

# St. Andrews State Park Aquatic Preserve

## SEACAR Habitat Analyses

Last compiled on 08 April, 2024

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## Threshold Filtering

Threshold filters, following the guidance of Florida Department of Environmental Protection's (*FDEP*) Division of Environmental Assessment and Restoration (*DEAR*) are used to exclude specific results values from the SEACAR Analysis. Based on the threshold filters, Quality Assurance / Quality Control (*QAQC*) Flags are inserted into the *SEACAR\_QAQCFlagCode* and *SEACAR\_QAQC\_Description* columns of the export data. The *Include* column indicates whether the *QAQC* Flag will also indicate that data are excluded from analysis. No data are excluded from the data export, but the analysis scripts can use the *Include* column to exclude data (1 to include, 0 to exclude).

Table 1: Continuous Water Quality threshold values

Parameter Name	Units	Low Threshold	High Threshold	Sensor Type
Dissolved Oxygen	mg/L	0	50	YSI EXOs
Dissolved Oxygen	mg/L	0	50	Analysis Only - 2022-04-04
Dissolved Oxygen	mg/L	0	50	6600 Series
Salinity	ppt	0	70	6600 Series
Salinity	ppt	0	70	YSI EXOs
Salinity	ppt	0	70	Analysis Only - 2022-04-04
Water Temperature	Degrees C	-5	45	YSI EXOs
Water Temperature	Degrees C	-5	45	Analysis Only - 2022-04-04
Water Temperature	Degrees C	-5	45	6600 Series
pH	pH	2	14	Analysis Only - 2022-04-04
pH	pH	2	14	6600 Series
pH	pH	2	14	YSI EXOs
Dissolved Oxygen Saturation	%	0	500	YSI EXOs
Dissolved Oxygen Saturation	%	0	500	6600 Series
Dissolved Oxygen Saturation	%	0	500	Analysis Only - 2022-04-04
Specific Conductivity	mS/cm	0	100	6600 Series
Specific Conductivity	mS/cm	0	200	YSI EXOs
Turbidity	NTU	0	4000	YSI EXOs
Turbidity	NTU	0	1000	6600 Series
Turbidity	NTU	0	4000	Analysis Only - 2022-04-04

Table 2: Discrete Water Quality threshold values

Parameter Name	Units	Low Threshold	High Threshold
Dissolved Oxygen	mg/L	0.000001	22
Salinity	ppt	0	70
Water Temperature	Degrees C	3	40
pH		2	13
Dissolved Oxygen Saturation	%	0.000001	310
Specific Conductivity	mS/cm	0.005000001	100
Turbidity	NTU	0	-
Total Suspended Solids (TSS)	mg/L	0	-
Chlorophyll a uncorrected for pheophytin	ug/L	0	-
Chlorophyll a corrected for pheophytin	ug/L	0	-
Secchi Depth	m	0.000001	50
Light Extinction Coefficient	m^1	0	-
Colored dissolved organic matter, CDOM	PCU	0	-
Fluorescent dissolved organic matter, FDOM	QSE	0	-
Total Nitrogen	mg/L	0	-
Total Kjeldahl Nitrogen TKN	mg/L	0	-
NO2+3 Filtered	mg/L	0	-
NH4 Filtered	mg/L	0	-
Total Phosphorus	mg/L	0	-

Parameter Name	Units	Low Threshold	High Threshold
PO4 Filtered	mg/L	0	-
Ammonia- Un-ionized (NH3)	mg/L	0	-
Nitrate (N)	mg/L	0	-
Nitrite (N)	mg/L	0	-
Nitrogen, organic	mg/L	0	-

Table 3: Quality Assurance Flags inserted based on threshold checks listed in Table 1 & 2

SEACAR QAQC Description	Include	SEACAR QAQCFlagCode
Exceeds Maximum threshold. Not verified in raw data	No	2Q
Exceeds Maximum threshold. Verified in raw data	No	3Q
Below Minimum threshold. Not verified in raw data	No	4Q
Below Minimum threshold. Verified in raw data	No	5Q
Within threshold tolerance	Yes	6Q
No defined thresholds for this parameter	Yes	7Q

## Value Qualifiers

Value qualifier codes included within the data are used to exclude certain results from the analysis. The data are retained in the data export files, but the analysis uses the *Include* column to filter the results.

### STORET and WIN value qualifier codes

Value qualifier codes from *STORET* and *WIN* data are examined with the database and used to populate the *Include* column in data exports.

Table 4: Value Qualifier codes excluded from analysis

Qualifier Source	Value Qualifier	Include	MDL	Description
STORET-WIN	H	No	0	Value based on field kit determination; results may not be accurate
STORET-WIN	J	No	0	Estimated value
STORET-WIN	V	No	0	Analyte was detected at or above method detection limit
STORET-WIN	Y	No	0	Lab analysis from an improperly preserved sample; data may be inaccurate

### Discrete Water Quality Value Qualifiers

The following value qualifiers are highlighted in the Discrete Water Quality section of this report. An exception is made for **Program 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network** and data flagged with Value Qualifier **H** are included for this program only.

**H** - Value based on field kit determination; results may not be accurate. This code shall be used if a field screening test (e.g., field gas chromatograph data, immunoassay, or vendor-supplied field kit) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.

**I** - The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.

**Q** - Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

**S** - Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.

**U** - Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported.

### Systemwide Monitoring Program (SWMP) value qualifier codes

Value qualifier codes from the *SWMP* continuous program are examined with the database and used to populate the *Include* column in data exports. *SWMP* Qualifier Codes are indicated by *QualifierSource=SWMP*.

Table 5: SWMP Value Qualifier codes

<i>Qualifier Source</i>	<i>Value Qualifier</i>	<i>Include</i>	<i>Description</i>
SWMP	-1	Yes	Optional parameter not collected
SWMP	-2	No	Missing data
SWMP	-3	No	Data rejected due to QA/QC
SWMP	-4	No	Outside low sensor range
SWMP	-5	No	Outside high sensor range
SWMP	0	Yes	Passed initial QA/QC checks
SWMP	1	No	Suspect data
SWMP	2	Yes	Reserved for future use
SWMP	3	Yes	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	Yes	Historical: Pre-auto QA/QC
SWMP	5	Yes	Corrected data

## Water Column

The water column habitat extends from the surface of all water bodies to the bottom sediments and encompasses the different features found in the water at different depths (National Oceanographic Center, 2016). The water column habitat must be viewed in relation to its interconnectedness with other habitats. A healthy water column is an integral component in ensuring a healthy marine and coastal ecosystem. Having a flourishing marine and coastal ecosystem in Florida is necessary to support a strong economy. The health of the water column is dependent upon factors as diverse as land use (e.g., agriculture, mining, forestry practices); human population growth; emissions, (e.g., power plants, automobiles, wastewater); climate (e.g., rainfall, temperature, winds and currents); and decadal trends (e.g., El Niño/La Niña, Atlantic Multidecadal Oscillation, climate change).

The water column is composed of various physical, chemical and biological features, and only a small number of them are adequately monitored. Features of the water column that are monitored are used as indicators of the water column health and help assess the status of other habitats. These indicators include nutrient concentrations (nitrogen and phosphorus); water quality (dissolved oxygen, temperature, salinity and pH); water clarity (Secchi depth, turbidity, chlorophyll-a and colored dissolved organic matter); and nekton (fish, macroinvertebrates and megafauna).

## Seasonal Kendall-Tau Analysis

Indicators must have a minimum of five to ten years, depending on the habitat, of data within the geographic range of the analysis to be included in the analysis. Ten years of data are required for discrete parameters, and five years of data are required for continuous parameters. If there are insufficient years of data, the number of years of data available will be noted and labeled as “insufficient data to conduct analysis”. Further, for the preferred Seasonal Kendall-Tau test, there must be data from at least two months in common across at least two consecutive years within the RCP managed area being analyzed. Values that pass both of these tests will be included in the analysis and be labeled as *Use\_In\_Analysis* = **TRUE**. Any that fail either test will be excluded from the analyses and labeled as *Use\_In\_Analysis* = **FALSE**.

## Water Quality - Discrete

The following files were used in the discrete analysis:

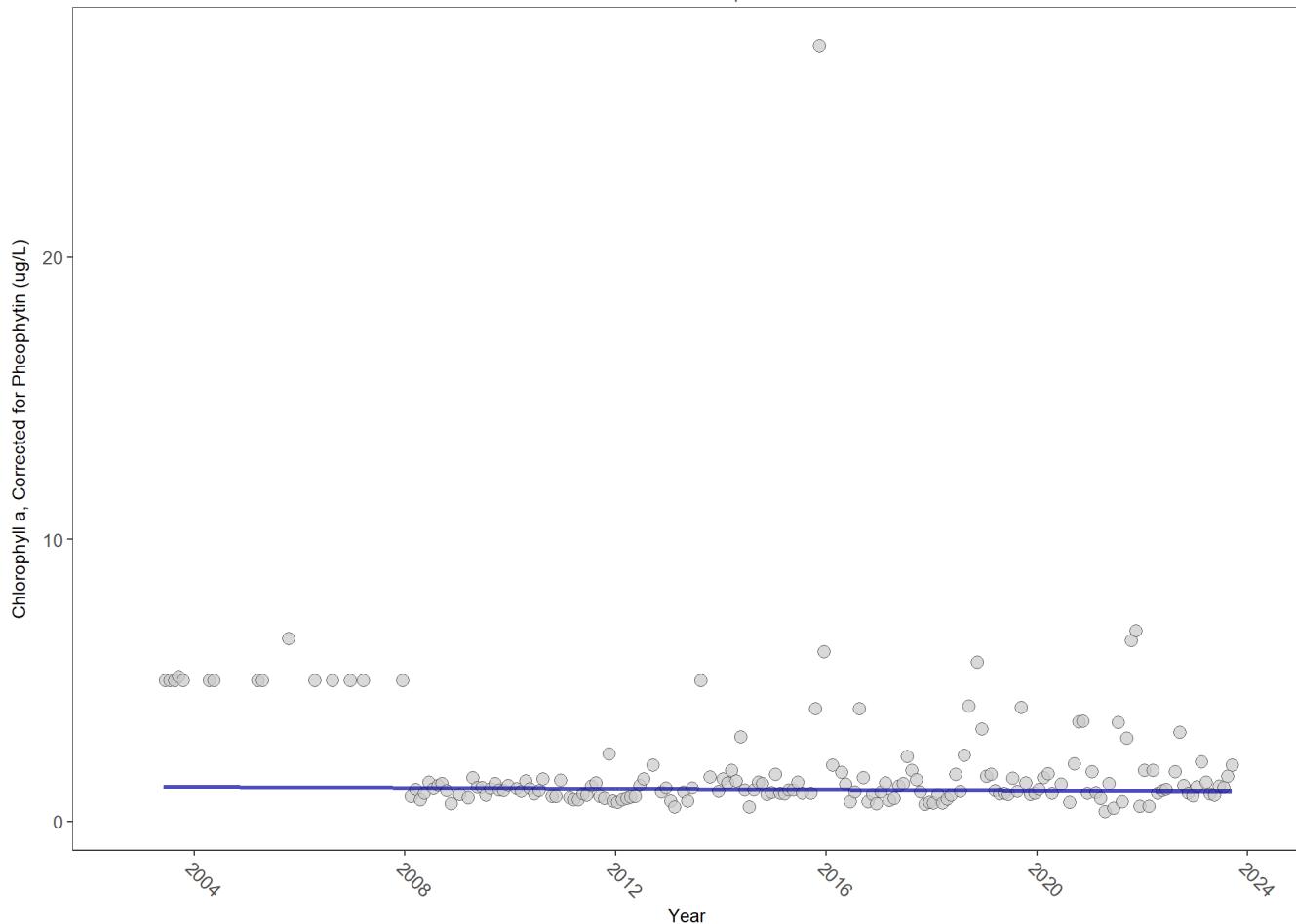
- *Combined\_WQ\_WC\_NUT\_Chlorophyll\_a\_corrected\_for\_pheophytin-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Chlorophyll\_a\_uncorrected\_for\_pheophytin-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Colored\_dissolved\_organic\_matter\_CDOM-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Dissolved\_Oxygen-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Dissolved\_Oxygen\_Saturation-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_pH-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Salinity-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Secchi\_Depth-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Nitrogen-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Phosphorus-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Suspended\_Solids\_TSS-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Turbidity-2024-Mar-27.txt*
- *Combined\_WQ\_WC\_NUT\_Water\_Temperature-2024-Mar-27.txt*

## Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality

Chlorophyll-a is monitored as a measure of microalgae growing in the water. Algae are a natural part of coastal and aquatic ecosystems but in excess can cause poor water quality and clarity, and decreased levels of dissolved oxygen.

### Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Corrected for Pheophytin, Lab, All Depths  
St. Andrews State Park Aquatic Preserve

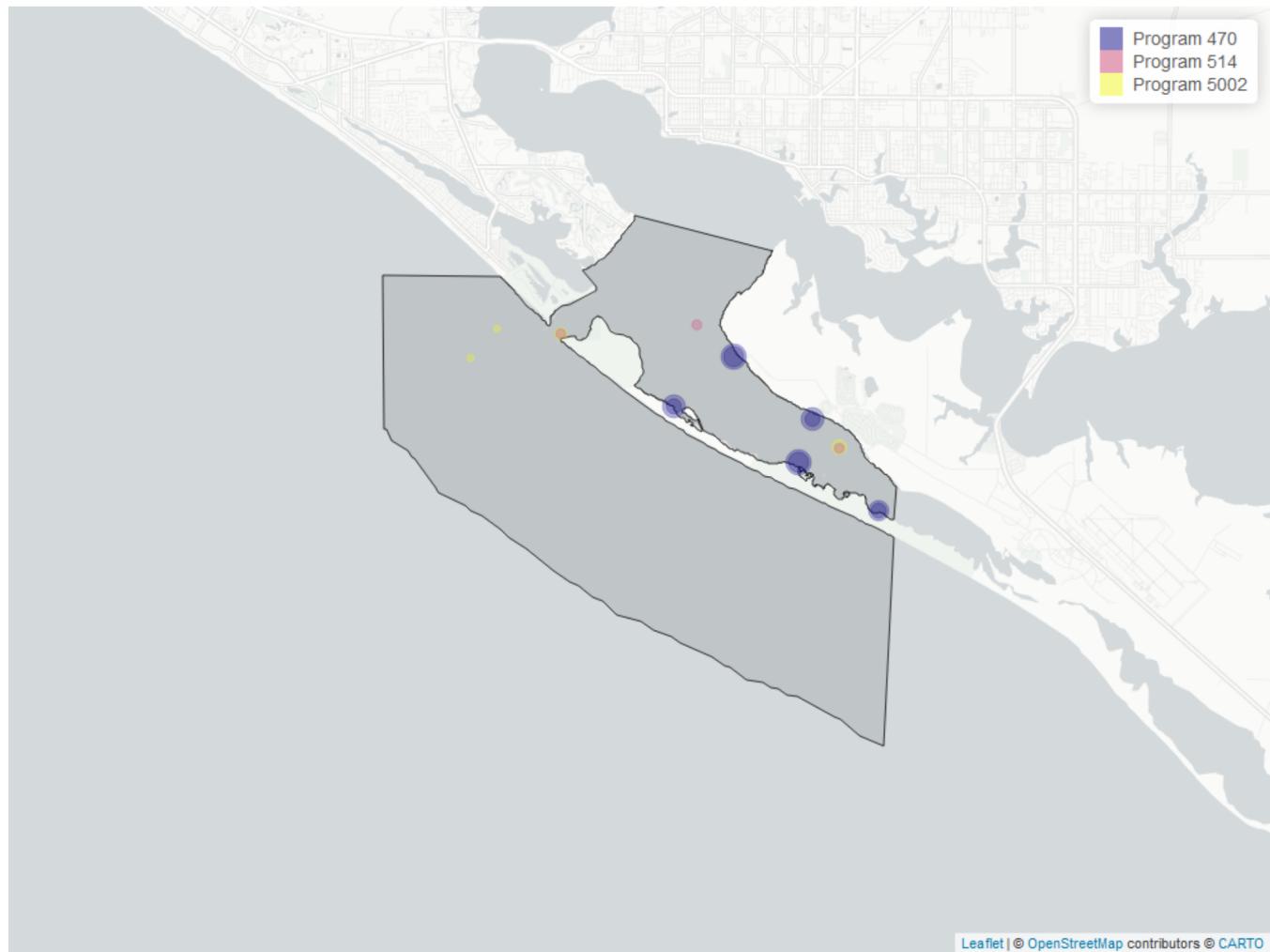


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	801	21	1.1	TRUE	-0.0388	0.2505	-0.0078	1.237763	25.4416	0.0079	0

$p < 0.00005$  appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 6: Programs contributing data for Chlorophyll a, Corrected for Pheophytin

ProgramID	N_Data	YearMin	YearMax
470	663	2003	2023
5002	84	2010	2016
514	54	2020	2023

**Program names:**

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

**Value Qualifiers**

- $N_{Total}$  is total amount of data for a given year
- $N_{}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 7: Value Qualifiers for Chlorophyll a, Corrected for Pheophytin

Year	$N_{Total}$	$N_I$	$perc_I$	$N_Q$	$perc_Q$	$N_U$	$perc_U$
2003	25					24	96.0
2004	10					10	100.0
2005	12					11	91.7
2006	13					13	100.0
2007	10					10	100.0
2008	39	35	89.7	2	5.1	4	10.3
2009	45	42	93.3			3	6.7
2010	41	36	87.8			4	9.8
2011	56	46	82.1			8	14.3
2012	47	35	74.5			8	17.0
2013	41	26	63.4			7	17.1
2014	59	35	59.3			2	3.4
2015	41	21	51.2			2	4.9
2016	46	34	73.9			5	10.9
2017	59	43	72.9			6	10.2
2018	55	32	58.2			4	7.3
2019	60	35	58.3			18	30.0
2020	44	21	47.7	2	4.6	15	34.1
2021	42	29	69.0	6	14.3	6	14.3
2022	35	20	57.1			11	31.4
2023	21	10	47.6			11	52.4

**Note:** <sup>1</sup>I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>Q  
 - Sample held beyond the accepted holding time <sup>3</sup>U - Compound was analyzed for but not detected

#### Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

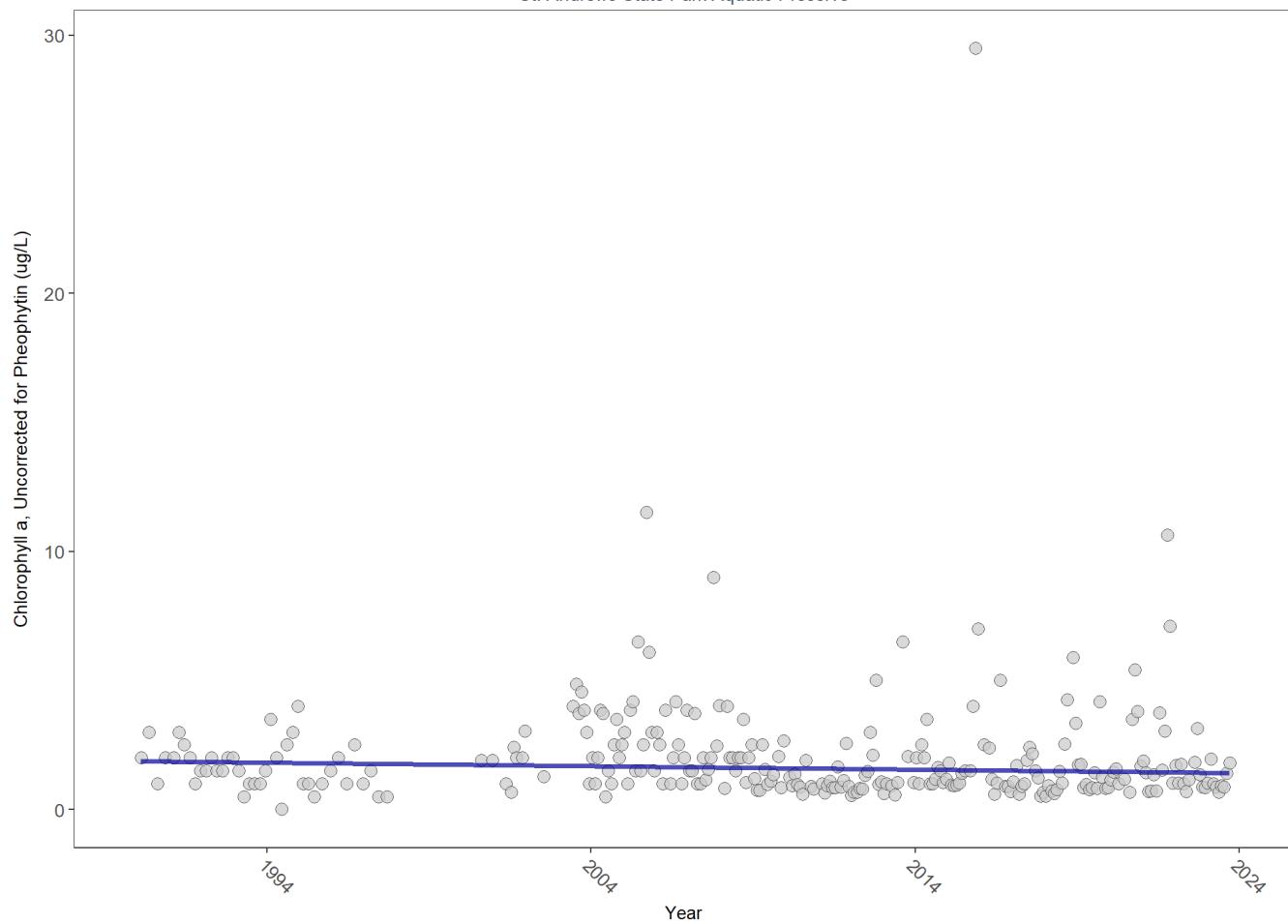
514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

# Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

## Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths  
St. Andrews State Park Aquatic Preserve

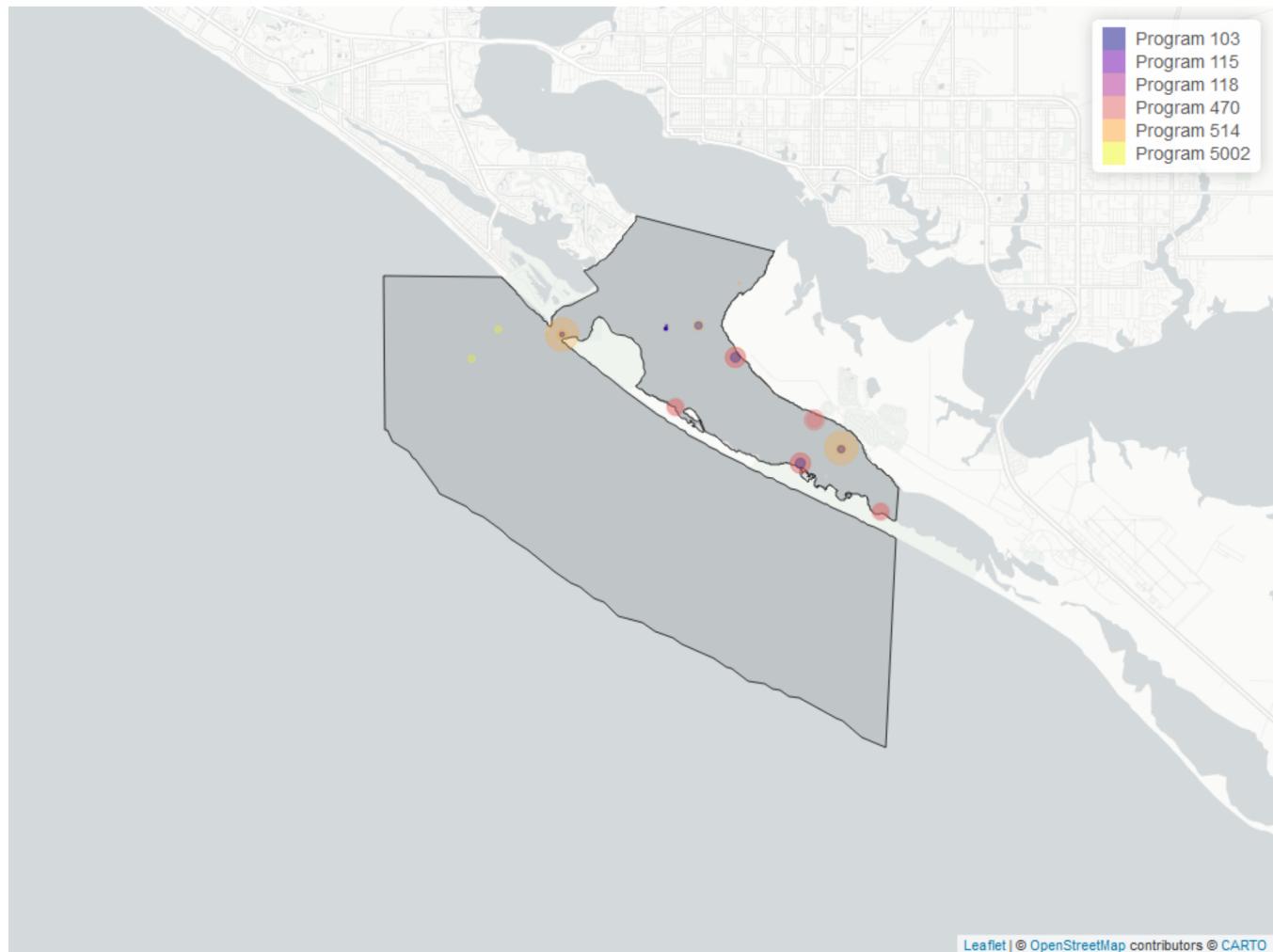


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1025	32	1.1	TRUE	-0.1287	0.0048	-0.01316523	1.876978	13.1213	0.2855	-1

$p < 0.00005$  appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 8: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

ProgramID	N_Data	YearMin	YearMax
470	521	2003	2023
514	414	1990	2023
103	62	2000	2021
5002	22	2010	2012
115	4	2000	2003
118	2	2000	2001

#### Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

514 - Florida LAKEWATCH Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

5002 - Florida STORET / WIN

115 - Environmental Monitoring Assessment Program

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment

### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year
- $N_{}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 9: Value Qualifiers for Chlorophyll a, Uncorrected for Pheophytin

Year	$N_{Total}$	$N_I$	$perc_I$	$N_Q$	$perc_Q$	$N_U$	$perc_U$
2003	41					24	58.5
2004	34					10	29.4
2005	36					11	30.6
2006	34					13	38.2
2007	34					10	29.4
2008	24			2	8.3		
2009	45	24	53.3			1	2.2
2010	34	20	58.8			2	5.9
2011	61	39	63.9			6	9.8
2012	52	30	57.7			6	11.5
2013	31	15	48.4			5	16.1
2014	39	14	35.9				
2015	32	12	37.5				
2016	38	25	65.8			1	2.6
2017	60	28	46.7			6	10.0
2018	64	26	40.6			3	4.7
2019	70	32	45.7			13	18.6
2020	48	18	37.5	2	4.2	12	25.0
2021	95	13	13.7	6	6.3	12	12.6
2022	35	14	40.0			13	37.1
2023	21	9	42.9			11	52.4

**Note:** <sup>1</sup>I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>Q  
- Sample held beyond the accepted holding time <sup>3</sup>U - Compound was analyzed for but not detected

### Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

514 - Florida LAKEWATCH Program

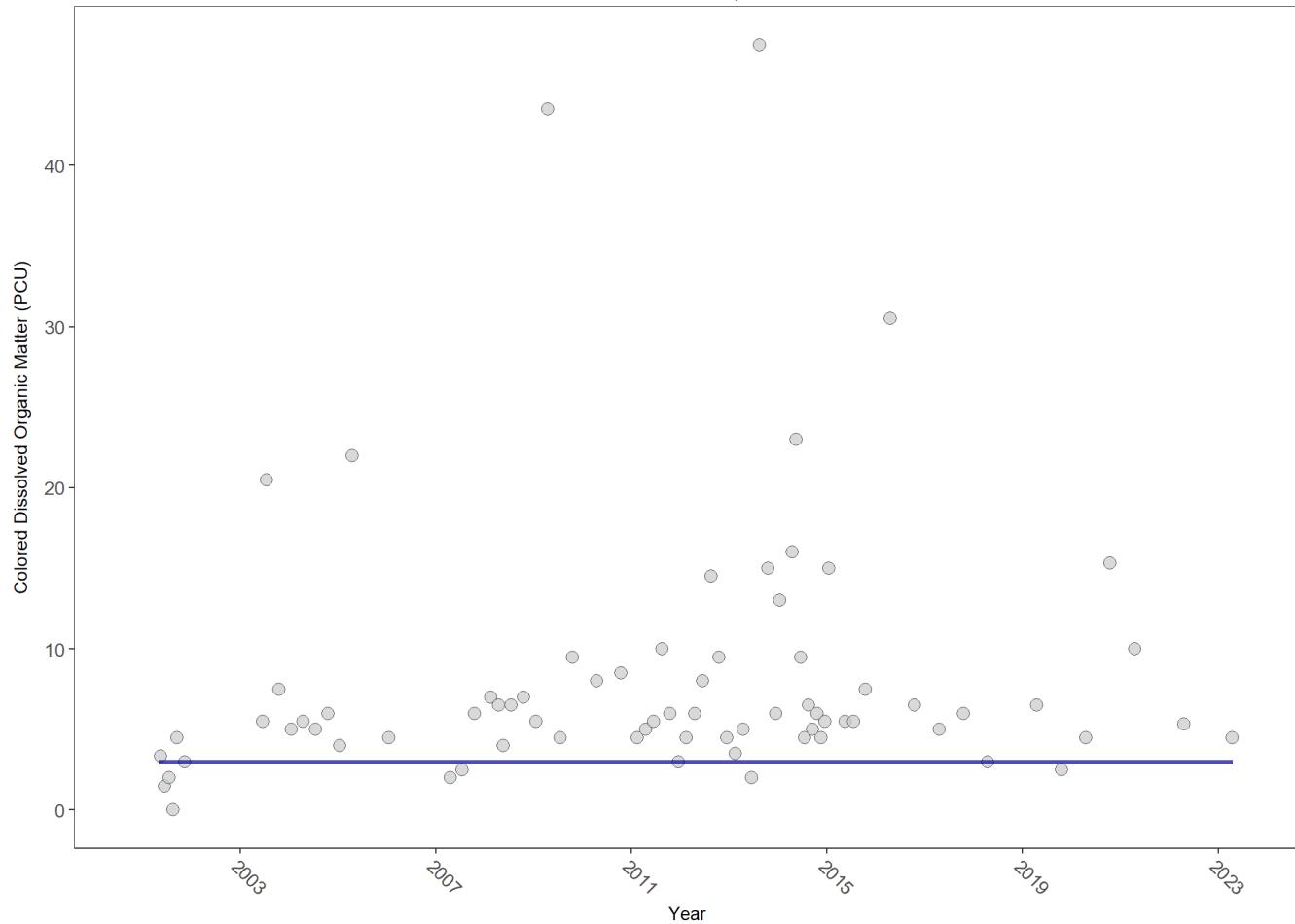
5002 - Florida STORET / WIN

### Colored Dissolved Organic Matter - Discrete Water Quality

**Colored Dissolved Organic Matter (CDOM)** occurs naturally in every water body. It is made up of mainly plant material, algae and bacteria. The composition is determined by its source; plants, soil, algae, and wastewater are common sources.

### Seasonal Kendall-Tau Trend Analysis

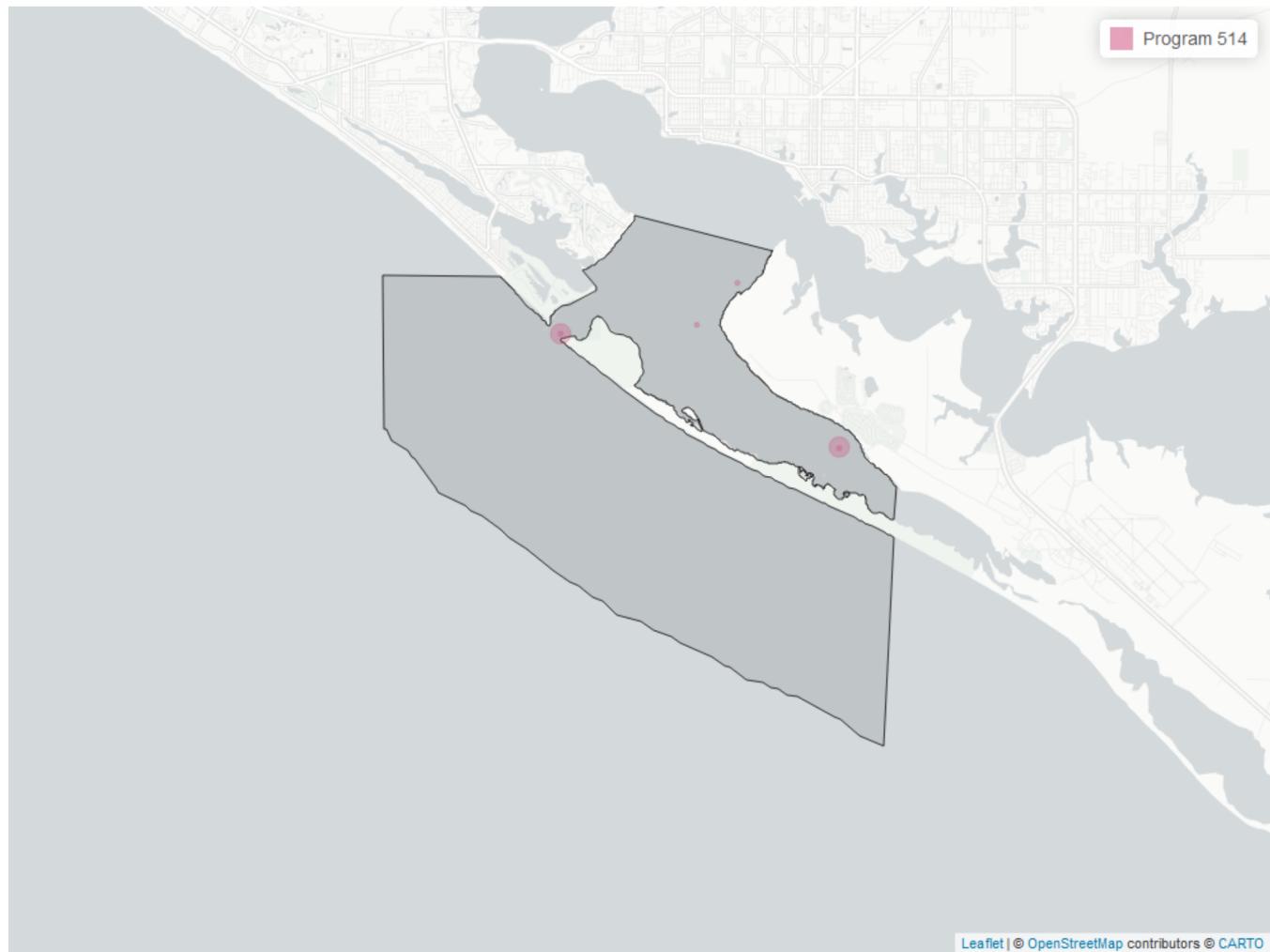
Colored Dissolved Organic Matter, Lab, All Depths  
St. Andrews State Park Aquatic Preserve



*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Colored Dissolved Organic Matter



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 10: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	N_Data	YearMin	YearMax
514	148	2001	2023

#### Program names:

514 - Florida LAKEWATCH Program

#### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year
- $N_{\cdot}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{\cdot}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 11: Value Qualifiers for Colored Dissolved Organic Matter

<i>Year</i>	<i>N_Total</i>	<i>N_Q</i>	<i>perc_Q</i>	<i>N_U</i>	<i>perc_U</i>
2020	5	5	100		
2021	3	3	100		
2022	3	3	100	1	33.3
2023	2	2	100		

**Note:** <sup>1</sup>**Q** - Sample held beyond the accepted holding time <sup>2</sup>**U** - Compound was analyzed for but not detected

**Programs containing Value Qualified data:**

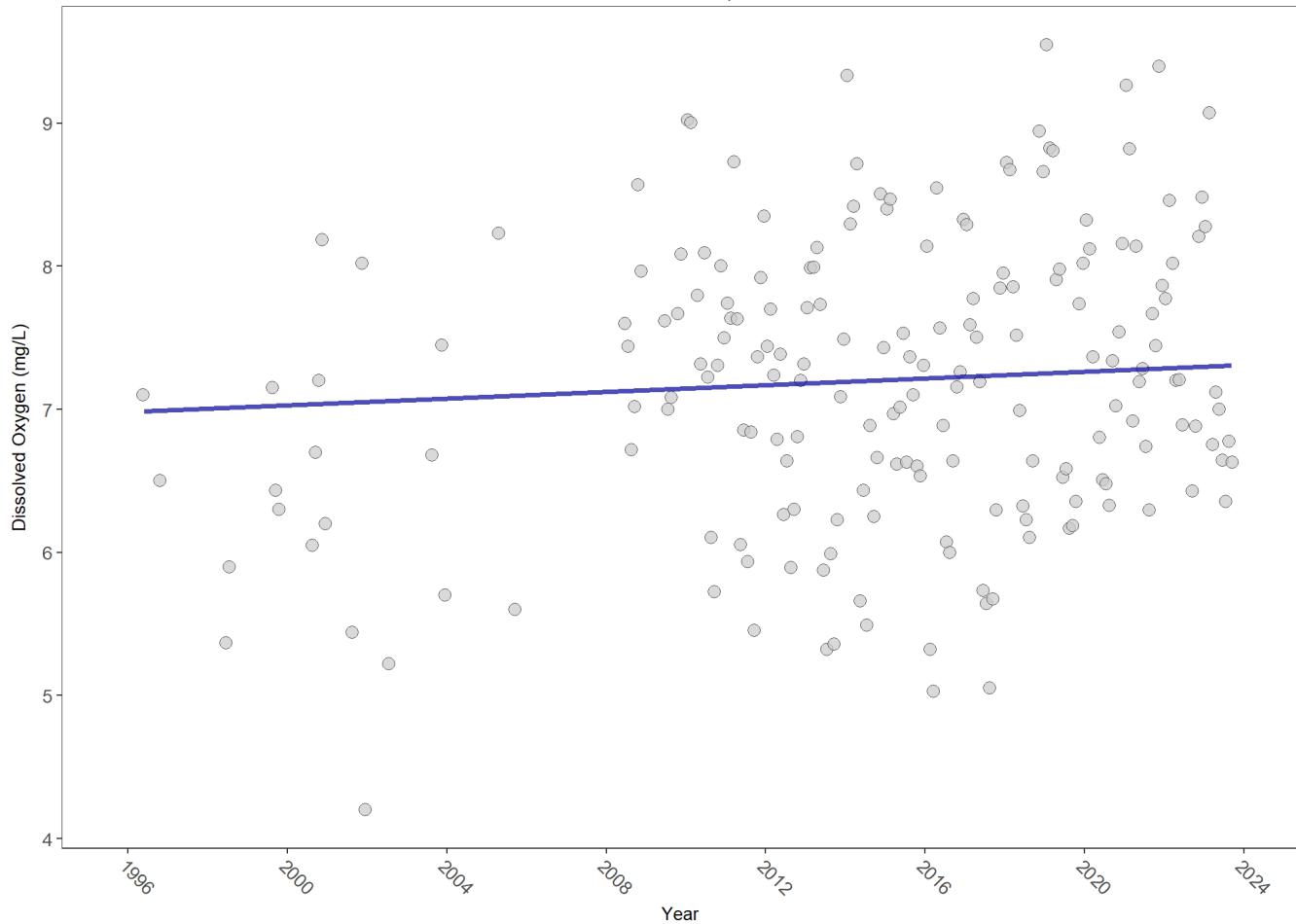
514 - Florida LAKEWATCH Program

### Dissolved Oxygen - Discrete Water Quality

**Dissolved Oxygen (DO)** is a key indicator of water quality. Oxygen enters surface waters by air-sea gas exchange, by wind action, or as a byproduct of aquatic plant photosynthesis. The actual quantity of DO in aquatic environments is dependent on the above processes as well as water temperature and salinity.

