Pine Island Sound Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 22 May, 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	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

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-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

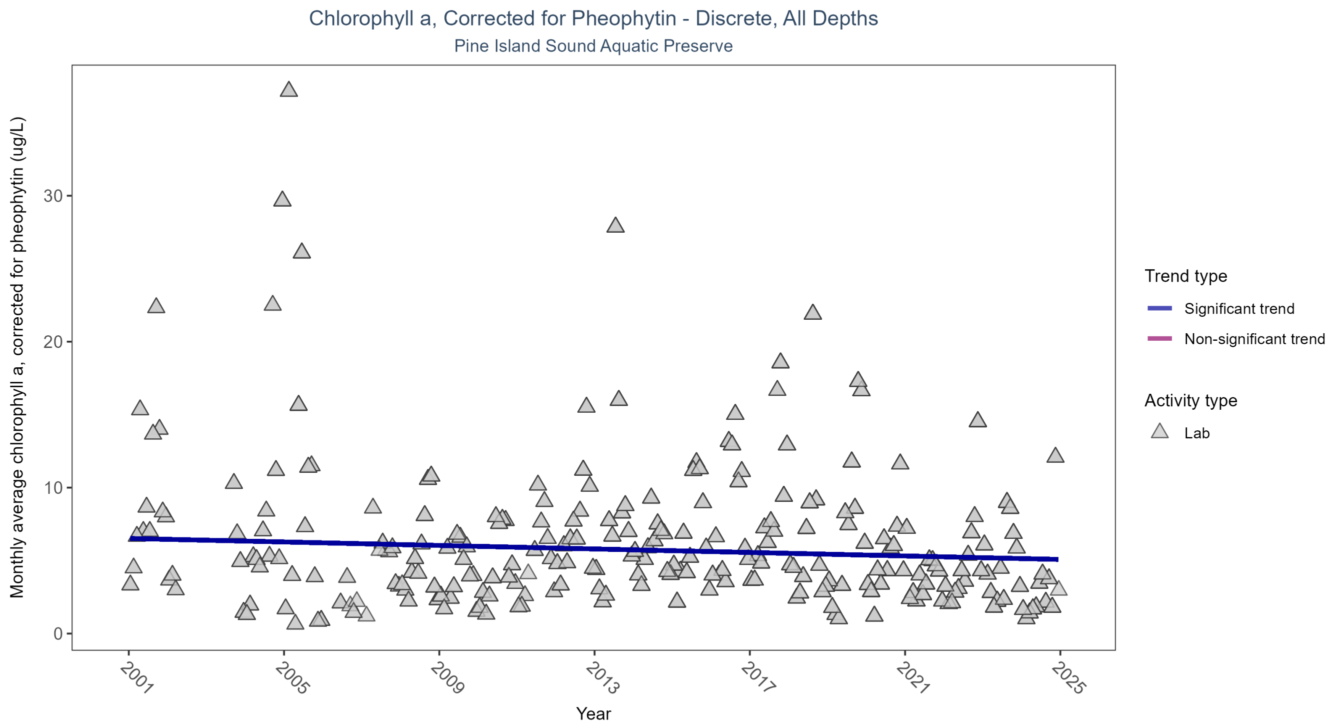

Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	3936	24	2001 - 2024	3.9	-0.101	6.517	-0.0599	0.0366

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

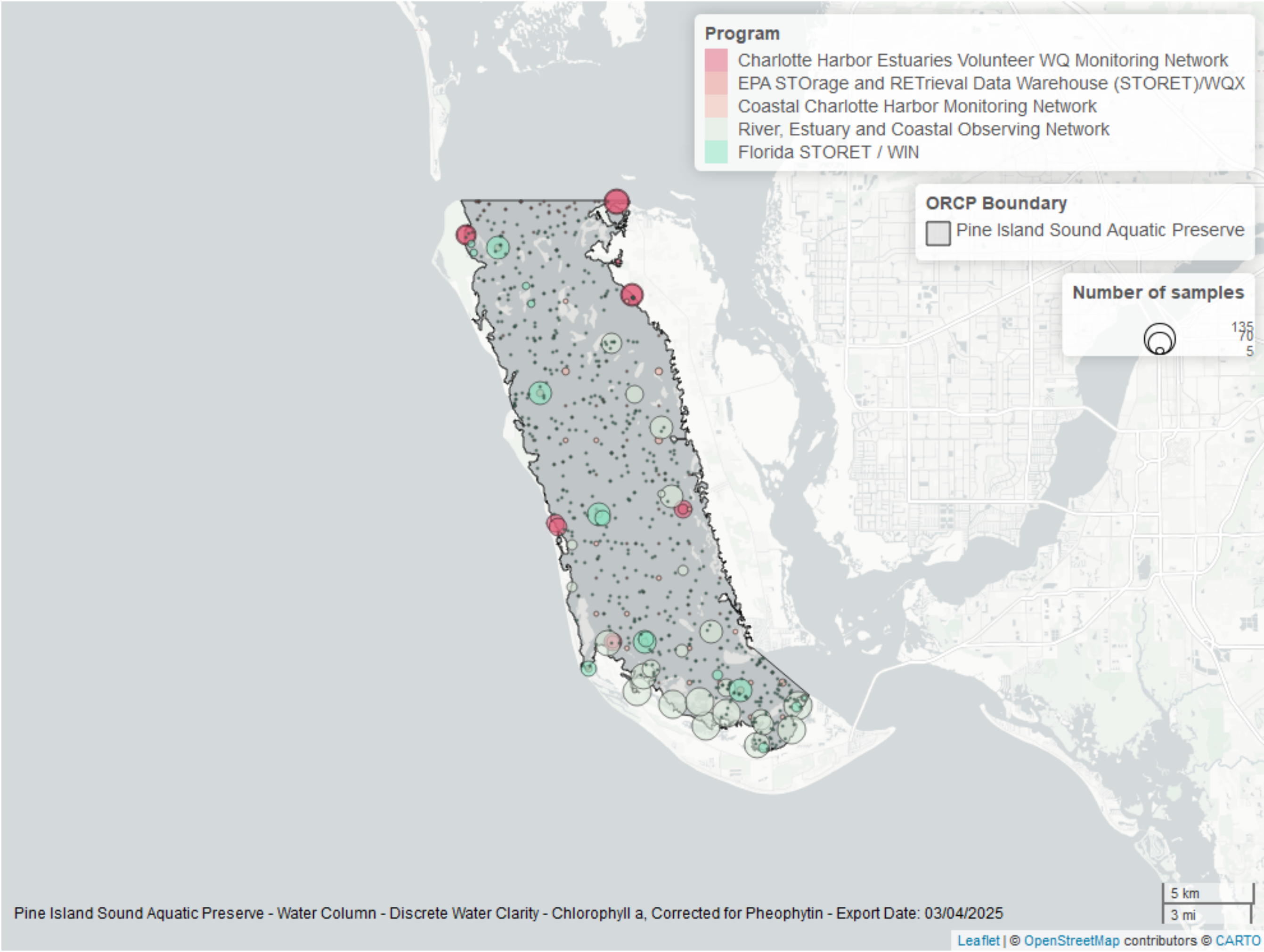

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
303	1893	2012	2024
5002	1113	2001	2024
476	683	2008	2024
513	182	2003	2023
103	115	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

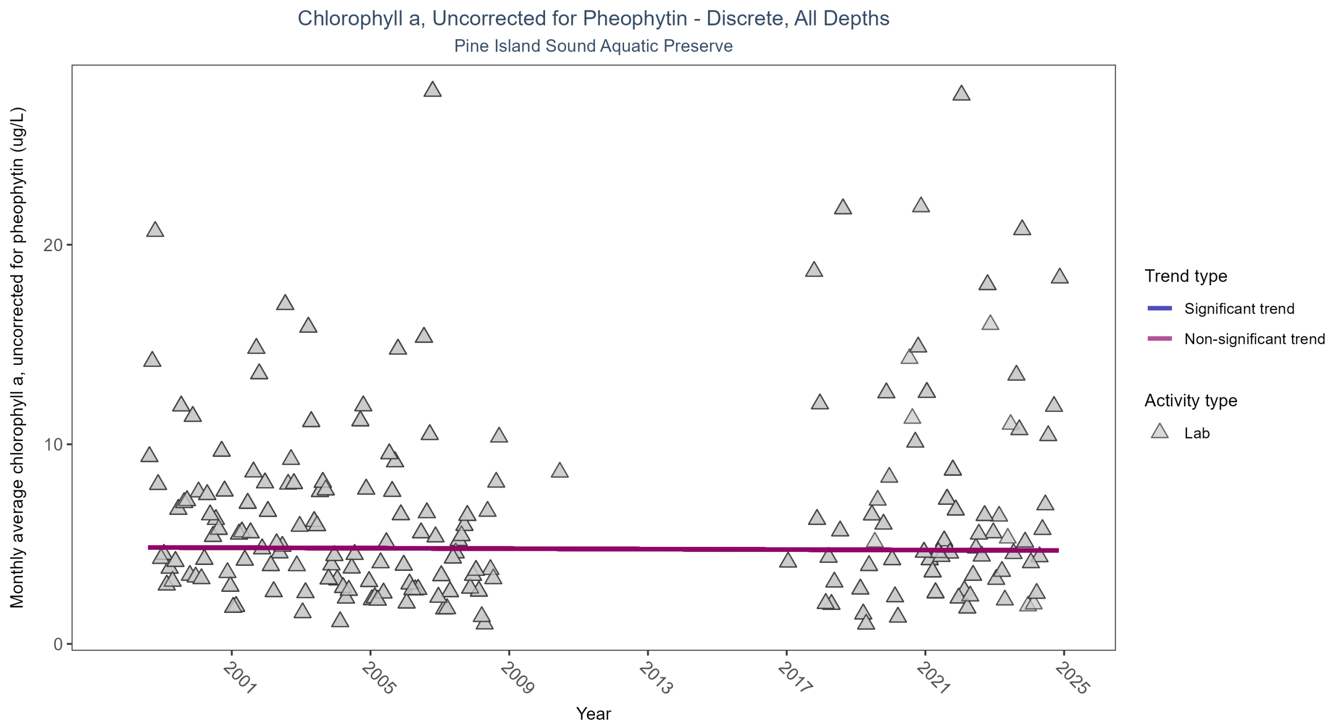

Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	No significant trend	1460	20	1998 - 2024	4.3	-0.0153	4.8348	-0.0058	0.7721

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 1998 and 2024.

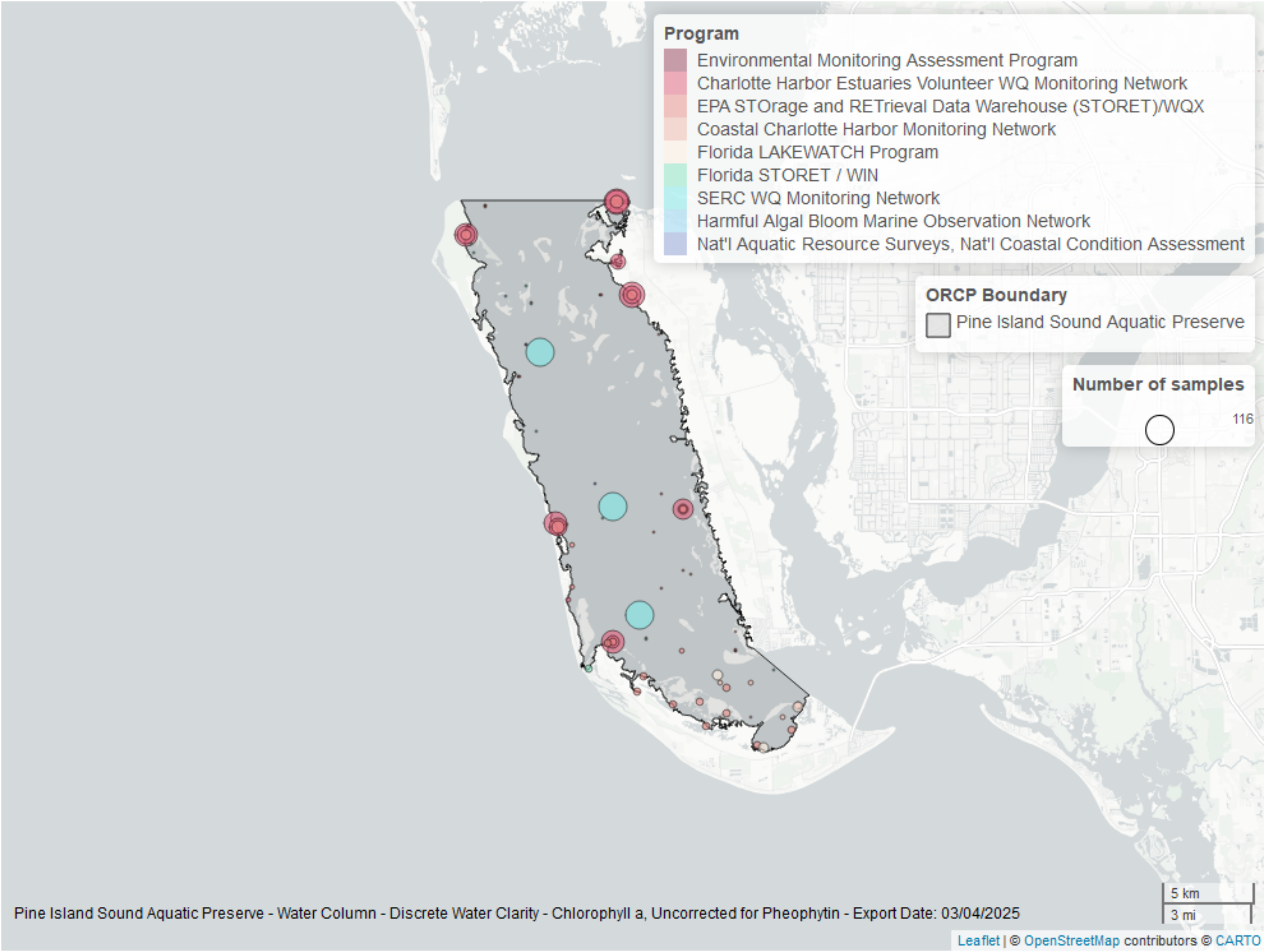

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
476	822	1998	2024
509	348	1999	2008
103	228	2002	2022
514	59	2001	2002
5002	22	2005	2021
513	16	2002	2004
115	4	2002	2004
95	3	2011	2013
118	3	2006	2010

Program names:

95 - Harmful Algal Bloom Marine Observation Network[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[8]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
514 - Florida LAKEWATCH Program[10]
5002 - Florida STORET / WIN[5]

Colored Dissolved Organic Matter - Discrete

Seasonal Kendall-Tau Trend Analysis

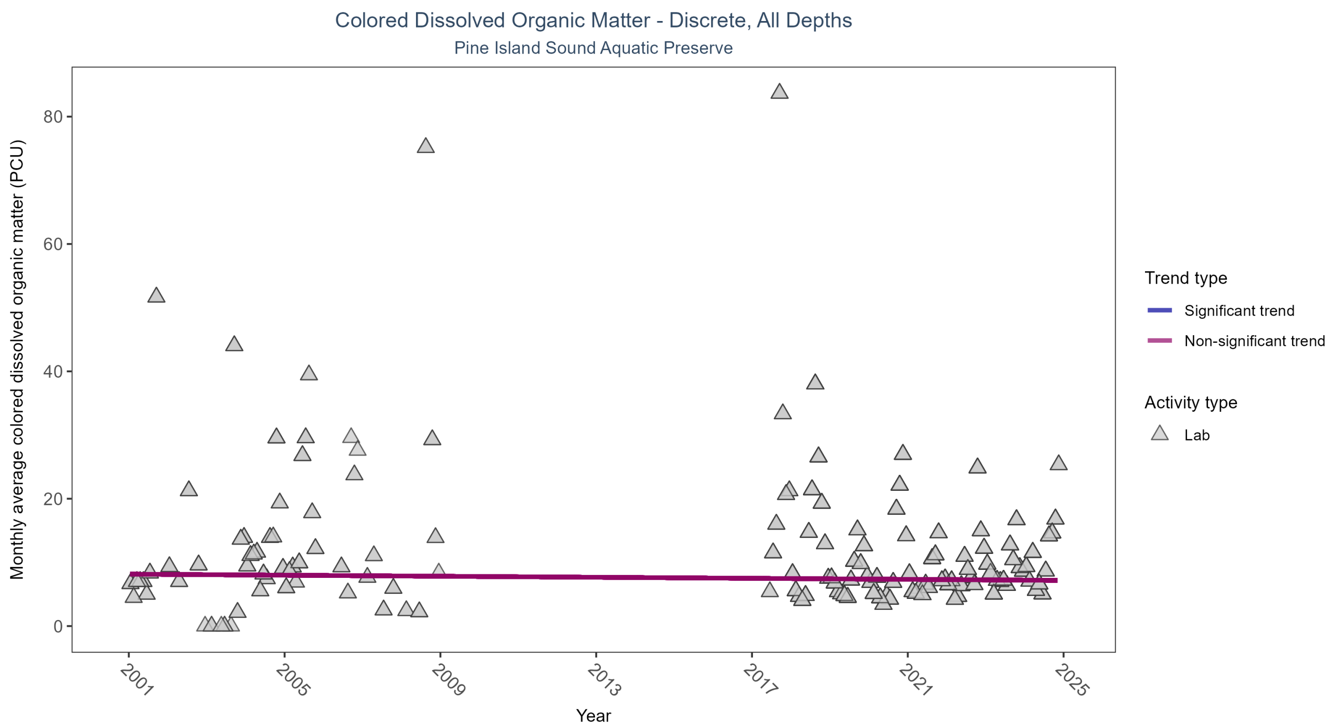

Figure 5: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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	No significant trend	1506	16	2001 - 2024	7.615	-0.0472	8.1522	-0.0408	0.5009

Colored dissolved organic matter showed no detectable trend between 2001 and 2024.

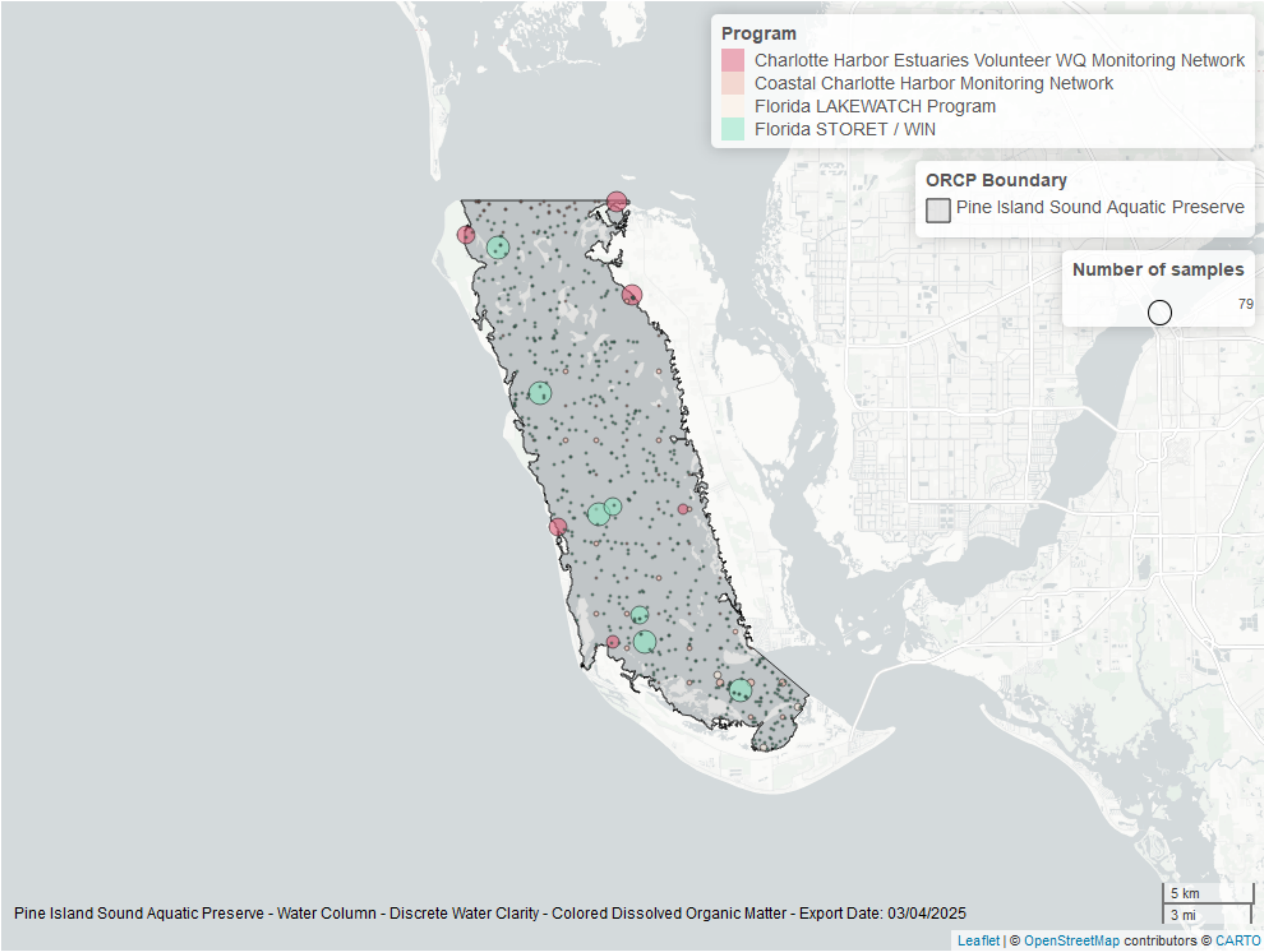

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1025	2018	2024
476	268	2017	2024
513	179	2002	2023
514	35	2001	2002

Program names:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
513 - Coastal Charlotte Harbor Monitoring Network[4]
514 - Florida LAKEWATCH Program[10]
5002 - Florida STORET / WIN[5]

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

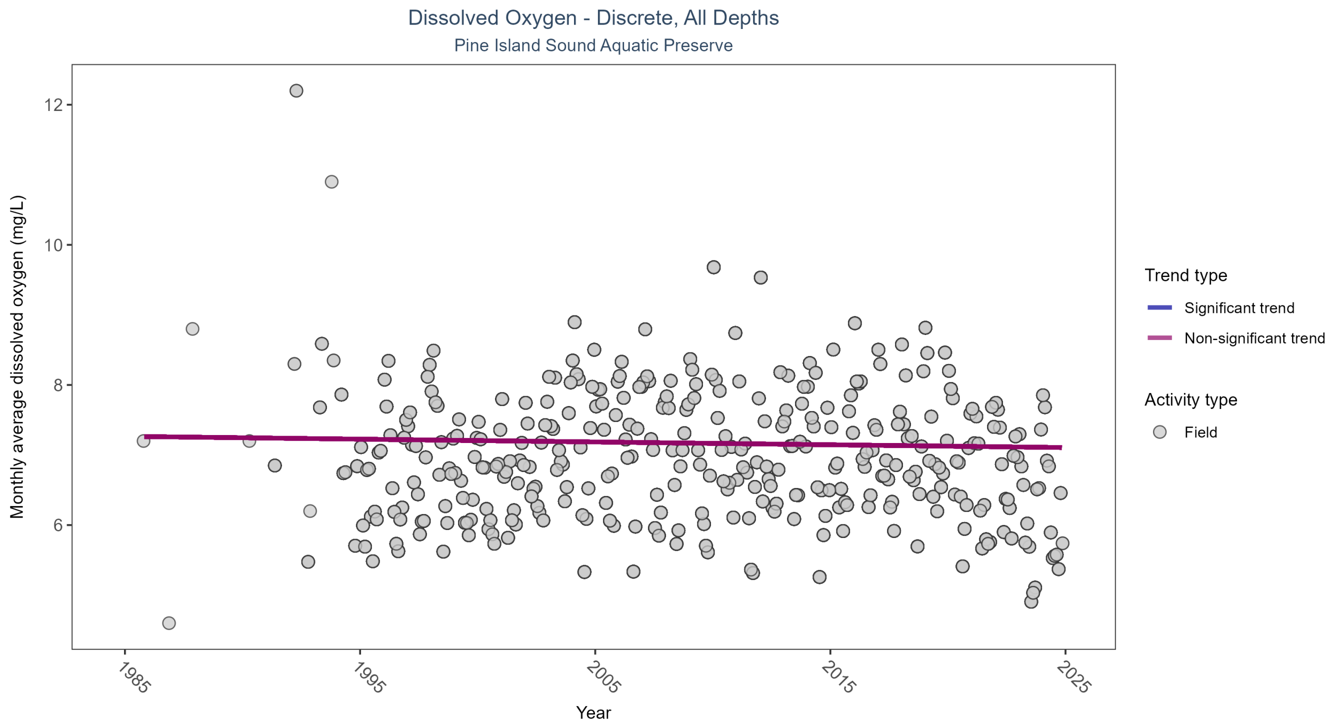

Figure 7: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	34710	38	1985 - 2024	6.9	-0.0366	7.2664	-0.004	0.3

Dissolved oxygen showed no detectable trend between 1985 and 2024.

