

Nature Coast Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 22 May, 2025

Contents

Funding & Acknowledgements	2
Threshold Filtering	2
Value Qualifiers	3
Water Column	5
Seasonal Kendall-Tau Analysis	5
Water Quality - Discrete	5
Chlorophyll a, Corrected for Pheophytin - Discrete	6
Chlorophyll a, Uncorrected for Pheophytin - Discrete	7
Colored Dissolved Organic Matter - Discrete	10
Dissolved Oxygen - Discrete	11
pH - Discrete	14
Salinity - Discrete	16
Secchi Depth - Discrete	18
Total Nitrogen - Discrete	20
Total Phosphorus - Discrete	23
Turbidity - Discrete	25
Water Temperature - Discrete	26
Water Quality - Continuous	30
Dissolved Oxygen - Continuous	32
Dissolved Oxygen Saturation - Continuous	34
pH - Continuous	36
Salinity - Continuous	38
Turbidity - Continuous	40
Water Temperature - Continuous	42
Submerged Aquatic Vegetation	44
Parameters	44
Species	44
Notes	44
Nekton	50
Coastal Wetlands	52
References	54

Funding & Acknowledgements

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

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Threshold Filtering

Threshold filters, following the guidance of Florida Department of Environmental Protection's (*FDEP*) Division of Environmental Assessment and Restoration (*DEAR*) are used to exclude specific results values from the SEACAR Analysis. Based on the threshold filters, Quality Assurance / Quality Control (*QAQC*) Flags are inserted into the *SEACAR_QAQCFlagCode* and *SEACAR_QAQC_Description* columns of the export data. The *Include* column indicates whether the *QAQC* Flag will also indicate that data are excluded from analysis. No data are excluded from the data export, but the analysis scripts can use the *Include* column to exclude data (1 to include, 0 to exclude).

Table 1: Continuous Water Quality threshold values

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	m^-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

<i>Qualifier Source</i>	<i>Value Qualifier</i>	<i>Include</i>	<i>Description</i>
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 $p \geq 0.05$). Any parameters with insufficient data to perform Seasonal Kendall-Tau test will have their monthly averages plotted without a corresponding trend line.

Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_pH-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Salinity-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Turbidity-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2025-Mar-06.txt*

Chlorophyll a, Corrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

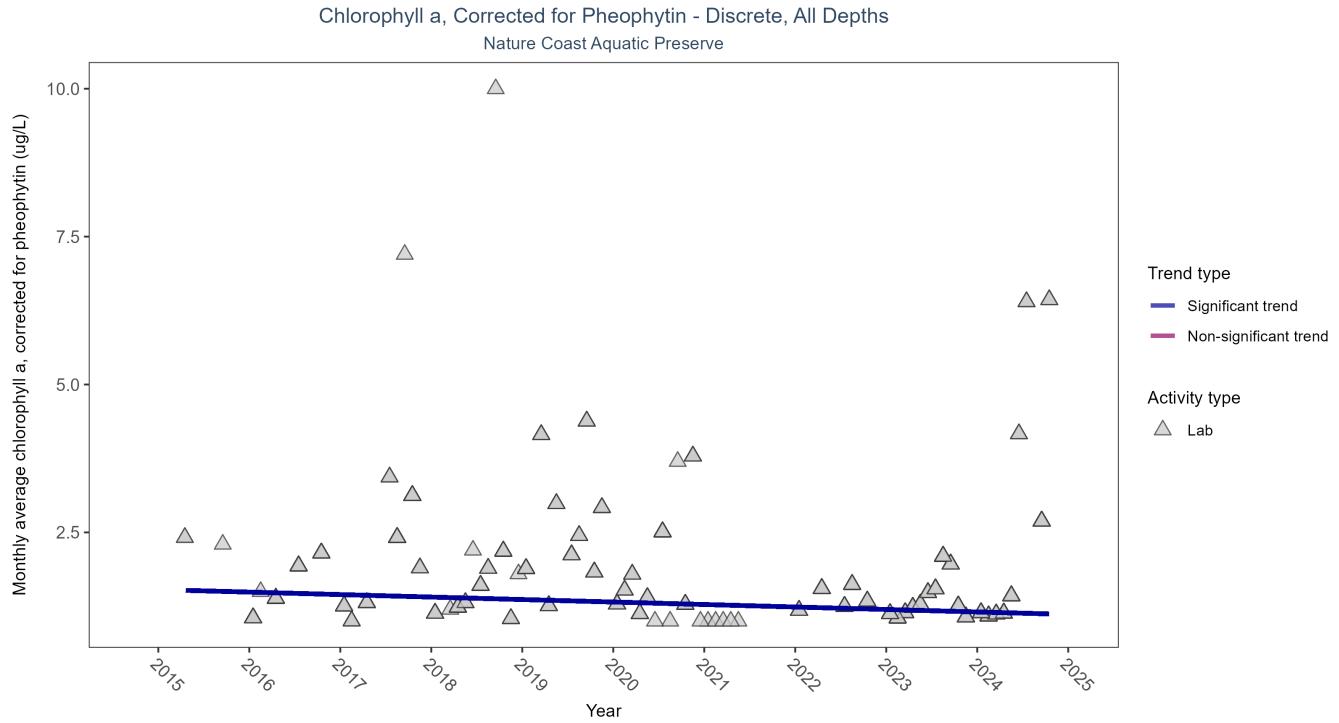


Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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 decreasing trend	2076	10	2015 - 2024	1	-0.1909	1.533	-0.042	0.0374

Monthly average chlorophyll a, corrected for pheophytin, decreased by 0.04 µg/L per year, indicating an increase in water clarity.

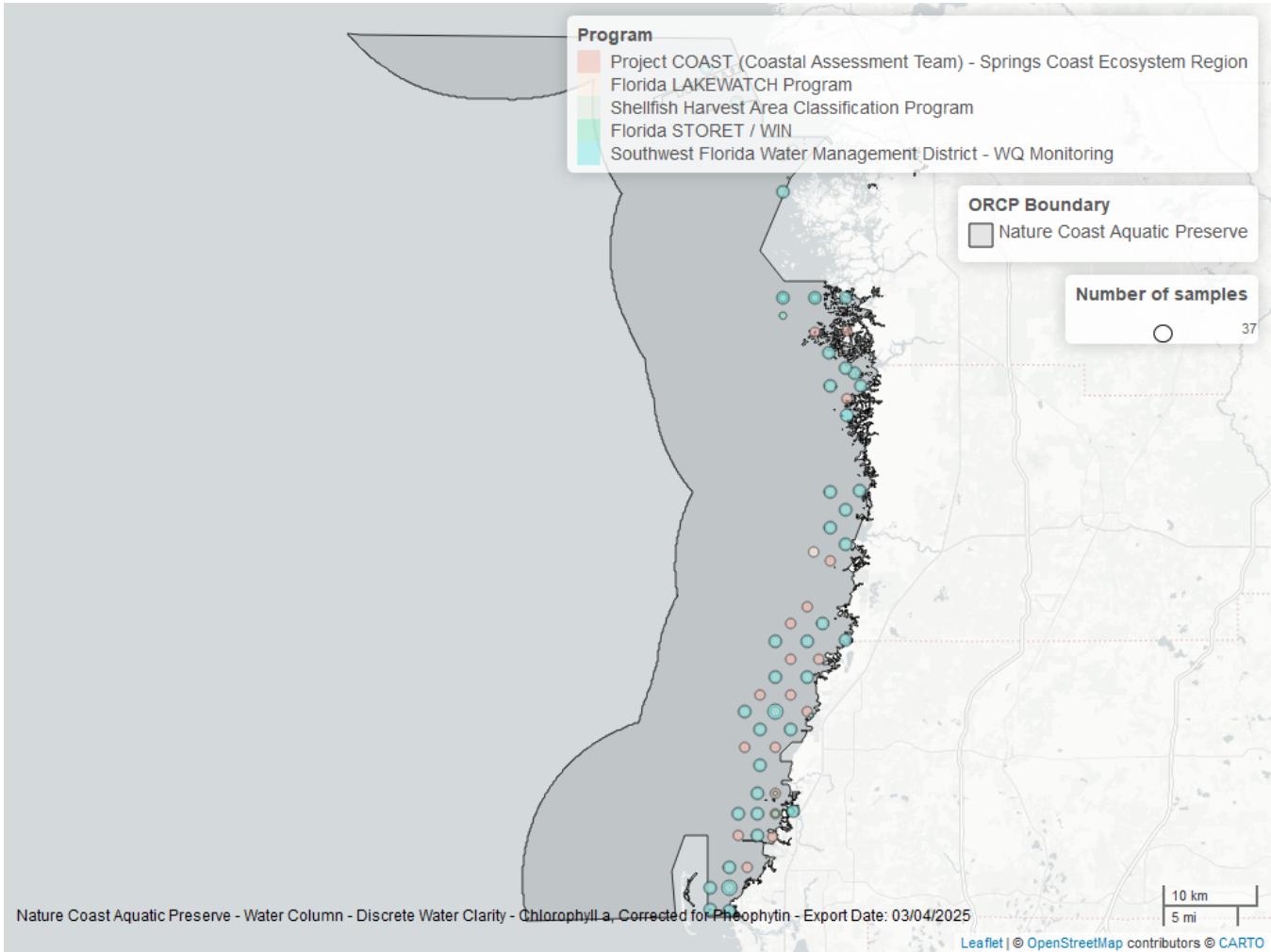


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	N_Data	YearMin	YearMax
479	1045	2016	2023
5008	962	2023	2024
5002	82	2015	2024
514	17	2020	2024
540	7	2017	2019

Program names:

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

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

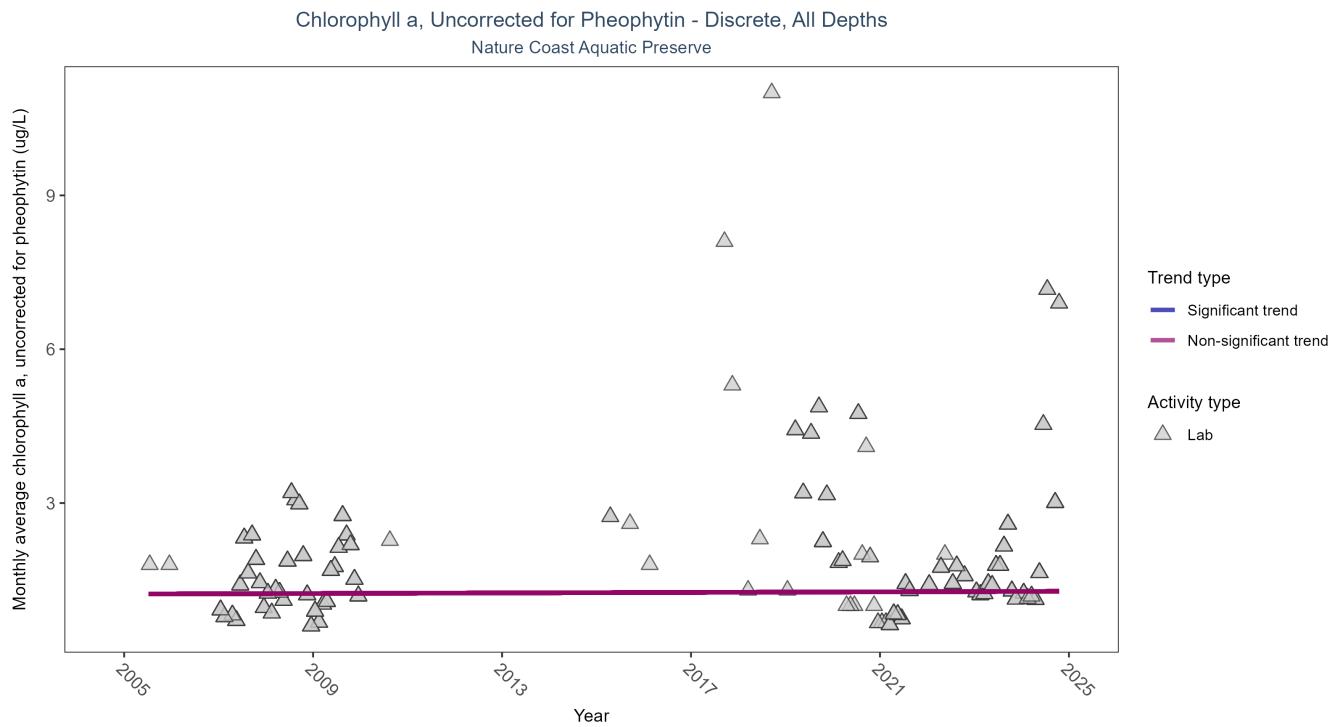


Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	No significant trend	3146	15	2005 - 2024	1	0.0207	1.2257	0.0027	0.667

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 2005 and 2024.

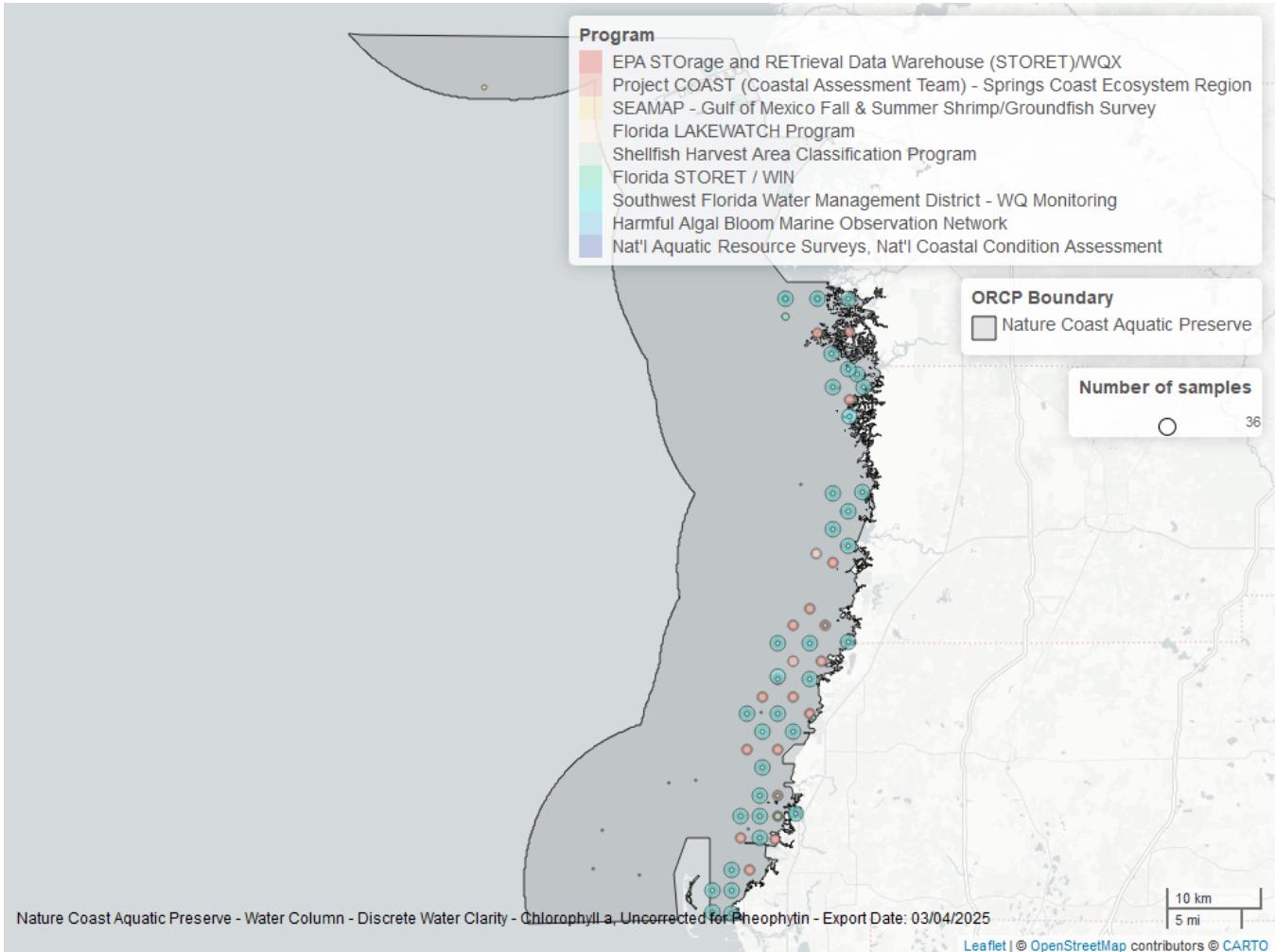


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	1494	2007	2022
5008	967	2021	2024
103	586	2005	2021
5002	84	2015	2024
514	17	2020	2024
95	12	2003	2016
540	8	2017	2019
60	3	2015	2015
118	2	2005	2010

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey⁶

95 - Harmful Algal Bloom Marine Observation Network⁷

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁸

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁹

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Colored Dissolved Organic Matter - Discrete

Seasonal Kendall-Tau Trend Analysis

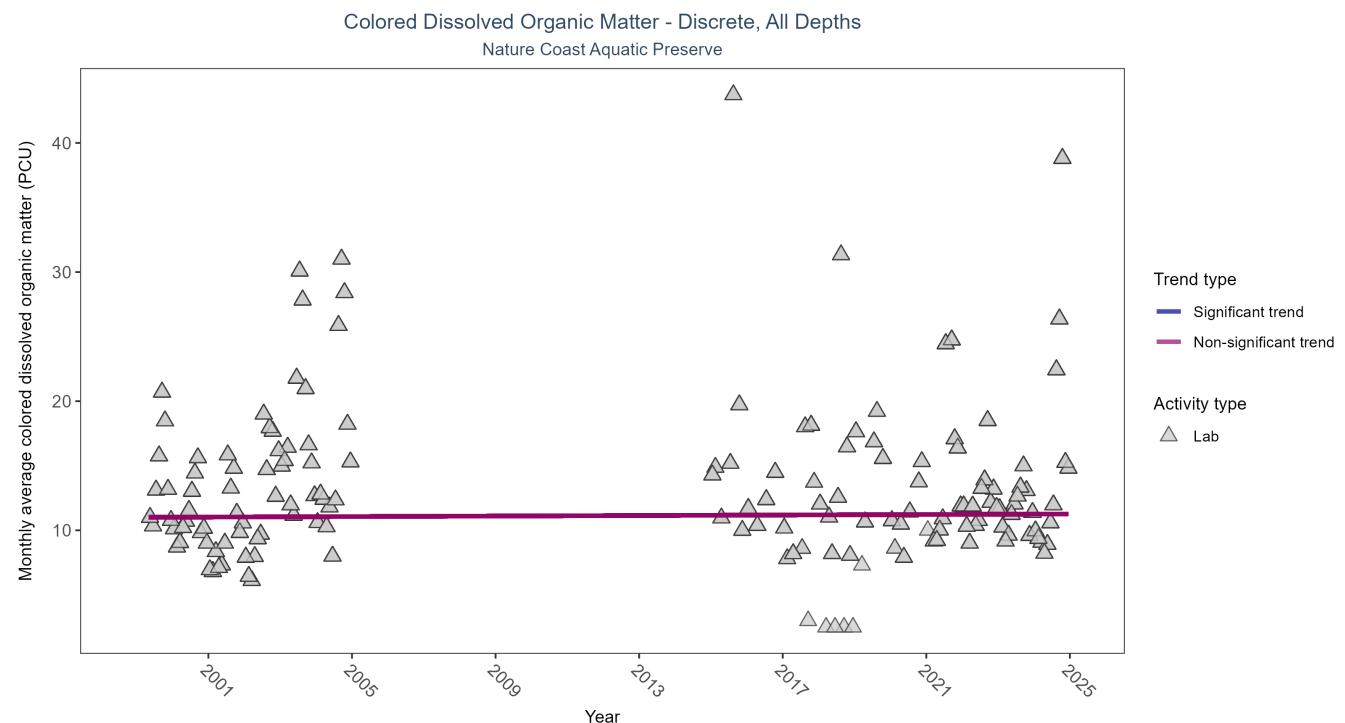


Figure 5: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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	No significant trend	6001	16	1999 - 2024	10.421	0.0439	11.0041	0.01	0.565

Colored dissolved organic matter showed no detectable trend between 1999 and 2024.

