

# Cape Romano-Ten Thousand Islands Aquatic Preserve

## SEACAR Habitat Analyses

Last compiled on 08 January, 2025

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## Funding & Acknowledgements

The data used in this analysis is from the Export Standardized Tables in the SEACAR Data Discovery Interface (DDI). Documents and information available through the SEACAR DDI are owned by the data provider(s) and users are expected to provide appropriate credit following accepted citation formats. Users are encouraged to access data to maximize utilization of gained knowledge, reducing redundant research and facilitating partnerships and scientific innovation.

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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>
Dissolved Oxygen	mg/L	-0.000001	50
Dissolved Oxygen Saturation	%	-0.000001	500
Salinity	ppt	-0.000001	70
Turbidity	NTU	-0.000001	4000
Water Temperature	Degrees C	-5.000000	45
pH	None	2.000000	14

Table 2: Discrete Water Quality threshold values

<i>Parameter Name</i>	<i>Units</i>	<i>Low Threshold</i>	<i>High Threshold</i>
Ammonia, Un-ionized (NH3)	mg/L	-	-
Ammonium, Filtered (NH4)	mg/L	-	-
Chlorophyll a, Corrected for Pheophytin	ug/L	-	-
Chlorophyll a, Uncorrected for Pheophytin	ug/L	-	-
Colored Dissolved Organic Matter	PCU	-	-

<i>Parameter Name</i>	<i>Units</i>	<i>Low Threshold</i>	<i>High Threshold</i>
Dissolved Oxygen	mg/L	-0.000001	25
Dissolved Oxygen Saturation	%	-0.000001	310
Fluorescent Dissolved Organic Matter	QSE	-	-
Light Extinction Coefficient	m <sup>-1</sup>	-	-
NO <sub>2</sub> + <sub>3</sub> , Filtered	mg/L	-	-
Nitrate (NO <sub>3</sub> )	mg/L	-	-
Nitrite (NO <sub>2</sub> )	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO <sub>4</sub> )	mg/L	-	-
Salinity	ppt	-0.000001	70
Secchi Depth	m	0.000001	50
Specific Conductivity	mS/cm	0.005000	100
Total Kjeldahl Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Phosphorus	mg/L	-	-
Total Suspended Solids	mg/L	-	-
Turbidity	NTU	-	-
Water Temperature	Degrees C	3.000000	40
pH	None	2.000000	13

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

<i>SEACAR QAQC Description</i>	<i>Include</i>	<i>SEACAR QAQCFlagCode</i>
Exceeds maximum threshold	0	2Q
Below minimum threshold	0	4Q
Within threshold tolerance	1	6Q
No defined thresholds for this parameter	1	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

<i>Qualifier Source</i>	<i>Value Qualifier</i>	<i>Include</i>	<i>MDL</i>	<i>Description</i>
STORET-WIN	H	0	0	Value based on field kit determination; results may not be accurate
STORET-WIN	J	0	0	Estimated value
STORET-WIN	V	0	0	Analyte was detected at or above method detection limit
STORET-WIN	Y	0	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 water's surface to the bottom sediments, and it's where fish, dolphins, crabs and people swim! So much life makes its home in the water column that the health of marine and coastal ecosystems, as well as human economies, depend on the condition of this vulnerable habitat. Local patterns of rainfall, temperature, winds and currents can rapidly change the condition of the water column, while global influences such as [El Niño/La Niña](#), large-scale fluctuation in sea temperatures and climate change can have long-term effects. Inputs from the prosperity of our day-to-day lives including farming, mining and forestry, and emissions from power generation, automobiles and water treatment can also alter the health of the water column. Acting alone or together, each input can have complex and lasting effects on habitats and ecosystems.

SEACAR evaluates water column health with several essential parameters. These include nutrient surveys of nitrogen and phosphorus, and water quality assessments of salinity, dissolved oxygen, pH, and water temperature. Water clarity is evaluated with Secchi depth, turbidity, levels of chlorophyll a, total suspended solids, and colored dissolved organic matter. Additionally, the richness of nekton is indicated by the abundance of free-swimming fishes and macroinvertebrates like crabs and shrimps.

## 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**. The points for all Water Column plots displayed in this section are monthly averages. Trend significance will be denoted as “Significant Trend” (when  $p < 0.05$ ), or “Non-significant Trend” (when  $p \geq 0.05$ ). Any parameters with insufficient data to perform Seasonal Kendall-Tau test will have their monthly averages plotted without a corresponding trend line.

## Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined\_WQ\_WC\_NUT\_Chlorophyll\_a\_corrected\_for\_pheophytin-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Chlorophyll\_a\_uncorrected\_for\_pheophytin-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Colored\_dissolved\_organic\_matter\_CDOM-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Dissolved\_Oxygen-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Dissolved\_Oxygen\_Saturation-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_pH-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Salinity-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Secchi\_Depth-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Nitrogen-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Phosphorus-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Total\_Suspended\_Solids\_TSS-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Turbidity-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_Water\_Temperature-2024-Dec-08.txt*

# Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality

## Seasonal Kendall-Tau Trend Analysis

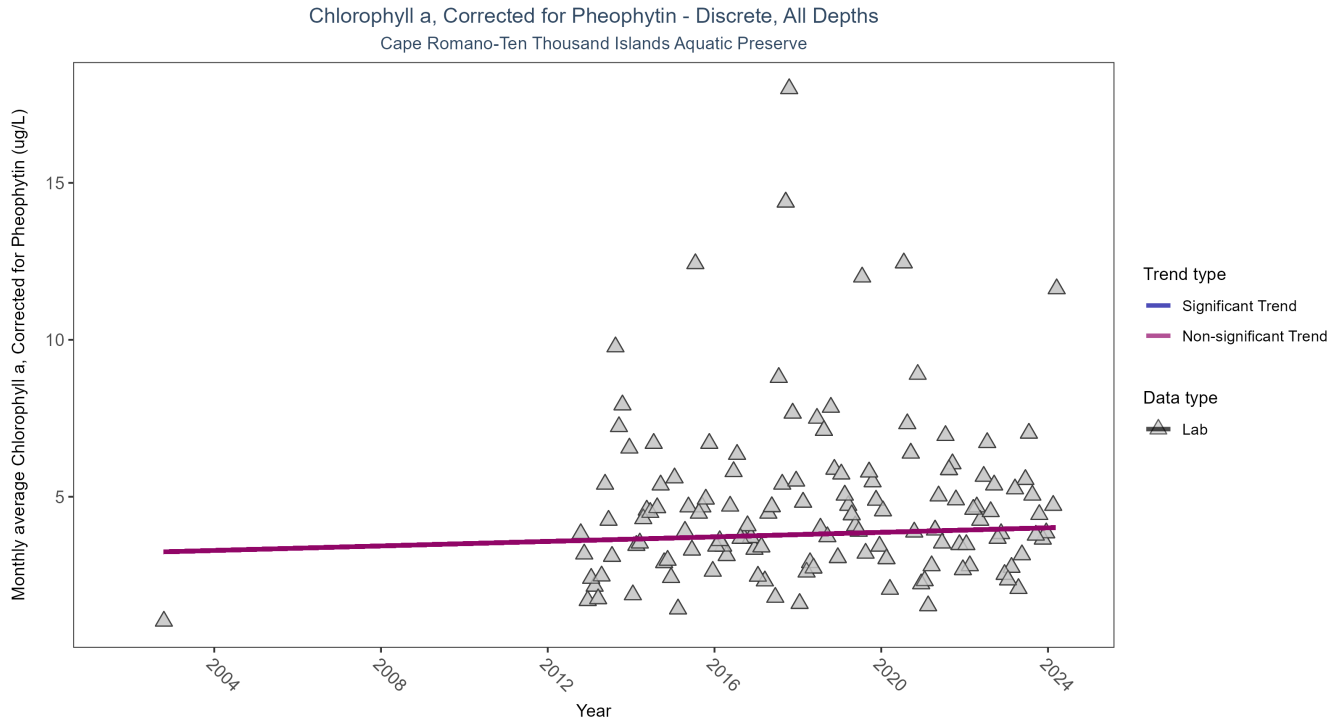


Figure 1: Seasonal Kendall-Tau Results for Chlorophyll a, Corrected for Pheophytin - Discrete

Table 6: Seasonal Kendall-Tau Trend Analysis for Chlorophyll a, Corrected for Pheophytin

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	585	14	3.7	TRUE	0.0685	0.3002	0.0361	3.2164	7.4413	0.7623	0

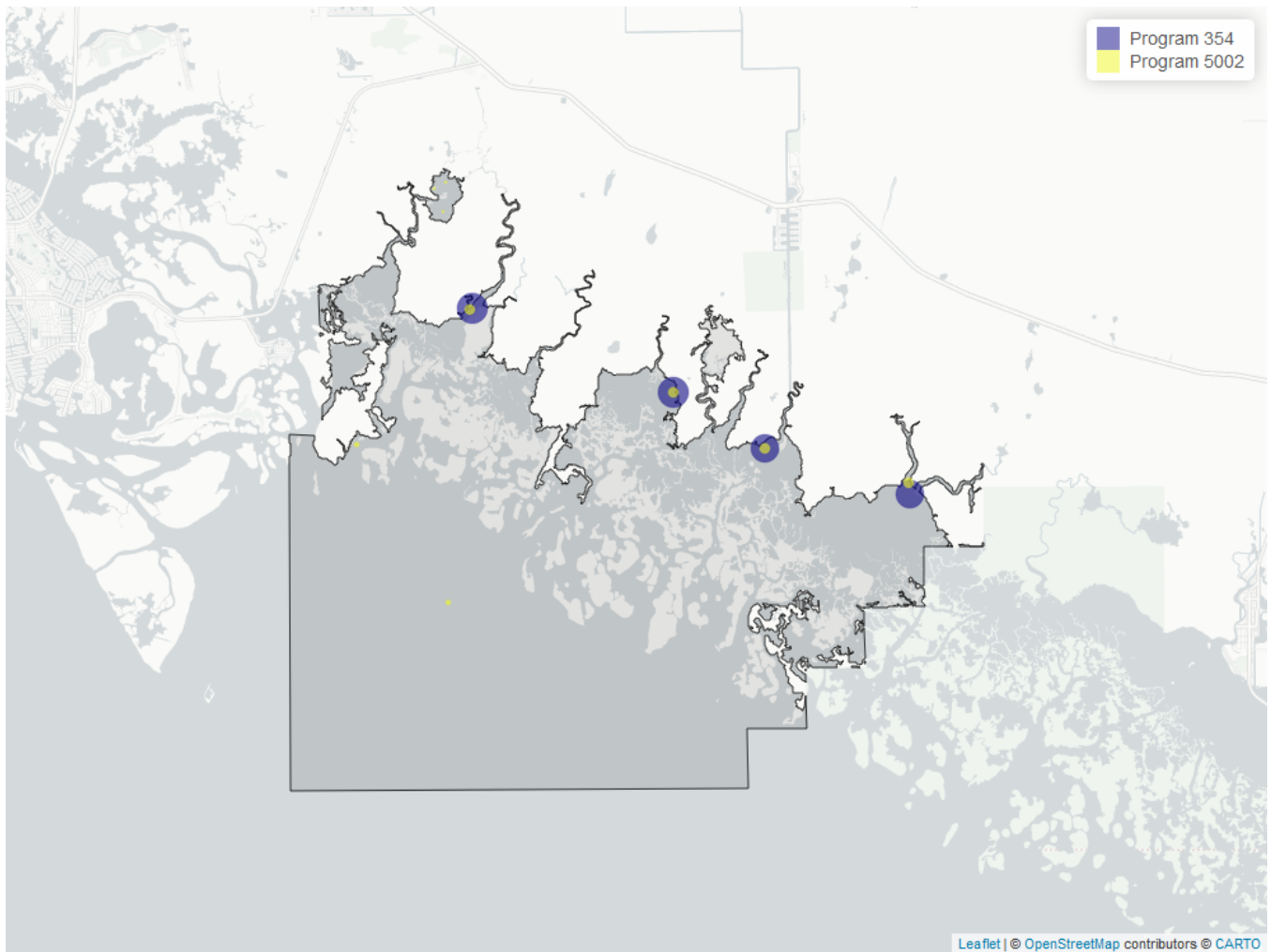


Figure 2: Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 7: Programs contributing data for Chlorophyll a, Corrected for Pheophytin

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
354	529	2012	2024
5002	68	2002	2021

**Program names:**

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>  
 5002 - Florida STORET / WIN<sup>2</sup>

**Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality  
 Seasonal Kendall-Tau Trend Analysis**

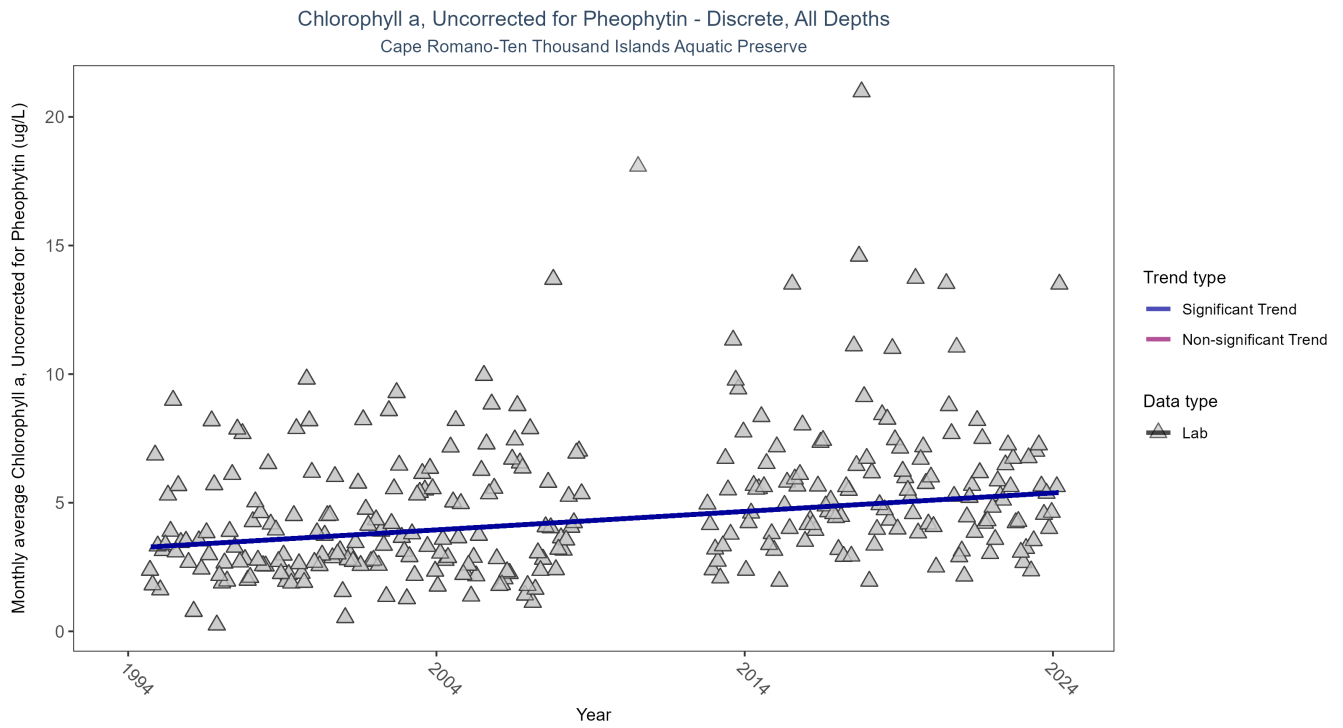


Figure 3: Seasonal Kendall-Tau Results for Chlorophyll a, Uncorrected for Pheophytin - Discrete

Table 8: Seasonal Kendall-Tau Trend Analysis for Chlorophyll a, Uncorrected for Pheophytin

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2142	29	3.6014	TRUE	0.2597	0	0.0718	3.2262	6.8382	0.812	1



