Big Bend Seagrasses Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 08 October, 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	1	Optional parameter not collected
SWMP	-2	0	Missing data
SWMP	-3	0	Data rejected due to QA/QC
SWMP	-4	0	Outside low sensor range
SWMP	-5	0	Outside high sensor range
SWMP	0	1	Passed initial QA/QC checks
SWMP	1	0	Suspect data
SWMP	2	1	Reserved for future use
SWMP	3	1	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	1	Historical: Pre-auto QA/QC
SWMP	5	1	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 $p >= 0.05$). 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-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_pH-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Salinity-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Turbidity-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2025-Sep-04.txt*

Chlorophyll a, Corrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

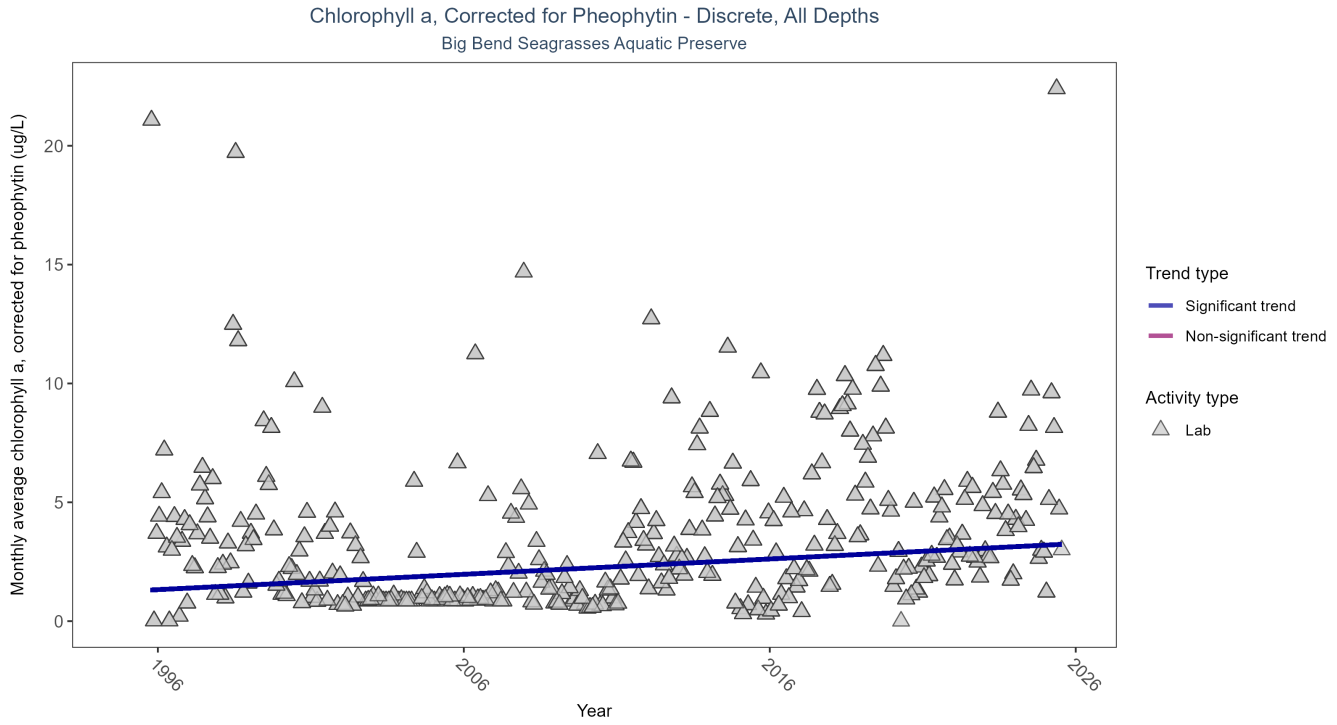

Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	4920	31	1995 - 2025	1.1	0.1864	1.2607	0.0645	0

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.06 µg/L per year, indicating a decrease in water clarity.

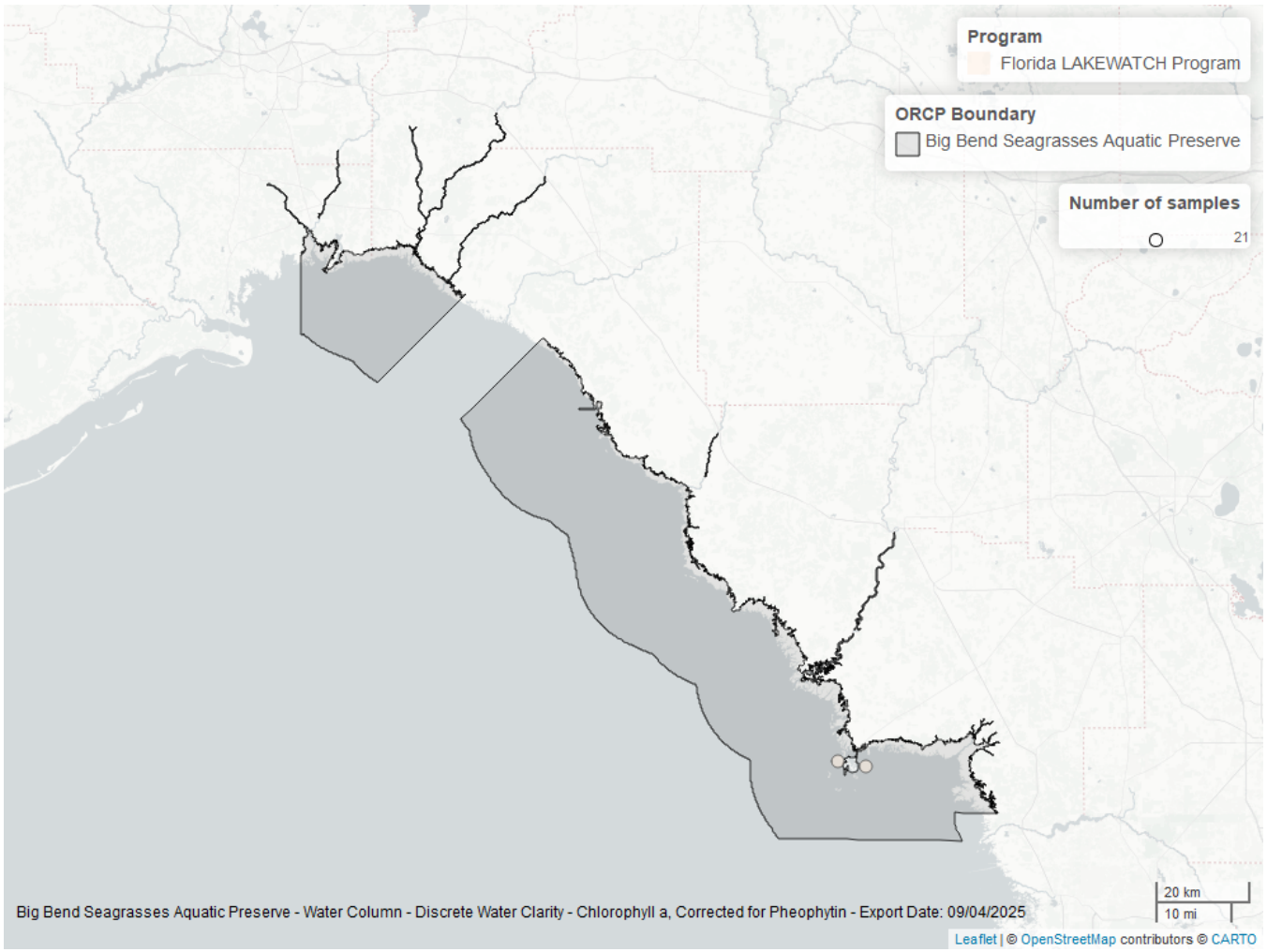

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	4204	1995	2025
477	325	2016	2025
514	314	2013	2024
540	131	2017	2022
5008	28	2023	2025

Program names:

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

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

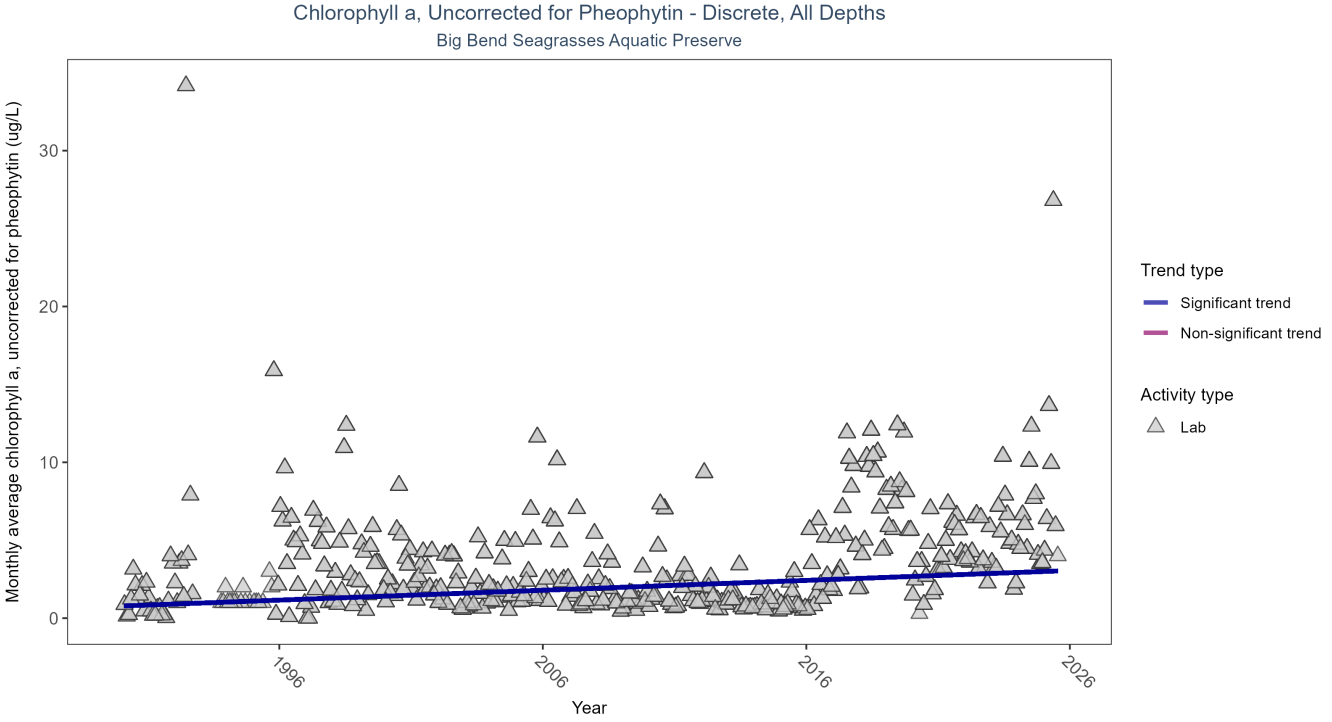

Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	6287	36	1990 - 2025	1.2	0.2221	0.7769	0.0633	0

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.06 µg/L per year, indicating a decrease in water clarity.

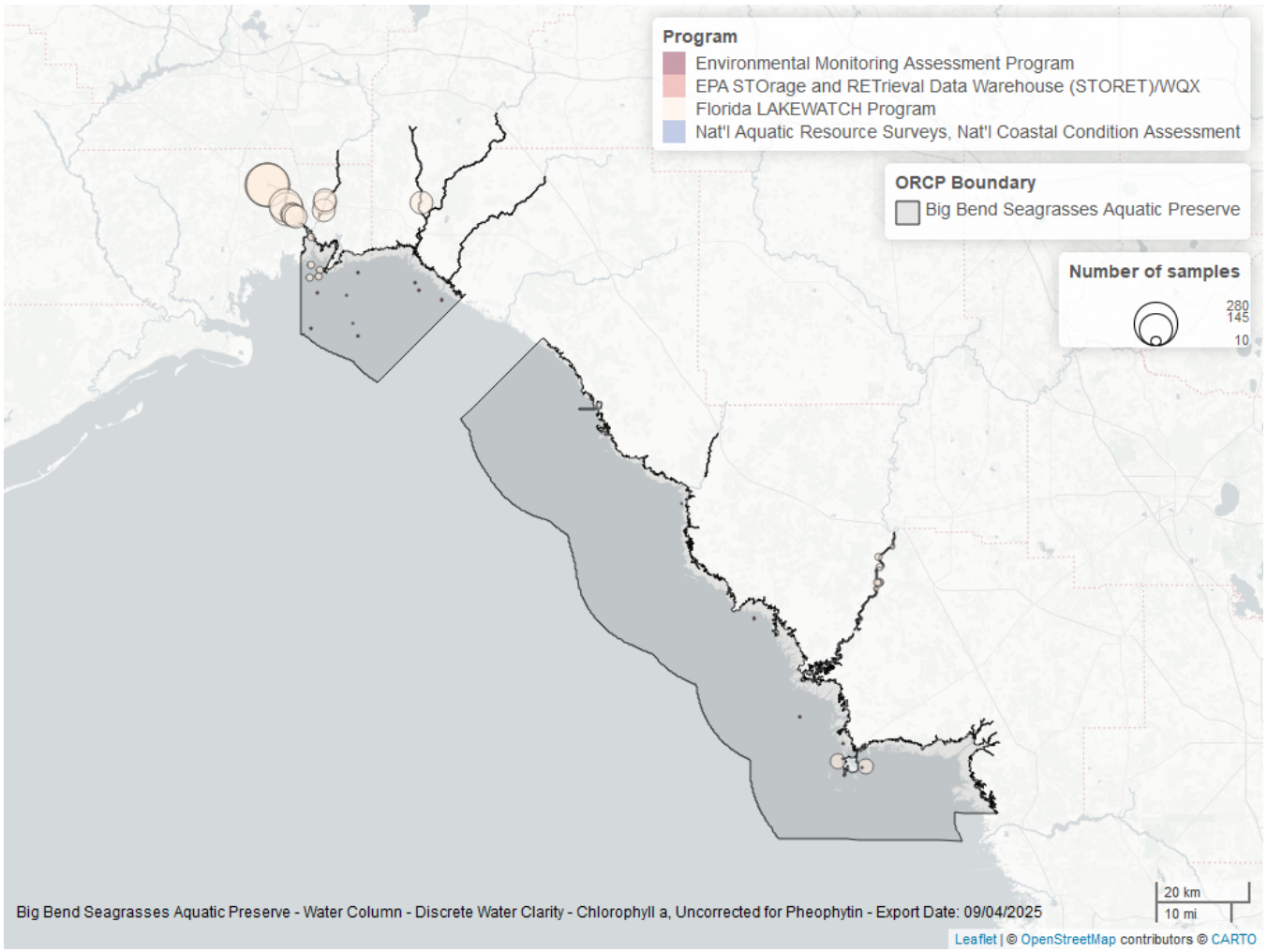

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	3621	1990	2025
514	2245	1993	2025
477	328	2016	2025
540	142	2017	2022
60	39	1986	2014
5008	29	2021	2025
103	22	2000	2015
118	12	2000	2010
115	7	2000	2004

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]

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[1]
514 - Florida LAKEWATCH Program[2]
540 - Shellfish Harvest Area Classification Program[3]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Colored Dissolved Organic Matter - Discrete

Seasonal Kendall-Tau Trend Analysis

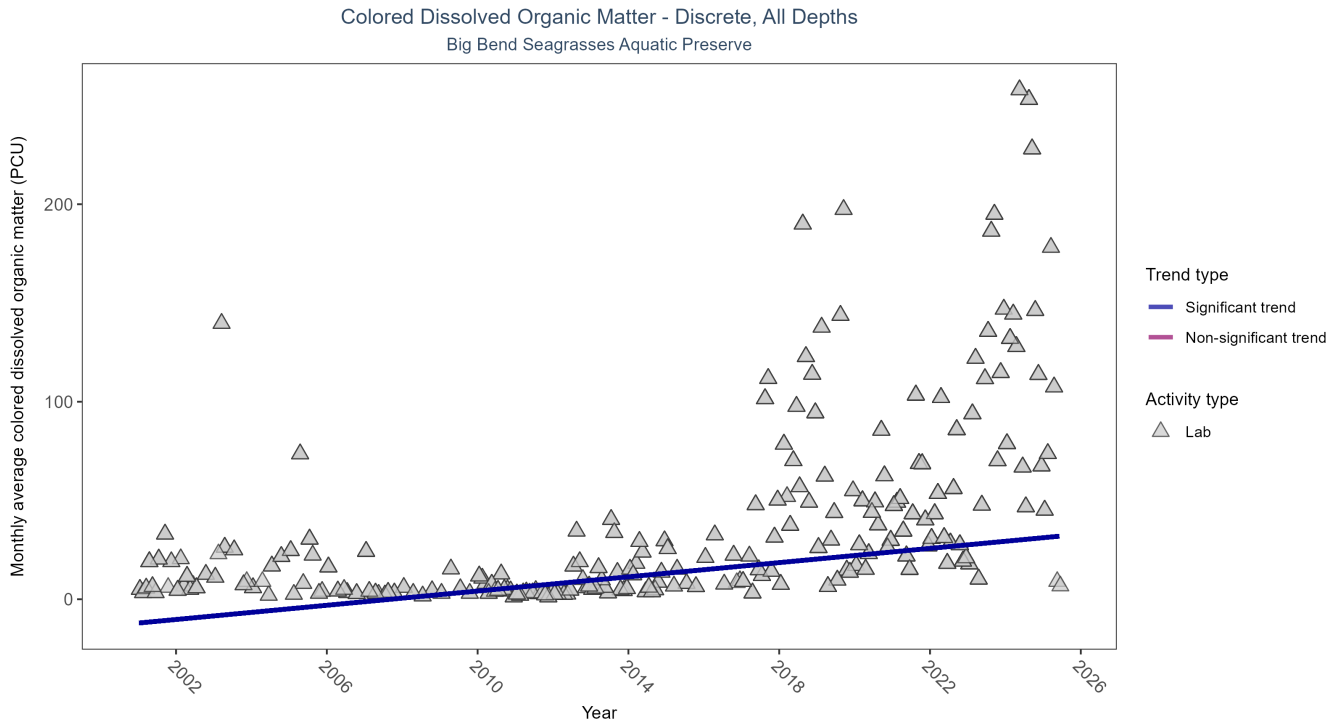

Figure 5: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	2889	25	2001 - 2025	17.6	0.4847	-12.0515	1.8	0

Monthly average colored dissolved organic matter increased by 1.8 PCU per year, indicating a decrease in water clarity.

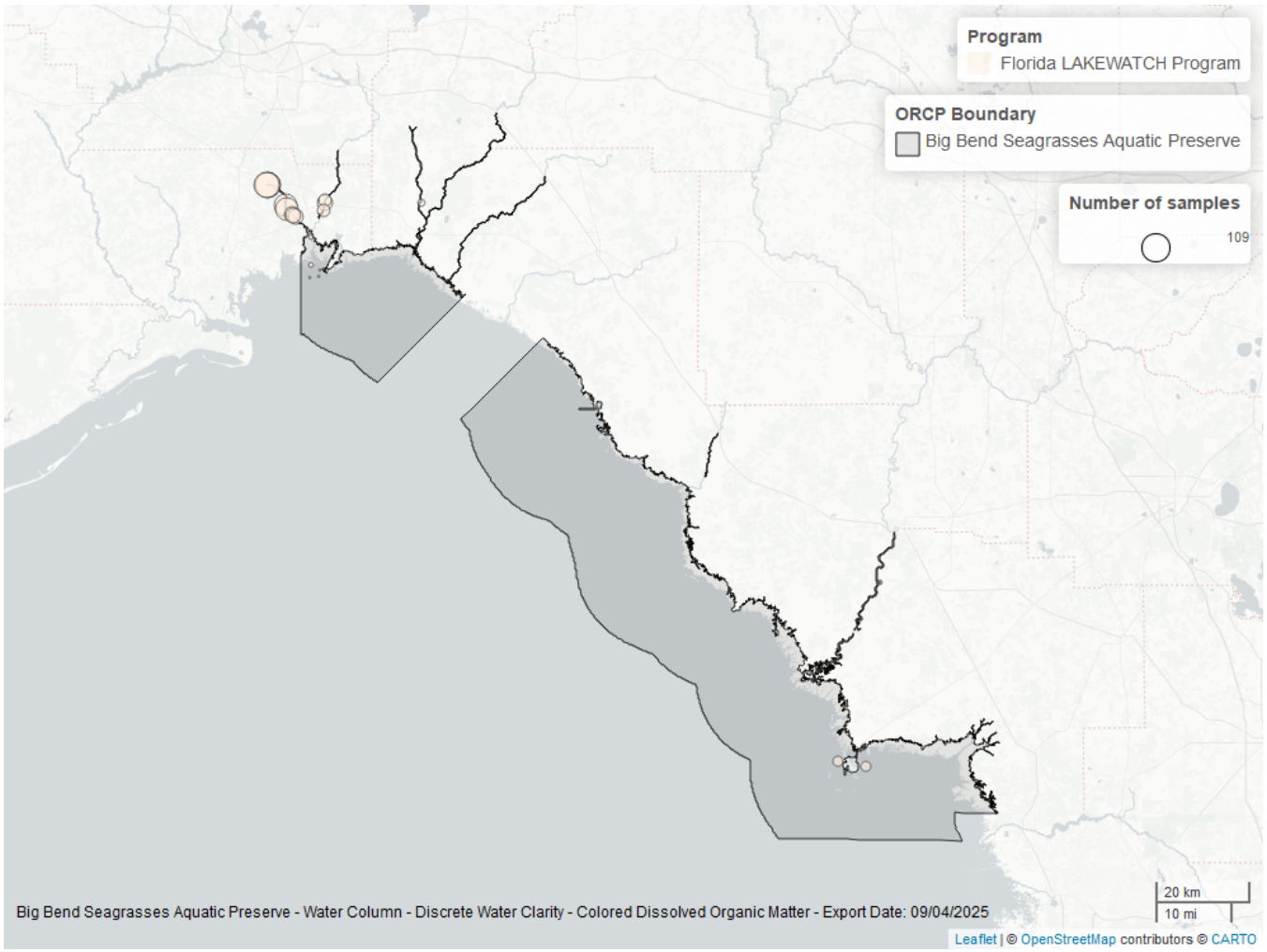

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1488	2014	2025
514	899	2001	2024
477	385	2016	2025
540	99	2017	2019
5008	50	2021	2025

Program names:

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

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

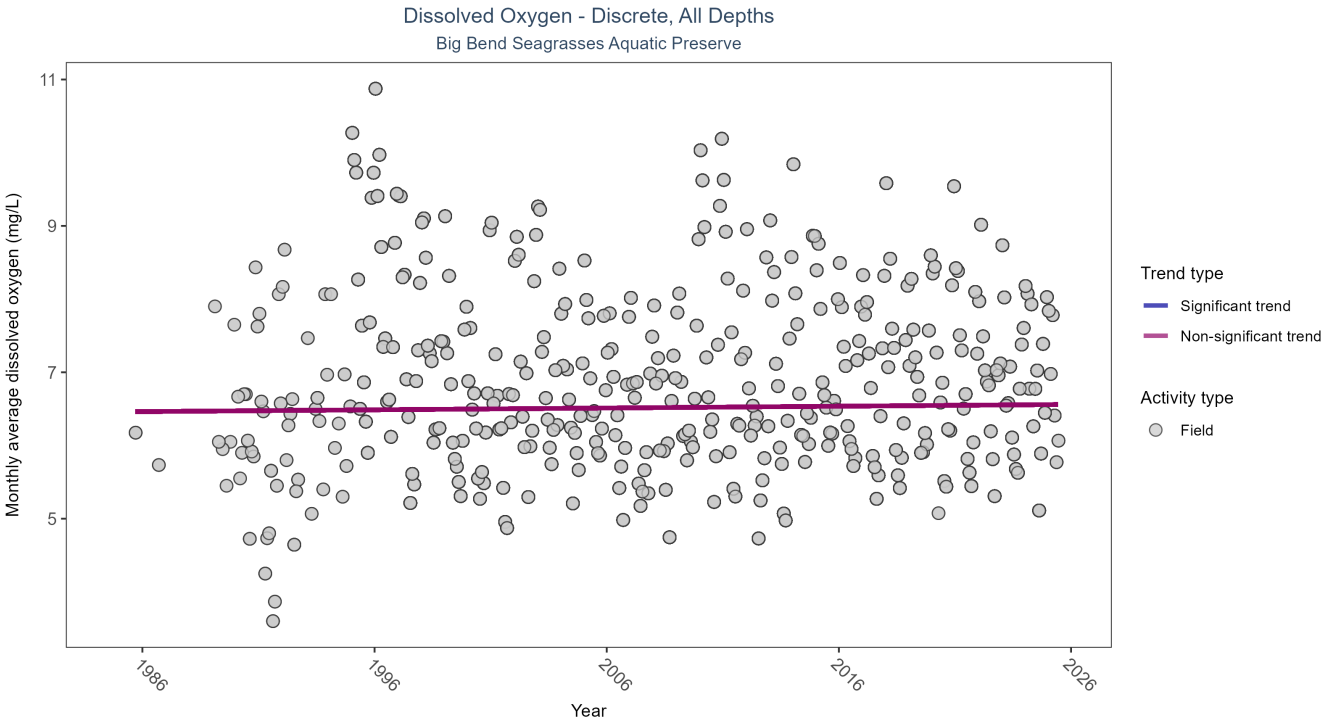

Figure 7: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	No significant trend	153189	39	1985 - 2025	6.71	0.0211	6.4604	0.0024	0.5065

Dissolved oxygen showed no detectable trend between 1985 and 2025.

