LAKEWATCH Report for Ponce Inlet-1 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Lower Halifax River		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Ponce Inlet-1
Latitude	29.0953
Longitude	-80.9464
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

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Long-Term Data Summary Estuary: 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.
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- **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.
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- **Specific Conductance (µS/cm@25°C), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	43 - 61	51 (5)
Total Nitrogen (µg/L)	331 - 441	385 (5)
Chlorophyll- uncorrected (µg/L)	5.9 - 9.3	8.1 (5)
Secchi (ft)	4.3 - 5.5	4.8 (5)
Secchi (m)	1.3 - 1.7	1.5 (5)
Color (Pt-Co Units)	8 -40	19 (5)
Specific Conductance (µS/cm@25 C)	38000 - 48250	43576 (5)
Salinity (ppt)	24 - 30	27 (5)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

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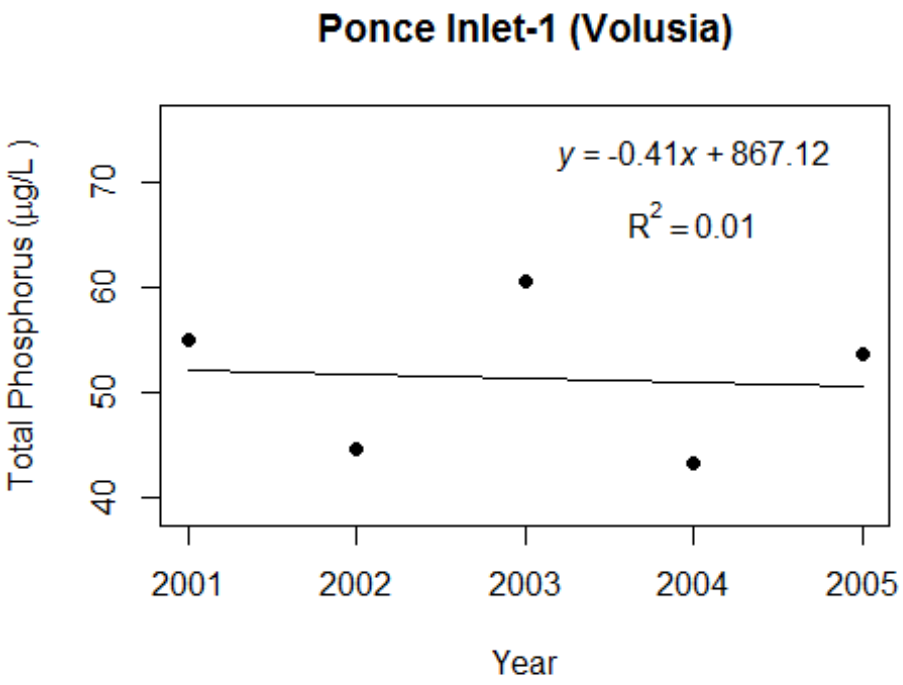
Trend Analyses Estuary

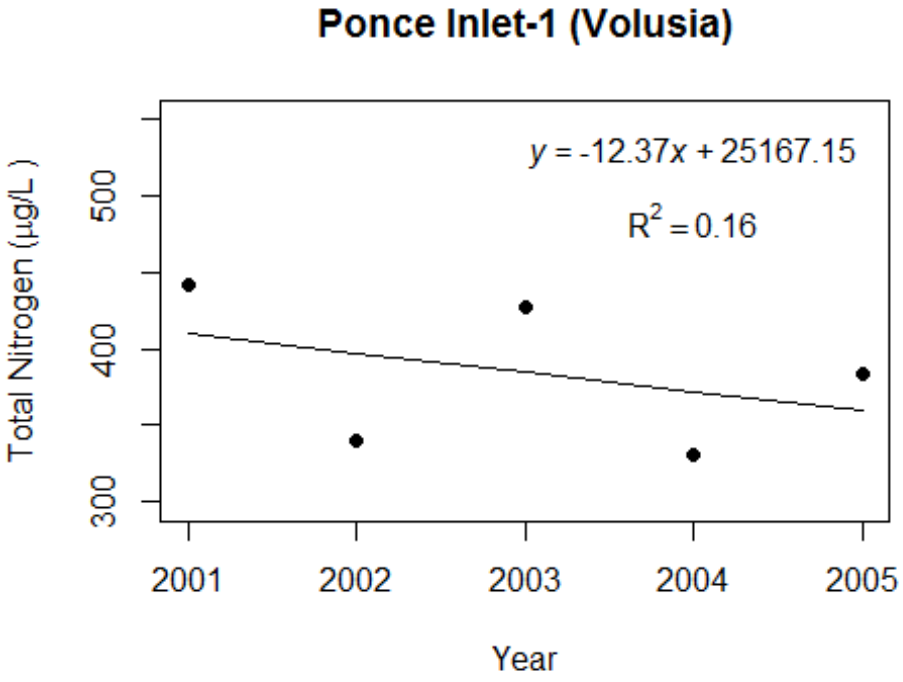
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over 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:

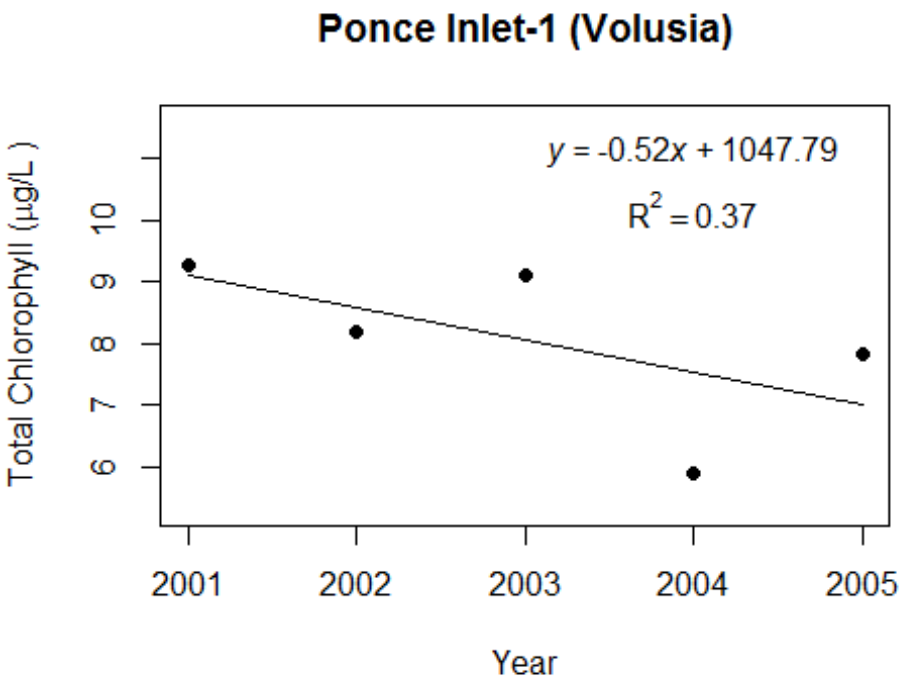
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive 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 values 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.