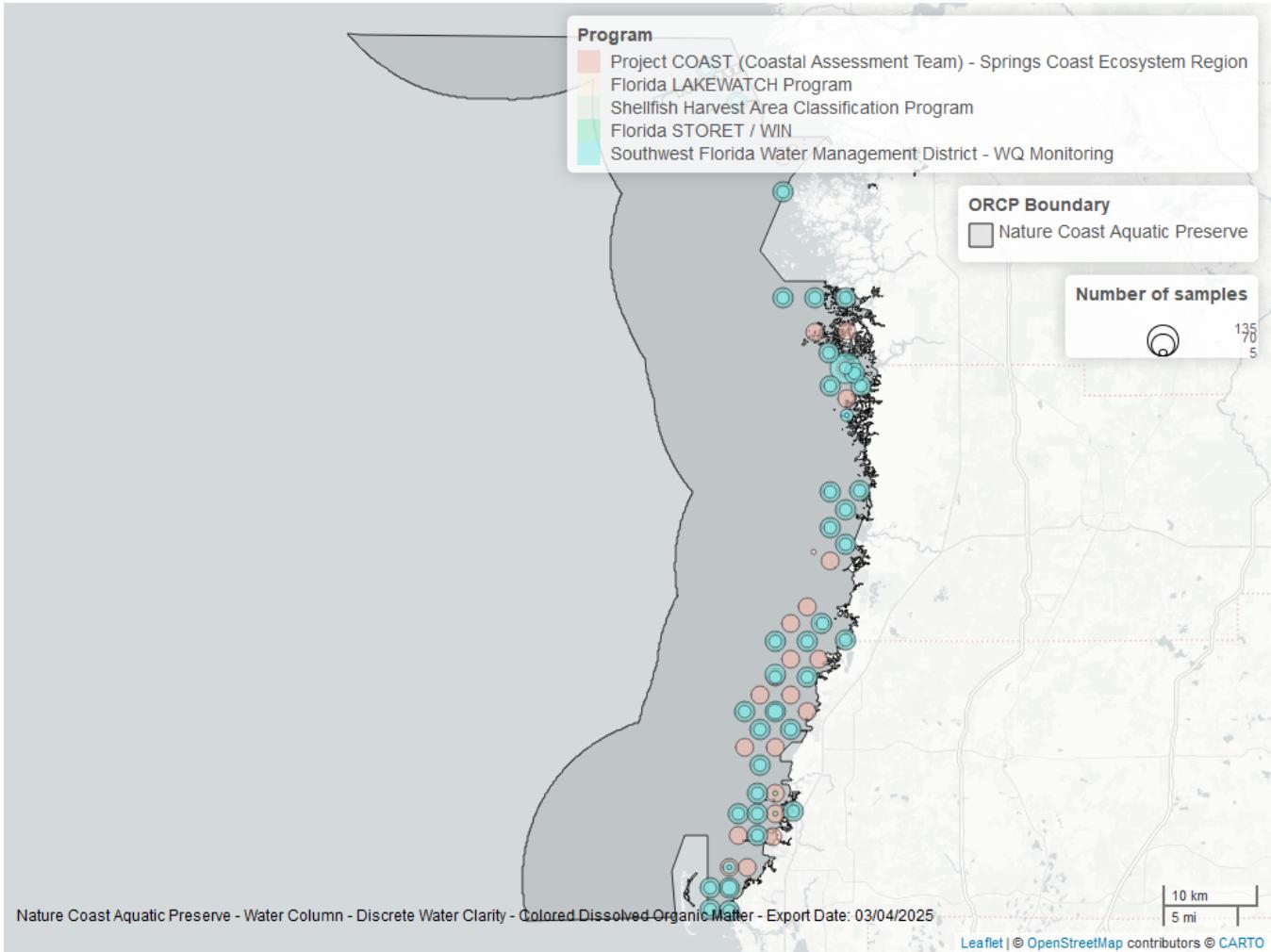


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	N_Data	YearMin	YearMax
479	3541	1999	2023
5008	2467	2021	2024
5002	18	2024	2024
540	7	2017	2019
514	6	2020	2021

Program names:

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

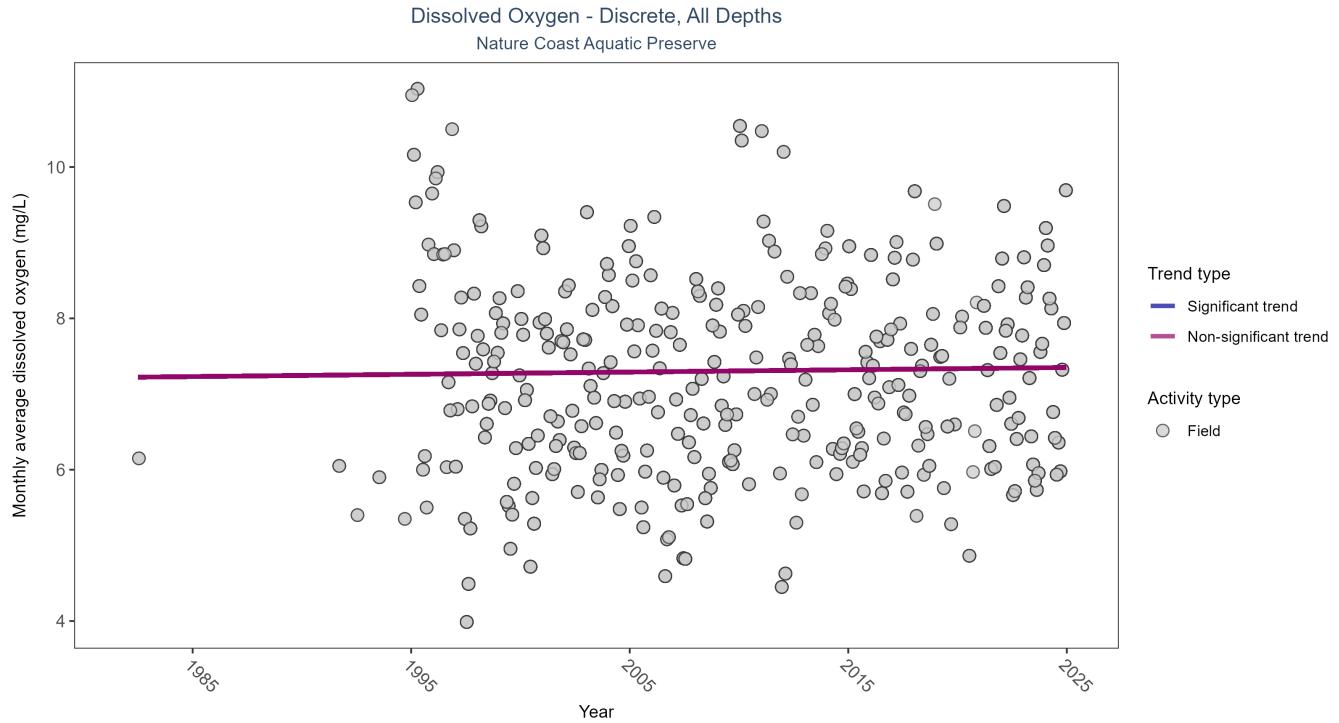


Figure 7: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	9960	35	1982 - 2024	7.17	0.028	7.2215	0.003	0.4889

Dissolved oxygen showed no detectable trend between 1982 and 2024.

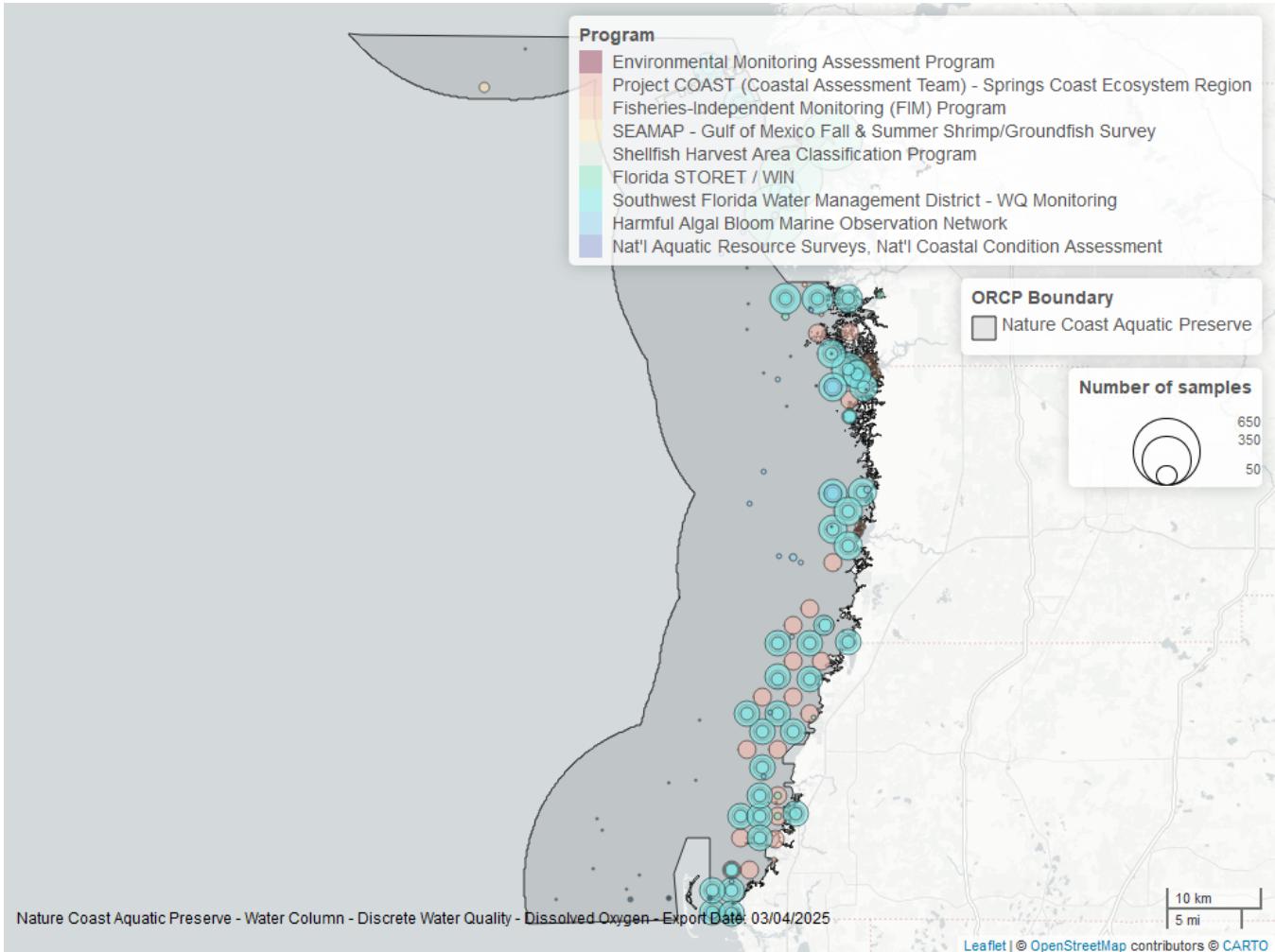


Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
479	4979	1996	2023
5008	2464	2021	2024
5002	1824	1995	2024
69	428	2003	2009
95	225	1982	2018
60	15	2015	2015
115	12	1991	1994
540	7	2017	2019
118	6	2005	2021

Program names:

- 60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey⁶
- 69 - Fisheries-Independent Monitoring (FIM) Program¹⁰
- 95 - Harmful Algal Bloom Marine Observation Network⁷

115 - Environmental Monitoring Assessment Program¹¹

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁹

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

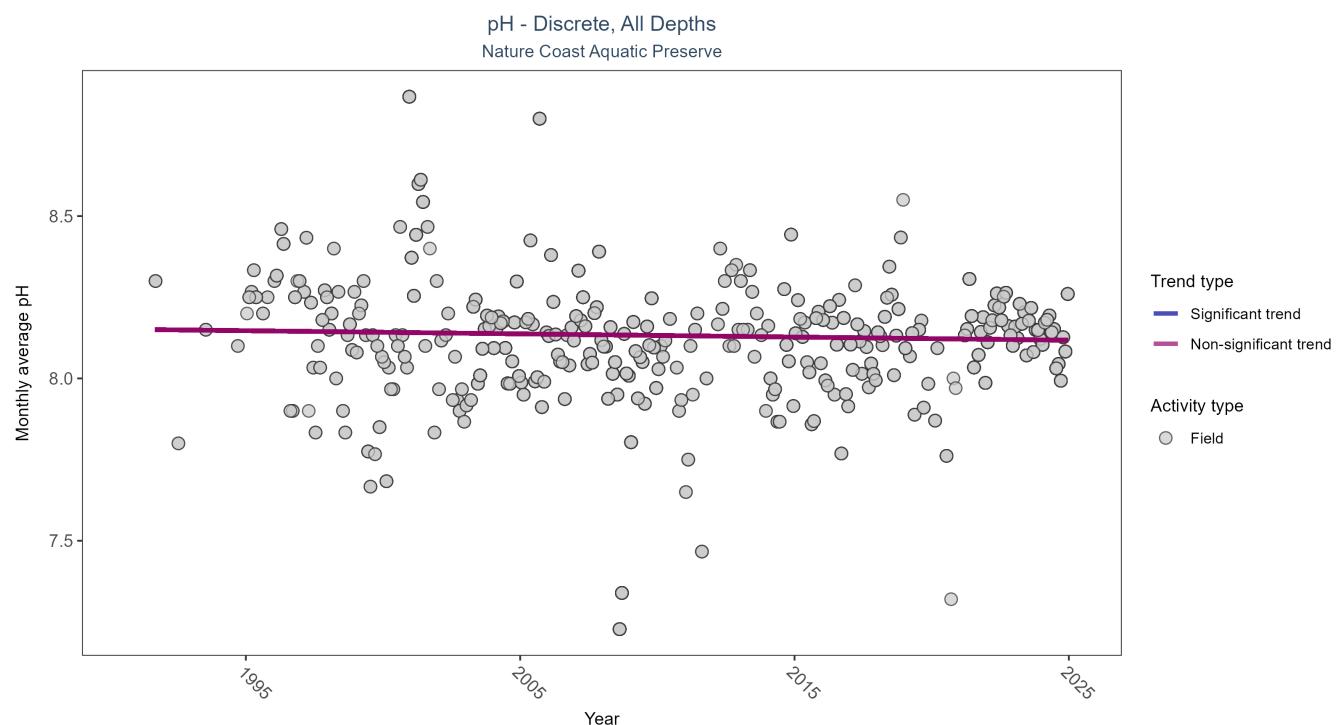


Figure 9: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 14: 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	7392	34	1991 - 2024	8.15	-0.0378	8.1509	-0.001	0.3153

pH showed no detectable trend between 1991 and 2024.

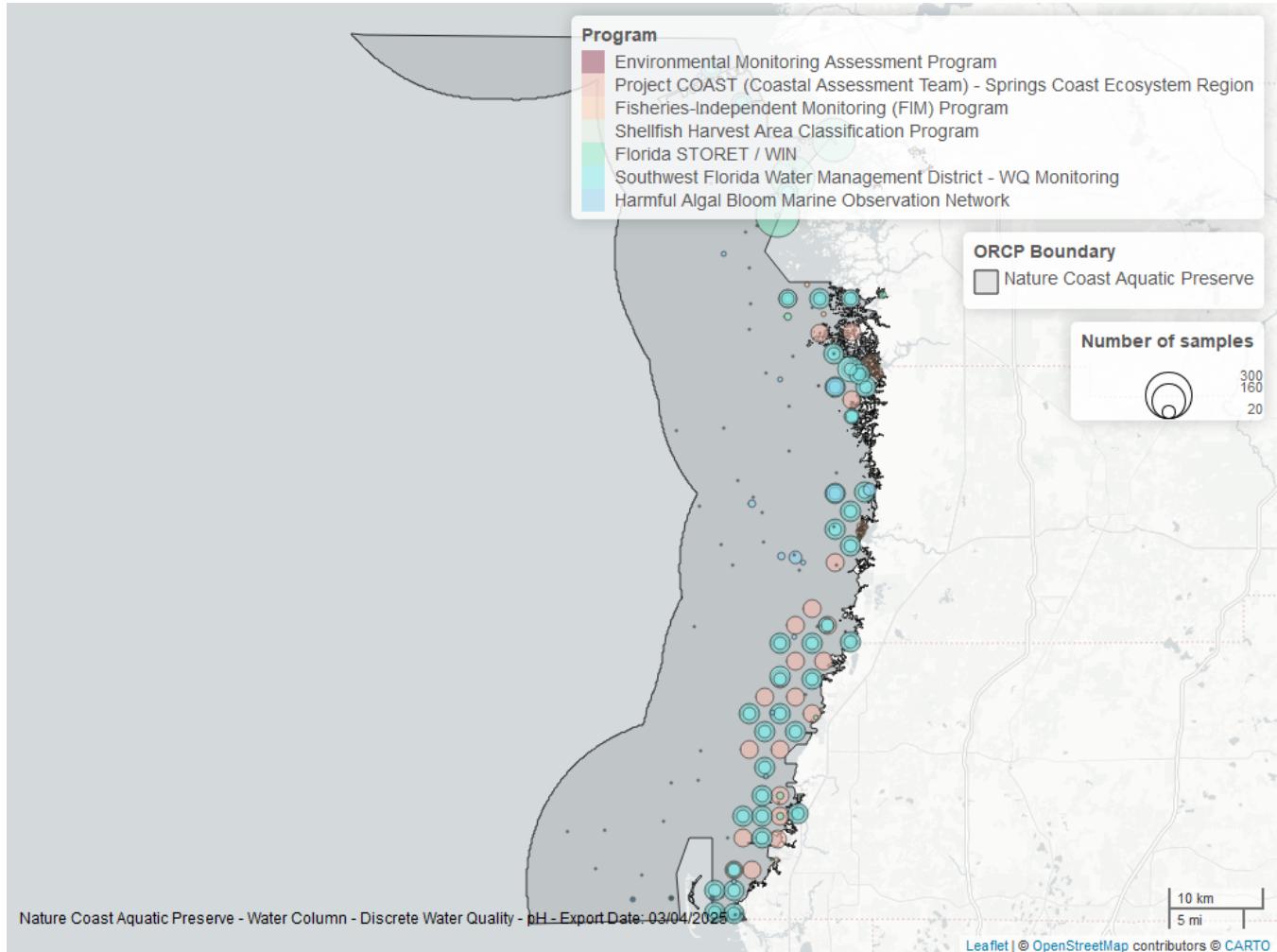


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for pH

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	3261	2000	2023
5008	2464	2021	2024
5002	955	1995	2024
69	428	2003	2009
95	276	2003	2018
115	12	1991	1994
540	3	2017	2018

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program¹⁰

95 - Harmful Algal Bloom Marine Observation Network⁷

115 - Environmental Monitoring Assessment Program¹¹

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

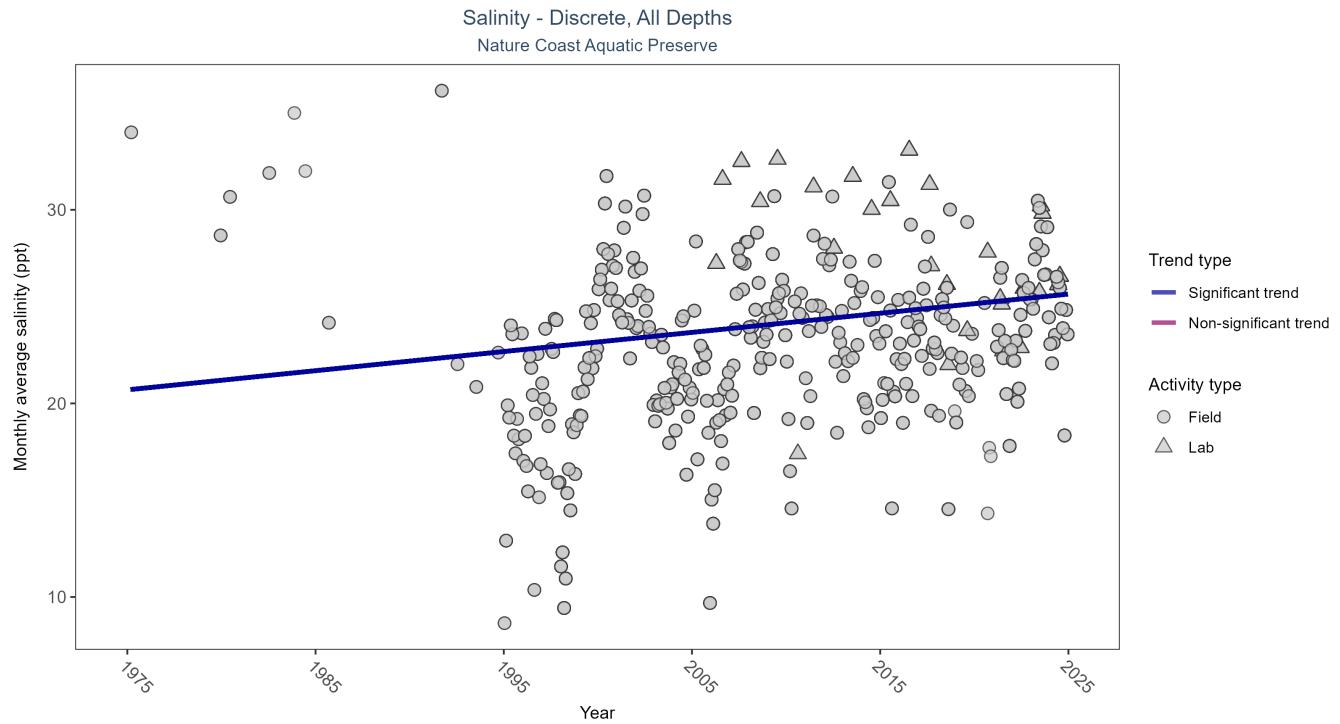


Figure 11: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (triangles) are both included in the plot.

