

# Terra Ceia Aquatic Preserve

## SEACAR Habitat Analyses

Last compiled on 04 September, 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

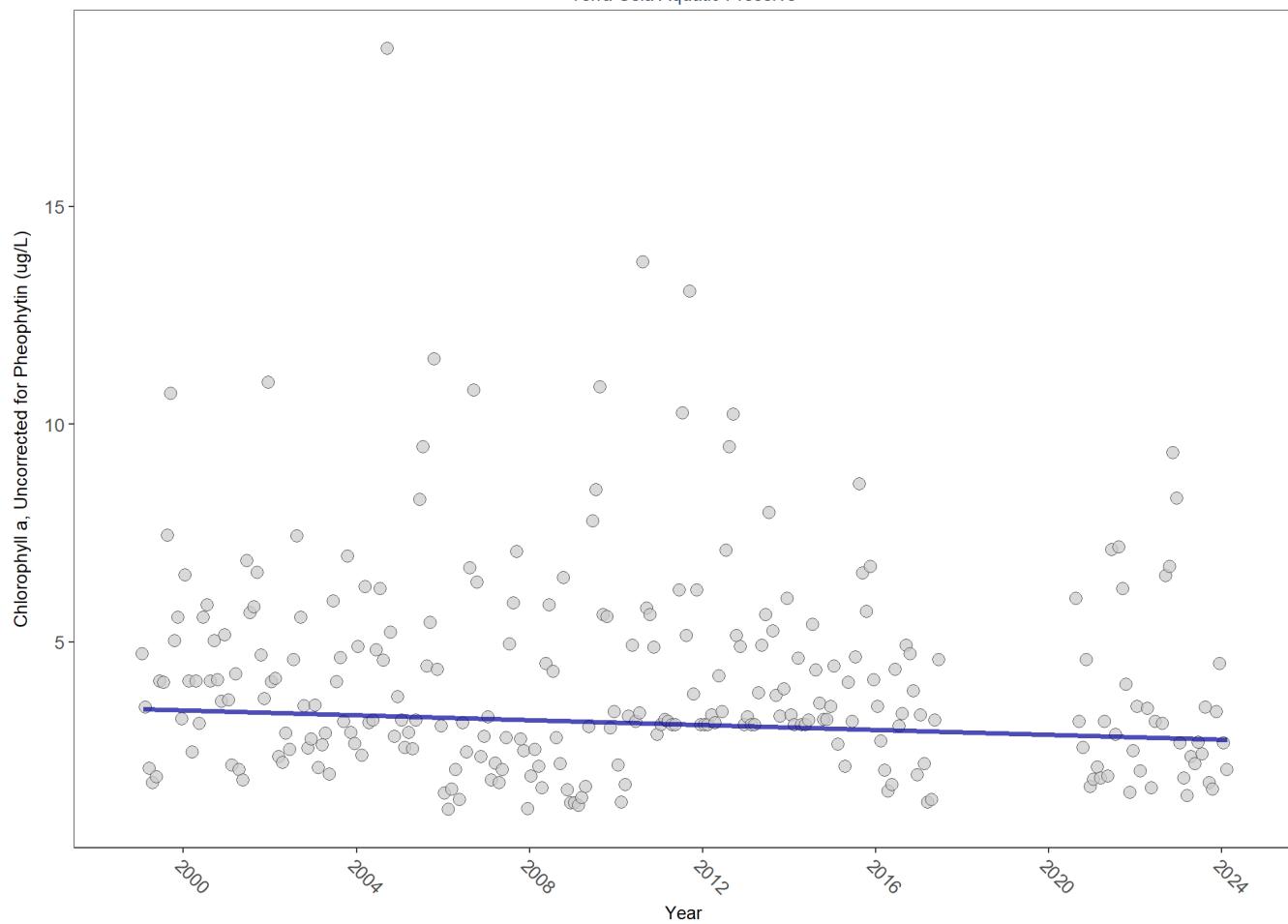
The following files were used in the discrete analysis:

- *Combined\_WQ\_WC\_NUT\_Chlorophyll\_a\_corrected\_for\_pheophytin-2024-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, Uncorrected for Pheophytin - Discrete Water Quality

## Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths  
Terra Ceia Aquatic Preserve

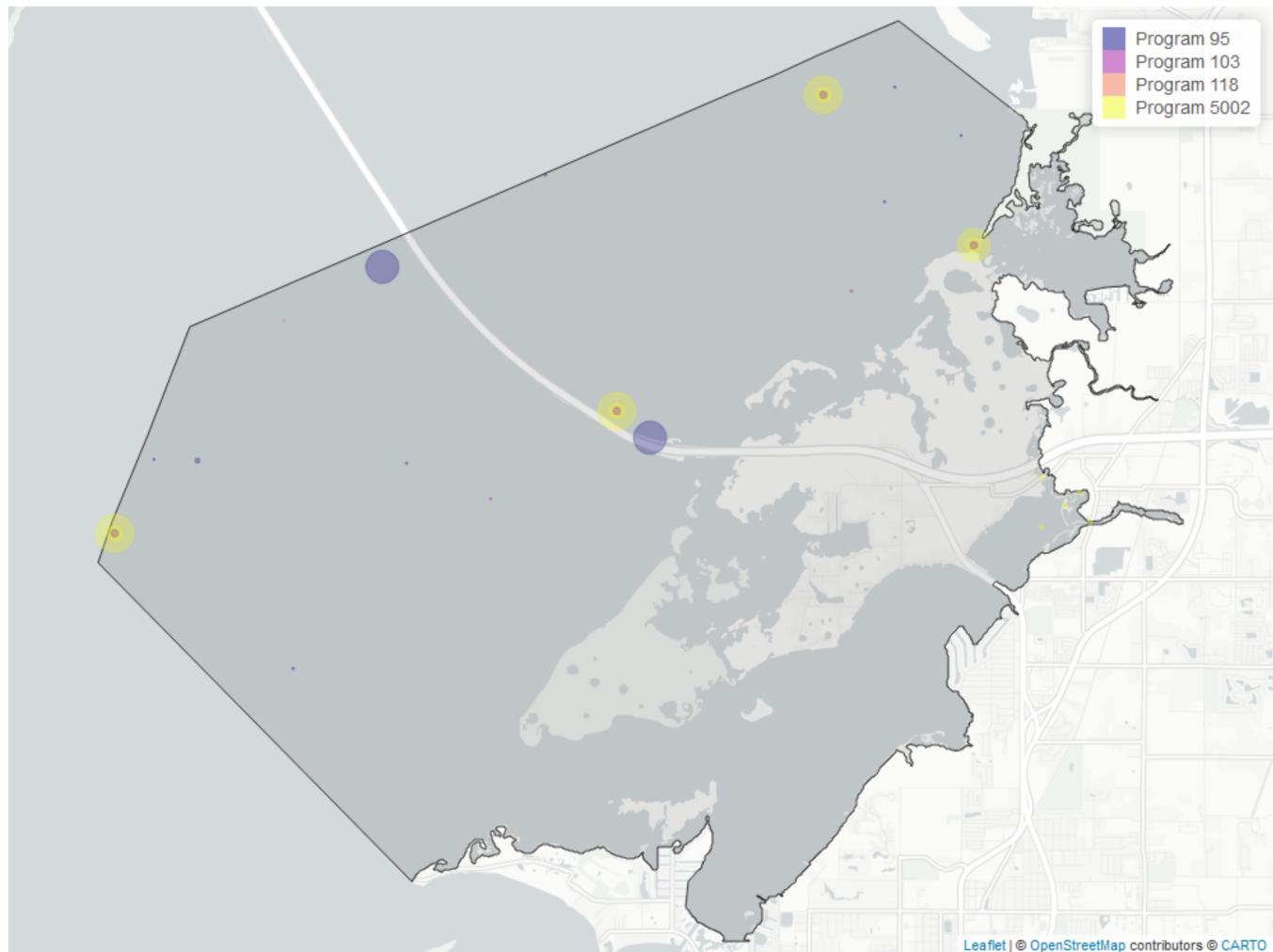


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1055	24	3.2	TRUE	-0.0977	0.0288	-0.02825758	3.462774	8.0638	0.7076	-1

*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 6: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

ProgramID	N_Data	YearMin	YearMax
5002	1017	1999	2024
95	336	2004	2018
103	46	2000	2021
118	1	2010	2010

#### Program names:

5002 - Florida STORET / WIN

95 - Harmful Algal Bloom Marine Observation Network

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

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 7: Value Qualifiers for Chlorophyll a, Uncorrected for Pheophytin

Year	$N_{Total}$	$N_I$	$perc_I$	$N_U$	$perc_U$
2004	48	35	72.9	9	18.8
2005	48	32	66.7	9	18.8
2006	48	28	58.3	8	16.7
2007	48	29	60.4	2	4.2
2009	48	4	8.3		
2010	48	10	20.8	3	6.2
2011	60	23	38.3	23	38.3
2012	48	24	50.0	22	45.8
2013	50	26	52.0	21	42.0
2014	48	20	41.7	26	54.2
2015	48	30	62.5	2	4.2
2016	48	40	83.3	2	4.2
2017	24	18	75.0	4	16.7
2020	24	13	54.2	3	12.5
2021	88	35	39.8	1	1.1
2022	50	29	58.0	6	12.0
2023	48	43	89.6	3	6.2
2024	8	8	100.0		

**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>U  
- Compound was analyzed for but not detected

## Programs containing Value Qualified data:

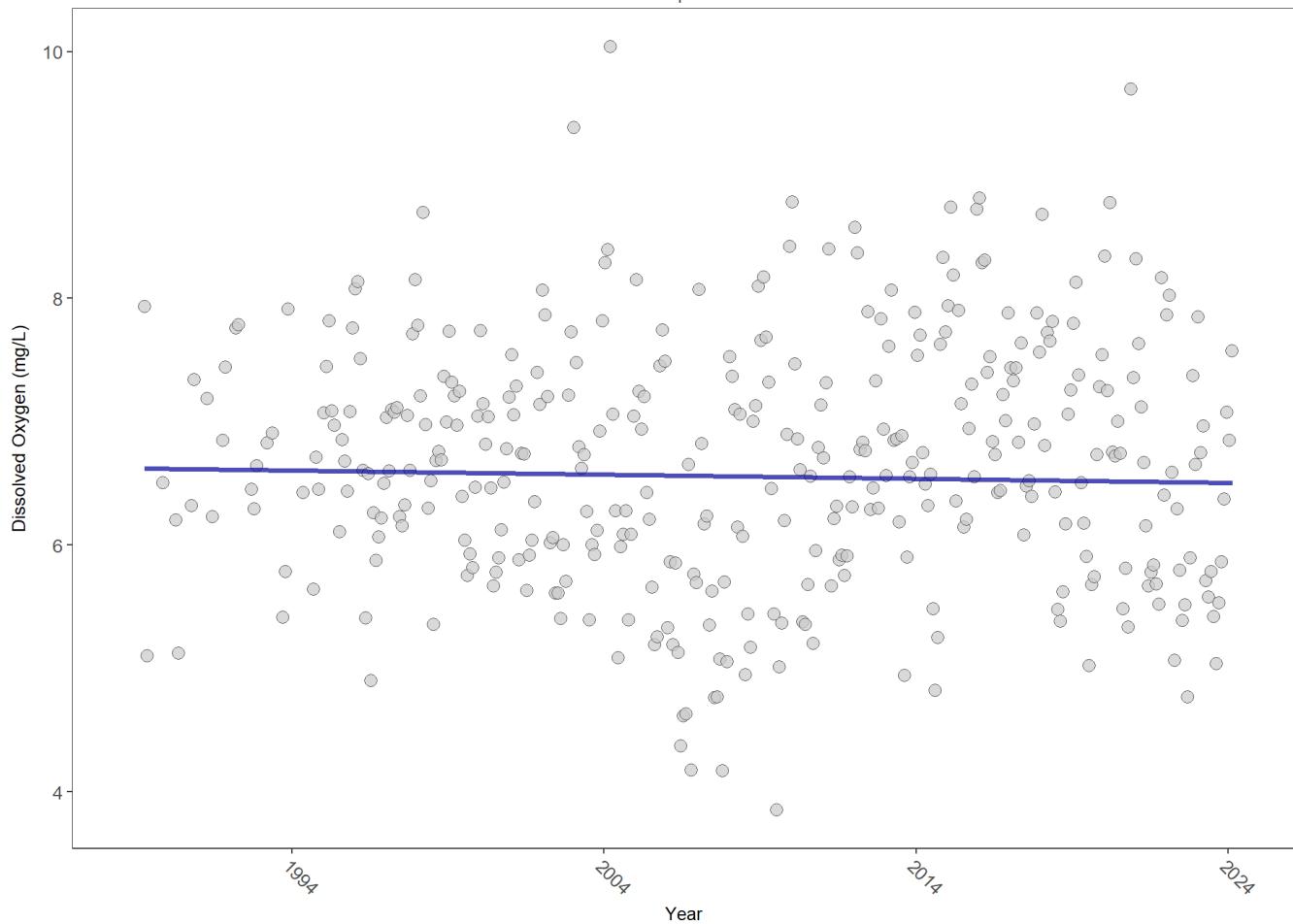
5002 - Florida STORET / WIN

## 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  
Terra Ceia Aquatic Preserve

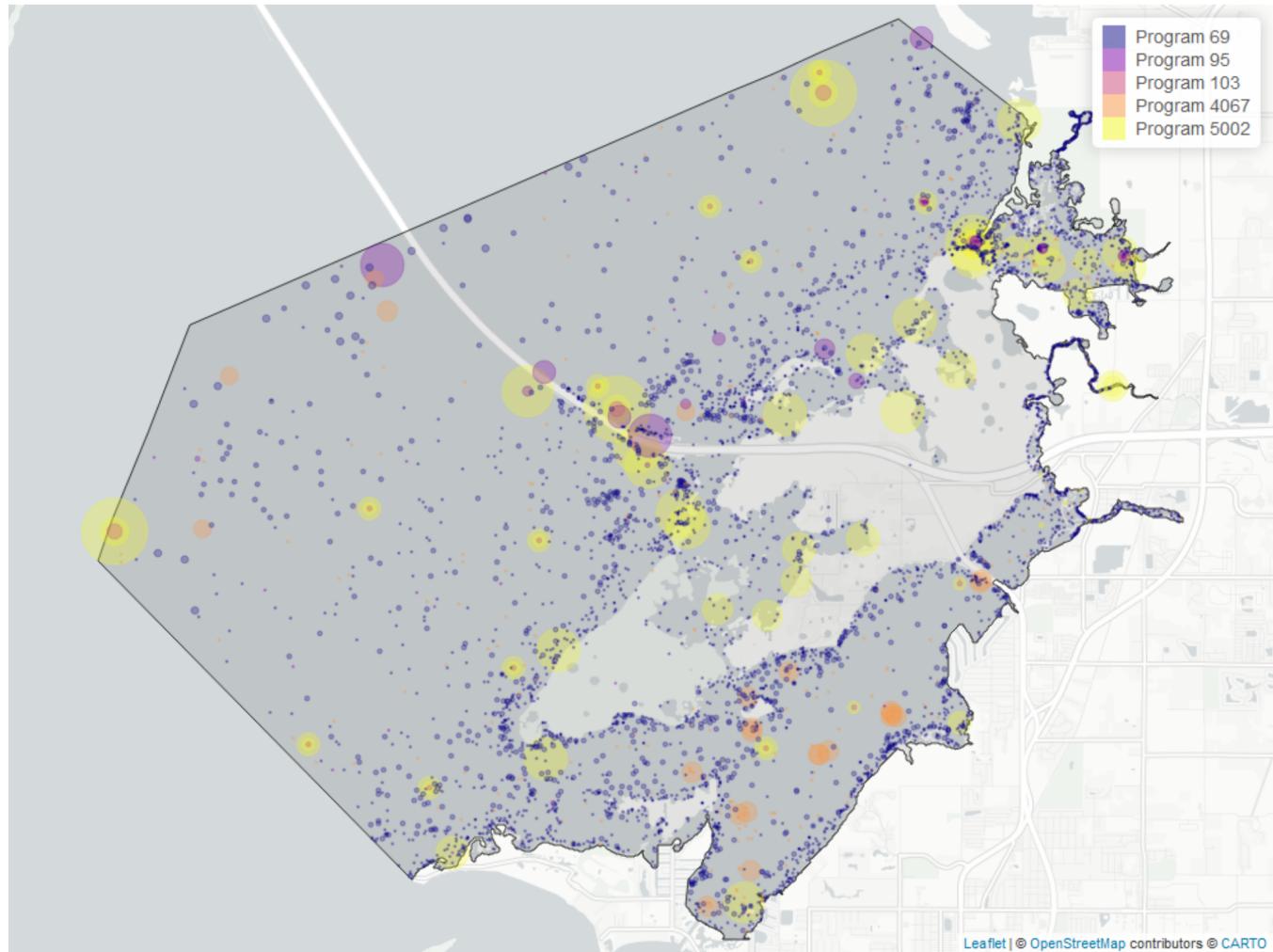


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	24399	36	6.54	TRUE	-0.0239	0.5169	-0.003339107	6.622528	11.6867	0.3876	0

