

St. Martins Marsh Aquatic Preserve
SEACAR Habitat Analyses

Last compiled on 08 January, 2025

Contents

Funding & Acknowledgements	2
Threshold Filtering	2
Value Qualifiers	3
Water Column	5
Seasonal Kendall-Tau Analysis	5
Water Quality - Discrete	5
Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality	6
Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality	7
Colored Dissolved Organic Matter - Discrete Water Quality	10
Dissolved Oxygen - Discrete Water Quality	11
pH - Discrete Water Quality	14
Salinity - Discrete Water Quality	16
Secchi Depth - Discrete Water Quality	18
Total Nitrogen - Discrete Water Quality	20
Total Phosphorus - Discrete Water Quality	22
Total Suspended Solids - Discrete Water Quality	25
Turbidity - Discrete Water Quality	26
Water Temperature - Discrete Water Quality	28
Water Quality - Continuous	32
Submerged Aquatic Vegetation	33
Parameters	33
Species	33
Notes	33
Nekton	39
References	40

Funding & Acknowledgements

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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 ⁻¹	-	-
NO ₂ + ₃ , Filtered	mg/L	-	-
Nitrate (NO ₃)	mg/L	-	-
Nitrite (NO ₂)	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO ₄)	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

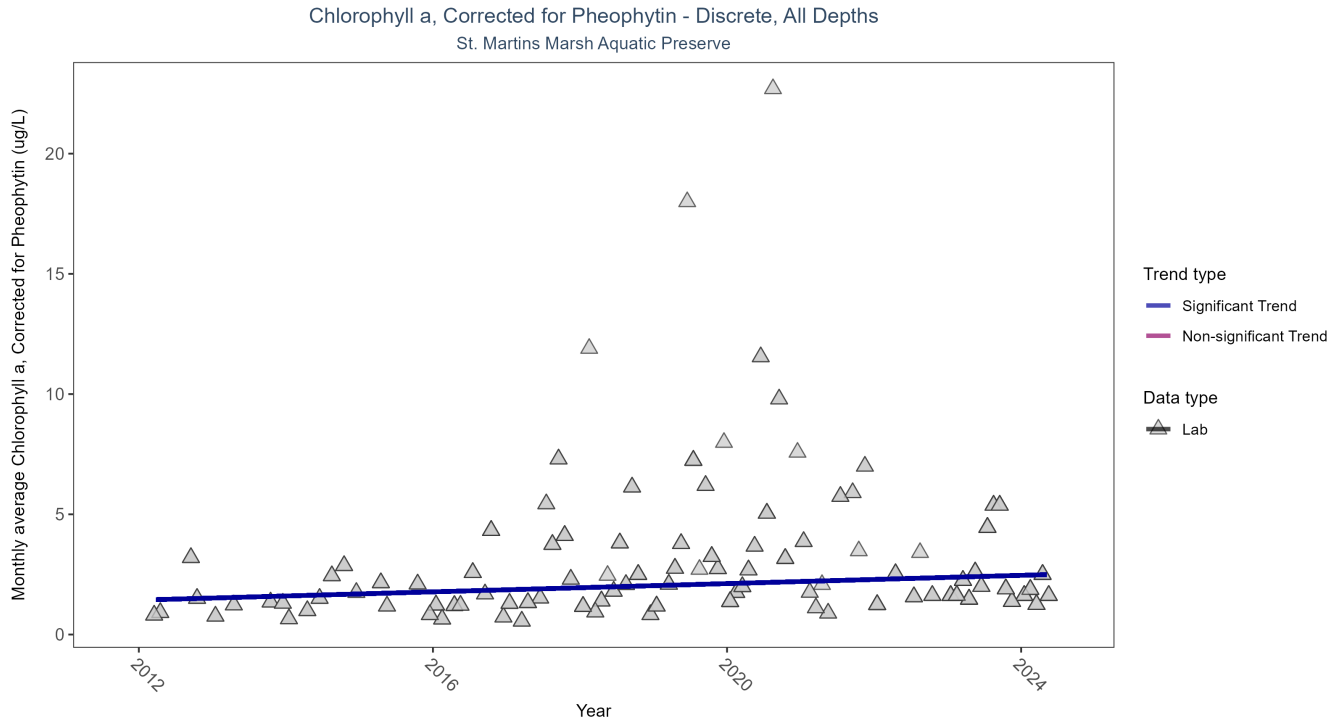


Figure 1: Seasonal Kendall-Tau Results for Chlorophyll a, Corrected for Pheophytin - Discrete

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	483	13	1.41	TRUE	0.3116	0.0001	0.0859	1.4316	9.2095	0.6026	1

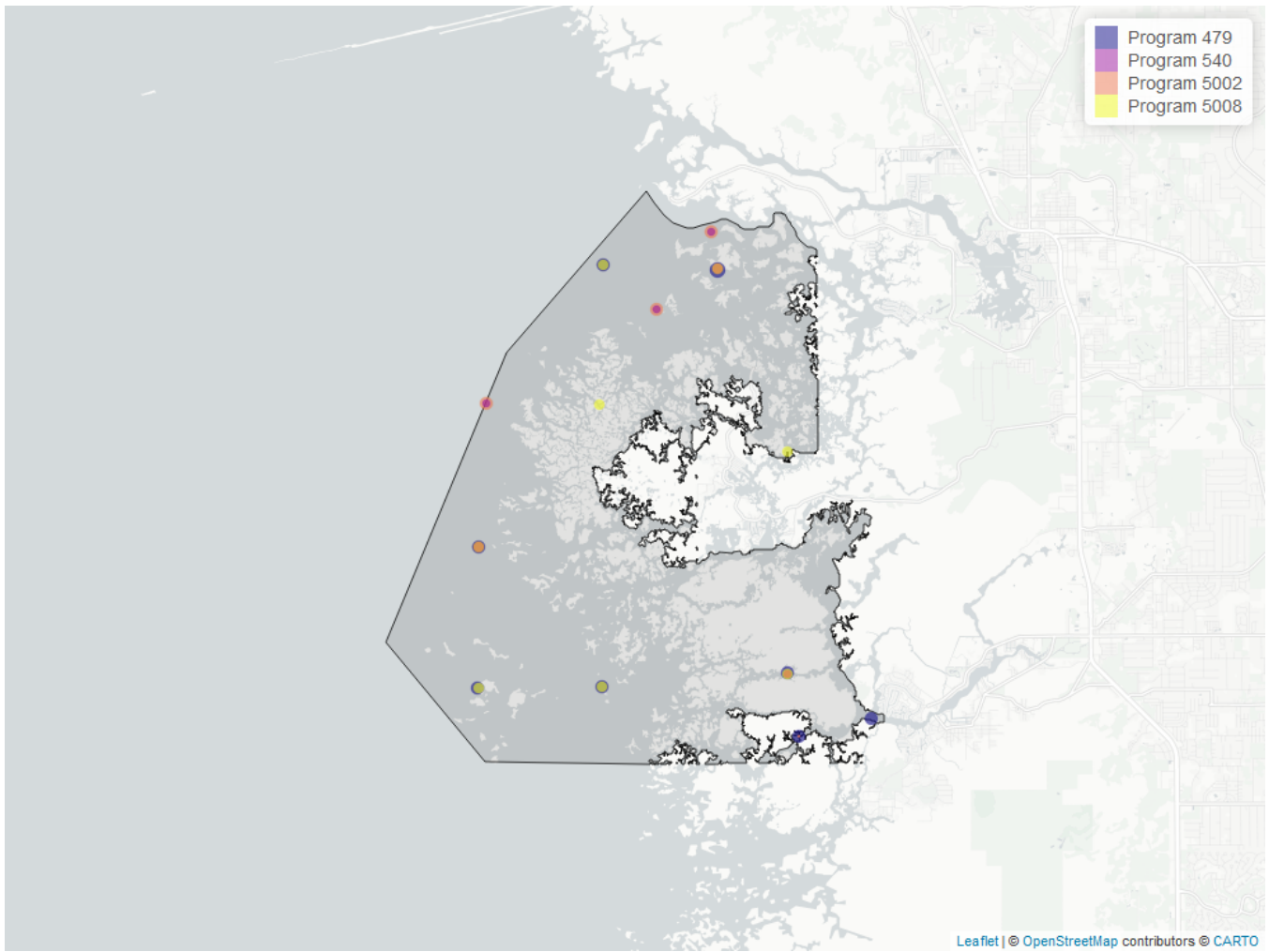


Figure 2: Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

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

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	223	2016	2023
5008	128	2023	2024
5002	116	2012	2021
540	21	2017	2019

Program names:

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program²

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

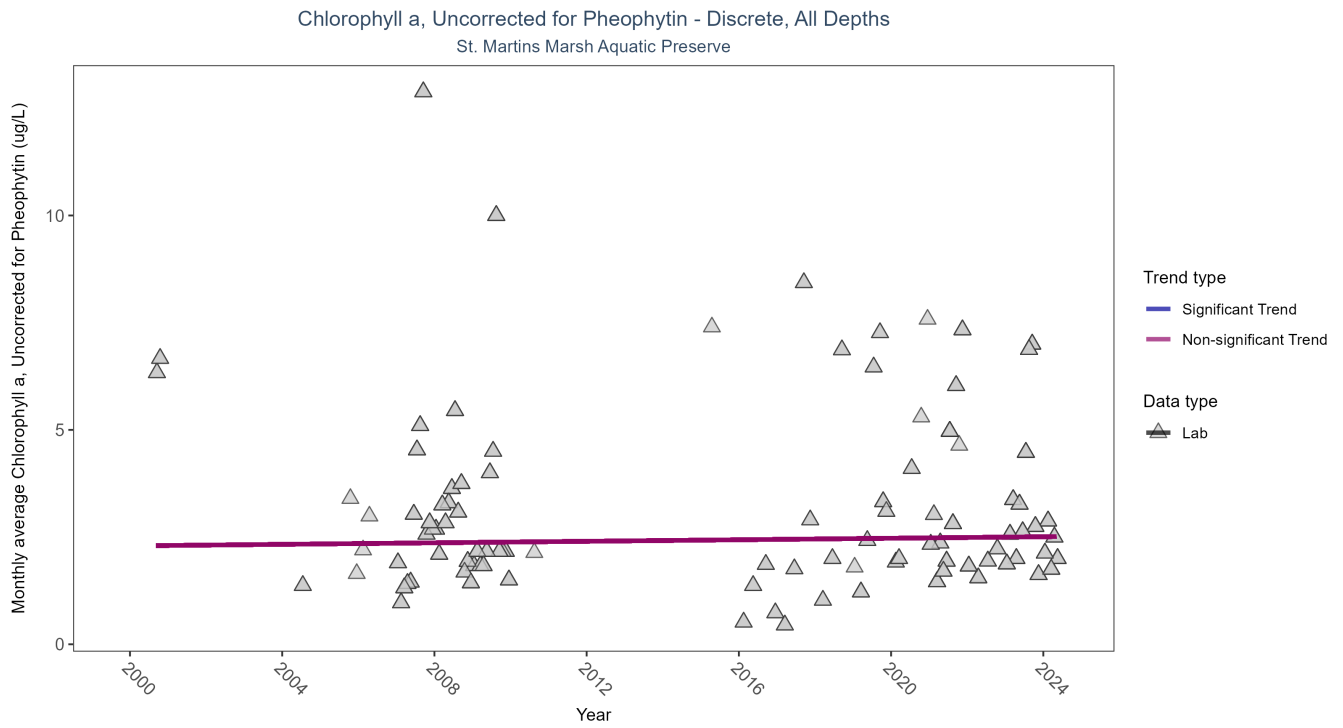


Figure 3: Seasonal Kendall-Tau Results for Chlorophyll a, Uncorrected for Pheophytin - Discrete

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	588	18	2	TRUE	0.0233	0.7426	0.0089	2.295	3.7607	0.9764	0

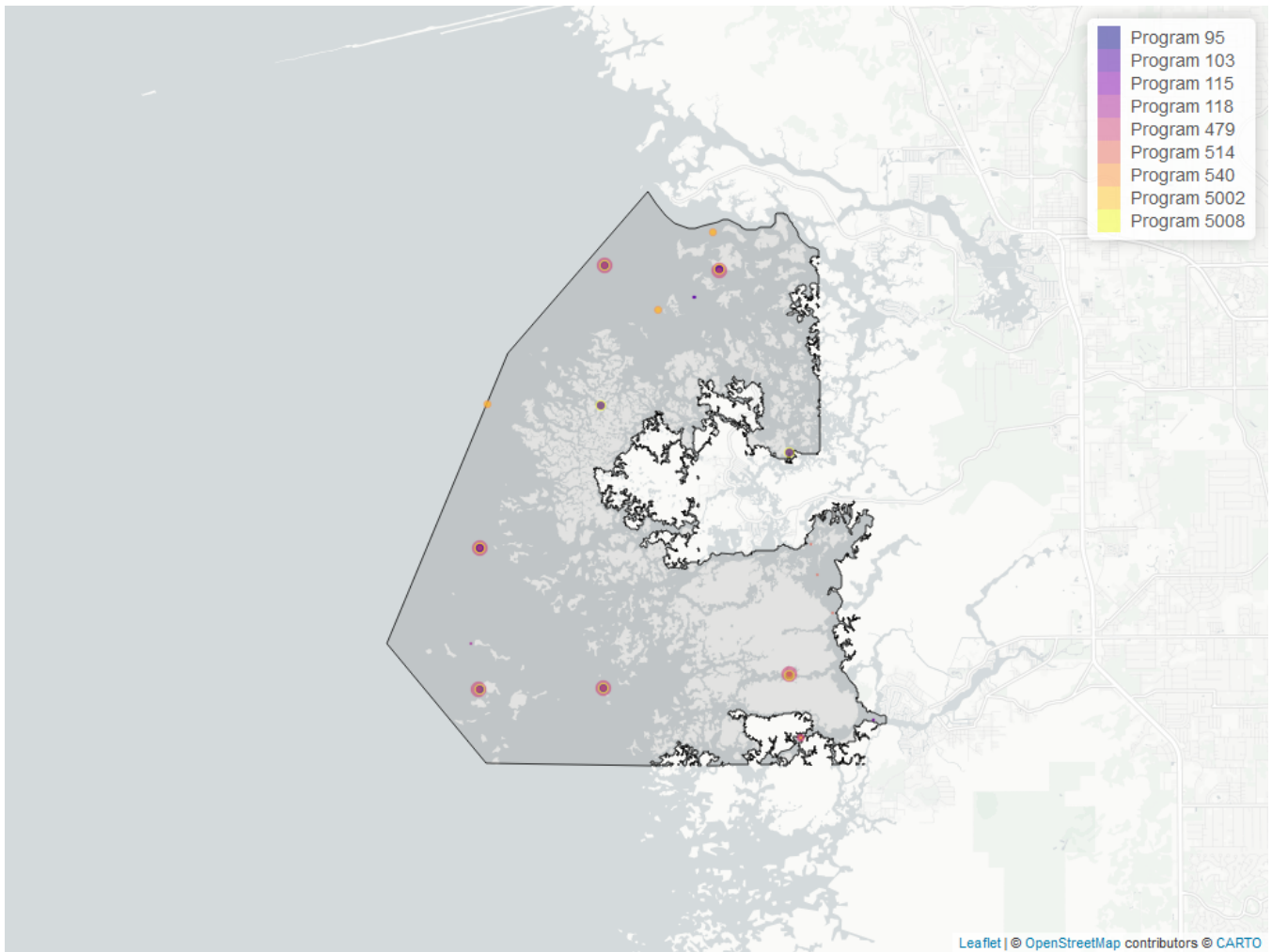


Figure 4: Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

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

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	258	2005	2023
5008	132	2022	2024
103	115	2004	2021
5002	62	2015	2021
540	21	2017	2019
514	6	2000	2000
115	1	2004	2004
118	1	2010	2010