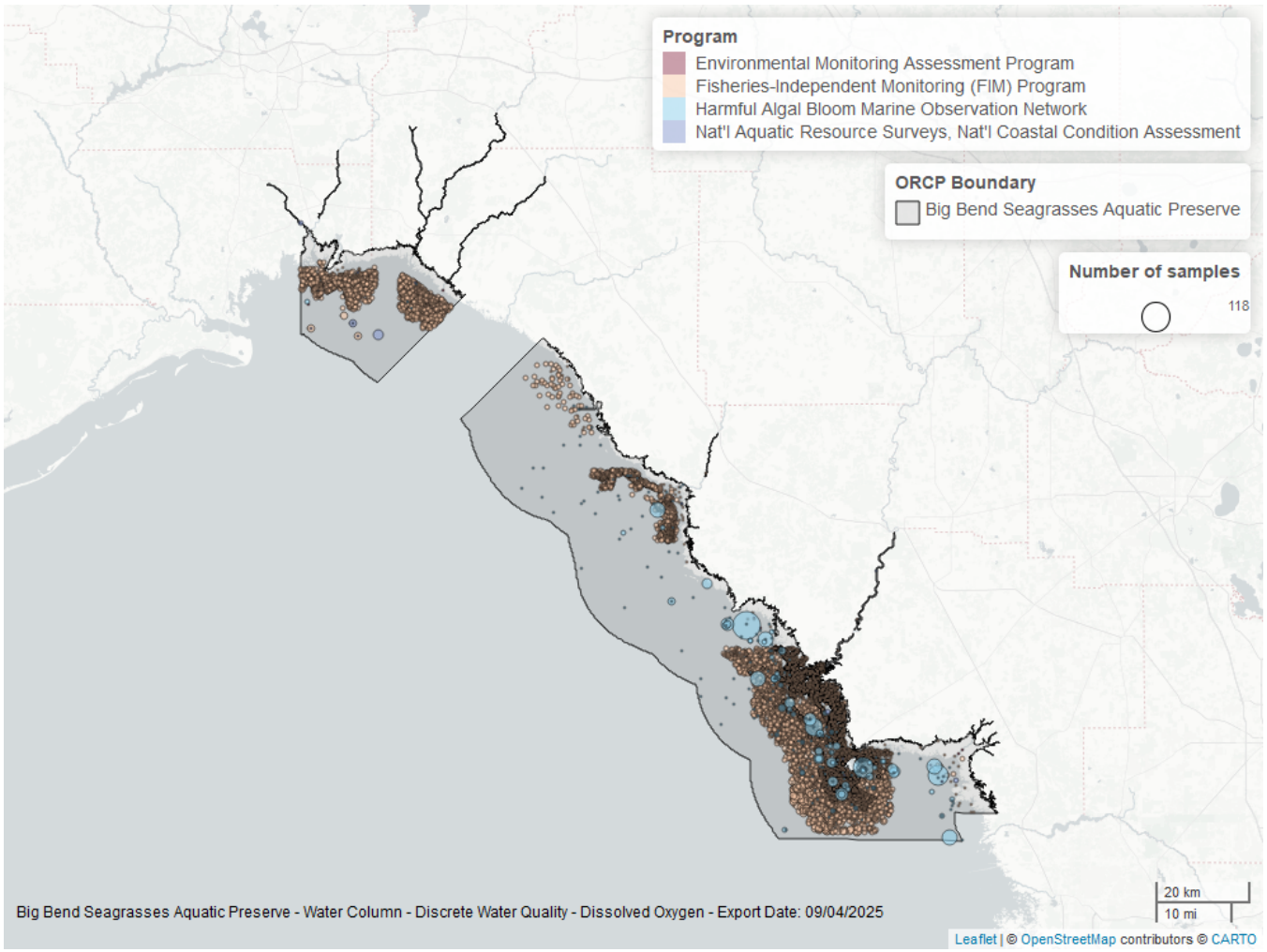

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	94123	1989	2025
69	57261	1996	2024
95	1163	1985	2018
477	385	2016	2025
540	121	2017	2022
60	113	1986	2014
118	53	2000	2021
5008	50	2021	2025
115	43	1991	2004
103	8	2015	2015

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[6]

69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]
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[1]
540 - Shellfish Harvest Area Classification Program[3]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

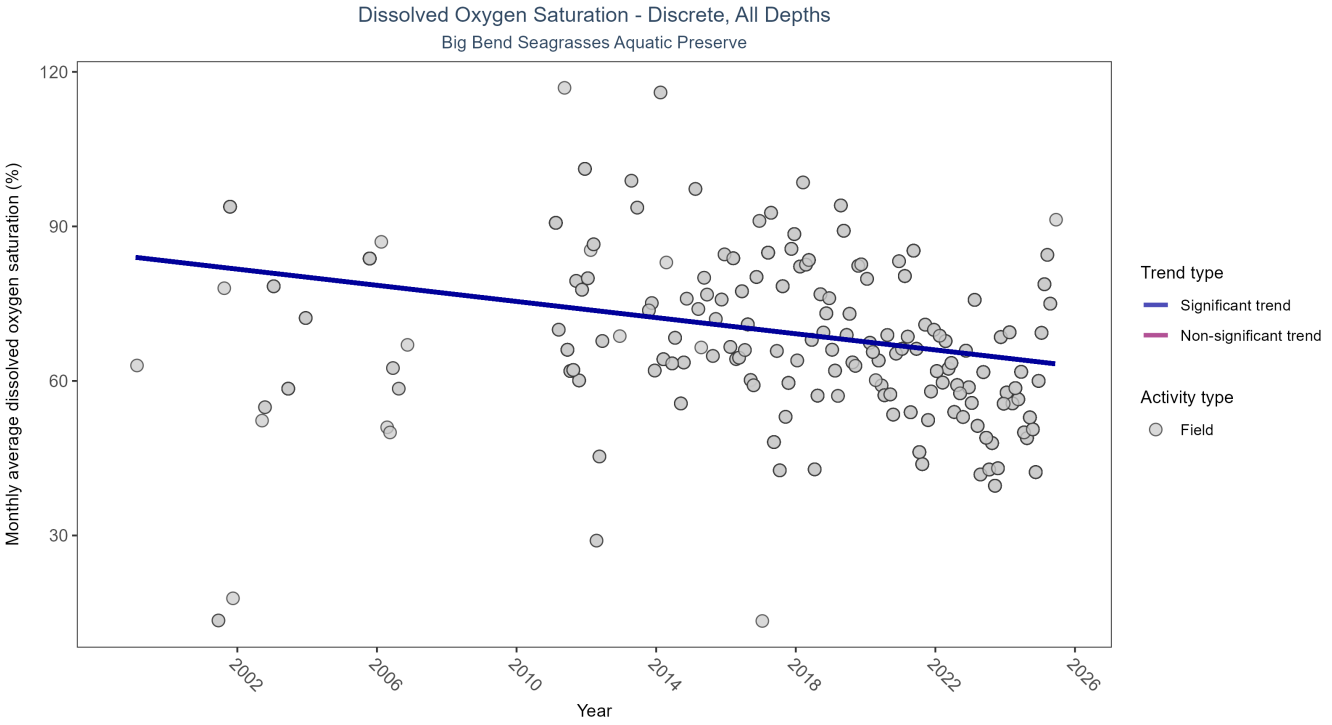

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly decreasing trend	1912	21	1999 - 2025	67	-0.2126	84.0559	-0.7841	0.0007

Monthly average dissolved oxygen saturation decreased by 0.78% per year.

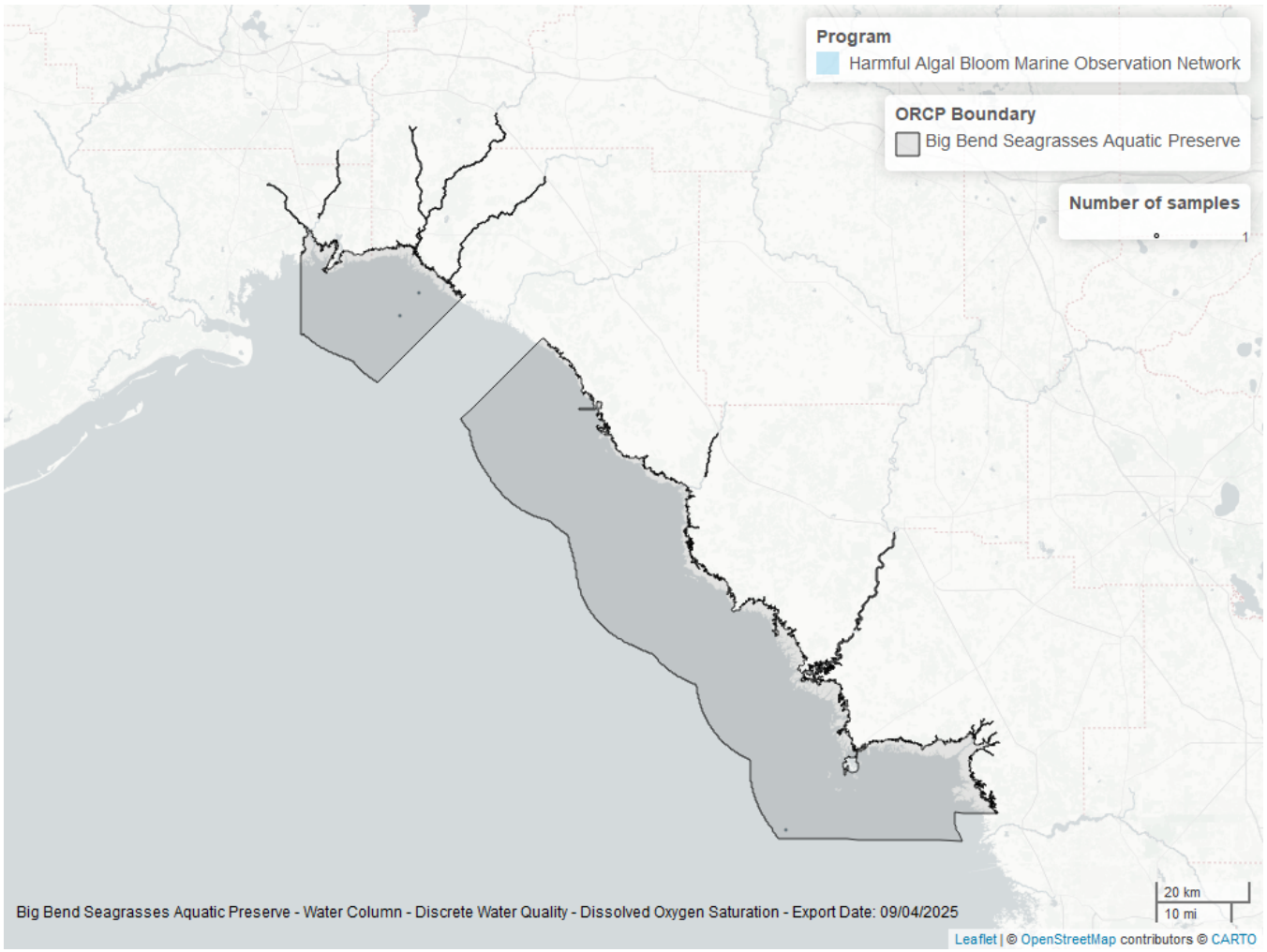

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1511	1999	2025
477	385	2016	2025
5008	49	2021	2025
95	3	2016	2018

Program names:

95 - Harmful Algal Bloom Marine Observation Network[11]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

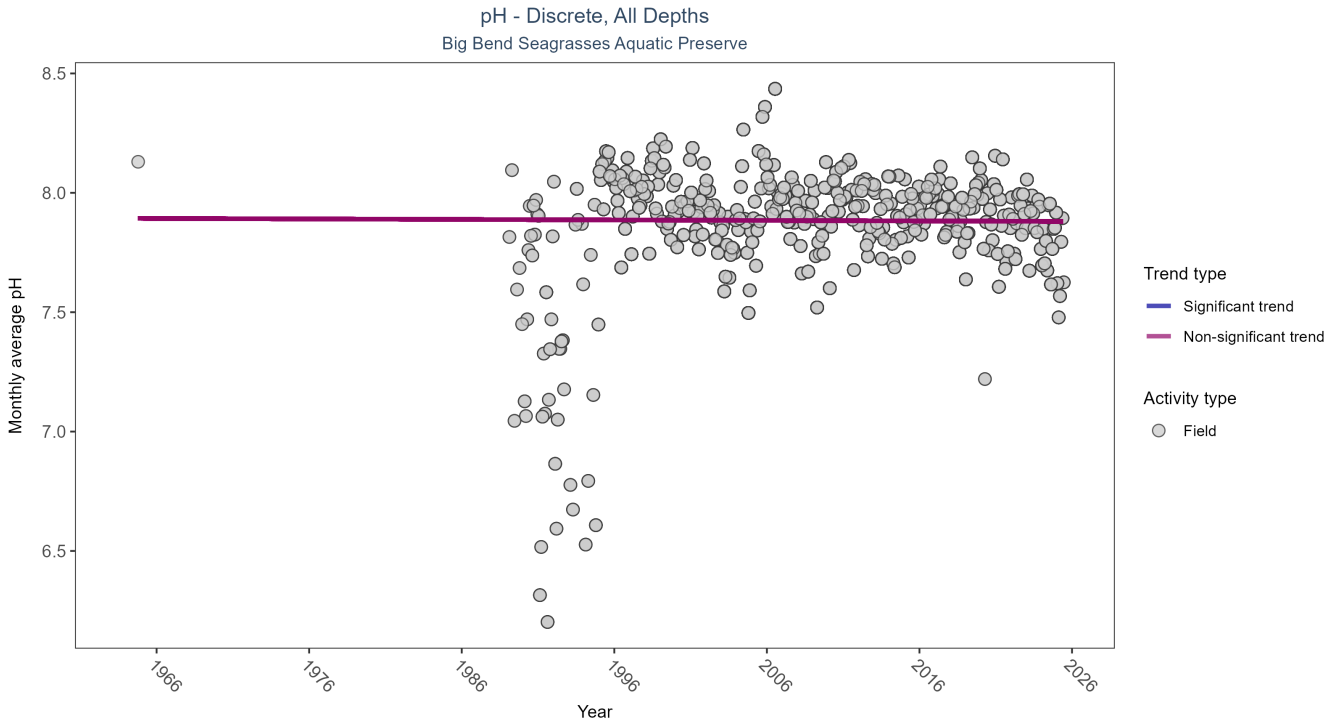

Figure 11: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 16: Seasonal Kendall-Tau Trend Analysis for pH

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	No significant trend	110554	38	1964 - 2025	8	-0.0112	7.8931	-0.0002	0.8406

pH showed no detectable trend between 1964 and 2025.

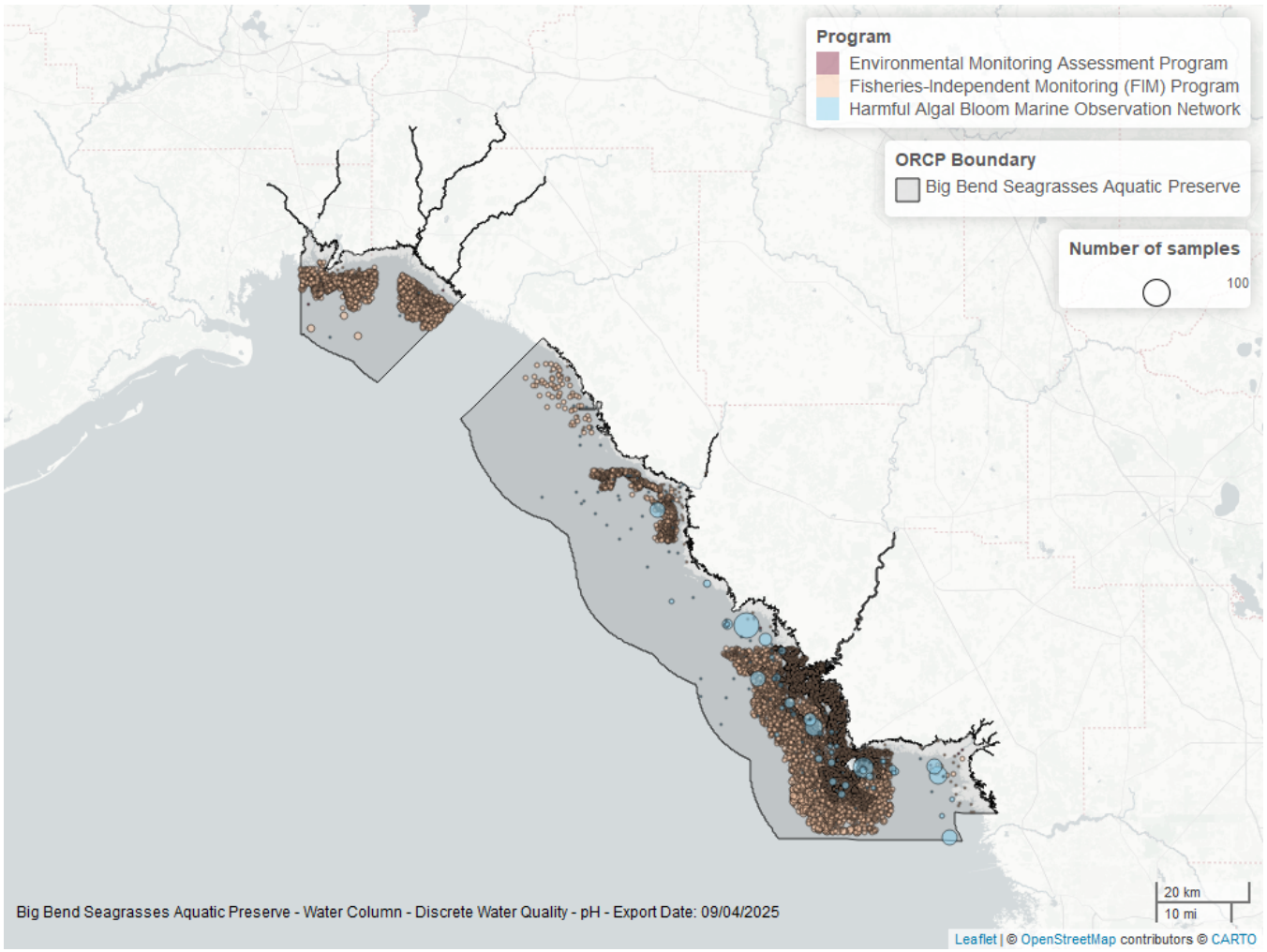

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	57154	1996	2024
5002	52139	1989	2025
95	776	1964	2018
477	385	2016	2025
540	85	2017	2022
5008	48	2021	2025
115	43	1991	2004
103	8	2015	2015

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[7]
115 - Environmental Monitoring Assessment Program[8]

477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
540 - Shellfish Harvest Area Classification Program[3]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

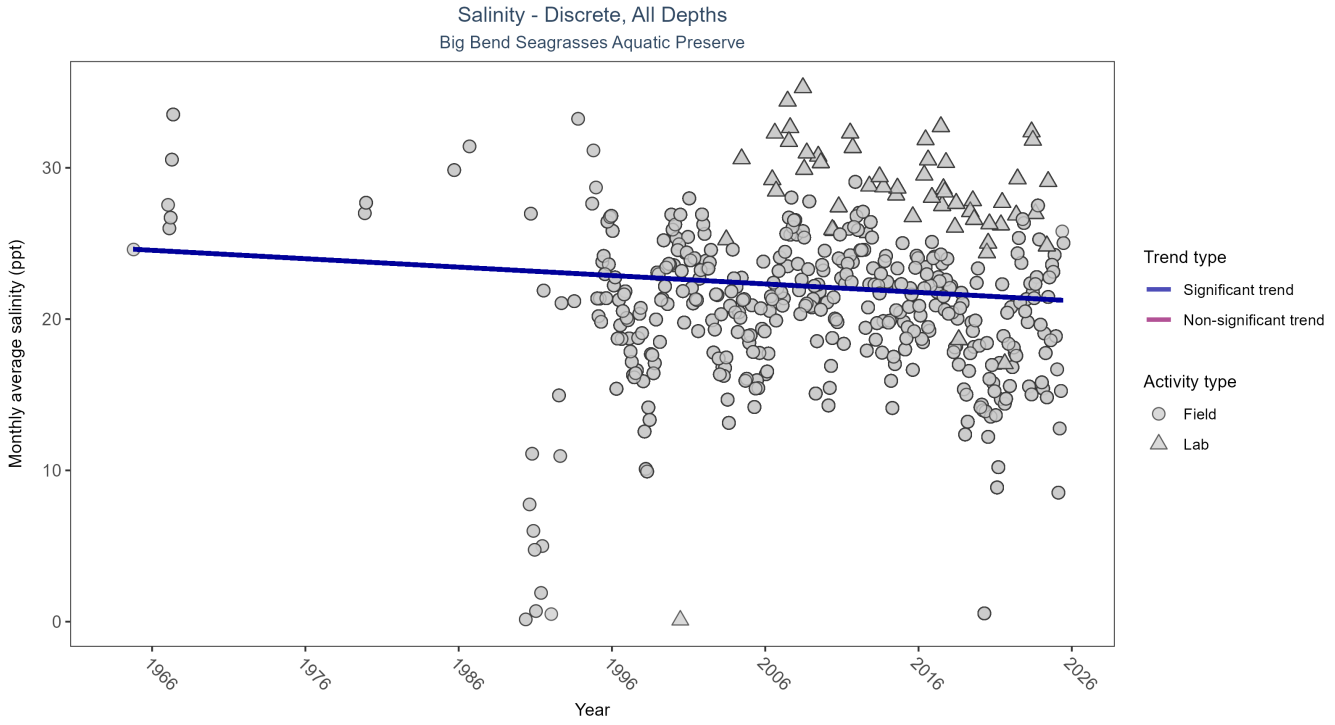

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (triangles) are both included in the plot.