*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 8: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
5002	11221	1995	2024
69	10086	1989	2022
4067	1865	1993	2022
95	1260	1999	2018
103	183	2020	2021

#### Program names:

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

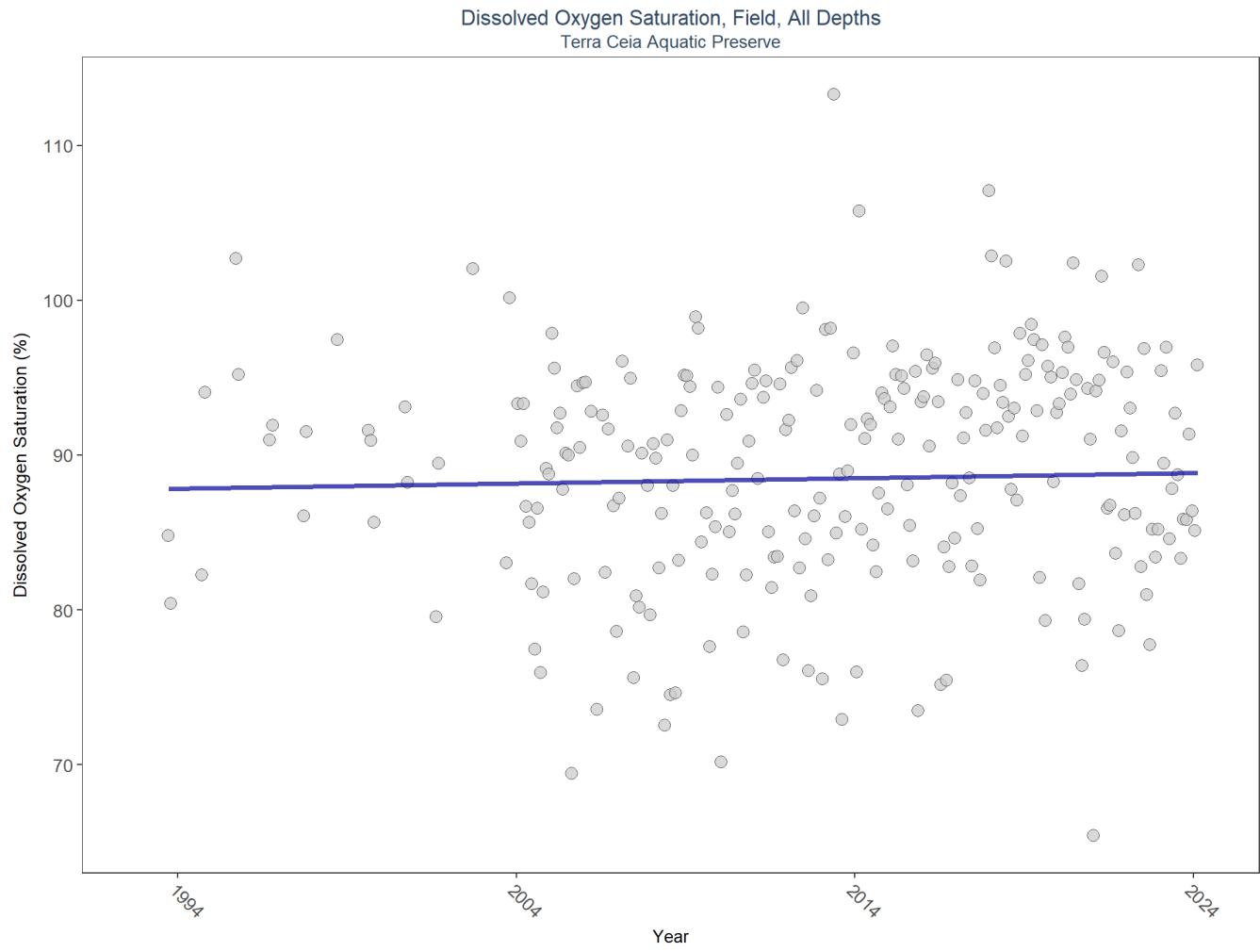
4067 - Tampa Bay Benthic Monitoring

95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Dissolved Oxygen in Terra Ceia Aquatic Preserve

## Dissolved Oxygen Saturation - Discrete Water Quality

### 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 Dissolved Oxygen Saturation

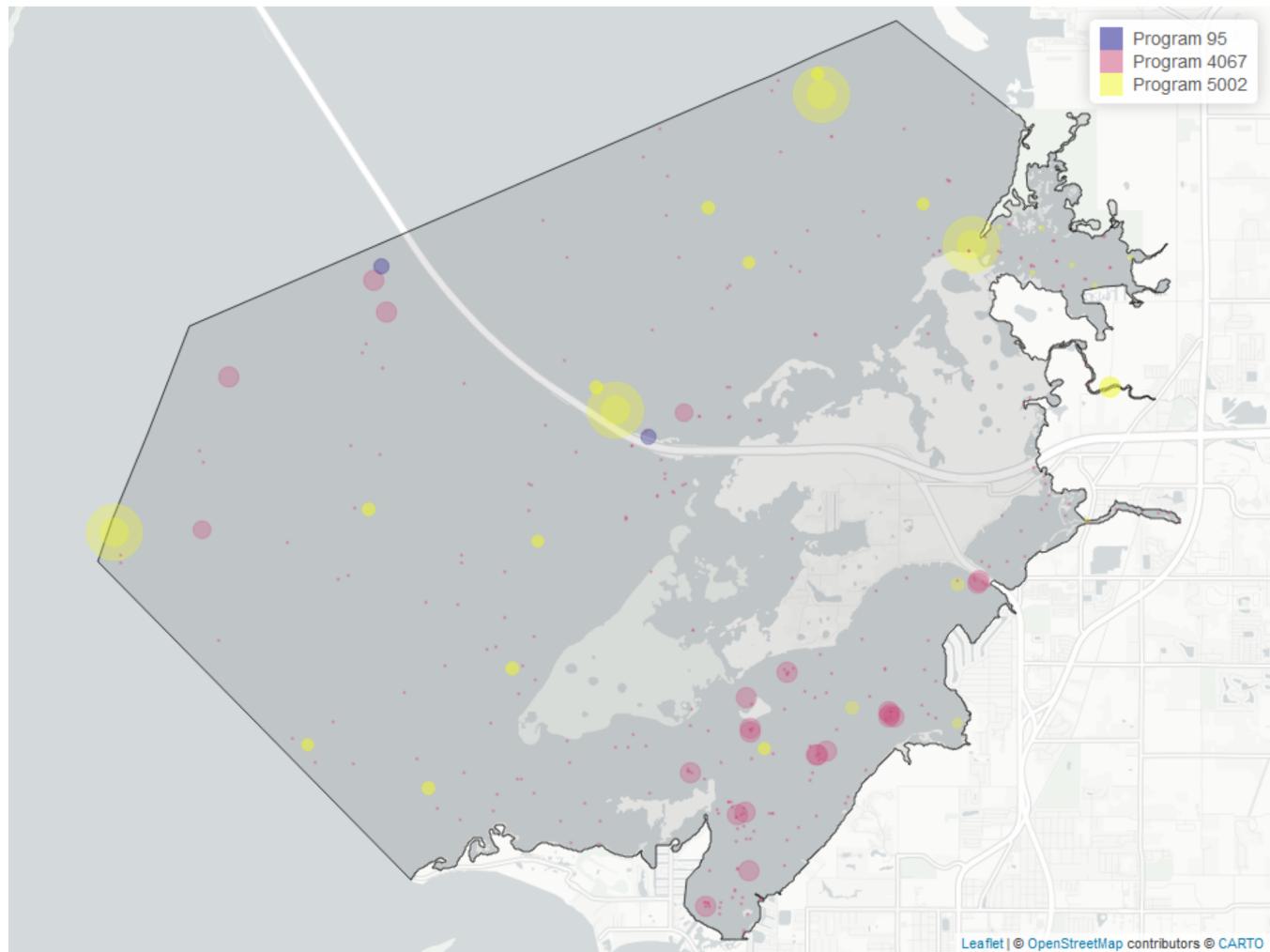


Table 9: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	N_Data	YearMin	YearMax
5002	3122	2004	2024
4067	1890	1993	2022
95	67	2014	2018

**Program names:**

5002 - Florida STORET / WIN

4067 - Tampa Bay Benthic Monitoring

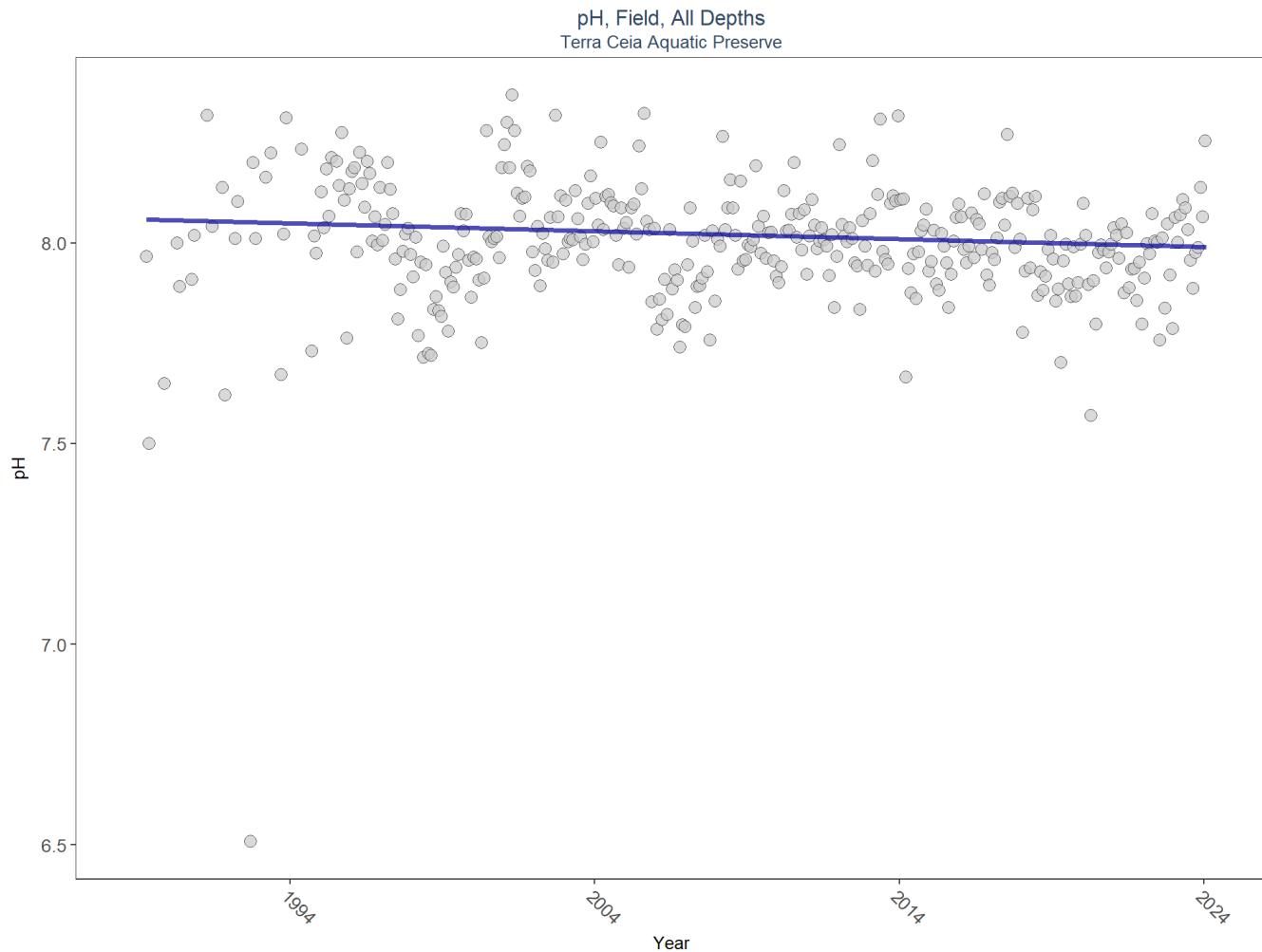
95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in Terra Ceia 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.

