Nassau River-St. Johns River Marshes Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 08 October, 2025

Contents

Funding & Acknowledgements

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Threshold Filtering

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

Table 1: Continuous Water Quality threshold values

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Dissolved Oxygen	mg/L	-0.000001	50
Dissolved Oxygen Saturation	%	-0.000001	500
Salinity	ppt	-0.000001	70
Turbidity	NTU	-0.000001	4000
Water Temperature	Degrees C	-5.000000	45
pH	None	2.000000	14

Table 2: Discrete Water Quality threshold values

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Ammonia, Un-ionized (NH3)	mg/L	-	-
Ammonium, Filtered (NH4)	mg/L	-	-
Chlorophyll a, Corrected for Pheophytin	ug/L	-	-
Chlorophyll a, Uncorrected for Pheophytin	ug/L	-	-
Colored Dissolved Organic Matter	PCU	-	-

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Dissolved Oxygen	mg/L	-0.000001	25
Dissolved Oxygen Saturation	%	-0.000001	310
Fluorescent Dissolved Organic Matter	QSE	-	-
Light Extinction Coefficient	mˆ-1	-	-
NO2+3, Filtered	mg/L	-	-
Nitrate (NO3)	mg/L	-	-
Nitrite (NO2)	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO4)	mg/L	-	-
Salinity	ppt	-0.000001	70
Secchi Depth	m	0.000001	50
Specific Conductivity	mS/cm	0.005000	100
Total Kjeldahl Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Phosphorus	mg/L	-	-
Total Suspended Solids	mg/L	-	-
Turbidity	NTU	-	-
Water Temperature	Degrees C	3.000000	40
pH	None	2.000000	13

Table 3: Quality Assurance Flags inserted based on threshold checks listed in Table 1 and 2

SEACAR QAQC Description	*Include*	*SEACAR QAQCFlagCode*
Exceeds maximum threshold	0	2Q
Below minimum threshold	0	4Q
Within threshold tolerance	1	6Q
No defined thresholds for this parameter	1	7Q

Value Qualifiers

Value qualifier codes included within the data are used to exclude certain results from the analysis. The data are retained in the data export files, but the analysis uses the *Include* column to filter the results.

STORET and WIN value qualifier codes

Value qualifier codes from *STORET* and *WIN* data are examined with the database and used to populate the *Include* column in data exports.

Table 4: Value Qualifier codes excluded from analysis

Qualifier Source	*Value Qualifier*	*Include*	*MDL*	*Description*
STORET-WIN	H	0	0	Value based on field kit determination; results may not be accurate
STORET-WIN	J	0	0	Estimated value
STORET-WIN	V	0	0	Analyte was detected at or above method detection limit
STORET-WIN	Y	0	0	Lab analysis from an improperly preserved sample; data may be inaccurate

Discrete Water Quality Value Qualifiers

The following value qualifiers are highlighted in the Discrete Water Quality section of this report. An exception is made for **Program 476** - *Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network* and data flagged with Value Qualifier **H** are included for this program only.

H - Value based on field kit determiniation; results may not be accurate. This code shall be used if a field screening test (e.g., field gas chromatograph data, immunoassay, or vendor-supplied field kit) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.

I - The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.

Q - Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

S - Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.

U - Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported

Systemwide Monitoring Program (SWMP) value qualifier codes

Value qualifier codes from the *SWMP* continuous program are examined with the database and used to populate the *Include* column in data exports. *SWMP* Qualifier Codes are indicated by *QualifierSource=SWMP*.

Table 5: SWMP Value Qualifier codes

Qualifier Source	*Value Qualifier*	*Include*	*Description*
SWMP	-1	1	Optional parameter not collected
SWMP	-2	0	Missing data
SWMP	-3	0	Data rejected due to QA/QC
SWMP	-4	0	Outside low sensor range
SWMP	-5	0	Outside high sensor range
SWMP	0	1	Passed initial QA/QC checks
SWMP	1	0	Suspect data
SWMP	2	1	Reserved for future use
SWMP	3	1	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	1	Historical: Pre-auto QA/QC
SWMP	5	1	Corrected data

Water Column

The water column habitat extends from the water's surface to the bottom sediments, and it's where fish, dolphins, crabs and people swim! So much life makes its home in the water column that the health of marine and coastal ecosystems, as well as human economies, depend on the condition of this vulnerable habitat. Local patterns of rainfall, temperature, winds and currents can rapidly change the condition of the water column, while global influences such as El Niño/La Niña, large-scale fluctuation in sea temperatures and climate change can have long-term effects. Inputs from the prosperity of our day-to-day lives including farming, mining and forestry, and emissions from power generation, automobiles and water treatment can also alter the health of the water column. Acting alone or together, each input can have complex and lasting effects on habitats and ecosystems.

SEACAR evaluates water column health with several essential parameters. These include nutrient surveys of nitrogen and phosphorus, and water quality assessments of salinity, dissolved oxygen, pH, and water temperature. Water clarity is evaluated with Secchi depth, turbidity, levels of chlorophyll a, total suspended solids, and colored dissolved organic matter. Additionally, the richness of nekton is indicated by the abundance of free-swimming fishes and macroinvertebrates like crabs and shrimps.

Seasonal Kendall-Tau Analysis

Indicators must have a minimum of five to ten years, depending on the habitat, of data within the geographic range of the analysis to be included in the analysis. Ten years of data are required for discrete parameters, and five years of data are required for continuous parameters. If there are insufficient years of data, the number of years of data available will be noted and labeled as "insufficient data to conduct analysis". Further, for the preferred Seasonal Kendall-Tau test, there must be data from at least two months in common across at least two consecutive years within the RCP managed area being analyzed. Values that pass both of these tests will be included in the analysis and be labeled as *Use_In_Analysis* = **TRUE**. Any that fail either test will be excluded from the analyses and labeled as *Use_In_Analysis* = **FALSE**. The points for all Water Column plots displayed in this section are monthly averages. Trend significance will be denoted as "Significant Trend" (when $p < 0.05$), or "Non-significant Trend" (when $p >= 0.05$). Any parameters with insufficient data to perform Seasonal Kendall-Tau test will have their monthly averages plotted without a corresponding trend line.

Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_pH-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Salinity-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Turbidity-2025-Sep-04.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2025-Sep-04.txt*

Chlorophyll a, Corrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

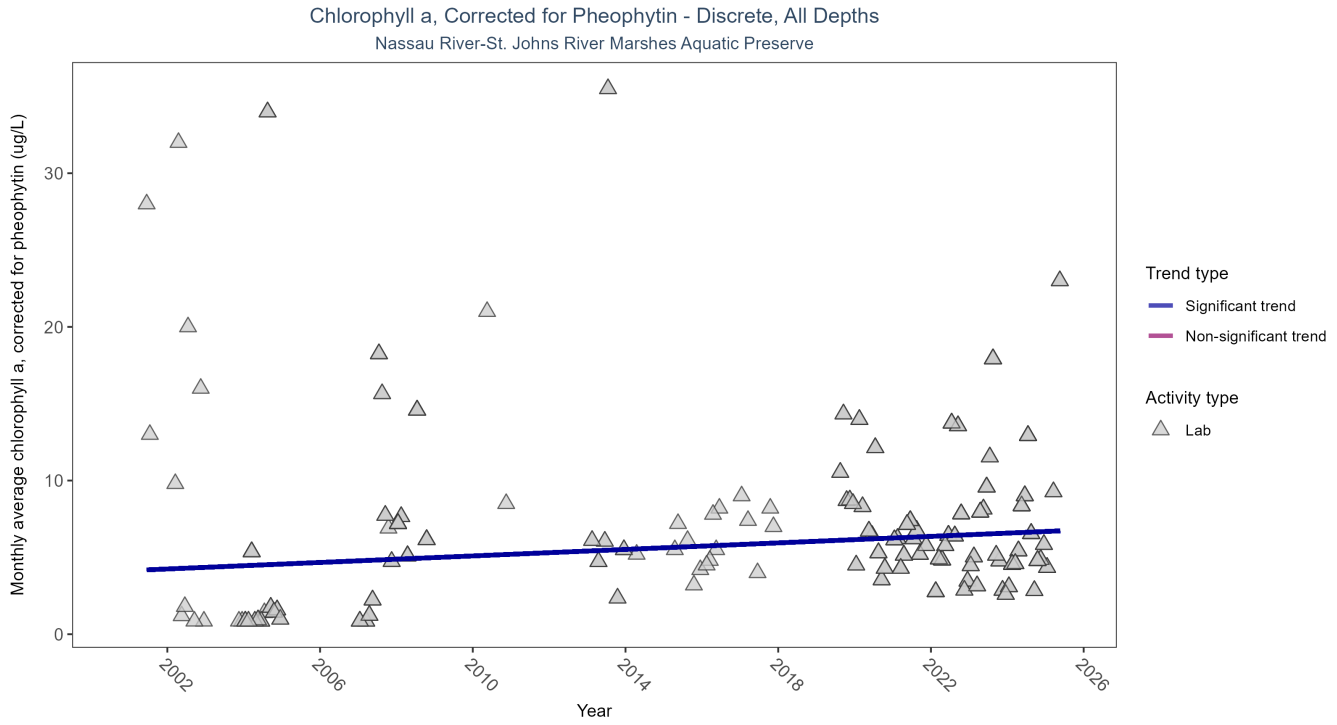

Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles)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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	699	19	2001 - 2025	5.7	0.1302	4.1393	0.1061	0.0473

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.11 µg/L per year, indicating a decrease in water clarity.