Table 18: Seasonal Kendall-Tau Trend Analysis for Salinity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
All	Significantly decreasing trend	158388	41	1964 - 2025	23.3	-0.0966	24.6595	-0.0556	0.0062

Monthly average salinity decreased by 0.06 ppt per year.

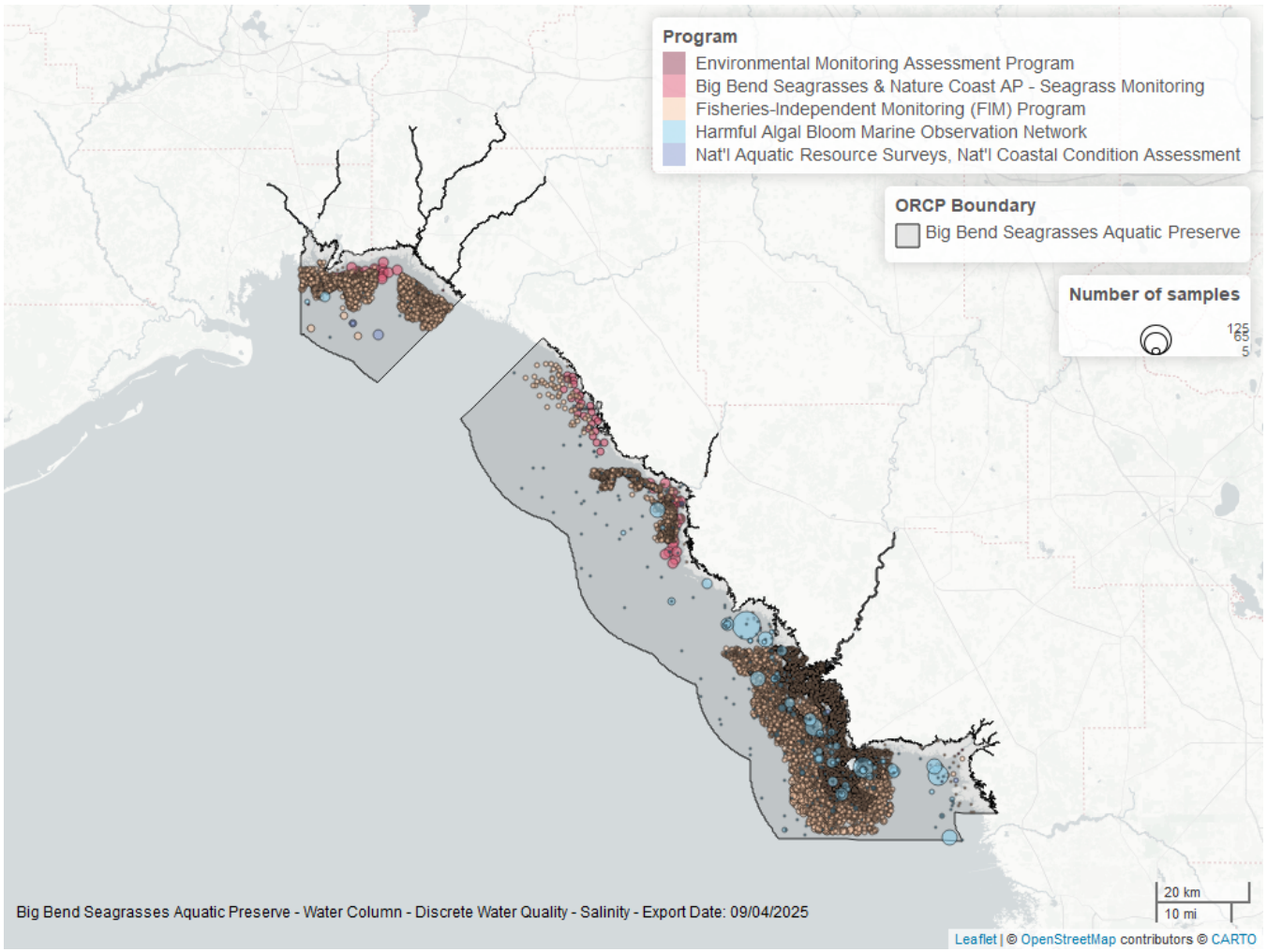

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	97556	1990	2025
69	57414	1996	2024
560	1474	2003	2024
95	1289	1964	2018
477	356	2016	2025
540	132	2017	2022
60	109	1986	2014
118	51	2015	2021
5008	51	2021	2025
115	43	1991	2004

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[6]

69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]
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[1]
540 - Shellfish Harvest Area Classification Program[3]
560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring[12]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

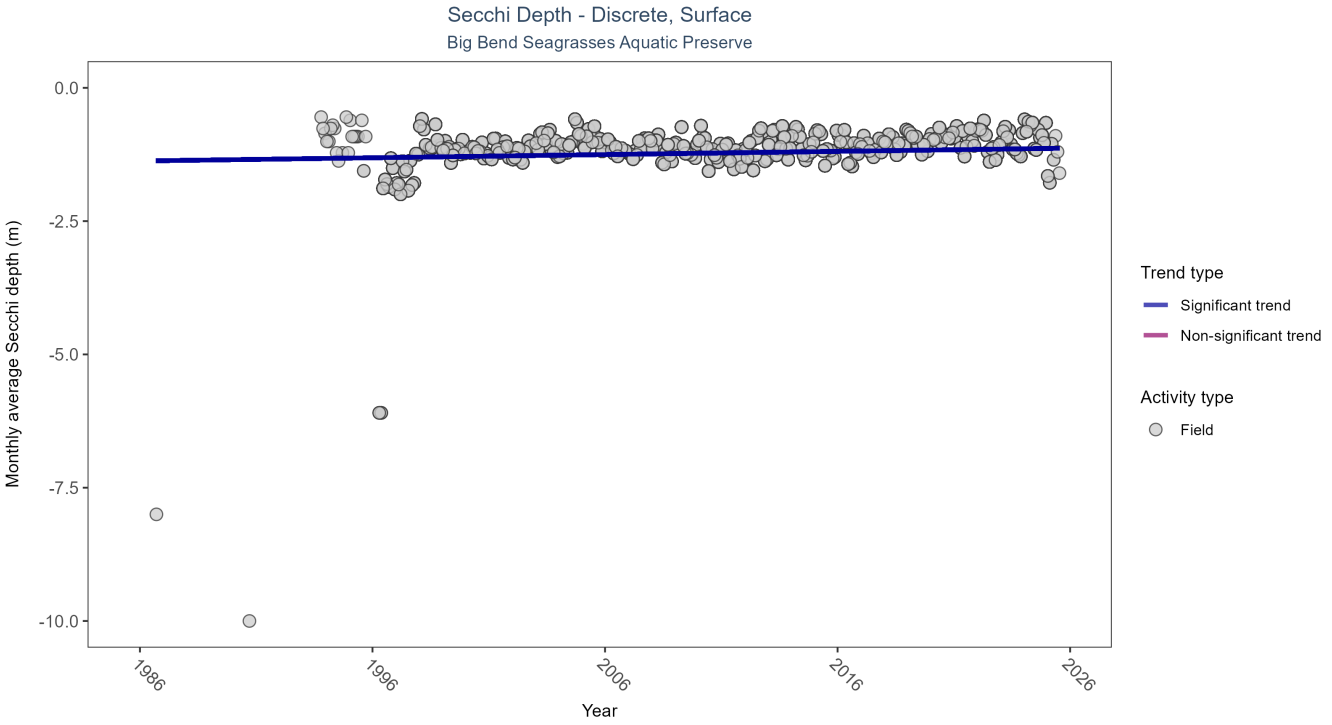

Figure 15: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly increasing trend	62713	37	1986 - 2025	-0.9	0.1283	-1.372	0.006	0.0004

Monthly average Secchi depth became shallower by 0.01 m per year, indicating a decrease in water clarity.

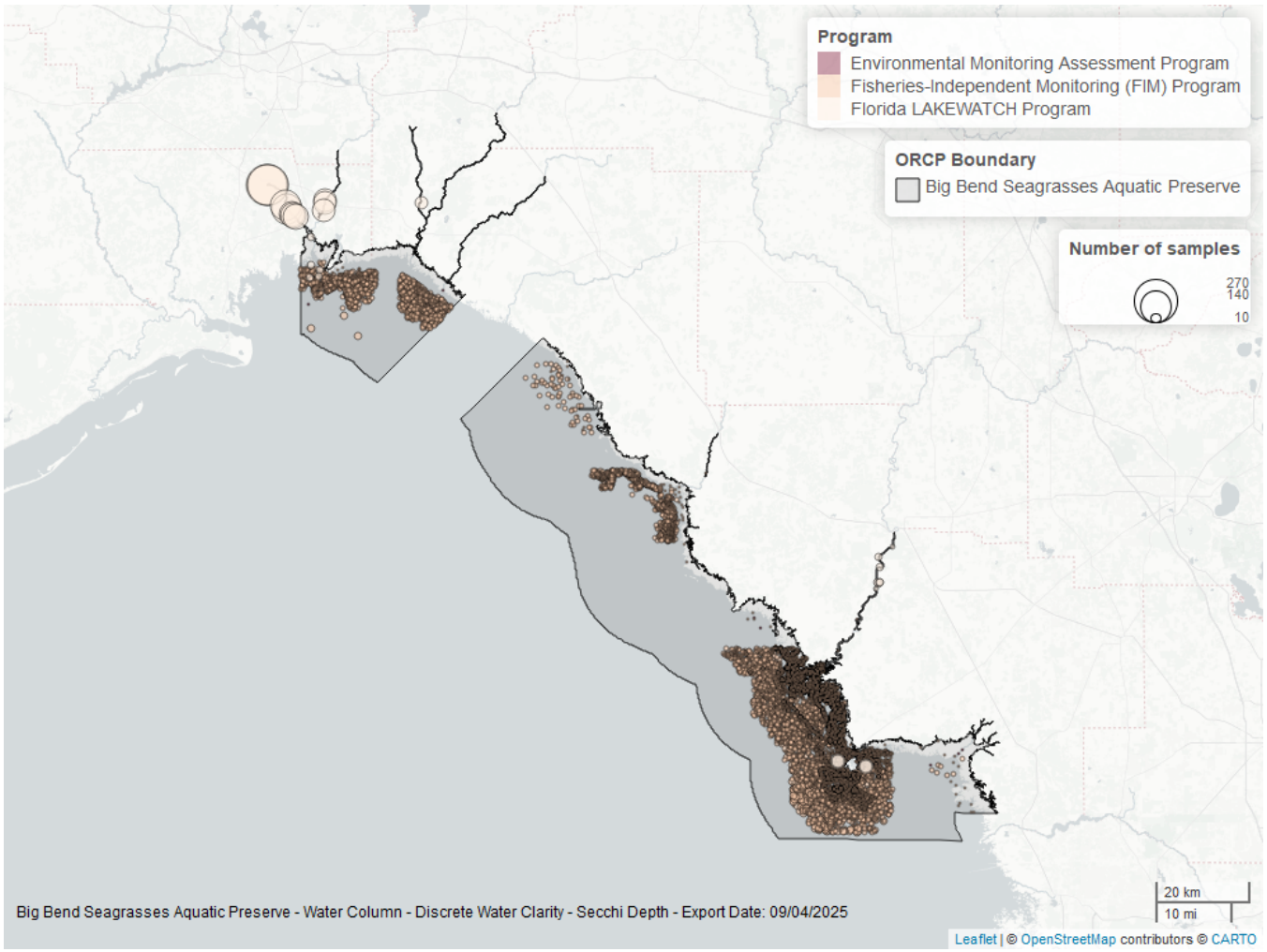

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	57396	1996	2024
5002	2592	1992	2025
514	2276	1993	2025
477	382	2016	2025
5008	44	2021	2025
115	21	1991	2004
60	6	1986	2009
103	4	2001	2015

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[6]
69 - Fisheries-Independent Monitoring (FIM) Program[10]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]

115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
514 - Florida LAKEWATCH Program[2]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Total Nitrogen - Discrete

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

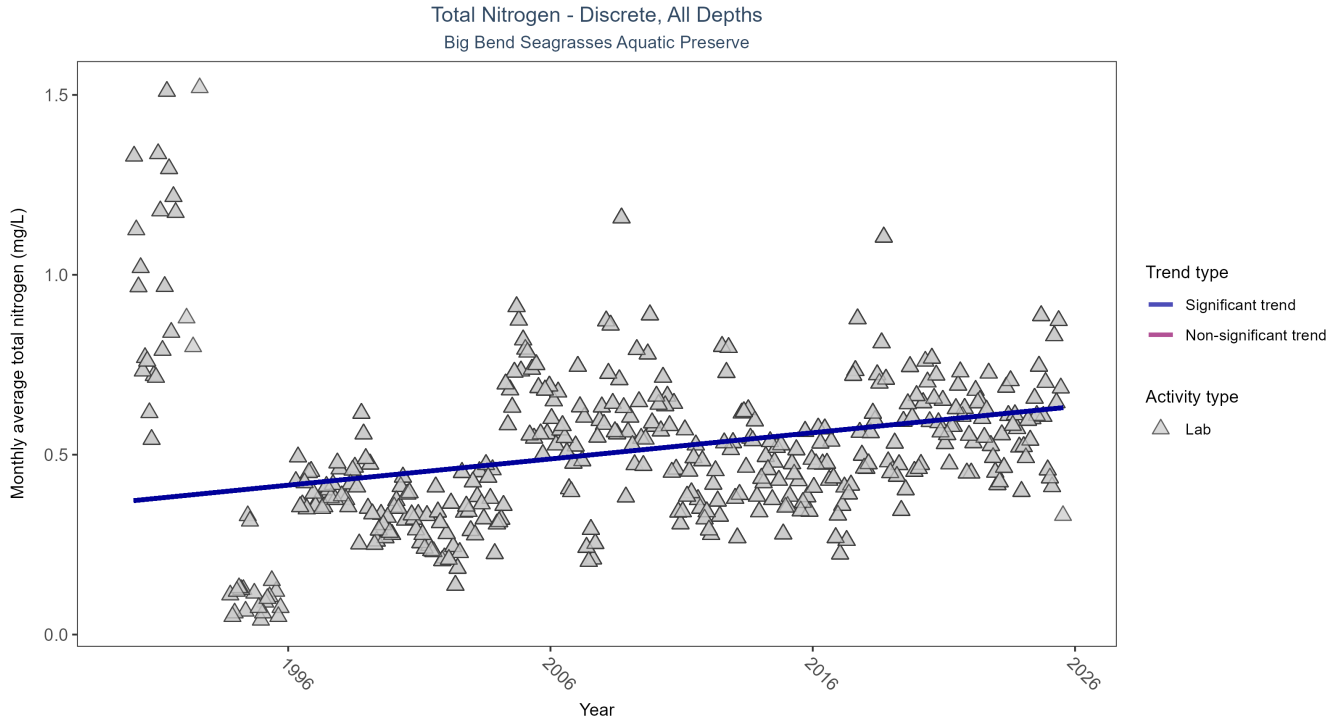

Figure 17: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	8222	36	1990 - 2025	0.466	0.2315	0.3715	0.0073	0

Monthly average total nitrogen increased by 0.01 mg/L per year.

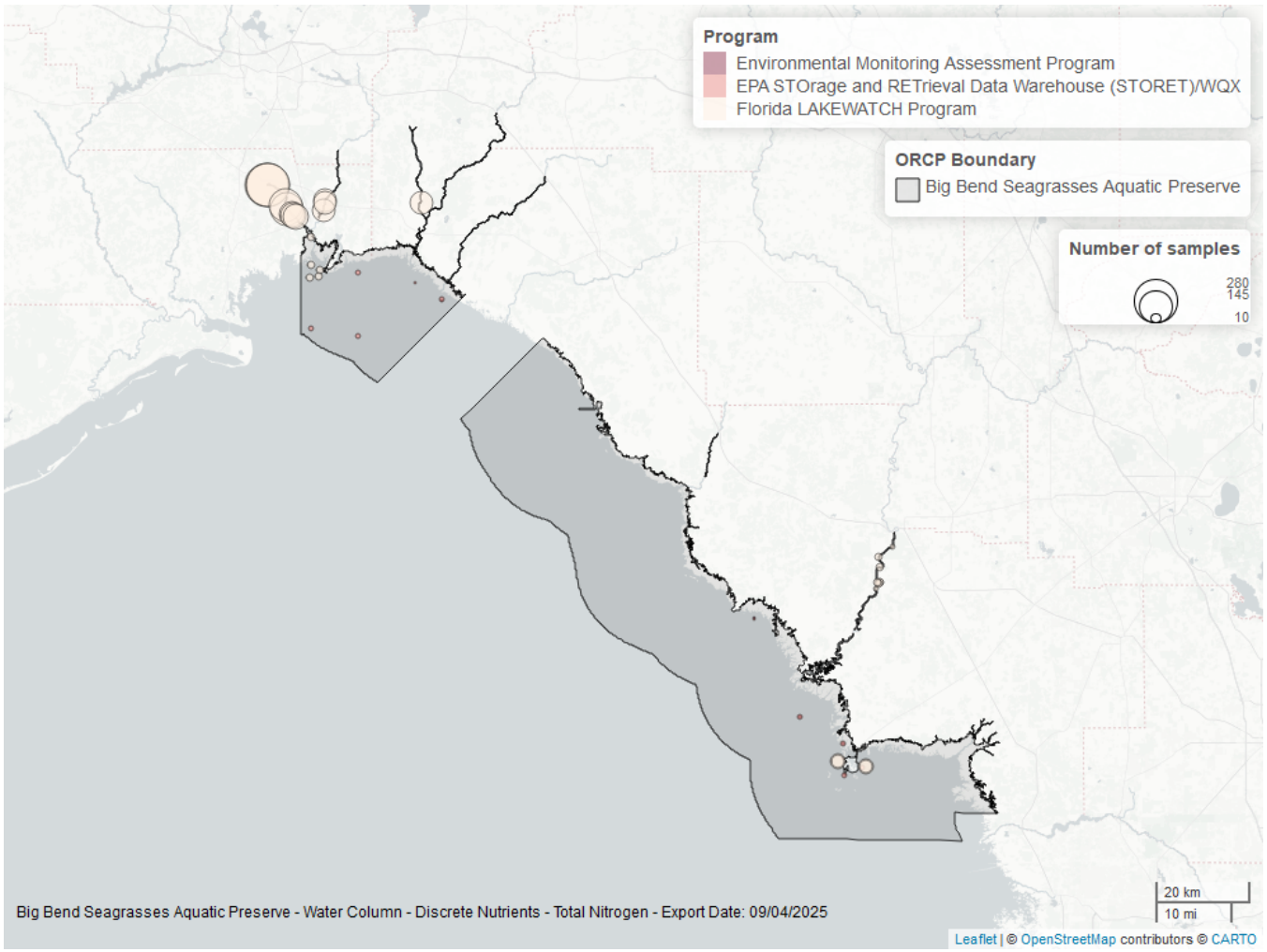

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	5630	1990	2025
514	2391	1993	2024
540	131	2017	2022
103	36	2000	2006
5008	30	2021	2025
115	5	2000	2004
477	3	2017	2017

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
514 - Florida LAKEWATCH Program[2]
540 - Shellfish Harvest Area Classification Program[3]

5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

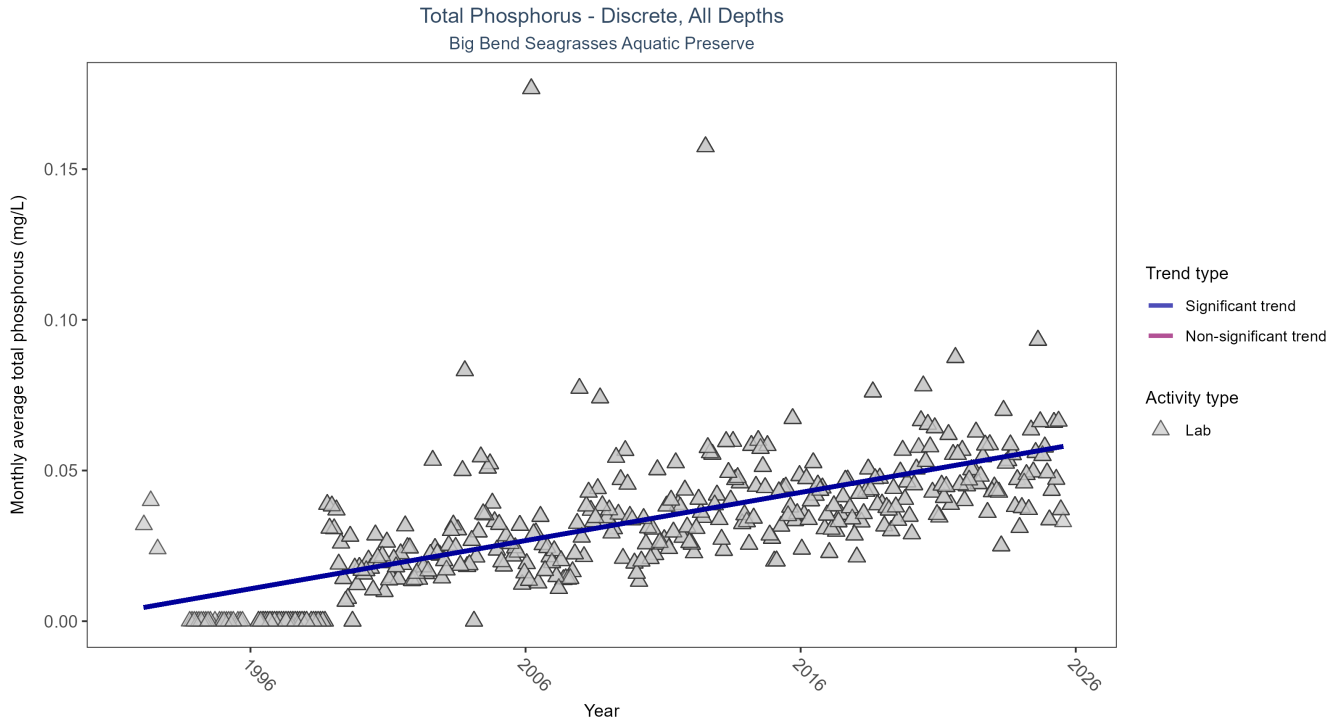

Figure 19: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	6513	34	1992 - 2025	0.032	0.6035	0.0044	0.0016	0

Monthly average total phosphorus increased by less than 0.01 mg/L per year.

