

Indian River-Malabar to Vero Beach Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 14 March, 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

| <i>Parameter Name</i> | <i>Units</i> | <i>Low Threshold</i> | <i>High Threshold</i> | <i>Sensor Type</i> |
|-----------------------------|--------------|----------------------|-----------------------|----------------------------|
| 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

| <i>Parameter Name</i> | <i>Units</i> | <i>Low Threshold</i> | <i>High Threshold</i> |
|--|--------------|----------------------|-----------------------|
| 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 | - |
| NO ₂ +3 Filtered | mg/L | 0 | - |
| NH ₄ 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:

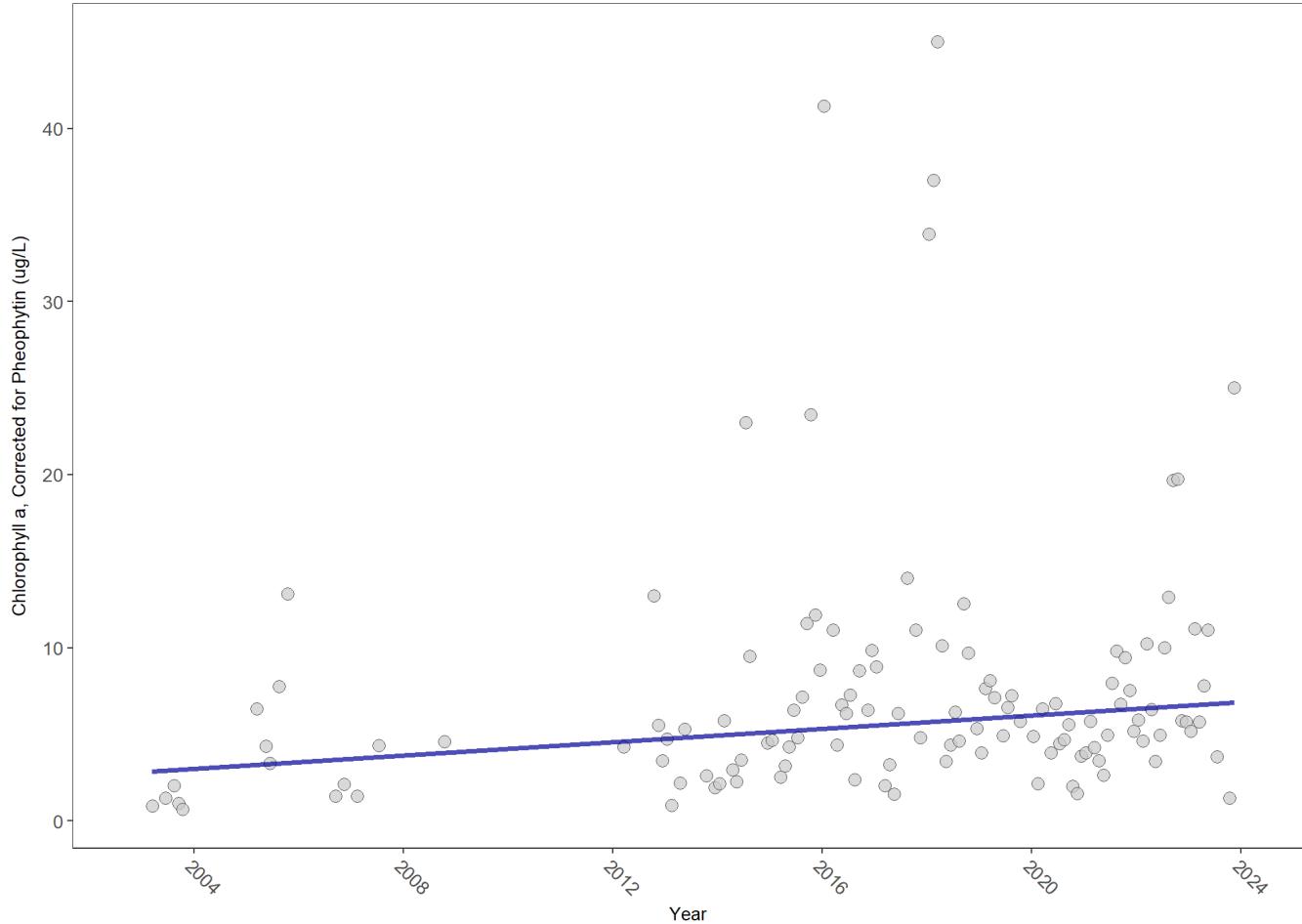
- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_pH-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Salinity-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Turbidity-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2024-Feb-22.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
Indian River-Malabar to Vero Beach Aquatic Preserve

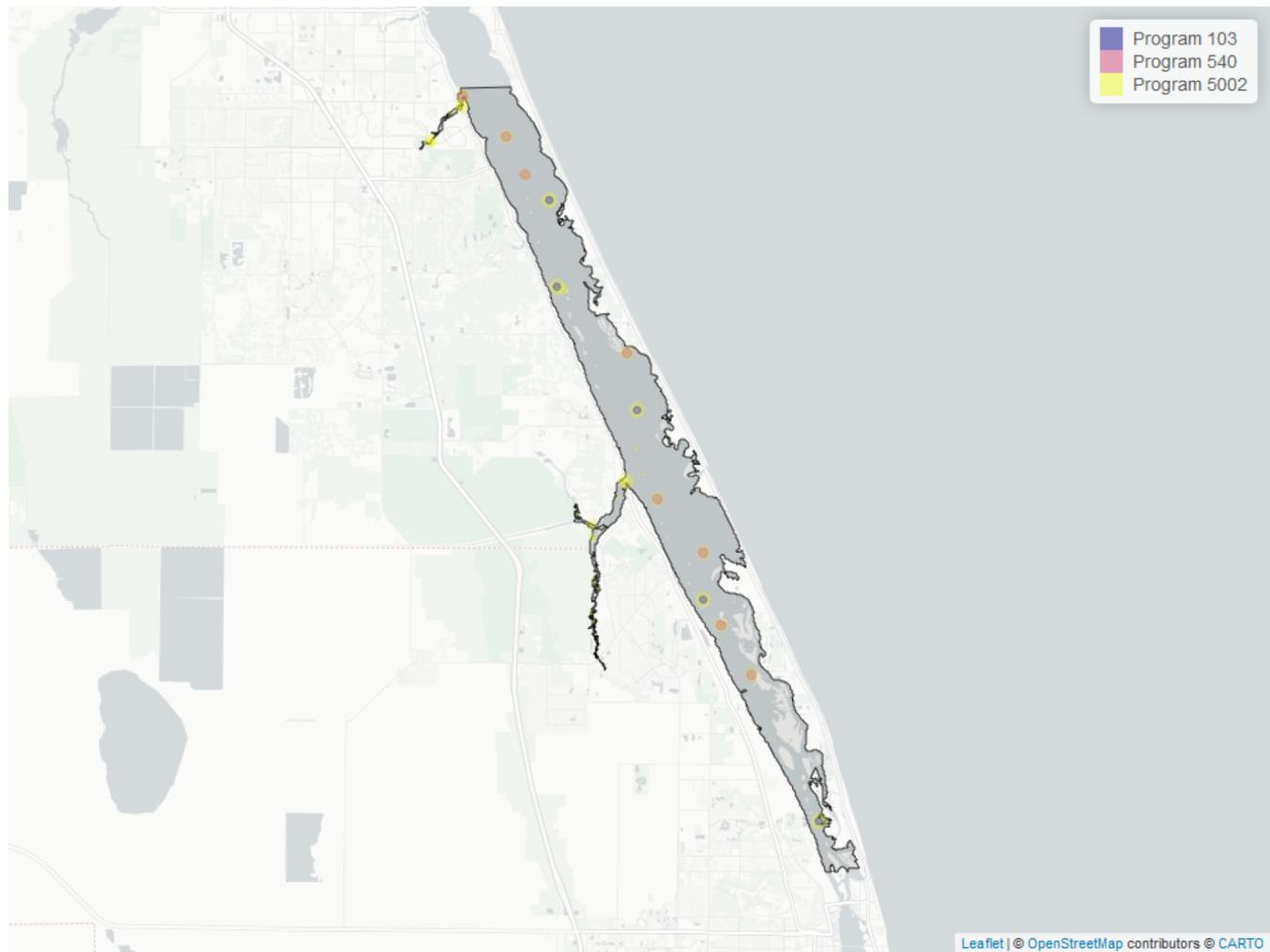


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| All | 666 | 17 | 4.3894 | TRUE | 0.2214 | 0.0043 | 0.1919531 | 2.83449 | 7.895 | 0.7227 | 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, 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 |
|-----------|--------|---------|---------|
| 5002 | 516 | 2003 | 2023 |
| 540 | 127 | 2016 | 2020 |
| 103 | 35 | 2020 | 2021 |

Program names:

5002 - Florida STORET / WIN

540 - Shellfish Harvest Area Classification 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 7: Value Qualifiers for Chlorophyll a, Corrected for Pheophytin

| Year | N_{Total} | N_I | $perc_I$ | N_Q | $perc_Q$ | N_U | $perc_U$ |
|------|-------------|-------|----------|-------|----------|-------|----------|
| 2003 | 6 | | | | | 1 | 16.7 |
| 2005 | 12 | 7 | 58.3 | | | | |
| 2006 | 3 | 2 | 66.7 | | | 1 | 33.3 |
| 2007 | 3 | 2 | 66.7 | | | 1 | 33.3 |
| 2012 | 14 | 1 | 7.1 | | | | |
| 2013 | 26 | 9 | 34.6 | | | | |
| 2014 | 50 | 14 | 28.0 | | | 1 | 2.0 |
| 2015 | 59 | 2 | 3.4 | | | | |
| 2016 | 46 | 1 | 2.2 | | | | |
| 2017 | 35 | 9 | 25.7 | | | | |
| 2018 | 58 | 1 | 1.7 | | | | |
| 2019 | 30 | 1 | 3.3 | 2 | 6.7 | | |
| 2020 | 84 | 30 | 35.7 | | | 5 | 6.0 |
| 2021 | 134 | 25 | 18.7 | | | 1 | 0.8 |
| 2022 | 91 | 29 | 31.9 | | | | |
| 2023 | 25 | 7 | 28.0 | | | | |

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:

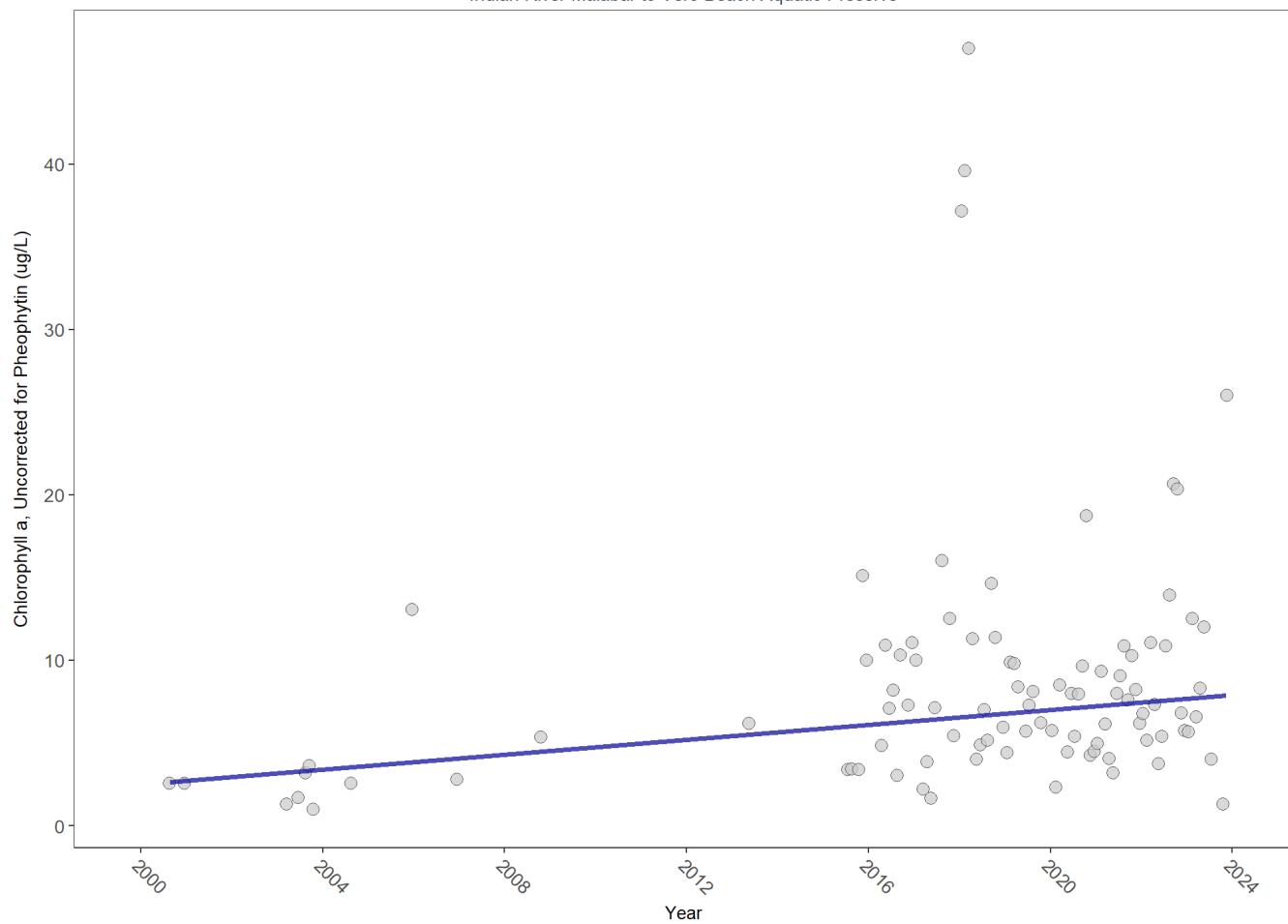
5002 - Florida STORET / WIN

540 - Shellfish Harvest Area Classification Program

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths
Indian River-Malabar to Vero Beach Aquatic Preserve

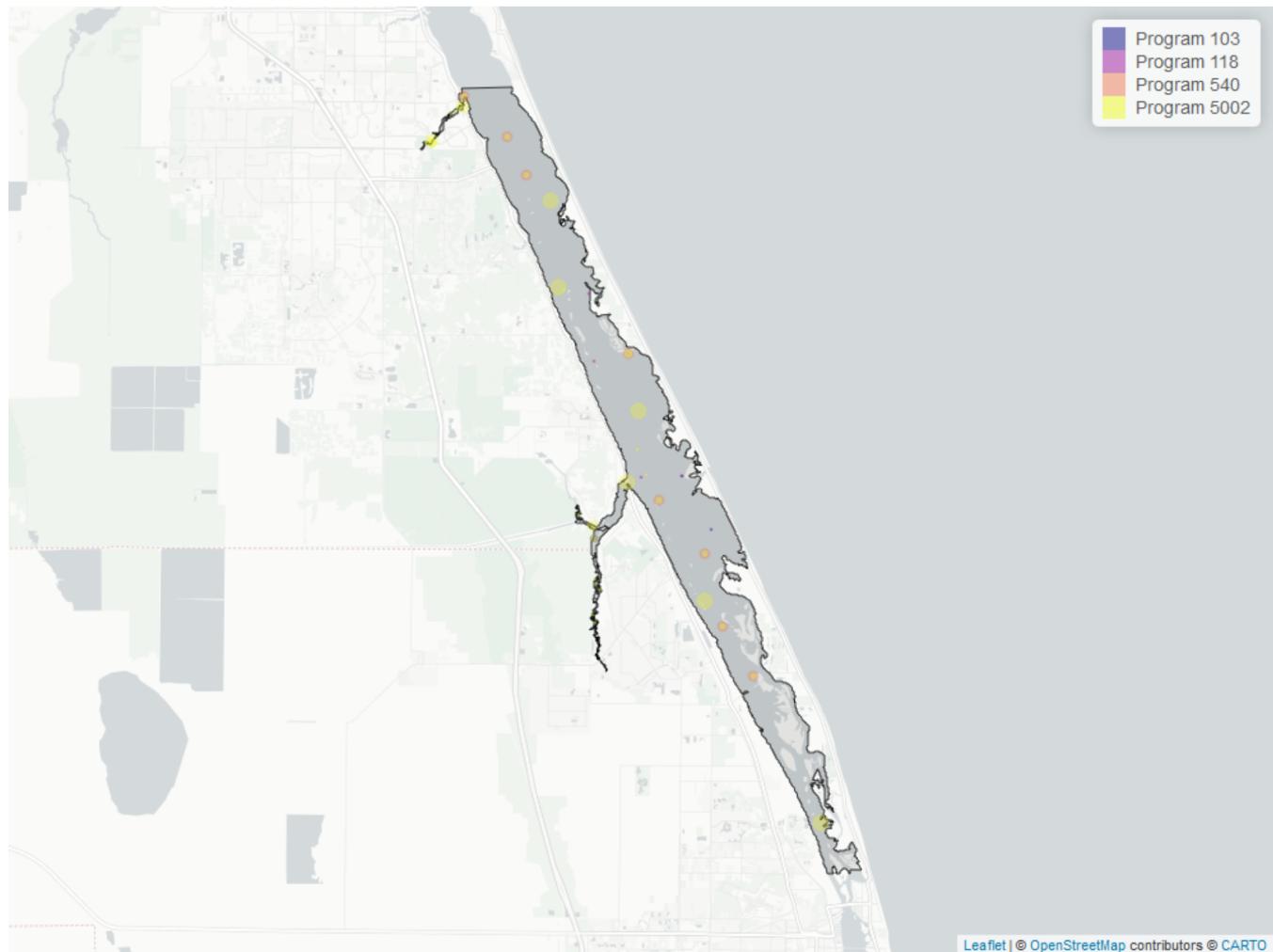


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|---------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| All | 493 | 16 | 5.94029 | TRUE | 0.1798 | 0.0126 | 0.2255248 | 2.47788 | 9.747 | 0.5533 | 1 |

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

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



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

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

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 356 | 2003 | 2023 |
| 540 | 126 | 2016 | 2020 |
| 103 | 14 | 2000 | 2021 |
| 118 | 4 | 2000 | 2006 |

Program names:

5002 - Florida STORET / WIN

540 - Shellfish Harvest Area Classification Program

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 9: Value Qualifiers for Chlorophyll a, Uncorrected 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> |
|-------------|----------------|------------|---------------|------------|---------------|------------|---------------|
| 2017 | 34 | 3 | 8.8 | | | | |
| 2019 | 30 | 1 | 3.3 | 2 | 6.7 | | |
| 2020 | 80 | 13 | 16.2 | | | 1 | 1.2 |
| 2021 | 114 | 22 | 19.3 | | | | |
| 2022 | 91 | 19 | 20.9 | | | | |
| 2023 | 25 | 6 | 24.0 | | | | |

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:

5002 - Florida STORET / WIN

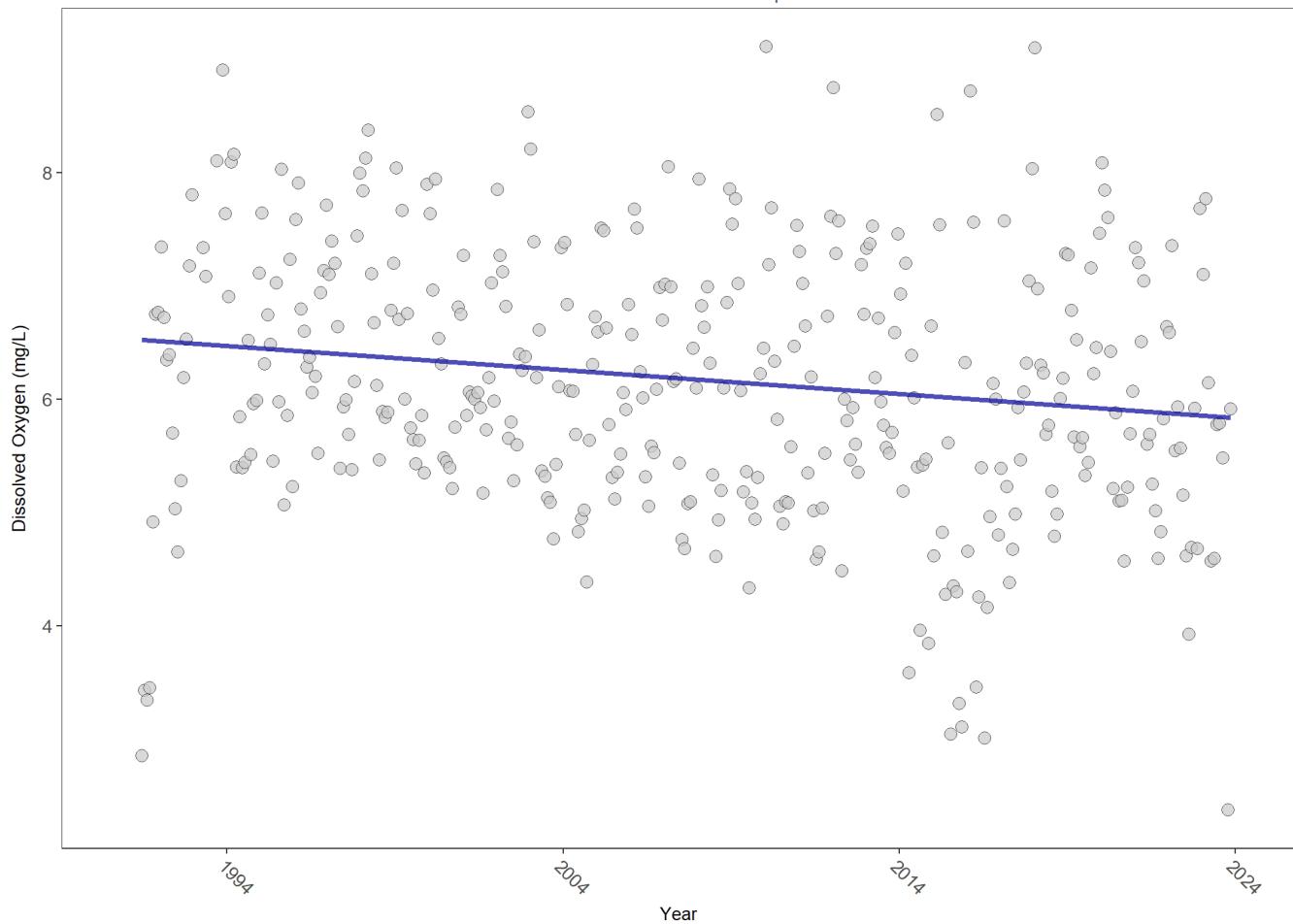
540 - Shellfish Harvest Area Classification Program

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
Indian River-Malabar to Vero Beach Aquatic Preserve

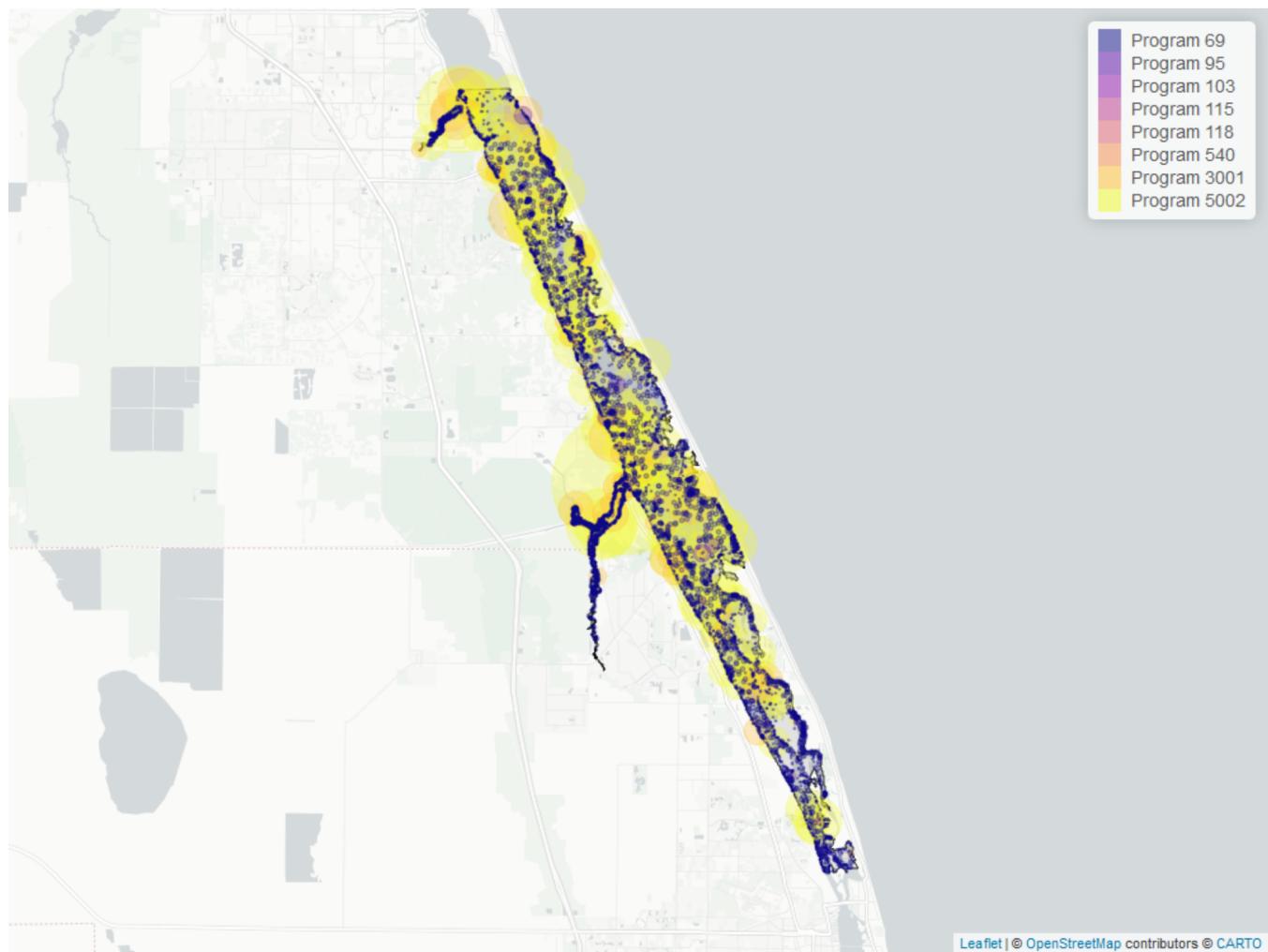


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|---------|--------|-------------|---------------|------------|-------------|-------|
| All | 52853 | 33 | 6.2 | TRUE | -0.1884 | 0.0000 | -0.02107284 | 6.530333 | 12.2762 | 0.3432 | -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 |
|-----------|--------|---------|---------|
| 5002 | 29406 | 1991 | 2023 |
| 69 | 15858 | 1991 | 2017 |
| 3001 | 6092 | 1991 | 2022 |
| 3013 | 1107 | 2003 | 2023 |
| 95 | 447 | 1996 | 2018 |
| 540 | 127 | 2016 | 2020 |
| 103 | 63 | 2004 | 2021 |
| 115 | 28 | 1994 | 1995 |
| 118 | 4 | 2000 | 2006 |

Program names:

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

3001 - Lagoon Watch (Formerly Marine Discovery Center)

3013 - Seagrass (SJRWMD)

95 - Harmful Algal Bloom Marine Observation Network

540 - Shellfish Harvest Area Classification Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

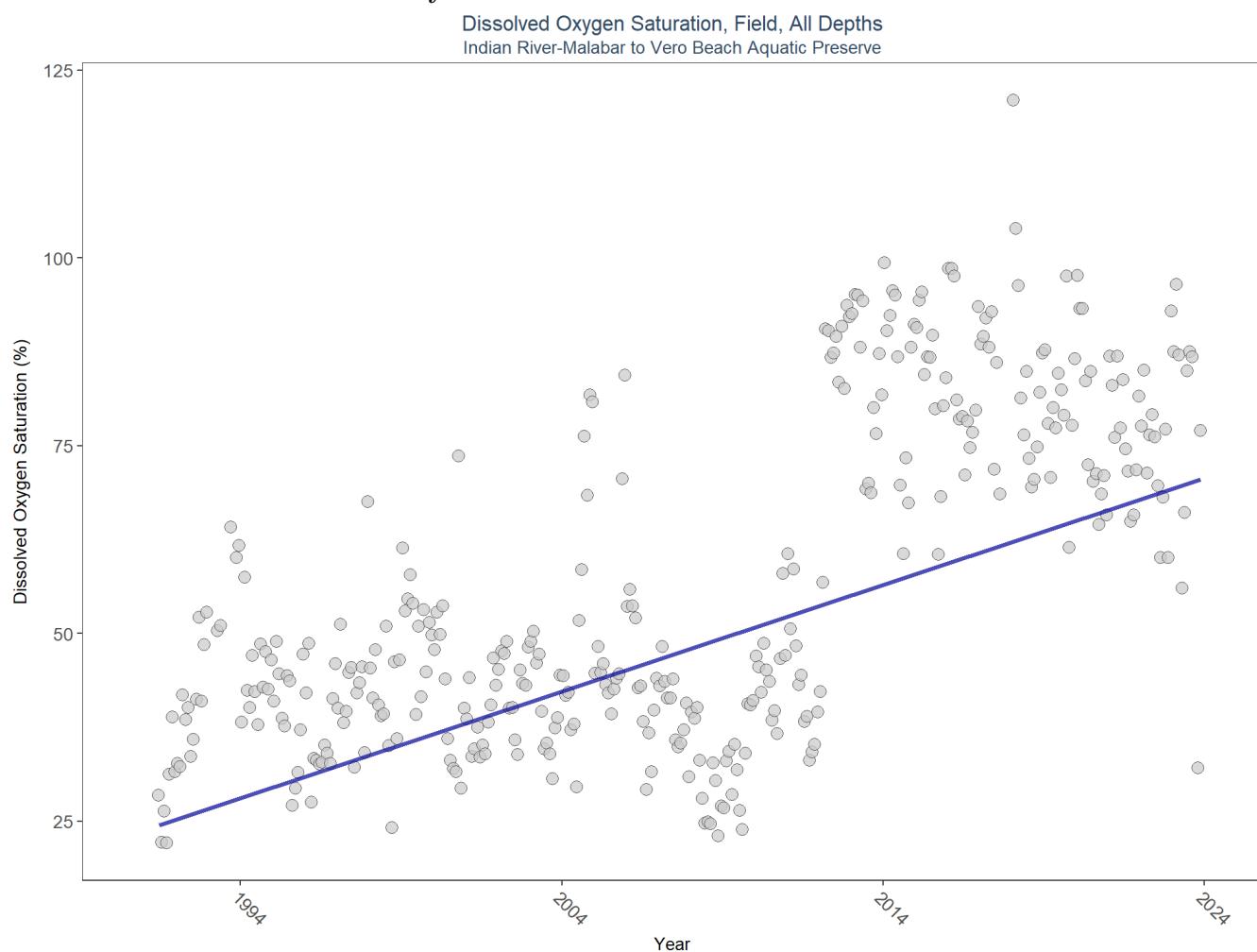
115 - Environmental Monitoring Assessment Program

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment

There are no qualifying Value Qualifiers for Dissolved Oxygen in Indian River-Malabar to Vero Beach Aquatic Preserve

Dissolved Oxygen Saturation - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

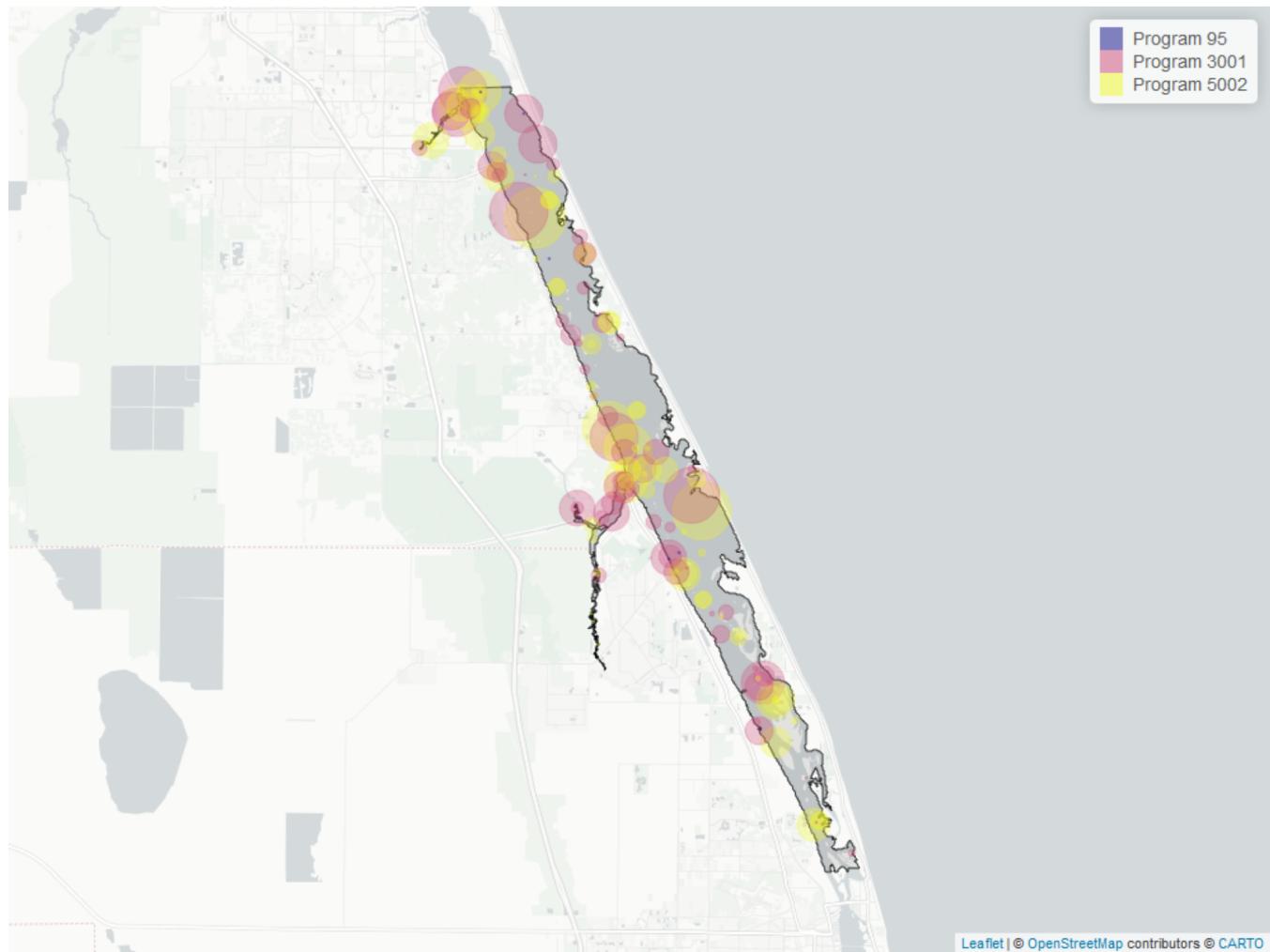


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| All | 12809 | 33 | 68 | TRUE | 0.4112 | 0.0000 | 1.421591 | 23.8009 | 4.266 | 0.9615 | 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 11: Programs contributing data for Dissolved Oxygen Saturation

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 6143 | 1991 | 2023 |
| 3001 | 6104 | 1991 | 2022 |
| 3013 | 570 | 2012 | 2023 |
| 95 | 5 | 2016 | 2018 |

Program names:

5002 - Florida STORET / WIN

3001 - Lagoon Watch (Formerly Marine Discovery Center)

3013 - Seagrass (SJRWMD)

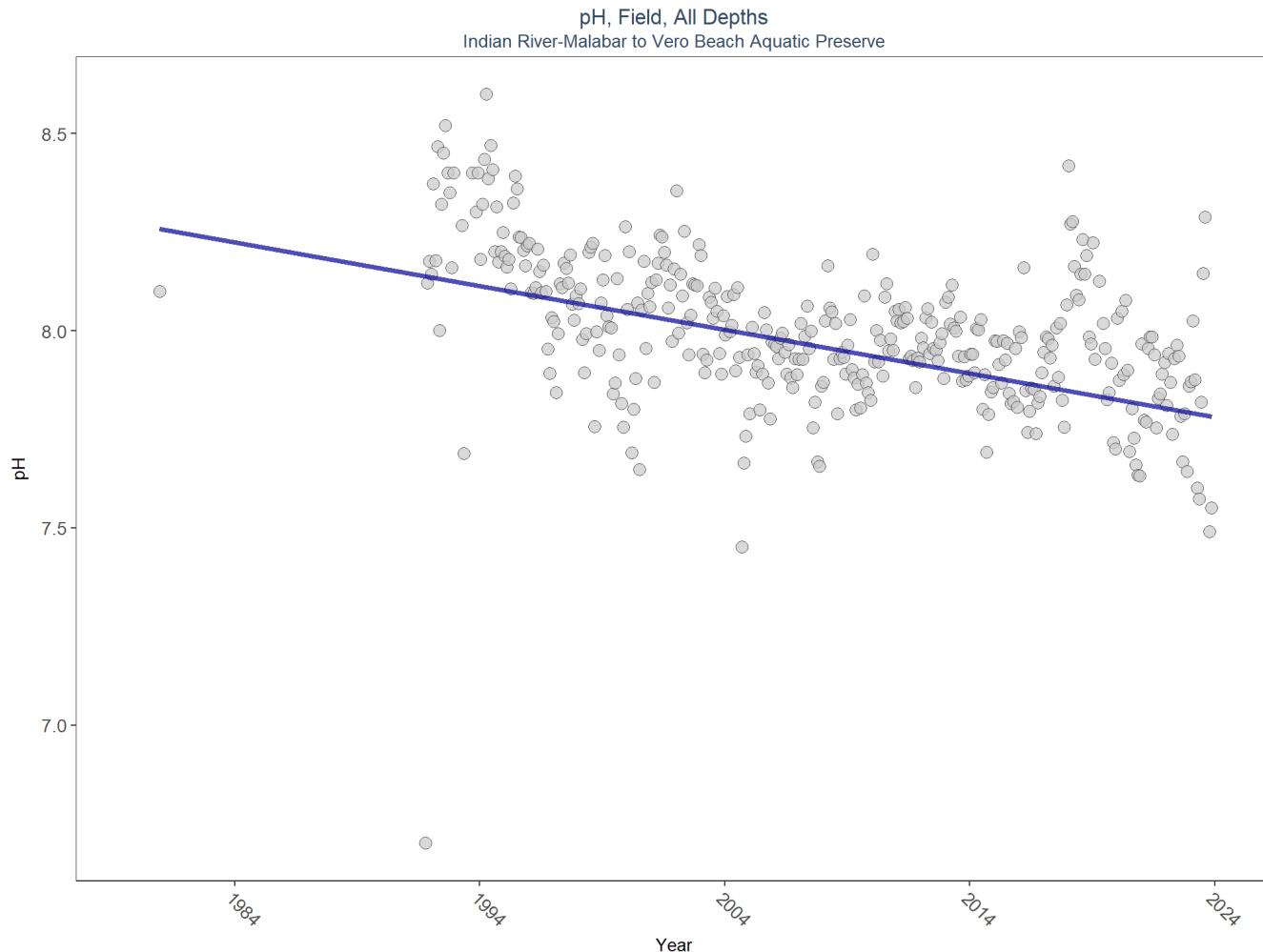
95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in Indian River-Malabar to Vero Beach 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