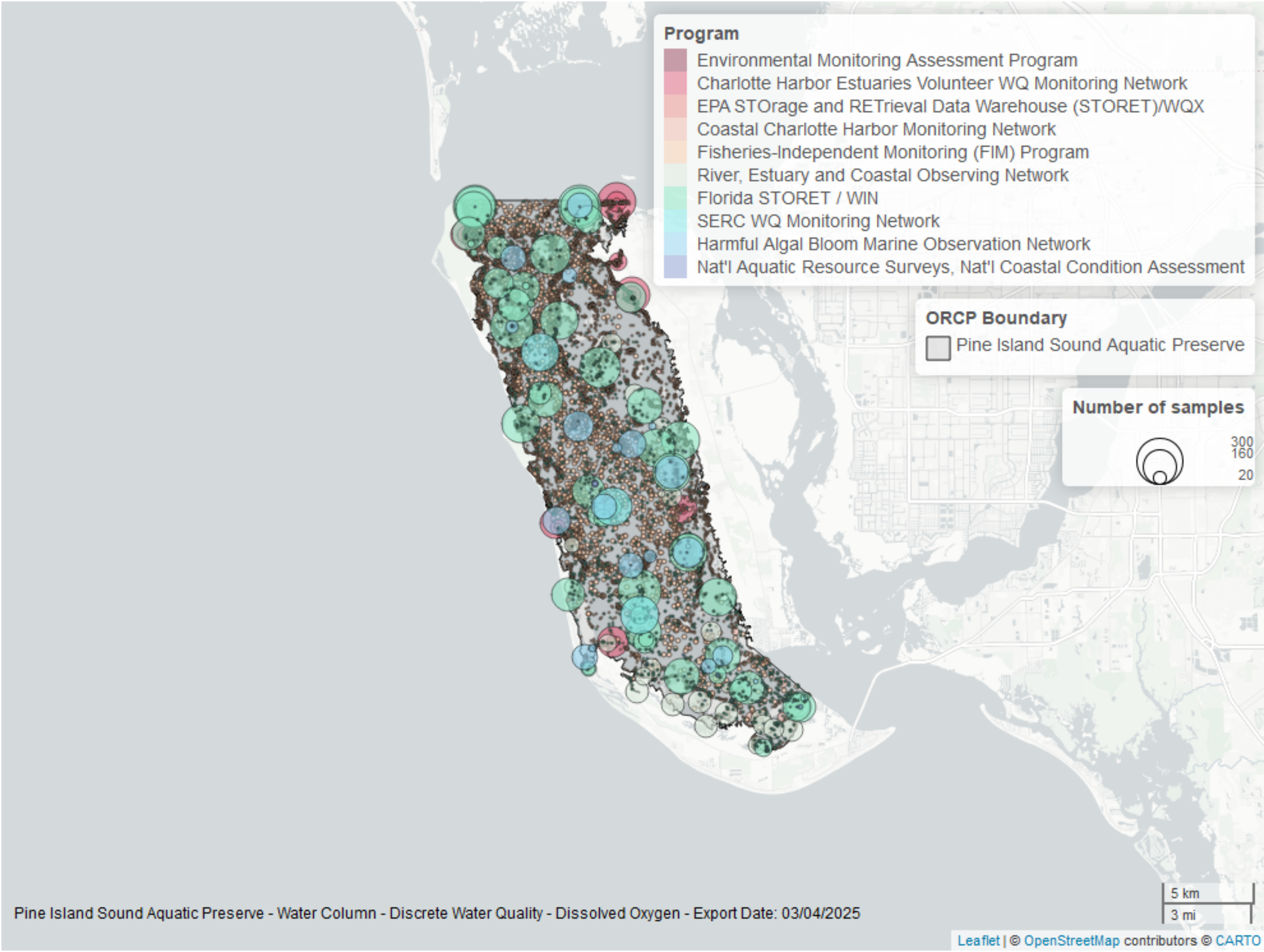

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19960	1990	2022
5002	9576	1987	2024
95	1534	1985	2018
303	1406	2012	2020
476	1223	1998	2024
509	696	1999	2008
103	223	2003	2022
513	196	2002	2023
118	16	2006	2020
115	14	2002	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[11]
95 - Harmful Algal Bloom Marine Observation Network[6]

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[8]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

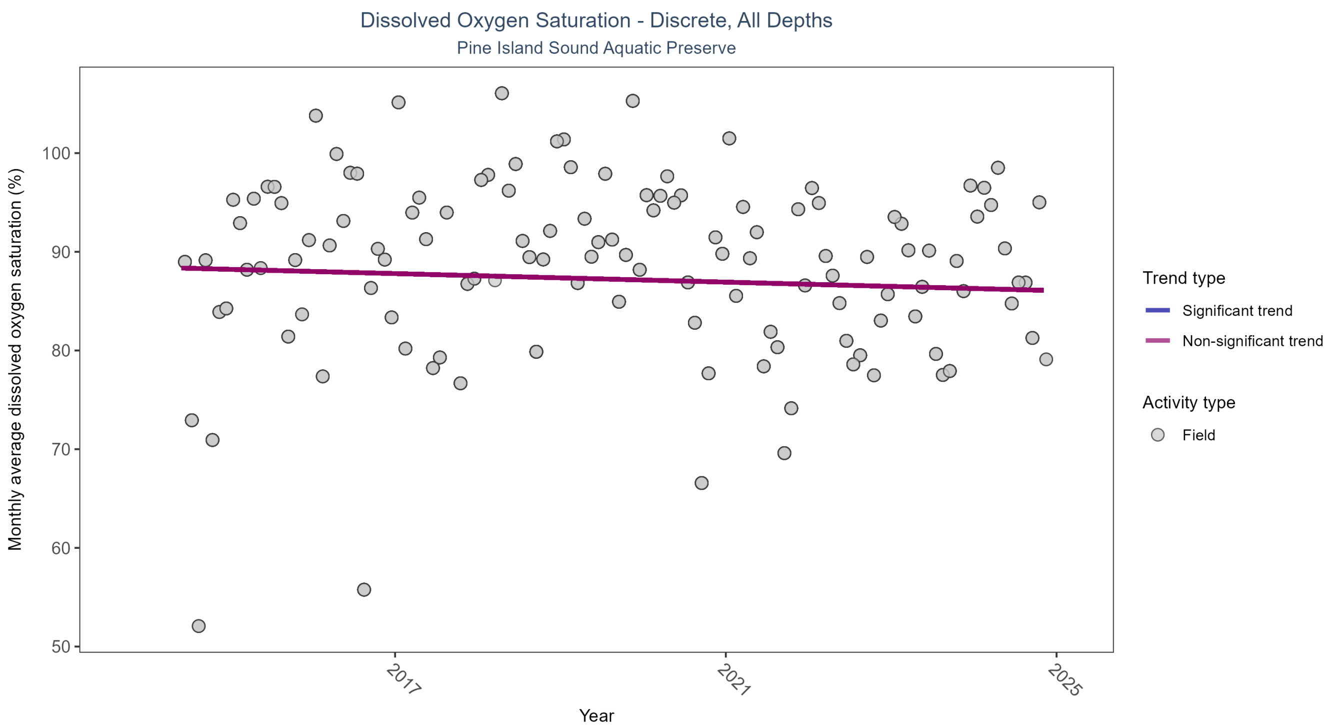

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	No significant trend	3205	11	2014 - 2024	90.8	-0.0777	88.4401	-0.2162	0.2751

Dissolved oxygen saturation showed no detectable trend between 2014 and 2024.

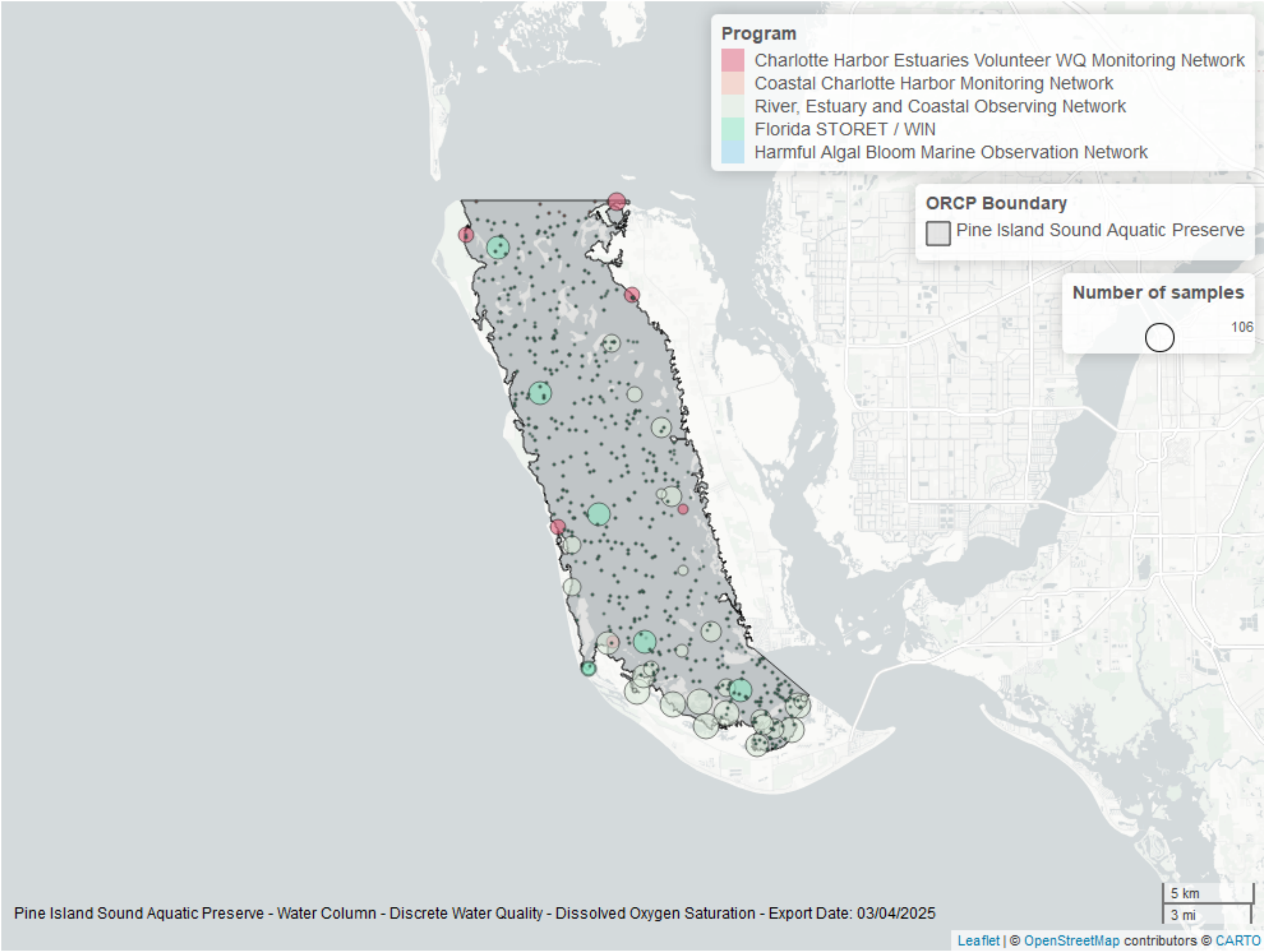

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
303	1676	2014	2024
5002	1328	2014	2024
476	205	2017	2024
513	15	2023	2023
95	2	2016	2016

Program names:

95 - Harmful Algal Bloom Marine Observation Network[6]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

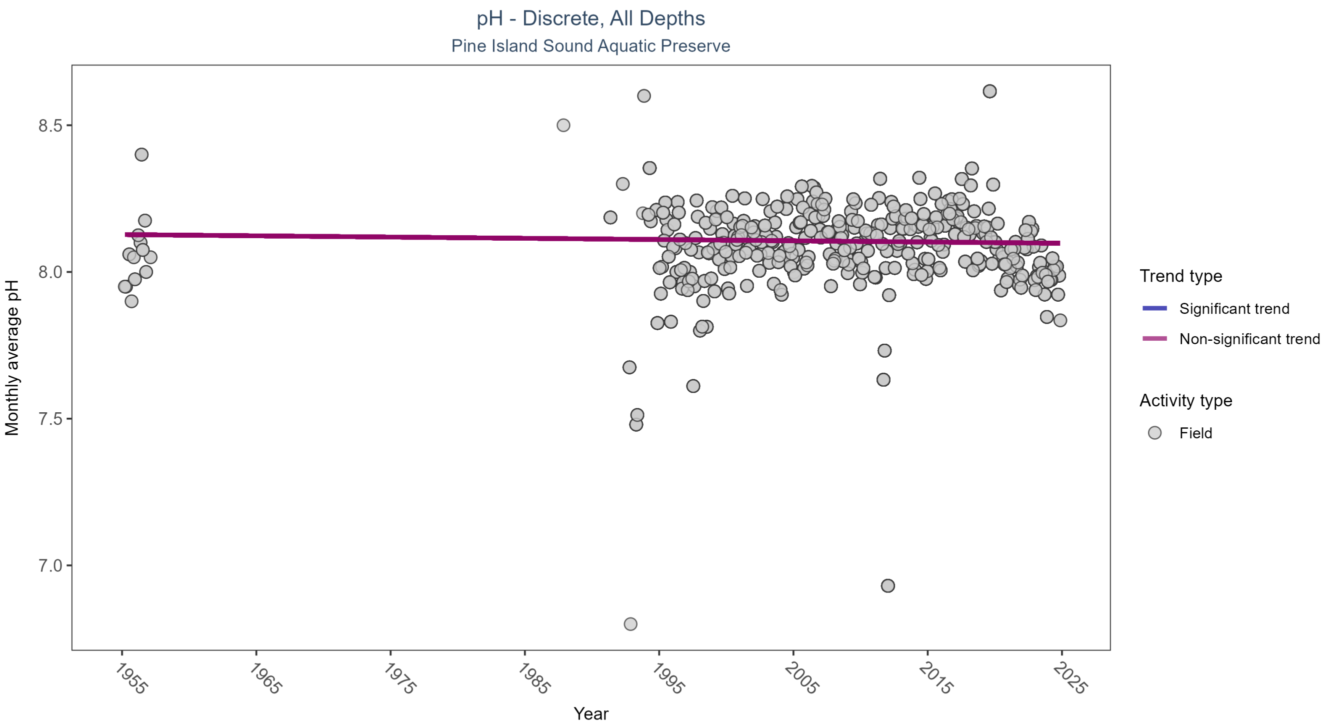

Figure 11: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	32410	38	1955 - 2024	8.1	-0.0313	8.1274	-0.0004	0.3864

pH showed no detectable trend between 1955 and 2024.

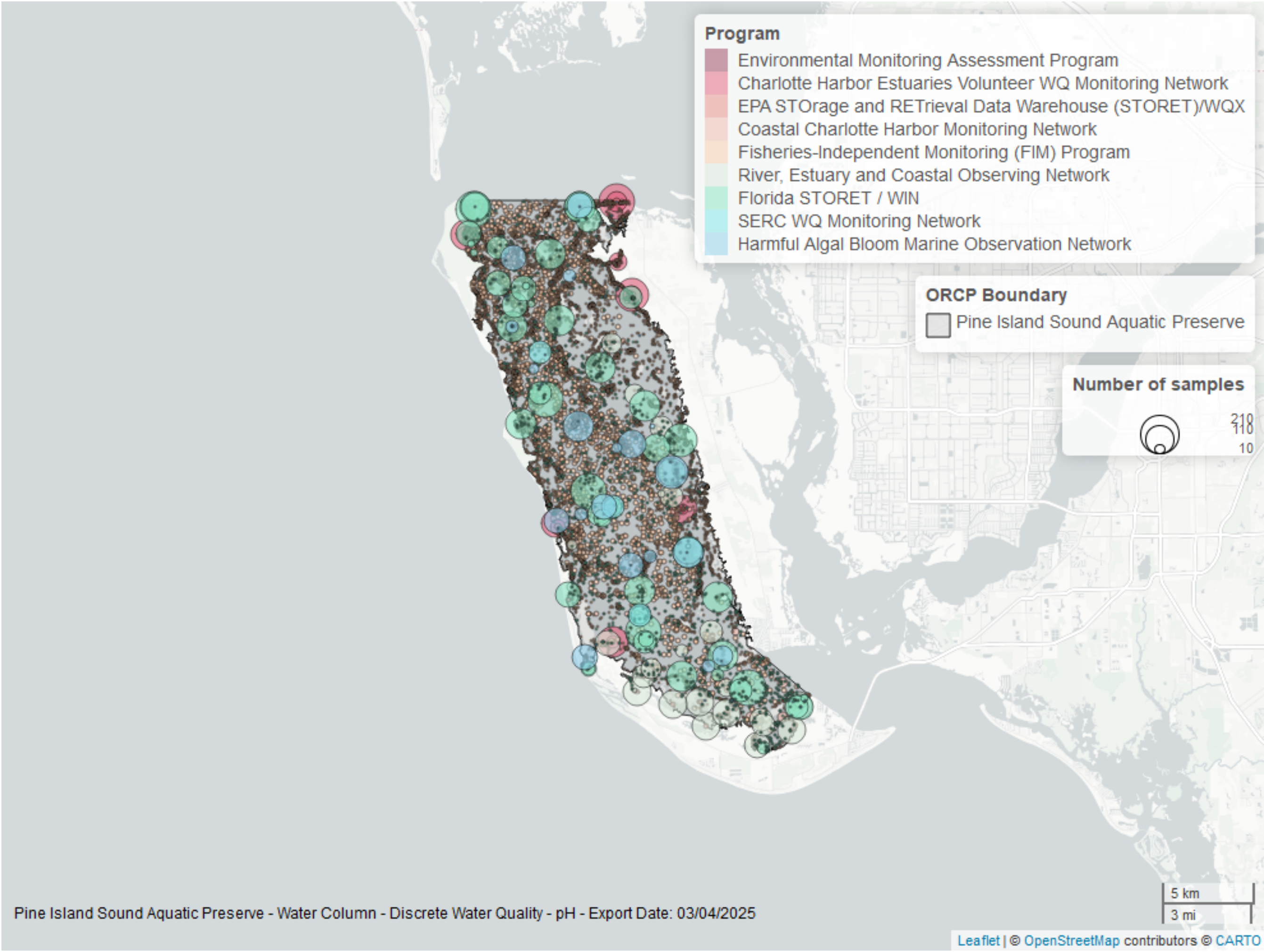

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19776	1991	2022
5002	7361	1987	2024
303	1881	2012	2024
95	1467	1955	2018
476	1224	1998	2024
103	291	2020	2022
509	270	2001	2008
513	197	2002	2023
115	14	2002	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[11]
95 - Harmful Algal Bloom Marine Observation Network[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]

115 - Environmental Monitoring Assessment Program[7]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

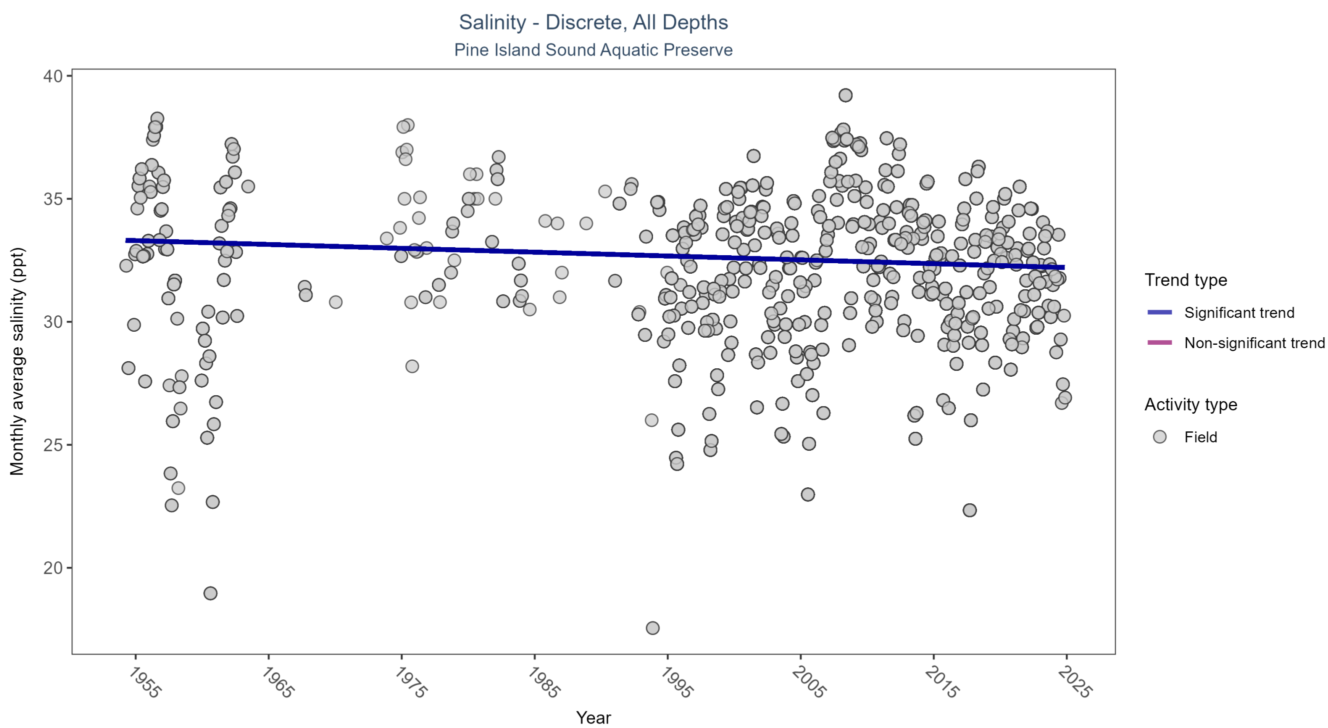

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	33544	63	1954 - 2024	32.8	-0.0849	33.3163	-0.0156	0.0067

Monthly average salinity decreased by 0.02 ppt per year.