Table 16: 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 increasing trend	10994	41	1975 - 2024	24.2	0.1594	20.7004	0.0989	0

Monthly average salinity increased by 0.1 ppt per year.

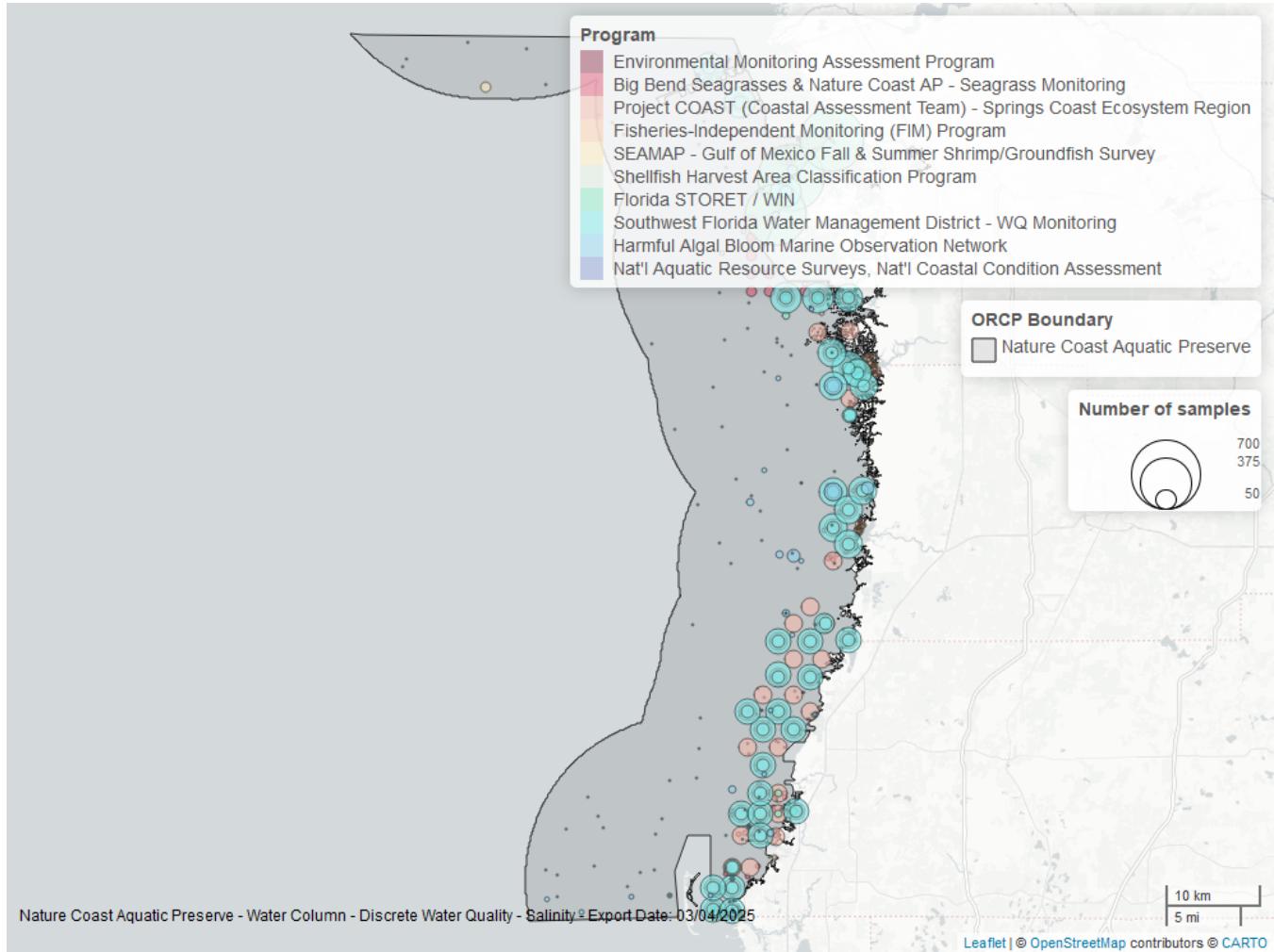


Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
479	5008	1996	2023
5008	2574	2021	2024
5002	1971	1995	2024
560	580	2006	2024
69	428	2003	2009
95	403	1975	2018
60	15	2015	2015
115	12	1991	1994
540	7	2017	2019
118	5	2021	2021

Program names:

60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey⁶

69 - Fisheries-Independent Monitoring (FIM) Program¹⁰

- 95 - Harmful Algal Bloom Marine Observation Network⁷
 115 - Environmental Monitoring Assessment Program¹¹
 118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁹
 479 - Southwest Florida Water Management District - Water Quality Monitoring¹
 540 - Shellfish Harvest Area Classification Program³
 560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring¹²
 5002 - Florida STORET / WIN⁴
 5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

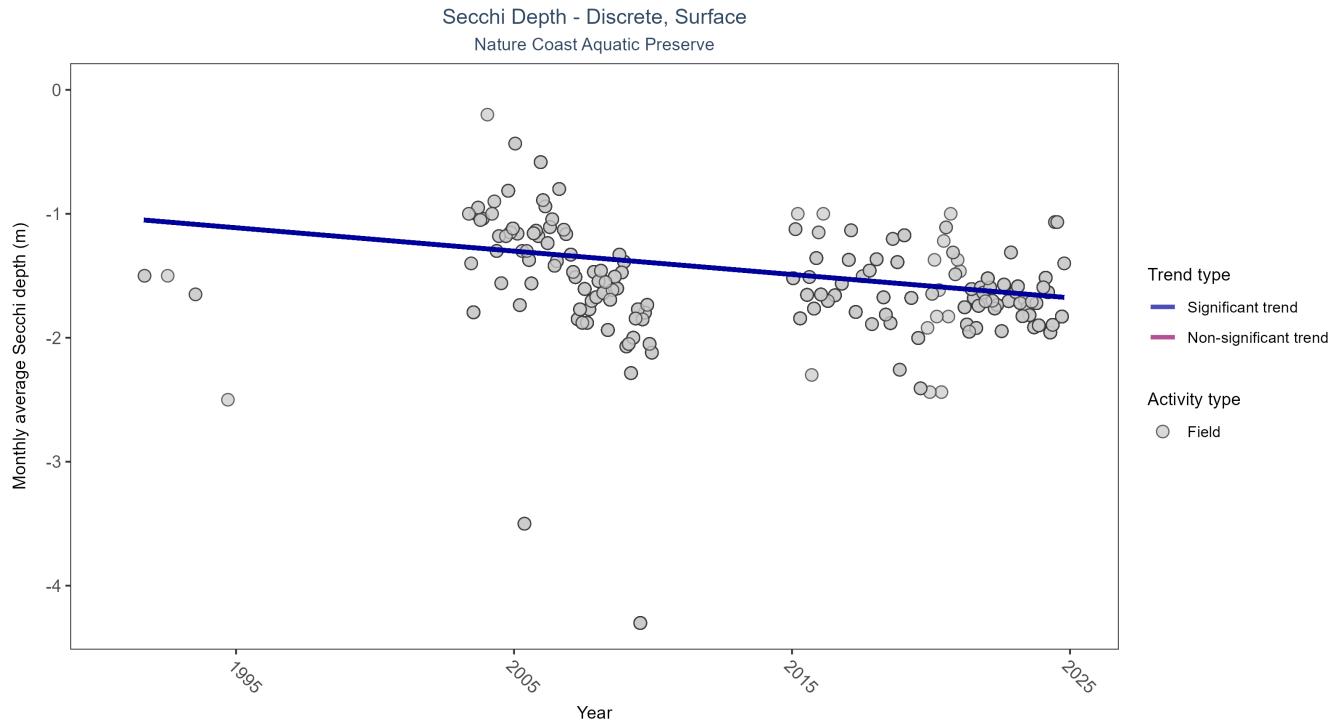


Figure 13: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 18: 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 decreasing trend	4436	21	1991 - 2024	-1.59	-0.297	-1.0373	-0.0188	0

Monthly average Secchi depth became deeper by 0.02 m per year, indicating an increase in water clarity.

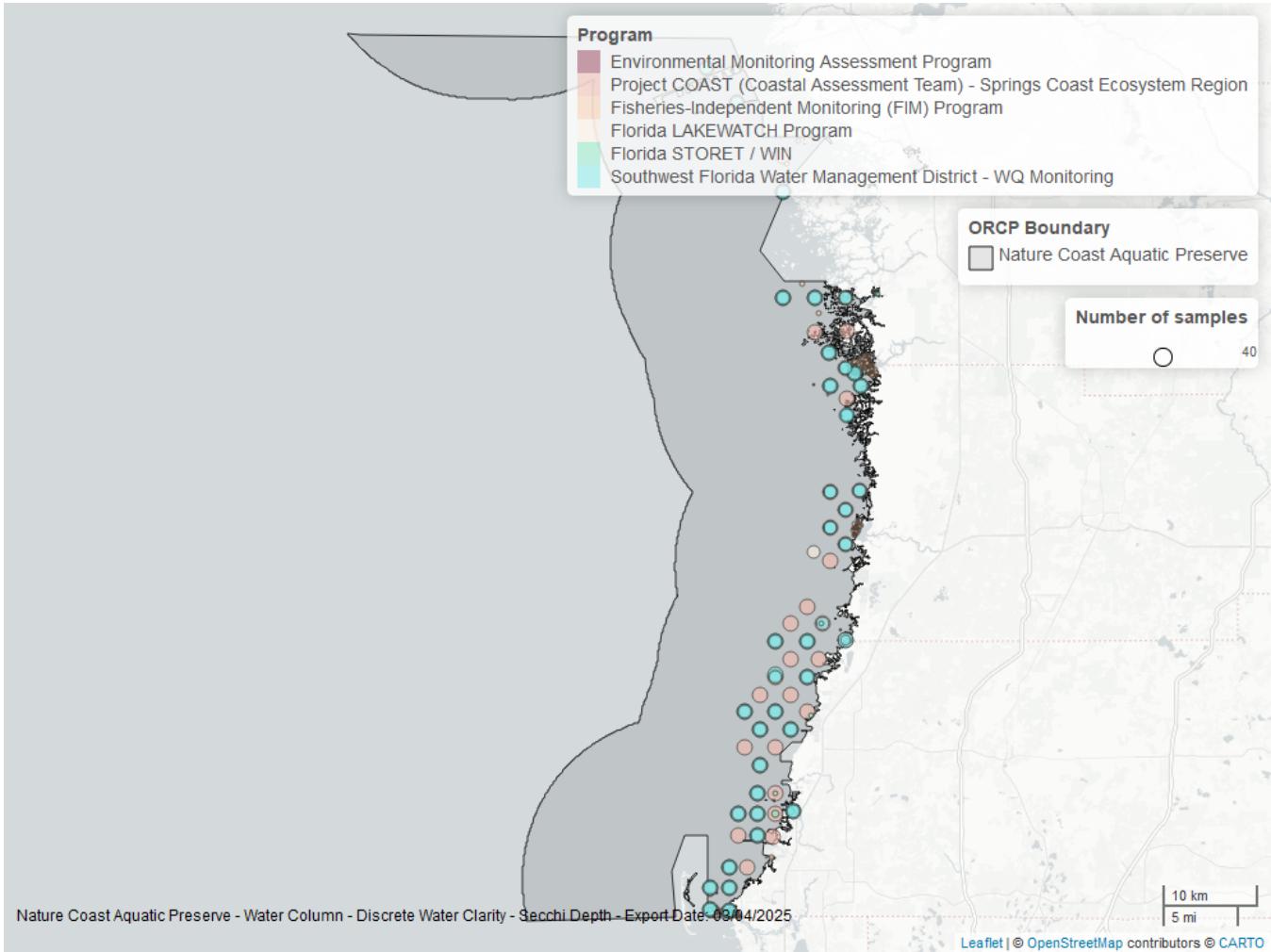


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Secchi Depth

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	2146	2007	2023
5008	1802	2021	2024
69	428	2003	2009
5002	33	2015	2024
514	21	2019	2024
115	6	1991	1994

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program¹⁰

115 - Environmental Monitoring Assessment Program¹¹

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

5002 - Florida STORET / WIN⁴

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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) $TN = TKN + NO_3O_2;$
- 2) $TN = TKN + NO_3 + NO_2;$
- 3) $TN = ORGN + NH_4 + NO_3O_2;$
- 4) $TN = ORGN + NH_4 + NO_2 + NO_3;$
- 5) $TN = TKN + NO_3;$
- 6) $TN = ORGN + NH_4 + NO_3;$

Additional Information:

- Rules for use of sample fraction:
 - Florida Department of Environmental Protection (FDEP) report that if both “Total” and “Dissolved” components are reported, only “Total” is used. If the total is not reported, then the dissolved components are used as a best available replacement.
 - Total nitrogen calculations are done using nitrogen components with the same sample fraction, nitrogen components with mixed total/dissolved sample fractions are not used. In other words, total nitrogen can be calculated when TKN and NO₃O₂ are both total sample fractions, or when both are dissolved sample fractions. *Future calculations of total nitrogen values may be based on components with mixed sample fractions.*
- Values inserted into data:
 - ParameterName = “Total Nitrogen”
 - SEACAR_QAQCFlagCode = “1Q”
 - SEACAR_QAQC_Description = “SEACAR Calculated”

Seasonal Kendall-Tau Trend Analysis

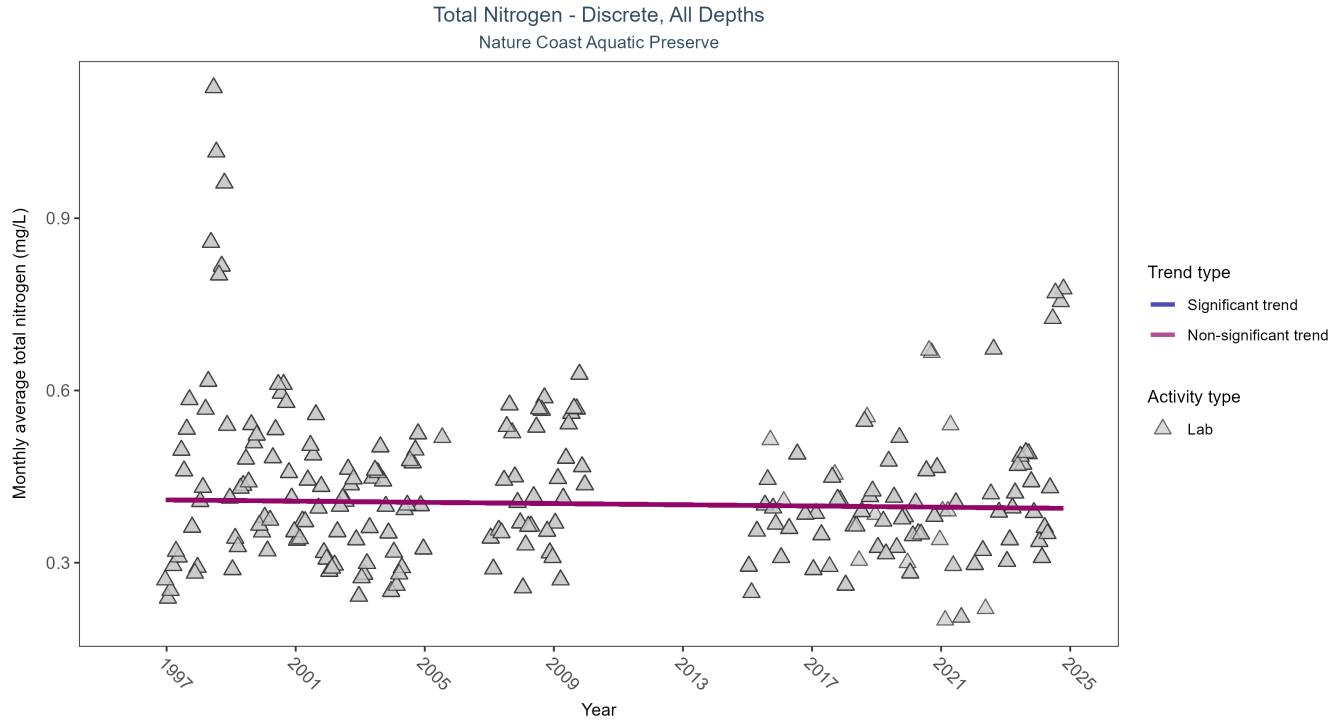


Figure 15: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the plot.

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	τ_{au}	Sen Intercept	Sen Slope	p
Lab	No significant trend	6219	23	1996 - 2024	0.39	-0.0401	0.41	-0.0005	0.3387

Total nitrogen showed no detectable trend between 1996 and 2024.

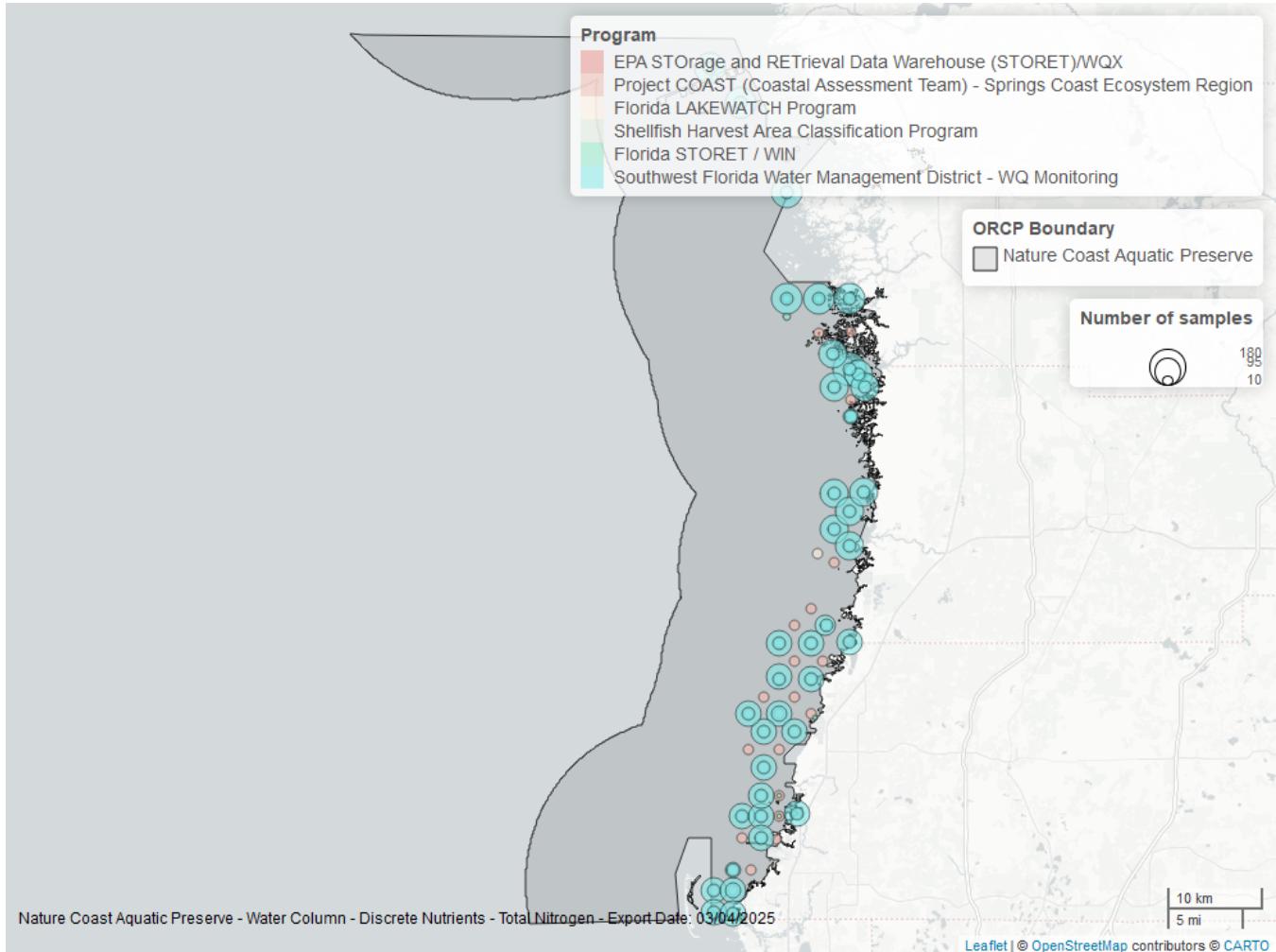


Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Total Nitrogen

ProgramID	N_Data	YearMin	YearMax
479	5237	1996	2023
5008	922	2021	2024
5002	79	2015	2024
514	20	2019	2021
540	6	2017	2019
103	2	2005	2005