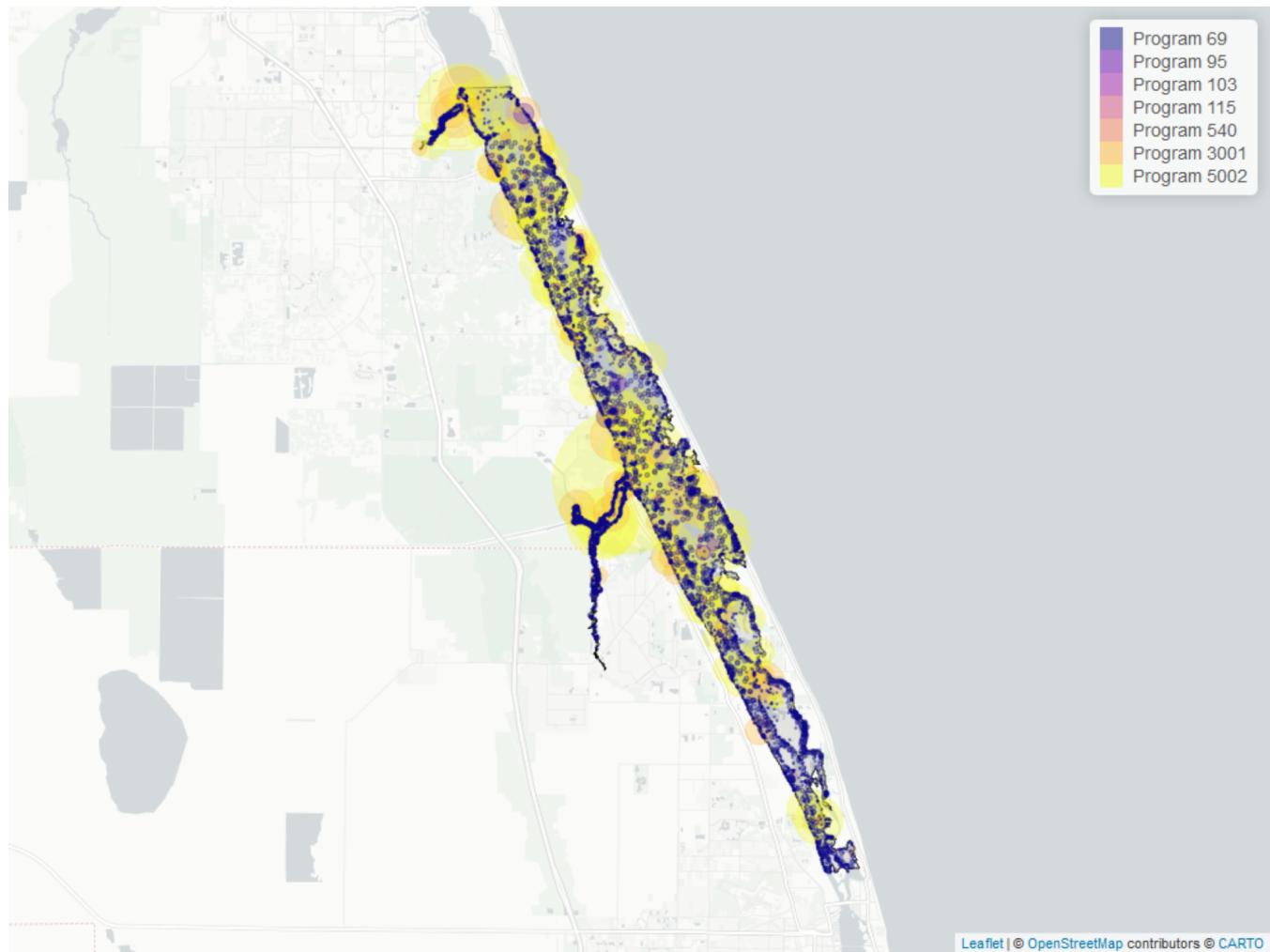


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|---------|--------|-------------|---------------|------------|-------------|-------|
| All | 43862 | 34 | 8 | TRUE | -0.3986 | 0.0000 | -0.01105698 | 8.268269 | 9.645 | 0.5626 | -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 12: Programs contributing data for pH

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 21786 | 1995 | 2023 |
| 69 | 15859 | 1991 | 2017 |
| 3001 | 5699 | 1991 | 2022 |
| 3013 | 1119 | 2003 | 2023 |
| 95 | 440 | 1980 | 2018 |
| 540 | 119 | 2016 | 2020 |
| 103 | 62 | 2004 | 2021 |
| 115 | 22 | 1994 | 1995 |

Program names:

5002 - Florida STORET / WIN

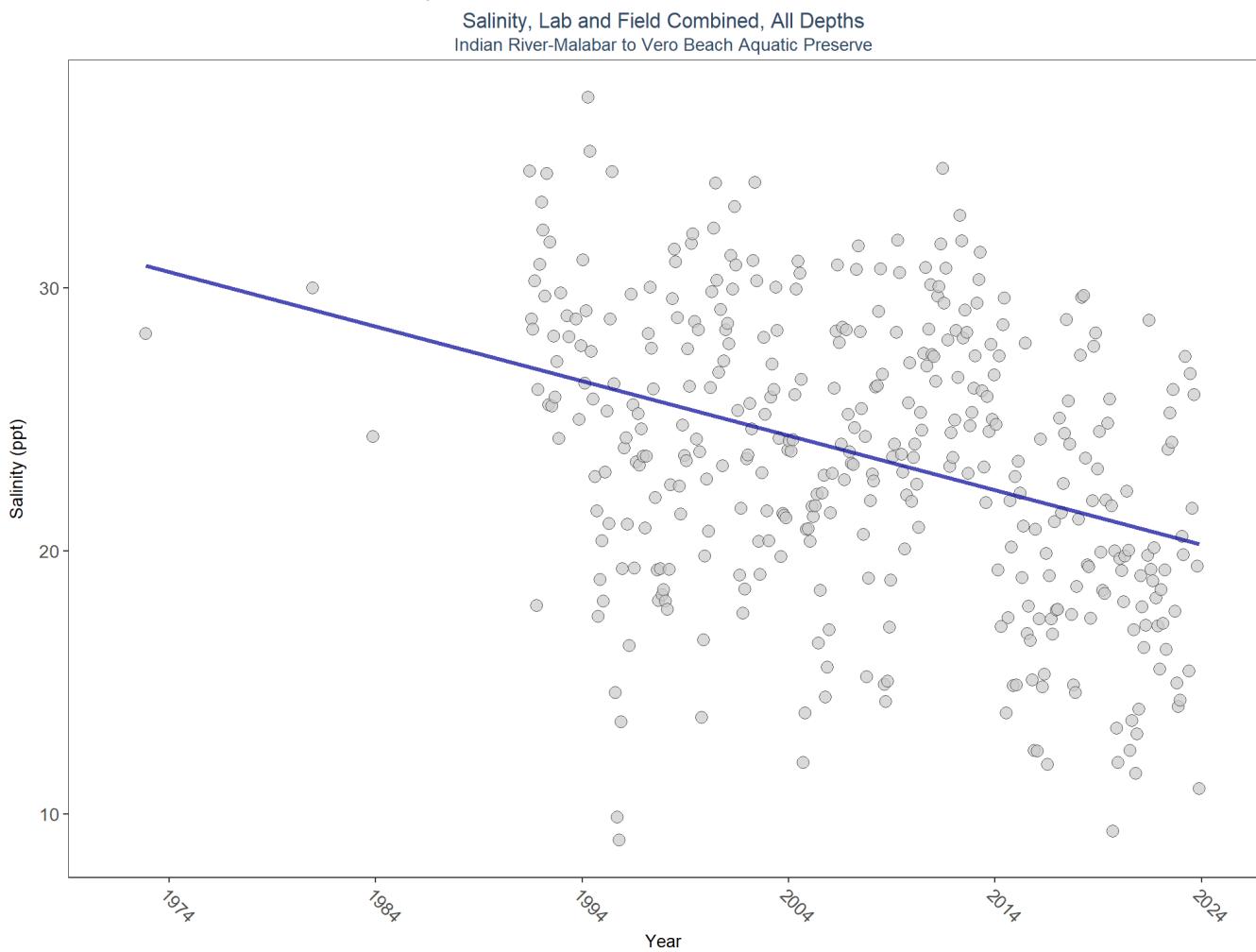
- 69 - Fisheries-Independent Monitoring (FIM) Program
 3001 - Lagoon Watch (Formerly Marine Discovery Center)
 3013 - Seagrass (SJRWM)
 95 - Harmful Algal Bloom Marine Observation Network
 540 - Shellfish Harvest Area Classification Program
 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
 115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for pH in Indian River-Malabar to Vero Beach 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.

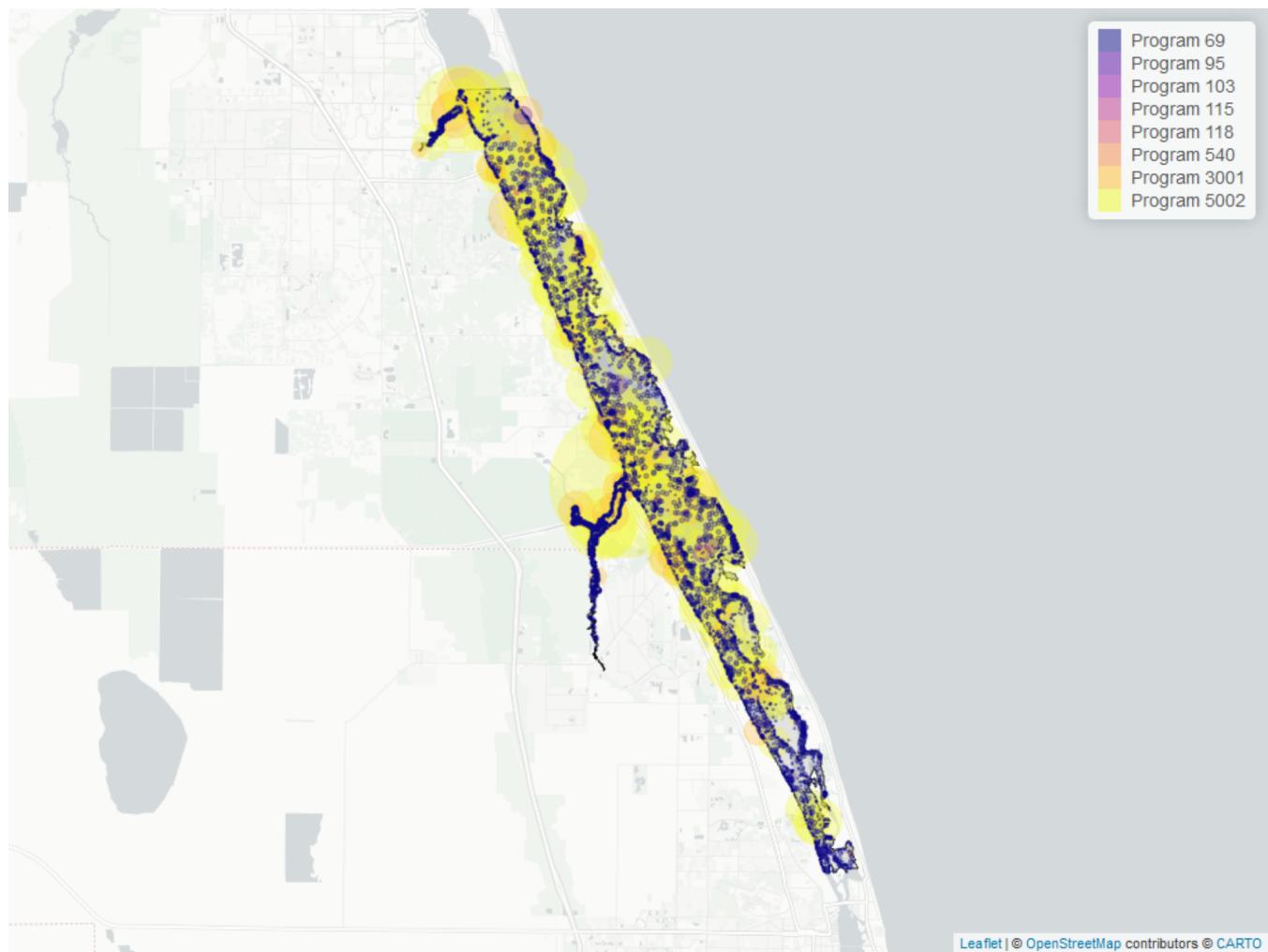
Seasonal Kendall-Tau Trend Analysis



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 13: Programs contributing data for Salinity

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 32129 | 1991 | 2023 |
| 69 | 15924 | 1991 | 2017 |
| 3001 | 6058 | 1991 | 2022 |
| 3013 | 1123 | 2003 | 2023 |
| 95 | 471 | 1972 | 2018 |
| 540 | 127 | 2016 | 2020 |
| 115 | 25 | 1994 | 1995 |
| 118 | 10 | 2015 | 2021 |
| 103 | 2 | 2004 | 2004 |

Program names:

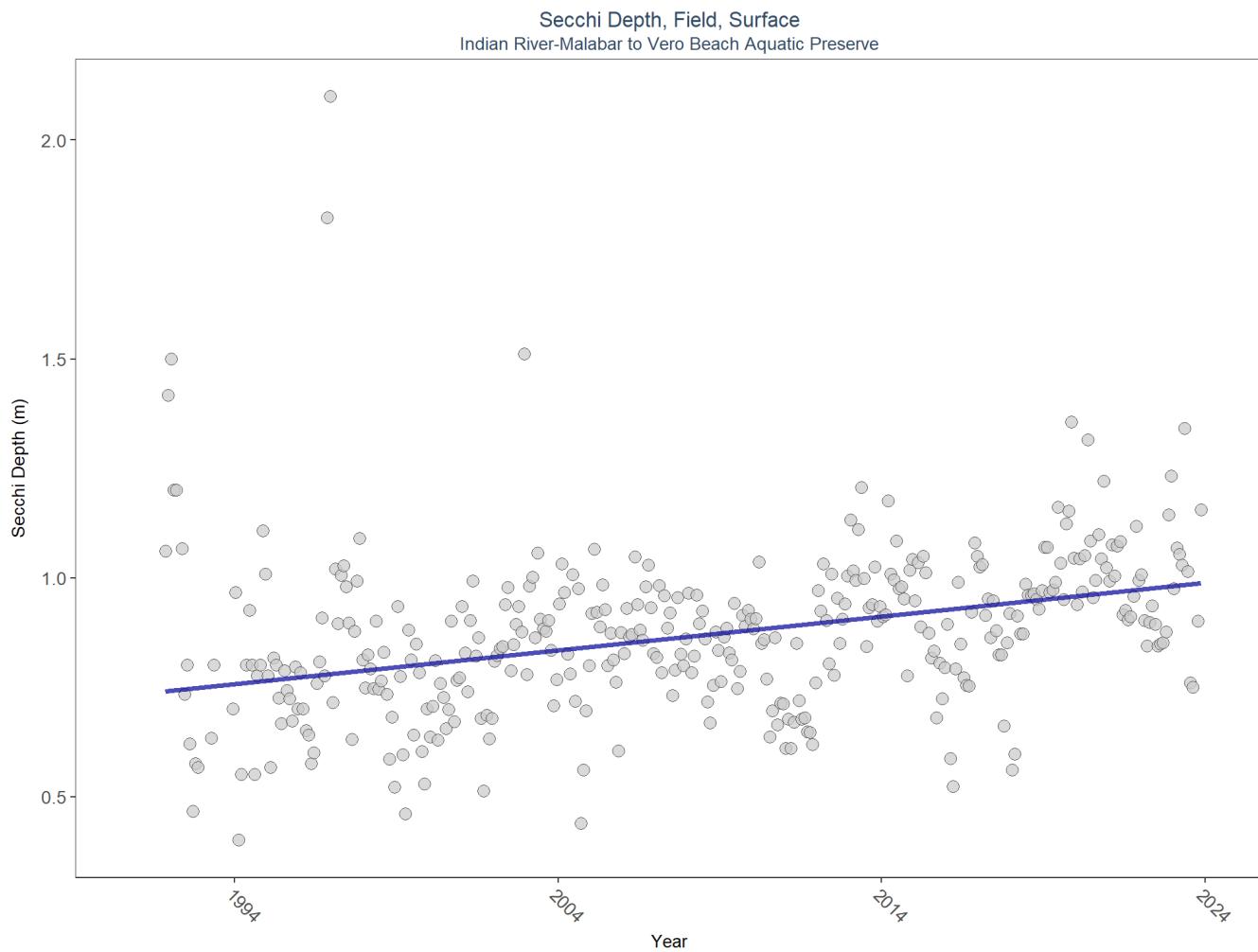
5002 - Florida STORET / WIN
 69 - Fisheries-Independent Monitoring (FIM) Program
 3001 - Lagoon Watch (Formerly Marine Discovery Center)
 3013 - Seagrass (SJRWMD)
 95 - Harmful Algal Bloom Marine Observation Network
 540 - Shellfish Harvest Area Classification Program
 115 - Environmental Monitoring Assessment Program
 118 - National Aquatic Resource Surveys, National Coastal Condition Assessment
 103 - EPA STOrage and RETrieval Data Warehouse (STORET)

There are no qualifying Value Qualifiers for Salinity in Indian River-Malabar to Vero Beach 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

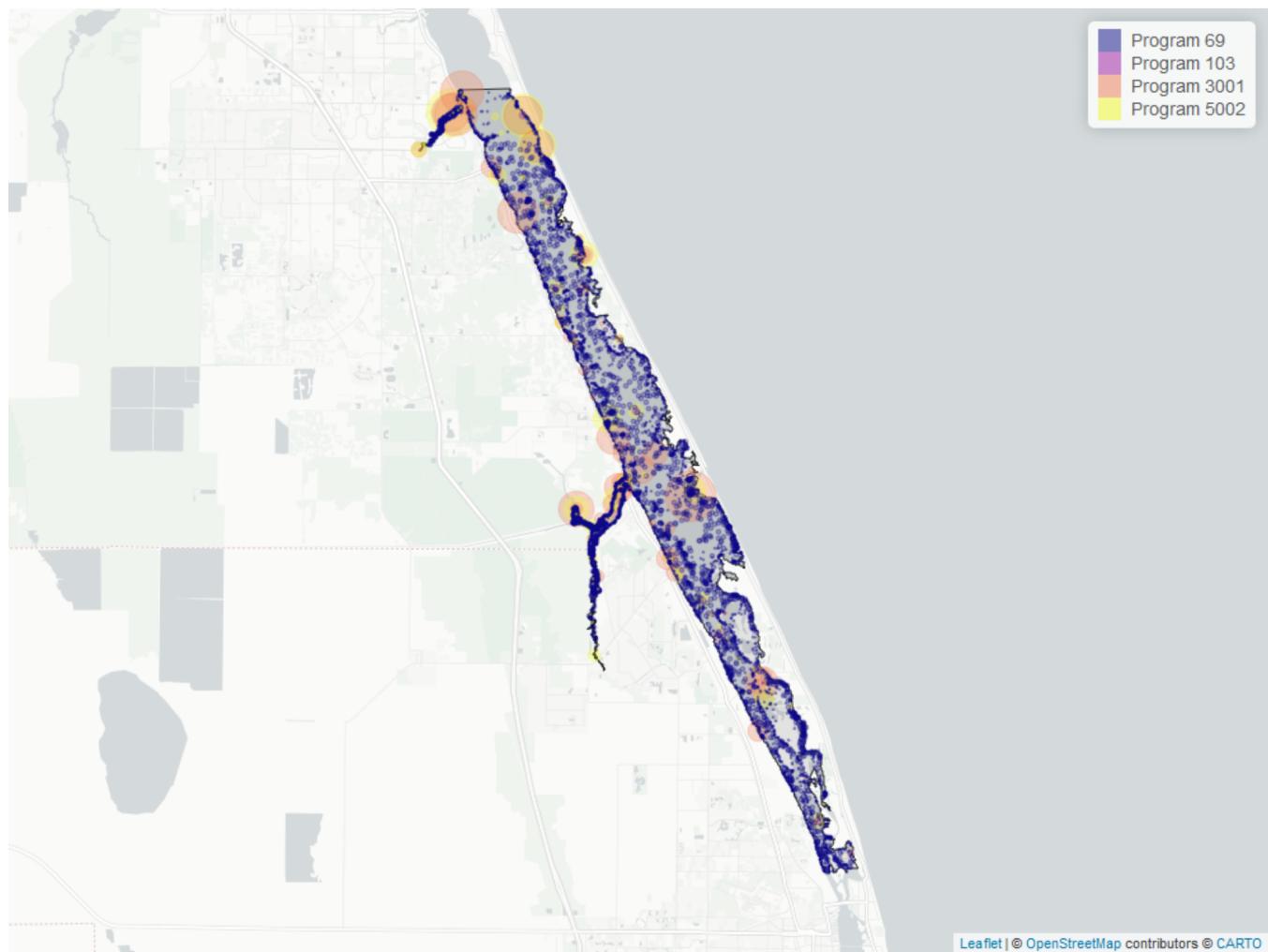


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-------------|---------------|------------|-------------|-------|
| Surface | 22900 | 33 | 0.8 | TRUE | 0.3125 | 0.0000 | 0.007734021 | 0.7340312 | 2.6855 | 0.9943 | 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 14: Programs contributing data for Secchi Depth