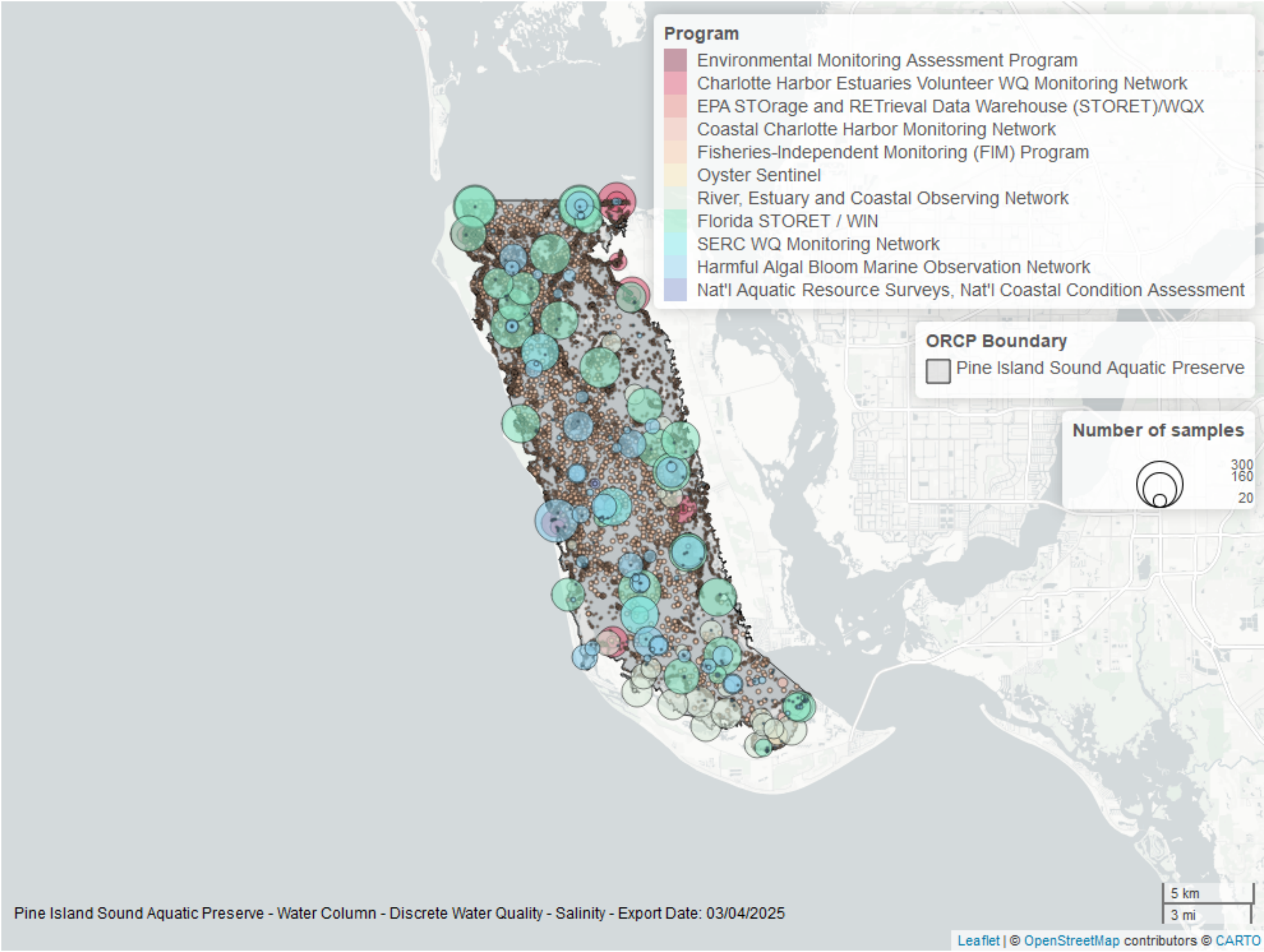

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	20075	1990	2022
5002	6209	1995	2024
95	2929	1954	2018
303	2073	2012	2024
476	1283	1998	2024
509	702	1999	2008
513	169	2002	2008
456	71	1970	2012
118	20	2015	2020
115	14	2002	2004
103	4	2004	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[11]

95 - Harmful Algal Bloom Marine Observation Network[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[8]
303 - River, Estuary and Coastal Observing Network[2]
456 - Oyster Sentinel[12]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

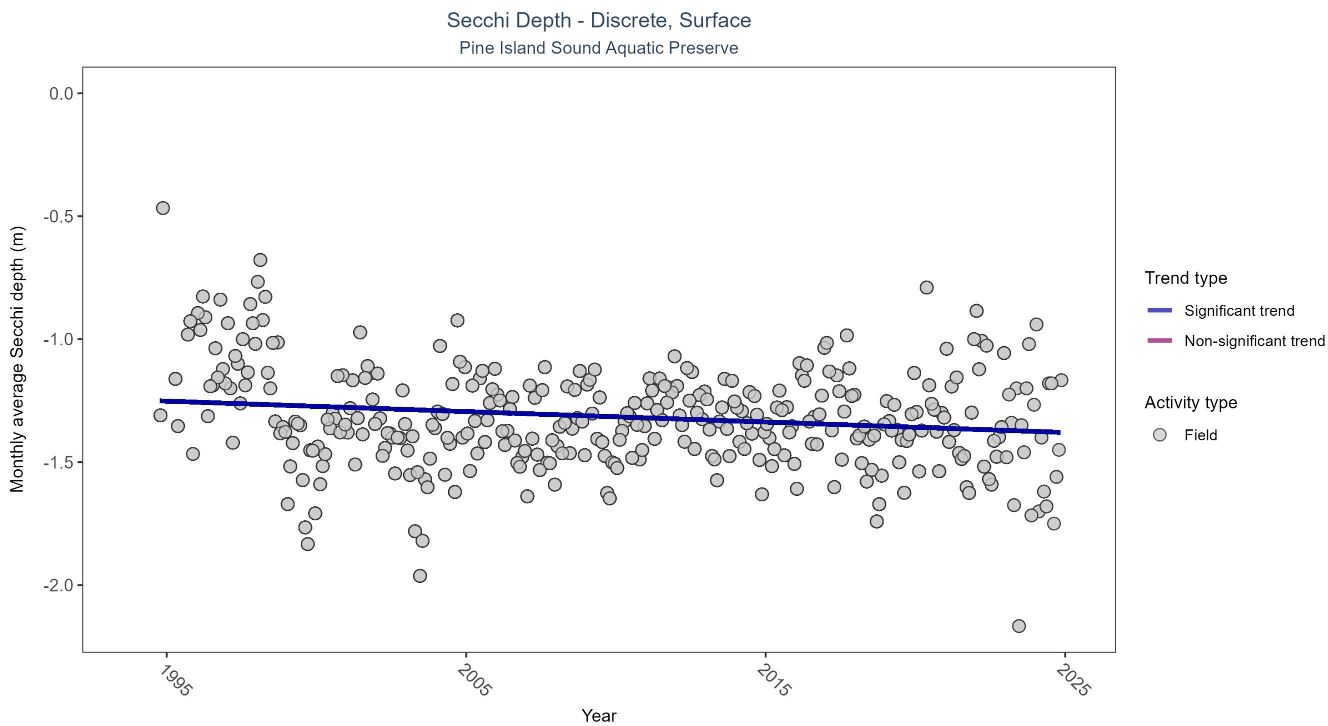

Figure 15: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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 decreasing trend	21128	31	1994 - 2024	-1.2	-0.1126	-1.2477	-0.0043	0.0024

Monthly average Secchi depth became deeper by less than 0.01 m per year, indicating an increase in water clarity.

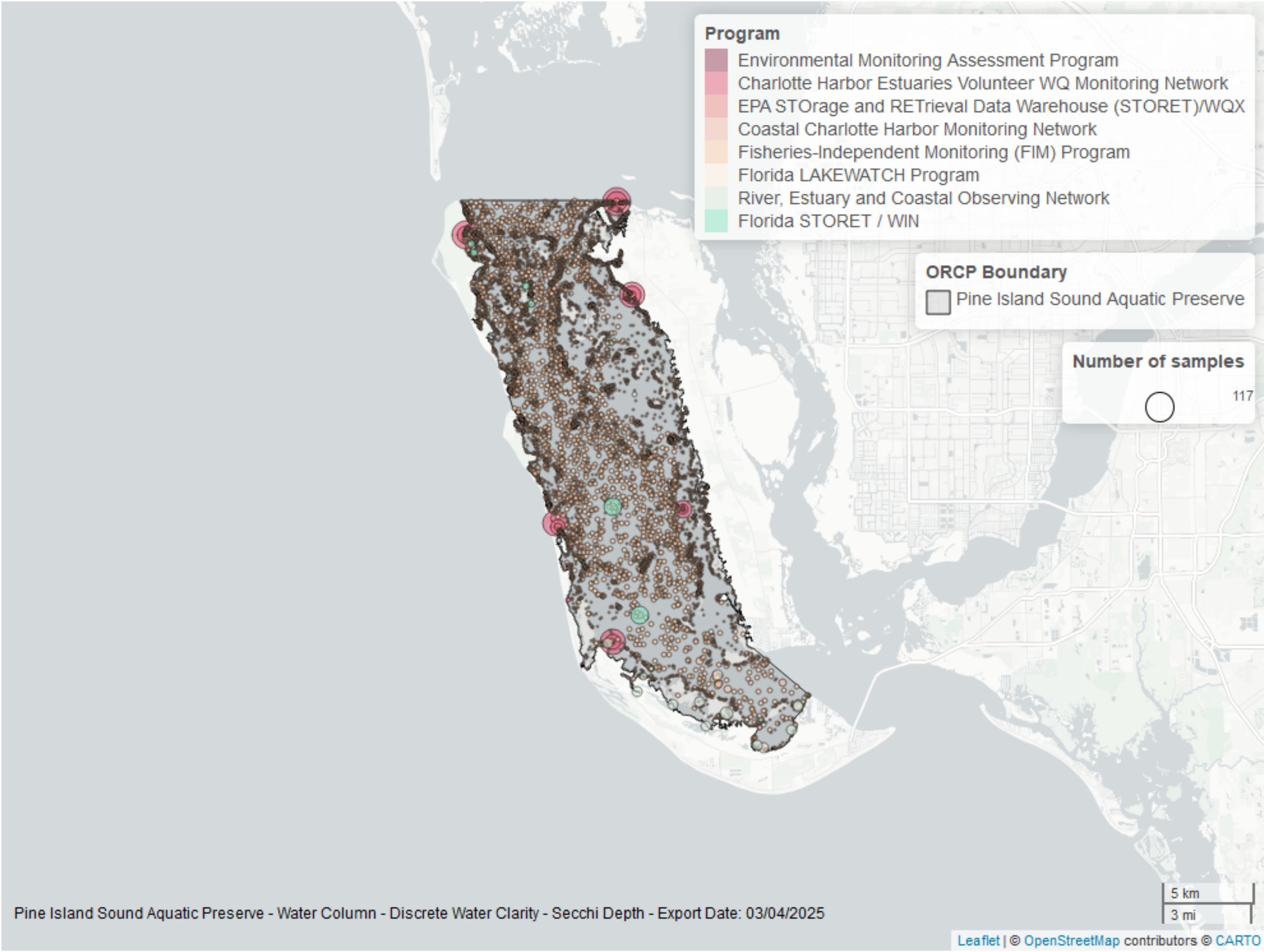

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19789	1994	2022
476	825	1998	2024
303	185	2012	2019
5002	130	2005	2024
513	75	2003	2008
103	69	2020	2022
514	53	2001	2002
115	3	2002	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[11]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
303 - River, Estuary and Coastal Observing Network[2]

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
513 - Coastal Charlotte Harbor Monitoring Network[4]
514 - Florida LAKEWATCH Program[10]
5002 - Florida STORET / WIN[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

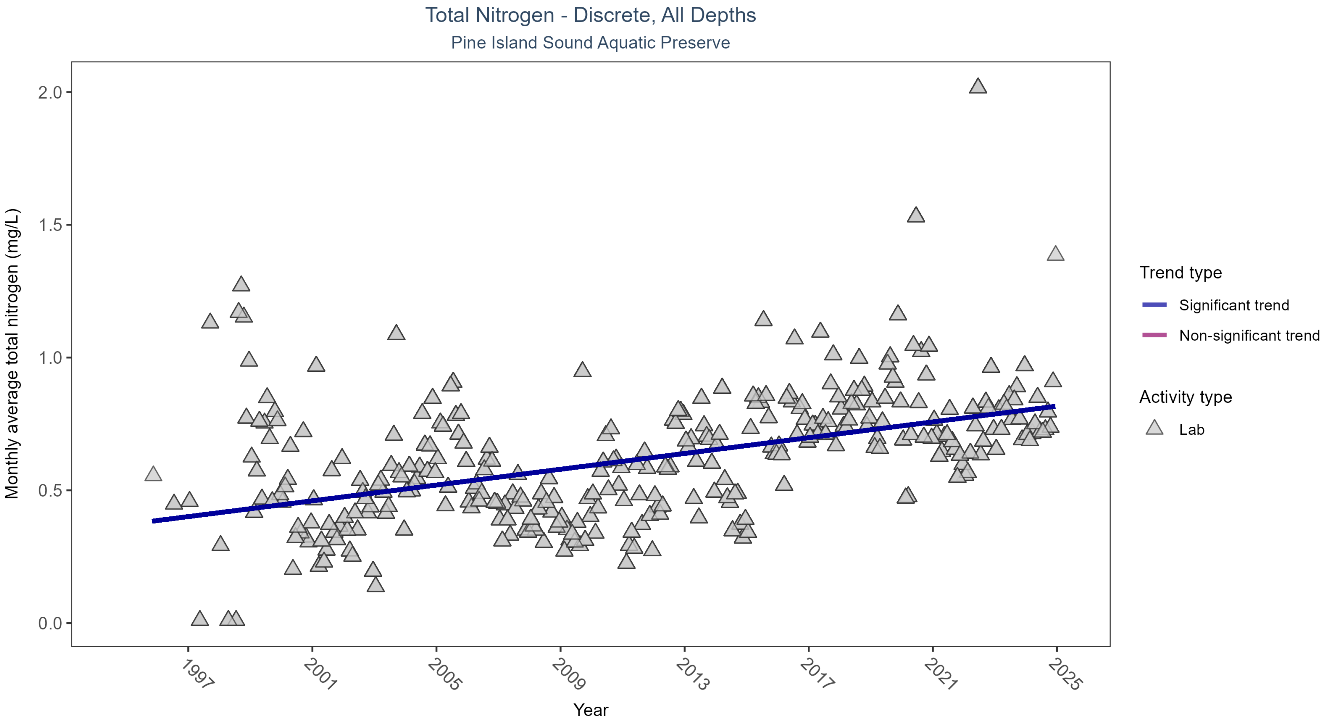

Figure 17: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	5992	30	1995 - 2024	0.605	0.3485	0.3712	0.0149	0

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

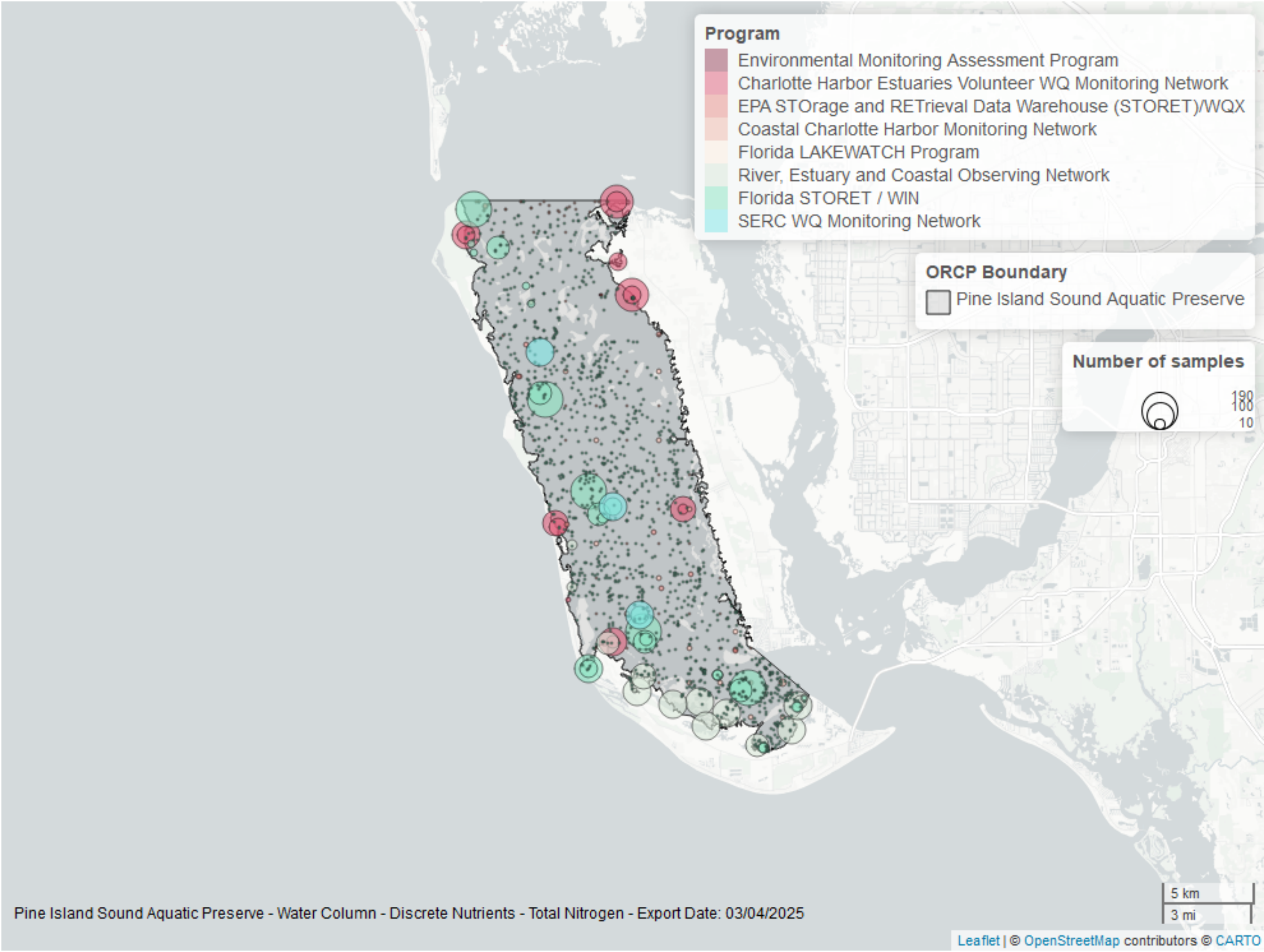

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	3088	1995	2024
303	1213	2012	2023
476	1110	1998	2024
509	351	1999	2008
513	151	2002	2023
514	59	2001	2002
103	45	2002	2006
115	4	2002	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]

509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
514 - Florida LAKEWATCH Program[10]
5002 - Florida STORET / WIN[5]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

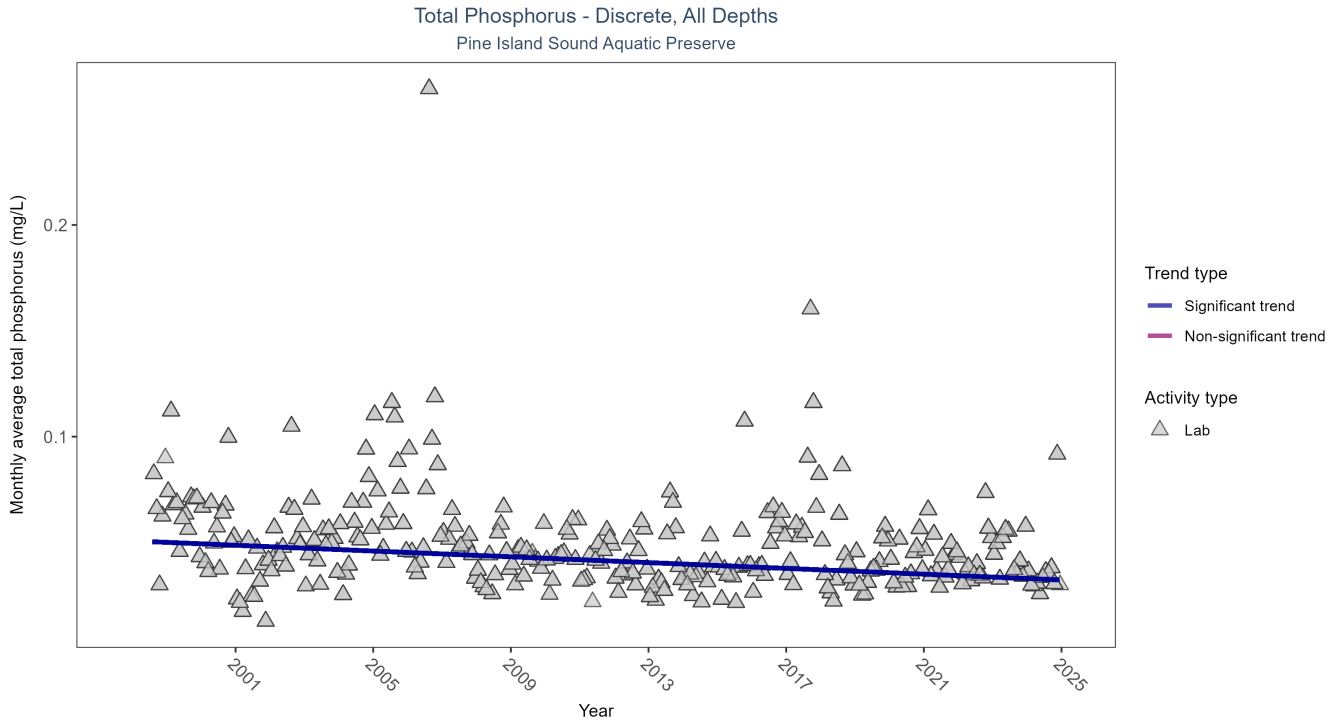

Figure 19: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included 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 decreasing trend	4367	27	1998 - 2024	0.038	-0.2256	0.0507	-0.0007	0

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

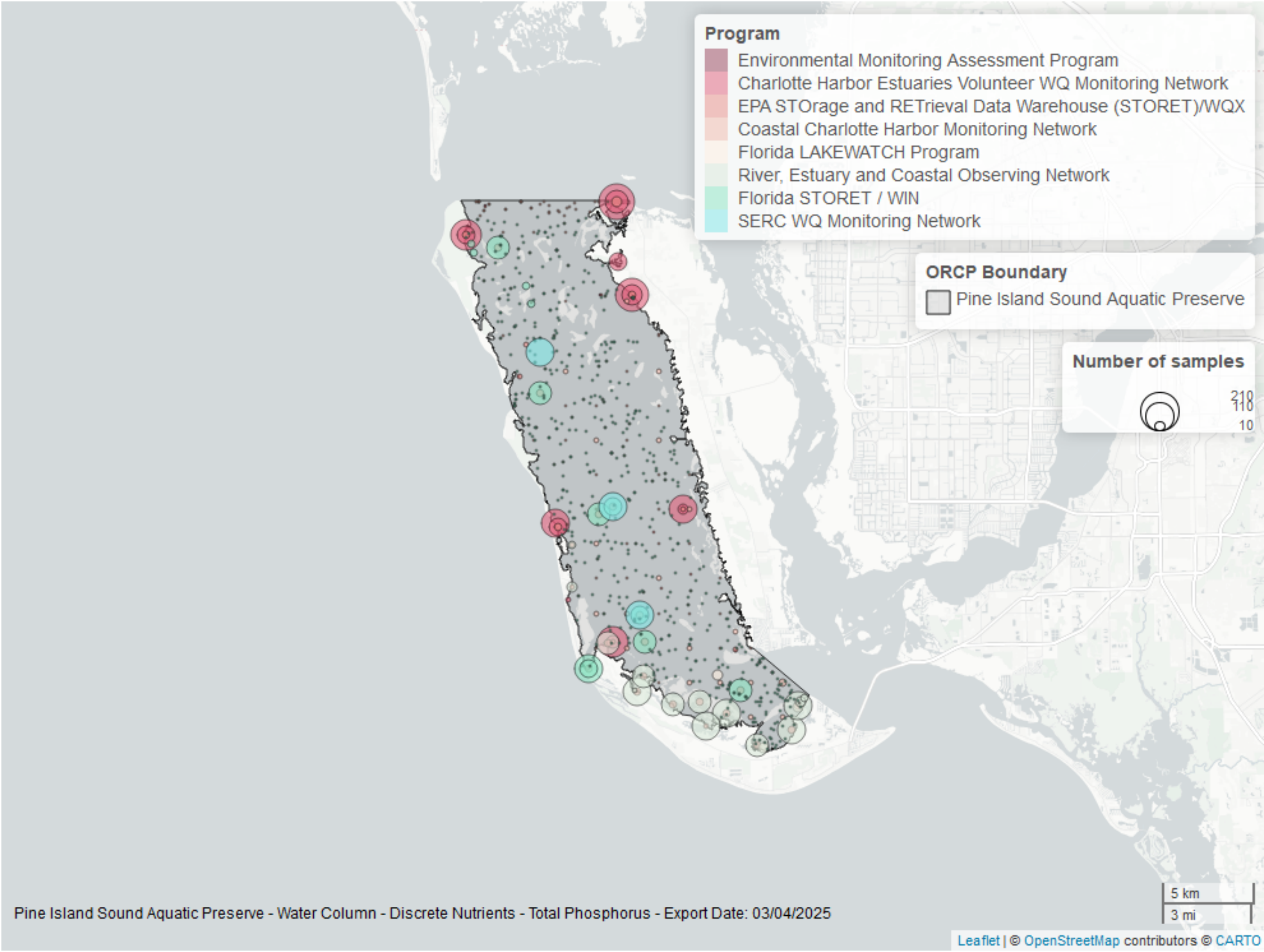

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
476	1249	1998	2024
5002	1236	2005	2024
303	1077	2012	2023
509	348	1999	2008
103	293	2002	2022
513	162	2003	2023
514	59	2001	2002
115	4	2002	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]