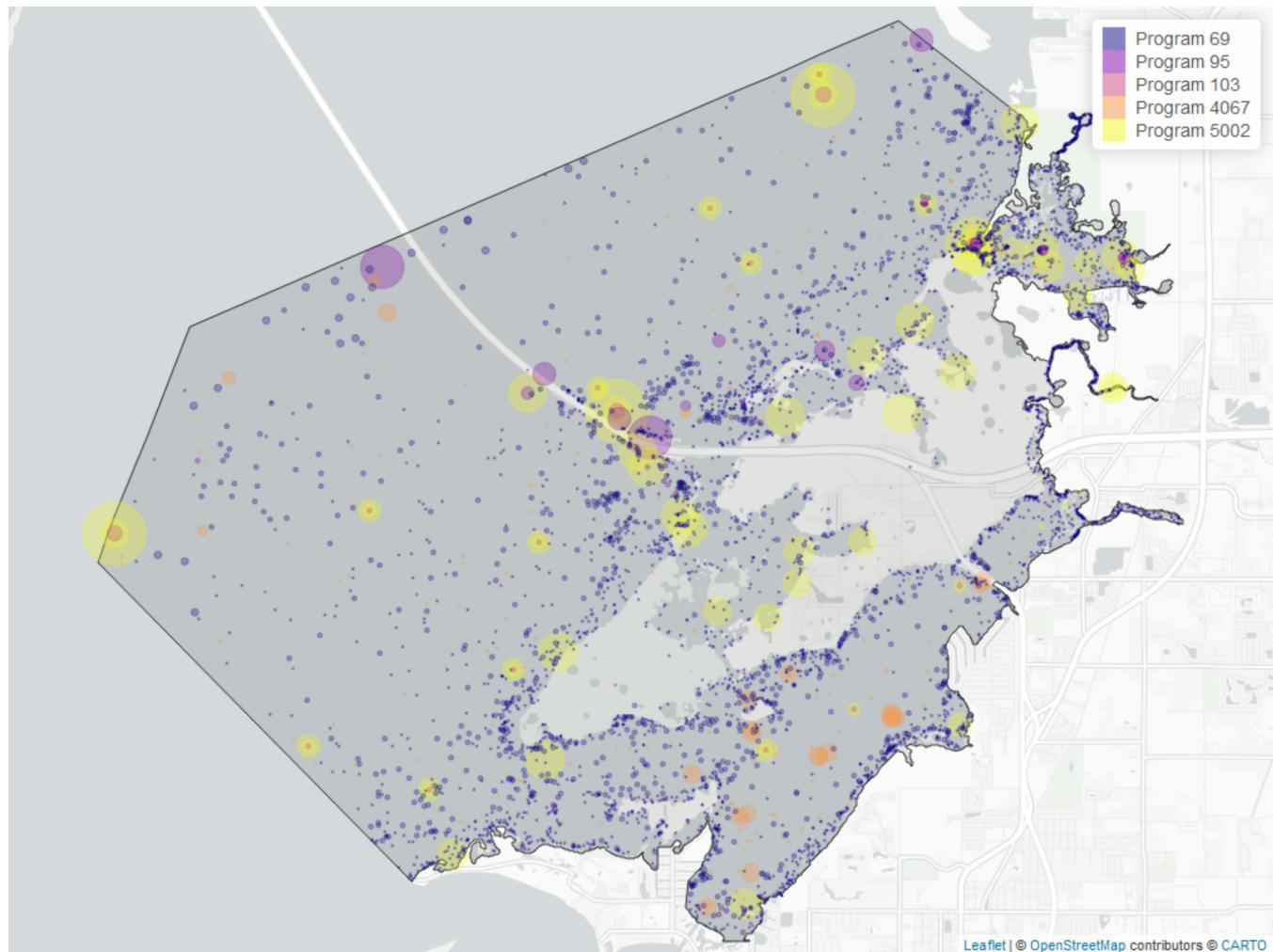
### Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$  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 10: Programs contributing data for pH

ProgramID	N_Data	YearMin	YearMax
69	9992	1989	2022
5002	9691	1995	2024
4067	1592	1993	2022
95	1255	1999	2018
103	183	2020	2021

#### Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

4067 - Tampa Bay Benthic Monitoring

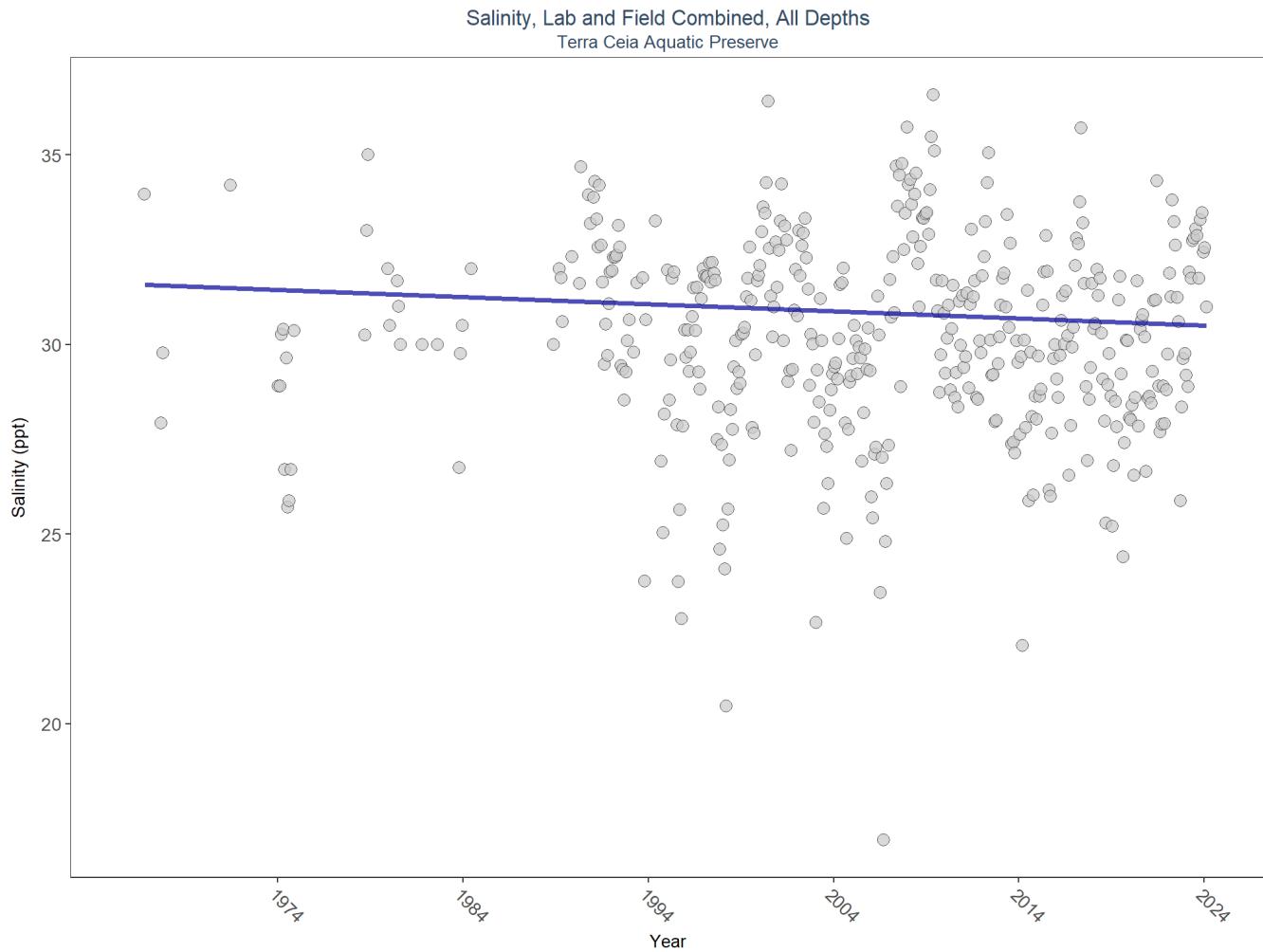
95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for pH in Terra Ceia 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	24640	48	30.6	TRUE	-0.0692	0.0403	-0.01892176	31.59038	6	0.8734	-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

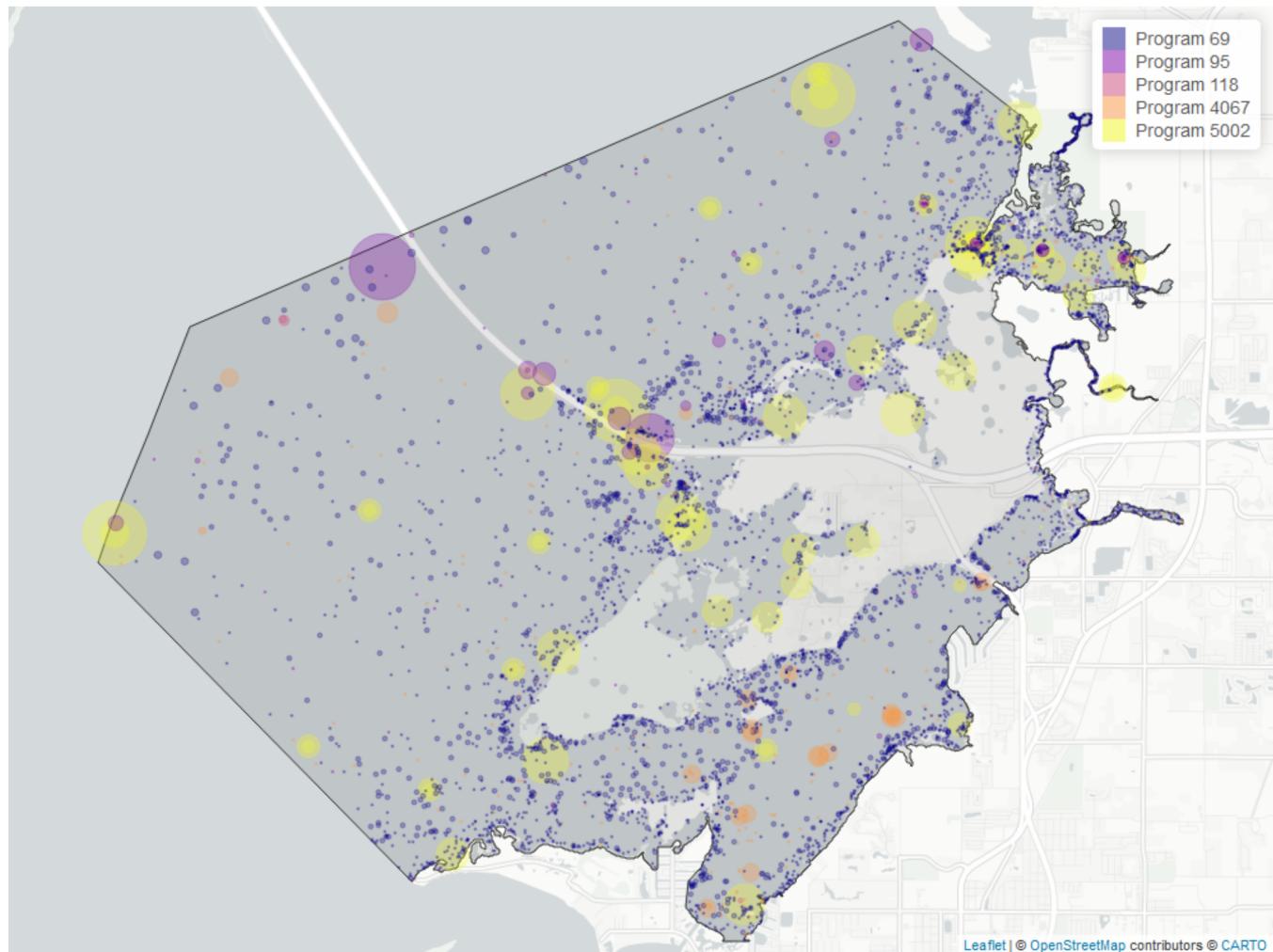


Table 11: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
5002	10913	1995	2024
69	10149	1989	2022
95	1976	1966	2018
4067	1605	1993	2022
118	30	2015	2020

#### Program names:

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

95 - Harmful Algal Bloom Marine Observation Network

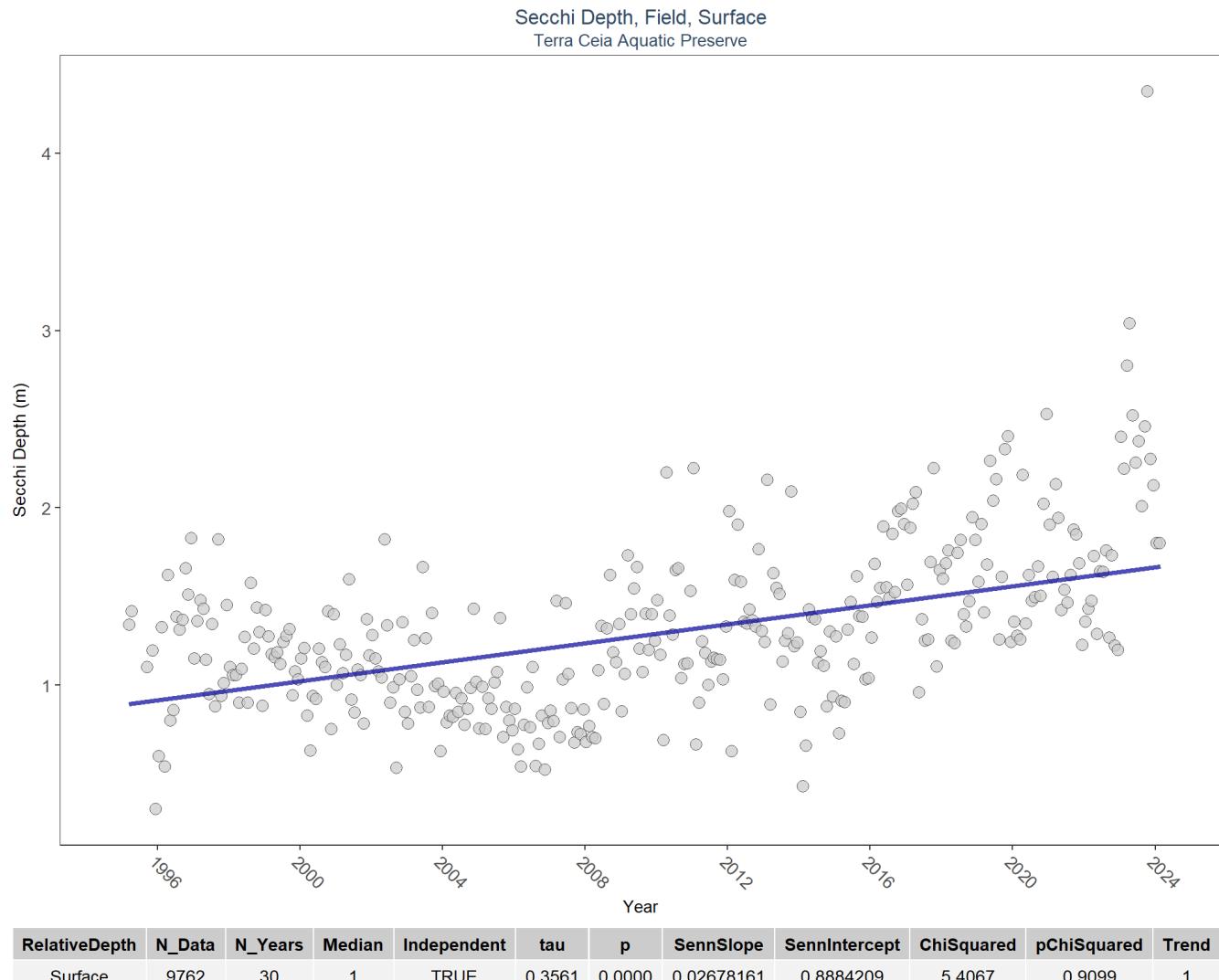
4067 - Tampa Bay Benthic Monitoring

There are no qualifying Value Qualifiers for Salinity in Terra Ceia 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.

