

# Cape Haze Aquatic Preserve

## SEACAR Habitat Analyses

Last compiled on 03 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

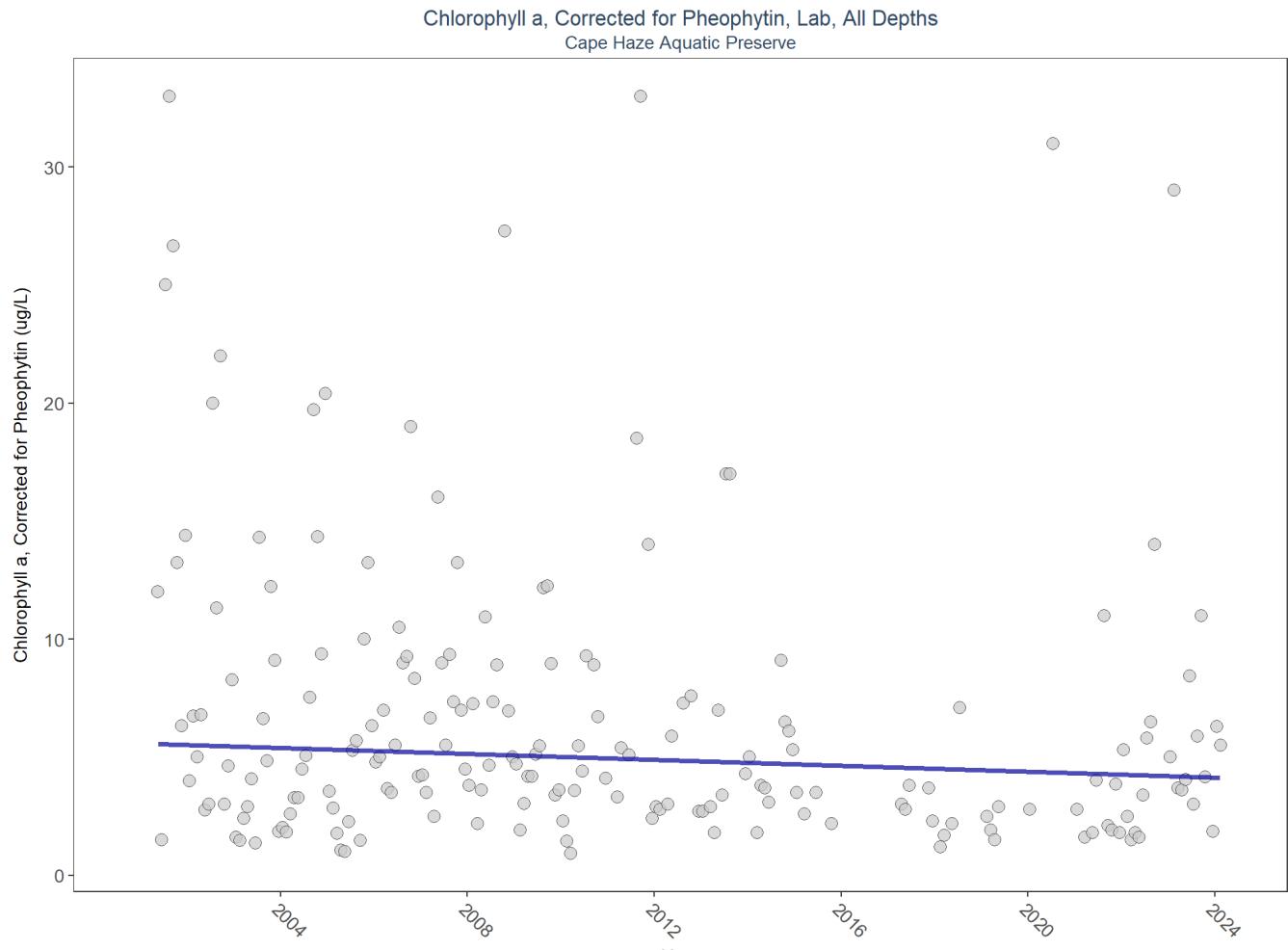
The following files were used in the discrete analysis:

- *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, 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.

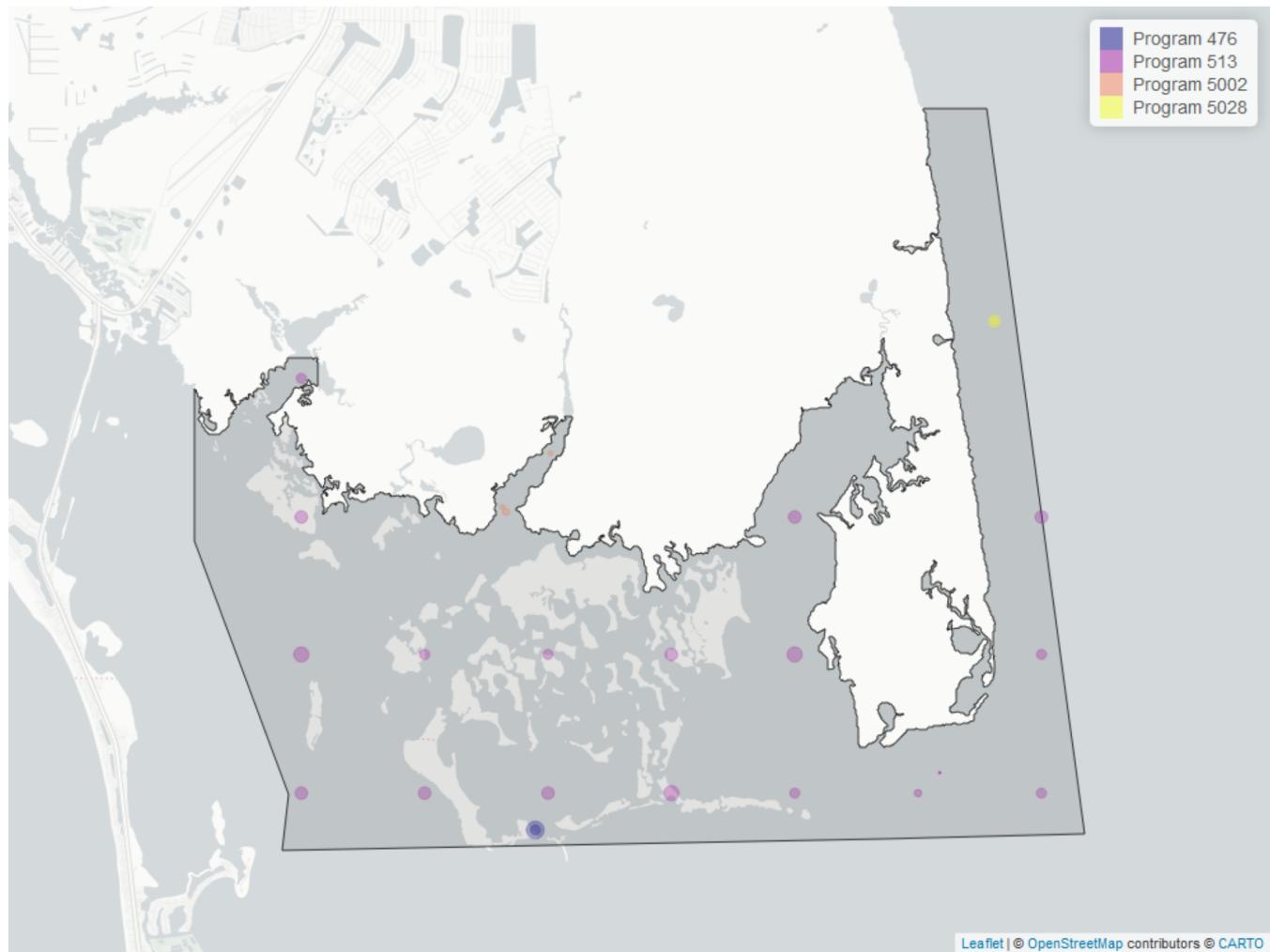
### Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$  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
513	383	2001	2021
476	70	2008	2023
5028	34	2021	2024
5002	18	2011	2023

#### Program names:

513 - Coastal Charlotte Harbor Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

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 7: Value Qualifiers for Chlorophyll a, Corrected for Pheophytin

<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>
2003	41					6	14.6
2004	41					2	4.9
2005	38					3	7.9
2006	42	5	11.9				
2007	37	2	5.4			2	5.4
2009	50	1	2.0				
2010	26	4	15.4			1	3.9
2011	14				1	7.1	
2013	8	1	12.5				
2018	4	2	50.0				
2019	4	2	50.0				
2021	17	4	23.5	2	11.8	2	11.8
2022	10	4	40.0				
2023	18	7	38.9	1	5.6		

**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:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

513 - Coastal Charlotte Harbor Monitoring Network

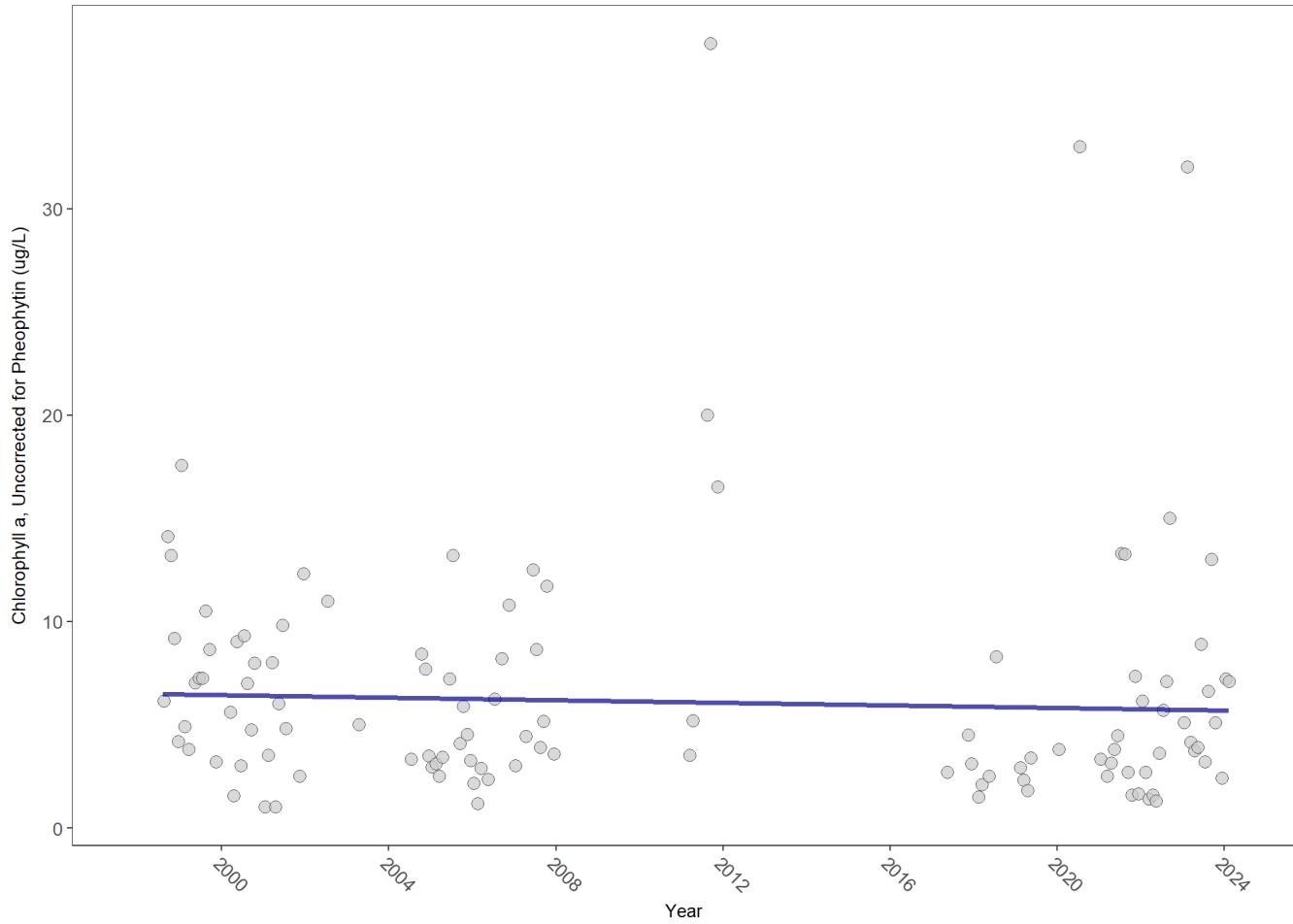
5002 - Florida STORET / WIN

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

# Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

## Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths  
Cape Haze Aquatic Preserve