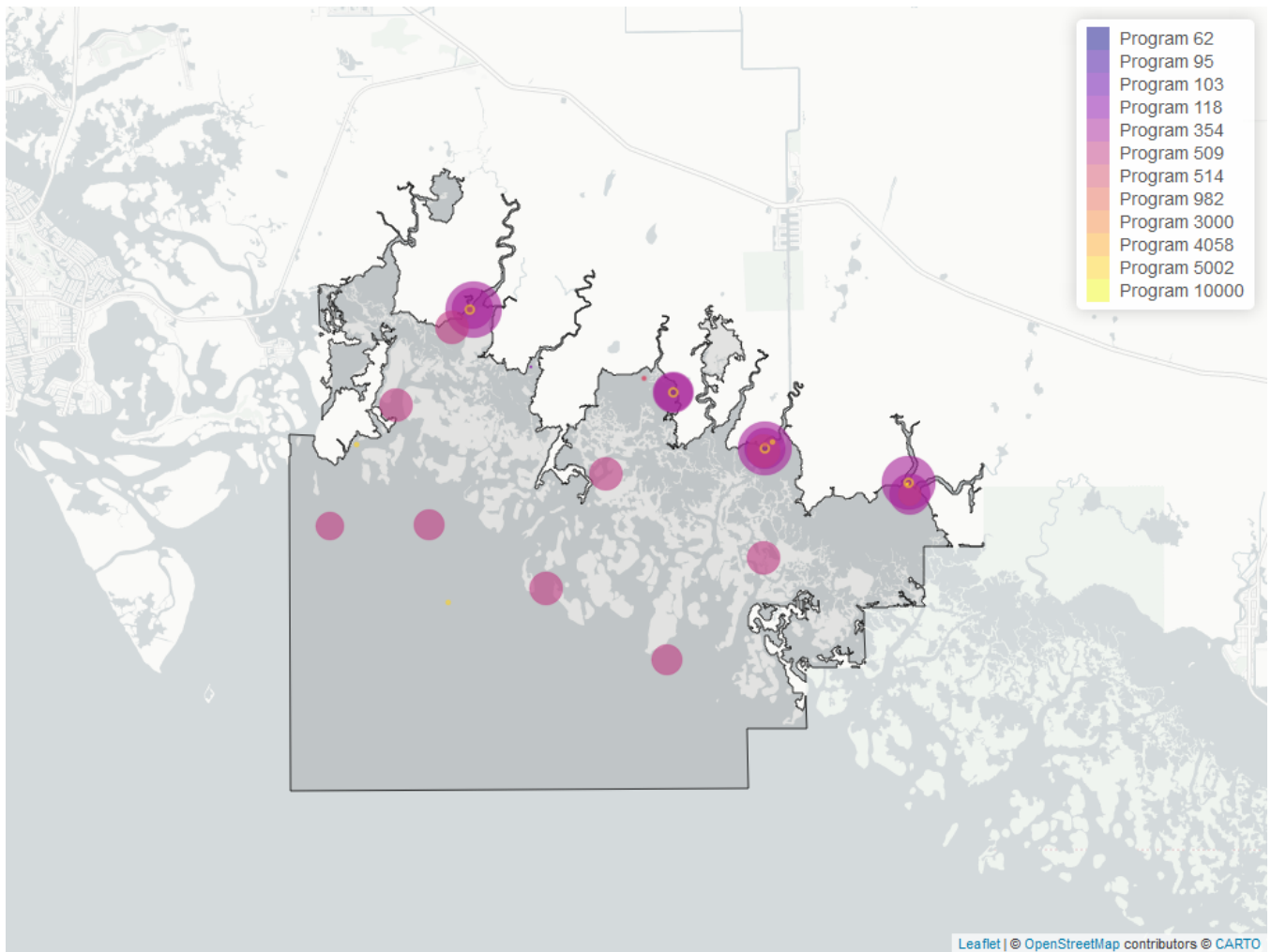


Figure 4: Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 9: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
354	2682	2002	2024
509	1512	1994	2008
5002	72	2001	2021
103	24	2021	2021
514	15	2001	2001
118	1	2010	2010

**Program names:**

- 103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>
- 118 - National Aquatic Resource Surveys, National Coastal Condition Assessment<sup>4</sup>
- 354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>
- 509 - SERC Water Quality Monitoring Network<sup>5</sup>
- 514 - Florida LAKEWATCH Program<sup>6</sup>
- 5002 - Florida STORET / WIN<sup>2</sup>

# Dissolved Oxygen - Discrete Water Quality

## Seasonal Kendall-Tau Trend Analysis

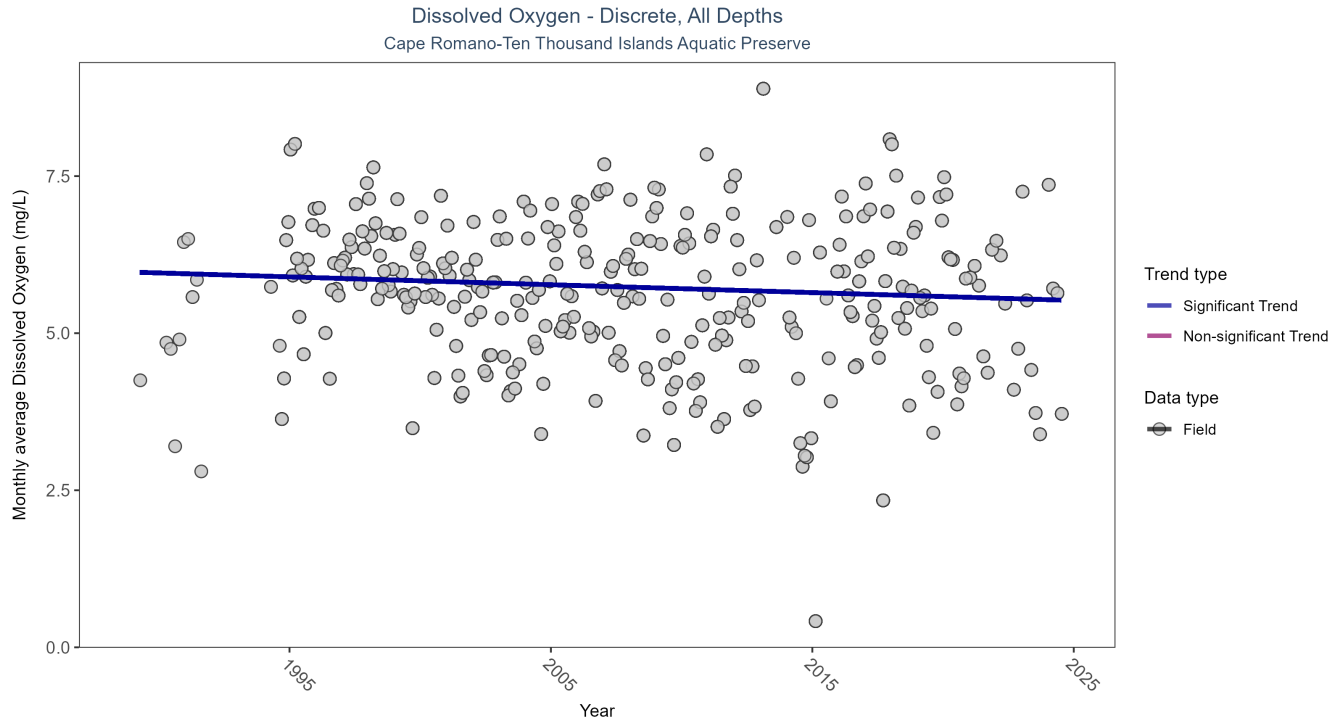


Figure 5: Seasonal Kendall-Tau Results for Dissolved Oxygen - Discrete

Table 10: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10665	34	5.8	TRUE	-0.0863	0.0287	-0.0125	5.9716	15.5726	0.1578	-1

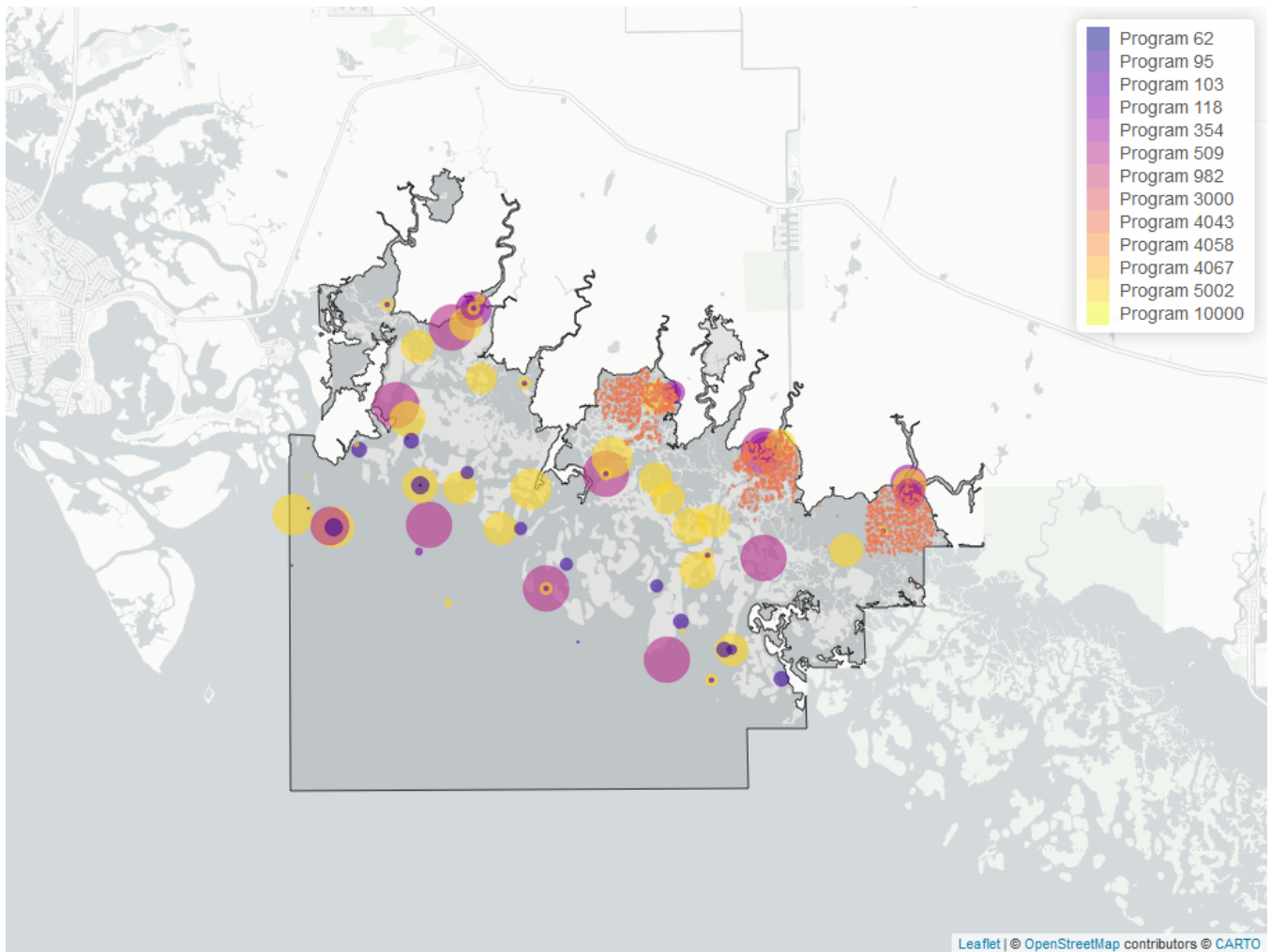


Figure 6: Map showing location of Discrete sampling sites for Dissolved Oxygen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Dissolved Oxygen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	4183	1989	2024
509	2974	1994	2008
4043	2478	1999	2020
354	917	2002	2023
95	390	1997	2018
103	48	2021	2021
118	10	2015	2021

**Program names:**

95 - Harmful Algal Bloom Marine Observation Network<sup>7</sup>

103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment<sup>4</sup>

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

509 - SERC Water Quality Monitoring Network<sup>5</sup>

## Dissolved Oxygen Saturation - Discrete Water Quality

### Seasonal Kendall-Tau Trend Analysis

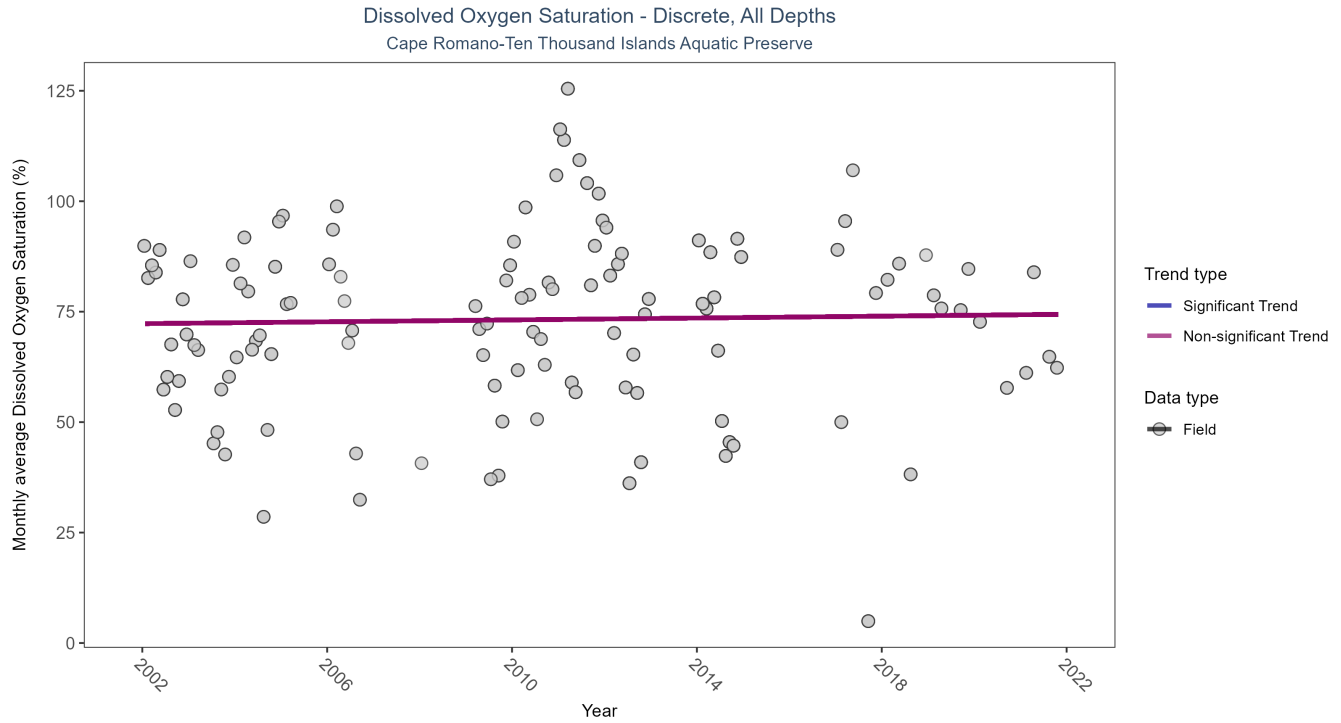


Figure 7: Seasonal Kendall-Tau Results for Dissolved Oxygen Saturation - Discrete

Table 12: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen Saturation

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	570	16	74.75	TRUE	0.0495	0.597	0.1062	72.2842	4.8347	0.9389	0