509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
514 - Florida LAKEWATCH Program[10]
5002 - Florida STORET / WIN[5]

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

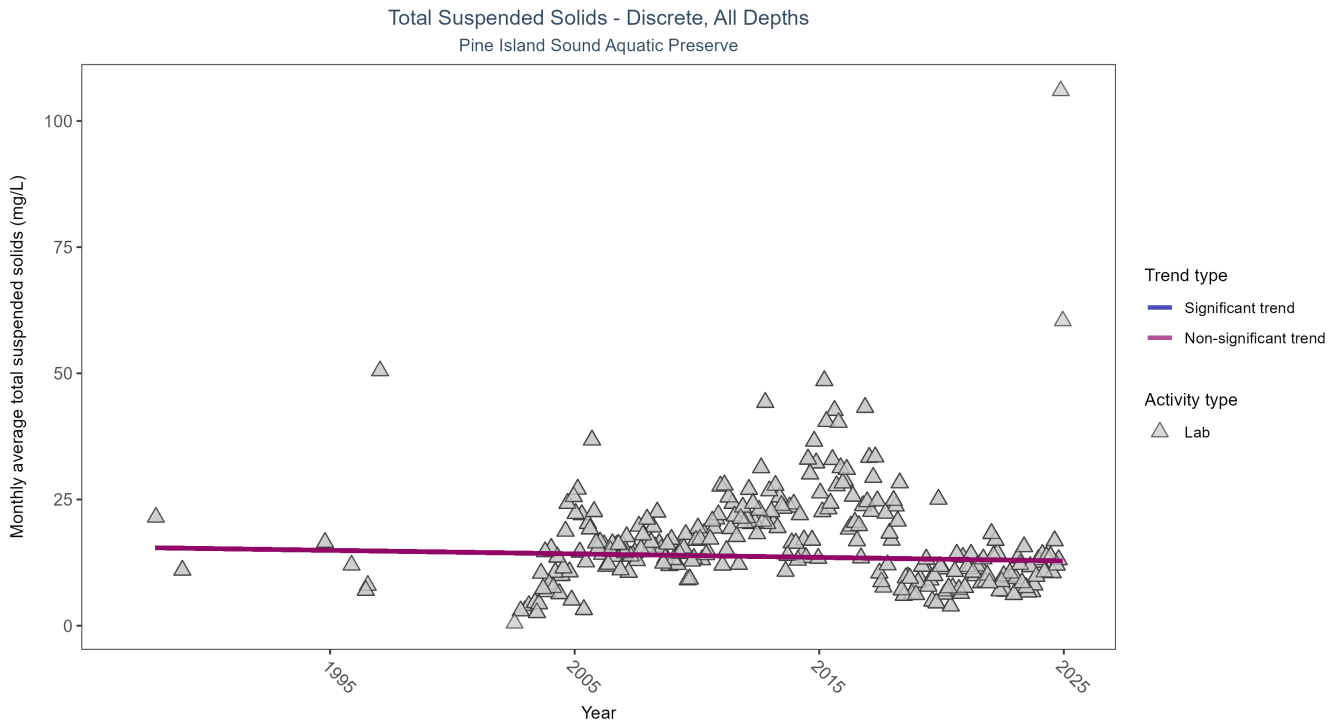

Figure 21: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	No significant trend	2820	29	1987 - 2024	12.3	-0.0367	15.4896	-0.0701	0.4305

Total suspended solids showed no detectable trend between 1987 and 2024.

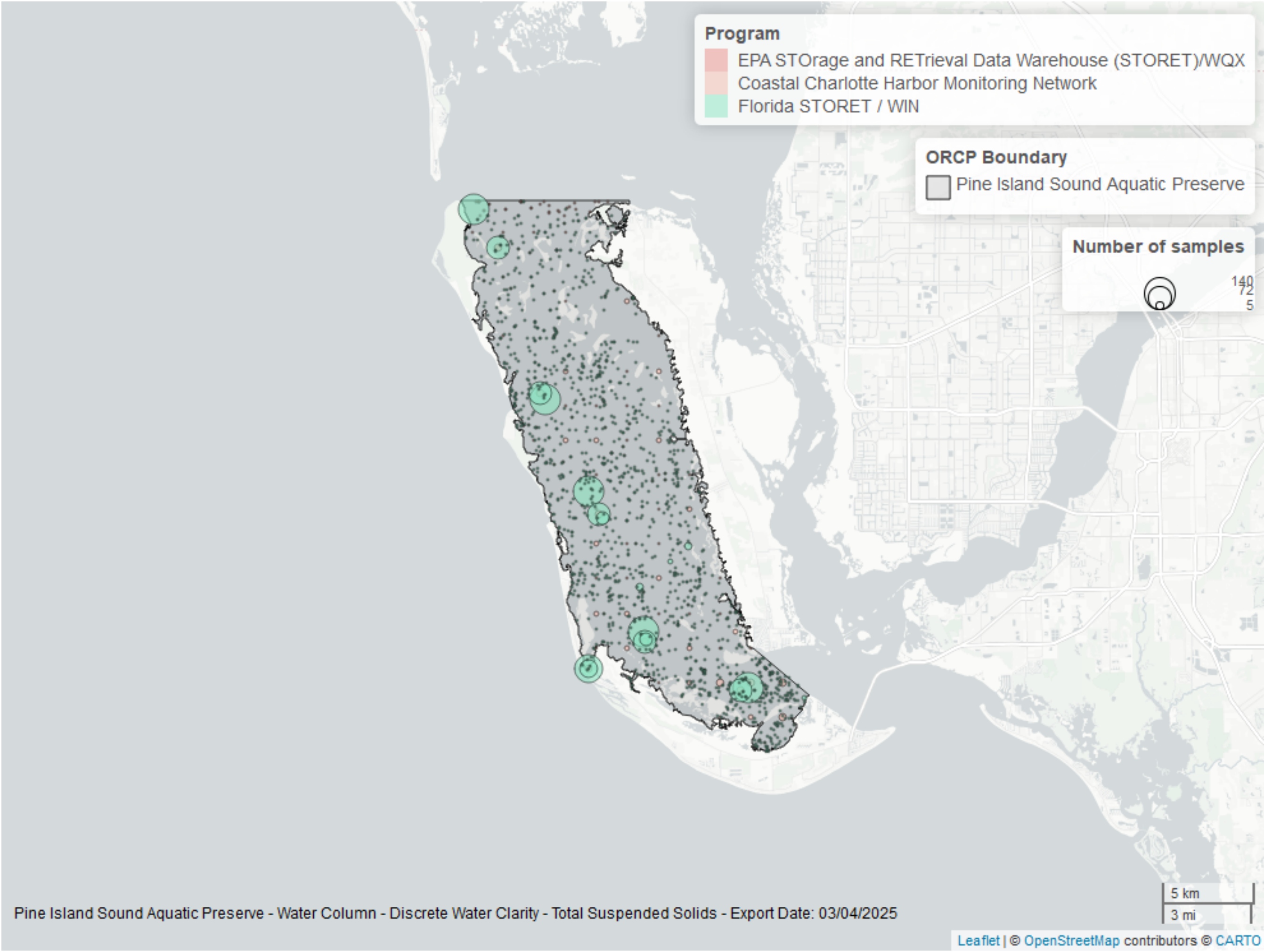

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	2661	1987	2024
513	184	2002	2023
103	115	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

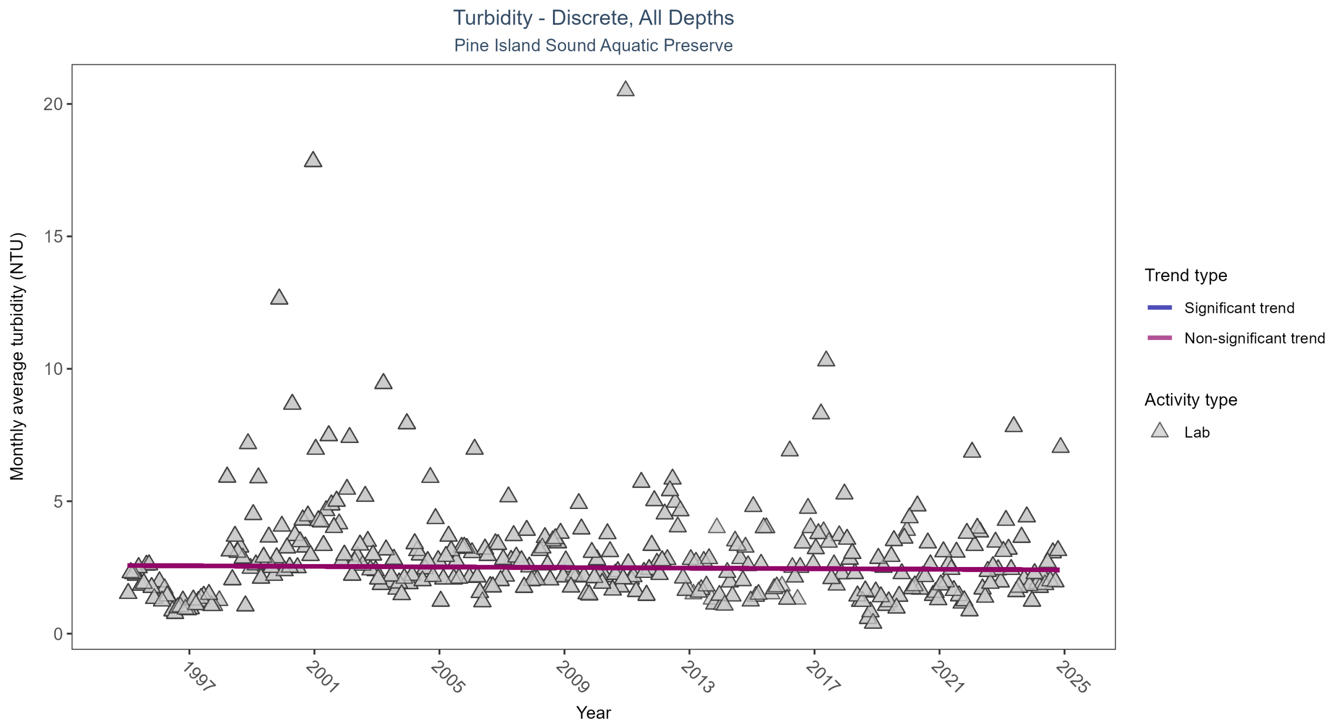

Figure 23: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	No significant trend	6642	30	1995 - 2024	2	-0.0226	2.5721	-0.0054	0.5624

Turbidity showed no detectable trend between 1995 and 2024.

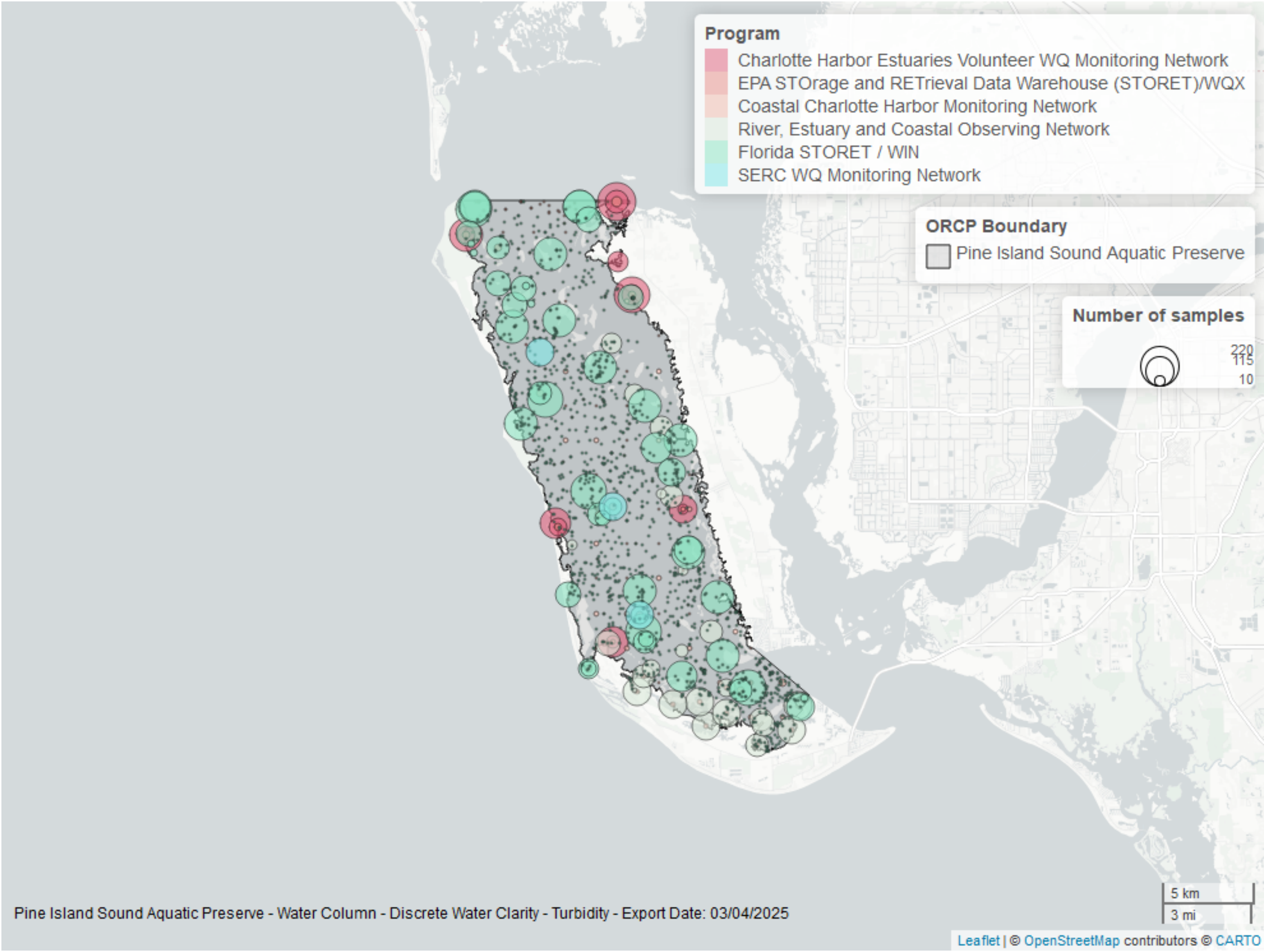

Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	6744	1995	2024
303	1888	2012	2024
476	1326	1998	2024
509	348	1999	2008
103	263	2006	2022
513	166	2003	2023

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
303 - River, Estuary and Coastal Observing Network[2]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

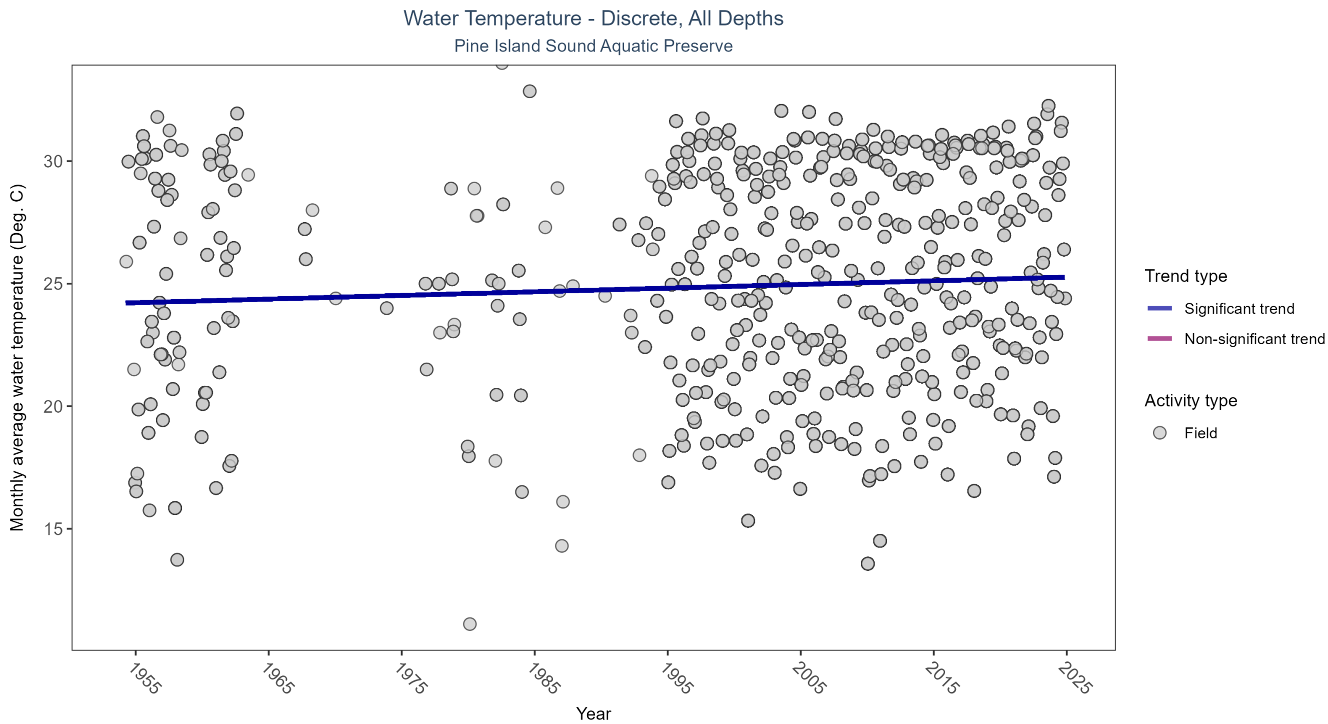

Figure 25: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	36824	61	1954 - 2024	26.4	0.149	24.2063	0.0149	0

Monthly average water temperature increased by 0.01°C per year.

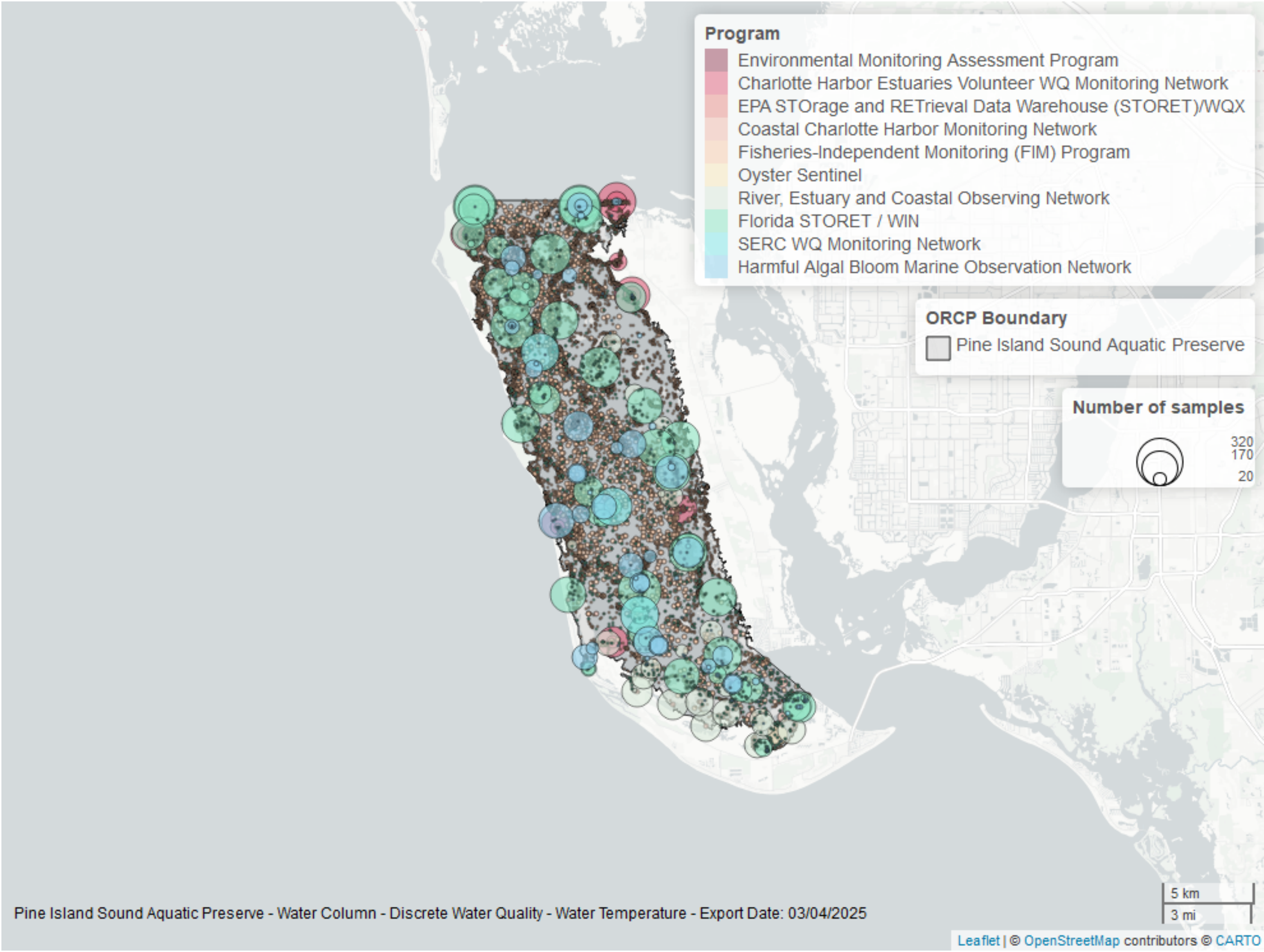

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	20072	1990	2022
5002	9627	1987	2024
95	2617	1954	2018
303	1966	2012	2024
476	1273	1998	2024
509	702	1999	2008
103	294	2004	2022
513	189	2002	2023
456	71	1970	2012
115	14	2002	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[11]
95 - Harmful Algal Bloom Marine Observation Network[6]

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[7]
303 - River, Estuary and Coastal Observing Network[2]
456 - Oyster Sentinel[12]
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network[3]
509 - SERC Water Quality Monitoring Network[9]
513 - Coastal Charlotte Harbor Monitoring Network[4]
5002 - Florida STORET / WIN[5]

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_SW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_SW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_pH_SW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_SW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_SW-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_SW-2025-Mar-06.txt*

Continuous monitoring locations in Pine Island Sound Aquatic Preserve

Table 32: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
7	02293249	4	FALSE	DO , pH , Sal , Turb , TempW

Program names:

7 - National Water Information System[13]