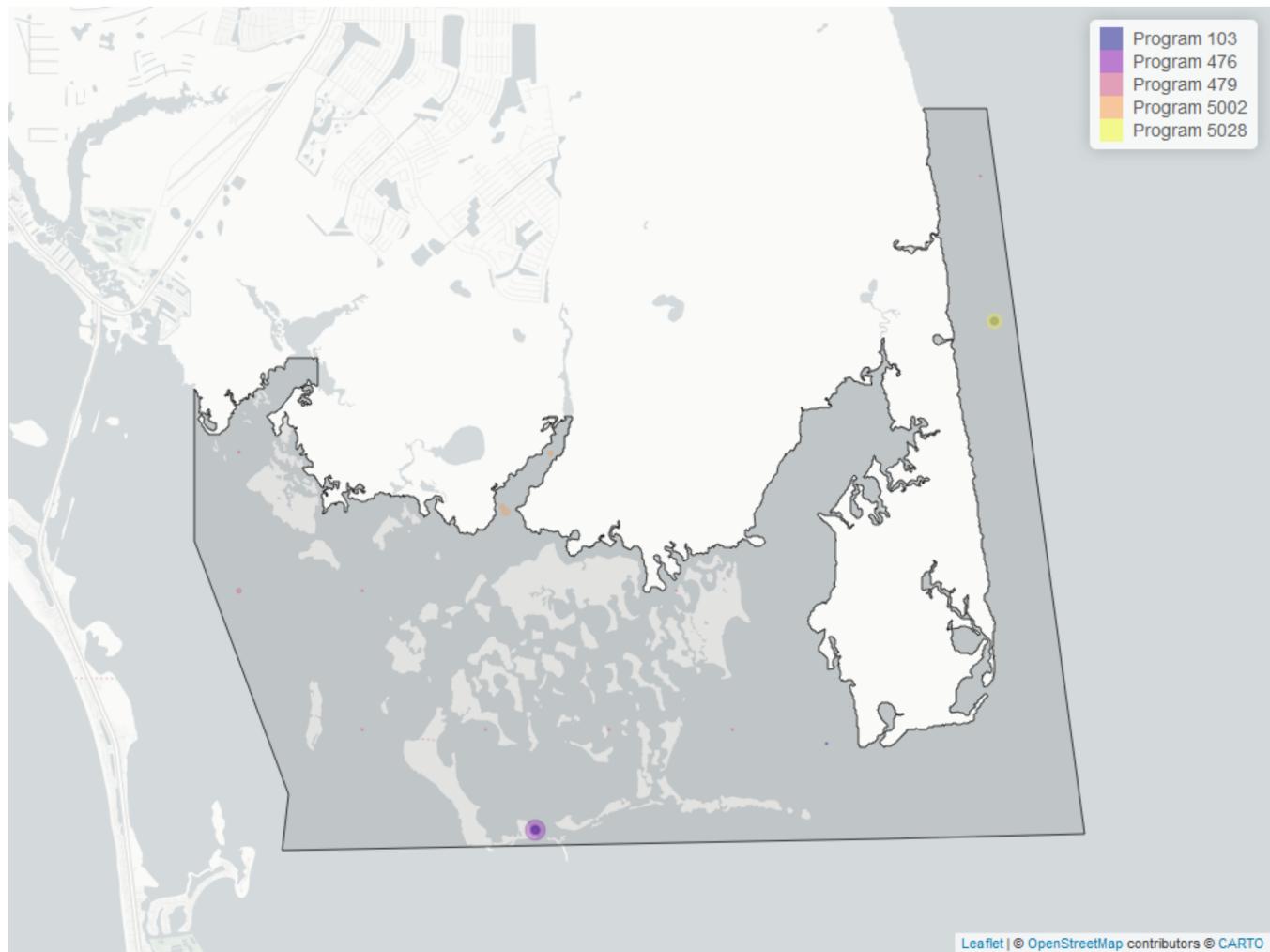


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	164	19	4.77	TRUE	-0.0699	0.4638	-0.03	6.490855	16.1295	0.1364	0

*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
476	85	1998	2023
5028	42	2021	2024
103	20	2002	2022
5002	18	2011	2023
479	13	2021	2021

#### Program names:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

5002 - Florida STORET / WIN

479 - Southwest Florida Water Management District - Water Quality Monitoring

### 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	$N_{Total}$	$N_I$	$perc_I$	$N_Q$	$perc_Q$	$N_U$	$perc_U$
2001	9					2	22.2
2003	1					1	100.0
2006	8					1	12.5
2007	8	3	37.5				
2021	45	2	4.4	2	4.4		
2022	12	3	25.0				
2023	18	2	11.1	1	5.6		

**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:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5002 - Florida STORET / WIN

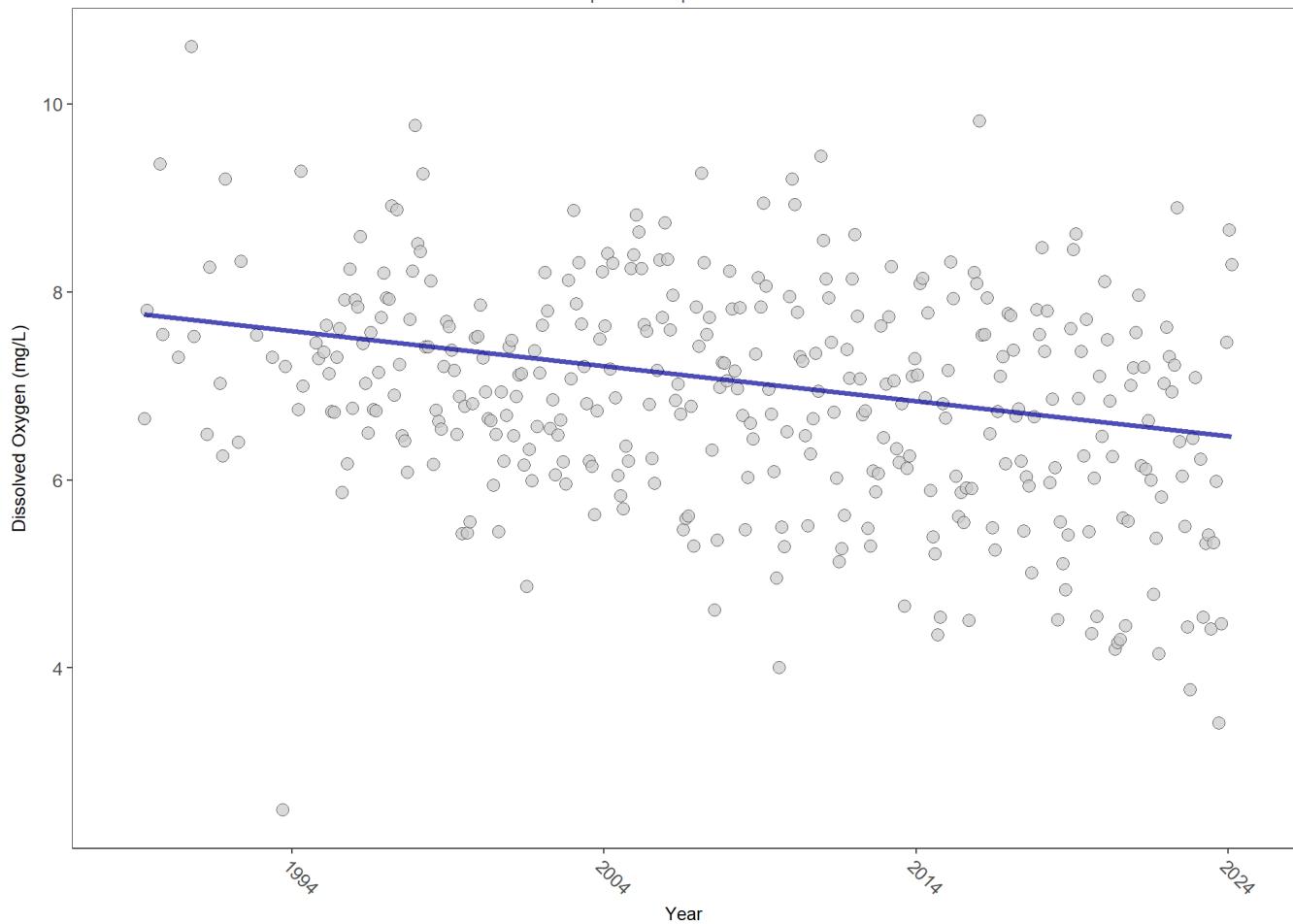
5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

## 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  
Cape Haze Aquatic Preserve

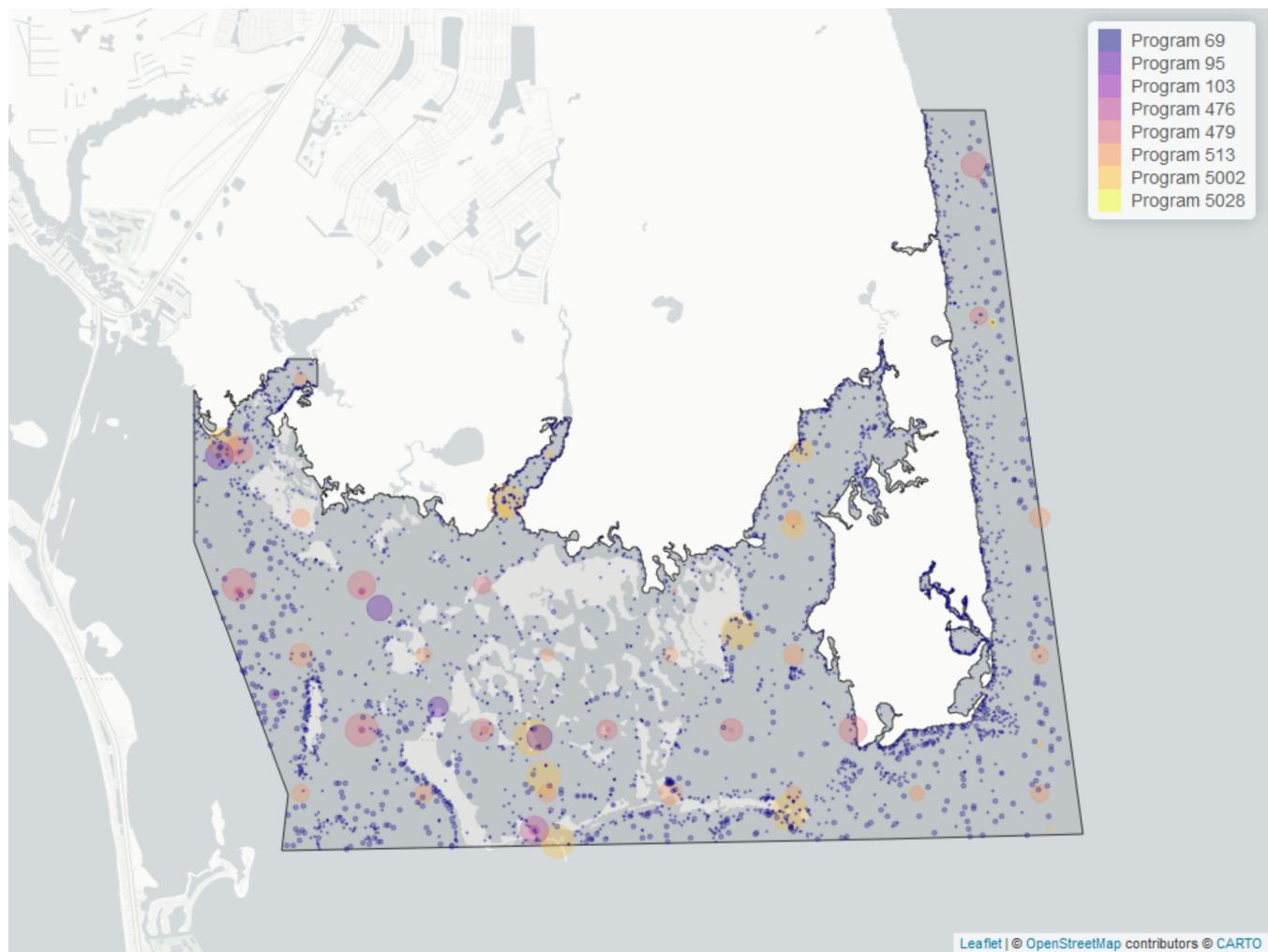


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10807	36	6.8	TRUE	-0.2765	0.0000	-0.03720238	7.767019	19.1237	0.0589	-1

*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



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

Table 10: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
69	6769	1989	2022
5002	1483	1995	2023
479	1176	2001	2021
513	816	2001	2010
95	422	1998	2018
476	140	1998	2023
103	15	2020	2022
5028	12	2022	2024

**Program names:**

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

479 - Southwest Florida Water Management District - Water Quality Monitoring

513 - Coastal Charlotte Harbor Monitoring Network

95 - Harmful Algal Bloom Marine Observation Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

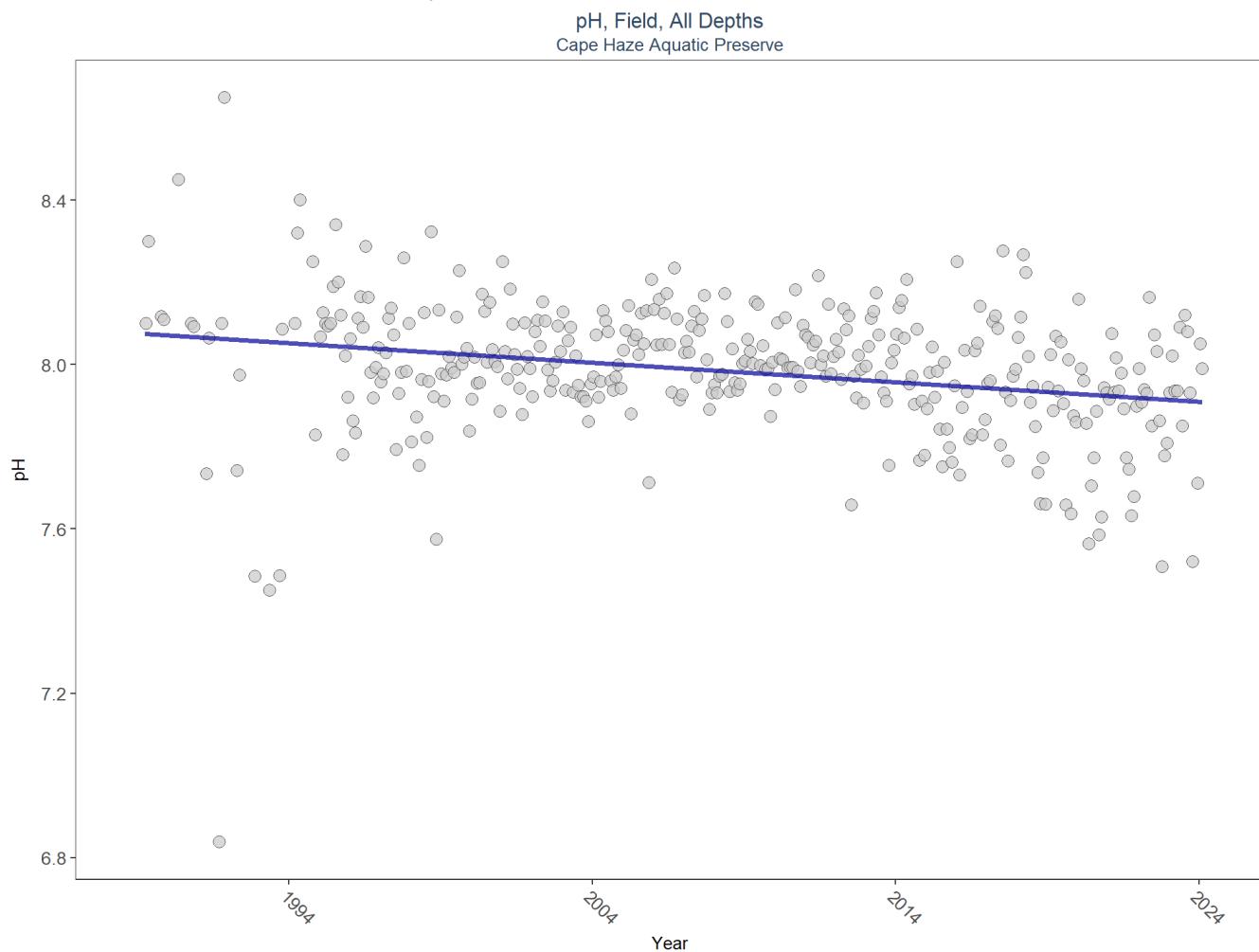
5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