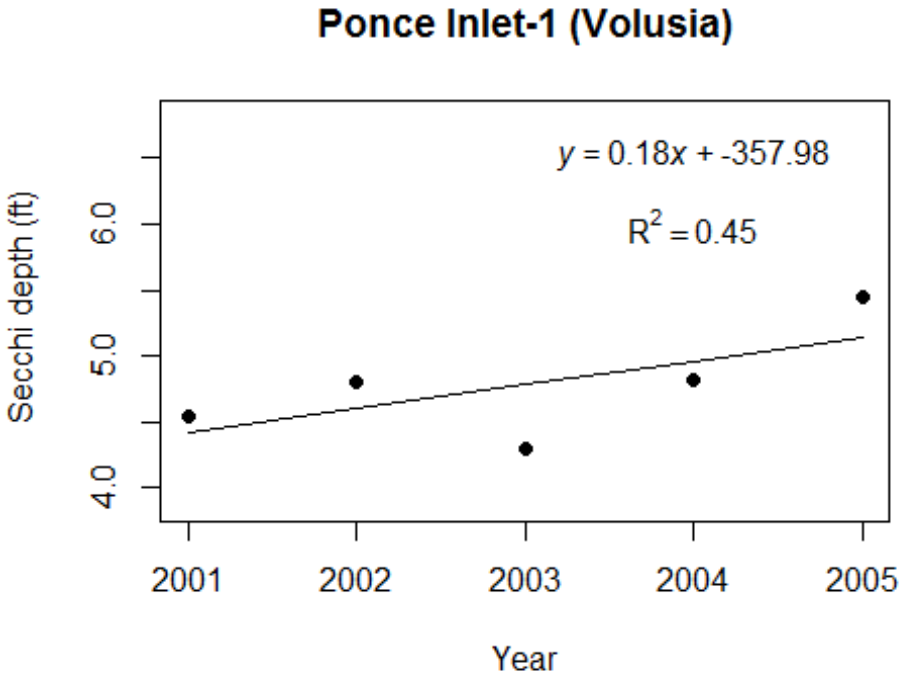
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	867	25167	1048	-358
Slope (b)	-0.41	-12.37	-0.52	0.18
Coefficient of Determination (R^2)	0.01	0.16	0.37	0.45
Probability of Significance (p)	0.89	0.51	0.28	0.22
Potential Trend	No Trend	No Trend	No Trend	No 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 Ponce Inlet-1 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Ponce Inlet-1 (Volusia)
y = -0.41x + 867.12
R2 = 0.01
Total Phosphorus (µg/L)
40
50
60
70
2001
2002
2003
2004
2005
Year


Ponce Inlet-1 (Volusia)
y = -12.37x + 25167.15
R2 = 0.16
Total Nitrogen (µg/L)
300
400
500
2001
2002
2003
2004
2005
Year


Ponce Inlet-1 (Volusia)
y = -0.52x + 1047.79
R2 = 0.37
Total Chlorophyll (µg/L)
6
7
8
9
10
2001
2002
2003
2004
2005
Year


Ponce Inlet-1 (Volusia)
y = 0.18x + -357.98
R2 = 0.45
Secchi depth (ft)
4.0
5.0
6.0
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Ponce Inlet-2 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

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The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Mosquito Lagoon	Mosquito Lagoon: Ponce de Leon to Edgewater		

Base File Data: Definitions

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

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- **Name**: Estuary name that LAKEWATCH uses for the system.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
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- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Ponce Inlet-2
Latitude	29.0586
Longitude	-80.9172
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

LAKEWATCH Report for Ponce Inlet-2 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: Definitions

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- **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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	38 - 47	42 (5)
Total Nitrogen (µg/L)	290 - 405	342 (5)
Chlorophyll- uncorrected (µg/L)	6.4 - 8.9	7.3 (5)
Secchi (ft)	3.9 - 4.6	4.4 (5)
Secchi (m)	1.2 - 1.4	1.3 (5)
Color (Pt-Co Units)	6 -25	12 (5)
Specific Conductance (µS/cm@25 C)	43211 - 50000	46442 (5)
Salinity (ppt)	27 - 31	29 (5)

Coastal Trophic State

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Oligotrophic	< 3.0	< 0.5
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Trend Analyses Estuary

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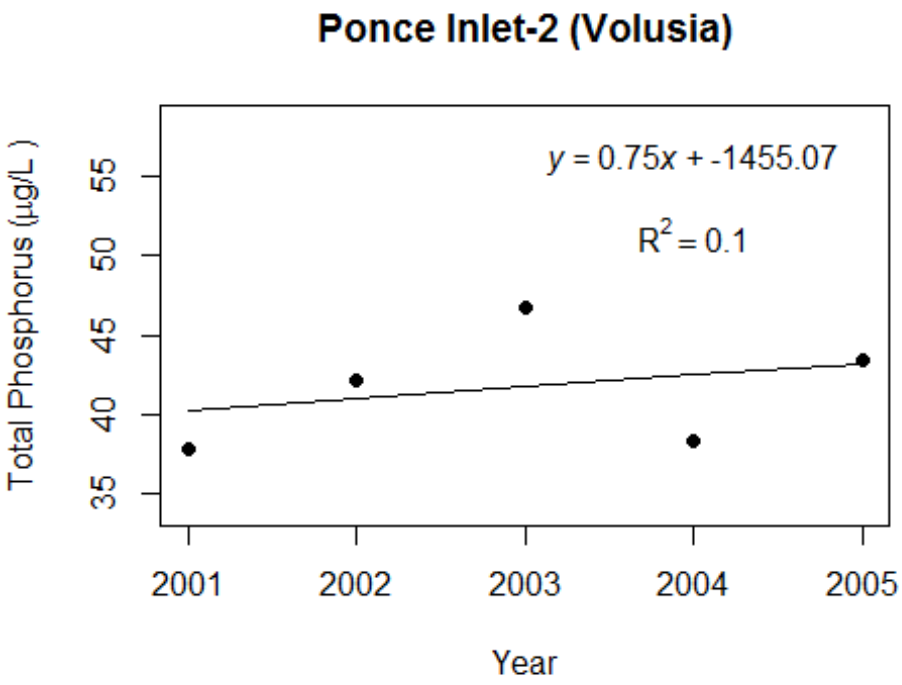
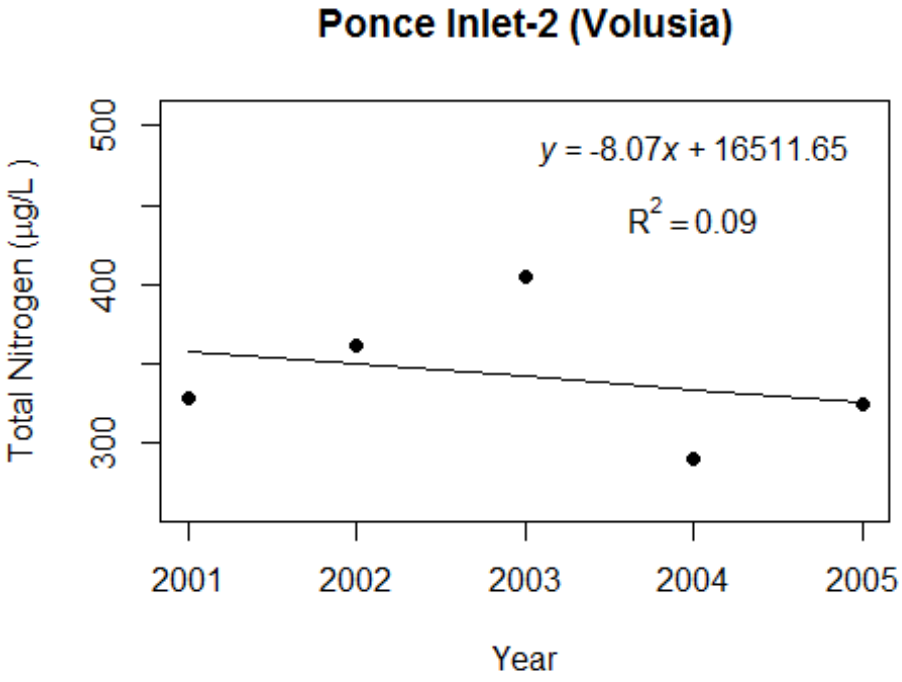
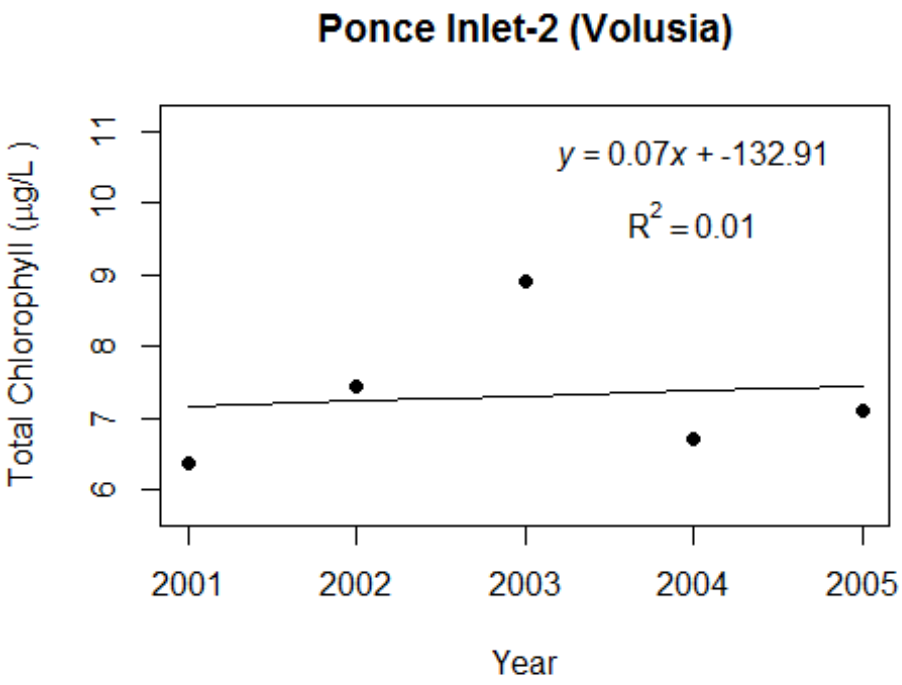
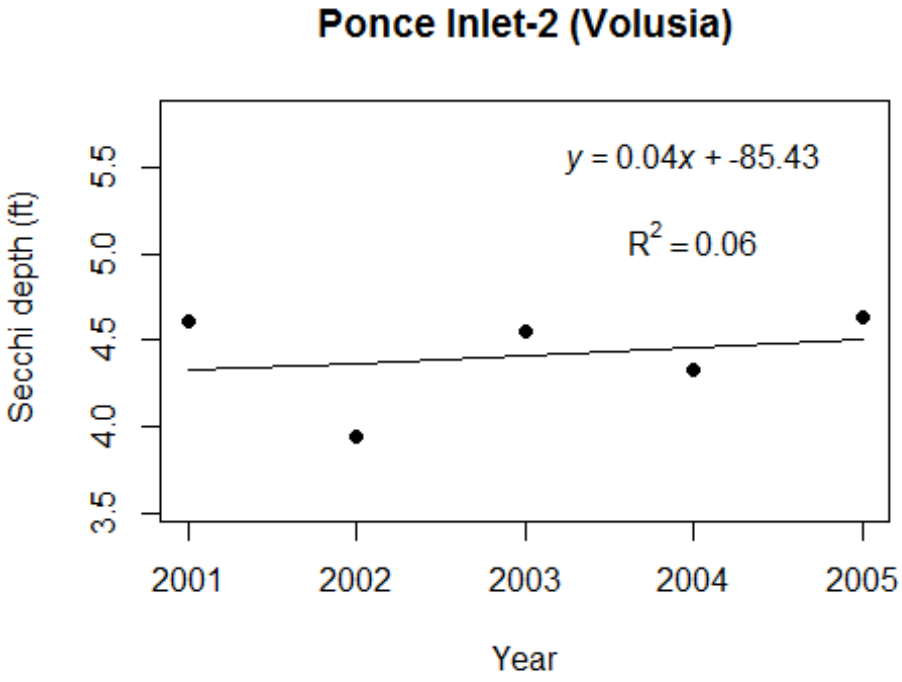
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	-1455	16512	-133	-85
Slope (b)	0.75	-8.07	0.07	0.04
Coefficient of Determination (R^2)	0.10	0.09	0.01	0.06
Probability of Significance (p)	0.60	0.63	0.86	0.69
Potential Trend	No Trend	No Trend	No Trend	No 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 Ponce Inlet-2 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Ponce Inlet-2 (Volusia)
y = 0.75x + -1455.07
R2 = 0.1
Total Phosphorus (µg/L)
35
40
45
50
55
2001
2002
2003
2004
2005
Year