#### Seasonal Kendall-Tau Trend Analysis

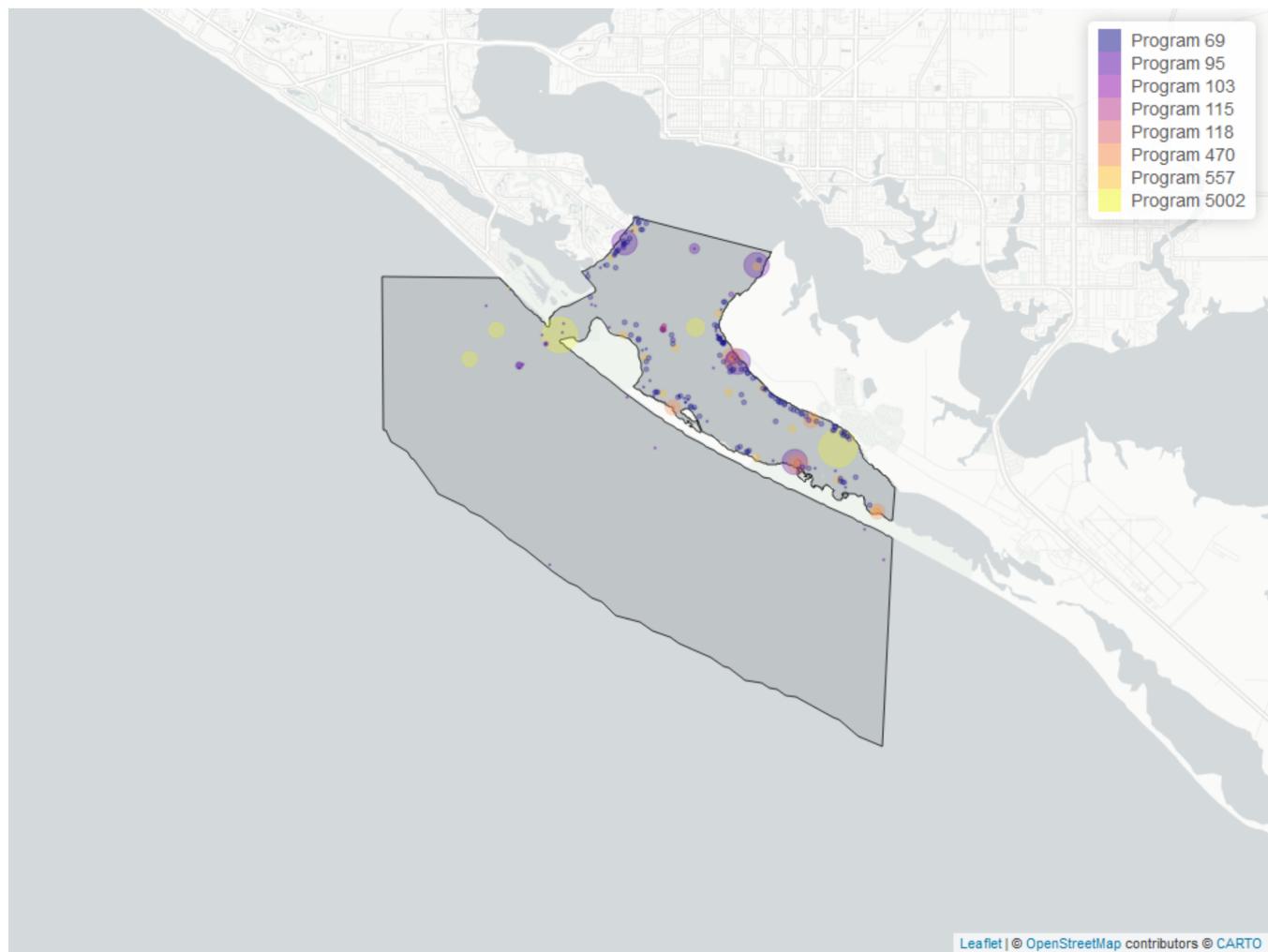
Dissolved Oxygen, Field, All Depths  
St. Andrews State Park Aquatic Preserve



*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Dissolved Oxygen



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 12: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
5002	540	2005	2023
95	498	1996	2018
69	432	2001	2017
470	265	2011	2023
557	147	2016	2021
103	21	2003	2021
115	16	2000	2003
118	2	2000	2001

**Program names:**

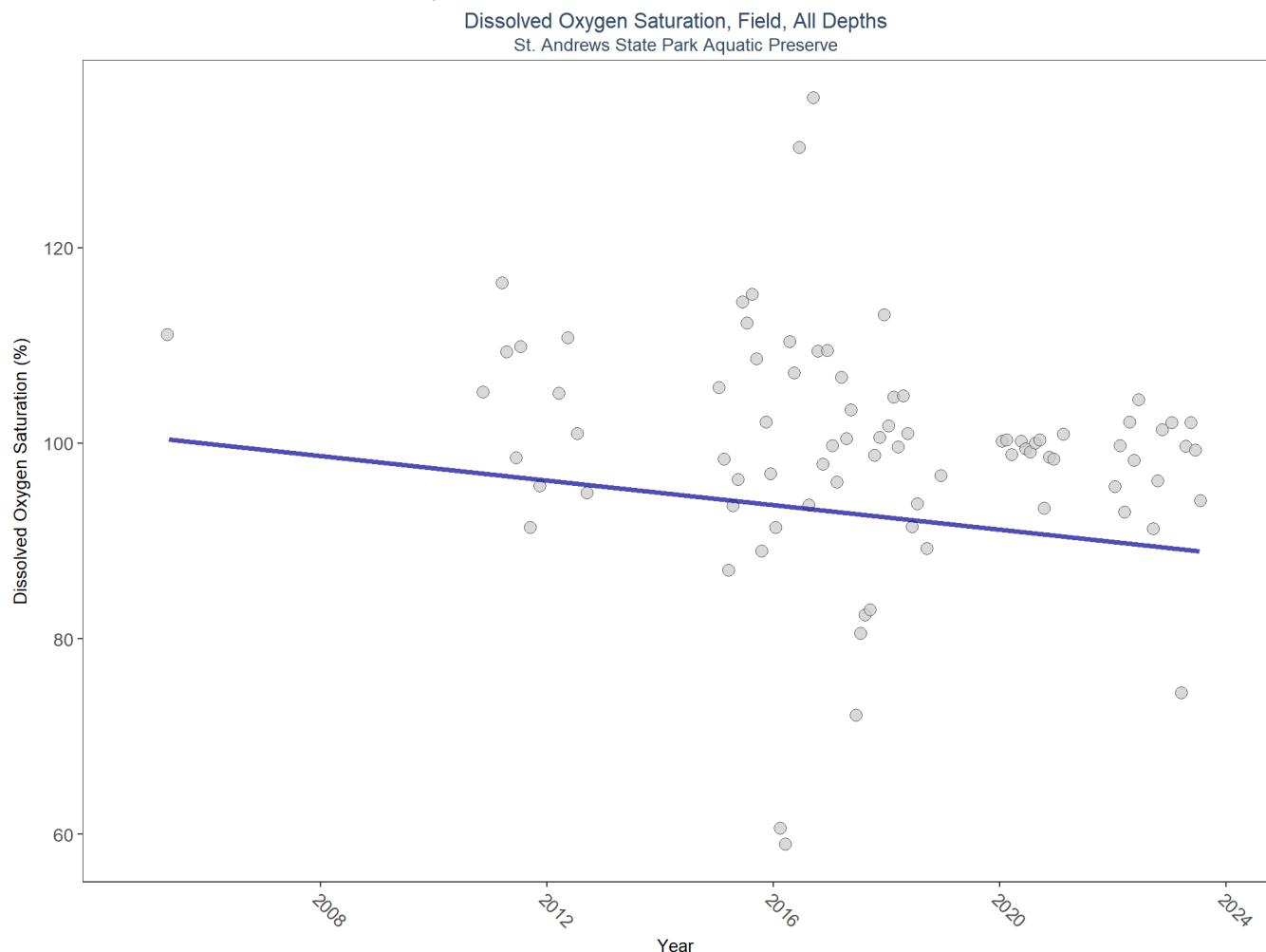
5002 - Florida STORET / WIN

- 95 - Harmful Algal Bloom Marine Observation Network  
 69 - Fisheries-Independent Monitoring (FIM) Program  
 470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
 557 - Central Panhandle Aquatic Preserves Seagrass Monitoring  
 103 - EPA STOrage and RETrieval Data Warehouse (STORET)  
 115 - Environmental Monitoring Assessment Program  
 118 - National Aquatic Resource Surveys, National Coastal Condition Assessment

There are no qualifying Value Qualifiers for Dissolved Oxygen in St. Andrews State Park Aquatic Preserve

## Dissolved Oxygen Saturation - Discrete Water Quality

### Seasonal Kendall-Tau Trend Analysis

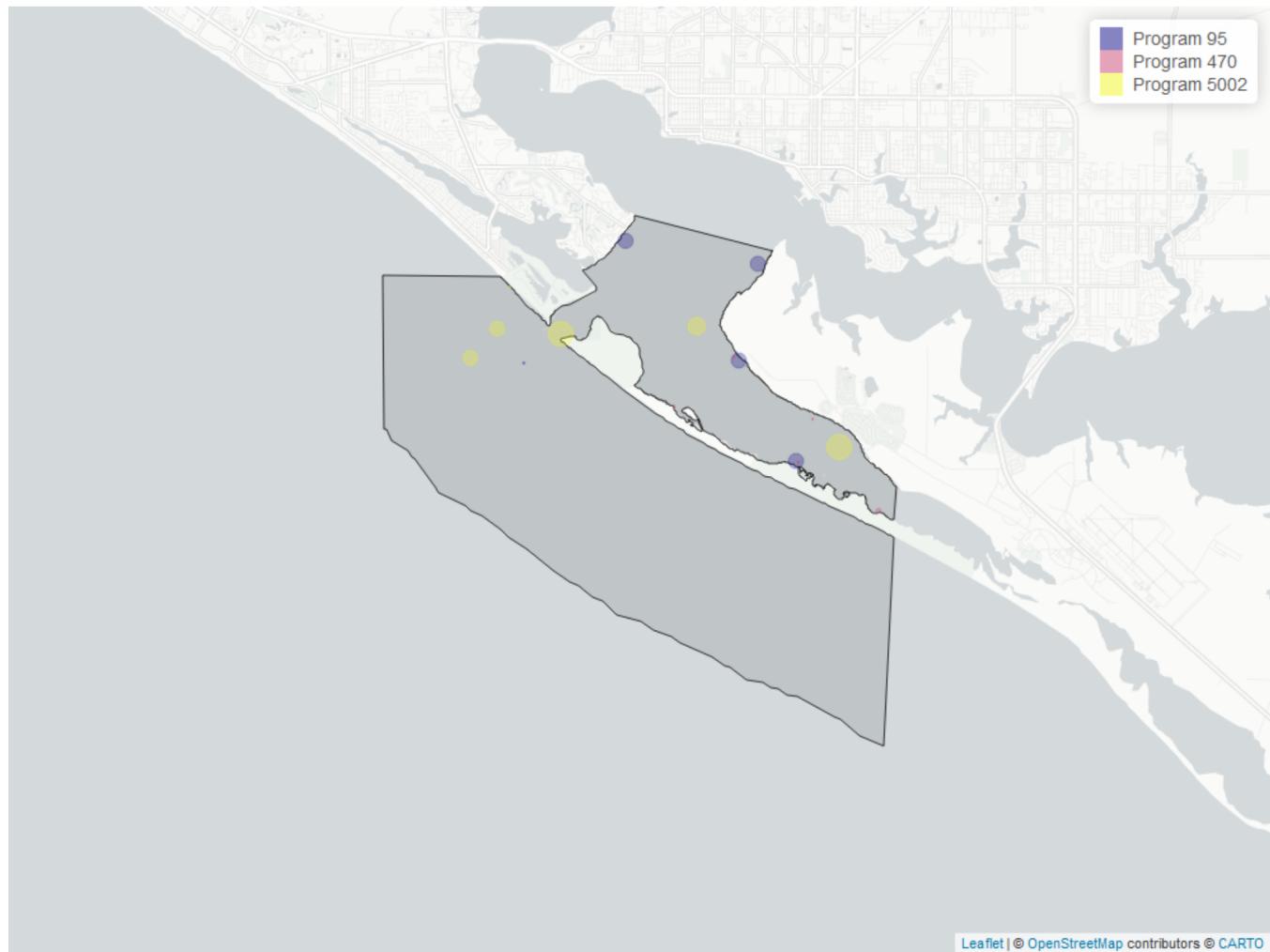


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	477	12	99.9	TRUE	-0.1469	0.0867	-0.6289562	100.5865	6.9401	0.8039	0

*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Dissolved Oxygen Saturation



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 13: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	N_Data	YearMin	YearMax
5002	314	2005	2023
95	161	2015	2018
470	13	2011	2023

#### Program names:

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

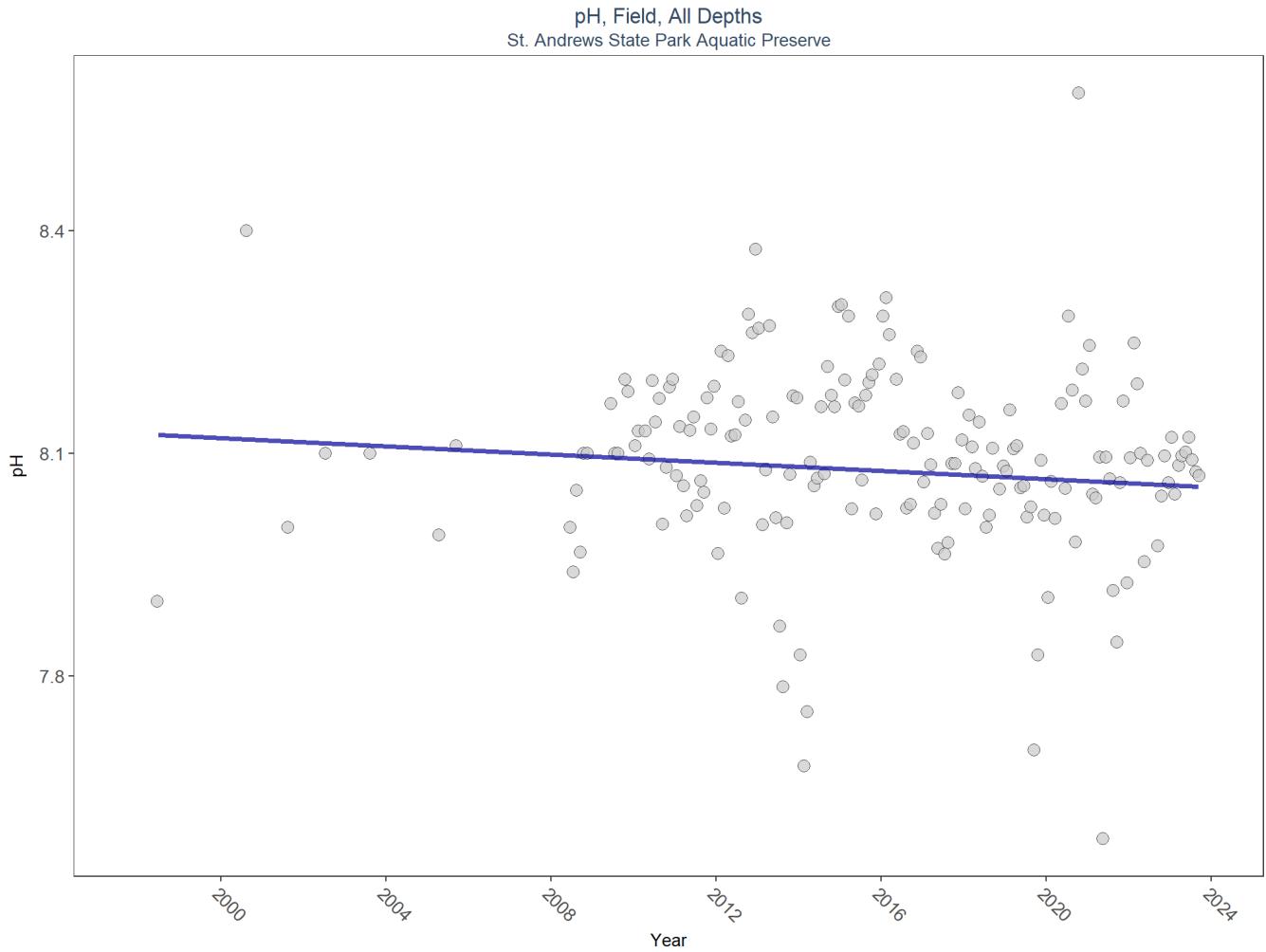
470 - St. Andrews Aquatic Preserve Water Quality Monitoring

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in St. Andrews State Park Aquatic Preserve

## pH - Discrete Water Quality

The **pH** of water is the measure of how acidic or basic the water body is on a scale of 0-14, with lower readings indicating acidic and higher readings indicating basic, and a pH of 7 being neutral. Florida's natural waters fall between 6.5 and 8.5 on this scale. A water body's pH can change due to precipitation, geology, vegetation, water pollution and air pollution.