There are no qualifying Value Qualifiers for Dissolved Oxygen in Cape Haze 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

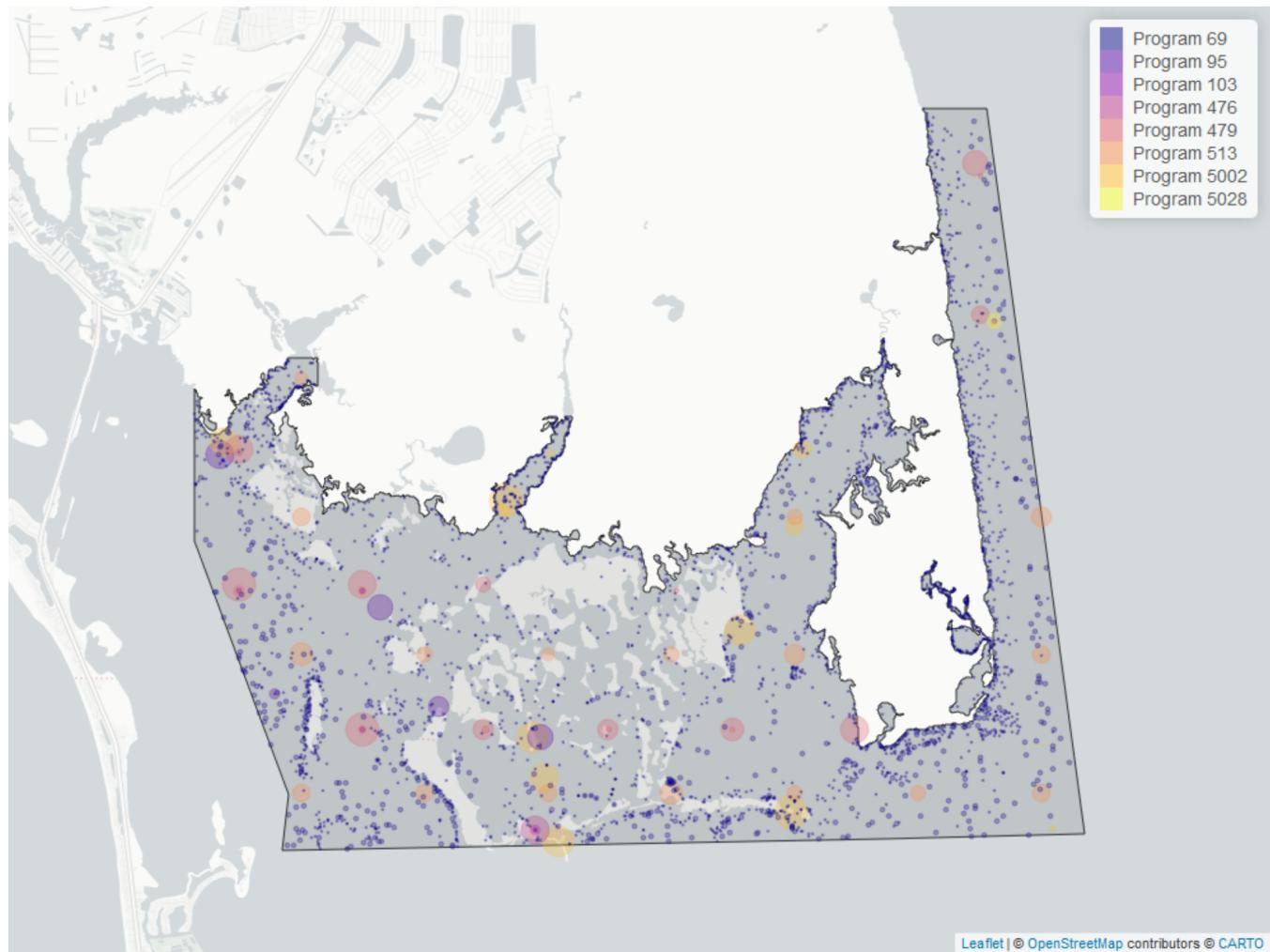


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10407	36	8	TRUE	-0.2162	0.0000	-0.004738636	8.07527	18.4471	0.0718	-1

*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 pH



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

Table 11: Programs contributing data for pH

ProgramID	N_Data	YearMin	YearMax
69	6714	1989	2022
479	1162	2001	2021
5002	1107	1995	2023
513	815	2001	2010
95	421	2008	2018
476	146	1998	2023
5028	31	2021	2024
103	20	2020	2022

**Program names:**

69 - Fisheries-Independent Monitoring (FIM) Program

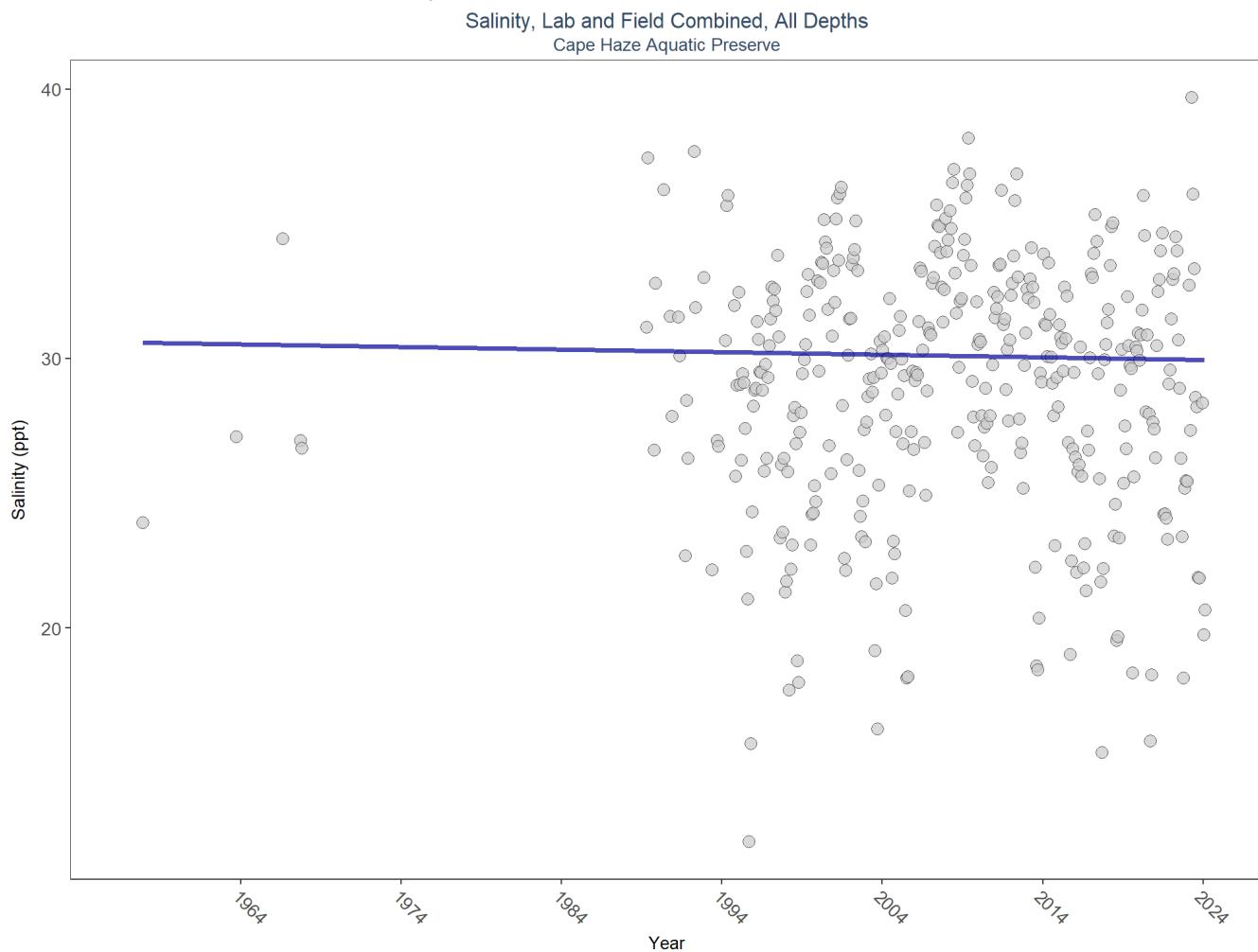
479 - Southwest Florida Water Management District - Water Quality Monitoring  
 5002 - Florida STORET / WIN  
 513 - Coastal Charlotte Harbor Monitoring Network  
 95 - Harmful Algal Bloom Marine Observation Network  
 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network  
 5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program  
 103 - EPA STORET and RETrieval Data Warehouse (STORET)

There are no qualifying Value Qualifiers for pH in Cape Haze 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

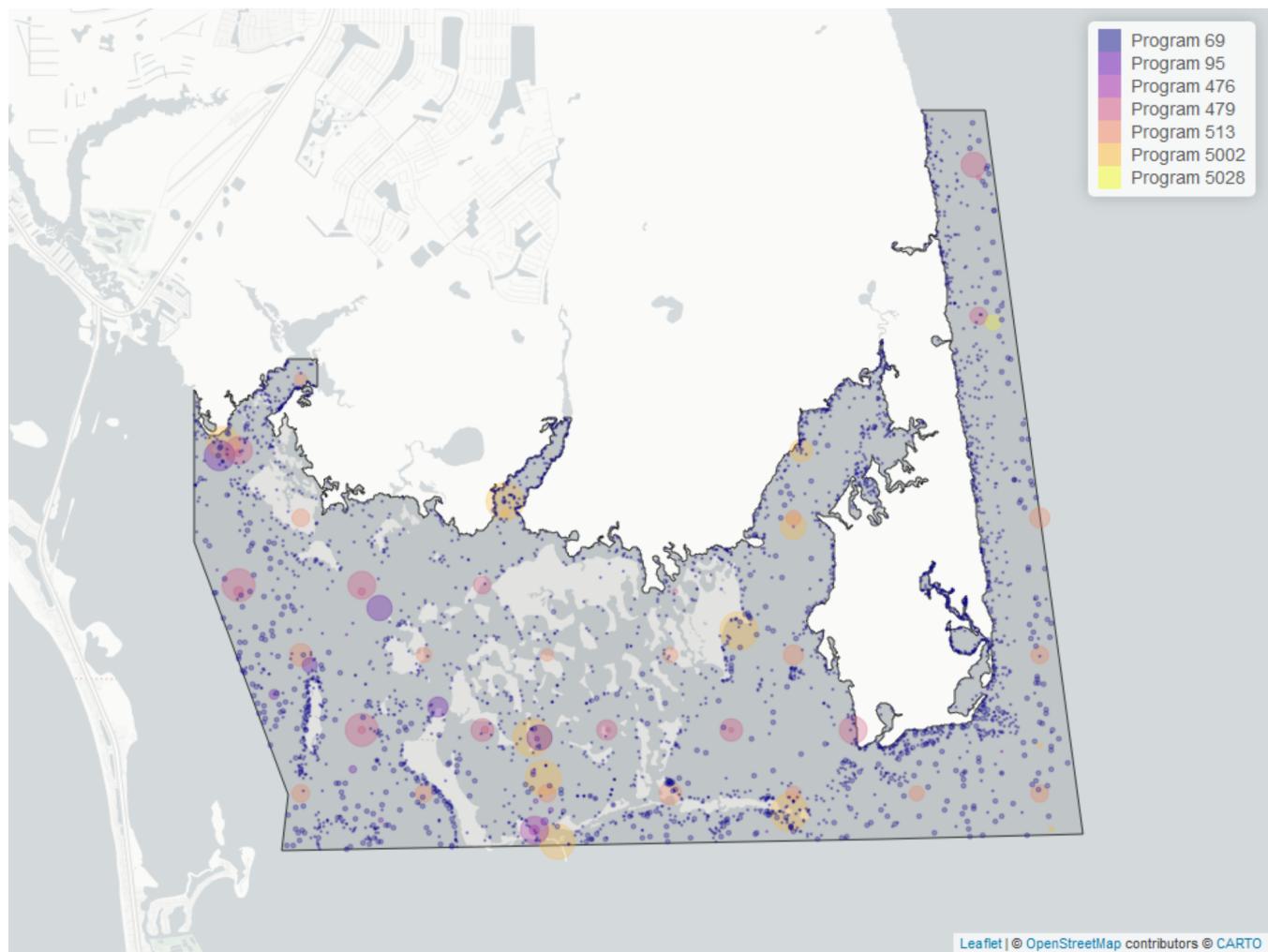


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	11137	40	30	TRUE	-0.0189	0.6107	-0.009655797	30.59627	9.6579	0.5614	0

*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 Salinity



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

Table 12: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
69	6839	1989	2022
5002	1617	1995	2023
479	1170	2001	2021
513	817	2001	2010
95	519	1957	2018
476	146	1998	2023
5028	31	2021	2024

#### Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

479 - Southwest Florida Water Management District - Water Quality Monitoring

513 - Coastal Charlotte Harbor Monitoring Network

95 - Harmful Algal Bloom Marine Observation Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