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁸

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

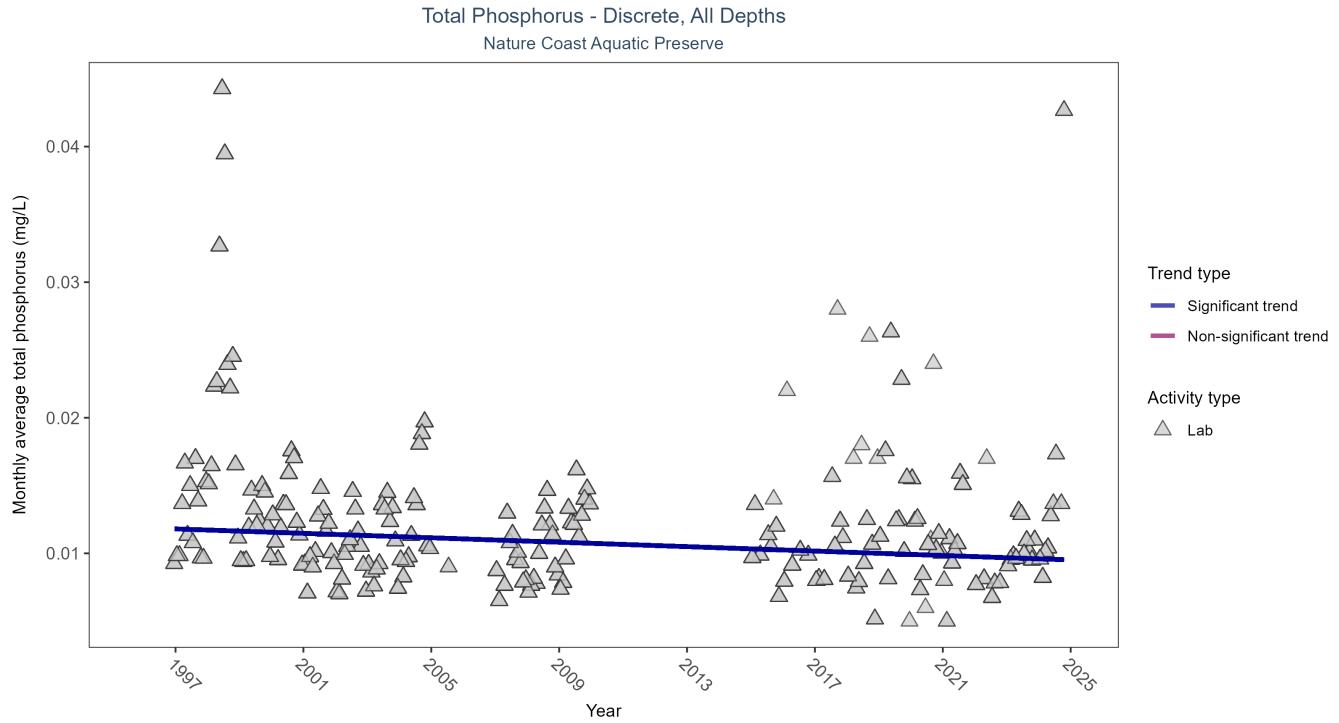


Figure 17: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included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

Table 22: 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 decreasing trend	6612	23	1996 - 2024	0.009	-0.1509	0.0119	-0.0001	0.0014

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

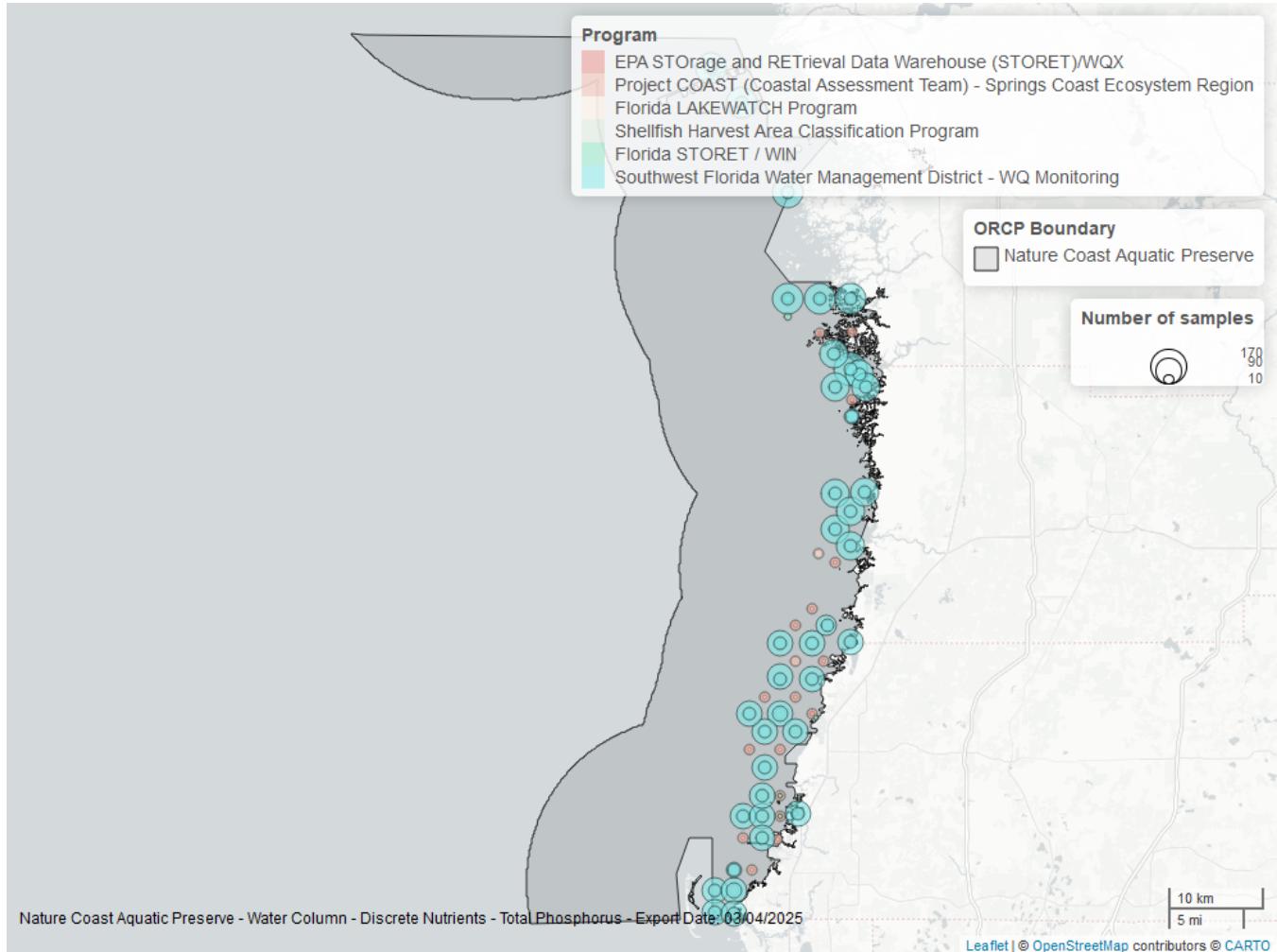


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
479	5239	1996	2023
5008	922	2021	2024
103	345	2005	2021
5002	80	2015	2024
514	20	2019	2021
540	7	2017	2019

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁸

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

514 - Florida LAKEWATCH Program²

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

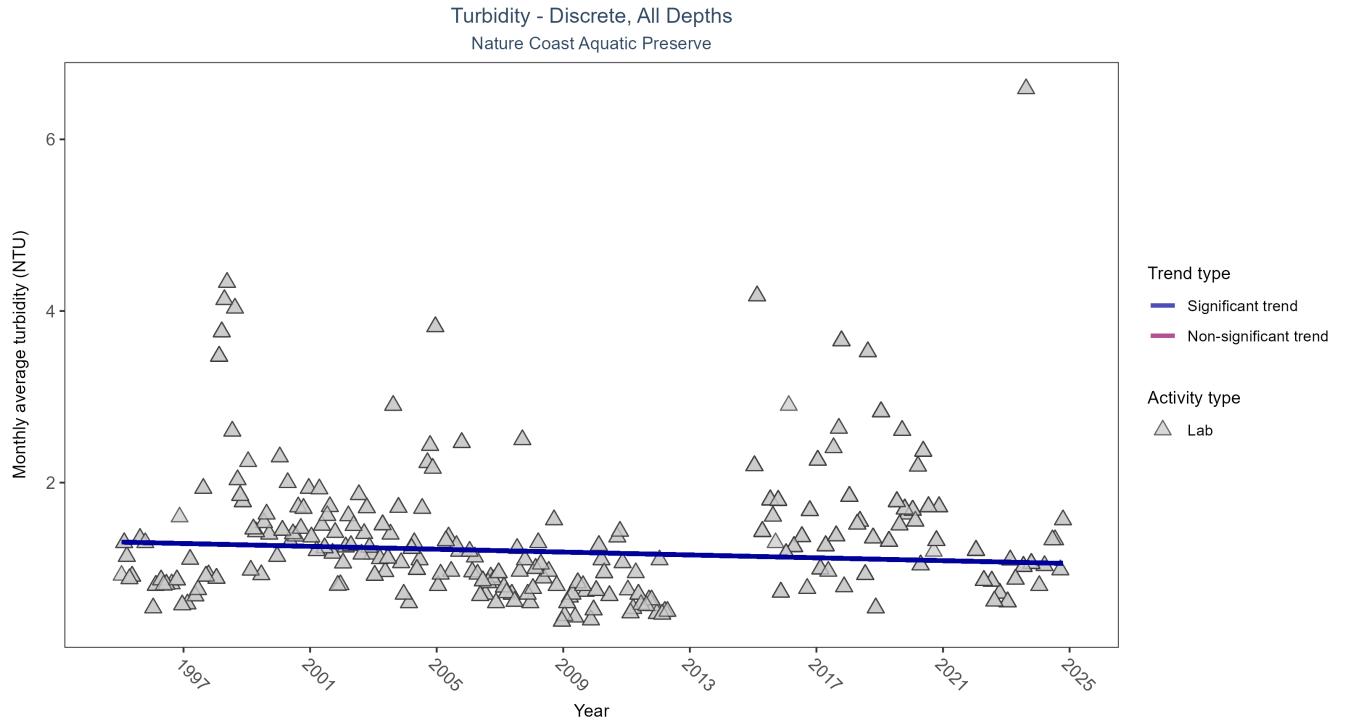


Figure 19: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 24: 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	1958	27	1995 - 2024	1	-0.1212	1.3072	-0.0083	0.0305

Monthly average turbidity decreased by 0.01 NTU per year, indicating an increase in water clarity.

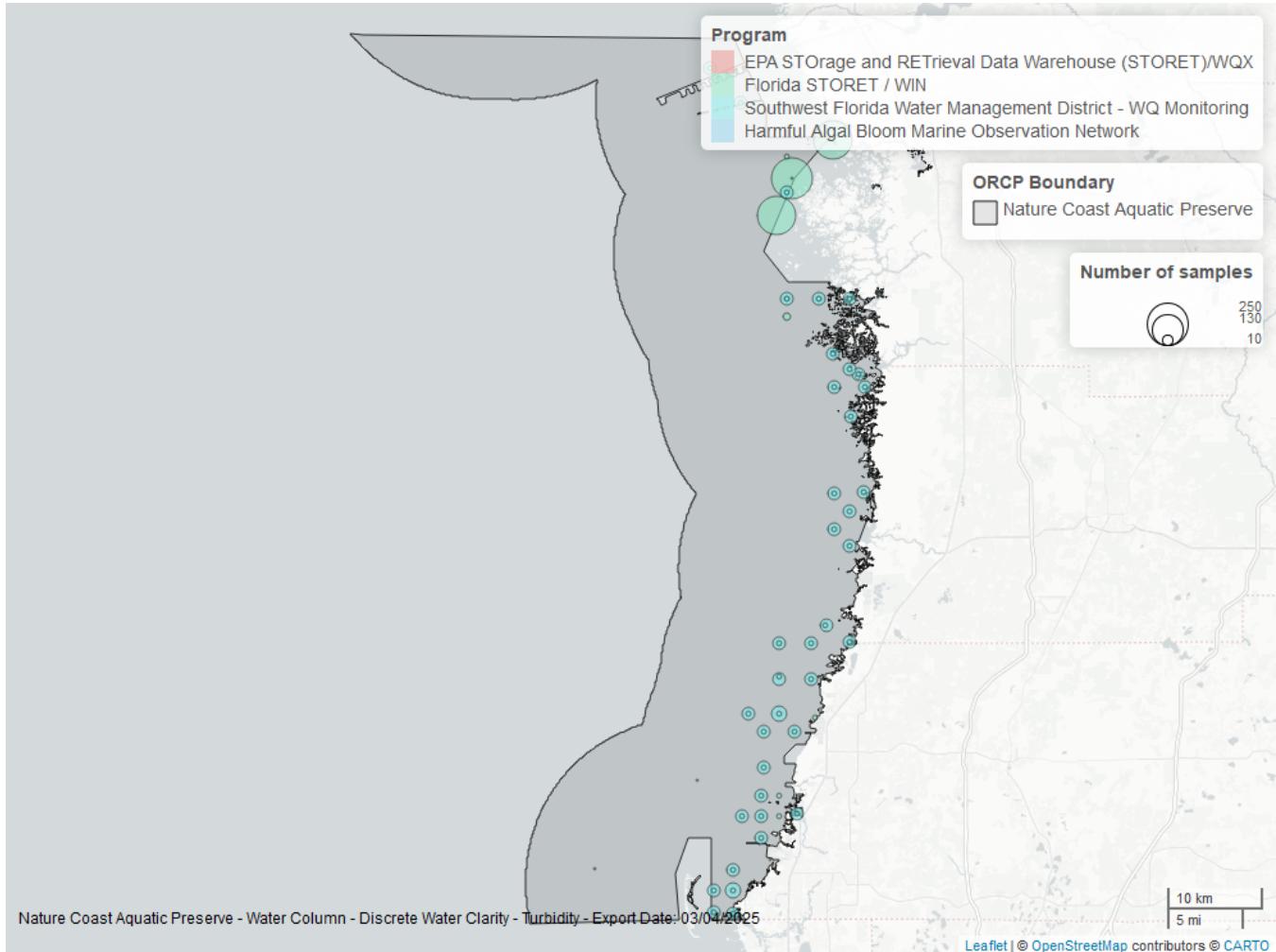


Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
479	1198	2015	2023
5002	761	1995	2024
95	4	2003	2003
103	1	2005	2005

Program names:

95 - Harmful Algal Bloom Marine Observation Network⁷

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁸

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

5002 - Florida STORET / WIN⁴

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

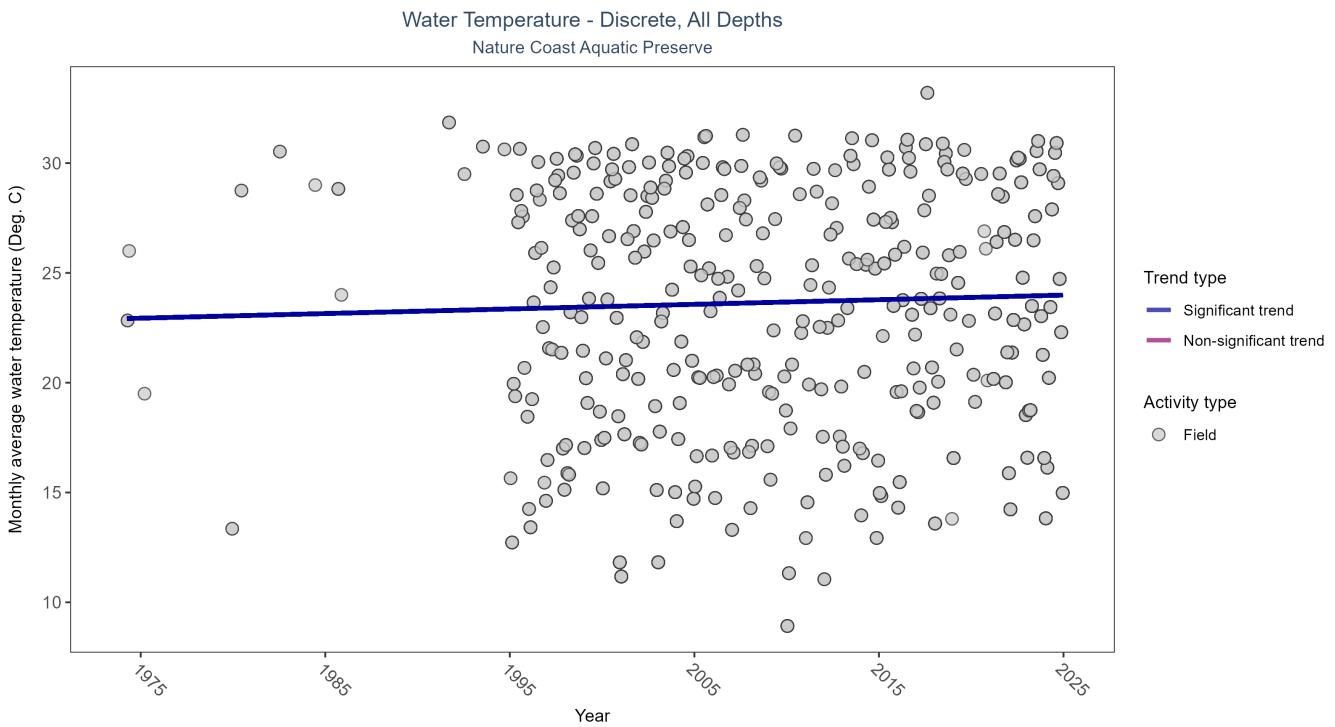


Figure 21: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 26: 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	8990	41	1974 - 2024	24.3	0.0909	22.9174	0.021	0.0184

Monthly average water temperature increased by 0.02°C per year.

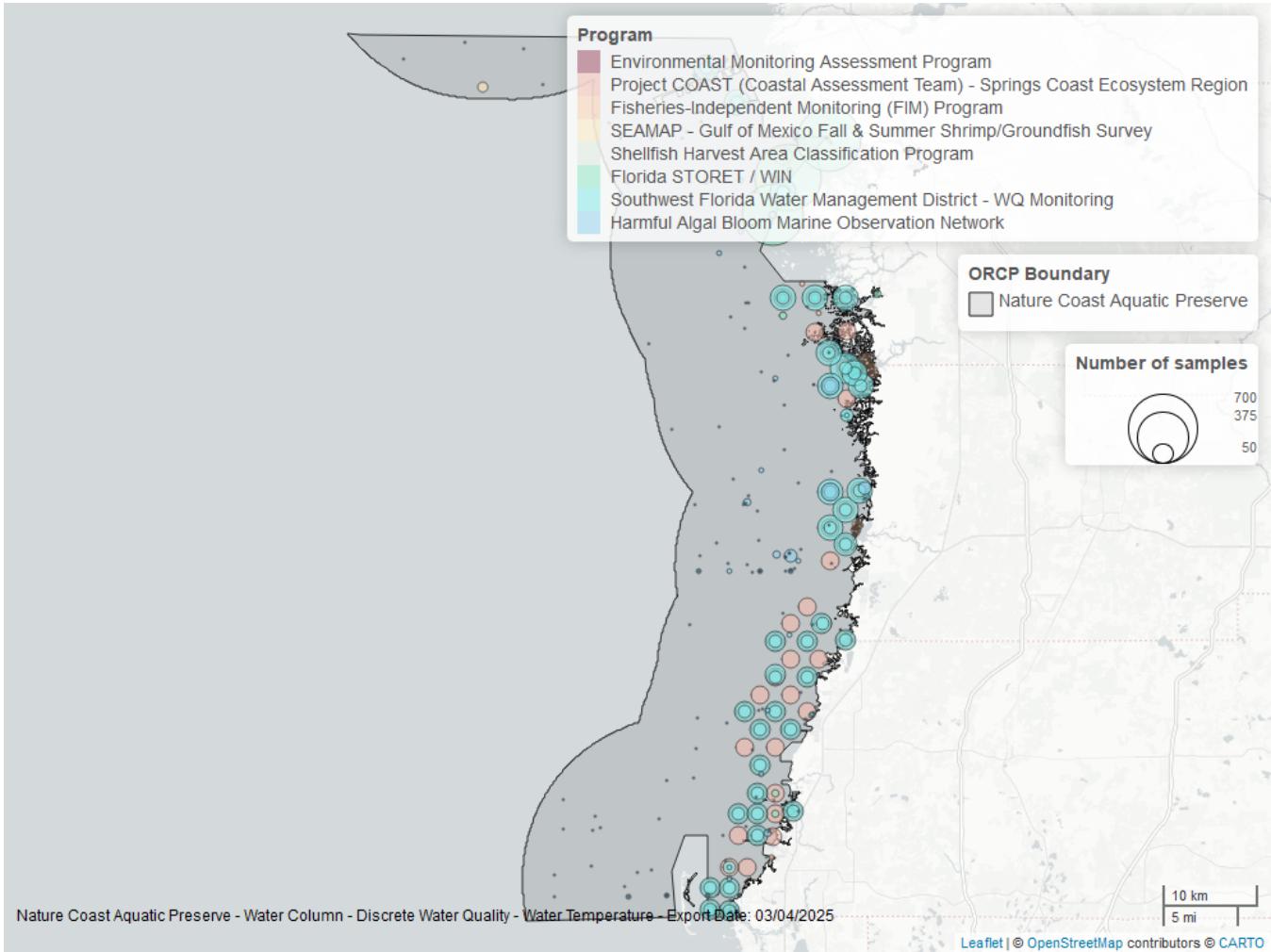


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Water Temperature

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
479	3677	1996	2023
5008	2464	2021	2024
5002	1979	1995	2024
69	428	2003	2009
95	408	1974	2018
60	15	2015	2015
115	12	1991	1994
540	7	2017	2019

