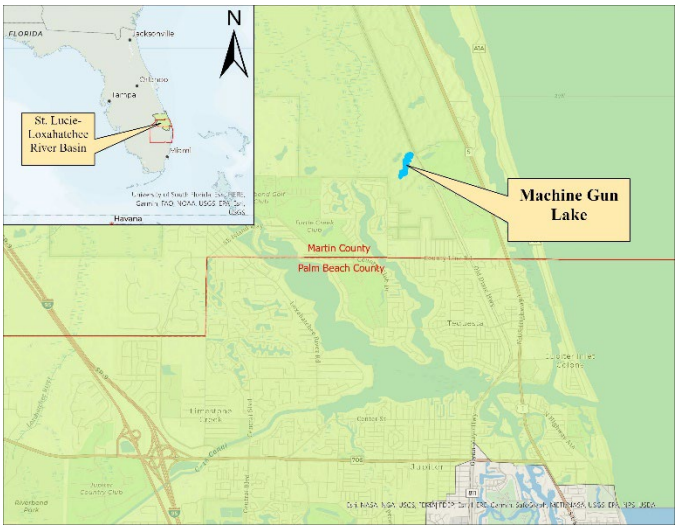


Figure 2. Location of Machine Gun Lake in Martin County.

Machine Gun Lake is located within Jonathan Dickinson State Park and can be accessed privately from County Line Road in Martin County, Florida. The lake is approximately 4.95 hectares and is part of the Loxahatchee River Watershed. Water depths of 1.8 and 1.5 meters were recorded within the lake, respectively.

The predominant land uses surrounding Machine Gun Lake are vegetated non-forested wetlands and pine flatwoods. This lake is not currently listed on the Impaired Waters Verified List (11/24/2021). Additional information about this WBID is available in the Status Network Interactive Report Card.
(https://floridadep.gov/dear/watershed-monitoring-section/content/interactive-water-quality-report-cards).

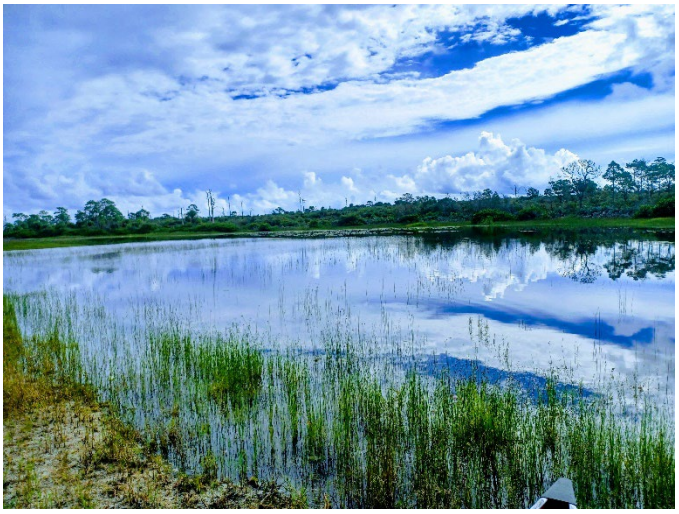


Figure 3. Machine Gun Lake on September 20, 2021

Methods

Water Quality

This lake was sampled on 09/19/2016 and 09/20/2021 by the DEP Southeast Regional Operations Center (SEROC). Surface water samples were collected from the center of the lake for analysis of nutrients, metals, chlorophyll *a*, color, alkalinity, total suspended solids, total dissolved solids, turbidity, *Escherichia coli* (E. coli), and chloride, fluoride, and sulfate, following DEP Standard Operating Procedures (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 presented in this report, Machine Gun Lake is a low 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 Everglades region for DO criteria assessment. Percent saturation incorporates 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 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 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 (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 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.