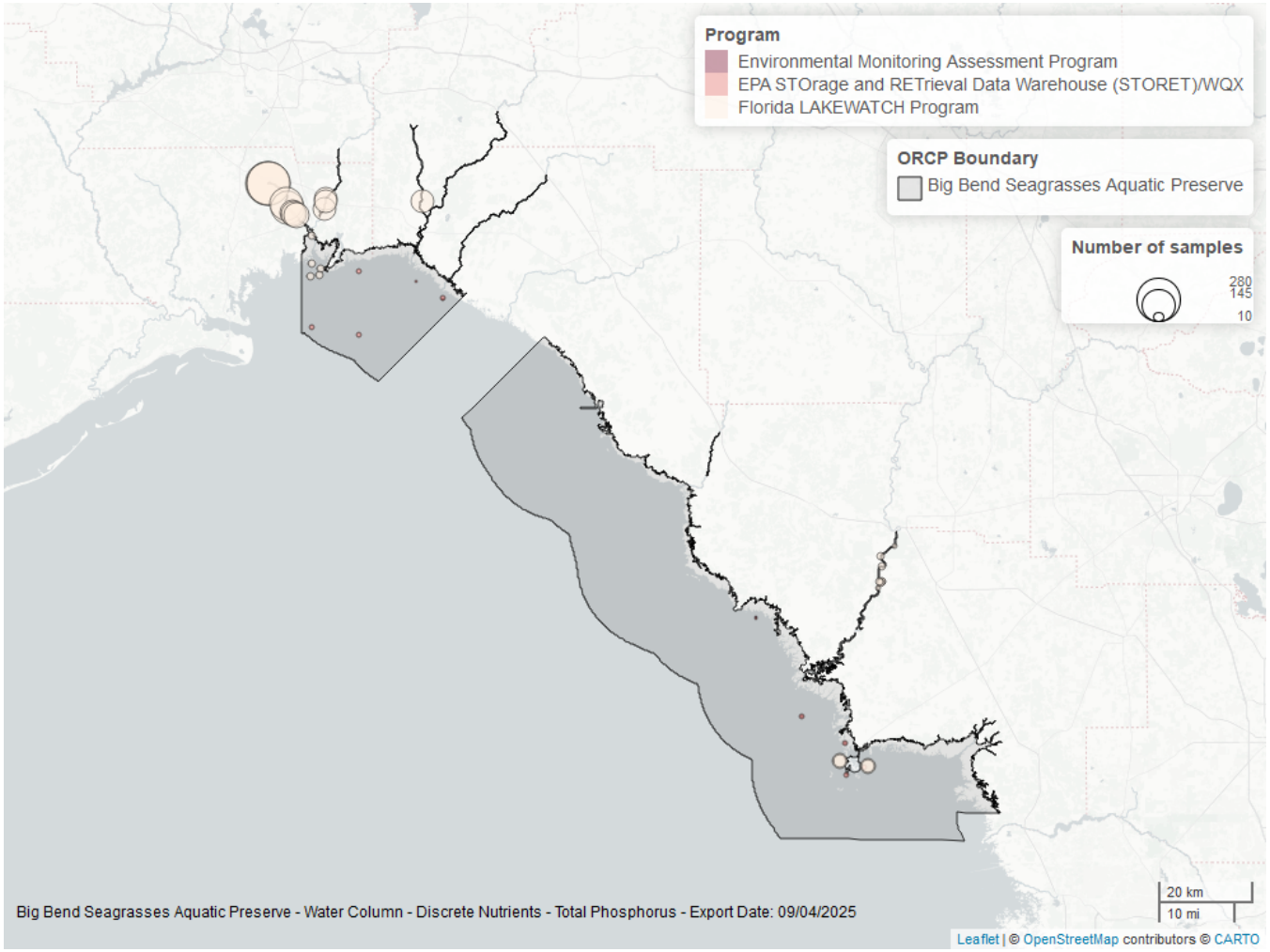

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	3709	1992	2025
514	2374	1993	2024
477	385	2016	2025
540	131	2017	2022
103	37	2000	2015
5008	29	2021	2025
115	5	2000	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]
115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
514 - Florida LAKEWATCH Program[2]
540 - Shellfish Harvest Area Classification Program[3]

5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

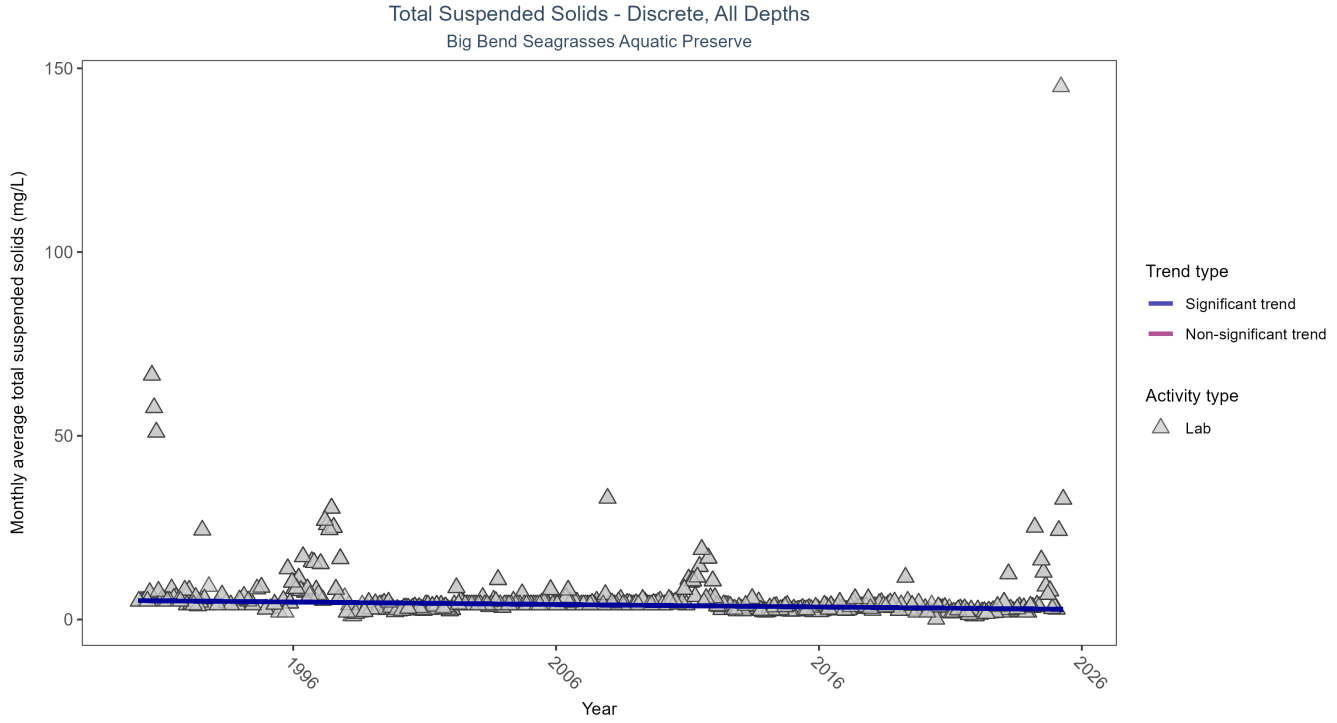

Figure 21: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly decreasing trend	3003	36	1990 - 2025	4	-0.3001	5.156	-0.0667	0

Monthly average total suspended solids decreased by 0.07 mg/L per year, indicating an increase in water clarity.

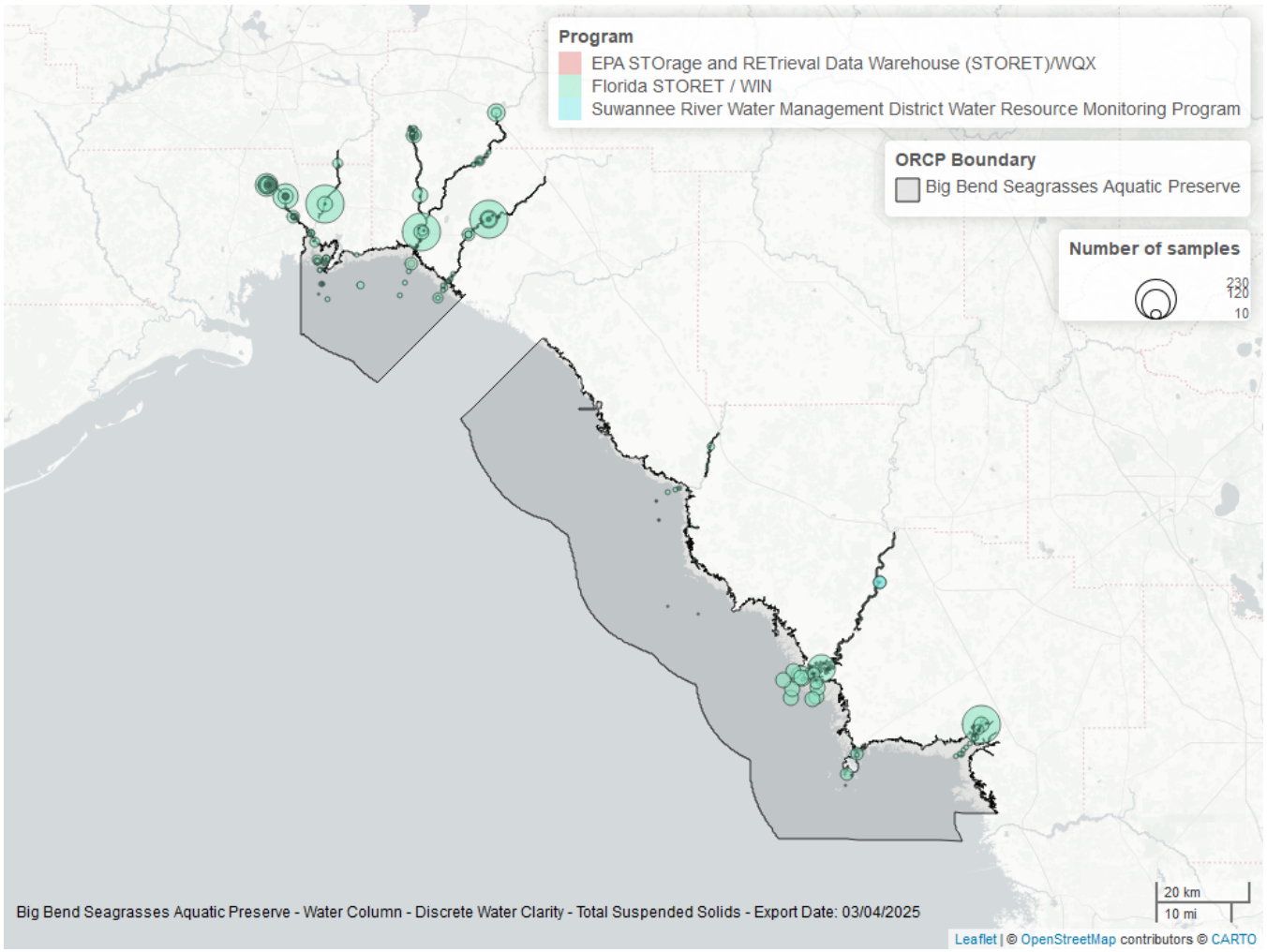

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	2996	1990	2025
477	28	2021	2023

Program names:

477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
5002 - Florida STORET / WIN[4]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

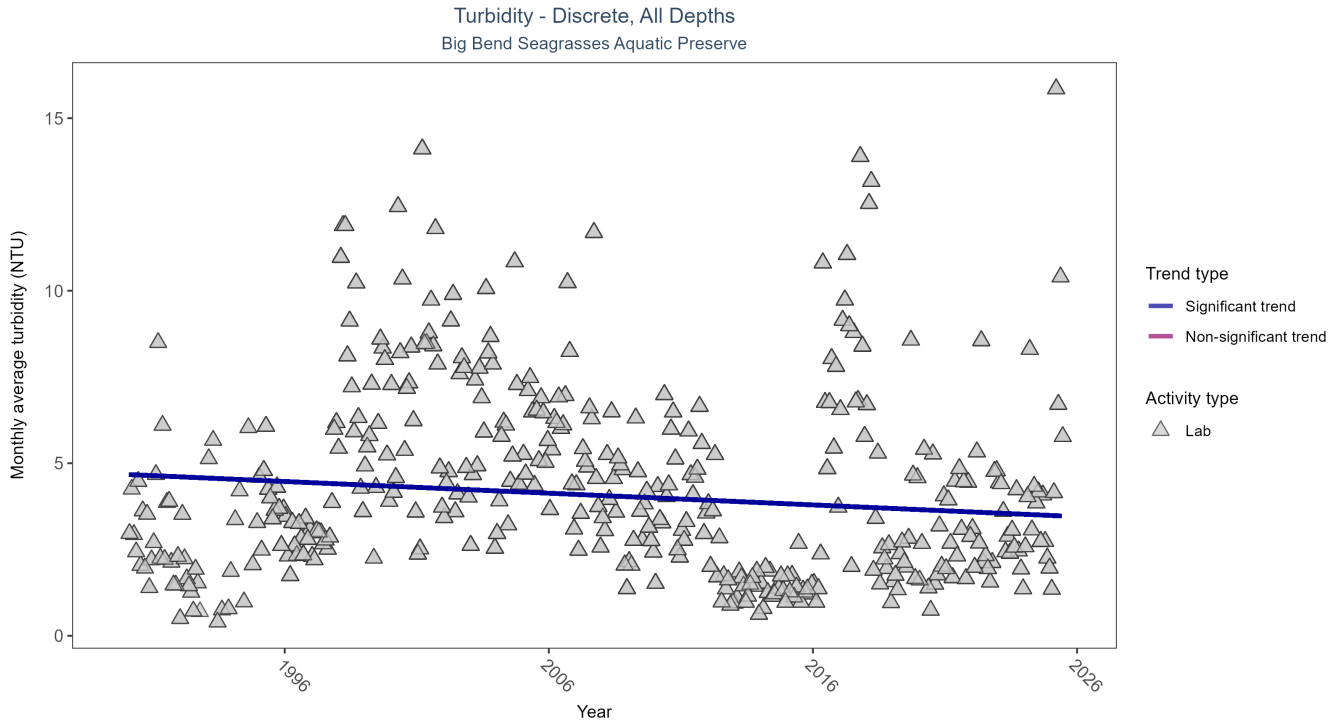

Figure 23: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 28: Seasonal Kendall-Tau Trend Analysis for Turbidity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly decreasing trend	42959	36	1990 - 2025	3.4	-0.1016	4.6754	-0.034	0.0033

Monthly average turbidity decreased by 0.03 NTU per year, indicating an increase in water clarity.

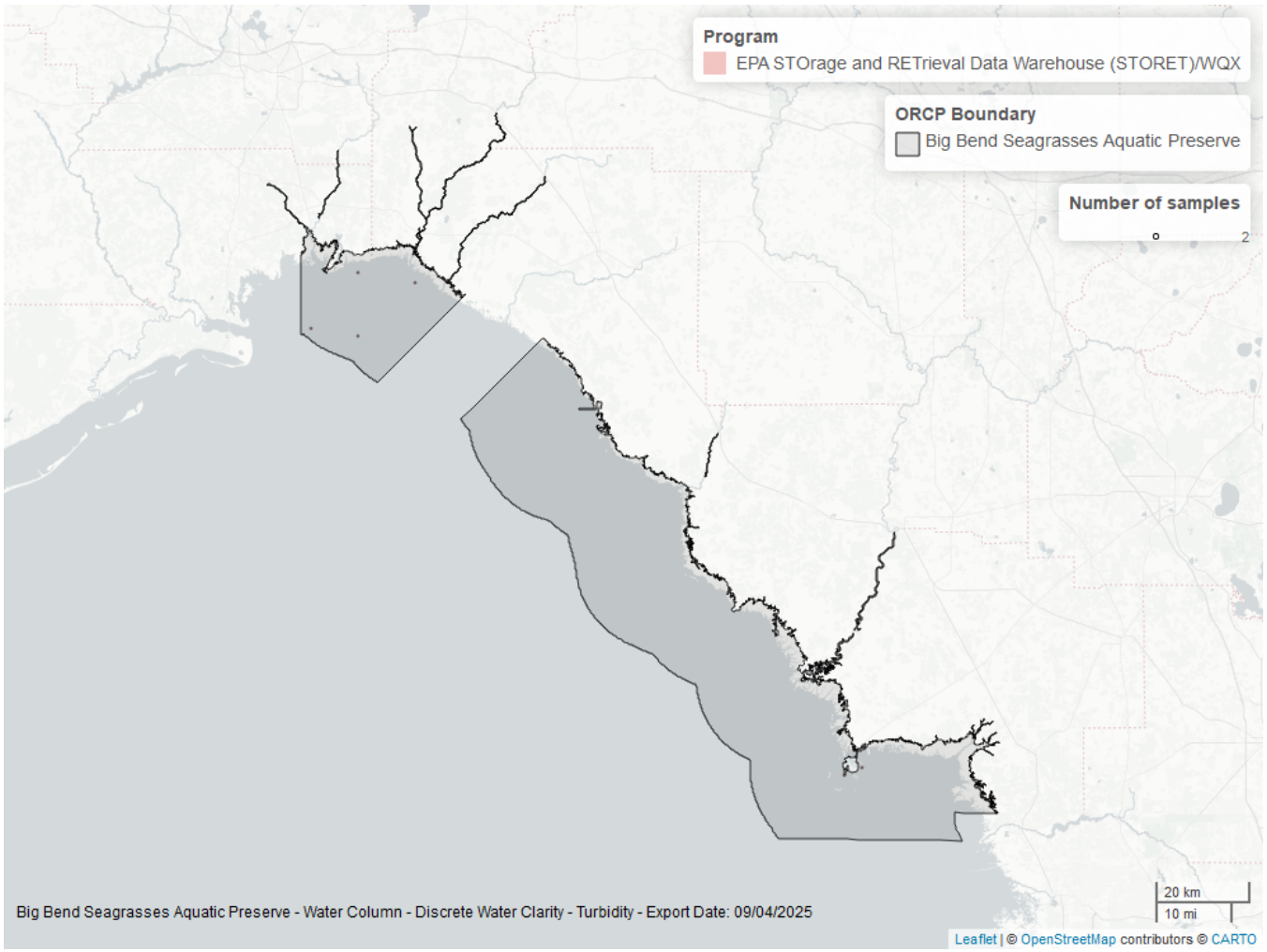

Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	42694	1990	2025
477	678	2016	2025
540	35	2019	2022
103	11	2005	2006

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[7]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
540 - Shellfish Harvest Area Classification Program[3]
5002 - Florida STORET / WIN[4]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

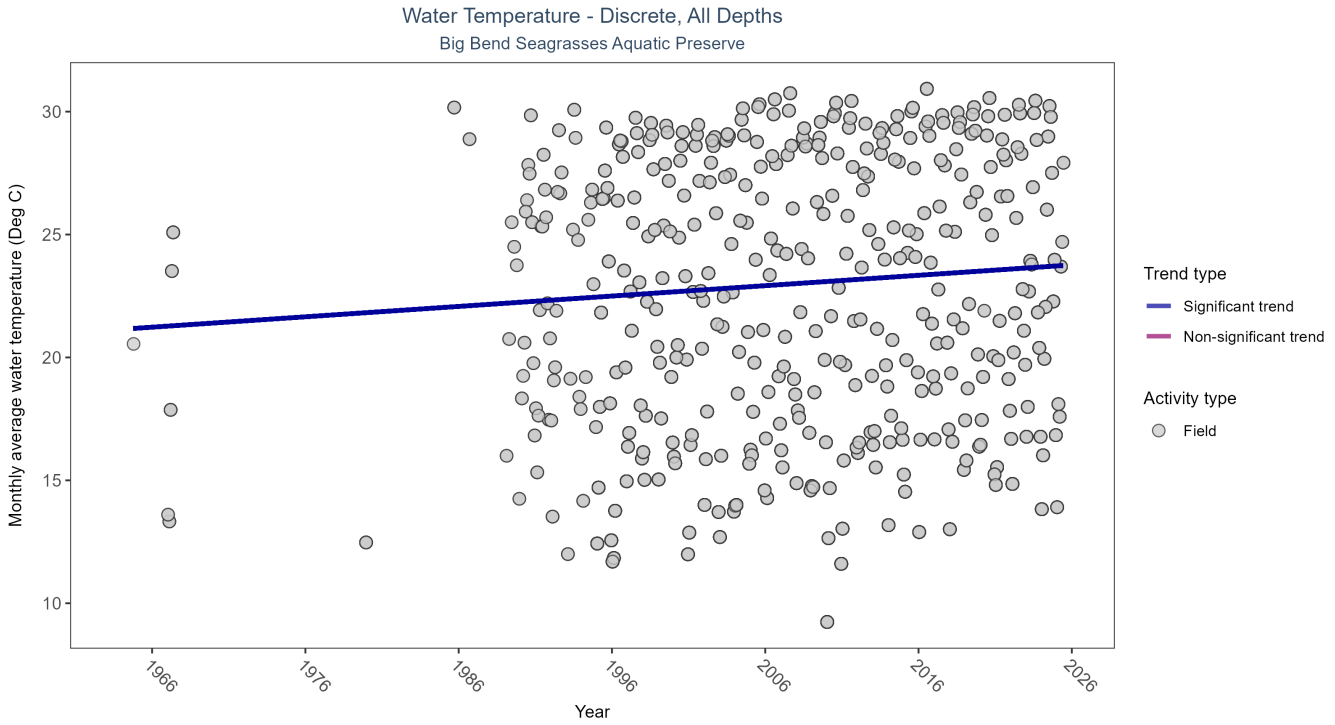

Figure 25: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly increasing trend	159977	42	1964 - 2025	24.1	0.2258	21.1463	0.0422	0

Monthly average water temperature increased by 0.04°C per year.