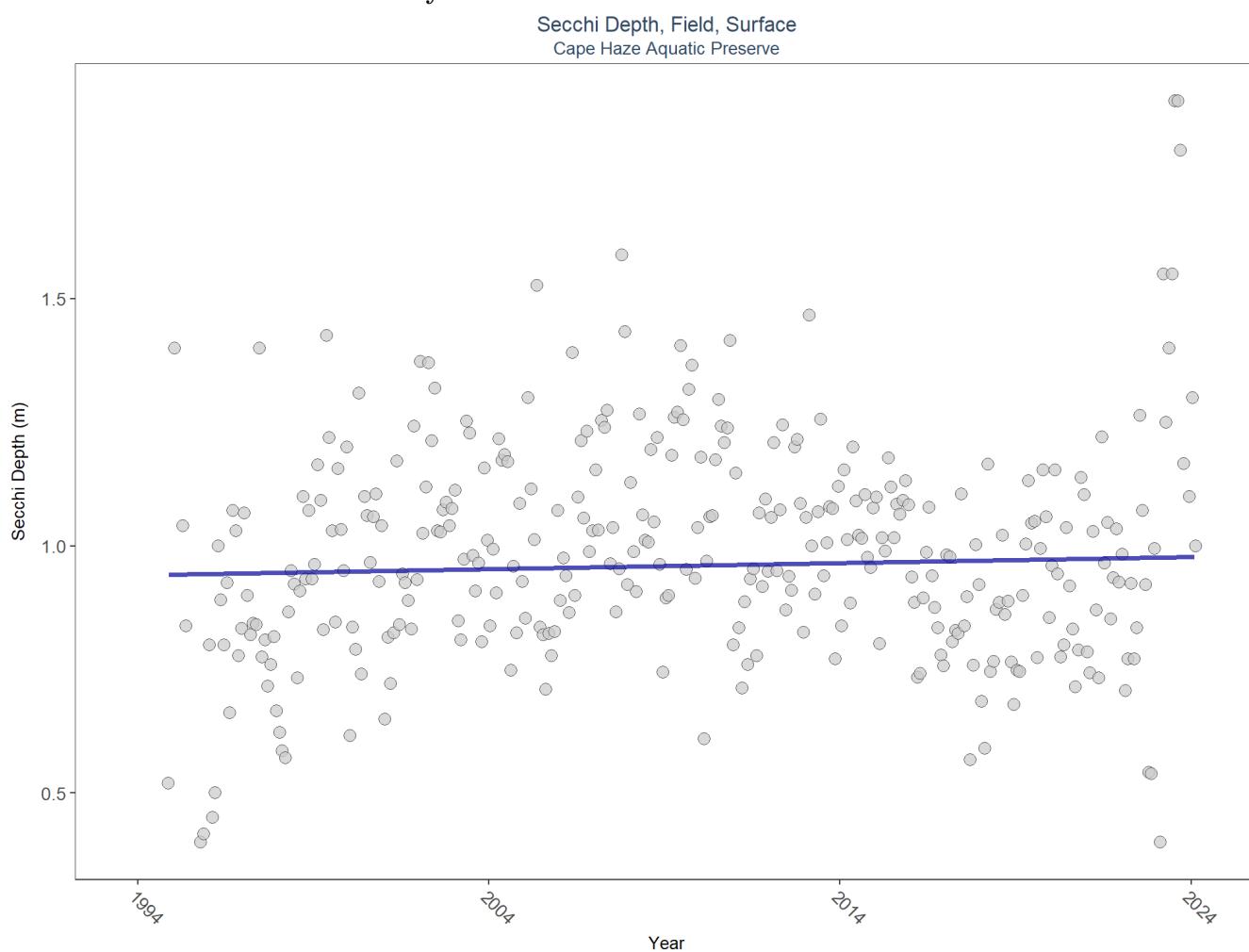
5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program

There are no qualifying Value Qualifiers for Salinity in Cape Haze 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.

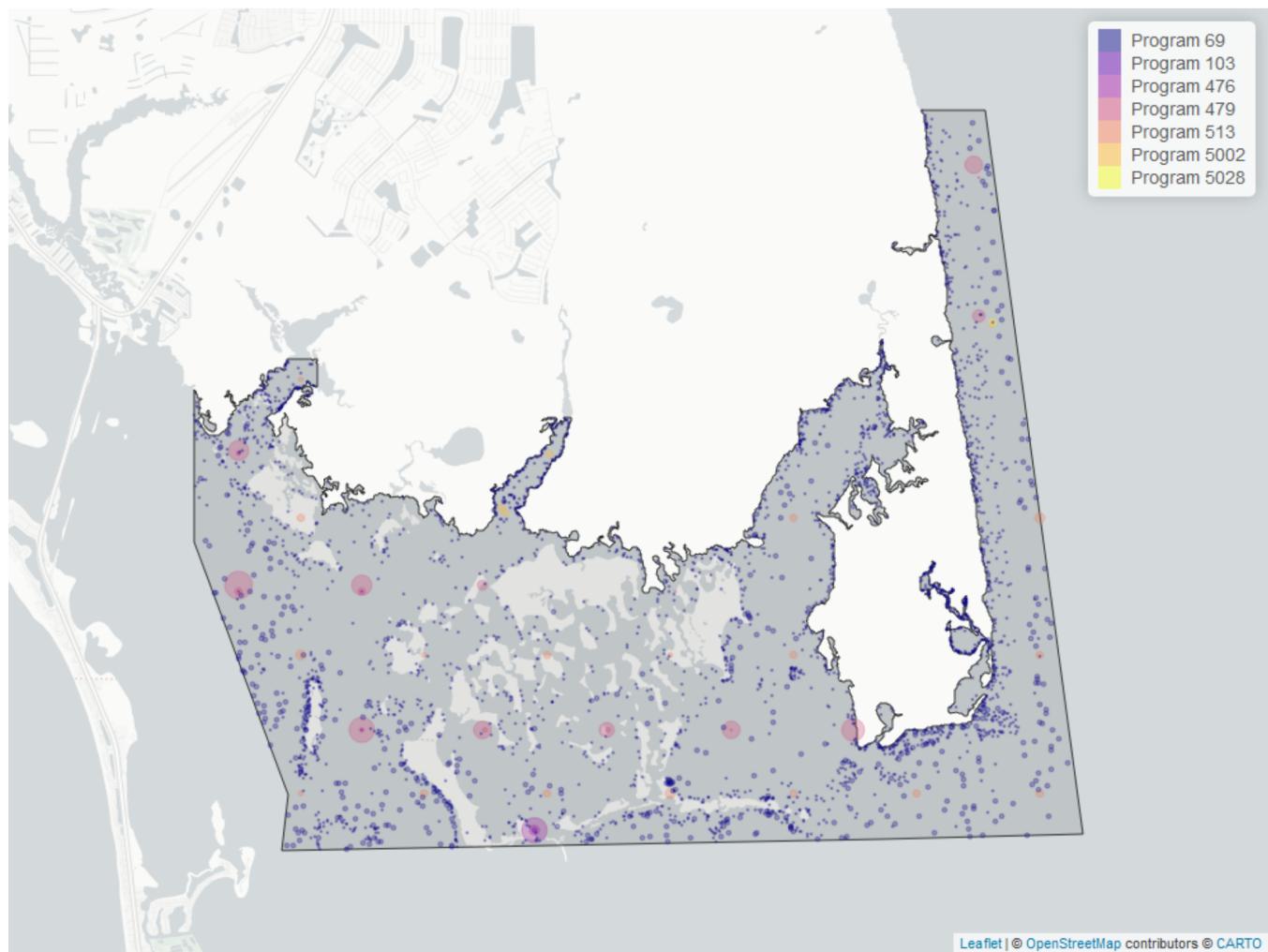
### Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$  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 13: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
69	6580	1994	2022
479	694	2001	2021
513	161	2001	2010
476	125	1998	2023
5002	24	2008	2023
5028	12	2022	2024
103	8	2020	2022

#### Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

479 - Southwest Florida Water Management District - Water Quality Monitoring

513 - Coastal Charlotte Harbor Monitoring Network  
 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network  
 5002 - Florida STORET / WIN  
 5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program  
 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 14: Value Qualifiers for Secchi Depth

Year	$N_{Total}$	$N_S$	$perc_S$
2017	367	2	0.5
2018	363	1	0.3
2019	353	1	0.3
2020	308	4	1.3
2021	330	10	3.0
2022	306	1	0.3
2023	17	14	82.3
2024	2	1	50.0

**Note:** <sup>1</sup>S - Secchi disk visible to bottom of waterbody

### Programs containing Value Qualified data:

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program  
 5002 - Florida STORET / WIN  
 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network  
 479 - Southwest Florida Water Management District - Water Quality Monitoring

## 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:

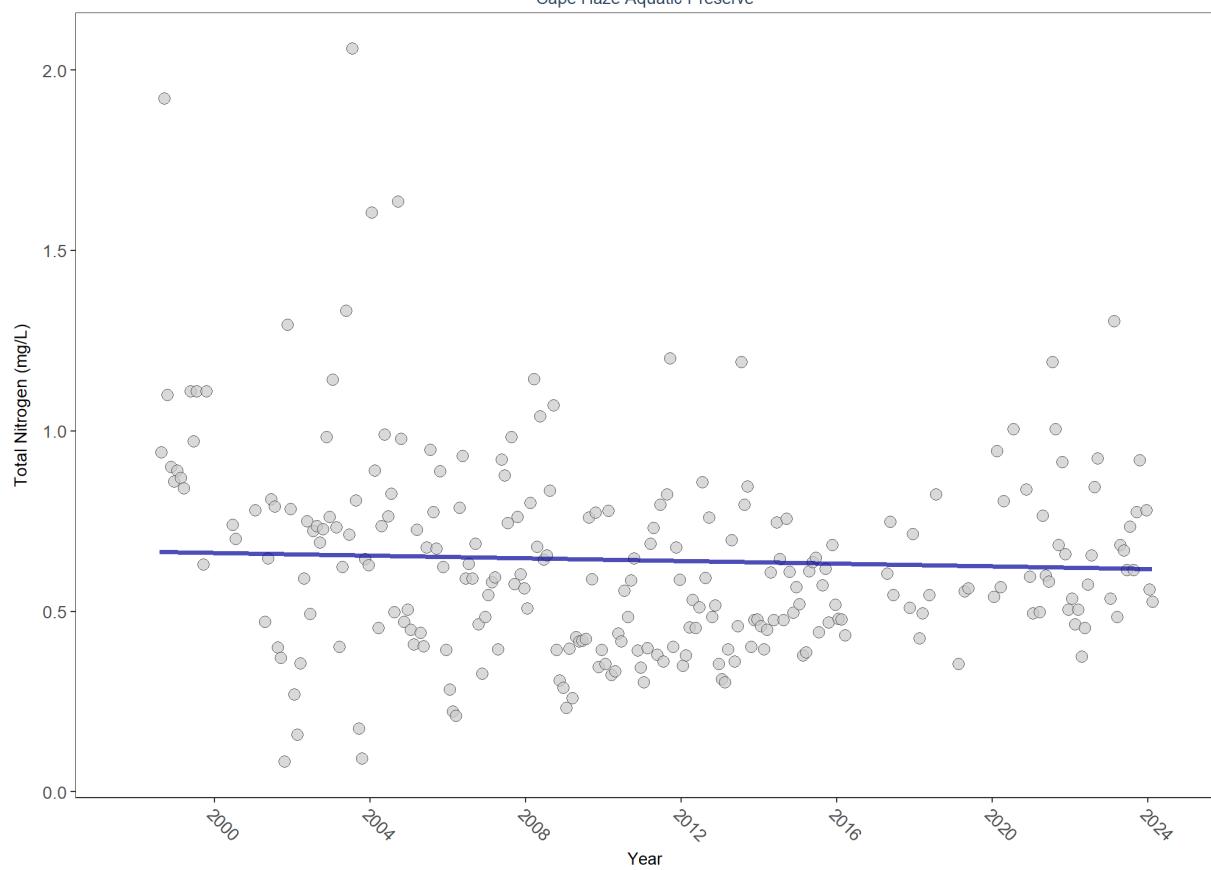
- Rules for use of sample fraction:
  - FDEP report that if both “Total” and “Dissolved” are reported, only “Total” is used. If the total is not reported, they do use dissolved as a best available replacement.
  - An analysis of all SEACAR data shows that 90% of all possible TN calculations can be done 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<sub>3</sub>O<sub>2</sub> 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  
Cape Haze Aquatic Preserve

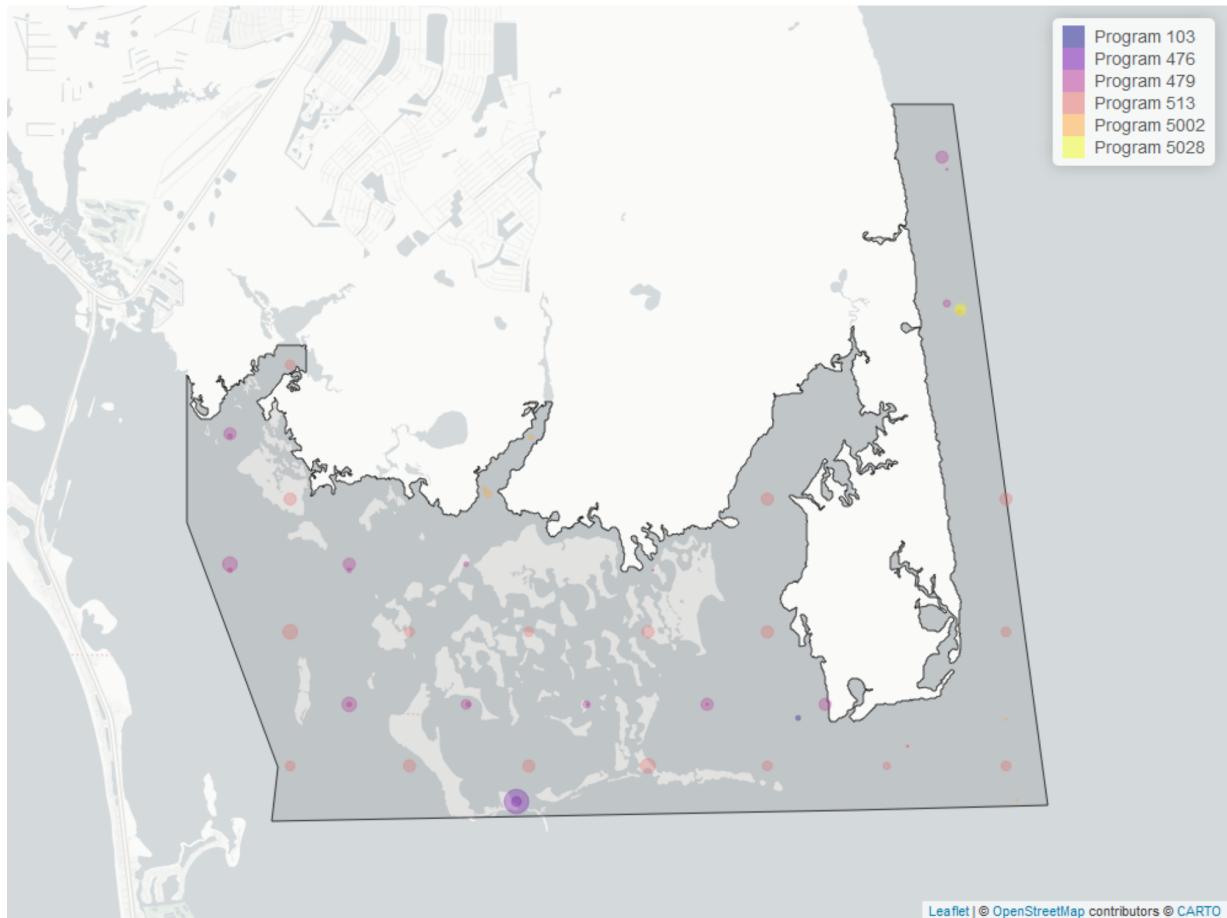


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	818	27	0.5605	TRUE	-0.0356	0.4343	-0.001875	0.6658861	7.5569	0.7524	0