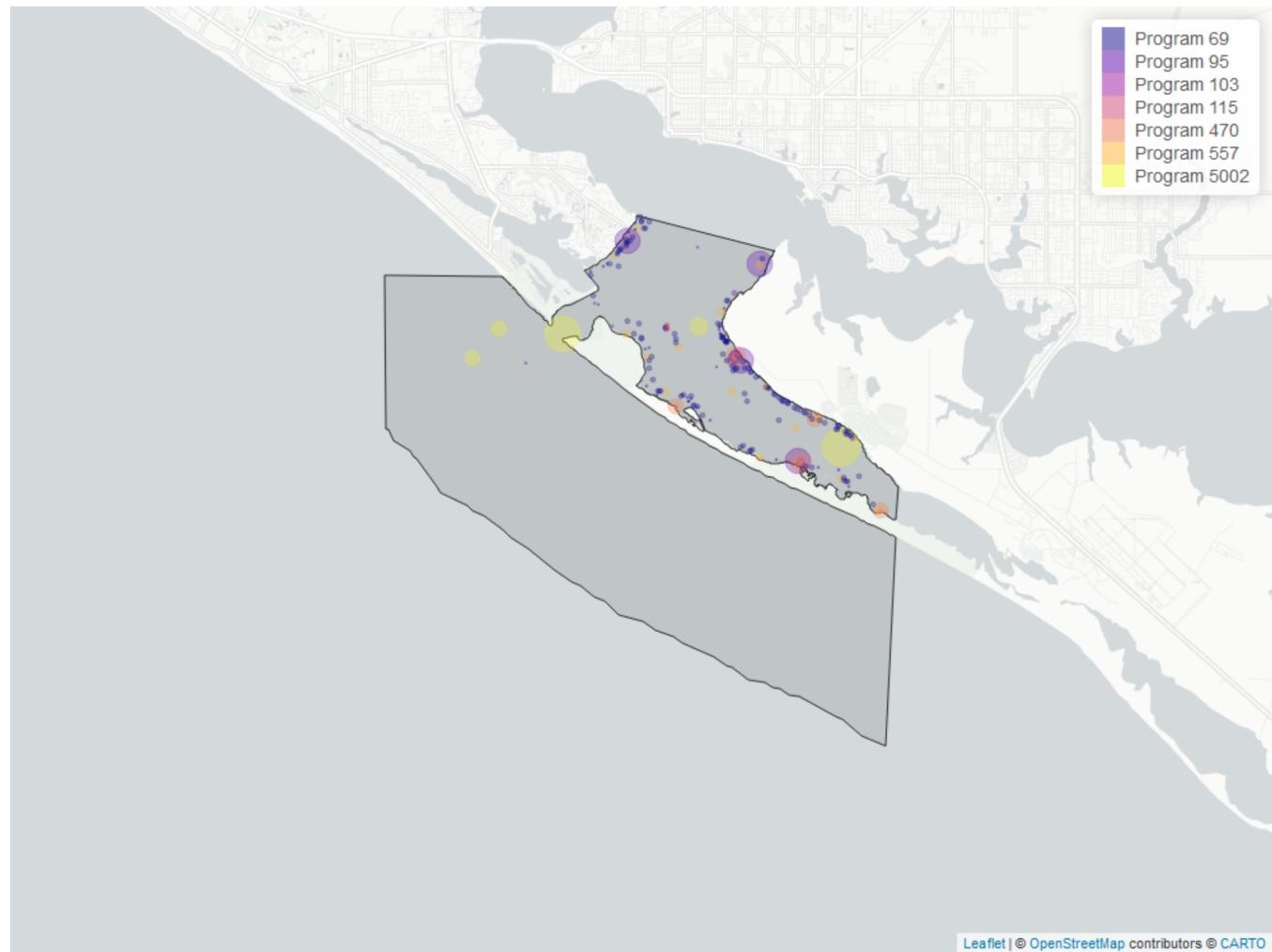
### Seasonal Kendall-Tau Trend Analysis



*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for pH



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 14: Programs contributing data for pH

ProgramID	N_Data	YearMin	YearMax
5002	540	2005	2023
95	442	1998	2018
69	435	2001	2017
470	266	2010	2023
557	172	2016	2021
103	20	2021	2021
115	16	2000	2003

**Program names:**

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

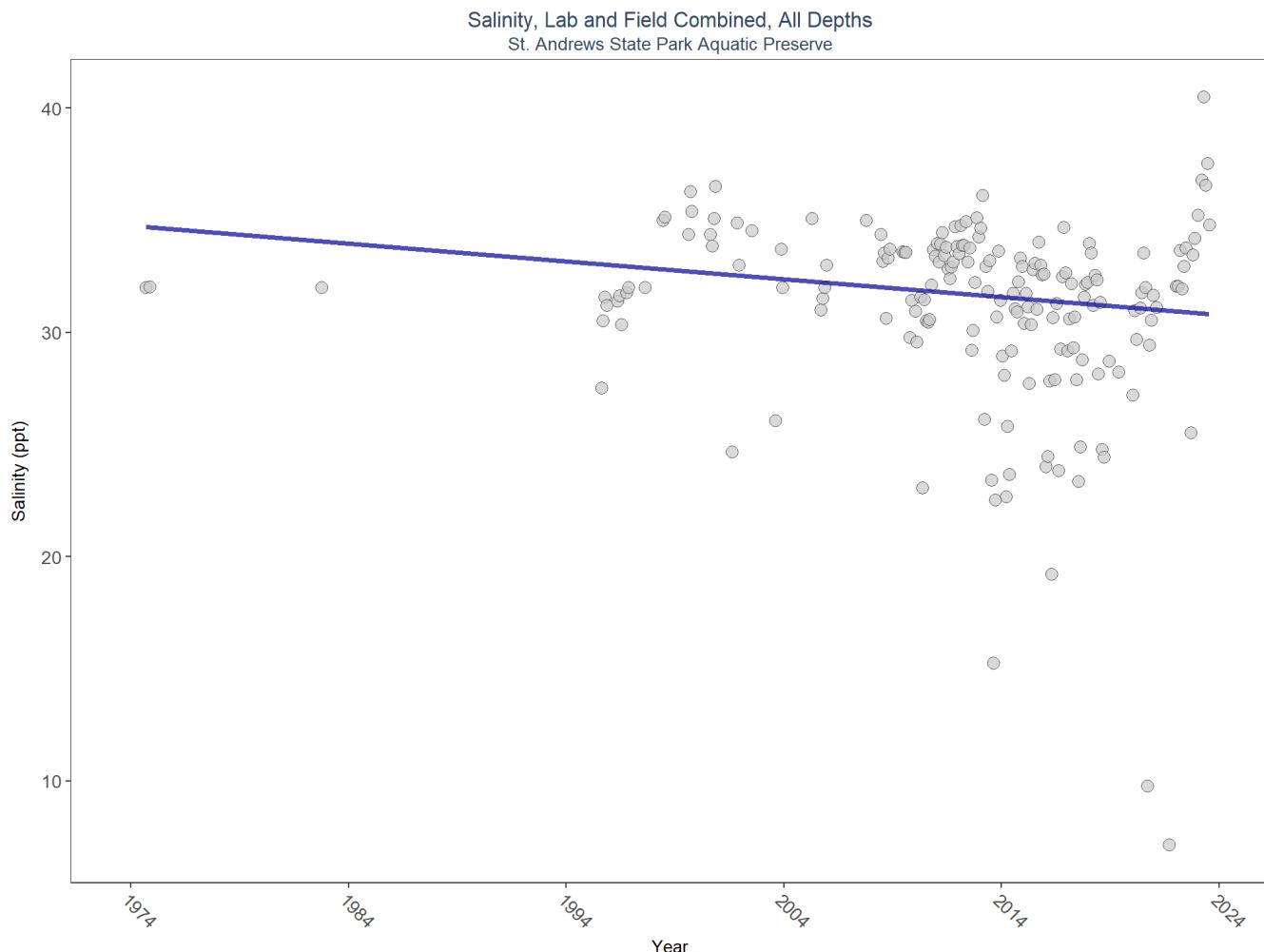
- 69 - Fisheries-Independent Monitoring (FIM) Program
- 470 - St. Andrews Aquatic Preserve Water Quality Monitoring
- 557 - Central Panhandle Aquatic Preserves Seagrass Monitoring
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
- 115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for pH in St. Andrews State Park Aquatic Preserve

## Salinity - Discrete Water Quality

Salinity is a measure of the amount of salt in the water. In estuarine ecosystems, salinity is influenced by precipitation, evaporation, surface-water inputs, and exchange with coastal waters.

### Seasonal Kendall-Tau Trend Analysis

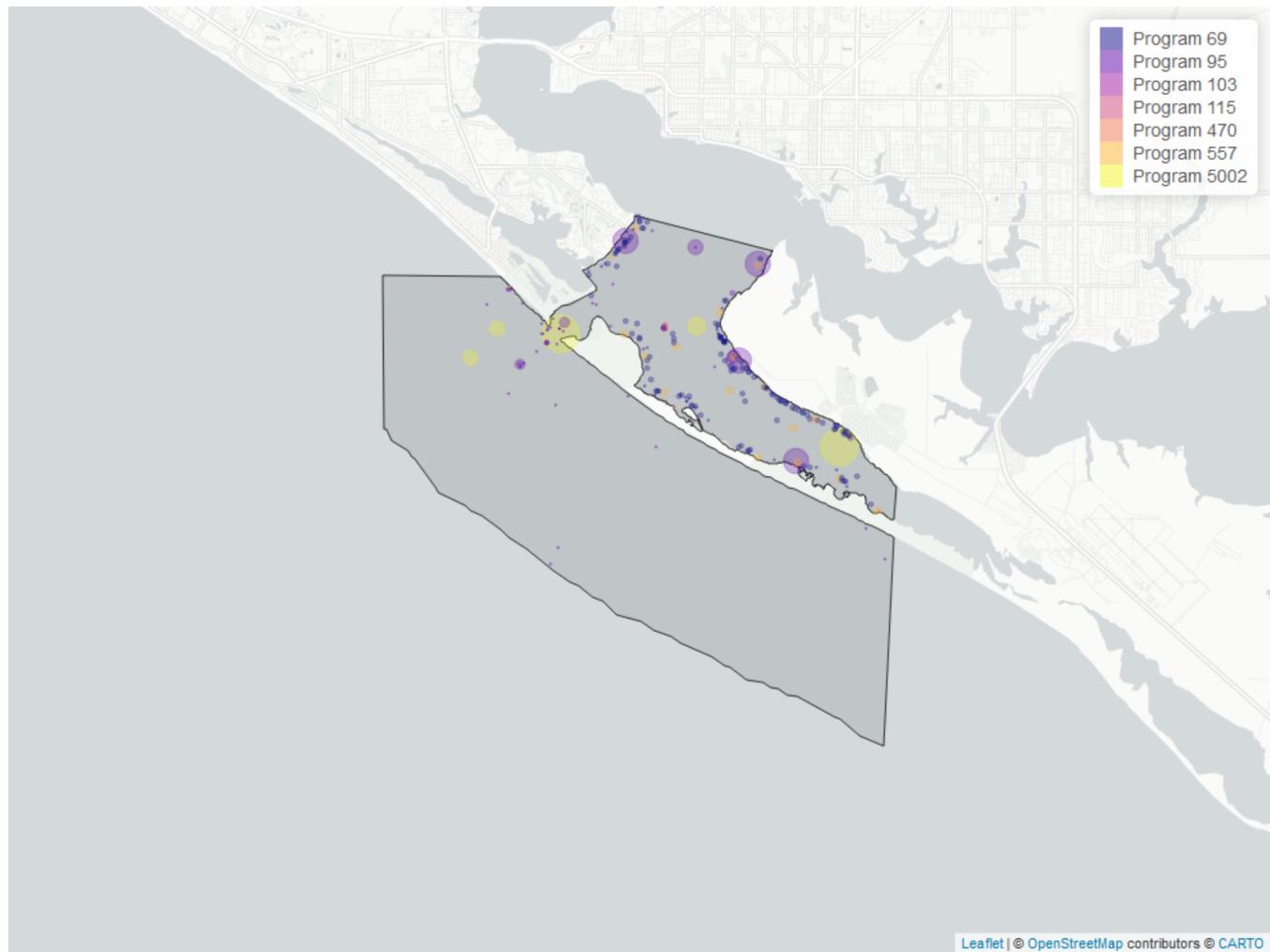


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1766	29	32	TRUE	-0.1337	0.0087	-0.07978472	34.77278	14.4779	0.2077	-1

*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Salinity



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 15: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
95	594	1974	2018
5002	547	2005	2023
69	434	2001	2017
557	172	2016	2021
115	16	2000	2003
470	12	2016	2018
103	1	2003	2003

**Program names:**

95 - Harmful Algal Bloom Marine Observation Network

5002 - Florida STORET / WIN

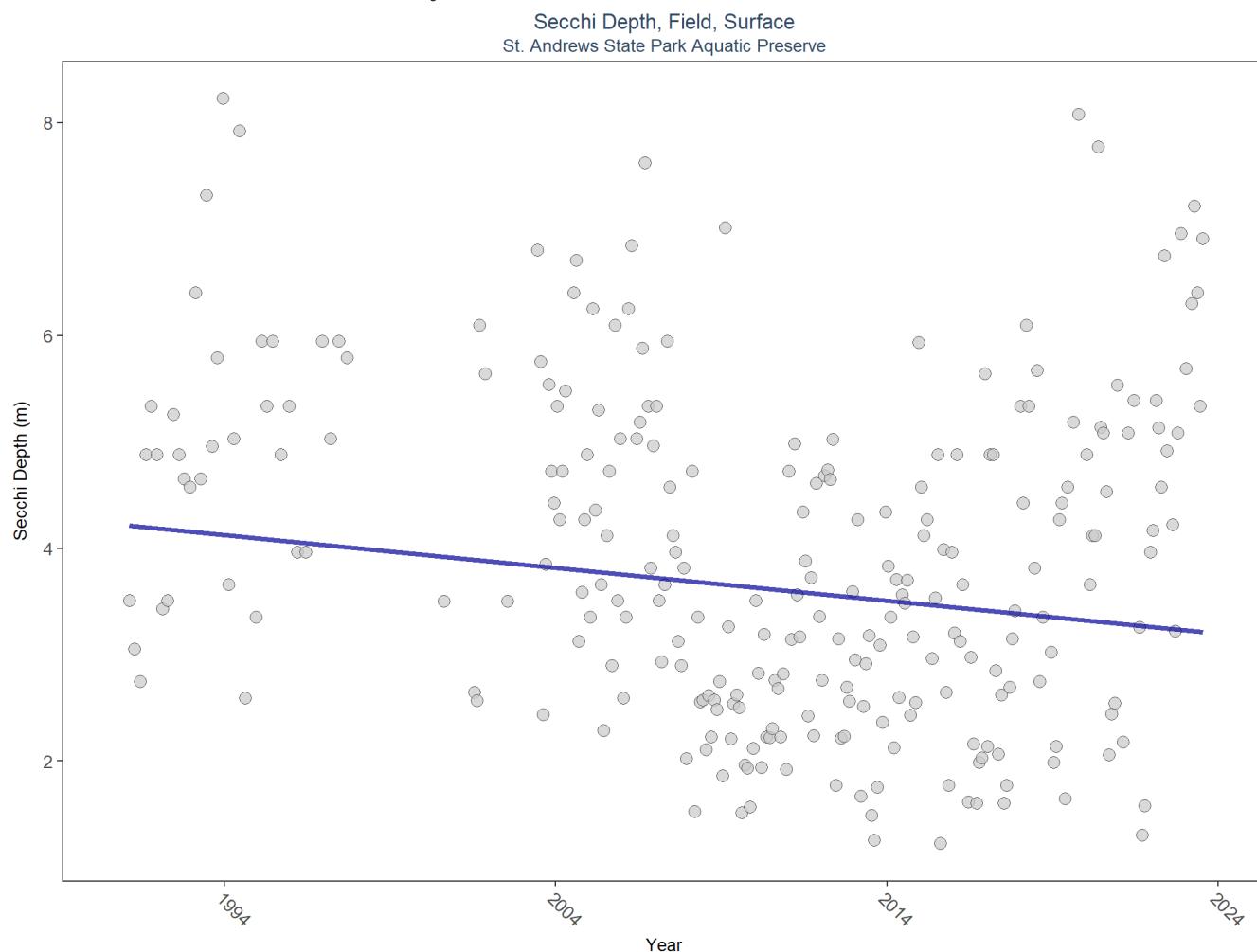
- 69 - Fisheries-Independent Monitoring (FIM) Program  
 557 - Central Panhandle Aquatic Preserves Seagrass Monitoring  
 115 - Environmental Monitoring Assessment Program  
 470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
 103 - EPA STORET and RETrieval Data Warehouse (STORET)

There are no qualifying Value Qualifiers for Salinity in St. Andrews State Park Aquatic Preserve

## Secchi Depth - Discrete Water Quality

**Secchi depth** is a measure of the transparency or clarity of the water by a device called a Secchi disk. A Secchi disk is a black and white disk that is lowered into the water on a cord. The Secchi depth is the depth at which the disk can no longer be seen. The deeper the Secchi depth, the greater the water clarity.

### Seasonal Kendall-Tau Trend Analysis

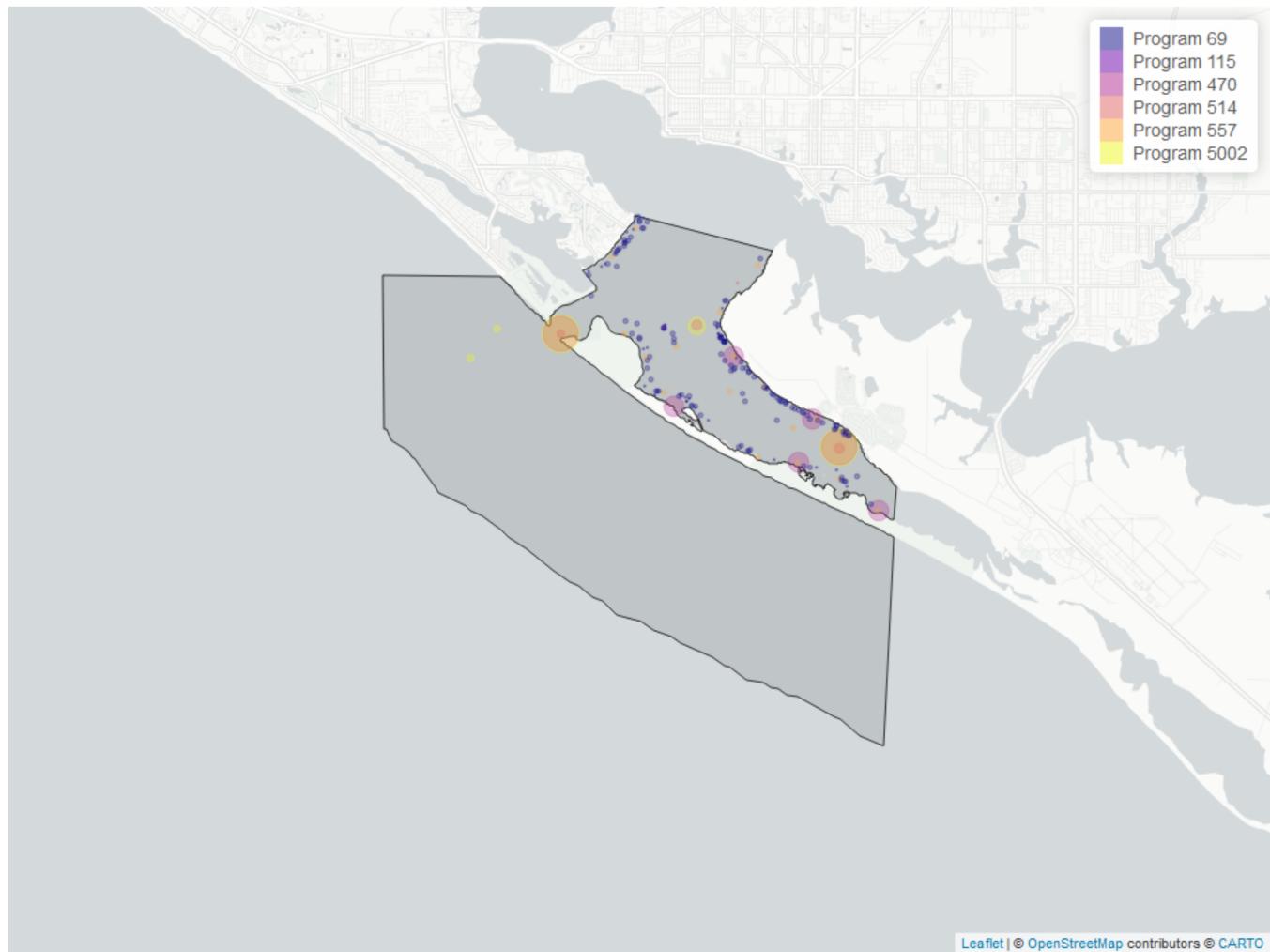


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	1758	31	2.9	TRUE	-0.0982	0.0221	-0.03088994	4.21774	15.2103	0.1731	-1

*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept* is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Secchi Depth



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 16: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
5002	504	2010	2023
514	437	1991	2023
69	435	2001	2017
470	298	2003	2014
557	82	2016	2021
115	3	2000	2002

#### Program names:

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

69 - Fisheries-Independent Monitoring (FIM) Program

470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring  
115 - Environmental Monitoring Assessment Program

### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year
- $N_S$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_S$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 17: Value Qualifiers for Secchi Depth

Year	$N_{Total}$	$N_S$	$perc_S$
2021	23	1	4.3
2022	60	1	1.7

Note:  $^1S$  - Secchi disk visible to bottom of waterbody

### Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
514 - Florida LAKEWATCH Program

## Total Nitrogen - Discrete Water Quality

**Nitrogen** and **Phosphorous** are key nutrients that provide nourishment essential for the growth and maintenance of aquatic plants and animals; however, excess nutrients can cause harmful algal blooms and other water quality concerns. Nutrients enter water bodies several ways, including runoff from rain events and atmospheric deposition from natural and industrial sources.