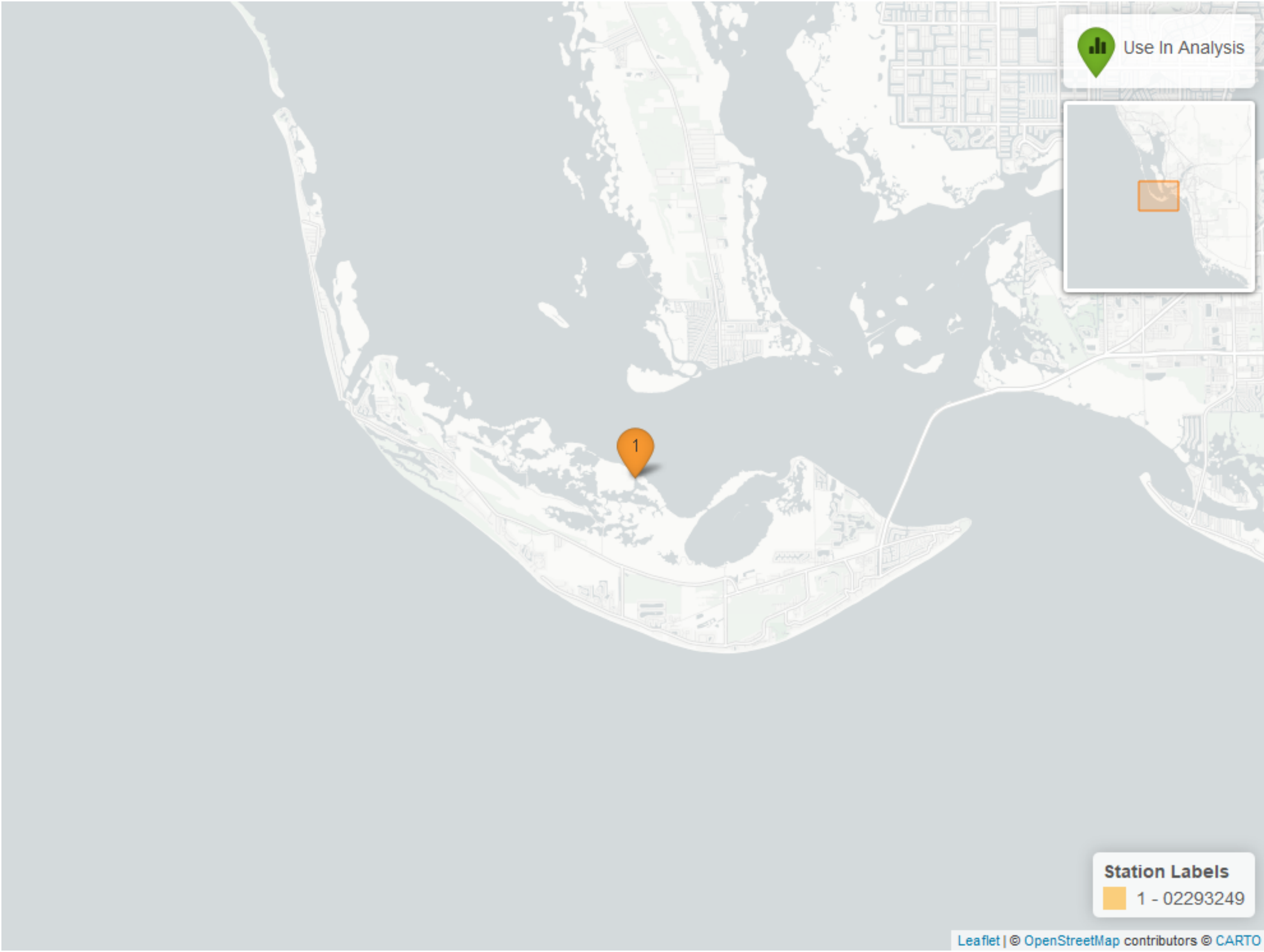

Figure 27: Map showing continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

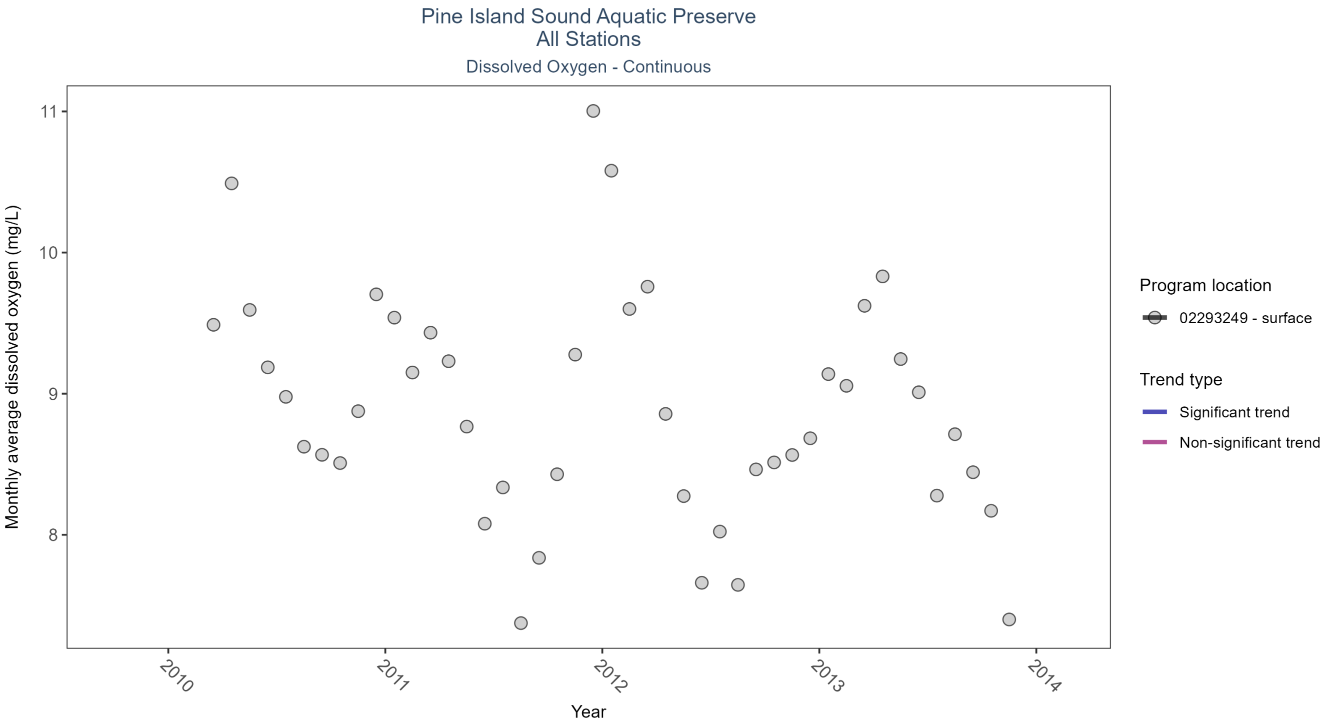

Figure 28: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
02293249	Insufficient data to calculate trend	1302	4	2010 - 2013	8.8	-	-	-	-

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

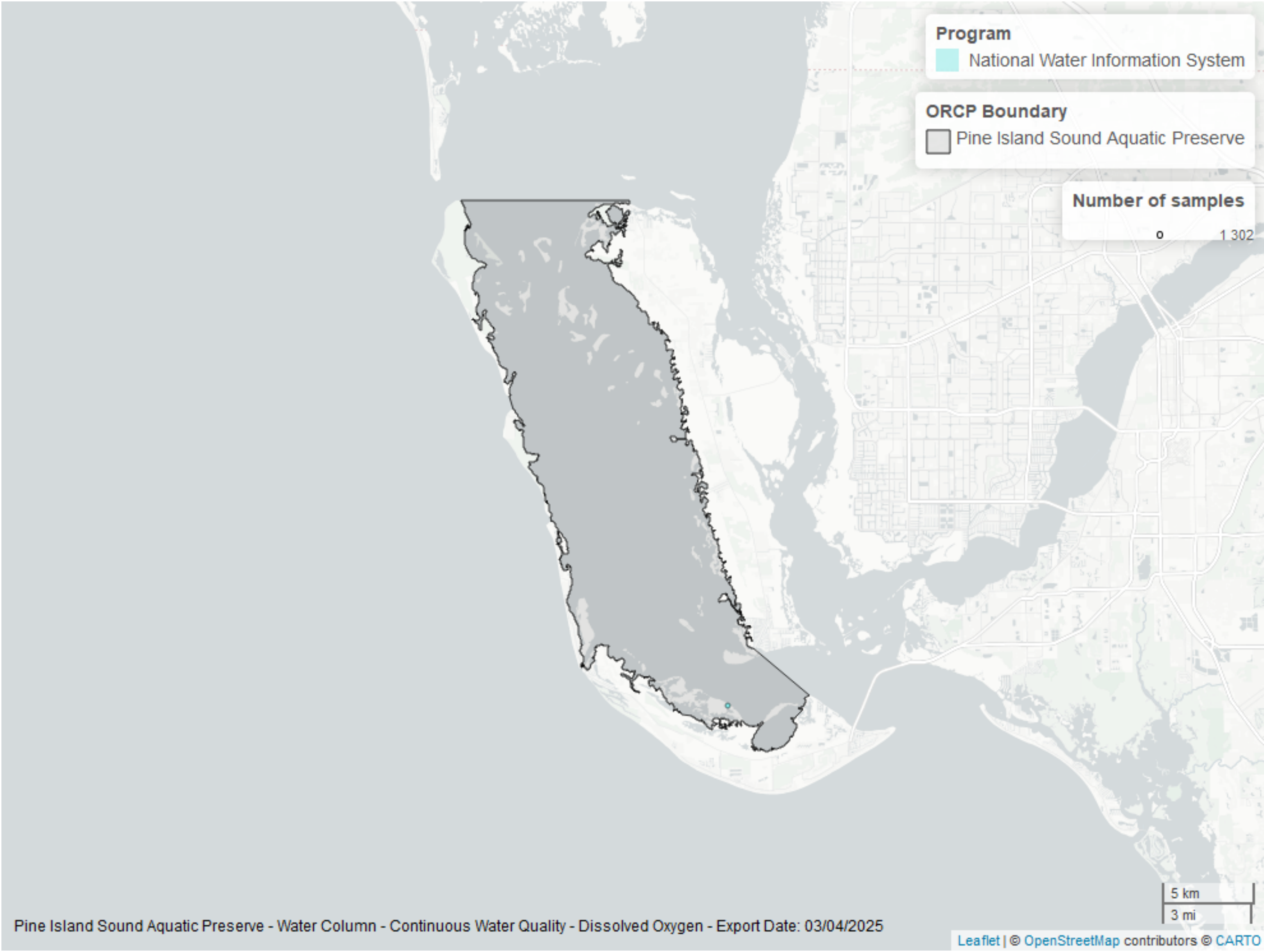

Figure 29: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

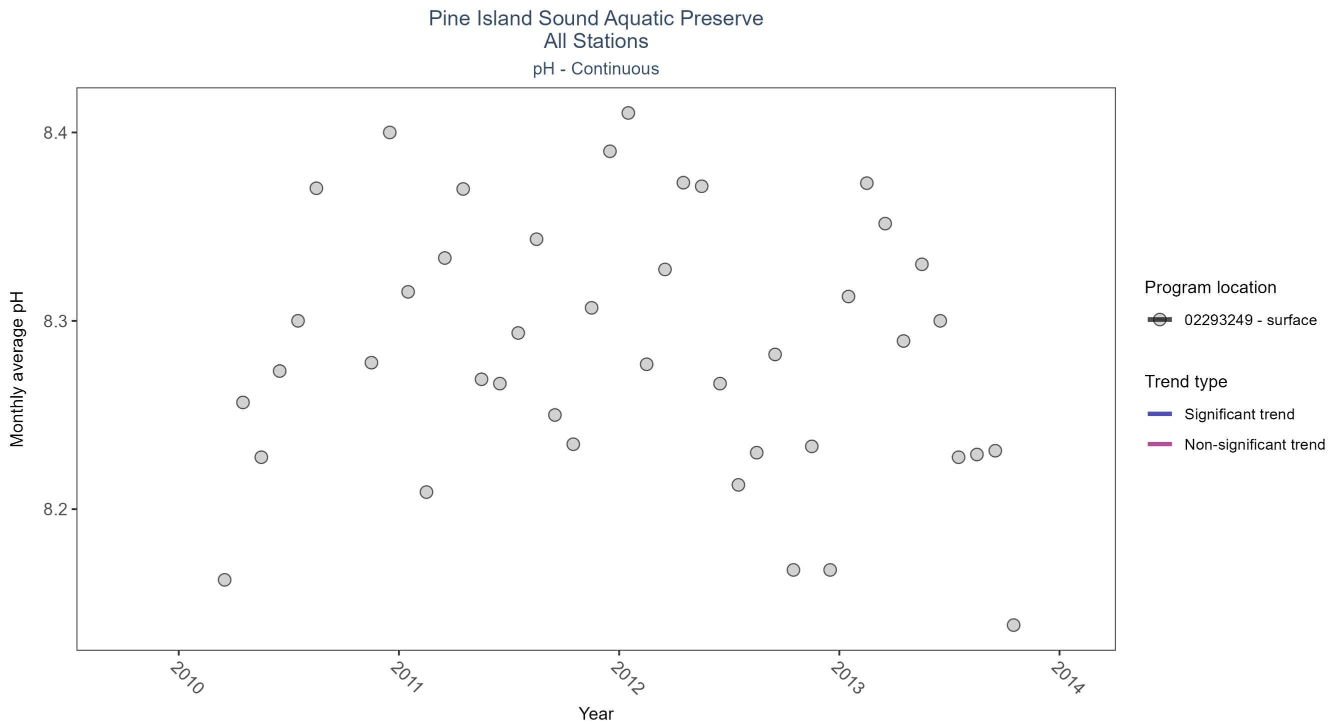

Figure 30: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 34: 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
02293249	Insufficient data to calculate trend	1164	4	2010 - 2013	8.3	-	-	-	-

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

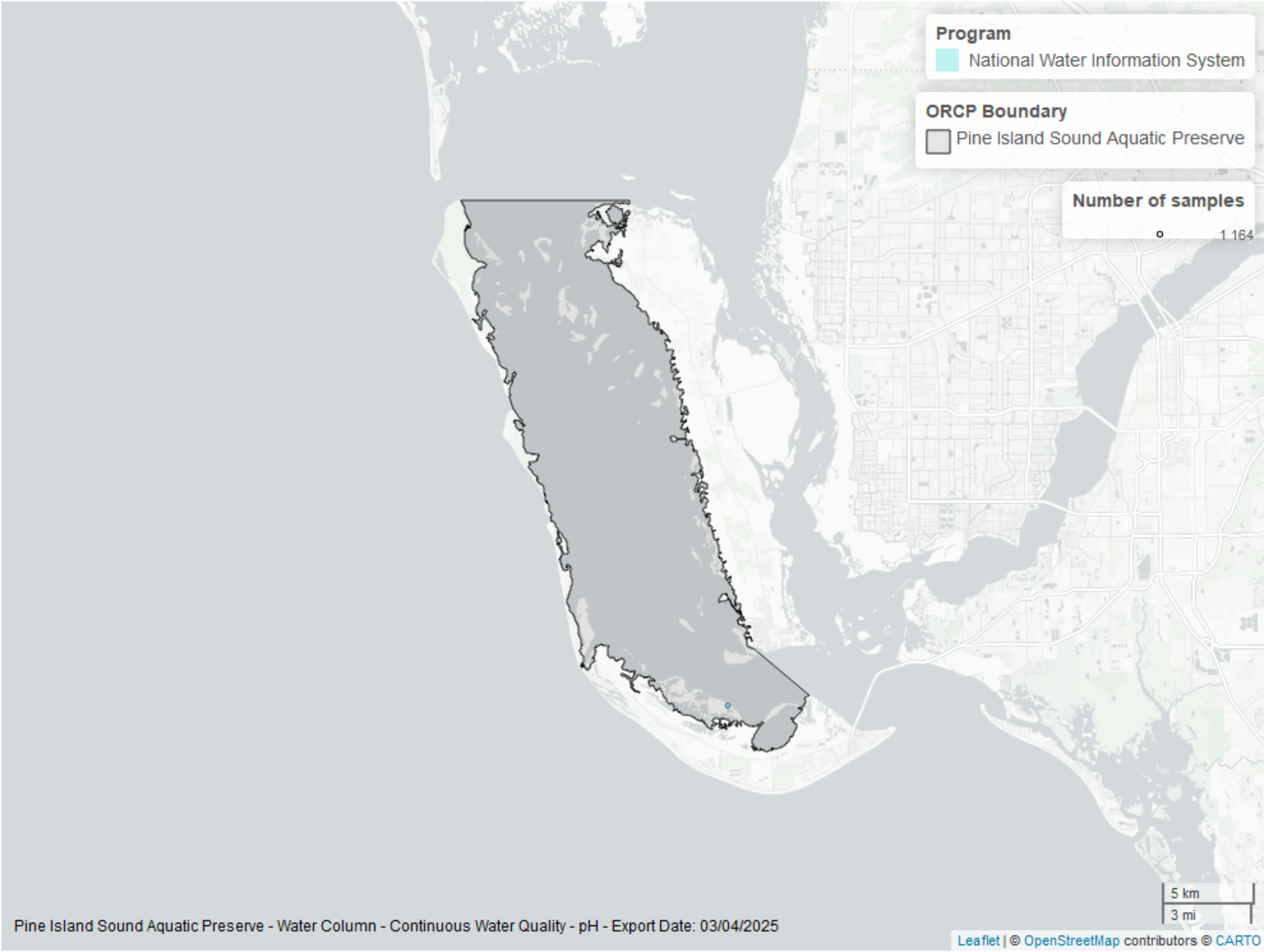

Figure 31: Map showing location of ph continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

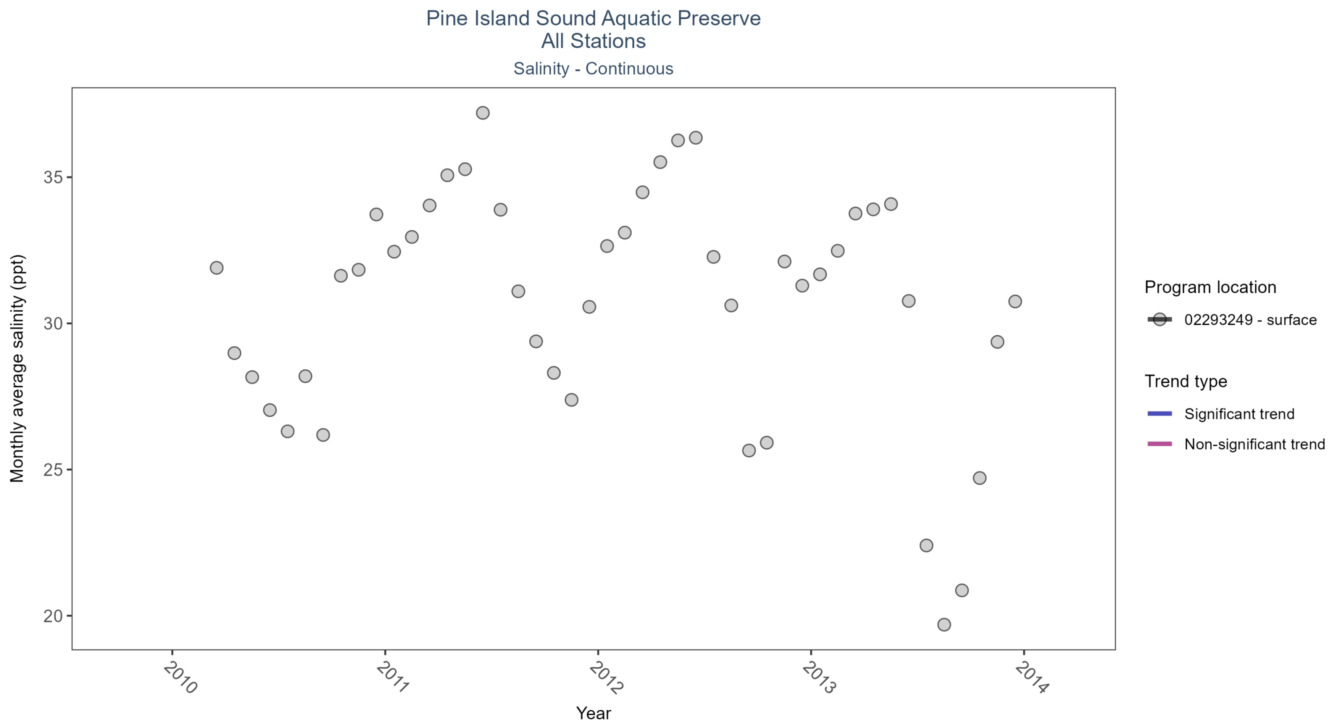

Figure 32: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 35: 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
02293249	Insufficient data to calculate trend	1871	4	2010 - 2013	32	-	-	-	-

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

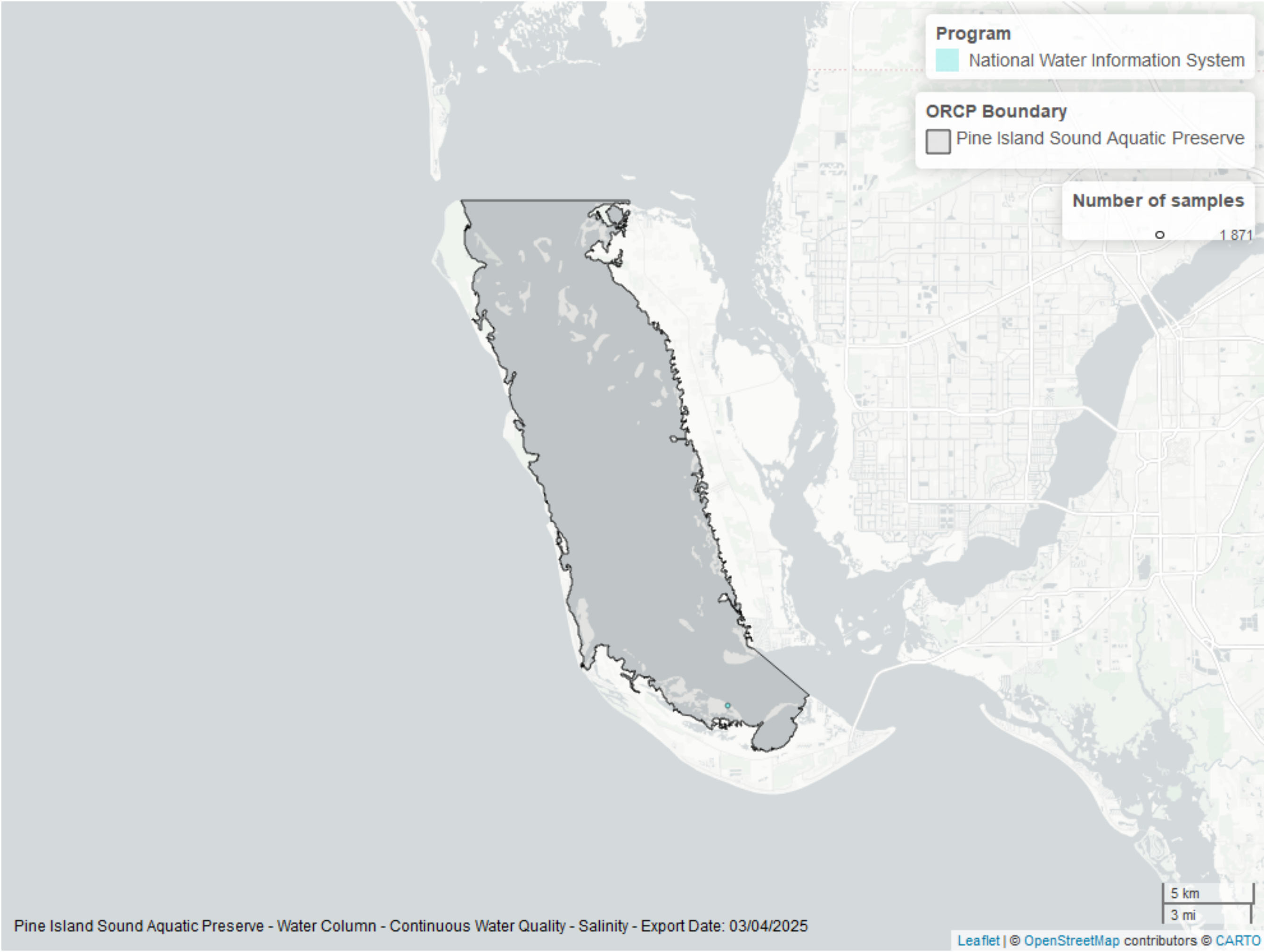

Figure 33: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

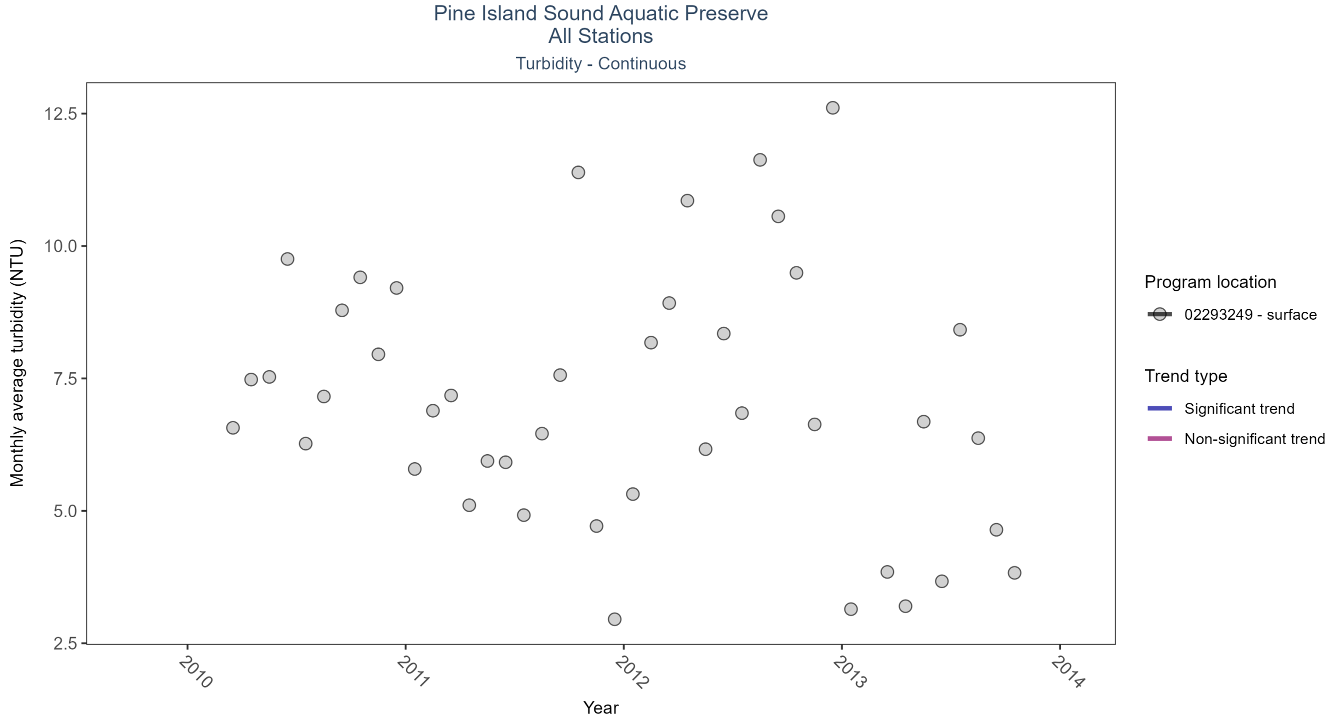

Figure 34: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 36: 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
02293249	Insufficient data to calculate trend	1174	4	2010 - 2013	5.4	-	-	-	-