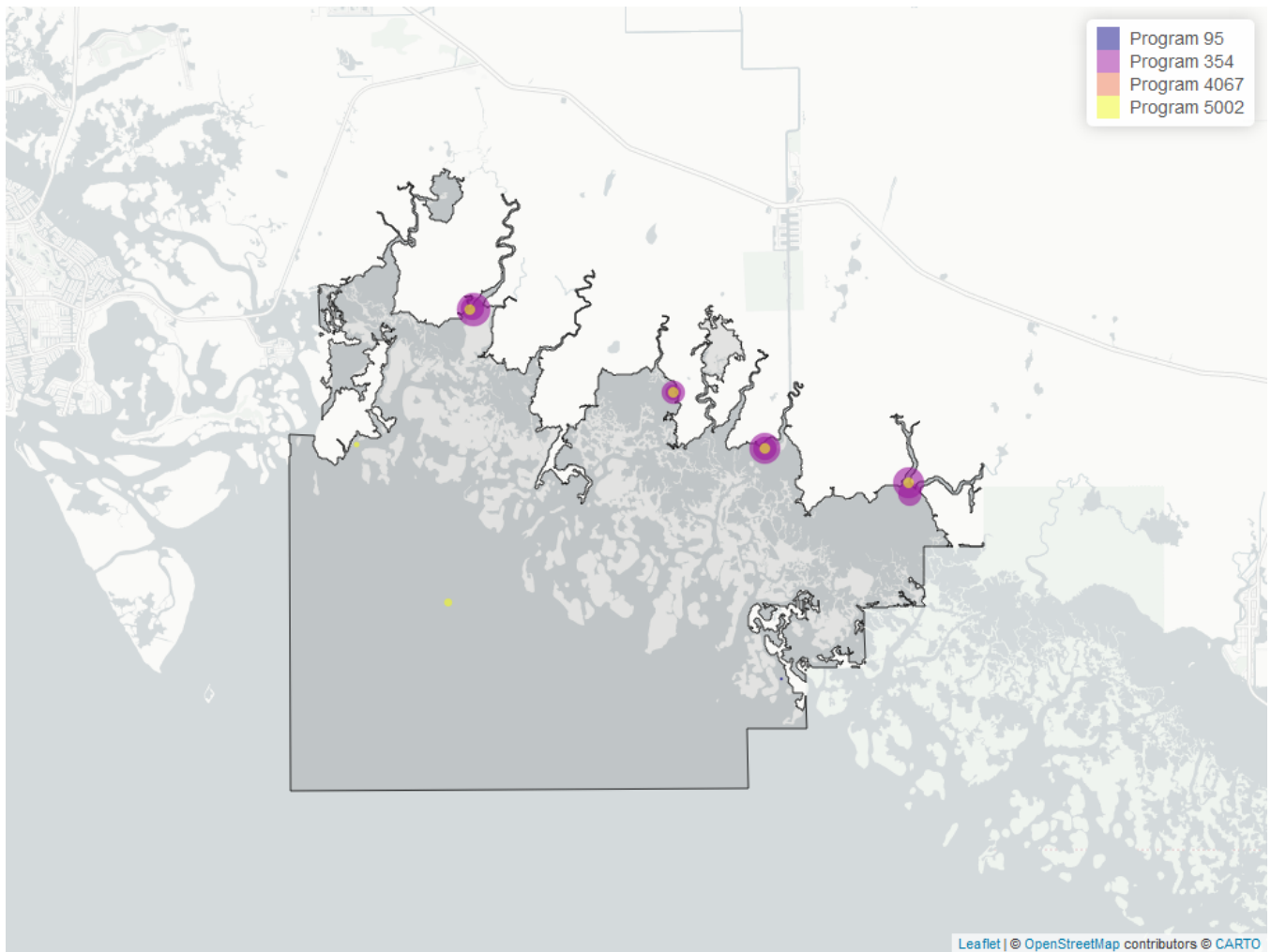


Figure 8: Map showing location of Discrete sampling sites for Dissolved Oxygen Saturation. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen Saturation

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
354	829	2002	2024
5002	71	2017	2021
95	1	2008	2008

**Program names:**

95 - Harmful Algal Bloom Marine Observation Network<sup>7</sup>

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

5002 - Florida STORET / WIN<sup>2</sup>

**pH - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**

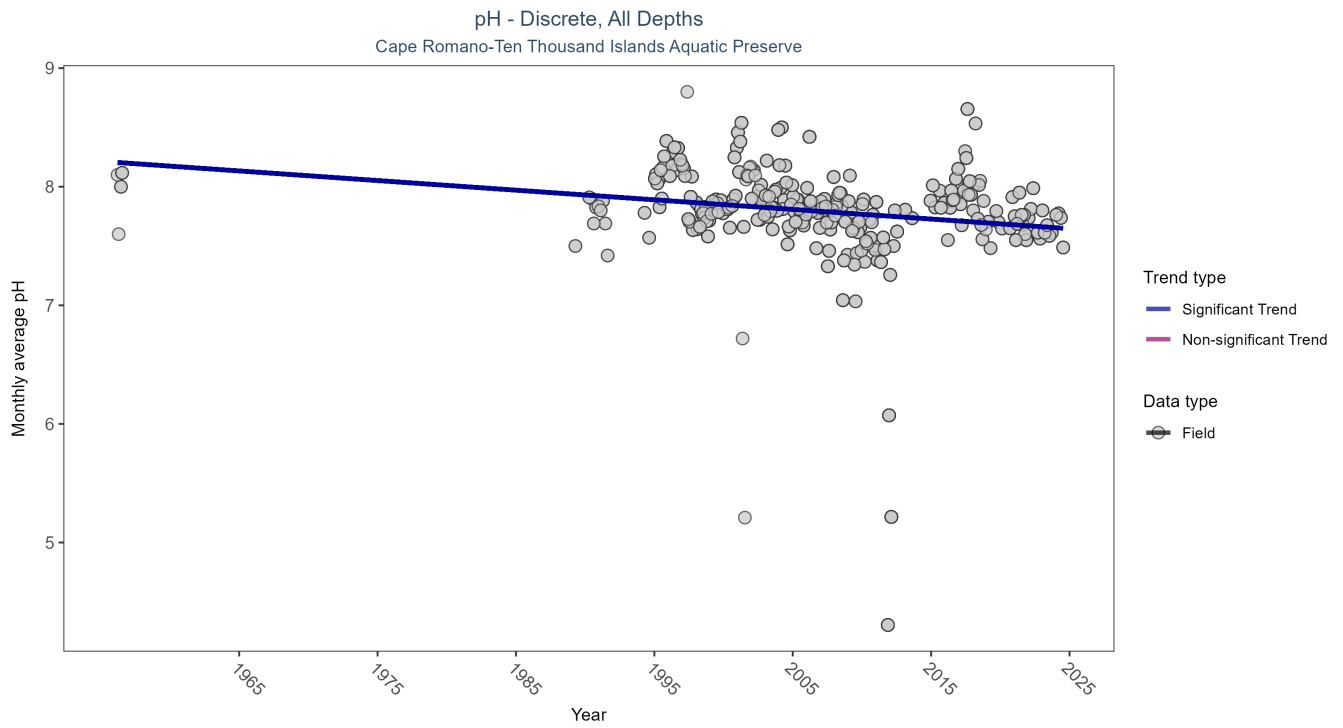


Figure 9: Seasonal Kendall-Tau Results for pH - Discrete

Table 14: Seasonal Kendall-Tau Trend Analysis for pH

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4605	35	7.865	TRUE	-0.2307	0	-0.0081	8.2061	13.6066	0.2555	-1

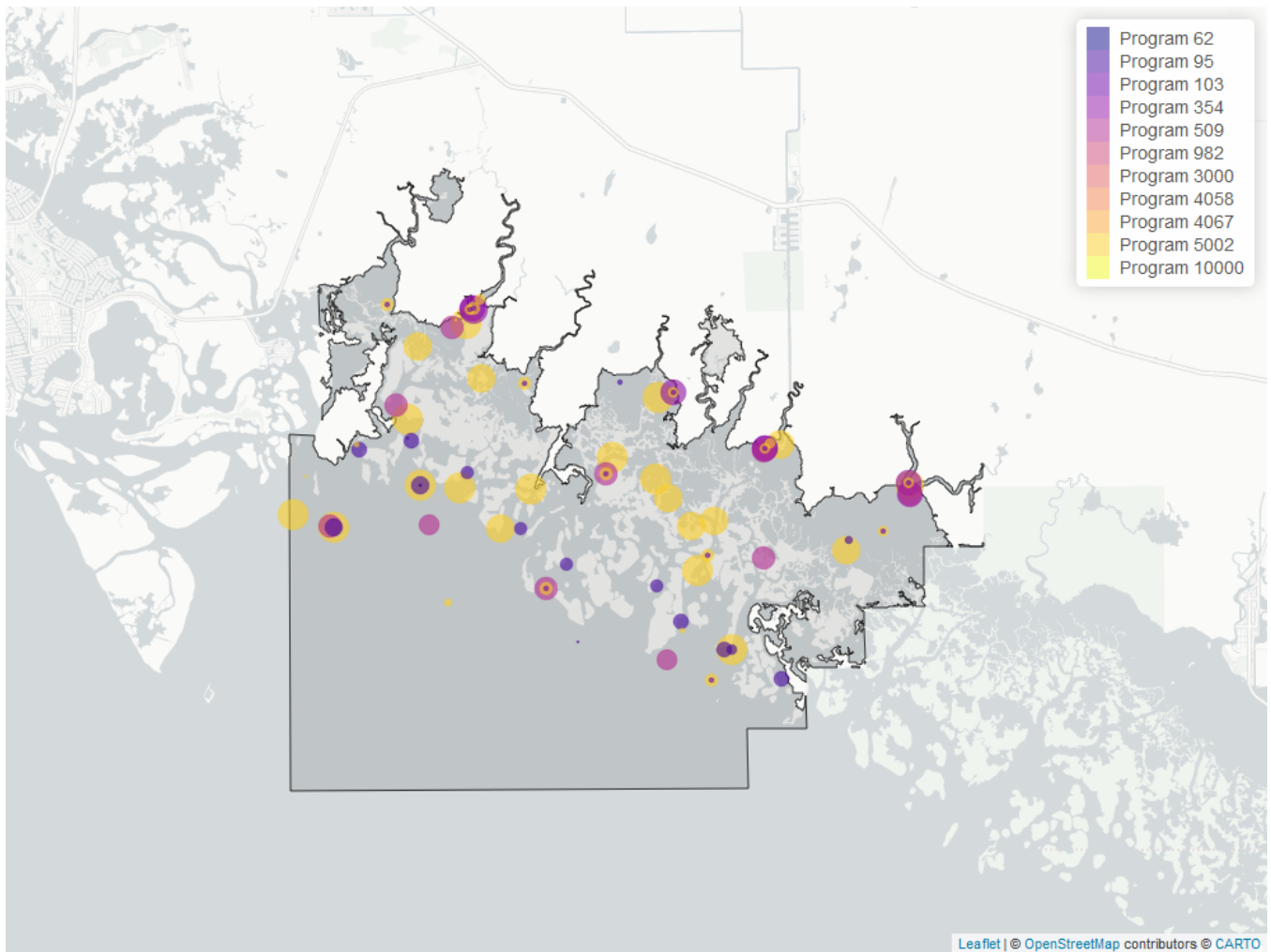


Figure 10: Map showing location of Discrete sampling sites for pH. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for pH

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	3082	1989	2024
509	748	2001	2008
354	686	2002	2024
95	395	1956	2018
103	63	2021	2021

**Program names:**

- 95 - Harmful Algal Bloom Marine Observation Network<sup>7</sup>
- 103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>
- 354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>
- 509 - SERC Water Quality Monitoring Network<sup>5</sup>
- 5002 - Florida STORET / WIN<sup>2</sup>

**Salinity - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**

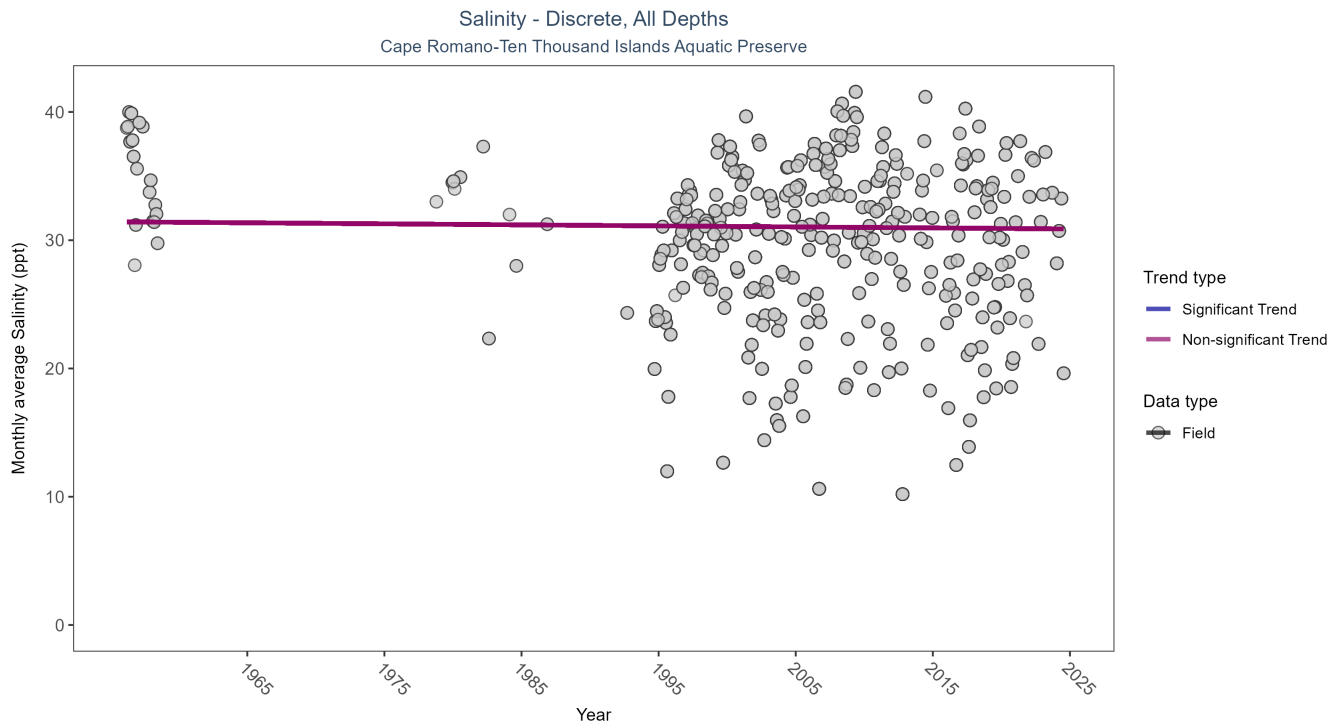


Figure 11: Seasonal Kendall-Tau Results for Salinity - Discrete

Table 16: Seasonal Kendall-Tau Trend Analysis for Salinity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10977	44	31.9	TRUE	-0.0153	0.717	-0.008	31.4304	10.6373	0.4741	0