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵

115 - Environmental Monitoring Assessment Program⁶

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁷

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program⁸
 540 - Shellfish Harvest Area Classification Program²
 5002 - Florida STORET / WIN³
 5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Colored Dissolved Organic Matter - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

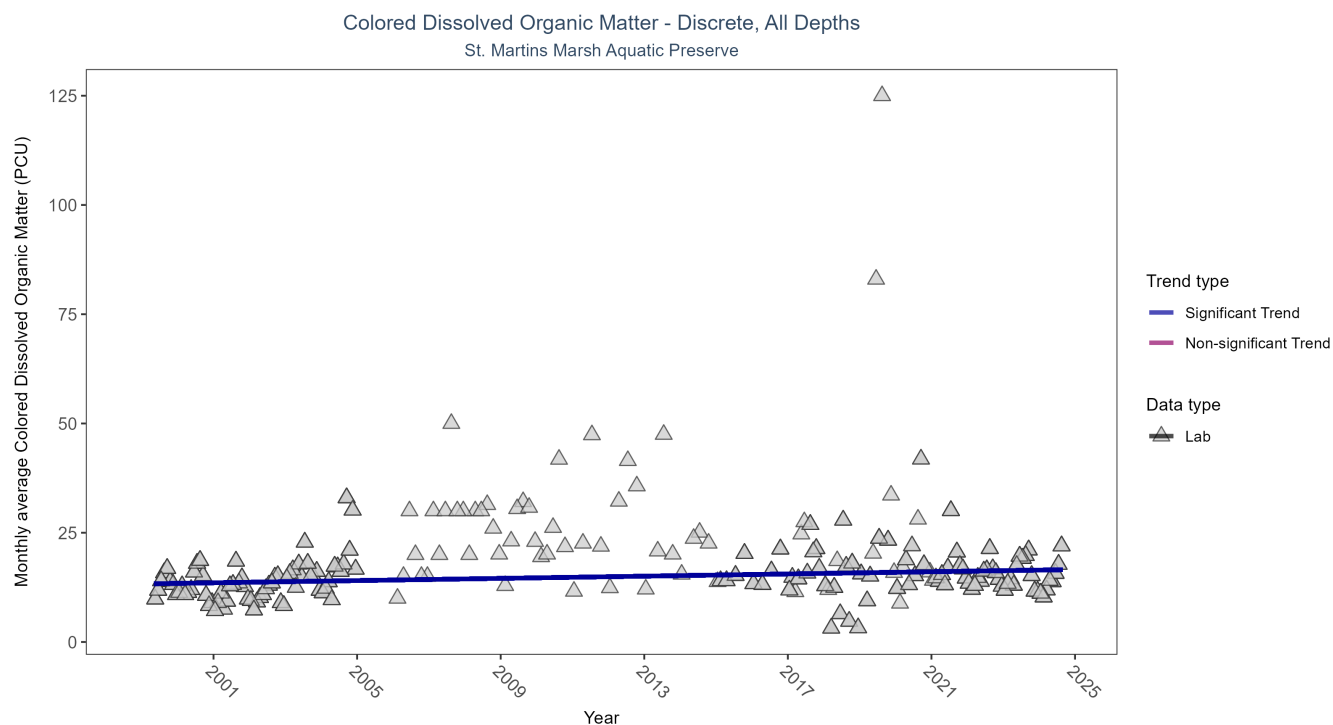


Figure 5: Seasonal Kendall-Tau Results for Colored Dissolved Organic Matter - Discrete

Table 10: Seasonal Kendall-Tau Trend Analysis for Colored Dissolved Organic Matter

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1055	25	13	TRUE	0.1706	0.0016	0.1263	13.2916	2.0215	0.9984	1

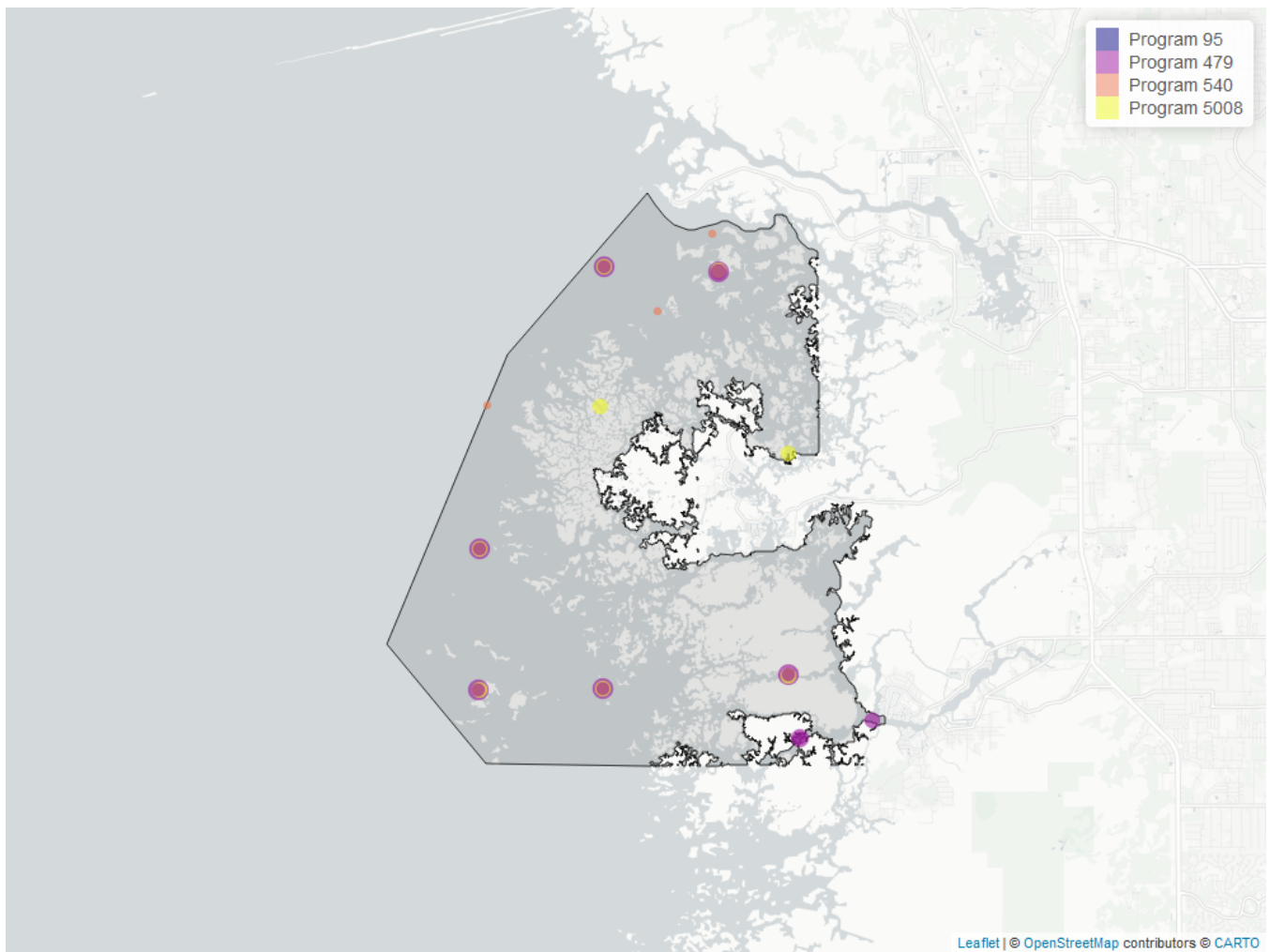


Figure 6: Map showing location of Discrete sampling sites for Colored Dissolved Organic Matter. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	714	1999	2023
5008	320	2021	2024
540	21	2017	2019

Program names:

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program²

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Dissolved Oxygen - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

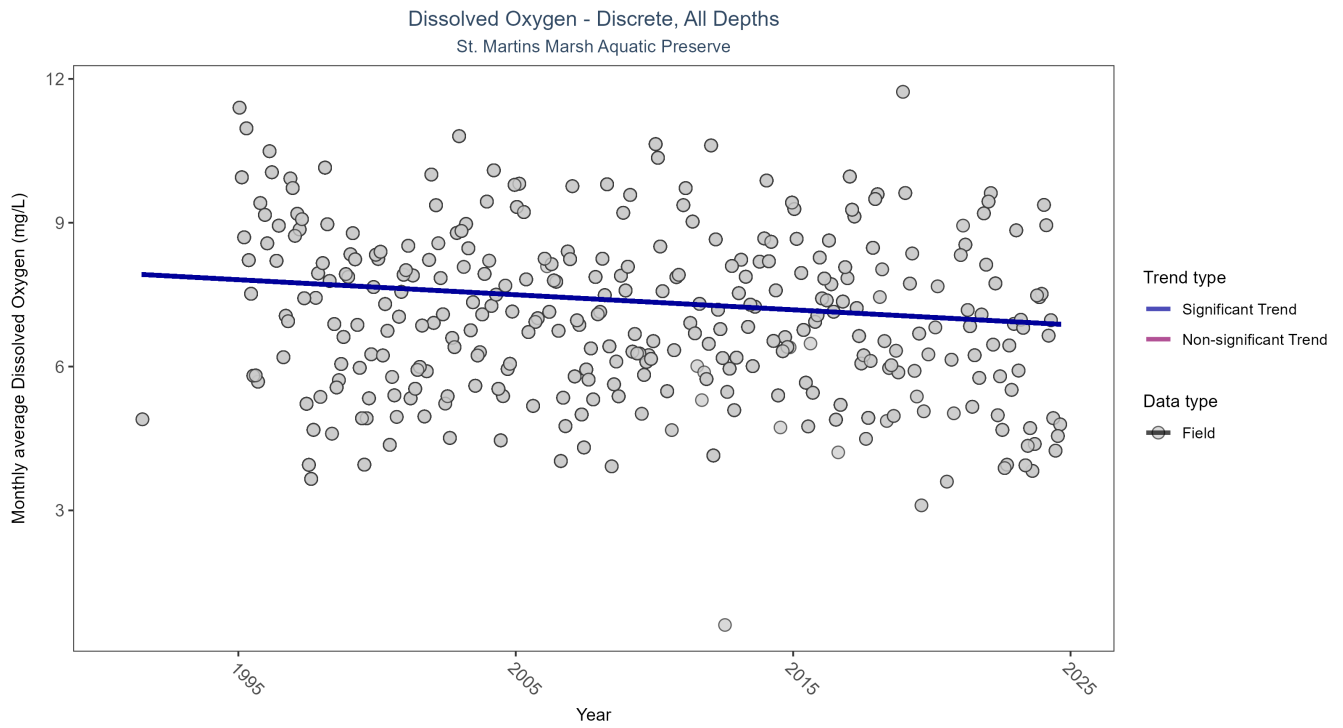


Figure 7: Seasonal Kendall-Tau Results for Dissolved Oxygen - Discrete

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

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	8590	31	7.3	TRUE	-0.1496	0.0002	-0.0314	7.9369	9.4061	0.5845	-1

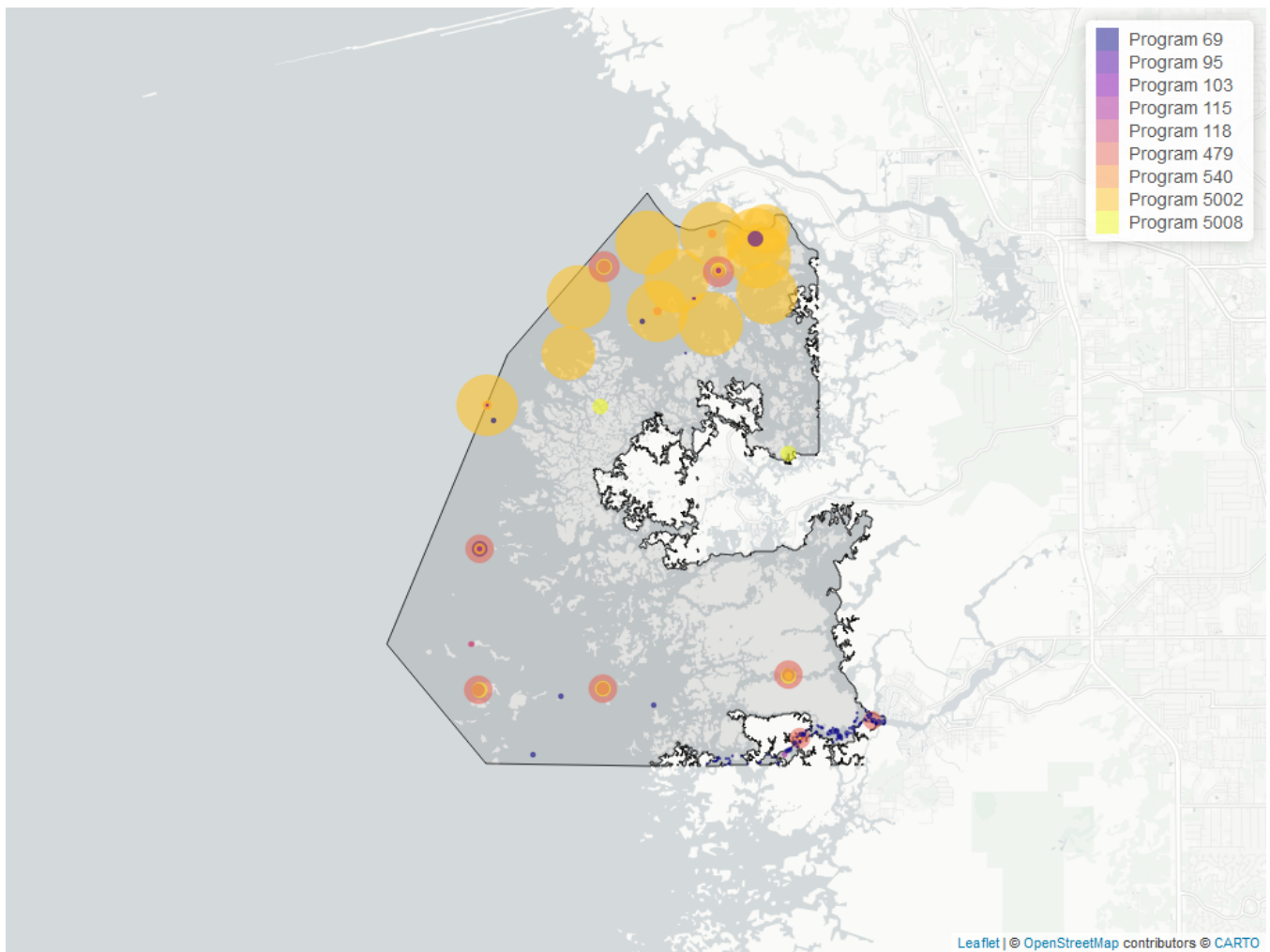


Figure 8: Map showing location of Discrete sampling sites for Dissolved Oxygen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	6897	1995	2021
479	1048	1996	2023
5008	320	2021	2024
69	221	2003	2008
95	72	2011	2018
540	21	2017	2019
103	12	2021	2021
118	9	2015	2020
115	5	1991	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁹

95 - Harmful Algal Bloom Marine Observation Network¹⁰

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵

115 - Environmental Monitoring Assessment Program⁶

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁷
 479 - Southwest Florida Water Management District - Water Quality Monitoring¹
 540 - Shellfish Harvest Area Classification Program²
 5002 - Florida STORET / WIN³
 5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

pH - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

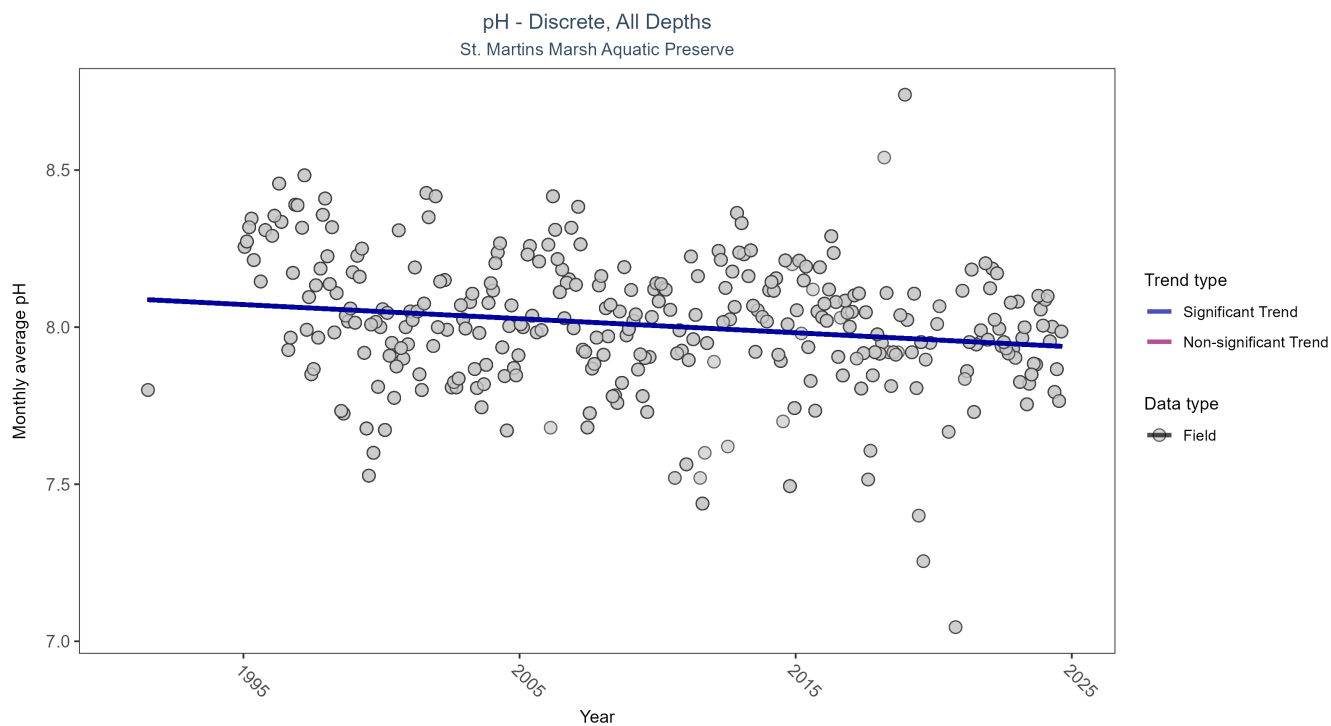


Figure 9: Seasonal Kendall-Tau Results for pH - Discrete

Table 14: Seasonal Kendall-Tau Trend Analysis for pH

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4700	31	8.07	TRUE	-0.1422	0.0004	-0.0045	8.0899	14.4026	0.2115	-1

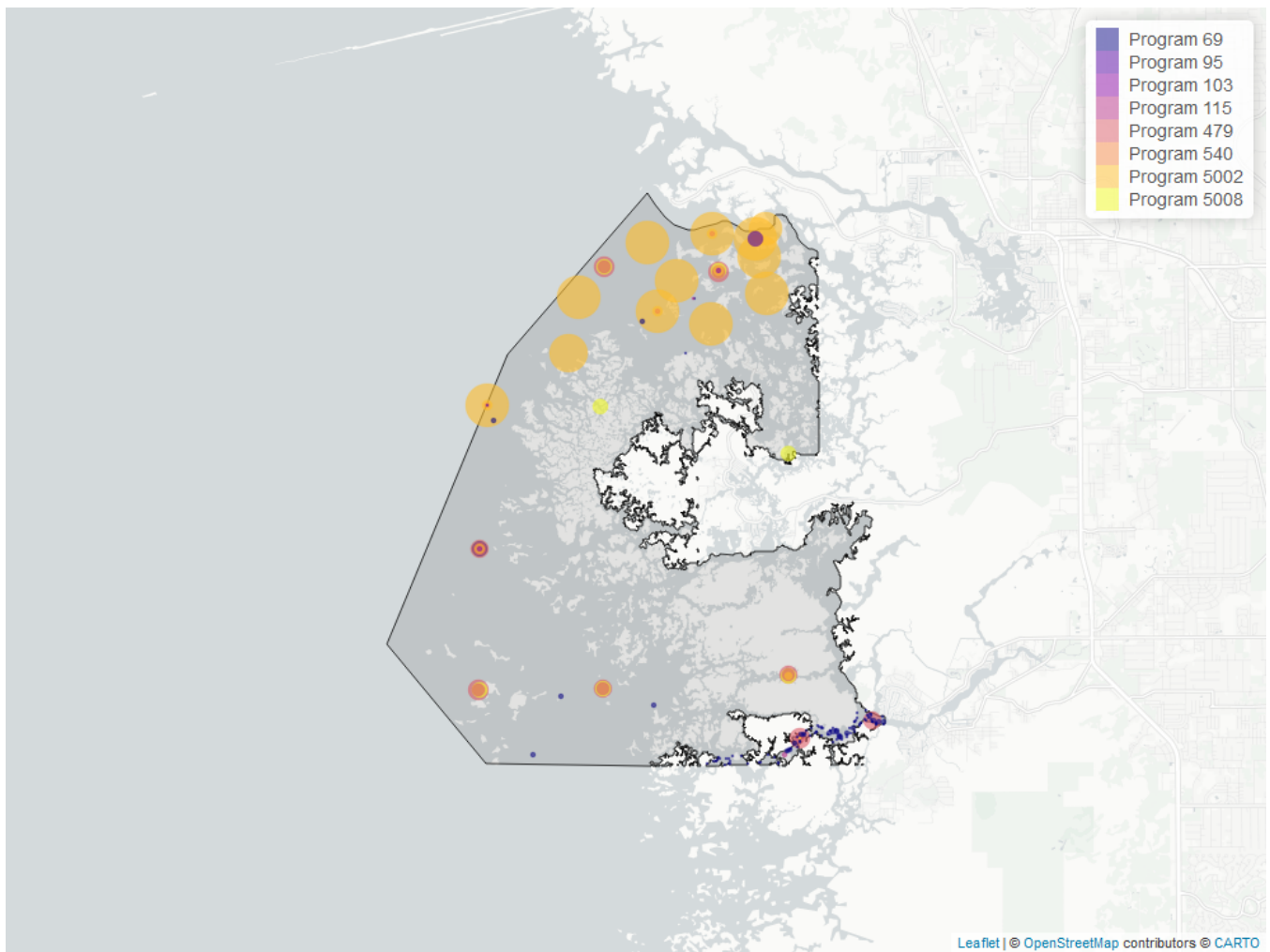


Figure 10: Map showing location of Discrete sampling sites for pH. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for pH

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	3487	1995	2021
479	597	2003	2023
5008	319	2021	2024
69	221	2003	2008
95	70	2011	2018
103	12	2021	2021
540	9	2017	2018
115	5	1991	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁹

95 - Harmful Algal Bloom Marine Observation Network¹⁰

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵

115 - Environmental Monitoring Assessment Program⁶

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program²

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Salinity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

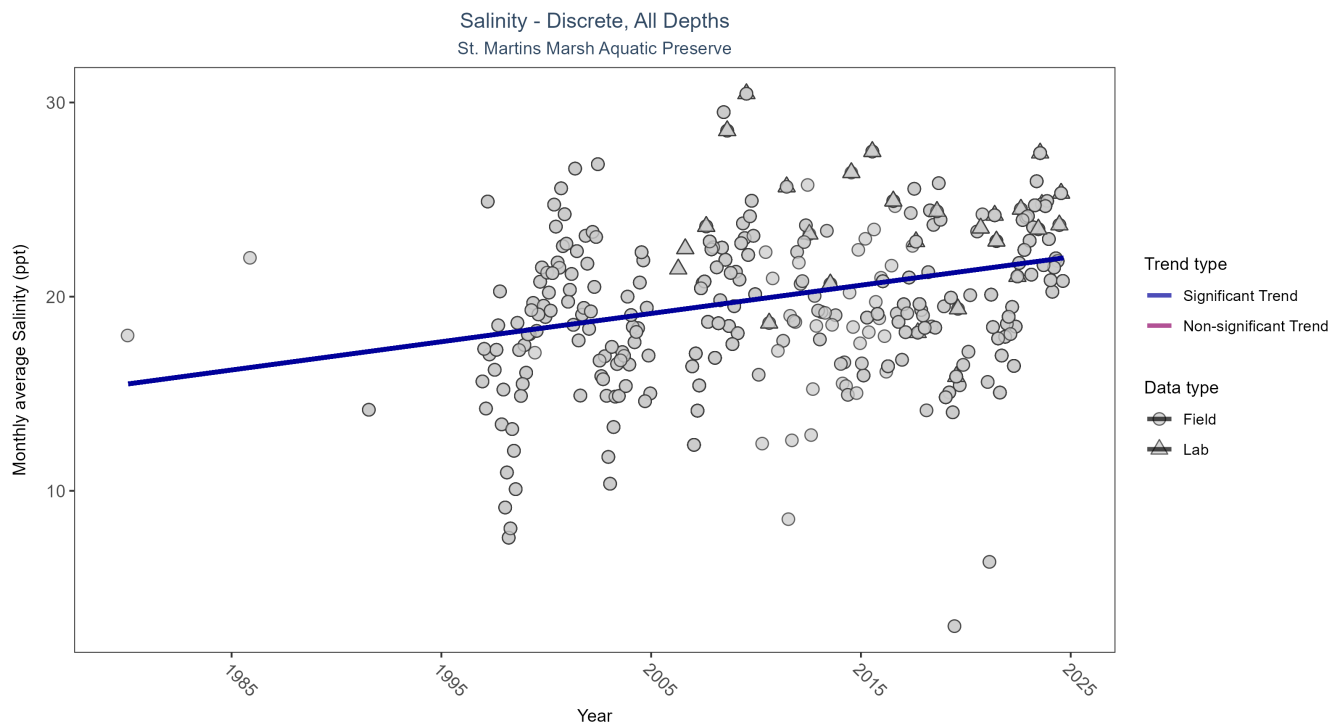


Figure 11: Seasonal Kendall-Tau Results for Salinity - Discrete

Table 16: Seasonal Kendall-Tau Trend Analysis for Salinity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	9523	33	18.4	TRUE	0.2427	0	0.1456	15.4954	5.3042	0.9155	1

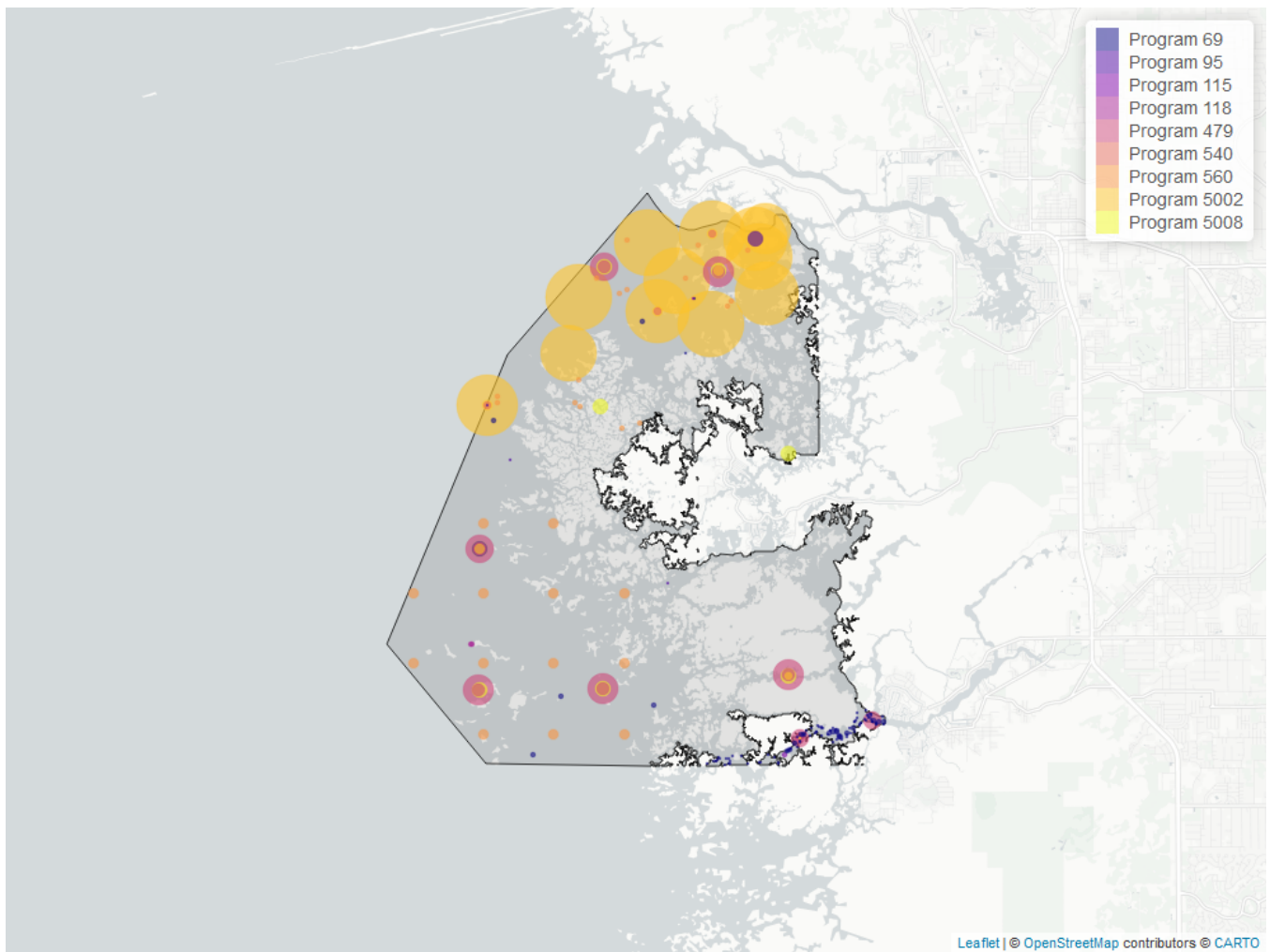


Figure 12: Map showing location of Discrete sampling sites for Salinity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Salinity