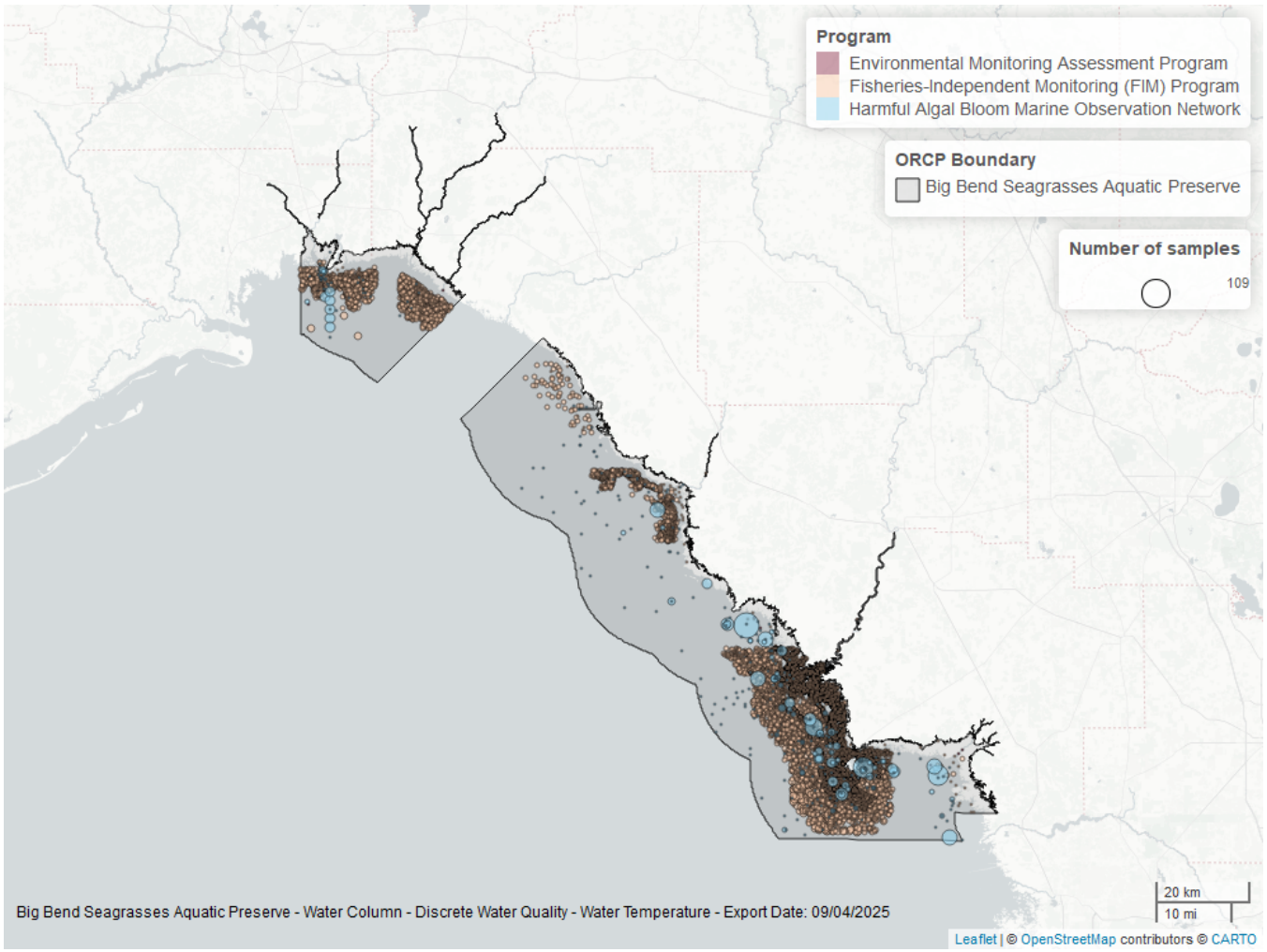

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	100539	1989	2025
69	57437	1996	2024
95	1377	1964	2018
477	385	2016	2025
540	133	2017	2022
60	119	1986	2014
5008	49	2021	2025
115	43	1991	2004

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey[6]
69 - Fisheries-Independent Monitoring (FIM) Program[10]
95 - Harmful Algal Bloom Marine Observation Network[11]

115 - Environmental Monitoring Assessment Program[8]
477 - Suwannee River Water Management District Water Resource Monitoring Program[1]
540 - Shellfish Harvest Area Classification Program[3]
5002 - Florida STORET / WIN[4]
5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region[5]

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NW-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NW-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_pH_NW-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NW-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NW-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NW-2025-Sep-19.txt*

Continuous monitoring locations in Big Bend Seagrasses Aquatic Preserve

Table 32: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
7	02313700	8	TRUE	DO , pH , Sal
7	02313700	24	TRUE	TempW
7	02323566	12	TRUE	DO , pH , TempW
7	02323592	16	TRUE	Sal
7	02323592	26	TRUE	TempW
7	02326050	5	TRUE	TempW
7	02326516	6	TRUE	DO , pH , TempW
7	02326526	10	TRUE	DO , pH , TempW
7	02326550	8	TRUE	Sal
7	02326550	24	TRUE	TempW
7	02327022	3	FALSE	TempW
7	291652083064100	1	FALSE	Sal , TempW
7	291842083085100	1	FALSE	Sal , TempW
471	BBSCK	1	FALSE	DO , DOS , pH , Sal , Turb , TempW
471	BBSDB	10	TRUE	DO , DOS , pH , Sal , Turb , TempW
471	BBSSK	12	TRUE	DO , DOS , pH , Sal , Turb , TempW
471	BBSST	6	TRUE	DO , DOS , pH , Sal , Turb , TempW
471	BBSSW	8	TRUE	DO , DOS , pH , Sal , Turb , TempW

Program names:

7 - National Water Information System[13]
471 - Big Bend Seagrasses Aquatic Preserves Continuous Water Quality Monitoring[14]

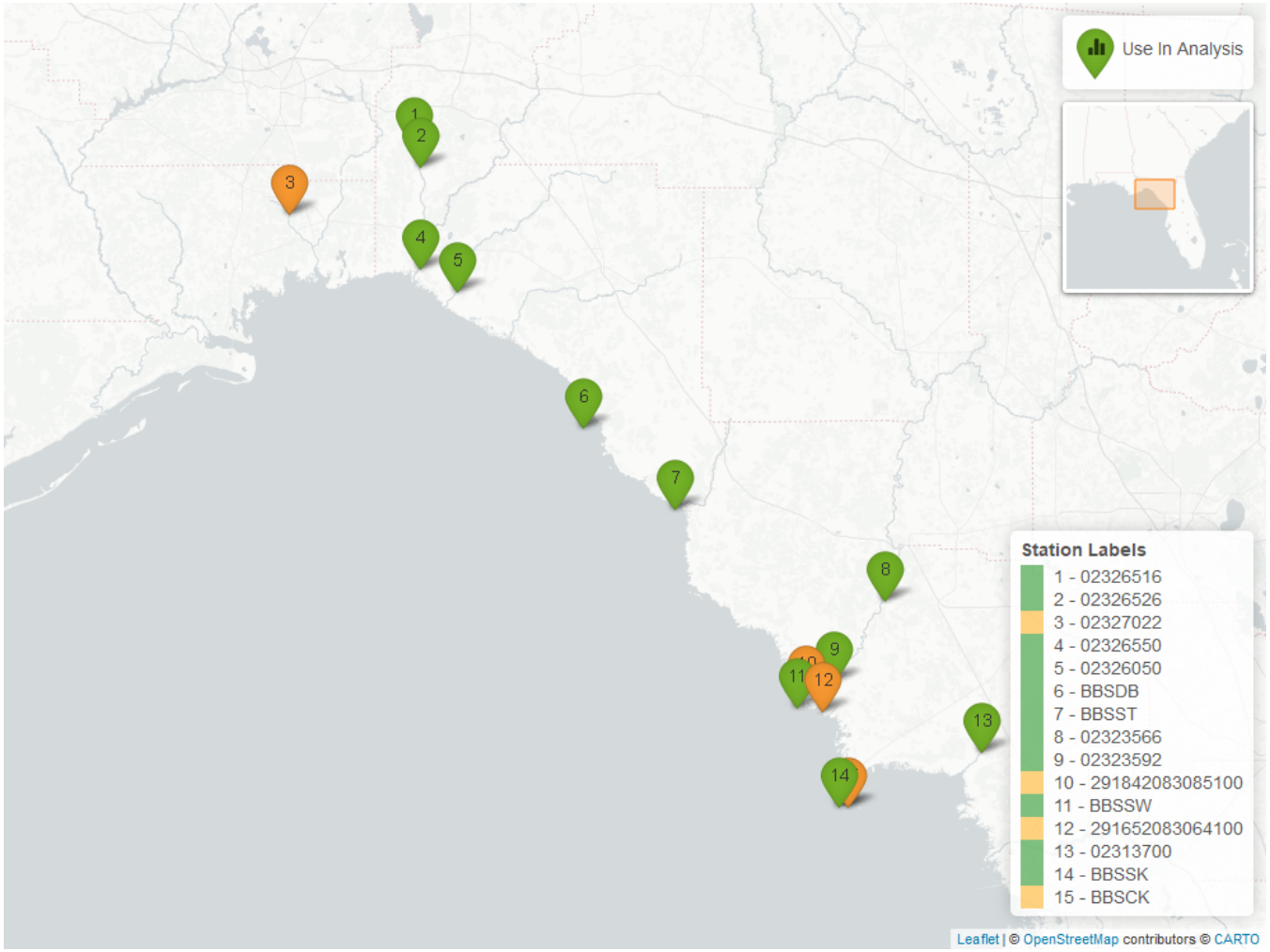

Figure 27: Map showing continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

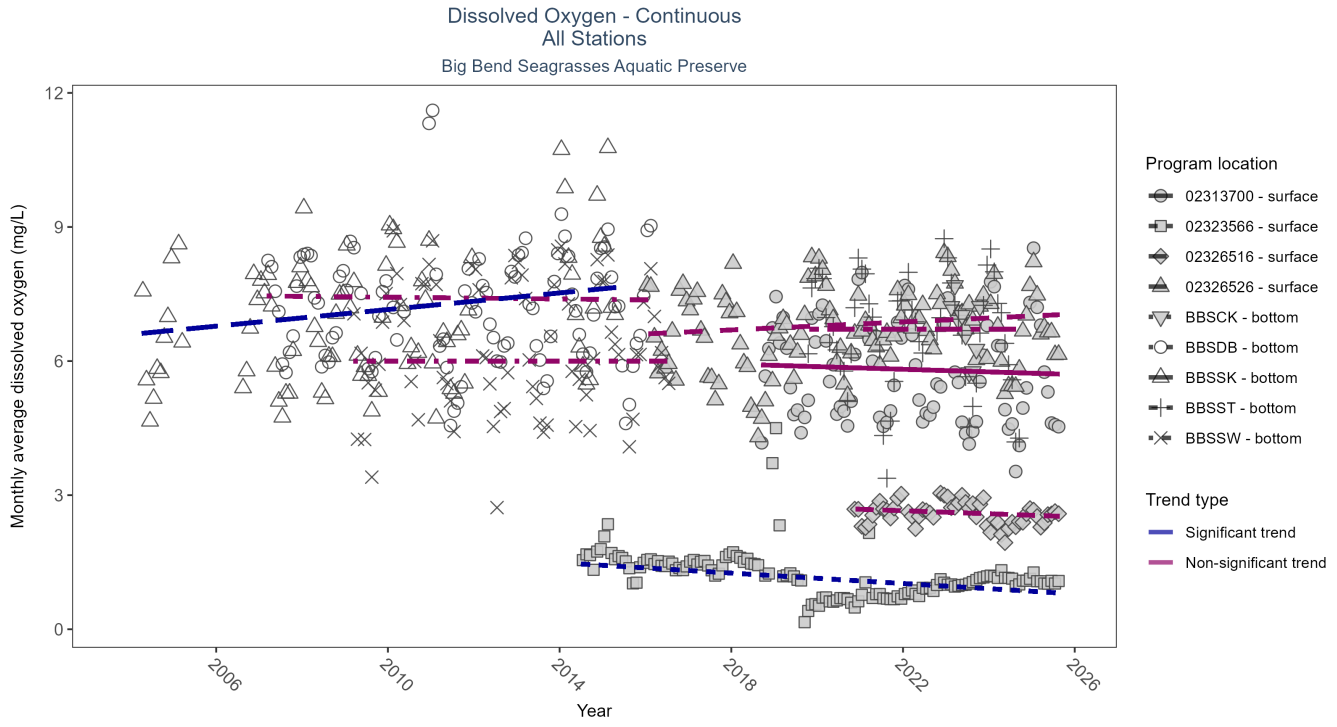

Figure 28: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 33: Seasonal Kendall-Tau Results for Dissolved Oxygen - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
02326526	No significant trend	3342	10	2016 - 2025	6.7	0.14	6.61	0.04	0.05
02323566	Significantly decreasing trend	3879	12	2014 - 2025	1.1	-0.38	1.49	-0.06	0
02313700	No significant trend	2425	8	2018 - 2025	5.5	-0.12	5.93	-0.03	0.17
02326516	No significant trend	1583	6	2020 - 2025	2.6	-0.2	2.72	-0.03	0.13
BBSDB	No significant trend	184327	10	2007 - 2016	7.3	-0.05	7.46	-0.01	0.61
BBSCK	Insufficient data to calculate trend	14788	1	2023 - 2023	6.7	-	-	-	-
BBSST	No significant trend	146149	6	2019 - 2024	6.9	-0.01	6.71	0	1
BBSSK	Significantly increasing trend	134287	10	2004 - 2015	7.1	0.28	6.6	0.09	0
BBSSW	No significant trend	182327	8	2009 - 2016	6.2	0	6	0	1

At one program location, monthly average dissolved oxygen increased by 0.09 mg/L per year. At one program location, monthly average dissolved oxygen decreased by 0.06 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at six locations. There was insufficient data to fit a model for one location.

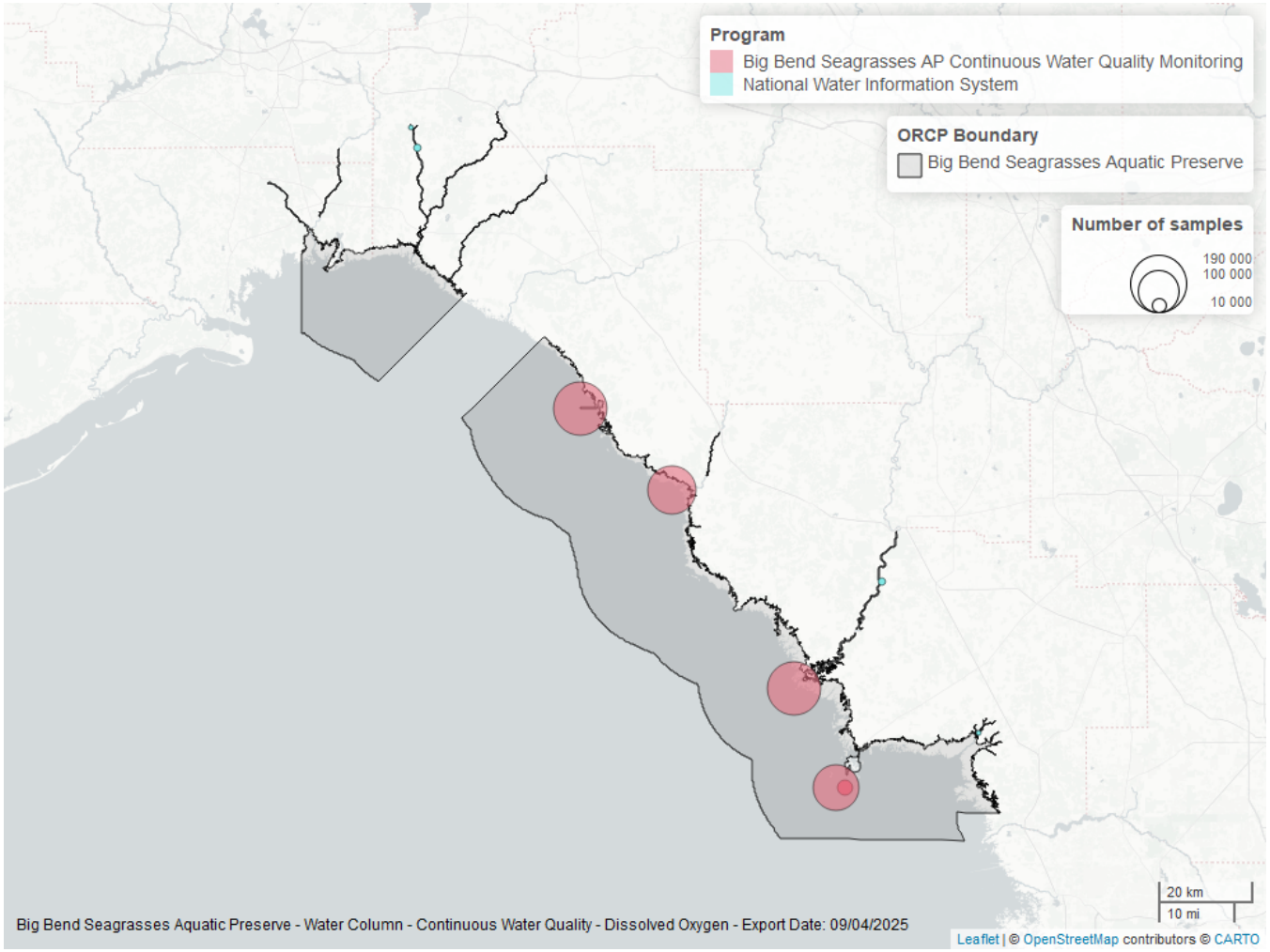

Figure 29: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

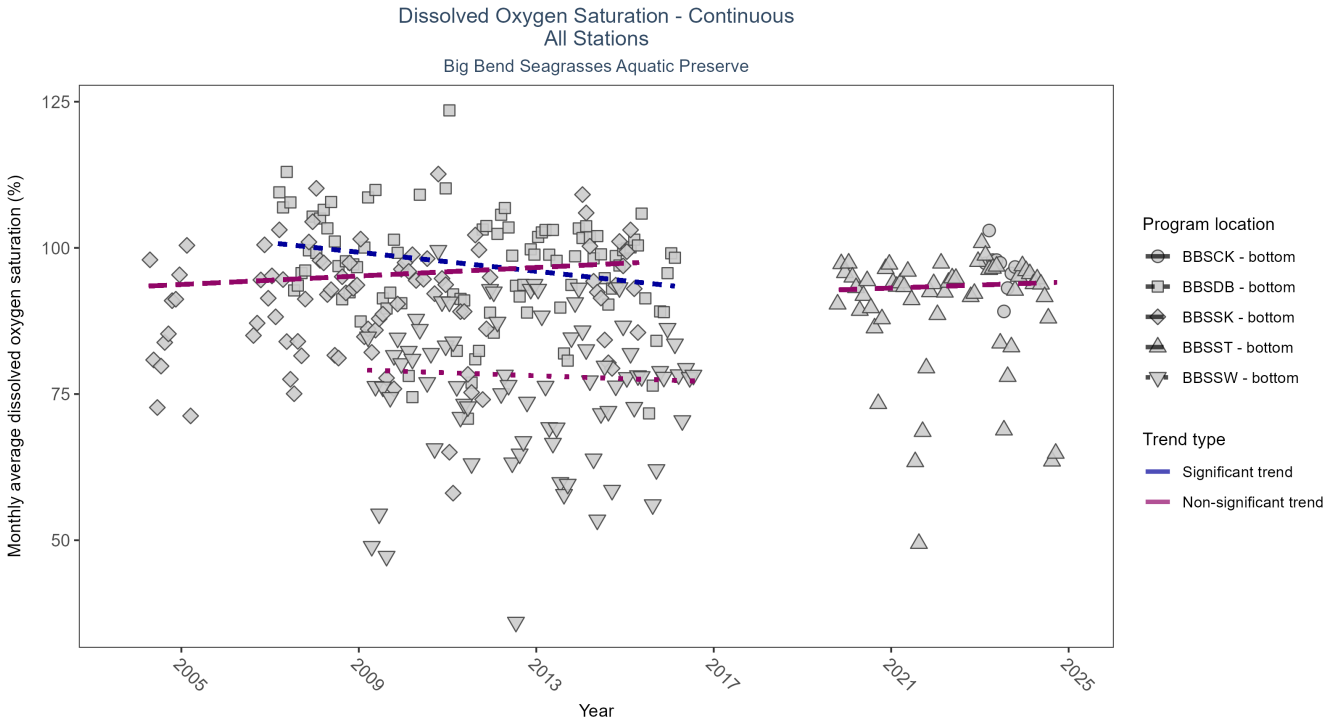

Figure 30: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
BBSDB	Significantly decreasing trend	183530	10	2007 - 2016	97.6	-0.3	100.88	-0.81	0
BBSCK	Insufficient data to calculate trend	19834	1	2023 - 2023	95.7	-	-	-	-
BBSSK	No significant trend	134196	10	2004 - 2015	91.8	0.12	93.37	0.36	0.26
BBSST	No significant trend	149203	6	2019 - 2024	93.3	0.08	92.61	0.26	0.5
BBSSW	No significant trend	182158	8	2009 - 2016	75.8	-0.05	79.14	-0.25	0.68

At one program location, monthly average dissolved oxygen saturation decreased by 0.81% per year. No detectable change in monthly average dissolved oxygen saturation was observed at three locations. There was insufficient data to fit a model for one location.

