

St. Andrews State Park Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 03 September, 2024

Contents

Threshold Filtering	2
Value Qualifiers	3
Water Column	5
Seasonal Kendall-Tau Analysis	5
Water Quality - Discrete	5
Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality	6
Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality	9
Colored Dissolved Organic Matter - Discrete Water Quality	11
Dissolved Oxygen - Discrete Water Quality	14
Dissolved Oxygen Saturation - Discrete Water Quality	17
pH - Discrete Water Quality	19
Salinity - Discrete Water Quality	21
Secchi Depth - Discrete Water Quality	23
Total Nitrogen - Discrete Water Quality	25
Total Phosphorus - Discrete Water Quality	29
Total Suspended Solids - Discrete Water Quality	31
Turbidity - Discrete Water Quality	34
Water Temperature - Discrete Water Quality	37
Submerged Aquatic Vegetation	41
Parameters	41
Species	41
Notes	41

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:

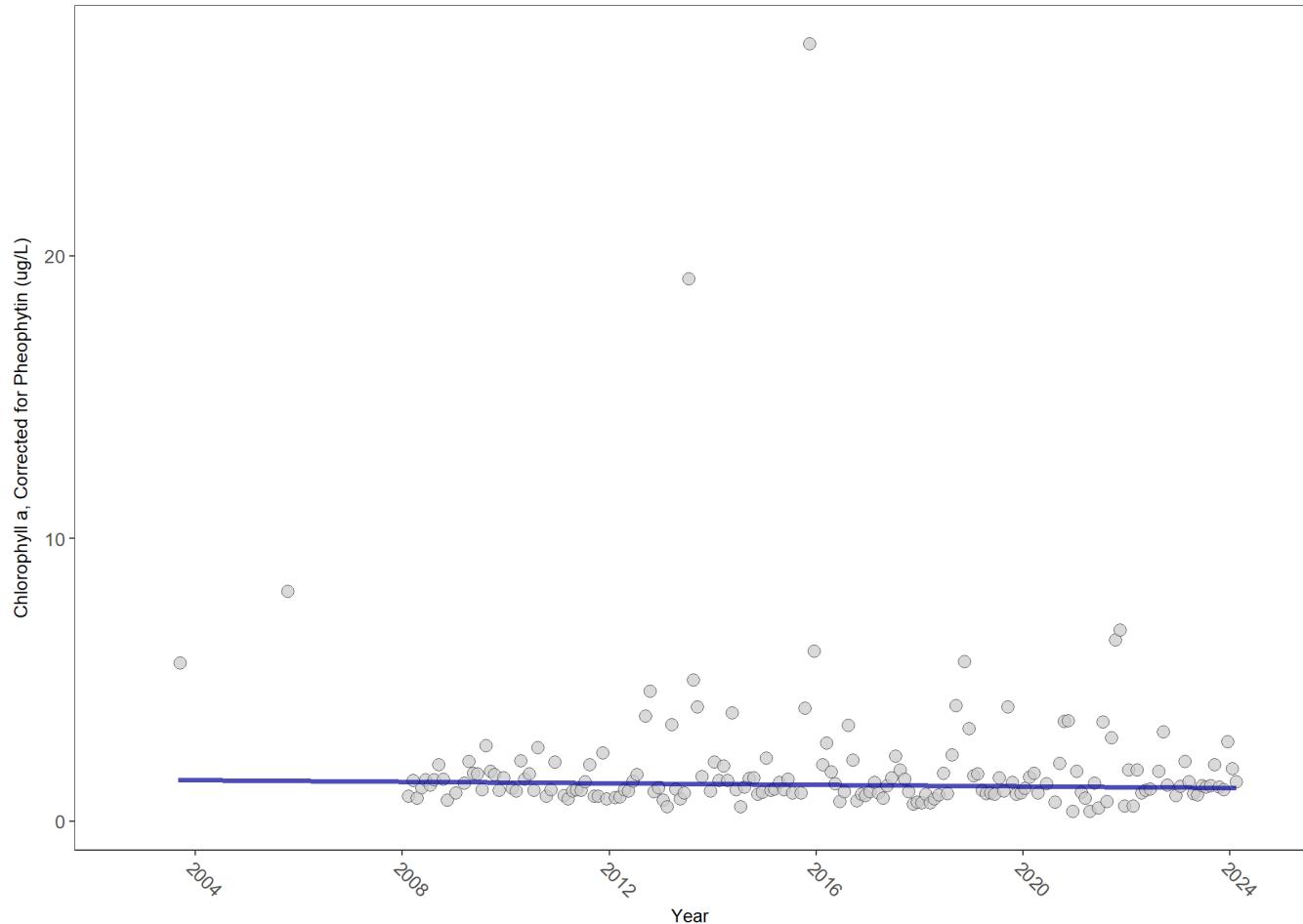
- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_pH-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Salinity-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Turbidity-2024-Jul-11.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2024-Jul-11.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

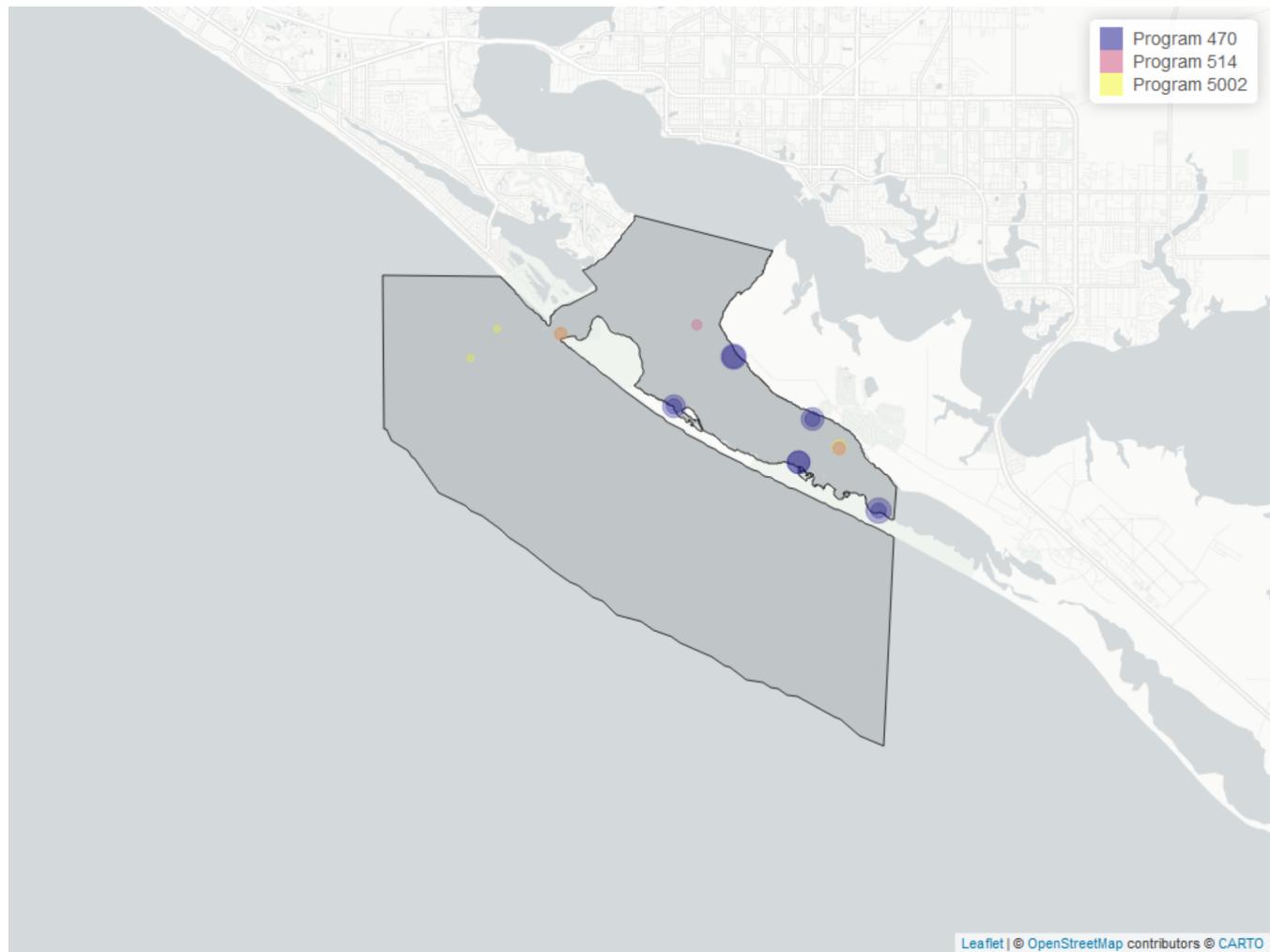


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	828	19	1.2	TRUE	-0.0703	0.1786	-0.01390476	1.475786	16.2895	0.1307	0

$p < 0.00005$ 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	691	2003	2024
5002	84	2010	2016
514	61	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	$perc_U$
2008	46	35	76.1	2	4.3		
2009	57	42	73.7				
2010	47	36	76.6				
2011	56	46	82.1			2	3.6
2012	55	35	63.6			2	3.6
2013	51	26	51.0			2	3.9
2014	80	35	43.8			2	2.5
2015	50	21	42.0			2	4.0
2016	60	34	56.7			3	5.0
2017	57	42	73.7			2	3.5
2018	54	31	57.4			4	7.4
2019	60	35	58.3			18	30.0
2020	45	22	48.9	2	4.4	15	33.3
2021	42	29	69.0	6	14.3	6	14.3
2022	35	20	57.1			11	31.4
2023	33	15	45.5			17	51.5
2024	4	4	100.0				

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

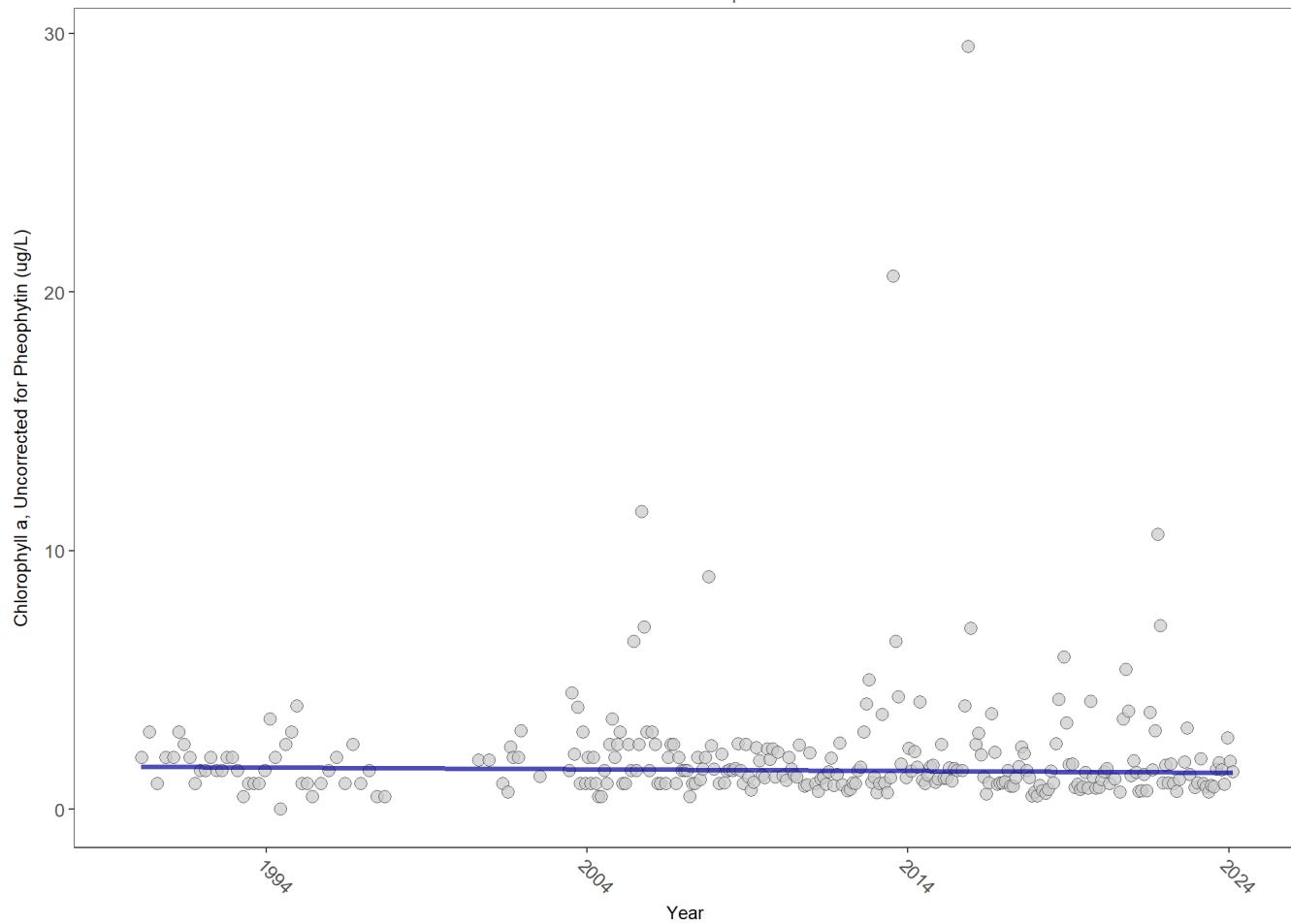
Programs containing Value Qualified data:

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

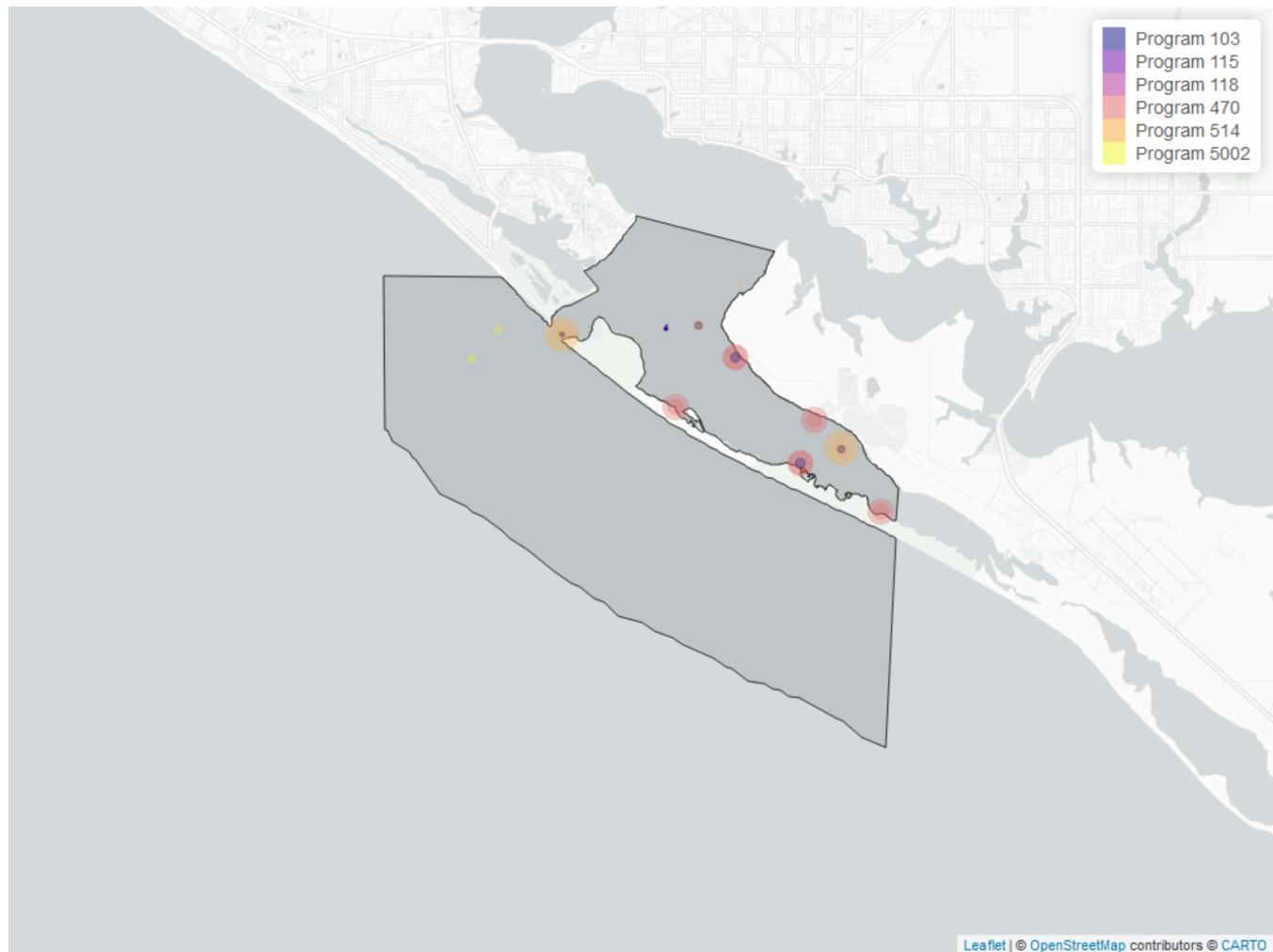


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1215	33	1.3	TRUE	-0.0875	0.0511	-0.007012987	1.656051	9.2698	0.597	0