### Total Nitrogen Calculation:

The logic for calculated Total Nitrogen was provided by Kevin O'Donnell and colleagues at FDEP (with the help of Jay Silvanima, Watershed Monitoring Section). The following logic is used, in this order, based on the availability of specific nitrogen components.

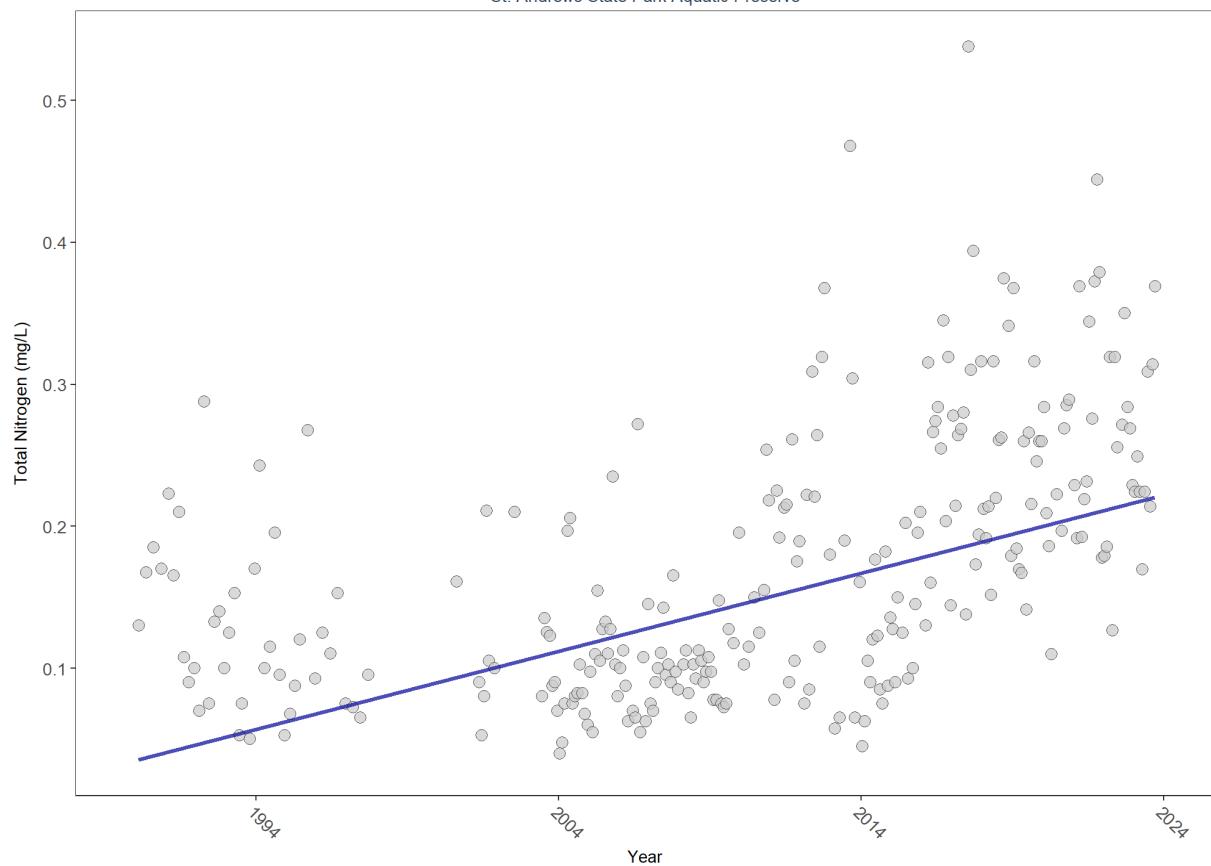
- 1)  $TN = TKN + NO_3O_2;$
- 2)  $TN = TKN + NO_3 + NO_2;$
- 3)  $TN = ORGN + NH_4 + NO_3O_2;$
- 4)  $TN = ORGN + NH_4 + NO_2 + NO_3;$
- 5)  $TN = TKN + NO_3;$
- 6)  $TN = ORGN + NH_4 + NO_3;$

Additional Information:

- Rules for use of sample fraction:
  - FDEP report that if both “Total” and “Dissolved” are reported, only “Total” is used. If the total is not reported, they do use dissolved as a best available replacement.
  - An analysis of all SEACAR data shows that 90% of all possible TN calculations can be done using nitrogen components with the same sample fraction, rather than use nitrogen components with mixed total/dissolved sample fractions. In other words, TN can be calculated when TKN and  $NO_3O_2$  are both total sample fraction, or when both are dissolved sample fraction. This is important, because then the calculated TN value is not based on components with mixed sample fractions.
- Values inserted into data:
  - ParameterName = “Total Nitrogen”
  - SEACAR\_QAQCFlagCode = “1Q”
  - SEACAR\_QAQC\_Description = “SEACAR Calculated”

## Seasonal Kendall-Tau Trend Analysis

Total Nitrogen, Lab, All Depths  
St. Andrews State Park Aquatic Preserve

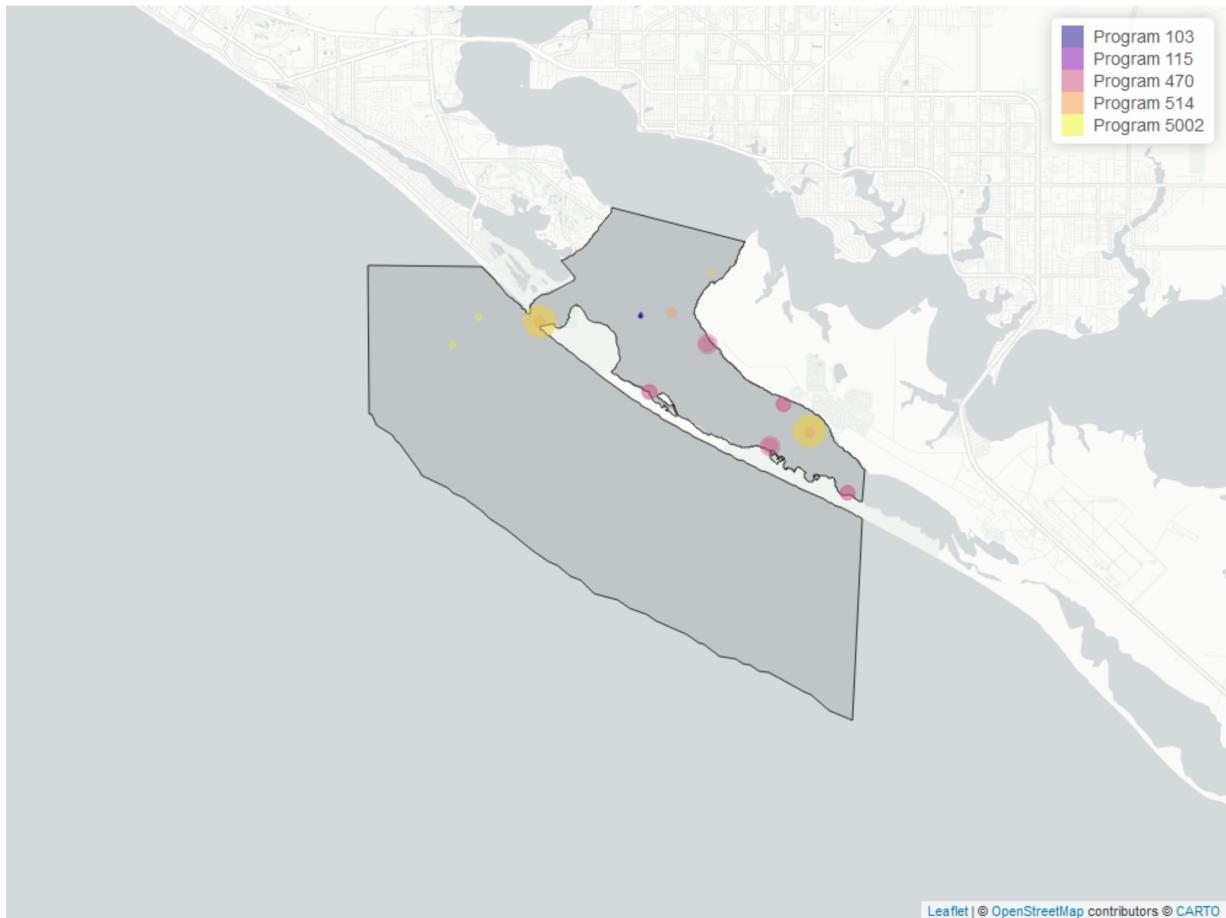


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1180	32	0.18	TRUE	0.4159	0.0000	0.005509673	0.03473363	10.8728	0.454	1

*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Total Nitrogen



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 18: Programs contributing data for Total Nitrogen

ProgramID	N_Data	YearMin	YearMax
470	412	2004	2023
514	401	1990	2023
5002	352	1990	2016
103	11	2000	2003
115	4	2000	2003

#### Program names:

- 470 - St. Andrews Aquatic Preserve Water Quality Monitoring
- 514 - Florida LAKEWATCH Program
- 5002 - Florida STORET / WIN
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
- 115 - Environmental Monitoring Assessment Program

#### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year

- $N_{\_}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{\_}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{\_Total}$

Table 19: Value Qualifiers for Total Nitrogen

<i>Year</i>	<i>N_Total</i>	<i>N_I</i>	<i>perc_I</i>	<i>N_Q</i>	<i>perc_Q</i>
2014	63	1	1.6	4	6.3
2016	55	1	1.8		
2020	39			2	5.1

**Note:** <sup>1</sup>**I** - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>**Q**  
 - Sample held beyond the accepted holding time

**Programs containing Value Qualified data:**

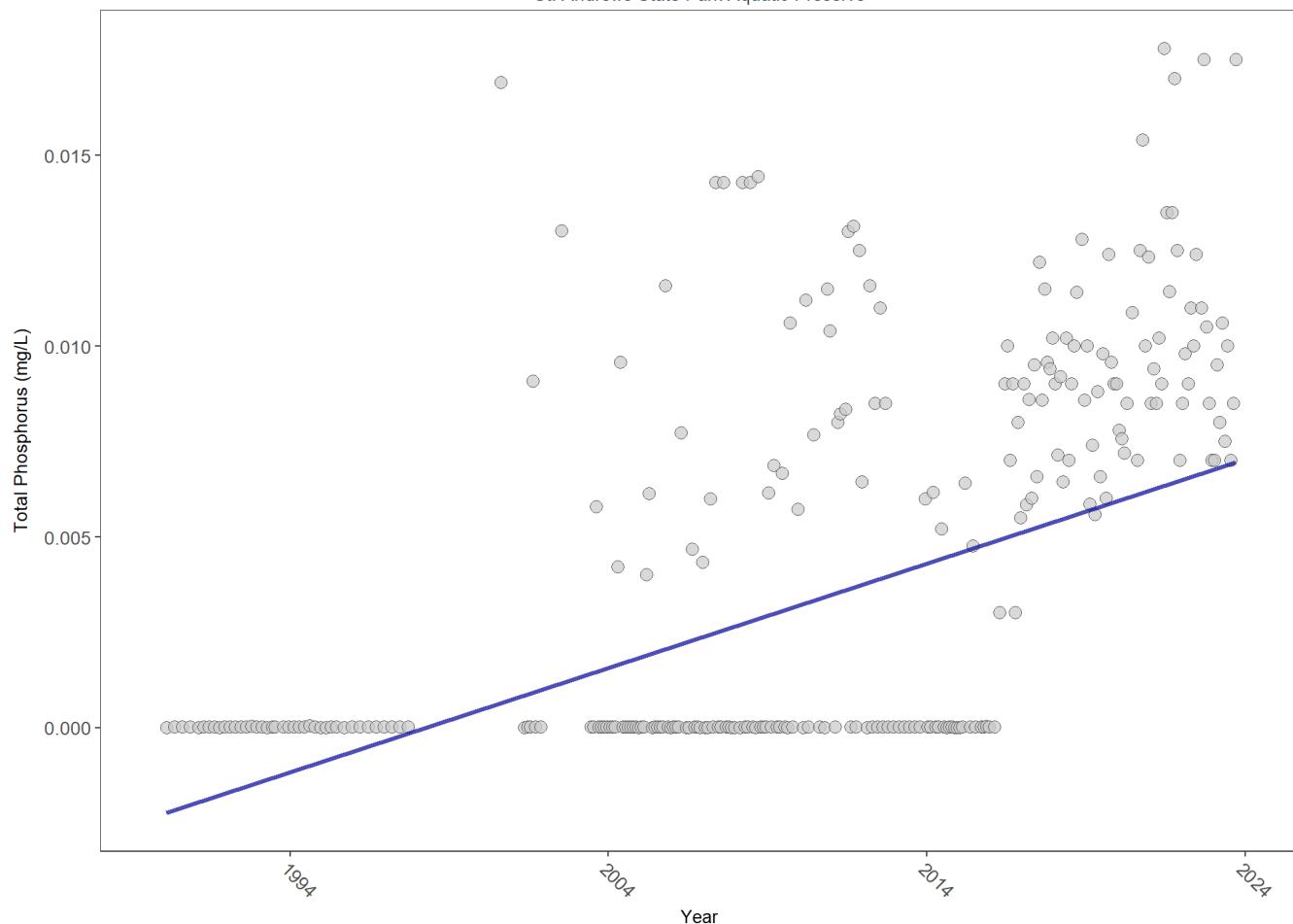
514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

## Total Phosphorus - Discrete Water Quality

### Seasonal Kendall-Tau Trend Analysis

Total Phosphorus, Lab, All Depths  
St. Andrews State Park Aquatic Preserve

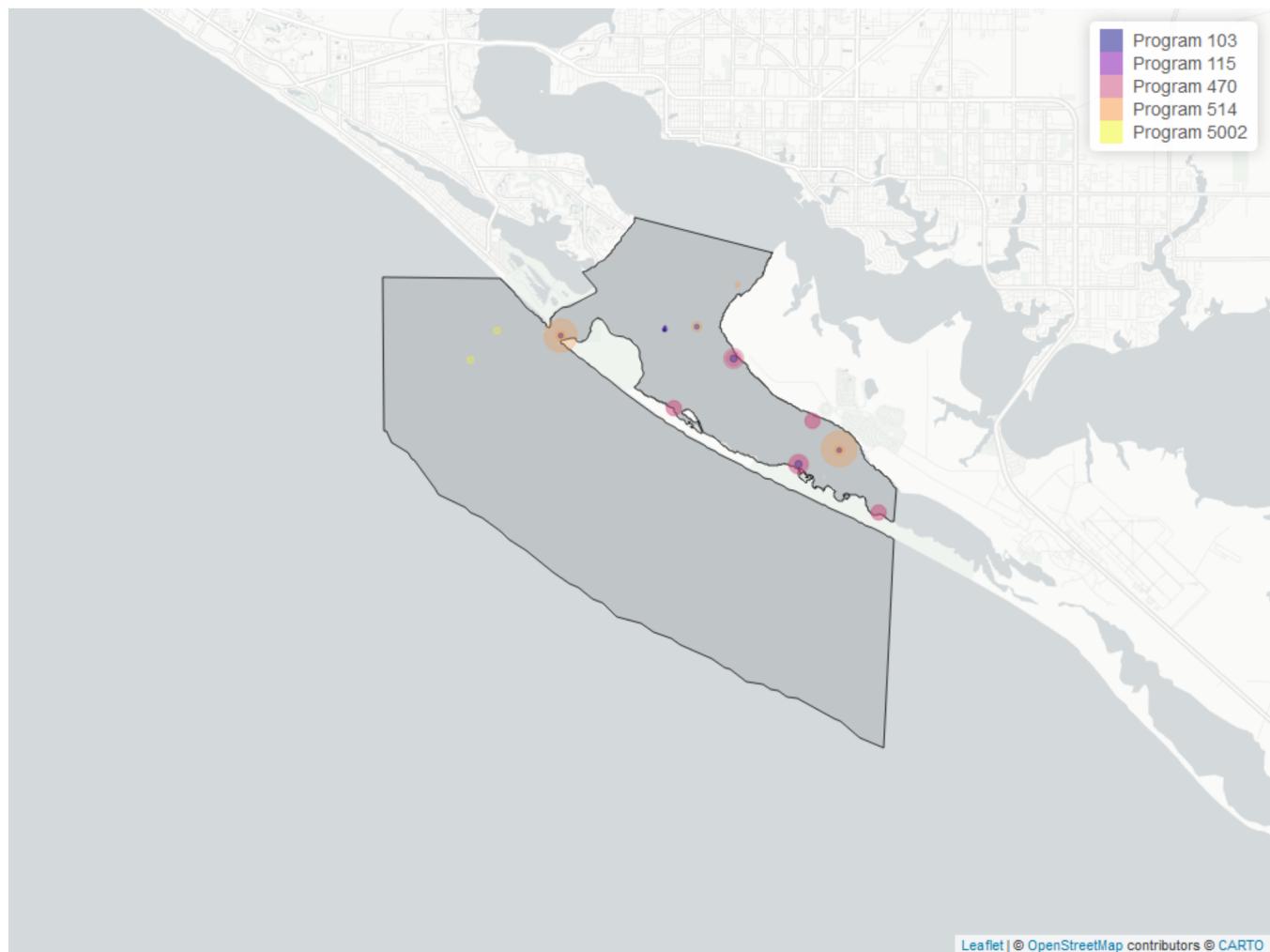


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	897	32	0.008	TRUE	0.4625	0.0000	0.0002738387	-0.002265592	8.6303	0.656	1