Program names:

- 60 - Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey⁶
- 69 - Fisheries-Independent Monitoring (FIM) Program¹⁰
- 95 - Harmful Algal Bloom Marine Observation Network⁷
- 115 - Environmental Monitoring Assessment Program¹¹

479 - Southwest Florida Water Management District - Water Quality Monitoring¹

540 - Shellfish Harvest Area Classification Program³

5002 - Florida STORET / WIN⁴

5008 - Project COAST (Coastal Assessment Team) - Springs Coast Ecosystem Region⁵

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_pH_NW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NW-2025-Mar-06.txt*

Continuous monitoring locations in Nature Coast Aquatic Preserve

Table 28: Station overview for Continuous parameters by Program

<i>ProgramID</i>	<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
7	283925082441201	2	FALSE	TempW
7	284506082435801	2	FALSE	TempW
471	BBSHS	1	FALSE	DO , DOS , pH , Turb
471	BBSHS	13	TRUE	Sal , TempW

Program names:

7 - National Water Information System¹³

471 - Big Bend Seagrasses Aquatic Preserves Continuous Water Quality Monitoring¹⁴

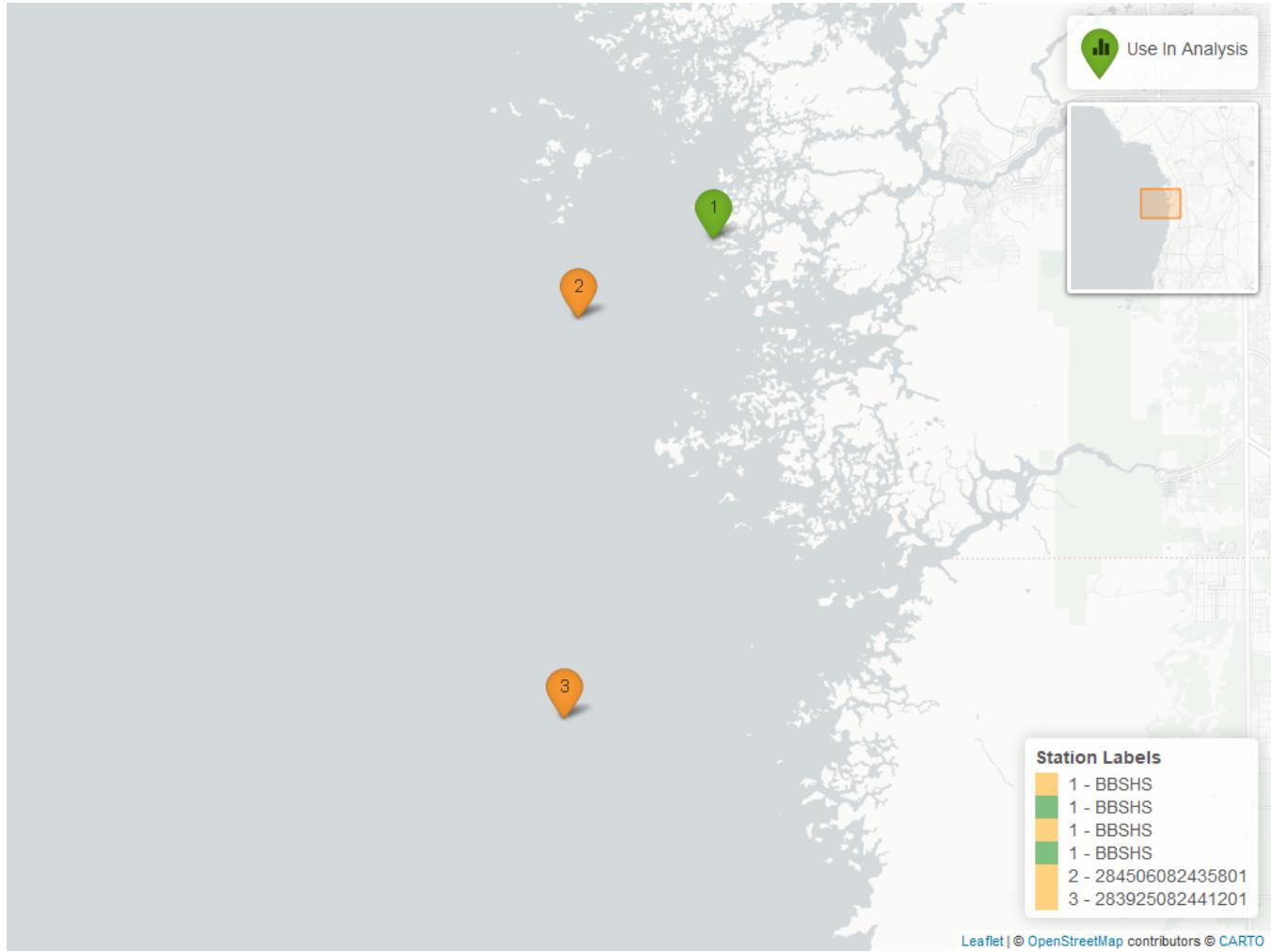


Figure 23: Map showing continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

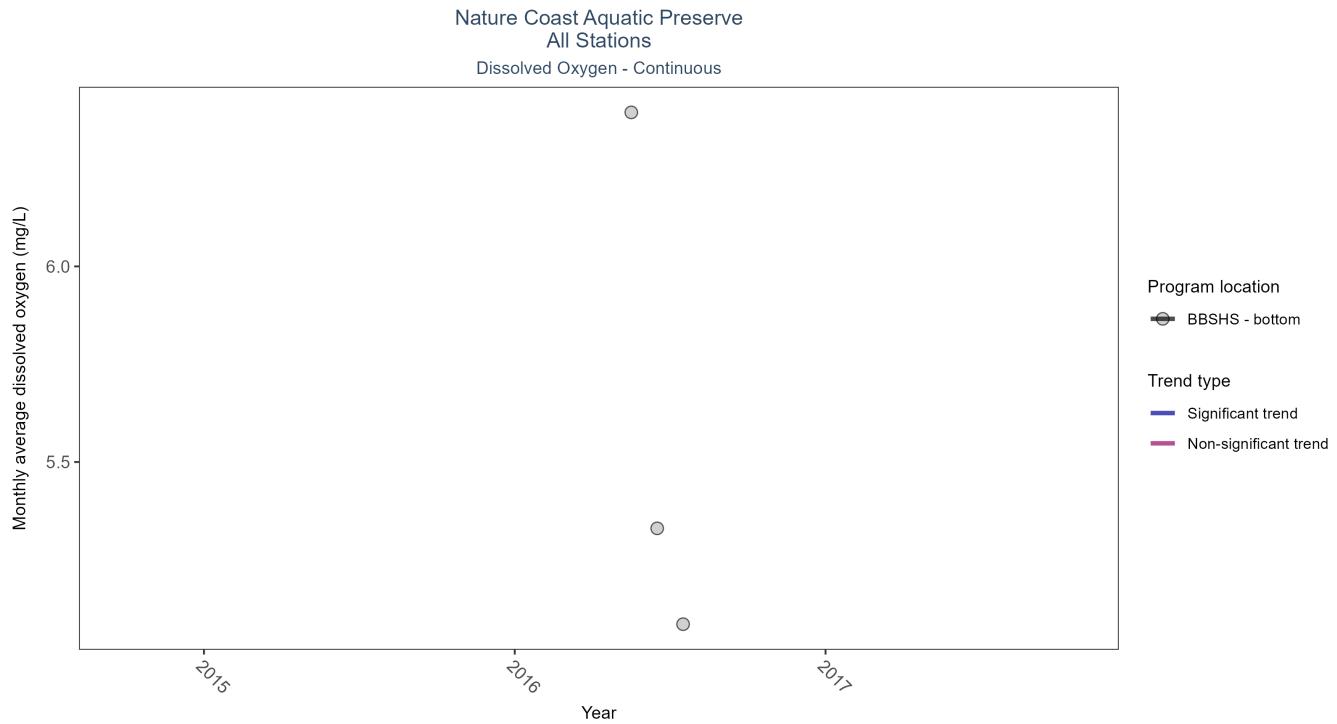


Figure 24: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 29: 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
BBSHS	Insufficient data to calculate trend	6555	1	2016 - 2016	5.7	-	-	-	-

There was insufficient data to fit a model for one location.

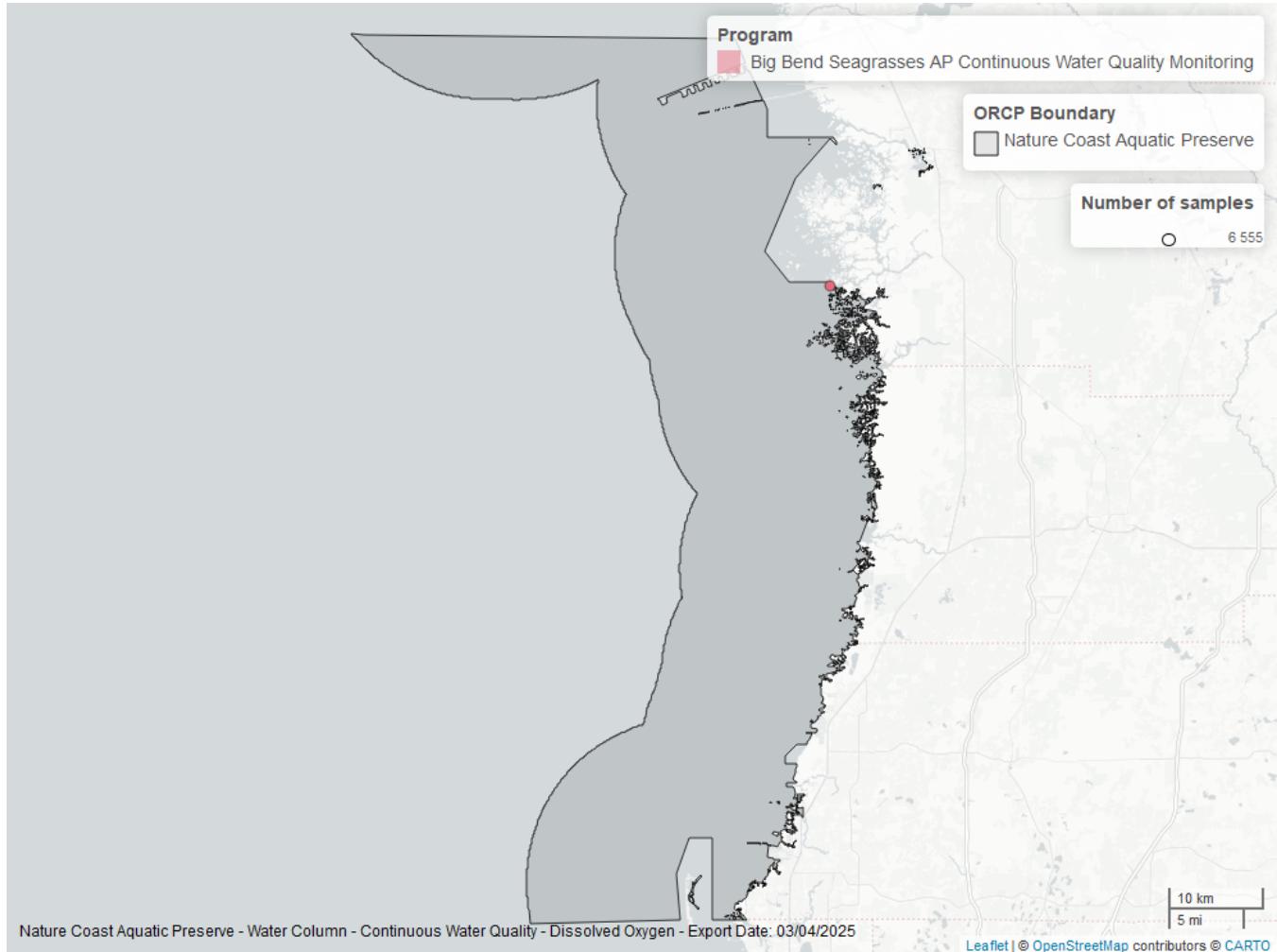


Figure 25: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

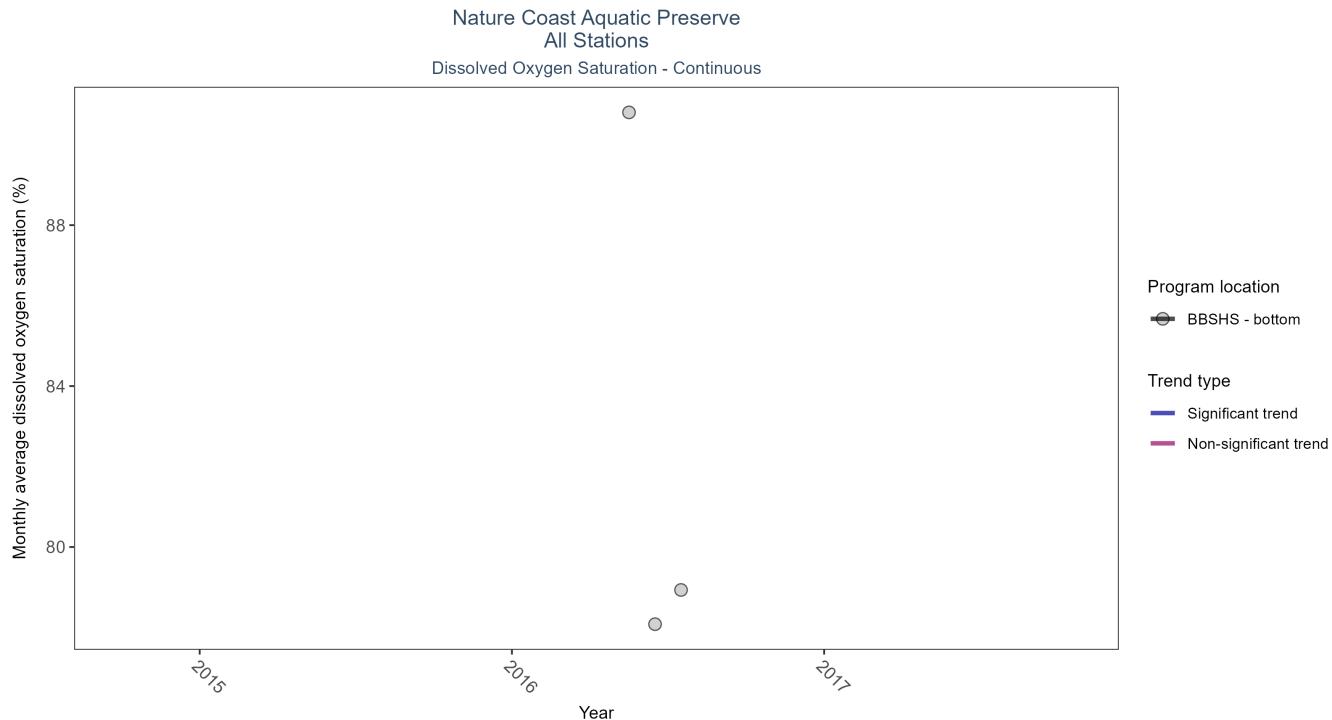


Figure 26: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 30: 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
BBSHS	Insufficient data to calculate trend	6555	1	2016 - 2016	82.6	-	-	-	-

There was insufficient data to fit a model for one location.

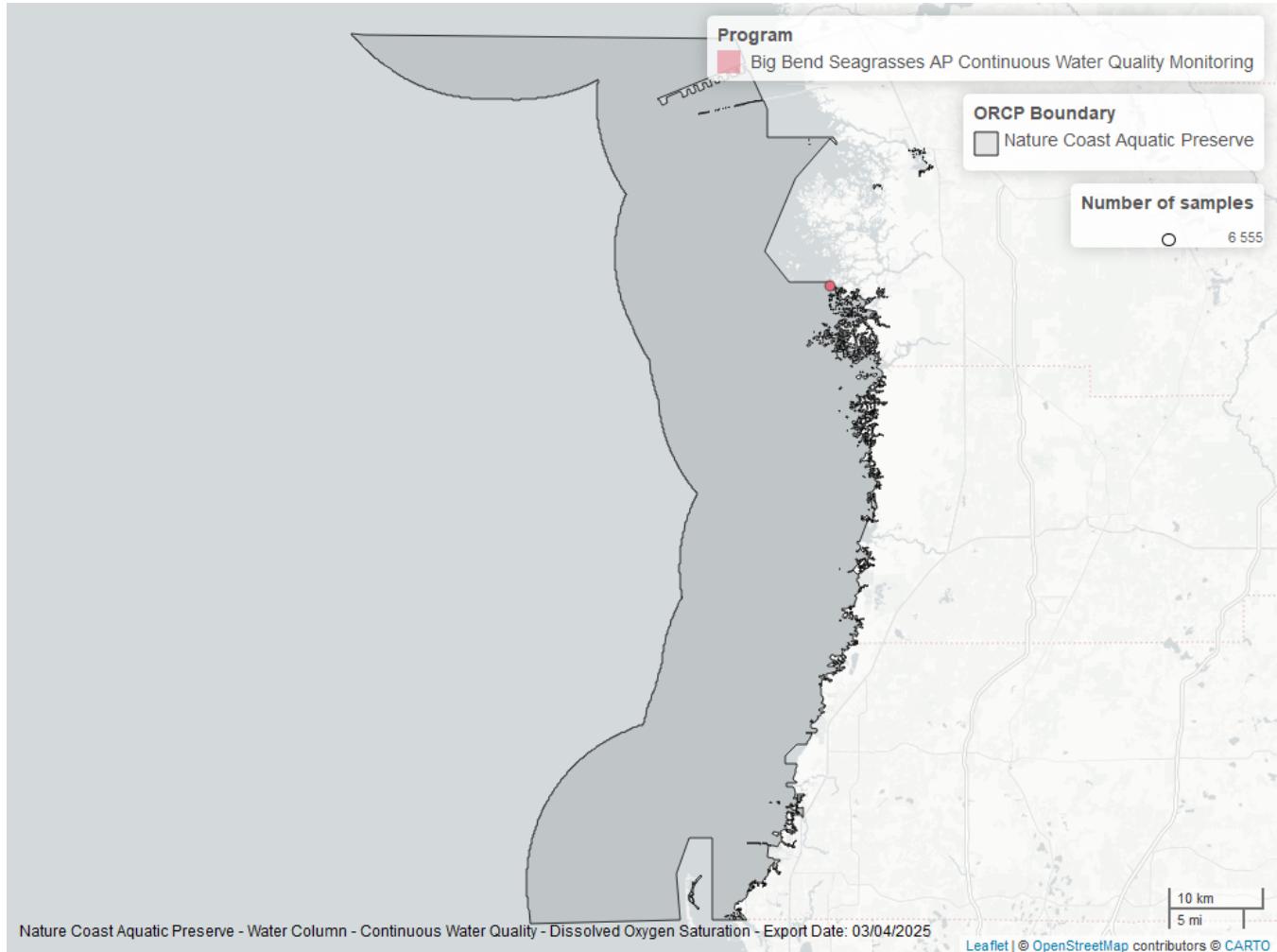


Figure 27: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

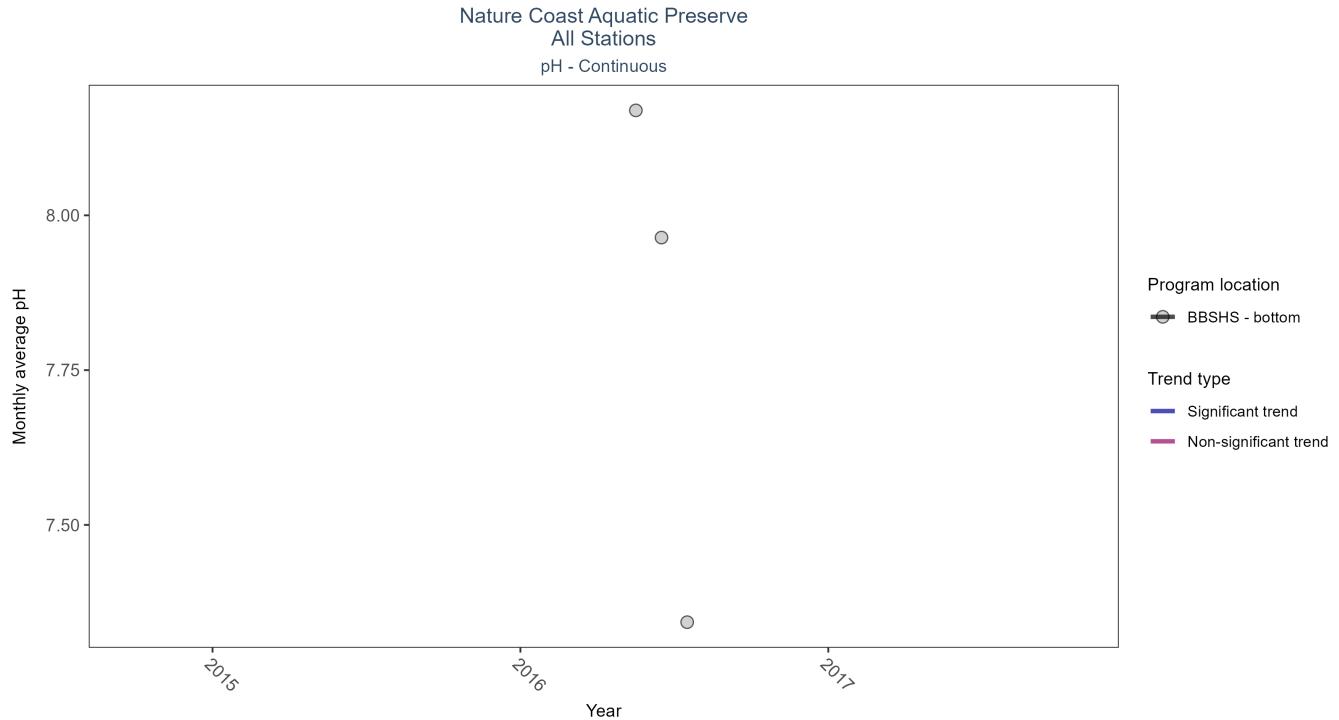


Figure 28: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 31: 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
BBSHS	Insufficient data to calculate trend	6555	1	2016 - 2016	8	-	-	-	-

There was insufficient data to fit a model for one location.