$p < 0.00005$ 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, 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	766	2000	2024
514	420	1990	2023
103	64	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	$perc_U$
2008	71			2	2.8		
2009	79	24	30.4				
2010	59	20	33.9				
2011	70	39	55.7			2	2.9
2012	69	30	43.5			2	2.9
2013	51	15	29.4				
2014	80	14	17.5				
2015	50	12	24.0				
2016	62	25	40.3				
2017	68	28	41.2			2	2.9
2018	64	26	40.6			3	4.7
2019	69	32	46.4			12	17.4
2020	49	18	36.7	2	4.1	12	24.5
2021	95	13	13.7	6	6.3	12	12.6
2022	35	14	40.0			13	37.1
2023	33	13	39.4			13	39.4
2024	4	3	75.0				

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²Q

- Sample held beyond the accepted holding time ³U - Compound was analyzed for but not detected

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

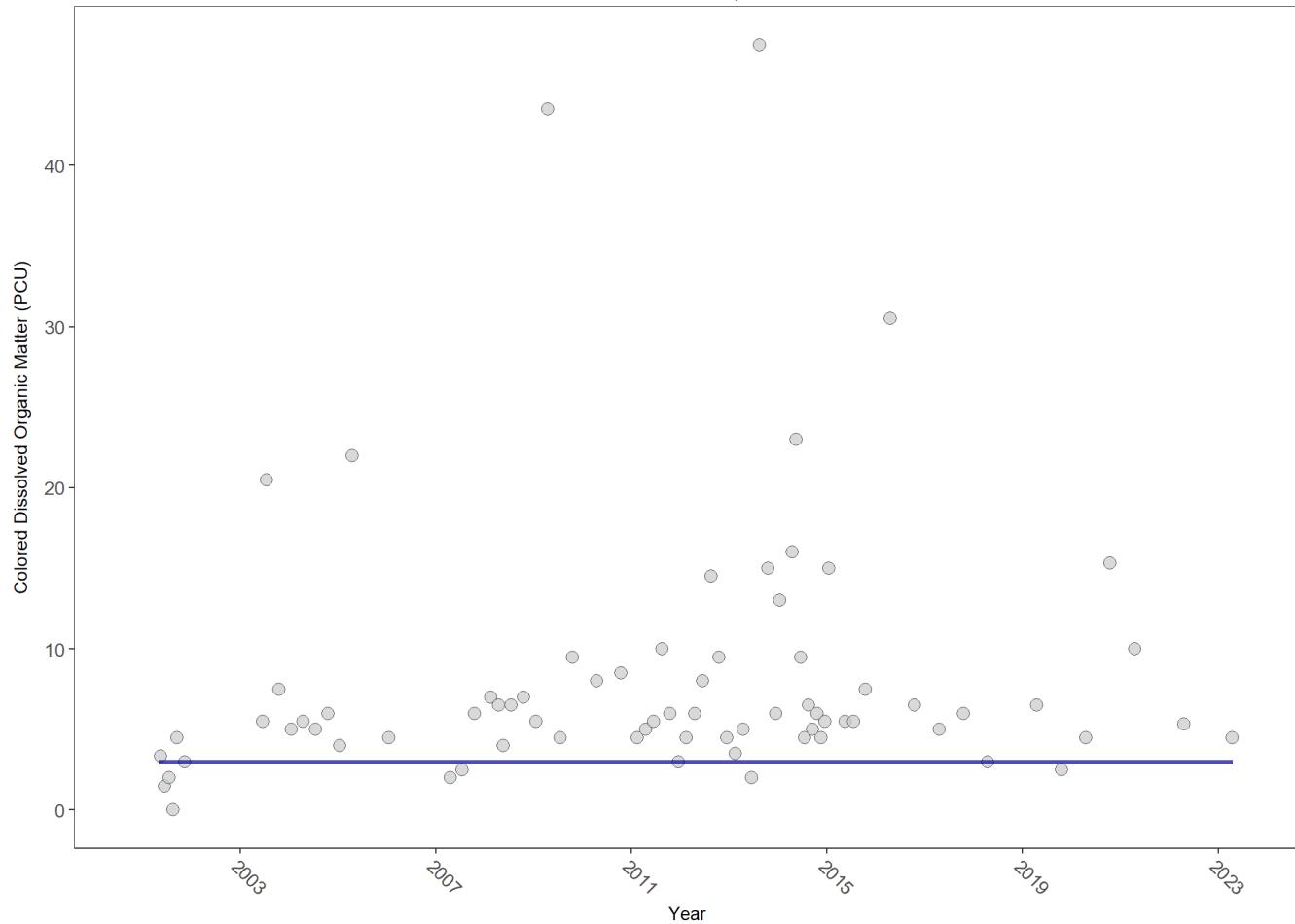
514 - Florida LAKEWATCH Program

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

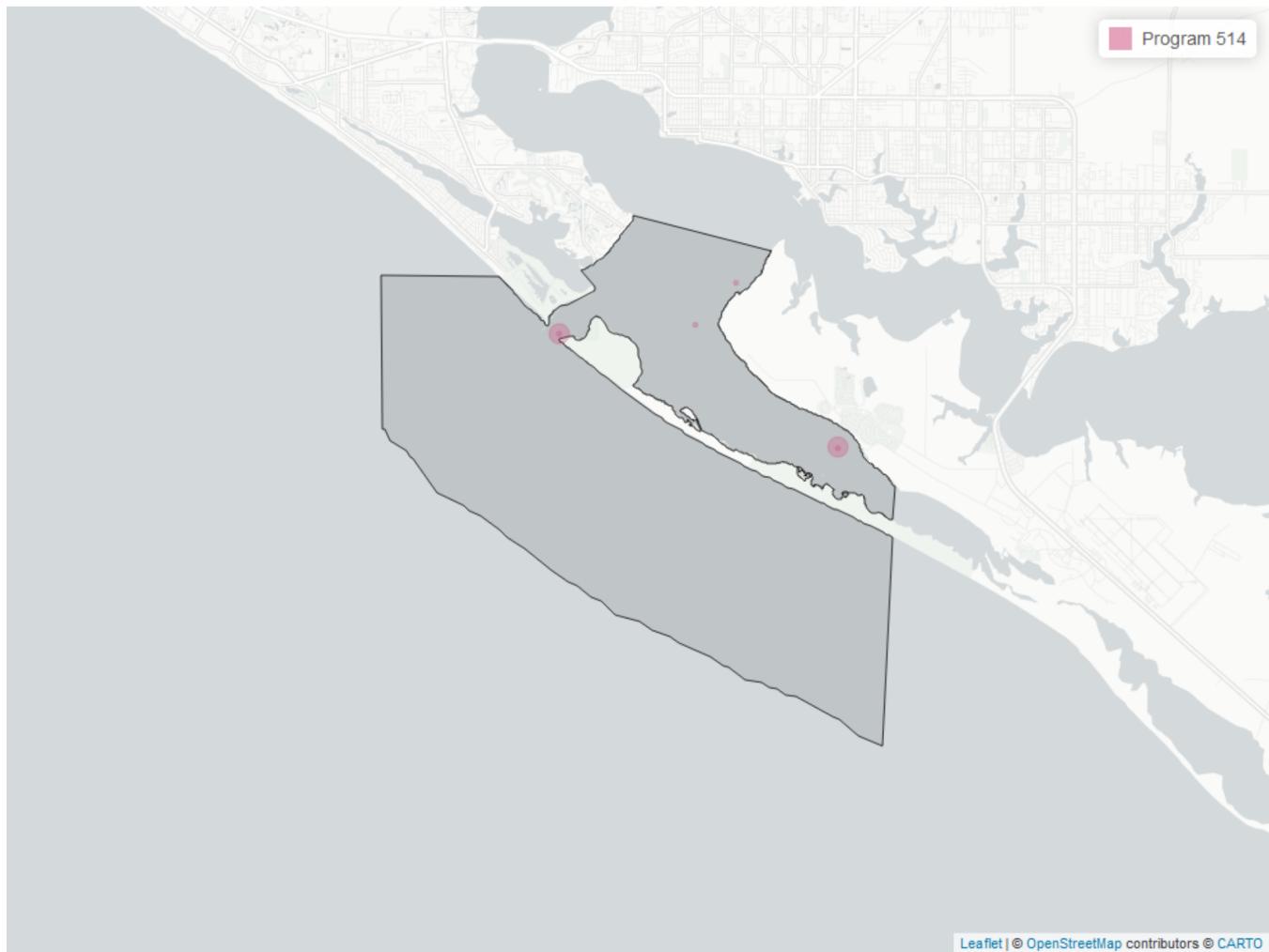
Colored Dissolved Organic Matter, Lab, All Depths
St. Andrews State Park Aquatic Preserve



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

Programs containing Value Qualified data:

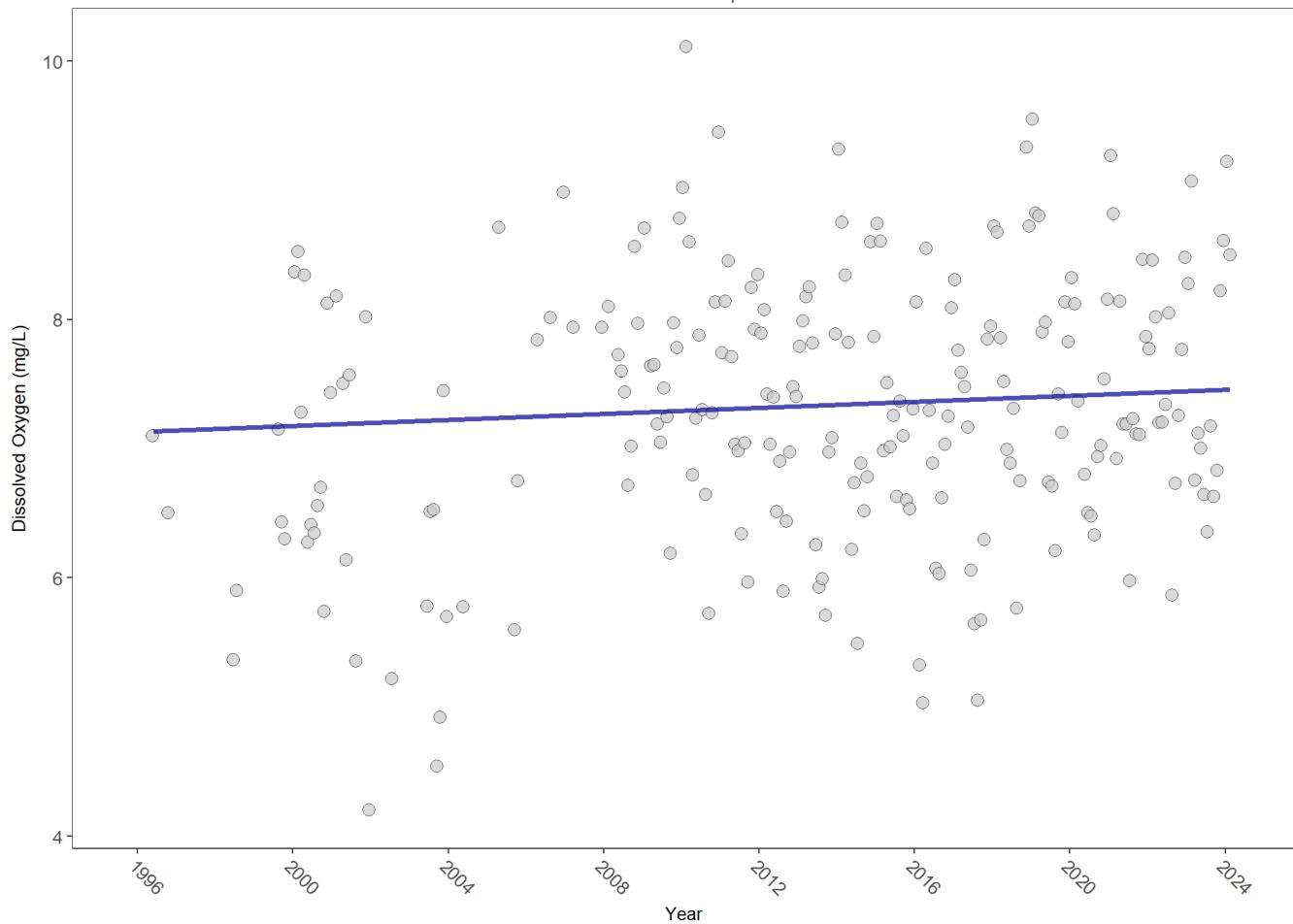
514 - Florida LAKEWATCH Program

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

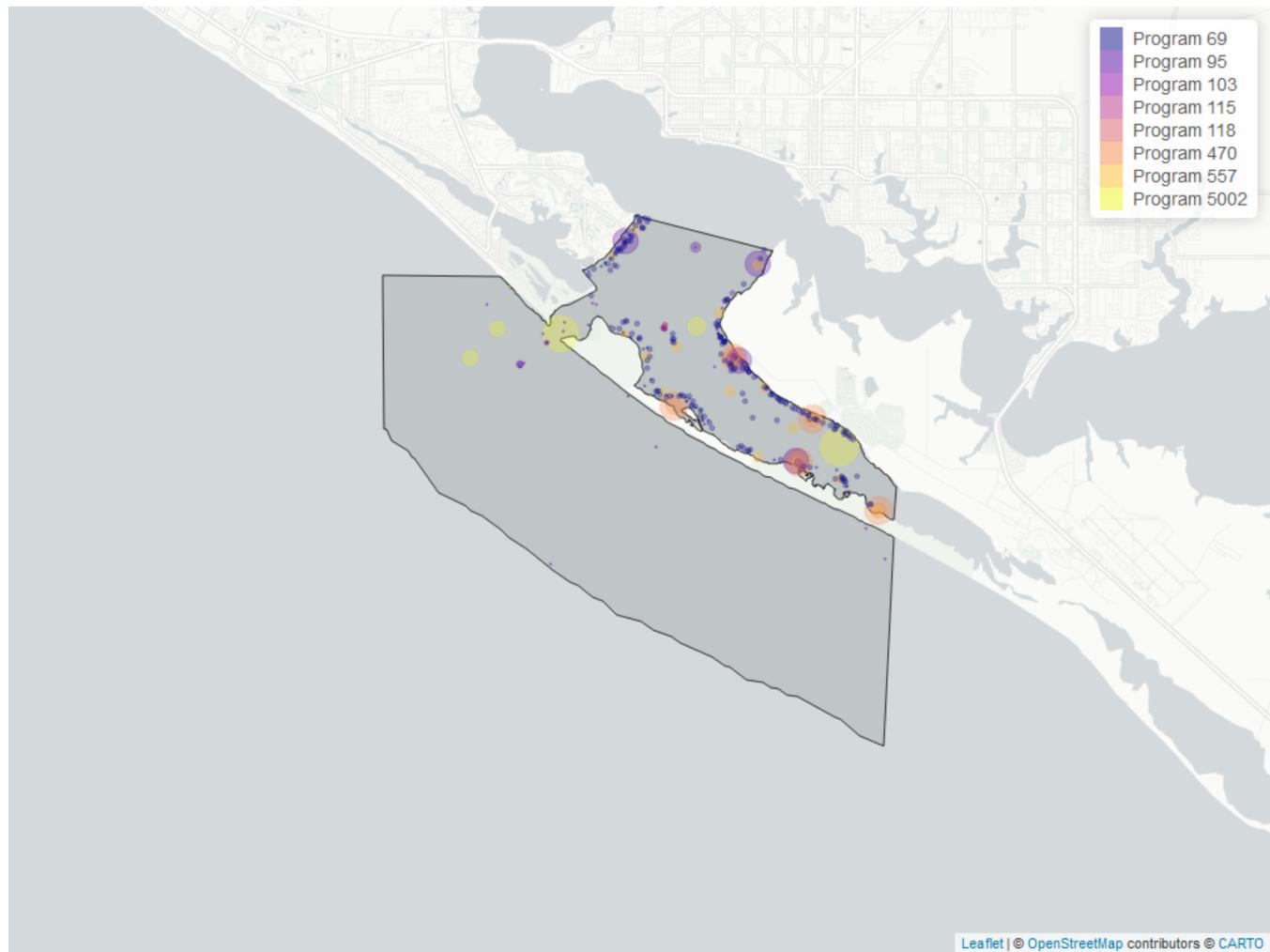


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2741	28	7.18	TRUE	0.0715	0.1222	0.01178571	7.127736	9.7455	0.5534	0