Ponce Inlet-2 (Volusia)
y = -8.07x + 16511.65
R2 = 0.09
Total Nitrogen (µg/L)
300
400
500
2001
2002
2003
2004
2005
Year


Ponce Inlet-2 (Volusia)
y = 0.07x + -132.91
R2 = 0.01
Total Chlorophyll (µg/L)
6
7
8
9
10
11
2001
2002
2003
2004
2005
Year


Ponce Inlet-2 (Volusia)
y = 0.04x + -85.43
R2 = 0.06
Secchi depth (ft)
3.5
4.0
4.5
5.0
5.5
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Ponce Inlet-3 in Volusia County
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Introduction Estuary

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- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Ponce Inlet-3
Latitude	29.0442
Longitude	-80.9103
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

LAKEWATCH Report for Ponce Inlet-3 in Volusia County
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Long-Term Data Summary Estuary: Definitions

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Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	37 - 50	44 (5)
Total Nitrogen (µg/L)	341 - 435	402 (5)
Chlorophyll- uncorrected (µg/L)	7.5 - 10.8	9.1 (5)
Secchi (ft)	2.6 - 5.2	4.0 (5)
Secchi (m)	0.8 - 1.6	1.2 (5)
Color (Pt-Co Units)	7 -14	10 (5)
Specific Conductance (µS/cm@25 C)	43333 - 50500	47742 (5)
Salinity (ppt)	27 - 31	30 (5)

Coastal Trophic State

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Mesotrophic	3.0 - 7.0	0.5 - 1.8
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Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

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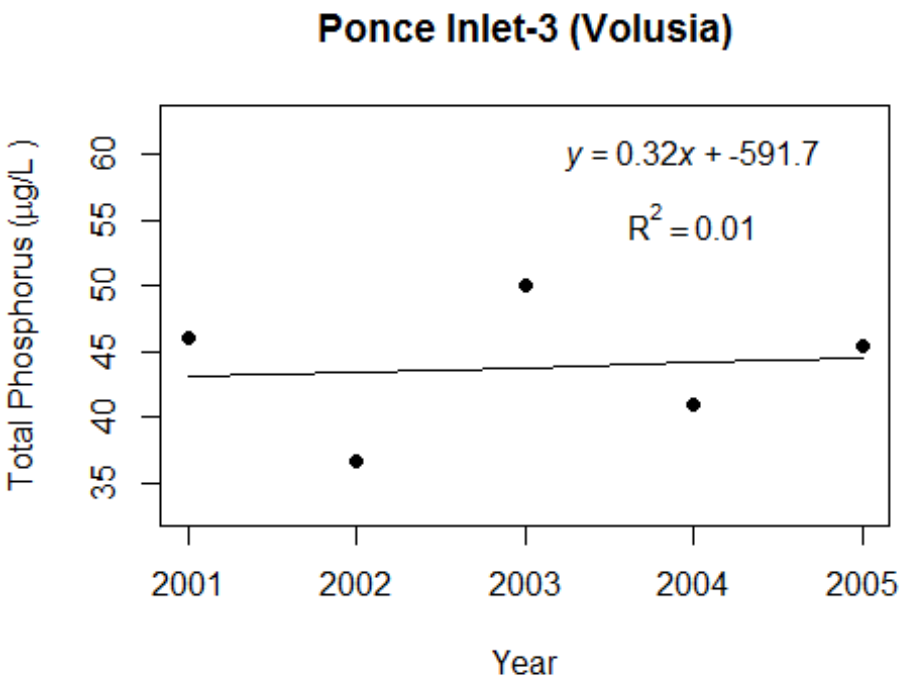
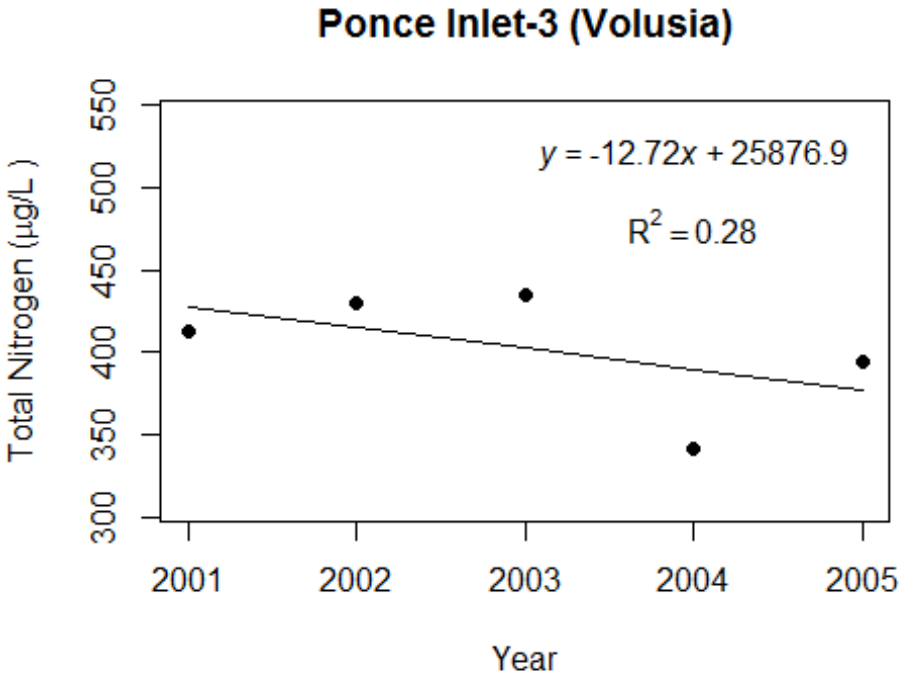
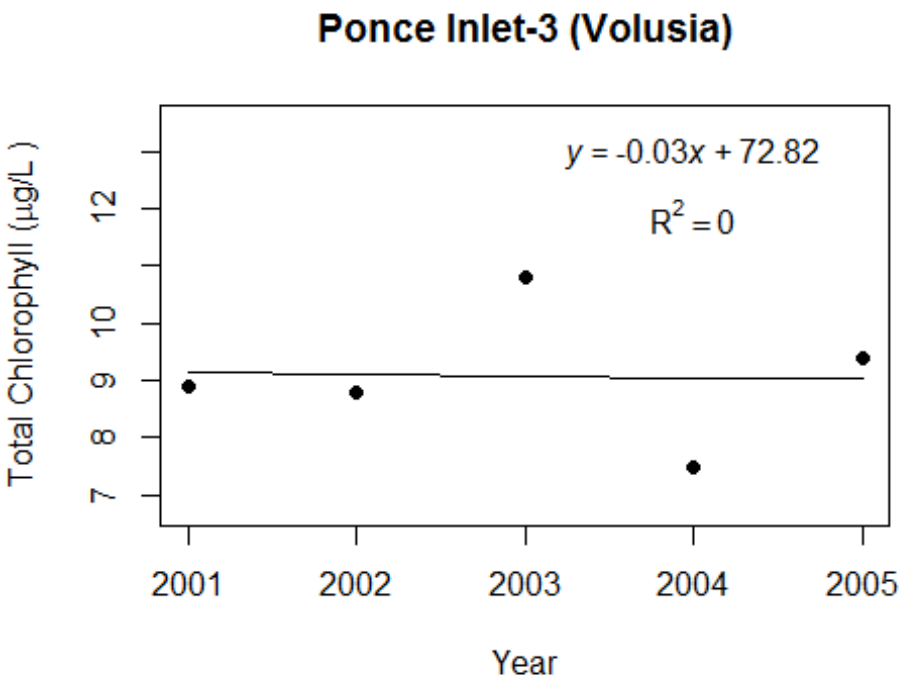
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