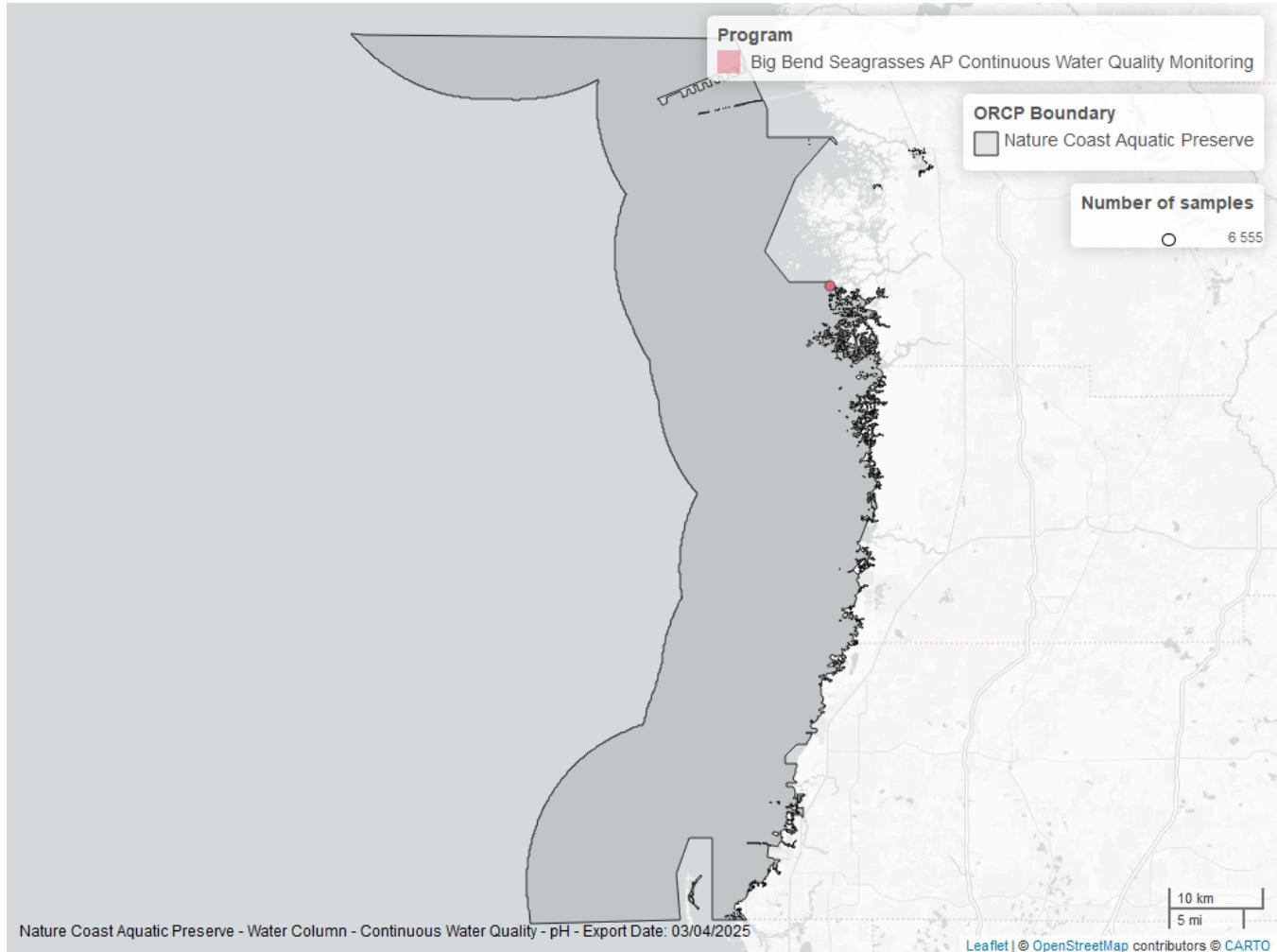


Figure 29: Map showing location of ph continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

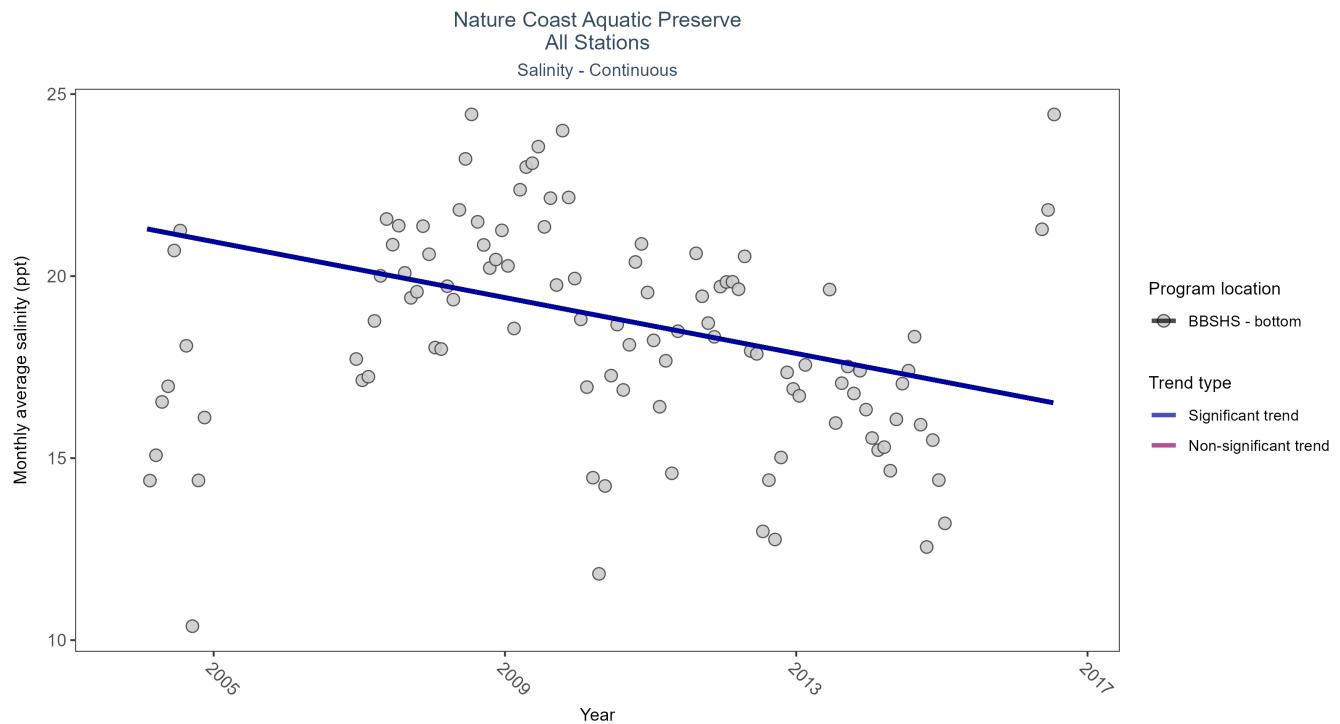


Figure 30: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 32: 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
BBSHS	Significantly decreasing trend	235670	12	2004 - 2016	18.4	-0.22	21.33	-0.38	0

At one program location, monthly average salinity decreased by 0.38 ppt per year.

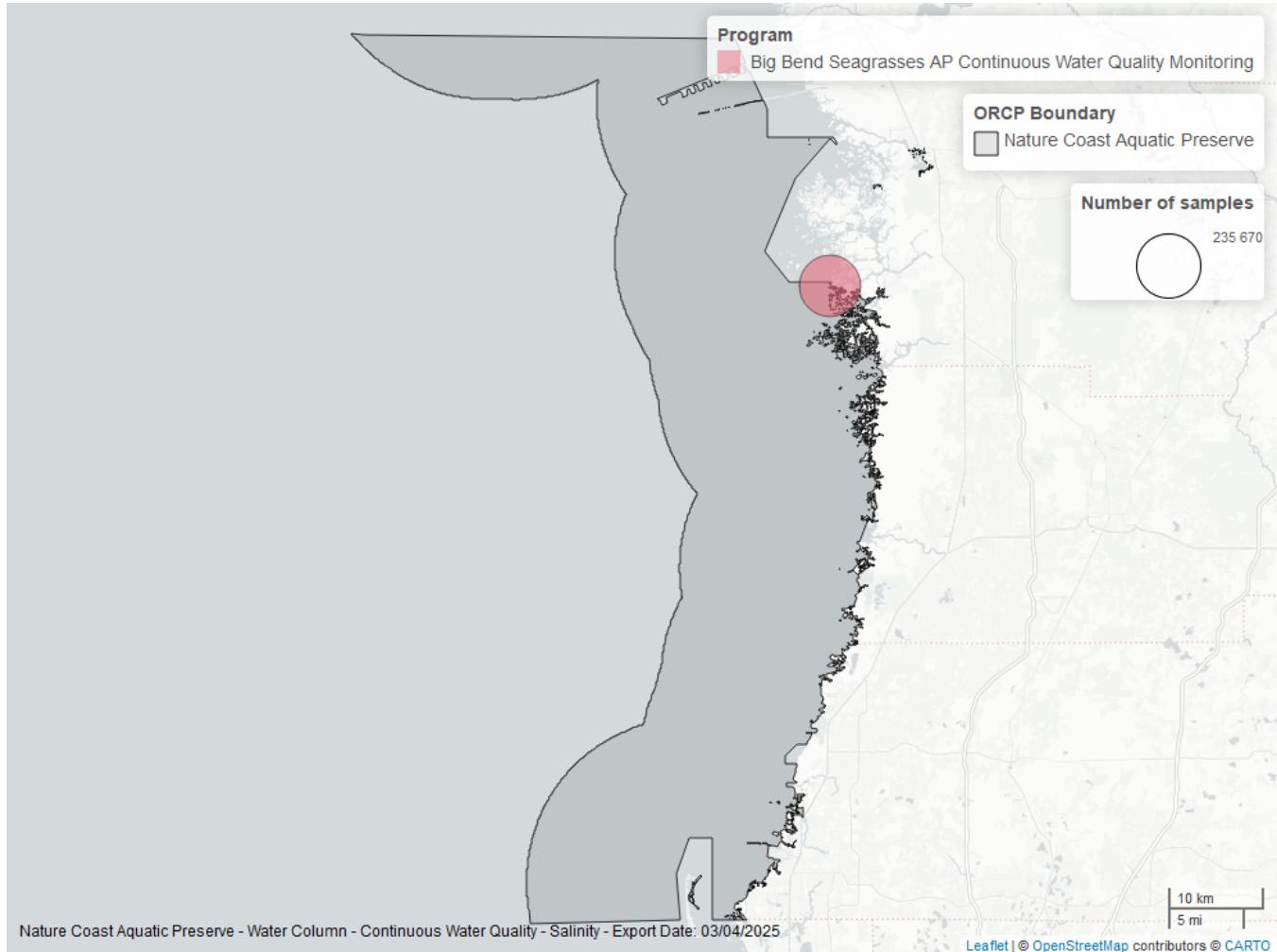


Figure 31: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

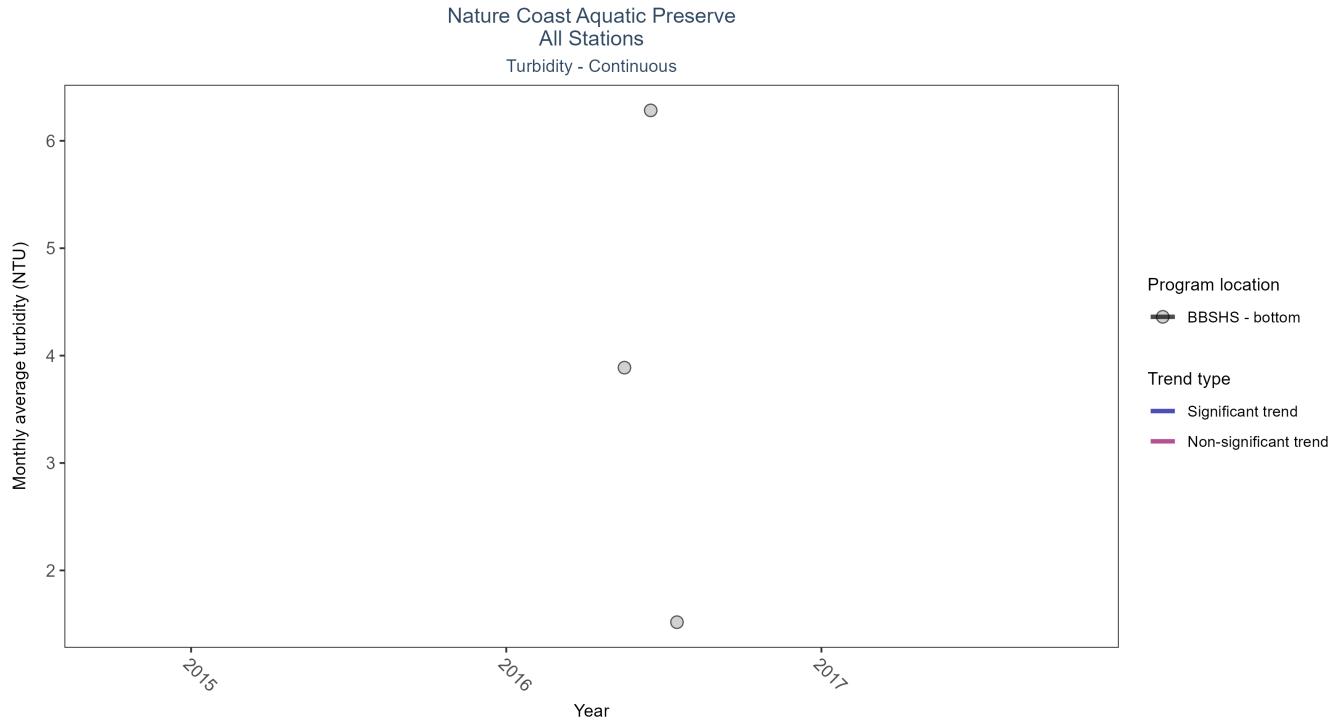


Figure 32: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 33: 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
BBSHS	Insufficient data to calculate trend	6368	1	2016 - 2016	2	-	-	-	-

There was insufficient data to fit a model for one location.

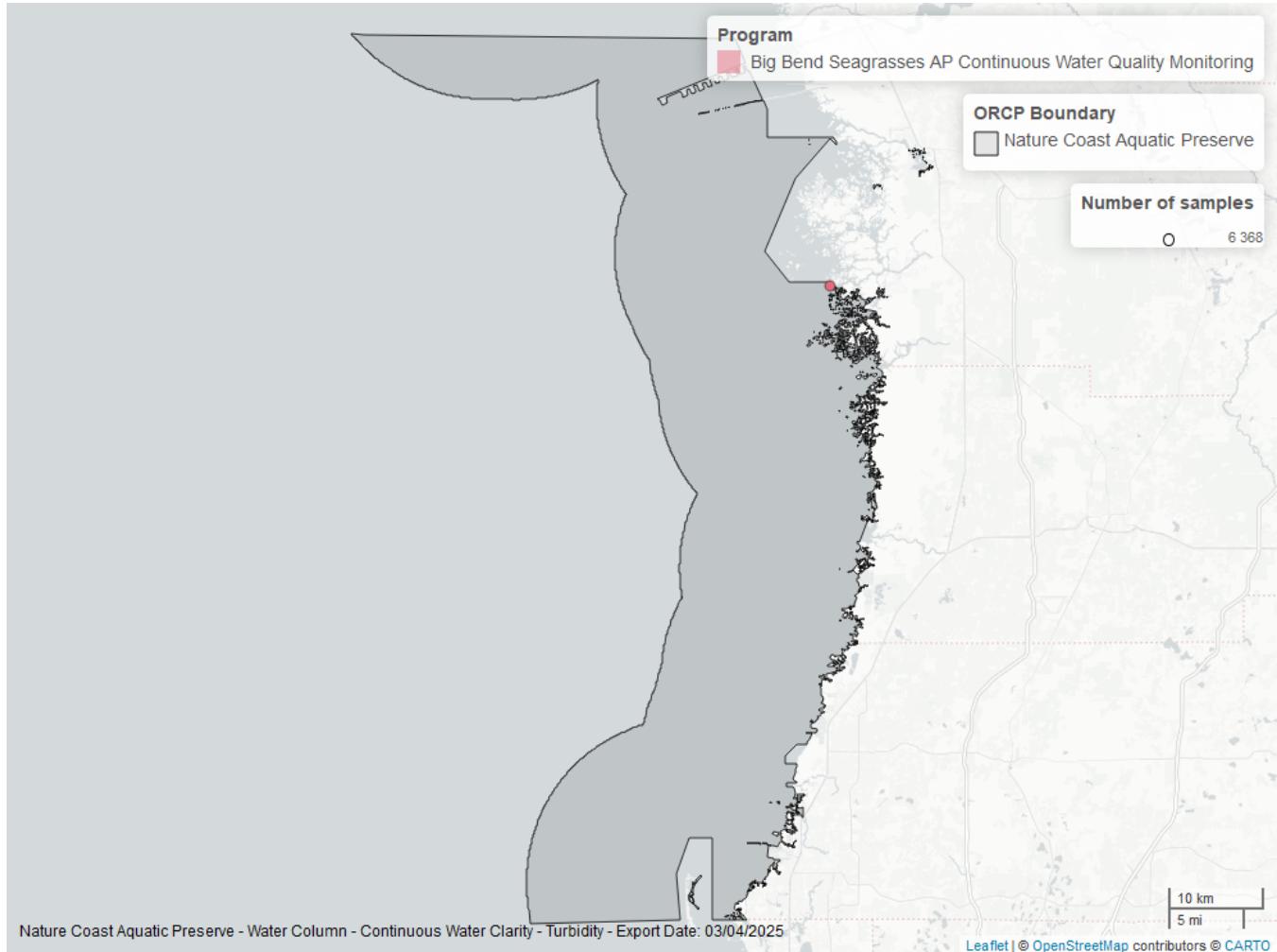


Figure 33: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

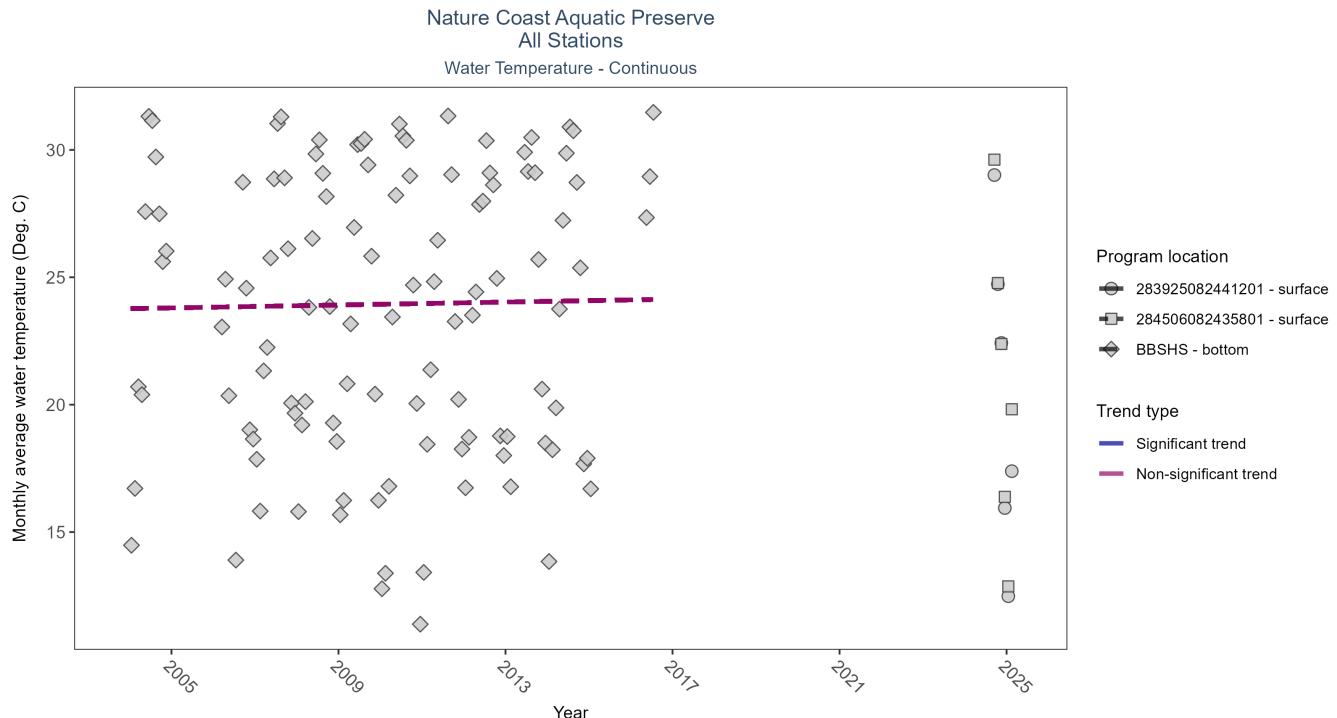


Figure 34: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 34: Seasonal Kendall-Tau Results for Water Temperature - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
283925082441201	Insufficient data to calculate trend	203	2	2024 - 2025	19.3	-	-	-	-
284506082435801	Insufficient data to calculate trend	197	2	2024 - 2025	19.2	-	-	-	-
BBSHS	No significant trend	244110	12	2004 - 2016	24.5	0.05	23.77	0.03	0.52

No detectable change in monthly average water temperature was observed at one location. There was insufficient data to fit a model for two locations.