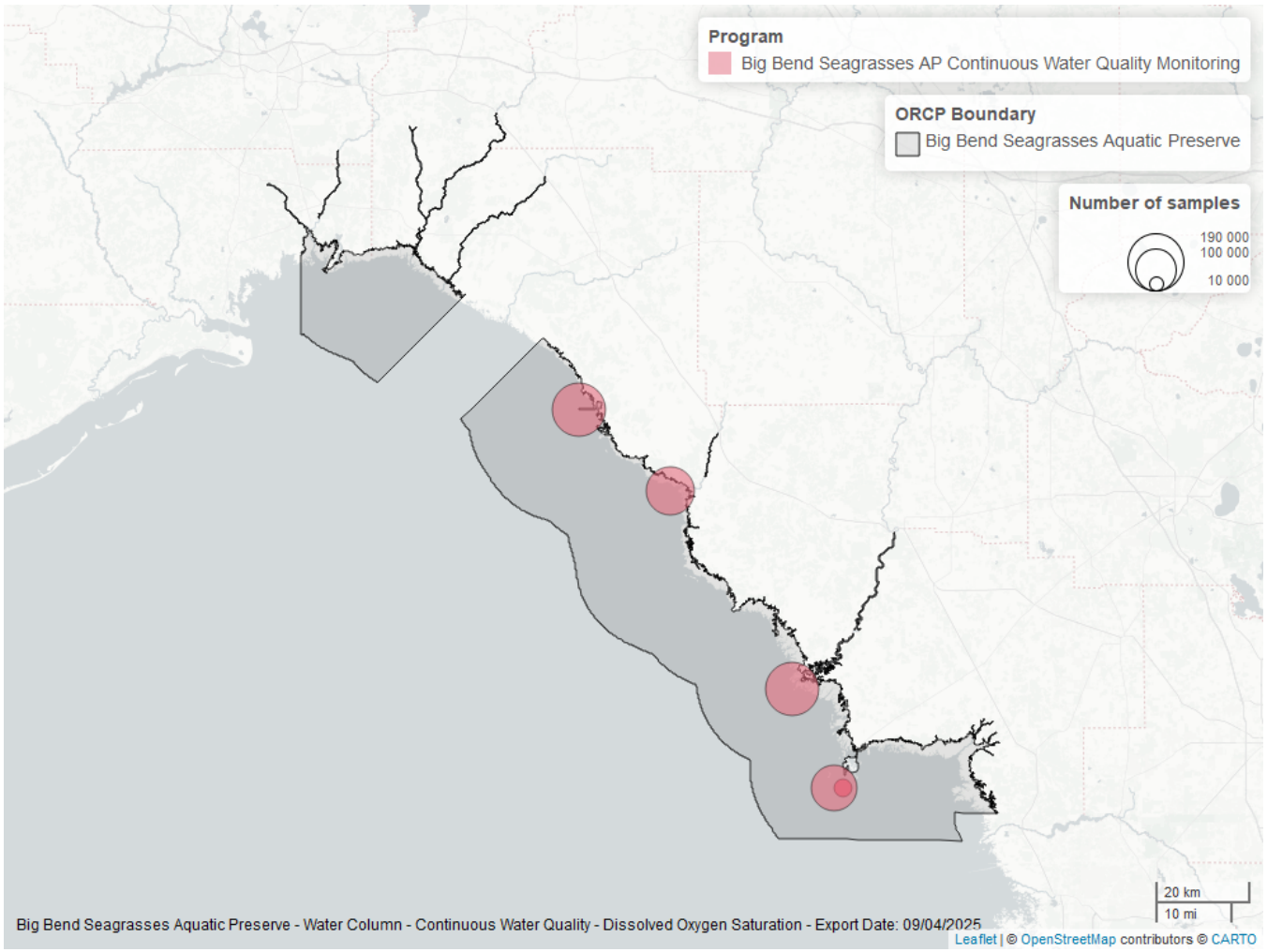

Figure 31: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

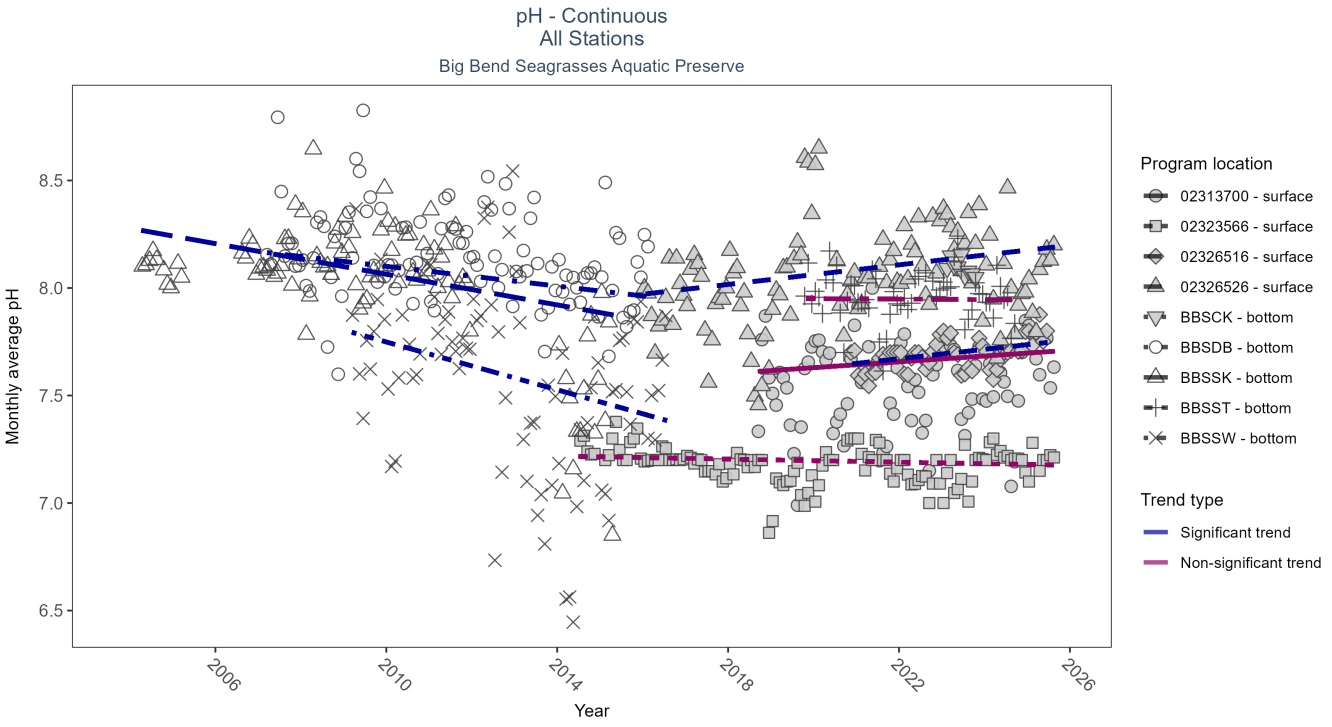

Figure 32: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
02326516	Significantly increasing trend	1485	6	2020 - 2025	7.7	0.4	7.63	0.02	0
02326526	Significantly increasing trend	3148	10	2016 - 2025	8.0	0.19	7.97	0.02	0.02
02323566	No significant trend	3666	12	2014 - 2025	7.2	-0.13	7.22	0	0.06
02313700	No significant trend	2388	8	2018 - 2025	7.6	0.16	7.6	0.01	0.11
BBSDB	Significantly decreasing trend	250183	10	2007 - 2016	8.1	-0.28	8.17	-0.02	0
BBSCK	Insufficient data to calculate trend	18185	1	2023 - 2023	8.1	-	-	-	-
BBSST	No significant trend	153335	6	2019 - 2024	8.0	-0.01	7.95	0	0.94
BBSSK	Significantly decreasing trend	168278	10	2004 - 2015	8.1	-0.37	8.28	-0.04	0
BBSSW	Significantly decreasing trend	224733	8	2009 - 2016	7.6	-0.29	7.8	-0.06	0

At two program locations, monthly average pH increased by 0.02 pH units per year. At three program locations, monthly average pH decreased between 0.02 and 0.06 pH units per year. No detectable change in monthly average pH was observed at three locations. There was insufficient data to fit a model for one location.

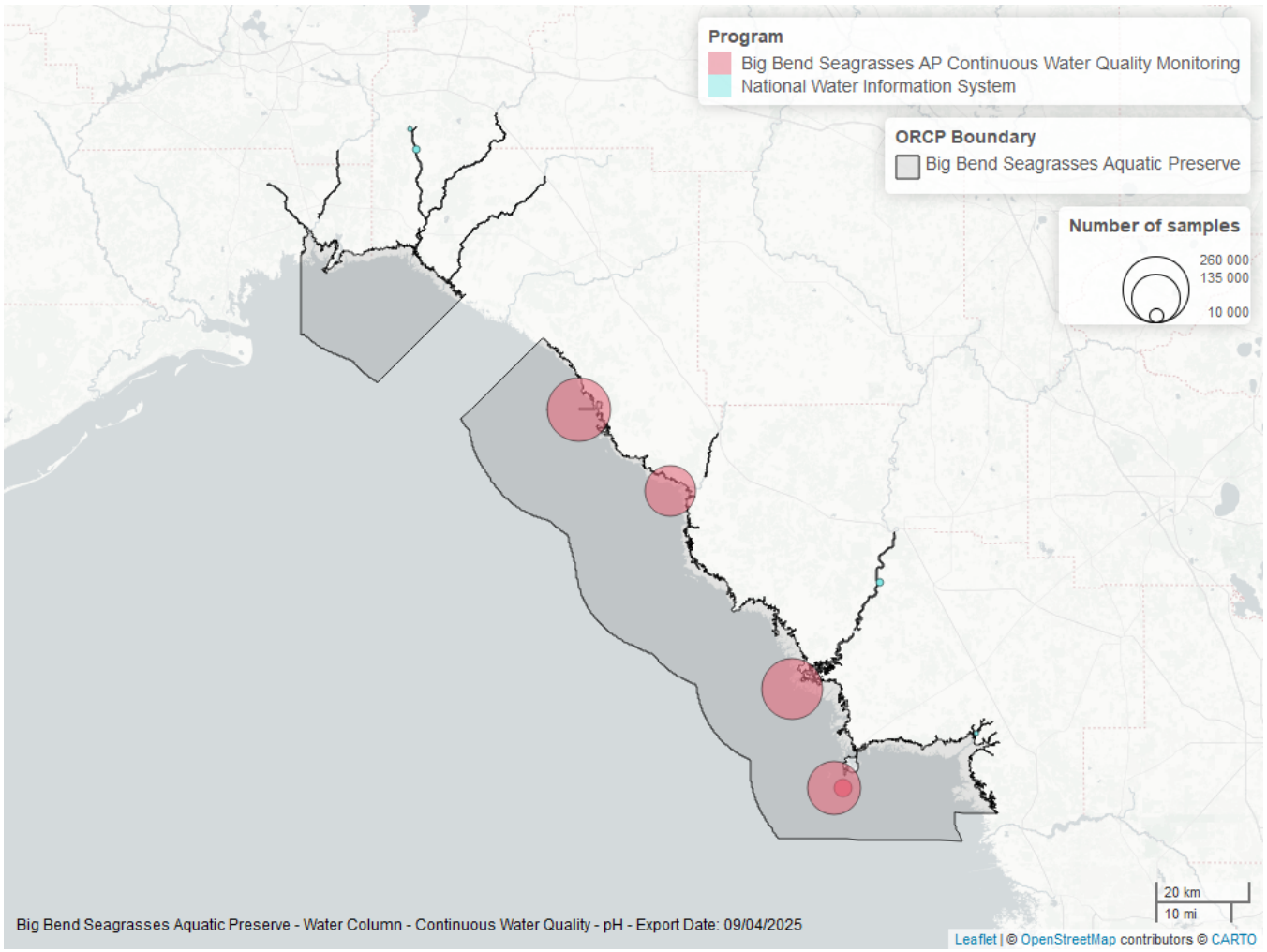

Figure 33: Map showing location of ph continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

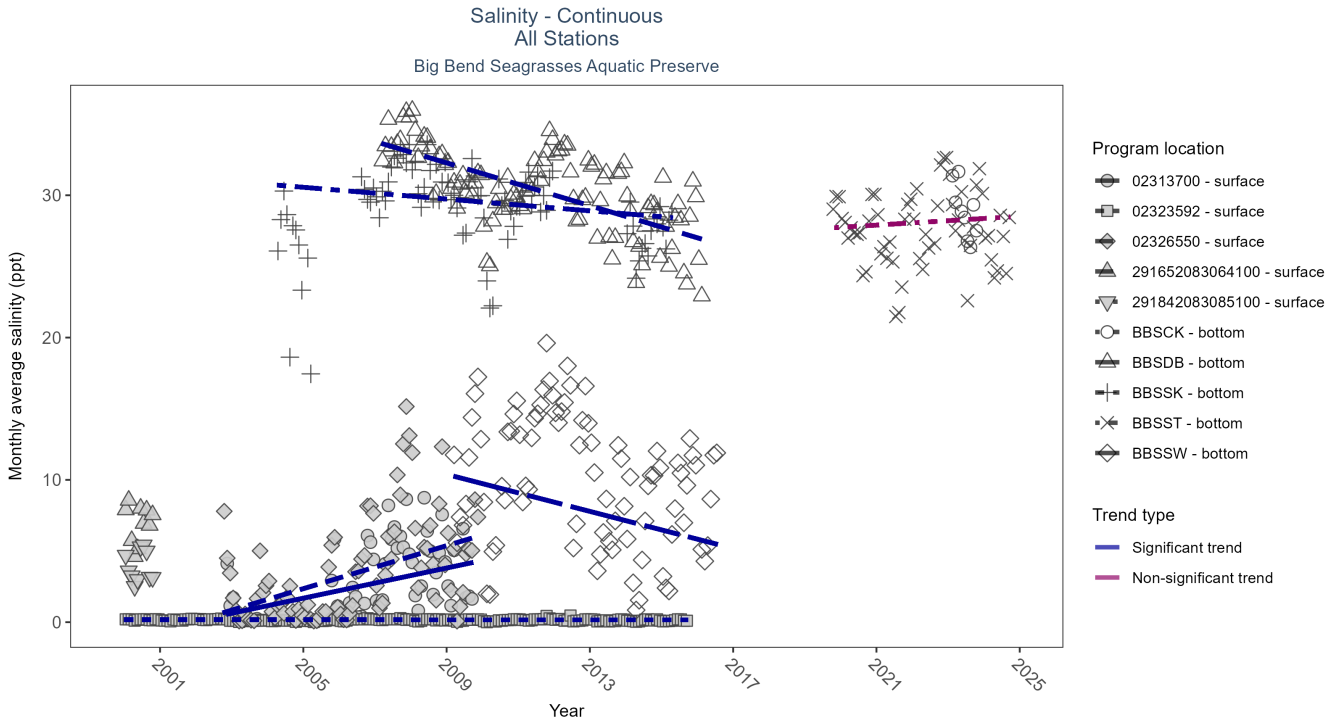

Figure 34: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 36: Seasonal Kendall-Tau Results for Salinity - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
02323592	Significantly decreasing trend	6064	16	2000 - 2015	0.1	-0.13	0.18	0	0.02
291652083064100	Insufficient data to calculate trend	827	1	2000 - 2000	6.7	-	-	-	-
02326550	Significantly increasing trend	2507	8	2002 - 2009	1.7	0.48	0.09	0.76	0
02313700	Significantly increasing trend	1601	7	2002 - 2009	2.1	0.52	0.1	0.53	0
291842083085100	Insufficient data to calculate trend	584	1	2000 - 2000	3.7	-	-	-	-
BBSDB	Significantly decreasing trend	265544	10	2007 - 2016	30.6	-0.53	33.78	-0.75	0
BBSCK	Insufficient data to calculate trend	14782	1	2023 - 2023	29.2	-	-	-	-
BBSSK	Significantly decreasing trend	178356	10	2004 - 2015	29.6	-0.22	30.77	-0.21	0.02
BBSST	No significant trend	156720	6	2019 - 2024	28.5	0.08	27.59	0.15	0.52
BBSSW	Significantly decreasing trend	221696	8	2009 - 2016	7.5	-0.23	10.39	-0.65	0.02

At two program locations, monthly average salinity increased by 0.53 ppt per year at one site and by 0.76 ppt per year at the other. At four program locations, monthly average salinity decreased between less than 0.01 and 0.75 ppt per year. No detectable change in monthly average salinity was observed at one location. There was insufficient data to fit a model for three locations.

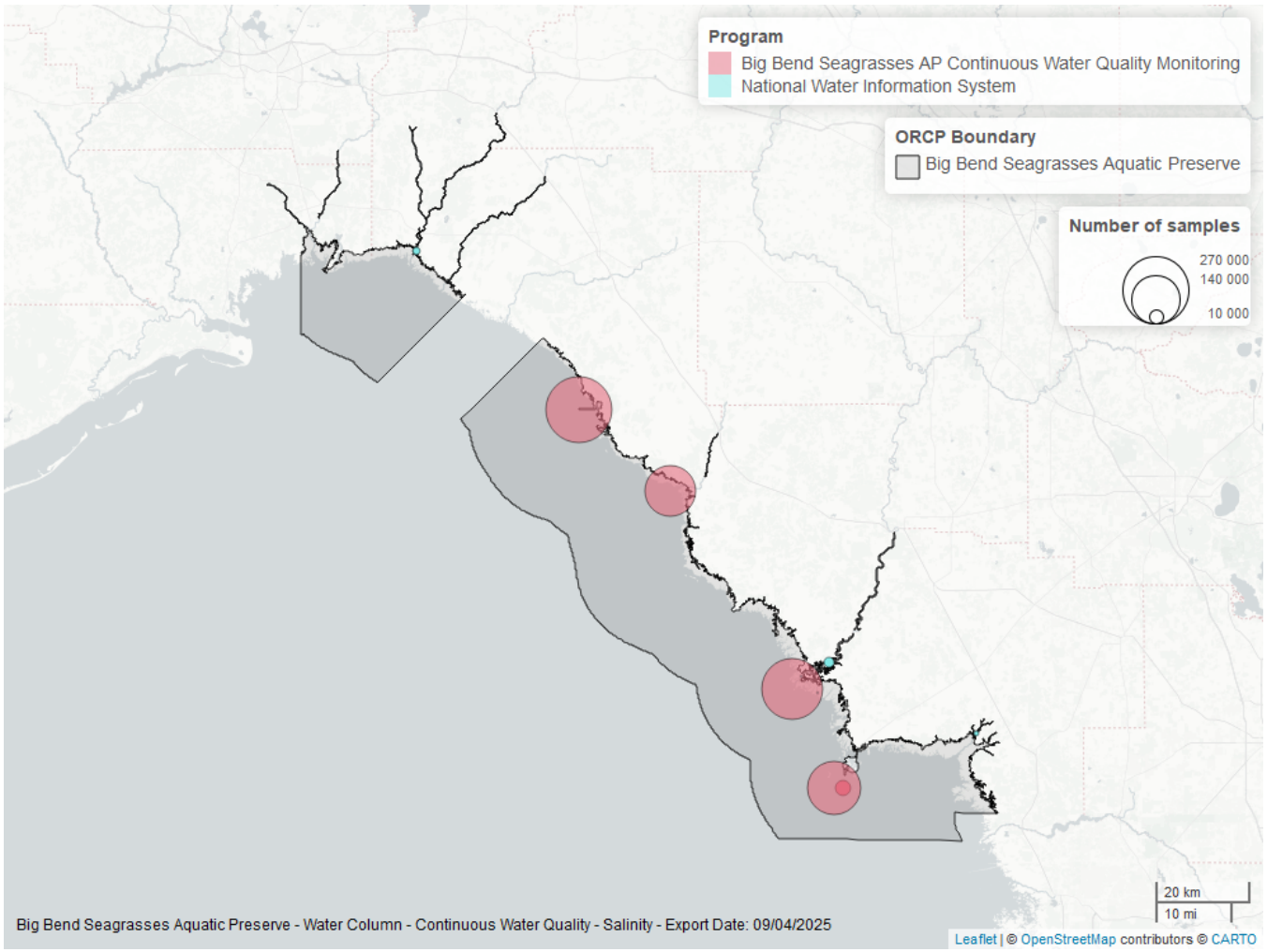

Figure 35: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

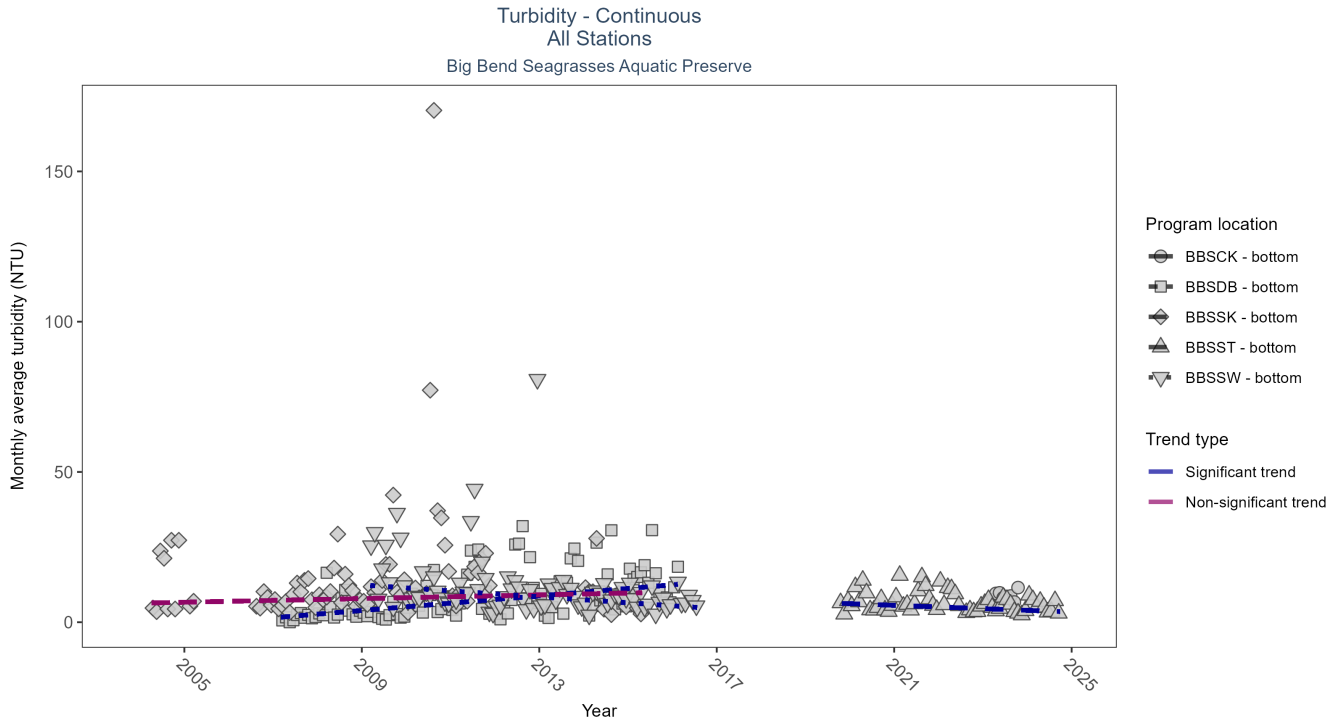

Figure 36: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
BBSDB	Significantly increasing trend	224613	10	2007 - 2016	1	0.49	1.47	1.22	0
BBSCK	Insufficient data to calculate trend	23243	1	2023 - 2023	7	-	-	-	-
BBSSK	No significant trend	165043	10	2004 - 2015	5	0.11	6.35	0.3	0.19
BBSST	Significantly decreasing trend	157393	6	2019 - 2024	4	-0.31	6.73	-0.55	0.01
BBSSW	Significantly decreasing trend	202699	8	2009 - 2016	6	-0.35	12.41	-0.99	0

At one program location, monthly average turbidity increased by 1.22 NTU per year. At two program locations, monthly average turbidity decreased by 0.55 NTU per year at one site and by 0.99 NTU per year at the other. No detectable change in monthly average turbidity was observed at one location. There was insufficient data to fit a model for one location.