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

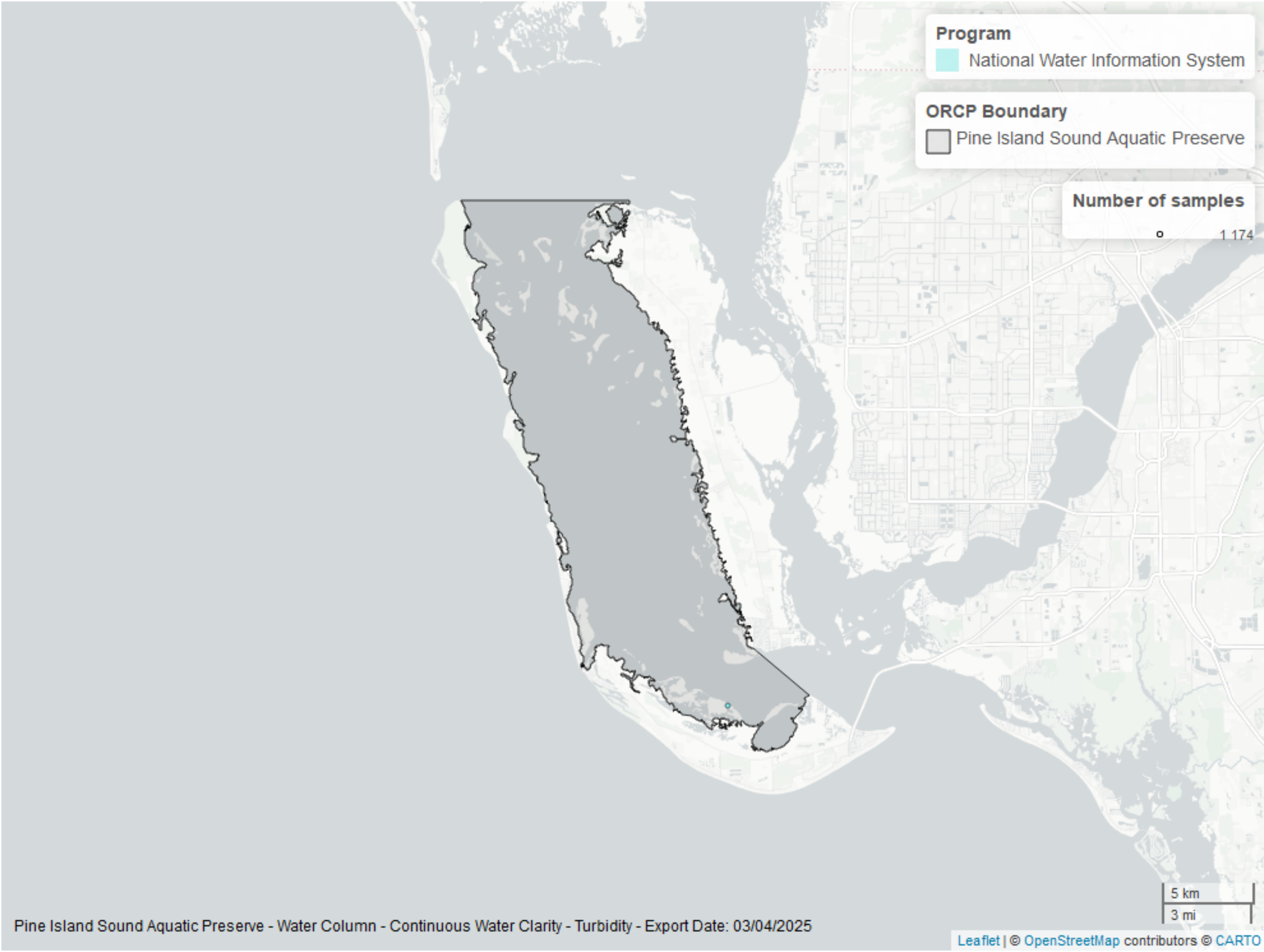

Figure 35: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

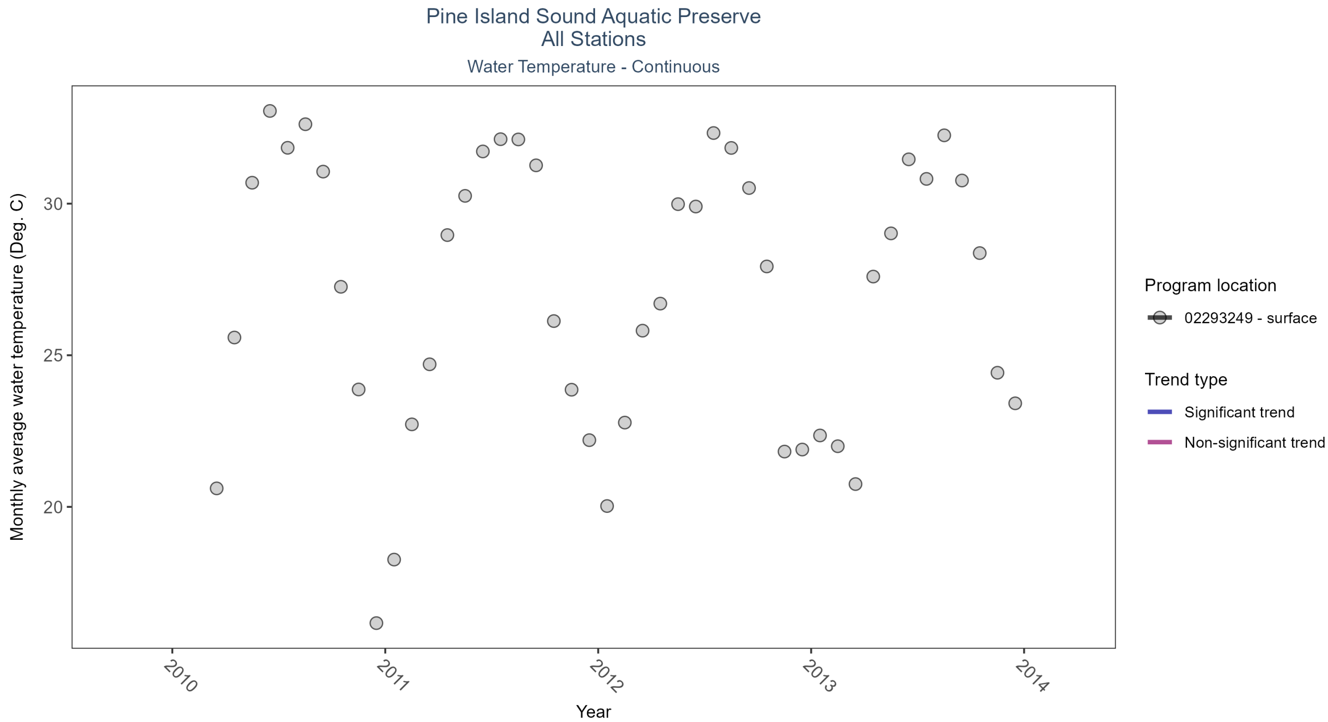

Figure 36: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 37: 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
02293249	Insufficient data to calculate trend	2445	4	2010 - 2013	28.1	-	-	-	-

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

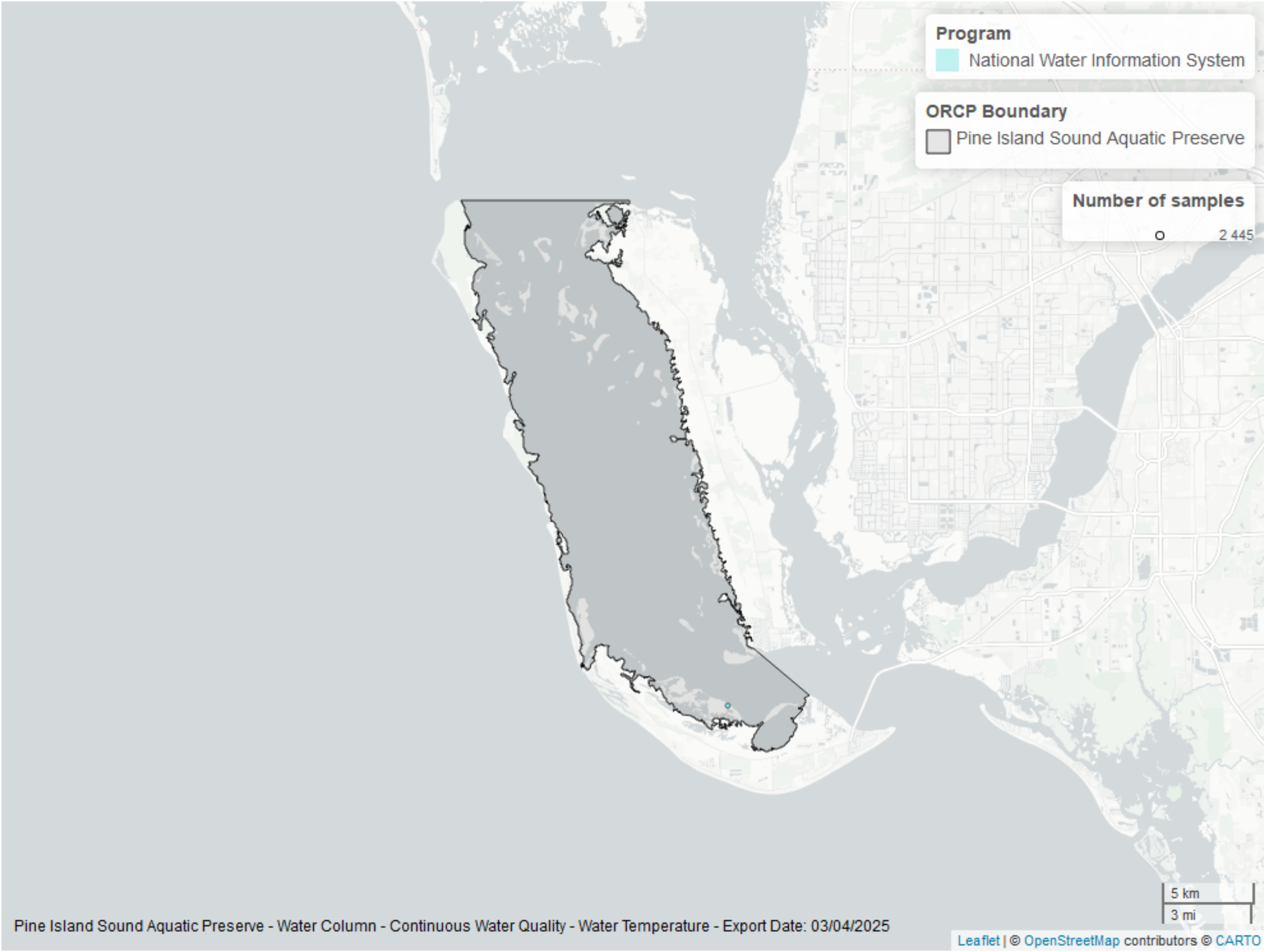

Figure 37: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

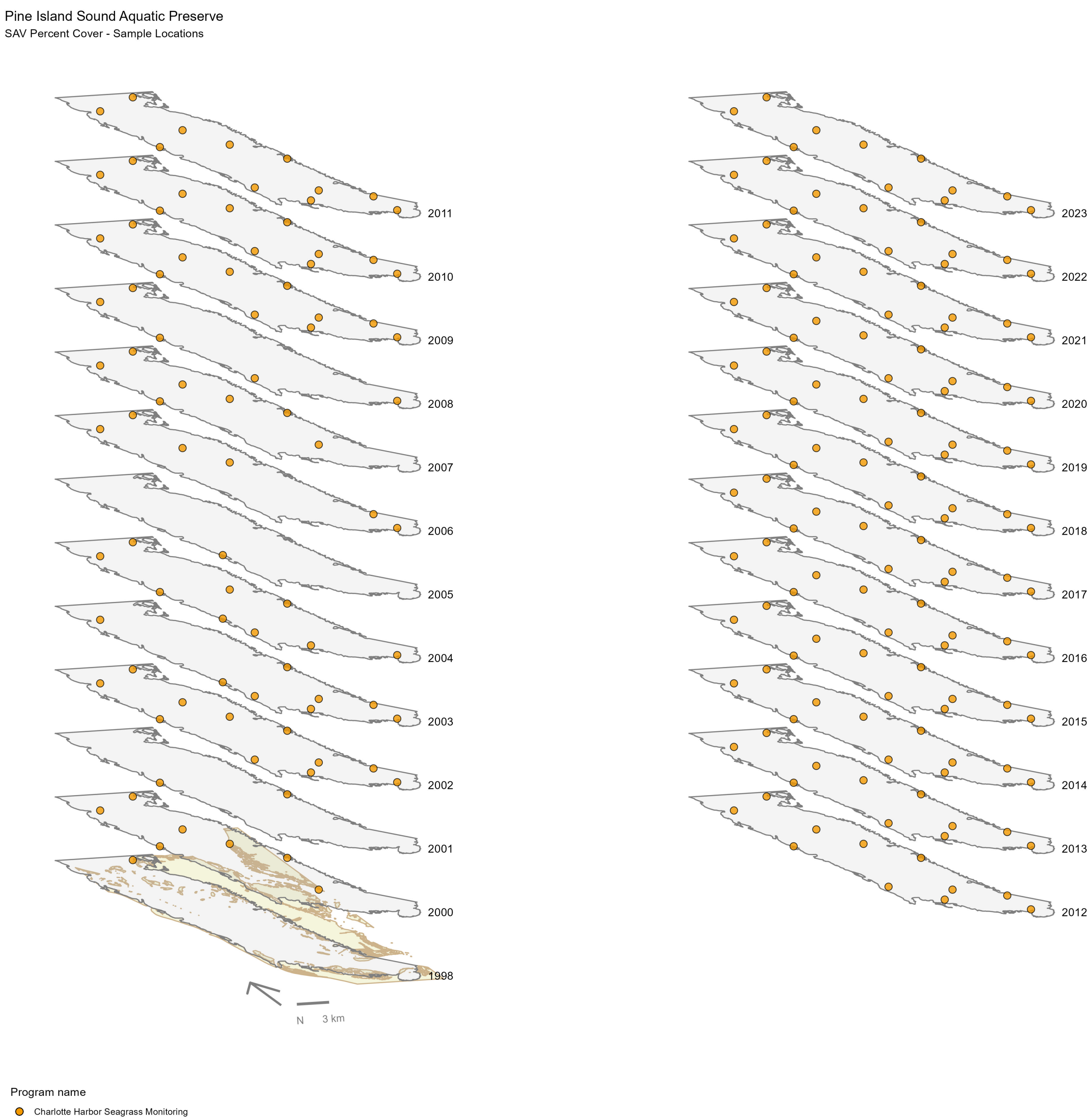

Figure 38: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Pine Island Sound Aquatic Preserve* by Program name.

Click here to view spatio-temporal plots on GitHub.

Sampling locations by Program:

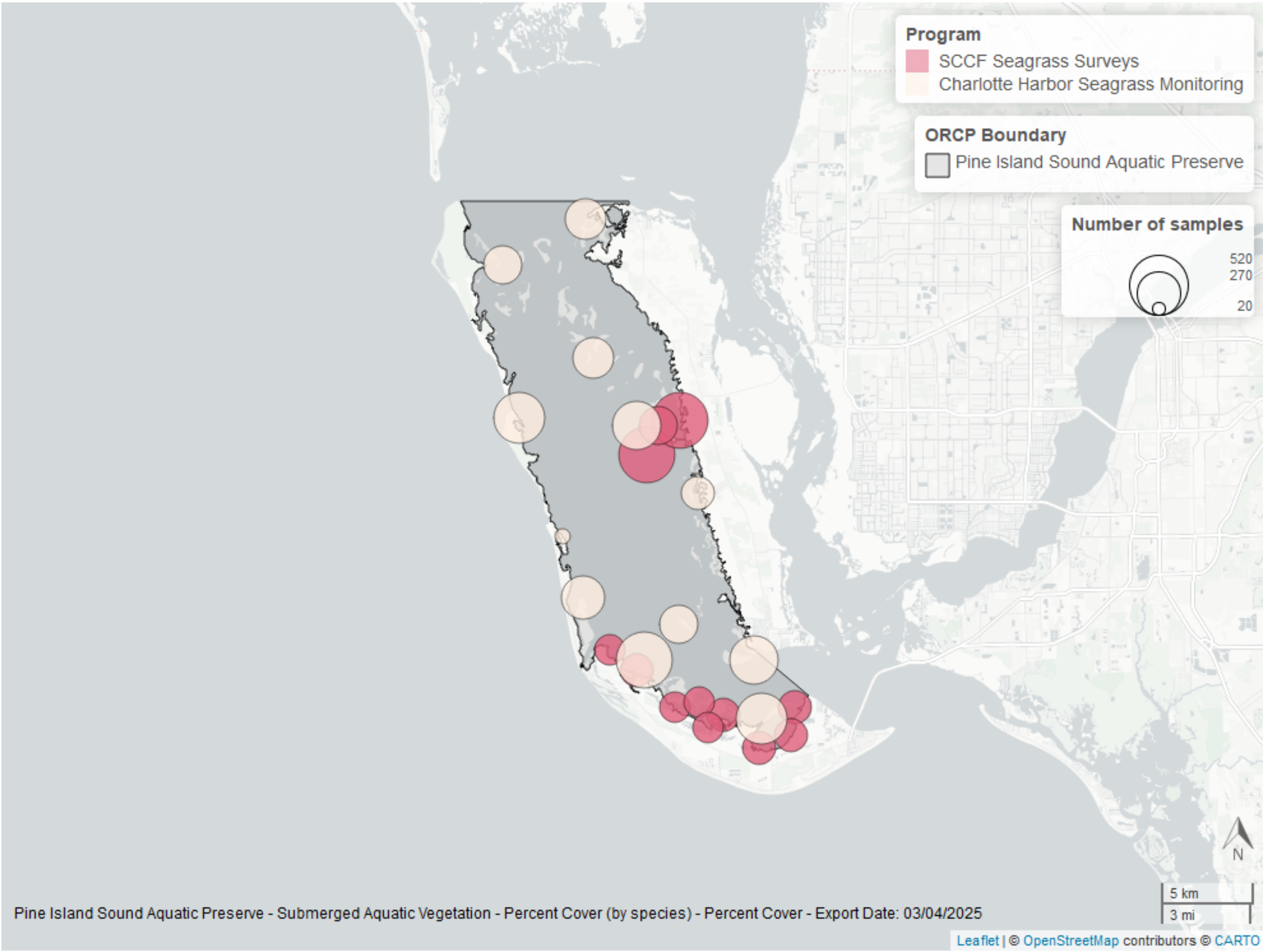

Figure 39: Map showing SAV sampling sites within the boundaries of *Pine Island Sound Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 38: Program Information for Submerged Aquatic Vegetation

ProgramID	*N-Data*	*YearMin*	*YearMax*	*method*	*Sample Locations*
570	3442	1998	2023	Braun Blanquet	12
3015	2639	2010	2022	Percent Occurrence	12

Program names:

570 - Charlotte Harbor Seagrass Monitoring[14]
3015 - SCCF Seagrass Surveys[15]