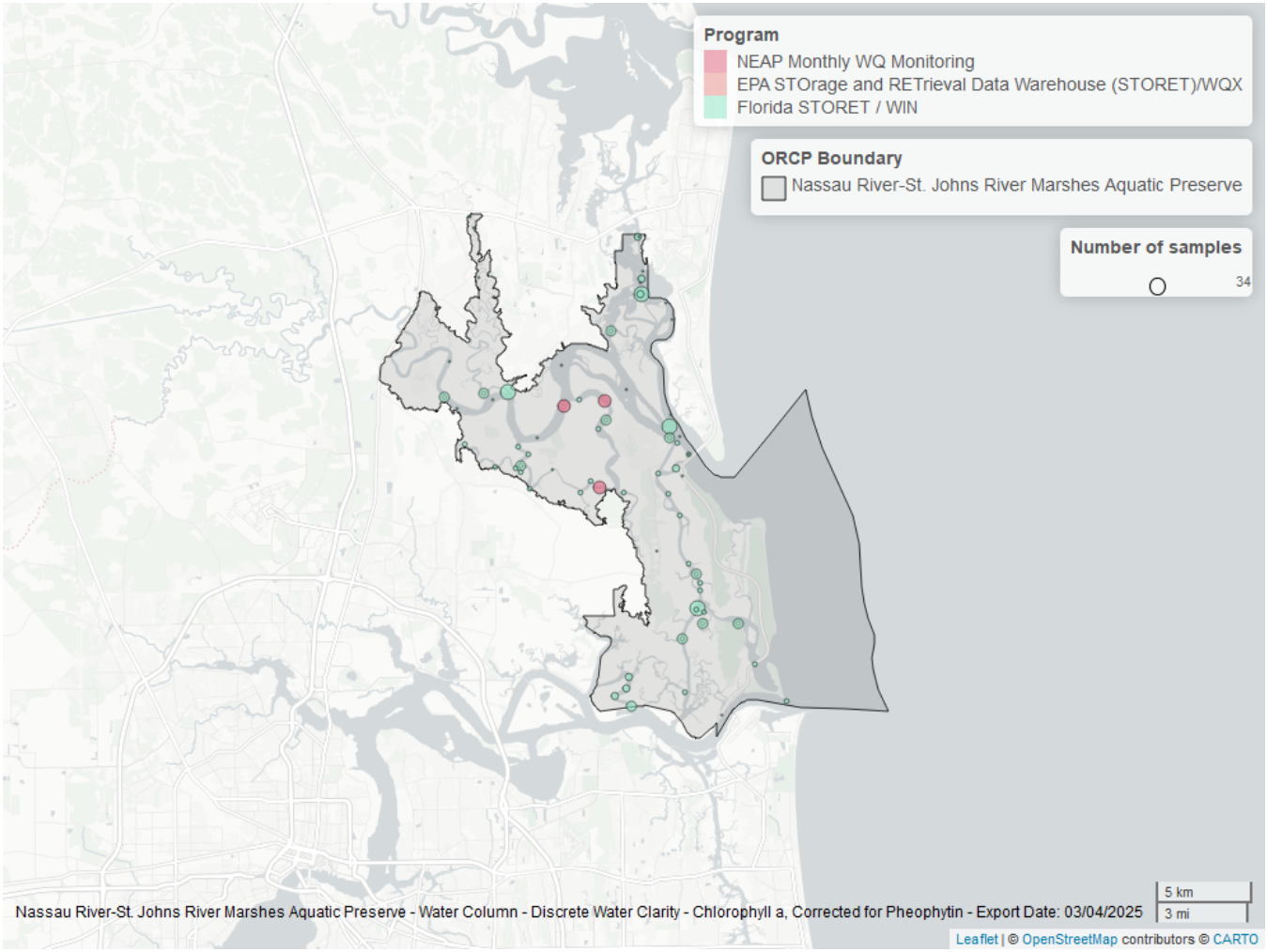

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	638	2001	2025
5016	81	2019	2025

Program names:

5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

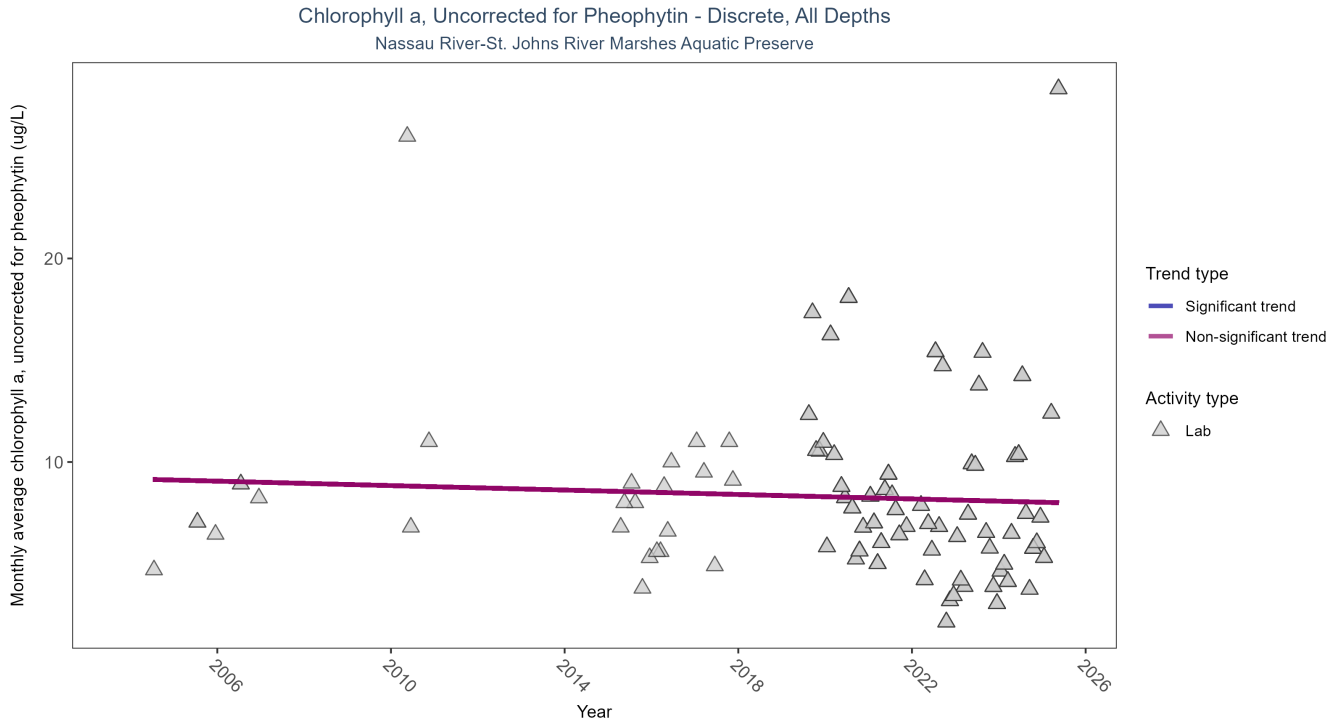

Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	379	14	2004 - 2025	6.8	-0.1007	9.1688	-0.0546	0.6

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 2004 and 2025.