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	7536	1995	2021
479	1042	1996	2023
5008	333	2021	2024
560	310	2006	2024
69	221	2003	2008
95	77	1980	2018
540	21	2017	2019
118	8	2015	2020
115	5	1991	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁹

95 - Harmful Algal Bloom Marine Observation Network¹⁰

115 - Environmental Monitoring Assessment Program⁶

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁷

479 - Southwest Florida Water Management District - Water Quality Monitoring¹
 540 - Shellfish Harvest Area Classification Program²
 560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring¹¹
 5002 - Florida STORET / WIN³
 5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Secchi Depth - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

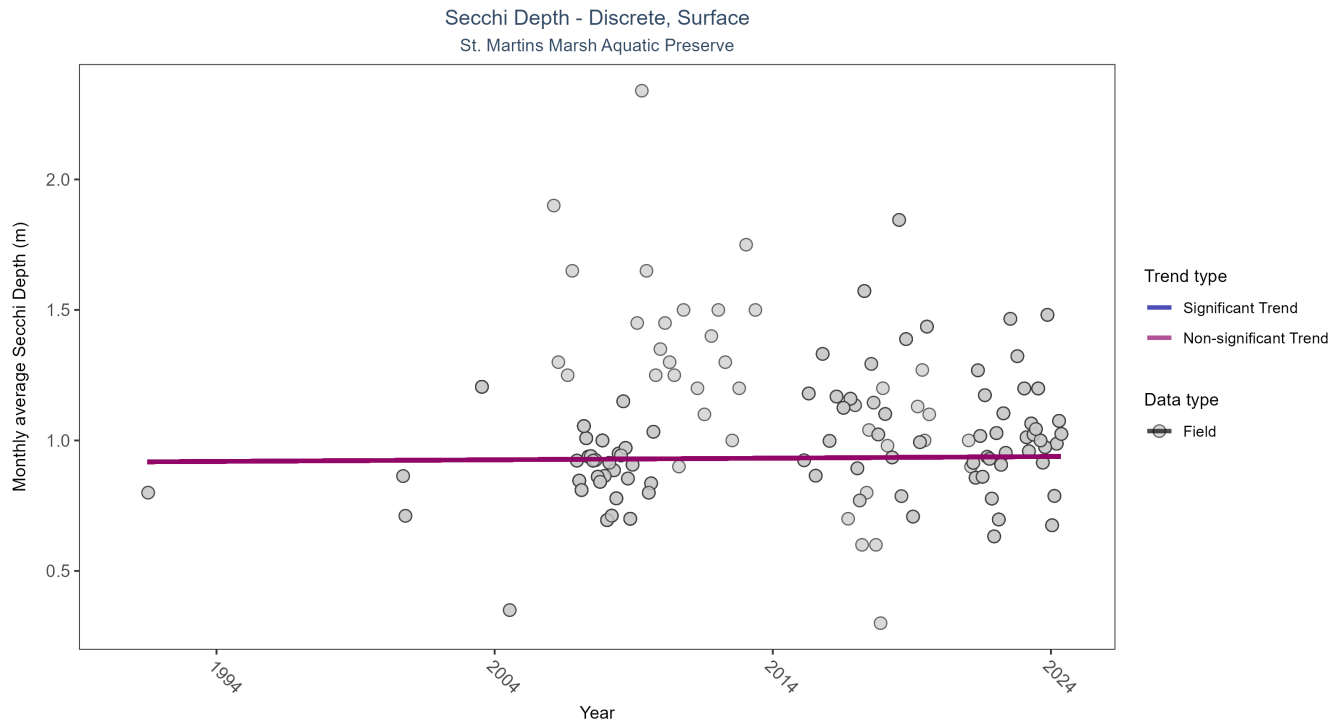


Figure 13: Seasonal Kendall-Tau Results for Secchi Depth - Discrete

Table 18: Seasonal Kendall-Tau Trend Analysis for Secchi Depth

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	865	21	0.9	TRUE	0.0194	0.8837	0.0006	0.9178	11.8992	0.3713	0

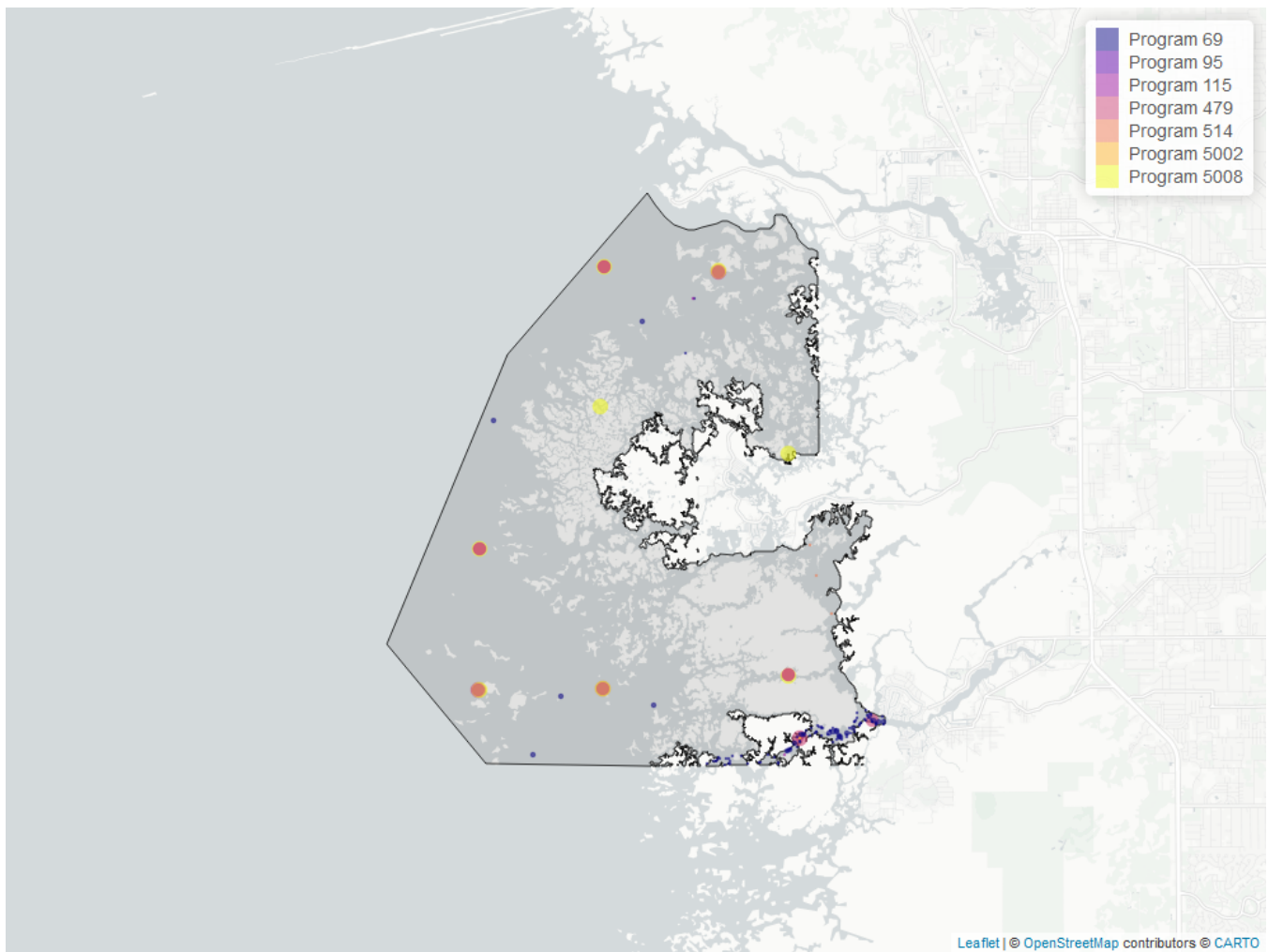


Figure 14: Map showing location of Discrete sampling sites for Secchi Depth. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Secchi Depth

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	386	2006	2023
5008	248	2021	2024
69	221	2003	2008
514	6	2000	2000
115	3	1991	2004
5002	1	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁹

115 - Environmental Monitoring Assessment Program⁶

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program⁸

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

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

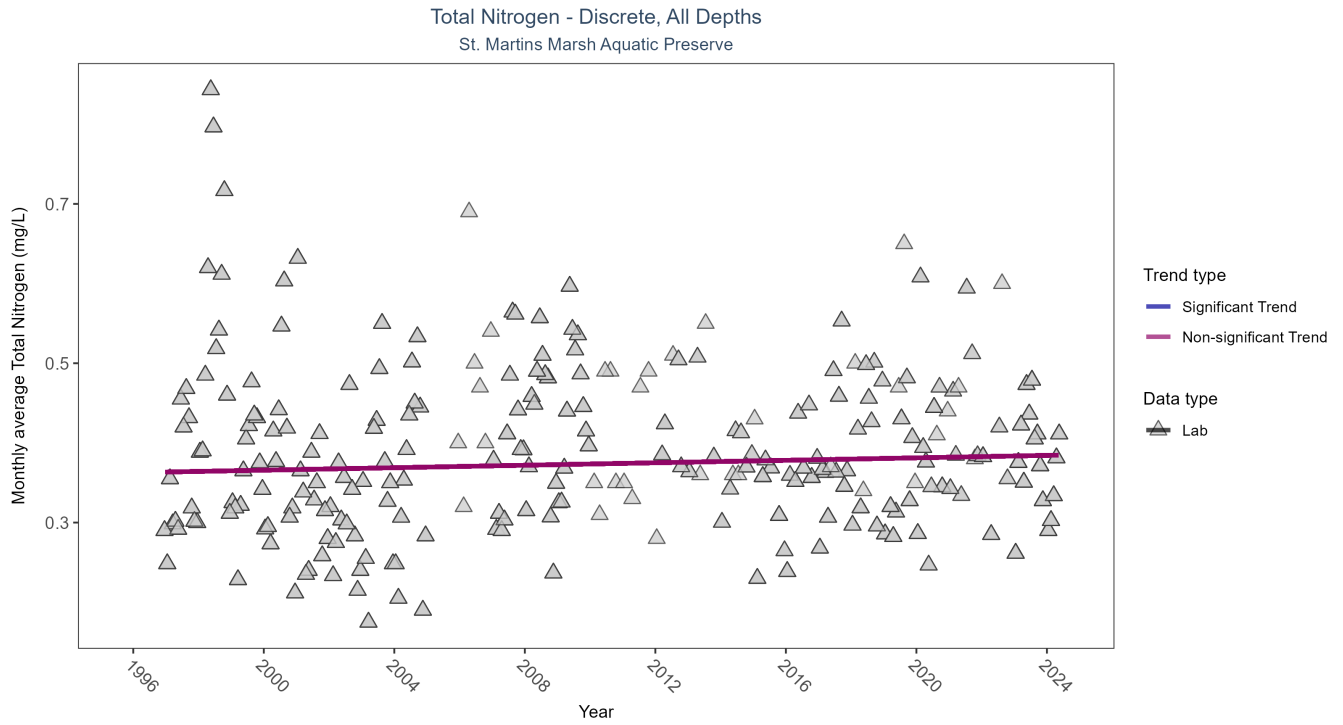


Figure 15: Seasonal Kendall-Tau Results for Total Nitrogen - Discrete

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

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1375	29	0.364	TRUE	0.0579	0.3261	0.0008	0.3627	12.3579	0.3374	0

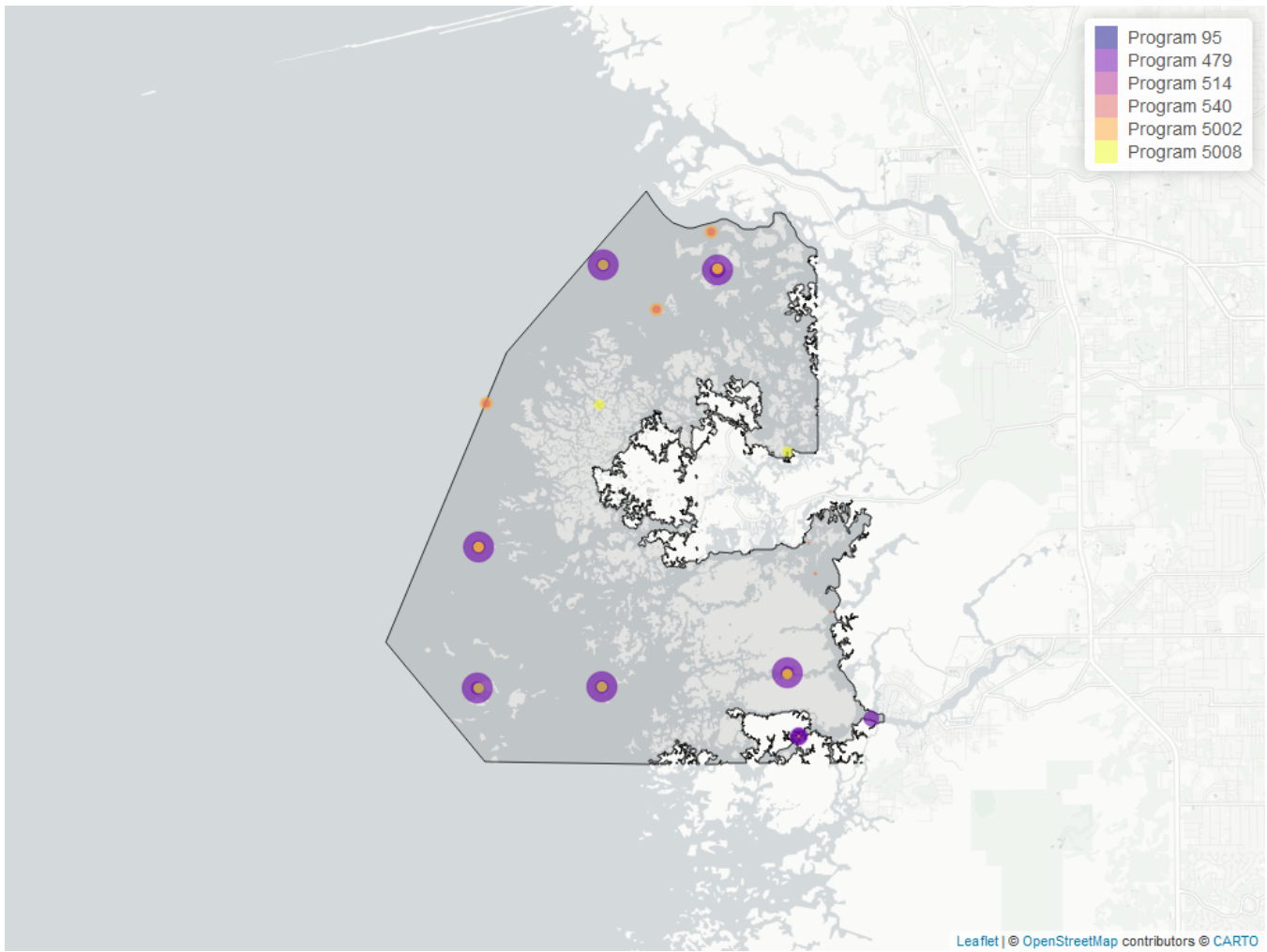


Figure 16: Map showing location of Discrete sampling sites for Total Nitrogen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Total Nitrogen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	1107	1996	2023
5008	132	2022	2024
5002	118	2000	2021
540	21	2017	2019
514	6	2000	2000