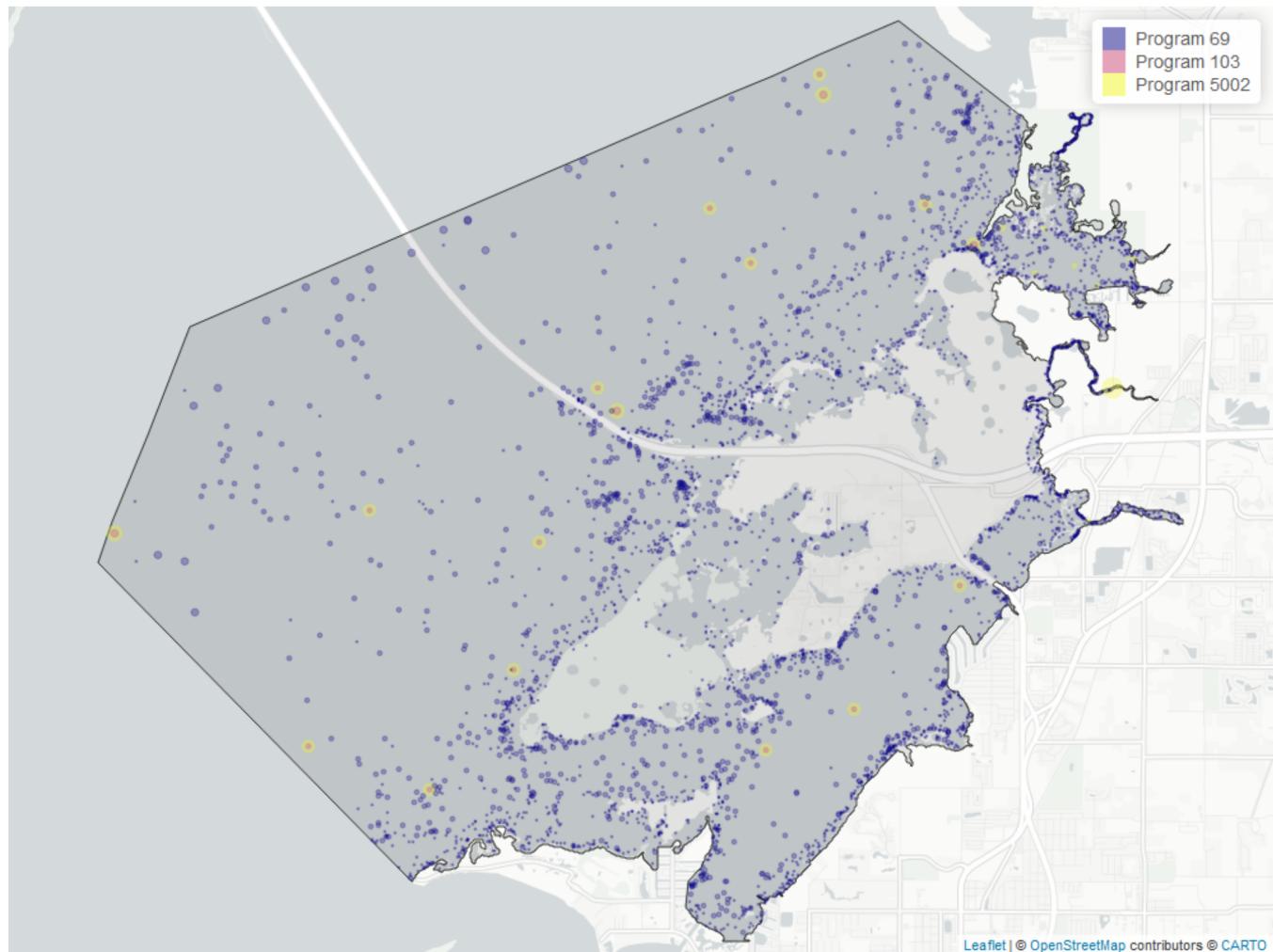
### Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$  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 12: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
69	9101	1995	2022
5002	566	2000	2024
103	95	2020	2021

#### Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

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 13: Value Qualifiers for Secchi Depth

<i>Year</i>	<i>N_Total</i>	<i>N_S</i>	<i>perc_S</i>
2018	343	21	6.1
2019	413	17	4.1
2020	308	32	10.4
2021	428	31	7.2
2022	344	13	3.8
2023	93	25	26.9
2024	8	2	25.0

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

#### Programs containing Value Qualified data:

5002 - Florida STORET / WIN

### 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.

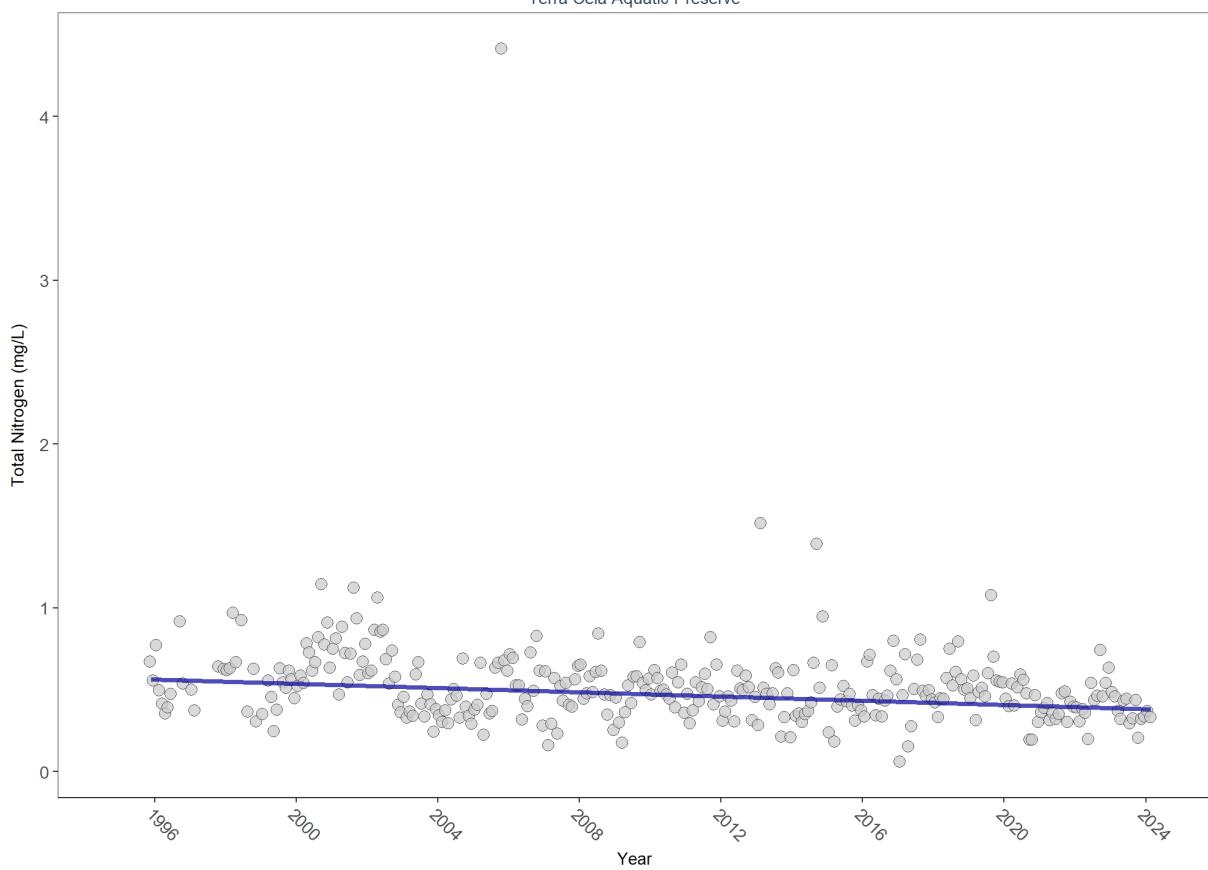
- 1)  $TN = TKN + NO_3O_2;$
- 2)  $TN = TKN + NO_3 + NO_2;$
- 3)  $TN = ORGN + NH_4 + NO_3O_2;$
- 4)  $TN = ORGN + NH_4 + NO_2 + NO_3;$
- 5)  $TN = TKN + NO_3;$
- 6)  $TN = ORGN + NH_4 + NO_3;$

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  
Terra Ceia Aquatic Preserve

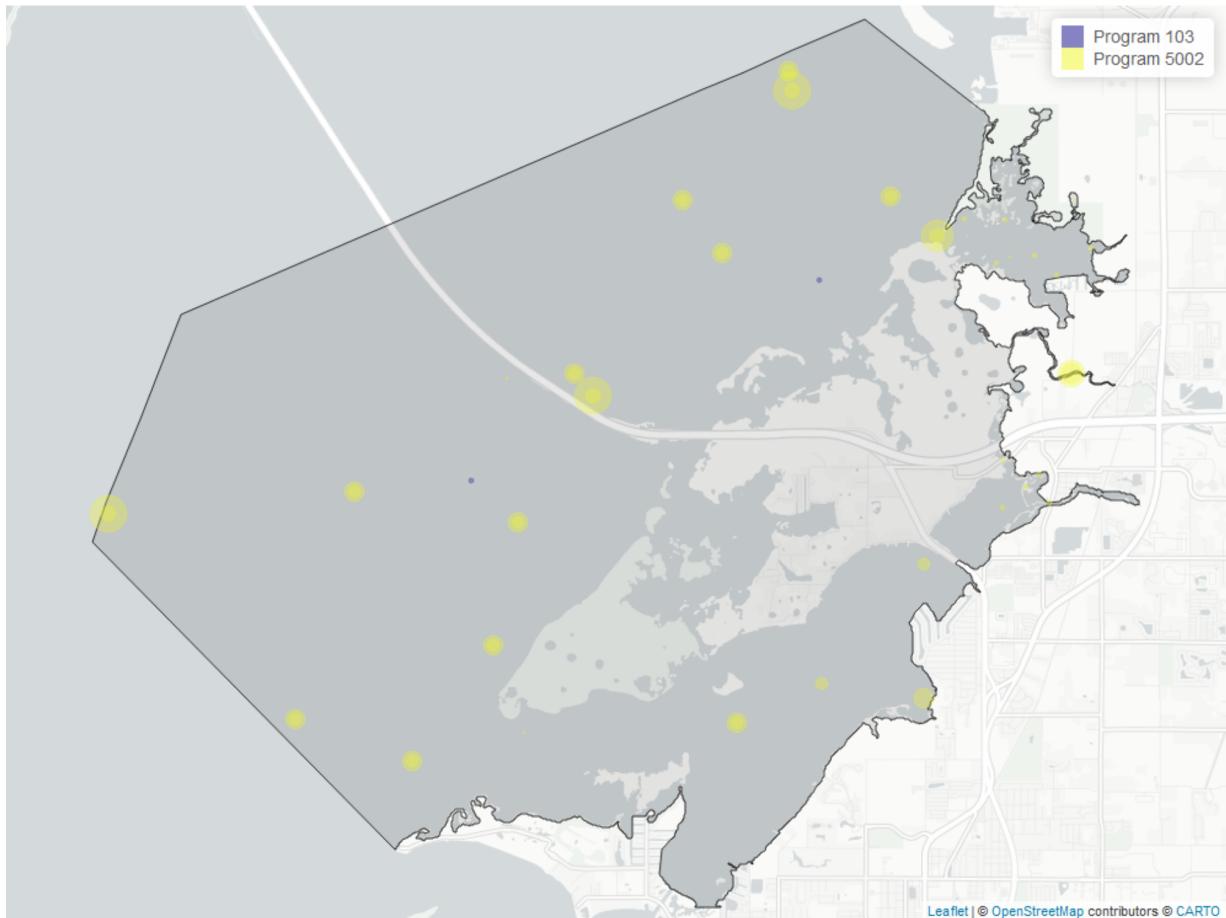


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2258	30	0.384	TRUE	-0.2148	0.0000	-0.006427268	0.5688917	5.4014	0.9102	-1

$p < 0.00005$  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 14: Programs contributing data for Total Nitrogen

ProgramID	N_Data	YearMin	YearMax
5002	2276	1995	2024
103	6	2000	2000

#### Program names:

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

#### 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 15: Value Qualifiers for Total Nitrogen

Year	N_Total	N_I	perc_I	N_U	perc_U
2004	96	1	1.0		
2011	108	2	1.9		
2012	99	3	3.0		
2017	82	5	6.1	2	2.4

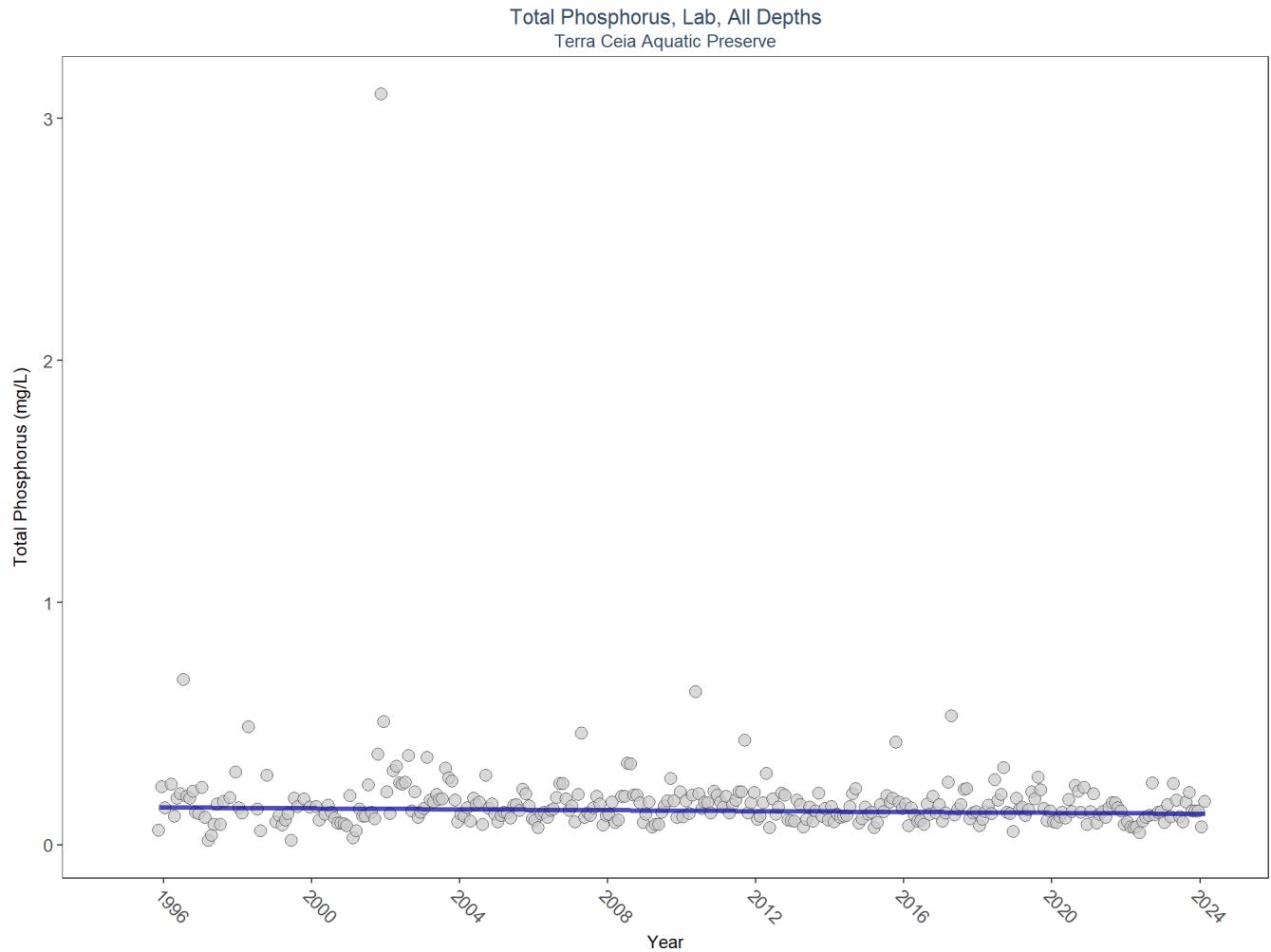
Note: <sup>1</sup>I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit <sup>2</sup>U  
- Compound was analyzed for but not detected