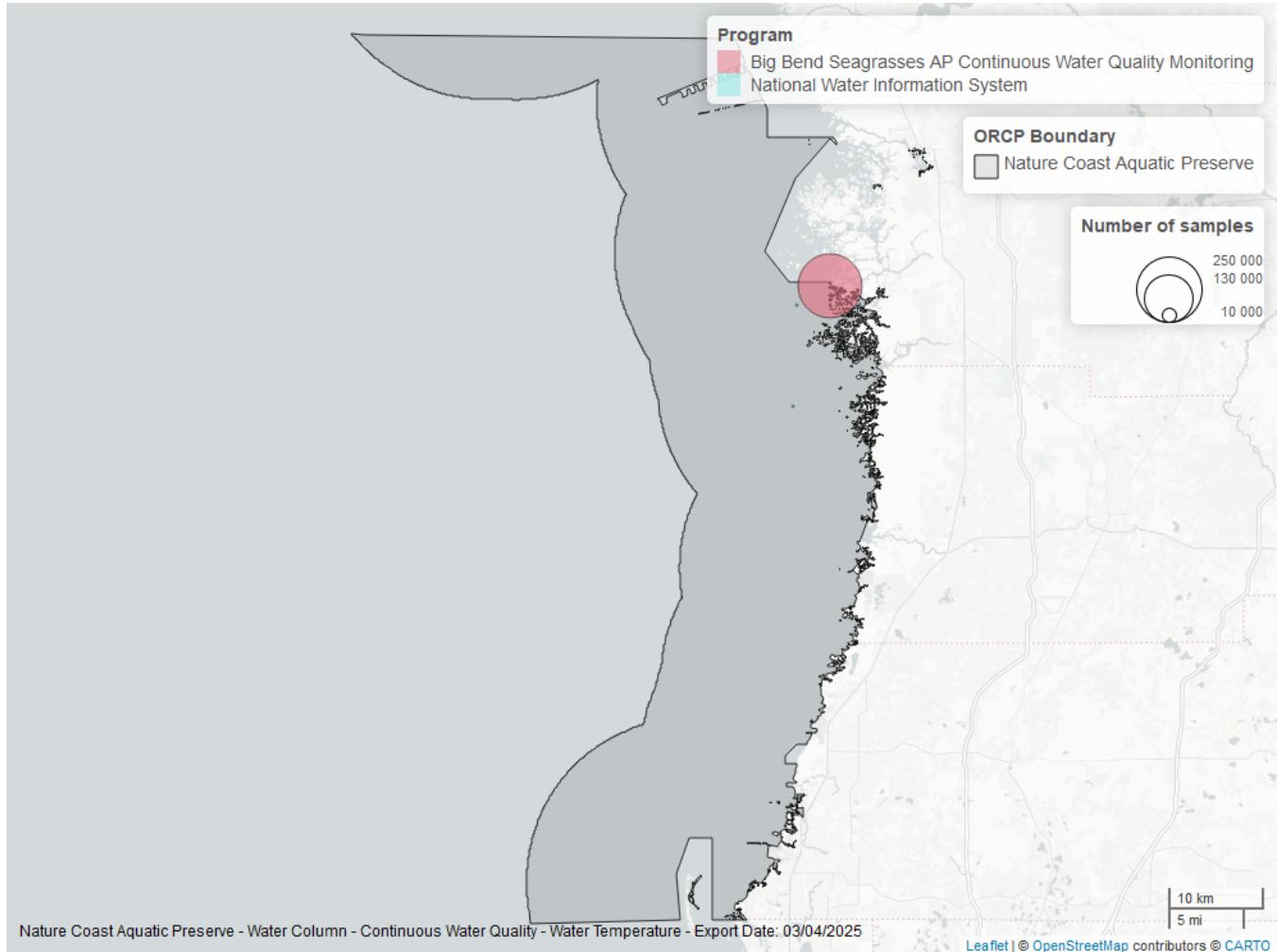


Figure 35: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Submerged Aquatic Vegetation

The data file used is: All_SAV_Parameters-2025-Mar-06.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.

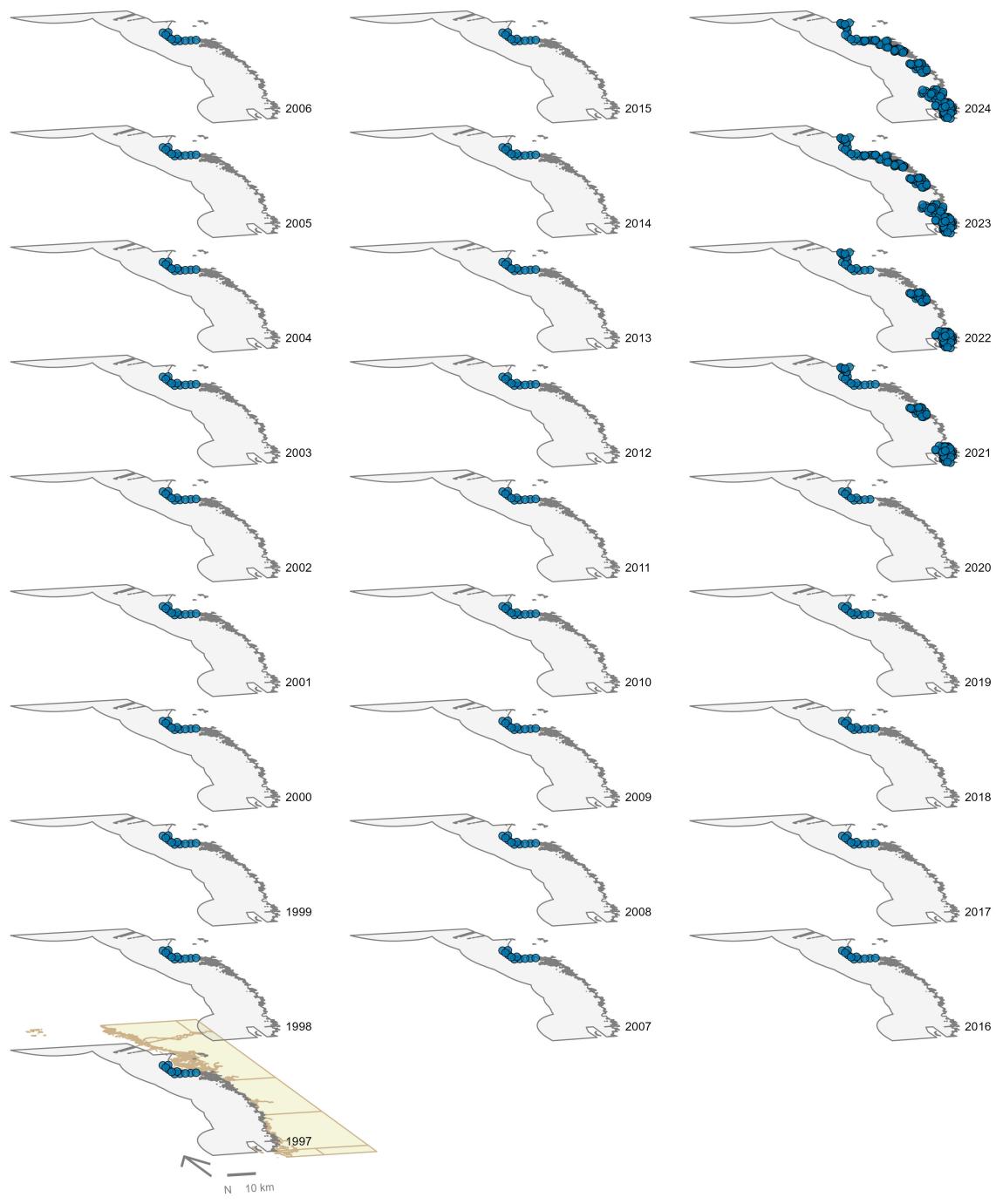
Notes

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

Nature Coast Aquatic Preserve
SAV Percent Cover - Sample Locations



Program name
● Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring

Figure 36: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Nature Coast Aquatic Preserve* by Program name.

Click [here](#) to view spatio-temporal plots on GitHub.

Sampling locations by Program:

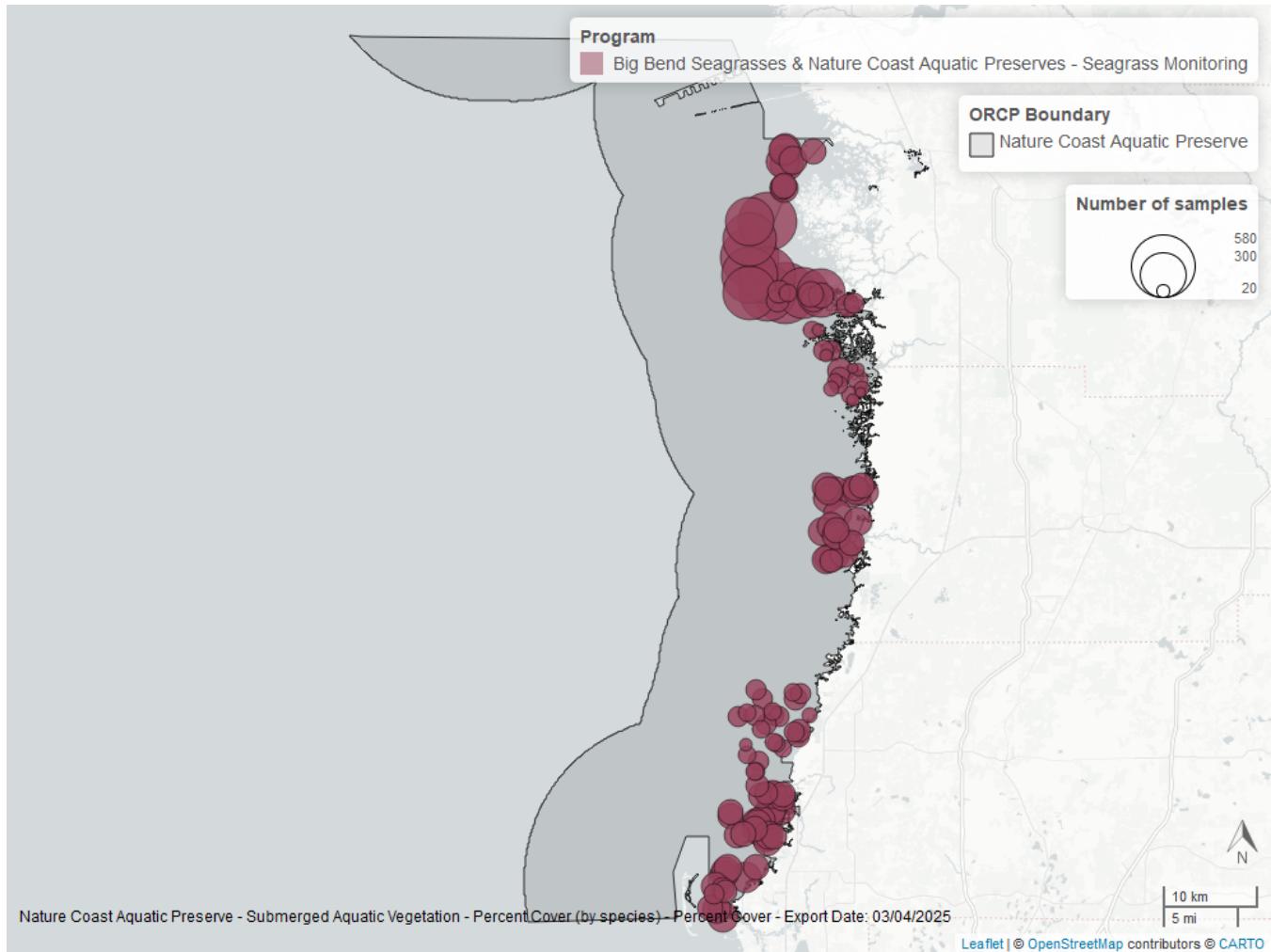


Figure 37: Map showing SAV sampling sites within the boundaries of *Nature Coast Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 35: Program Information for Submerged Aquatic Vegetation

ProgramID	N-Data	YearMin	YearMax	method	Sample Locations
560	9545	1997	2024	Modified Braun Blanquet	129
560	6417	2021	2024	Percent Cover	129

Program names:

560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring¹²
560 - Big Bend Seagrasses & Nature Coast Aquatic Preserves - Seagrass Monitoring¹²

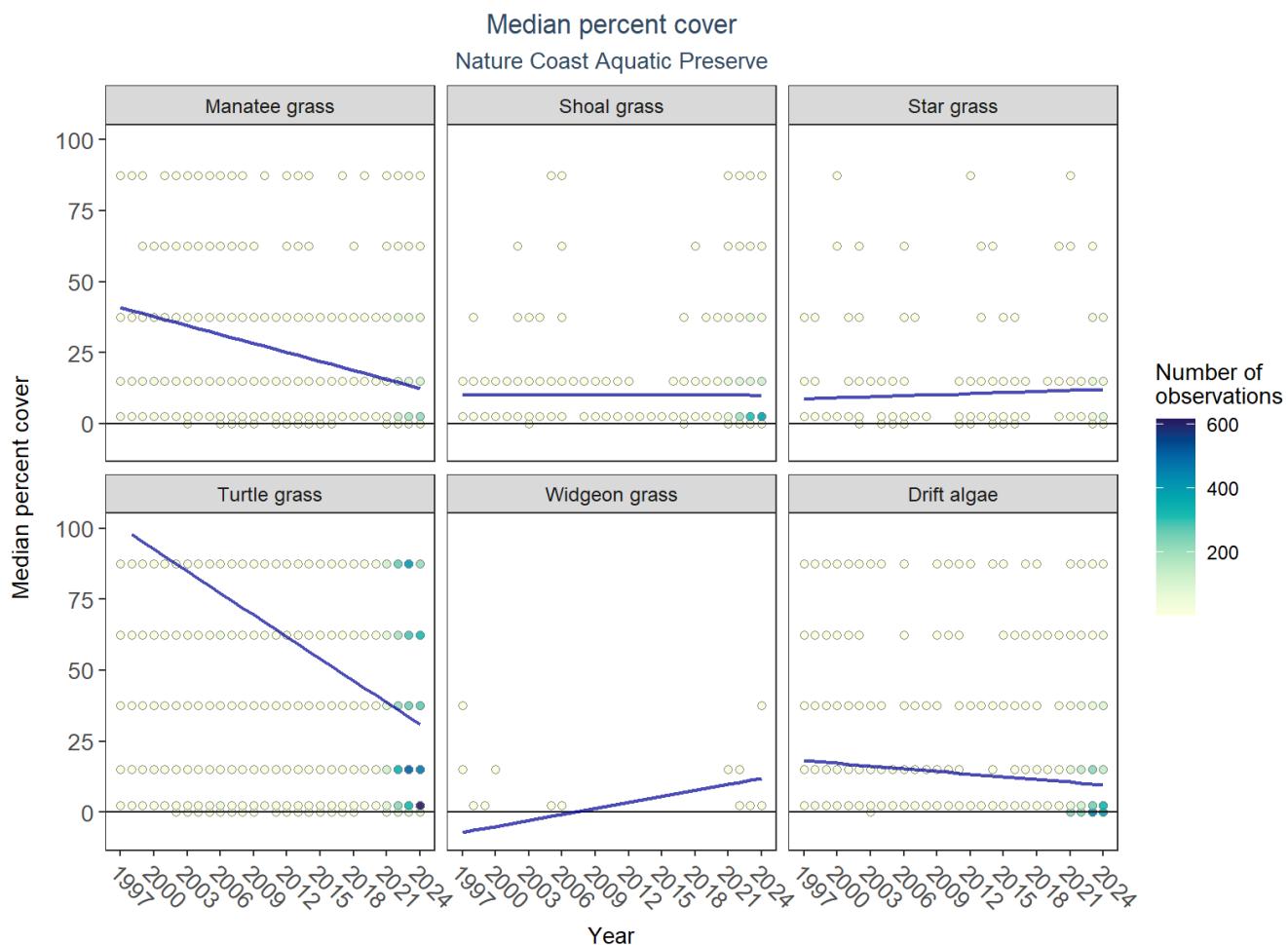


Figure 38: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

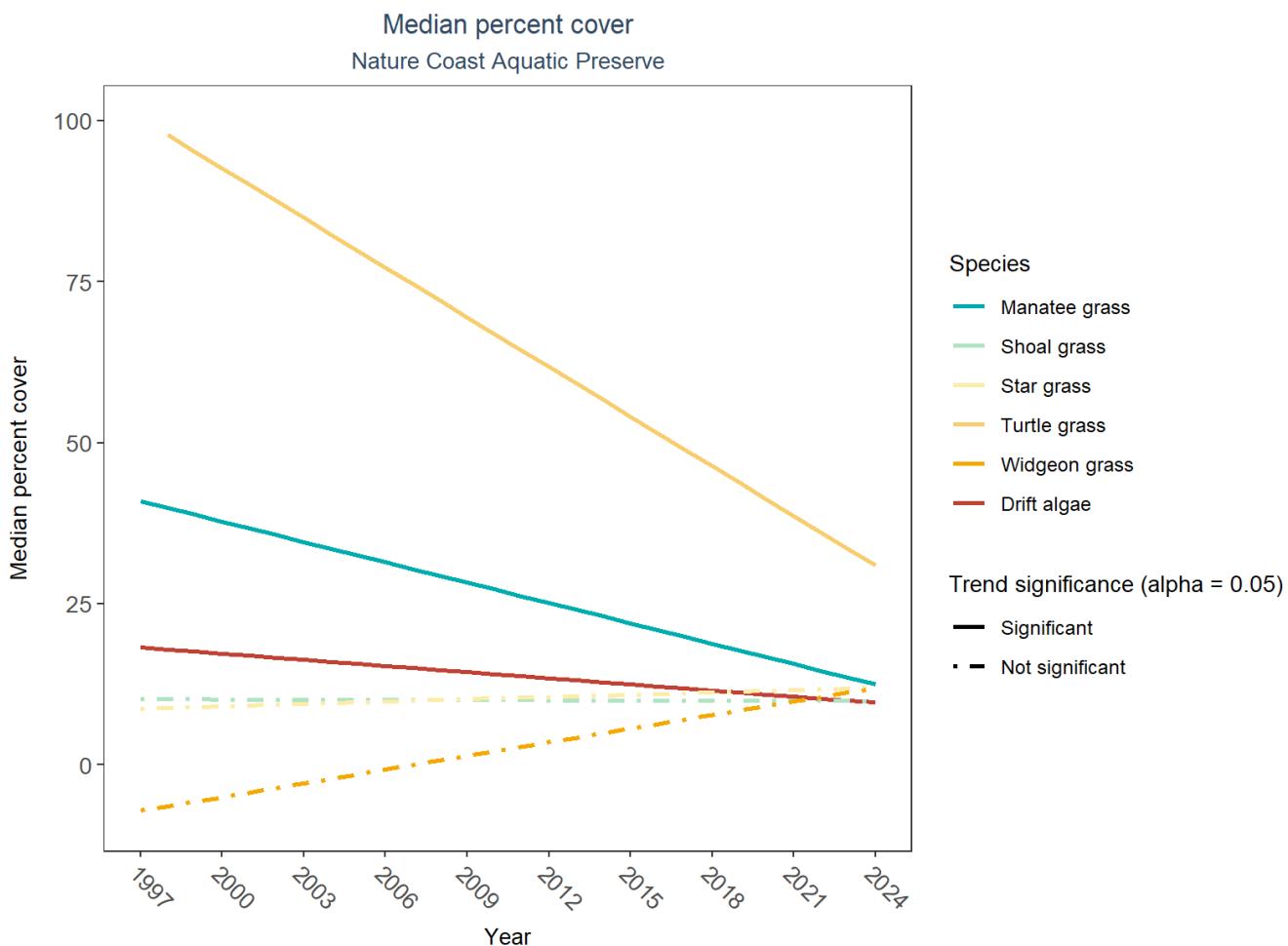


Figure 39: Trends in median percent cover for various seagrass species in Nature Coast Aquatic Preserve - simplified

Table 36: Percent Cover Trend Analysis for Nature Coast Aquatic Preserve

CommonName	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae	Significantly decreasing trend	1997 - 2024	19.149971	-0.3161658	0.0160055
Shoal grass	No significant trend	1997 - 2024	10.224301	-0.0105459	0.8700689
Star grass	No significant trend	1997 - 2024	8.345838	0.1223518	0.2948394
No grass in quadrat	Model did not fit the available data	1998 - 2024	-	-	-
Widgeon grass	No significant trend	1997 - 2024	-9.226378	0.7048694	0.7467166
Manatee grass	Significantly decreasing trend	1997 - 2024	44.072094	-1.0522148	0.0095636
Turtle grass	Significantly decreasing trend	1997 - 2024	108.014730	-2.5697740	0.0000000

Annual decreases in percent cover were observed for manatee grass (-1.0%), turtle grass (-2.6%), and drift algae (-0.3%). Shoal grass, star grass, and widgeon grass showed no detectable change in percent cover.