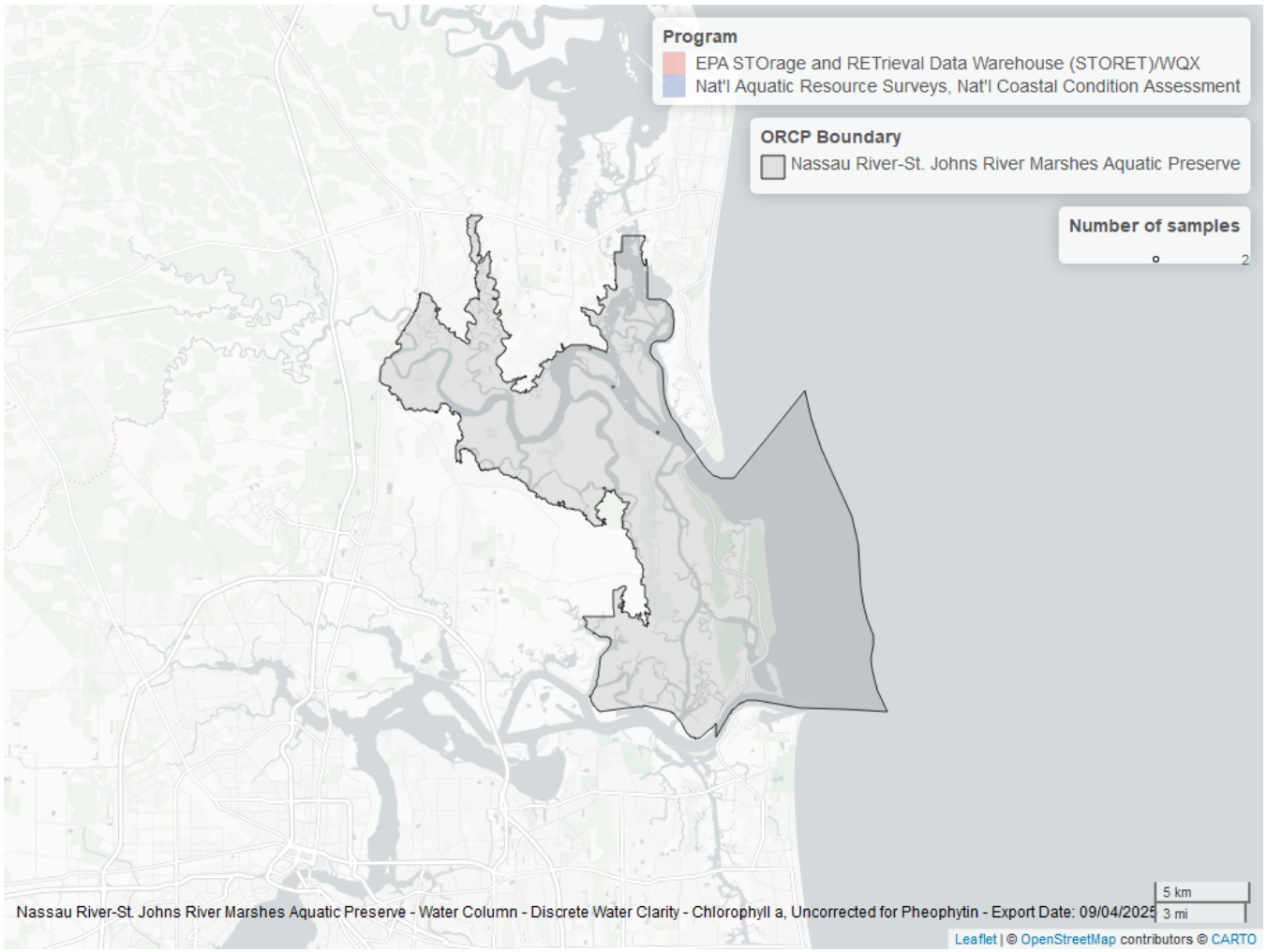

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	293	2010	2025
5016	82	2019	2025
103	6	2004	2015
118	3	2005	2010

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[4]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

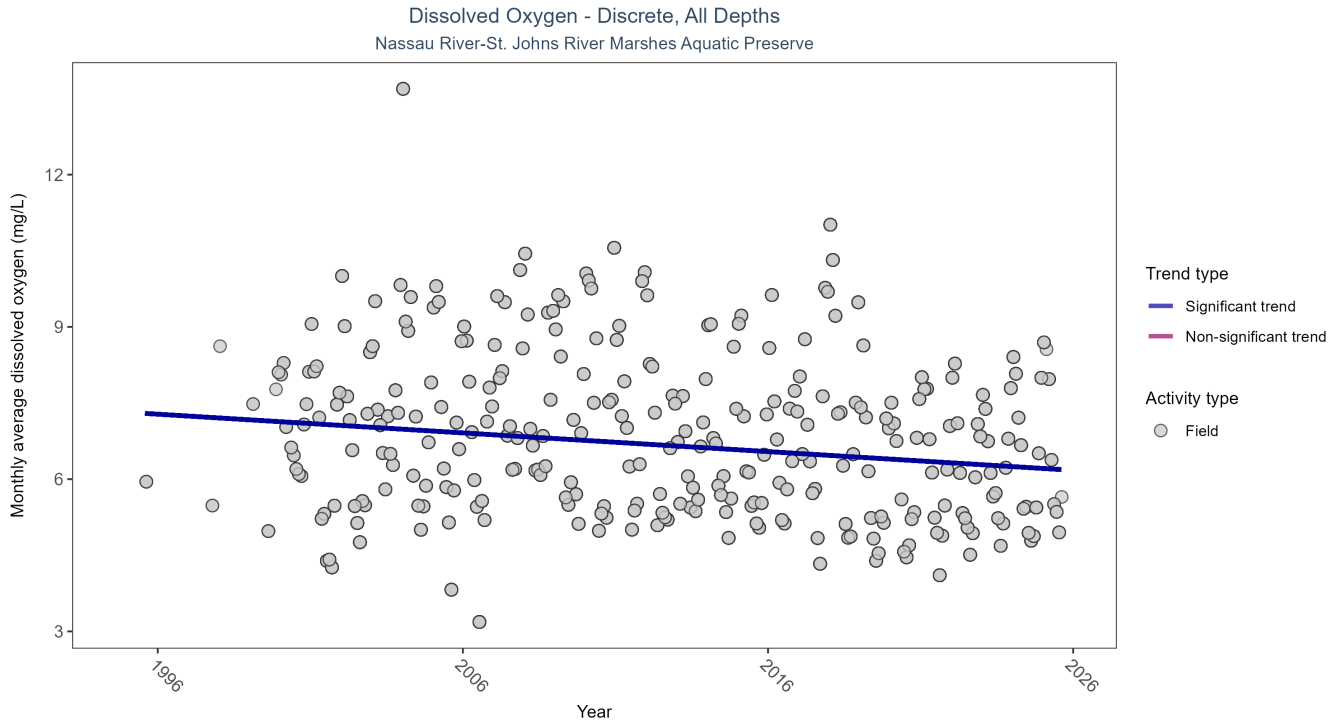

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

Table 10: 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	Significantly decreasing trend	22657	30	1995 - 2025	6.8	-0.2692	7.3169	-0.0369	0

Monthly average dissolved oxygen decreased by 0.04 mg/L per year.