$p < 0.00005$  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 Total Nitrogen



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

Table 15: Programs contributing data for Total Nitrogen

ProgramID	N_Data	YearMin	YearMax
513	378	2001	2021
479	271	2007	2021
476	117	1998	2023
5028	33	2021	2024
5002	23	2006	2023
103	3	2002	2002

#### Program names:

513 - Coastal Charlotte Harbor Monitoring Network

479 - Southwest Florida Water Management District - Water Quality Monitoring

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality 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 16: Value Qualifiers for Total Nitrogen

Year	$N_{Total}$	$N_I$	$perc_I$	$N_U$	$perc_U$
2001	29			3	10.3
2002	61			5	8.2
2006	48	5	10.4	5	10.4
2008	81	1	1.2		
2009	75	3	4.0		

**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

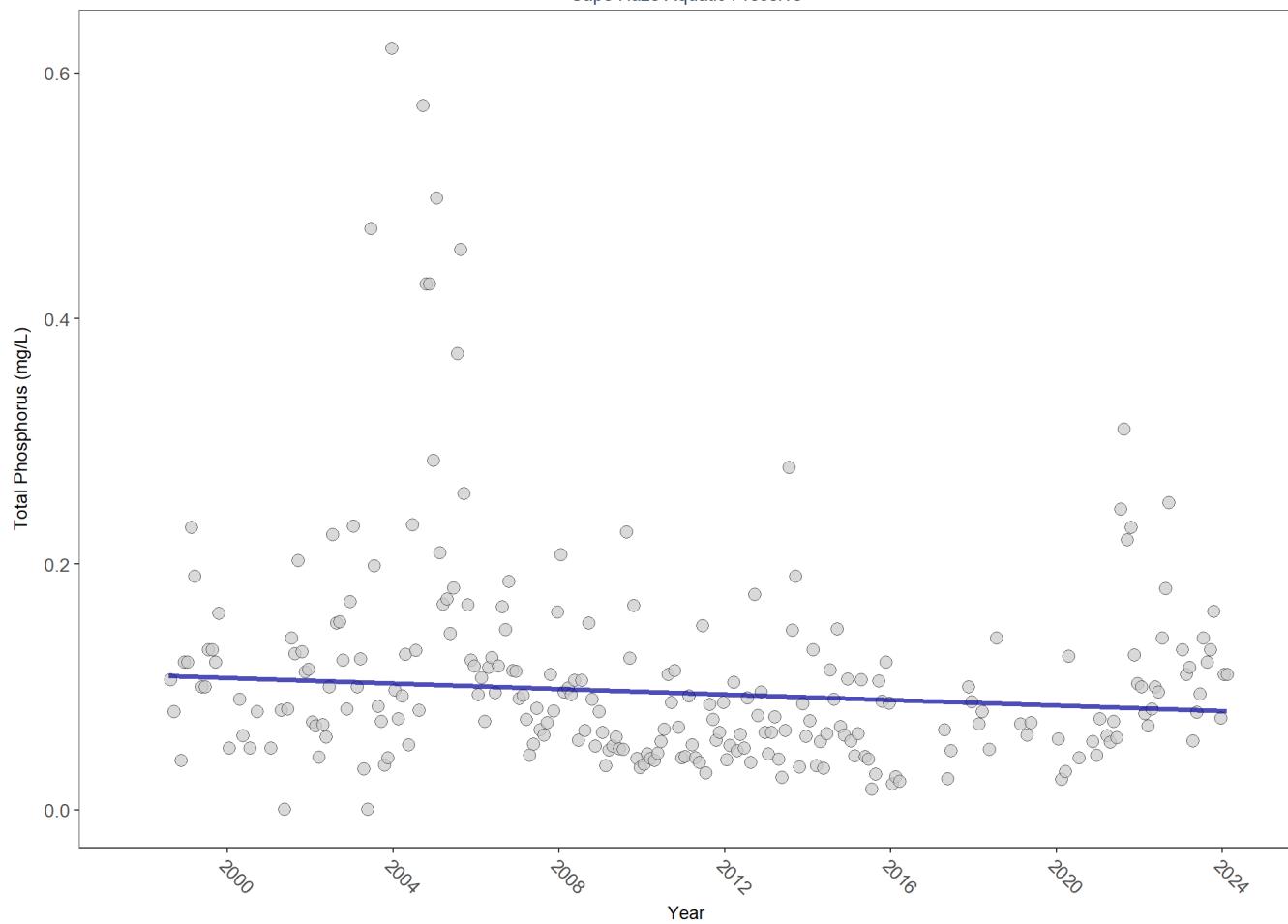
## Programs containing Value Qualified data:

513 - Coastal Charlotte Harbor Monitoring Network

## Total Phosphorus - Discrete Water Quality

### Seasonal Kendall-Tau Trend Analysis

Total Phosphorus, Lab, All Depths  
Cape Haze Aquatic Preserve

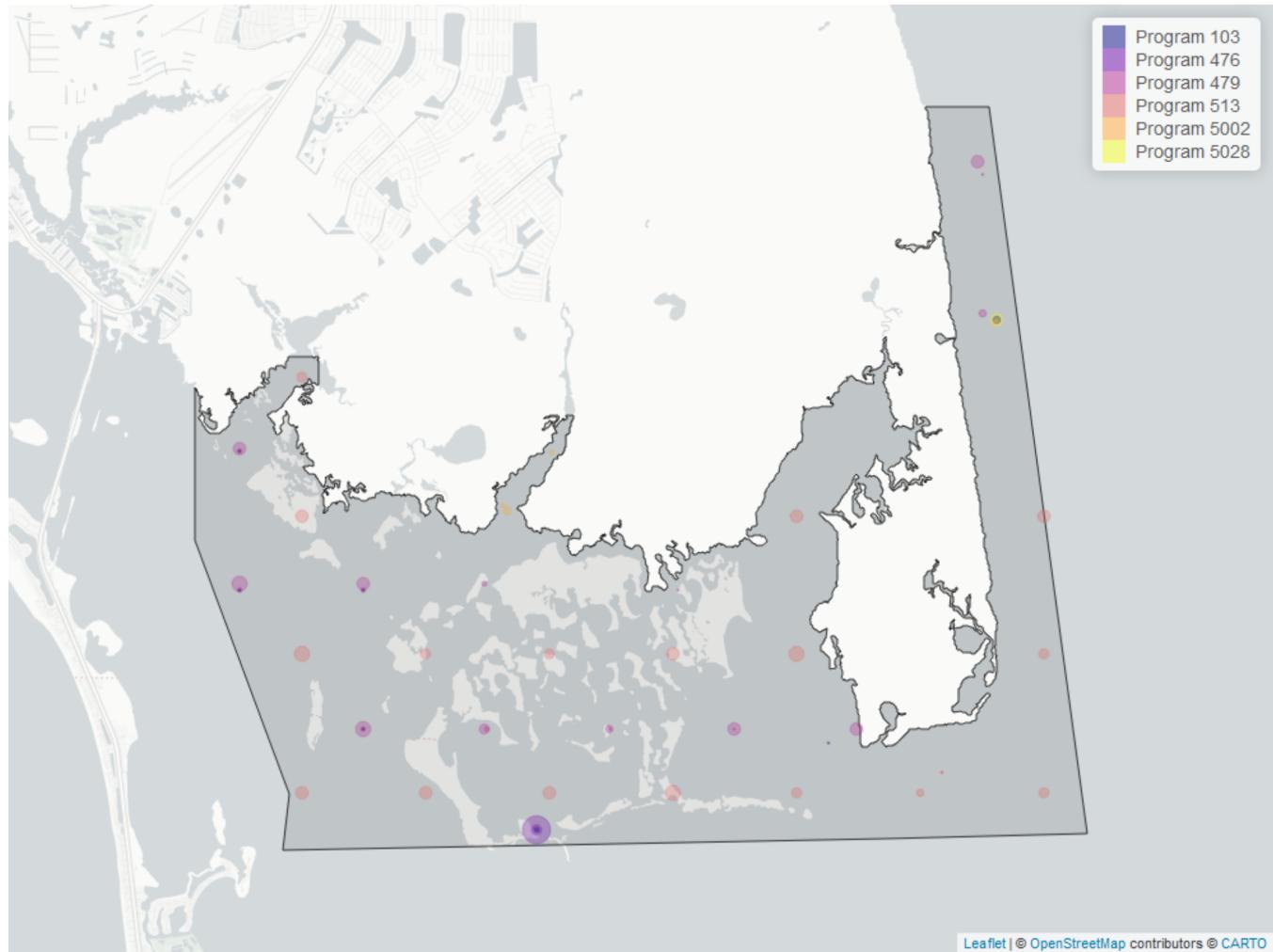


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	852	27	0.08	TRUE	-0.1082	0.0220	-0.001136364	0.109803	12.6878	0.3142	-1

$p < 0.00005$  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 17: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
513	384	2001	2021
479	270	2007	2021
476	137	1998	2023
5028	34	2021	2024
5002	21	2008	2023
103	17	2002	2022

**Program names:**

513 - Coastal Charlotte Harbor Monitoring Network

479 - Southwest Florida Water Management District - Water Quality Monitoring

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality 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 18: Value Qualifiers for Total Phosphorus

Year	$N_{Total}$	$N_I$	$perc_I$	$N_Q$	$perc_Q$	$N_U$	$perc_U$
1999	10			2	20.0		
2000	6			1	16.7		
2001	30			1	3.3	3	10.0
2002	61					4	6.6
2003	42					10	23.8
2004	47			1	2.1	1	2.1
2005	49	1	2.0			1	2.0
2006	50	3	6.0				
2007	50	27	54.0				
2008	81	16	19.8			1	1.2
2010	57	4	7.0				
2020	20	4	20.0				

**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:

513 - Coastal Charlotte Harbor Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