$p < 0.00005$  appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Total Phosphorus



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 20: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
470	433	2004	2023
514	408	1990	2023
103	38	2000	2021
5002	22	2010	2012
115	4	2000	2003

#### Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

514 - Florida LAKEWATCH Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

5002 - Florida STORET / WIN

### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year
- $N_{}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 21: Value Qualifiers for Total Phosphorus

Year	$N_{Total}$	$N_I$	$perc_I$	$N_Q$	$perc_Q$	$N_U$	$perc_U$
2004	32	8	25.0				
2005	40	14	35.0			2	5.0
2006	35	11	31.4			2	5.7
2007	39	4	10.3			11	28.2
2008	36	1	2.8			14	38.9
2009	45	18	40.0			6	13.3
2010	26	16	61.5				
2011	44	29	65.9			3	6.8
2012	30	9	30.0				
2013	15	4	26.7				
2014	32	7	21.9				
2015	24	6	25.0				
2016	30	19	63.3				
2017	65	31	47.7				
2018	63	28	44.4				
2019	70	44	62.9				
2020	42	25	59.5	2	4.8	2	4.8
2021	71	23	32.4				
2022	32	17	53.1				
2023	21	18	85.7				

**Note:** <sup>1</sup>I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>Q  
 - Sample held beyond the accepted holding time <sup>3</sup>U - Compound was analyzed for but not detected

### Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

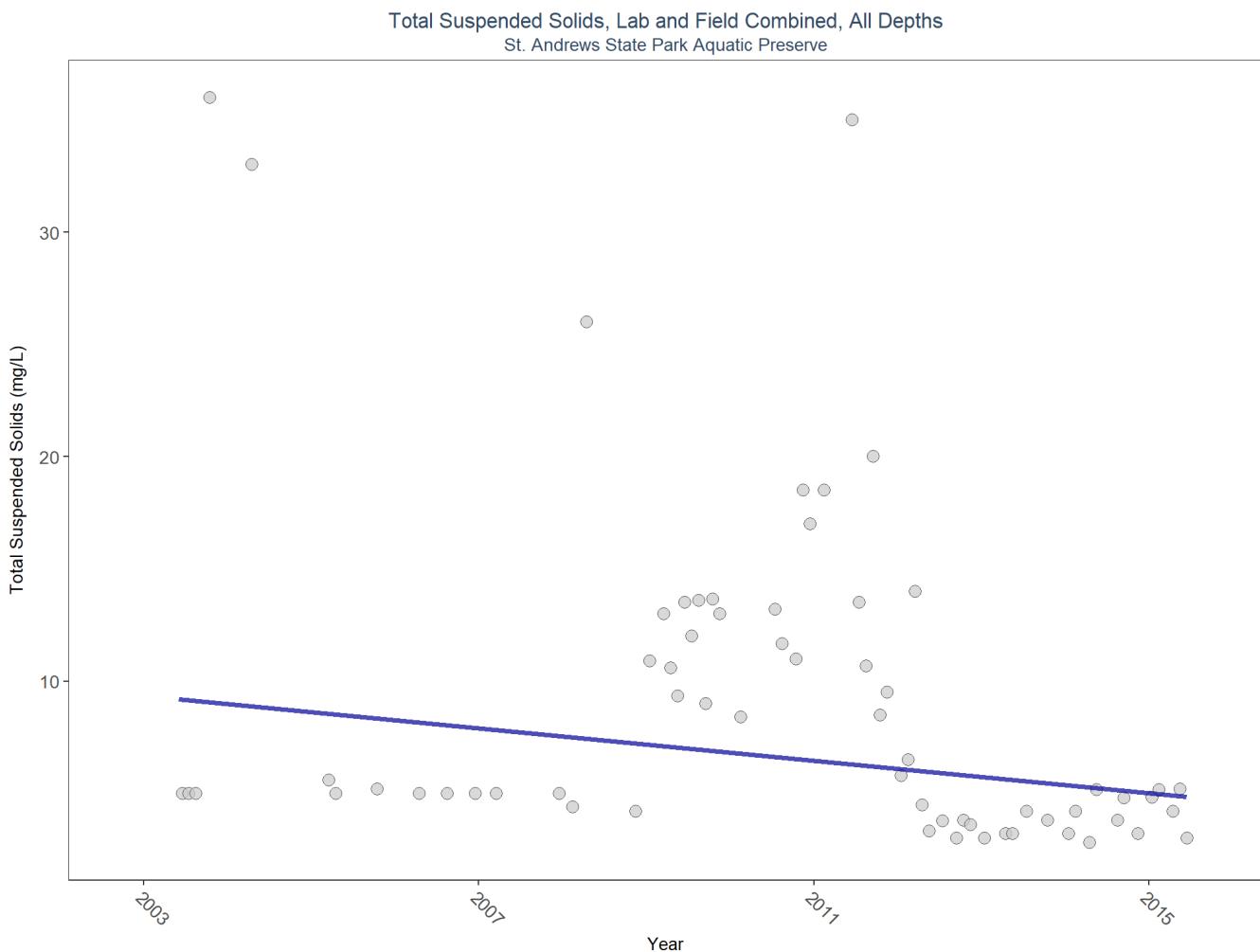
514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

### Total Suspended Solids - Discrete Water Quality

**Total Suspended Solids (TSS)** are solid particles suspended in water that exceed 2 microns in size and can be trapped by a filter.

#### Seasonal Kendall-Tau Trend Analysis

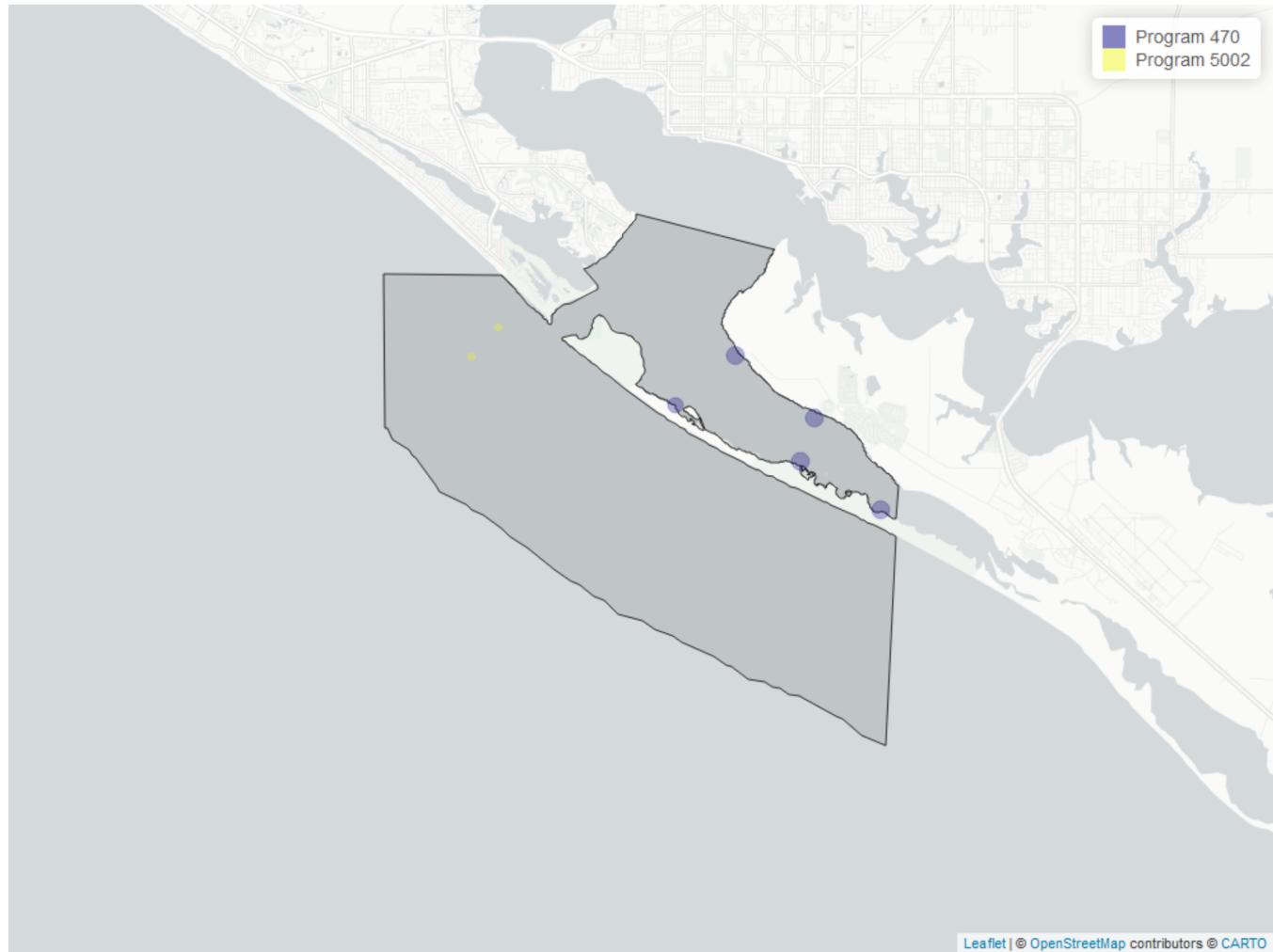


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	248	13	5	TRUE	-0.2197	0.0053	-0.3611111	9.355556	14.2697	0.2184	-1

$p < 0.00005$  appear as 0 due to rounding.

*SennIntercept* is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Total Suspended Solids



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 22: Programs contributing data for Total Suspended Solids

ProgramID	N_Data	YearMin	YearMax
470	230	2003	2015
5002	18	2010	2012

#### Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
5002 - Florida STORET / WIN

#### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year
- $N_{\text{Qualifier}}$  is the total amount of values flagged with the respective value qualifier in a given year
- $\text{perc}_{\text{Qualifier}}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{Total}$

Table 23: Value Qualifiers for Total Suspended Solids

Year	N_Total	N_I	perc_I	N_Q	perc_Q	N_U	perc_U
2003	10					9	90.0
2005	12					10	83.3
2006	9					9	100.0
2007	3					3	100.0
2008	12	2	16.7	2	16.7	8	66.7
2009	37	34	91.9			1	2.7
2010	21	17	81.0				
2011	15	6	40.0				
2012	40	26	65.0			12	30.0
2013	25	8	32.0			17	68.0
2014	36	22	61.1			14	38.9
2015	27	21	77.8			6	22.2

**Note:** <sup>1</sup>I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>Q  
 - Sample held beyond the accepted holding time <sup>3</sup>U - Compound was analyzed for but not detected

#### Programs containing Value Qualified data:

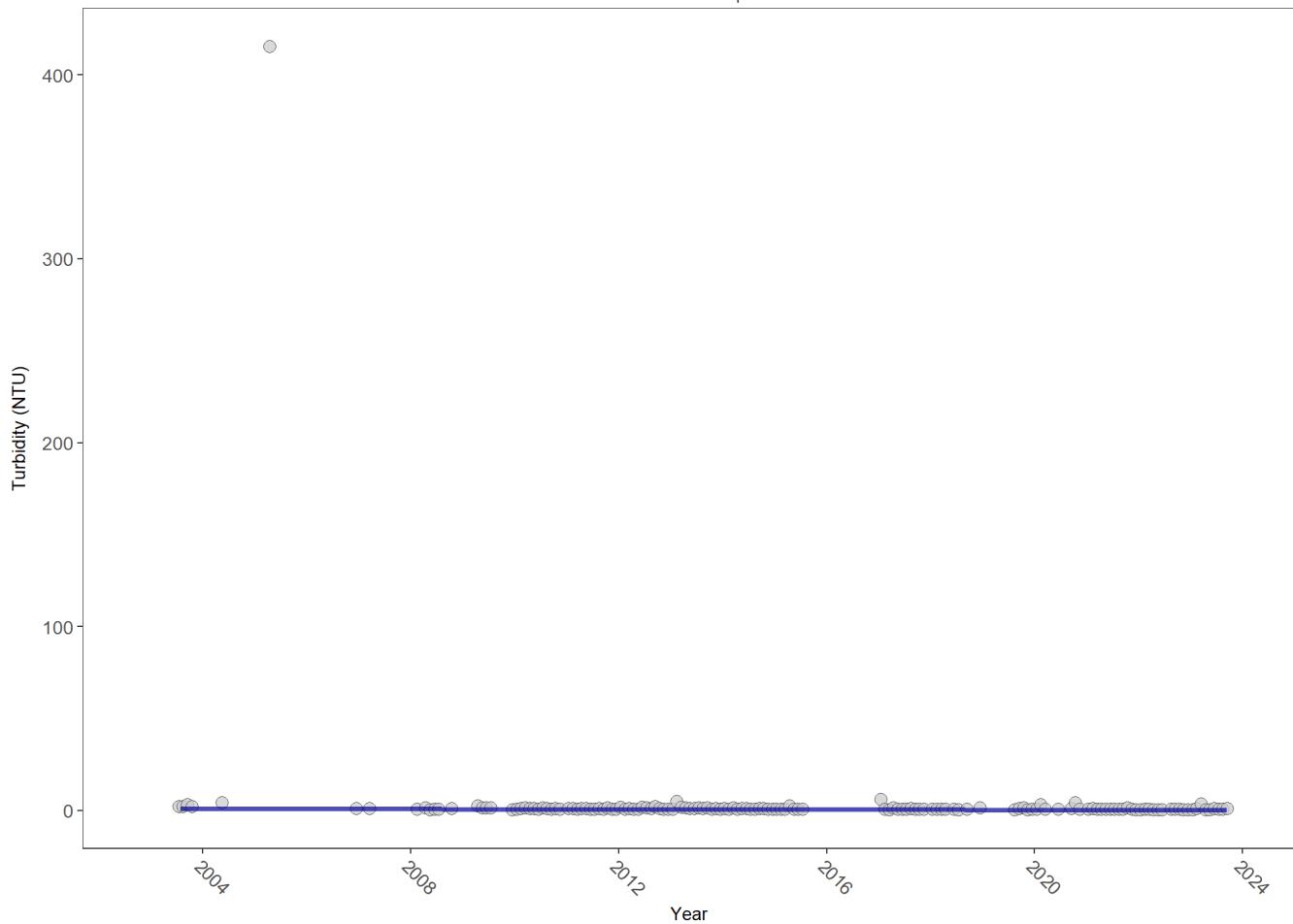
470 - St. Andrews Aquatic Preserve Water Quality Monitoring  
 5002 - Florida STORET / WIN

### Turbidity - Discrete Water Quality

**Turbidity** results from suspended solids in the water, including silts, clays, tannins, industrial wastes, sewage and plankton, which are all factors that contribute to how clouded or murky a water column is. Turbidity is caused by soil erosion, excess nutrients, pollutants, and physical forces such as winds, currents and bottom feeders.

#### Seasonal Kendall-Tau Trend Analysis

Turbidity, Lab and Field Combined, All Depths  
St. Andrews State Park Aquatic Preserve

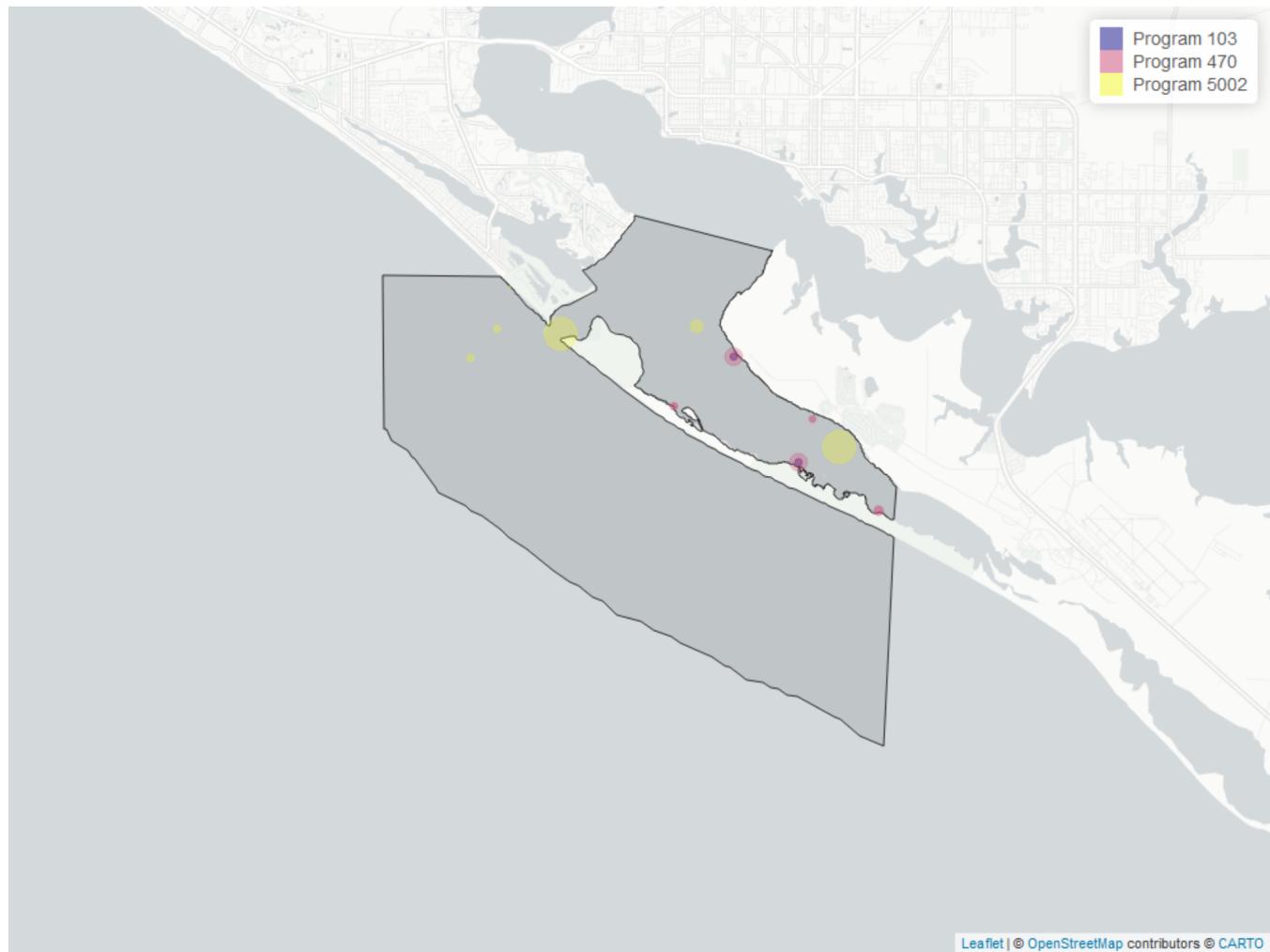


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	579	20	0.65	TRUE	-0.3465	0.0000	-0.03525	1.120796	7.7026	0.7397	-1

*p < 0.00005 appear as 0 due to rounding.*

*SennIntercept is intercept value at beginning of record for monitoring location*

Map showing location of Discrete sampling sites for Turbidity



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 24: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
5002	398	2005	2023
470	161	2003	2023
103	20	2021	2021

#### Program names:

5002 - Florida STORET / WIN

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

#### Value Qualifiers

- $N_{Total}$  is total amount of data for a given year

- $N_{\_}$  is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{\_}$  is the percent of data flagged with the respective value qualifier as a proportion of  $N_{\_Total}$