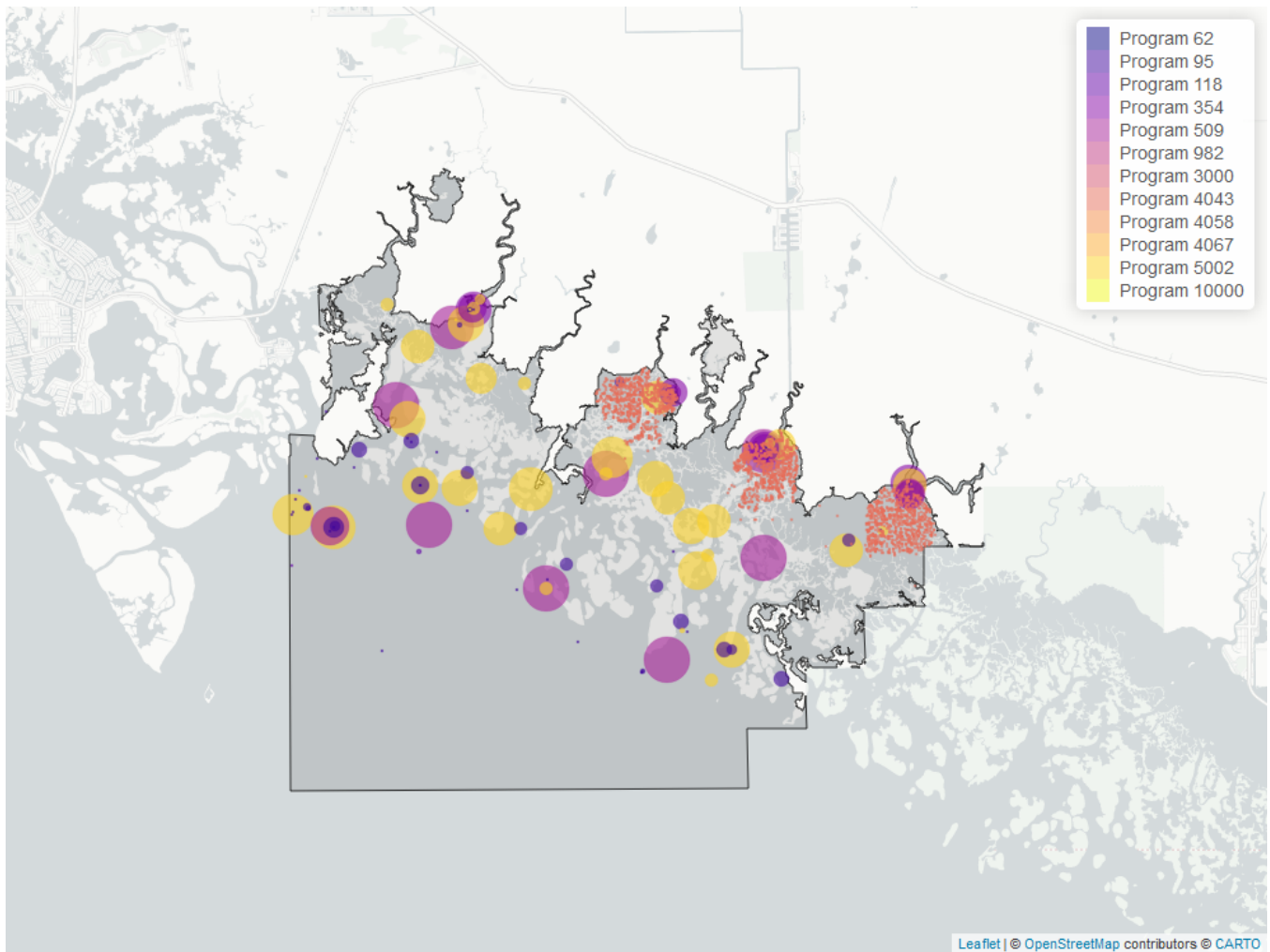


Figure 12: Map showing location of Discrete sampling sites for Salinity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Salinity

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	4370	1989	2024
509	2948	1994	2008
4043	2539	1999	2020
354	1105	2002	2024
95	532	1956	2018
118	8	2015	2021

**Program names:**

95 - Harmful Algal Bloom Marine Observation Network<sup>7</sup>

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment<sup>4</sup>

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

509 - SERC Water Quality Monitoring Network<sup>5</sup>

4043 - RBNERR Fish Assessment<sup>8</sup>

5002 - Florida STORET / WIN<sup>2</sup>

## Total Nitrogen - Discrete Water Quality

### 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)  $TN = TKN + NO3O2$ ;
- 2)  $TN = TKN + NO3 + NO2$ ;
- 3)  $TN = ORGN + NH4 + NO3O2$ ;
- 4)  $TN = ORGN + NH4 + NO2 + NO3$ ;
- 5)  $TN = TKN + NO3$ ;
- 6)  $TN = ORGN + NH4 + NO3$ ;

### Additional Information:

- Rules for use of sample fraction:
  - Florida Department of Environmental Protection (FDEP) report that if both “Total” and “Dissolved” components are reported, only “Total” is used. If the total is not reported, then the dissolved components are used as a best available replacement.
  - Total nitrogen calculations are done using nitrogen components with the same sample fraction, nitrogen components with mixed total/dissolved sample fractions are not used. In other words, total nitrogen can be calculated when TKN and NO3O2 are both total sample fractions, or when both are dissolved sample fractions. *Future calculations of total nitrogen values may be 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

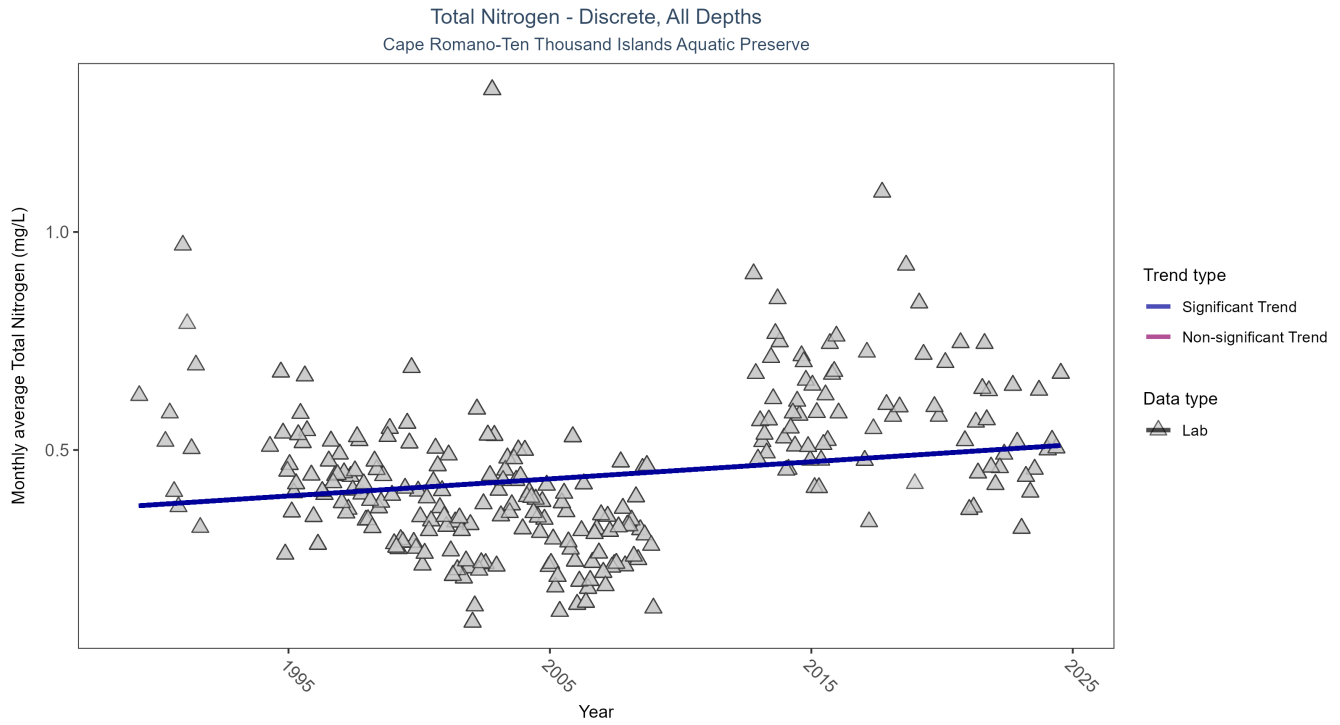


Figure 13: Seasonal Kendall-Tau Results for Total Nitrogen - Discrete

Table 18: Seasonal Kendall-Tau Trend Analysis for Total Nitrogen

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2468	31	0.3761	TRUE	0.1385	0.0016	0.0039	0.3711	9.2005	0.6034	1

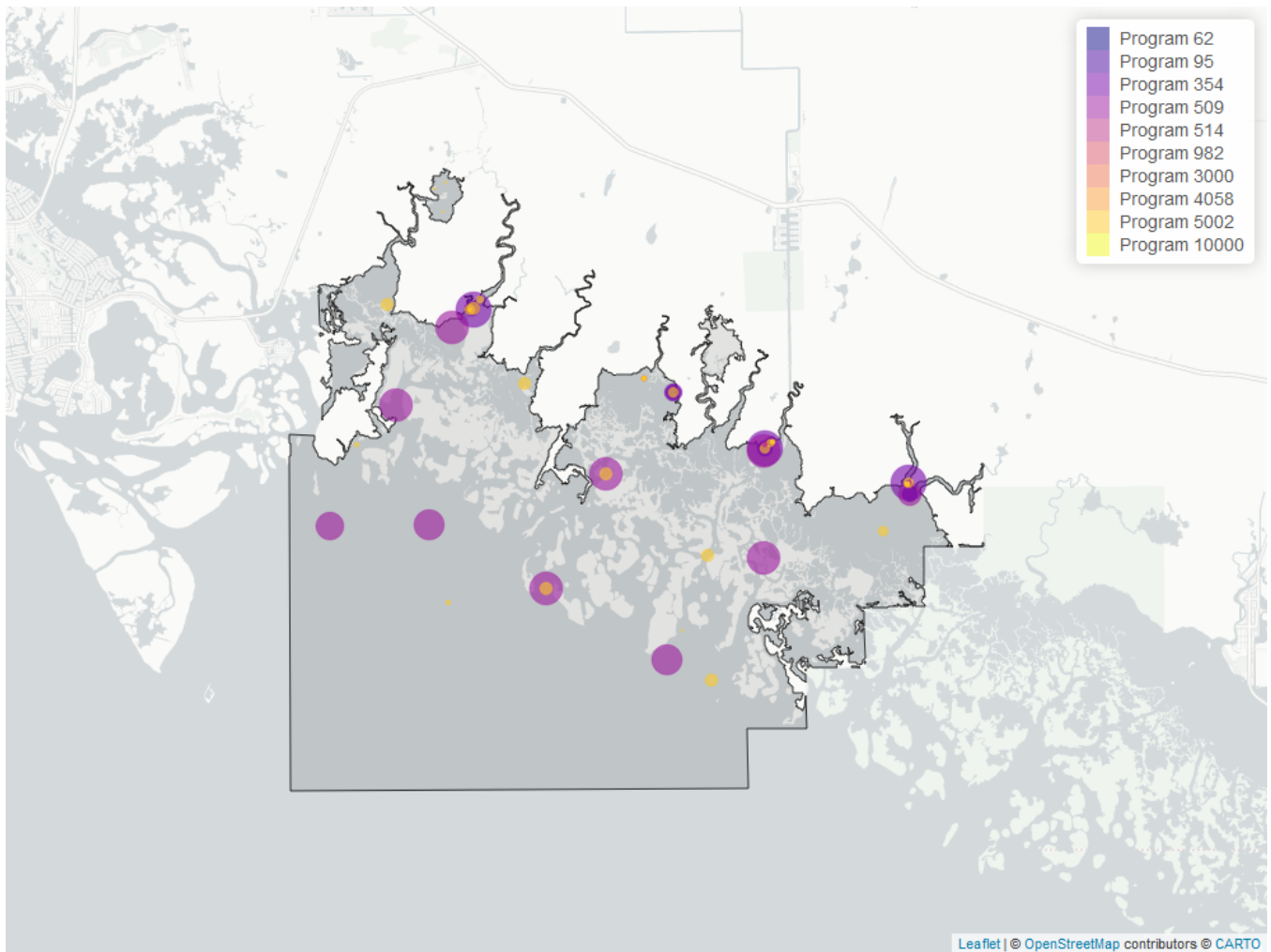


Figure 14: Map showing location of Discrete sampling sites for Total Nitrogen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Total Nitrogen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
509	1512	1994	2008
354	812	2002	2018
5002	293	1989	2024
514	35	2001	2001

**Program names:**

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

509 - SERC Water Quality Monitoring Network<sup>5</sup>

514 - Florida LAKEWATCH Program<sup>6</sup>

5002 - Florida STORET / WIN<sup>2</sup>

**Total Phosphorus - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**

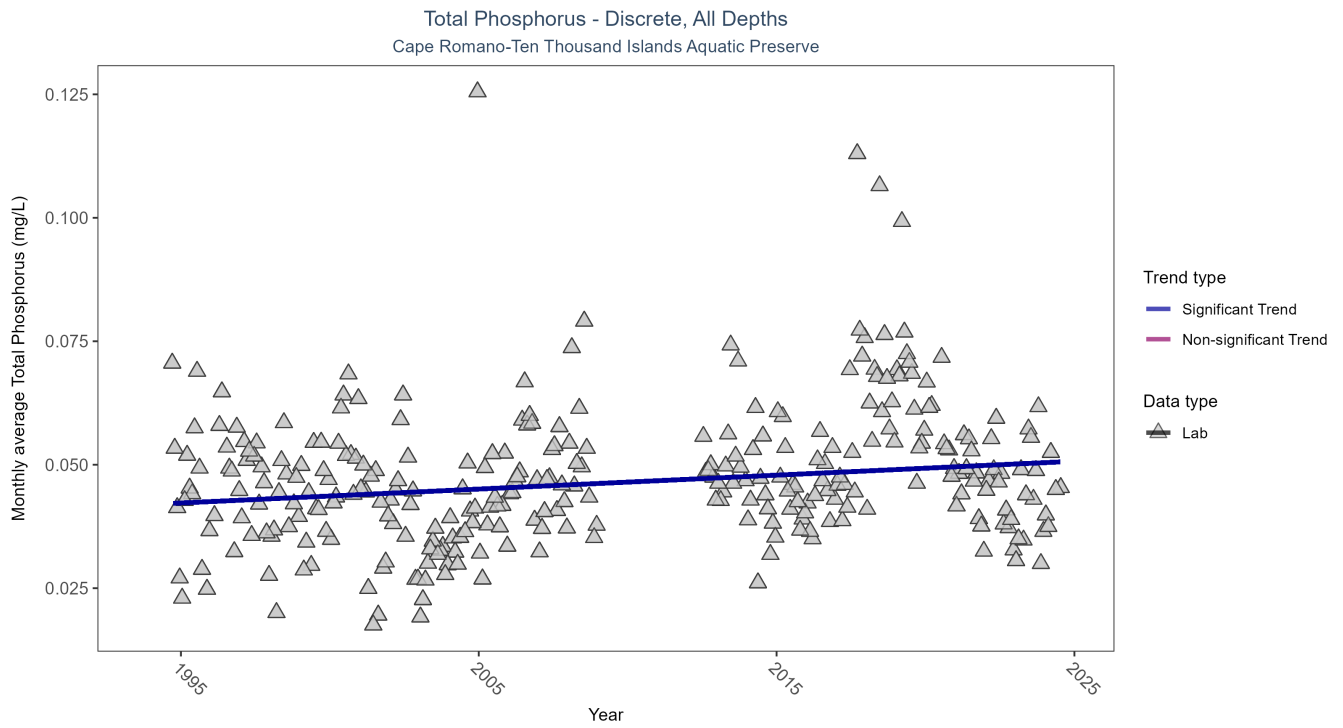


Figure 15: Seasonal Kendall-Tau Results for Total Phosphorus - Discrete

Table 20: Seasonal Kendall-Tau Trend Analysis for Total Phosphorus

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2958	28	0.0431	TRUE	0.1557	0.0001	0.0003	0.042	2.1204	0.998	1

