Big Bend Seagrasses Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 08 January, 2025

Contents

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

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
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

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
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	-	-

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Dissolved Oxygen	mg/L	-0.000001	25
Dissolved Oxygen Saturation	%	-0.000001	310
Fluorescent Dissolved Organic Matter	QSE	-	-
Light Extinction Coefficient	mˆ-1	-	-
NO2+3, Filtered	mg/L	-	-
Nitrate (NO3)	mg/L	-	-
Nitrite (NO2)	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO4)	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

SEACAR QAQC Description	*Include*	*SEACAR QAQCFlagCode*
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

Qualifier Source	*Value Qualifier*	*Include*	*MDL*	*Description*
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 determiniation; 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

Qualifier Source	*Value Qualifier*	*Include*	*Description*
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, andwater 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 $p >= 0.05$). 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

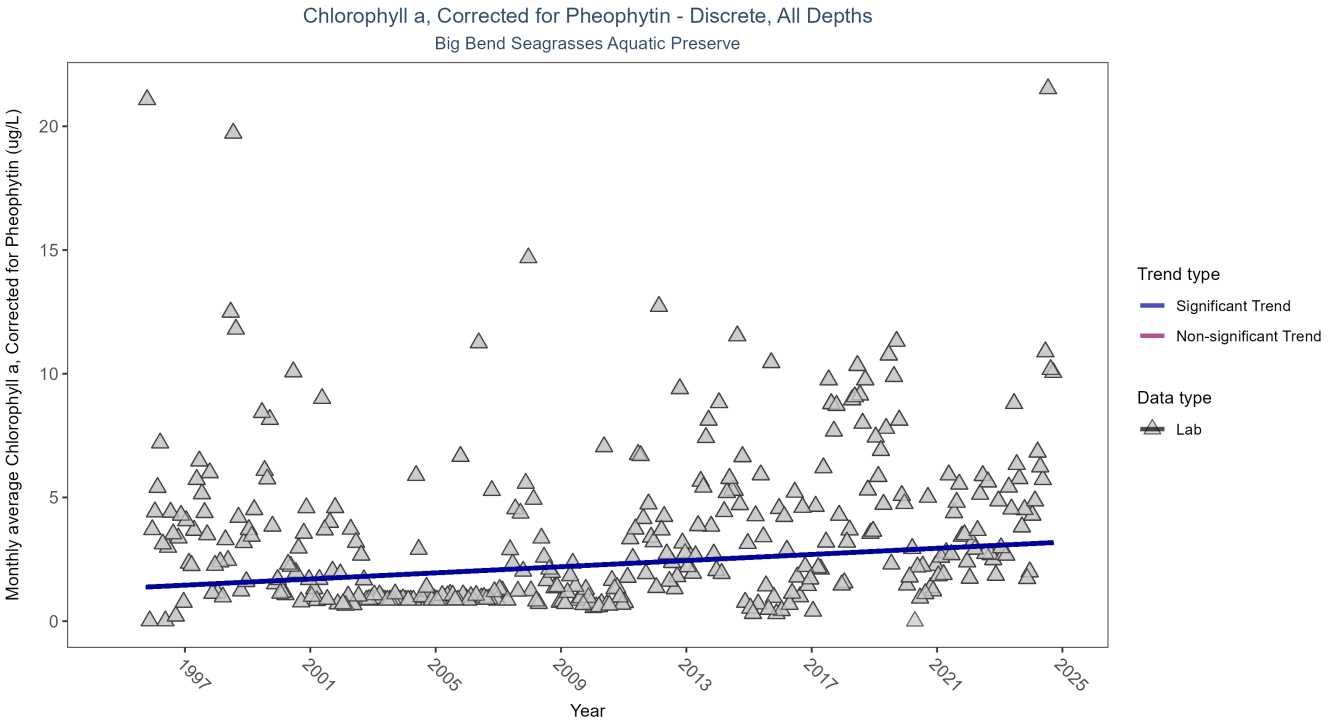

Figure 1: Seasonal Kendall-Tau Results for Chlorophyll a, Corrected for Pheophytin - Discrete

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	4739	30	1.1	TRUE	0.179	0	0.0621	1.3303	5.768	0.8884	1

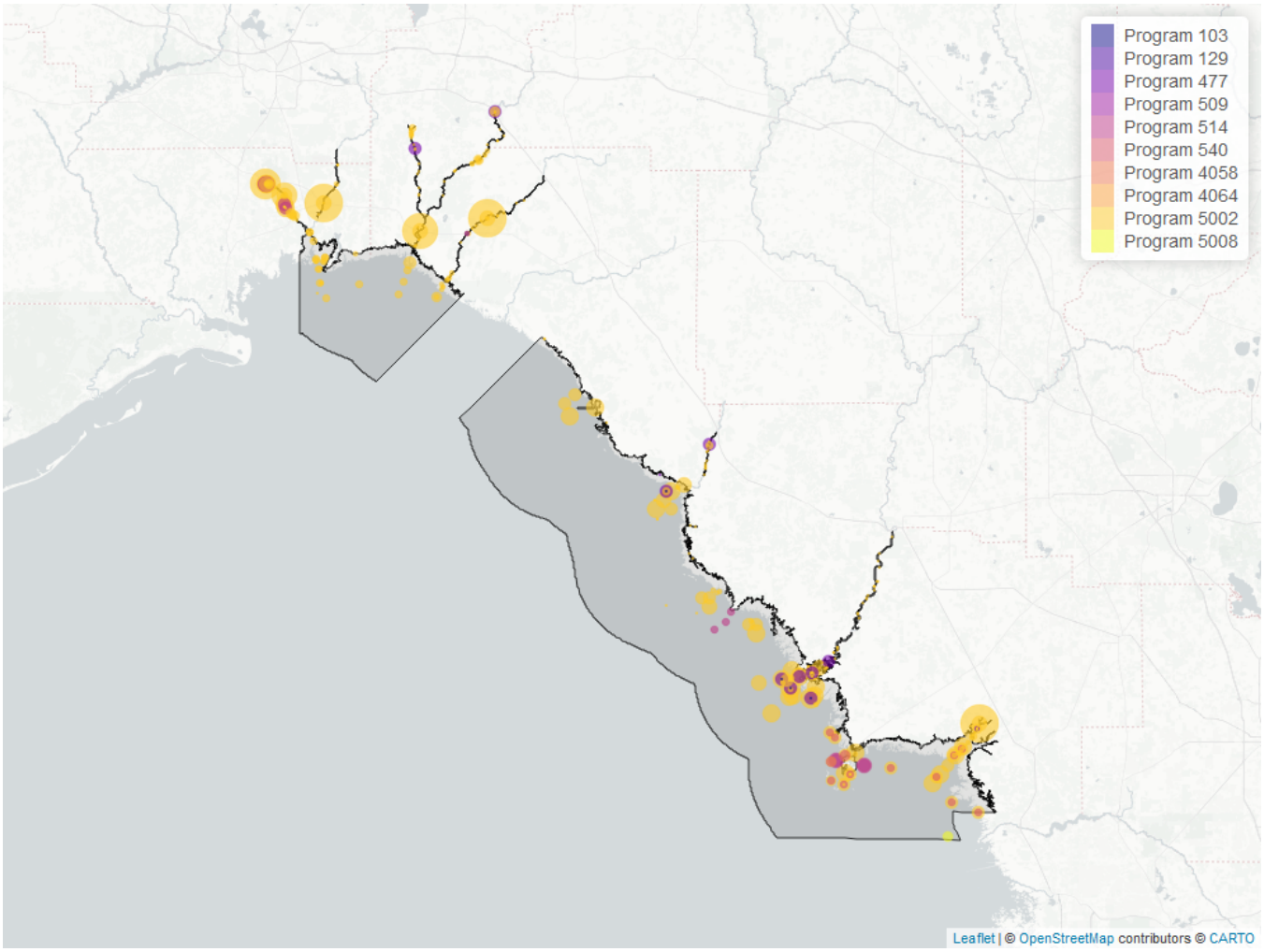

Figure 2: Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	4085	1995	2024
514	300	2013	2024
477	272	2016	2024
540	131	2017	2022
5008	16	2023	2024
103	10	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

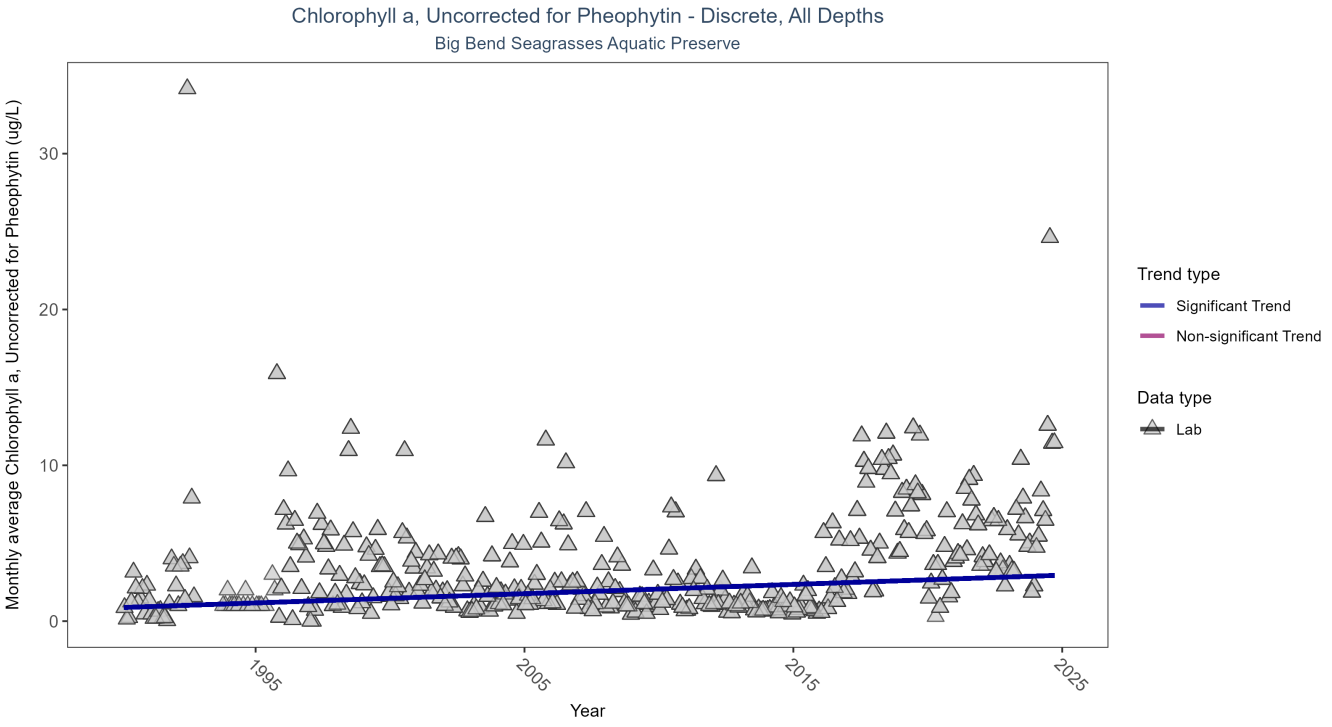

Figure 3: Seasonal Kendall-Tau Results for Chlorophyll a, Uncorrected for Pheophytin - Discrete

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	6343	35	1.204	TRUE	0.21	0	0.0594	0.8723	16.4799	0.1242	1

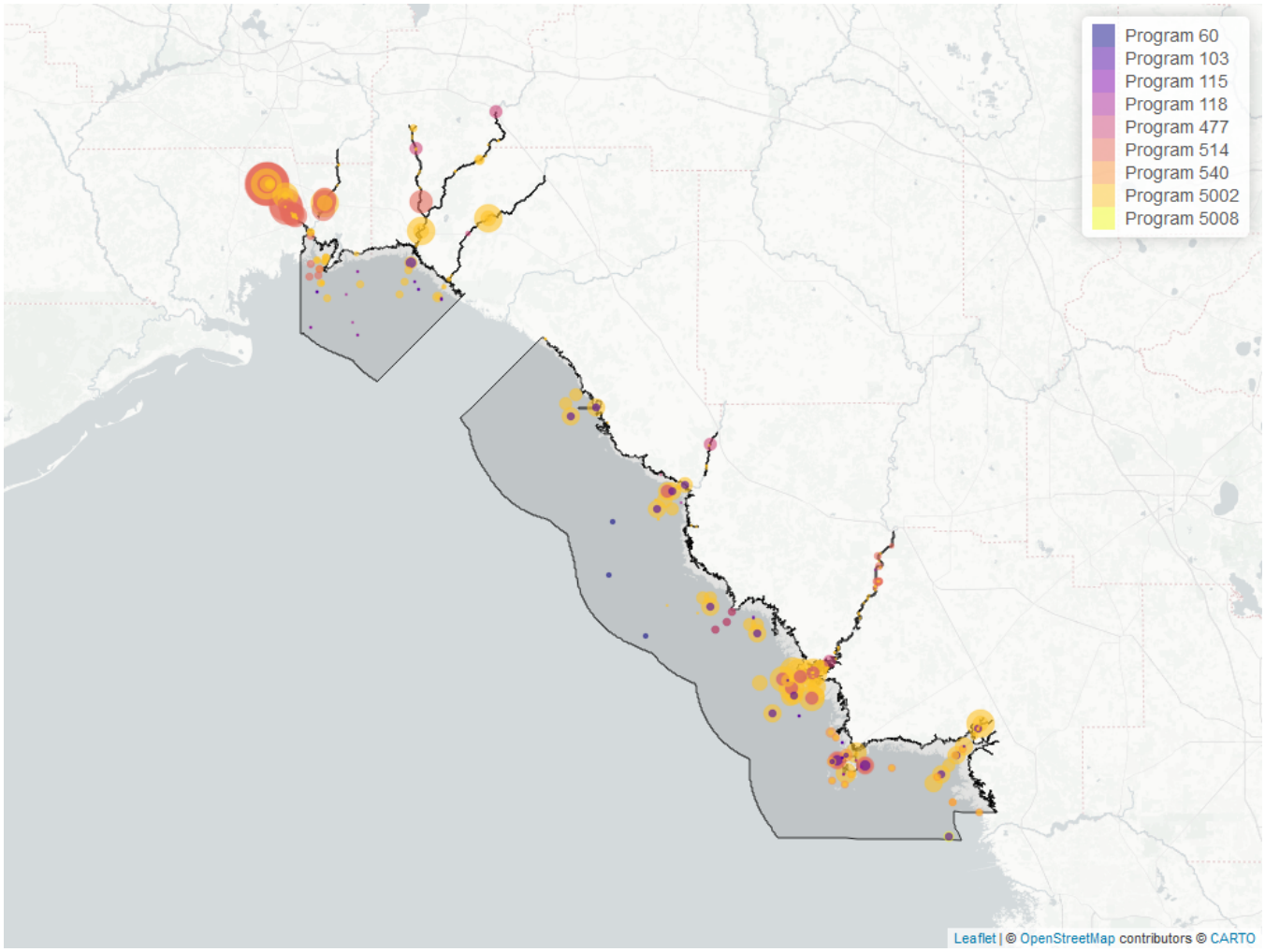

Figure 4: Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	3501	1990	2024
514	2229	1993	2024
477	275	2016	2024
103	270	2000	2021
540	142	2017	2022
5008	17	2021	2024
118	12	2000	2010
60	9	2014	2015
115	7	2000	2004

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[7]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]

115 - Environmental Monitoring Assessment Program[8]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[9]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Colored Dissolved Organic Matter - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

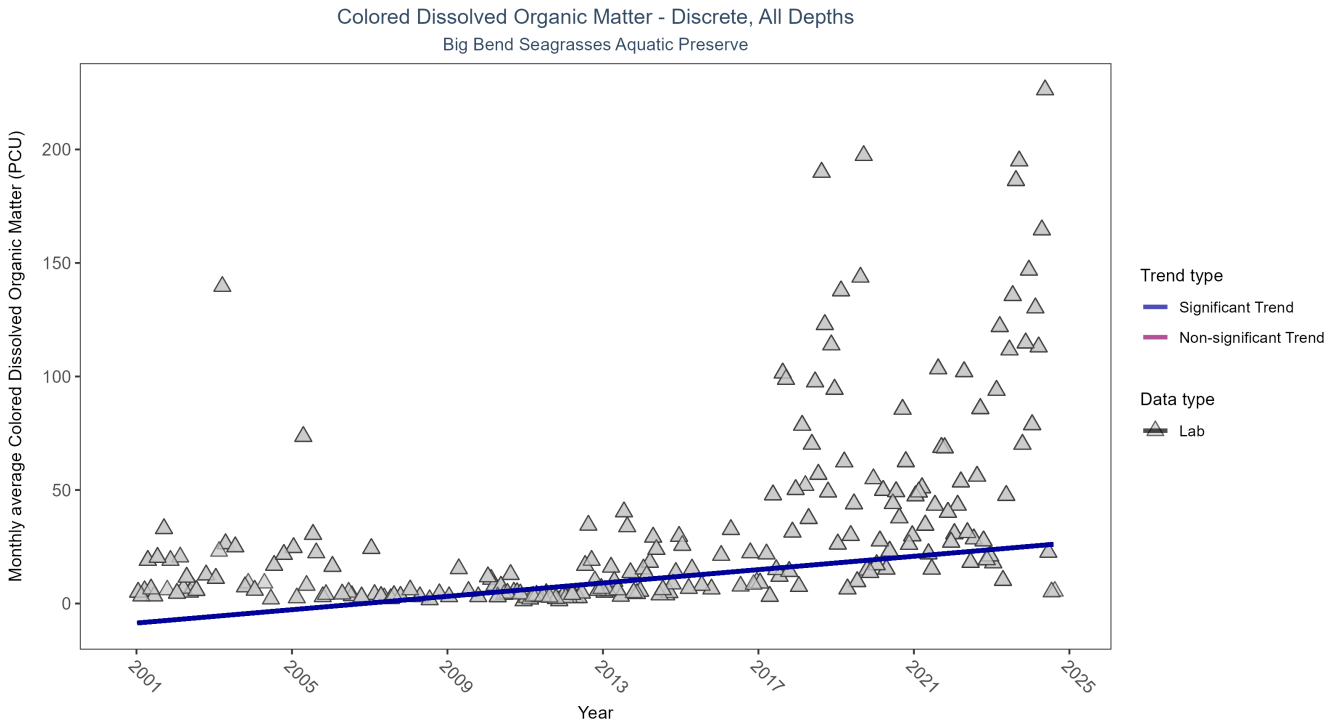

Figure 5: Seasonal Kendall-Tau Results for Colored Dissolved Organic Matter - Discrete

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	2756	24	17	TRUE	0.4381	0	1.4704	-8.5975	3.9703	0.9708	1