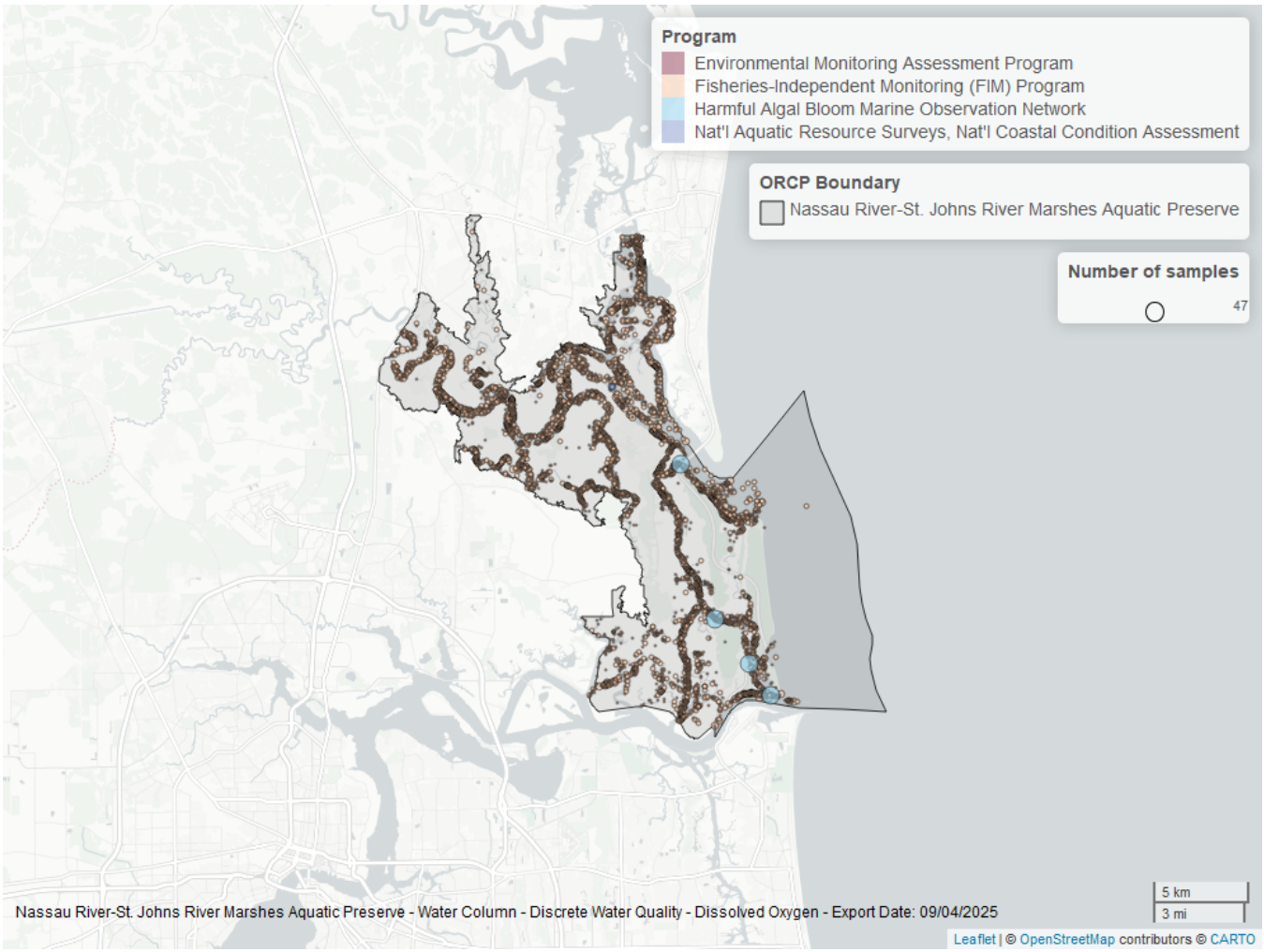

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19767	2001	2024
5002	2689	1997	2025
95	189	2013	2018
5016	81	2019	2025
118	12	2005	2021
115	4	1995	1995
103	3	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
95 - Harmful Algal Bloom Marine Observation Network[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[7]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[4]

5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

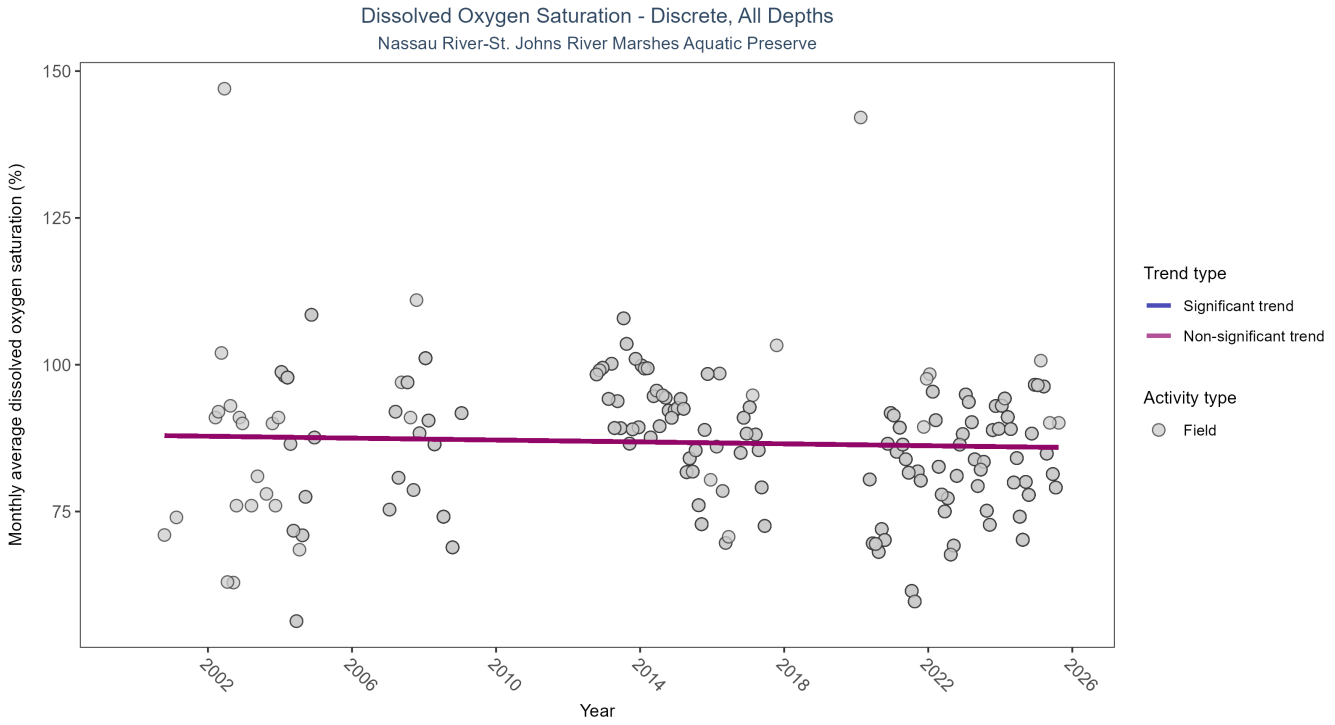

Figure 7: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles)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

Table 12: 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	1431	20	2000 - 2025	88	-0.075	87.9841	-0.0808	0.1877

Dissolved oxygen saturation showed no detectable trend between 2000 and 2025.