#### Programs containing Value Qualified data:

5002 - Florida STORET / WIN

### Total Phosphorus - Discrete Water Quality

#### Seasonal Kendall-Tau Trend Analysis

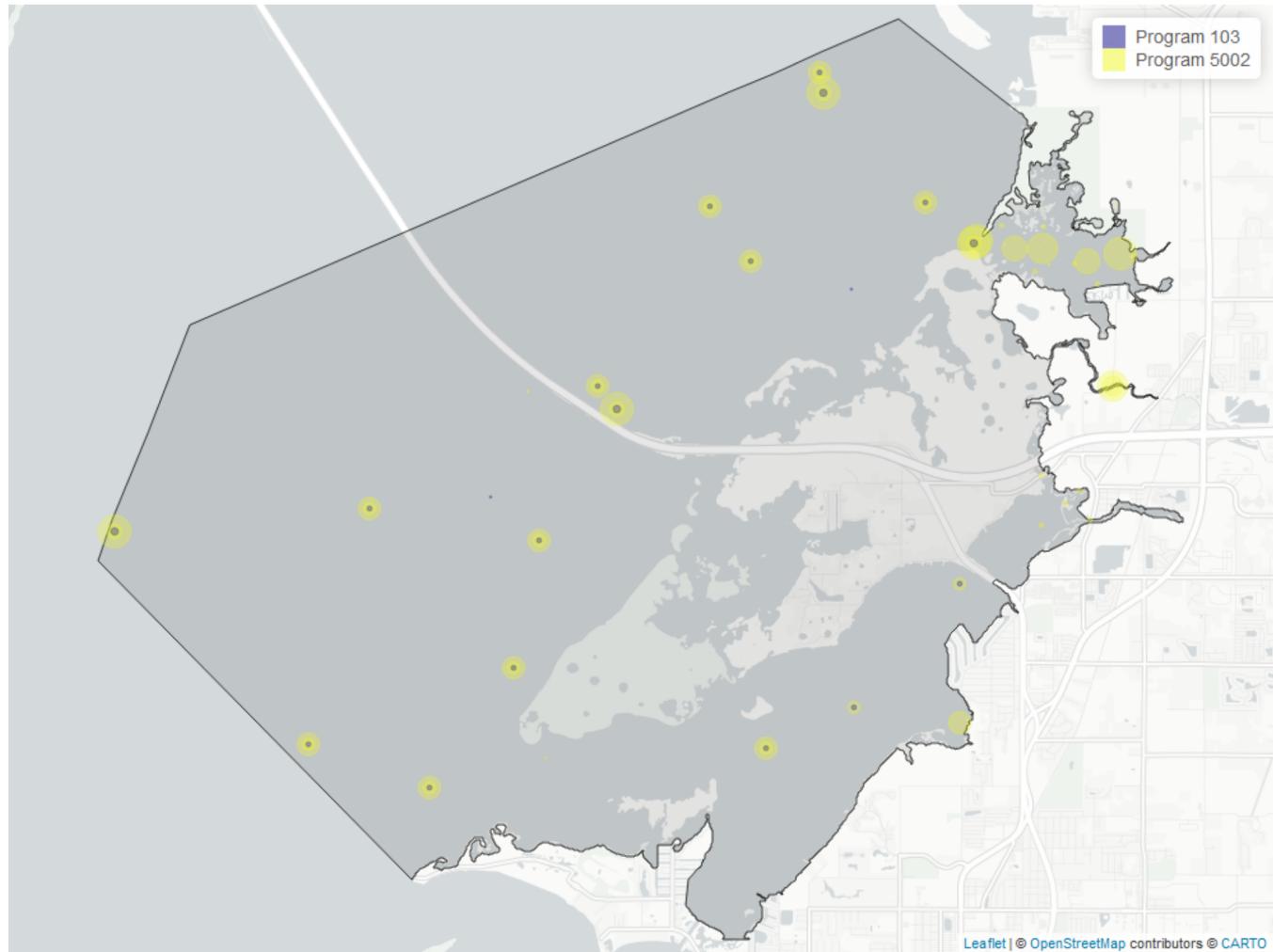


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	3047	30	0.11	TRUE	-0.0978	0.0105	-0.001	0.1564155	18.1572	0.078	-1

*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 16: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
5002	3064	1995	2024
103	101	2000	2021

#### Program names:

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

#### 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 17: Value Qualifiers for Total Phosphorus

Year	N_Total	N_I	perc_I	N_Q	perc_Q	N_U	perc_U
2003	324					14	4.3
2004	239	22	9.2			58	24.3
2005	171	23	13.4	2	1.2	34	19.9
2006	154	5	3.2			46	29.9
2007	153					63	41.2
2008	104					15	14.4
2009	85	3	3.5			19	22.4
2010	89	5	5.6			23	25.8
2011	117	7	6.0	7	6.0	17	14.5
2012	109					21	19.3
2013	117					46	39.3
2014	107					45	42.1
2015	106					36	34.0
2016	84					24	28.6
2017	83			7	8.4	1	1.2
2018	64	25	39.1			7	10.9
2019	64	25	39.1				
2020	95	49	51.6	4	4.2	6	6.3
2021	203	66	32.5	8	3.9	18	8.9
2022	101	34	33.7			35	34.6
2023	92	16	17.4			56	60.9
2024	8	3	37.5			4	50.0

**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:

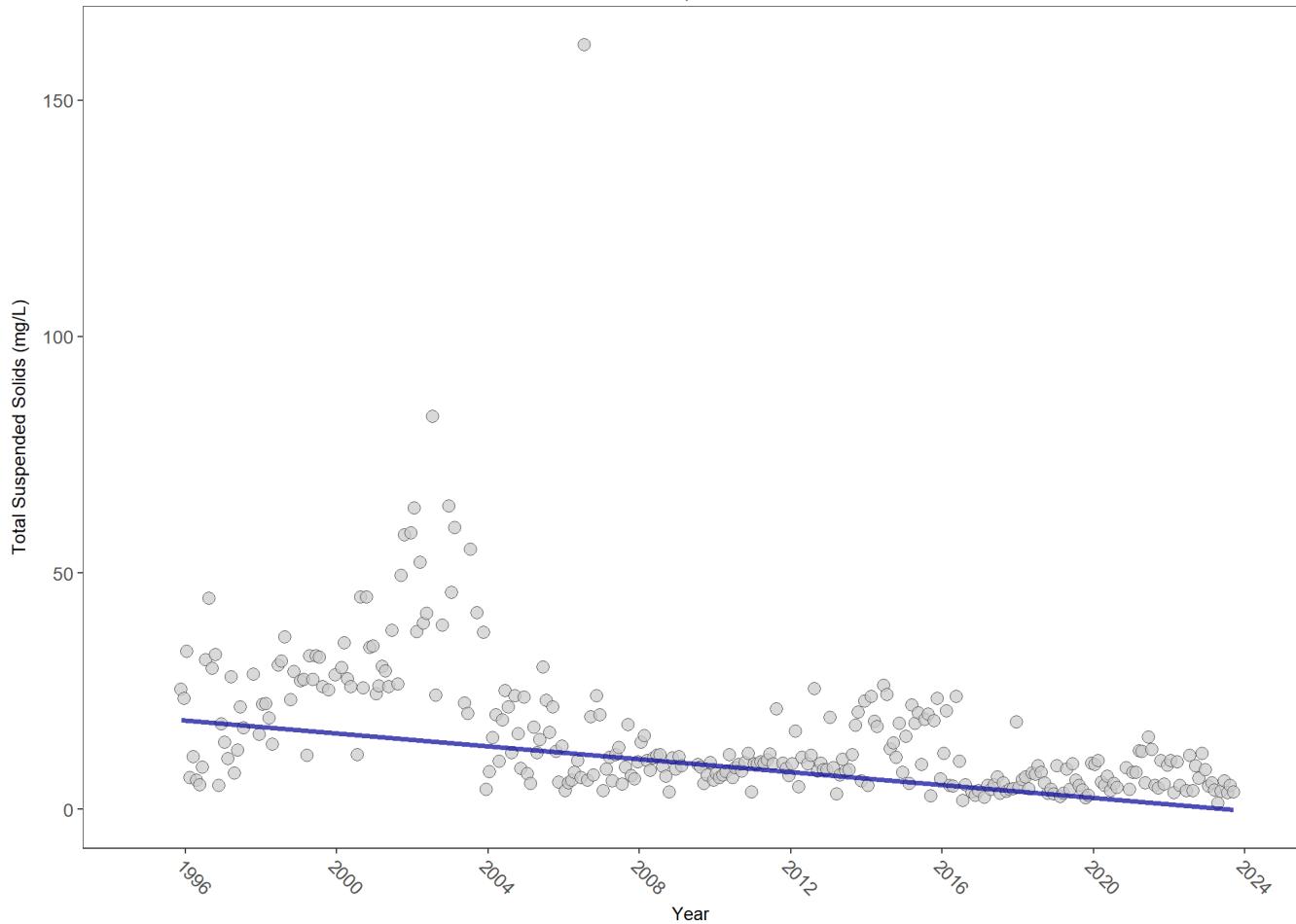
5002 - Florida STORET / WIN

### 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  
Terra Ceia Aquatic Preserve

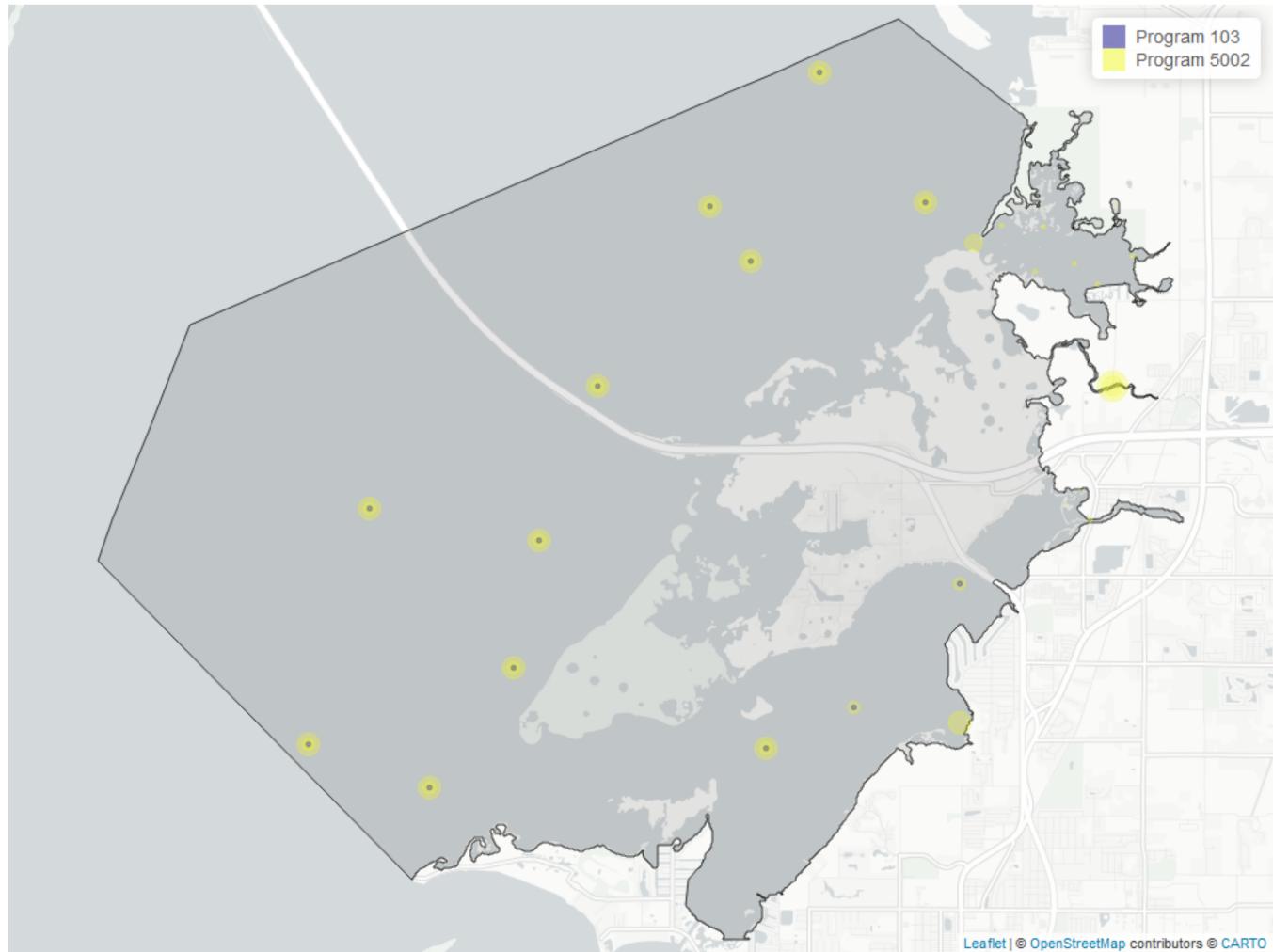


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1662	29	10.8	TRUE	-0.4503	0.0000	-0.6862745	19.54531	5.8627	0.8824	-1

*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 18: Programs contributing data for Total Suspended Solids

ProgramID	N_Data	YearMin	YearMax
5002	1611	1995	2023
103	53	2020	2021

#### Program names:

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

#### Value Qualifiers

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

Table 19: Value Qualifiers for Total Suspended Solids

Year	N_Total	N_I	perc_I	N_Q	perc_Q	N_U	perc_U
2005	89	21	23.6			3	3.4
2006	72					1	1.4
2007	72	2	2.8				
2013	65	1	1.5			2	3.1
2016	36			1	2.8		
2019	64	15	23.4				
2020	71	1	1.4				
2021	117	3	2.6				
2022	59	9	15.2	1	1.7		
2023	47	2	4.3	1	2.1		