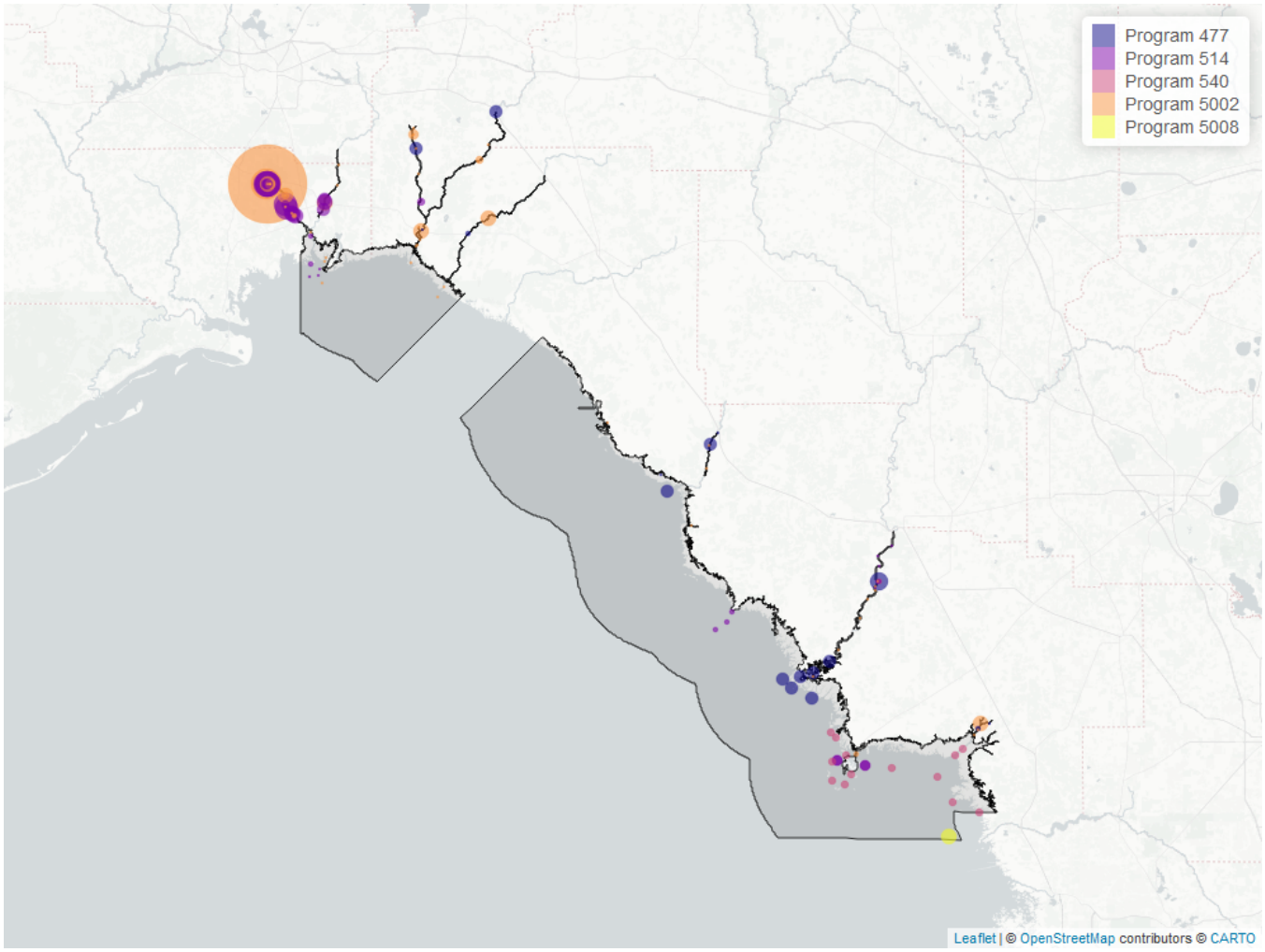

Figure 6: Map showing location of Discrete sampling sites for Colored Dissolved Organic Matter. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1412	2014	2024
514	893	2001	2024
477	330	2016	2024
540	99	2017	2019
5008	40	2021	2024

Program names:

477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Dissolved Oxygen - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

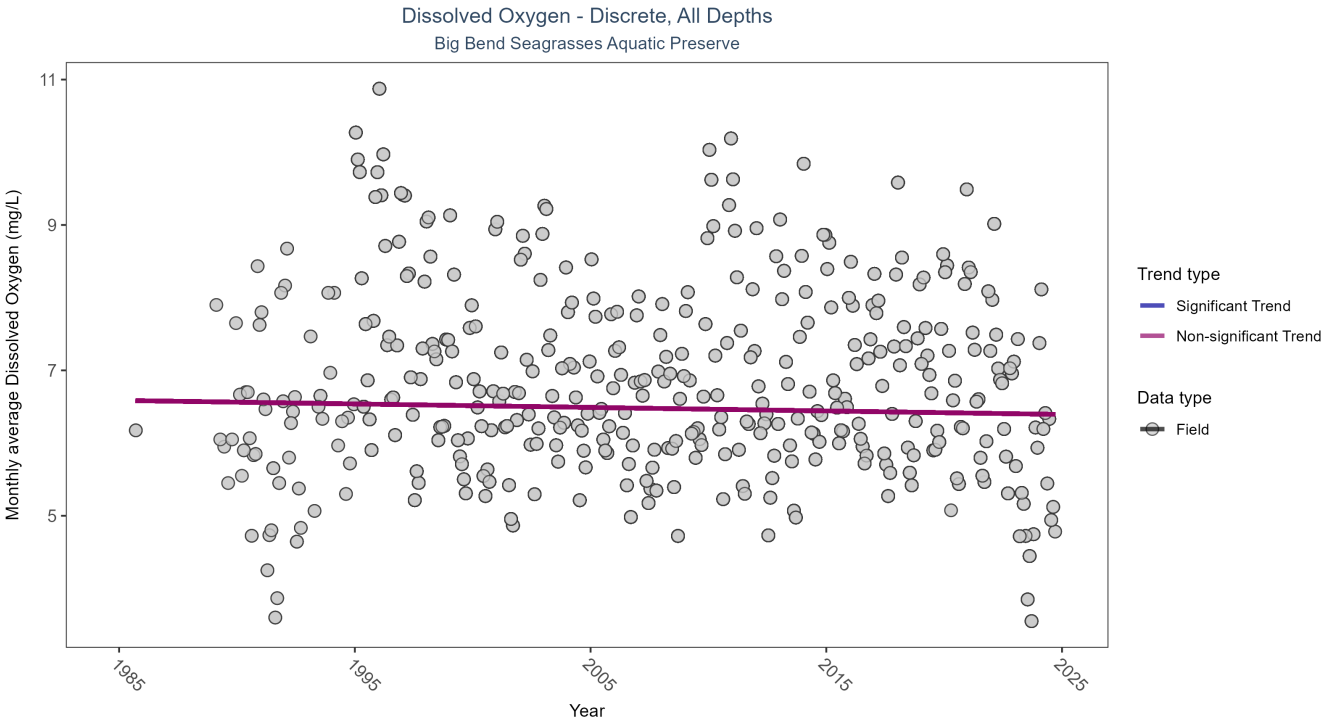

Figure 7: Seasonal Kendall-Tau Results for Dissolved Oxygen - Discrete

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	149151	37	6.7	TRUE	-0.044	0.224	-0.0048	6.5868	5.3778	0.9115	0

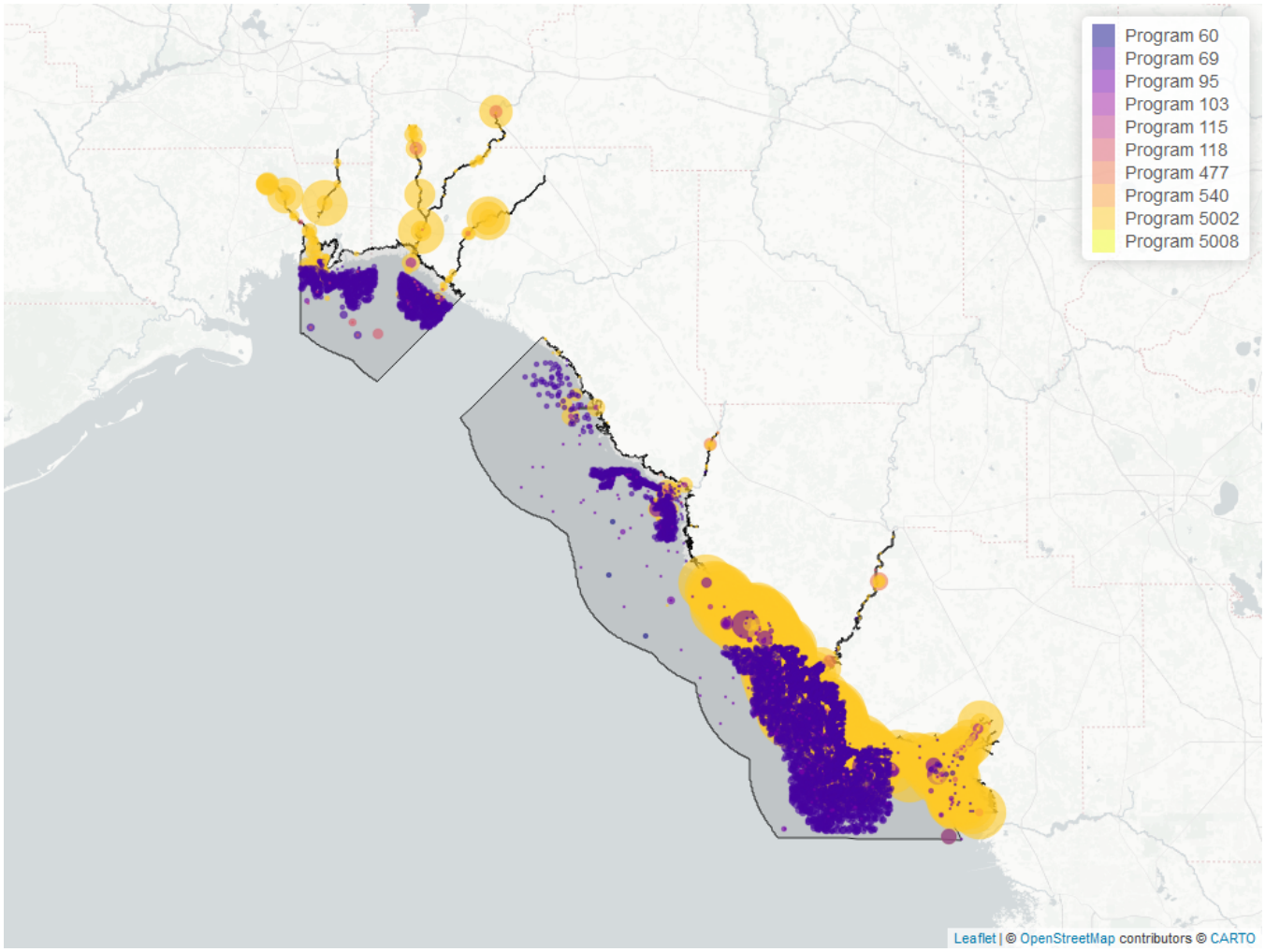

Figure 8: Map showing location of Discrete sampling sites for Dissolved Oxygen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	93868	1989	2024
69	53488	1996	2022
95	1163	1985	2018
477	330	2016	2024
103	158	2004	2021
540	121	2017	2022
118	53	2000	2021
115	43	1991	2004
5008	40	2021	2024
60	18	2014	2015

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[7]
69 - Fisheries-Independent Monitoring (FIM) Program[10]

95 - Harmful Algal Bloom Marine Observation Network[11]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[9]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Dissolved Oxygen Saturation - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

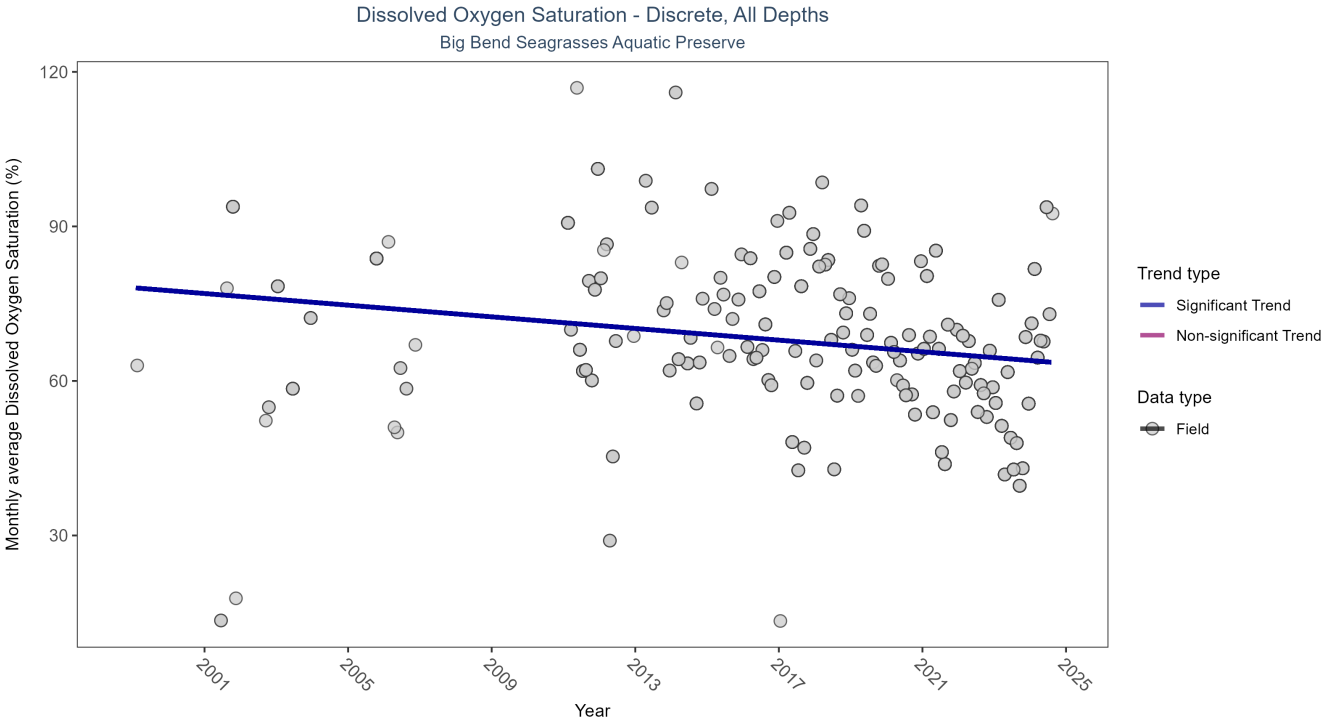

Figure 9: Seasonal Kendall-Tau Results for Dissolved Oxygen Saturation - Discrete

Table 14: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen Saturation

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1630	20	69.4	TRUE	-0.1375	0.0393	-0.5656	78.1025	9.6211	0.5648	-1

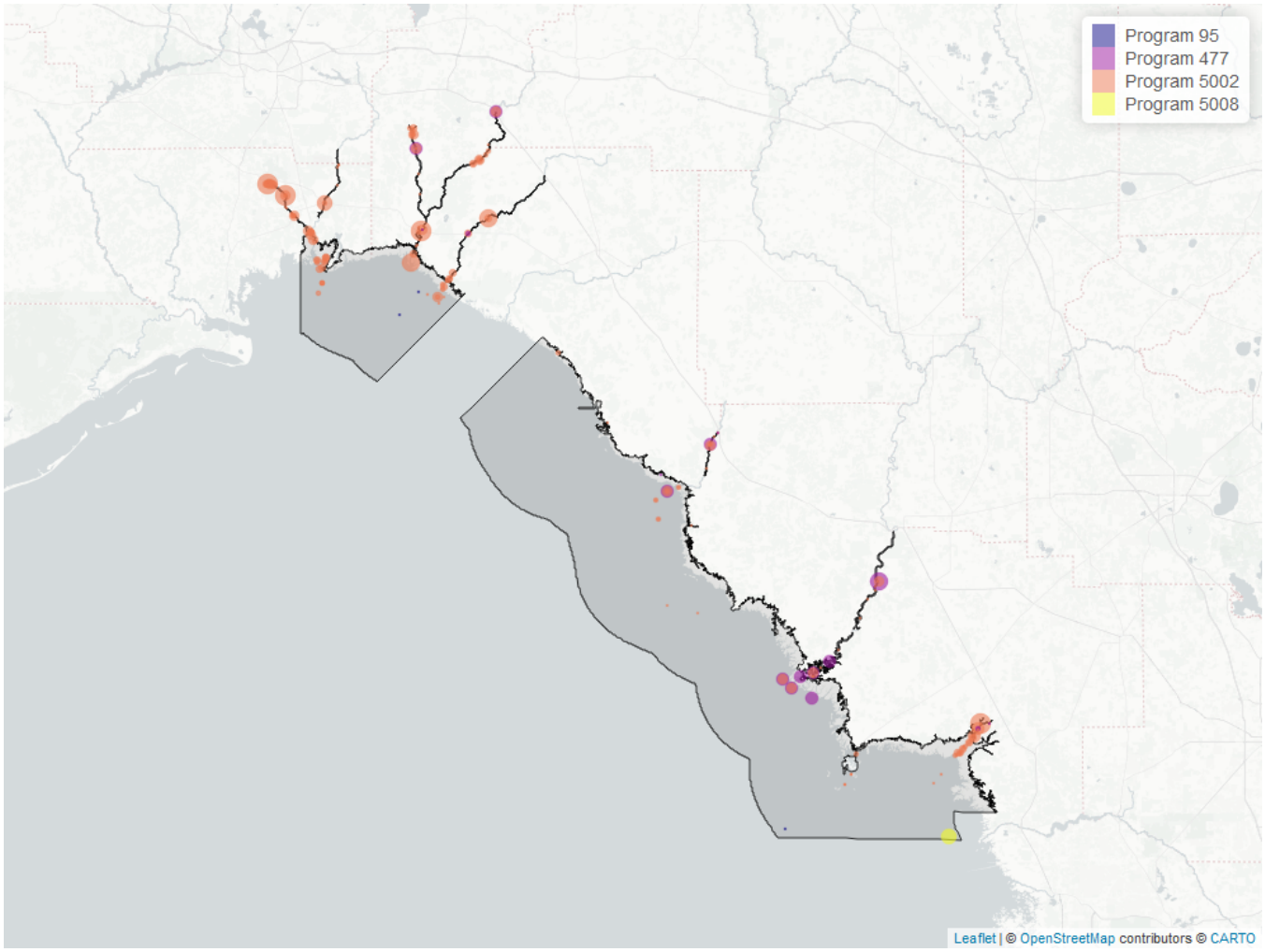

Figure 10: Map showing location of Discrete sampling sites for Dissolved Oxygen Saturation. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1293	1999	2024
477	330	2016	2024
5008	40	2021	2024
95	3	2016	2018

Program names:

95 - Harmful Algal Bloom Marine Observation Network[11]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

pH - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

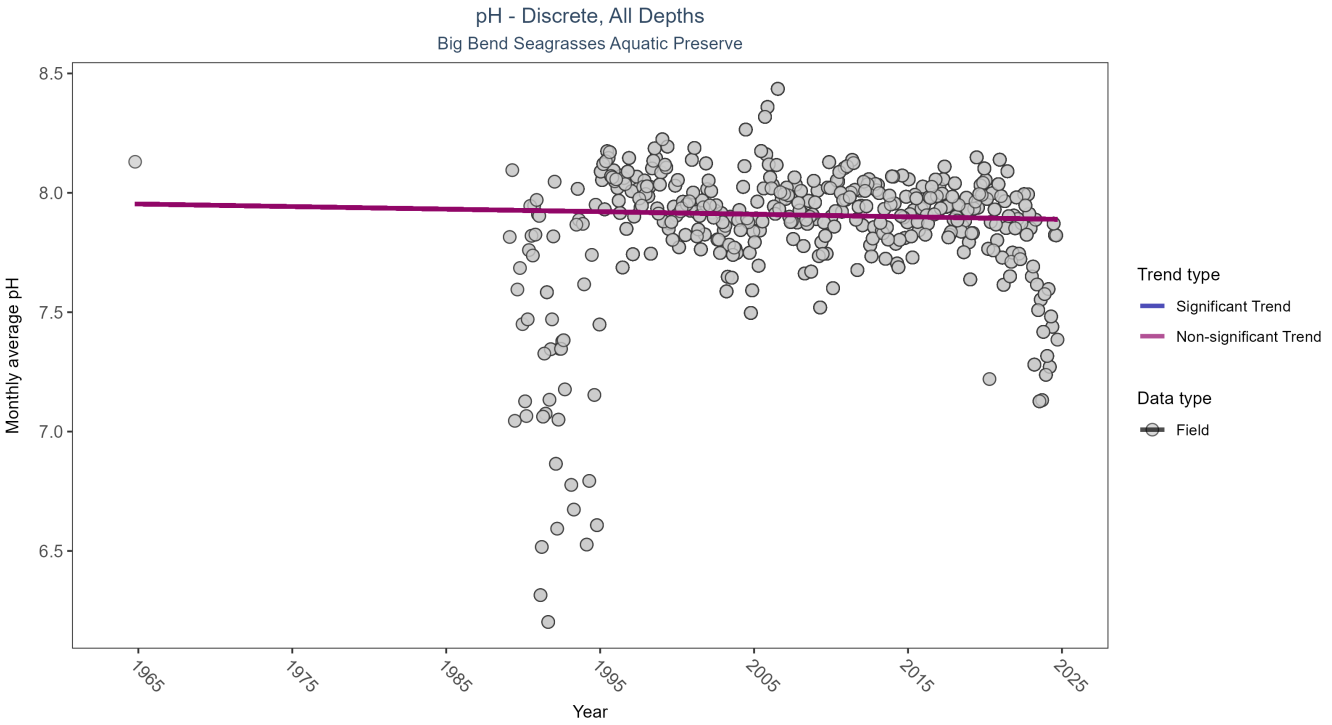

Figure 11: Seasonal Kendall-Tau Results for pH - Discrete

Table 16: Seasonal Kendall-Tau Trend Analysis for pH

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	106743	37	8	TRUE	-0.0425	0.2724	-0.0011	7.9542	11.6682	0.3891	0