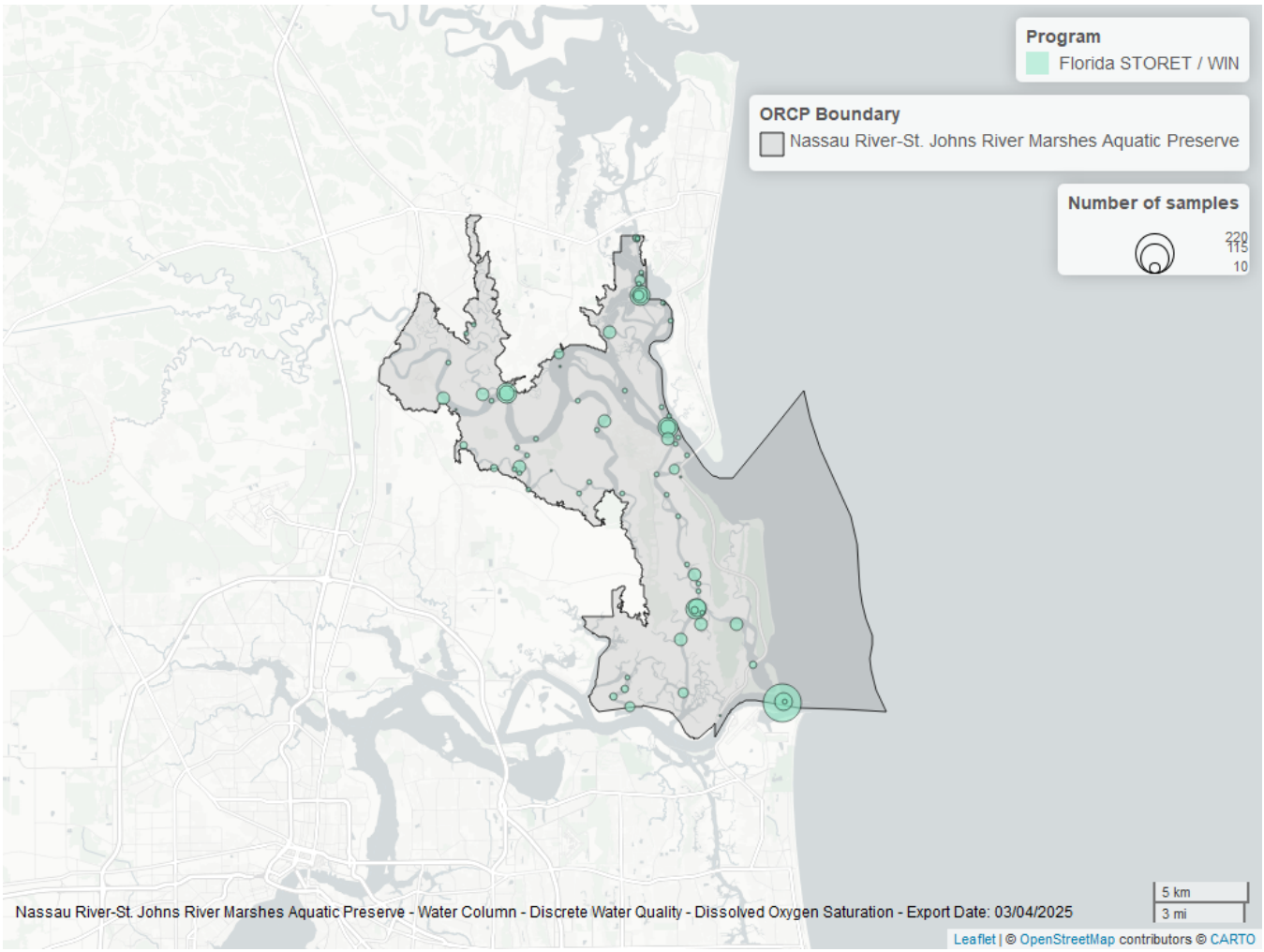

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1449	2000	2025

Program names:

5002 - Florida STORET / WIN[1]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

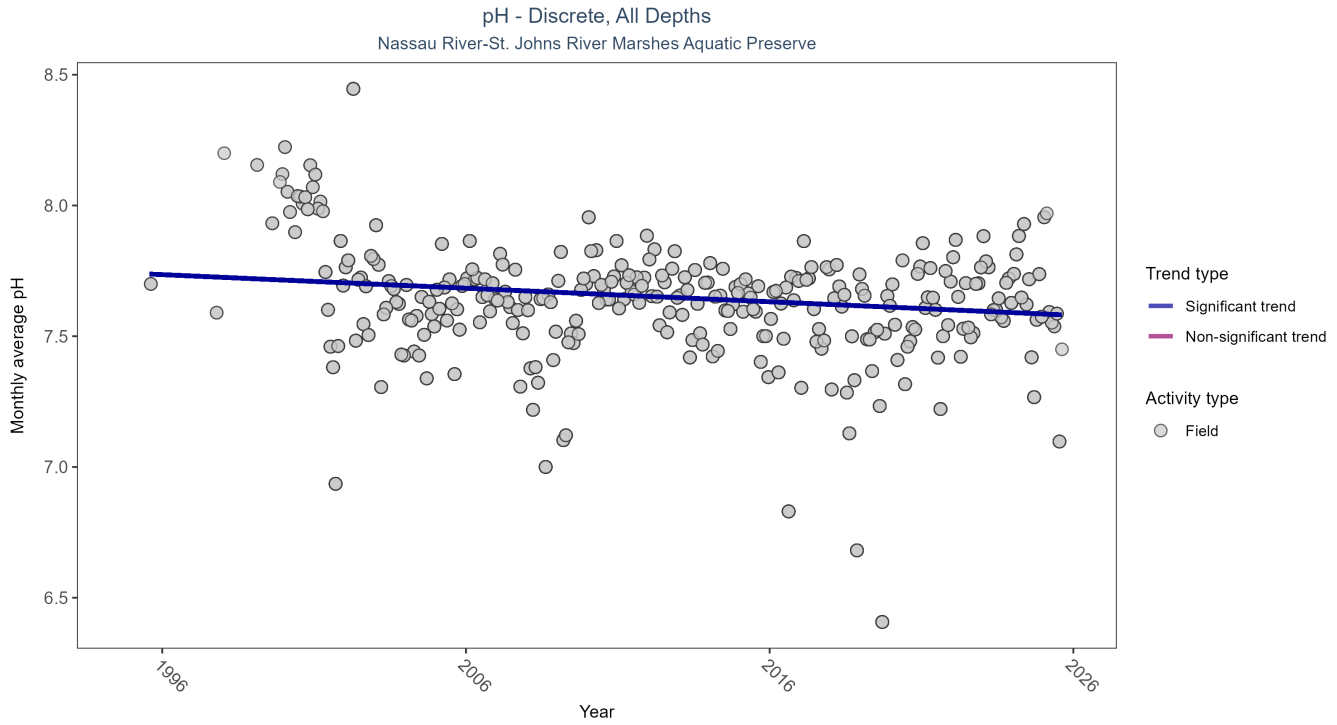

Figure 9: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	Significantly decreasing trend	22580	30	1995 - 2025	7.6	-0.1486	7.7407	-0.0052	0.0002

Monthly average pH decreased by 0.01 pH units per year.

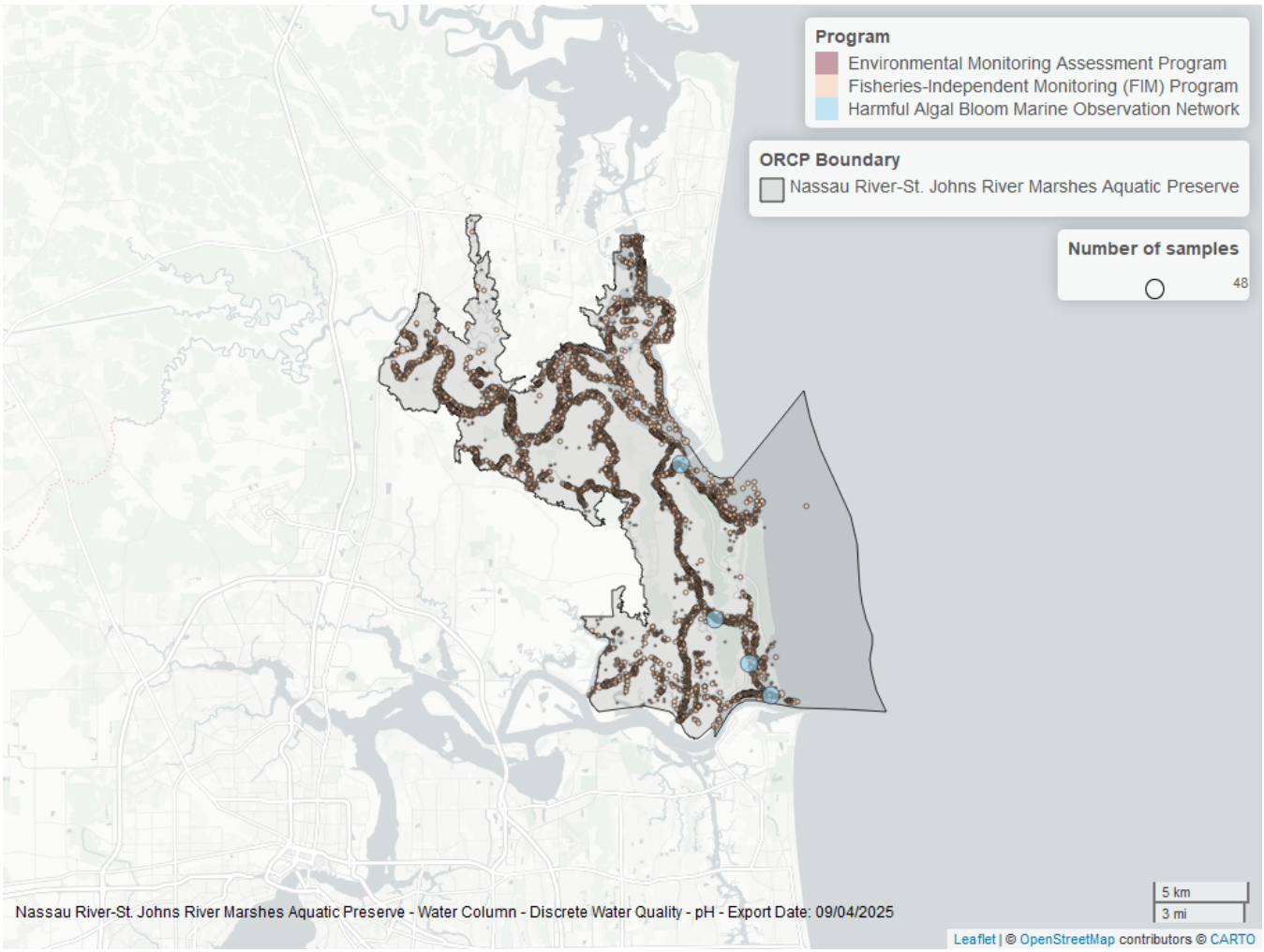

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19771	2001	2024
5002	2576	1997	2025
95	192	2013	2018
5016	81	2019	2025
103	7	2015	2015
115	3	1995	1995