Program names:

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program⁸

540 - Shellfish Harvest Area Classification Program²

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

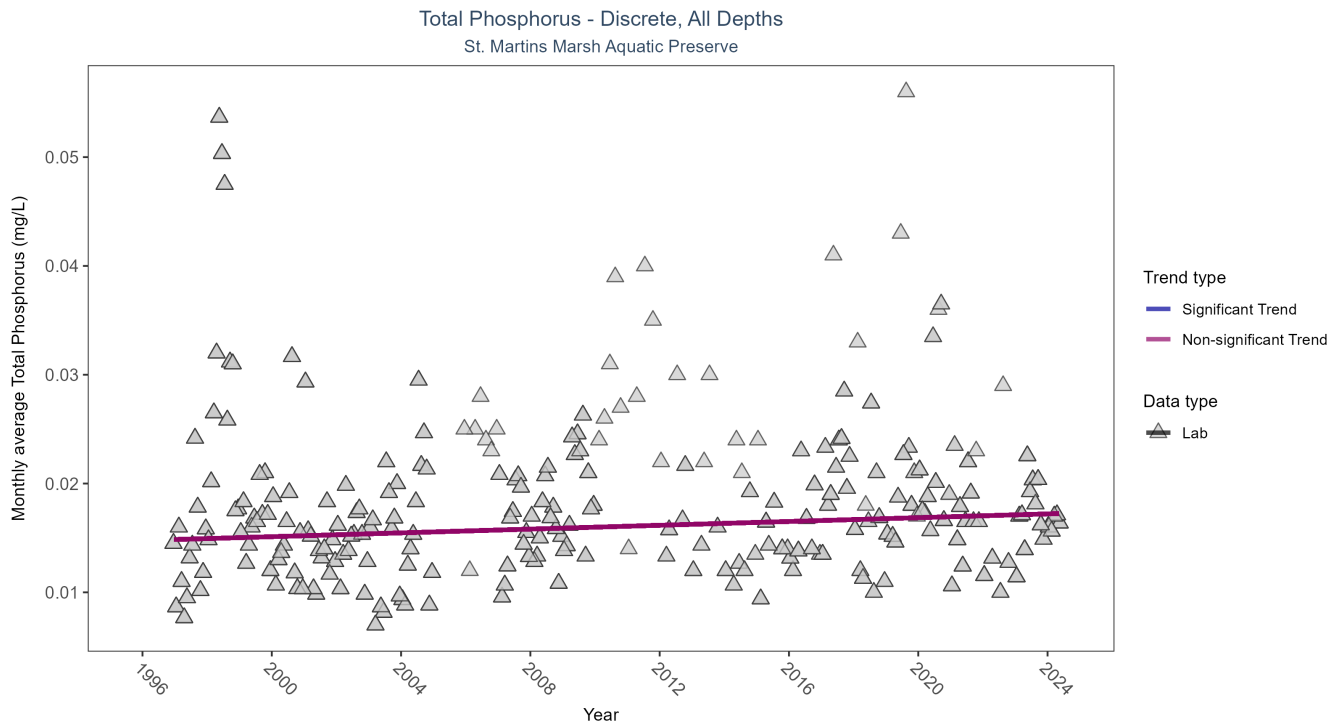


Figure 17: Seasonal Kendall-Tau Results for Total Phosphorus - Discrete

Table 22: Seasonal Kendall-Tau Trend Analysis for Total Phosphorus

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1433	29	0.015	TRUE	0.098	0.0526	0.0001	0.0148	5.2034	0.9209	0

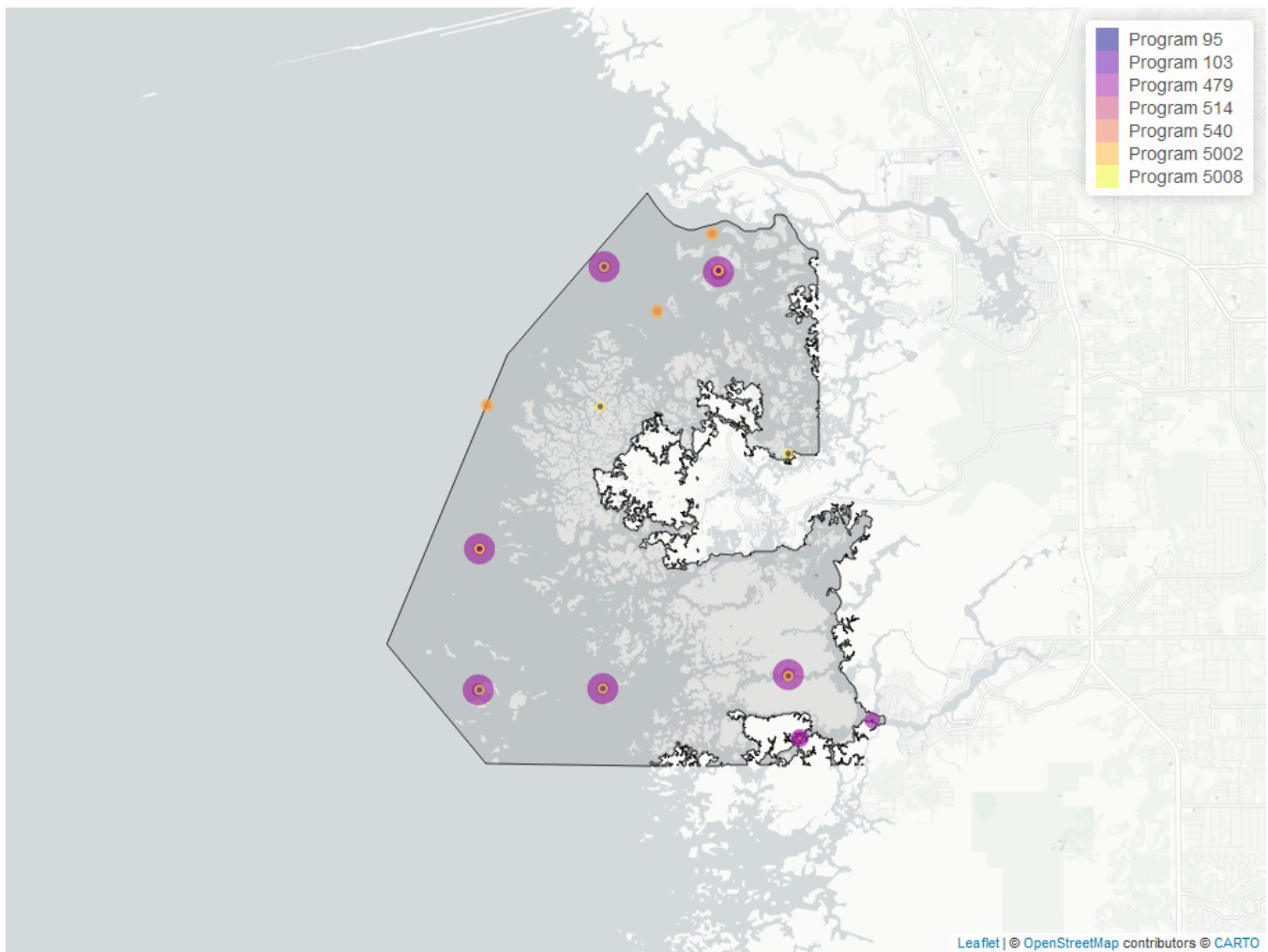


Figure 18: Map showing location of Discrete sampling sites for Total Phosphorus. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Phosphorus

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	1105	1996	2023
5008	132	2022	2024
5002	112	2012	2021
103	61	2020	2021
540	21	2017	2019
514	6	2000	2000

Program names:

103 - EPA STORage and RETrieval Data Warehouse (STORET)/WQX⁵

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program⁸

540 - Shellfish Harvest Area Classification Program²

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Total Suspended Solids - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

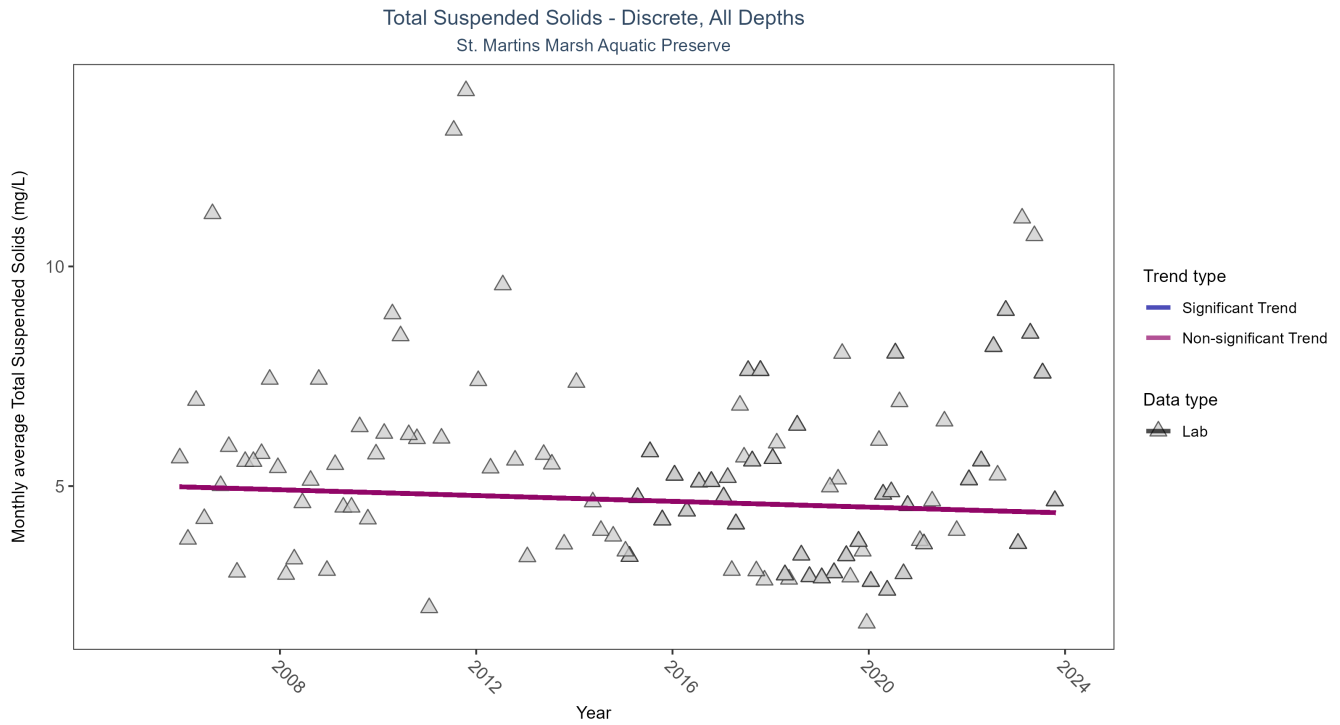


Figure 19: Seasonal Kendall-Tau Results for Total Suspended Solids - Discrete

Table 24: Seasonal Kendall-Tau Trend Analysis for Total Suspended Solids

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	307	19	4.62	TRUE	-0.0203	0.4603	-0.033	5.0156	13.217	0.2794	0

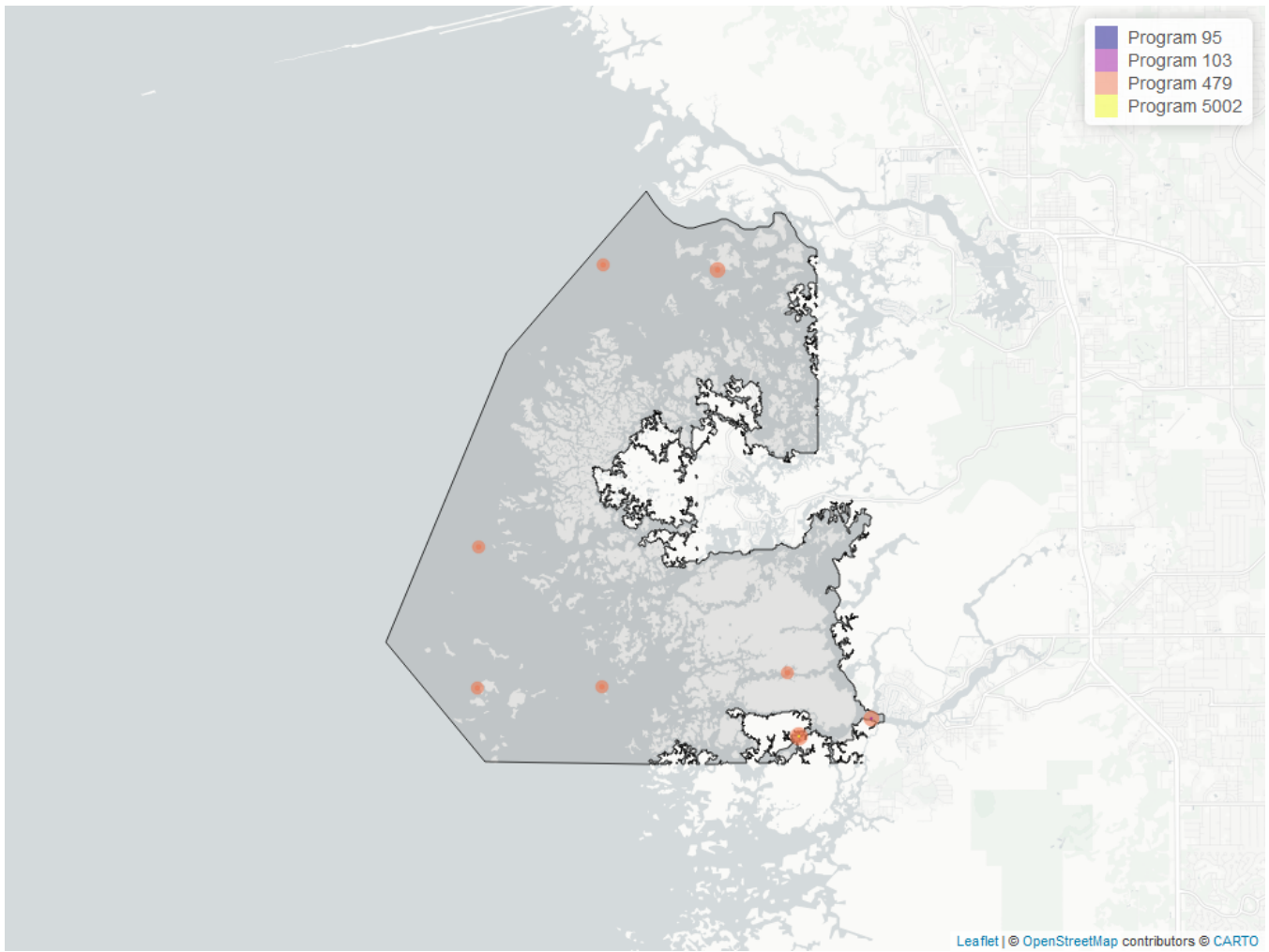


Figure 20: Map showing location of Discrete sampling sites for Total Suspended Solids. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Suspended Solids