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 69 | 15762 | 1995 | 2017 |
| 3001 | 3819 | 1991 | 2022 |
| 5002 | 2129 | 2005 | 2023 |
| 3013 | 1130 | 2003 | 2023 |
| 103 | 71 | 2020 | 2021 |

Program names:

- 69 - Fisheries-Independent Monitoring (FIM) Program
- 3001 - Lagoon Watch (Formerly Marine Discovery Center)
- 5002 - Florida STORET / WIN
- 3013 - Seagrass (SJRWMD)

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 15: Value Qualifiers for Secchi Depth

| Year | $N_{_Total}$ | $N_{_S}$ | $perc_{_S}$ |
|------|---------------|-----------|--------------|
| 2015 | 1081 | 12 | 1.1 |
| 2016 | 1071 | 26 | 2.4 |
| 2017 | 1216 | 188 | 15.5 |
| 2018 | 538 | 167 | 31.0 |
| 2019 | 413 | 130 | 31.5 |
| 2020 | 389 | 87 | 22.4 |
| 2021 | 578 | 128 | 22.1 |
| 2022 | 437 | 80 | 18.3 |
| 2023 | 170 | 70 | 41.2 |

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) $TN = ORGN + NH_4 + NO_3;$

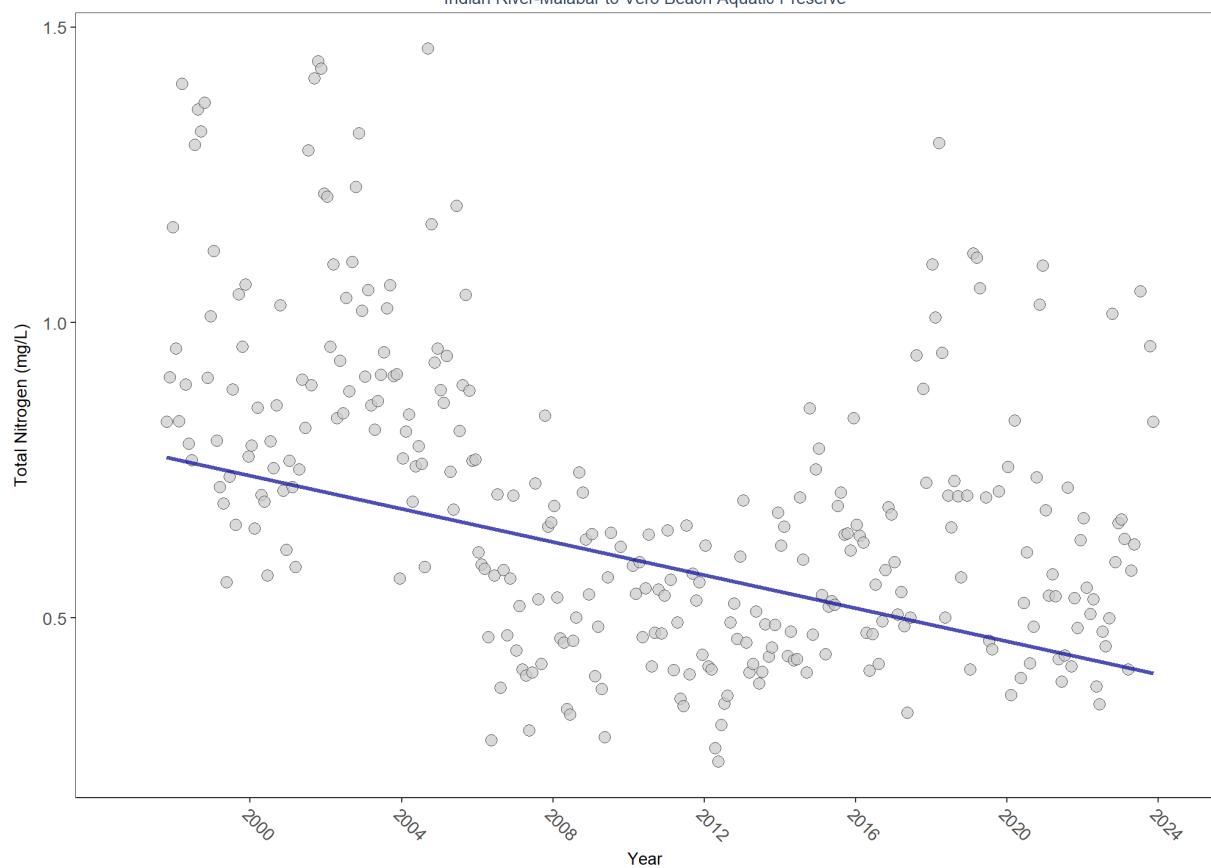
Additional Information:

- 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
Indian River-Malabar to Vero Beach Aquatic Preserve

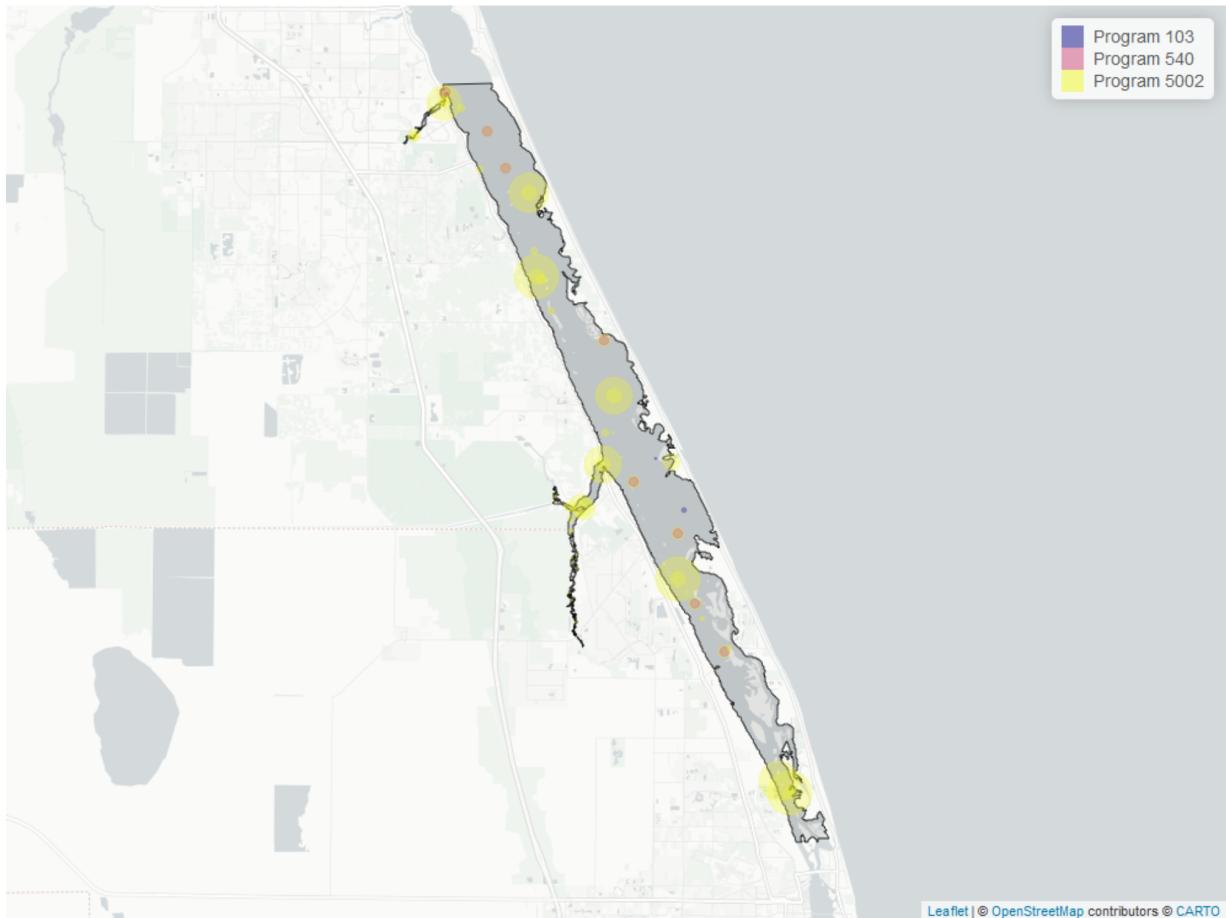


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|---------|--------|-------------|---------------|------------|-------------|-------|
| All | 3105 | 27 | 0.655 | TRUE | -0.3079 | 0.0000 | -0.01400208 | 0.783046 | 6.0474 | 0.8702 | -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 16: Programs contributing data for Total Nitrogen

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 2977 | 1997 | 2023 |
| 540 | 124 | 2016 | 2020 |
| 103 | 4 | 2000 | 2004 |

Program names:

5002 - Florida STORET / WIN

540 - Shellfish Harvest Area Classification Program

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 Nitrogen

| Year | N_Total | N_I | perc_I |
|------|---------|-----|--------|
| 2009 | 90 | 1 | 1.1 |

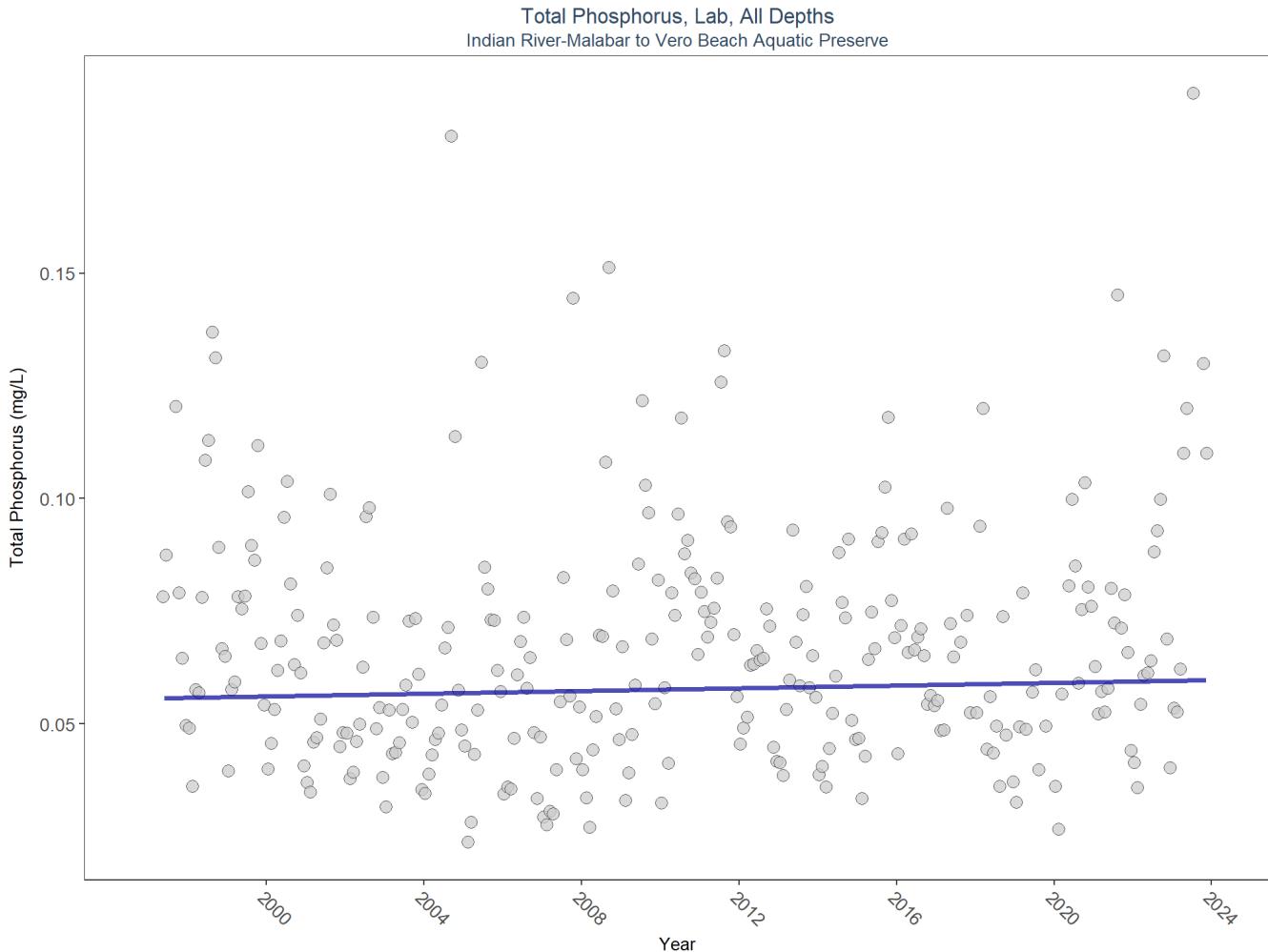
Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

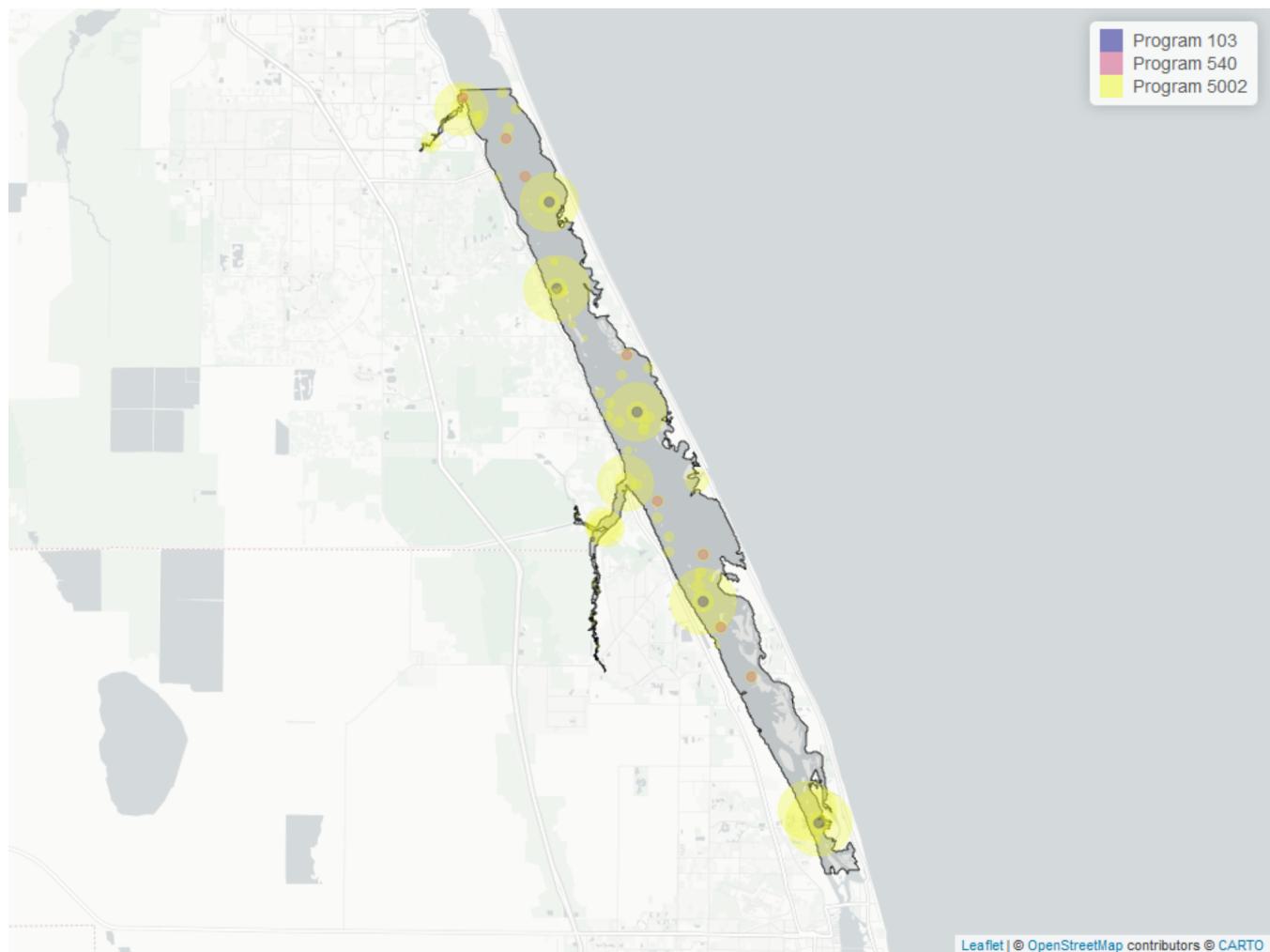


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|---------|-------------|--------|--------|--------------|---------------|------------|-------------|-------|
| All | 6316 | 27 | 0.05303 | TRUE | 0.0463 | 0.2450 | 0.0001509858 | 0.05558169 | 14.6745 | 0.1979 | 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 Phosphorus



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

Table 18: Programs contributing data for Total Phosphorus

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 6171 | 1997 | 2023 |
| 540 | 126 | 2016 | 2020 |
| 103 | 76 | 2020 | 2021 |

Program names:

5002 - Florida STORET / WIN

540 - Shellfish Harvest Area Classification 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 19: Value Qualifiers for Total Phosphorus

| Year | $N_{_Total}$ | $N_{_I}$ | $perc_{_I}$ | $N_{_Q}$ | $perc_{_Q}$ | $N_{_U}$ | $perc_{_U}$ |
|------|---------------|-----------|--------------|-----------|--------------|-----------|--------------|
| 1997 | 137 | 26 | 19.0 | | | | |
| 1998 | 408 | 93 | 22.8 | 6 | 1.5 | | |
| 1999 | 295 | 30 | 10.2 | 1 | 0.3 | | |
| 2001 | 288 | | | 24 | 8.3 | | |
| 2002 | 477 | 128 | 26.8 | 8 | 1.7 | | |
| 2003 | 318 | 112 | 35.2 | 12 | 3.8 | | |
| 2004 | 378 | 134 | 35.5 | 1 | 0.3 | | |
| 2005 | 301 | 114 | 37.9 | | | | |
| 2006 | 297 | 130 | 43.8 | | | | |
| 2007 | 283 | 133 | 47.0 | | | | |
| 2008 | 276 | 107 | 38.8 | | | 4 | 1.4 |
| 2009 | 259 | 76 | 29.3 | | | 2 | 0.8 |
| 2010 | 238 | 113 | 47.5 | 20 | 8.4 | | |
| 2011 | 221 | 109 | 49.3 | 12 | 5.4 | | |
| 2012 | 182 | 132 | 72.5 | | | | |
| 2013 | 202 | 119 | 58.9 | | | | |
| 2014 | 239 | 122 | 51.0 | 7 | 2.9 | | |
| 2015 | 251 | 142 | 56.6 | 34 | 13.6 | | |
| 2016 | 240 | 132 | 55.0 | 16 | 6.7 | | |
| 2017 | 120 | 64 | 53.3 | | | | |
| 2020 | 151 | 20 | 13.2 | 1 | 0.7 | 1 | 0.7 |
| 2021 | 266 | 43 | 16.2 | 1 | 0.4 | 1 | 0.4 |
| 2022 | 175 | 41 | 23.4 | 3 | 1.7 | 4 | 2.3 |
| 2023 | 43 | 12 | 27.9 | | | | |

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:

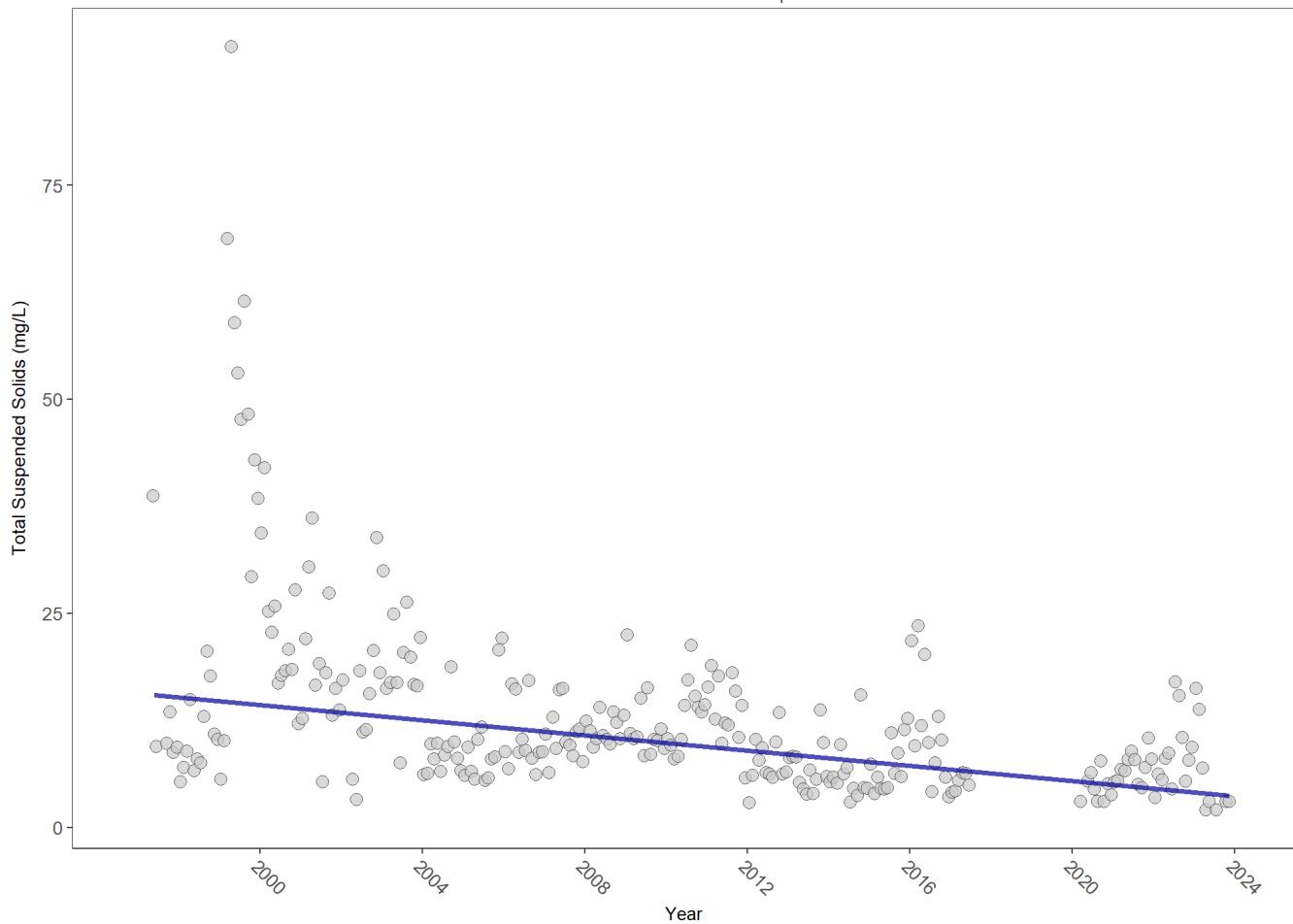
5002 - Florida STORET / WIN

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
Indian River-Malabar to Vero Beach Aquatic Preserve

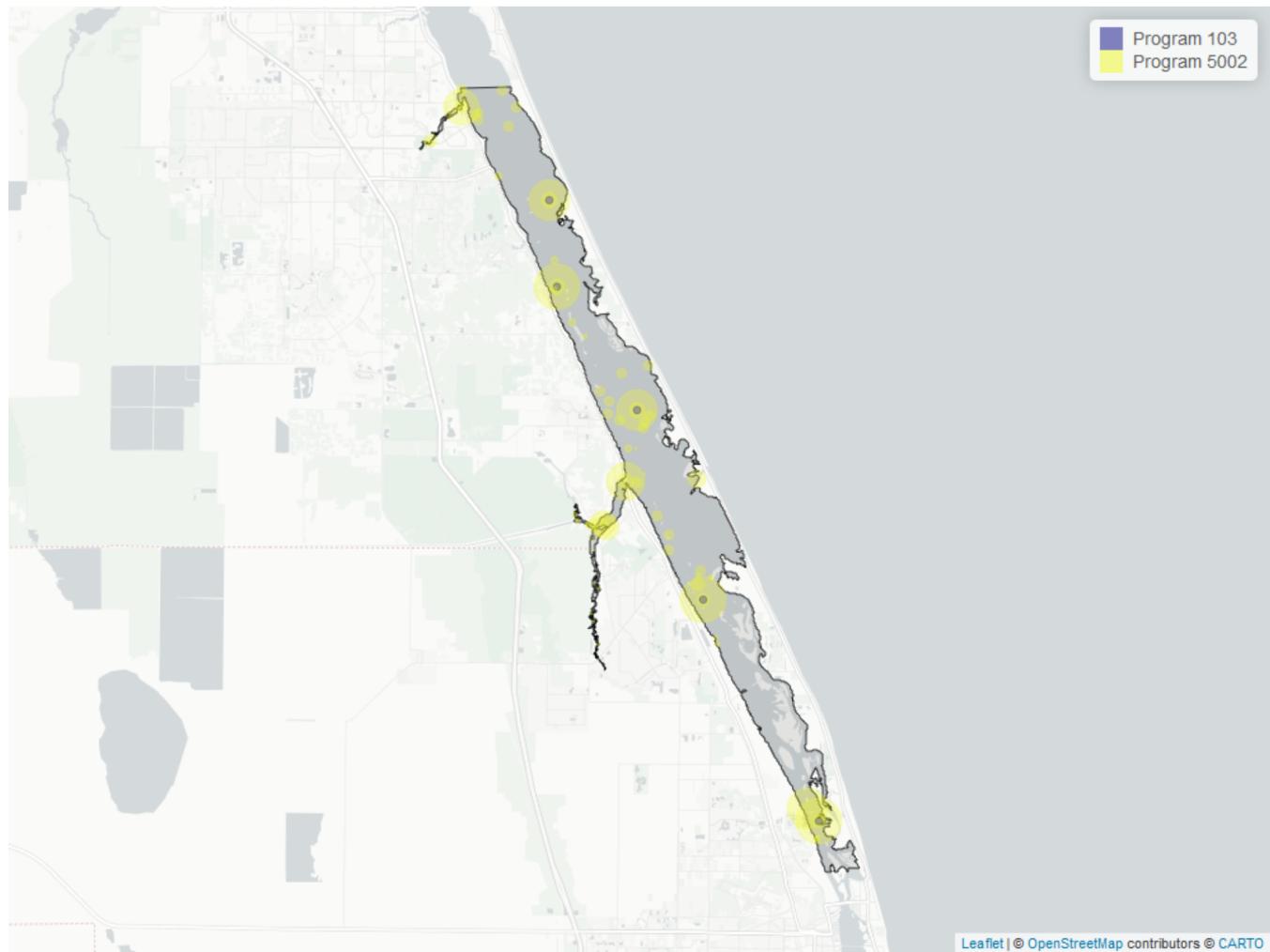


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|---------|--------|------------|---------------|------------|-------------|-------|
| All | 3218 | 25 | 9.2 | TRUE | -0.4027 | 0.0000 | -0.4454196 | 15.66875 | 4.4816 | 0.9537 | -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 20: Programs contributing data for Total Suspended Solids

| <i>ProgramID</i> | <i>N_Data</i> | <i>YearMin</i> | <i>YearMax</i> |
|------------------|---------------|----------------|----------------|
| 5002 | 3220 | 1997 | 2023 |
| 103 | 41 | 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_{\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 21: Value Qualifiers for Total Suspended Solids

| Year | N_Total | N_I | perc_I | N_Q | perc_Q | N_U | perc_U |
|------|---------|-----|--------|-----|--------|-----|--------|
| 1997 | 86 | 46 | 53.5 | | | | |
| 1998 | 203 | 151 | 74.4 | | | | |
| 1999 | 145 | 21 | 14.5 | | | 2 | 1.4 |
| 2000 | 120 | | | | | 9 | 7.5 |
| 2001 | 172 | | | 22 | 12.8 | 6 | 3.5 |
| 2002 | 258 | 86 | 33.3 | 14 | 5.4 | 3 | 1.2 |
| 2003 | 176 | 82 | 46.6 | 18 | 10.2 | | |
| 2004 | 252 | 139 | 55.2 | 5 | 2.0 | | |
| 2005 | 198 | 103 | 52.0 | | | 1 | 0.5 |
| 2006 | 155 | 55 | 35.5 | 3 | 1.9 | | |
| 2007 | 144 | 57 | 39.6 | | | | |
| 2008 | 145 | 32 | 22.1 | | | 8 | 5.5 |
| 2009 | 140 | 24 | 17.1 | | | 2 | 1.4 |
| 2010 | 119 | 13 | 10.9 | | | | |
| 2011 | 111 | 13 | 11.7 | 2 | 1.8 | | |
| 2012 | 84 | 43 | 51.2 | | | | |
| 2013 | 89 | 64 | 71.9 | | | | |
| 2014 | 96 | 75 | 78.1 | 1 | 1.0 | | |
| 2015 | 106 | 72 | 67.9 | 1 | 0.9 | 1 | 0.9 |
| 2016 | 106 | 54 | 50.9 | 3 | 2.8 | 1 | 0.9 |
| 2017 | 43 | 40 | 93.0 | | | | |
| 2020 | 57 | 38 | 66.7 | 2 | 3.5 | 5 | 8.8 |
| 2021 | 140 | 66 | 47.1 | 11 | 7.9 | 12 | 8.6 |
| 2022 | 91 | 57 | 62.6 | | | 9 | 9.9 |
| 2023 | 25 | 12 | 48.0 | 3 | 12.0 | 3 | 12.0 |

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:

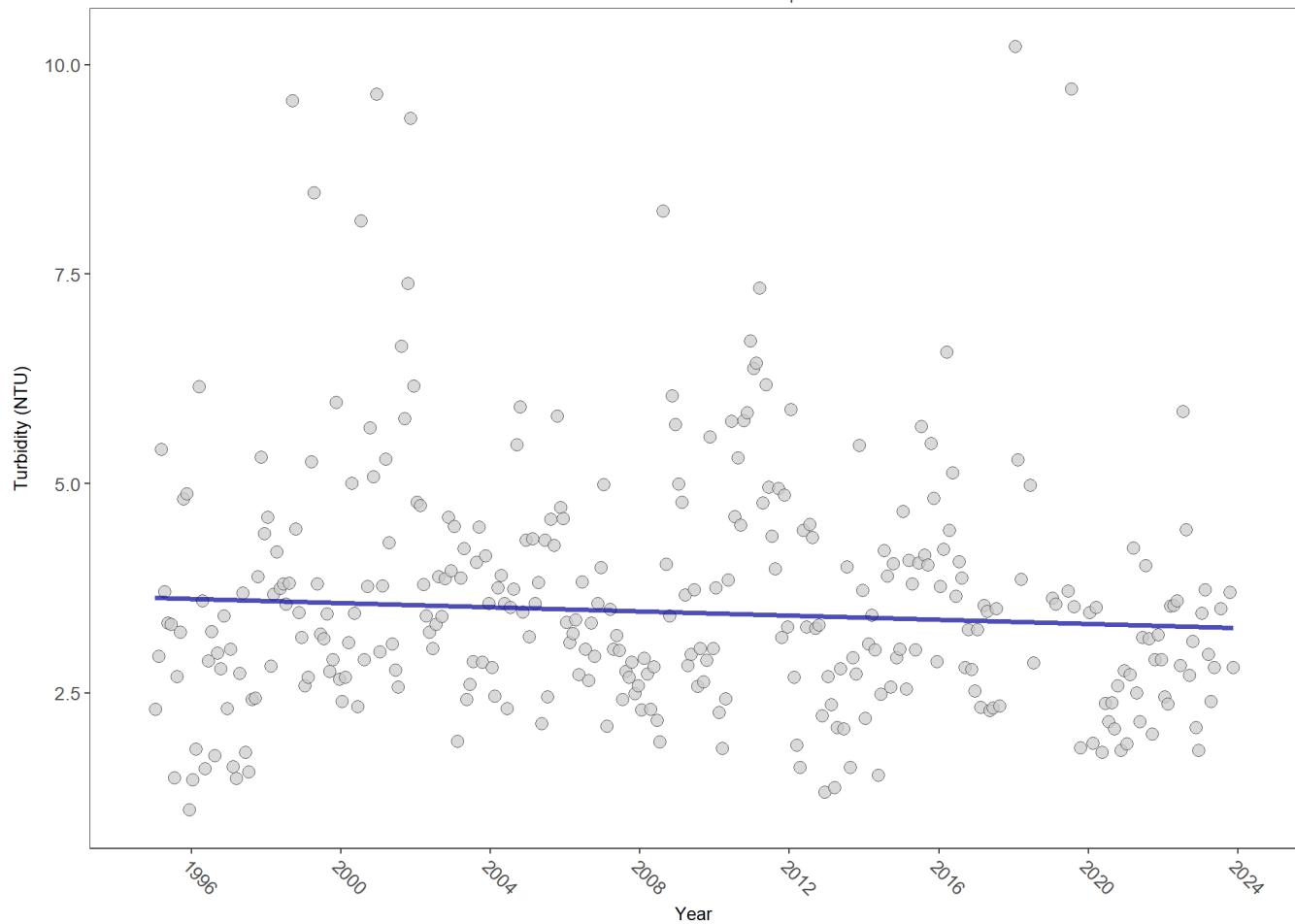
5002 - Florida STORET / WIN

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
Indian River-Malabar to Vero Beach Aquatic Preserve

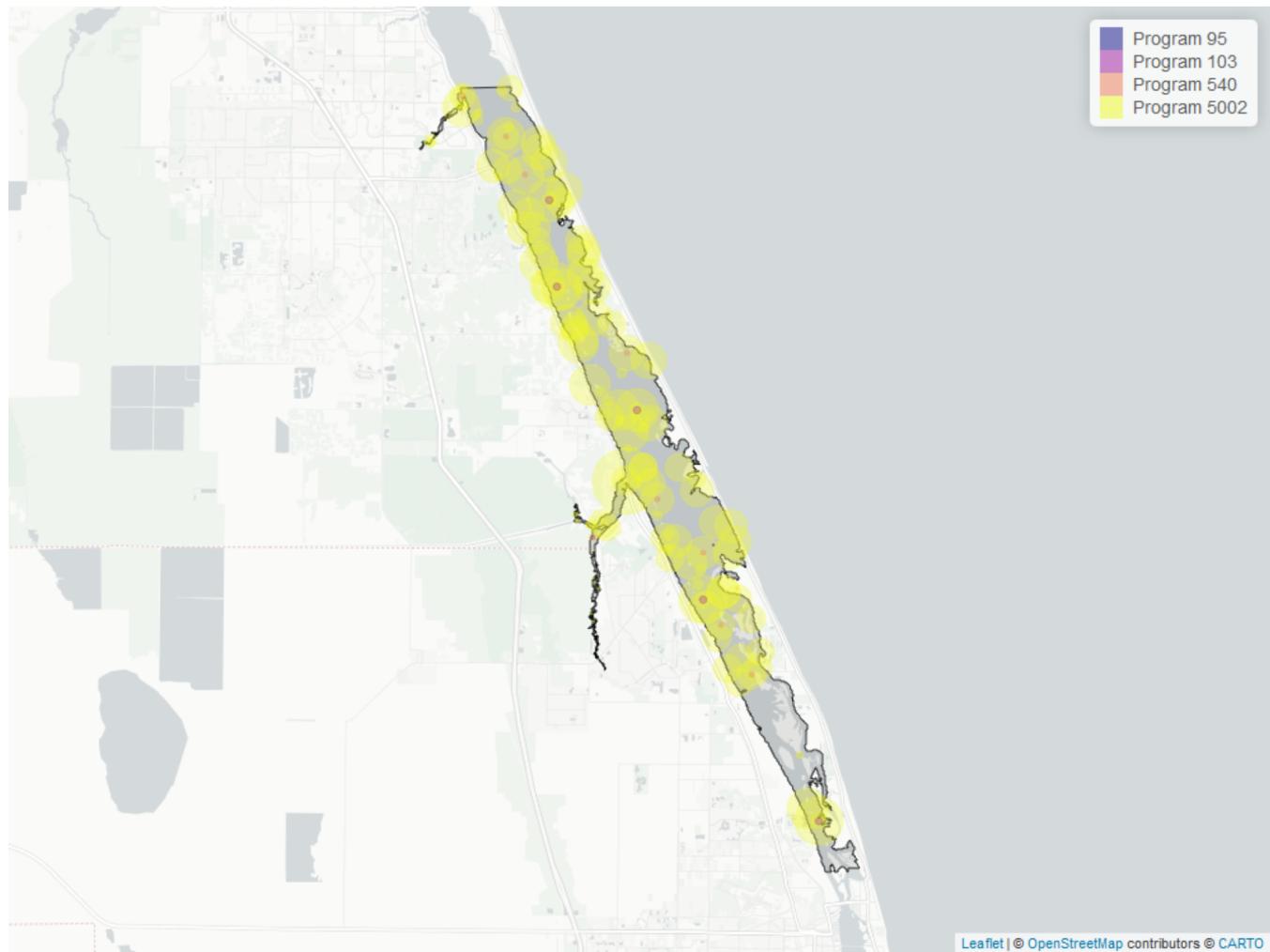


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|---------|--------|-------------|---------------|------------|-------------|-------|
| All | 15855 | 29 | 2.9 | TRUE | -0.0679 | 0.1313 | -0.01232027 | 3.632727 | 22.0716 | 0.0238 | 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 22: Programs contributing data for Turbidity

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 14877 | 1995 | 2023 |
| 3013 | 938 | 2004 | 2019 |
| 103 | 40 | 2020 | 2021 |
| 540 | 29 | 2019 | 2020 |
| 95 | 1 | 2008 | 2008 |

Program names:

5002 - Florida STORET / WIN

3013 - Seagrass (SJRWMD)

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

540 - Shellfish Harvest Area Classification Program

Value Qualifiers

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

Table 23: Value Qualifiers for Turbidity

| Year | N_{Total} | N_I | perc_I | N_Q | perc_Q | N_U | perc_U |
|------|--------------------|-------|-----------------|-------|-----------------|-------|-----------------|
| 1998 | 1127 | 20 | 1.8 | | | | |
| 1999 | 873 | 5 | 0.6 | | | | |
| 2001 | 976 | | | 18 | 1.8 | | |
| 2002 | 905 | 25 | 2.8 | 2 | 0.2 | | |
| 2003 | 725 | 27 | 3.7 | | | | |
| 2004 | 869 | 32 | 3.7 | | | | |
| 2005 | 739 | 28 | 3.8 | 3 | 0.4 | | |
| 2006 | 637 | 17 | 2.7 | 3 | 0.5 | | |
| 2007 | 660 | 58 | 8.8 | 4 | 0.6 | | |
| 2008 | 650 | 30 | 4.6 | 7 | 1.1 | | |
| 2009 | 631 | 6 | 0.9 | 10 | 1.6 | | |
| 2012 | 264 | 20 | 7.6 | 8 | 3.0 | | |
| 2013 | 150 | 26 | 17.3 | 3 | 2.0 | | |
| 2014 | 163 | 31 | 19.0 | 1 | 0.6 | | |
| 2015 | 189 | 7 | 3.7 | 9 | 4.8 | | |
| 2016 | 186 | 22 | 11.8 | | | | |
| 2017 | 88 | 5 | 5.7 | 2 | 2.3 | | |
| 2020 | 84 | 18 | 21.4 | | | 1 | 1.2 |
| 2021 | 138 | 20 | 14.5 | 4 | 2.9 | 1 | 0.7 |
| 2022 | 91 | 15 | 16.5 | | | | |
| 2023 | 25 | 4 | 16.0 | | | | |

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:

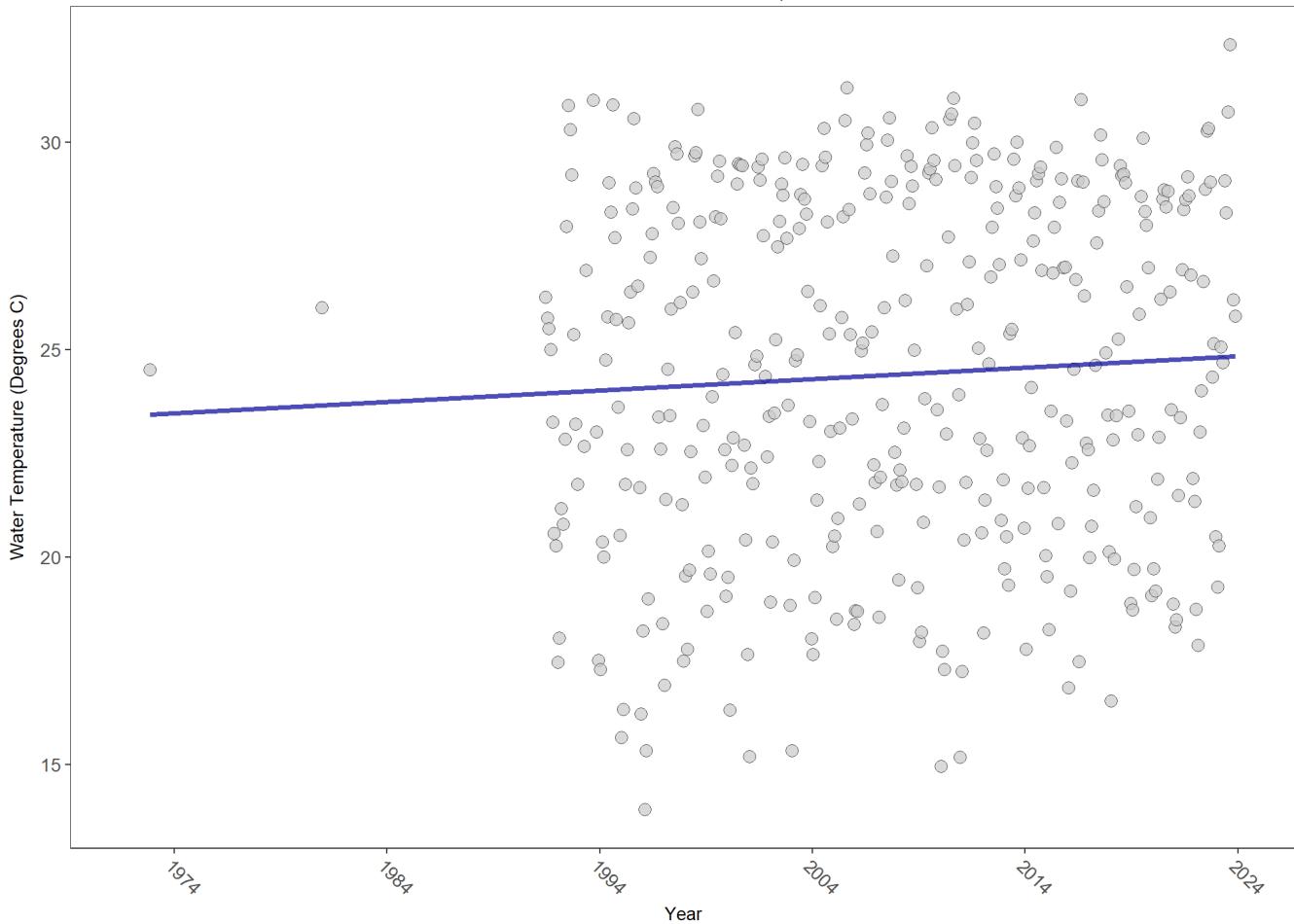
5002 - Florida STORET / WIN
 540 - Shellfish Harvest Area Classification Program

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
Indian River-Malabar to Vero Beach Aquatic Preserve

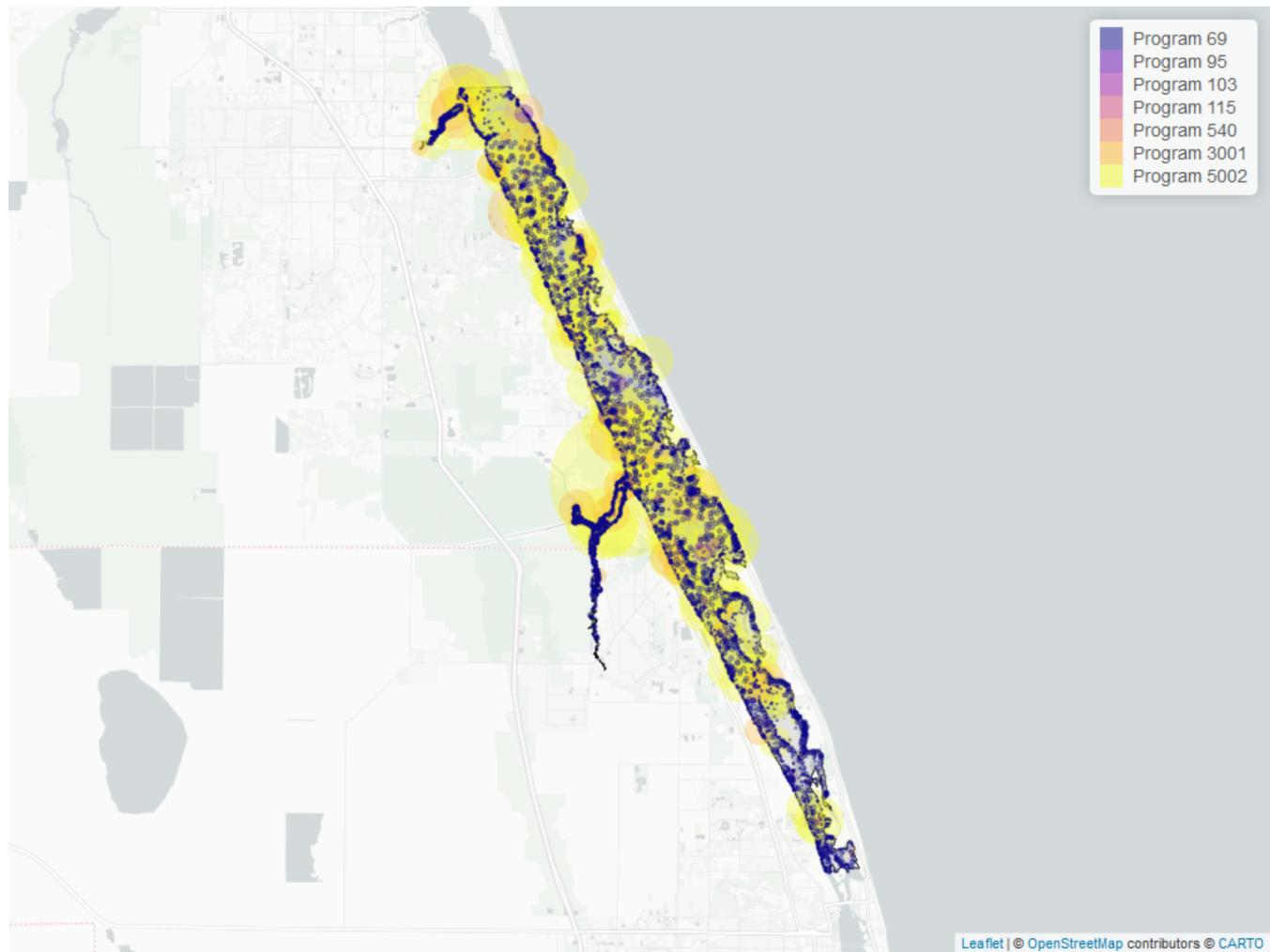


| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|------------|---------------|------------|-------------|-------|
| All | 54906 | 35 | 25.4 | TRUE | 0.1374 | 0.0001 | 0.02742726 | 23.40877 | 4.7864 | 0.9411 | 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 24: Programs contributing data for Water Temperature

| ProgramID | N_Data | YearMin | YearMax |
|-----------|--------|---------|---------|
| 5002 | 32594 | 1991 | 2023 |
| 69 | 15918 | 1991 | 2017 |
| 3001 | 6084 | 1991 | 2022 |
| 3013 | 1115 | 2003 | 2023 |
| 95 | 463 | 1972 | 2018 |
| 540 | 127 | 2016 | 2020 |
| 103 | 62 | 2004 | 2021 |
| 115 | 25 | 1994 | 1995 |

Program names:

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

3001 - Lagoon Watch (Formerly Marine Discovery Center)

3013 - Seagrass (SJRWMD)

95 - Harmful Algal Bloom Marine Observation Network

540 - Shellfish Harvest Area Classification Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for Water Temperature in Indian River-Malabar to Vero Beach Aquatic Preserve

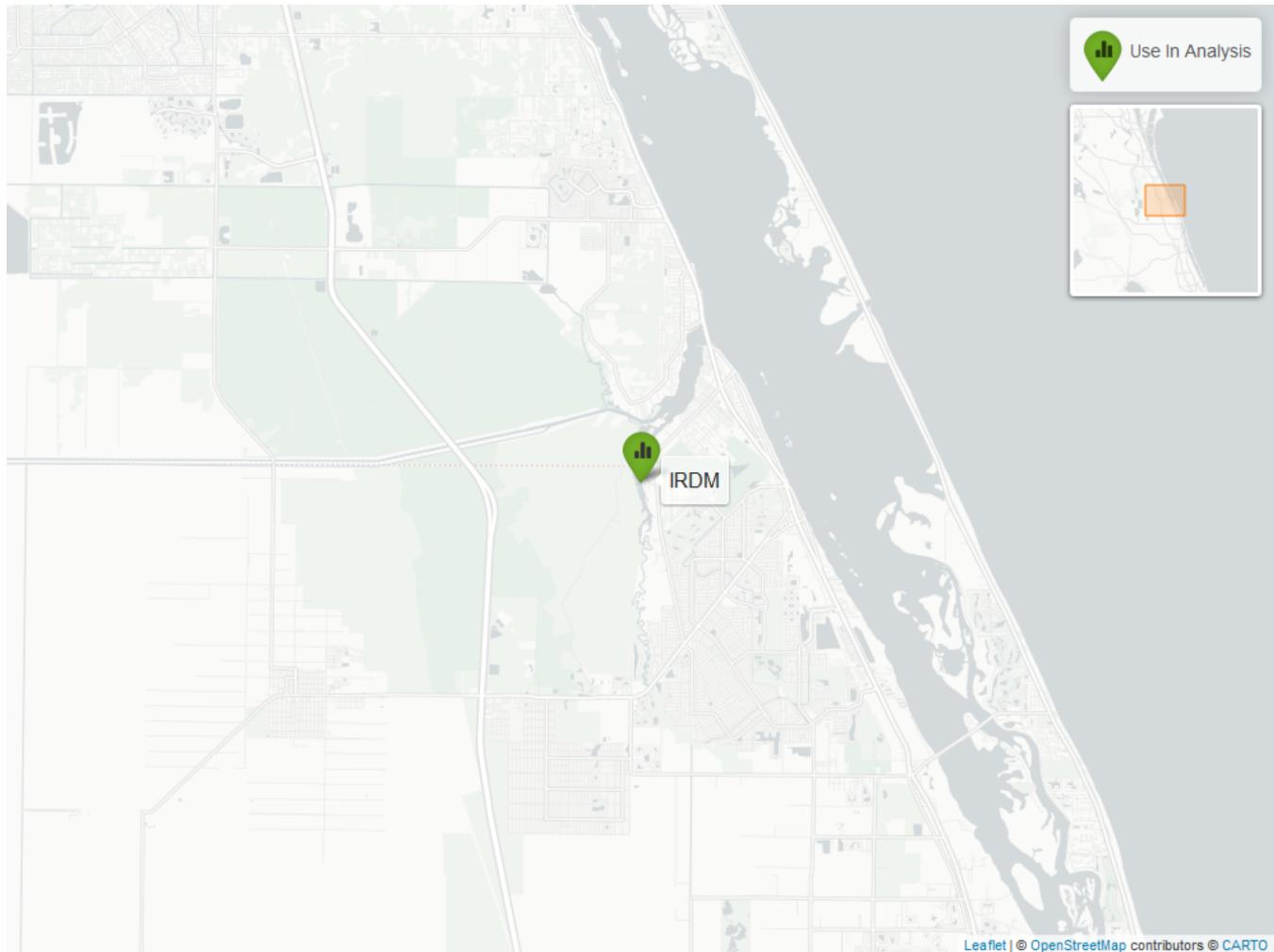
Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_pH_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NE-2024-Feb-22.txt*

Table 25: Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

| <i>Program</i> | <i>LocationID</i> | <i>Years of Data</i> | <i>Use in Analysis</i> | <i>Parameters</i> |
|----------------|-------------------|----------------------|------------------------|------------------------------------|
| IRDM | | 5 | TRUE | DO , DOS , pH , Sal , Turb , TempW |



Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Indian River-Malabar to Vero Beach Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

Dissolved Oxygen - Continuous Water Quality

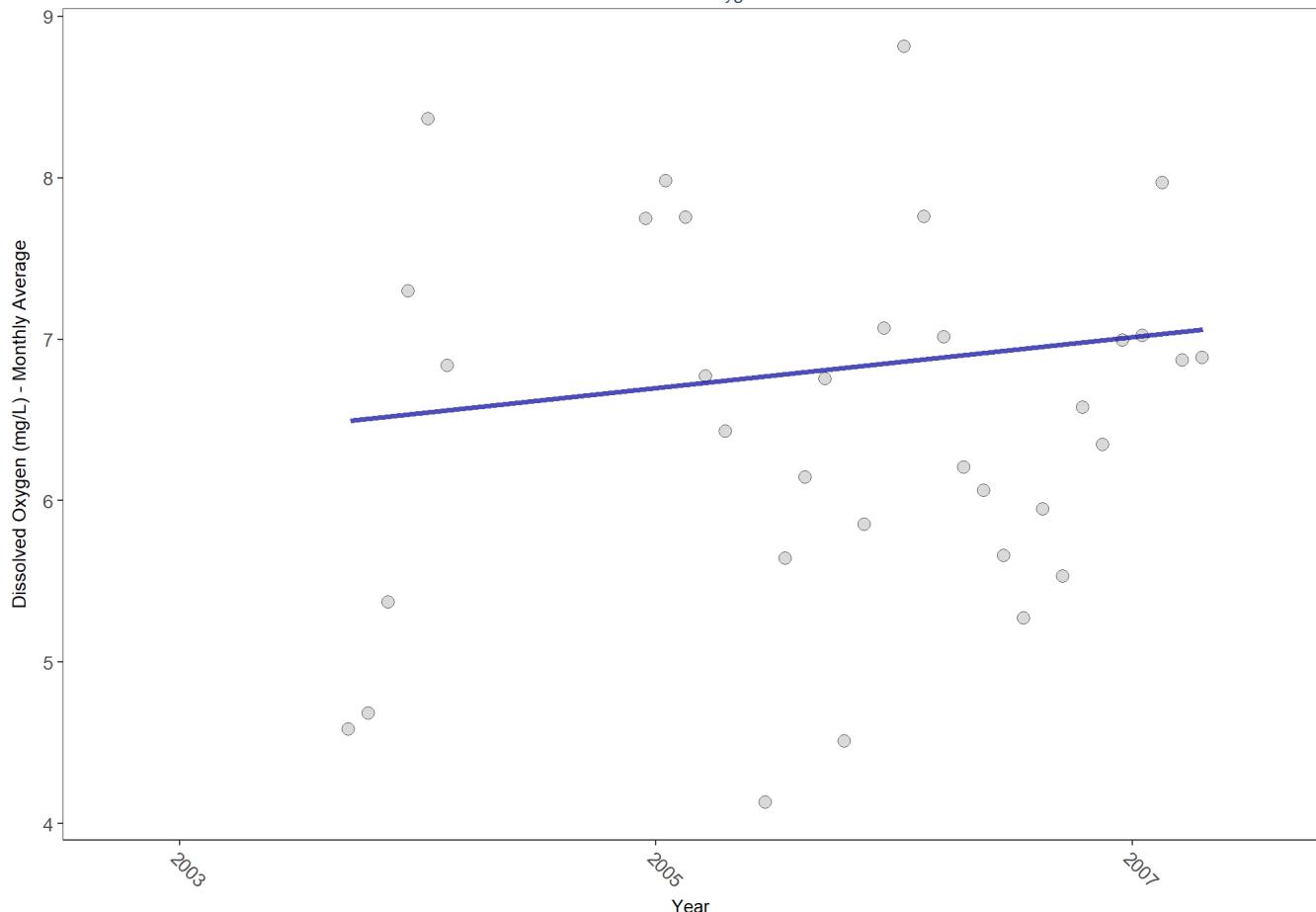
IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve

IRDM

Dissolved Oxygen



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| bottom | 39746 | 5 | 6.5 | TRUE | 0.1515 | 0.4674 | 0.1586875 | 6.380433 | 12.3659 | 0.2613 | 0 |

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

SennIntercept is intercept value at beginning of record for monitoring location

Dissolved Oxygen Saturation - Continuous Water Quality

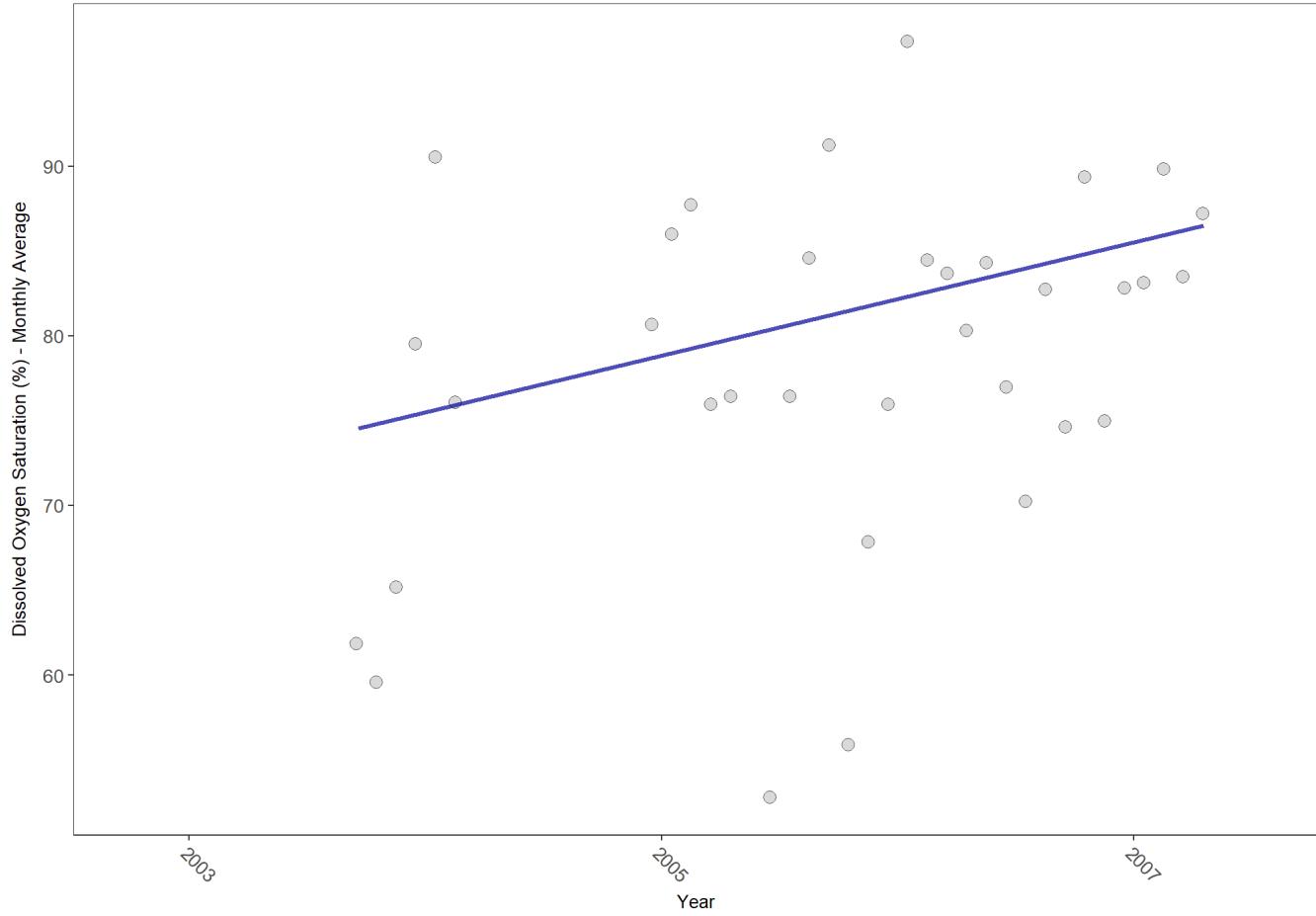
IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve

IRDM

Dissolved Oxygen Saturation



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| bottom | 39746 | 5 | 77.7 | TRUE | 0.2929 | 0.1099 | 3.336711 | 72.16269 | 9.17 | 0.5161 | 0 |