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
95 - Harmful Algal Bloom Marine Observation Network[6]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[7]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

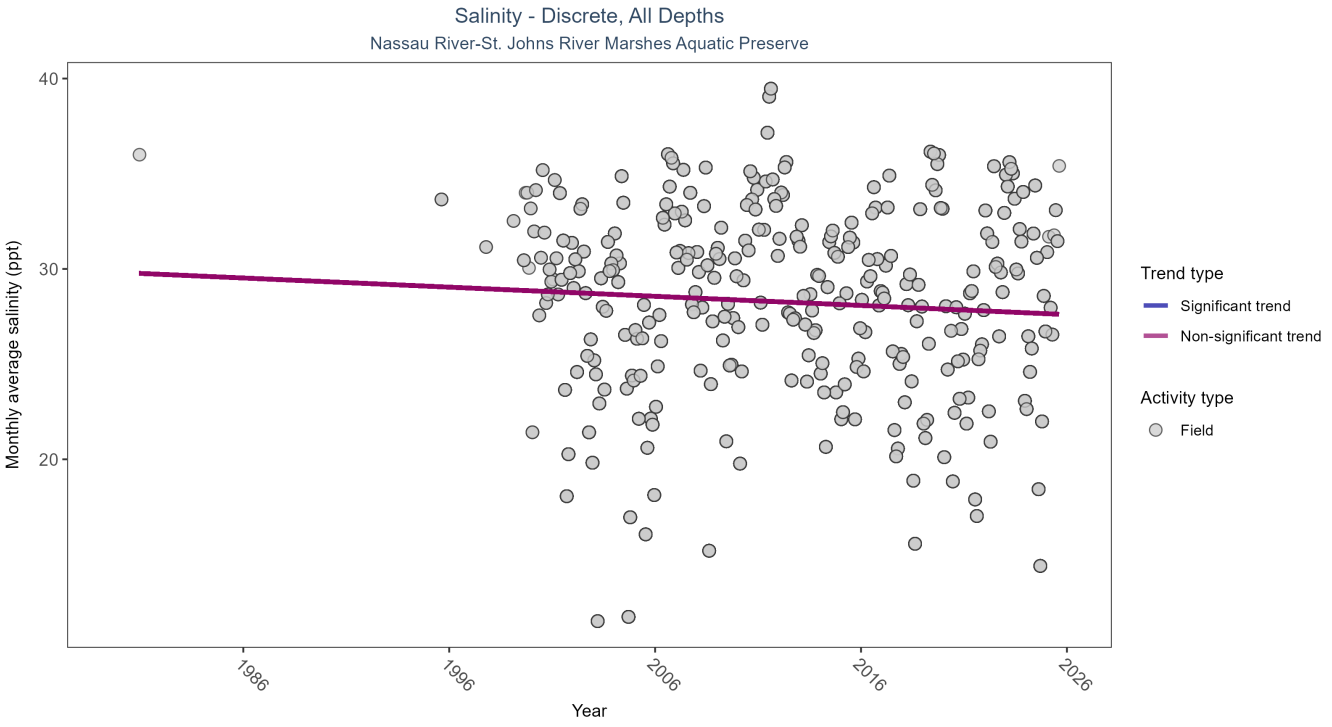

Figure 11: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	No significant trend	22769	30	1980 - 2025	30.5	-0.0506	29.8116	-0.0481	0.1992

Salinity showed no detectable trend between 1980 and 2025.

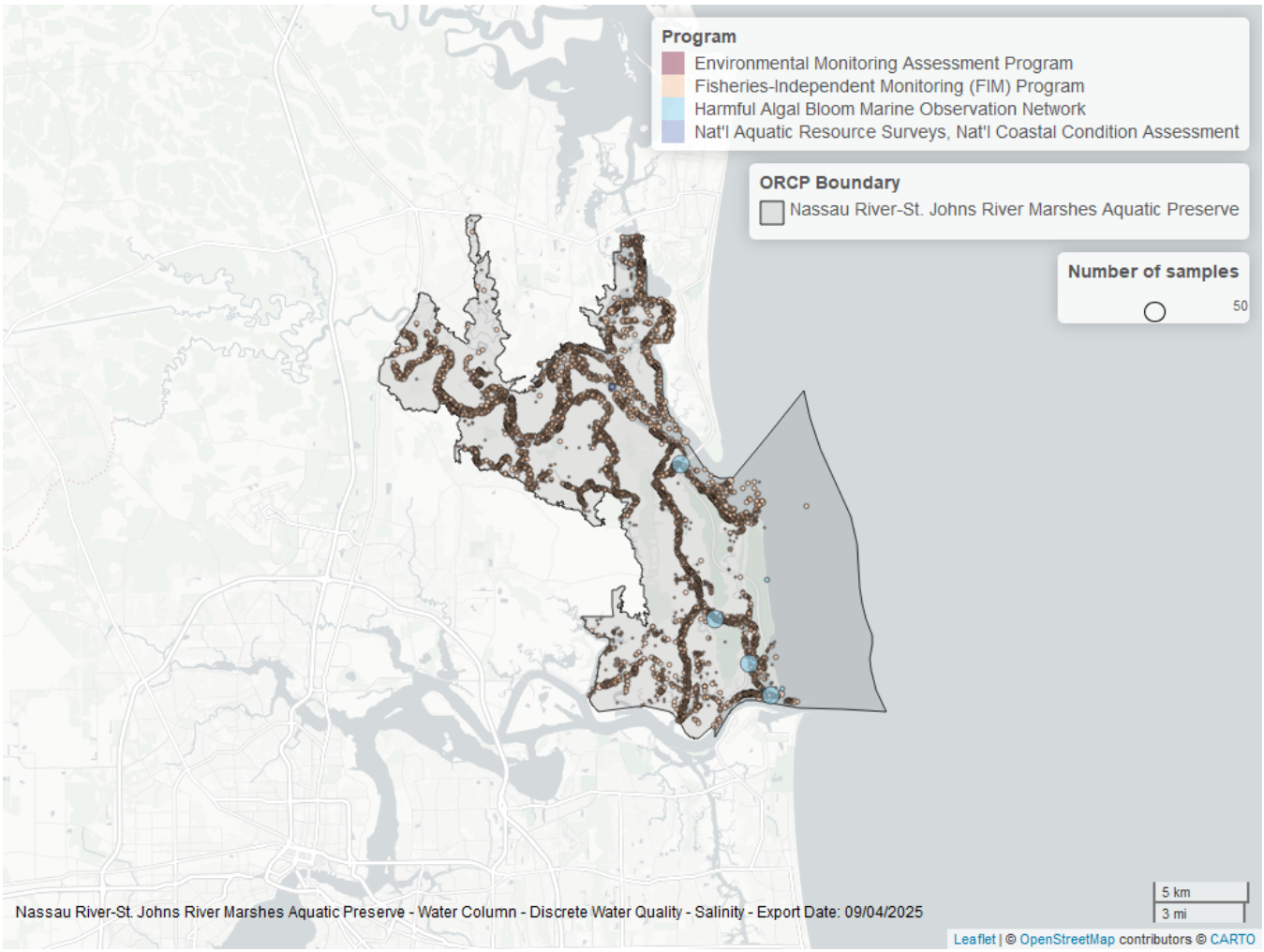

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19830	2001	2024
5002	2678	1997	2025
95	212	1980	2018
5016	52	2019	2024
118	13	2015	2021
115	4	1995	1995

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
95 - Harmful Algal Bloom Marine Observation Network[6]
115 - Environmental Monitoring Assessment Program[7]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[4]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

