LAKEWATCH Report for Middle in Sarasota County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

The long-term data summary will include the following parameters listed with a definition after each one:

- **County**: Name of county in which the lake resides.
- **Name**: Lake name that LAKEWATCH uses for the system.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, streams and springs.
- **Surface Area (ha and acre)**: LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft)**: This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year)**: Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone**: Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (color greater than 40 Pt-Co units), clear soft water lakes (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

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Base File Data and Nutrient Zone Comparisons for Lakes

County	Sarasota
Name	Middle
Latitude	27.1864
Longitude	-82.464
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2002 to 2003
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP5
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	45 (35 to 54)
TN Zone	TN5
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1128 (1000 to 1257)

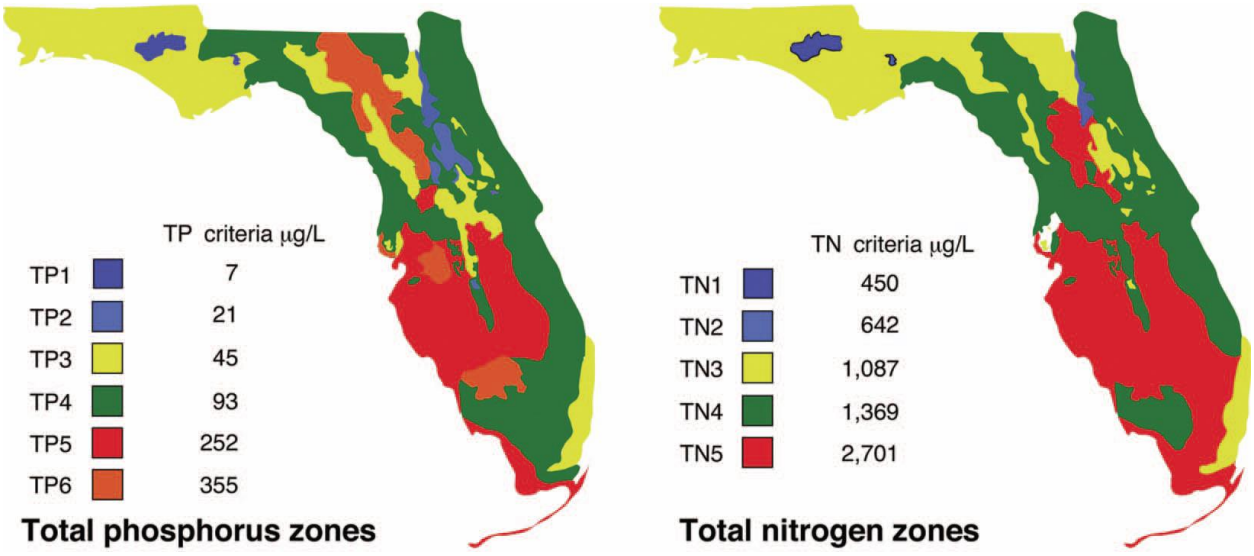

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

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FDEP Nutrient Criteria Lakes

For lakes, the applicable numeric interpretations of the narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., for chlorophyll *a* are shown in the table below. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability of chlorophyll *a* data and the concentrations of nutrients and chlorophyll *a* in the lake, as described below. The applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, for lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region; or 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 the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

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Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	35 - 54	45 (2)
Total Nitrogen (µg/L)	1000 - 1257	1128 (2)
Chlorophyll- uncorrected (µg/L)	16.0 - 30.0	23.0 (2)
Secchi (ft)	3.0 - 3.2	3.1 (2)
Secchi (m)	0.9 - 1.0	0.9 (2)
Color (Pt-Co Units)	58 - 59	59 (2)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

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Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Middle in Sarasota County. If there are no plots then there is less than five years of data, which is not enough for the analysis.