$p < 0.00005$ 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



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
470	808	2000	2024
69	651	2001	2022
5002	540	2005	2023
95	491	1996	2018
557	243	2016	2023
103	22	2003	2021
115	17	2000	2003
118	2	2000	2001

Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

557 - Central Panhandle Aquatic Preserves Seagrass Monitoring

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

115 - Environmental Monitoring Assessment Program

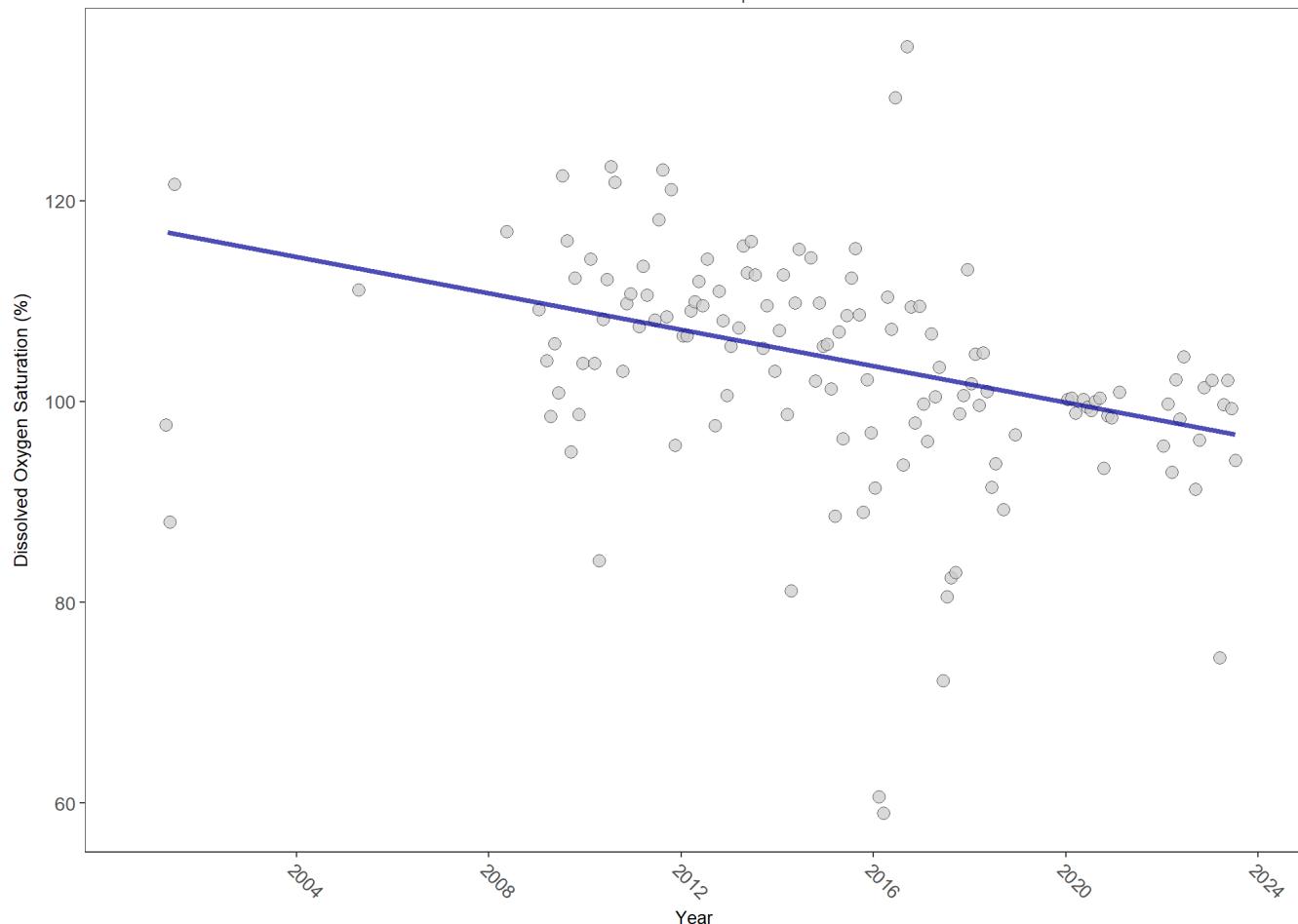
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment

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

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

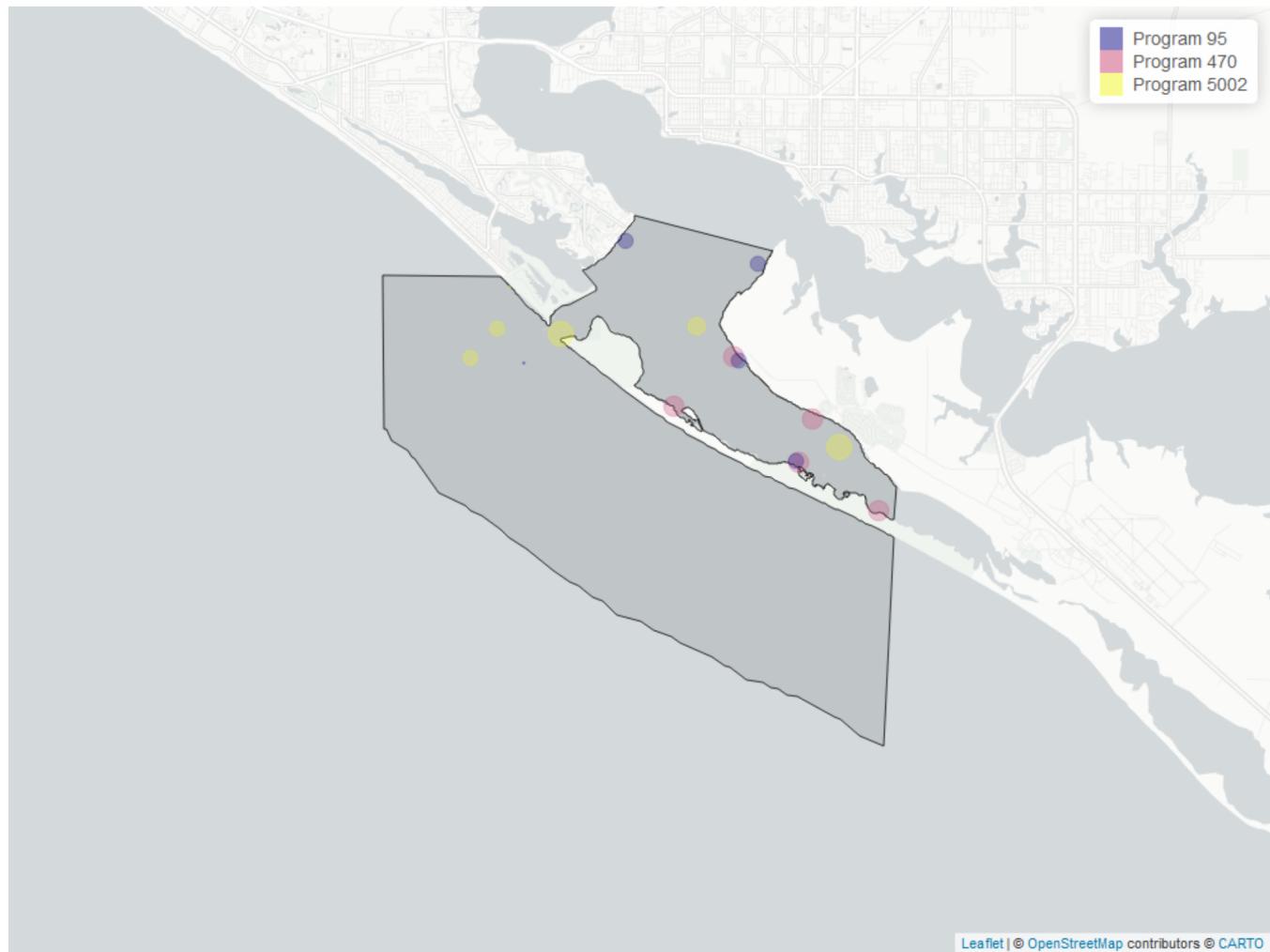


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	822	17	102.75	TRUE	-0.3588	0.0000	-0.9040404	117.1257	9.1843	0.6049	-1

$p < 0.00005$ 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 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
470	358	2001	2023
5002	314	2005	2023
95	161	2015	2018

Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

5002 - Florida STORET / WIN

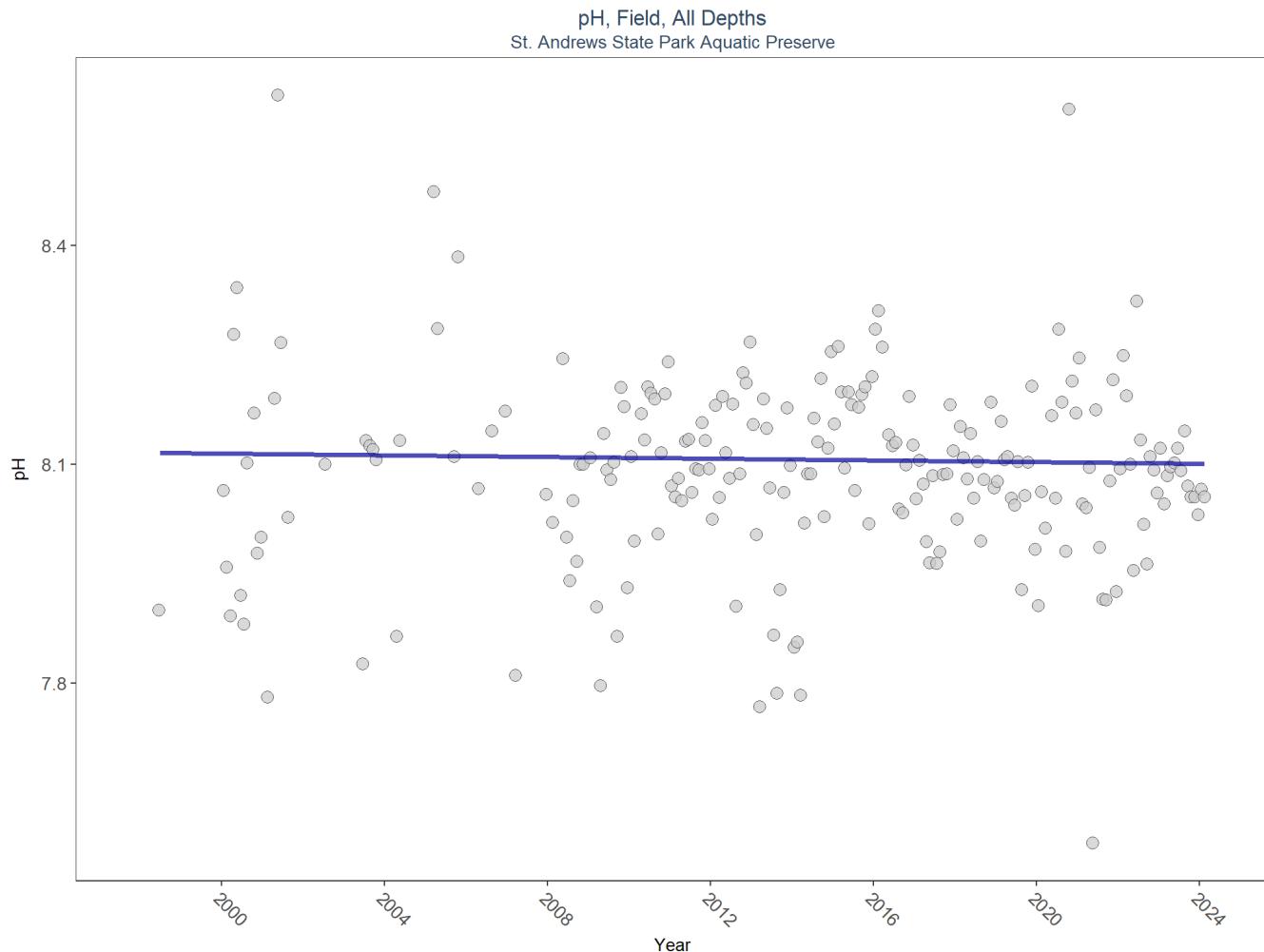
95 - Harmful Algal Bloom Marine Observation Network

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.