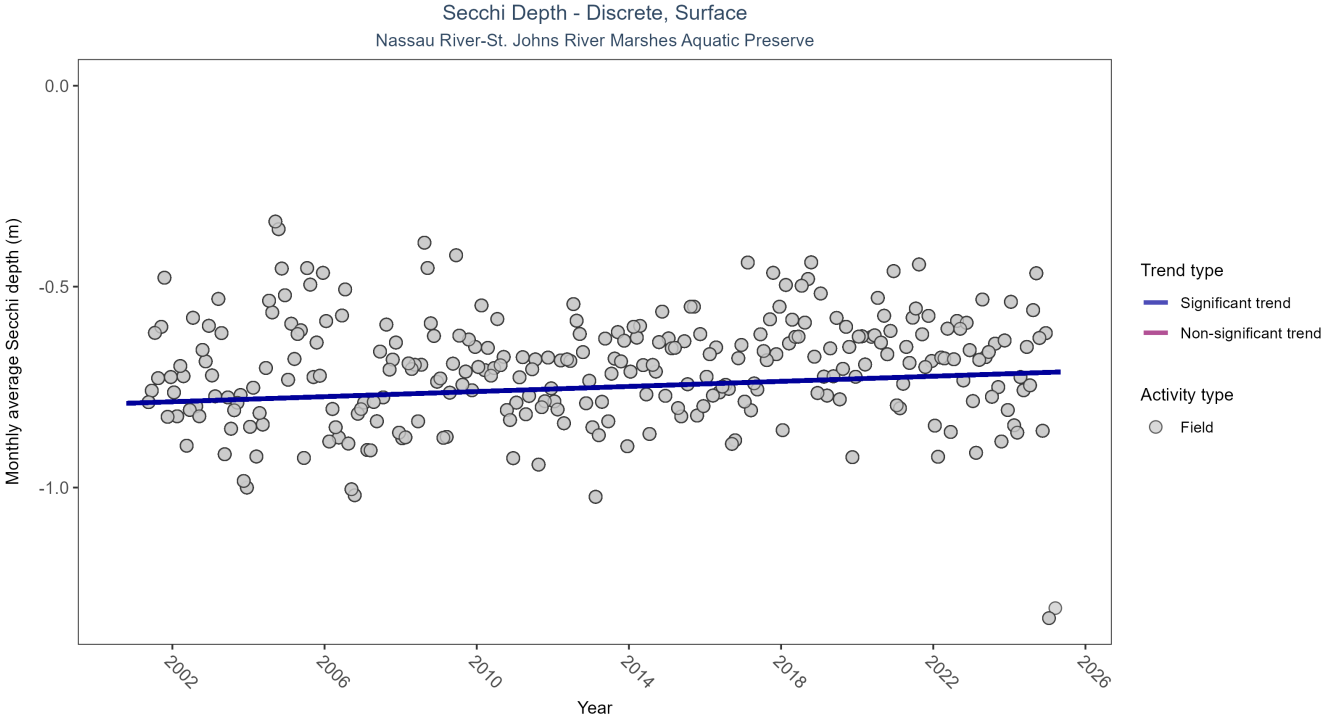

Figure 13: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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 increasing trend	20402	26	2000 - 2025	-0.7	0.1122	-0.7929	0.0032	0.0085

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

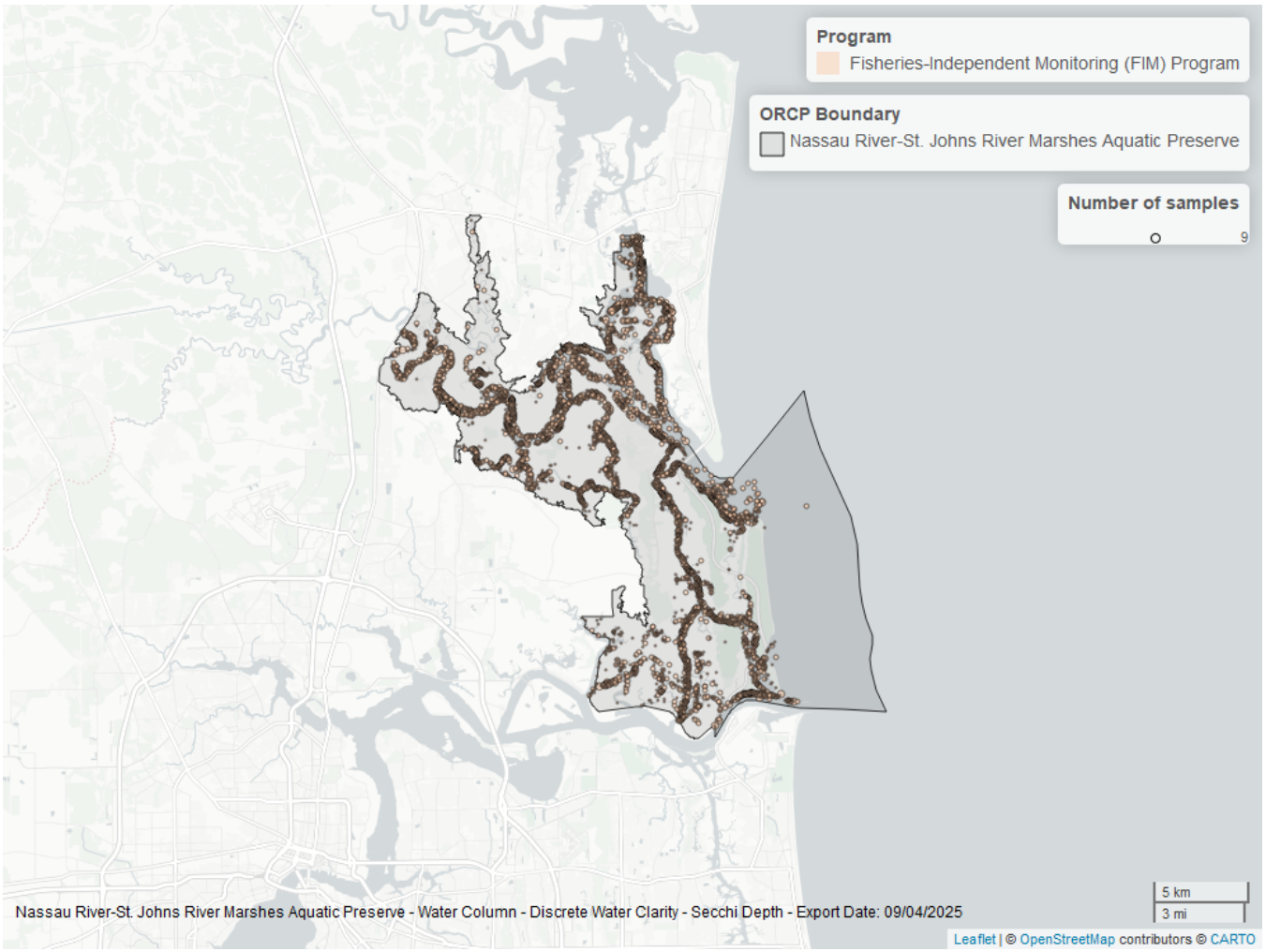

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19754	2001	2024
5002	648	2000	2025
103	2	2003	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[1]

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

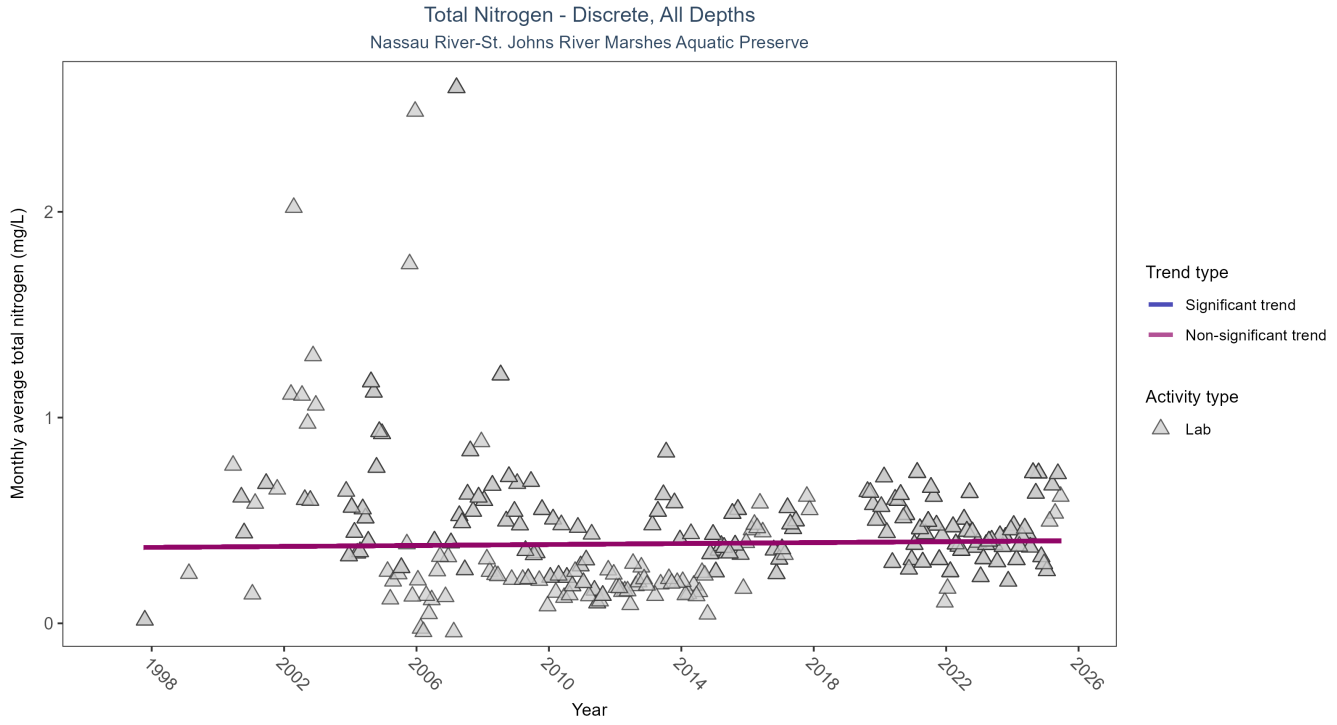

Figure 15: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	No significant trend	1022	27	1997 - 2025	0.4	0.0254	0.3678	0.0012	0.6032

Total nitrogen showed no detectable trend between 1997 and 2025.