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

SennIntercept is intercept value at beginning of record for monitoring location

pH - Continuous Water Quality

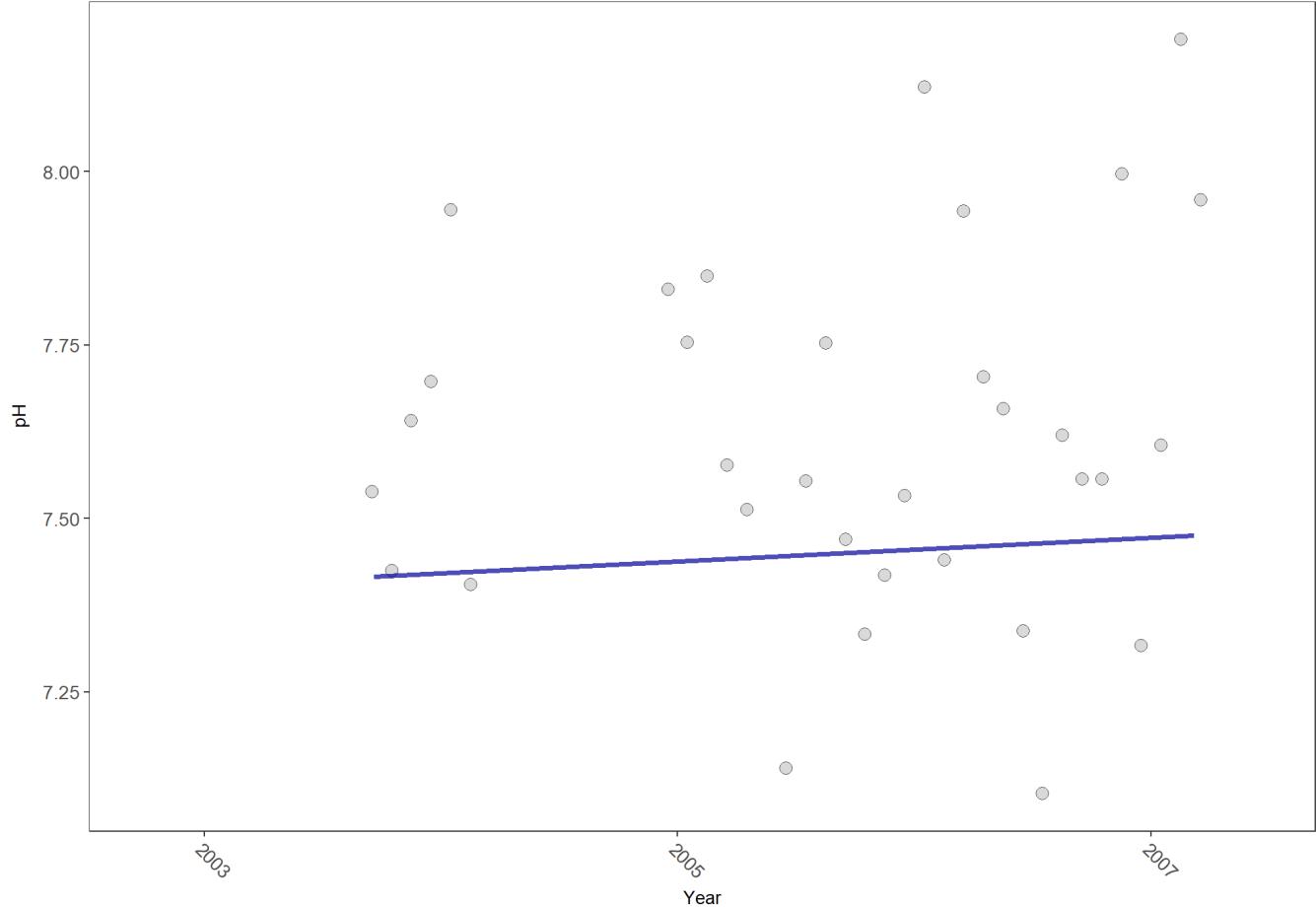
IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve

IRDM

pH



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|------------|---------------|------------|-------------|-------|
| bottom | 38184 | 5 | 7.6 | TRUE | 0.1458 | 0.6535 | 0.01711302 | 7.403957 | 10.8791 | 0.367 | 0 |

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

SennIntercept is intercept value at beginning of record for monitoring location

Salinity - Continuous Water Quality

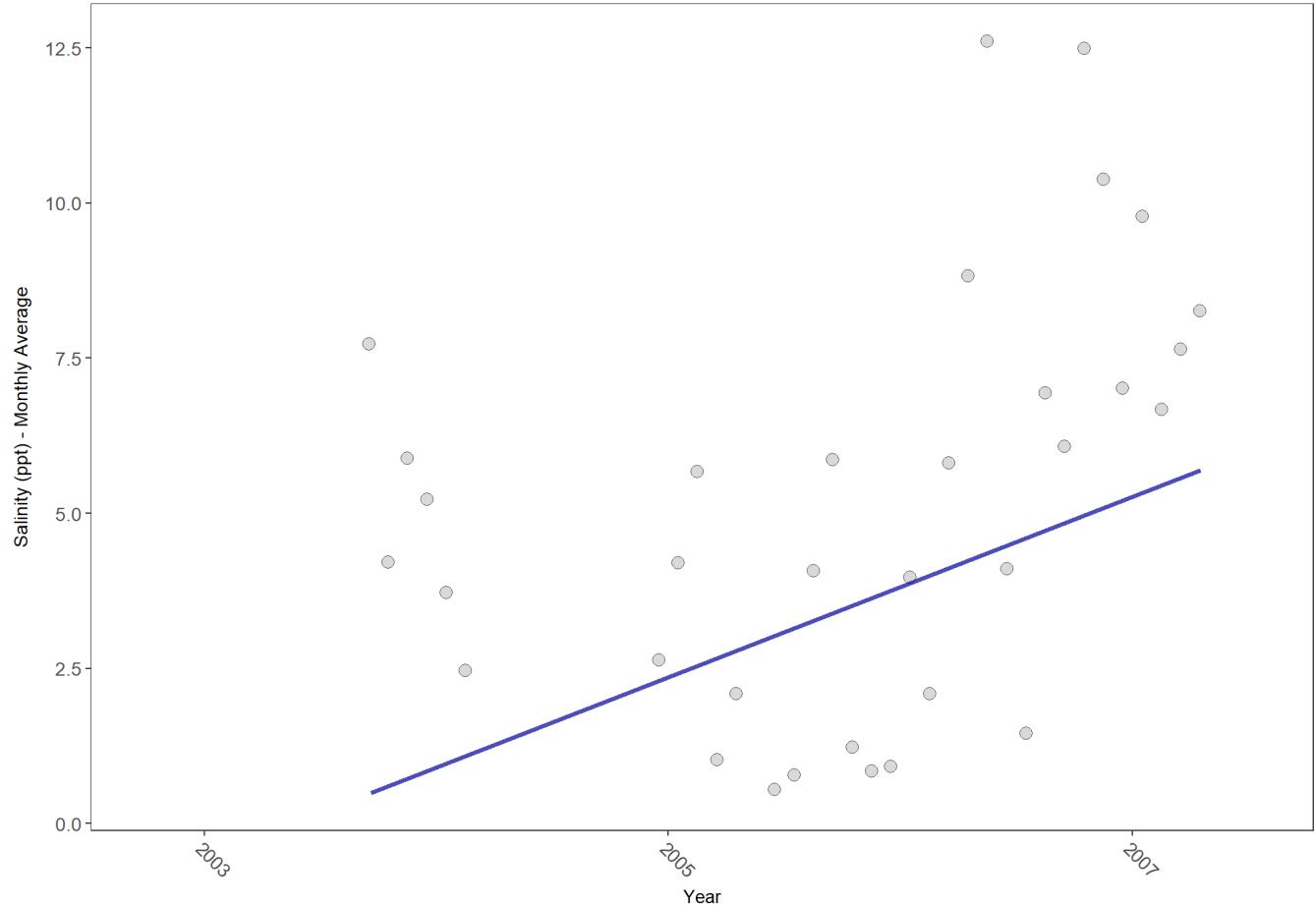
IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve

IRDM

Salinity



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| bottom | 43791 | 5 | 3.9 | TRUE | 0.4545 | 0.0588 | 1.452301 | -0.5491935 | 3.5339 | 0.9659 | 0 |

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

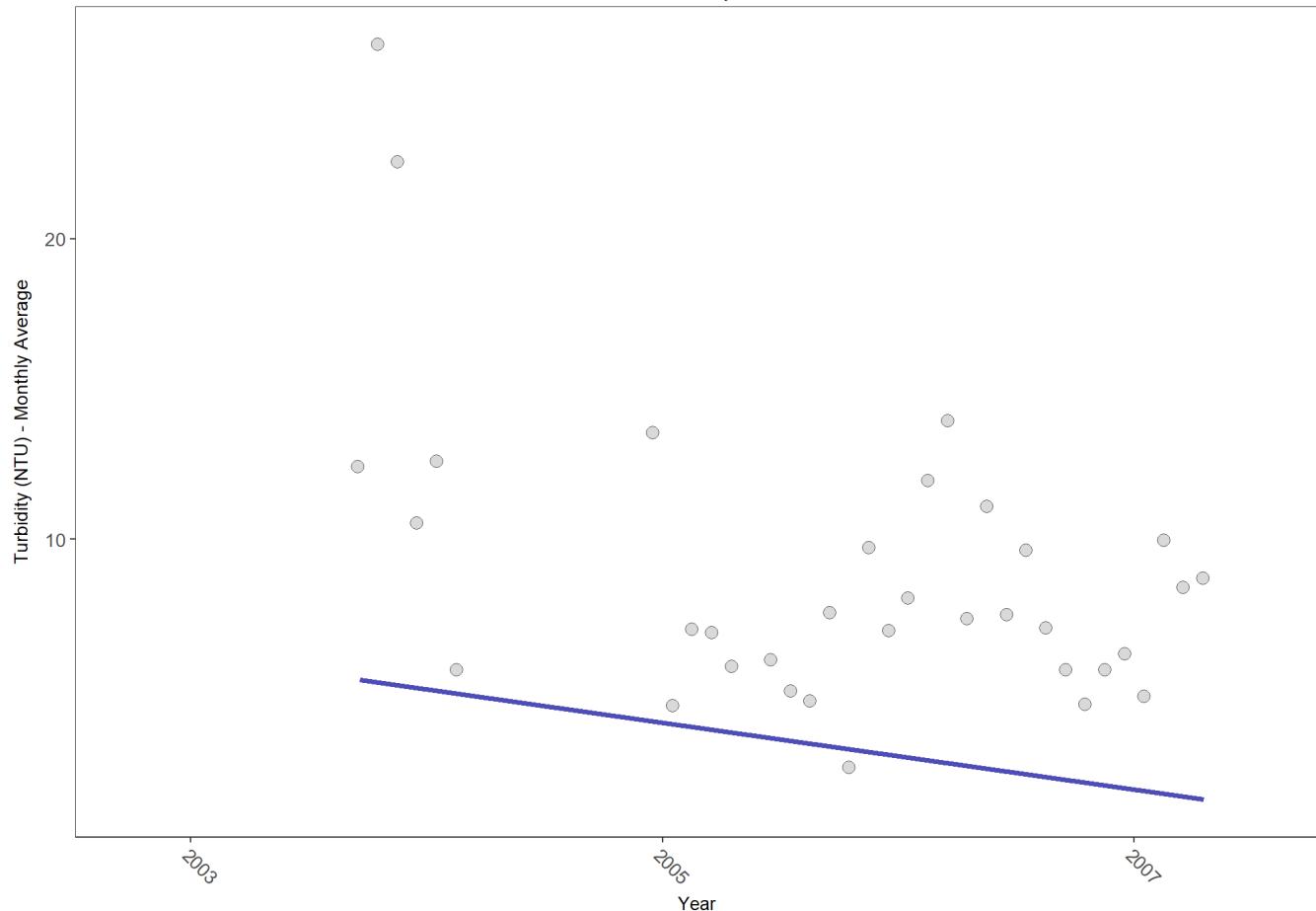
SennIntercept is intercept value at beginning of record for monitoring location

Turbidity - Continuous Water Quality

IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve
IRDM
Turbidity



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| bottom | 39124 | 5 | 5 | TRUE | 0.0505 | 0.8844 | -1.112982 | 6.134734 | 15.0113 | 0.1317 | 0 |

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

SennIntercept is intercept value at beginning of record for monitoring location

Water Temperature - Continuous Water Quality

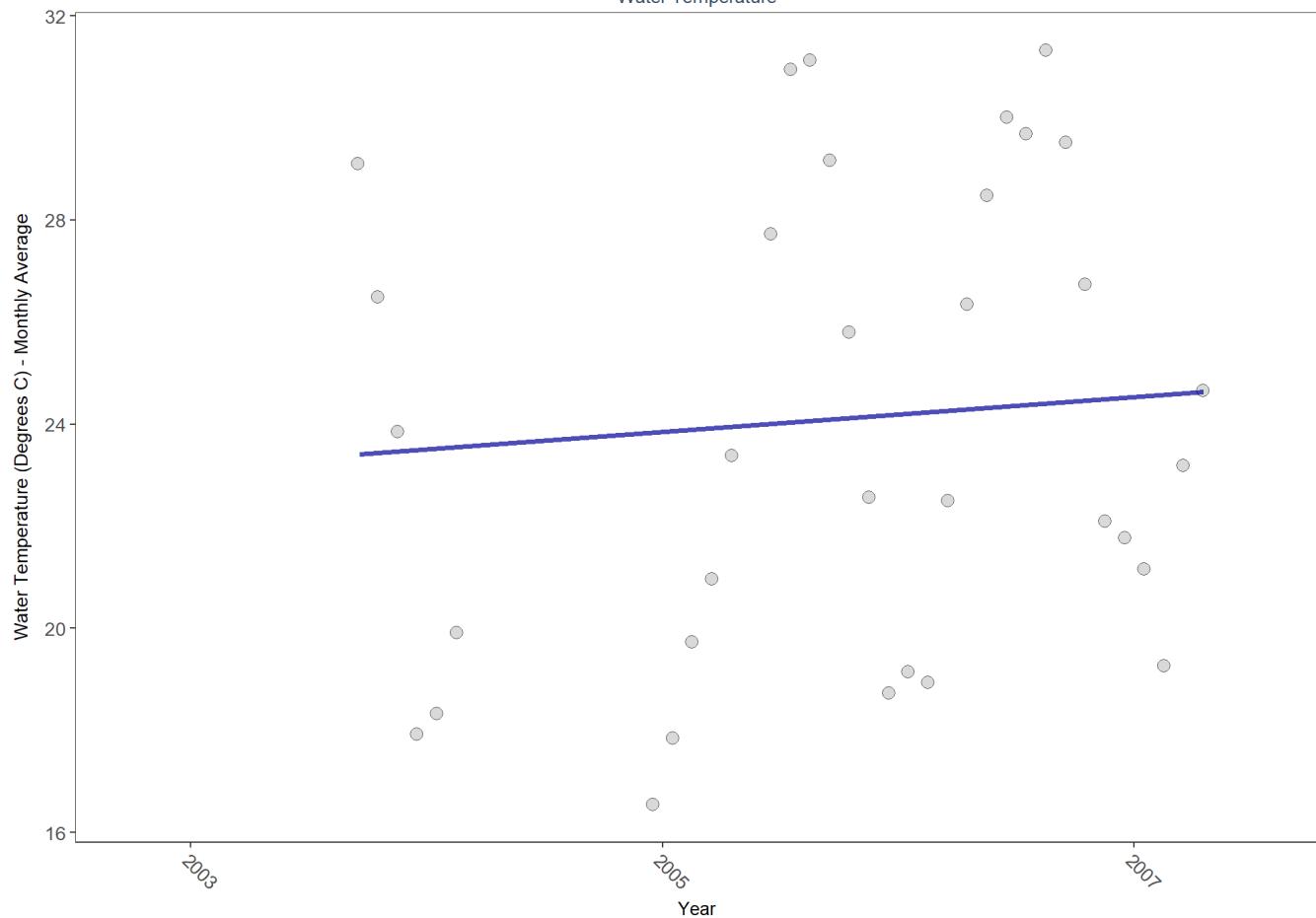
IRDM

Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring (5005)

Indian River-Malabar to Vero Beach Aquatic Preserve

IRDM

Water Temperature



| RelativeDepth | N_Data | N_Years | Median | Independent | tau | p | SennSlope | SennIntercept | ChiSquared | pChiSquared | Trend |
|---------------|--------|---------|--------|-------------|--------|--------|-----------|---------------|------------|-------------|-------|
| bottom | 43791 | 5 | 23.5 | TRUE | 0.2929 | 0.1908 | 0.3408025 | 23.16665 | 14.2021 | 0.164 | 0 |

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

SennIntercept is intercept value at beginning of record for monitoring location

Submerged Aquatic Vegetation

The data file used is: **All_SAV_Parameters-2024-Feb-23.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

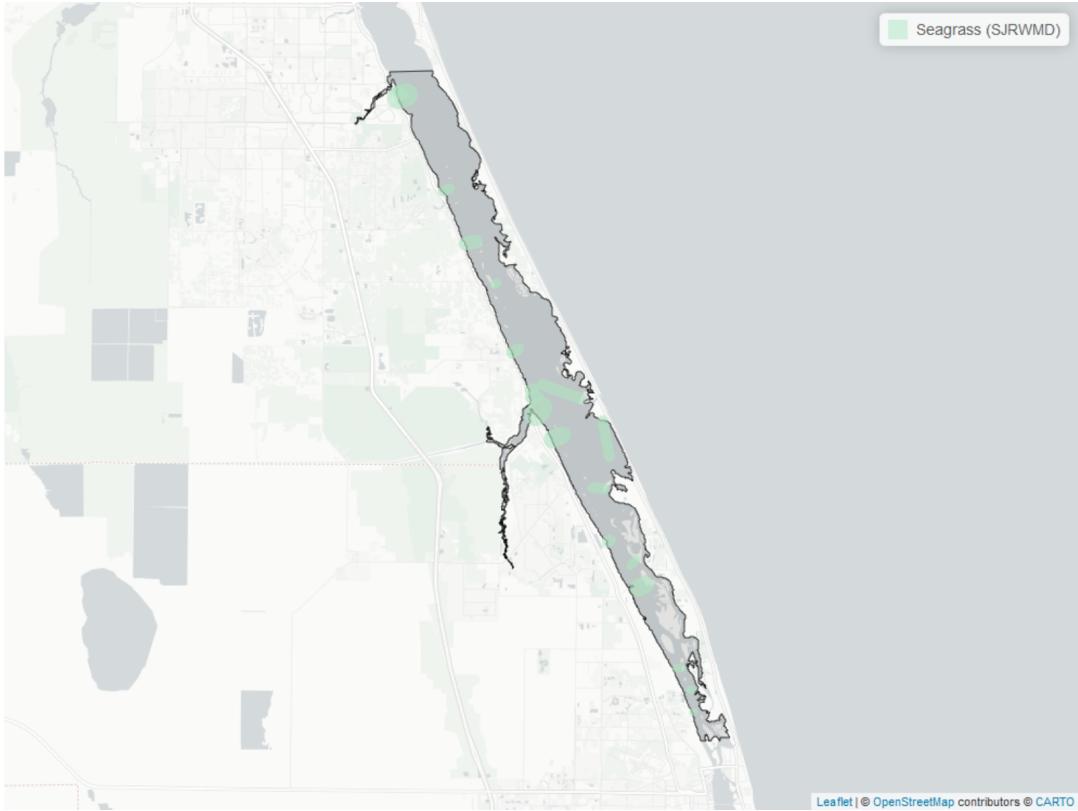
Indian River-Malabar to Vero Beach Aquatic Preserve
SAV Percent Cover - Sample Locations



Program name
Seagrass (SJRWMD)

Maps showing the temporal scope of SAV sampling sites within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve* by Program name.