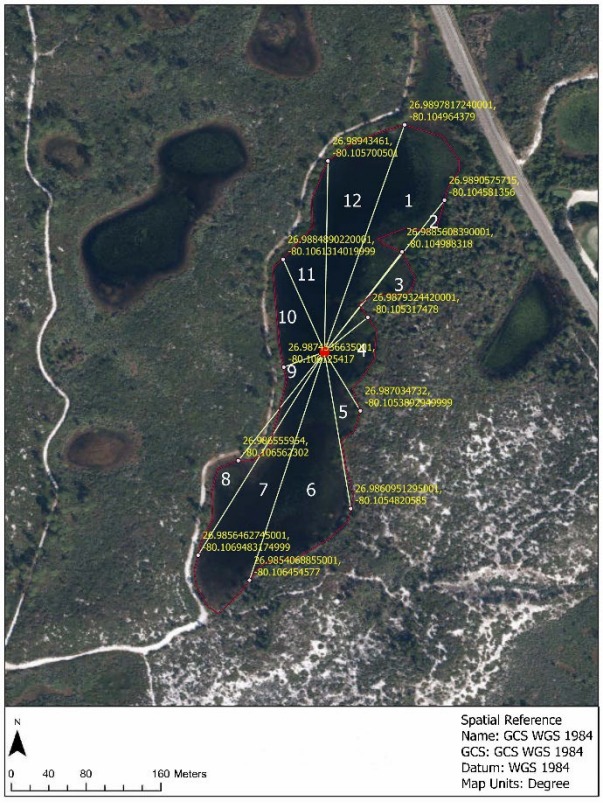


Figure 4. LVI sampling map of Machine Gun Lake. Sections 3, 6, 9, and 12 were sampled in 2016 and Sections 2, 5, 8, and 11 in 2021 for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2. Based on these two sampling events, the lake exceeded the nutrient thresholds for low 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.

Chlorophyll *a*, total phosphorus, and total nitrogen were higher in 2021 than in 2016, although total phosphorus did not exceed nutrient thresholds. 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 09/19/2016 and 09/20/2021 at Machine Gun Lake.

Analyte	Result 09/19/2016	Result 09/20/2021	Applicable Class III Water Quality Criteria
Field Temperature (°C)	30.9	31.1	N/A
Field pH (SU)	6.6	6.6	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	6.6 mg/L (89.0%)	5.85 mg/L (78.9%)	*>36.75%, >34.48%
Field Specific Conductance (µmhos/cm)	143.0	169.0	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	9.6	9.7	Shall not be depressed below 20 [or if natural alkalinity is low, shall not be reduced by more than 25%]
Color (PCU)	37 A	37	N/A
Chlorophyll a (µg/L)	2.3	7.4	≤6 for clear alkaline lakes
Total Phosphorus (mg/L) as P	0.009	0.010	0.01 to 0.03 mg/L
Nitrate+Nitrite (mg/L) as N	0.004 UY	0.004 U	N/A
Ammonia (mg/L) as N	0.008	0.005 I	2.60 mg/L, 2.54 mg/L
Total Kjeldahl Nitrogen (mg/L) as N	0.93	1.1	N/A
Total Nitrogen (mg/L) as N	0.93	1.1	0.51 to 0.93 mg/L

* Instantaneous DO criterion calculated per DO Saturation Calculator

** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator

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.

Y - The laboratory analysis was from an unpreserved or improperly preserved sample. The data may not be accurate.

Lake Vegetation Index

The 2016 LVI score for this lake was 68 out of a possible 100 points, corresponding with a "Healthy" (43-77) designation. Table 3 contains the species list and occurrence information for this sampling event. A total of three invasive exotic plants were observed in the lake.

The 2021 LVI score for this lake was 67 out of a possible 100 points, corresponding with a "Healthy" (43-77) designation. Table 4 contains the species list and occurrence information for this sampling event. A total of two invasive exotic plants were observed in the lake.

Table 3. Species list for the 09/19/2016 LVI at Machine Gun Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant.