479 - Southwest Florida Water Management District - Water Quality Monitoring

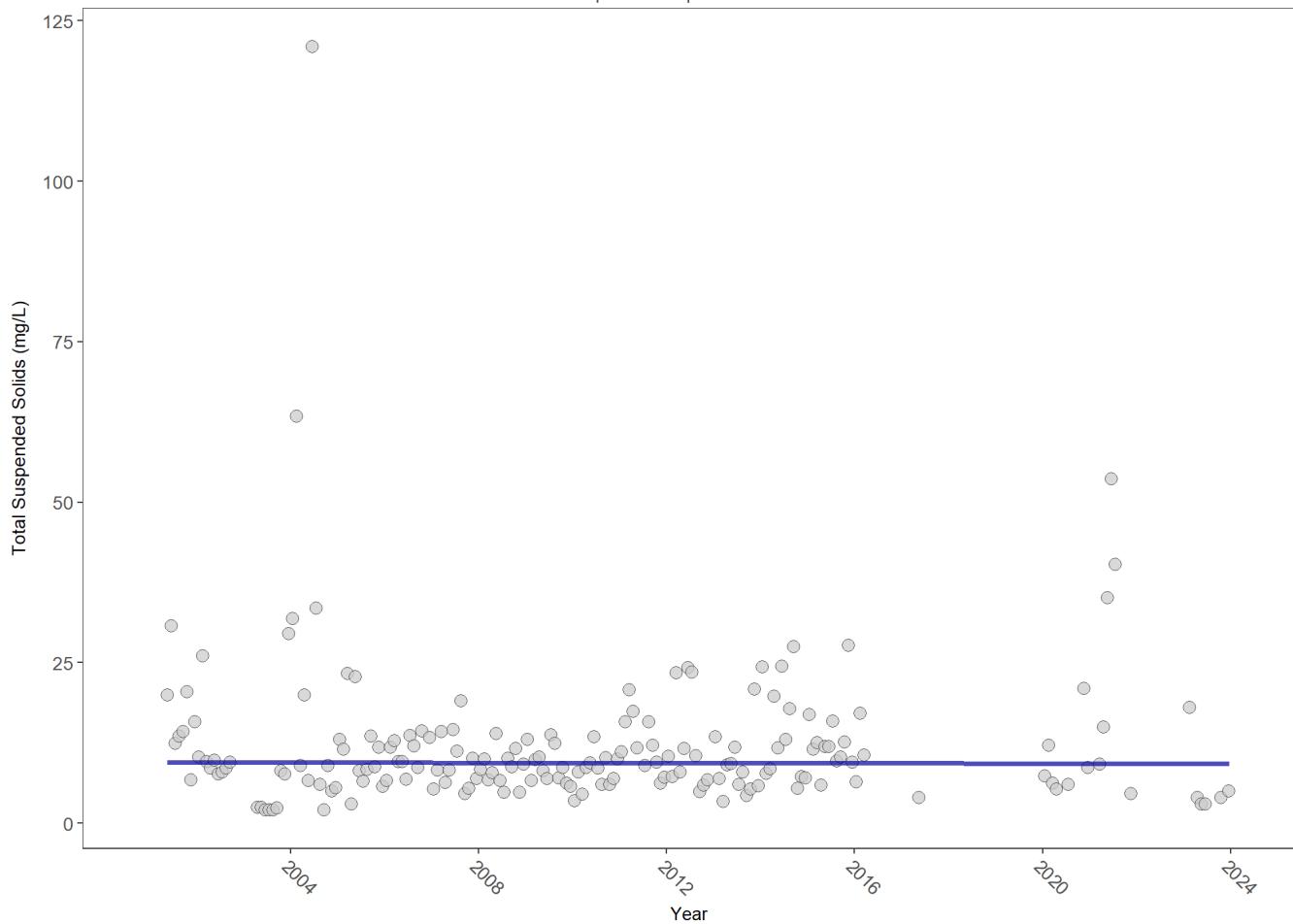
5002 - Florida STORET / WIN

### 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  
Cape Haze Aquatic Preserve

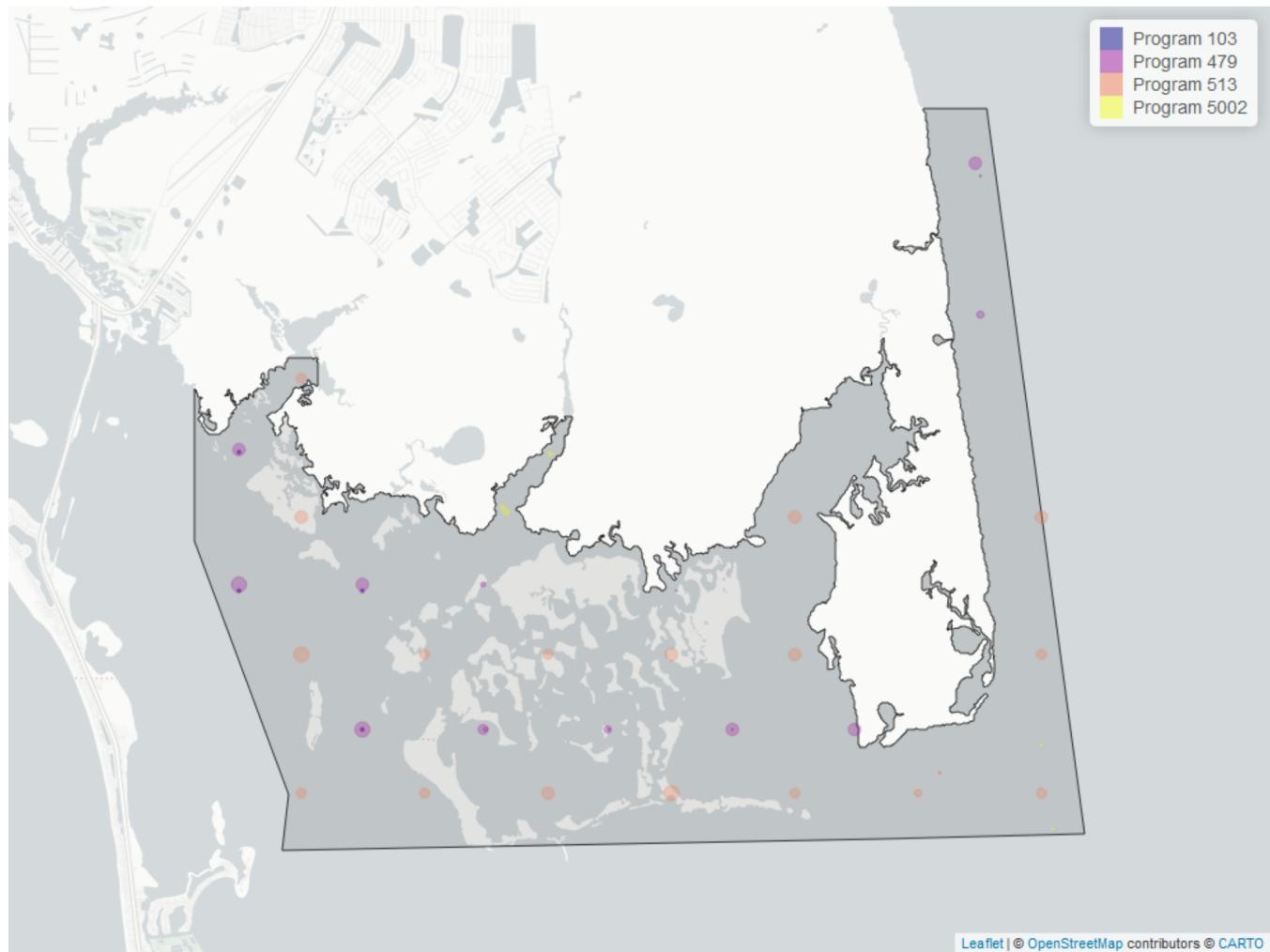


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	635	20	8.7	TRUE	-0.0068	0.9372	-0.01	9.526171	8.8681	0.6341	0

*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 Total Suspended Solids



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

Table 19: Programs contributing data for Total Suspended Solids

ProgramID	N_Data	YearMin	YearMax
513	360	2001	2021
479	270	2007	2021
5002	20	2006	2023
103	4	2020	2020

#### Program names:

513 - Coastal Charlotte Harbor Monitoring Network

479 - Southwest Florida Water Management District - Water Quality Monitoring

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 20: 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>
2003	31			6	19.4	15	48.4
2004	41			7	17.1	6	14.6
2010	50	1	2.0				
2011	38	4	10.5				
2017	1	1	100.0				
2020	19	1	5.3				
2023	6	3	50.0			2	33.3

**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

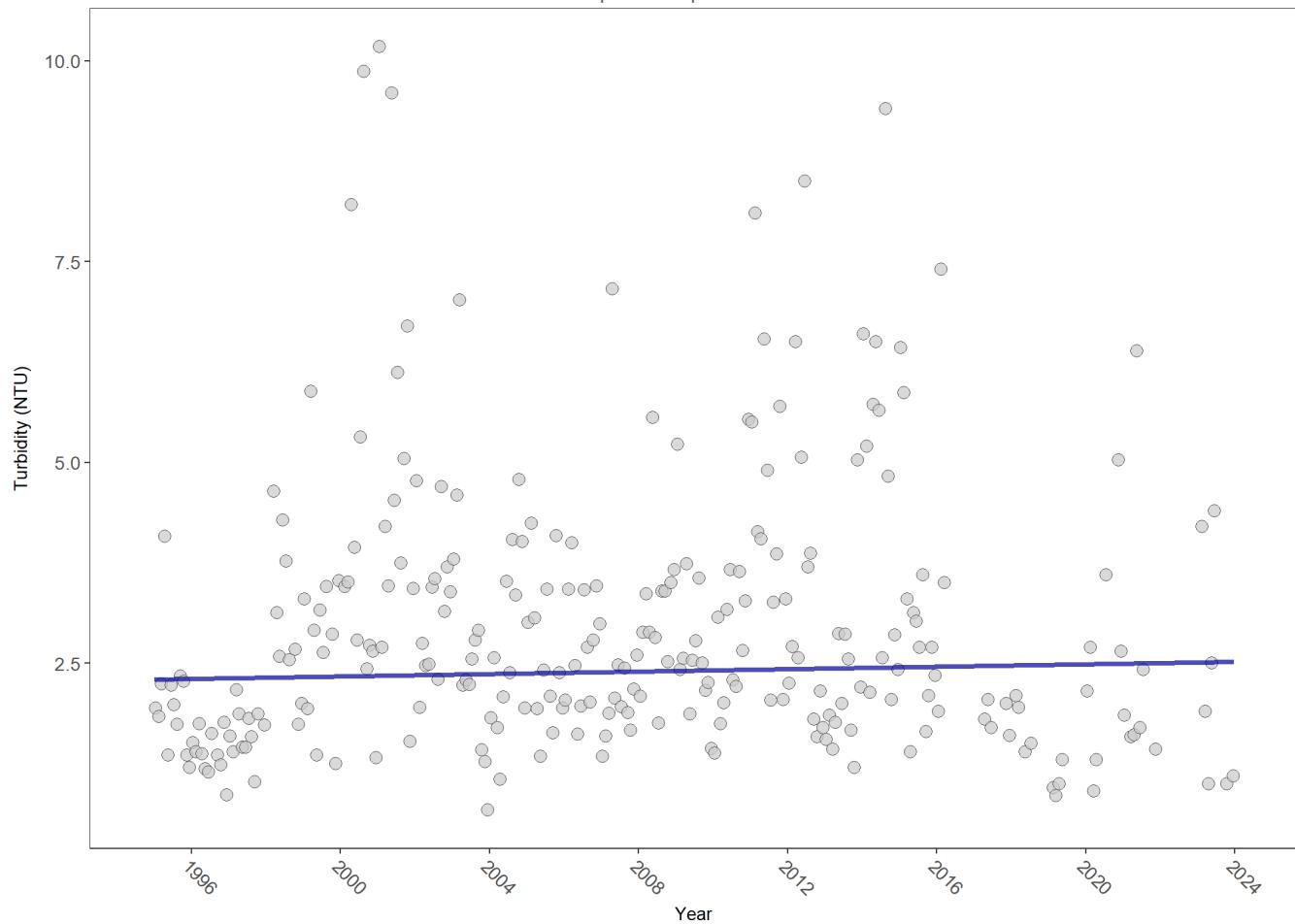
513 - Coastal Charlotte Harbor Monitoring Network

#### 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  
Cape Haze Aquatic Preserve

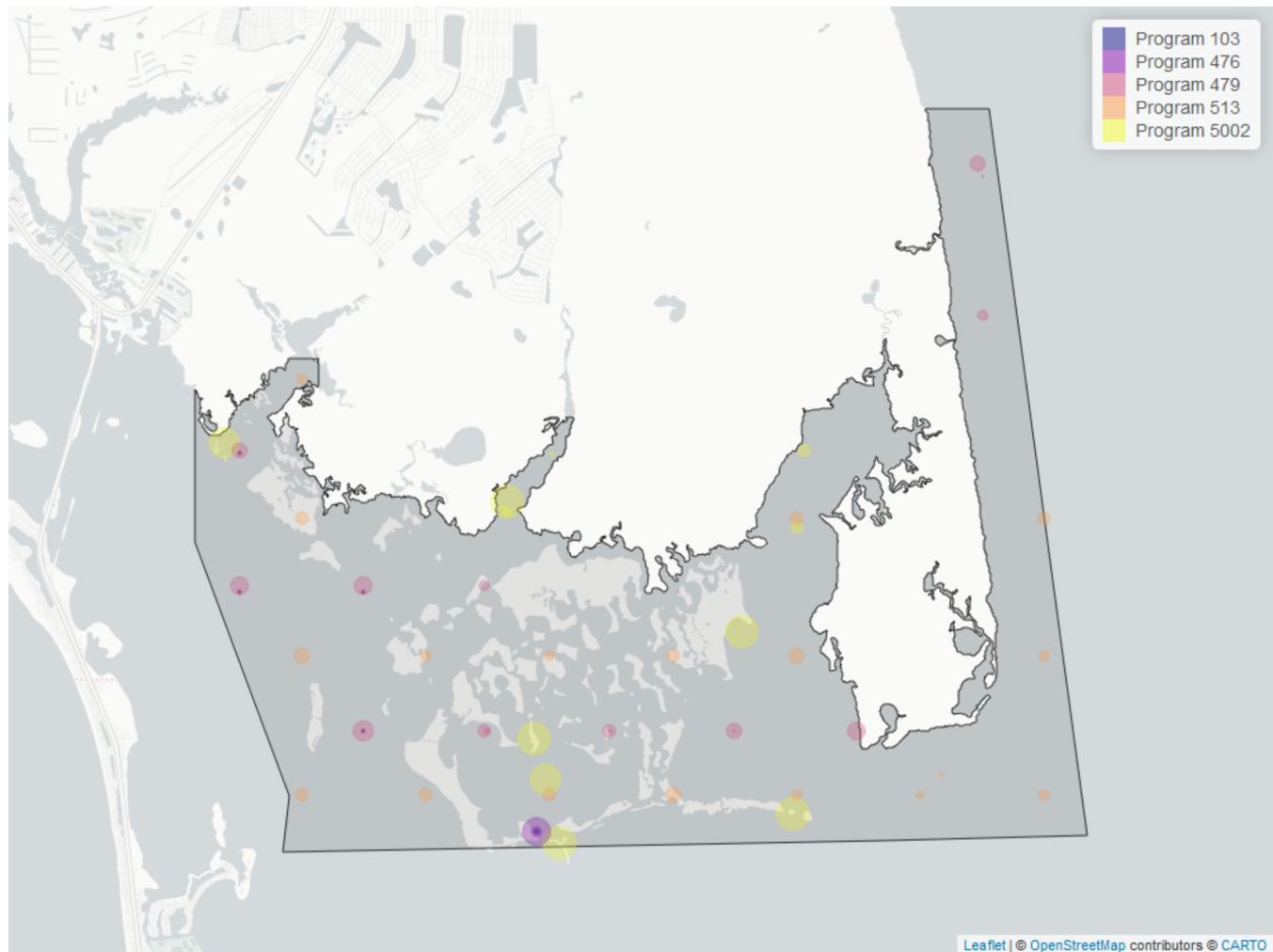


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2135	28	2.2	TRUE	0.0315	0.5798	0.007330409	2.303411	19.9046	0.0467	0

$p < 0.00005$  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



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

Table 21: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
5002	1192	1995	2023
479	410	2001	2021
513	384	2001	2021
476	147	1998	2023
103	8	2020	2021

#### Program names:

5002 - Florida STORET / WIN

479 - Southwest Florida Water Management District - Water Quality Monitoring

513 - Coastal Charlotte Harbor Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

### Value Qualifiers

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

Table 22: Value Qualifiers for Turbidity

Year	$N_{\text{Total}}$	$N_{\text{Q}}$	$\text{perc}_{\text{Q}}$
2007	121	1	0.8
2011	87	1	1.1
2023	8	1	12.5

**Note:**  ${}^1\mathbf{Q}$  - Sample held beyond the accepted holding time

### Programs containing Value Qualified data:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5002 - Florida STORET / WIN