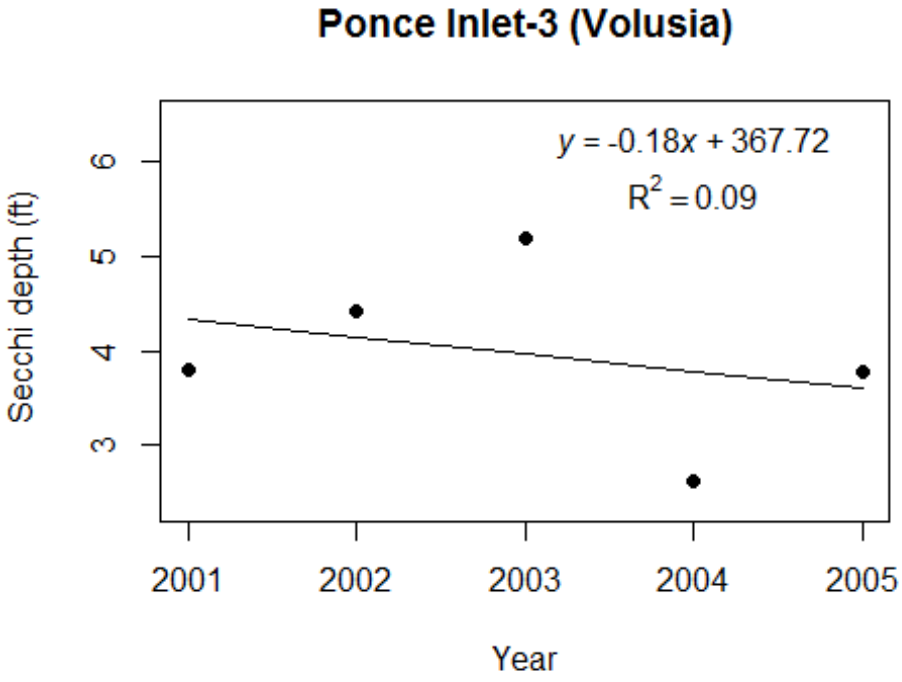
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	-592	25877	73	368
Slope (b)	0.32	-12.72	-0.03	-0.18
Coefficient of Determination (R^2)	0.01	0.28	0.00	0.09
Probability of Significance (p)	0.88	0.36	0.95	0.62
Potential Trend	No Trend	No Trend	No Trend	No 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 Ponce Inlet-3 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Ponce Inlet-3 (Volusia)
y = 0.32x + -591.7
R2 = 0.01
Total Phosphorus (µg/L)
35
40
45
50
55
60
2001
2002
2003
2004
2005
Year


Ponce Inlet-3 (Volusia)
y = -12.72x + 25876.9
R2 = 0.28
Total Nitrogen (µg/L)
300
350
400
450
500
550
2001
2002
2003
2004
2005
Year


Ponce Inlet-3 (Volusia)
y = -0.03x + 72.82
R2 = 0
Total Chlorophyll (µg/L)
7
8
9
10
12
2001
2002
2003
2004
2005
Year


Ponce Inlet-3 (Volusia)
y = -0.18x + 367.72
R2 = 0.09
Secchi depth (ft)
3
4
5
6
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Rose Bay-1 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Lower Halifax River		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Rose Bay-1
Latitude	29.1053
Longitude	-80.9777
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

LAKEWATCH Report for Rose Bay-1 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	95 - 125	110 (5)
Total Nitrogen (µg/L)	499 - 706	609 (5)
Chlorophyll- uncorrected (µg/L)	11.6 - 17.3	14.1 (5)
Secchi (ft)	2.1 - 2.6	2.4 (5)
Secchi (m)	0.6 - 0.8	0.7 (5)
Color (Pt-Co Units)	23 -63	41 (5)
Specific Conductance (µS/cm@25 C)	12500 - 39333	25723 (5)
Salinity (ppt)	8 - 24	16 (5)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Rose Bay-1 in Volusia County
Using Data Downloaded 10/17/2016