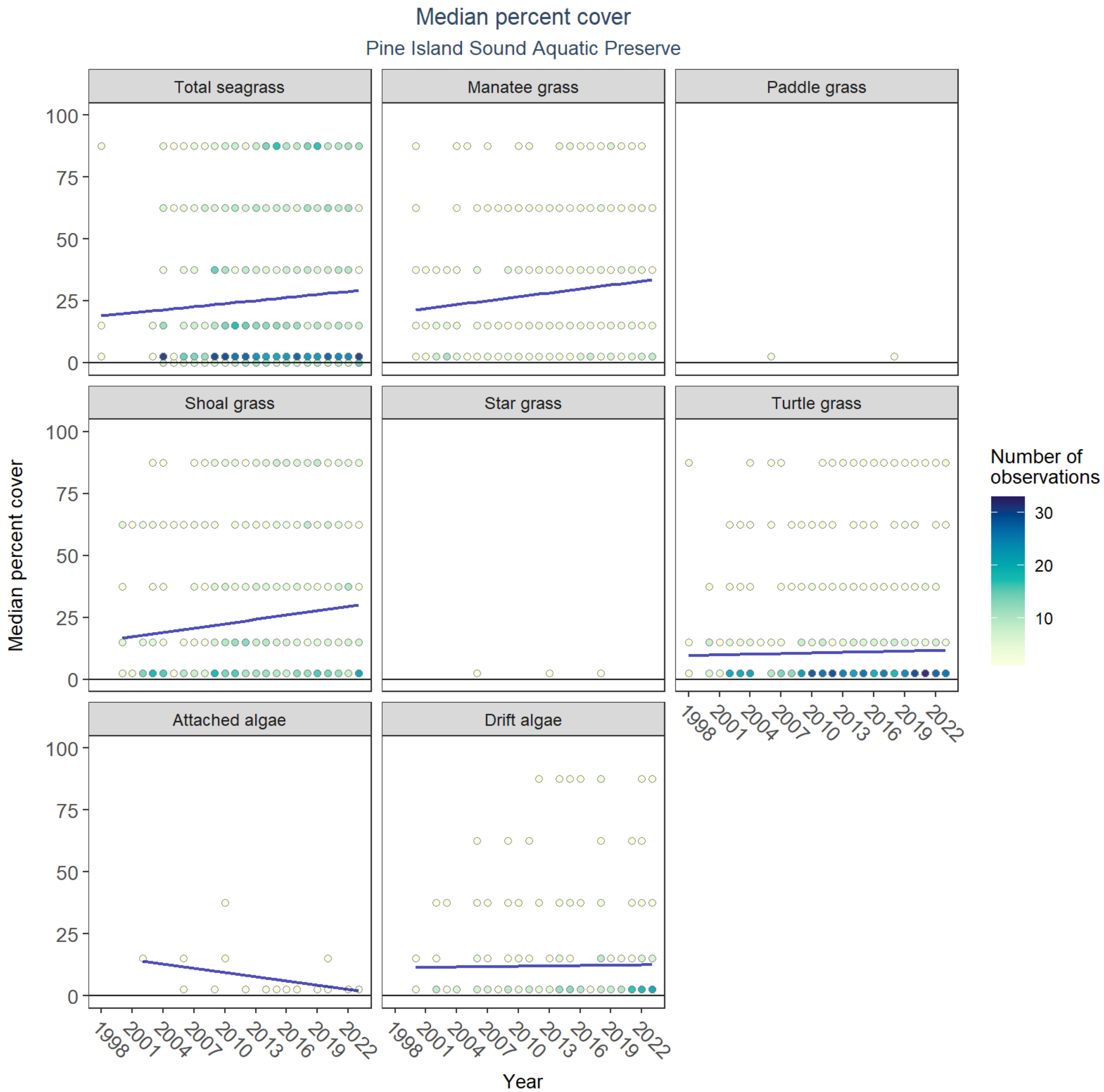

Figure 40: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

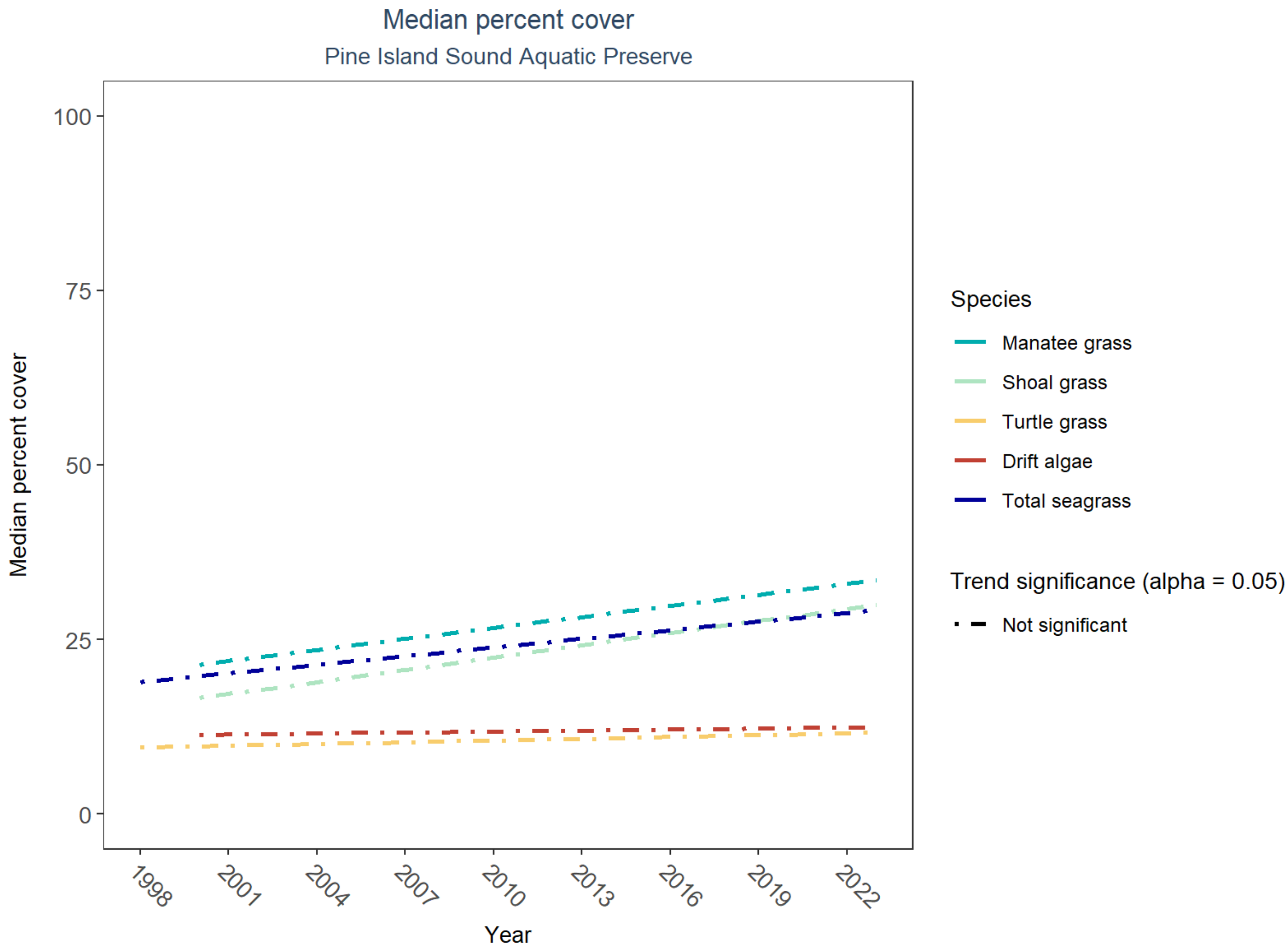

Figure 41: Trends in median percent cover for various seagrass species in Pine Island Sound Aquatic Preserve - simplified

Table 39: Percent Cover Trend Analysis for Pine Island Sound Aquatic Preserve

CommonName	*Trend Significance (0.05)*	*Period of Record*	*LME-Intercept*	*LME-Slope*	*p*
Attached algae	No significant trend	2002 - 2023	18.485846	-0.5710769	0.0671357
Drift algae	No significant trend	2000 - 2023	11.096231	0.0470731	0.7978636
Shoal grass	No significant trend	2000 - 2023	13.102894	0.5825778	0.1485287
Paddle grass	Insufficient data to calculate trend	-	-	-	-
Star grass	Insufficient data to calculate trend	-	-	-	-
No grass in quadrat	Model did not fit the available data	2002 - 2023	-	-	-
Widgeon grass	Insufficient data to calculate trend	-	-	-	-
Manatee grass	No significant trend	2000 - 2023	18.247343	0.5266455	0.1271798
Turtle grass	No significant trend	1998 - 2023	9.207814	0.0844146	0.5408324
Total seagrass	No significant trend	1998 - 2023	17.265665	0.4130112	0.2023720

Total seagrass, manatee grass, shoal grass, turtle grass, attached algae, and drift algae showed no detectable change in percent cover. Trends in percent cover could not be evaluated for paddle grass, star grass, and widgeon grass due to insufficient data.

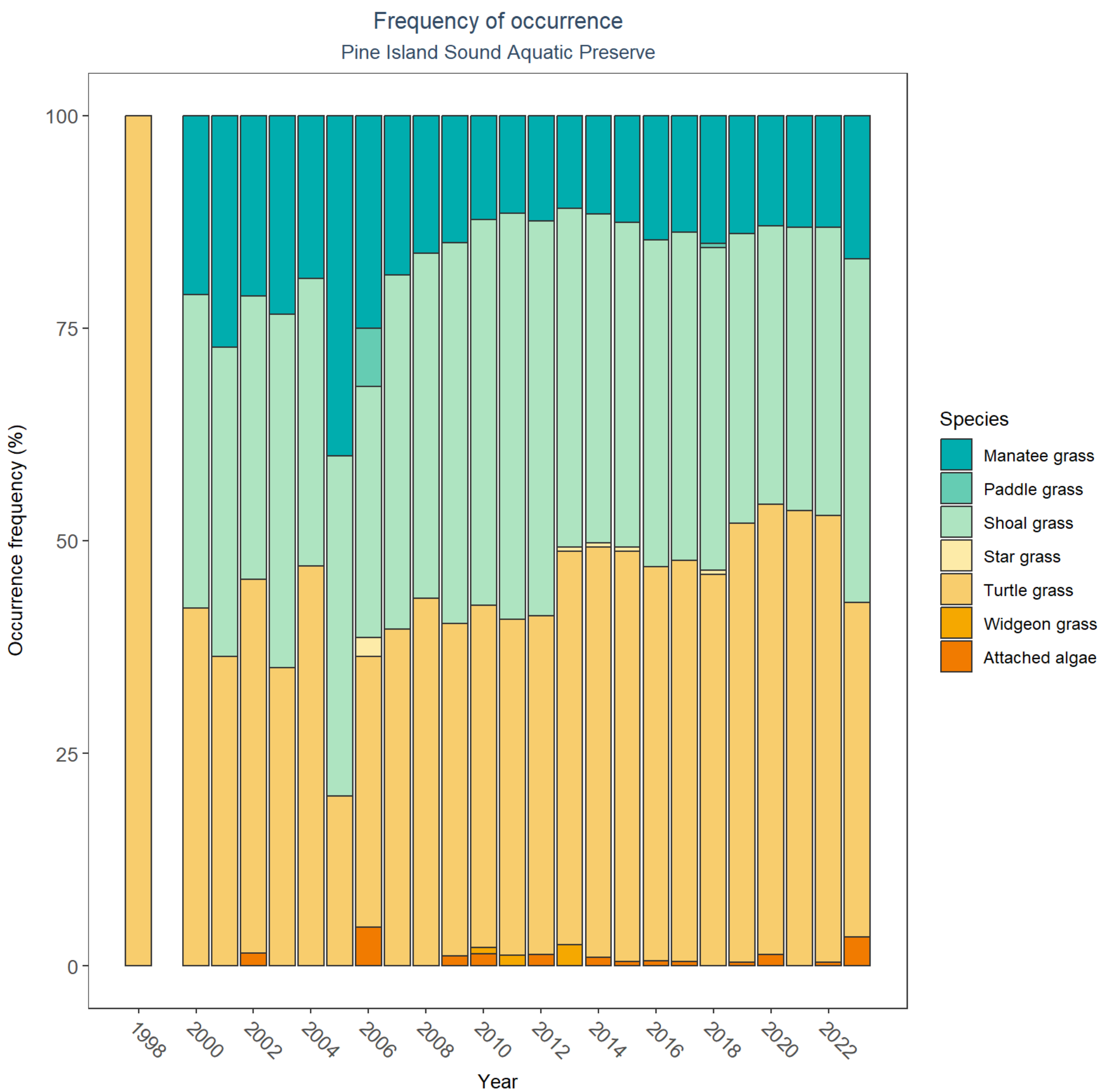

Figure 42: Frequency of occurrence for various seagrass species in Pine Island Sound Aquatic Preserve

Coastal Wetlands

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

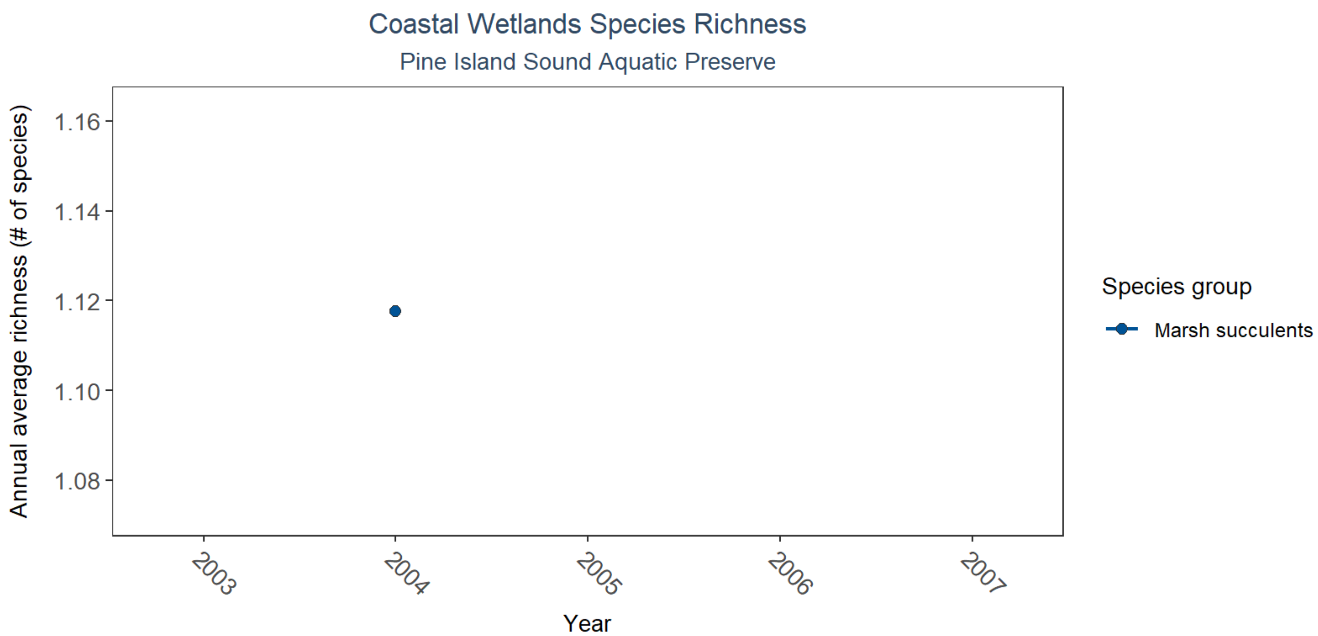

Figure 43: Line graph of annual average coastal wetlands species richness over time for mangroves and associates (triangles), marsh (squares), and marsh succulents (circles). If the time series by species group included more than one year of observations, a line connects data points for visualization.

Table 40: Coastal Wetlands Species Richness

Species Group	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Marsh succulents	17	1	2004 - 2004	1	1.12

In the year 2004, 1 species were observed for *marsh succulents* based on 17 observations.

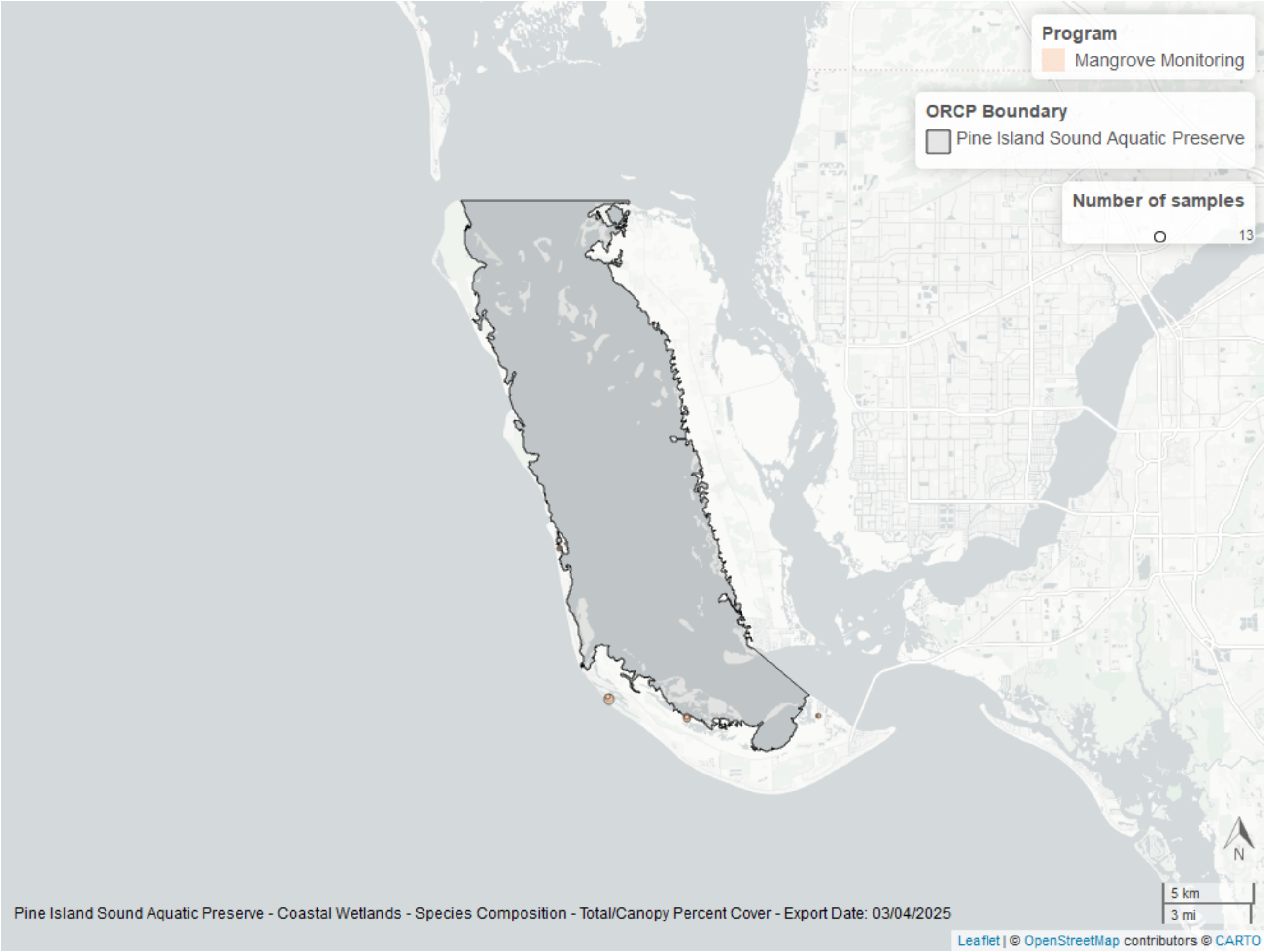

Figure 44: Map showing location of coastal wetlands sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Oyster

The data file used is: **All_OYSTER_Parameters-2025-Apr-24.txt**

Density

Natural

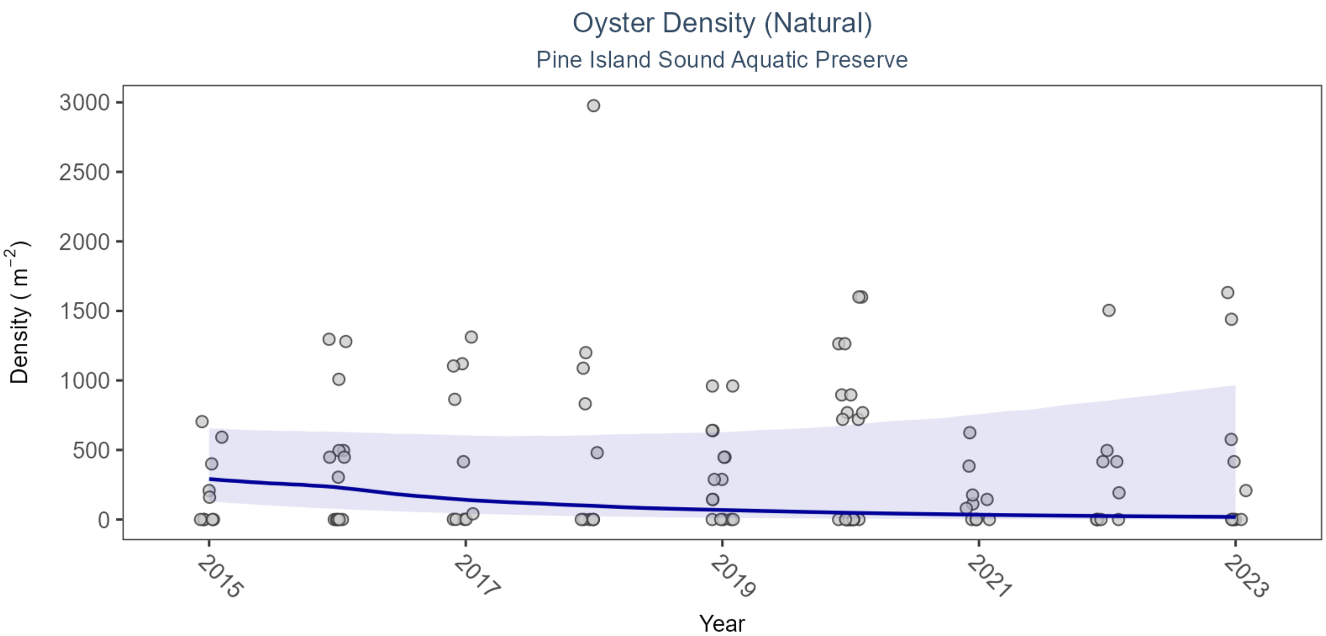

Figure 45: Scatter plot of oyster density over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 41: Model results for Oyster Density - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Natural	No significant change	-4.89	334.78	-16.24 to 43.13

For natural reefs, density decreased by an average of 4.89 oysters per square meter per year. For restored reefs, density decreased by an average of 214.22 oysters per square meter per year.

Restored

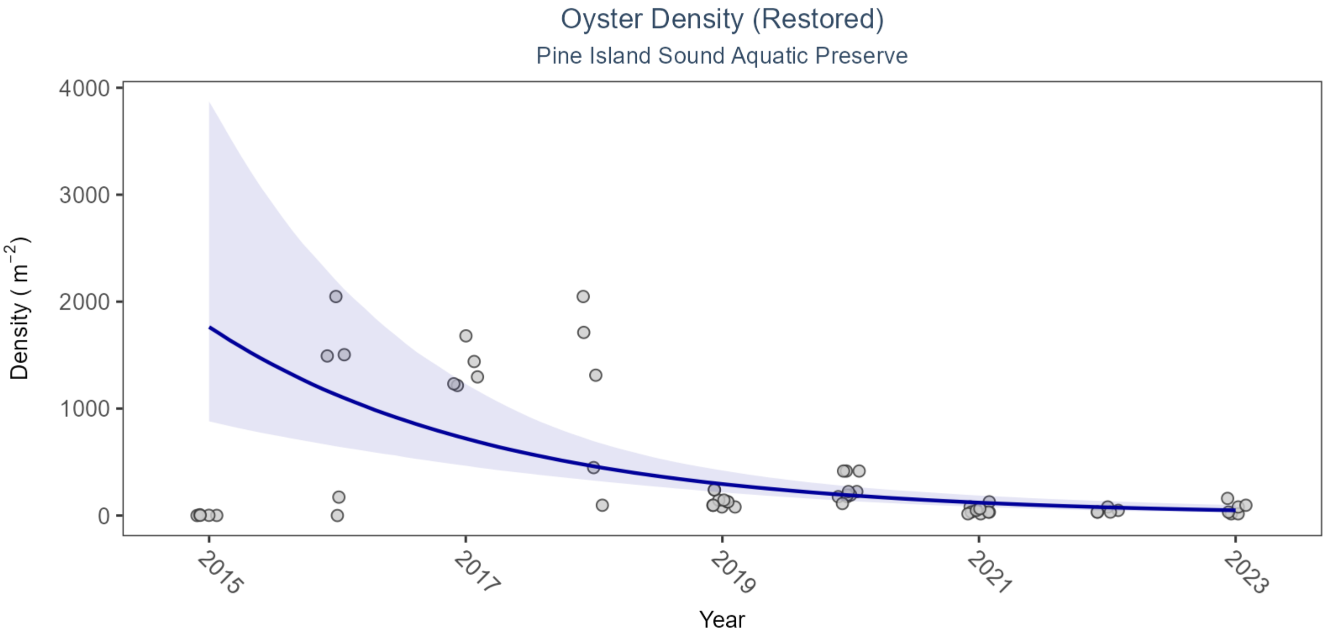

Figure 46: Scatter plot of oyster density over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 42: Model results for Oyster Density - Restored

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Restored	Significantly decreasing trend	-214.22	128.39	-106.83 to -471.59

For natural reefs, density decreased by an average of 4.89 oysters per square meter per year. For restored reefs, density decreased by an average of 214.22 oysters per square meter per year.