Table 25: Value Qualifiers for Turbidity

<i>Year</i>	<i>N_Total</i>	<i>N_I</i>	<i>perc_I</i>	<i>N_Q</i>	<i>perc_Q</i>	<i>N_U</i>	<i>perc_U</i>
2004	5			5	100.0		
2008	12			5	41.7	4	33.3
2009	5					1	20.0
2022	48	18	37.5				
2023	54	17	31.5				

**Note:** <sup>1</sup>**I** - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>**Q**  
 - Sample held beyond the accepted holding time <sup>3</sup>**U** - Compound was analyzed for but not detected

#### Programs containing Value Qualified data:

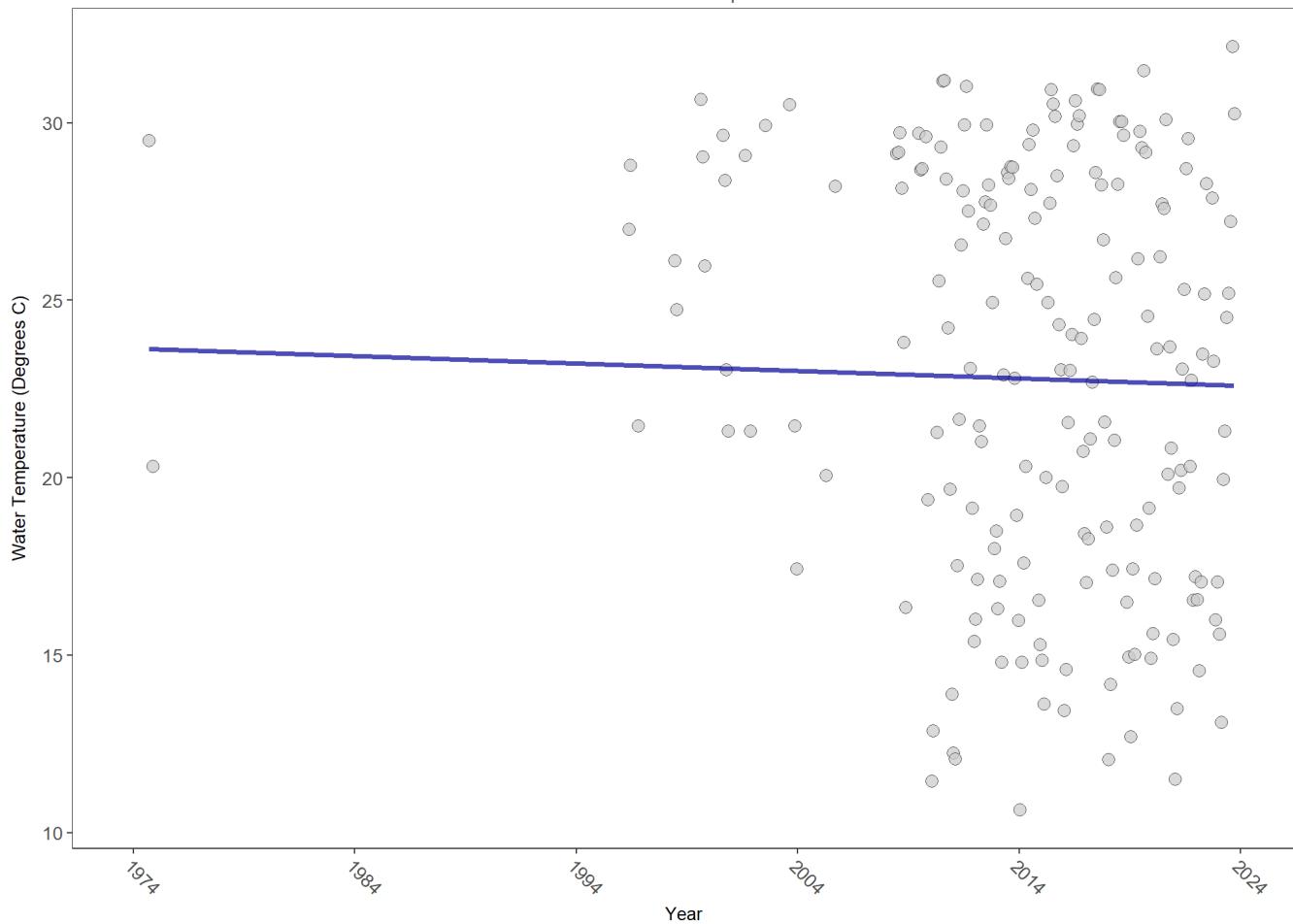
470 - St. Andrews Aquatic Preserve Water Quality Monitoring

### Water Temperature - Discrete Water Quality

**Temperature** determines the capacity of water to hold oxygen. Cooler water can hold more dissolved oxygen because water molecules are more tightly packed, making it harder for oxygen to escape. Additionally, as water temperature increases, fish and other aquatic organisms become more active and consume oxygen at a faster rate.

#### Seasonal Kendall-Tau Trend Analysis

Water Temperature, Field, All Depths  
St. Andrews State Park Aquatic Preserve

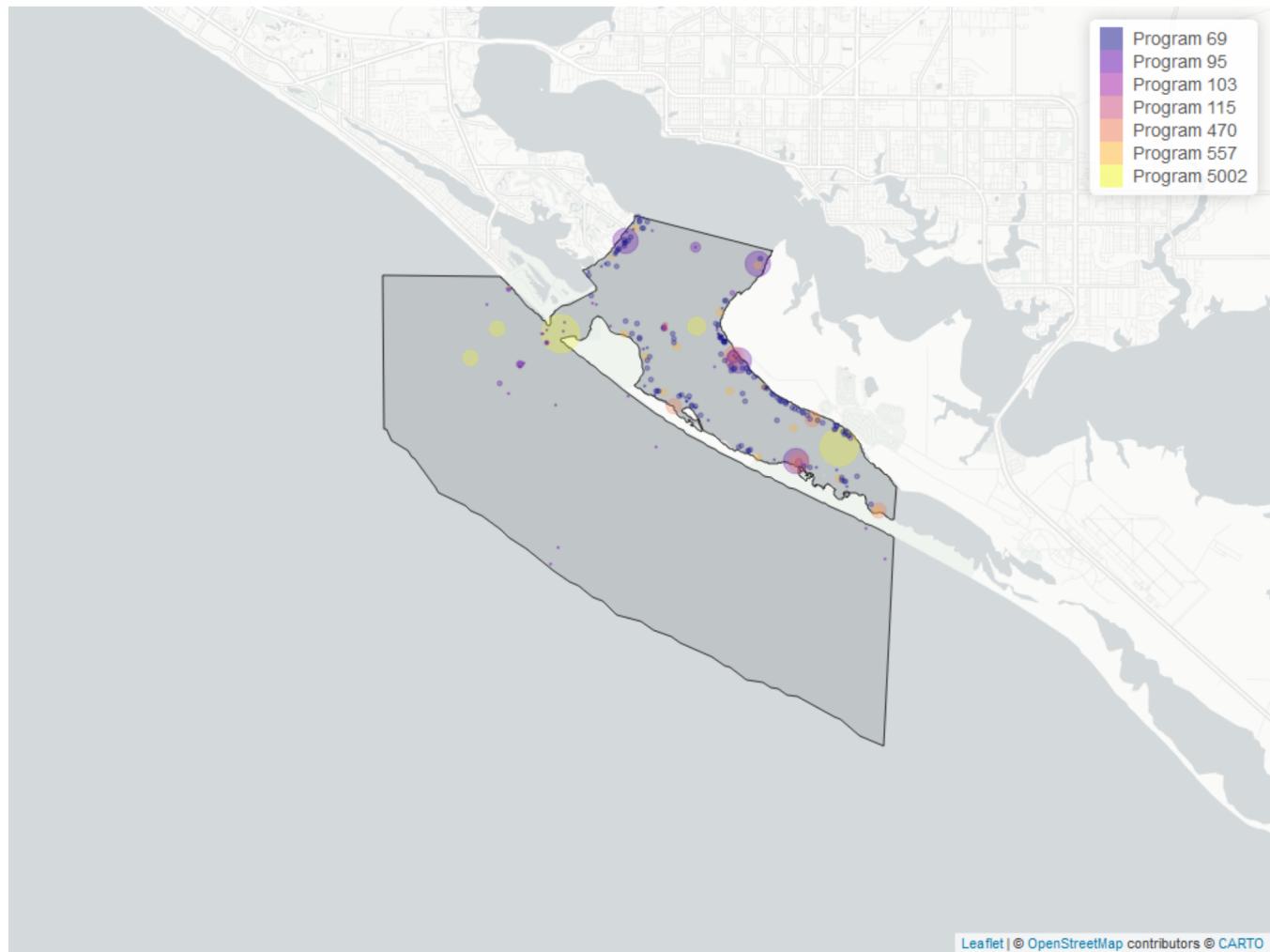


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1954	25	25.1	TRUE	-0.0403	0.4071	-0.02086538	23.63368	8.3754	0.6793	0

$p < 0.00005$  appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Water Temperature



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 26: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
5002	546	2005	2023
95	530	1974	2018
69	435	2001	2017
470	237	2016	2023
557	172	2016	2021
103	20	2021	2021
115	16	2000	2003

#### Program names:

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

- 69* - Fisheries-Independent Monitoring (FIM) Program
- 470* - St. Andrews Aquatic Preserve Water Quality Monitoring
- 557* - Central Panhandle Aquatic Preserves Seagrass Monitoring
- 103* - EPA STOrage and RETrieval Data Warehouse (STORET)
- 115* - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for Water Temperature in St. Andrews State Park Aquatic Preserve

# Submerged Aquatic Vegetation

The data file used is: All\_SAV\_Parameters-2024-Mar-29.txt

**Submerged aquatic vegetation (SAV)** refers to plants and plant-like macroalgae species that live entirely underwater. The two primary categories of SAV inhabiting Florida estuaries are *benthic macroalgae* and *seagrasses*. They often grow together in dense beds or meadows that carpet the seafloor. *Macroalgae* include multicellular species of green, red and brown algae that often live attached to the substrate by a holdfast. They tend to grow quickly and can tolerate relatively high nutrient levels, making them a threat to seagrasses and other benthic habitats in areas with poor water quality. In contrast, *seagrasses* are grass-like, vascular, flowering plants that are attached to the seafloor by extensive root systems. *Seagrasses* occur throughout the coastal areas of Florida, including protected bays and lagoons as well as deeper offshore waters on the continental shelf. *Seagrasses* have taken advantage of the broad, shallow shelf and clear water to produce two of the most extensive seagrass beds anywhere in continental North America.

## Parameters

**Percent Cover** measures the fraction of an area of seafloor that is covered by SAV, usually estimated by evaluating multiple small areas of seafloor. Percent cover is often estimated for total SAV, individual types of vegetation (seagrass, attached algae, drift algae) and individual species.

**Frequency of Occurrence** was calculated as the number of times a taxon was observed in a year divided by the number of sampling events, multiplied by 100. Analysis is conducted at the quadrat level and is inclusive of all quadrats (i.e., quadrats evaluated using Braun-Blanquet, modified Braun-Blanquet, and percent cover.)

## Species

**Turtle grass** (*Thalassia testudinum*) is the largest of the Florida seagrasses, with longer, thicker blades and deeper root structures than any of the other seagrasses. It is considered a climax seagrass species.

**Shoal grass** (*Halodule wrightii*) is an early colonizer of vegetated areas and usually grows in water too shallow for other species except *widgeon grass*. It can often tolerate larger salinity ranges than other seagrass species. *Shoal grass* is characterized by thin, flat blades, that are narrower than *turtle grass* blades.

**Manatee grass** (*Syringodium filiforme*) is easily recognizable because its leaves are thin and cylindrical instead of the flat, ribbon-like form shared by many other seagrass species. The leaves can grow up to half a meter in length. *Manatee grass* is usually found in mixed seagrass beds or small, dense monospecific patches.

**Widgeon grass** (*Ruppia maritima*) grows in both fresh and salt water and is widely distributed throughout Florida's estuaries in less saline areas, particularly in inlets along the east coast. This species resembles *shoal grass* in certain environments but can be identified by the pointed tips of its leaves.

Three species of *Halophila spp.* are found in Florida - **Star grass** (*Halophila engelmannii*), **Paddle grass** (*Halophila decipiens*), and **Johnson's seagrass** (*Halophila johnsonii*). These are smaller, more fragile seagrasses than other Florida species and are considered ephemeral. They grow along a single long rhizome, with short blades. These species are not well-studied, although surveys are underway to define their ecological roles.

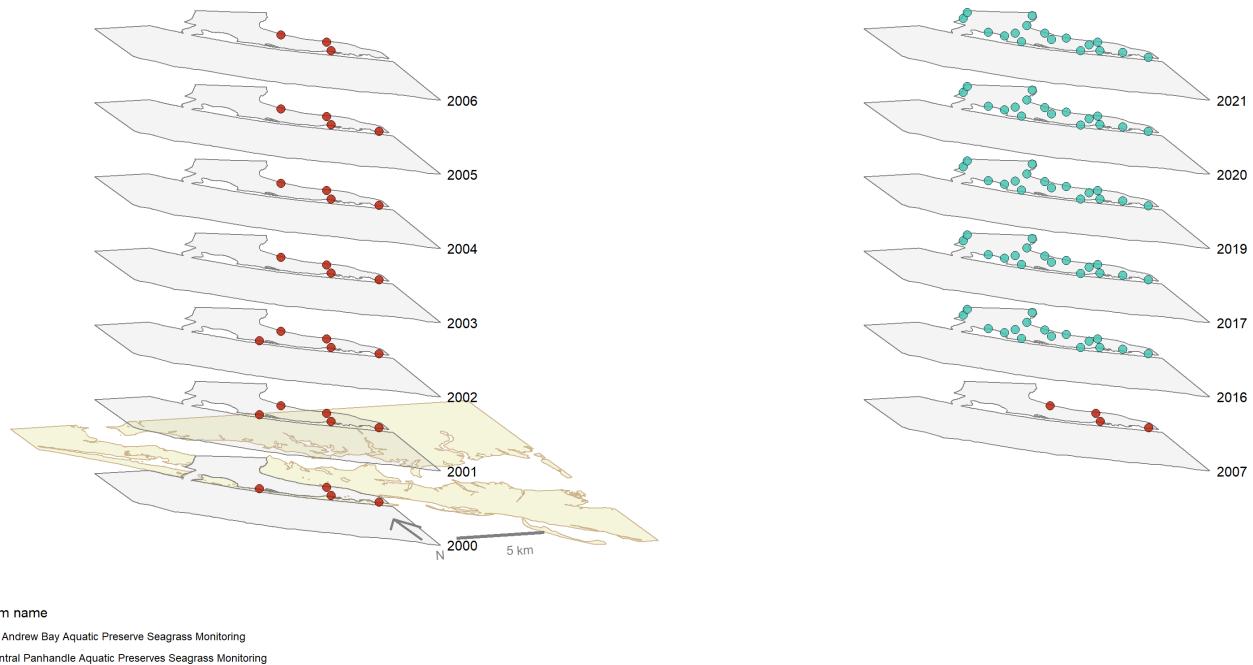
## Notes

*Star grass*, *Paddle grass*, and *Johnson's seagrass* will be grouped together and listed as **Halophila spp.** in the following managed areas. This is because several surveys did not specify to the species level:

- Banana River Aquatic Preserve
- Indian River-Malabar to Vero Beach Aquatic Preserve
- Indian River-Vero Beach to Ft. Pierce Aquatic Preserve
- Jensen Beach to Jupiter Inlet Aquatic Preserve
- Loxahatchee River-Lake Worth Creek Aquatic Preserve
- Mosquito Lagoon Aquatic Preserve

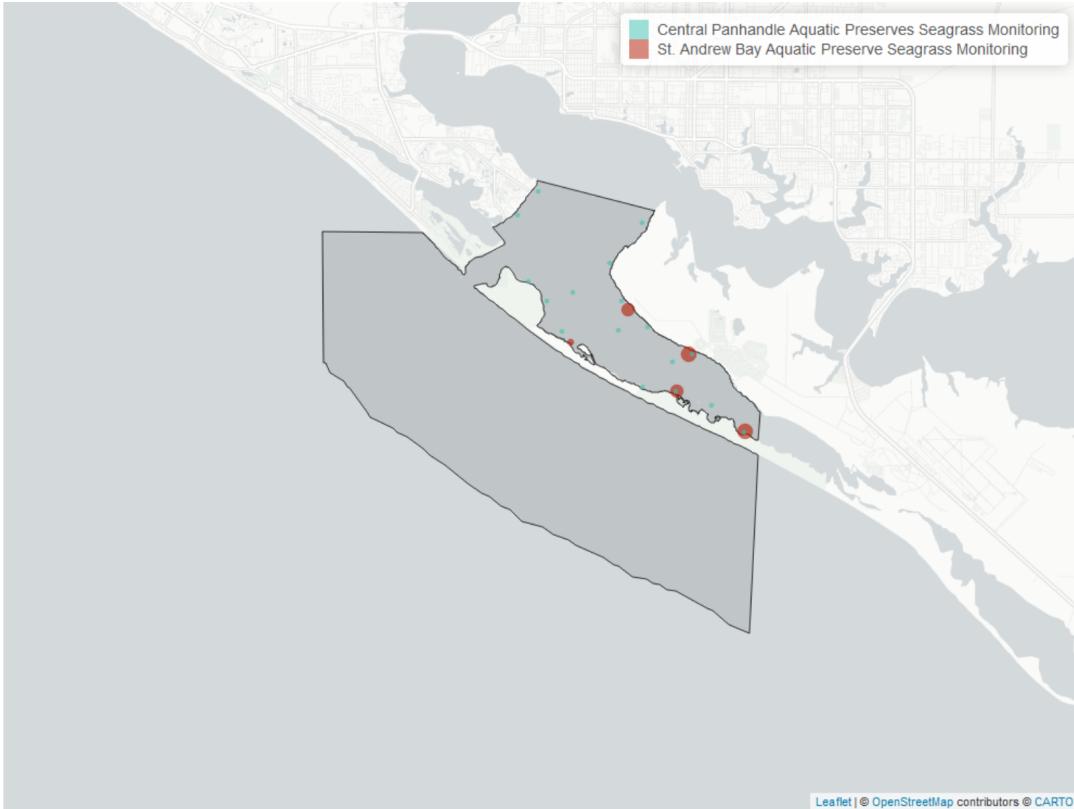
- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

St. Andrews State Park Aquatic Preserve  
SAV Percent Cover - Sample Locations



Maps showing the temporal scope of SAV sampling sites within the boundaries of *St. Andrews State Park Aquatic Preserve* by Program name.