**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 <sup>3</sup>U - Compound was analyzed for but not detected

#### Programs containing Value Qualified data:

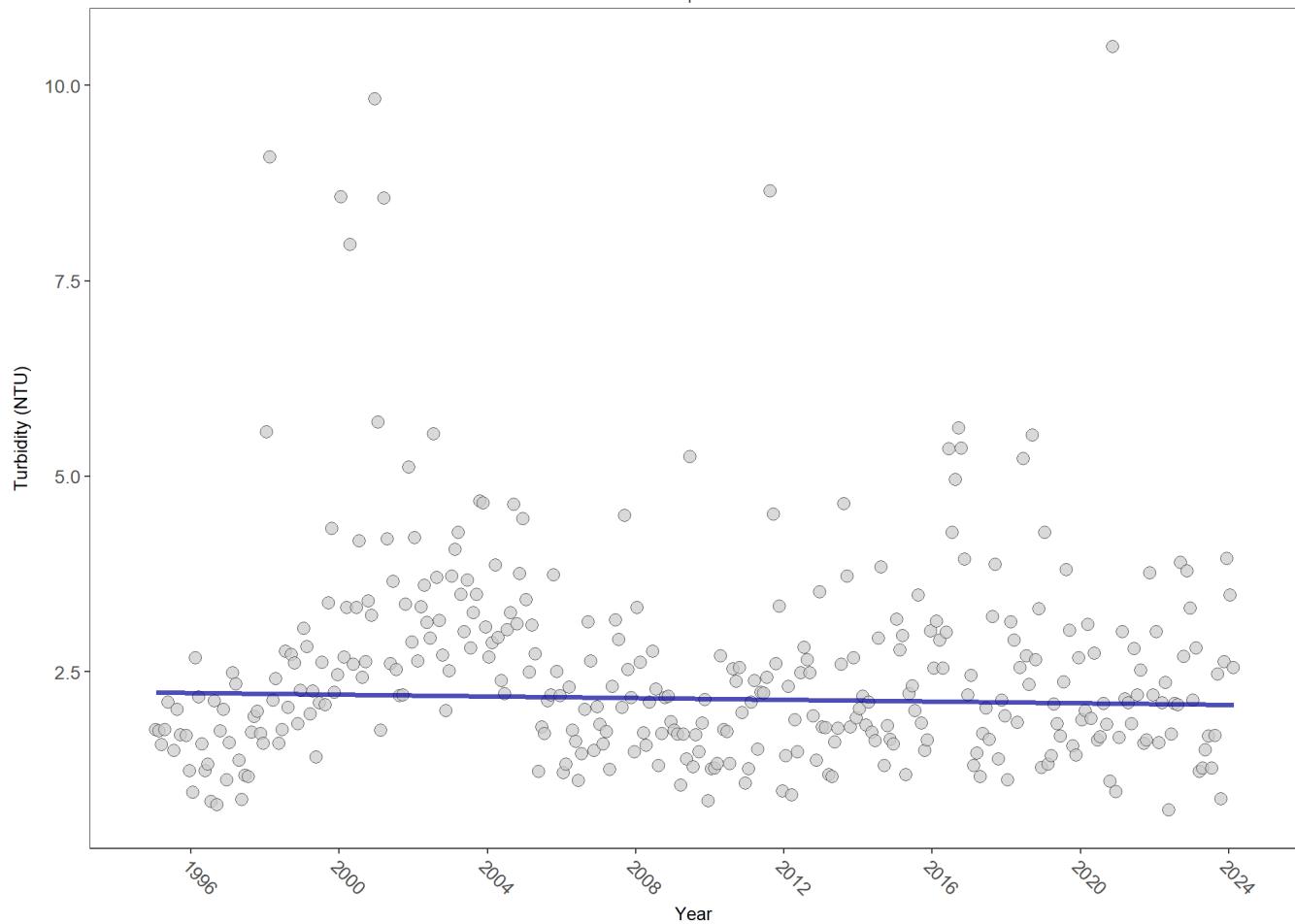
5002 - Florida STORET / WIN

### 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  
Terra Ceia Aquatic Preserve



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	8045	30	1.8	TRUE	-0.0447	0.2490	-0.005464646	2.234295	15.7137	0.1521	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 Turbidity

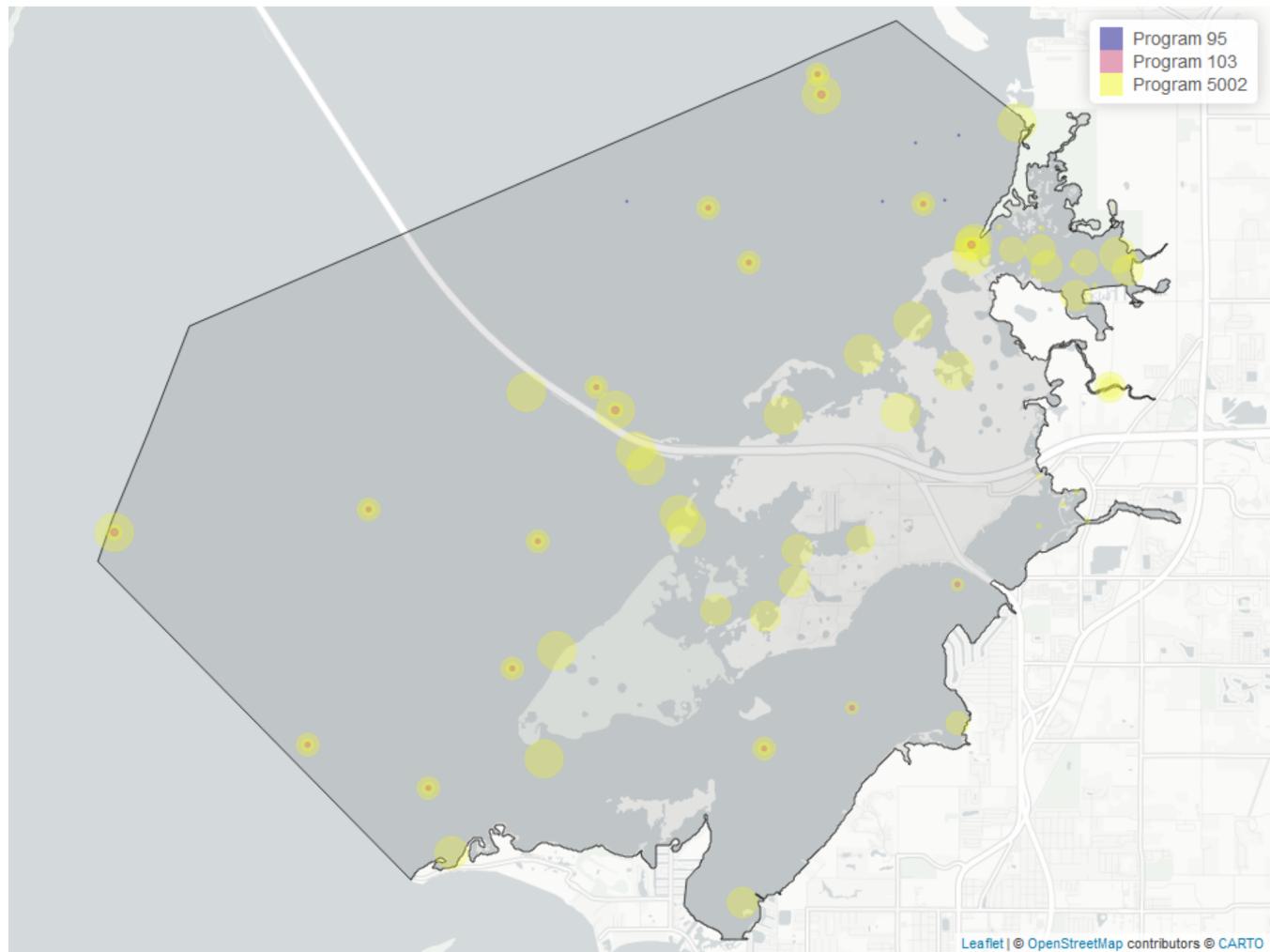


Table 20: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
5002	7990	1995	2024
103	94	2020	2021
95	8	2002	2004

#### Program names:

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

95 - Harmful Algal Bloom Marine Observation Network

#### 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 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	539	2	0.4	15	2.8
2007	299	3	1.0		
2009	235	2	0.8		
2010	329	2	0.6		
2011	245	2	0.8		
2012	123	1	0.8		
2013	111	10	9.0		
2014	107	3	2.8		
2015	106	1	0.9		
2019	64	2	3.1		
2021	199	1	0.5		
2023	94	2	2.1		

**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:

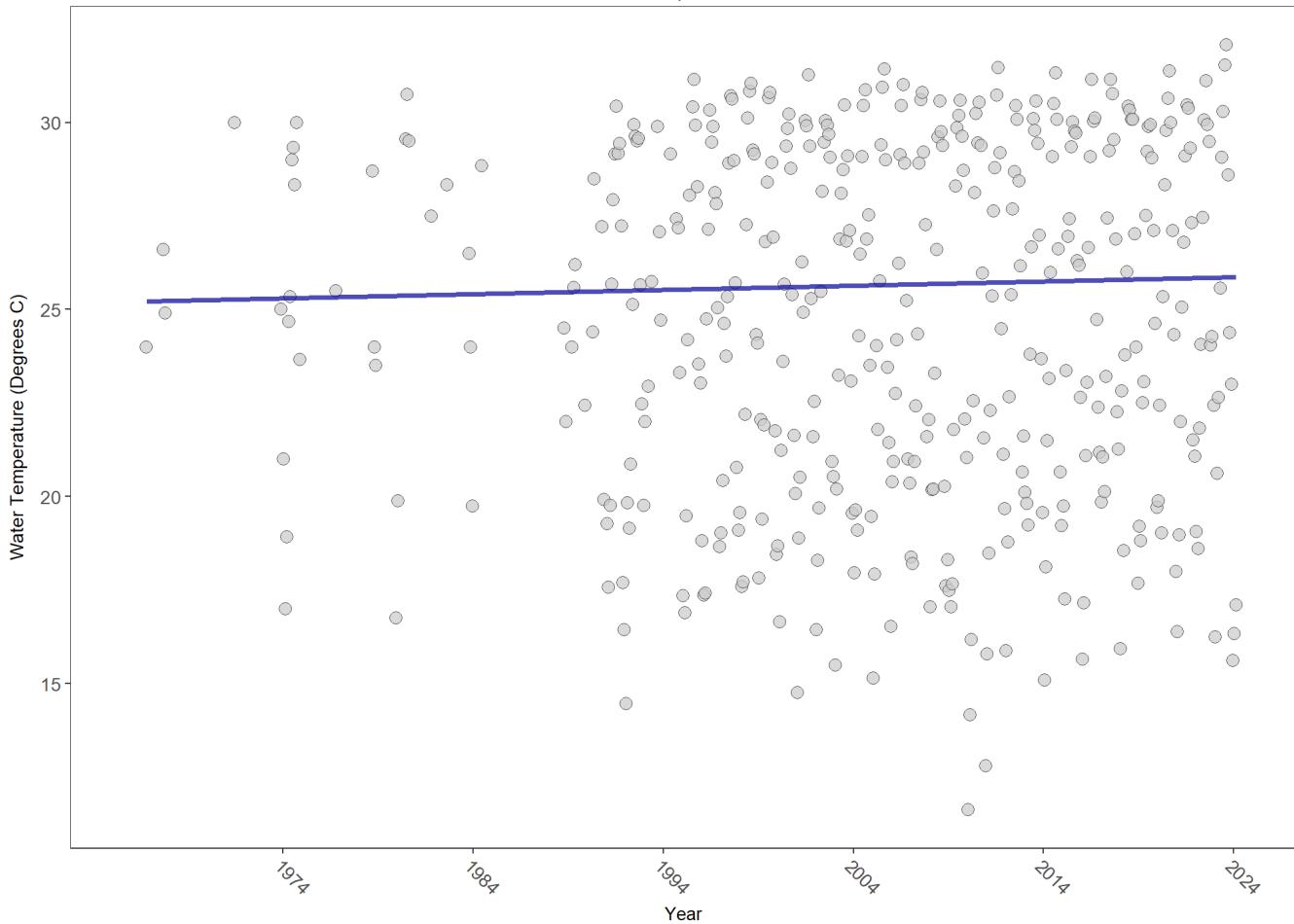
5002 - Florida STORET / WIN

### 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  
Terra Ceia Aquatic Preserve



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	25571	50	26.7	TRUE	0.0756	0.0342	0.0112724	25.20307	9.6142	0.5654	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 Water Temperature

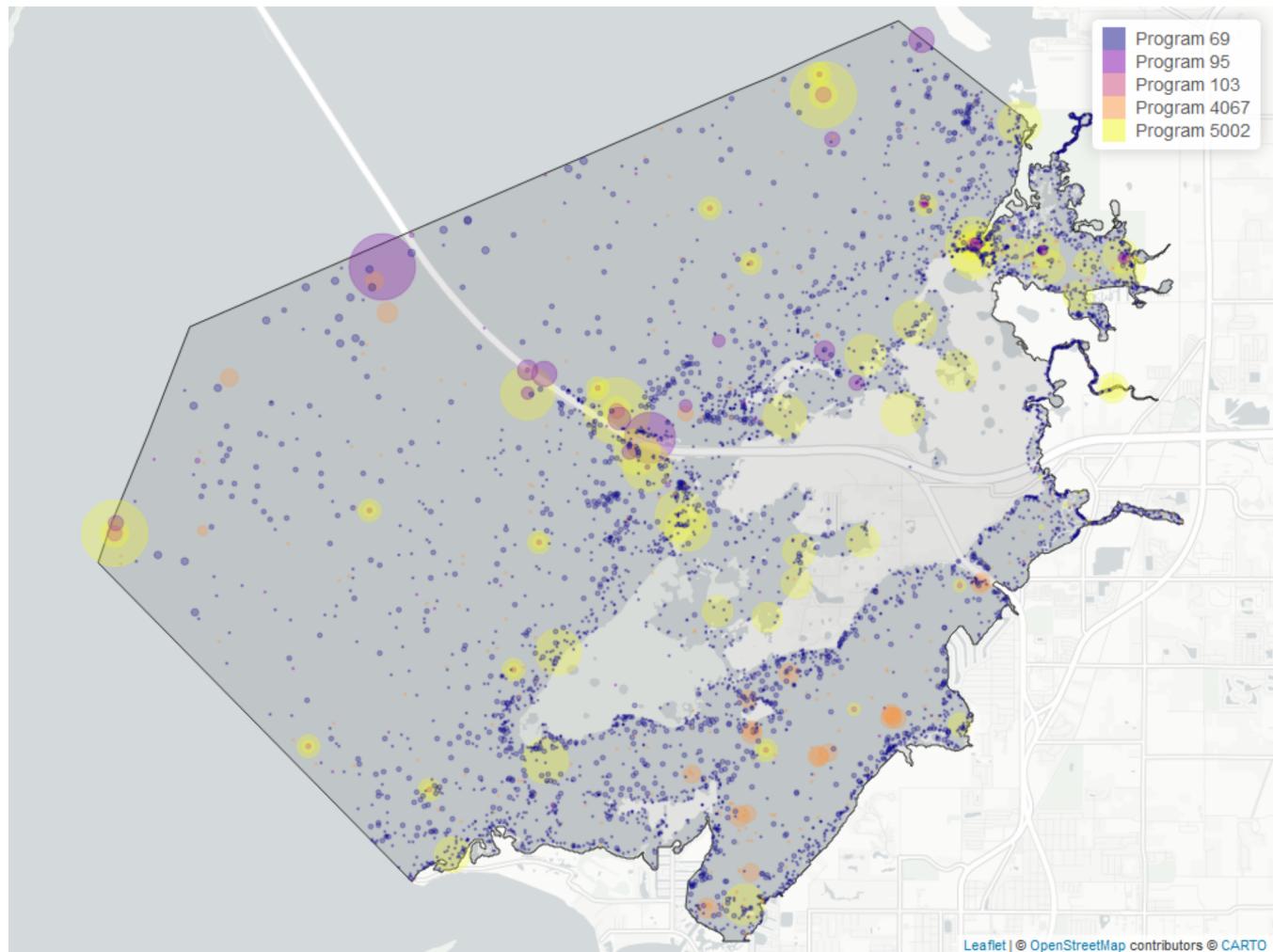


Table 22: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
5002	11514	1995	2024
69	10158	1989	2022
95	1971	1966	2018
4067	1771	1993	2022
103	183	2020	2021