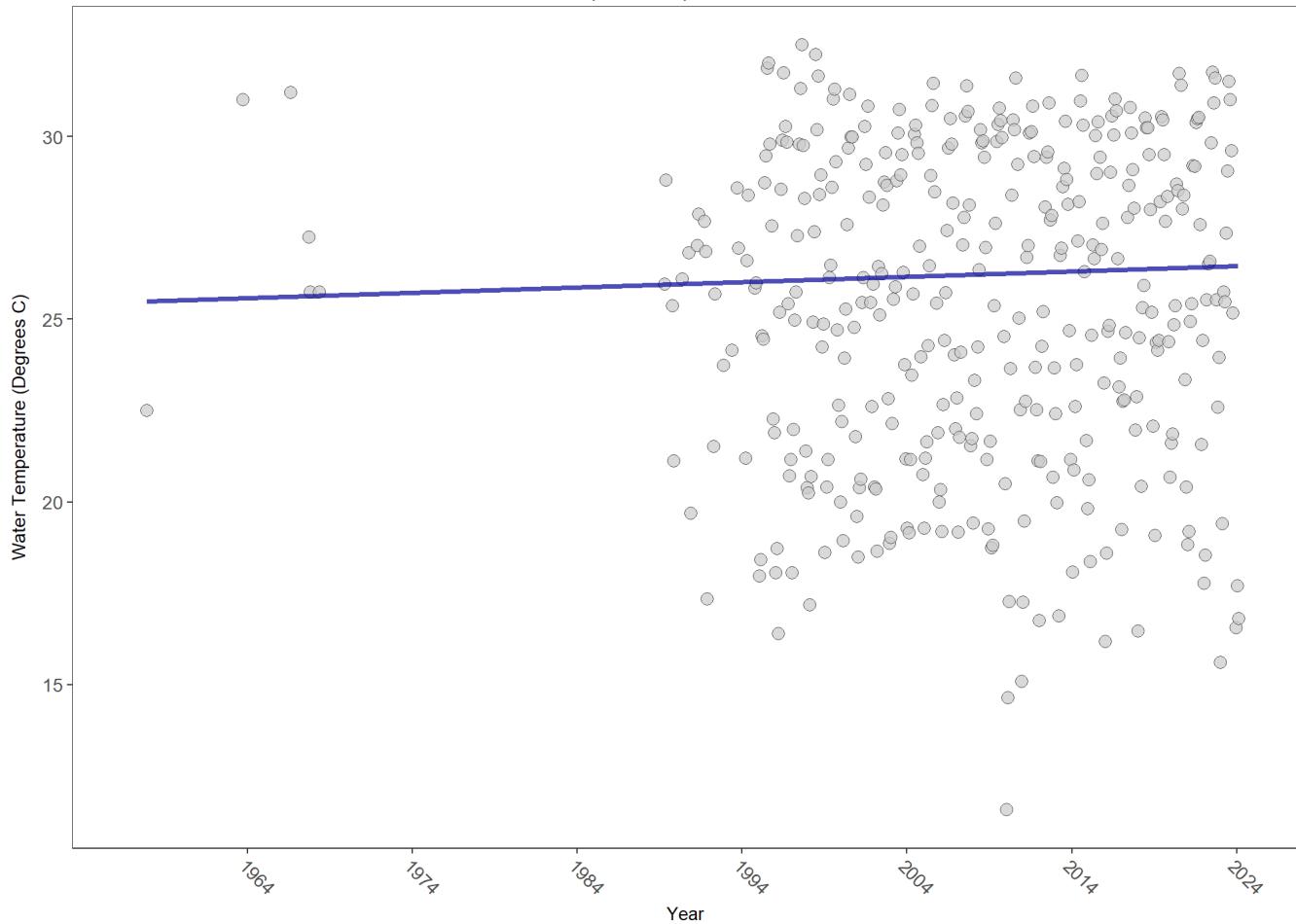
513 - Coastal Charlotte Harbor Monitoring Network

### 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  
Cape Haze Aquatic Preserve

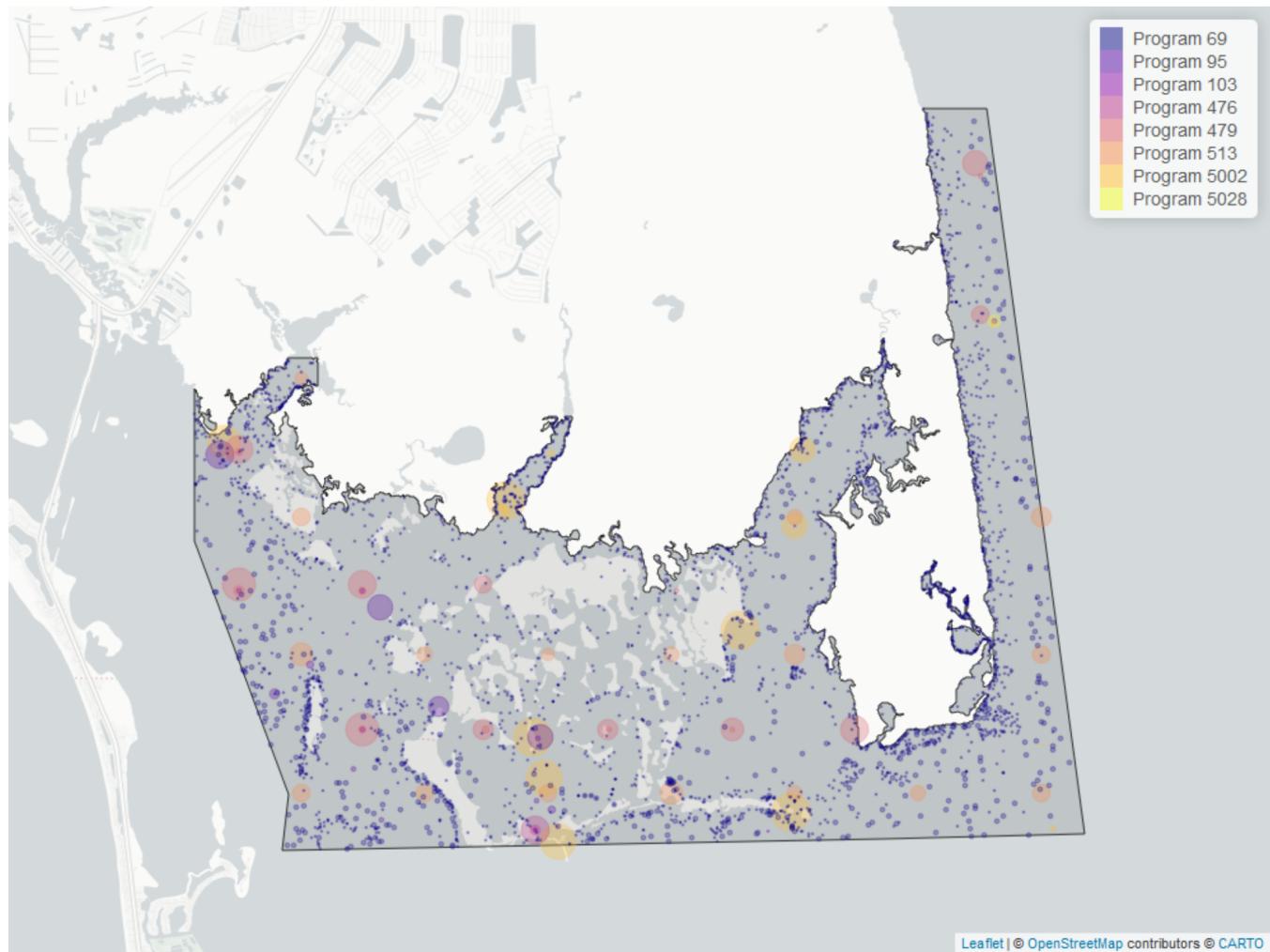


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	11154	41	26.9	TRUE	0.0691	0.0445	0.01444472	25.48495	10.8378	0.457	1

$p < 0.00005$  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



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

Table 23: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
69	6842	1989	2022
5002	1638	1995	2023
479	1184	2001	2021
513	817	2001	2010
95	481	1957	2018
476	149	1998	2023
5028	25	2021	2024
103	19	2020	2022

**Program names:**

69 - Fisheries-Independent Monitoring (FIM) Program

*5002 - Florida STORET / WIN*

*479 - Southwest Florida Water Management District - Water Quality Monitoring*

*513 - Coastal Charlotte Harbor Monitoring Network*

*95 - Harmful Algal Bloom Marine Observation Network*

*476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network*

*5028 - Charlotte Harbor Aquatic Preserves Monthly Water Quality Program*

*103 - EPA STOrage and RETrieval Data Warehouse (STORET)*

There are no qualifying Value Qualifiers for Water Temperature in Cape Haze Aquatic Preserve

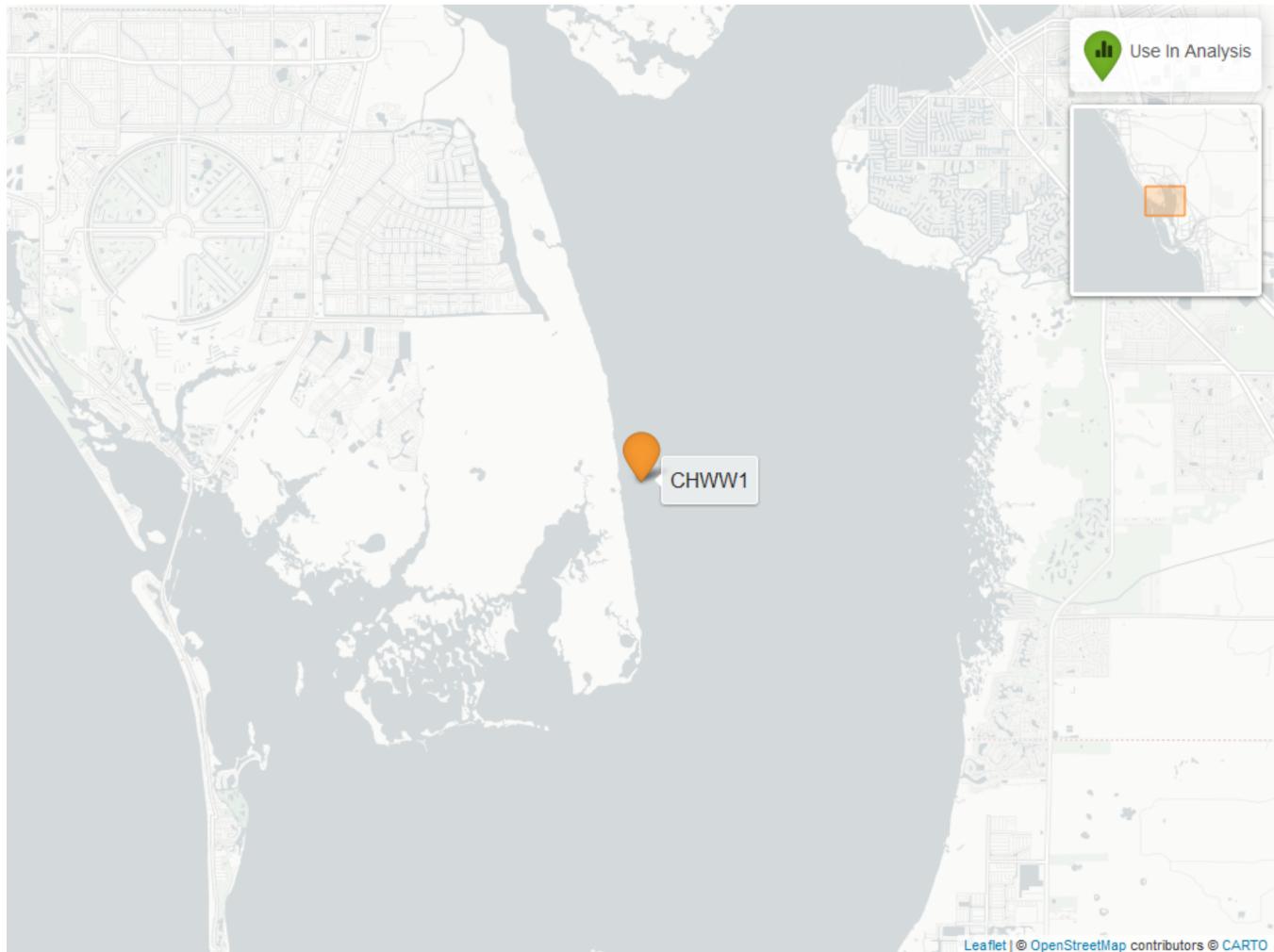
## Water Quality - Continuous

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 24: Charlotte Harbor Aquatic Preserves Continuous Water Quality Monitoring (512)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
CHWW1	3	FALSE	DO , DOS , pH , Sal , Turb , TempW



Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Cape Haze 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.

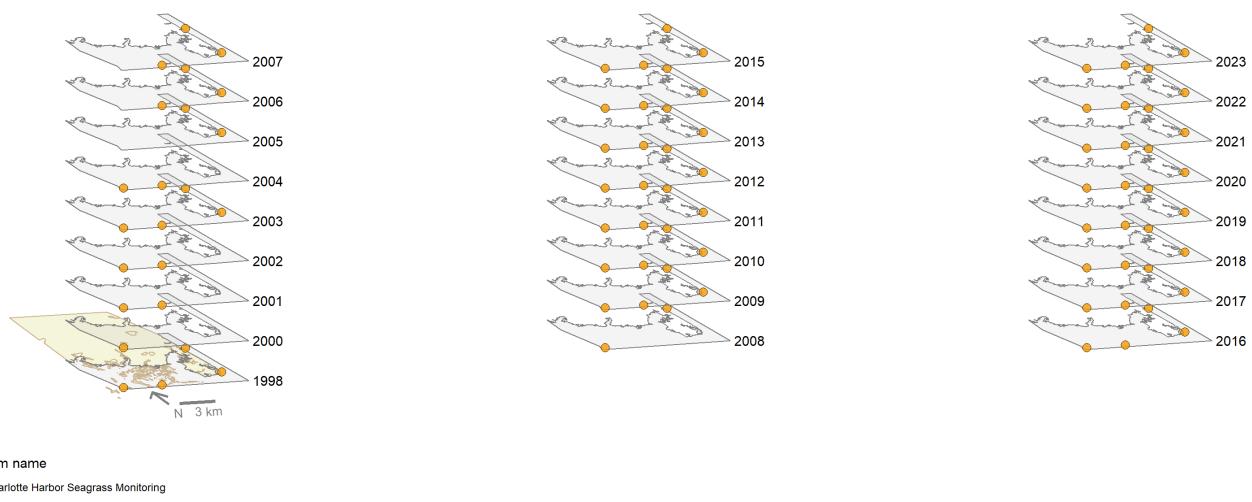
## Notes

*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

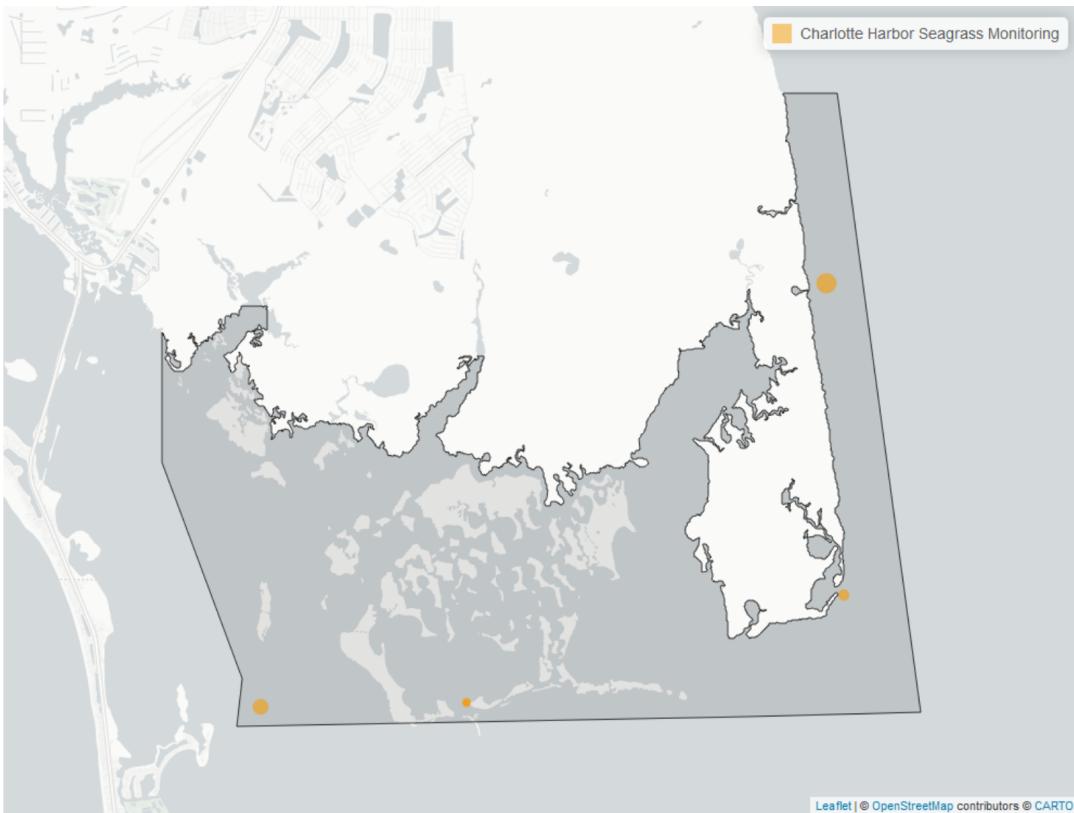
- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