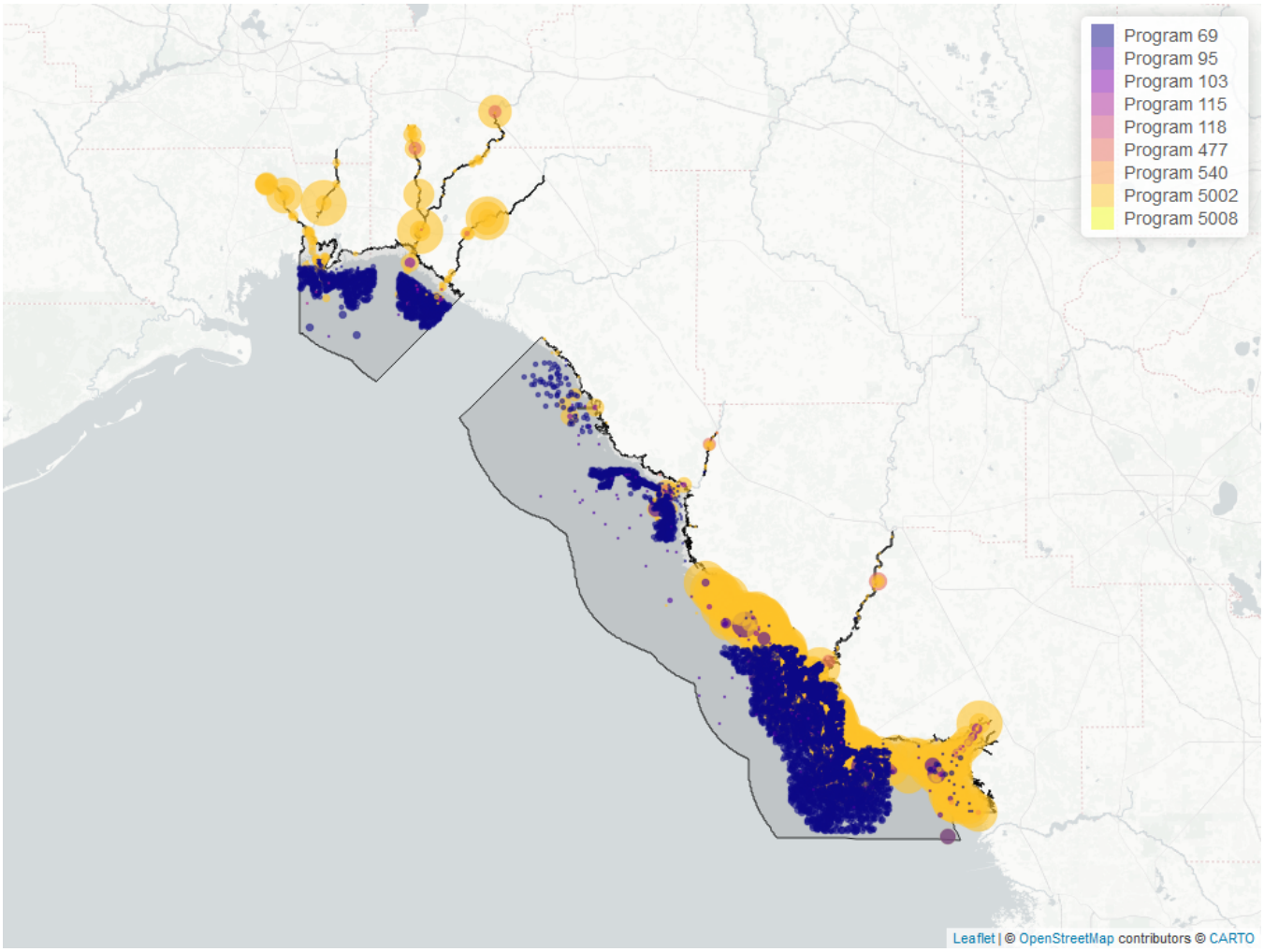

Figure 12: Map showing location of Discrete sampling sites for pH. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	53420	1996	2022
5002	51971	1989	2024
95	776	1964	2018
477	330	2016	2024
103	154	2004	2021
540	85	2017	2022
115	43	1991	2004
5008	40	2021	2024

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]

540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Salinity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

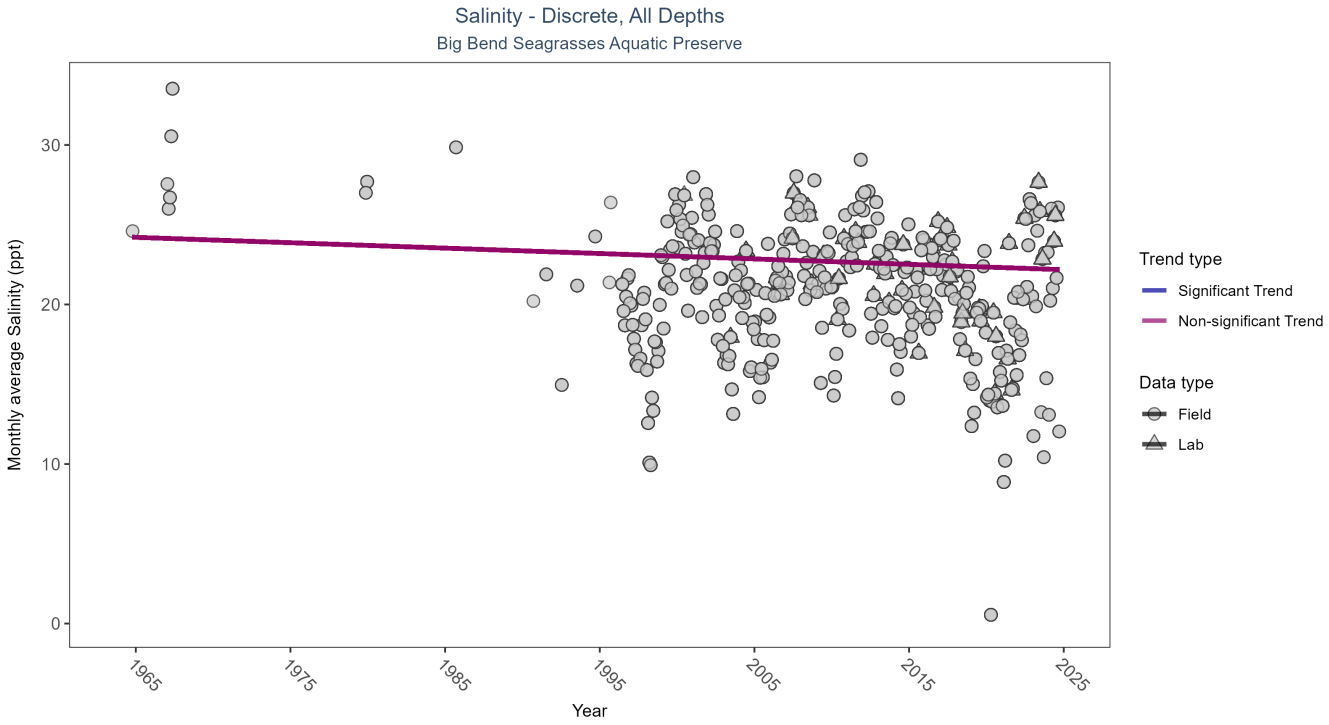

Figure 13: Seasonal Kendall-Tau Results for Salinity - Discrete

Table 18: Seasonal Kendall-Tau Trend Analysis for Salinity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	154406	39	23.2	TRUE	-0.0592	0.097	-0.0338	24.2427	17.7365	0.0879	0

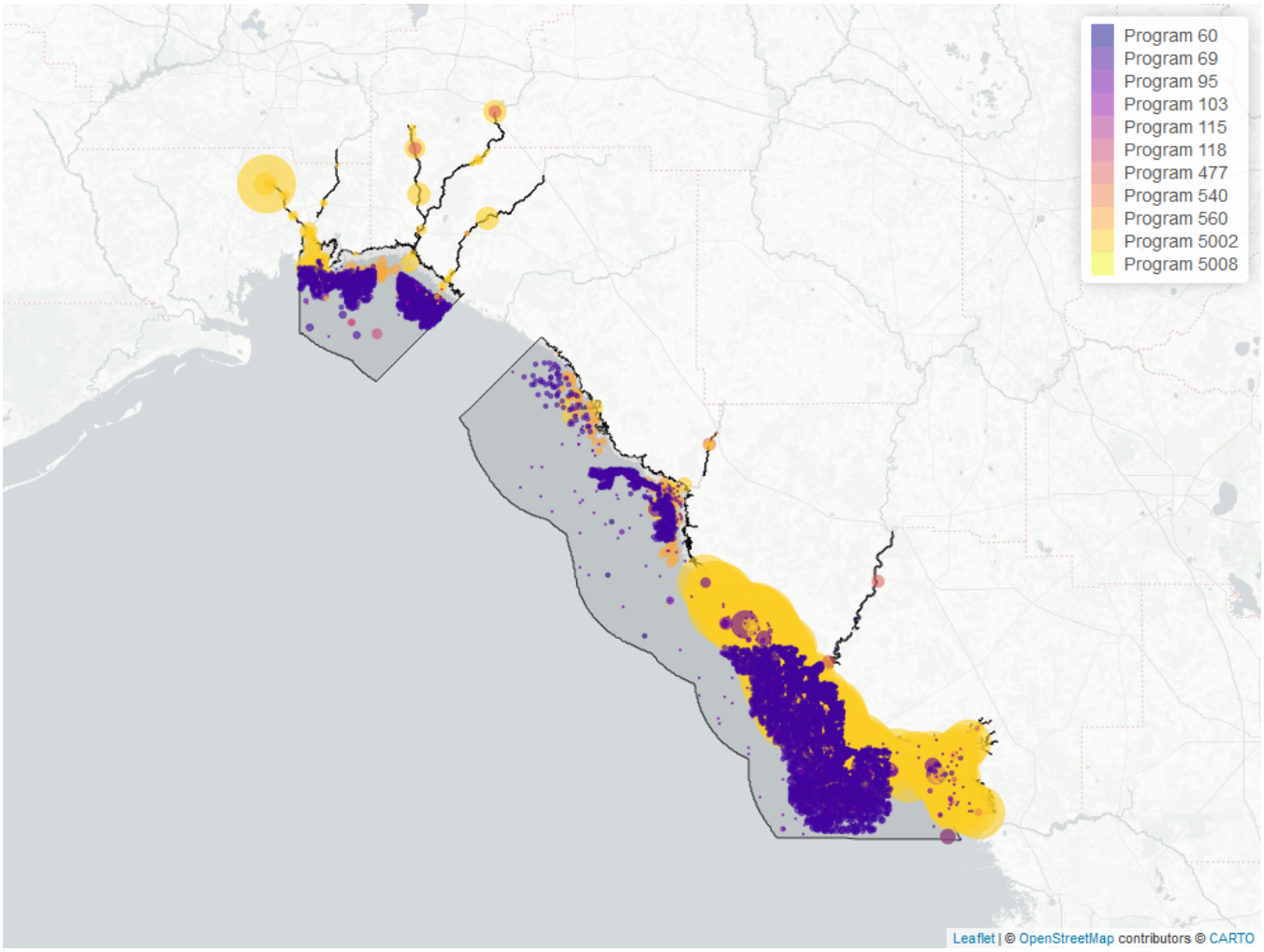

Figure 14: Map showing location of Discrete sampling sites for Salinity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	97498	1990	2024
69	53641	1996	2022
560	1474	2003	2024
95	1289	1964	2018
477	301	2016	2024
540	132	2017	2022
118	51	2015	2021
115	43	1991	2004
5008	42	2021	2024
60	18	2014	2015
103	4	2004	2004

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[7]

69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[9]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
540 - Shellfish Harvest Area Classification Program[4]
560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring[12]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Secchi Depth - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

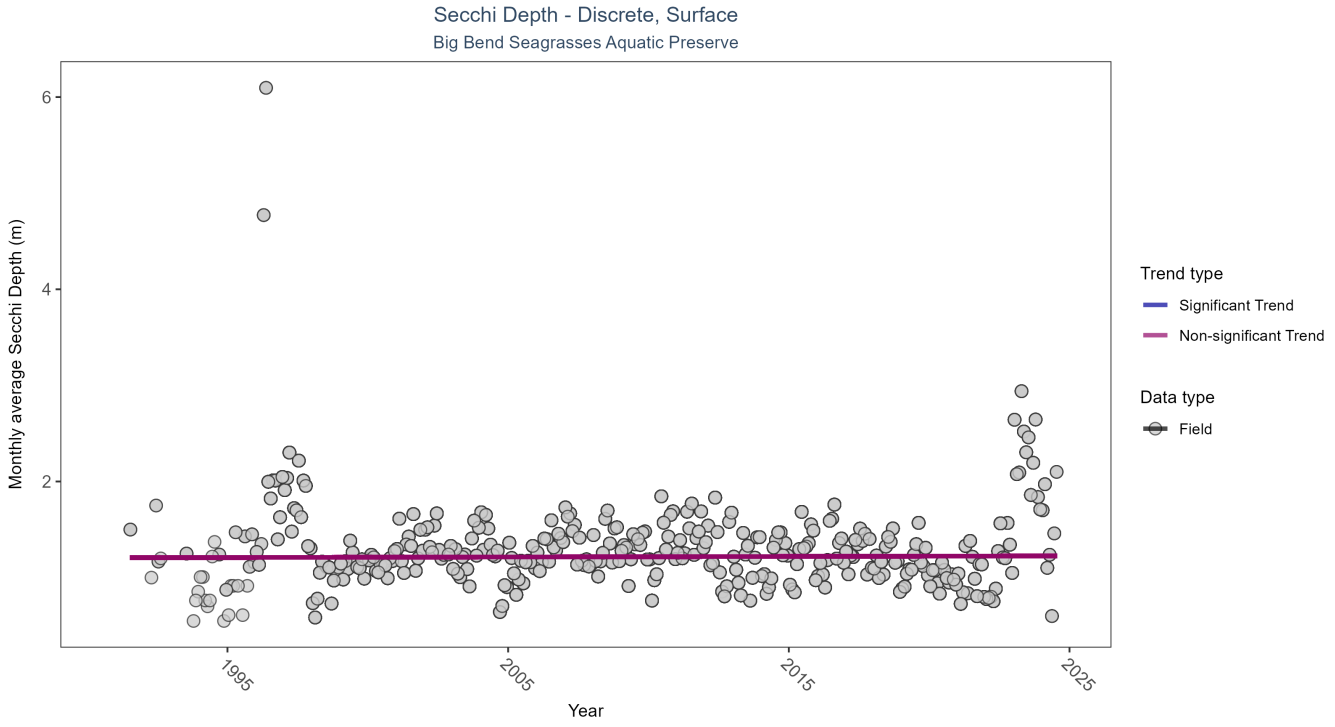

Figure 15: Seasonal Kendall-Tau Results for Secchi Depth - Discrete

Table 20: Seasonal Kendall-Tau Trend Analysis for Secchi Depth

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	58818	34	0.9	TRUE	0.0079	0.8148	0.0006	1.2068	10.092	0.5221	0

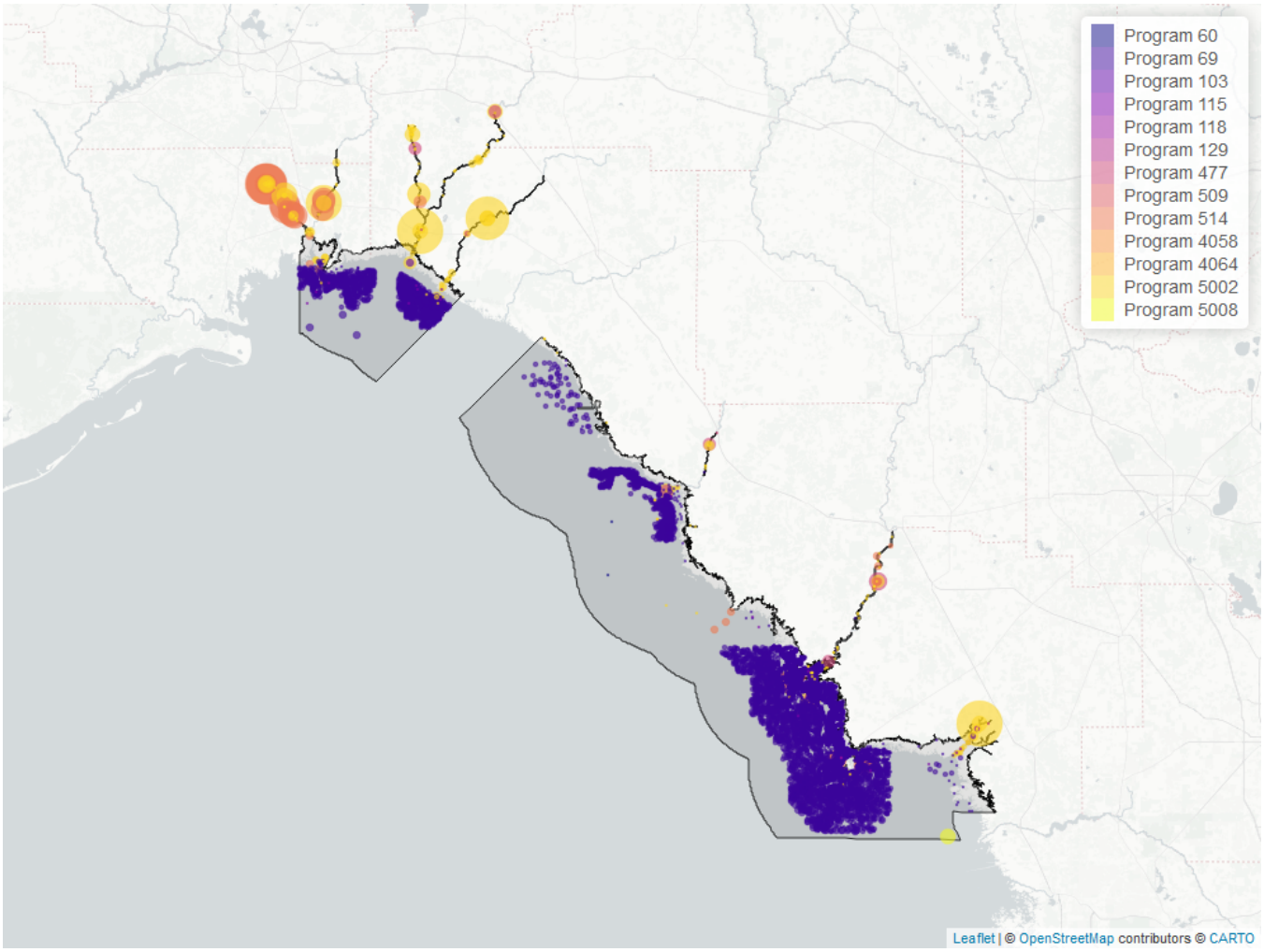

Figure 16: Map showing location of Discrete sampling sites for Secchi Depth. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	53622	1996	2022
5002	2520	1992	2024
514	2256	1993	2024
477	327	2016	2024
103	47	2020	2021
5008	31	2021	2024
115	21	1991	2004
60	2	2014	2014