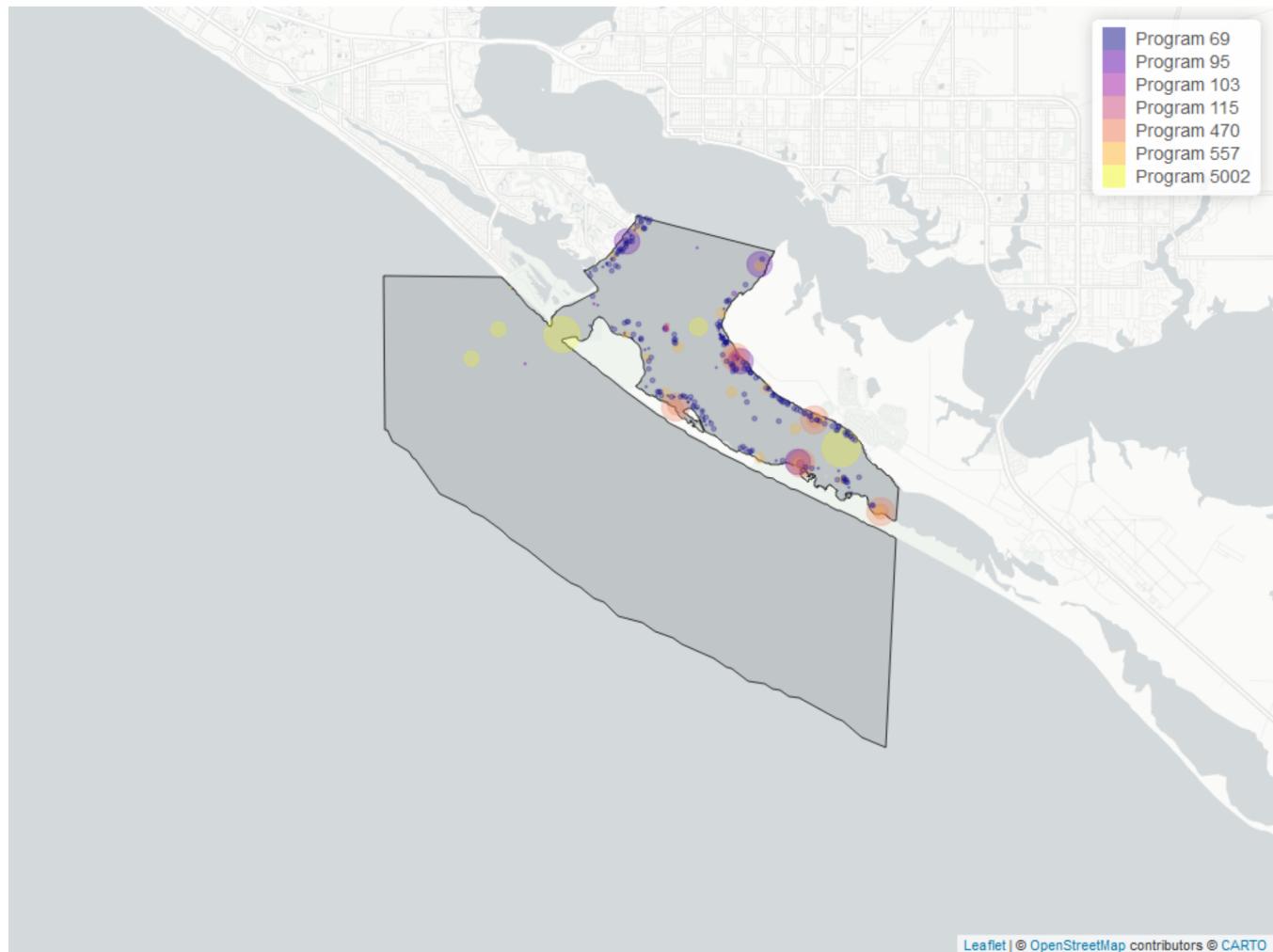
Seasonal Kendall-Tau Trend Analysis



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
470	831	2000	2024
69	629	2001	2022
5002	540	2005	2023
95	435	1998	2018
557	234	2016	2023
103	20	2021	2021
115	17	2000	2003

Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring
69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

557 - Central Panhandle Aquatic Preserves Seagrass Monitoring

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

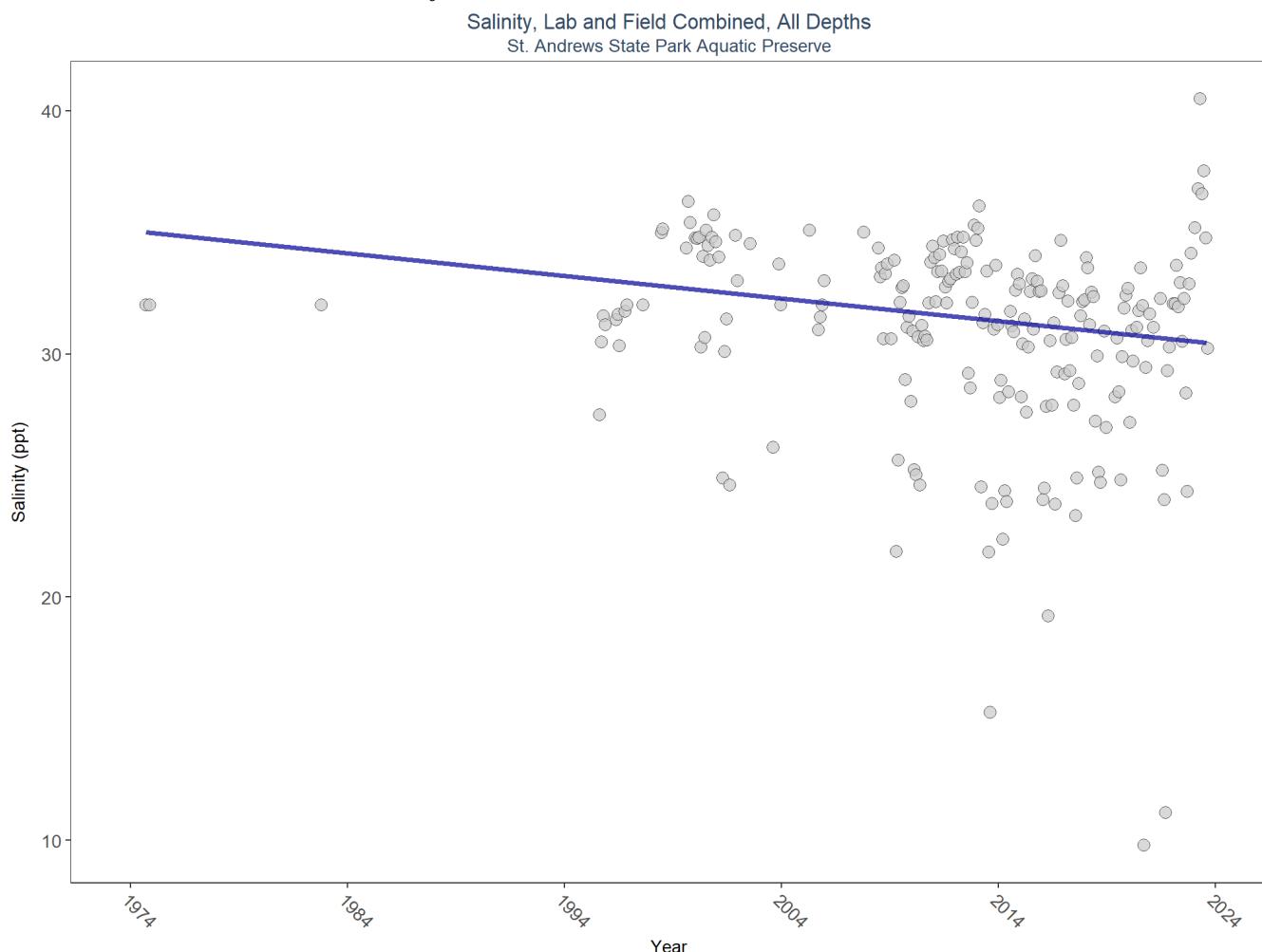
115 - Environmental Monitoring Assessment Program

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.

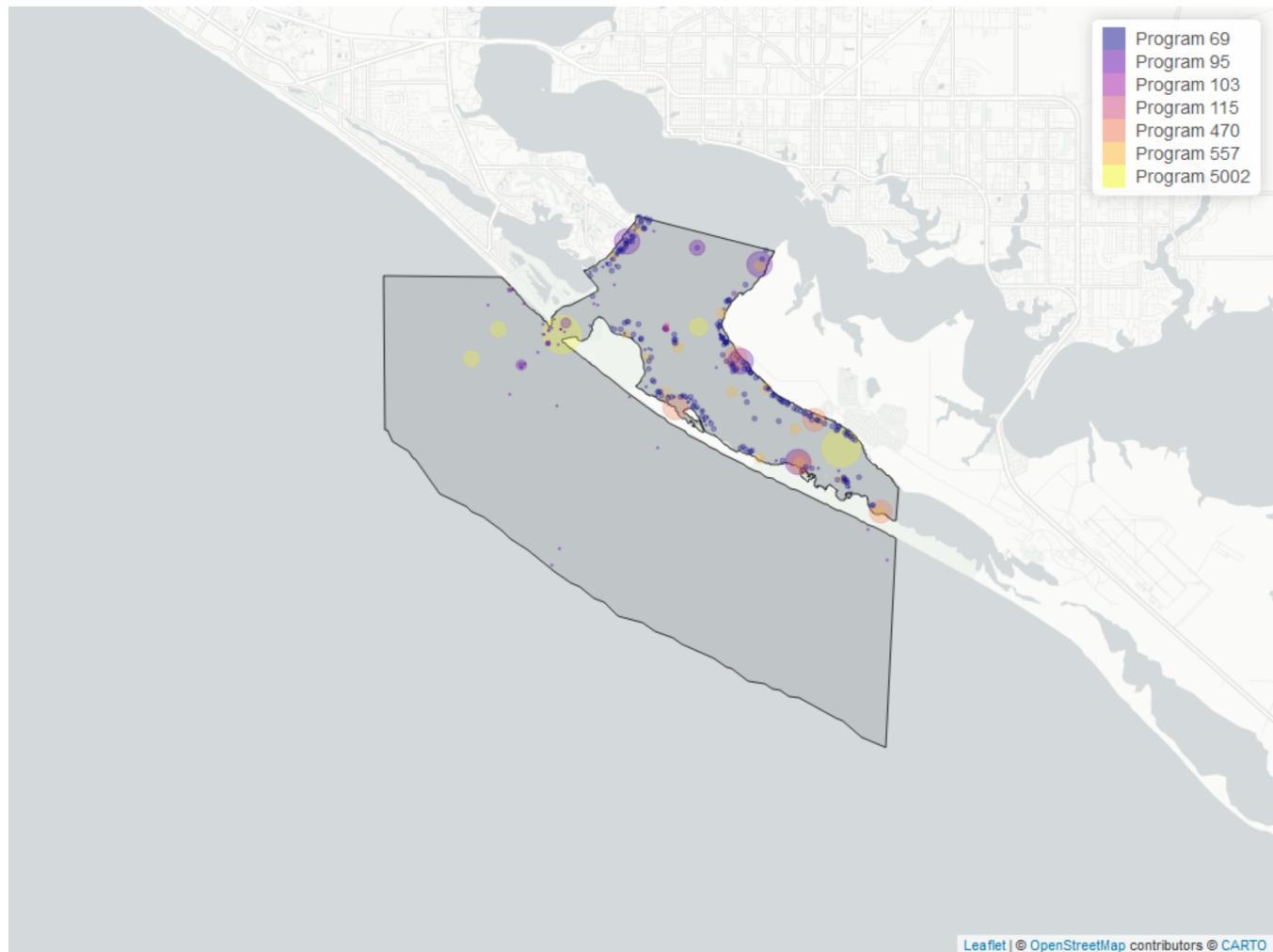
Seasonal Kendall-Tau Trend Analysis



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
69	652	2001	2022
95	593	1974	2018
5002	547	2005	2023
470	445	2000	2018
557	229	2016	2023
115	17	2000	2003
103	3	2003	2003

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

95 - Harmful Algal Bloom Marine Observation Network

5002 - Florida STORET / WIN

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

557 - Central Panhandle Aquatic Preserves Seagrass Monitoring

115 - Environmental Monitoring Assessment Program

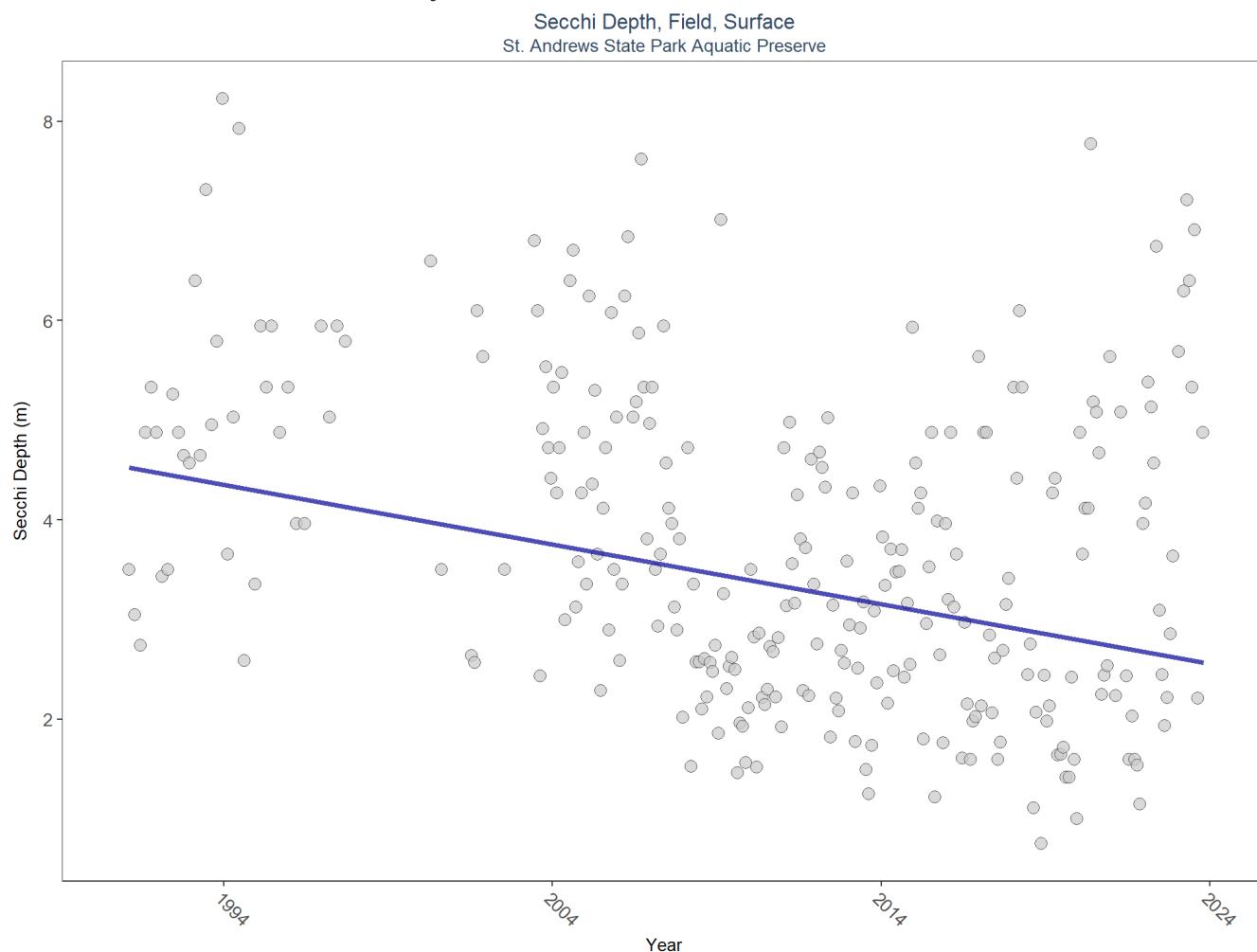
103 - EPA STOrage and RETrieval Data Warehouse (STORET)