Cape Haze Aquatic Preserve  
SAV Percent Cover - Sample Locations



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

**Sampling locations by Program:**



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

Table 25: Charlotte Harbor Seagrass Monitoring - *Program 570*

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
1649	1998	2023	Braun Blanquet	5



Median percent cover by species in *Cape Haze 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.

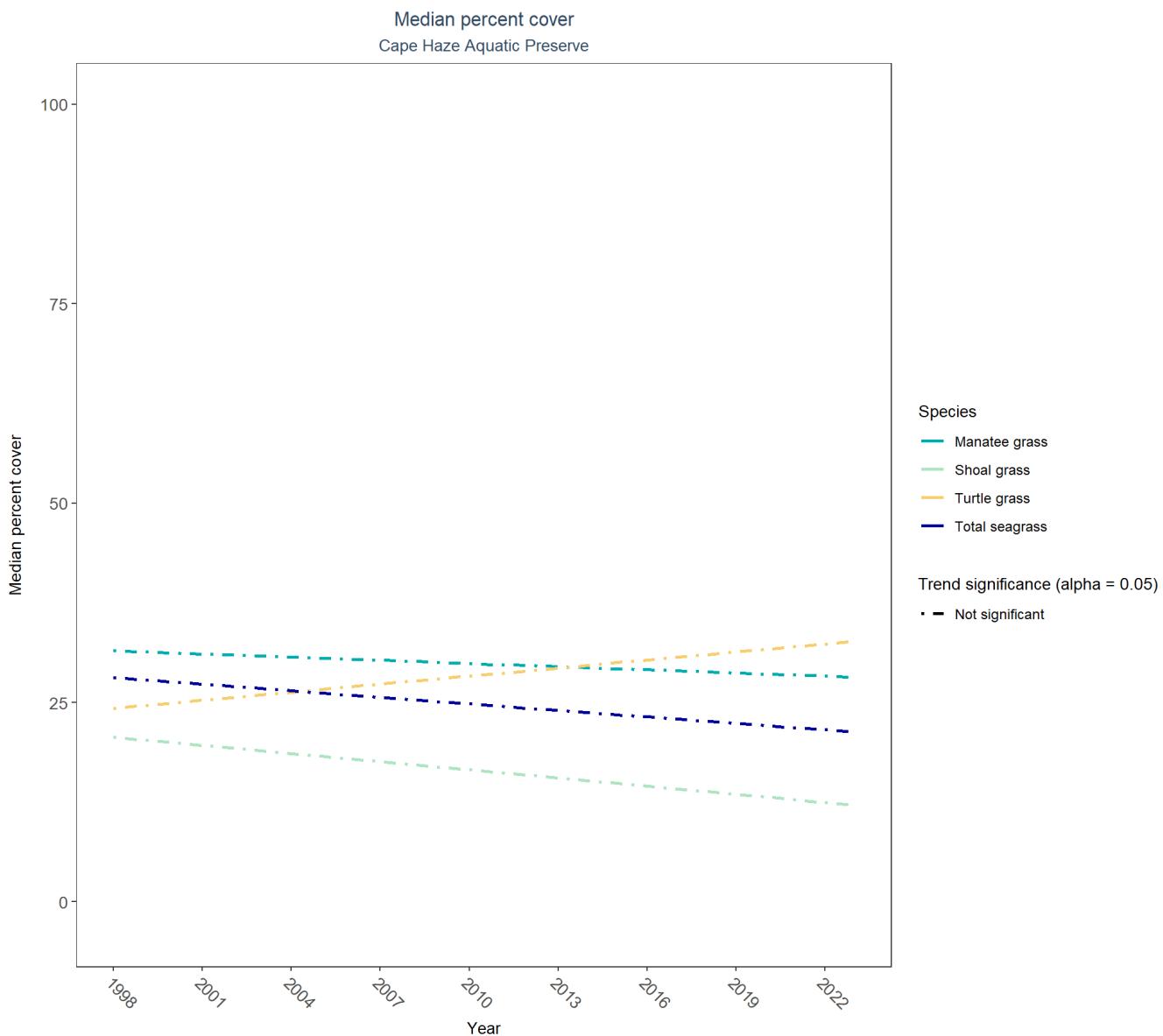
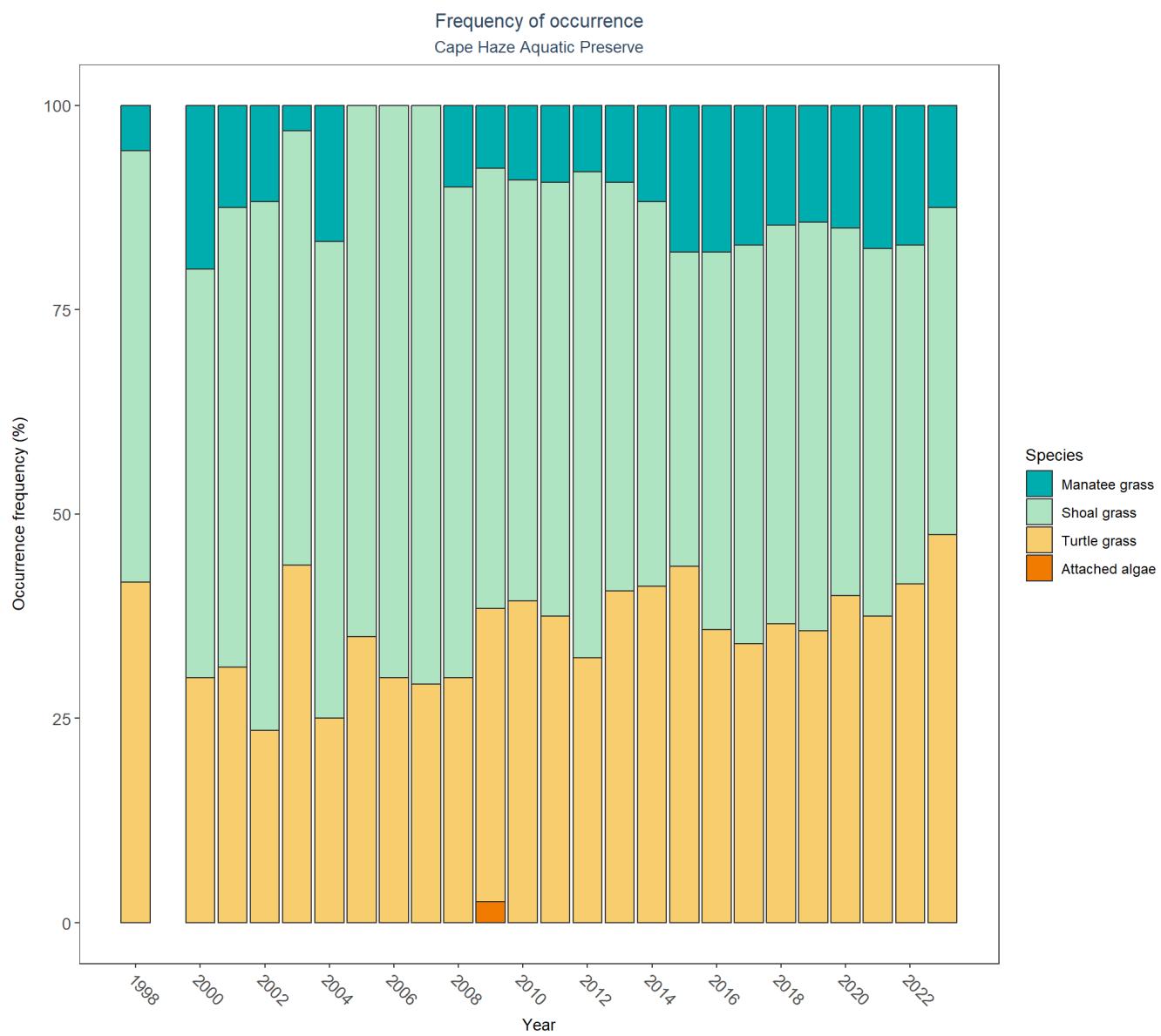
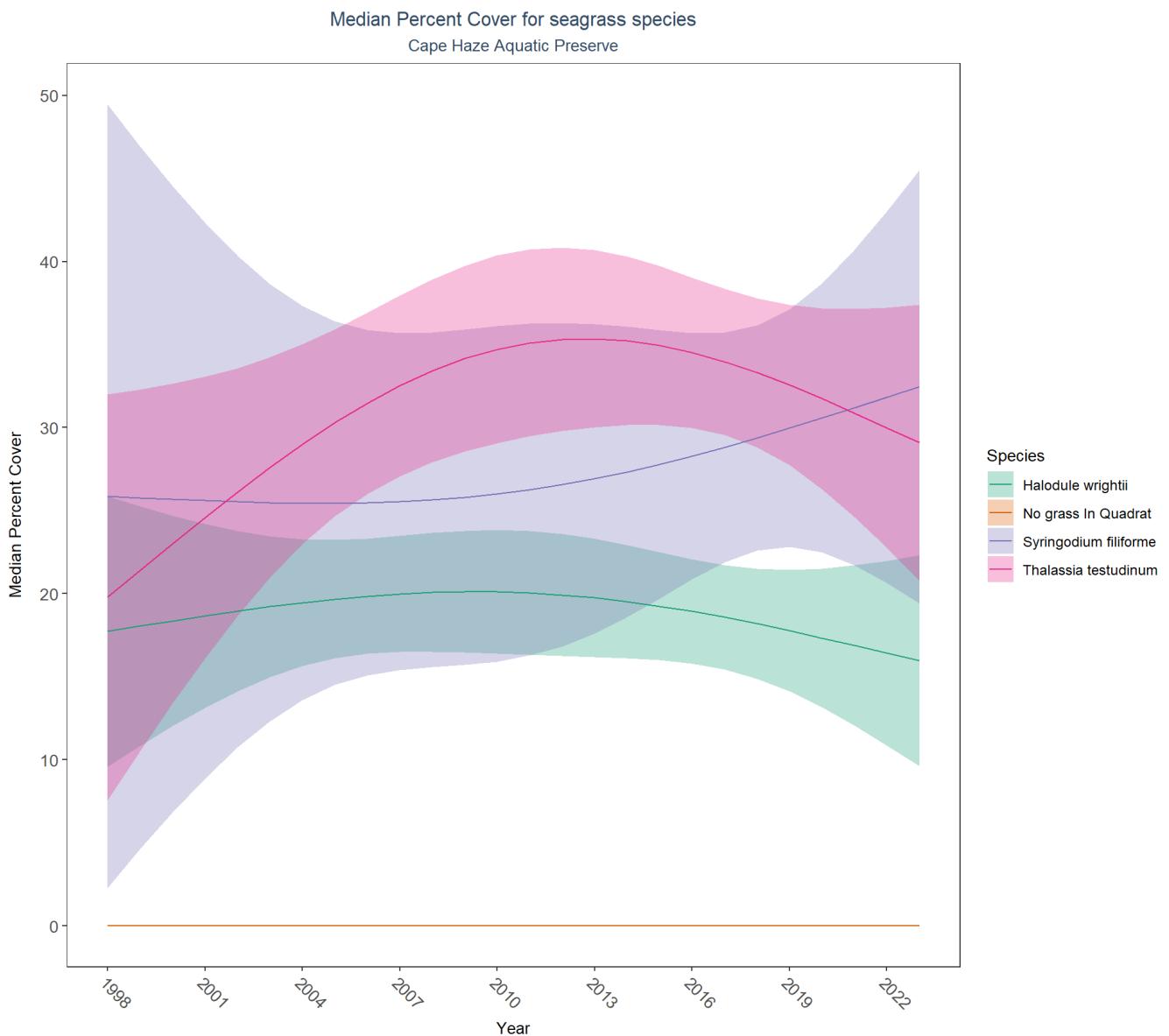


Table 26: Percent Cover Trend Analysis for Cape Haze Aquatic Preserve

Species	Common Name	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Attached algae		Insufficient data to calculate trend				
Drift algae		Significantly increasing trend	2003 - 2023	-14.7833	1.4146	0.0035
Halodule wrightii	Shoal grass	No significant trend	1998 - 2023	22.0065	-0.3404	0.3746
No grass In Quadrat		Model did not fit the available data	1998 - 2023			
Syringodium filiforme	Manatee grass	No significant trend	1998 - 2023	32.0129	-0.1322	0.9012
Thalassia testudinum	Turtle grass	No significant trend	1998 - 2023	22.9252	0.3365	0.2947
Total seagrass		No significant trend	1998 - 2023	29.1498	-0.2703	0.5092





Generalized additive models for each species in Cape Haze 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.