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[7]
69 - Fisheries-Independent Monitoring (FIM) Program[10]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]

477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

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

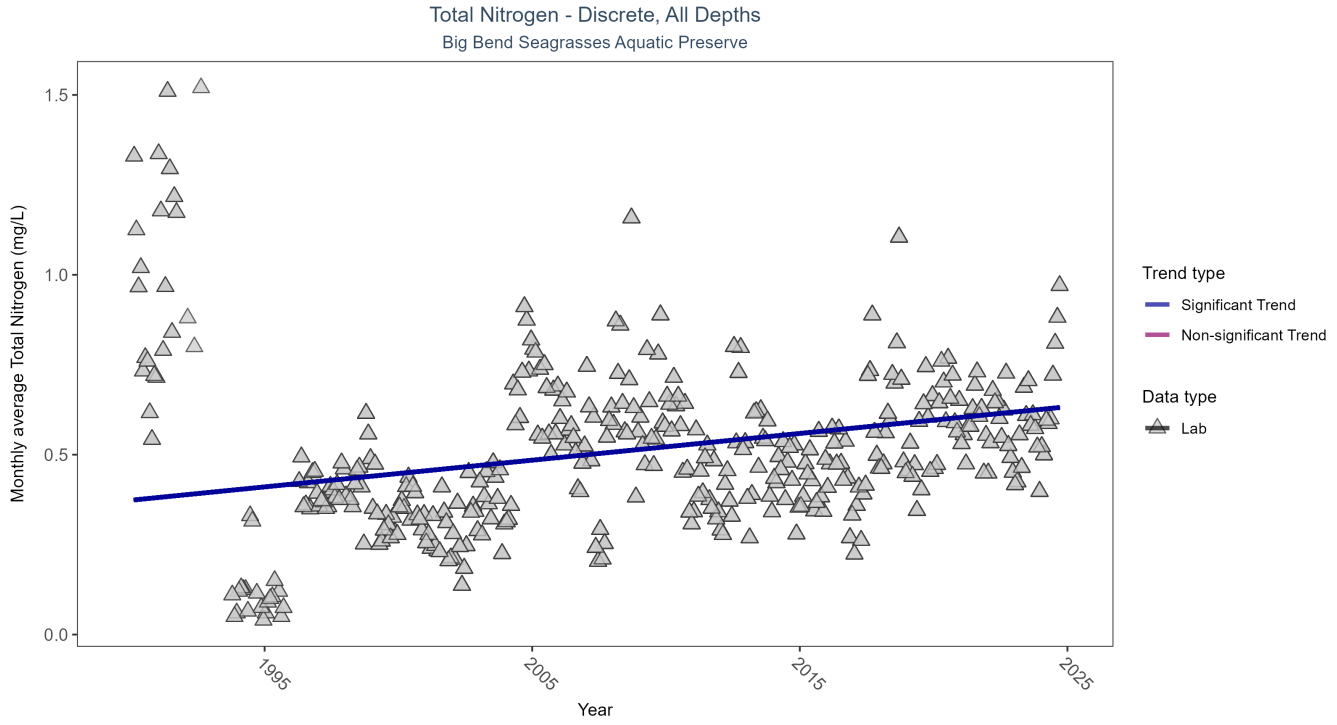

Figure 17: Seasonal Kendall-Tau Results for Total Nitrogen - Discrete

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

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	8090	35	0.464	TRUE	0.2297	0	0.0074	0.3733	8.0102	0.7124	1

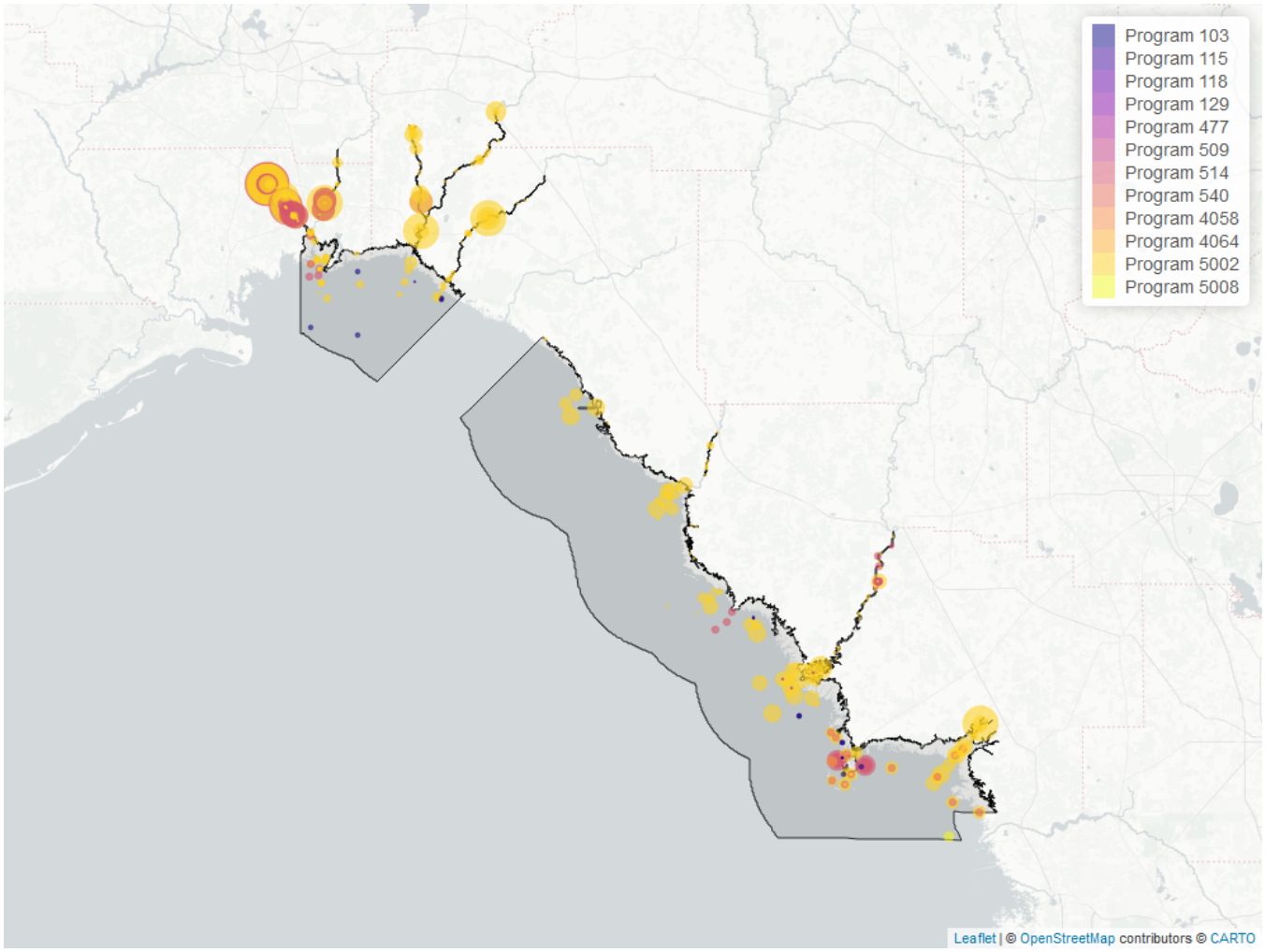

Figure 18: Map showing location of Discrete sampling sites for Total Nitrogen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	5512	1990	2024
514	2379	1993	2024
540	131	2017	2022
103	47	2000	2006
5008	17	2021	2024
115	5	2000	2004
477	3	2017	2017

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
540 - Shellfish Harvest Area Classification Program[4]

5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

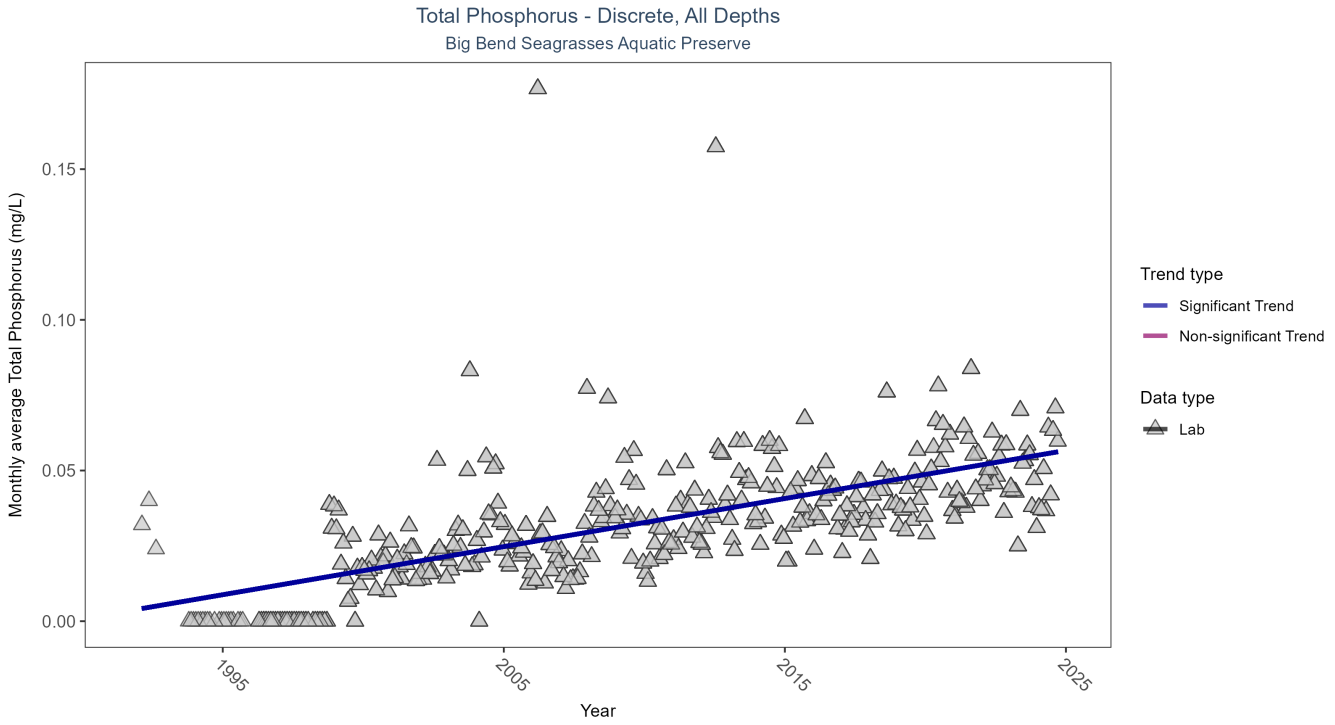

Figure 19: Seasonal Kendall-Tau Results for Total Phosphorus - Discrete

Table 24: Seasonal Kendall-Tau Trend Analysis for Total Phosphorus

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	6455	33	0.0314	TRUE	0.5954	0	0.0016	0.004	4.4602	0.9545	1

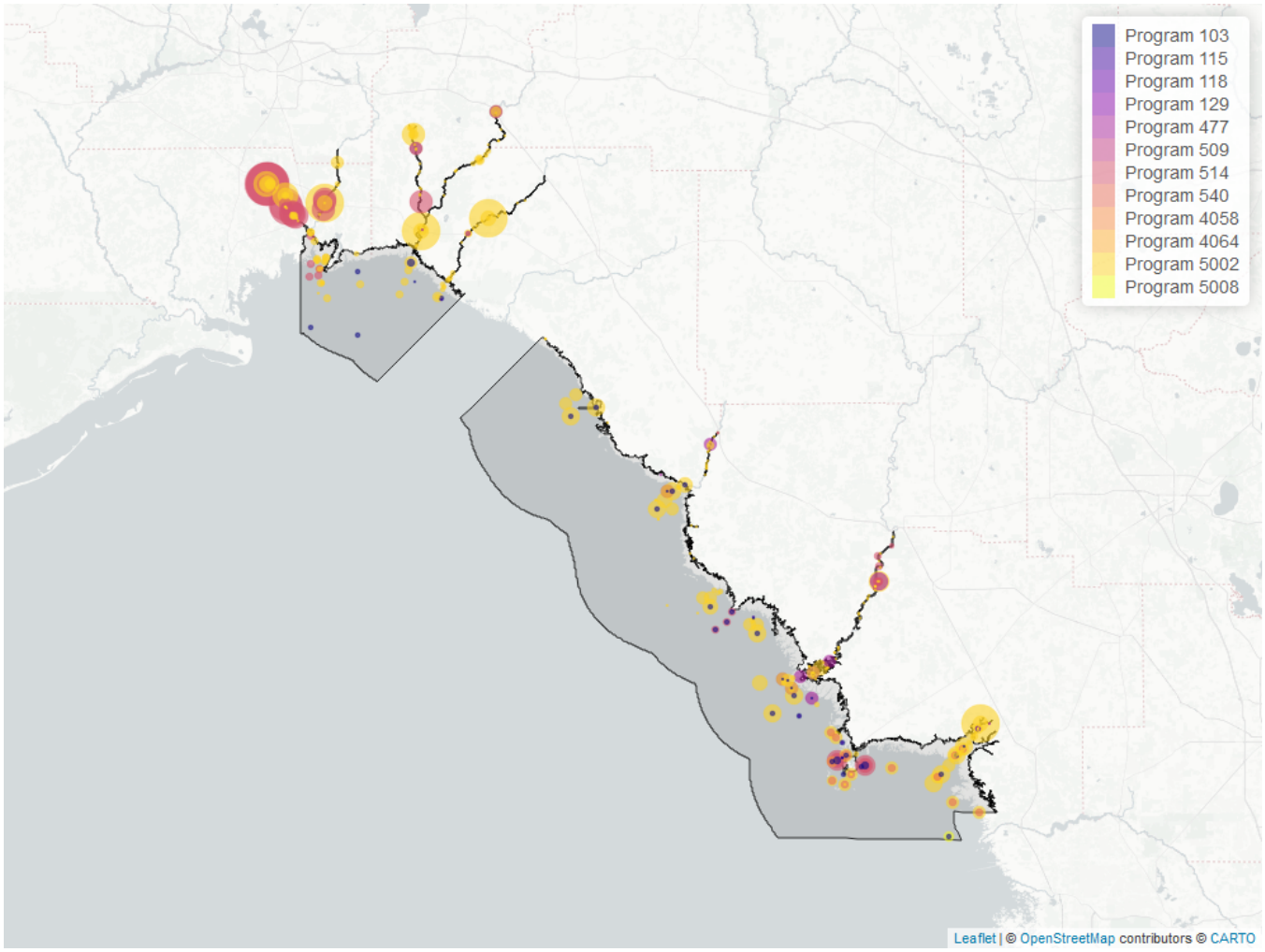

Figure 20: Map showing location of Discrete sampling sites for Total Phosphorus. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	3597	1992	2024
514	2356	1993	2024
477	330	2016	2024
103	169	2000	2021
540	131	2017	2022
5008	17	2021	2024
115	5	2000	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
514 - Florida LAKEWATCH Program[3]
540 - Shellfish Harvest Area Classification Program[4]

5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

Total Suspended Solids - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

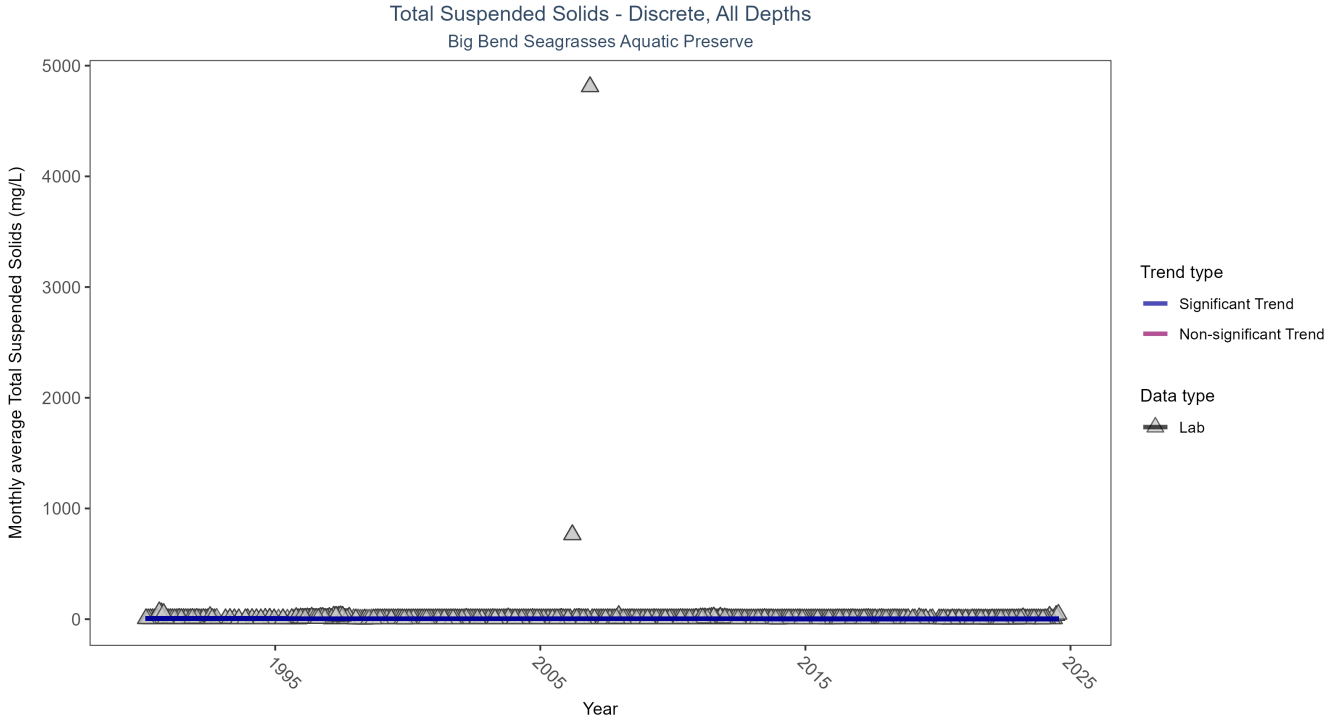

Figure 21: Seasonal Kendall-Tau Results for Total Suspended Solids - Discrete

Table 26: Seasonal Kendall-Tau Trend Analysis for Total Suspended Solids

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2931	35	4	TRUE	-0.3393	0	-0.0741	5.3064	8.6877	0.6507	-1