Machine Gun Lake 09/19/2016		Sections			
Scientific Name	Common Name	3	6	9	12
Andropogon	BLUESTEM			P	
Blechnum serrulatum	TOOTHED MIDSORUS FERN; SWAMP FERN	P			P
Centella asiatica	SPADELEAF			P	
Cephalanthus occidentalis	COMMON BUTTONBUSH	P	P	P	P
Chrysobalanus icaco	COCO PLUM	P	P	P	P
Eleocharis	SPIKERUSH	P	P	P	P
Eleocharis baldwinii	BALDWIN'S SPIKERUSH; ROADGRASS		P	P	P
Eleocharis elongata	SLIM SPIKERUSH	P	P	P	P
Eupatorium capillifolium	DOGFENNEL			P	P
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE	P	P	P	P
Hypericum fasciculatum	SANDWEED; PEELBARK ST.JOHN'S-WORT	P	P	P	P
Ludwigia arcuata	PIEDMONT PRIMROSEWILLOW	P			P
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW				P
Ludwigia suffruticosa	SHRUBBY PRIMROSEWILLOW	P		P	P
Melaleuca quinquenervia	MELALEUCA			P	P
Mikania scandens	CLIMBING HEMPVINE				P
Mimosa pigra*	CATCLAW MIMOSA	P	P	P	P
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE	P	P	P	P
Nymphaea odorata	AMERICAN WHITE WATERLILY	P	P	P	P
Panicum hemitomon	MAIDENCANE	P	P	P	P
Panicum repens*	TORPEDO GRASS	P	P	P	P
Pinus elliottii	SLASH PINE	P	P	P	P
Pluchea	CAMPHORWEED			P	P
Quercus	OAK			P	P
Rhynchospora tracyi	TRACY'S BEAKSEDGE	P	P		
Sabal palmetto	CABBAGE PALM	P	P		
Sagittaria graminea	GRASSY ARROWHEAD	P	P	P	P
Sagittaria lancifolia	BULLTONGUE ARROWHEAD	P	P	P	P
Serenoa repens	SAW PALMETTO	P	P	P	P
Smilax	GREENBRIER			P	
Triadenum virginicum	VIRGINIA MARSH ST.JOHN'S-WORT				P
Utricularia foliosa	LEAFY BLADDERWORT	P	P	P	P
Utricularia purpurea	PURPLE BLADDERWORT	D	D	D	D
Xyris	YELLOWEYED GRASS	P		P	

Table 4. Species list for the 09/20/2021 LVI at Machine Gun Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Machine Gun Lake 09/20/2021		Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
Chrysobalanus icaco	COCO PLUM	P			
Eleocharis baldwinii	BALDWIN'S SPIKERUSH; ROADGRASS	P	C	P	D
Eleocharis vivipara	UMBRELLA HAIR GRASS		P	P	P
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW				P
Nymphaea odorata	AMERICAN WHITE WATERLILY	D	P	P	P
Nyssa sylvatica biflora	SWAMP TUPELO		P		
Panicum hemitomon	MAIDENCANE	P	P		P
Panicum repens*	TORPEDO GRASS	P	P		P
Rhynchospora tracyi	TRACY'S BEAKSEDGE	P	P	P	P
Ricciocarpus natans	FLOATING CRYSTALWORT	P	C	D	P

Conclusions

Sampling at Machine Gun Lake indicates that the lake did not meet all applicable State Water Quality Criteria in 2021. The Lake Vegetation Index in 2016 and 2021 indicated plant communities that are consistent with expectations for a healthy, well-balanced lake. Despite the healthy vegetation community, the water quality results were inconclusive. Total nitrogen was at the upper end of the acceptable range in 2016 and exceeded the range in 2021 and chlorophyll *a* in 2021 exceeded the criterion for clear, low-alkalinity lakes. Compliance with NNC, however, is based on annual geometric mean values, not to be exceeded more than once in a three-year period. DEP's Watershed Assessment Section will evaluate the complete dataset to determine compliance with NNC.

The increase of chlorophyll *a* at Machine Gun Lake indicates that phytoplankton could become the primary producer if the lake's nutrients continue to increase.

Lower water levels could be responsible for the lack of plant diversity observed in 2021. Water levels were 0.3 meters lower than in 2016. Also, different sections of the lake were monitored in 2016 and in 2020 which could explain the difference in plant communities (Table 3 and Table 4). Additional monitoring in the next sampling cycle should help resolve the attainment status of Machine Gun 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

Andrew Luering, (772) 448-5881
Andrew.Luering@FloridaDEP.gov

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