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

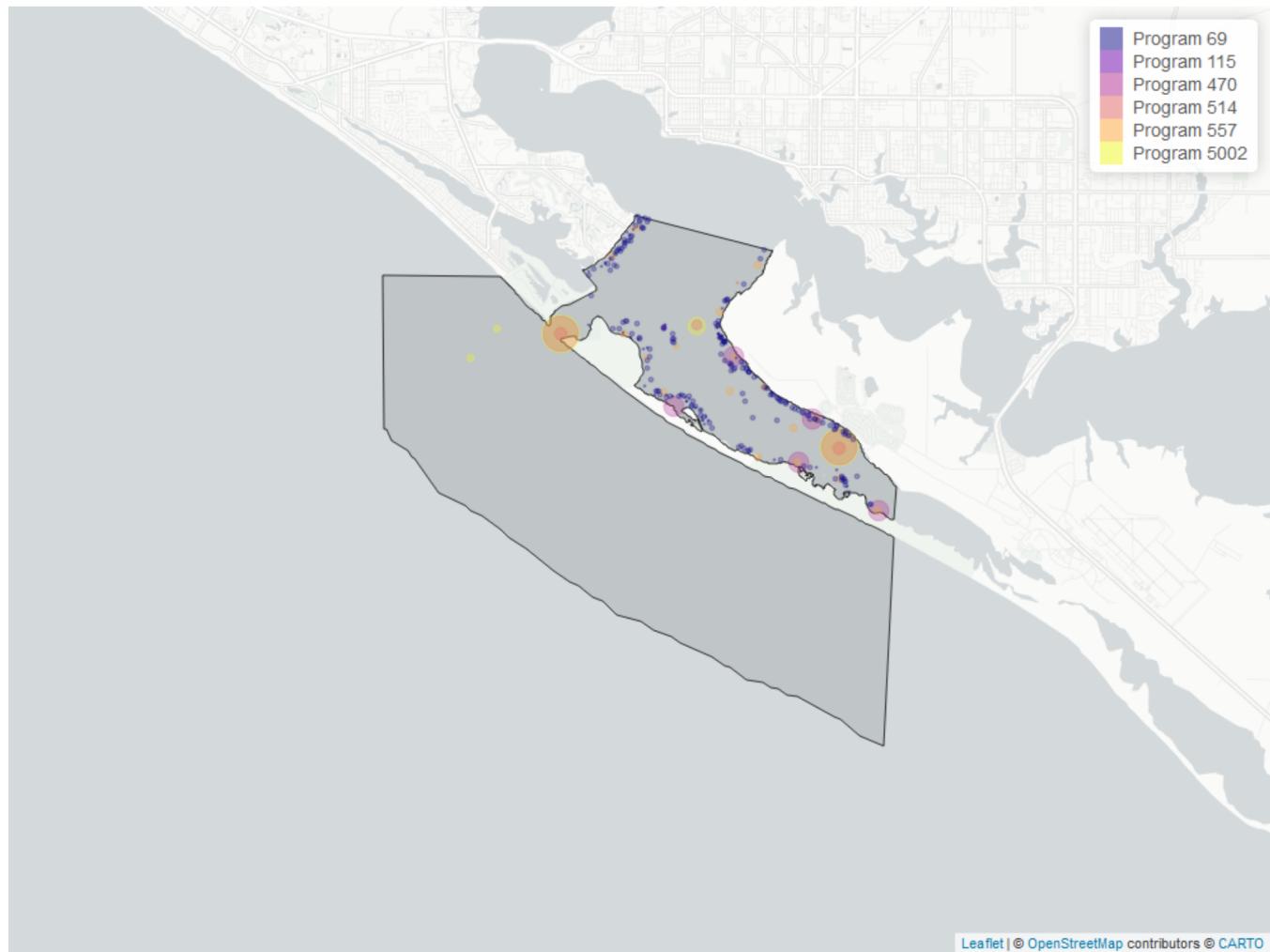


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	2085	31	2.43843	TRUE	-0.2095	0.0000	-0.06000199	4.53519	28.623	0.0026	-1

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
69	651	2001	2022
5002	504	2010	2023
514	456	1991	2023
470	356	2000	2015
557	116	2016	2023
115	3	2000	2002

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH 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	$perc_S$
2020	94	2	2.1
2021	78	1	1.3
2022	125	1	0.8

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.

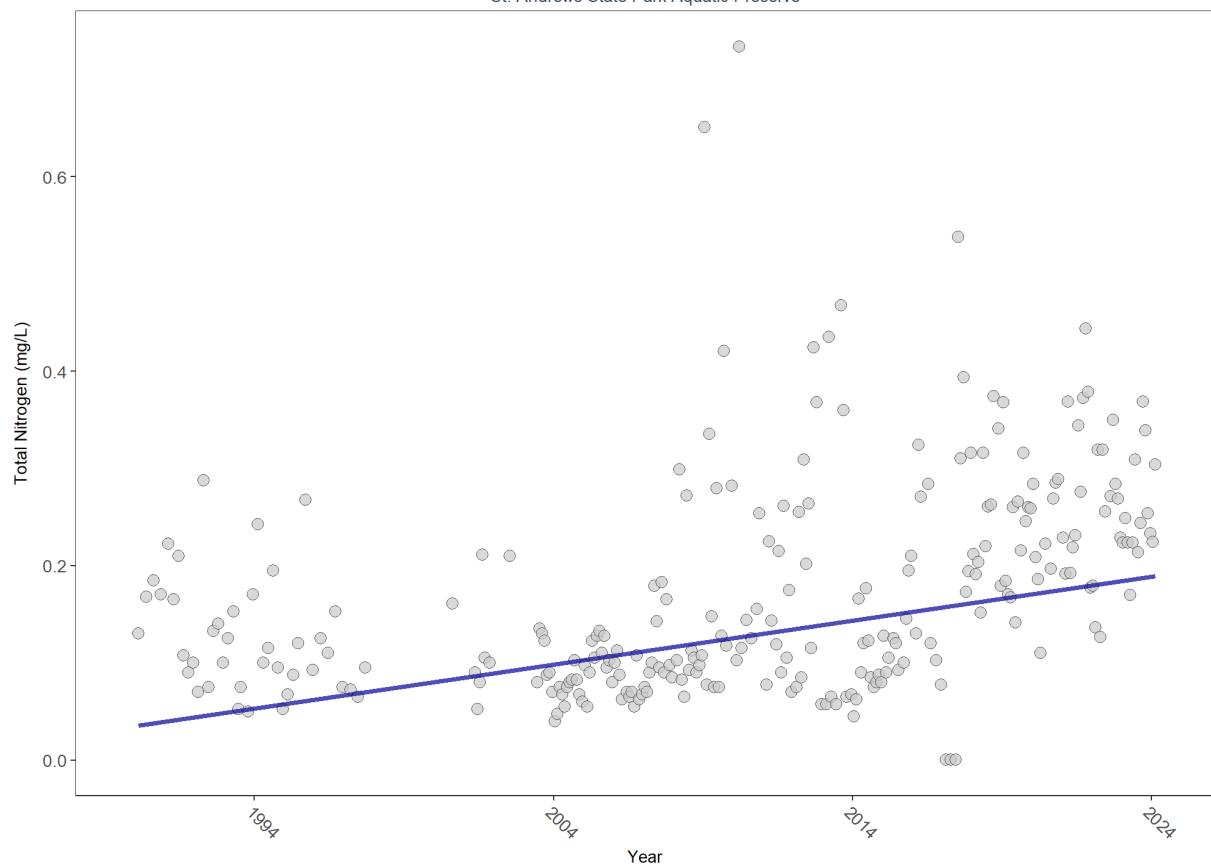
- 1) $TN = TKN + NO_3O_2;$
- 2) $TN = TKN + NO_3 + NO_2;$
- 3) $TN = ORGN + NH_4 + NO_3O_2;$
- 4) $TN = ORGN + NH_4 + NO_2 + NO_3;$
- 5) $TN = TKN + NO_3;$
- 6) $TN = ORGN + NH_4 + NO_3;$

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_QAACFlagCode = “1Q”
 - SEACAR_QAAC>Description = “SEACAR Calculated”

Seasonal Kendall-Tau Trend Analysis

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

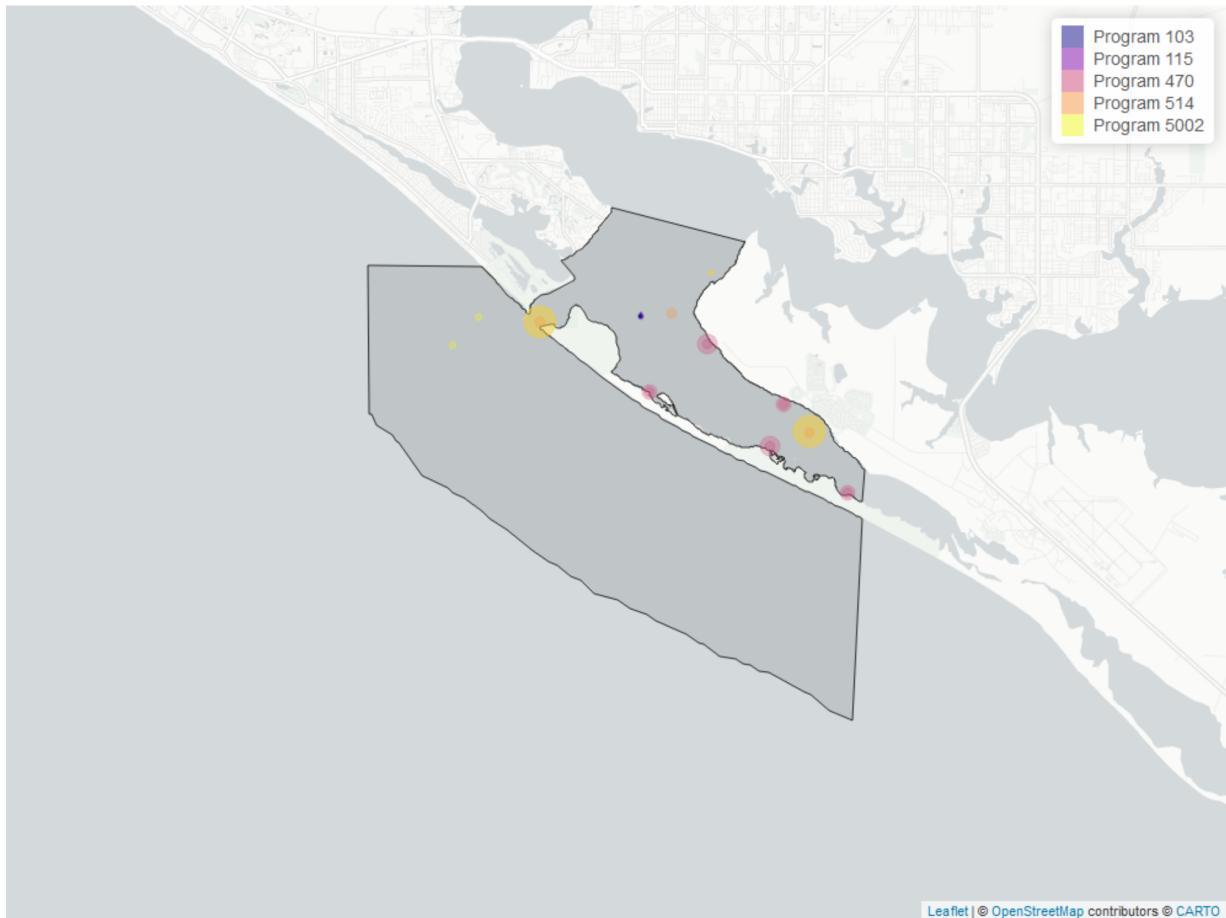


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1096	33	0.17	TRUE	0.3365	0.0000	0.004512458	0.03523233	6.4599	0.841	1

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
514	404	1990	2023
5002	350	1990	2016
470	326	2007	2024
103	12	2000	2003
115	4	2000	2003

Program names:

514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

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	55	1	1.8	4	7.3
2016	33	1	3.0		
2020	39			2	5.1

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

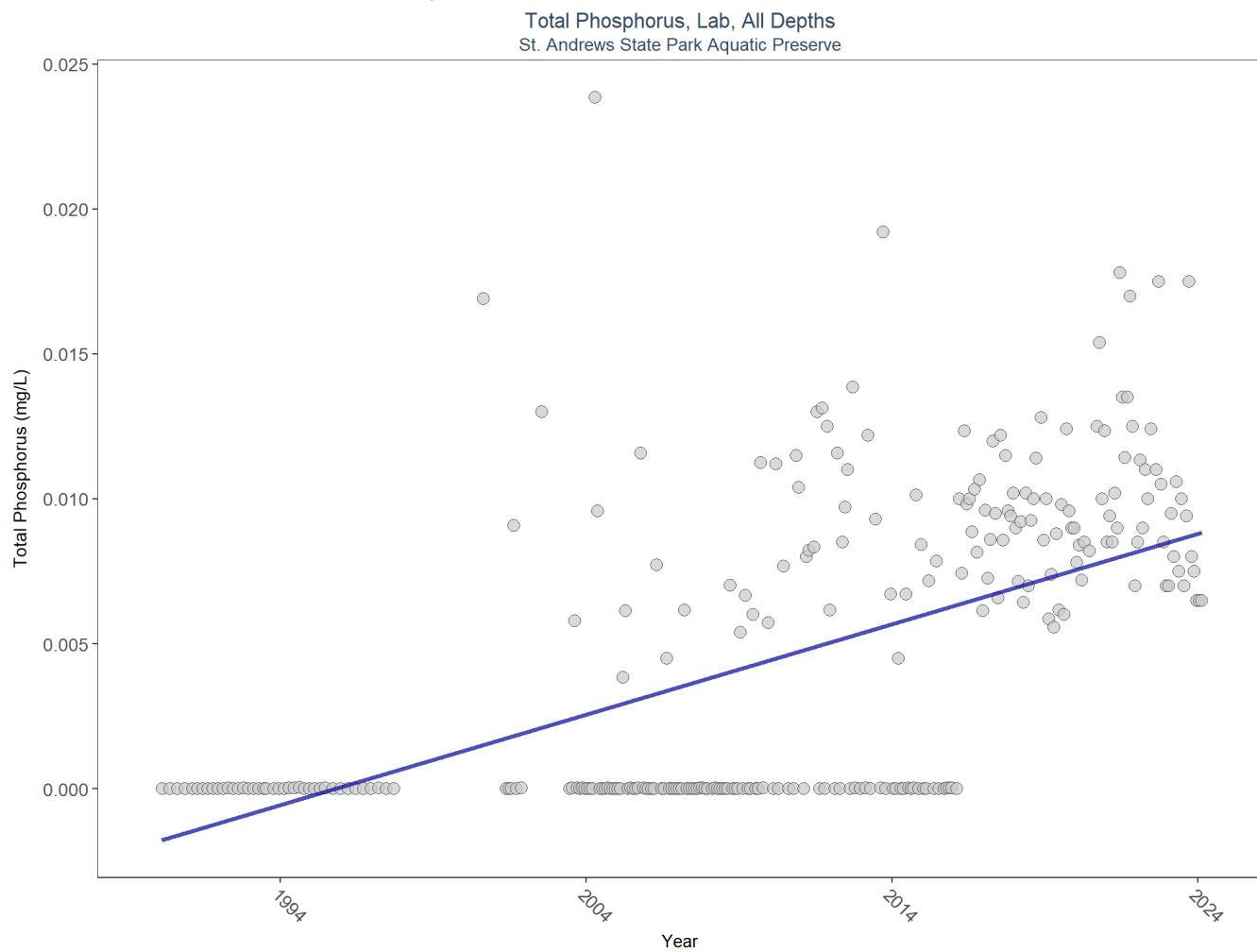
Programs containing Value Qualified data:

514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

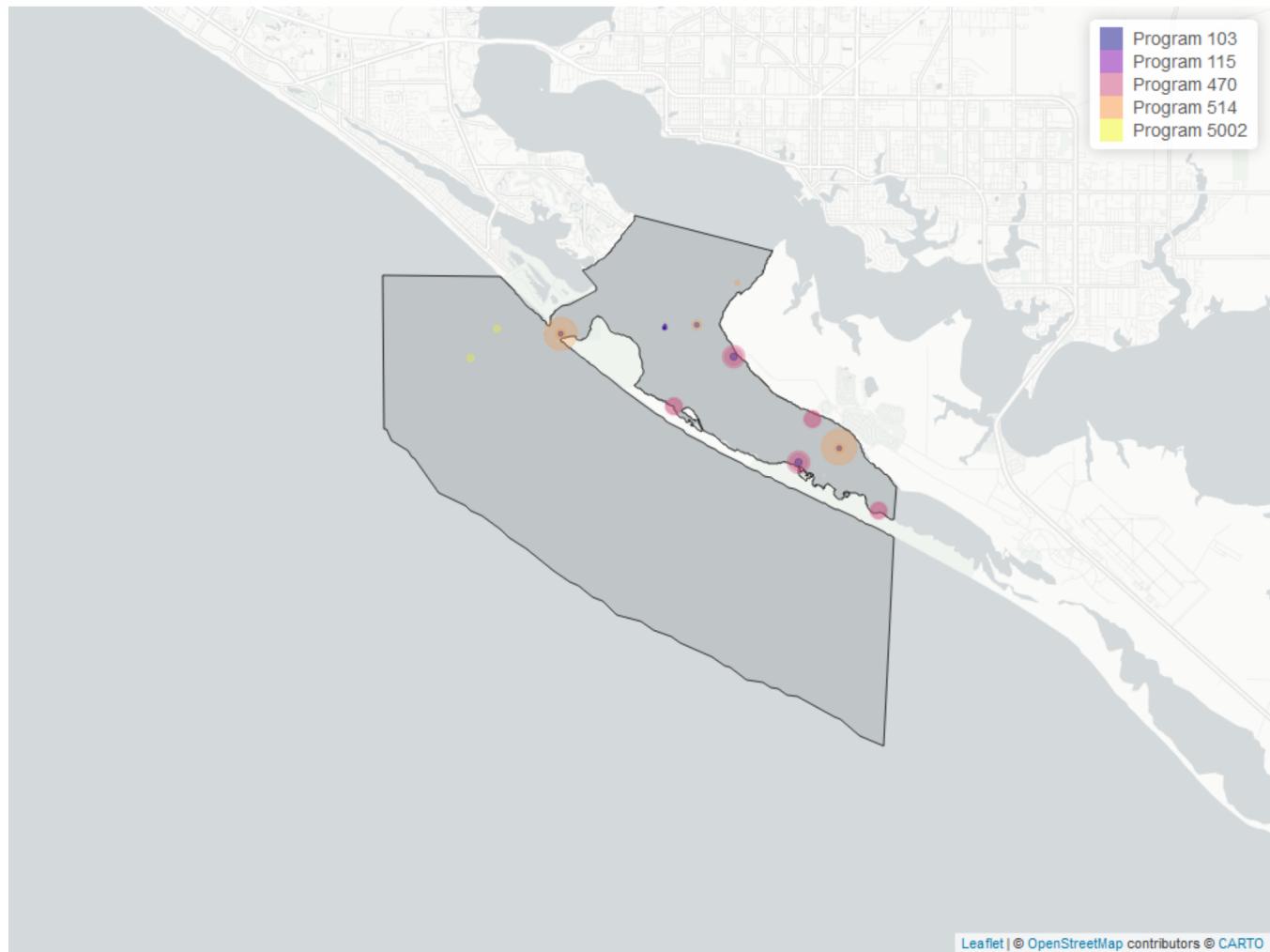


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	941	33	0.008	TRUE	0.458	0.0000	0.0003125269	-0.001818907	9.5545	0.5708	1