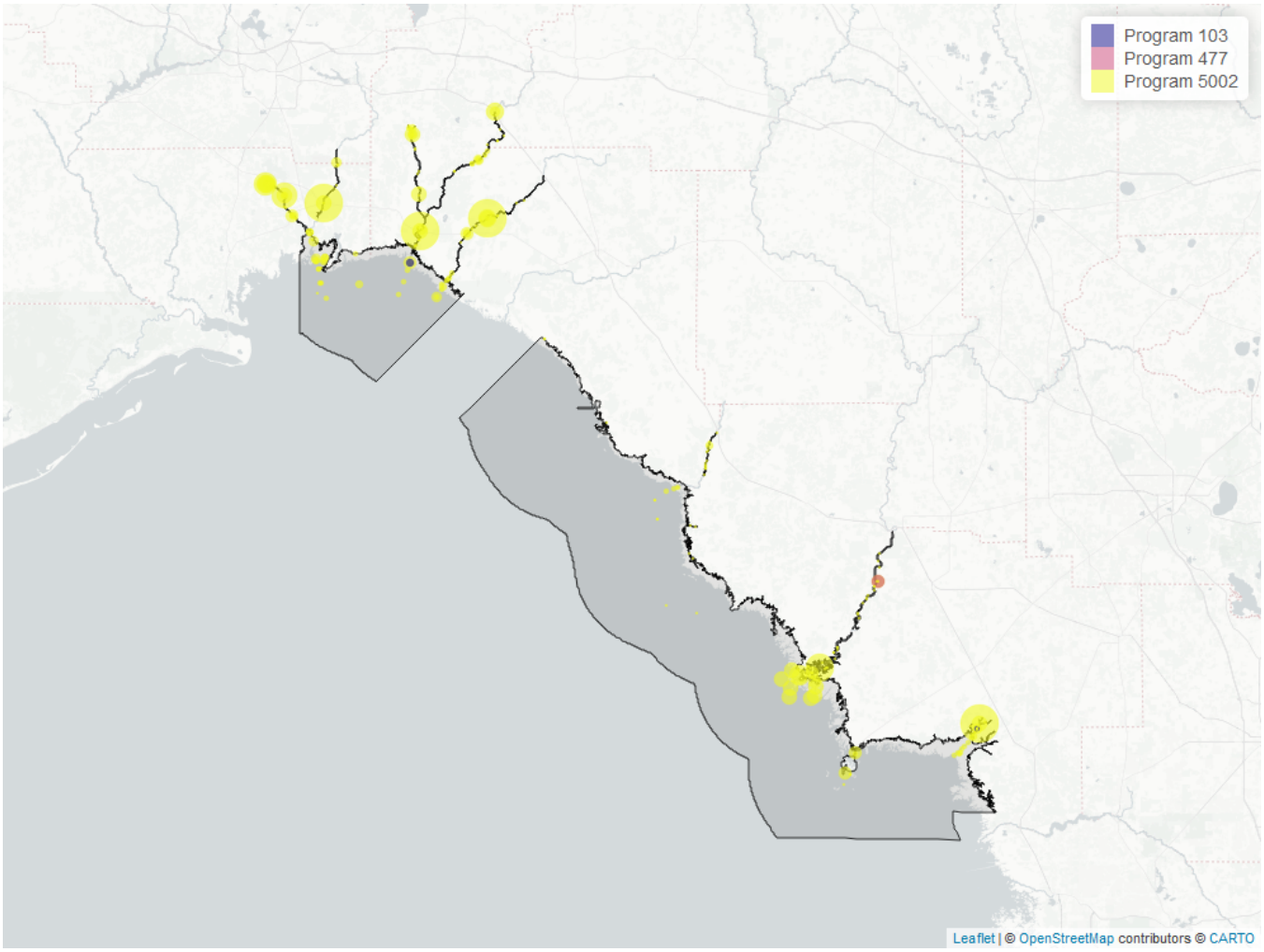

Figure 22: Map showing location of Discrete sampling sites for Total Suspended Solids. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	2923	1990	2024
477	28	2021	2023
103	12	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
5002 - Florida STORET / WIN[5]

Turbidity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

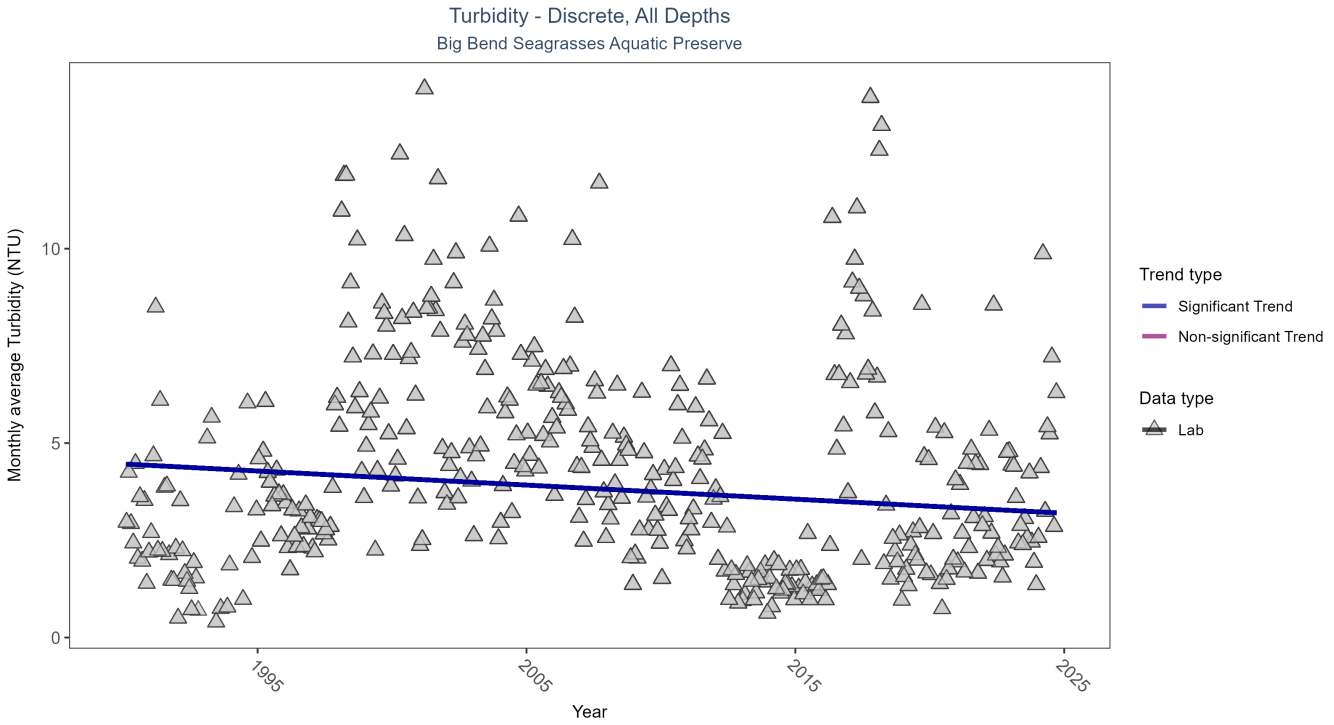

Figure 23: Seasonal Kendall-Tau Results for Turbidity - Discrete

Table 28: Seasonal Kendall-Tau Trend Analysis for Turbidity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	42779	35	3.4	TRUE	-0.1027	0.0032	-0.0362	4.4636	2.5569	0.9954	-1

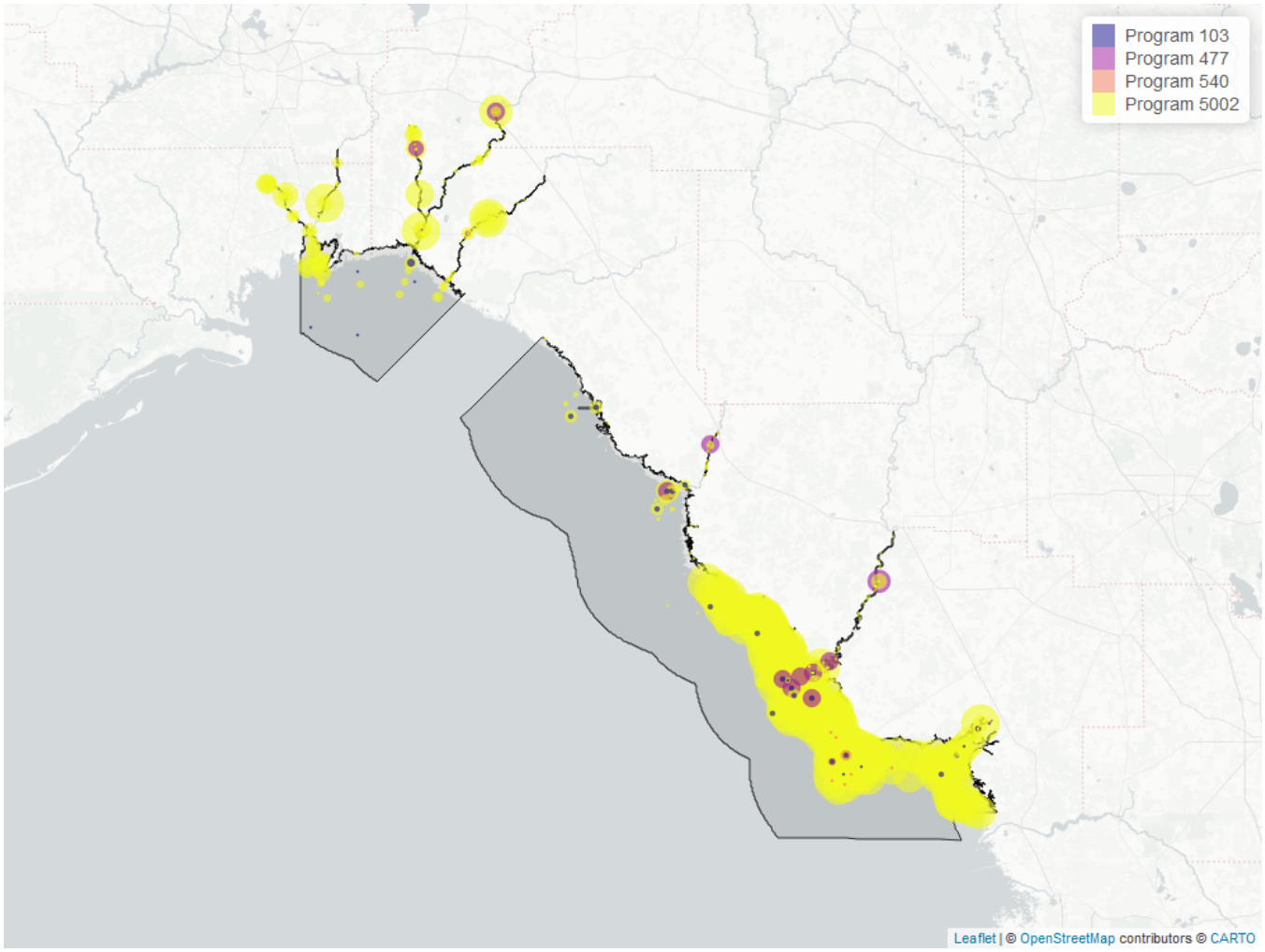

Figure 24: Map showing location of Discrete sampling sites for Turbidity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	42571	1990	2024
477	568	2016	2024
103	116	2005	2021
540	35	2019	2022

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]

Water Temperature - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

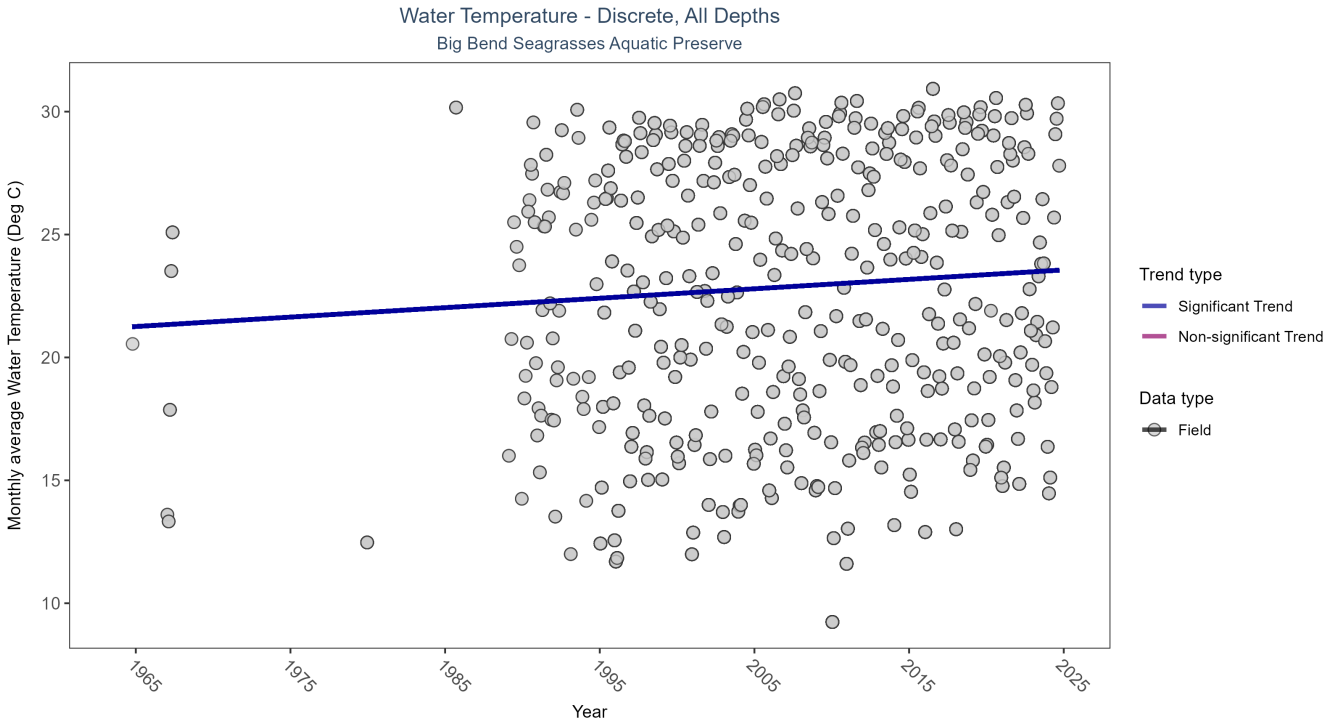

Figure 25: Seasonal Kendall-Tau Results for Water Temperature - Discrete

Table 30: Seasonal Kendall-Tau Trend Analysis for Water Temperature

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	155933	40	24.1	TRUE	0.1978	0	0.0384	21.2189	10.4746	0.4883	1

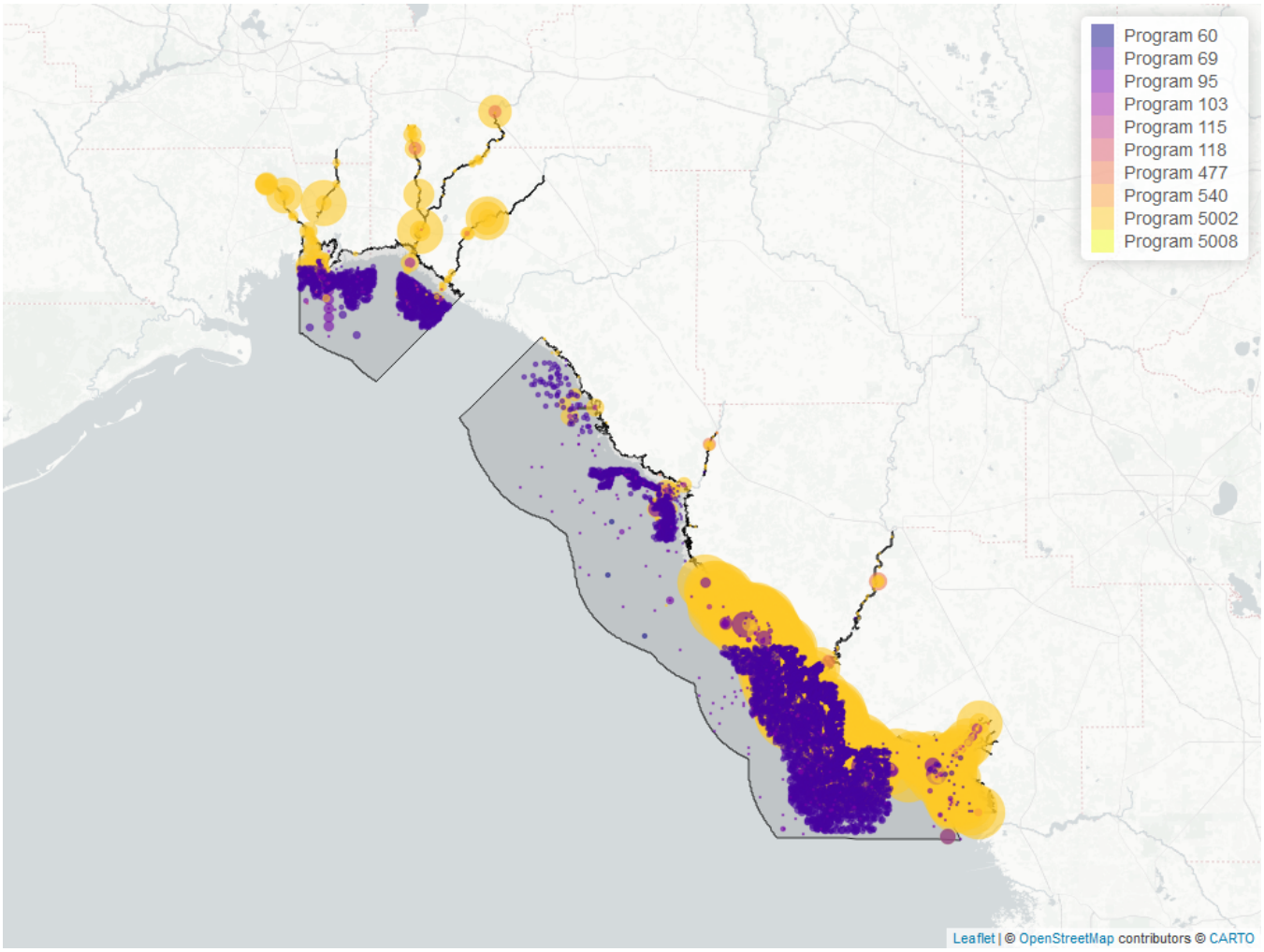

Figure 26: Map showing location of Discrete sampling sites for Water Temperature. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	100275	1989	2024
69	53664	1996	2022
95	1377	1964	2018
477	330	2016	2024
103	158	2004	2021
540	133	2017	2022
115	43	1991	2004
5008	40	2021	2024
60	17	2014	2015

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[7]
69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[2]
540 - Shellfish Harvest Area Classification Program[4]
5002 - Florida STORET / WIN[5]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[6]

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 Big Bend Seagrasses Aquatic Preserve

Table 32: National Water Information System (7)

ProgramLocationID	*Years of Data*	*Use in Analysis*	*Parameters*
02313700	7	TRUE	DO, pH
02313700	8	TRUE	Sal
02313700	23	TRUE	TempW
02323566	11	TRUE	DO , pH , TempW
02323592	16	TRUE	Sal
02323592	25	TRUE	TempW
02326050	4	FALSE	TempW
02326516	5	TRUE	DO , pH , TempW
02326526	9	TRUE	DO , pH , TempW
02326550	8	TRUE	Sal
02326550	23	TRUE	TempW
02327022	2	FALSE	TempW
2313700	1	FALSE	DO , pH , TempW
2323566	1	FALSE	DO , pH , TempW
2326526	1	FALSE	DO , pH , TempW
291652083064100	1	FALSE	Sal , TempW
291842083085100	1	FALSE	Sal , TempW

Table 33: Big Bend Seagrasses Aquatic Preserves Continuous Water Quality Monitoring (471)

ProgramLocationID	*Years of Data*	*Use in Analysis*	*Parameters*
BBSCK	1	FALSE	DO , DOS , pH , Sal , Turb , TempW
BBSDB	10	TRUE	DO , DOS , pH , Sal , Turb , TempW
BBSSK	12	TRUE	DO , DOS , pH , Sal , Turb , TempW
BBSST	6	TRUE	DO , DOS , pH , Sal , Turb , TempW
BBSSW	8	TRUE	DO , DOS , pH , Sal , Turb , TempW