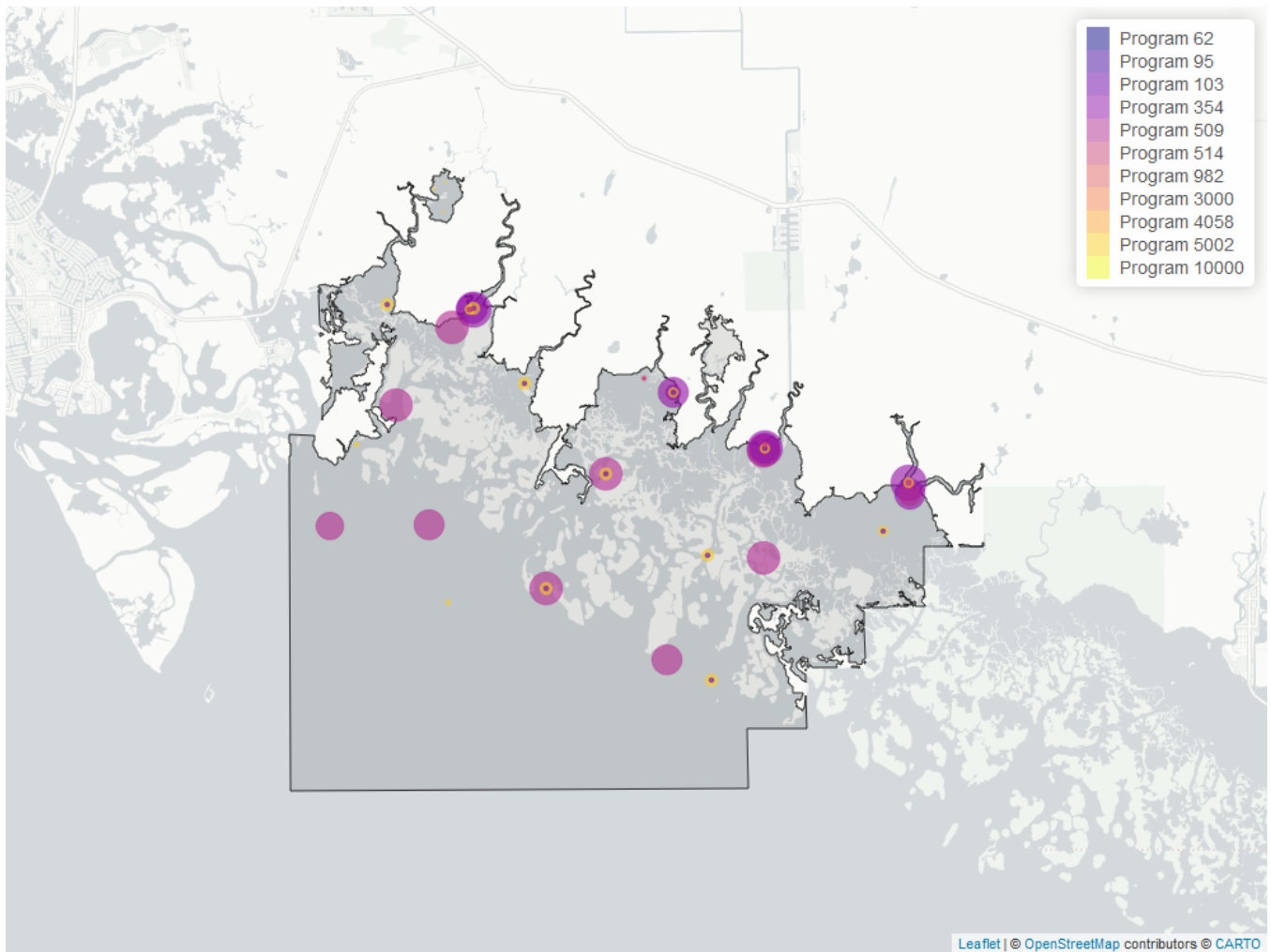


Figure 16: Map showing location of Discrete sampling sites for Total Phosphorus. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Total Phosphorus

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
509	1499	1994	2008
354	1147	2002	2024
5002	239	2002	2024
103	64	2021	2021
514	31	2001	2001

**Program names:**

- 103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>
- 354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>
- 509 - SERC Water Quality Monitoring Network<sup>5</sup>
- 514 - Florida LAKEWATCH Program<sup>6</sup>
- 5002 - Florida STORET / WIN<sup>2</sup>

**Total Suspended Solids - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**

Total Suspended Solids - Discrete, All Depths  
 Cape Romano-Ten Thousand Islands Aquatic Preserve

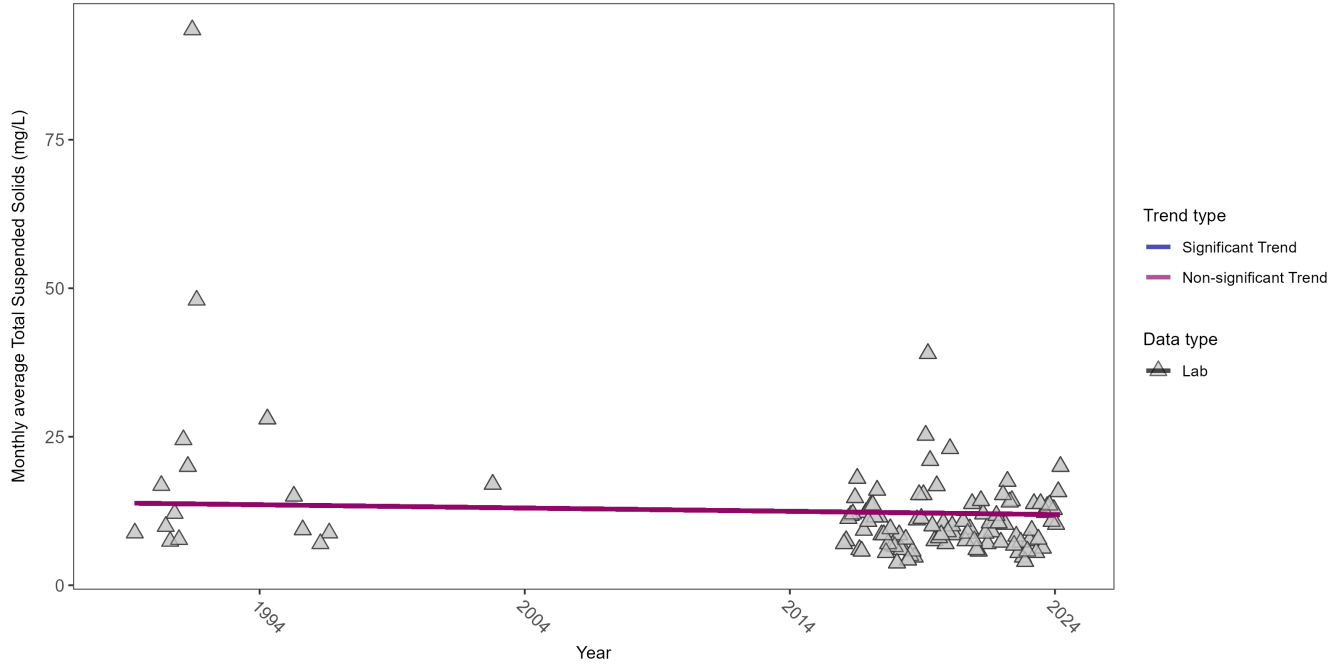


Figure 17: Seasonal Kendall-Tau Results for Total Suspended Solids - Discrete

Table 22: Seasonal Kendall-Tau Trend Analysis for Total Suspended Solids

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	429	16	10	TRUE	-0.0586	0.3813	-0.0552	13.8295	13.9661	0.2349	0

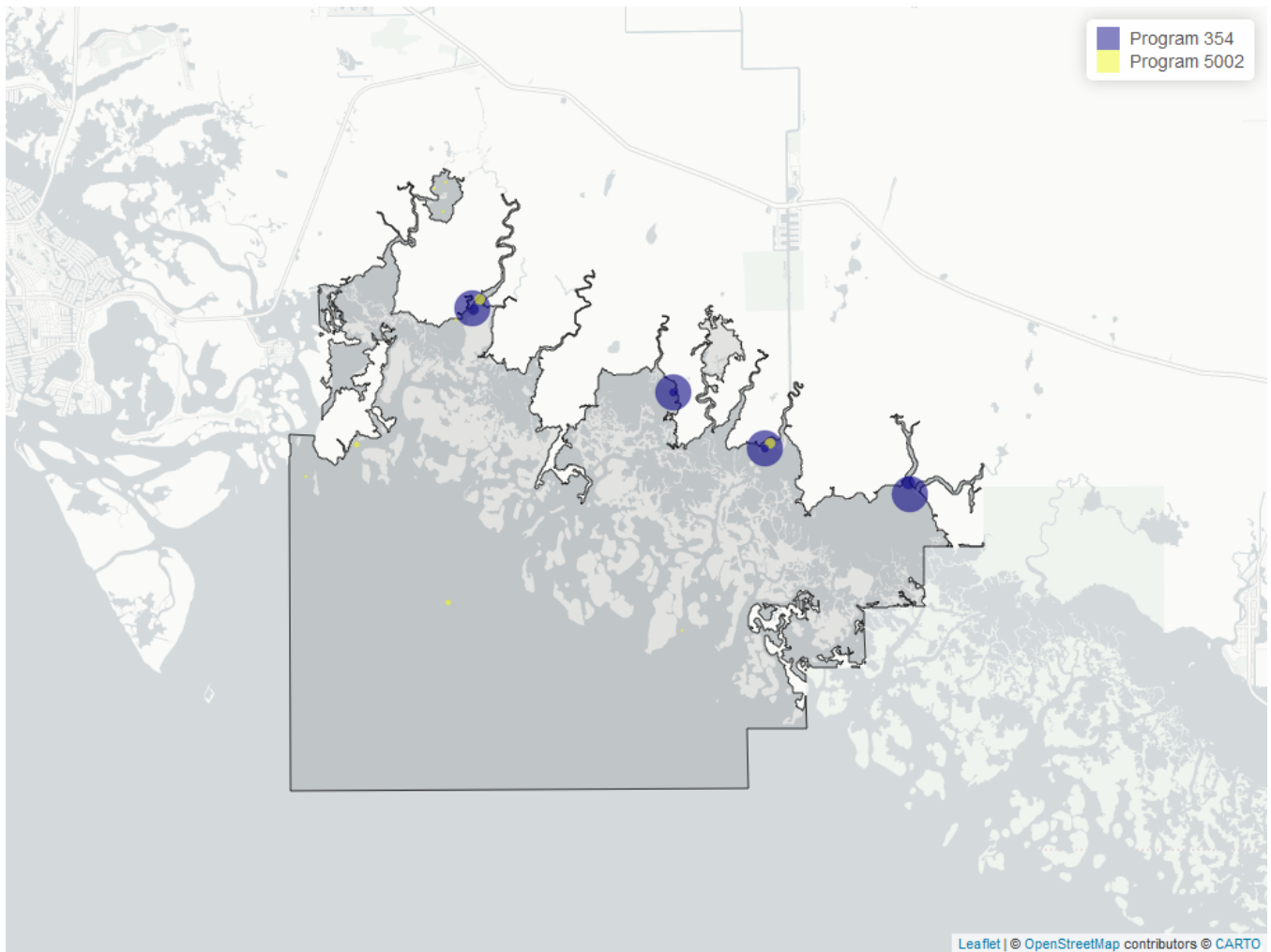


Figure 18: Map showing location of Discrete sampling sites for Total Suspended Solids. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Suspended Solids

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
354	819	2016	2024
5002	46	1989	2017

**Program names:**

*354* - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

*5002* - Florida STORET / WIN<sup>2</sup>

**Turbidity - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**



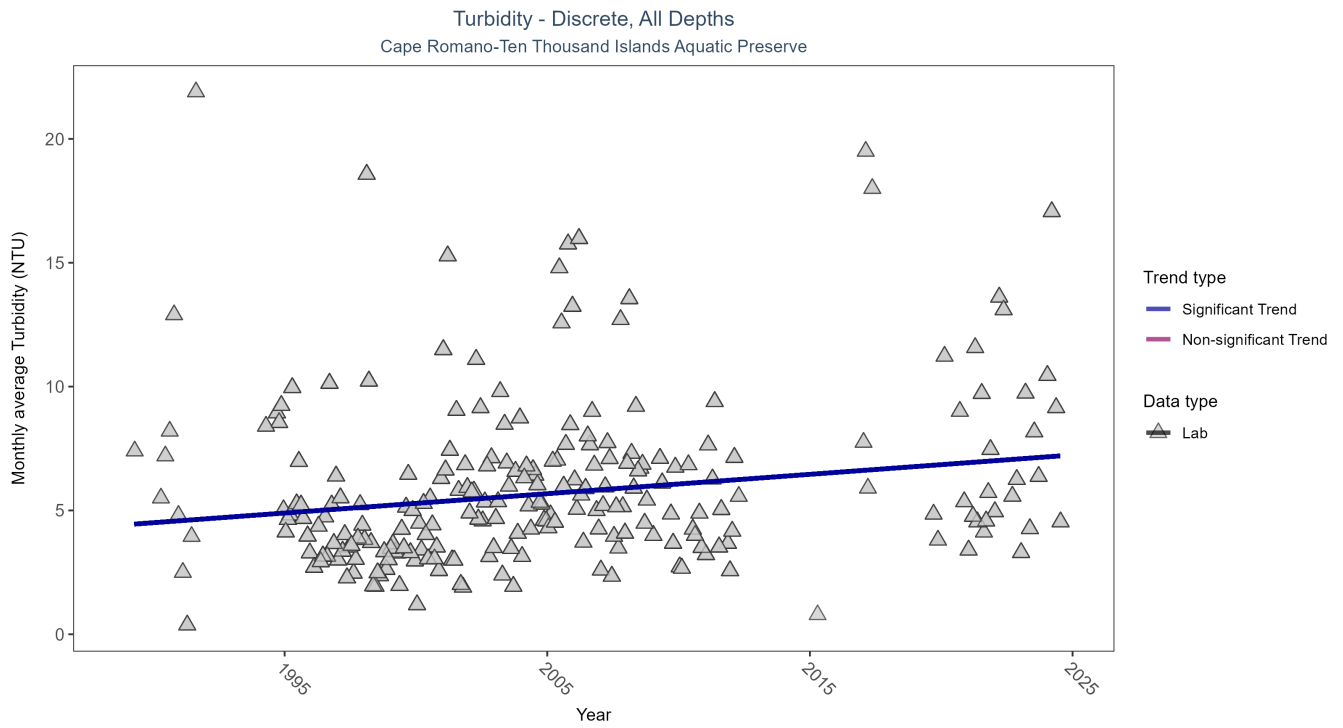


Figure 19: Seasonal Kendall-Tau Results for Turbidity - Discrete

Table 24: Seasonal Kendall-Tau Trend Analysis for Turbidity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4652	30	4	TRUE	0.1546	0.0007	0.0781	4.4264	12.6654	0.3158	1

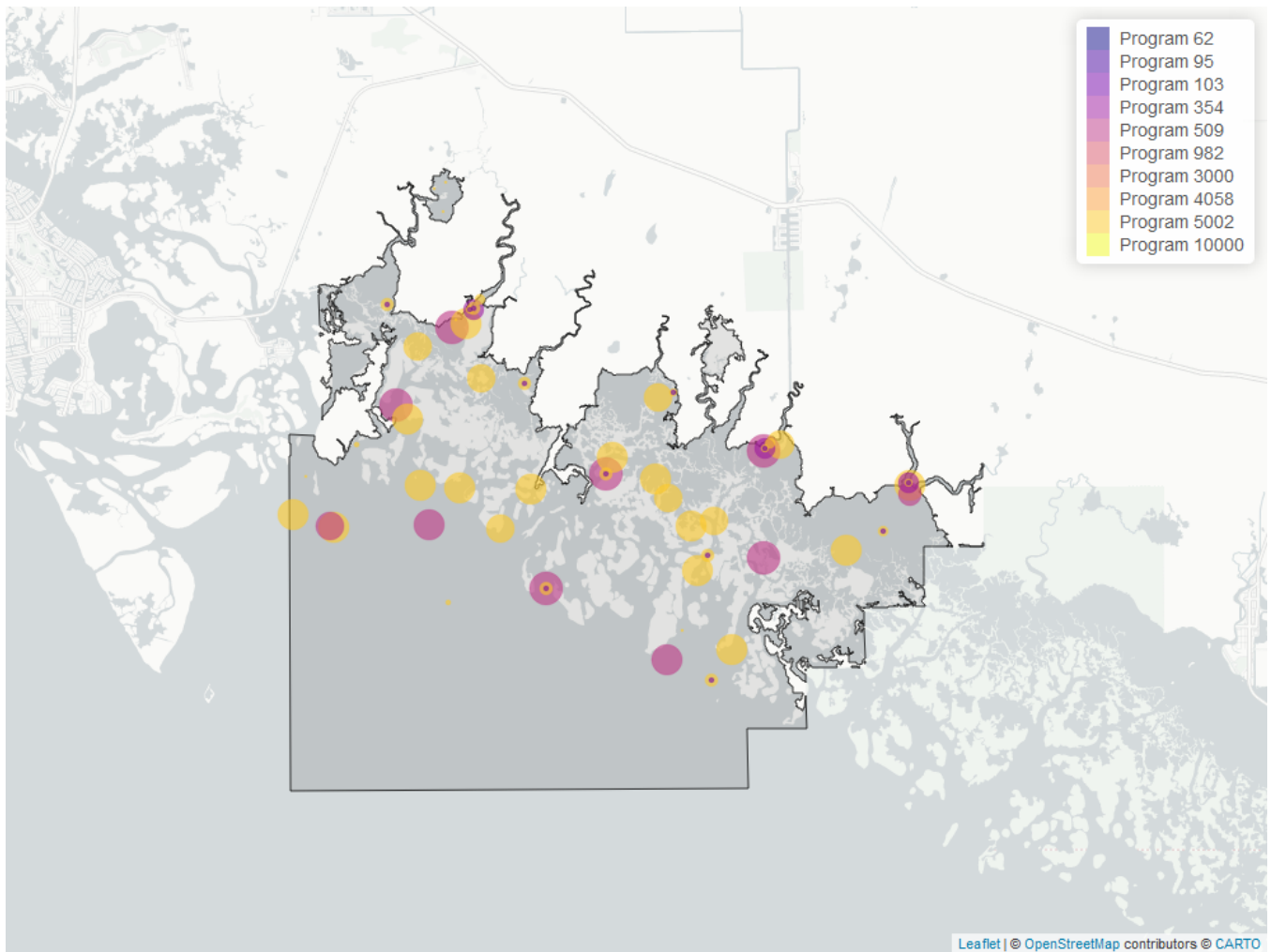


Figure 20: Map showing location of Discrete sampling sites for Turbidity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Turbidity