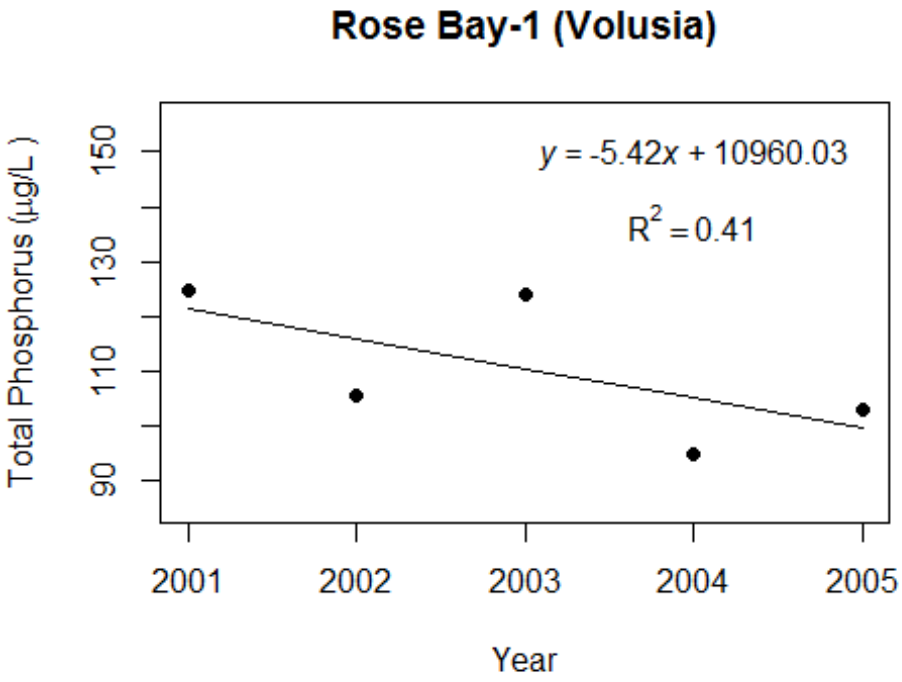
Trend Analyses Estuary

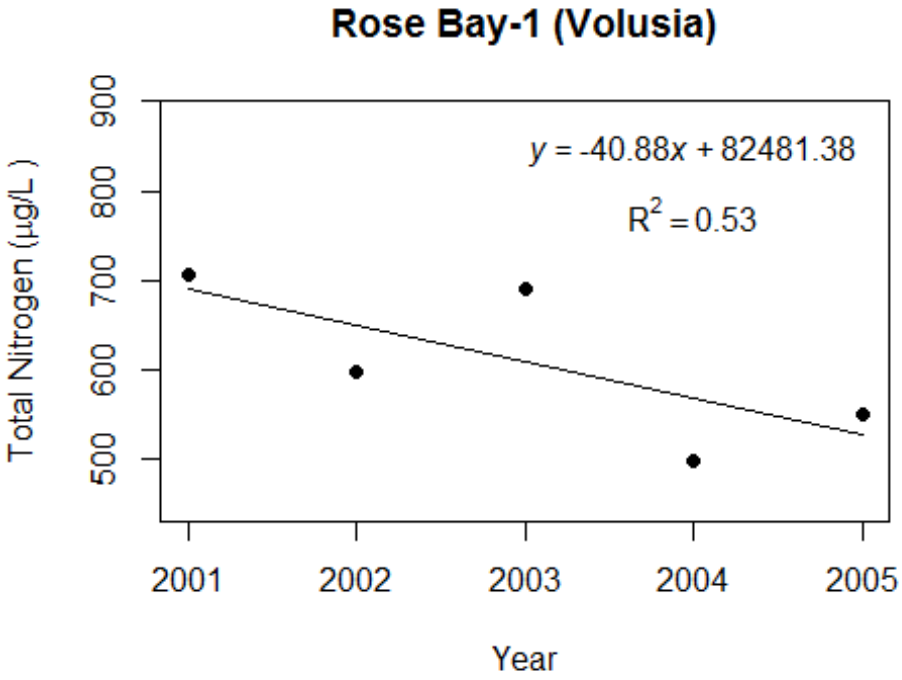
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over 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:

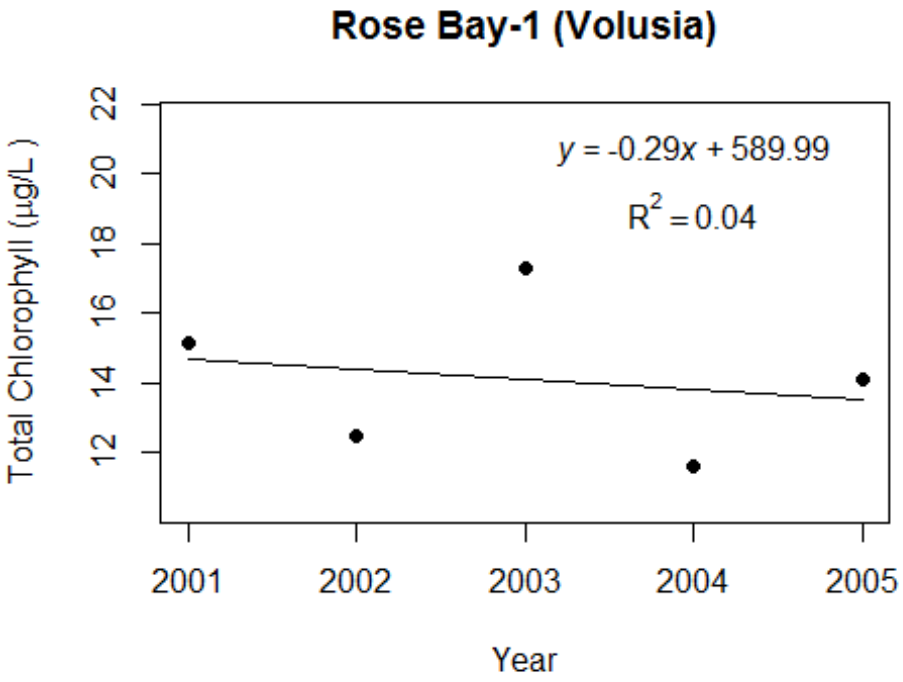
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive 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 values 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.

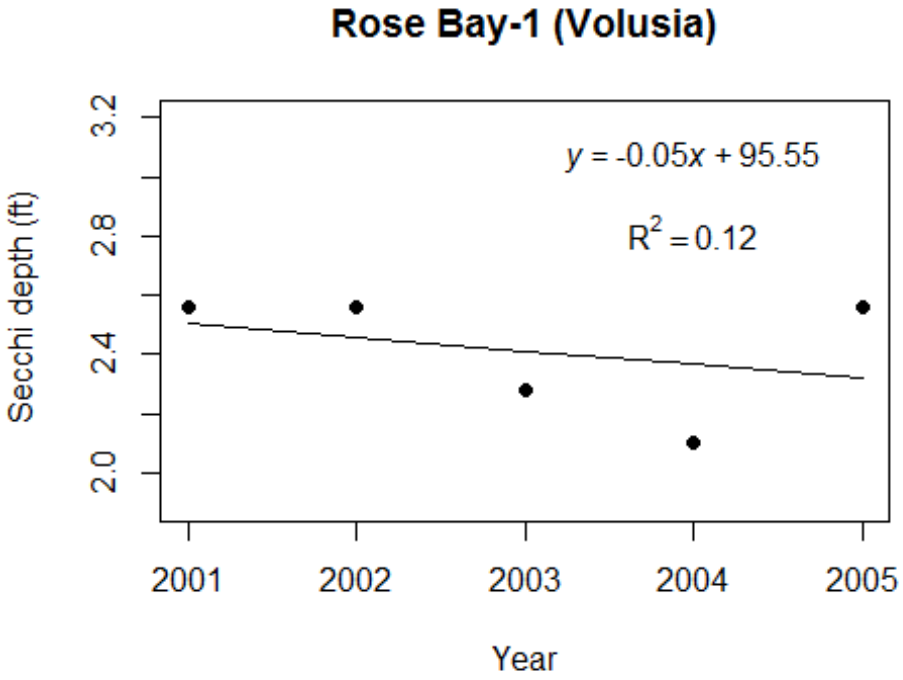
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	10960	82481	590	96
Slope (b)	-5.42	-40.88	-0.29	-0.05
Coefficient of Determination (R^2)	0.41	0.53	0.04	0.12
Probability of Significance (p)	0.25	0.16	0.74	0.57
Potential Trend	No Trend	No Trend	No Trend	No 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 Rose Bay-1 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Rose Bay-1 (Volusia)
y = -5.42x + 10960.03
R2 = 0.41
Total Phosphorus (µg/L)
90
110
130
150
2001
2002
2003
2004
2005
Year


Rose Bay-1 (Volusia)
y = -40.88x + 82481.38
R2 = 0.53
Total Nitrogen (µg/L)
500
600
700
800
900
2001
2002
2003
2004
2005
Year


Rose Bay-1 (Volusia)
Total Chlorophyll (µg/L)
12
14
16
18
20
22
y = -0.29x + 589.99
R2 = 0.04
2001
2002
2003
2004
2005
Year


Rose Bay-1 (Volusia)
Secchi depth (ft)
2.0
2.4
2.8
3.2
y = -0.05x + 95.55
R2 = 0.12
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Rose Bay-2 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Lower Halifax River		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Rose Bay-2
Latitude	29.1021
Longitude	-80.9644
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