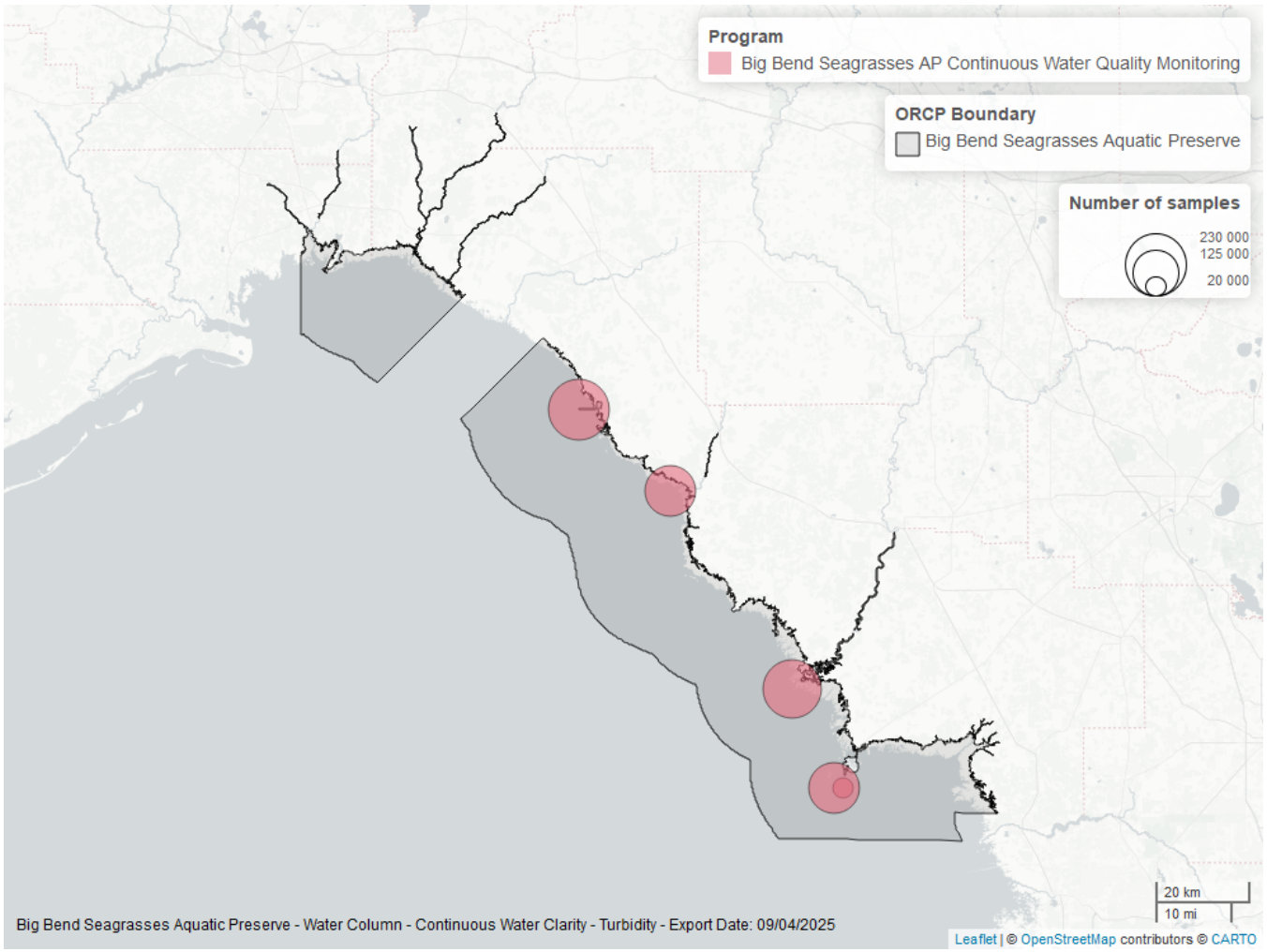

Figure 37: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous - Program 7

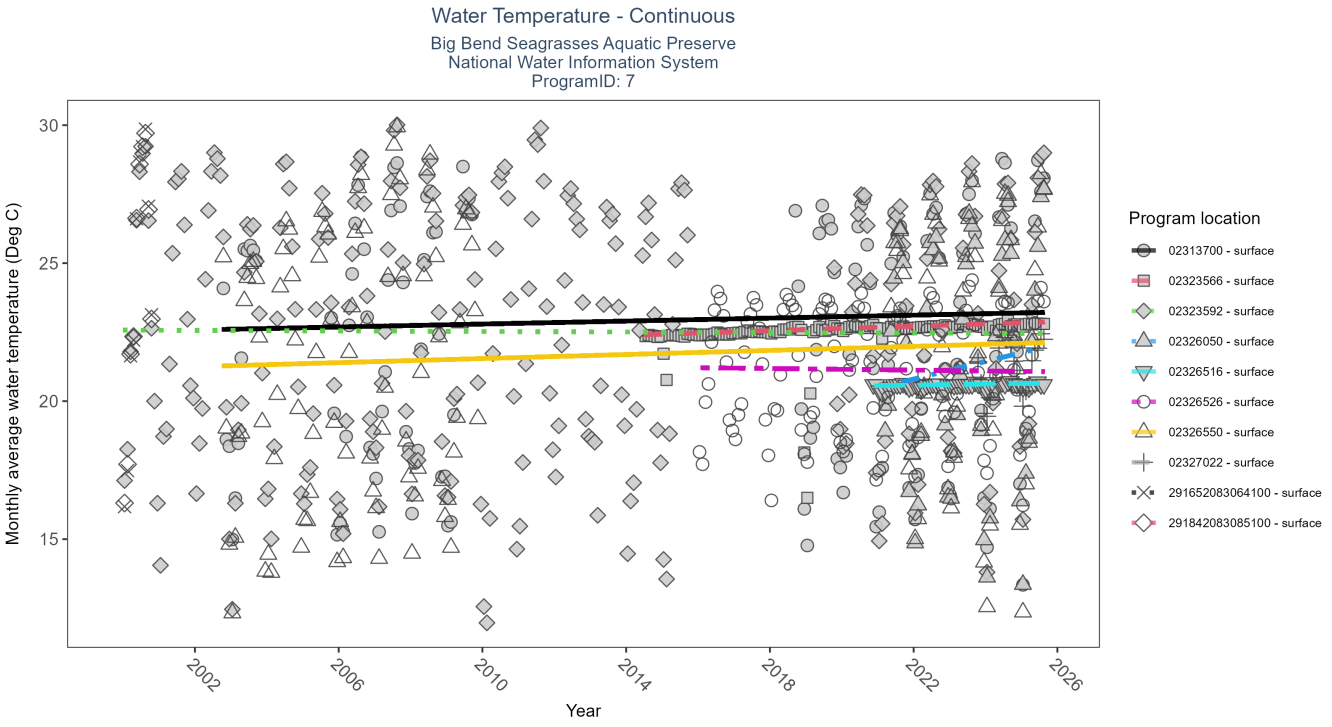

Figure 38: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 38: Seasonal Kendall-Tau Results for Water Temperature - Program 7

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
02326050	Significantly increasing trend	1695	5	2021 - 2025	21.9	0.32	20.48	0.32	0.01
02326526	No significant trend	3399	10	2016 - 2025	21.6	-0.06	21.21	-0.01	0.47
02313700	Significantly increasing trend	4097	15	2002 - 2025	23.0	0.14	22.58	0.03	0.04
02323592	No significant trend	13025	23	2000 - 2025	23.3	-0.02	22.57	0	0.72
02326516	Significantly increasing trend	1616	6	2020 - 2025	20.6	0.32	20.54	0.02	0.01
02323566	Significantly increasing trend	4020	12	2014 - 2025	22.6	0.77	22.39	0.04	0
02326550	Significantly increasing trend	4930	13	2002 - 2025	22.4	0.21	21.25	0.04	0
291842083085100	Insufficient data to calculate trend	542	1	2000 - 2000	23.1	-	-	-	-
02327022	Insufficient data to calculate trend	658	3	2023 - 2025	21.3	-	-	-	-
291652083064100	Insufficient data to calculate trend	473	1	2000 - 2000	26.1	-	-	-	-

At five program locations, monthly average water temperature increased between 0.02 and 0.32°C per year. At one program location, monthly average water temperature decreased by 0.37°C per year. No detectable change in monthly average water temperature was observed at five locations. There was insufficient data to fit a model for four locations.

Water Temperature - Continuous - Program 471

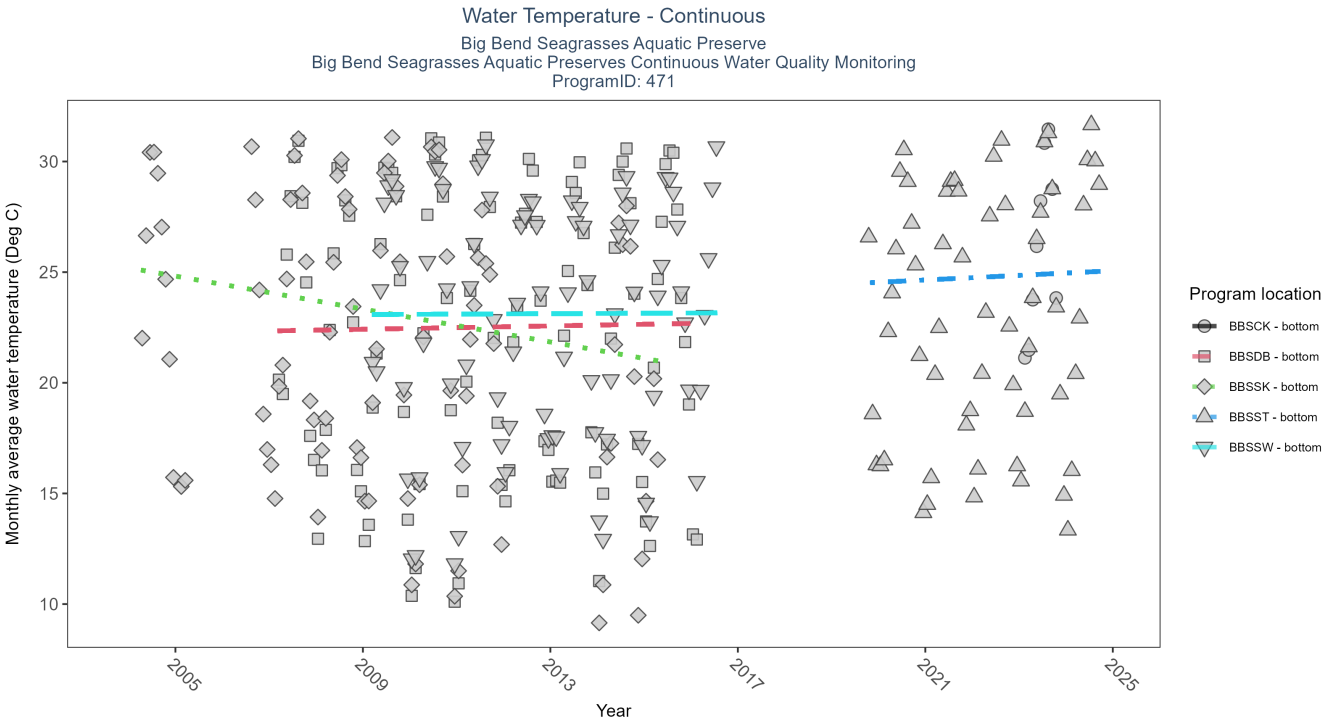

Figure 39: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 39: Seasonal Kendall-Tau Results for Water Temperature - Program 471

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
BBSDB	No significant trend	265988	10	2007 - 2016	23.2	0.08	22.34	0.04	0.29
BBSCK	Insufficient data to calculate trend	22232	1	2023 - 2023	26.4	-	-	-	-
BBSSK	Significantly decreasing trend	179213	10	2004 - 2015	21.7	-0.33	25.19	-0.37	0
BBSST	No significant trend	163227	6	2019 - 2024	23.5	0.1	24.44	0.1	0.52
BBSSW	No significant trend	227996	8	2009 - 2016	23.7	0.02	23.09	0.01	0.9

At five program locations, monthly average water temperature increased between 0.02 and 0.32°C per year. At one program location, monthly average water temperature decreased by 0.37°C per year. No detectable change in monthly average water temperature was observed at five locations. There was insufficient data to fit a model for four locations.

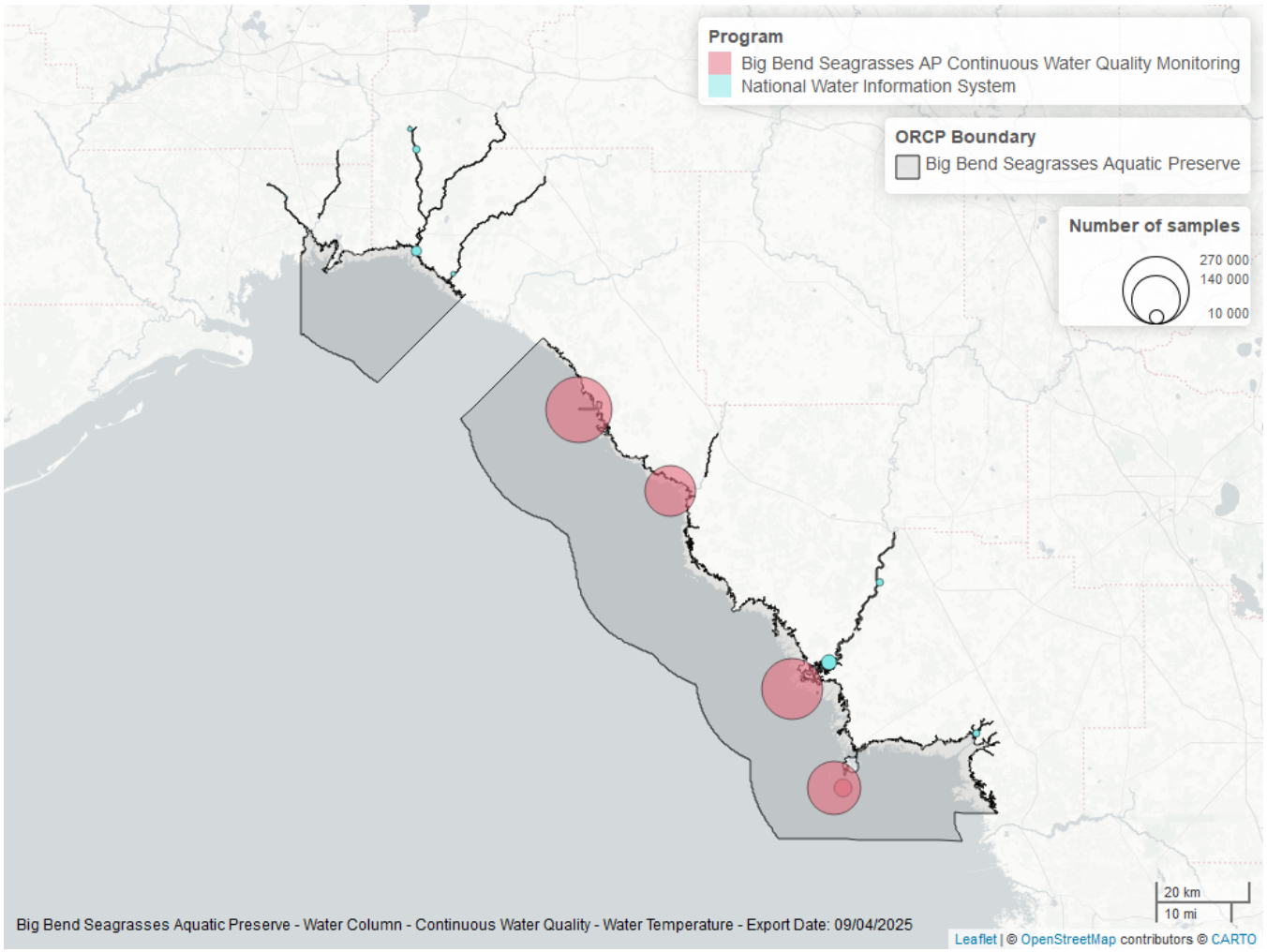

Figure 40: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Submerged Aquatic Vegetation

The data file used is: **All_SAV_Parameters-2025-Sep-04.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

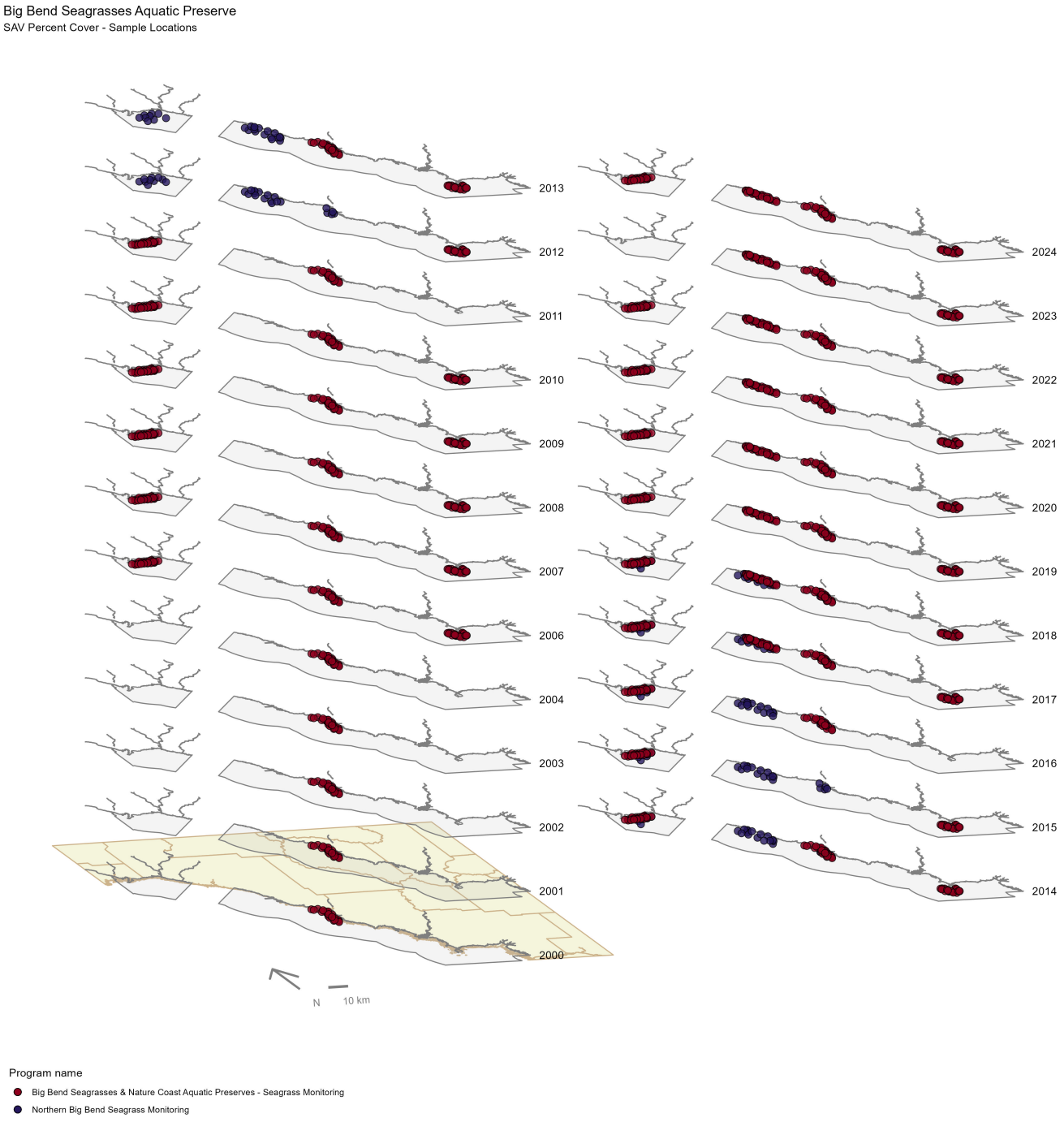

Figure 41: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Big Bend Seagrasses Aquatic Preserve* by Program name.

Click here to view spatio-temporal plots on GitHub.