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	310	2005	2023
103	1	2020	2020
5002	1	2015	2015

Program names:

- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵
- 479 - Southwest Florida Water Management District - Water Quality Monitoring¹
- 5002 - Florida STORET / WIN³

Turbidity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

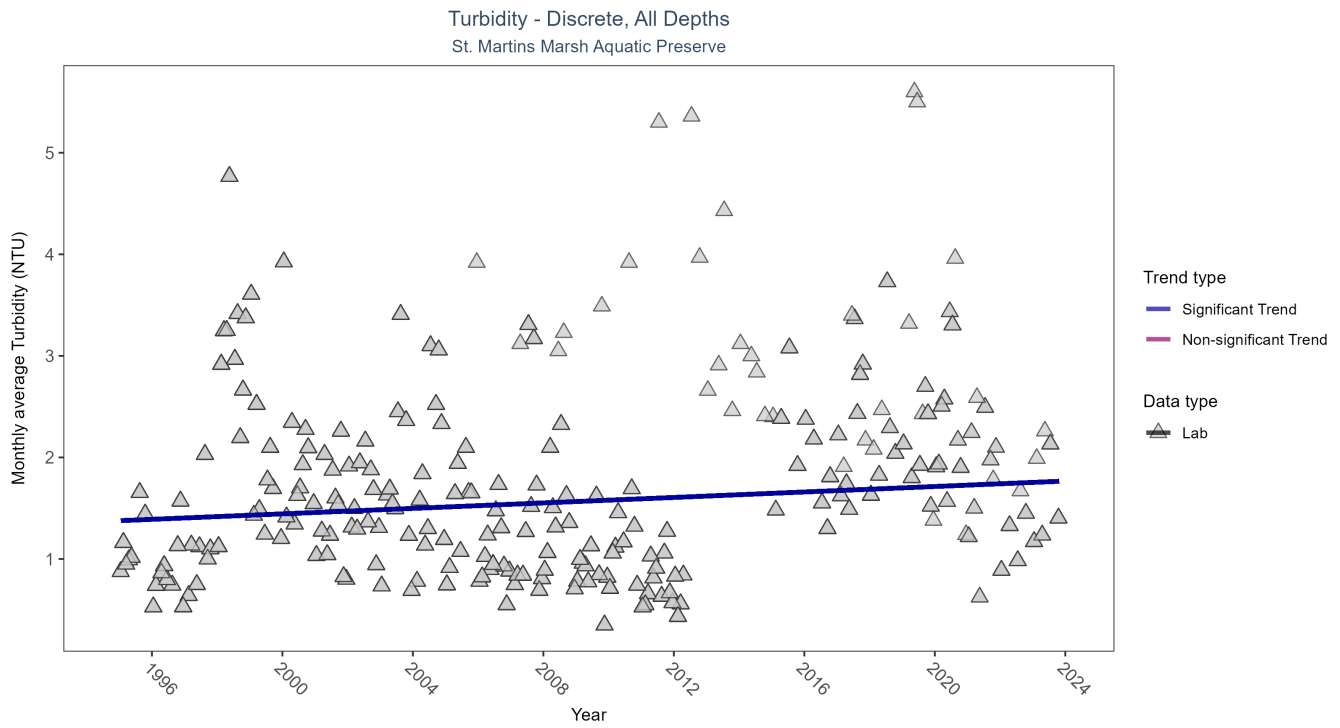


Figure 21: Seasonal Kendall-Tau Results for Turbidity - Discrete

Table 26: Seasonal Kendall-Tau Trend Analysis for Turbidity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	3133	29	1.1	TRUE	0.0975	0.031	0.0135	1.3769	4.4176	0.9561	1

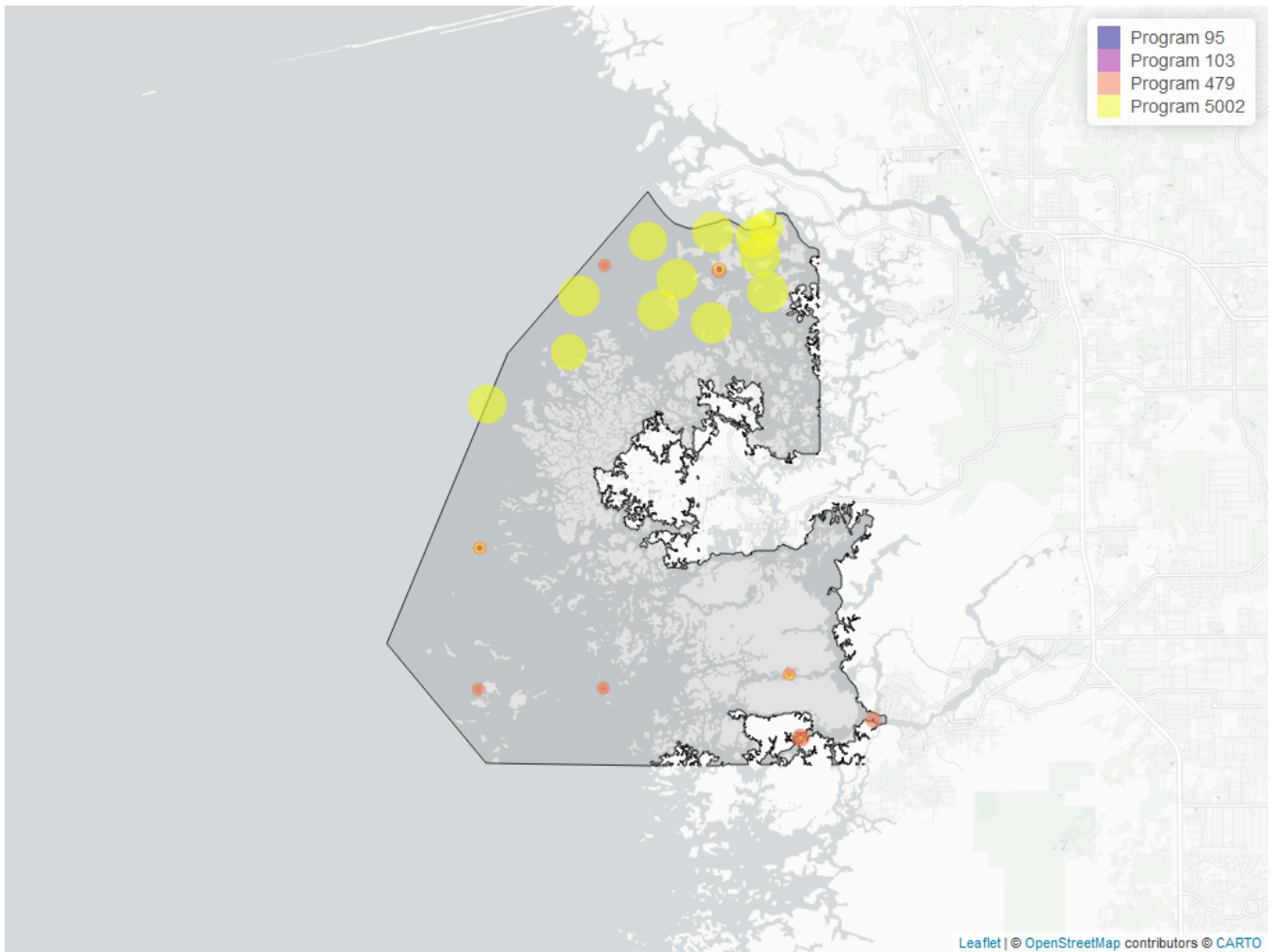


Figure 22: Map showing location of Discrete sampling sites for Turbidity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Turbidity

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	2819	1995	2021
479	316	2005	2023
103	13	2020	2021

Program names:

- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵
- 479 - Southwest Florida Water Management District - Water Quality Monitoring¹
- 5002 - Florida STORET / WIN³

Water Temperature - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

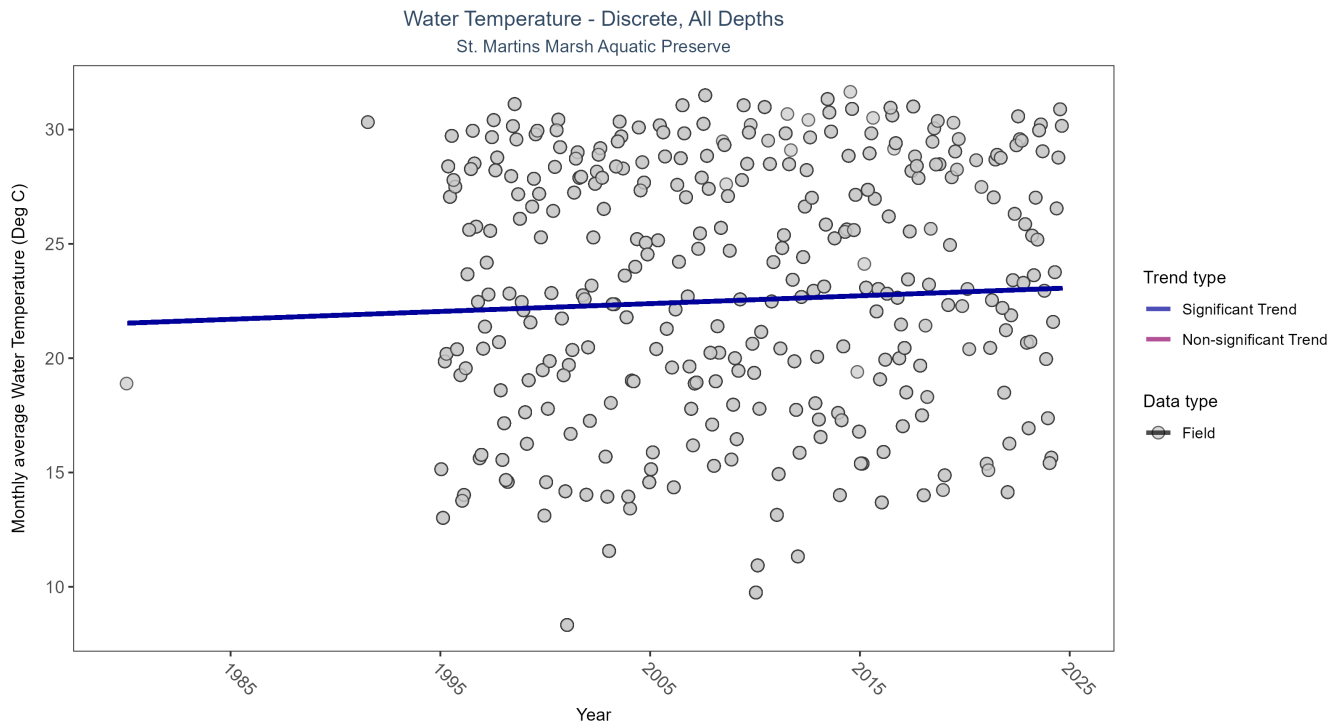


Figure 23: Seasonal Kendall-Tau Results for Water Temperature - Discrete

Table 28: Seasonal Kendall-Tau Trend Analysis for Water Temperature

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	9040	32	22.7	TRUE	0.1349	0.0007	0.0343	21.5299	6.3733	0.8473	1

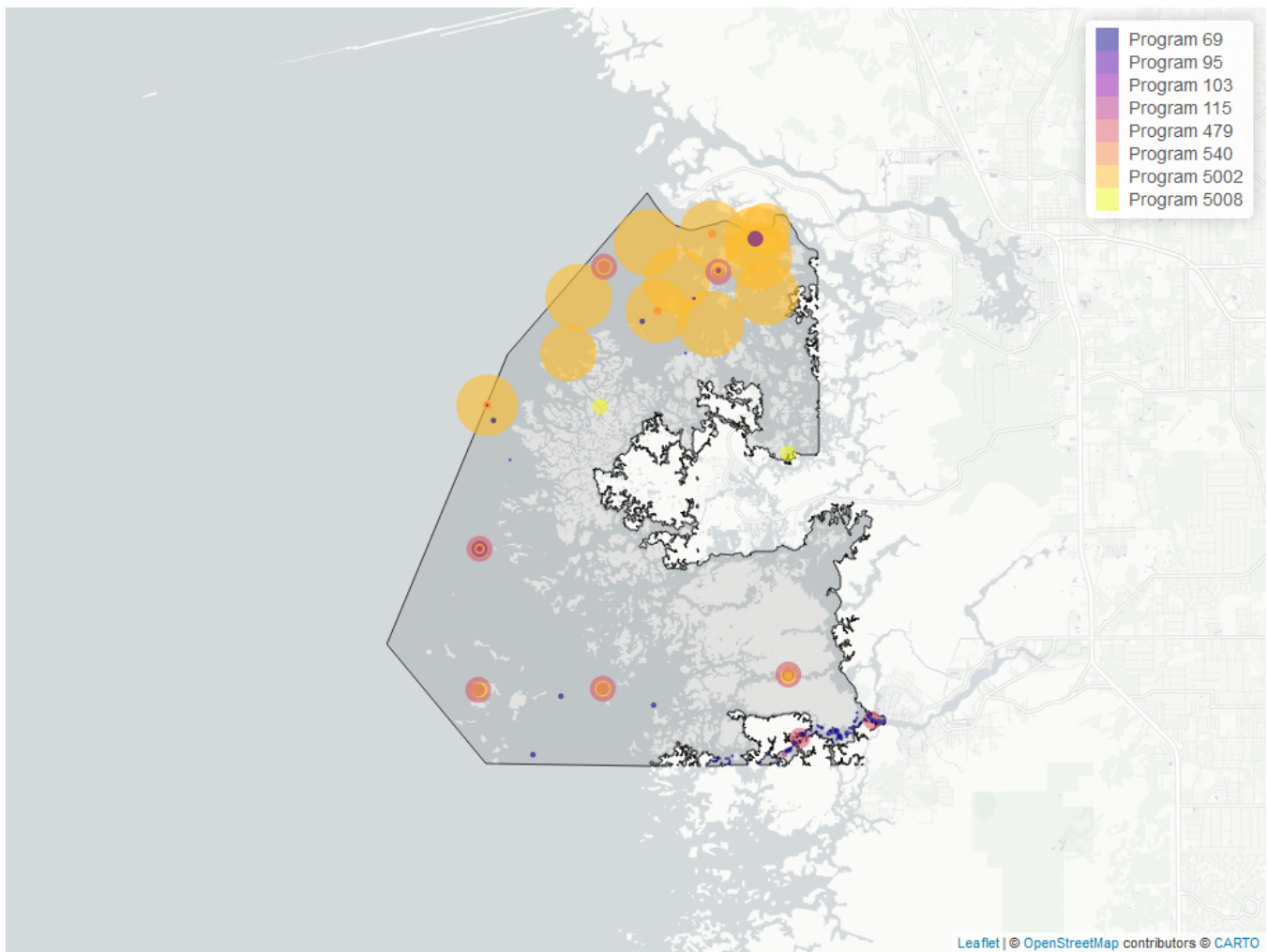


Figure 24: Map showing location of Discrete sampling sites for Water Temperature. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Water Temperature