LAKEWATCH Report for Rose Bay-2 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	75 - 111	95 (5)
Total Nitrogen (µg/L)	445 - 670	576 (5)
Chlorophyll- uncorrected (µg/L)	5.1 - 13.8	11.0 (5)
Secchi (ft)	2.4 - 2.9	2.6 (5)
Secchi (m)	0.7 - 0.9	0.8 (5)
Color (Pt-Co Units)	23 -79	47 (5)
Specific Conductance (µS/cm@25 C)	17950 - 40667	29773 (5)
Salinity (ppt)	11 - 25	18 (5)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Rose Bay-2 in Volusia County
Using Data Downloaded 10/17/2016

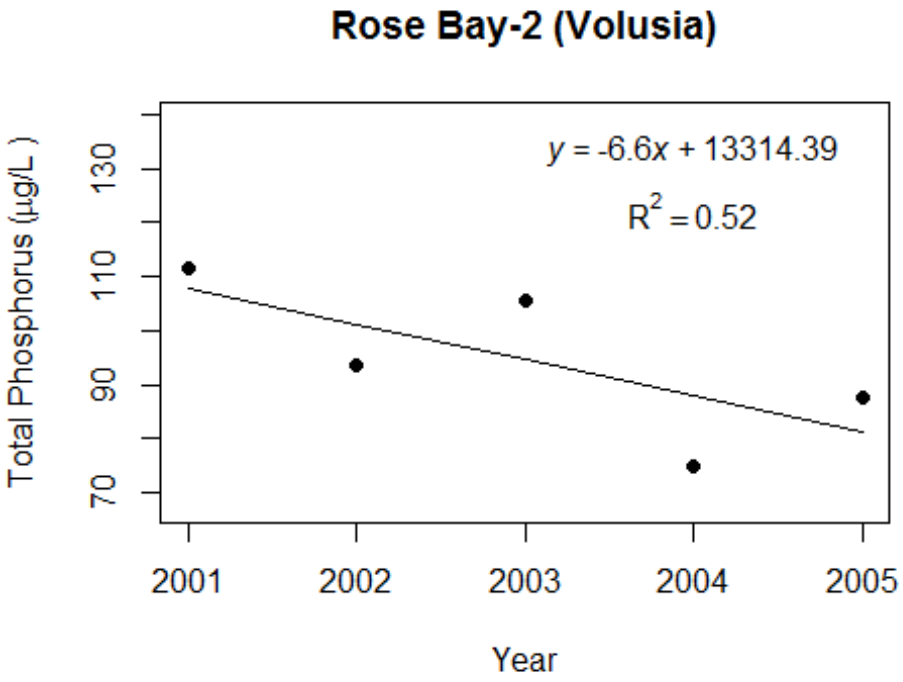
Trend Analyses Estuary

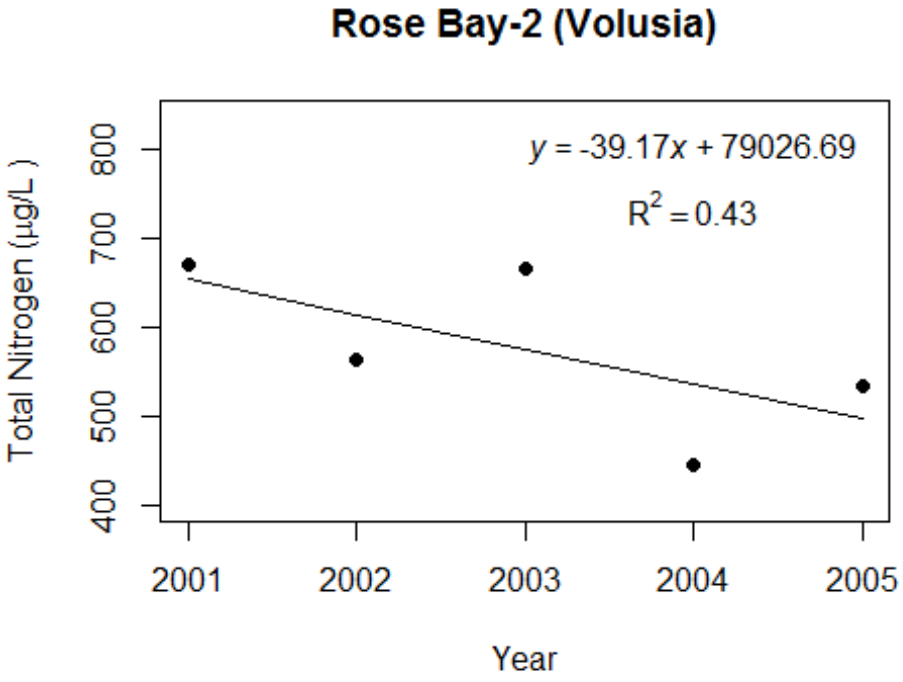
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over 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:

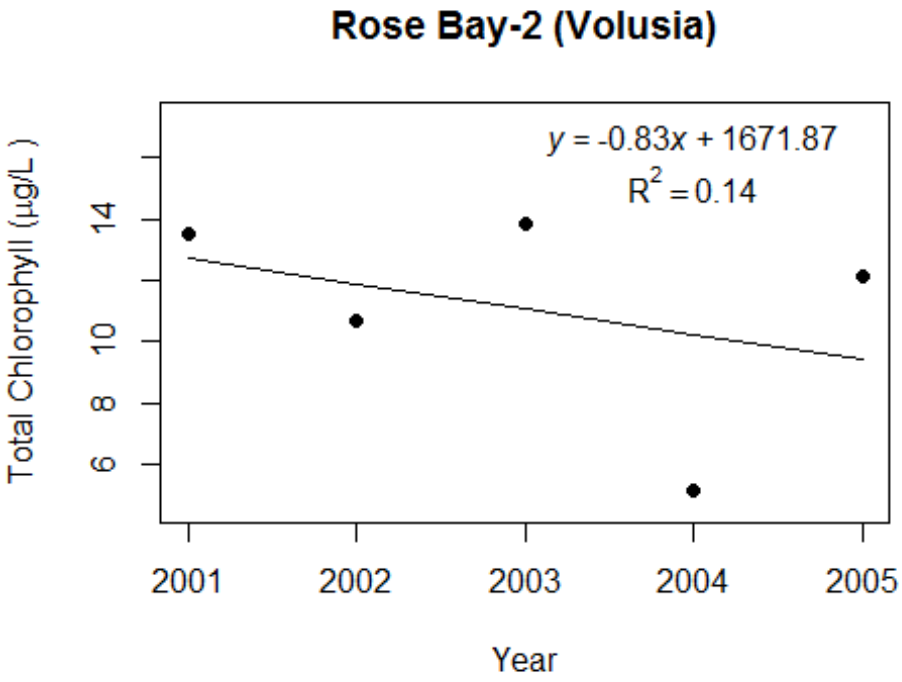
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive 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 values 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.

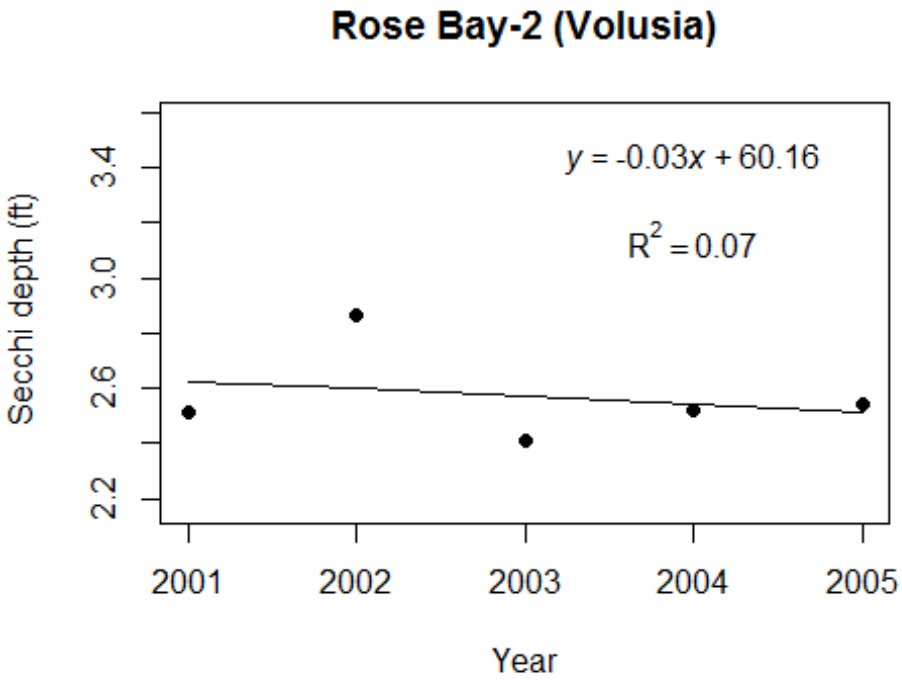
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	13314	79027	1672	60
Slope (b)	-6.60	-39.17	-0.83	-0.03
Coefficient of Determination (R^2)	0.52	0.43	0.14	0.07
Probability of Significance (p)	0.17	0.23	0.54	0.67
Potential Trend	No Trend	No Trend	No Trend	No 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 Rose Bay-2 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Rose Bay-2 (Volusia)
y = -6.6x + 13314.39
R2 = 0.52
Total Phosphorus (µg/L)
70
90
110
130
2001
2002
2003
2004
2005
Year