#### **Sampling locations by Program:**



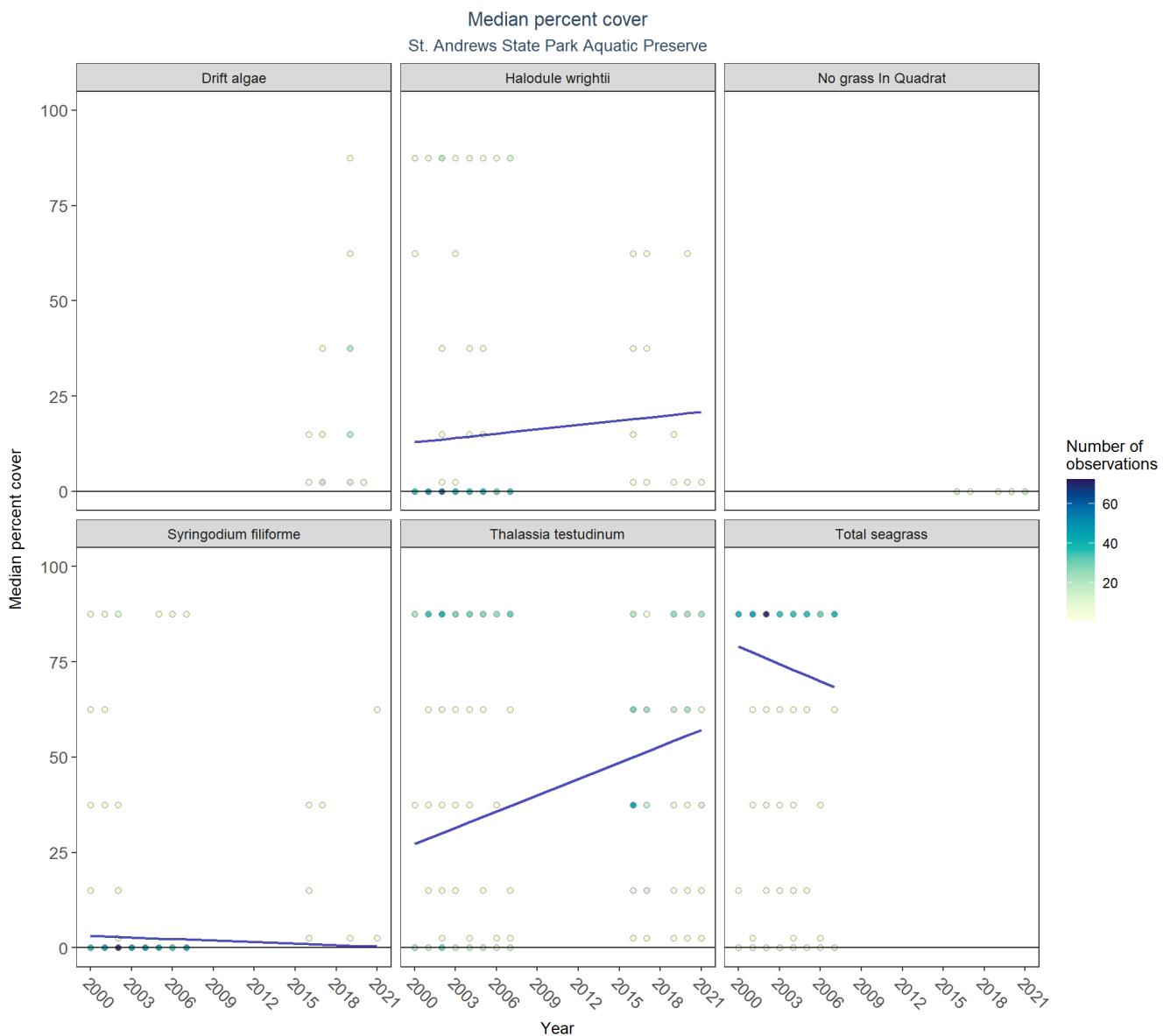
Map showing SAV sampling sites within the boundaries of *St. Andrews State Park Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 27: Central Panhandle Aquatic Preserves Seagrass Monitoring  
- Program 557

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
523	2016	2021	Braun Blanquet	17

Table 28: St. Andrew Bay Aquatic Preserve Seagrass Monitoring -  
Program 556

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
1652	2000	2007	Percent Cover	5



Median percent cover by species in *St. Andrews State Park Aquatic Preserve*. Linear mixed-effects models are applied to each species to produce species trends. The trendlines are then isolated and reproduced below for ease of viewing. The LME results are available in table form beneath the supplemental trendplot below.

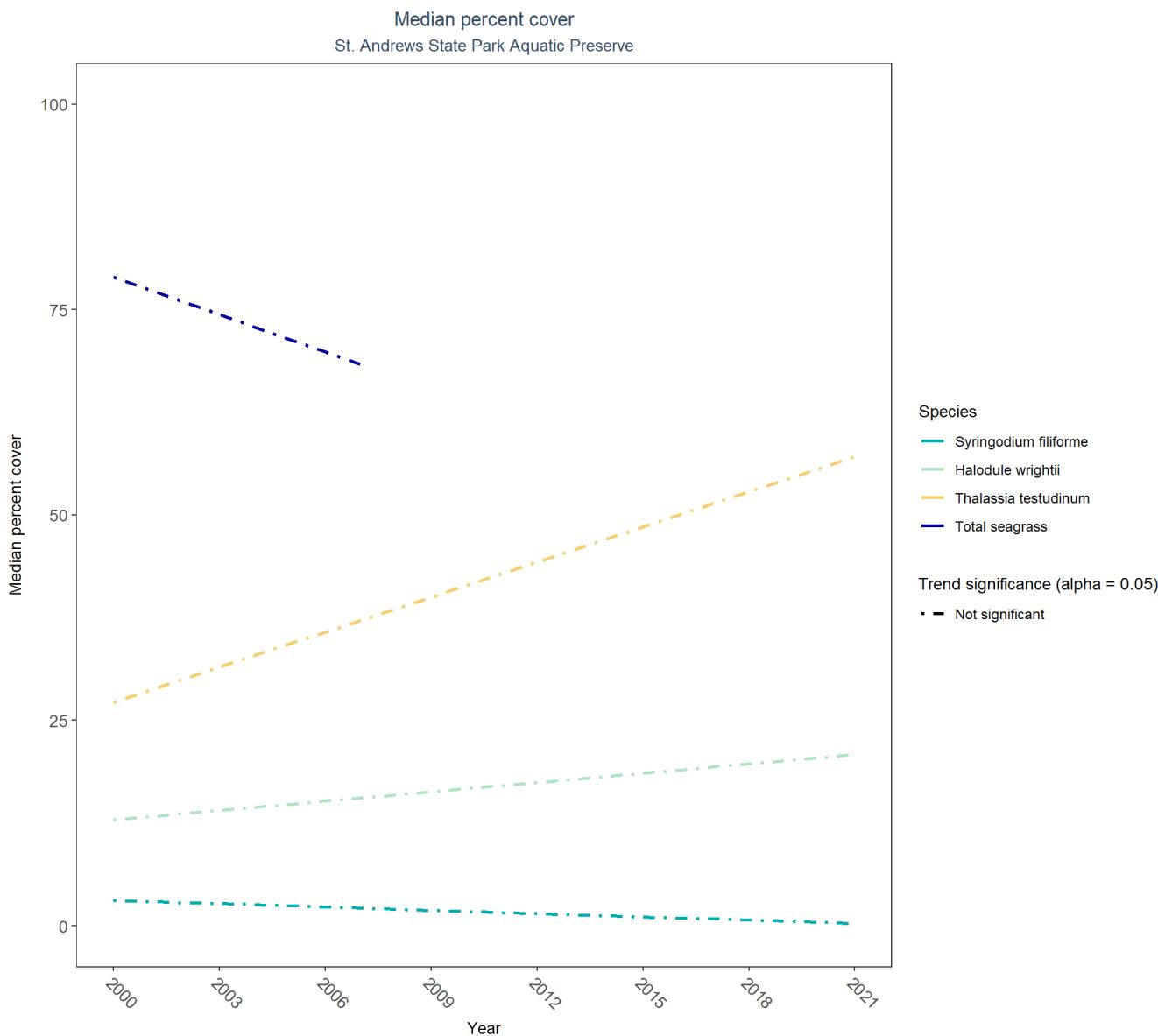
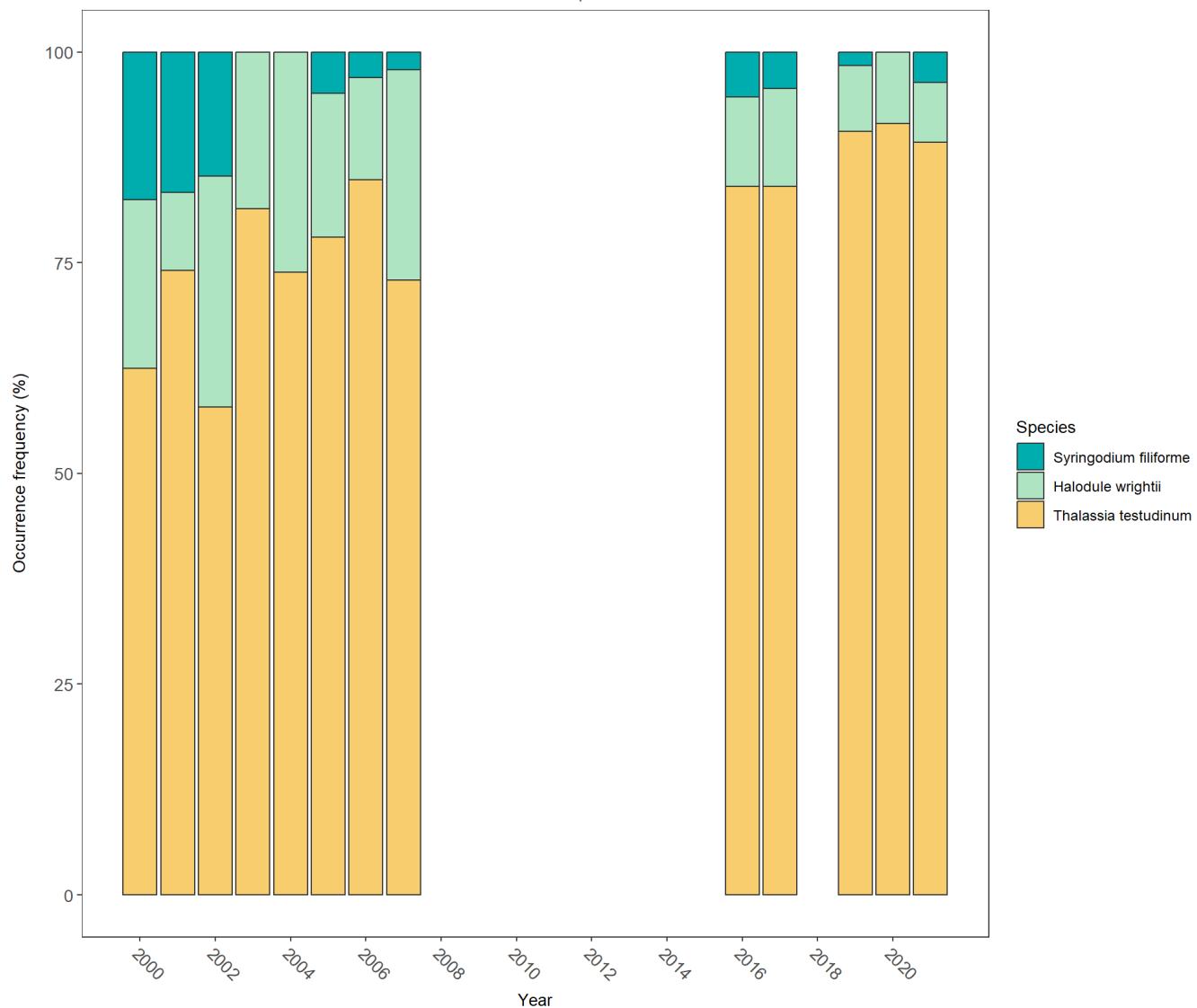
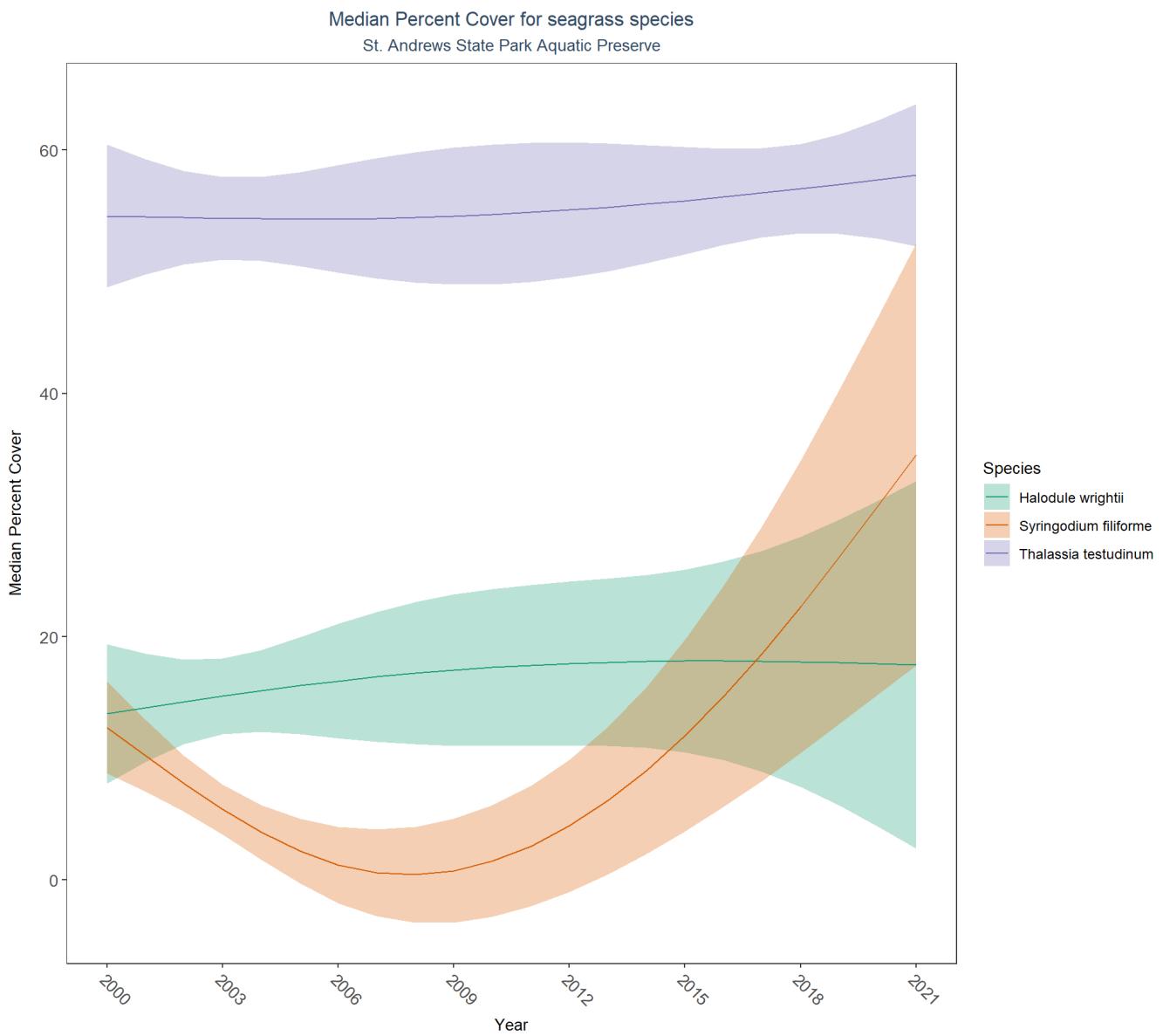


Table 29: Percent Cover Trend Analysis for St. Andrews State Park Aquatic Preserve

Species	CommonName	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae		Insufficient data to calculate trend				
Halodule wrightii	Shoal grass	No significant trend	2000 - 2021	10.6447	0.3782	0.4200
No grass In Quadrat		Model did not fit the available data	2016 - 2021			
Syringodium filiforme	Manatee grass	No significant trend	2000 - 2021	3.8889	-0.1330	0.8525
Thalassia testudinum	Turtle grass	No significant trend	2000 - 2021	18.6701	1.4234	0.1065
Total seagrass		No significant trend	2000 - 2007	88.1363	-1.5227	0.1502

Frequency of occurrence  
St. Andrews State Park Aquatic Preserve





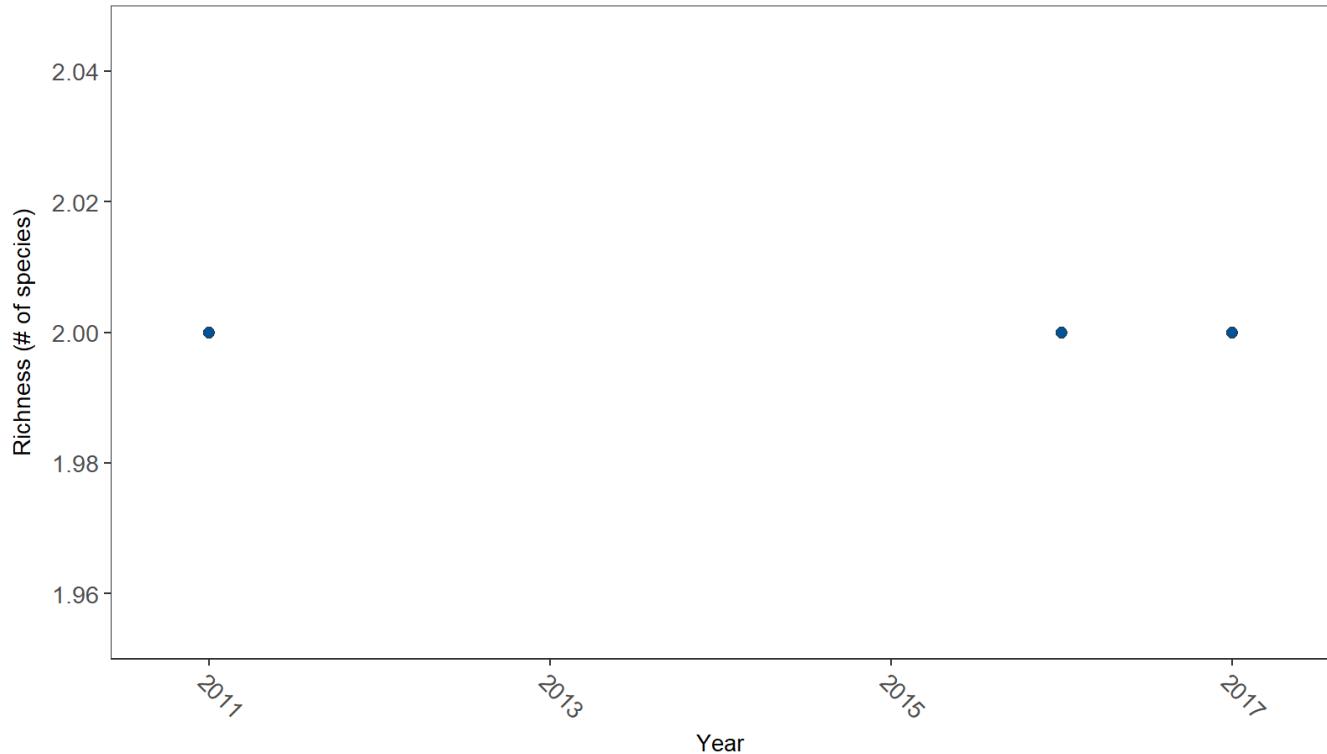
Generalized additive models for each species in St. Andrews State Park Aquatic Preserve. Species must have at least 10 years of data to be evaluated.

*Drift algae, Total seagrass, Attached algae, No grass in Quadrat, and Total SAV* are excluded from the analyses.

## Coral Reef

The data file used is: All\_CORAL\_Parameters-2024-Mar-28.txt

Grazers and Reef-Dependent Species Richness  
St. Andrews State Park Aquatic Preserve



N_Years	EarliestYear	LatestYear	N_Data	Min	Max	Median	Mean	StDev	Year_MinRichness	Year_MaxRichness
3	2011	2017	5	2	2	2	2	0	2011	2011