#### Program names:

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

95 - Harmful Algal Bloom Marine Observation Network

4067 - Tampa Bay Benthic Monitoring

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

There are no qualifying Value Qualifiers for Water Temperature in Terra Ceia Aquatic Preserve

## Water Quality - Continuous

The following files were used in the continuous analysis:

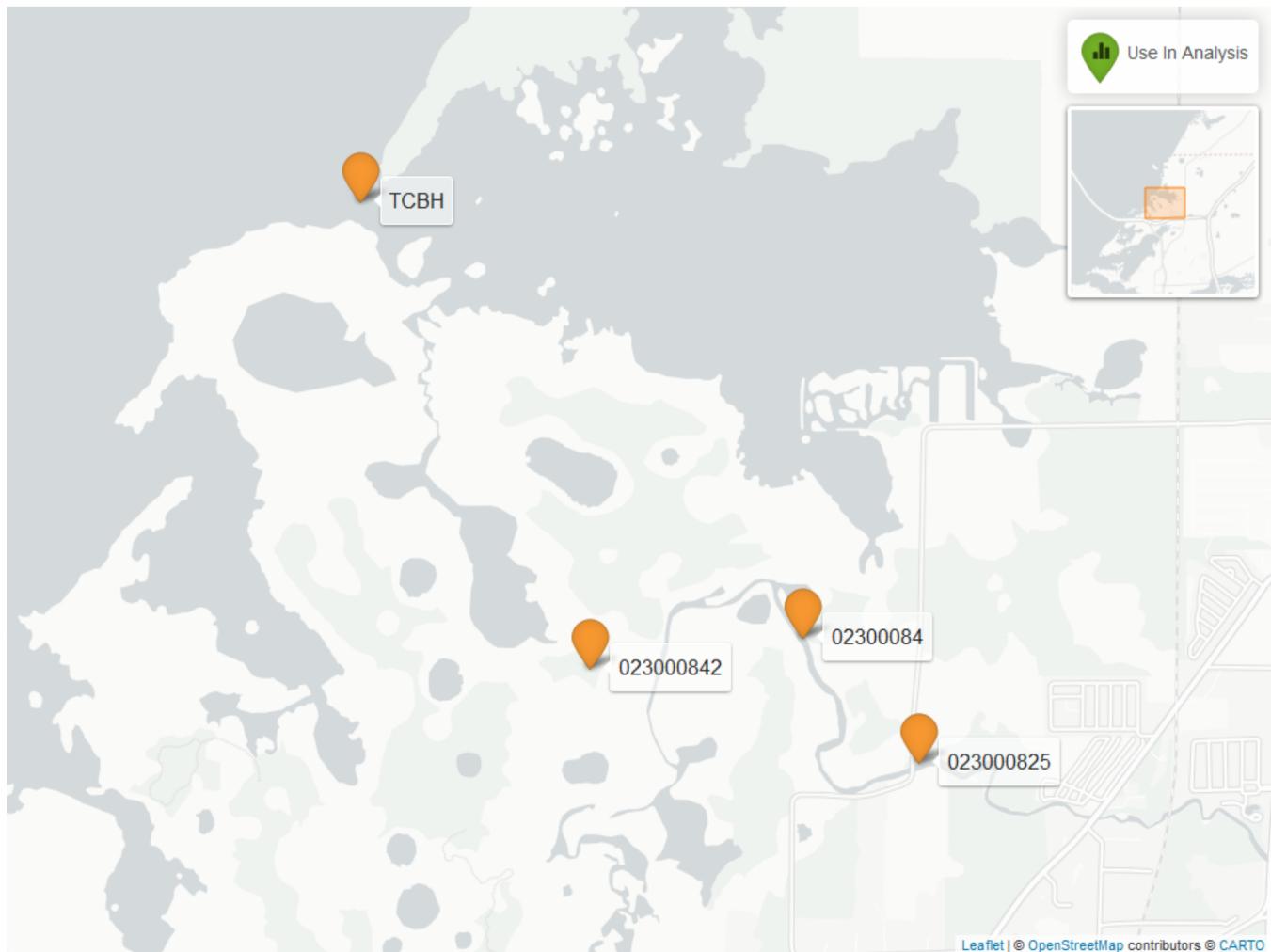
- *Combined\_WQ\_WC\_NUT\_cont\_Dissolved\_Oxygen\_SW-2024-Jul-02.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Dissolved\_Oxygen\_Saturation\_SW-2024-Jul-02.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_pH\_SW-2024-Jul-02.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Salinity\_SW-2024-Jul-02.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Turbidity\_SW-2024-Jul-02.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Water\_Temperature\_SW-2024-Jul-02.txt*

Table 23: Terra Ceia Aquatic Preserve Continuous Water Quality Monitoring (473)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
TCBH	2	FALSE	DO , DOS , pH , Sal , Turb , TempW

Table 24: National Water Information System (7)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
023000825	2	FALSE	Sal , TempW
02300084	2	FALSE	Sal , TempW
023000842	2	FALSE	Sal , TempW



Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Terra Ceia Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

# 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.

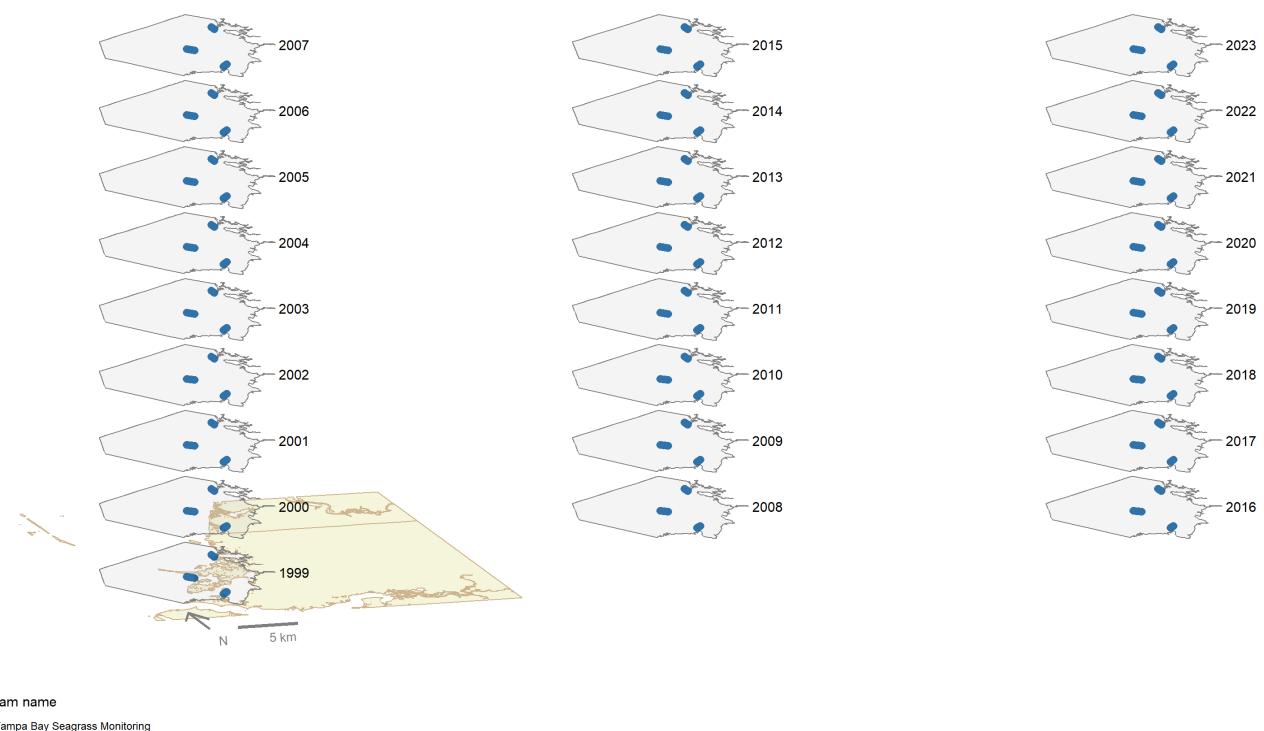
## Notes

*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

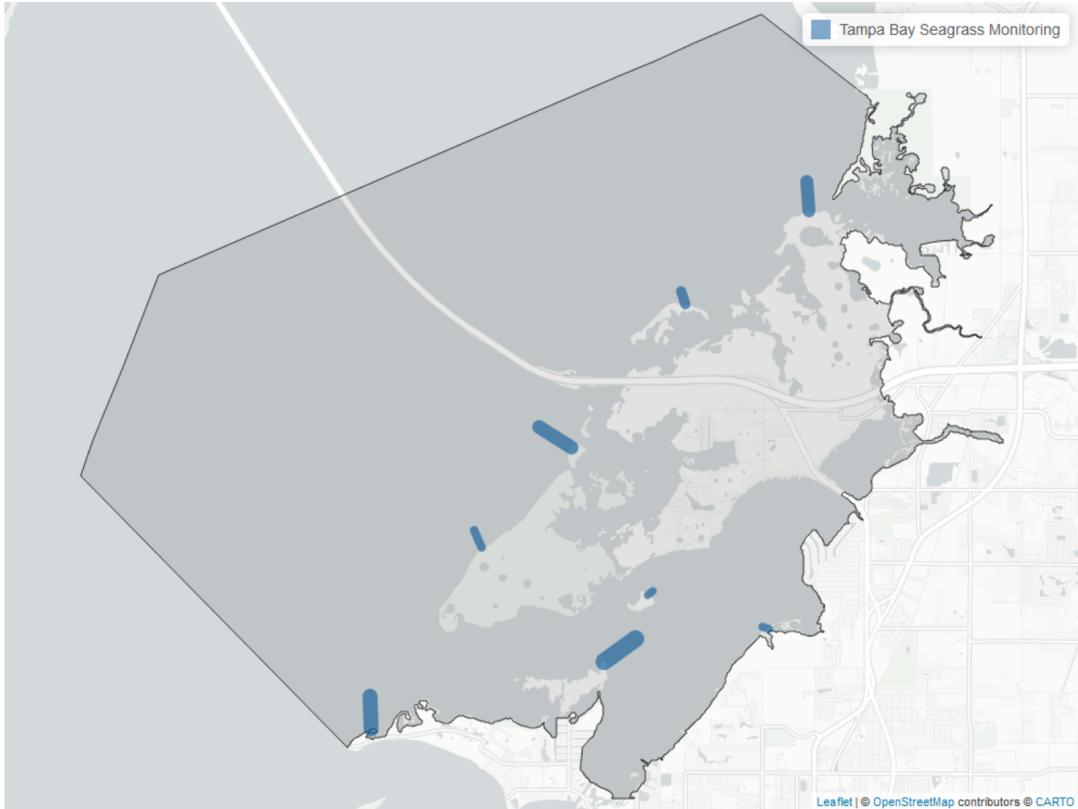
- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

Terra Ceia Aquatic Preserve  
SAV Percent Cover - Sample Locations



Maps showing the temporal scope of SAV sampling sites within the boundaries of *Terra Ceia Aquatic Preserve* by Program name.

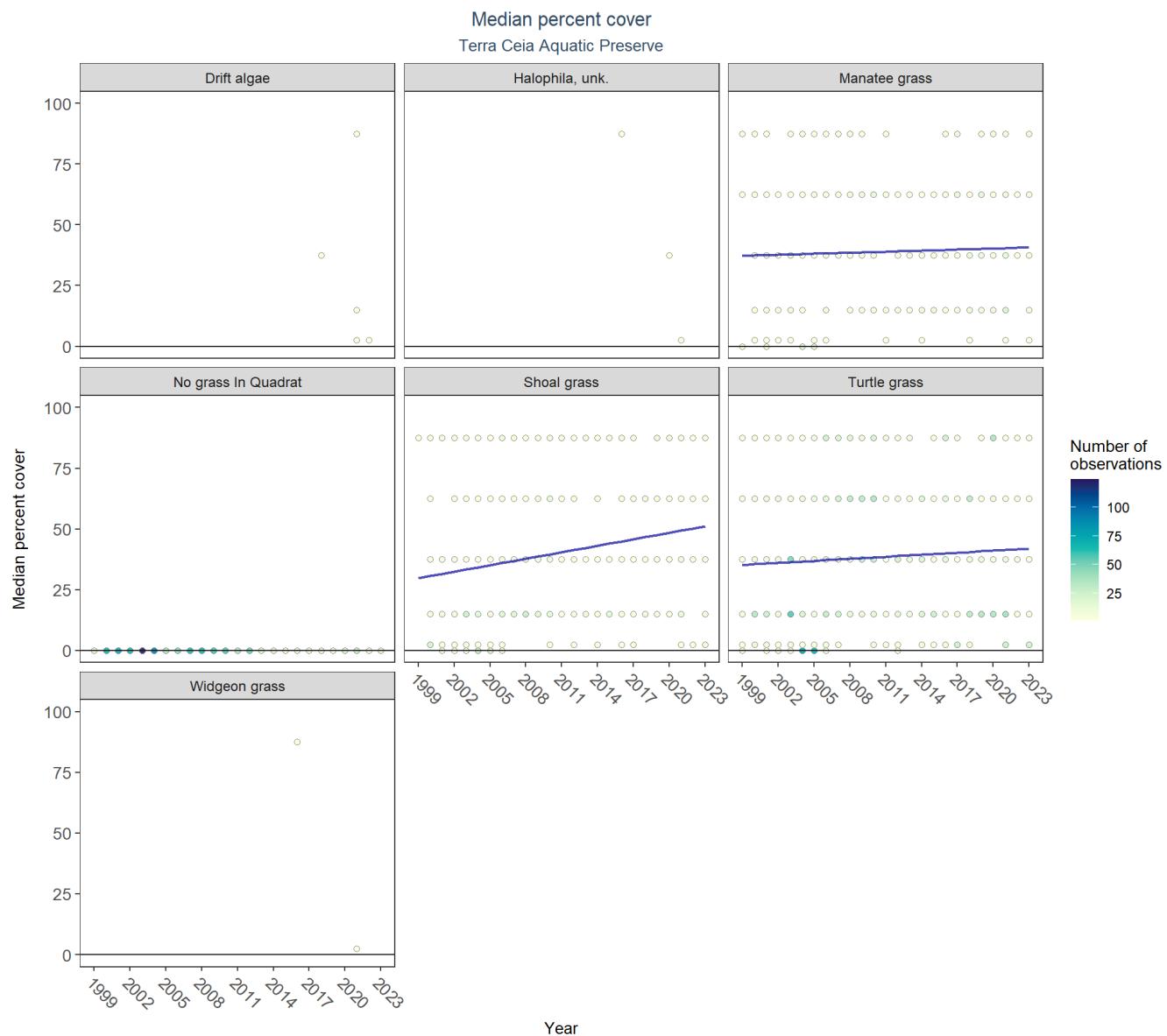
#### **Sampling locations by Program:**



Map showing SAV sampling sites within the boundaries of *Terra Ceia Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 25: Tampa Bay Seagrass Monitoring - *Program 565*

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
3968	1999	2023	Braun Blanquet	8



Median percent cover by species in *Terra Ceia 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.