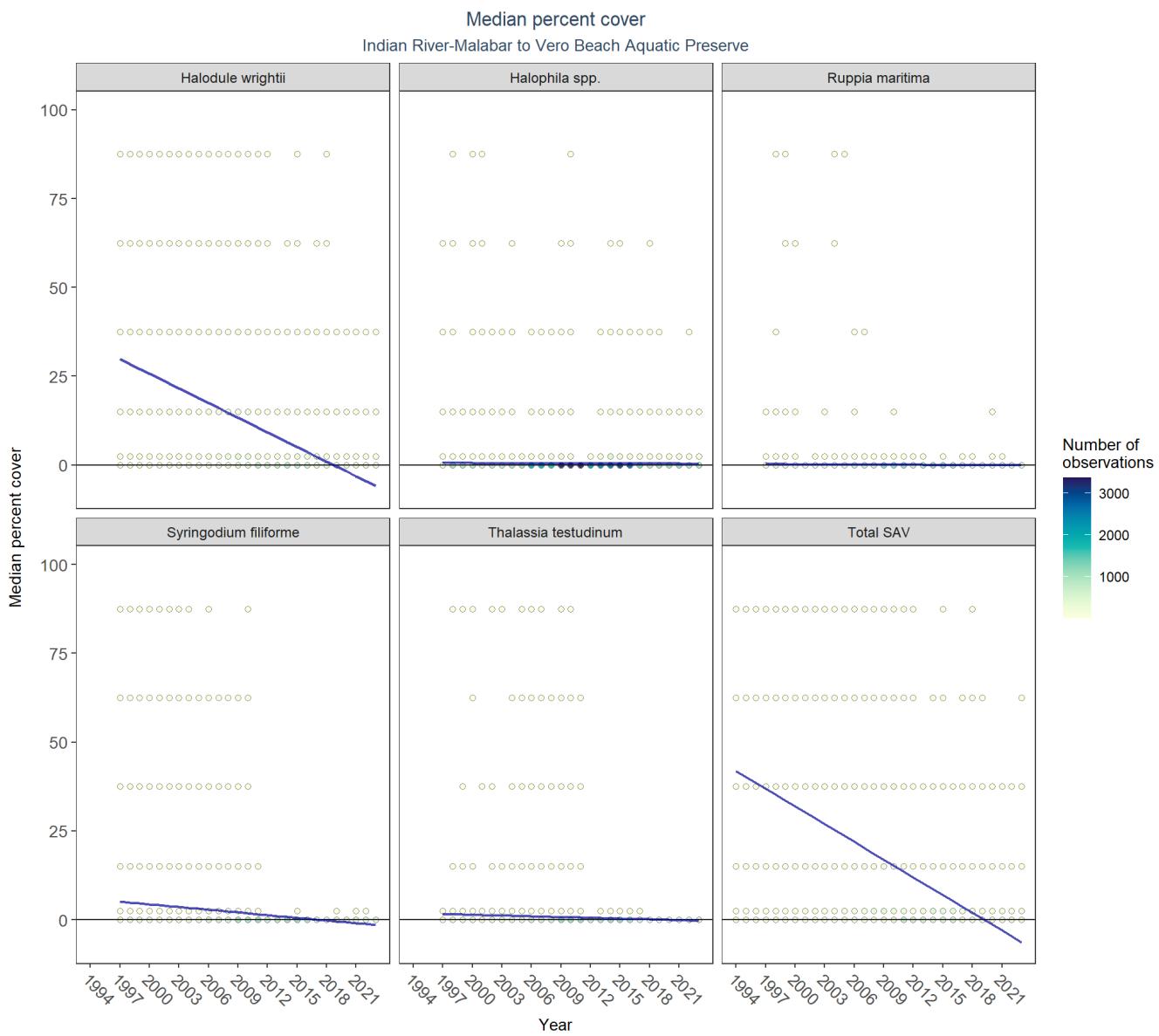
Sampling locations by Program:



Map showing SAV sampling sites within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 26: Seagrass (SJRWM) - Program 3013

| <i>N_Data</i> | <i>YearMin</i> | <i>YearMax</i> | <i>Collection Method</i> | <i>Sample Locations</i> |
|---------------|----------------|----------------|--------------------------|-------------------------|
| 123999 | 1994 | 2023 | Percent Cover | 19 |
| 146527 | 1994 | 2023 | Percent Occurrence | 19 |



Median percent cover by species in *Indian River-Malabar to Vero Beach 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.

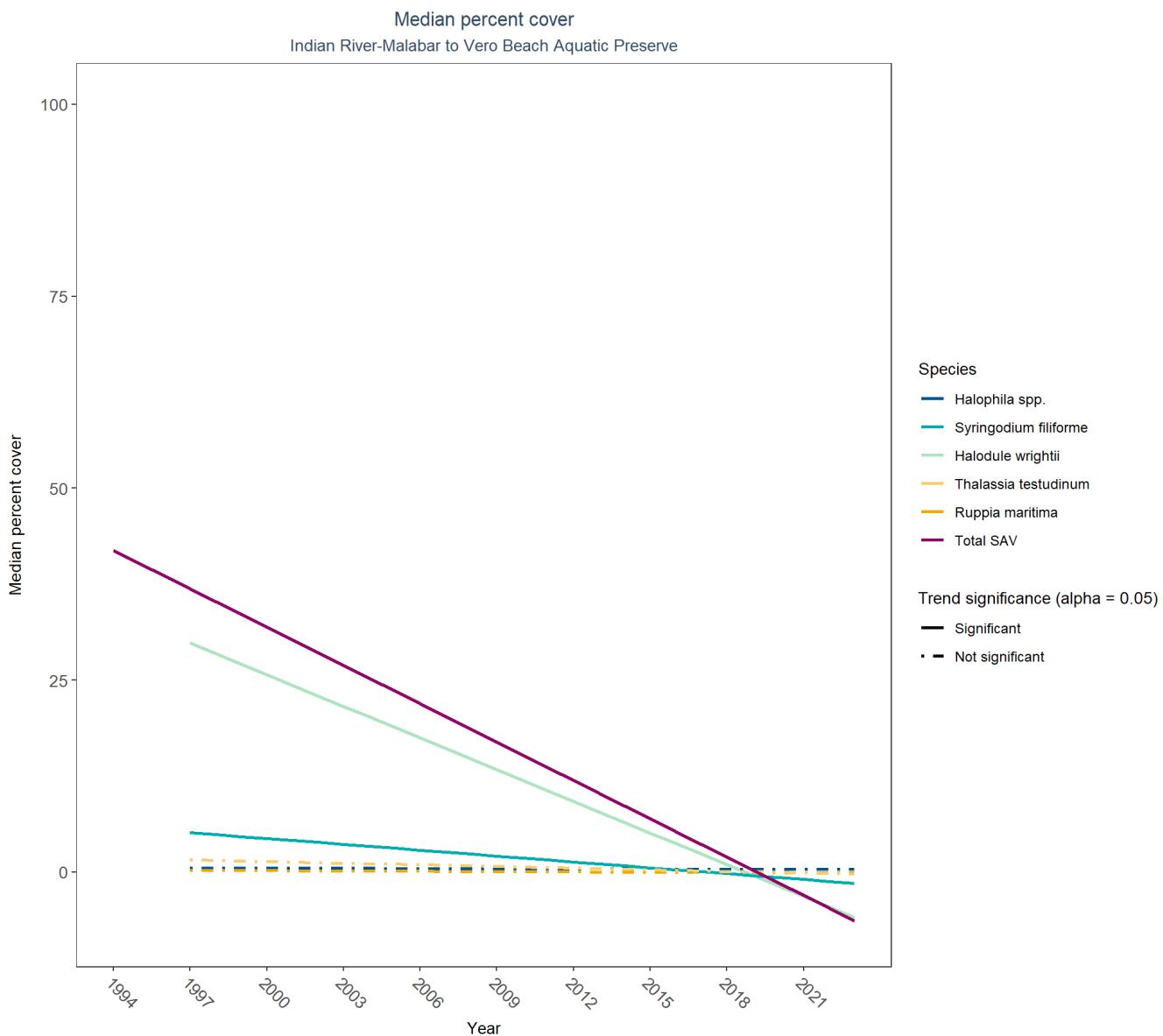
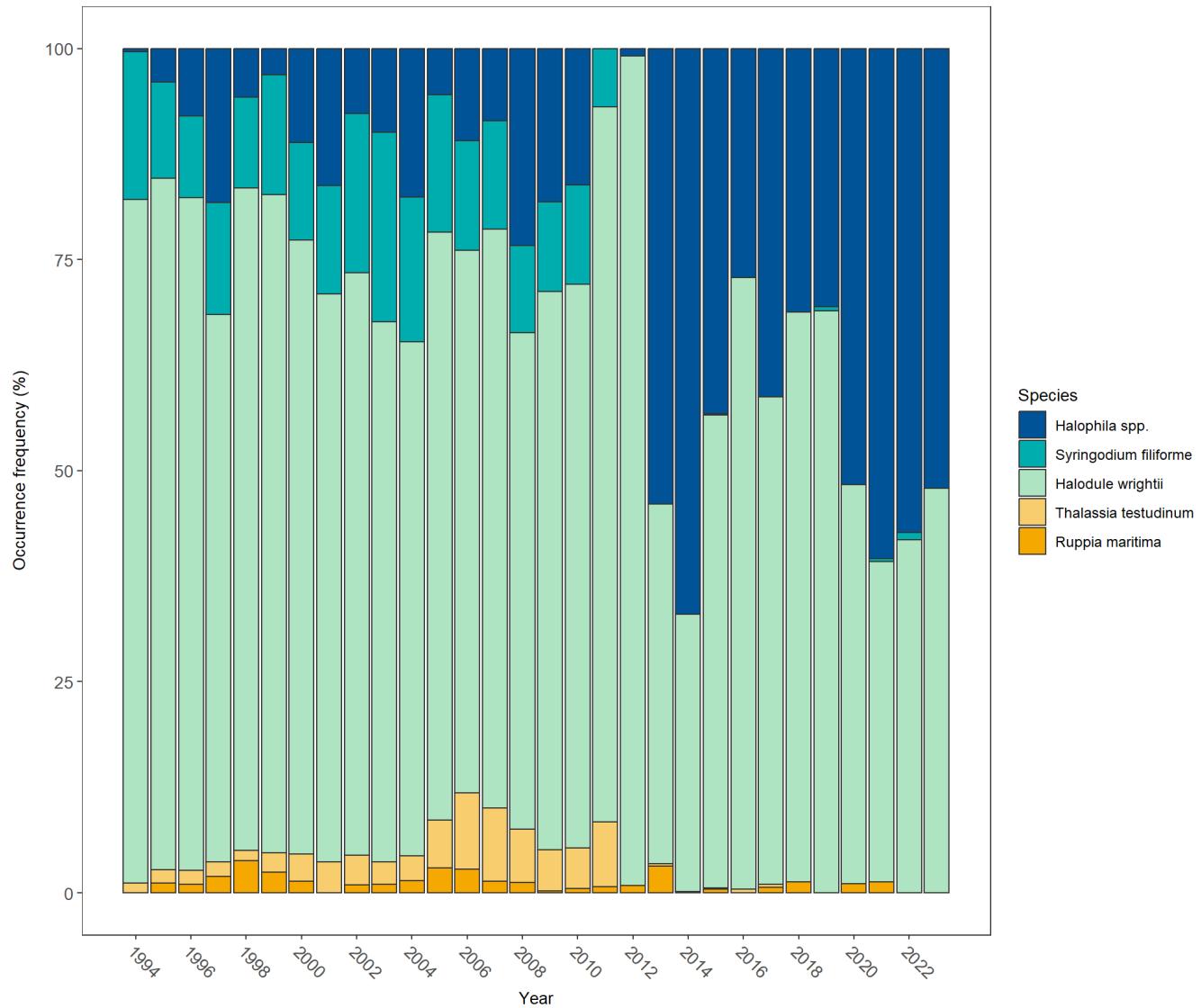


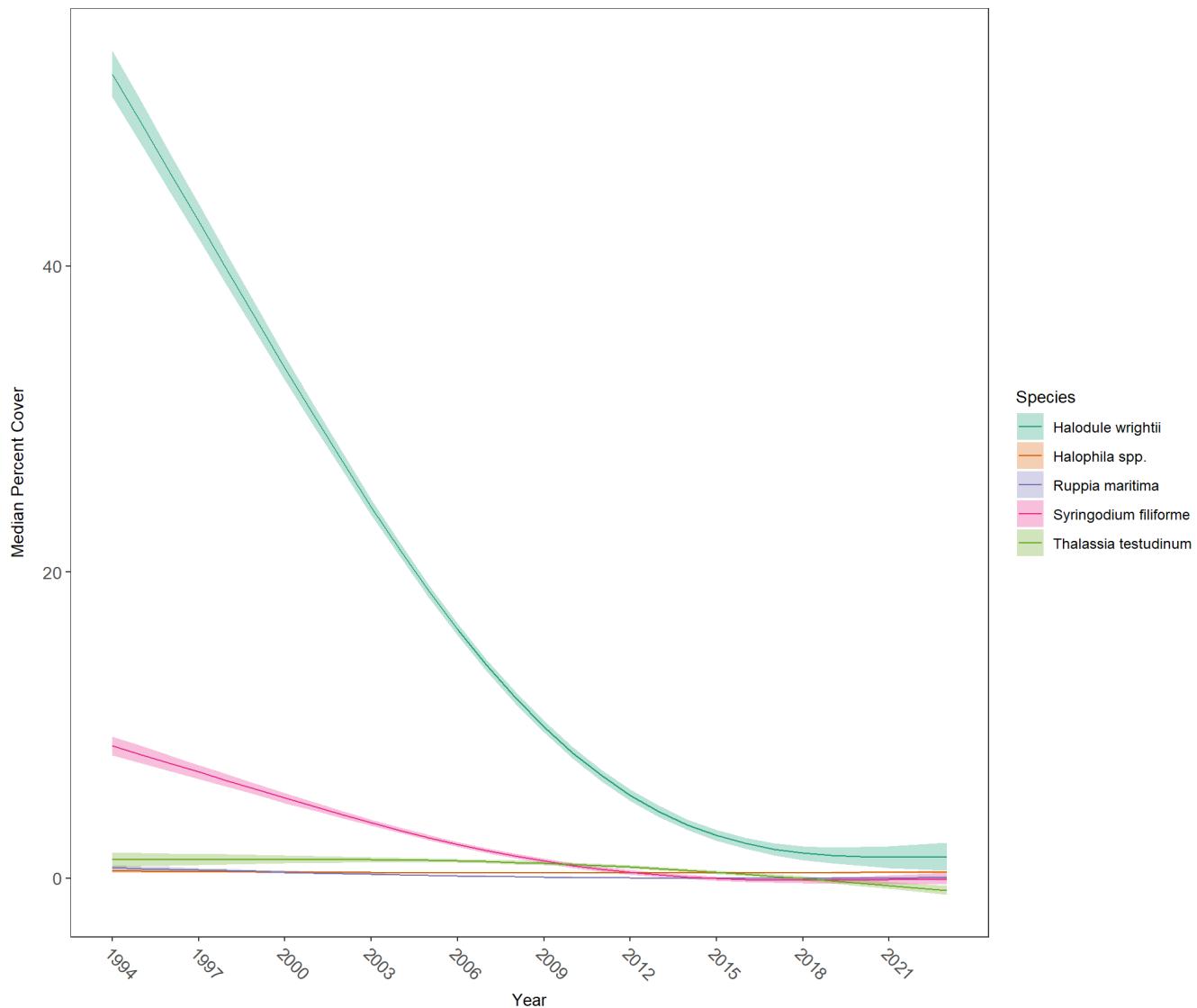
Table 27: Percent Cover Trend Analysis for Indian River-Malabar to Vero Beach Aquatic Preserve

| Species | CommonName | Trend Significance (0.05) | Period of Record | LME-Intercept | LME-Slope | p |
|-----------------------|---------------|--------------------------------------|------------------|---------------|-----------|--------|
| Drift algae | | Insufficient data to calculate trend | | | | |
| Halodule wrightii | Shoal grass | Significantly decreasing trend | 1997 - 2023 | 33.9584 | -1.3749 | 0.0000 |
| Halophila spp. | | No significant trend | 1997 - 2023 | 0.5667 | -0.0076 | 0.3586 |
| Ruppia maritima | Widgeon grass | No significant trend | 1997 - 2023 | 0.2582 | -0.0123 | 0.1028 |
| Syringodium filiforme | Manatee grass | Significantly decreasing trend | 1997 - 2023 | 5.9004 | -0.2544 | 0.0045 |
| Thalassia testudinum | Turtle grass | No significant trend | 1997 - 2023 | 1.8113 | -0.0715 | 0.0979 |
| Total SAV | | Significantly decreasing trend | 1994 - 2023 | 41.8892 | -1.6639 | 0.0000 |
| Total seagrass | | Insufficient data to calculate trend | | | | |

Frequency of occurrence
Indian River-Malabar to Vero Beach Aquatic Preserve



Median Percent Cover for seagrass species
Indian River-Malabar to Vero Beach Aquatic Preserve



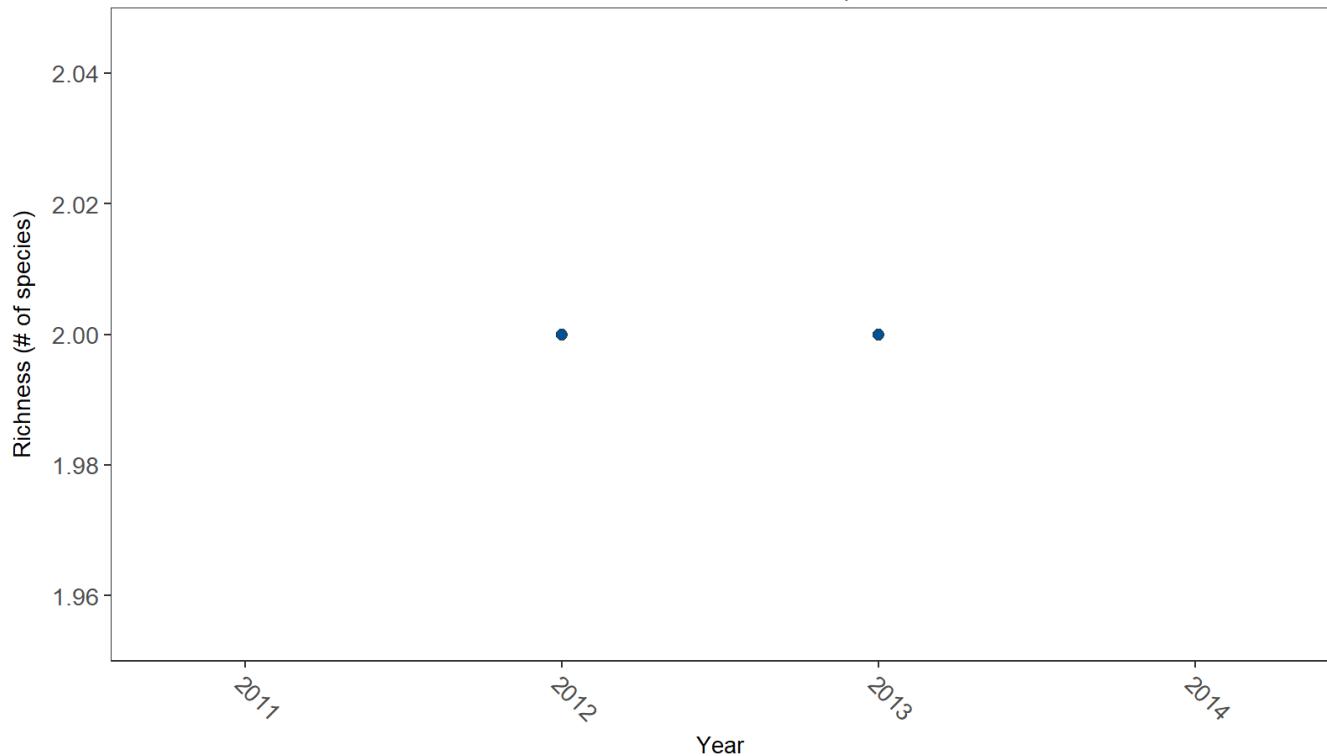
Generalized additive models for each species in Indian River-Malabar to Vero Beach Aquatic Preserve. Species must have at least 10 years of data to be evaluated.

Drift algae, Total seagrass, Attached algae, and Total SAV are excluded from the analyses.

Coral Reef

The data file used is: All_CORAL_Parameters-2024-Feb-23.txt

Grazers and Reef-Dependent Species Richness
Indian River-Malabar to Vero Beach Aquatic Preserve



| N_Years | EarliestYear | LatestYear | N_Data | Min | Max | Median | Mean | StDev | Year_MinRichness | Year_MaxRichness |
|---------|--------------|------------|--------|-----|-----|--------|------|-------|------------------|------------------|
| 2 | 2012 | 2013 | 3 | 2 | 2 | 2 | 2 | 0 | 2012 | 2012 |