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	7535	1995	2021
479	855	1996	2023
5008	320	2021	2024
69	221	2003	2008
95	72	1980	2018
540	21	2017	2019
103	12	2021	2021
115	5	1991	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁹

95 - Harmful Algal Bloom Marine Observation Network¹⁰

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁵

115 - Environmental Monitoring Assessment Program⁶

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program²

5002 - Florida STORET / WIN³

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁴

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NW-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NW-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_pH_NW-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NW-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NW-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NW-2024-Dec-08.txt*

Continuous monitoring locations in St. Martins Marsh Aquatic Preserve

Table 30: Big Bend Seagrasses Aquatic Preserves Continuous Water Quality Monitoring (471)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
BBSCH	7	TRUE	DO , DOS , pH , Sal , Turb , TempW

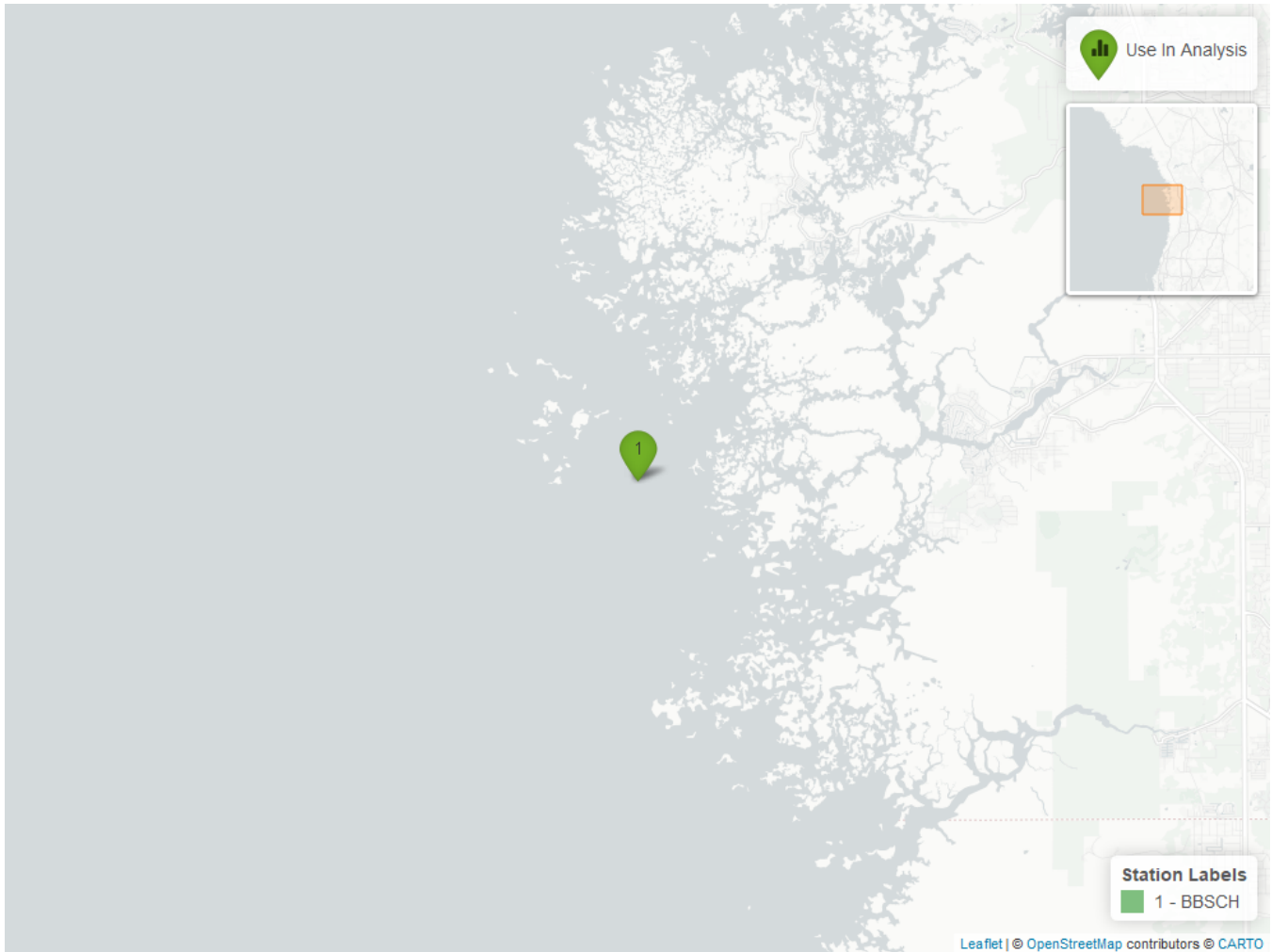


Figure 25: Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of St. Martins Marsh Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

Submerged Aquatic Vegetation

The data file used is: **All_SAV_Parameters-2024-Dec-08.txt**

Submerged aquatic vegetation (SAV) refers to plants and plant-like macroalgae species that live entirely underwater. The two primary categories of SAV inhabiting Florida estuaries are *benthic macroalgae* and *seagrasses*. They often grow together in dense beds or meadows that carpet the seafloor. *Macroalgae* include multicellular species of green, red and brown algae that often live attached to the substrate by a holdfast. They tend to grow quickly and can tolerate relatively high nutrient levels, making them a threat to seagrasses and other benthic habitats in areas with poor water quality. In contrast, *seagrasses* are grass-like, vascular, flowering plants that are attached to the seafloor by extensive root systems. *Seagrasses* occur throughout the coastal areas of Florida, including protected bays and lagoons as well as deeper offshore waters on the continental shelf. *Seagrasses* have taken advantage of the broad, shallow shelf and clear water to produce two of the most extensive seagrass beds anywhere in continental North America.

Parameters

Percent Cover measures the fraction of an area of seafloor that is covered by SAV, usually estimated by evaluating multiple small areas of seafloor. Percent cover is often estimated for total SAV, individual types of vegetation (seagrass, attached algae, drift algae) and individual species.

Frequency of Occurrence was calculated as the number of times a taxon was observed in a year divided by the number of sampling events, multiplied by 100. Analysis is conducted at the quadrat level and is inclusive of all quadrats (i.e., quadrats evaluated using Braun-Blanquet, modified Braun-Blanquet, and percent cover.”

Species

Turtle grass (*Thalassia testudinum*) is the largest of the Florida seagrasses, with longer, thicker blades and deeper root structures than any of the other seagrasses. It is considered a climax seagrass species.

Shoal grass (*Halodule wrightii*) is an early colonizer of vegetated areas and usually grows in water too shallow for other species except *widgeon grass*. It can often tolerate larger salinity ranges than other seagrass species. *Shoal grass* is characterized by thin, flat blades, that are narrower than *turtle grass* blades.

Manatee grass (*Syringodium filiforme*) is easily recognizable because its leaves are thin and cylindrical instead of the flat, ribbon-like form shared by many other seagrass species. The leaves can grow up to half a meter in length. *Manatee grass* is usually found in mixed seagrass beds or small, dense monospecific patches.

Widgeon grass (*Ruppia maritima*) grows in both fresh and salt water and is widely distributed throughout Florida’s estuaries in less saline areas, particularly in inlets along the east coast. This species resembles *shoal grass* in certain environments but can be identified by the pointed tips of its leaves.

Three species of *Halophila spp.* are found in Florida - **Star grass** (*Halophila engelmannii*), **Paddle grass** (*Halophila decipiens*), and **Johnson’s seagrass** (*Halophila johnsonii*). These are smaller, more fragile seagrasses than other Florida species and are considered ephemeral. They grow along a single long rhizome, with short blades. These species are not well-studied, although surveys are underway to define their ecological roles.

Notes

Star grass, *Paddle grass*, and *Johnson’s seagrass* will be grouped together and listed as **Halophila spp.** in the following managed areas. This is because several surveys did not specify to the species level:

- Banana River Aquatic Preserve
- Indian River-Malabar to Vero Beach Aquatic Preserve
- Indian River-Vero Beach to Ft. Pierce Aquatic Preserve
- Jensen Beach to Jupiter Inlet Aquatic Preserve
- Loxahatchee River-Lake Worth Creek Aquatic Preserve
- Mosquito Lagoon Aquatic Preserve

- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

St. Martins Marsh Aquatic Preserve
SAV Percent Cover - Sample Locations



Figure 26: Maps showing the temporal scope of SAV sampling sites within the boundaries of *St. Martins Marsh Aquatic Preserve* by Program name.

Sampling locations by Program:

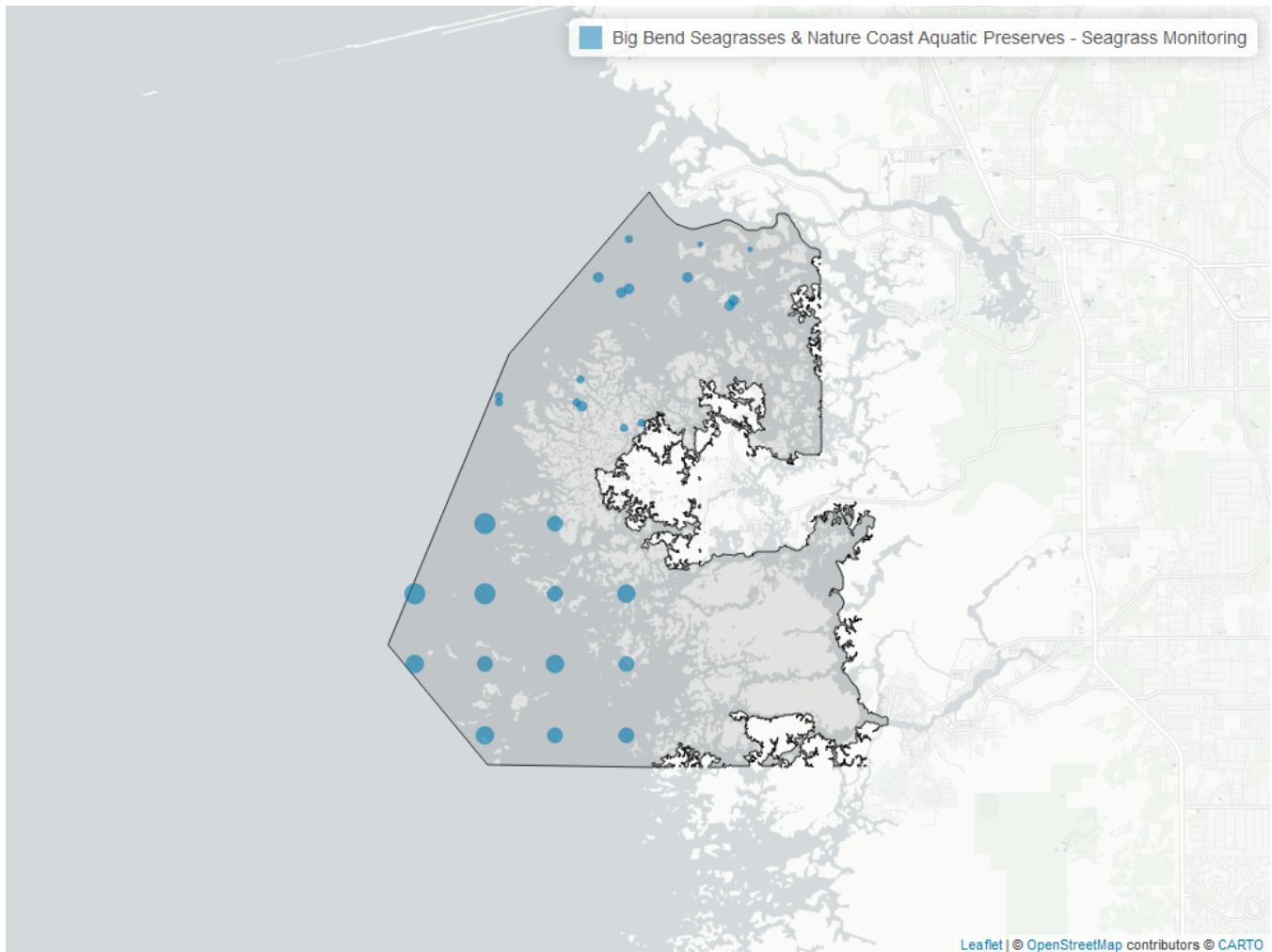


Figure 27: Map showing SAV sampling sites within the boundaries of *St. Martins Marsh Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 31: Big Bend Seagrasses and Nature Coast Aquatic Preserves - Seagrass Monitoring - Program 560

<i>N-Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>method</i>	<i>Sample Locations</i>
5773	1997	2024	Modified Braun Blanquet	29
1437	2021	2024	Percent Cover	29