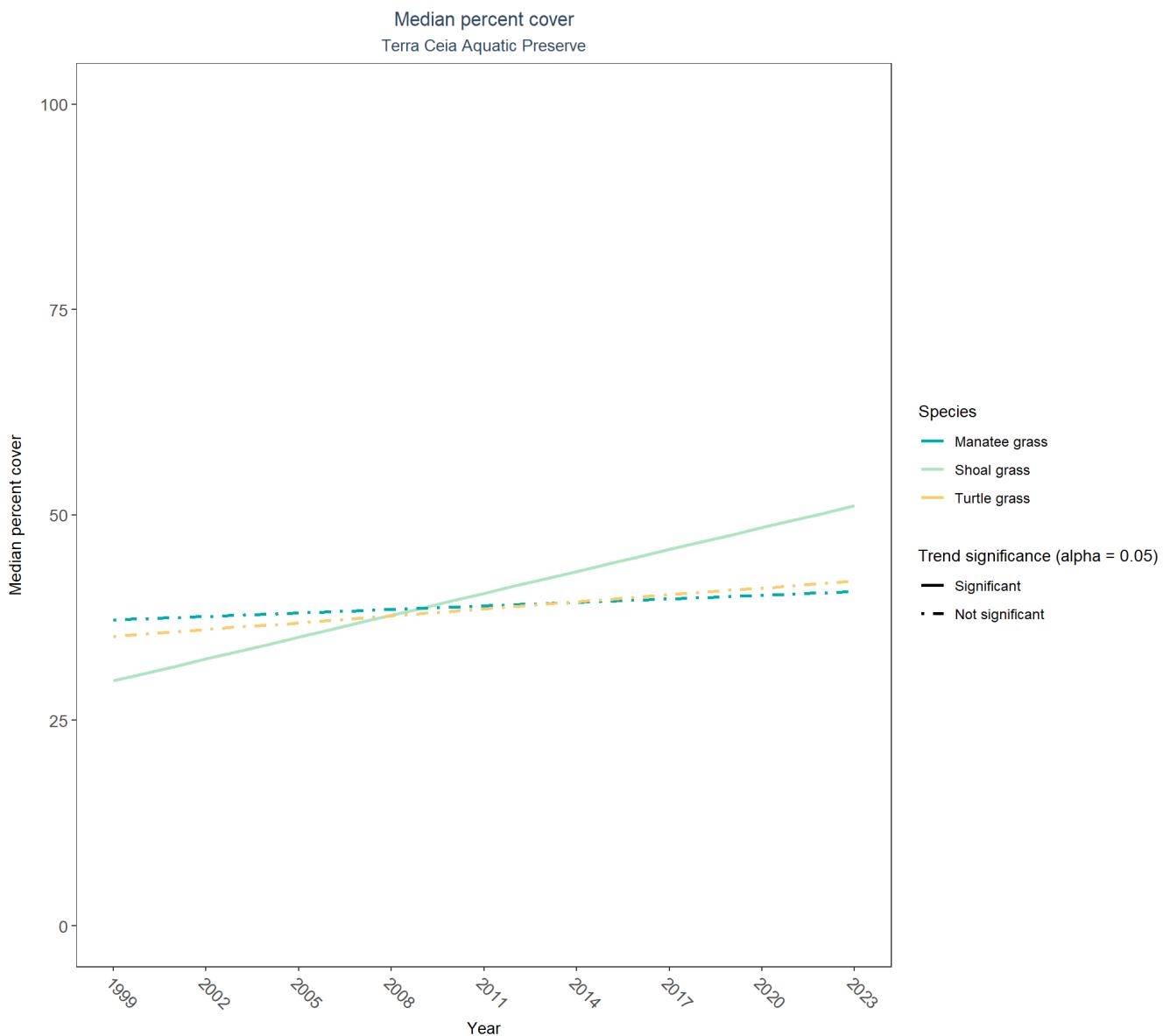
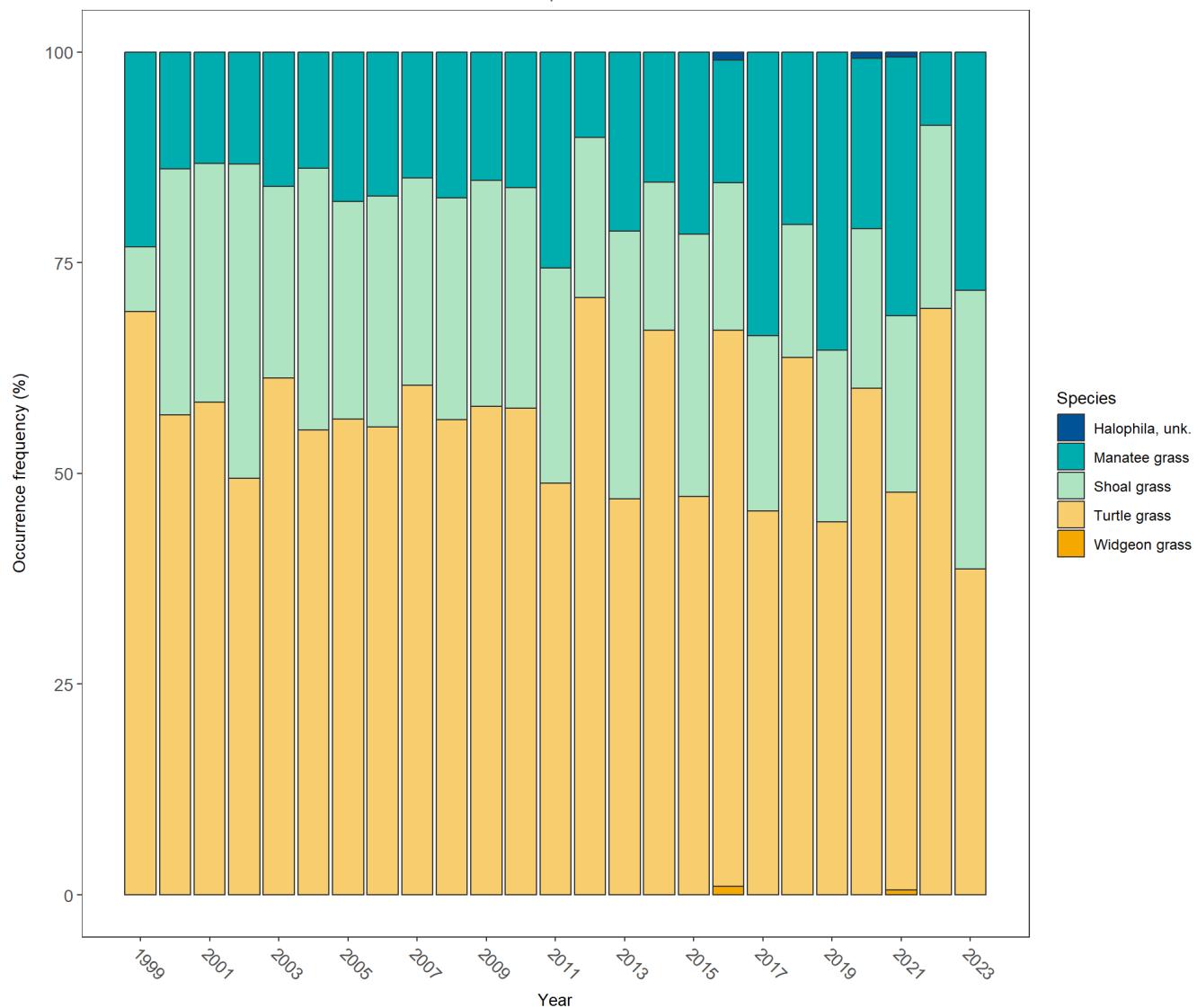
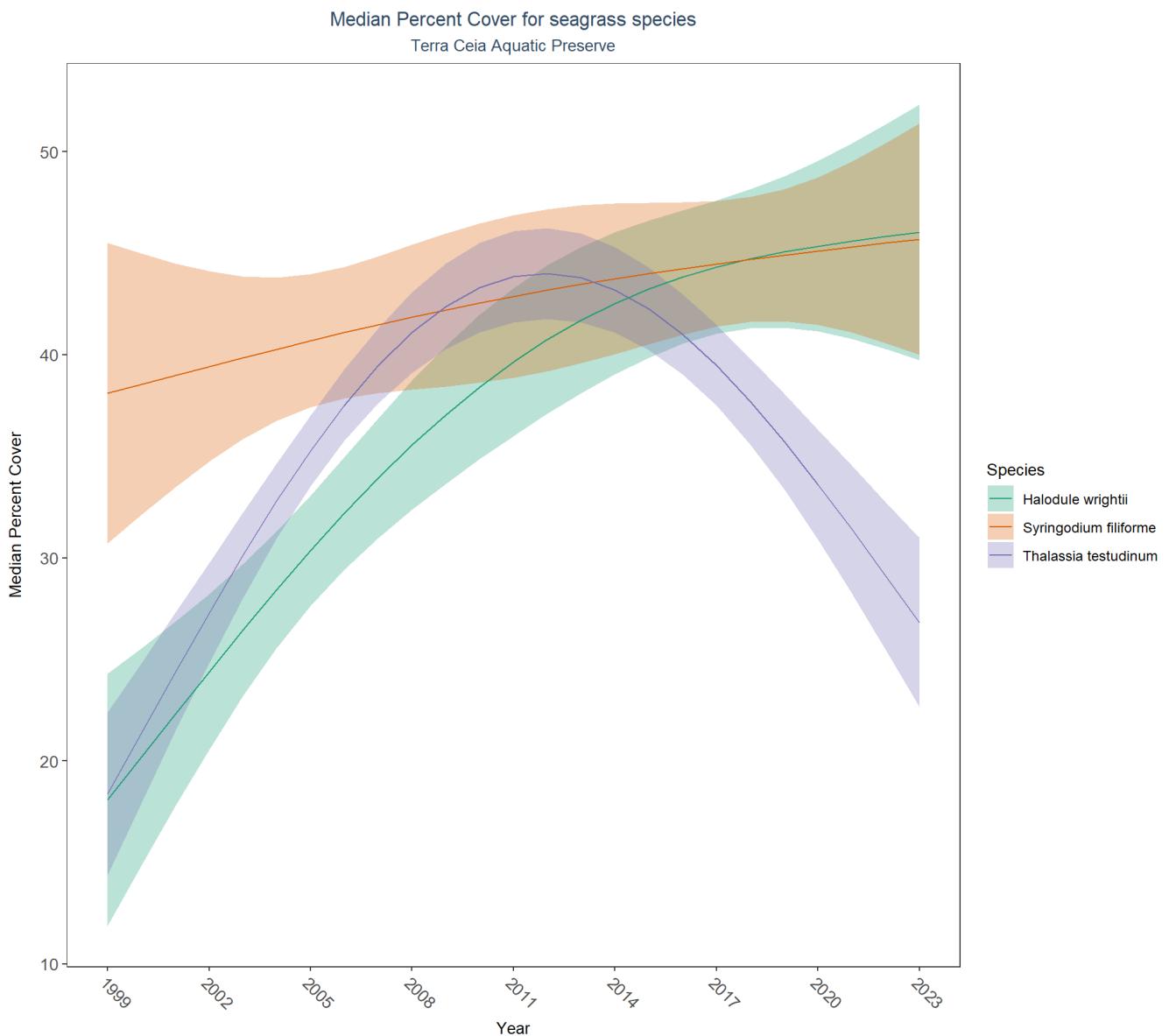


Table 26: Percent Cover Trend Analysis for Terra Ceia Aquatic Preserve

Species	Common Name	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae		Insufficient data to calculate trend				
Halodule wrightii	Shoal grass	Significantly increasing trend	1999 - 2023	25.3635	0.8886	0.0034
No grass In Quadrat		Model did not fit the available data	1999 - 2023			
Ruppia maritima	Widgeon grass	Insufficient data to calculate trend				
Syringodium filiforme	Manatee grass	No significant trend	1999 - 2023	36.5375	0.1419	0.7081
Thalassia testudinum	Turtle grass	No significant trend	1999 - 2023	33.7946	0.2824	0.3916
Halophila, unk.		Insufficient data to calculate trend				

Frequency of occurrence  
Terra Ceia Aquatic Preserve



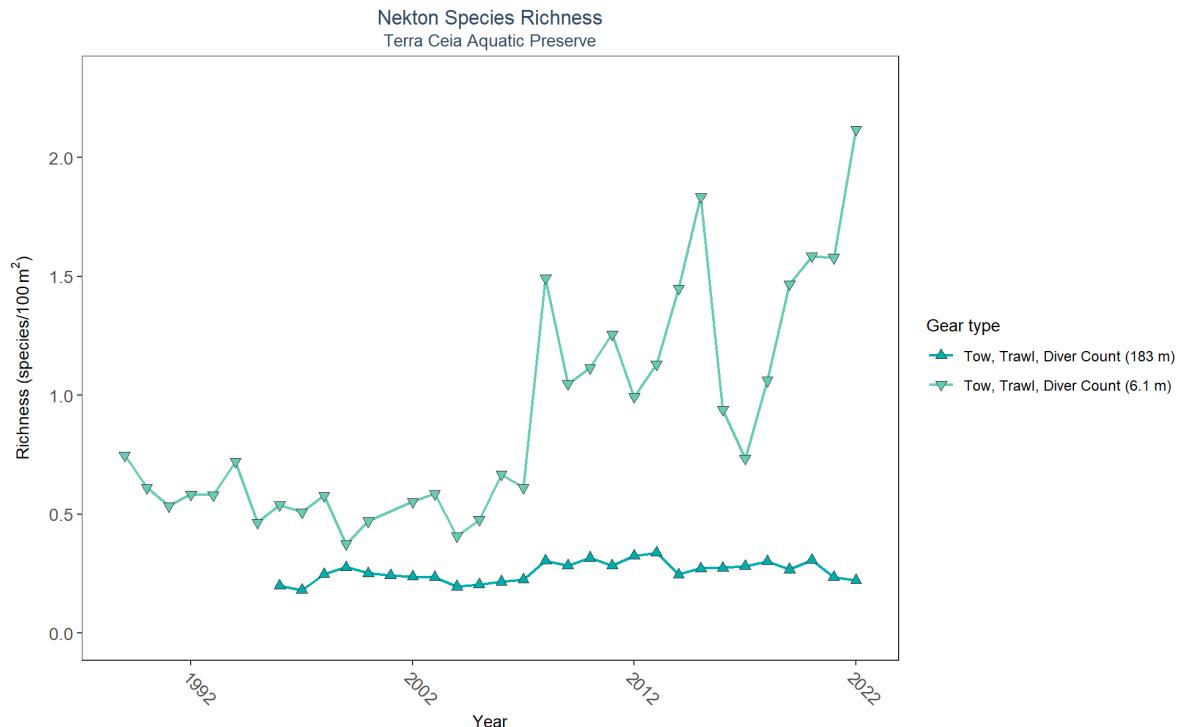


Generalized additive models for each species in Terra Ceia Aquatic Preserve. Species must have at least 10 years of data to be evaluated.

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

# Nekton

The data file used is: All\_NEKTON\_Parameters-2024-Jul-02.txt



GearType	GearSize_m	N_Years	EarliestYear	LatestYear	N_Data	Min	Max	Median	Mean	StDev	Year_MinRichness	Year_MaxRichness
Tow, Trawl, Diver Count	6.1	34	1989	2022	765	0	4.22	0.74	1.05	0.85	1999	2022
Tow, Trawl, Diver Count	183.0	27	1996	2022	976	0	0.70	0.24	0.26	0.12	1997	2013