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	3142	1989	2024
509	1510	1994	2008
354	207	2002	2006
103	60	2021	2021

**Program names:**

103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

509 - SERC Water Quality Monitoring Network<sup>5</sup>

5002 - Florida STORET / WIN<sup>2</sup>

**Water Temperature - Discrete Water Quality**

**Seasonal Kendall-Tau Trend Analysis**

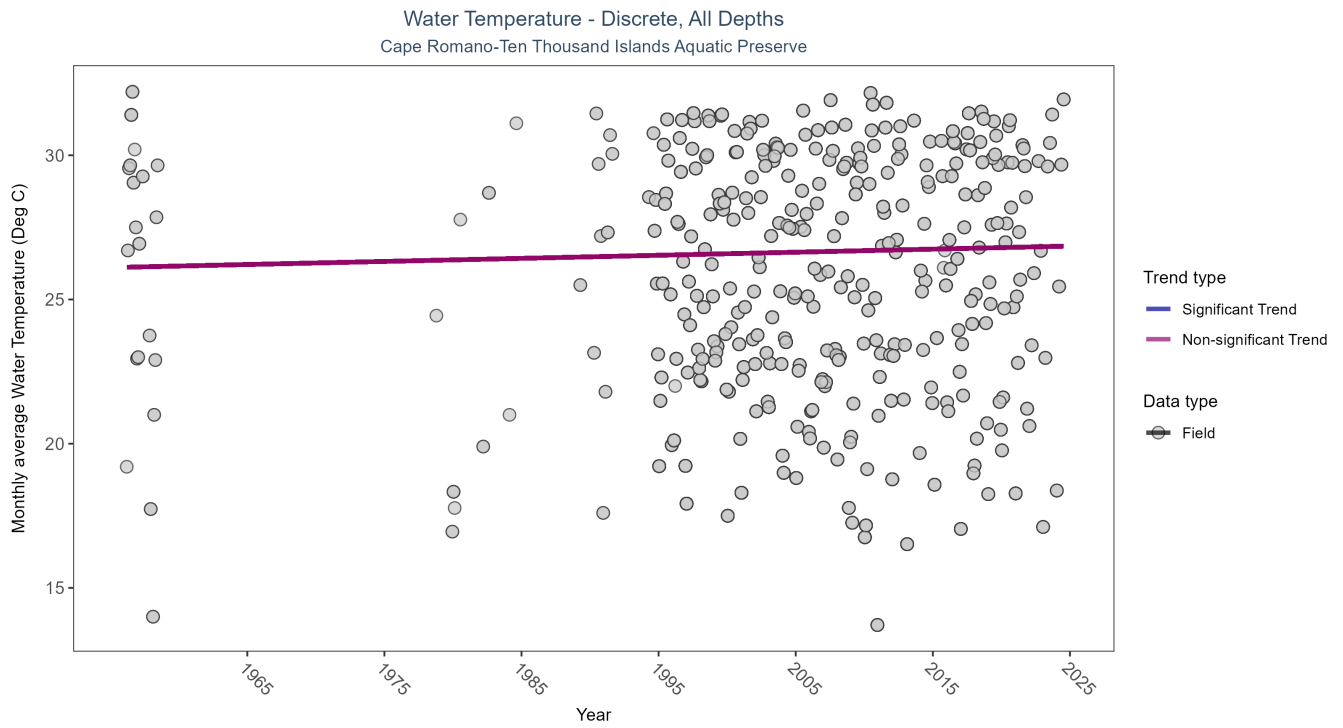


Figure 21: Seasonal Kendall-Tau Results for Water Temperature - Discrete

Table 26: Seasonal Kendall-Tau Trend Analysis for Water Temperature

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	11196	42	26.7	TRUE	0.0592	0.0994	0.0107	26.1169	14.5992	0.2016	0

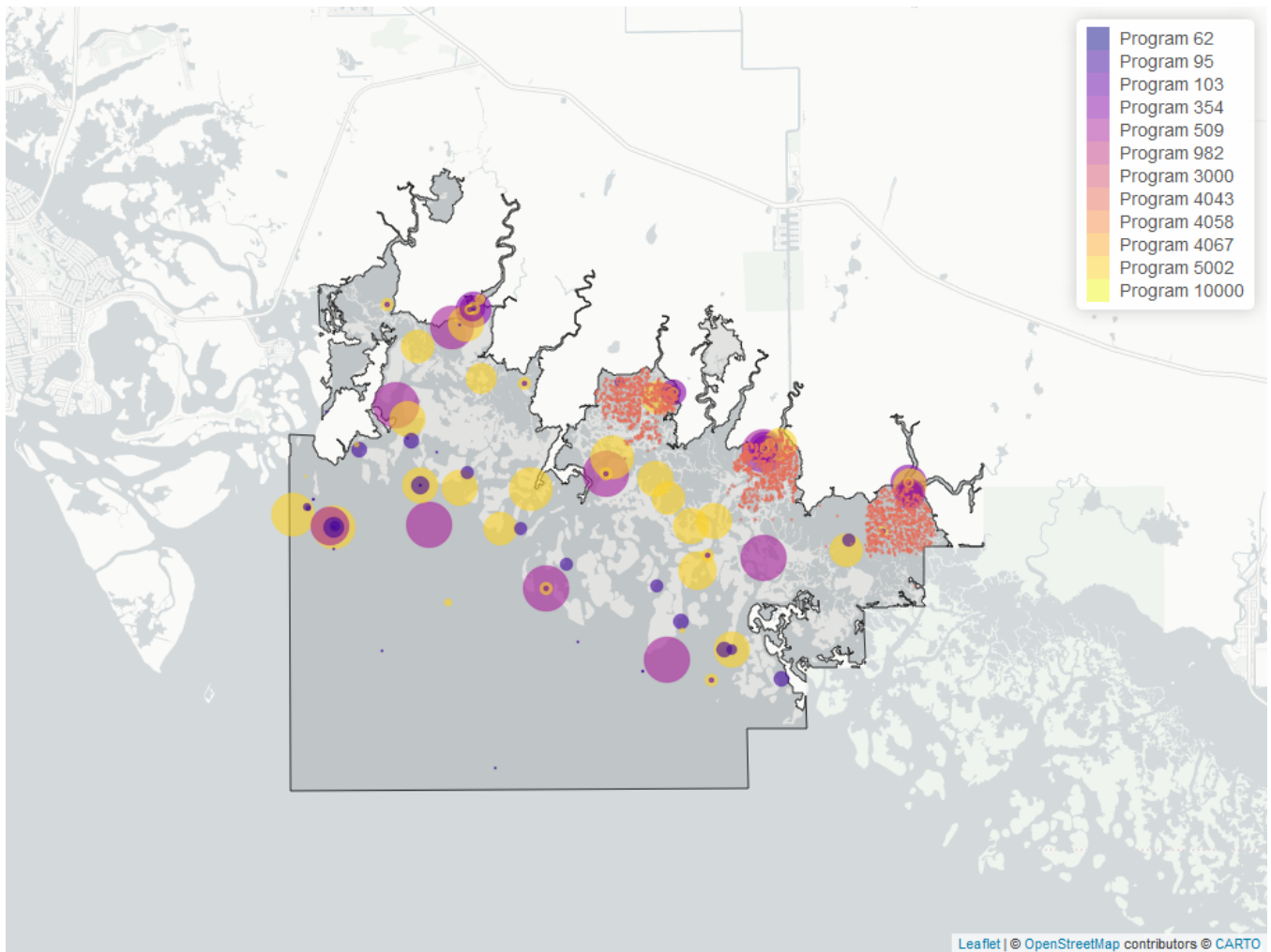


Figure 22: Map showing location of Discrete sampling sites for Water Temperature. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Water Temperature

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	4581	1989	2024
509	2944	1994	2008
4043	2534	1999	2020
354	971	2002	2024
95	482	1956	2018
103	63	2021	2021

**Program names:**

95 - Harmful Algal Bloom Marine Observation Network<sup>7</sup>

103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX<sup>3</sup>

354 - Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program<sup>1</sup>

509 - SERC Water Quality Monitoring Network<sup>5</sup>

4043 - RBNERR Fish Assessment<sup>8</sup>

5002 - Florida STORET / WIN<sup>2</sup>

## Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined\_WQ\_WC\_NUT\_cont\_Dissolved\_Oxygen\_SW-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Dissolved\_Oxygen\_Saturation\_SW-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_pH\_SW-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Salinity\_SW-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Turbidity\_SW-2024-Dec-08.txt*
- *Combined\_WQ\_WC\_NUT\_cont\_Water\_Temperature\_SW-2024-Dec-08.txt*

### Continuous monitoring locations in Cape Romano-Ten Thousand Islands Aquatic Preserve

Table 28: Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program (354)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
rkbfbwq	23	TRUE	DO , DOS , pH , Sal , Turb , TempW
rkbfuwq	23	TRUE	DO , DOS , pH , Sal , Turb , TempW
rkbmbwq	25	TRUE	DO , DOS , pH , Sal , Turb , TempW
rkbpbwq	9	TRUE	DO , DOS , pH , Sal , Turb , TempW

Table 29: National Water Information System (7)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
255123081321300	11	TRUE	Sal , TempW
255138081321701	8	TRUE	Sal , TempW
255432081303900	19	TRUE	Sal , TempW
255443081314700	5	FALSE	Sal , TempW
255532081314300	3	FALSE	Sal , TempW
255534081324000	18	TRUE	Sal , TempW
255654081350200	18	TRUE	Sal , TempW
255732081363700	5	TRUE	Sal , TempW

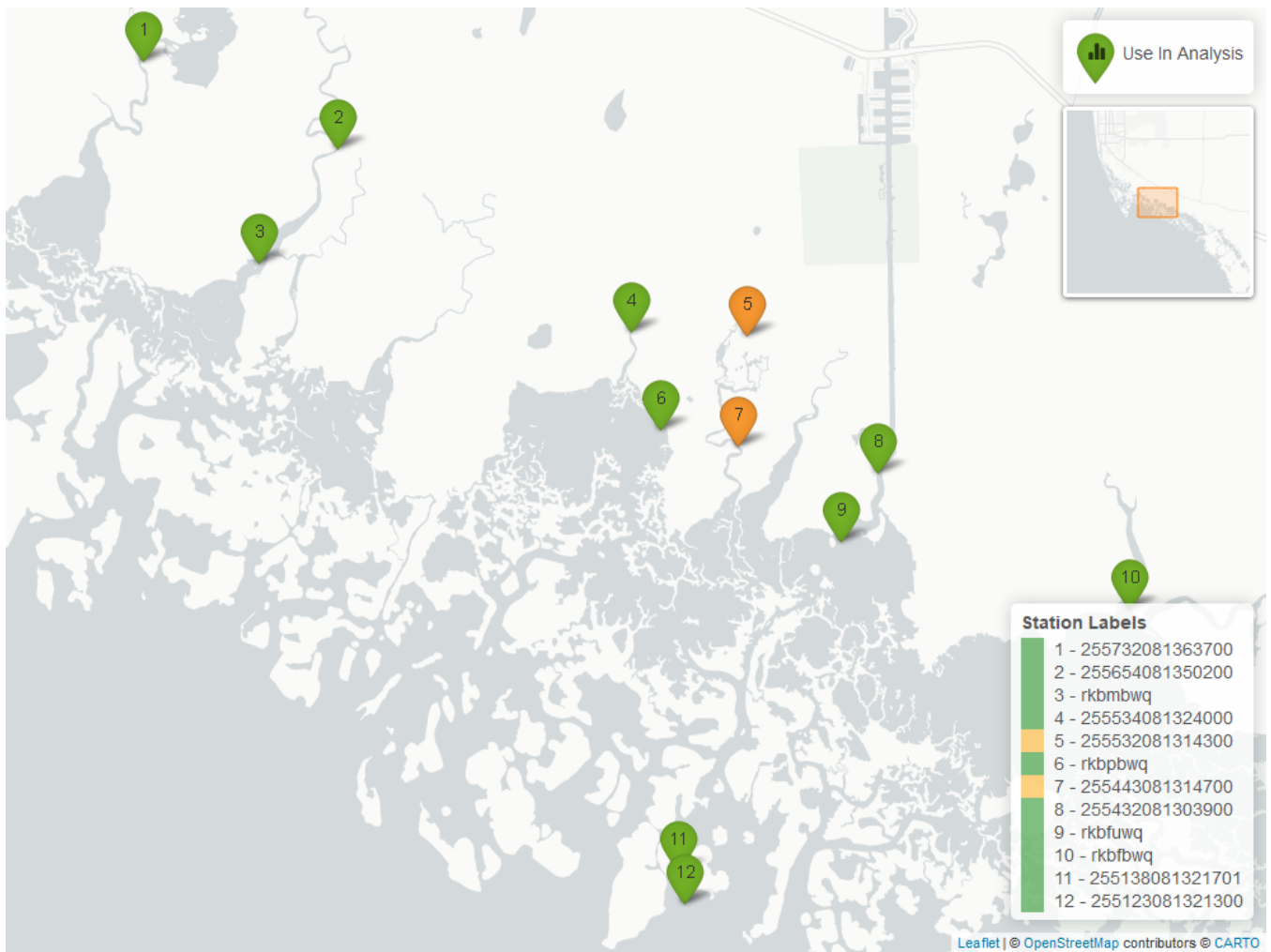


Figure 23: Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Cape Romano-Ten Thousand Islands Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