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	492	2004	2024
514	411	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	34	8	23.5				
2005	39	15	38.5				
2006	33	11	33.3				
2007	28	4	14.3				
2008	22	1	4.6				
2009	39	18	46.1				
2010	26	16	61.5				
2011	43	29	67.4			2	4.7
2012	40	9	22.5				
2013	31	4	12.9				
2014	45	7	15.6				
2015	28	6	21.4				
2016	64	19	29.7				
2017	71	31	43.7				
2018	63	28	44.4				
2019	69	43	62.3				
2020	42	25	59.5	2	4.8	2	4.8
2021	71	23	32.4				
2022	32	17	53.1				
2023	30	27	90.0				
2024	4	4	100.0				

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

Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

514 - Florida LAKEWATCH Program

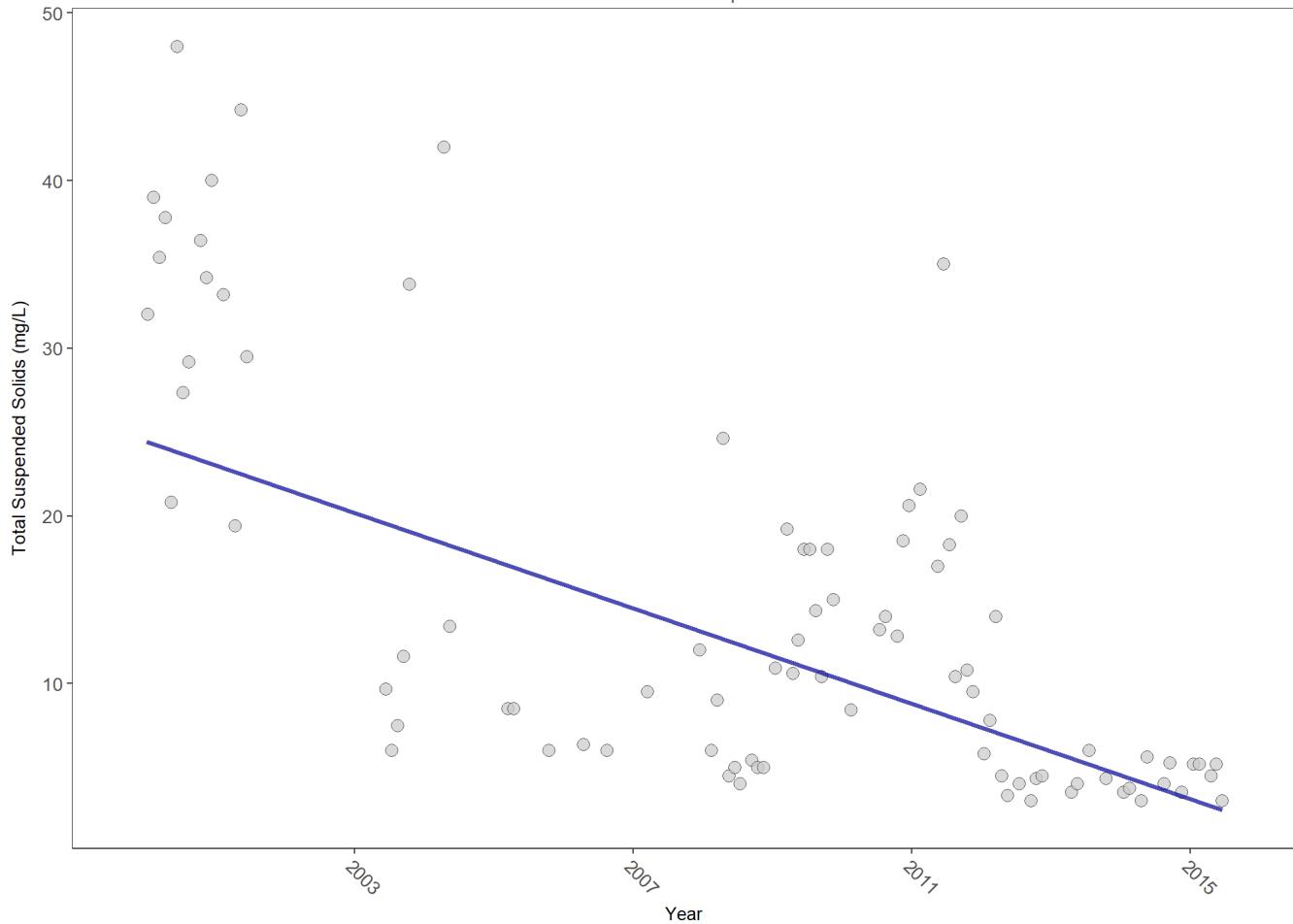
5002 - Florida STORET / WIN

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

Total Suspended Solids, Lab and Field Combined, All Depths
St. Andrews State Park Aquatic Preserve

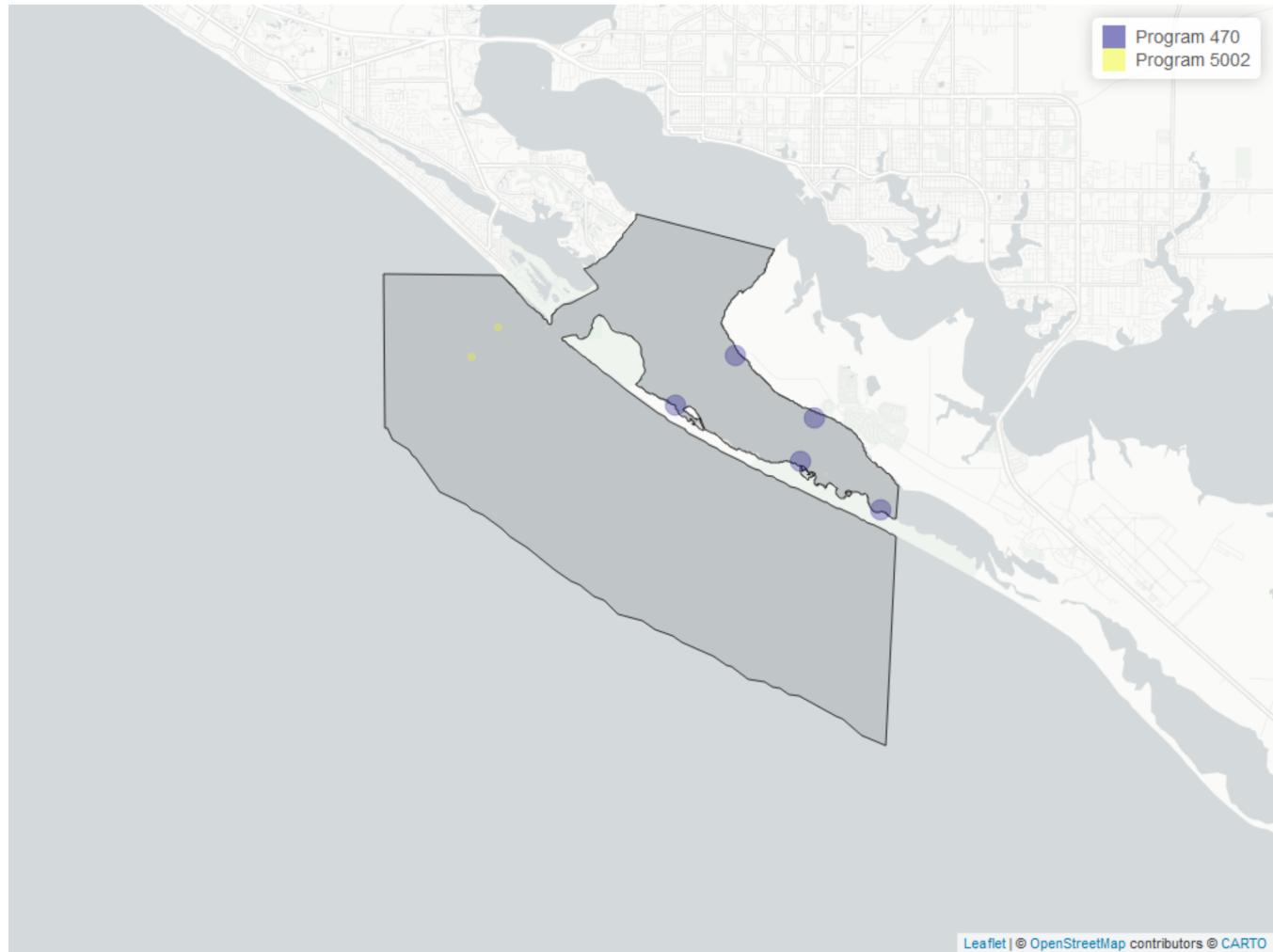


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	339	15	13	TRUE	-0.4759	0.0000	-1.425417	24.465	8.3563	0.6811	-2

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	321	2000	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_{\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 23: Value Qualifiers for Total Suspended Solids

<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>
2008	21	2	9.5	2	9.5		
2009	54	34	63.0				
2010	27	17	63.0				
2011	33	6	18.2				
2012	35	26	74.3			6	17.1
2013	8	8	100.0				
2014	22	22	100.0				
2015	21	21	100.0				

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

Programs containing Value Qualified data:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