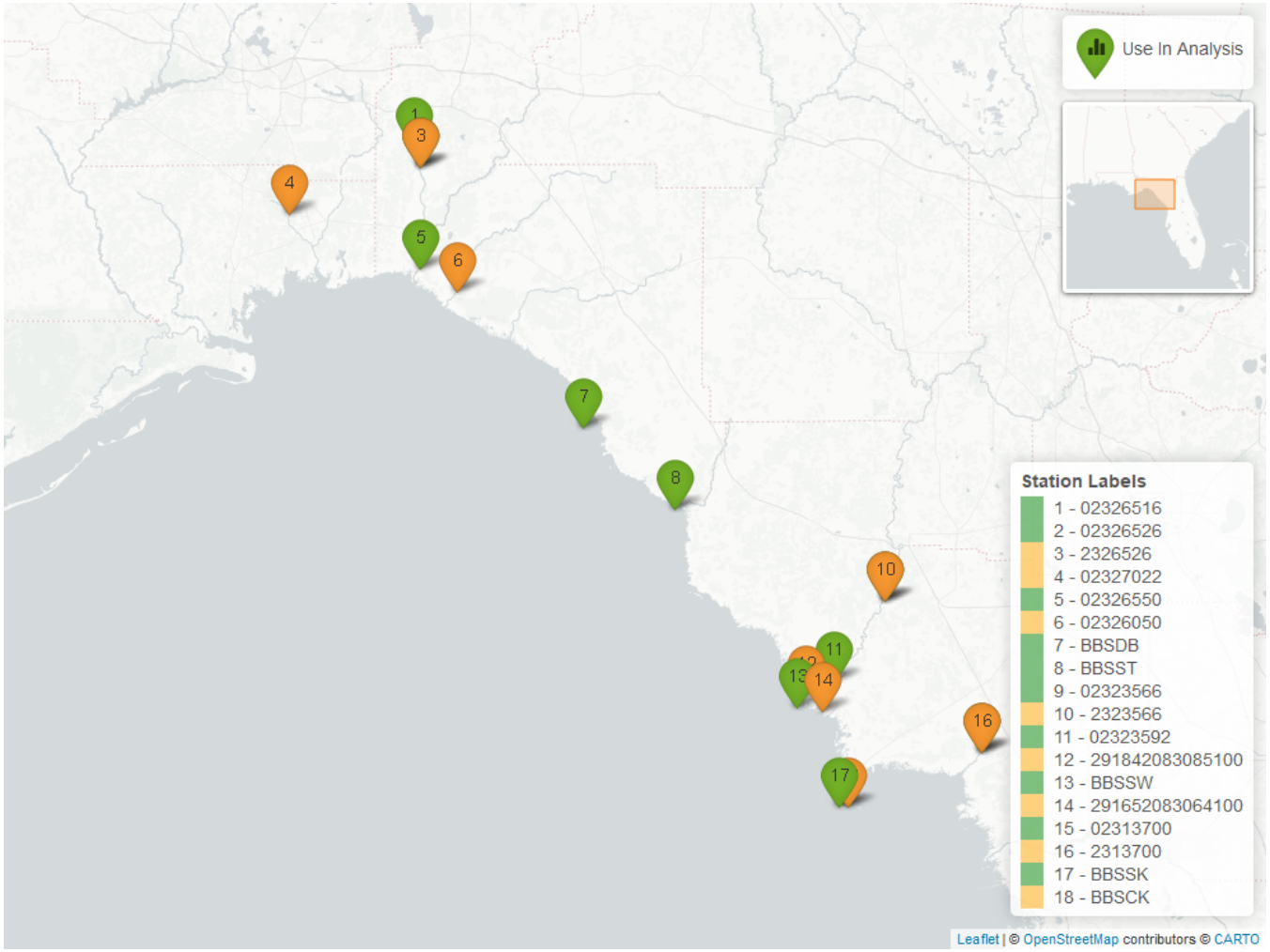

Figure 27: Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Big Bend Seagrasses Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

Dissolved Oxygen - All Stations Combined by Program

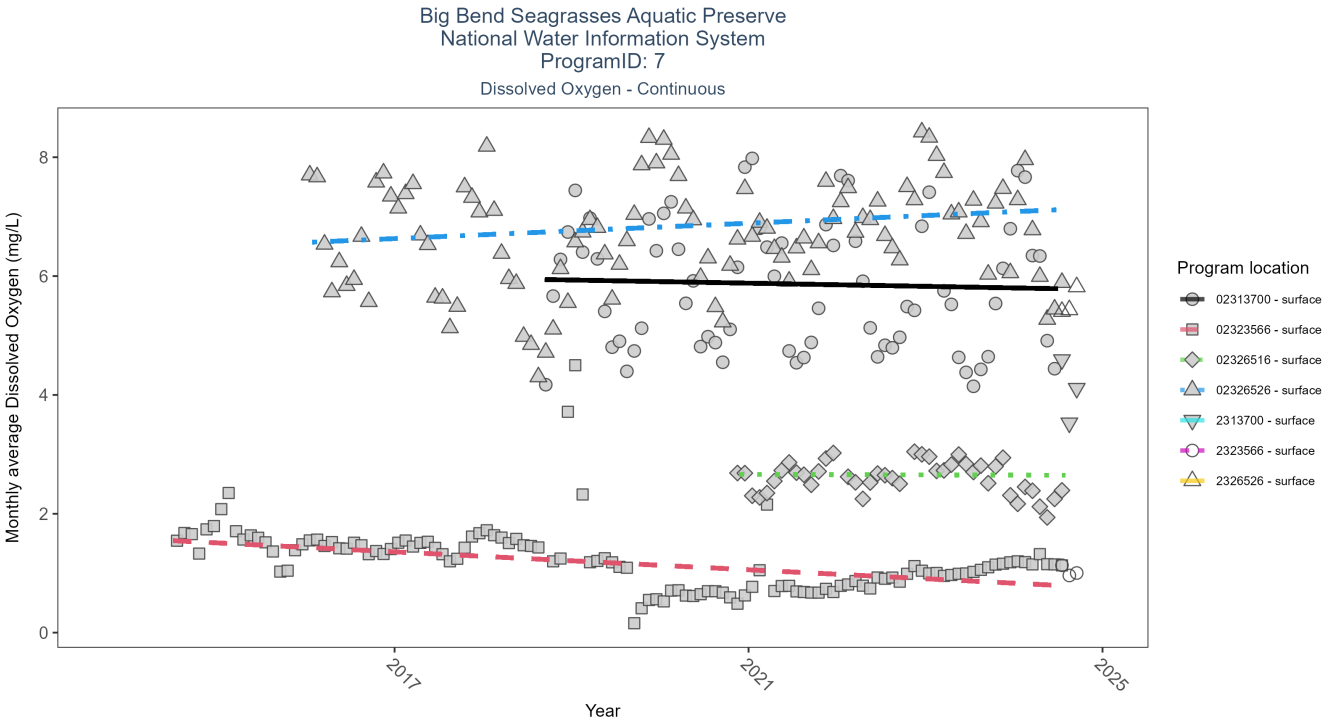

Figure 28: Figure for Dissolved Oxygen - Continuous - Program 7

Table 34: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
02313700	2034	7	2018 - 2024	5.6	-0.08	5.96	-0.03	0.4228
02326526	2932	9	2016 - 2024	6.7	0.18	6.57	0.06	0.0191
02323566	3484	11	2014 - 2024	1.2	-0.43	1.59	-0.08	0.0000
02326516	1200	5	2020 - 2024	2.6	0.05	2.67	0	1.0000
2323566	68	1	2024 - 2024	1.0	-	-	-	-
2313700	87	1	2024 - 2024	4.1	-	-	-	-
2326526	82	1	2024 - 2024	5.8	-	-	-	-

Dissolved Oxygen - All Stations Combined by Program

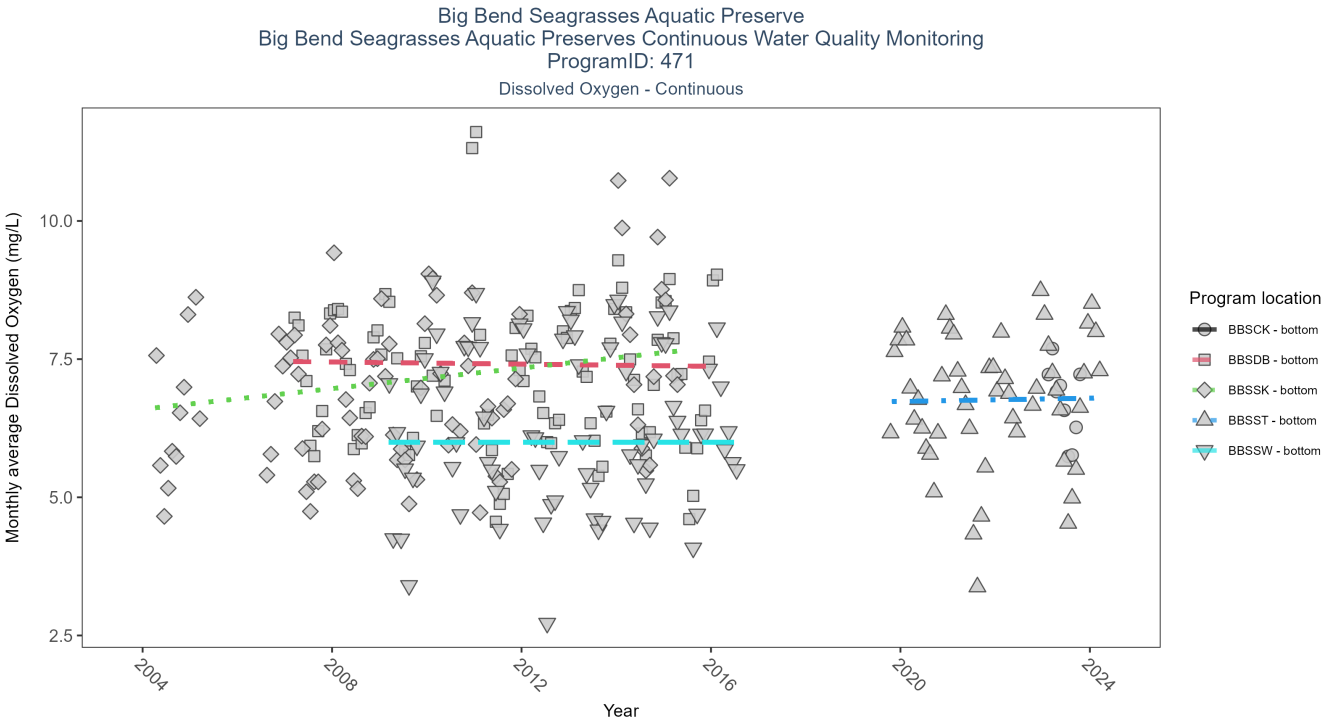

Figure 29: Figure for Dissolved Oxygen - Continuous - Program 471

Table 35: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
BBSCK	14788	1	2023 - 2023	6.7	-	-	-	-
BBSDB	184327	10	2007 - 2016	7.3	-0.05	7.46	-0.01	0.6066
BBSSK	134287	10	2004 - 2015	7.1	0.28	6.6	0.09	0.0023
BBSST	128978	6	2019 - 2024	7.0	0.01	6.72	0.01	0.7325
BBSSW	182327	8	2009 - 2016	6.2	0	6	0	1.0000

Dissolved Oxygen Saturation - All Stations Combined

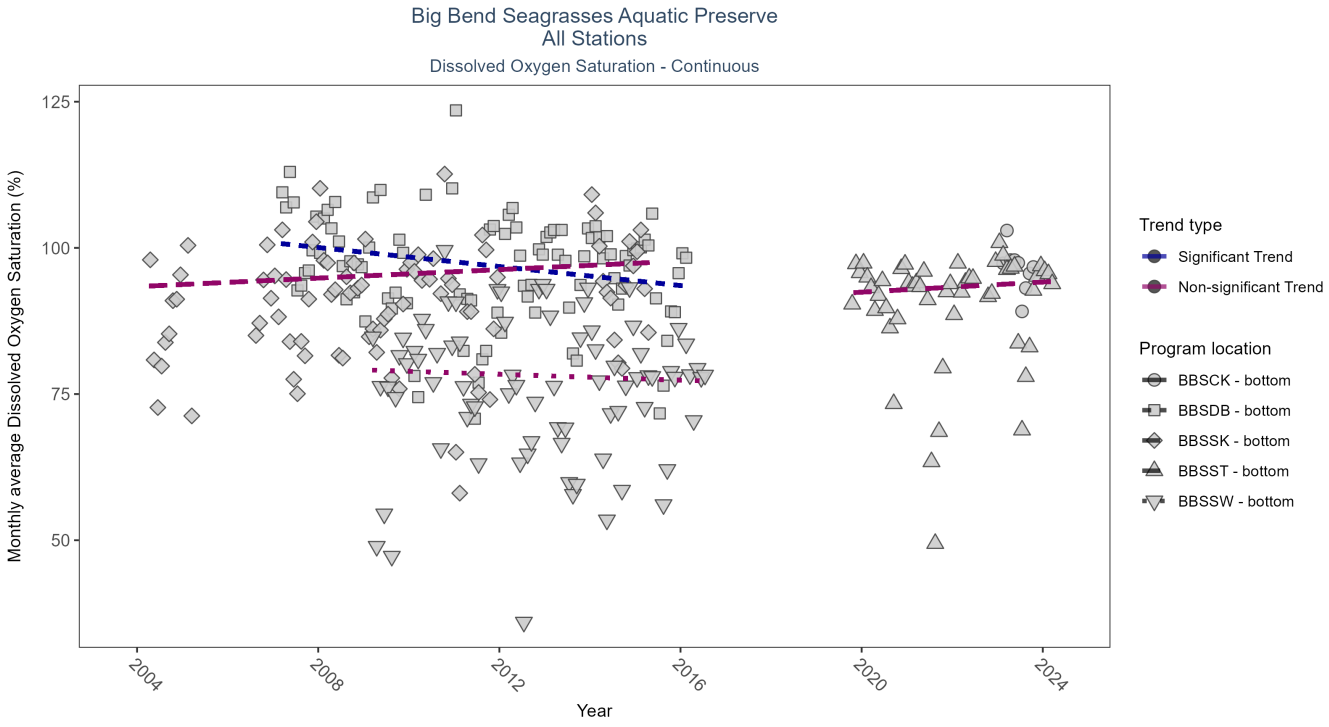

Figure 30: Figure for Dissolved Oxygen Saturation - Continuous - All stations combined

Table 36: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen Saturation

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
BBSCK	19834	1	2023 - 2023	95.7	-	-	-	-
BBSDB	183530	10	2007 - 2016	97.6	-0.3	100.88	-0.81	0.0003
BBSSK	134196	10	2004 - 2015	91.8	0.12	93.37	0.36	0.2612
BBSSW	182158	8	2009 - 2016	75.8	-0.05	79.14	-0.25	0.6835
BBSST	132032	6	2019 - 2024	93.8	0.14	91.99	0.43	0.3053

pH - All Stations Combined by Program

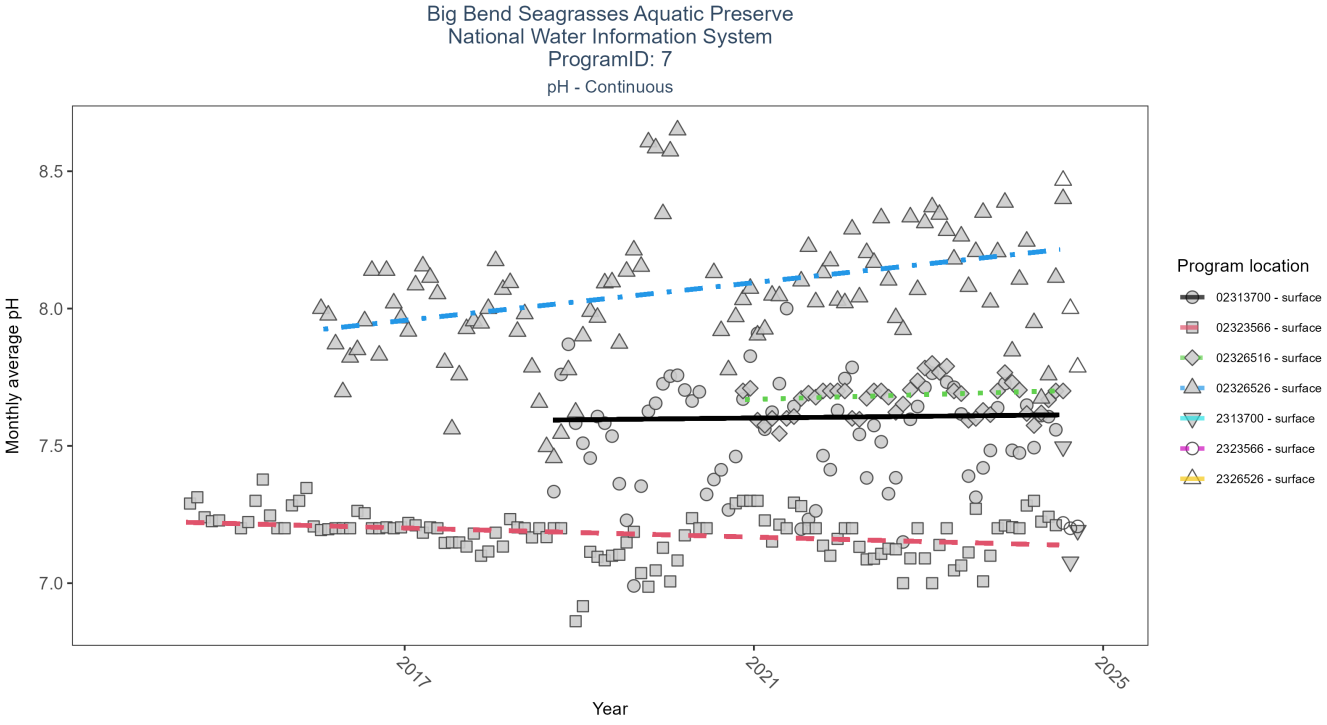

Figure 31: Figure for pH - Continuous - Program 7

Table 37: Seasonal Kendall-Tau Results for All Stations - pH

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
02313700	1997	7	2018 - 2024	7.6	0.03	7.59	0	0.9088
02323566	3303	11	2014 - 2024	7.2	-0.22	7.23	-0.01	0.0035
02326516	1221	5	2020 - 2024	7.7	0.18	7.66	0.01	0.1610
2323566	90	1	2024 - 2024	7.2	-	-	-	-
2326526	91	1	2024 - 2024	8.0	-	-	-	-
02326526	2733	9	2016 - 2024	8.0	0.3	7.92	0.03	0.0003
2313700	87	1	2024 - 2024	7.3	-	-	-	-

pH - All Stations Combined by Program

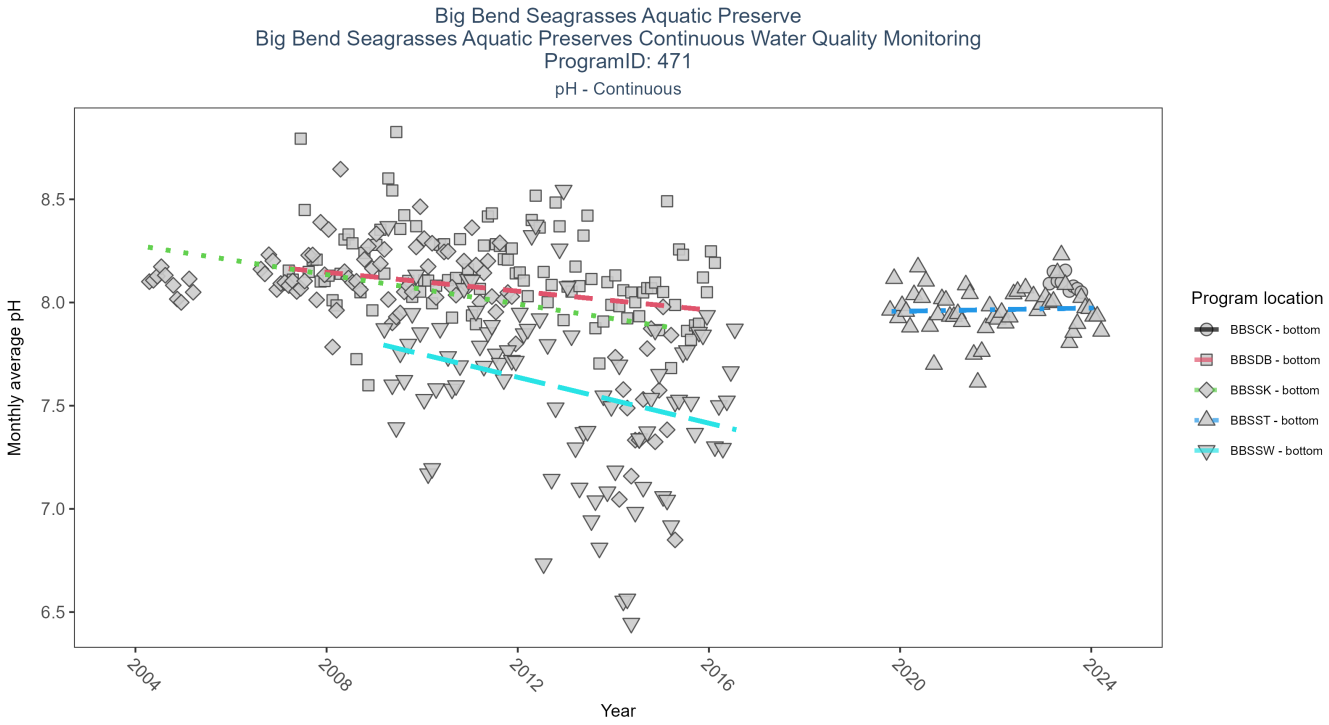

Figure 32: Figure for pH - Continuous - Program 471

Table 38: Seasonal Kendall-Tau Results for All Stations - pH

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
BBSCK	18185	1	2023 - 2023	8.1	-	-	-	-
BBSDB	250183	10	2007 - 2016	8.1	-0.28	8.17	-0.02	0.0004
BBSSK	168278	10	2004 - 2015	8.1	-0.37	8.28	-0.04	0.0000
BBSST	136969	6	2019 - 2024	8.0	0.08	7.95	0	0.8012
BBSSW	224733	8	2009 - 2016	7.6	-0.29	7.8	-0.06	0.0017