Rose Bay-2 (Volusia)
y = -39.17x + 79026.69
R2 = 0.43
Total Nitrogen (µg/L)
400
500
600
700
800
2001
2002
2003
2004
2005
Year


Rose Bay-2 (Volusia)
y = -0.83x + 1671.87
R2 = 0.14
Total Chlorophyll (µg/L)
6
8
10
14
2001
2002
2003
2004
2005
Year


Rose Bay-2 (Volusia)
y = -0.03x + 60.16
R2 = 0.07
Secchi depth (ft)
2.2
2.6
3.0
3.4
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Rose Bay-3 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

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The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Lower Halifax River		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Rose Bay-3
Latitude	29.0995
Longitude	-80.9645
Water Body Type	Estuary
Period of Record (year)	2001 to 2005

LAKEWATCH Report for Rose Bay-3 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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):

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- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
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- **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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	91 - 109	98 (5)
Total Nitrogen (µg/L)	536 - 651	601 (5)
Chlorophyll- uncorrected (µg/L)	5.4 - 12.8	10.3 (5)
Secchi (ft)	1.9 - 2.5	2.2 (5)
Secchi (m)	0.6 - 0.8	0.7 (5)
Color (Pt-Co Units)	24 -86	51 (5)
Specific Conductance (µS/cm@25 C)	18450 - 41667	30157 (5)
Salinity (ppt)	11 - 26	19 (5)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Rose Bay-3 in Volusia County
Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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:

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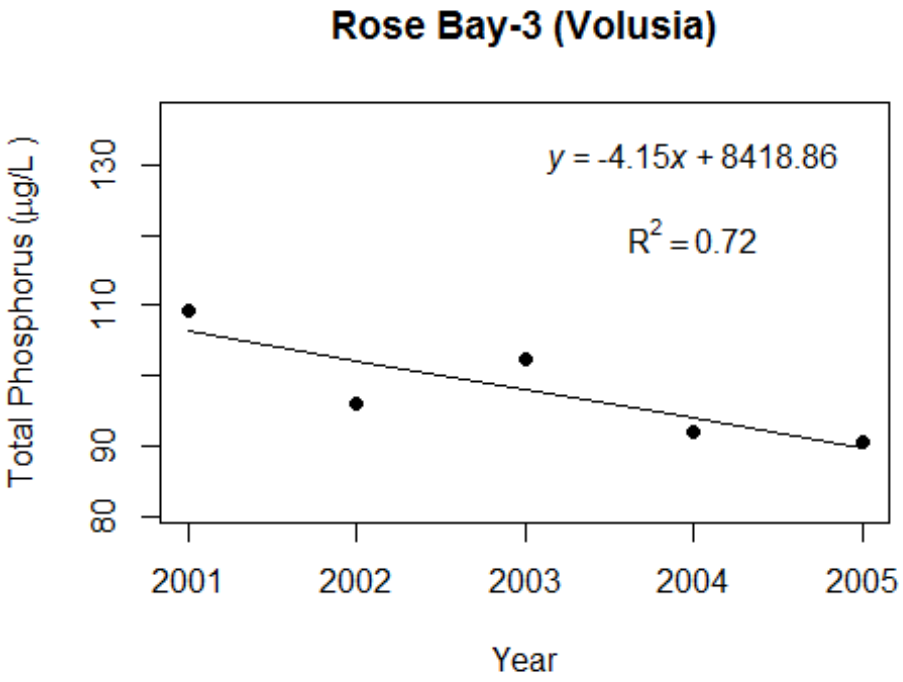
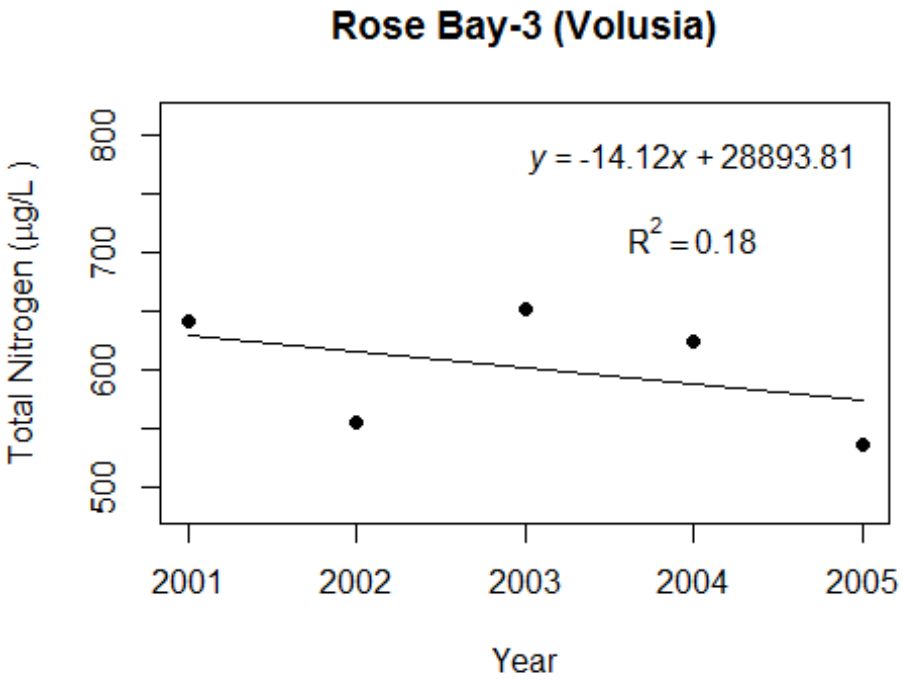
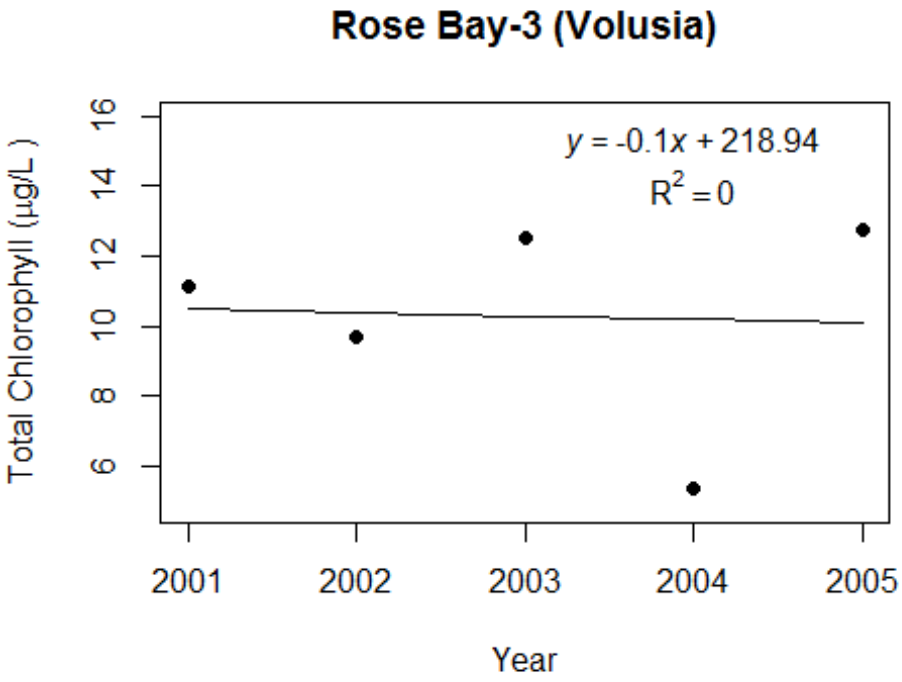
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This values ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical 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.