Sampling locations by Program:

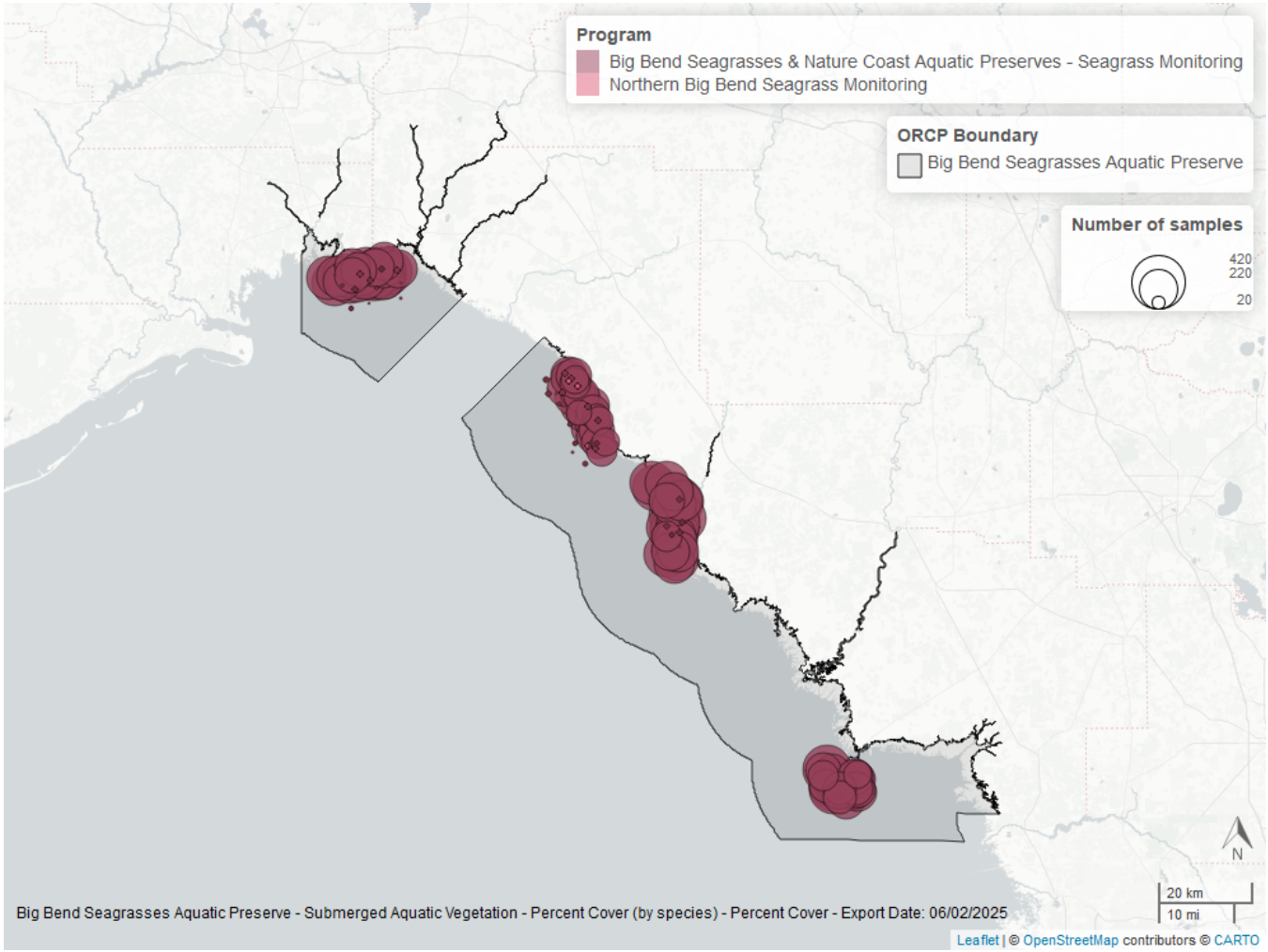

Figure 42: Map showing SAV sampling sites within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 40: Program Information for Submerged Aquatic Vegetation

ProgramID	*N-Data*	*YearMin*	*YearMax*	*method*	*Sample Locations*
559	537	2012	2018	Modified Braun Blanquet	195
560	19753	2000	2024	Modified Braun Blanquet	100
560	4271	2022	2024	Percent Cover	100

Program names:

559 - Northern Big Bend Seagrass Monitoring[15]
560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring[12]
560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring[12]

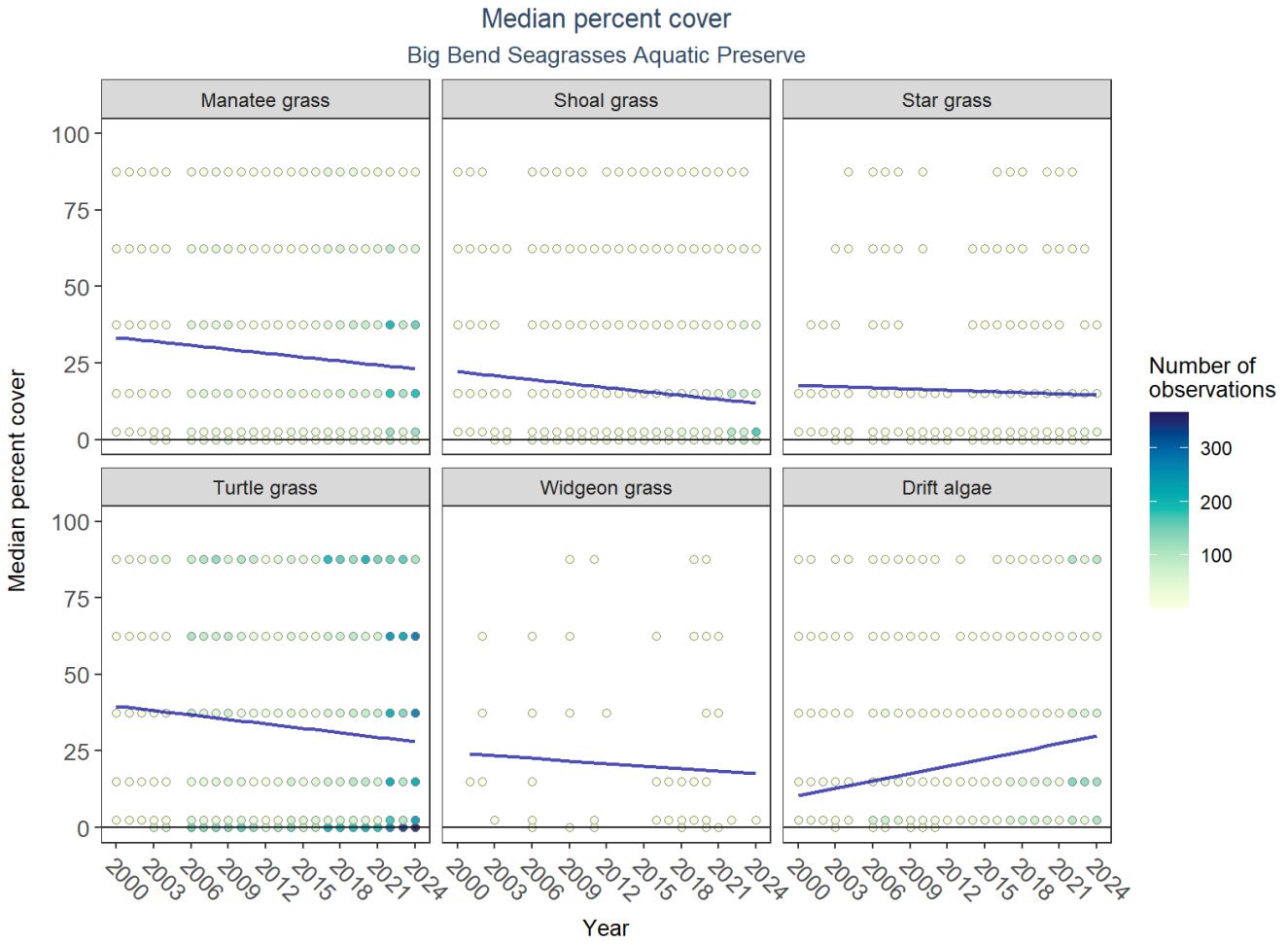

Figure 43: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

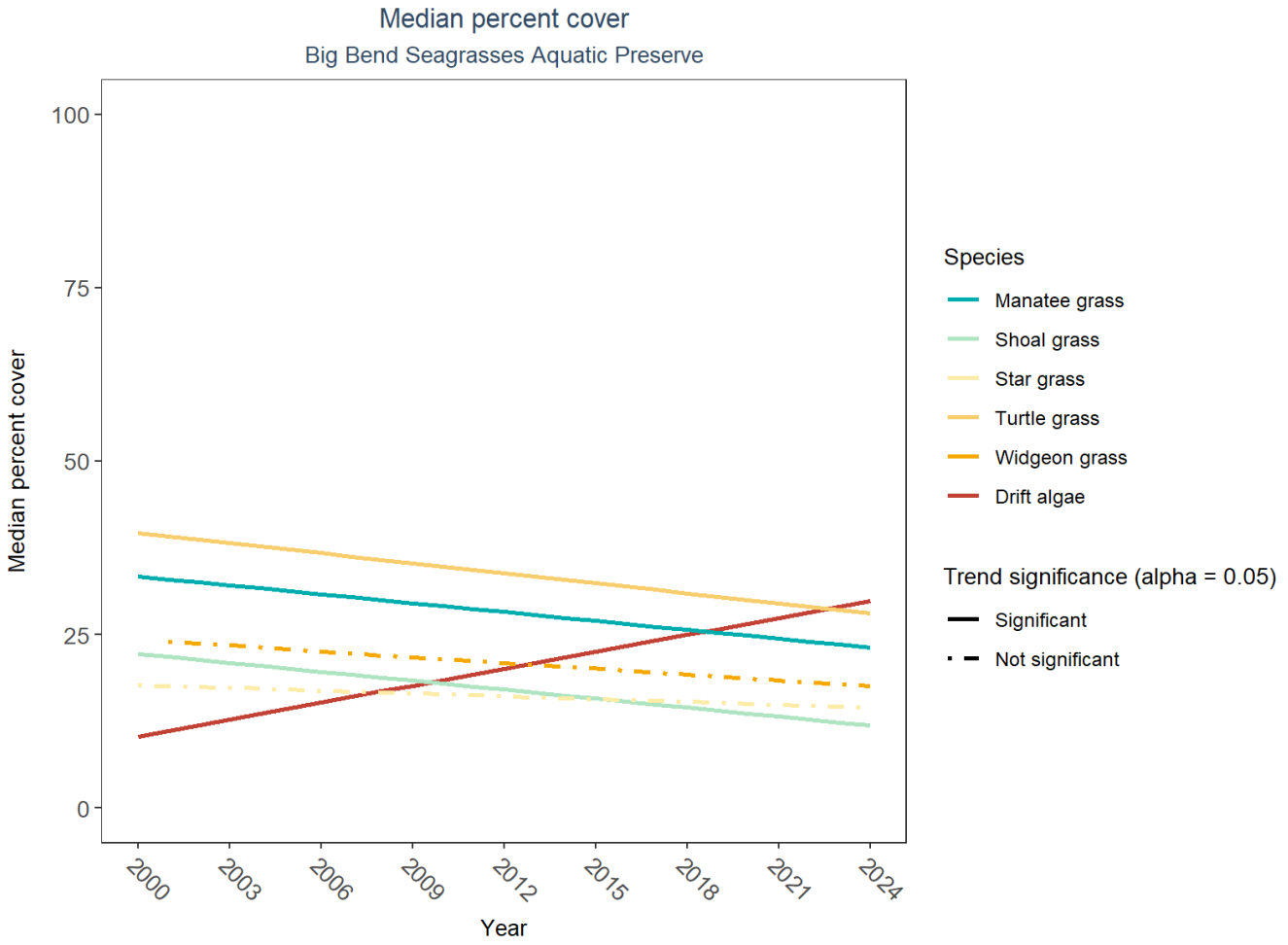

Figure 44: Trends in median percent cover for various seagrass species in Big Bend Seagrasses Aquatic Preserve - simplified

Table 41: 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	5.453911	0.8127330	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	25.939604	-0.2793089	0.5982584
Manatee grass	Significantly decreasing trend	2000 - 2024	35.945396	-0.4271771	0.0000536
Turtle grass	Significantly decreasing trend	2000 - 2024	42.516006	-0.4815112	0.0000000

An annual increase in percent cover was observed for drift algae (0.8%). Annual decreases in percent cover were observed for manatee grass (-0.4%), shoal grass (-0.4%), and turtle grass (-0.5%). No detectable change in percent cover was observed for star grass and widgeon grass.

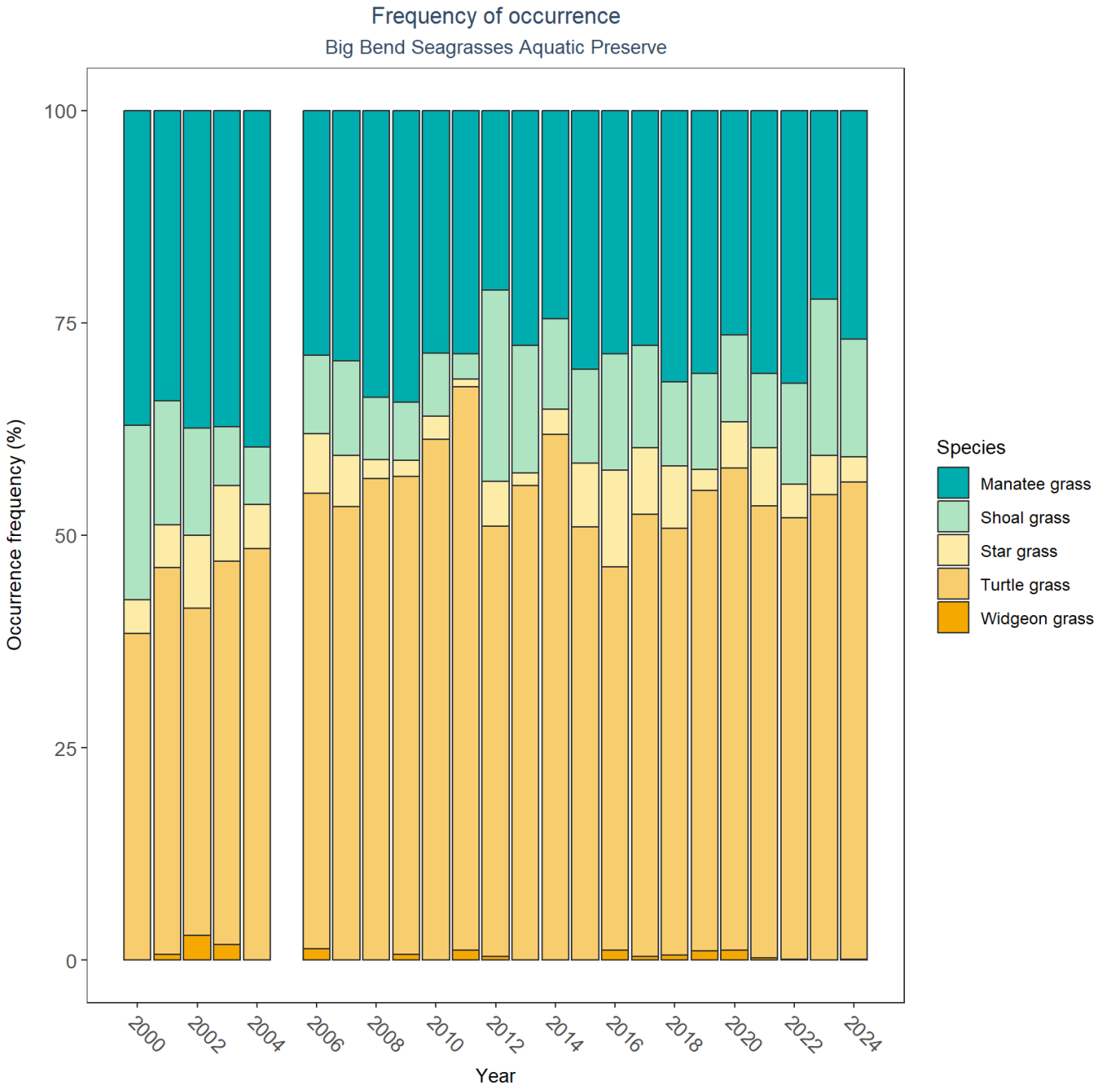

Figure 45: Frequency of occurrence for various seagrass species in Big Bend Seagrasses Aquatic Preserve

SAV Water Column Analysis

The following parameters are available for Big Bend Seagrasses Aquatic Preserve within the SAV_WC_Report:

- Colored Disolved Organic Matter
- Chlorophyll a
- Dissolved Oxygen
- Dissolved Oxygen Saturation
- pH
- Salinity

- Secchi Depth
- Water Temperature
- Total Nitrogen
- Total Suspended Solids
- Turbidity

Access the reports here: DRAFT_SAV_WC_Report_2024-11-20.pdf

Coastal Wetlands

The data file used is: **All_CW_Parameters-2025-Sep-04.txt**

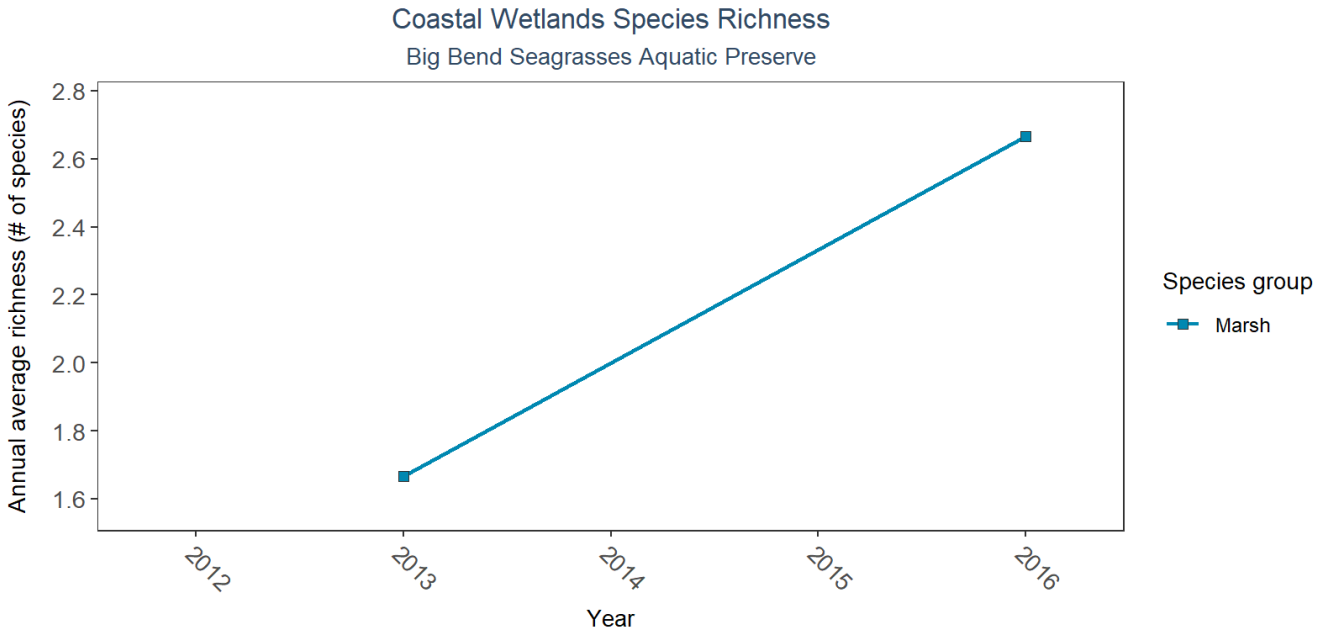

Figure 46: Line graph of annual average coastal wetlands species richness over time for mangroves and associates (triangles), marsh (squares), and marsh succulents (circles). If the time series by species group included more than one year of observations, a line connects data points for visualization.

Table 42: 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

Between 2013 and 2016, the median annual number of species for *marsh* was 2 based on 6 observations.

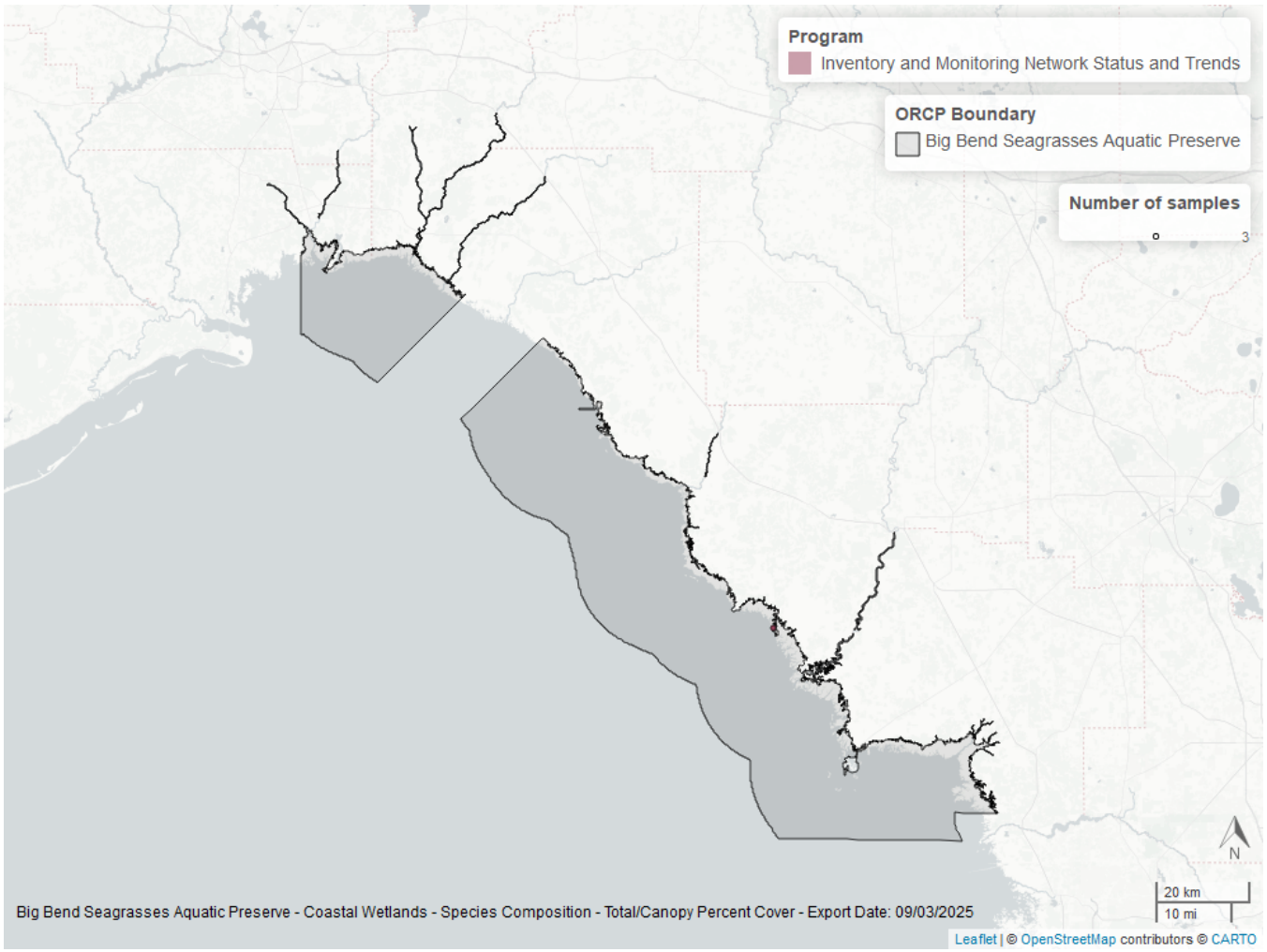

Figure 47: Map showing location of coastal wetlands sampling locations within the boundaries of *Big Bend Seagrasses Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

Acanthophora muscoides[1]	Drift algae[1]	Persicaria hydropiperoides
Acetabularia crenulata[1]	Drift red algae[1]	Pluchea camphorata
Anadyomene stellata[1]	Eupatorium mikanioides	Polysiphonia sp.[1]
Avrainvillea levis[1]	Gracilaria sp.[1]	Ruppia maritima[1]
Caulerpa[1]	Halimeda incrassata[1]	Sagittaria graminea
Caulerpa ashmeadii[1]	Halodule wrightii[1]	Sagittaria lancifolia lancifolia
Caulerpa cupressoides[1]	Halophila engelmannii[1]	Sargassum sp.[1]
Caulerpa mexicana[1]	Juncus roemerianus[2]	Sargassum spp.[1]
Caulerpa paspaloides[1]	Laurencia spp.[1]	Schoenoplectus tabernaemontani
Caulerpa prolifera[1]	Ludwigia repens	Spartina alterniflora[2]
Caulerpa racemosa[1]	Lythrum lineare	Spyridia[1]
Caulerpa sertularioides[1]	No grass in quadrat[1]	Syringodium filiforme[1]
Caulerpa spp.[1]	Padina[1]	Thalassia testudinum[1]
Cladium mariscus	Padina gymnospora[1]	Udotea flabellum[1]
Codium isthmocladum[1]	Penicillus capitatus[1]	Ulva sp.[1]
Digenea simplex[1]	Penicillus dumetosus[1]	Unidentified species
Distichlis spicata[2]	Penicillus spp.[1]	Yuzurua poiteaui[1]

1 - Submerged Aquatic Vegetation, 2 - Coastal Wetlands

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