Salinity - All Stations Combined

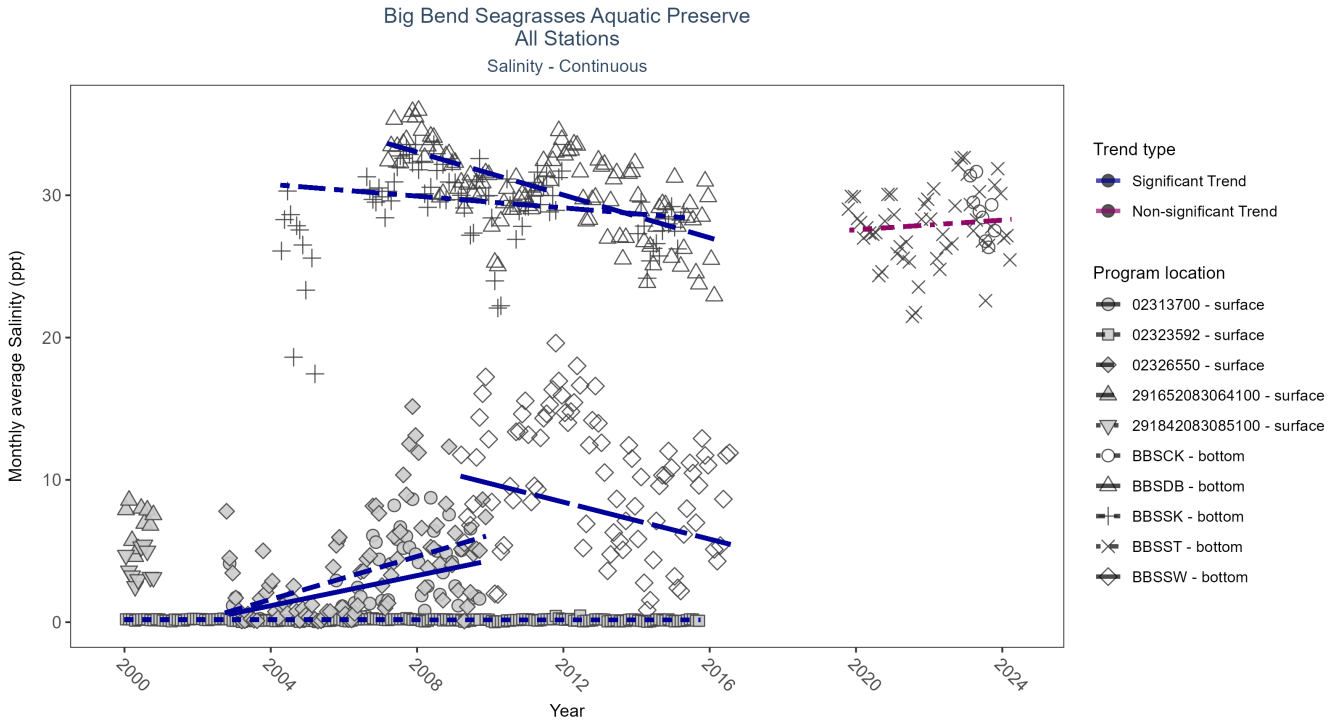

Figure 33: Figure for Salinity - Continuous - All stations combined

Table 39: Seasonal Kendall-Tau Results for All Stations - Salinity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
02326550	2507	8	2002 - 2009	1.7	0.48	0.09	0.76	0.0000
02323592	6064	16	2000 - 2015	0.1	-0.13	0.18	0	0.0156
02313700	1601	7	2002 - 2009	2.1	0.52	0.1	0.53	0.0000
291652083064100	827	1	2000 - 2000	6.7	-	-	-	-
291842083085100	584	1	2000 - 2000	3.7	-	-	-	-
BBSCK	14782	1	2023 - 2023	29.2	-	-	-	-
BBSDB	265544	10	2007 - 2016	30.6	-0.53	33.78	-0.75	0.0000
BBSSK	178356	10	2004 - 2015	29.6	-0.22	30.77	-0.21	0.0197
BBSSW	221696	8	2009 - 2016	7.5	-0.23	10.39	-0.65	0.0160
BBSST	139551	6	2019 - 2024	28.7	0.11	27.41	0.17	0.4095

Turbidity - All Stations Combined

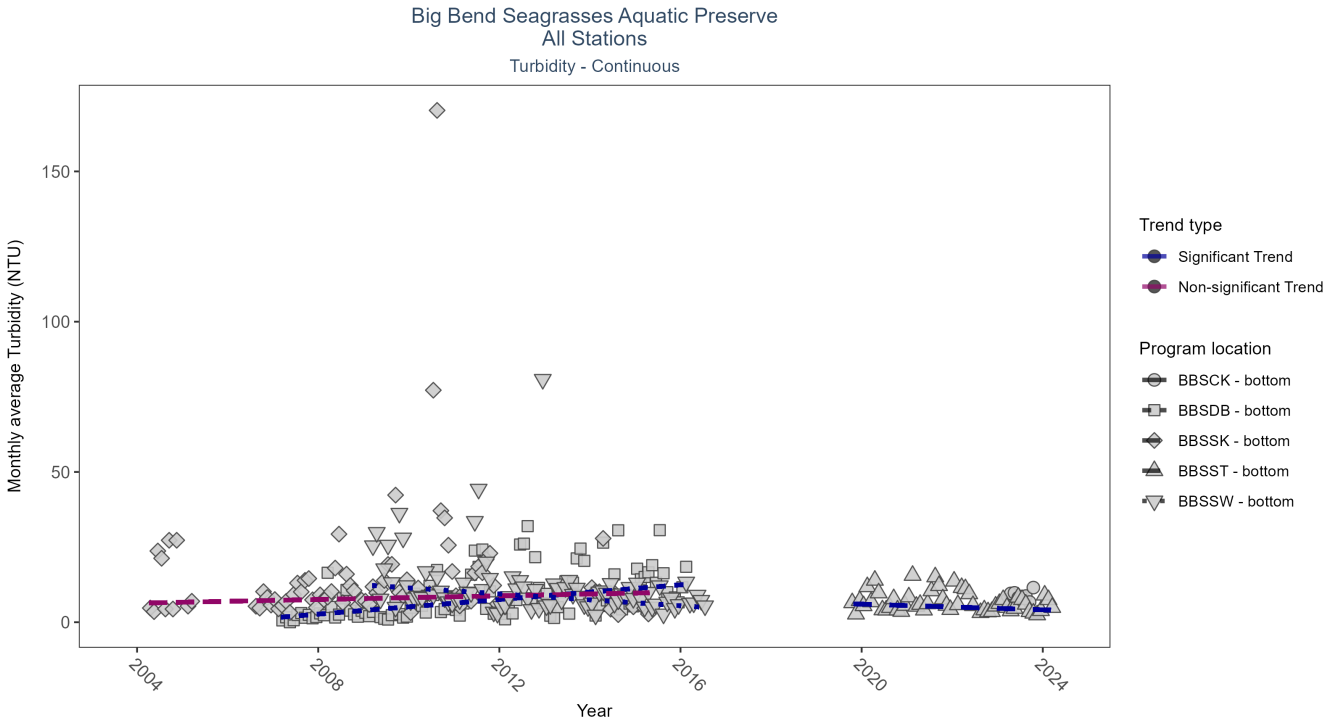

Figure 34: Figure for Turbidity - Continuous - All stations combined

Table 40: Seasonal Kendall-Tau Results for All Stations - Turbidity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
BBSCK	23243	1	2023 - 2023	7	-	-	-	-
BBSDB	224613	10	2007 - 2016	1	0.49	1.47	1.22	0.0000
BBSSK	165043	10	2004 - 2015	5	0.11	6.35	0.3	0.1867
BBSST	142812	6	2019 - 2024	4	-0.26	6.49	-0.47	0.0320
BBSSW	202699	8	2009 - 2016	6	-0.35	12.41	-0.99	0.0001

Water Temperature - All Stations Combined by Program

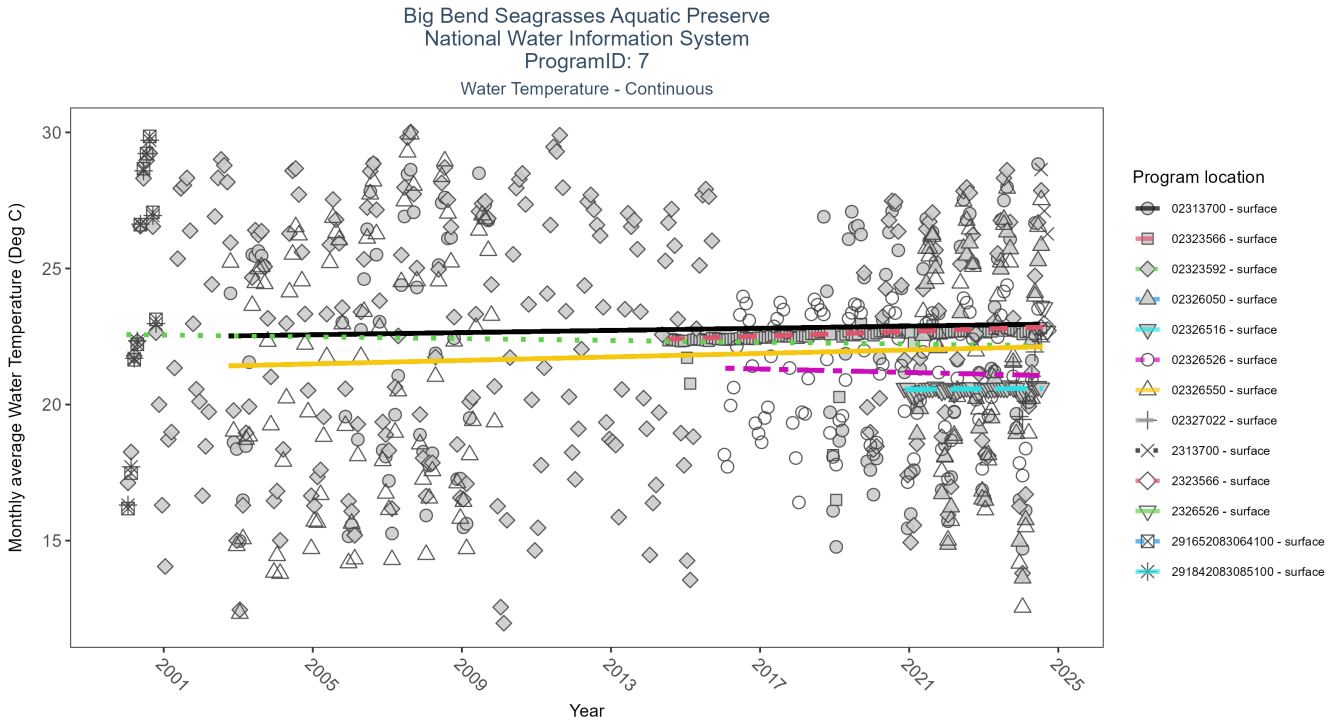

Figure 35: Figure for Water Temperature - Continuous - Program 7

Table 41: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
02313700	3706	14	2002 - 2024	22.9	0.1	22.51	0.02	0.1620
02323592	12465	22	2000 - 2024	23.3	-0.06	22.57	-0.02	0.1933
02326550	4278	12	2002 - 2024	22.2	0.17	21.4	0.03	0.0212
02323566	3622	11	2014 - 2024	22.6	0.74	22.38	0.04	0.0000
291652083064100	473	1	2000 - 2000	26.1	-	-	-	-
02326526	2978	9	2016 - 2024	21.4	-0.1	21.34	-0.03	0.2285
291842083085100	542	1	2000 - 2000	23.1	-	-	-	-
02326516	1238	5	2020 - 2024	20.6	0.25	20.55	0.01	0.1244
02326050	1321	4	2021 - 2024	21.7	-	-	-	-
02327022	274	2	2023 - 2024	20.9	-	-	-	-
2323566	70	1	2024 - 2024	22.8	-	-	-	-
2313700	87	1	2024 - 2024	27.3	-	-	-	-
2326526	92	1	2024 - 2024	23.4	-	-	-	-

Water Temperature - All Stations Combined by Program

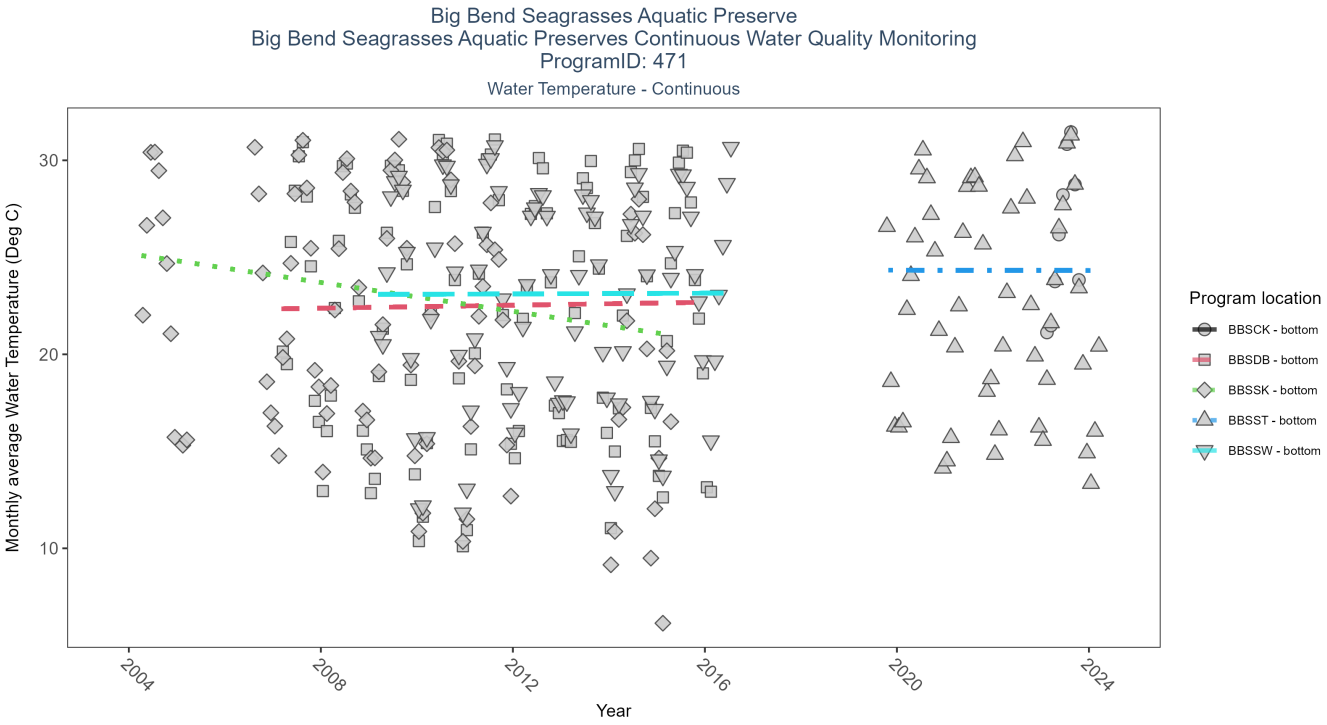

Figure 36: Figure for Water Temperature - Continuous - Program 471

Table 42: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
BBSCK	22232	1	2023 - 2023	26.4	-	-	-	-
BBSDB	265988	10	2007 - 2016	23.2	0.08	22.34	0.04	0.2922
BBSSK	179213	10	2004 - 2015	21.7	-0.33	25.19	-0.37	0.0002
BBSST	146056	6	2019 - 2024	22.7	0.04	24.34	0	1.0000
BBSSW	227996	8	2009 - 2016	23.7	0.02	23.09	0.01	0.9025

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

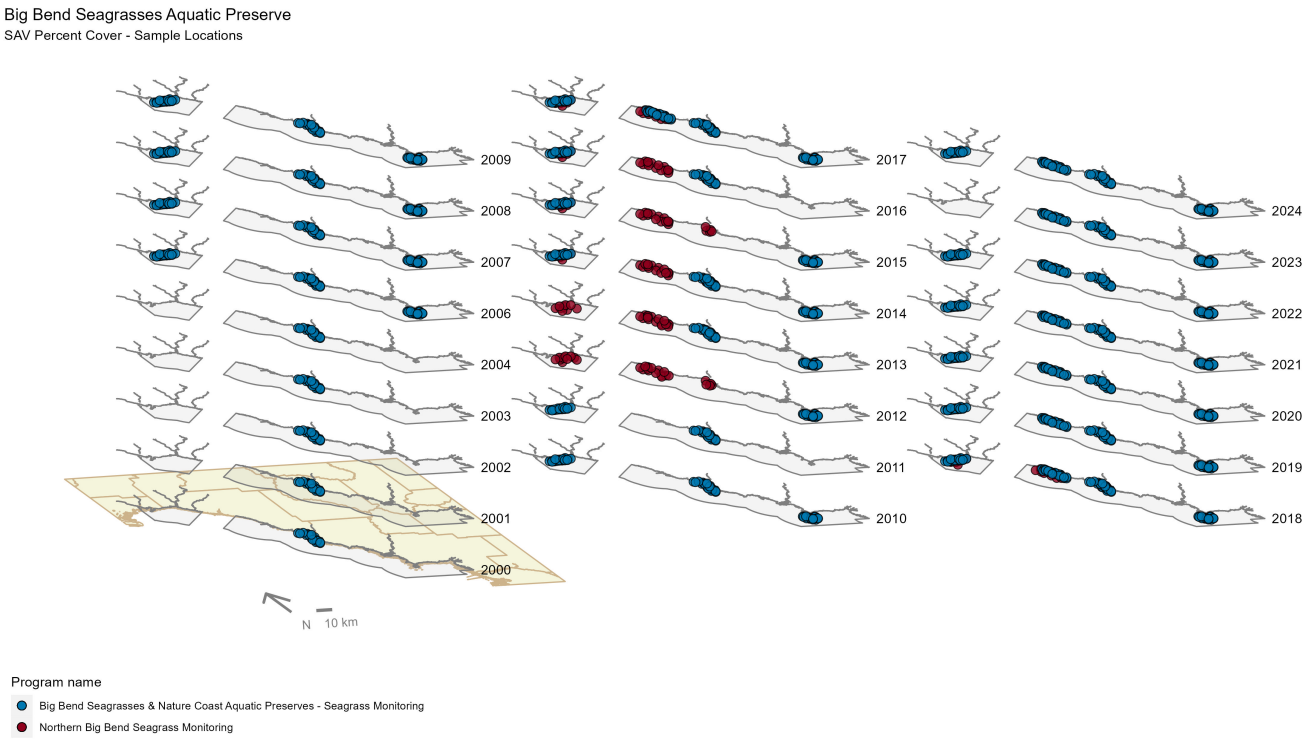

Figure 37: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Big Bend Seagrasses Aquatic Preserve* by Program name.