Frequency of occurrence
Nature Coast Aquatic Preserve

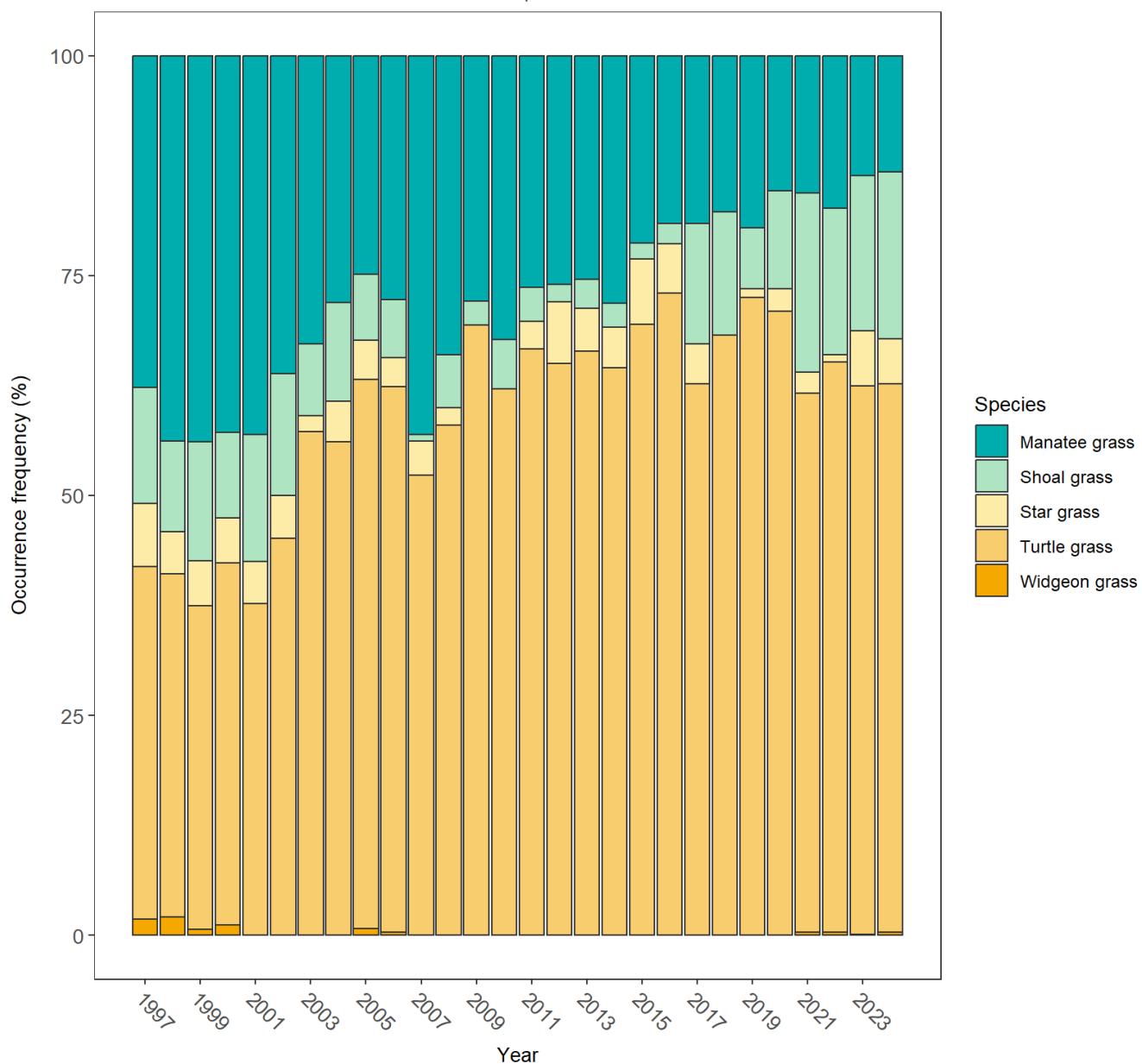


Figure 40: Frequency of occurrence for various seagrass species in Nature Coast Aquatic Preserve

Nekton

The data file used is: **All_NEKTON_Parameters-2025-Mar-06.txt**

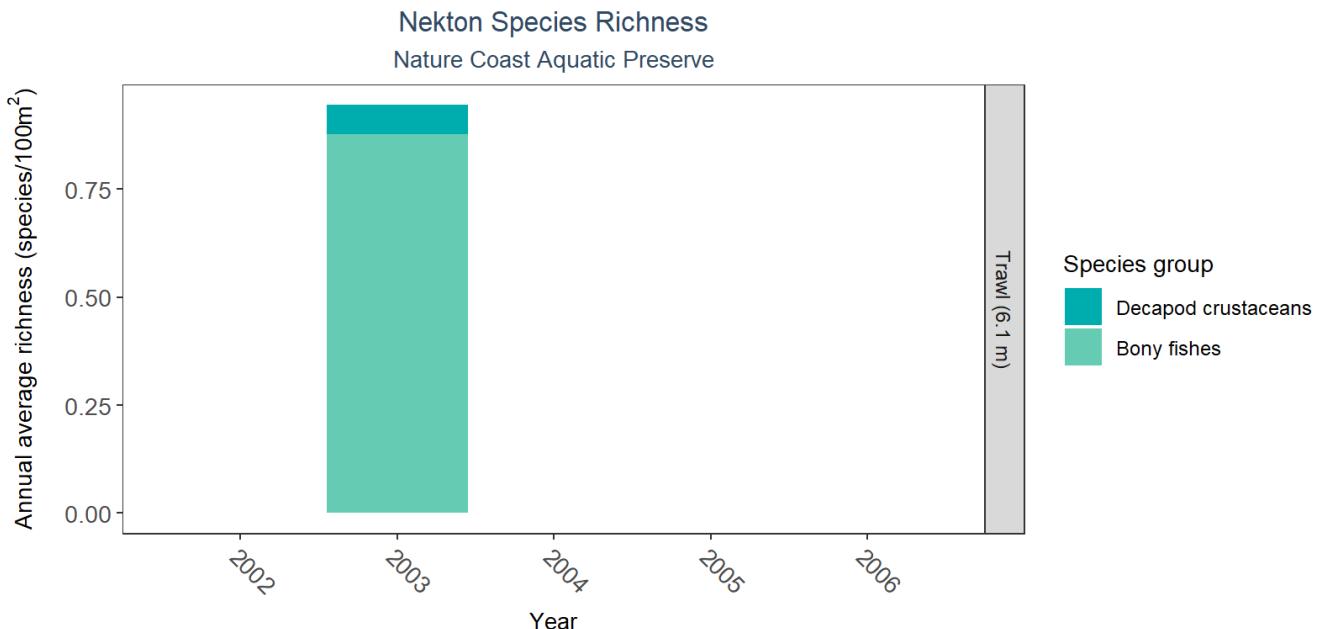


Figure 41: Bar graph(s) of annual average nekton richness over time for species groups occurring in at least 1% of samples. The bar colors represent species groups including bony fishes, cartilaginous fishes, decapod crustaceans (e.g., shrimps, crabs, and lobsters), and cephalopods (e.g., squid). Gear types and sizes are indicated in the panel label.

Table 37: Nekton Species Richness

Gear Type	Sample Count	Number of Years	Period of Record	Median N of Taxa	Mean N of Taxa
Trawl (6.1)	2	1	2003 - 2003	0.47	0.47

The median annual number of taxa was 0.47 based on 2 observations collected by 6.1-meter trawl between 2003 and 2003.

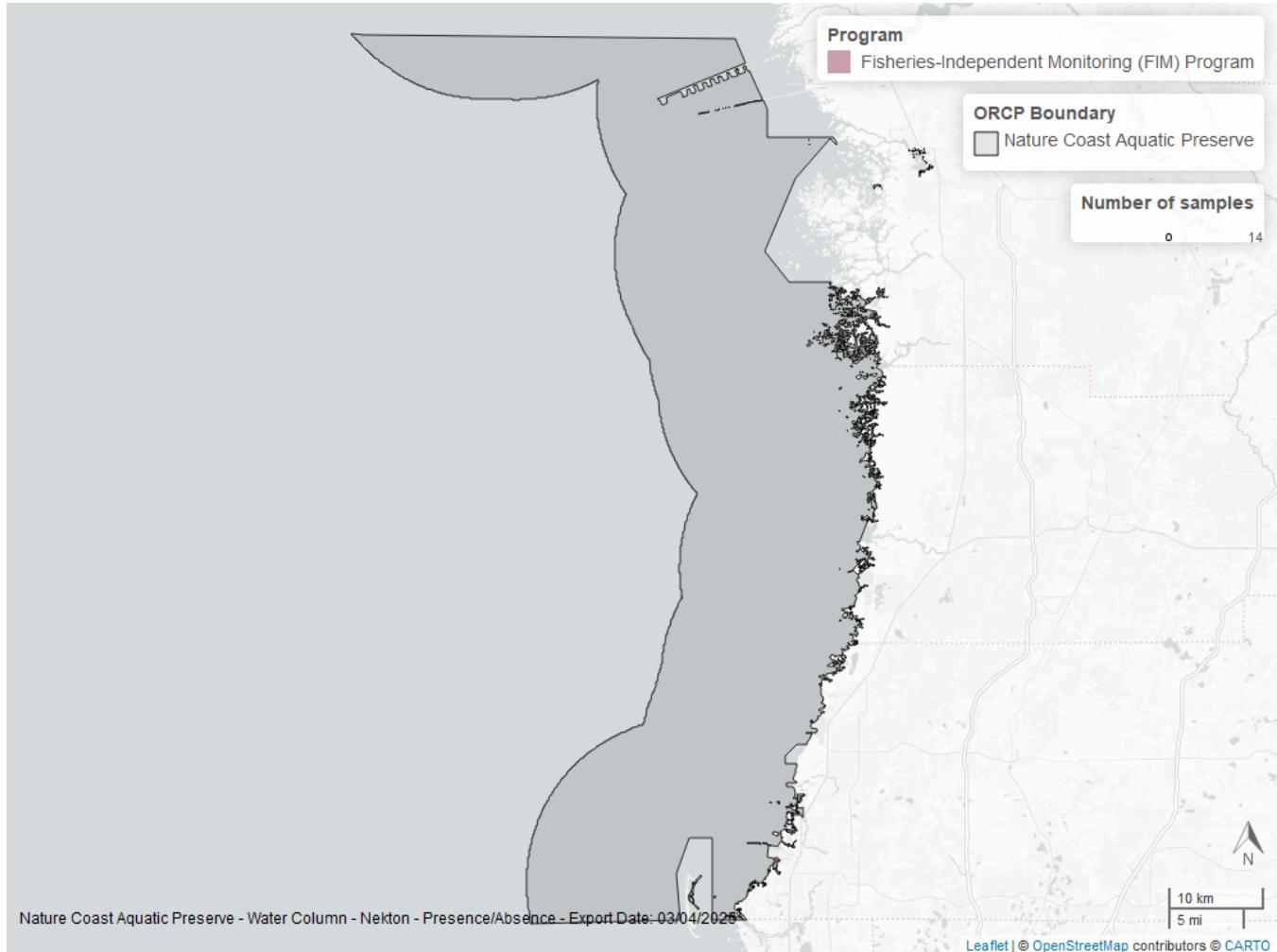


Figure 42: Map showing location of nekton sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Coastal Wetlands

The data file used is: All_CW_Parameters-2025-Mar-06.txt

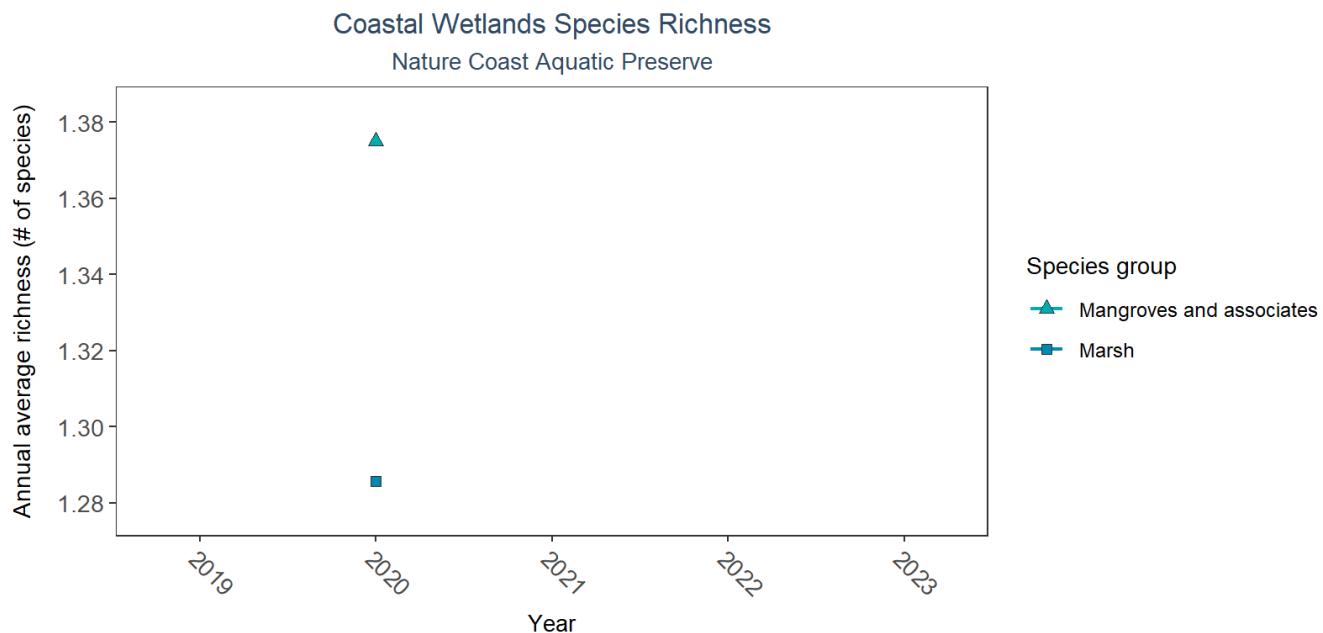


Figure 43: Line graph of annual average coastal wetlands species richness over time for mangroves and associates (triangles), marsh (squares), and marsh succulents (circles). If the time series by species group included more than one year of observations, a line connects data points for visualization.

Table 38: Coastal Wetlands Species Richness

Species Group	Sample Count	Number of Years	Period of Record	Median N of Taxa	Mean N of Taxa
Mangroves and associates	8	1	2020 - 2020	1	1.38
Marsh	14	1	2020 - 2020	1	1.29

In the year 2020, 1 species were observed for *mangroves and associates* based on 8 observations. In the year 2020, 1 species were observed for *marsh* based on 14 observations.

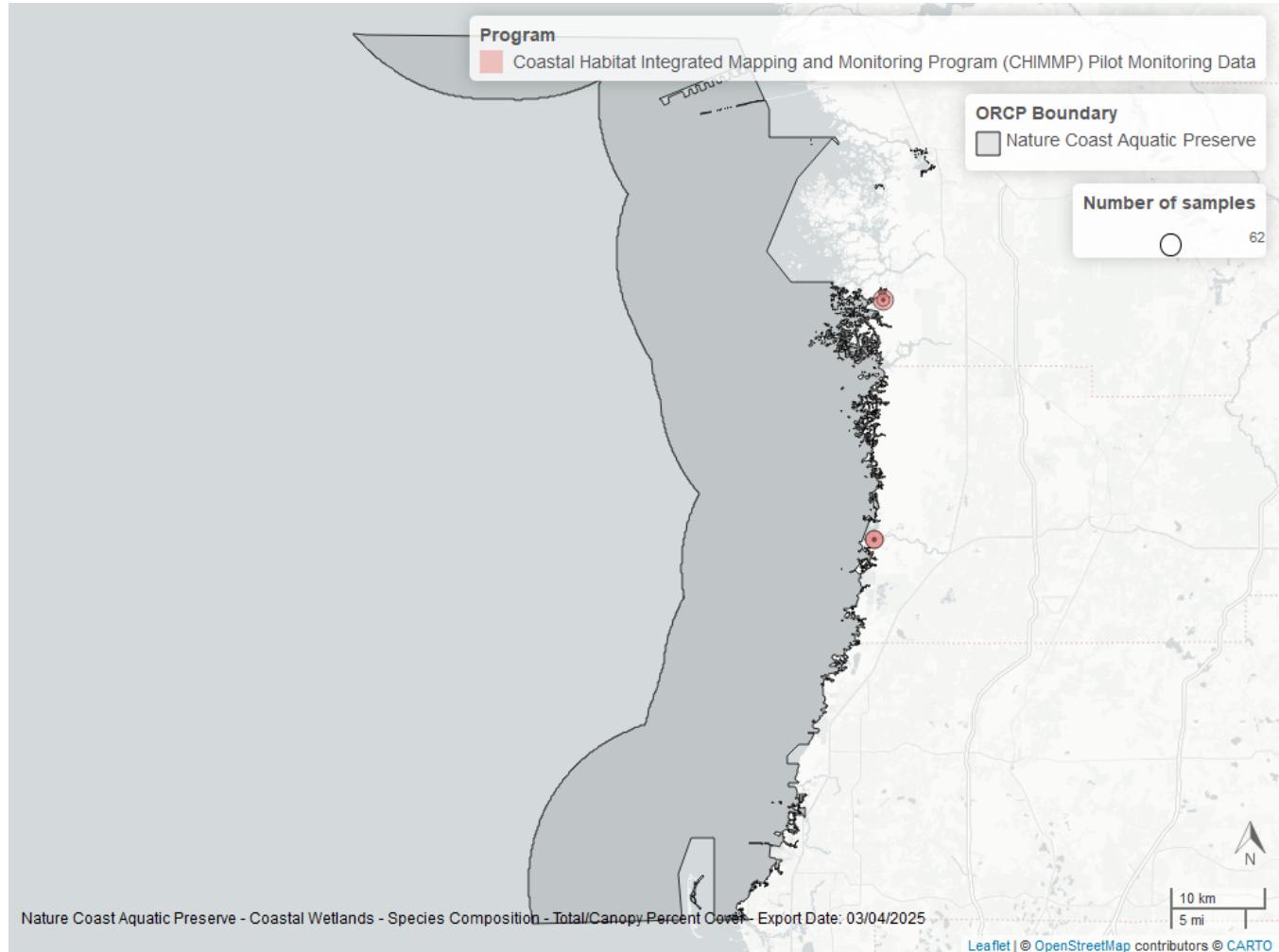


Figure 44: Map showing location of coastal wetlands sampling locations within the boundaries of *Nature Coast Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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