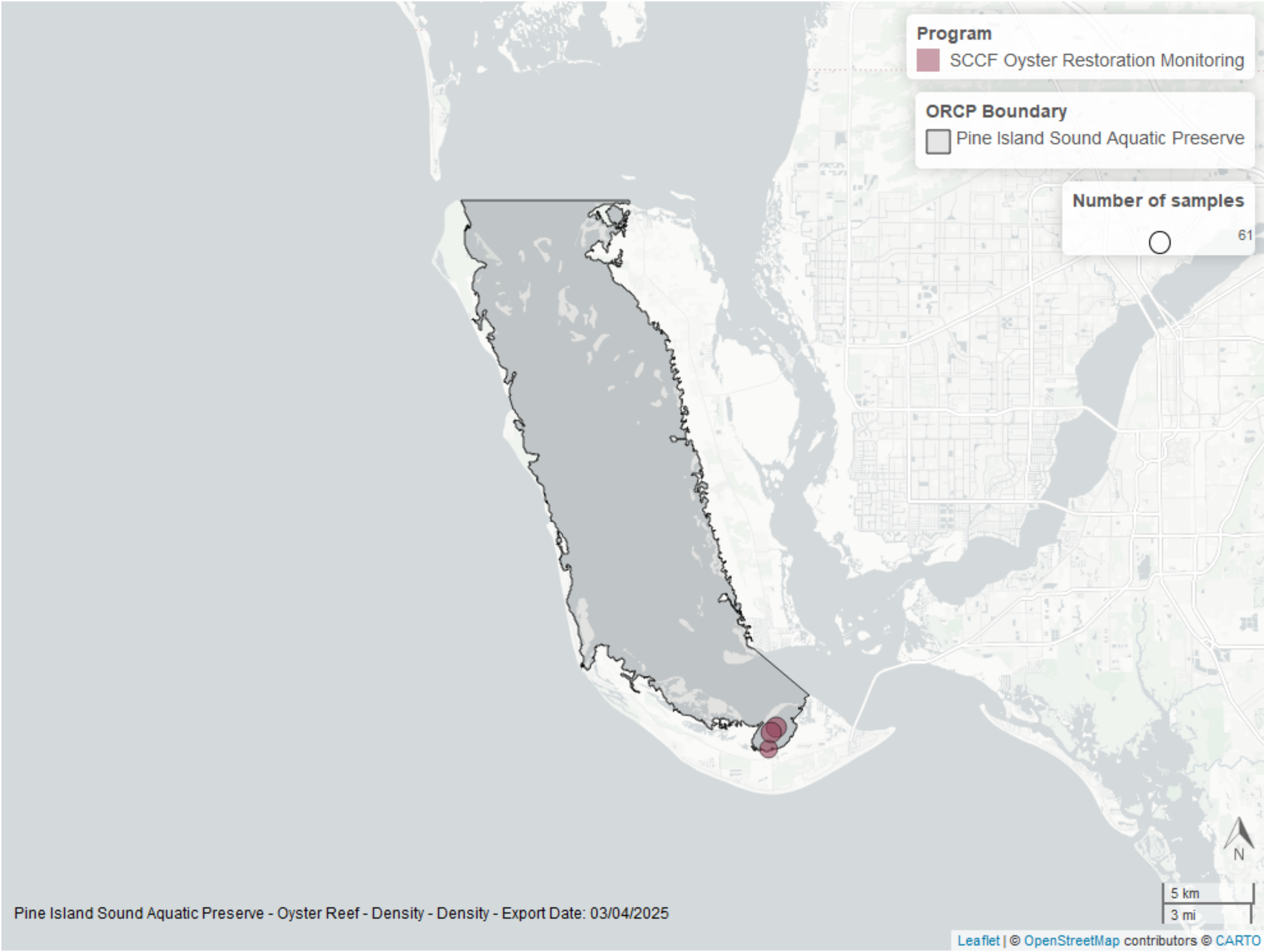

Figure 47: Map showing location of oyster density sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Percent Live

Natural

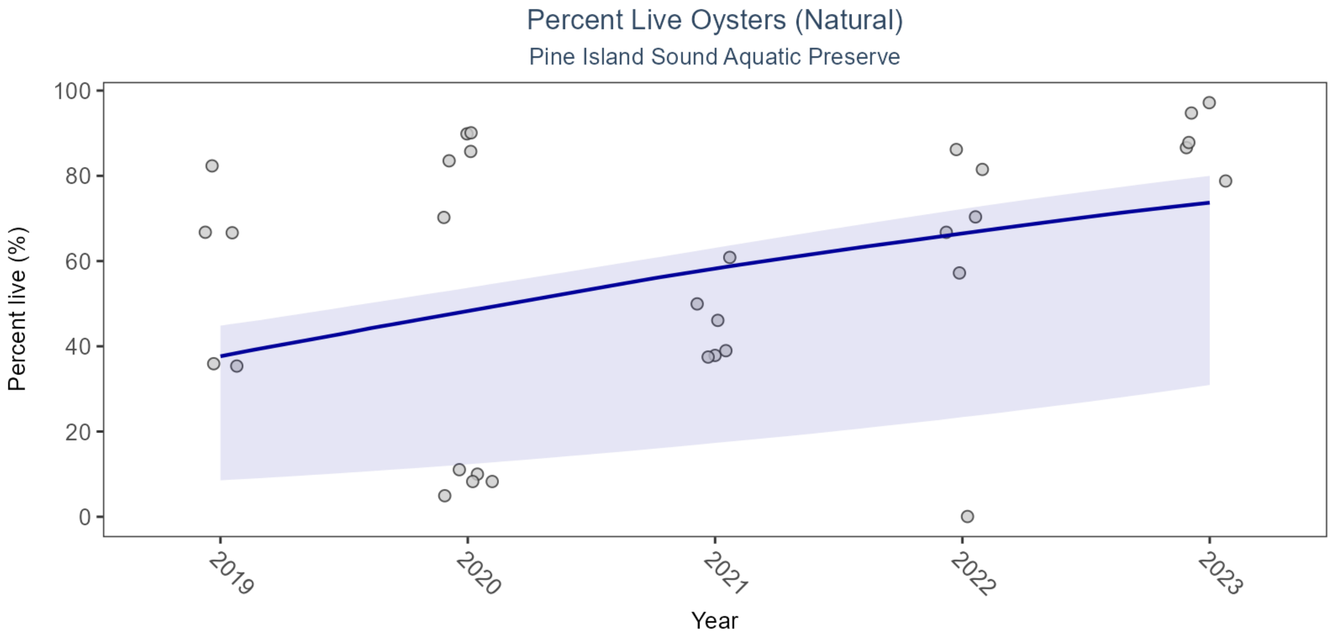

Figure 48: Scatter plot of percent live oysters over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 43: Model results for Oyster Percent Live - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Natural	Significantly increasing trend	8.98	6.04	5.73 to 8.78

For natural reefs, percent live cover increased by an average of 8.98% per year. For restored reefs, percent live cover increased by an average of 3.77% per year.

Restored

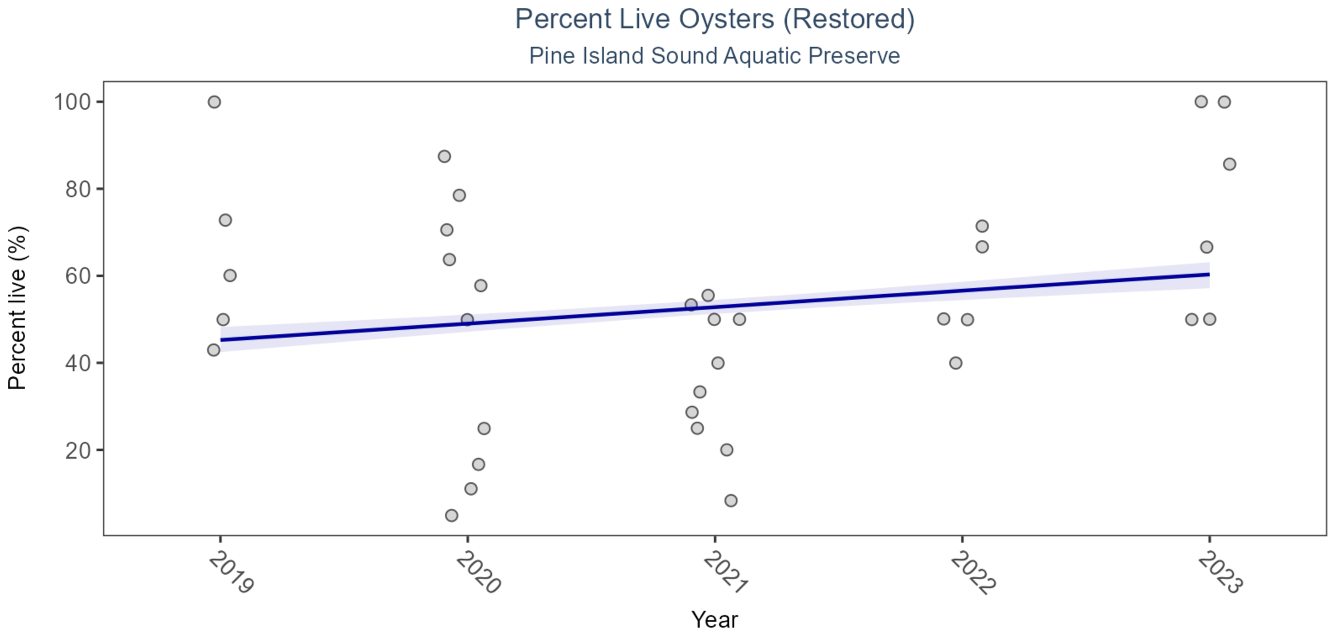

Figure 49: Scatter plot of percent live oysters over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 44: Model results for Oyster Percent Live - Restored

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Restored	Significantly increasing trend	3.77	1.1	3.67 to 3.72

For natural reefs, percent live cover increased by an average of 8.98% per year. For restored reefs, percent live cover increased by an average of 3.77% per year.

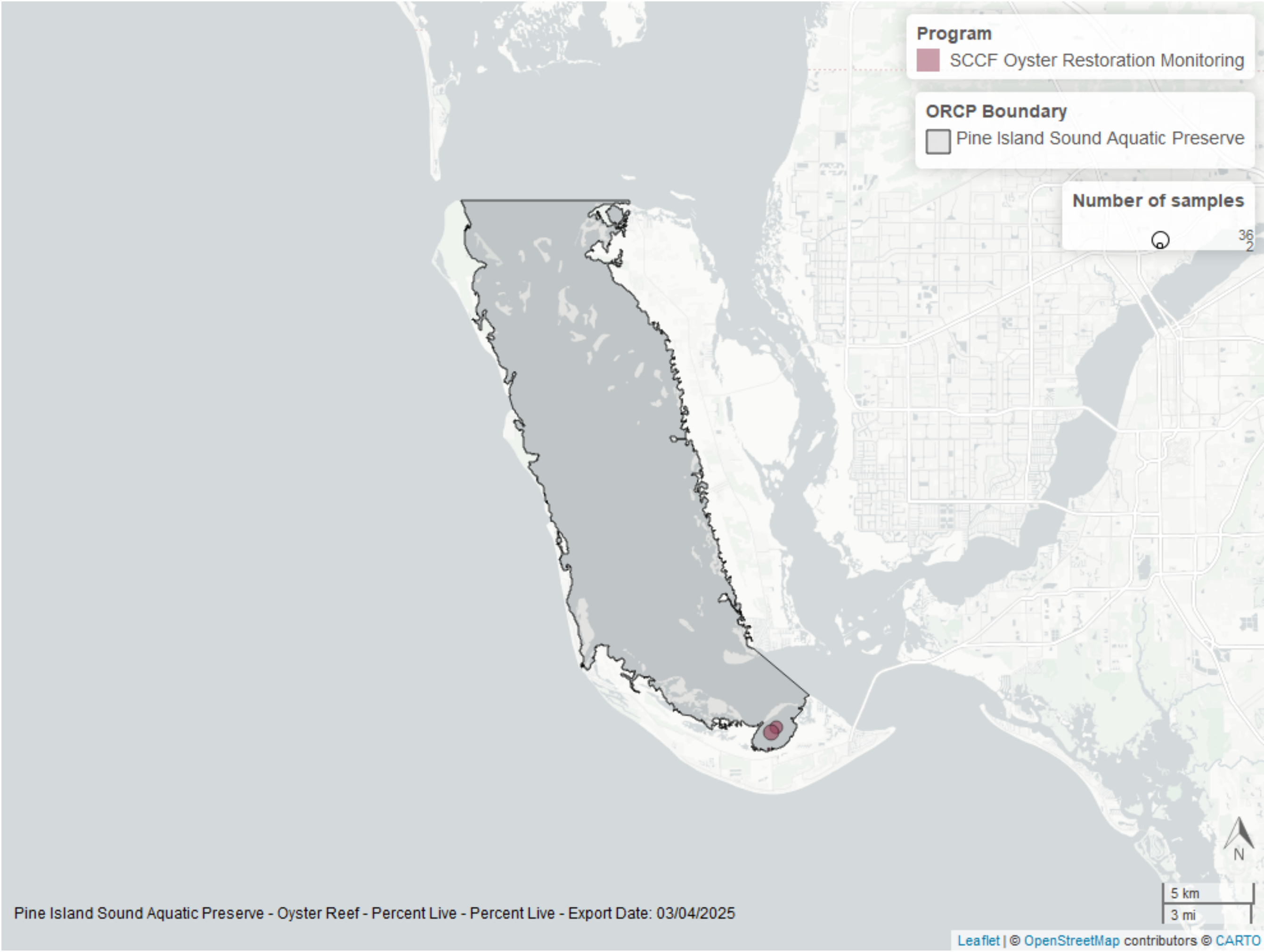

Figure 50: Map showing location of oyster percent live sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Shell Height

Natural

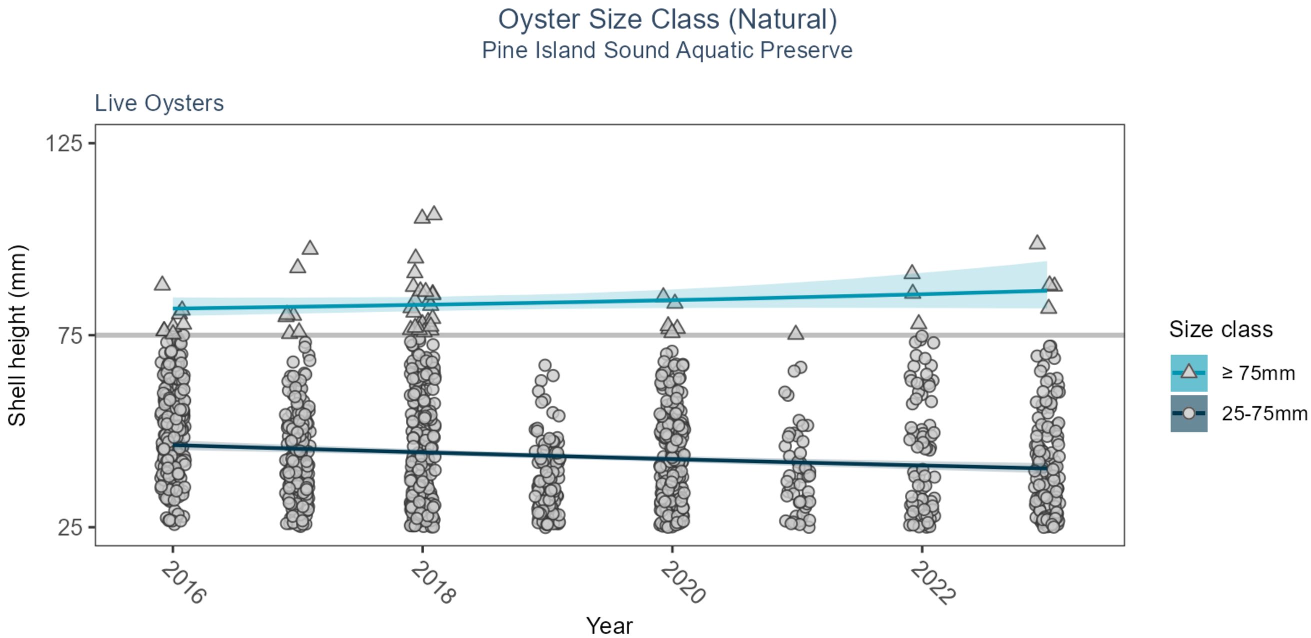

Table 45: Model results for Oyster Shell Height - Natural

Shell Type	*SizeClass*	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	>75mm	Natural	No significant change	2.37	2.01	-1.18 to 6.83
Live Oysters	25-75mm	Natural	Significantly decreasing trend	-3.88	1.12	-6.54 to -2.14
Live Oysters		Natural	-	-	-	-

For natural reefs, annual average live oyster shell height in the >=75mm size class increased by 2.37mm per year, and it decreased by 3.88mm per year in the 25-75mm size class. For restored reefs, annual average live oyster shell height in the >=75mm size class increased by 10.38mm per year, and it decreased by 8.81mm per year in the 25-75mm size class.

Restored

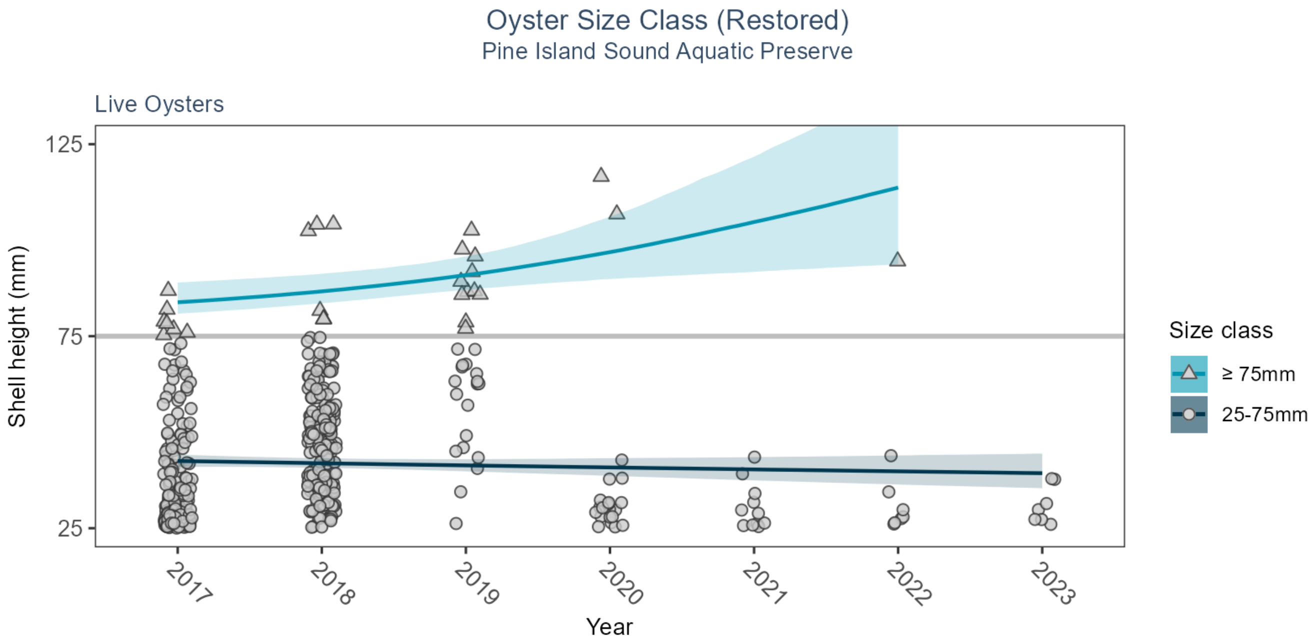

Table 46: Model results for Oyster Shell Height - Restored

Shell Type	*SizeClass*	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	>75mm	Restored	Significantly increasing trend	10.38	4.62	3.05 to 21.32
Live Oysters	25-75mm	Restored	No significant change	-8.81	10.55	-34.64 to 6.17
Live Oysters		Restored	-	-	-	-

For natural reefs, annual average live oyster shell height in the >=75mm size class increased by 2.37mm per year, and it decreased by 3.88mm per year in the 25-75mm size class. For restored reefs, annual average live oyster shell height in the >=75mm size class increased by 10.38mm per year, and it decreased by 8.81mm per year in the 25-75mm size class.

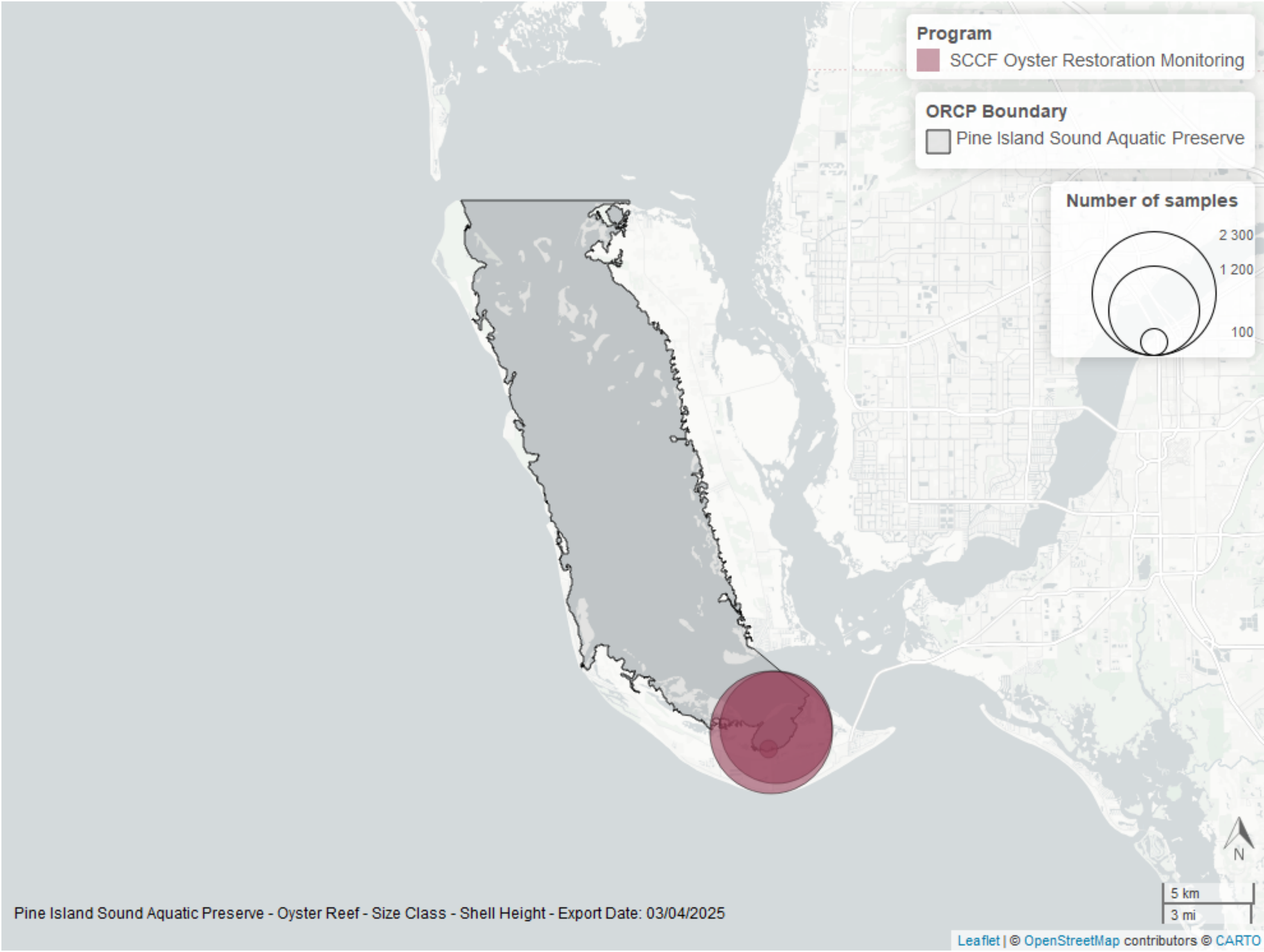

Figure 51: Map showing location of oyster shell height sampling locations within the boundaries of *Pine Island Sound Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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