## Dissolved Oxygen - All Stations Combined

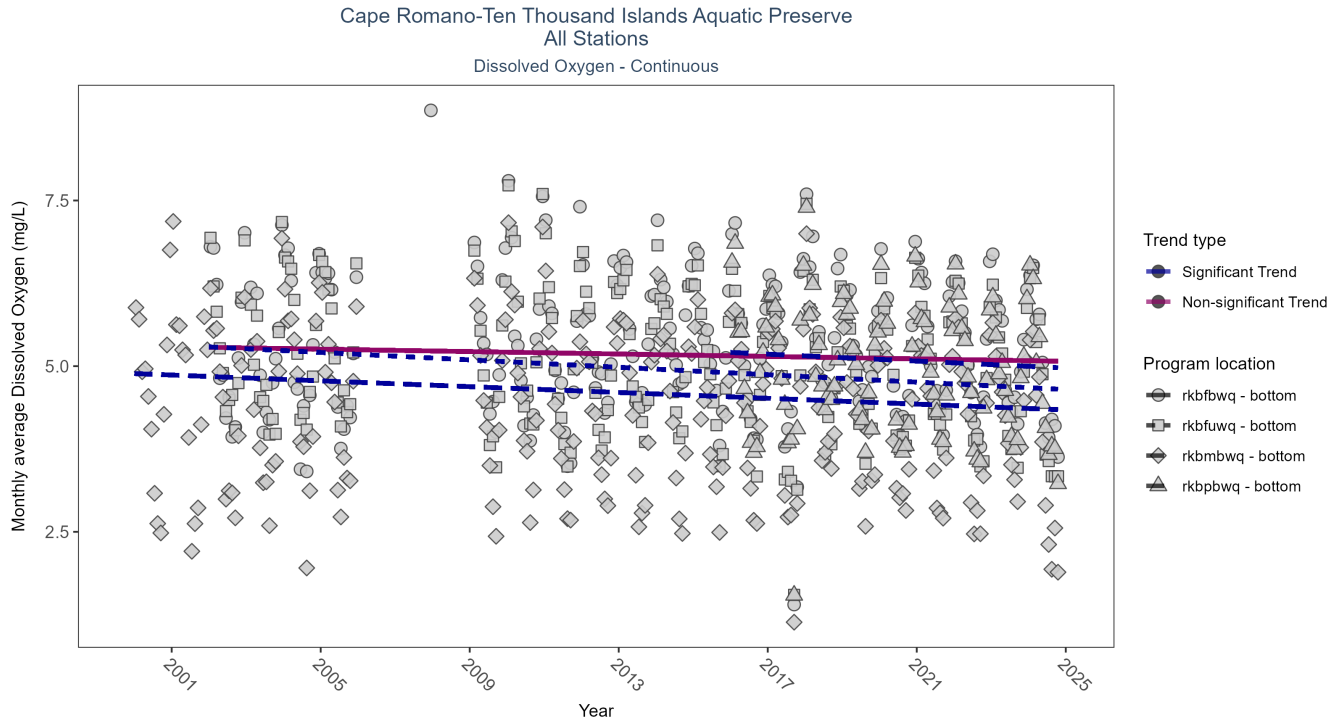


Figure 24: Figure for Dissolved Oxygen - Continuous - All stations combined

Table 30: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfbwq	559530	21	2002 - 2024	5.4	-0.08	5.28	-0.01	0.1032
rkbfuwq	594676	20	2002 - 2024	5.0	-0.33	5.29	-0.03	0.0000
rkmbbwq	613238	22	2000 - 2024	4.4	-0.26	4.89	-0.02	0.0000
rkbpbwq	289726	9	2016 - 2024	4.9	-0.18	5.21	-0.03	0.0246

# Dissolved Oxygen Saturation - All Stations Combined

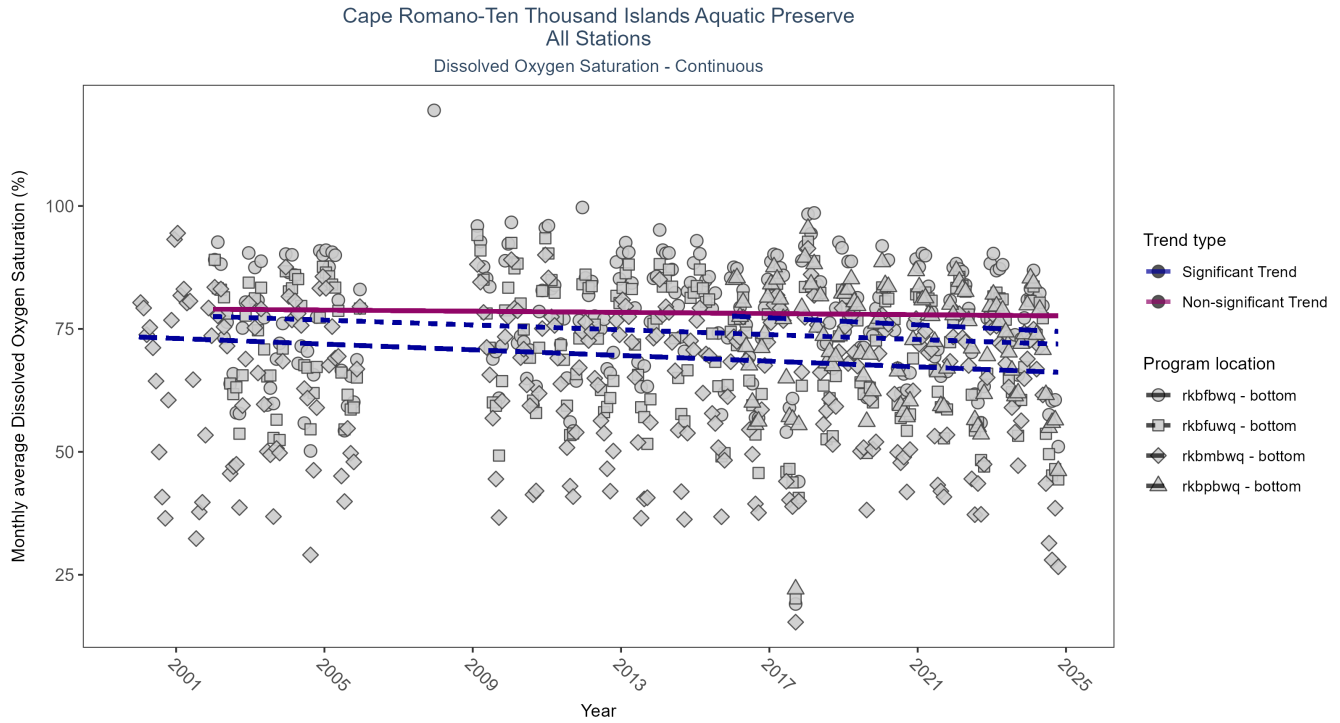


Figure 25: Figure for Dissolved Oxygen Saturation - Continuous - All stations combined

Table 31: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen Saturation

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfbwq	563836	21	2002 - 2024	78.3	-0.04	79.01	-0.06	0.4097
rkbfuwq	594935	20	2002 - 2024	72.2	-0.26	77.53	-0.25	0.0000
rkbmbwq	619562	22	2000 - 2024	65.1	-0.23	73.35	-0.29	0.0000
rkbpbwq	291357	9	2016 - 2024	72.3	-0.18	77.60	-0.36	0.0289



## pH - All Stations Combined

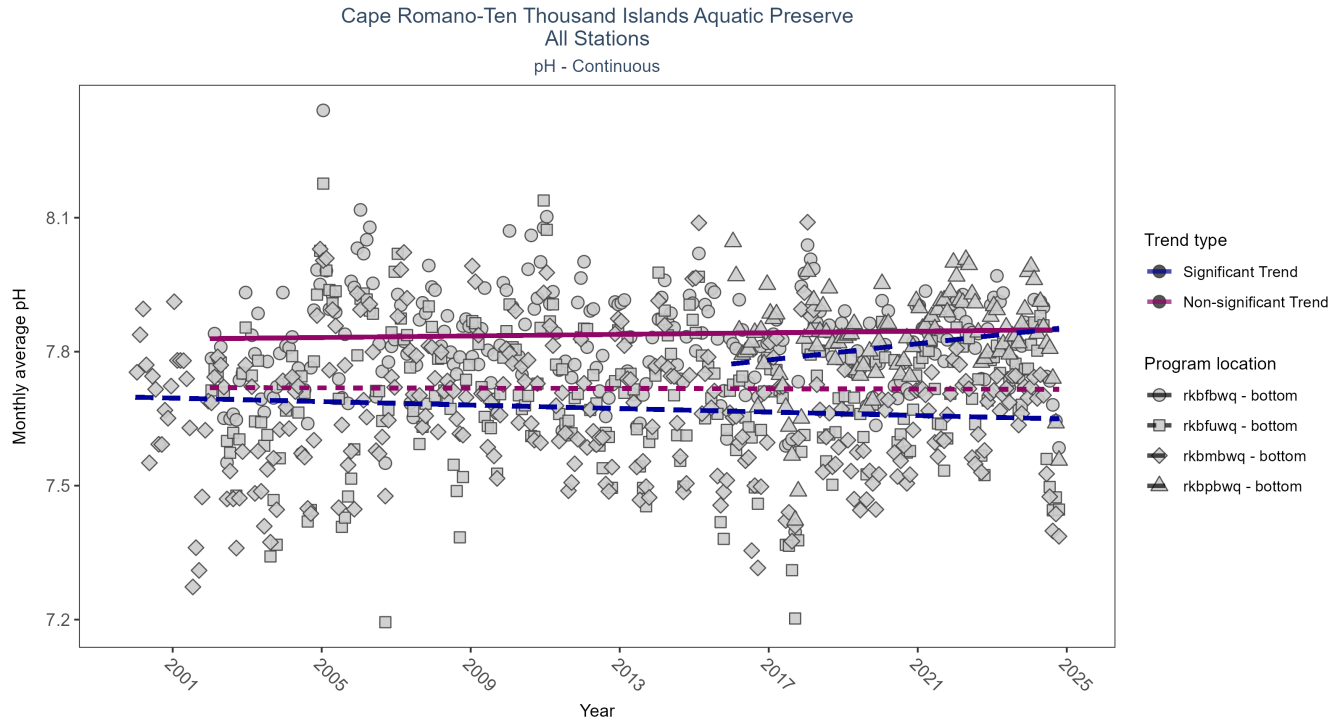


Figure 26: Figure for pH - Continuous - All stations combined

Table 32: Seasonal Kendall-Tau Results for All Stations - pH

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfbwq	626300	23	2002 - 2024	7.8	0.04	7.83	0.00	0.3005
rkbfuwq	649975	23	2002 - 2024	7.7	-0.01	7.72	0.00	0.8449
rkbmbwq	683502	25	2000 - 2024	7.7	-0.09	7.70	0.00	0.0346
rkbpbwq	283219	9	2016 - 2024	7.8	0.20	7.77	0.01	0.0176

# Salinity - All Stations Combined by Program

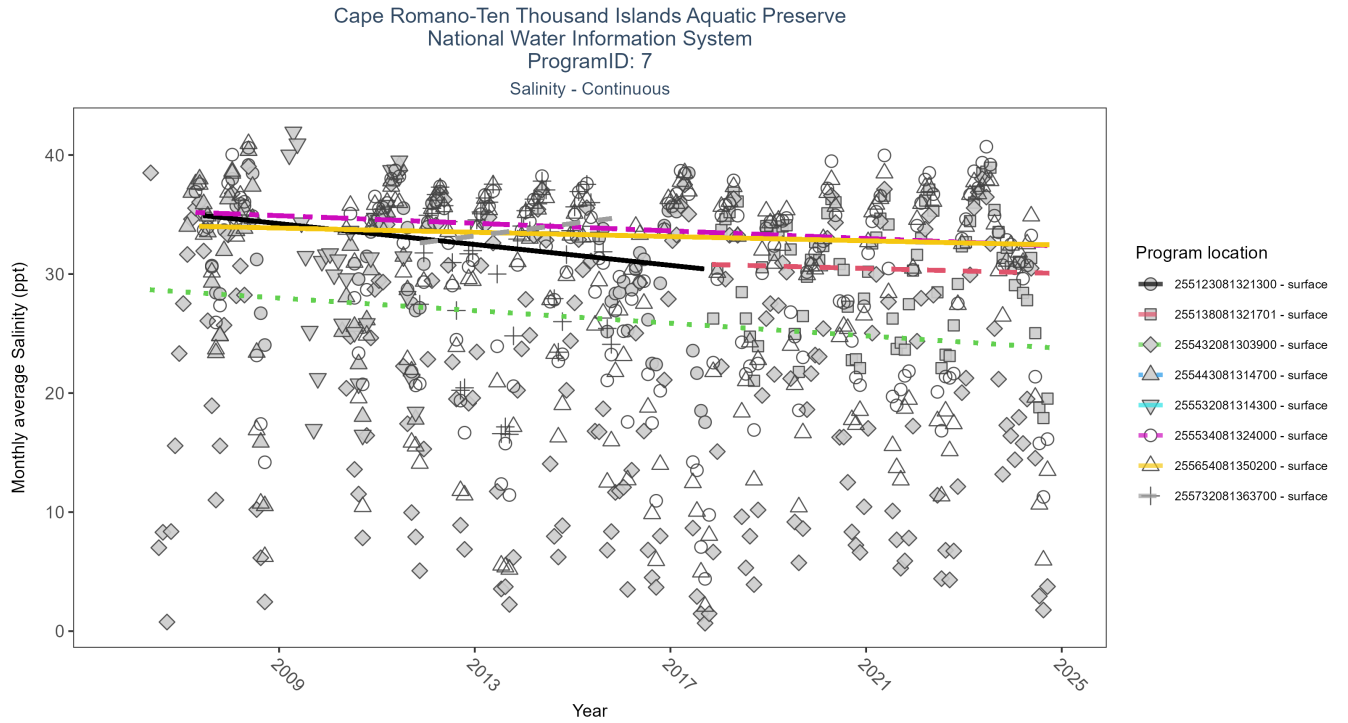


Figure 27: Figure for Salinity - Continuous - Program 7

Table 33: Seasonal Kendall-Tau Results for All Stations - Salinity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
255123081321300	1809	8	2007 - 2017	32	-0.23	35.11	-0.44	0.0182
255432081303900	5961	18	2006 - 2024	21	-0.2	28.77	-0.26	0.0001
255534081324000	5677	17	2007 - 2024	32	-0.14	35.22	-0.16	0.0083
255654081350200	5674	17	2007 - 2024	32	-0.09	34.04	-0.09	0.0955
255732081363700	1434	5	2011 - 2015	34	0.25	32.15	0.52	0.0955
255443081314700	1465	4	2007 - 2011	32	-	-	-	-
255532081314300	902	3	2009 - 2011	31	-	-	-	-
255138081321701	2482	8	2017 - 2024	31	-0.05	30.89	-0.11	0.5671

## Salinity - All Stations Combined by Program

Cape Romano-Ten Thousand Islands Aquatic Preserve  
 Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program  
 ProgramID: 354  
 Salinity - Continuous

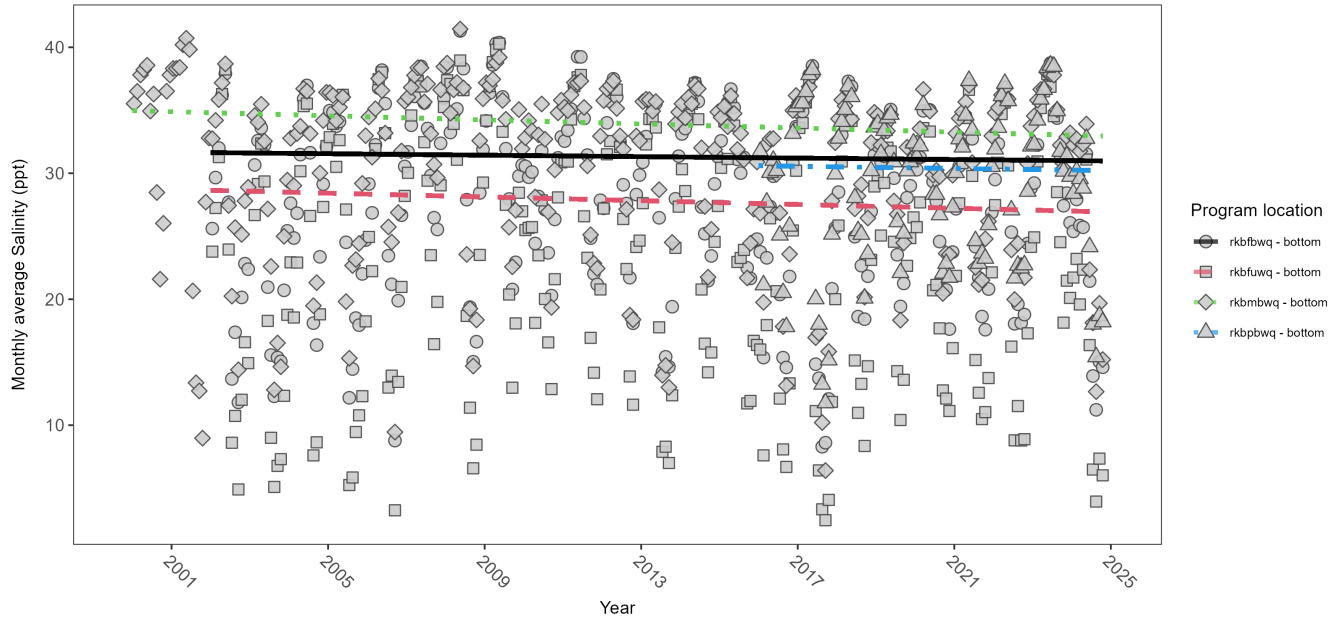


Figure 28: Figure for Salinity - Continuous - Program 354

Table 34: Seasonal Kendall-Tau Results for All Stations - Salinity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfbwq	658798	23	2002 - 2024	29.6	-0.03	31.64	-0.03	0.4691
rkbfuwq	675230	23	2002 - 2024	26.0	-0.07	28.65	-0.07	0.1290
rkmbbwq	694825	25	2000 - 2024	33.3	-0.12	34.97	-0.08	0.0032
rkpbwq	290041	9	2016 - 2024	30.2	-0.01	30.60	-0.04	0.9243