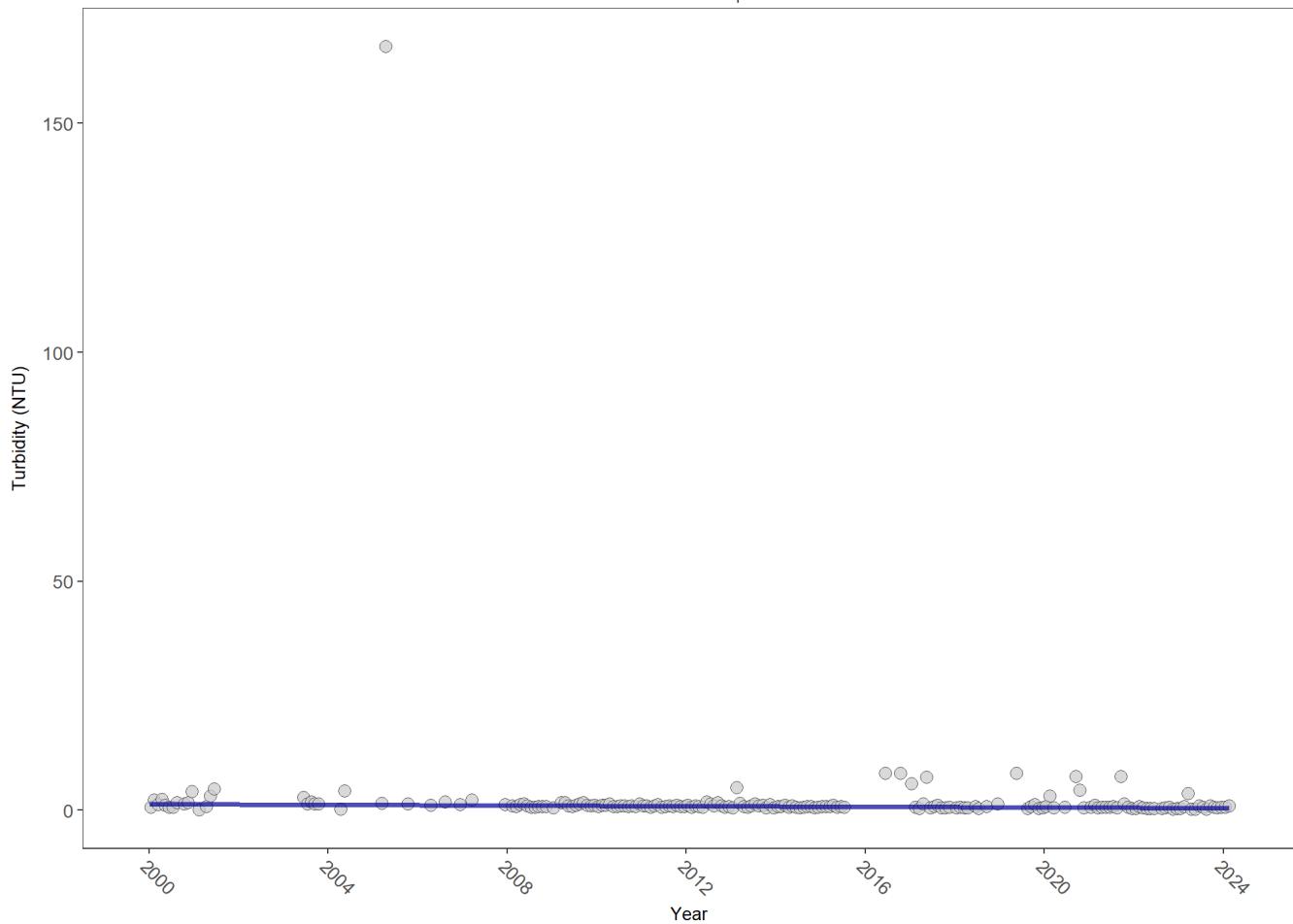
5002 - Florida STORET / WIN

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

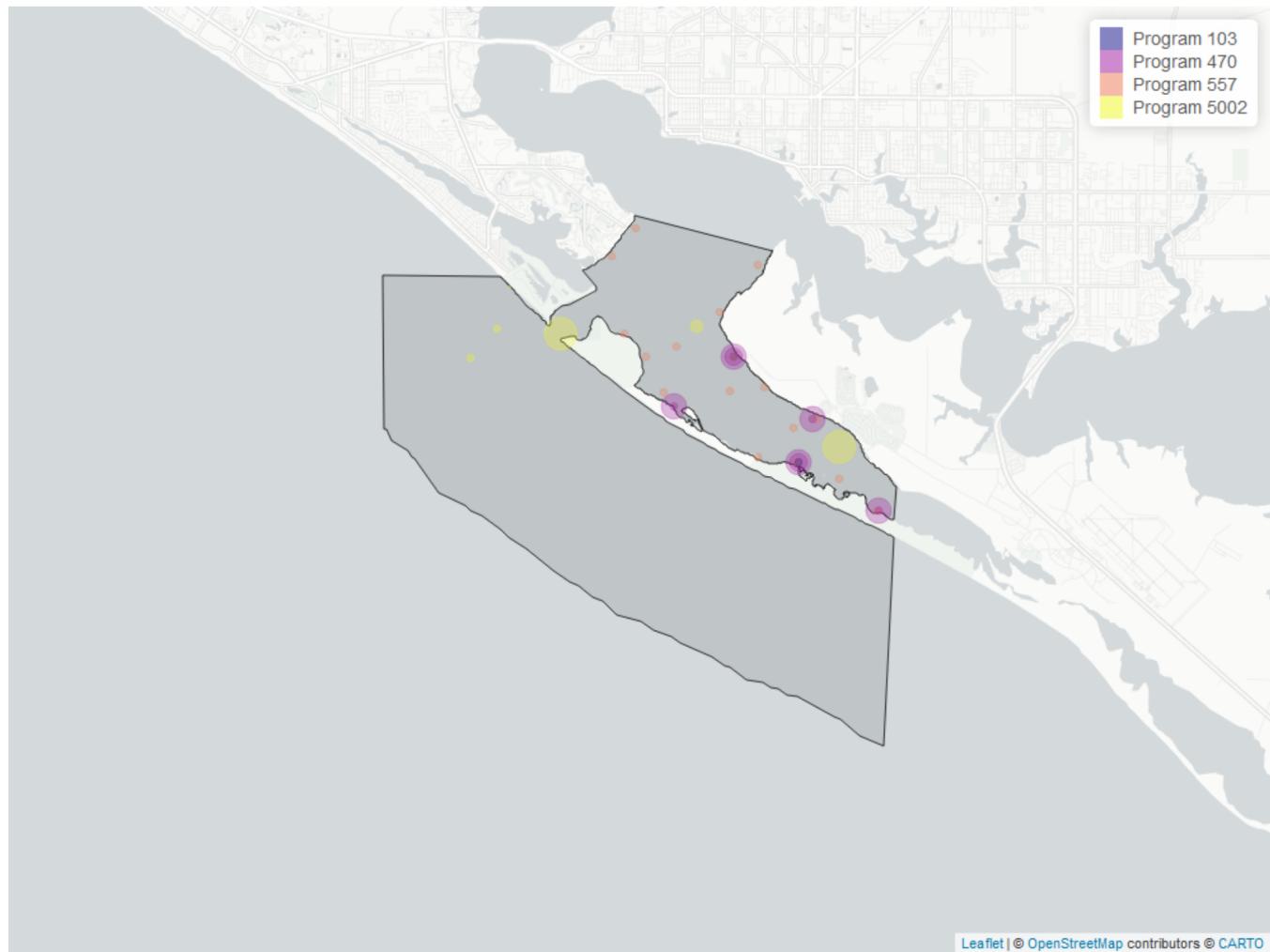


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1265	24	0.8	TRUE	-0.34	0.0000	-0.03394444	1.285919	12.9939	0.2937	-1

$p < 0.00005$ 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
470	660	2000	2024
5002	398	2005	2023
557	188	2016	2023
103	20	2021	2021

Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring

5002 - Florida STORET / WIN

557 - Central Panhandle Aquatic Preserves Seagrass 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>
2004	10			5	50.0
2008	46			5	10.9
2022	80	18	22.5		
2023	90	23	25.6		
2024	4	4	100.0		

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

Programs containing Value Qualified data:

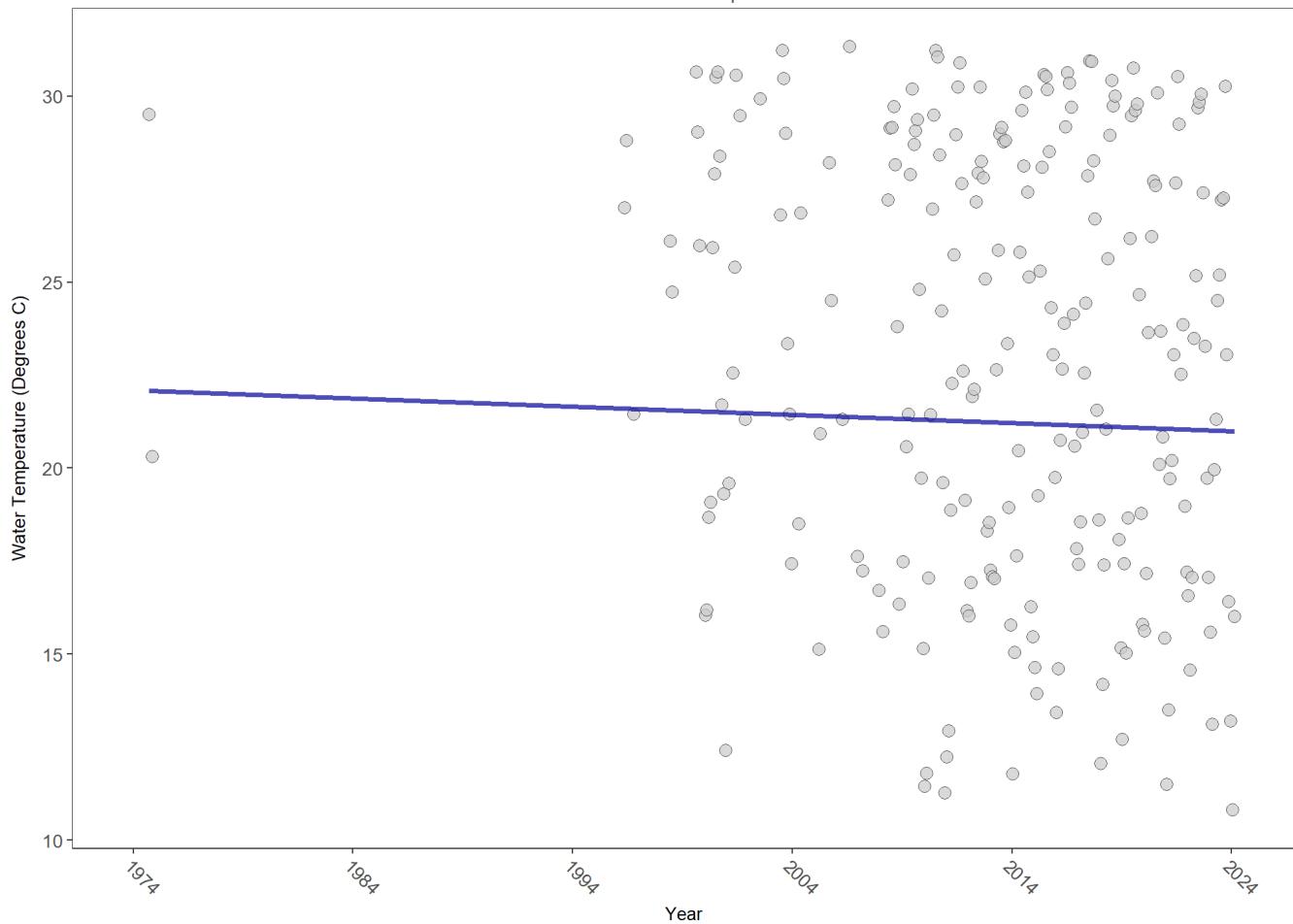
470 - St. Andrews Aquatic Preserve Water Quality Monitoring

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

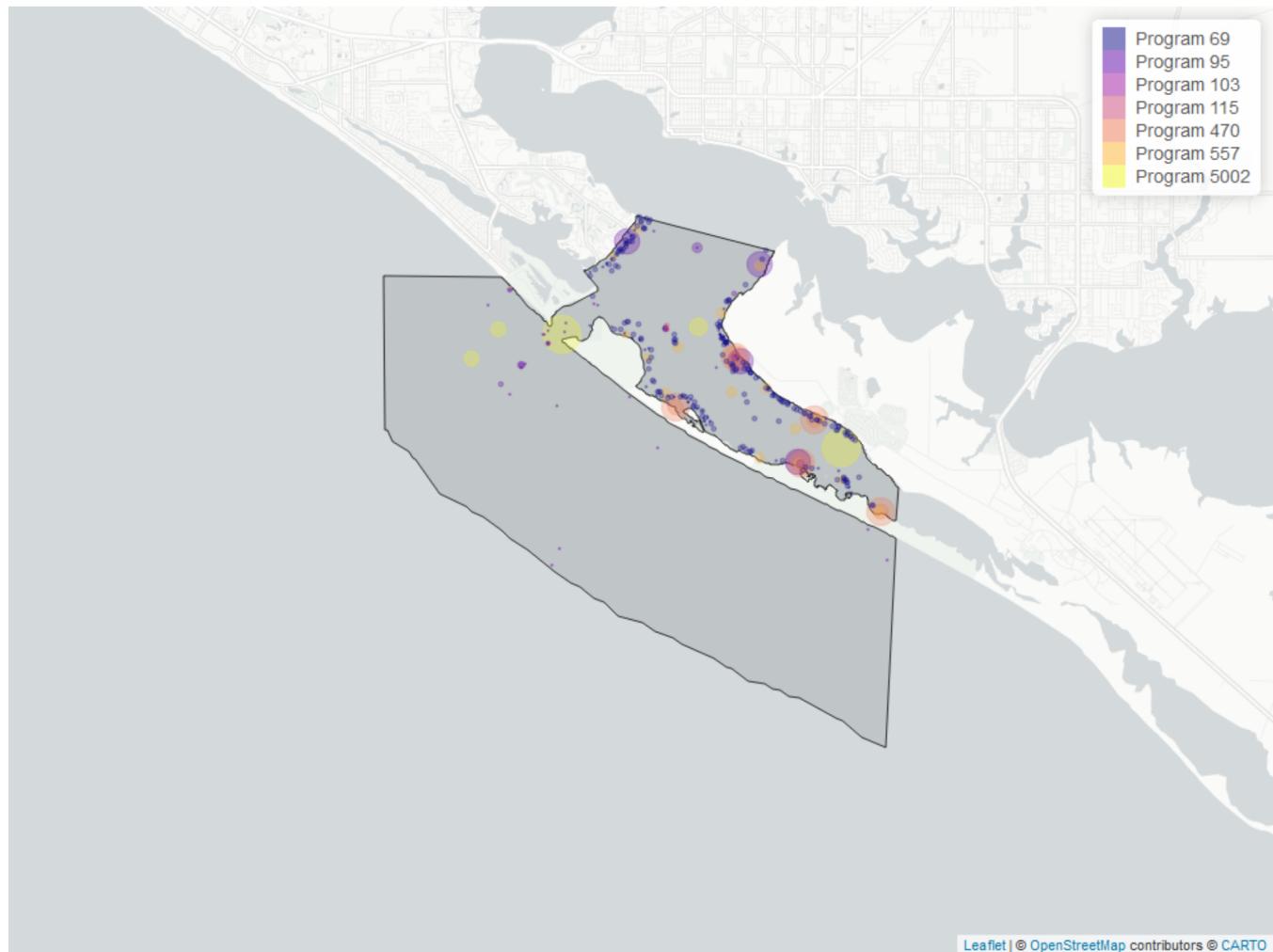


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2821	29	25.35	TRUE	-0.0729	0.1130	-0.02207714	22.09835	9.728	0.555	0

$p < 0.00005$ 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
470	830	2000	2024
69	655	2001	2022
5002	546	2005	2023
95	523	1974	2018
557	231	2016	2023
103	21	2003	2021
115	17	2000	2003

Program names:

470 - St. Andrews Aquatic Preserve Water Quality Monitoring
69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

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-Jul-02.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.

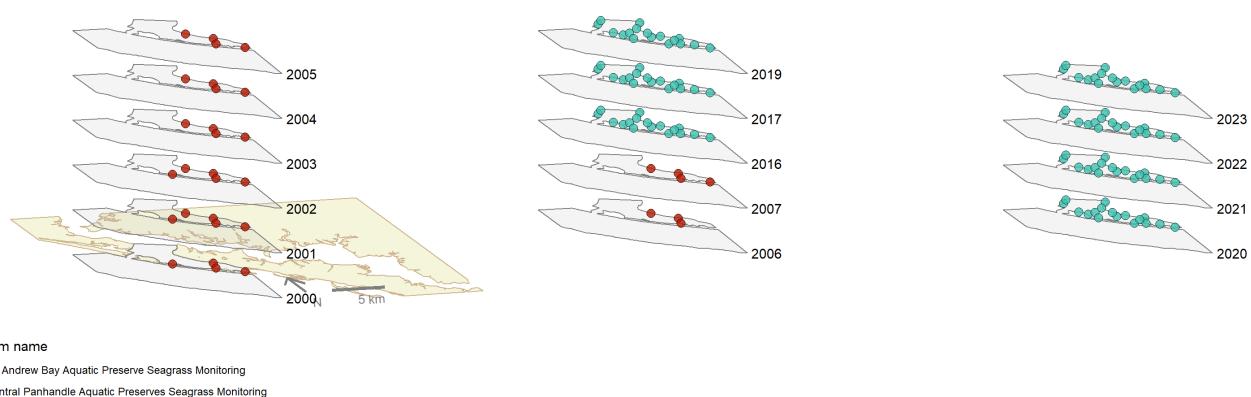
Notes

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

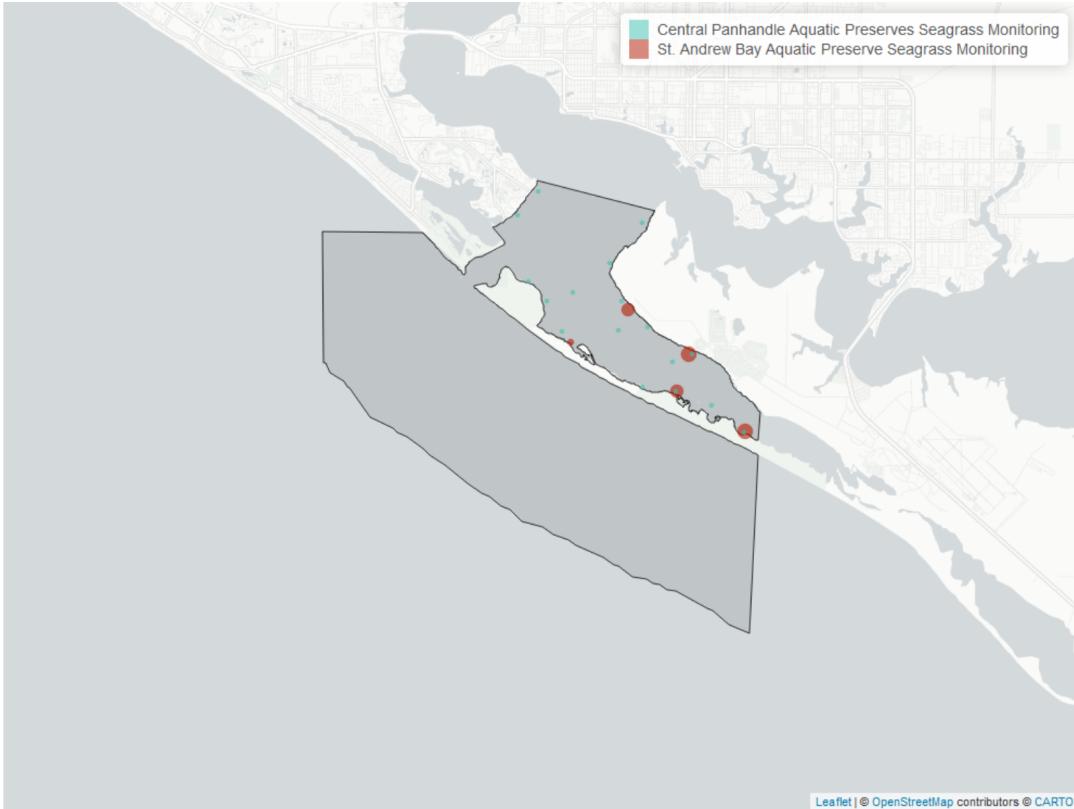
- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

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:



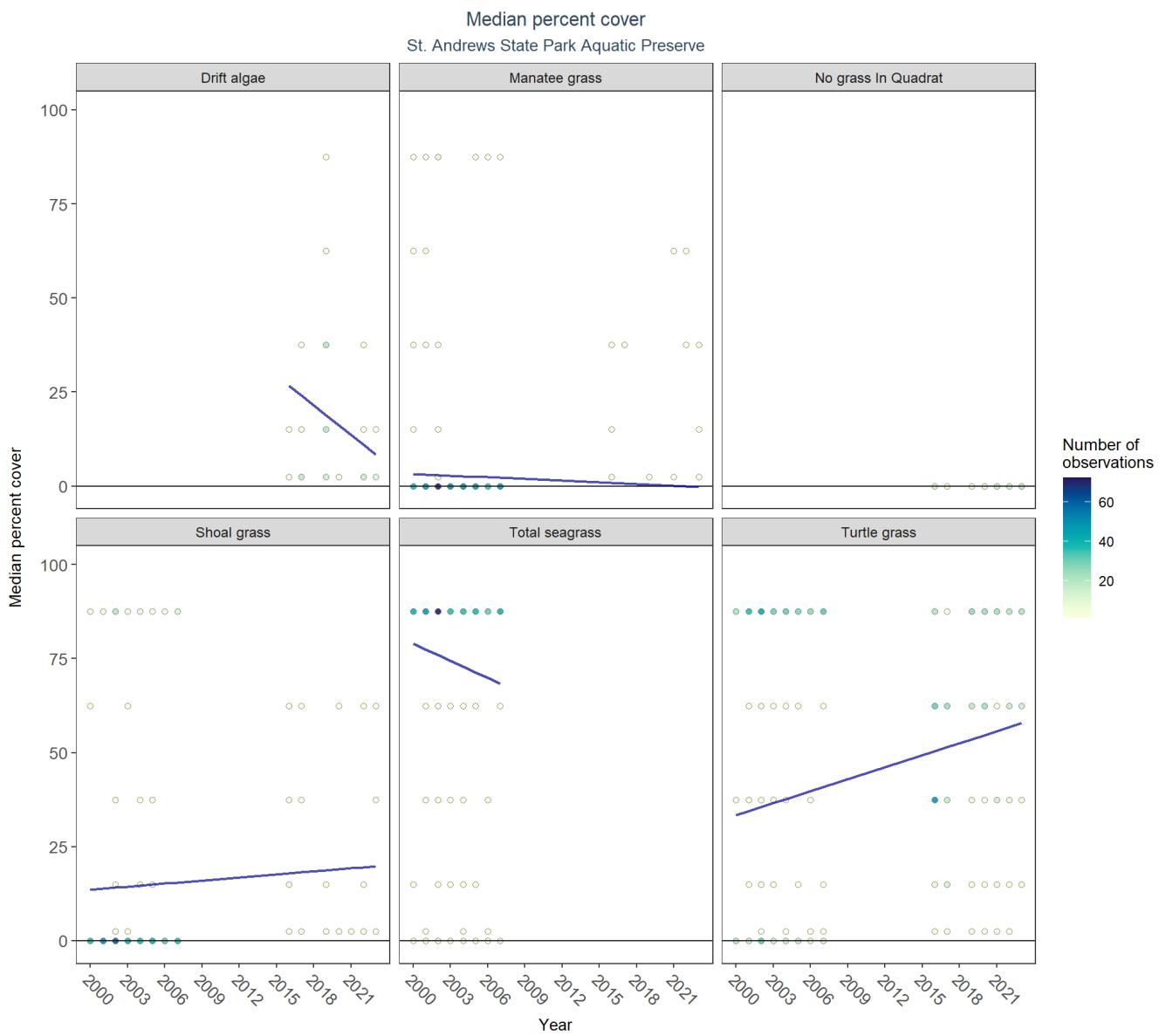
Map showing SAV sampling sites within the boundaries of *St. Andrews State Park Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 27: 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

Table 28: 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>
703	2016	2023	Braun Blanquet	17



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.

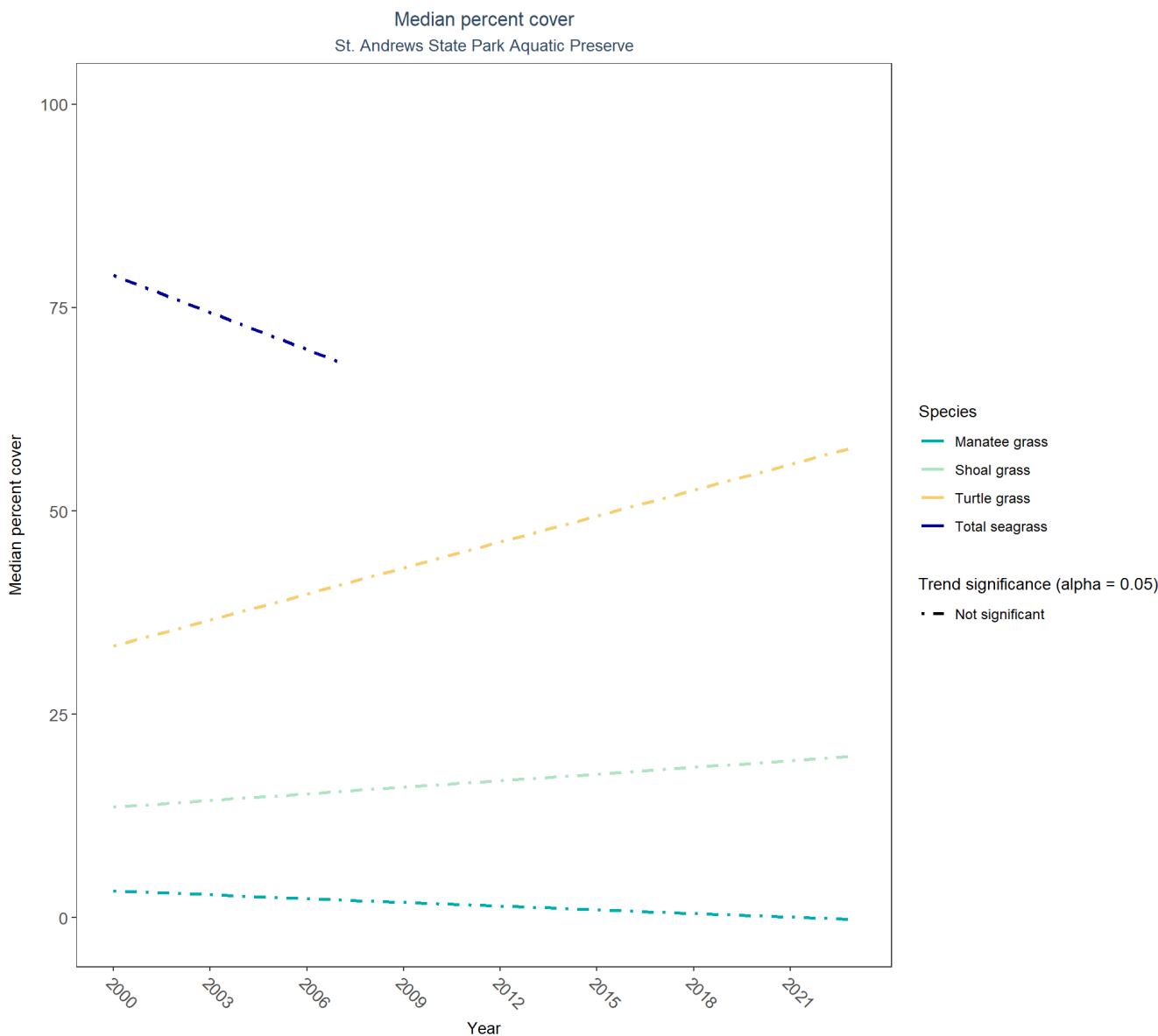
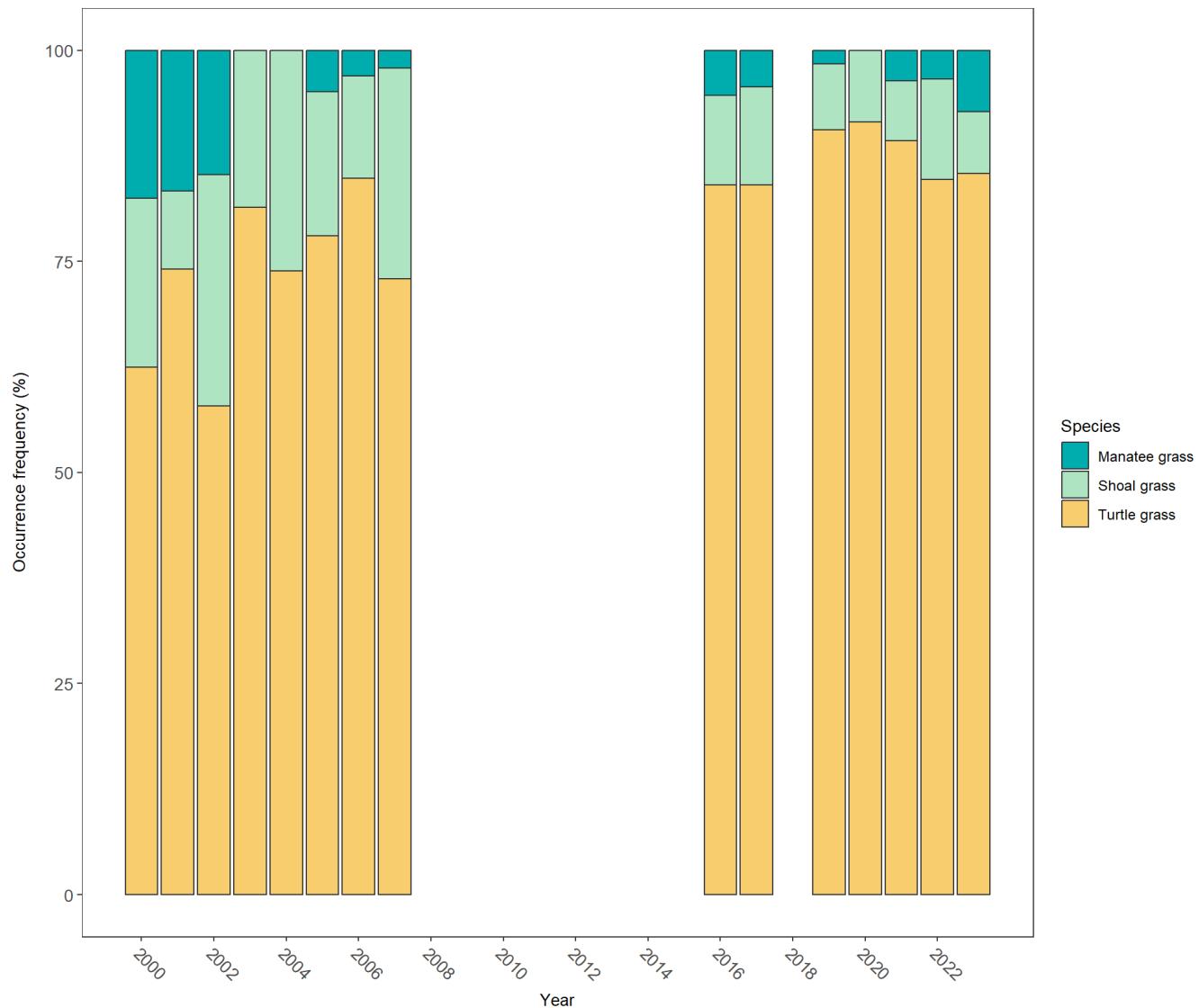


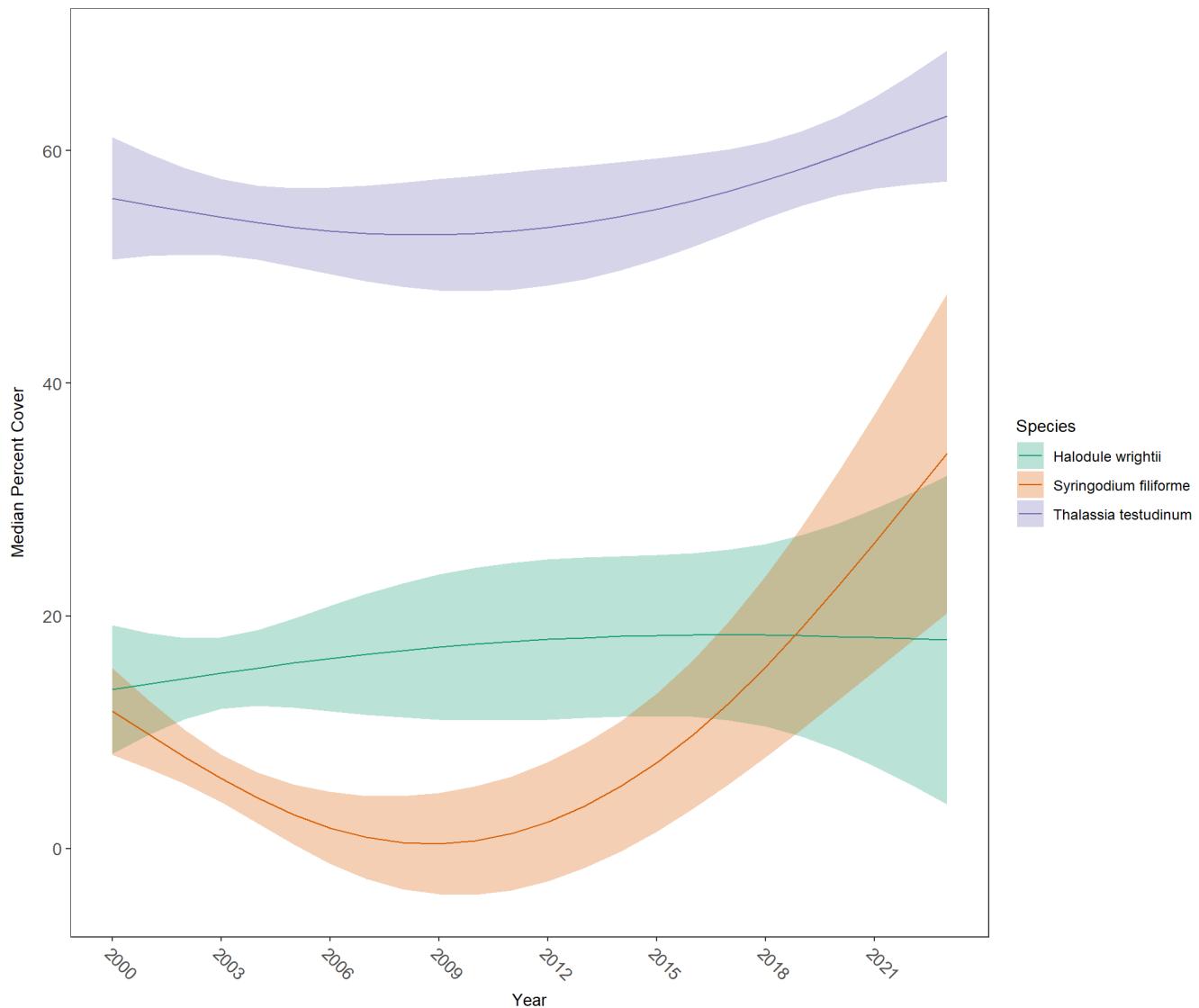
Table 29: Percent Cover Trend Analysis for St. Andrews State Park Aquatic Preserve

Species	Common Name	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae		No significant trend	2016 - 2023	84.4241	-2.6243	0.0740
Halodule wrightii	Shoal grass	No significant trend	2000 - 2023	11.9870	0.2705	0.4855
No grass In Quadrat		Model did not fit the available data	2016 - 2023			
Syringodium filiforme	Manatee grass	No significant trend	2000 - 2023	4.1728	-0.1514	0.8196
Thalassia testudinum	Turtle grass	No significant trend	2000 - 2023	27.0390	1.0625	0.1315
Total seagrass		No significant trend	2000 - 2007	88.1363	-1.5227	0.1502

Frequency of occurrence
St. Andrews State Park Aquatic Preserve



Median Percent Cover for seagrass species
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.