Sampling locations by Program:

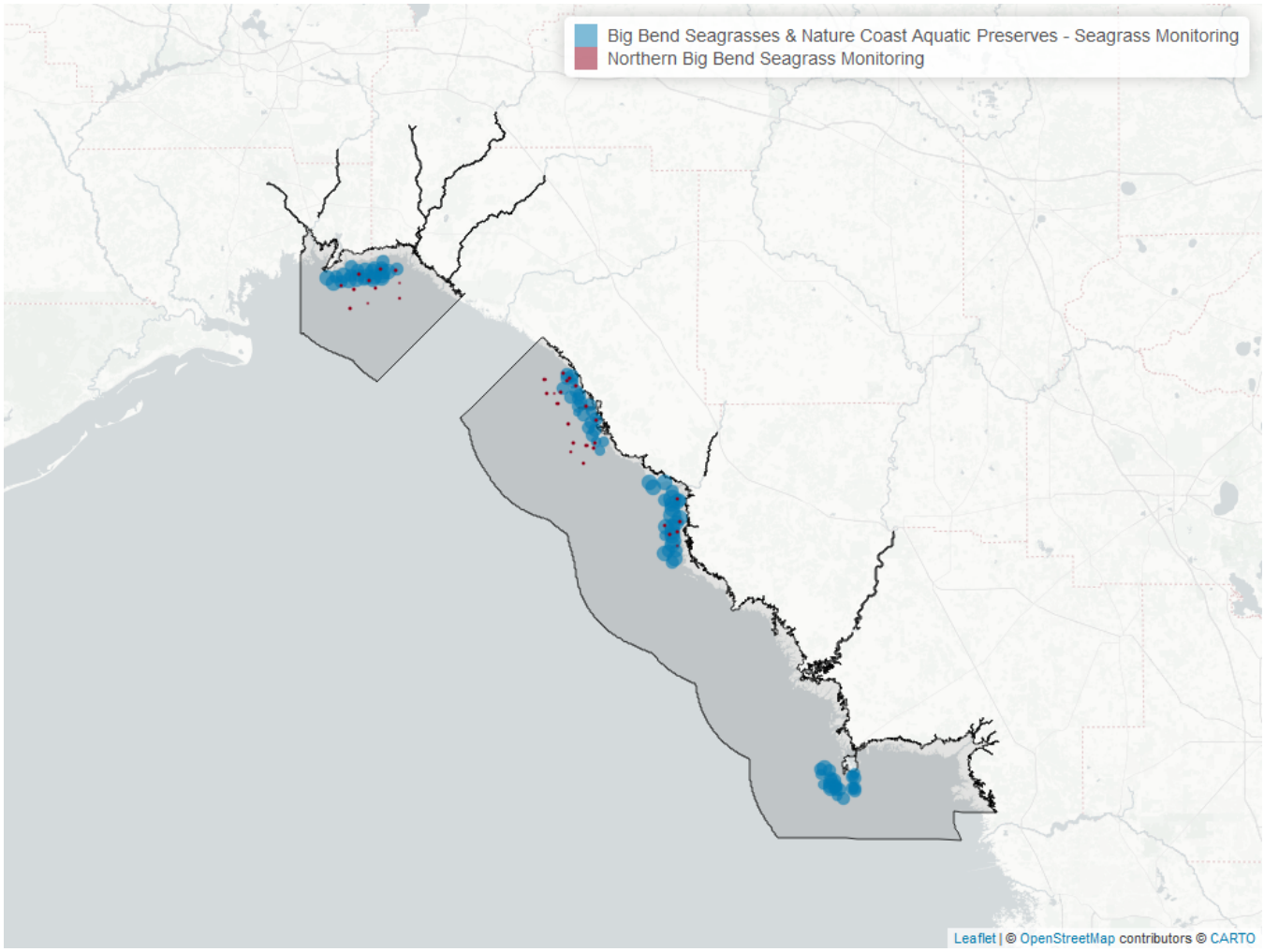

Figure 38: Map showing SAV sampling sites within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 43: Big Bend Seagrasses and Nature Coast Aquatic Preserves - Seagrass Monitoring - Program 560

N-Data	*YearMin*	*YearMax*	*method*	*Sample Locations*
19753	2000	2024	Modified Braun Blanquet	100
4271	2022	2024	Percent Cover	100

Table 44: Northern Big Bend Seagrass Monitoring - Program 559

N-Data	*YearMin*	*YearMax*	*method*	*Sample Locations*
537	2012	2018	Modified Braun Blanquet	195

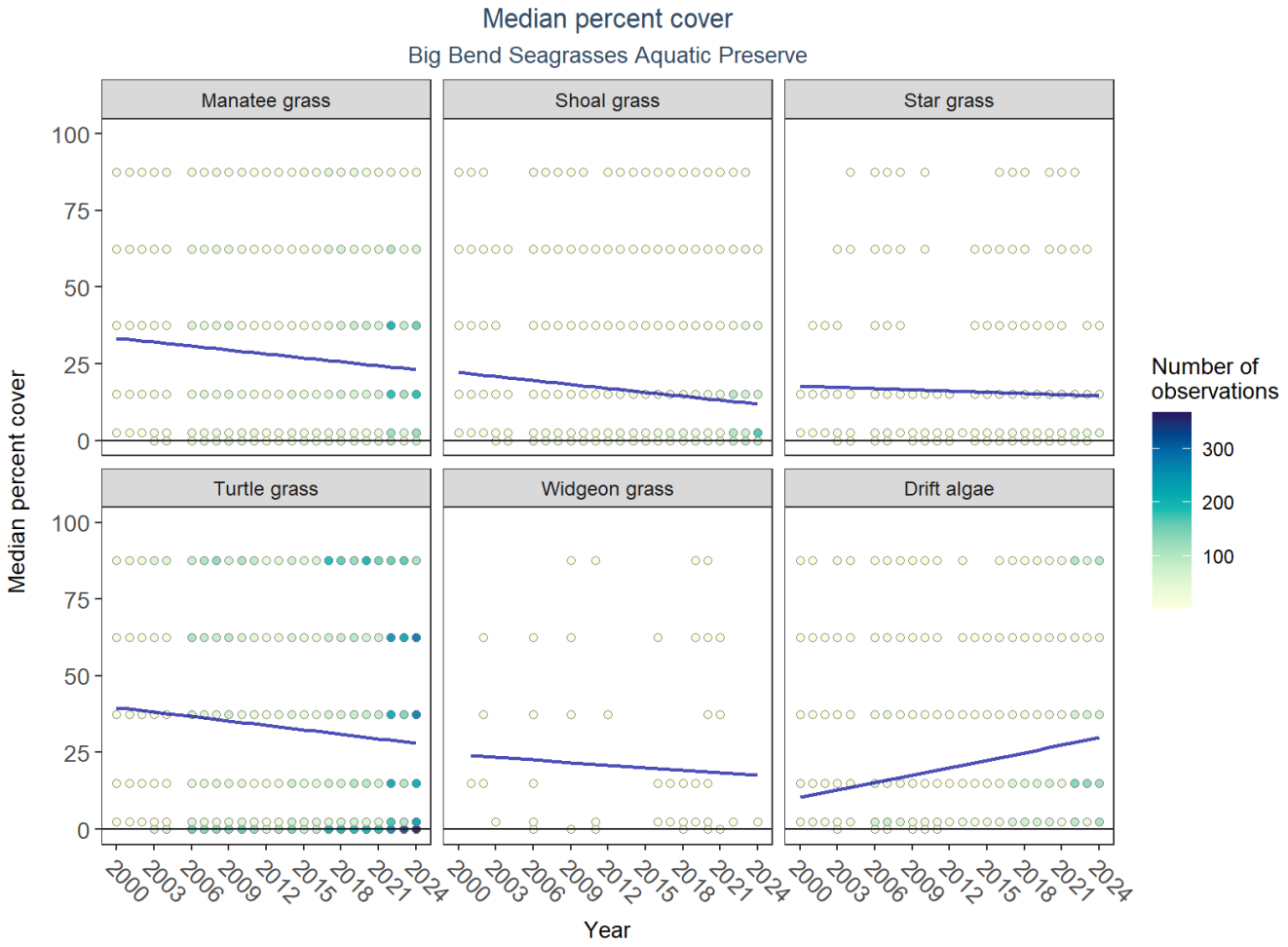

Figure 39: Trends in median percent cover for various seagrass species in Big Bend Seagrasses Aquatic Preserve

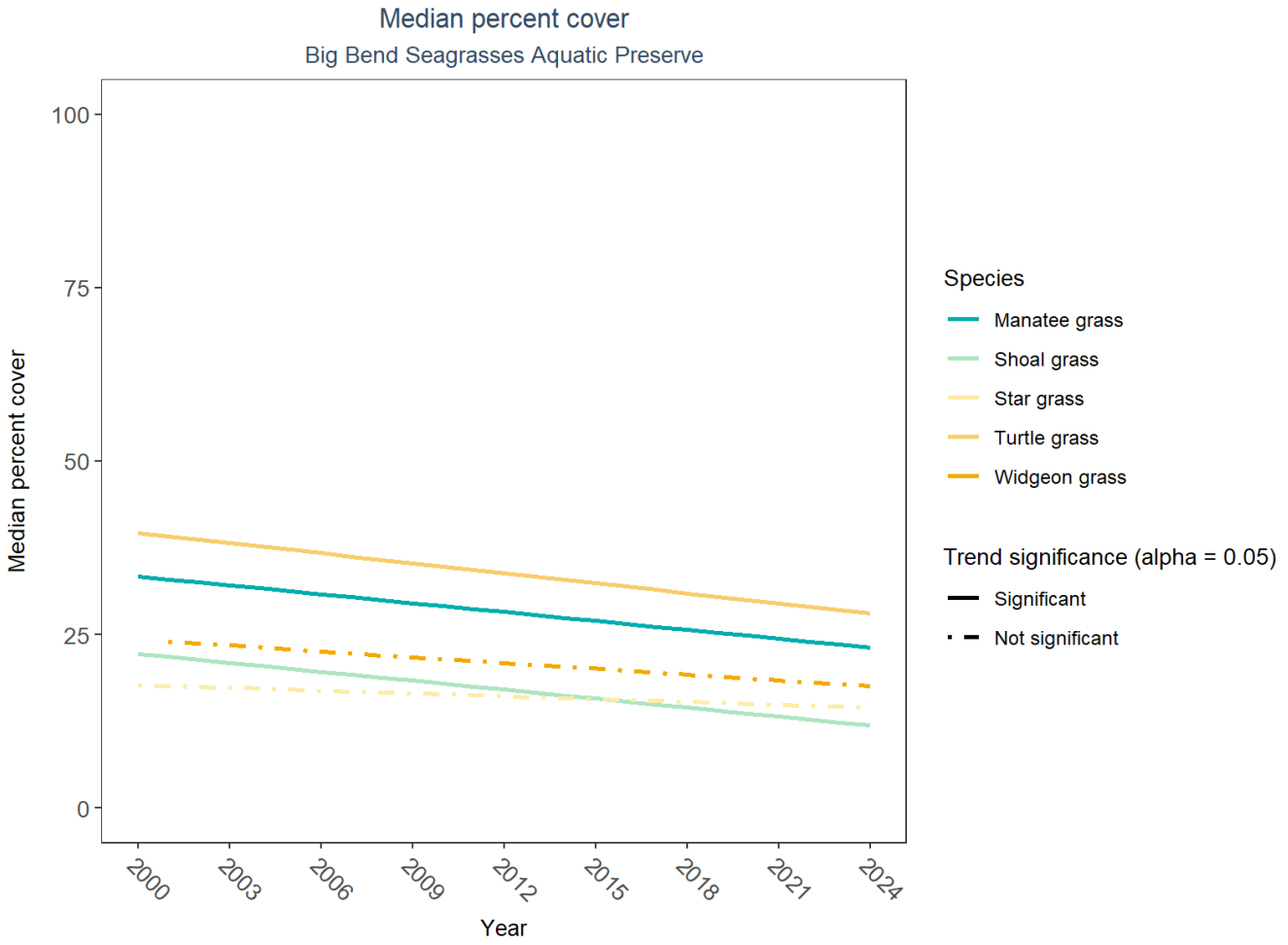

Figure 40: Trends in median percent cover for various seagrass species in Big Bend Seagrasses Aquatic Preserve - simplified

Table 45: Percent Cover Trend Analysis for Big Bend Seagrasses Aquatic Preserve

CommonName	*Trend Significance (0.05)*	*Period of Record*	*LME-Intercept*	*LME-Slope*	*p*
Drift algae	Significantly increasing trend	2000 - 2024	5.453919	0.8127327	0.0000009
Shoal grass	Significantly decreasing trend	2000 - 2024	24.829747	-0.4314551	0.0001280
Star grass	No significant trend	2000 - 2024	18.552789	-0.1347727	0.3089913
No grass in quadrat	Model did not fit the available data	2004 - 2024	-	-	-
Widgeon grass	No significant trend	2001 - 2024	25.939983	-0.2793425	0.5982235
Manatee grass	Significantly decreasing trend	2000 - 2024	35.945396	-0.4271771	0.0000536
Turtle grass	Significantly decreasing trend	2000 - 2024	42.516030	-0.4815126	0.0000000

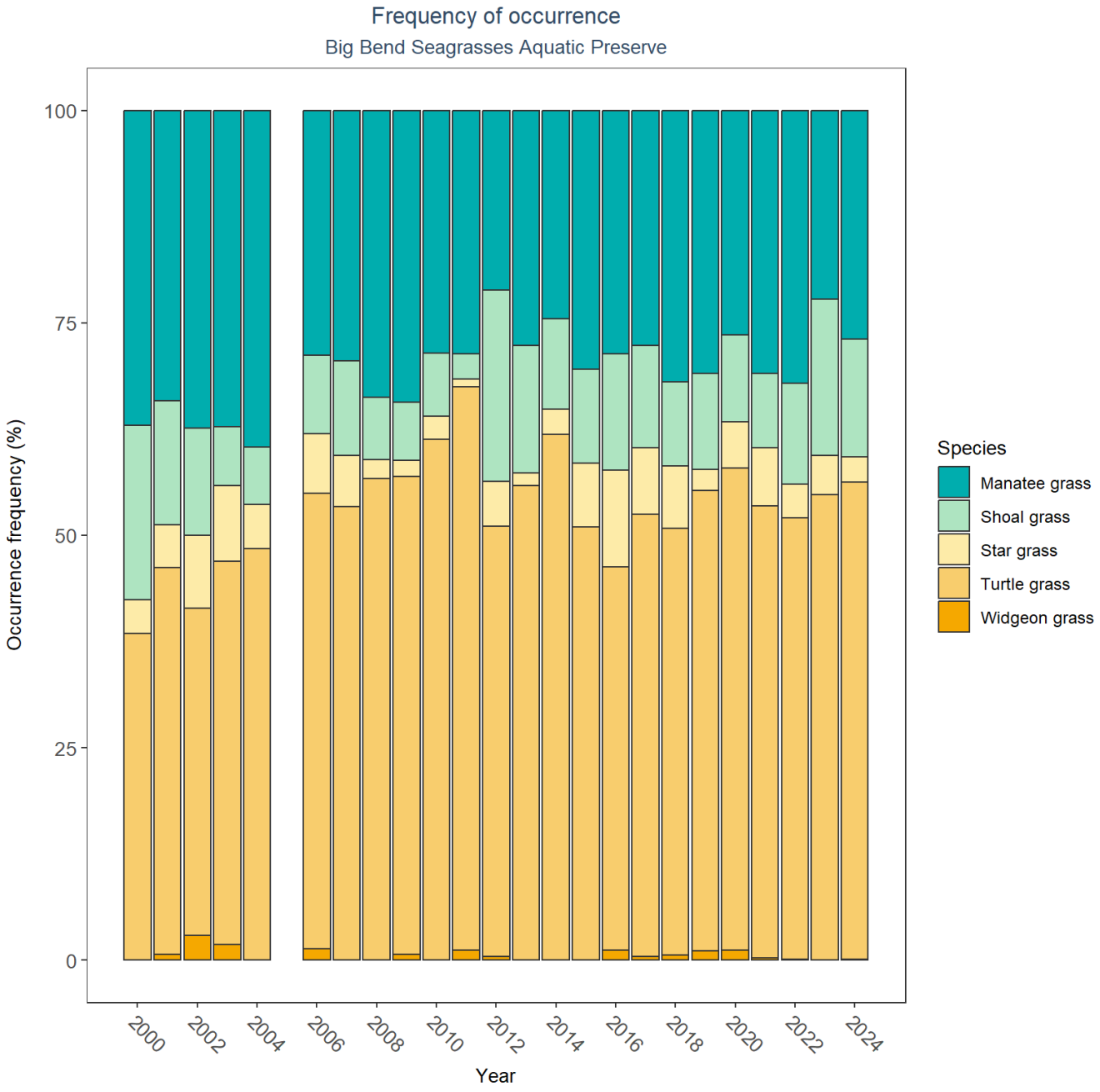

Figure 41: Frequency of occurrence for various seagrass species in Big Bend Seagrasses Aquatic Preserve

Coastal Wetlands

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

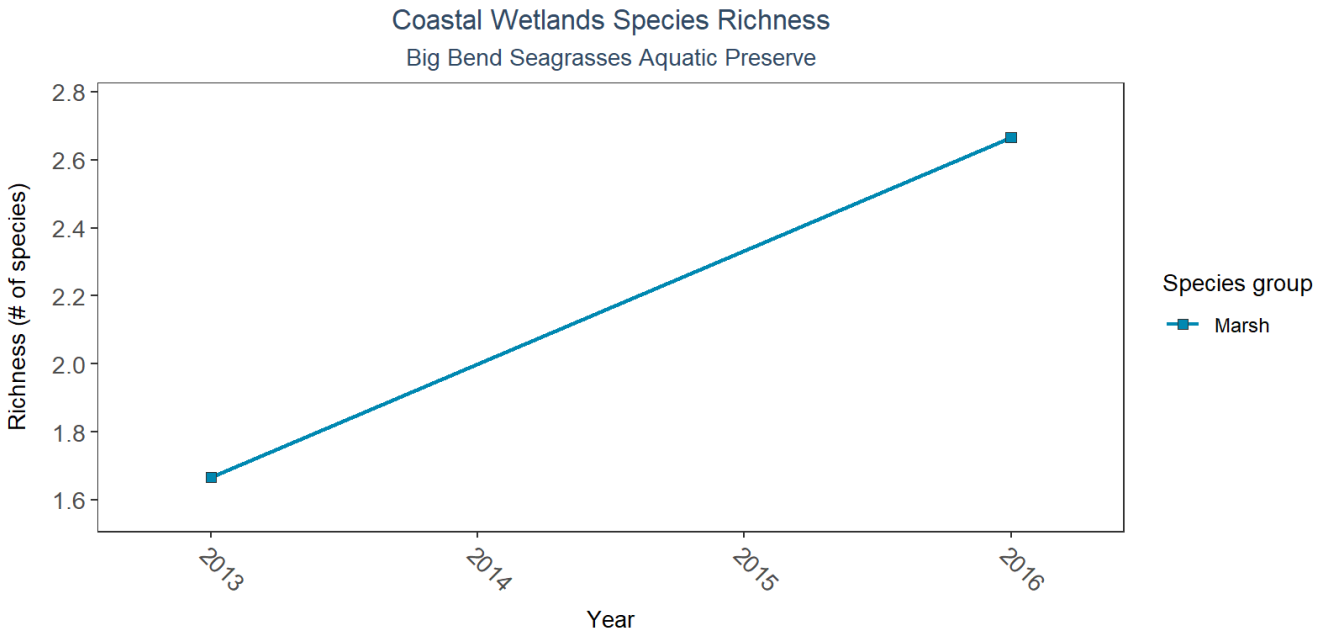

Figure 42: Figure for Coastal Wetlands Species Richness in Big Bend Seagrasses Aquatic Preserve

Table 46: Coastal Wetlands Species Richness

Species Group	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Marsh	6	2	2013 - 2016	2	2.17

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