## Turbidity - All Stations Combined

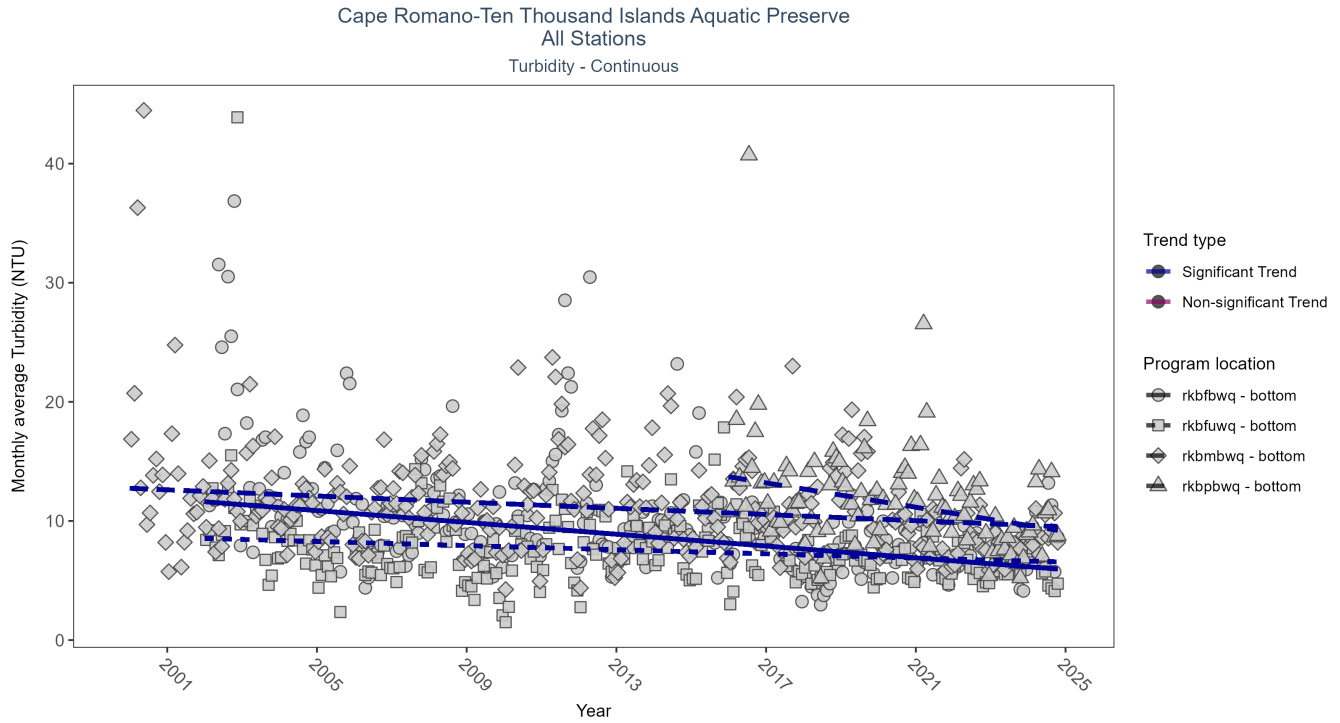


Figure 29: Figure for Turbidity - Continuous - All stations combined

Table 35: Seasonal Kendall-Tau Results for All Stations - Turbidity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfbwq	638544	23	2002 - 2024	7	-0.39	11.61	-0.25	0.0000
rkbfuwq	615945	23	2002 - 2024	6	-0.20	8.54	-0.09	0.0000
rkbmbwq	670439	25	2000 - 2024	9	-0.22	12.74	-0.13	0.0000
rkbpbwq	286433	9	2016 - 2024	10	-0.37	13.71	-0.51	0.0000

# Water Temperature - All Stations Combined by Program

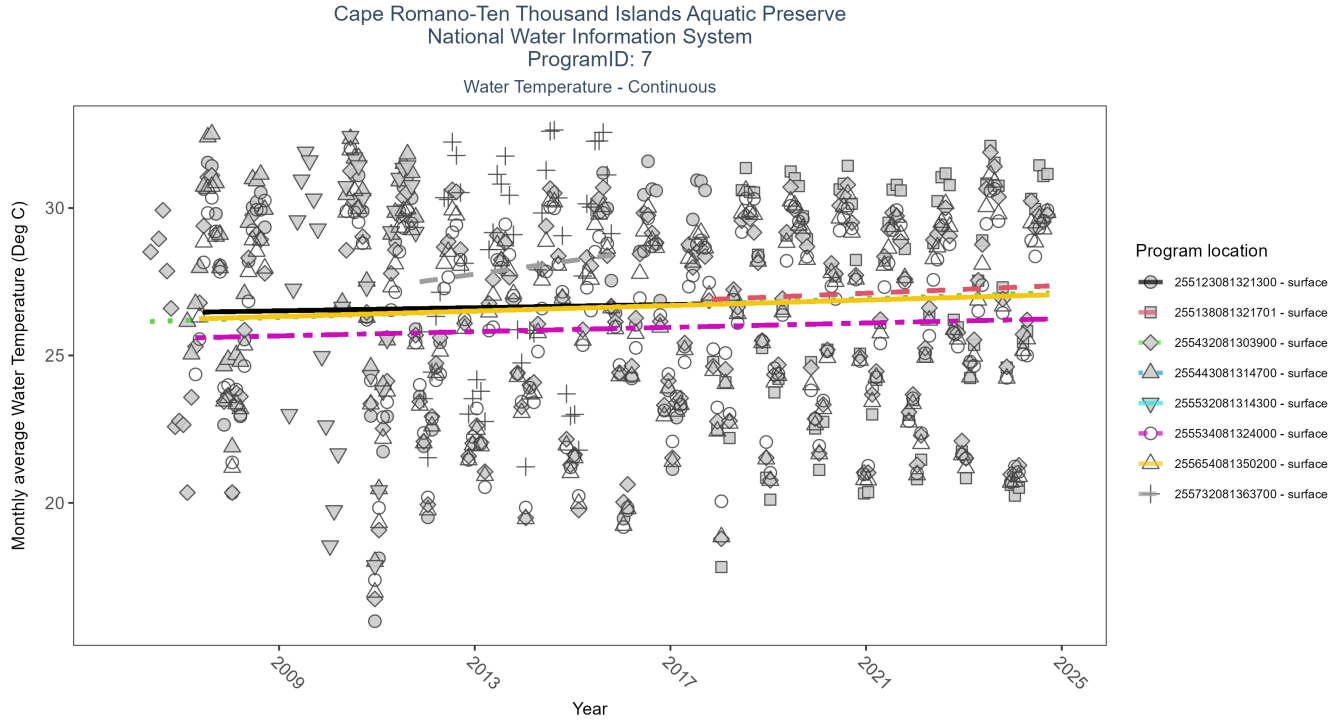


Figure 30: Figure for Water Temperature - Continuous - Program 7

Table 36: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
255123081321300	1818	8	2007 - 2017	27.3	0.1	26.46	0.03	0.3843
255432081303900	6019	18	2006 - 2024	27.1	0.17	26.13	0.05	0.0011
255534081324000	5733	17	2007 - 2024	26.7	0.14	25.59	0.04	0.0088
255532081314300	906	3	2009 - 2011	29.3	-	-	-	-
255654081350200	5712	17	2007 - 2024	26.9	0.15	26.23	0.05	0.0054
255443081314700	2011	4	2007 - 2011	29.3	-	-	-	-
255732081363700	1435	5	2011 - 2015	28.4	0.24	27.3	0.23	0.1149
255138081321701	2498	8	2017 - 2024	27.3	0.12	26.85	0.07	0.1723

## Water Temperature - All Stations Combined by Program

Cape Romano-Ten Thousand Islands Aquatic Preserve  
 Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program  
 ProgramID: 354  
 Water Temperature - Continuous

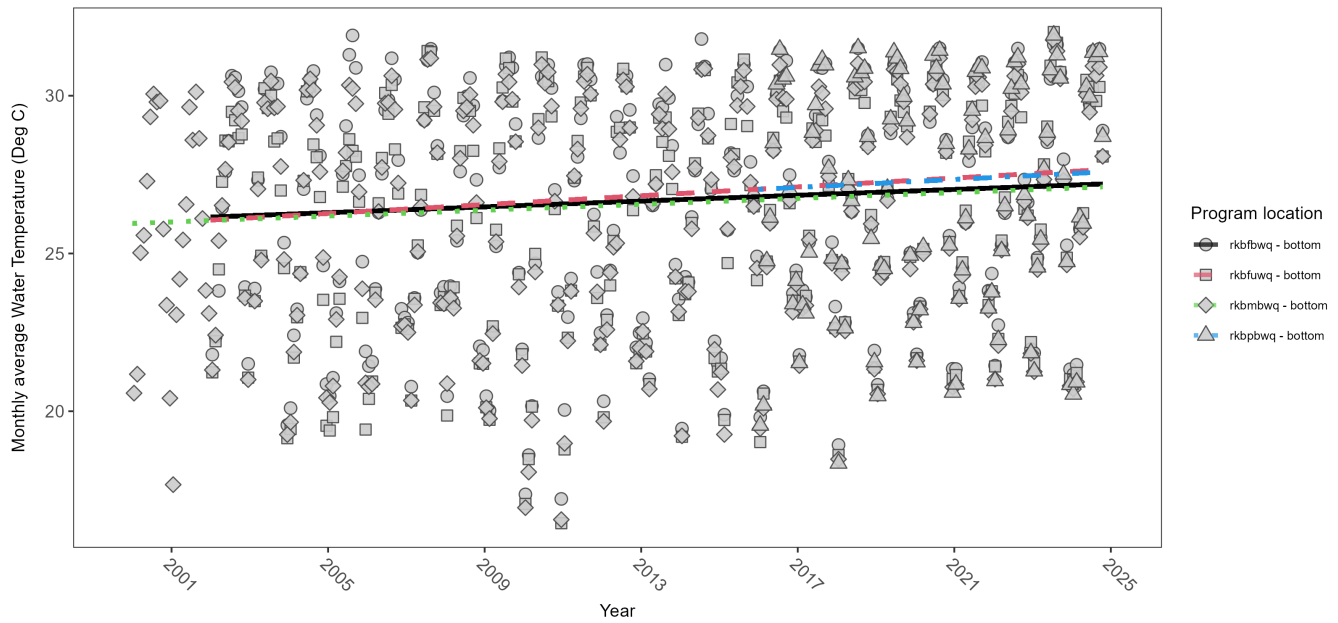


Figure 31: Figure for Water Temperature - Continuous - Program 354

Table 37: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
rkbfwbq	674632	23	2002 - 2024	27.1	0.24	26.15	0.05	0.0000
rkbfuwq	685661	23	2002 - 2024	27.0	0.27	26.06	0.07	0.0000
rkmbwbq	718152	25	2000 - 2024	26.9	0.26	25.95	0.05	0.0000
rkbpwbq	292925	9	2016 - 2024	27.6	0.14	27.03	0.06	0.0711

# Nekton

The data file used is: **All\_NEKTON\_Parameters-2024-Dec-17.txt**

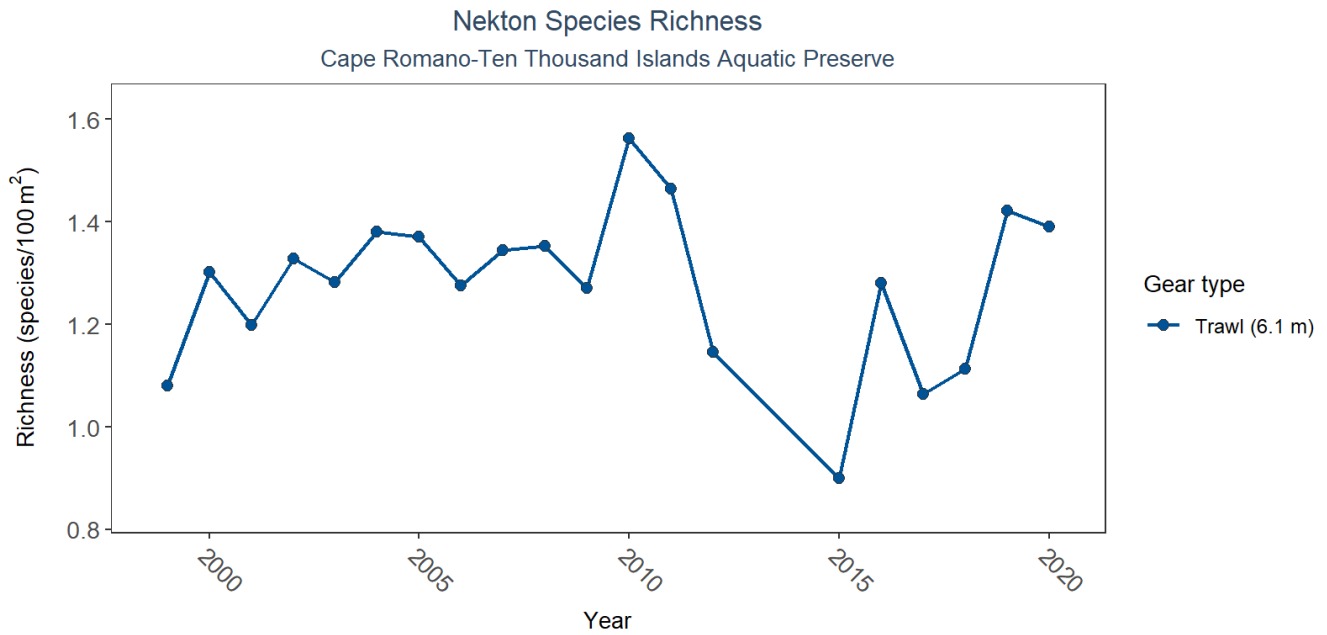


Figure 32: Figure for Nekton Species Richness in Cape Romano-Ten Thousand Islands Aquatic Preserve

Table 38: Nekton Species Richness

<i>Gear Type</i>	<i>Sample Count</i>	<i>Number of Years</i>	<i>Period of Record</i>	<i>Median N of Taxa</i>	<i>Mean N of Taxa</i>
Trawl (6.1)	2555	20	1999 - 2020	1.35	1.31

## References

1. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Rookery Bay National Estuarine Research Reserve. [Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program](#). (2024).
2. Florida Department of Environmental Protection (DEP). [Florida STORET / WIN](#). (2024).
3. U.S. Environmental Protection Agency (EPA). [EPA STORage and RETrieval Data Warehouse \(STORET\)/WQX](#). (2023).
4. U.S. Environmental Protection Agency (EPA); Office of Water; National Oceanic and Atmospheric Administration (NOAA); U.S. Geological Survey (USGS); U.S. Fish and Wildlife Service (USFWS); National Estuary Program (NEP); coastal states. [National Aquatic Resource Surveys, National Coastal Condition Assessment](#). (2021).
5. Florida International University (FIU); Southeastern Environmental Research Program. [SERC Water Quality Monitoring Network](#). (2008).
6. University of Florida (UF); Institute of Food and Agricultural Sciences. [Florida LAKEWATCH Program](#). (2024).
7. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). [Harmful Algal Bloom Marine Observation Network](#). (2018).
8. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Rookery Bay National Estuarine Research Reserve. [RBNERR Fish Assessment](#). (2023).