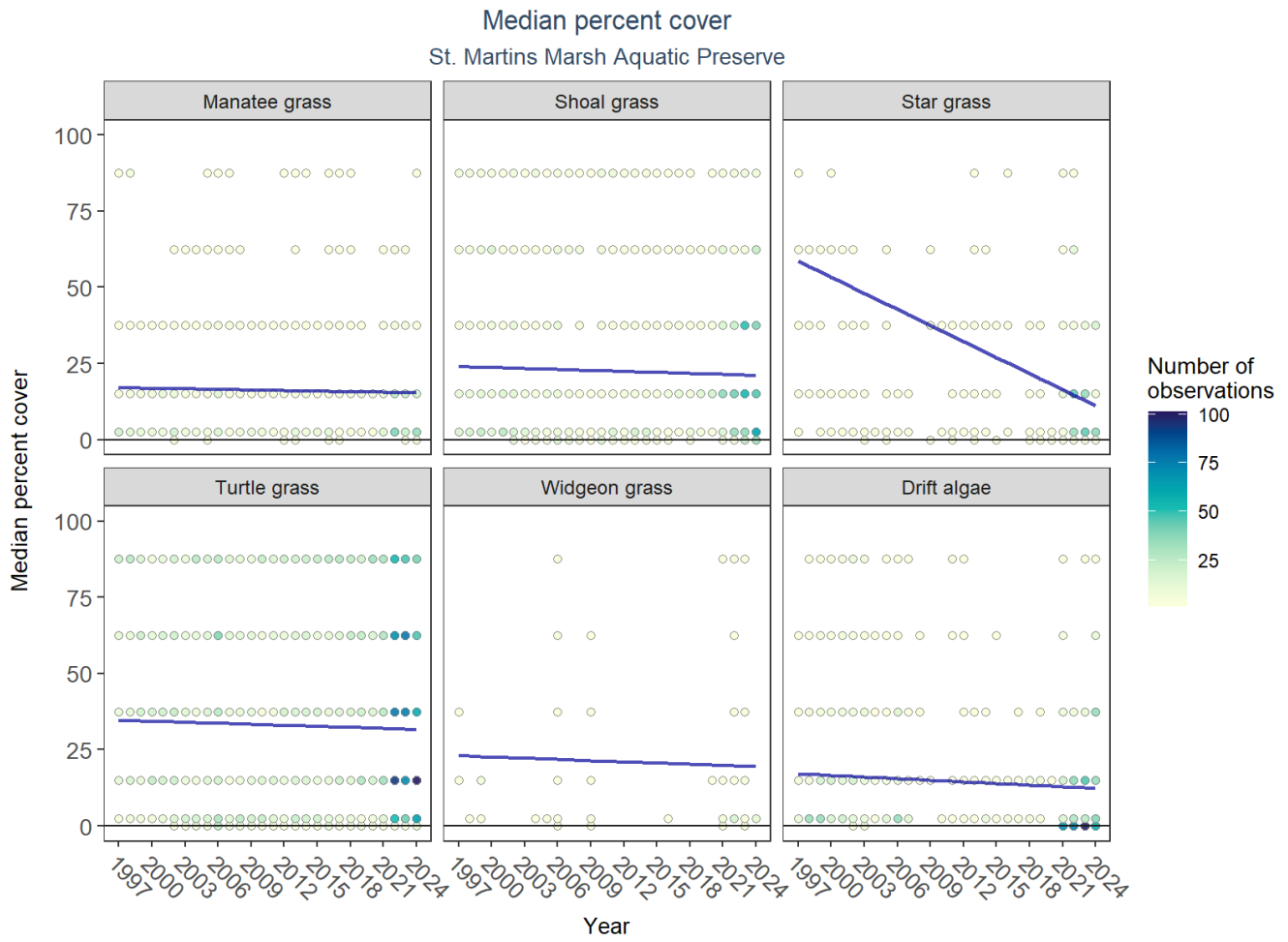


Figure 28: Trends in median percent cover for various seagrass species in St. Martins Marsh Aquatic Preserve

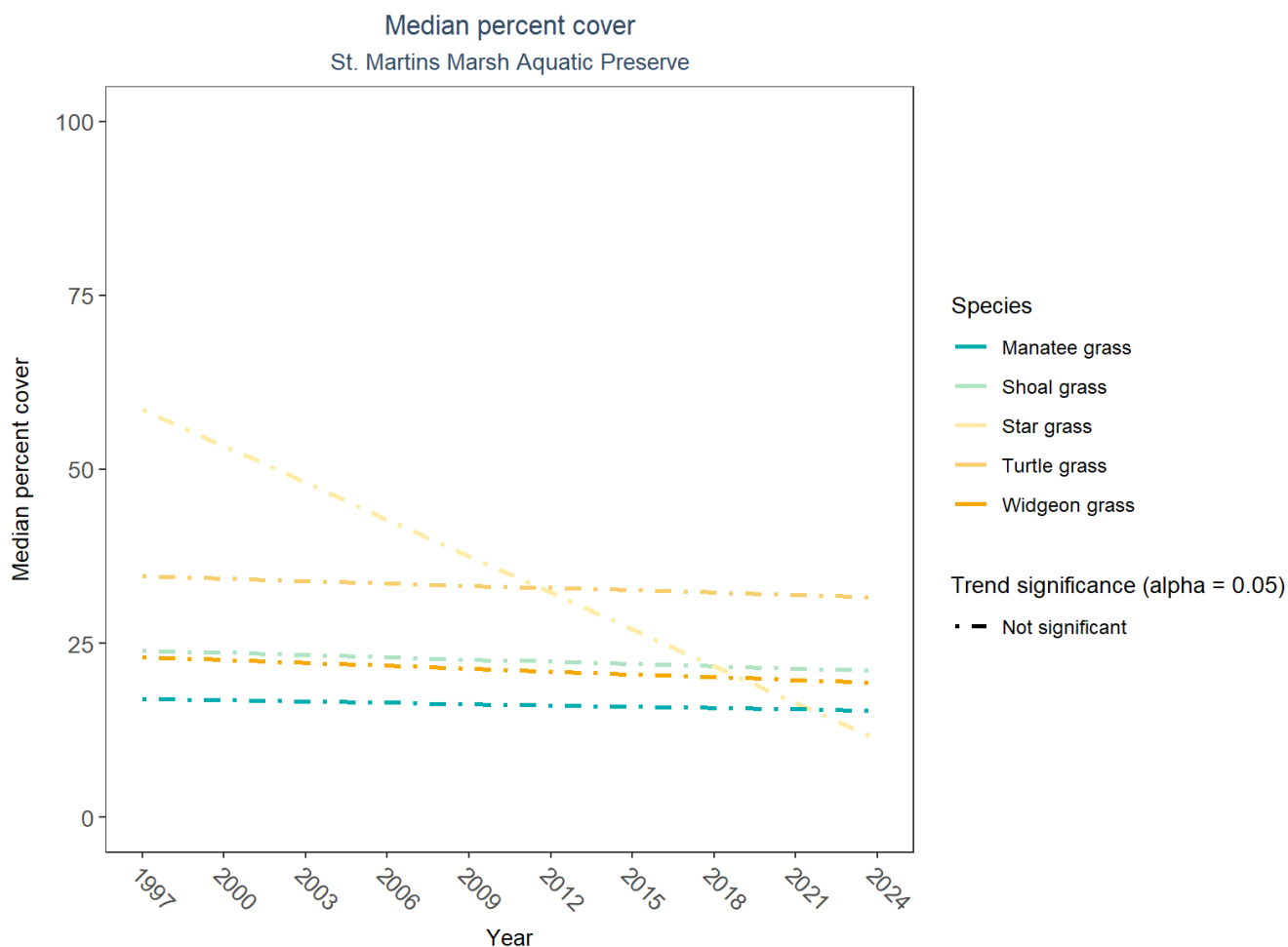


Figure 29: Trends in median percent cover for various seagrass species in St. Martins Marsh Aquatic Preserve - simplified

Table 32: Percent Cover Trend Analysis for St. Martins Marsh Aquatic Preserve

<i>CommonName</i>	<i>Trend Significance (0.05)</i>	<i>Period of Record</i>	<i>LME-Intercept</i>	<i>LME-Slope</i>	<i>p</i>
Drift algae	No significant trend	1997 - 2024	17.60004	-0.1772381	0.2145269
Shoal grass	No significant trend	1997 - 2024	24.31526	-0.1078263	0.5543763
Star grass	No significant trend	1997 - 2024	63.88822	-1.7563592	0.0916191
No grass in quadrat	Model did not fit the available data	1997 - 2021	-	-	-
Widgeon grass	No significant trend	1997 - 2024	23.38668	-0.1339982	0.7244749
Manatee grass	No significant trend	1997 - 2024	17.22458	-0.0625863	0.7444773
Turtle grass	No significant trend	1997 - 2024	34.98292	-0.1117754	0.4685834

Frequency of occurrence
St. Martins Marsh Aquatic Preserve

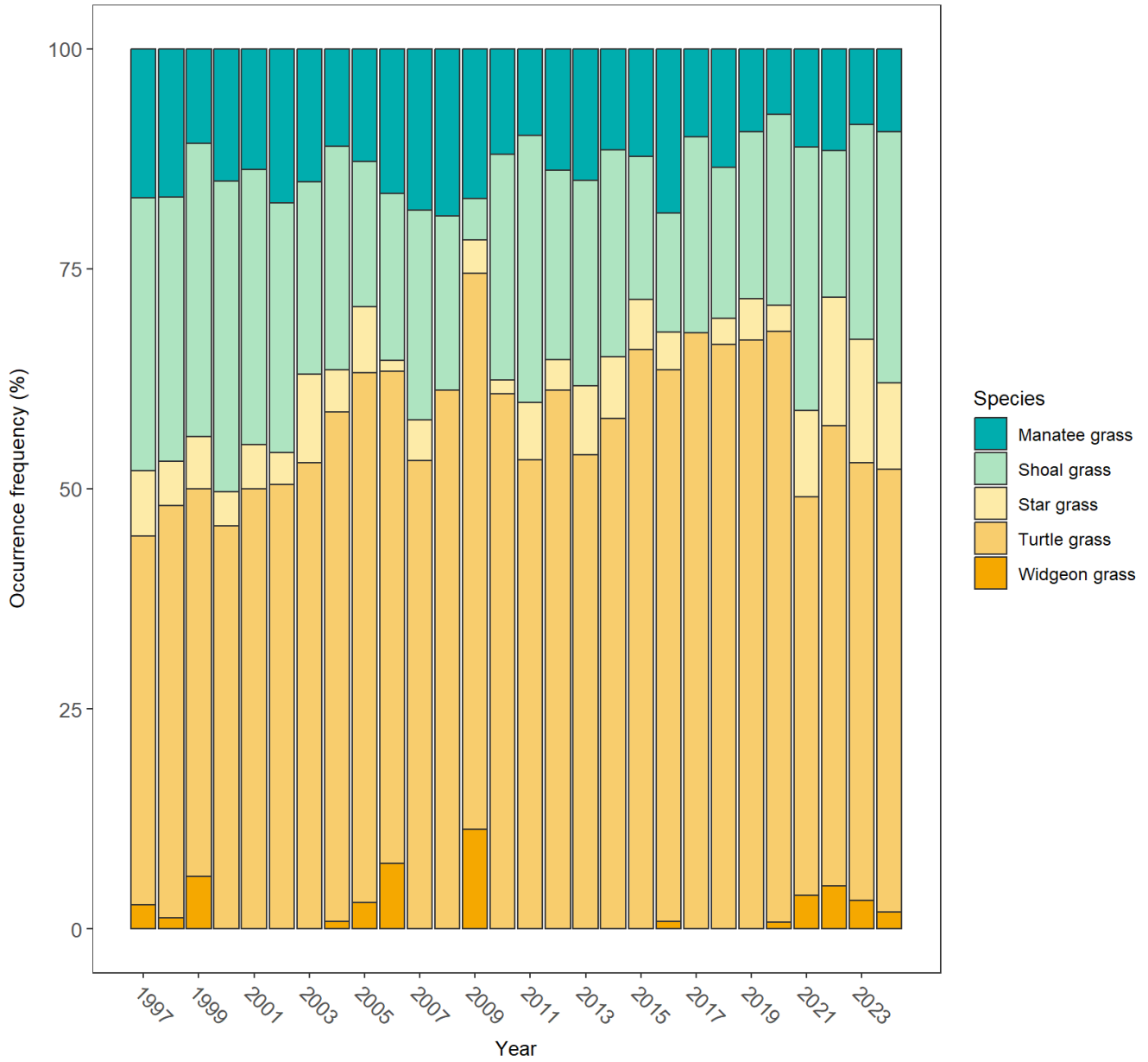


Figure 30: Frequency of occurrence for various seagrass species in St. Martins Marsh Aquatic Preserve

Nekton

The data file used is: **All_NEKTON_Parameters-2024-Dec-17.txt**

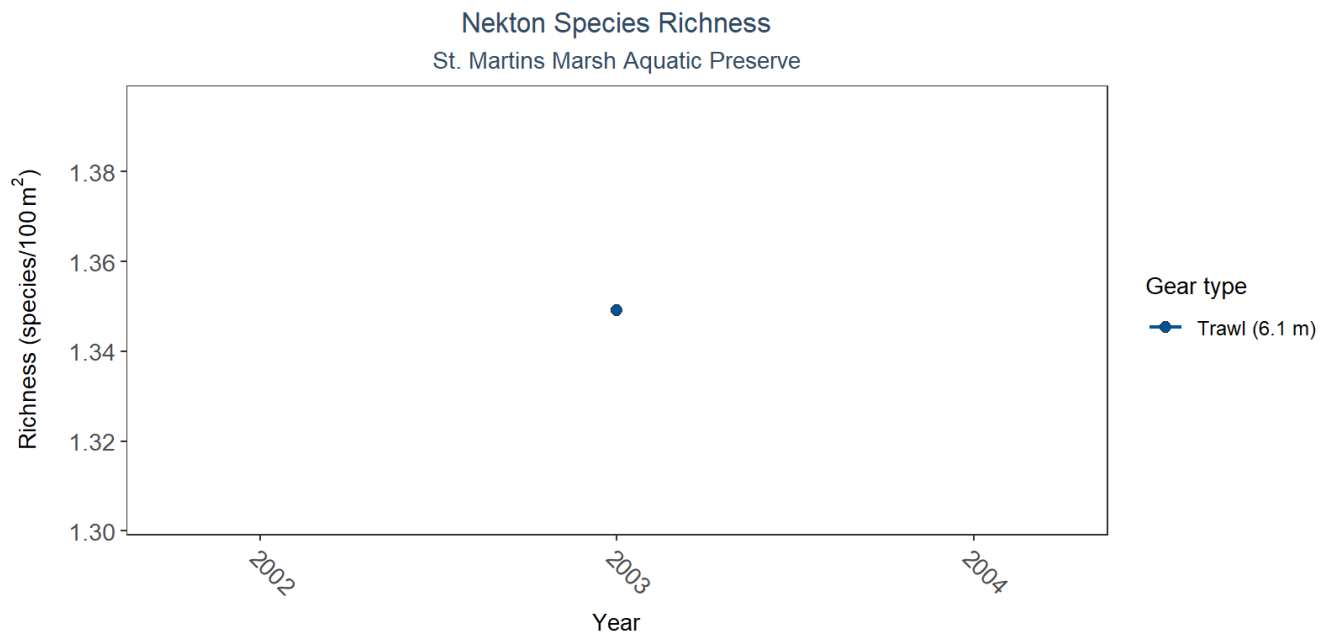


Figure 31: Figure for Nekton Species Richness in St. Martins Marsh Aquatic Preserve

Table 33: 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)	1	1	2003 - 2003	1.35	1.35

References

1. Southwest Florida Water Management District (SWFWMD). [Southwest Florida Water Management District - Water Quality Monitoring](#). (2024).
2. Florida Department of Agriculture and Consumer Services (FDACS) - Division of Aquaculture. [Shellfish Harvest Area Classification Program](#). (2022).
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5. U.S. Environmental Protection Agency (EPA). [EPA STORage and RETrieval Data Warehouse \(STORET\)/WQX](#). (2023).
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7. 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).
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10. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). [Harmful Algal Bloom Marine Observation Network](#). (2018).
11. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Big Bend Seagrasses Aquatic Preserves; University of Florida - Nature Coast Aquatic Preserve. [Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring](#). (2024).