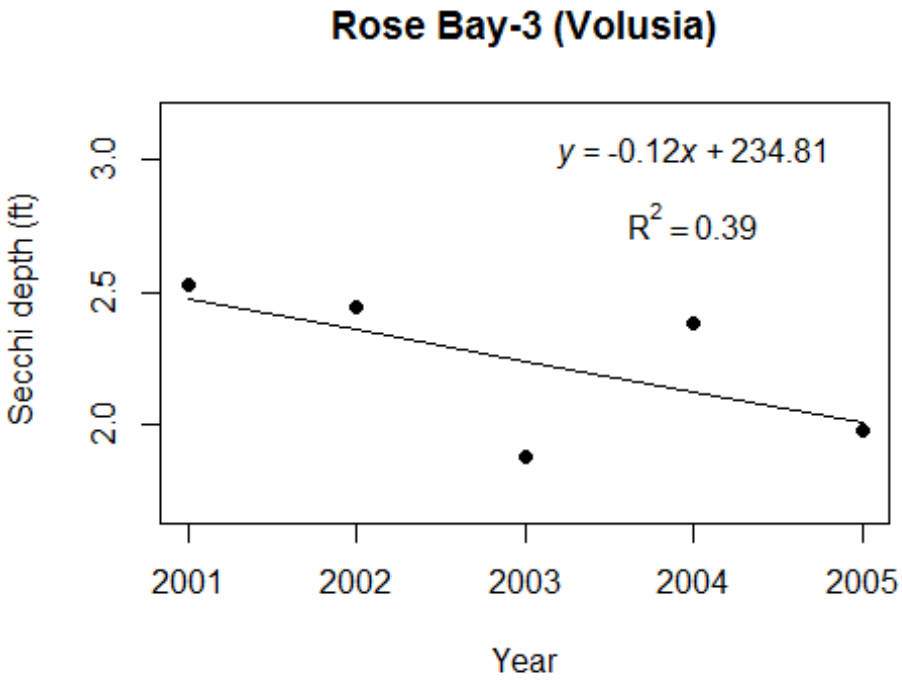
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	8419	28894	219	235
Slope (b)	-4.15	-14.13	-0.10	-0.12
Coefficient of Determination (R^2)	0.72	0.18	0.00	0.39
Probability of Significance (p)	0.07	0.47	0.93	0.26
Potential Trend	No Trend	No Trend	No Trend	No 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 Rose Bay-3 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Rose Bay-3 (Volusia)
y = -4.15x + 8418.86
R2 = 0.72
Total Phosphorus (µg/L)
80
90
110
130
2001
2002
2003
2004
2005
Year


Rose Bay-3 (Volusia)
y = -14.12x + 28893.81
R2 = 0.18
Total Nitrogen (µg/L)
500
600
700
800
2001
2002
2003
2004
2005
Year


Rose Bay-3 (Volusia)
y = -0.1x + 218.94
R2 = 0
Total Chlorophyll (µg/L)
6
8
10
12
14
16
2001
2002
2003
2004
2005
Year


Rose Bay-3 (Volusia)
y = -0.12x + 234.81
R2 = 0.39
Secchi depth (ft)
2.0
2.5
3.0
2001
2002
2003
2004
2005
Year

LAKEWATCH Report for Tomoka-1 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Tomoka Basin		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Tomoka-1
Latitude	29.3514
Longitude	-81.0919
Water Body Type	Estuary
Period of Record (year)	2000 to 2001

LAKEWATCH Report for Tomoka-1 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	72 - 92	82 (2)
Total Nitrogen (µg/L)	628 - 708	668 (2)
Chlorophyll- uncorrected (µg/L)	8.8 - 9.8	9.3 (2)
Secchi (ft)	1.5 - 1.8	1.6 (2)
Secchi (m)	0.5 - 0.5	0.5 (2)
Color (Pt-Co Units)	32 -32	32 (1)
Specific Conductance (µS/cm@25 C)	38250 - 38250	38250 (1)
Salinity (ppt)	24 - 24	24 (1)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tomoka-1 in Volusia County
Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 values 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 Tomoka-1 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Tomoka-2 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Tomoka Basin		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Tomoka-2
Latitude	29.3639
Longitude	-81.0931
Water Body Type	Estuary
Period of Record (year)	2000 to 2001

LAKEWATCH Report for Tomoka-2 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	62 - 73	68 (2)
Total Nitrogen (µg/L)	547 - 575	561 (2)
Chlorophyll- uncorrected (µg/L)	5.3 - 10.3	7.8 (2)
Secchi (ft)	1.9 - 2.0	2.0 (2)
Secchi (m)	0.6 - 0.6	0.6 (2)
Color (Pt-Co Units)	22 -22	22 (1)
Specific Conductance (µS/cm@25 C)	42250 - 42250	42250 (1)
Salinity (ppt)	26 - 26	26 (1)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tomoka-2 in Volusia County
Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 values 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 Tomoka-2 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Tomoka-3 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Tomoka Basin		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Tomoka-3
Latitude	29.3739
Longitude	-81.0906
Water Body Type	Estuary
Period of Record (year)	2000 to 2001

LAKEWATCH Report for Tomoka-3 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	51 - 58	54 (2)
Total Nitrogen (µg/L)	430 - 443	436 (2)
Chlorophyll- uncorrected (µg/L)	4.3 - 7.3	5.8 (2)
Secchi (ft)	2.0 - 3.0	2.5 (2)
Secchi (m)	0.6 - 0.9	0.8 (2)
Color (Pt-Co Units)	21 -21	21 (1)
Specific Conductance (µS/cm@25 C)	43500 - 43500	43500 (1)
Salinity (ppt)	27 - 27	27 (1)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tomoka-3 in Volusia County
Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 values 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 Tomoka-3 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Tomoka-4 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Tomoka Basin		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Tomoka-4
Latitude	29.3742
Longitude	-81.0869
Water Body Type	Estuary
Period of Record (year)	2000 to 2001

LAKEWATCH Report for Tomoka-4 in Volusia County
Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	59 - 60	60 (2)
Total Nitrogen (µg/L)	457 - 483	470 (2)
Chlorophyll- uncorrected (µg/L)	8.0 - 8.0	8.0 (2)
Secchi (ft)	2.0 - 2.8	2.4 (2)
Secchi (m)	0.6 - 0.9	0.7 (2)
Color (Pt-Co Units)	16 -16	16 (1)
Specific Conductance (µS/cm@25 C)	46500 - 46500	46500 (1)
Salinity (ppt)	29 - 29	29 (1)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tomoka-4 in Volusia County
Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 values 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 Tomoka-4 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Tomoka-5 in Volusia County
Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: https://www.flrules.org/Gateway/reference.asp?No=Ref-05420.
The individual nutrient criteria can be found at:
https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532
Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Halifax and Tomaka River Esturies	Tomoka Basin		

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 estuary resides.
- **Name**: Estuary 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.
- **Period of Record (year)**: Years an estuary has been in the LAKEWATCH program.

County	Volusia
Name	Tomoka-5
Latitude	29.3672
Longitude	-81.0825
Water Body Type	Estuary
Period of Record (year)	2000 to 2001

LAKEWATCH Report for Tomoka-5 in Volusia County
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Long-Term Data Summary Estuary: 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), Salinity (ppt)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	61 - 65	63 (2)
Total Nitrogen (µg/L)	453 - 478	465 (2)
Chlorophyll- uncorrected (µg/L)	8.3 - 9.3	8.8 (2)
Secchi (ft)	2.3 - 3.1	2.7 (2)
Secchi (m)	0.7 - 1.0	0.8 (2)
Color (Pt-Co Units)	16 -16	16 (1)
Specific Conductance (µS/cm@25 C)	46250 - 46250	46250 (1)
Salinity (ppt)	29 - 29	29 (1)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 – 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tomoka-5 in Volusia County
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Trend Analyses Estuary

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 values 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 Tomoka-5 in Volusia County. If there are no plots then there is less than five years of data, which is not enough for the analysis.