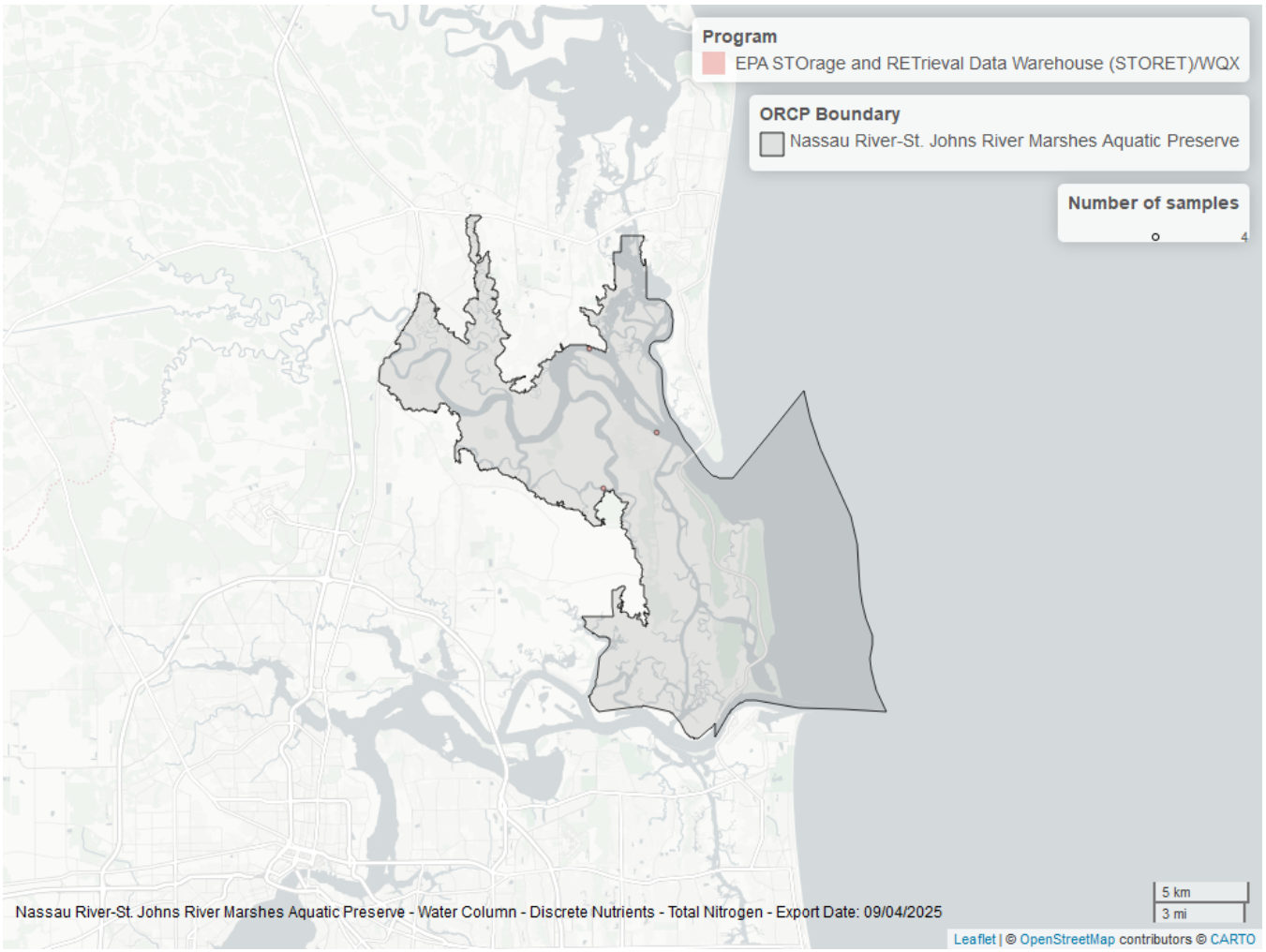

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	932	1997	2025
5016	78	2019	2025
103	12	2004	2006

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

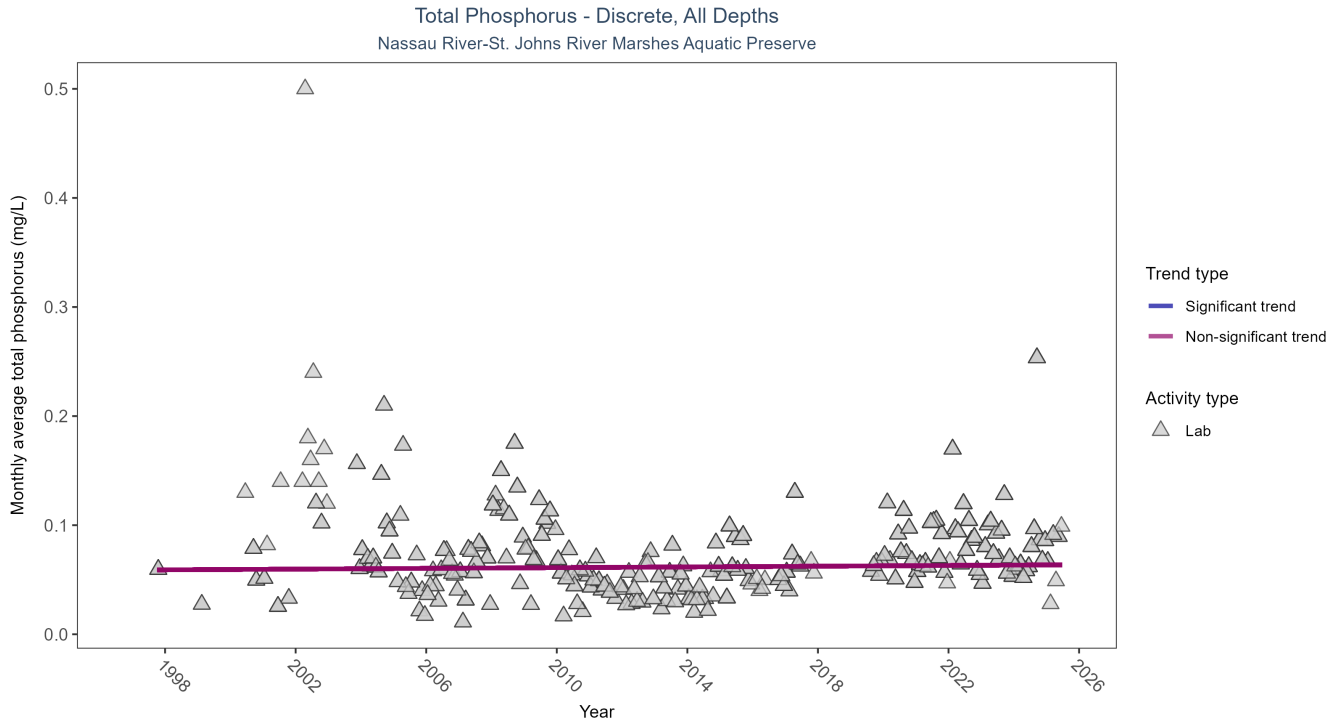

Figure 17: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included 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	No significant trend	1560	27	1997 - 2025	0.067	0.0226	0.0589	0.0002	0.5539

Total phosphorus showed no detectable trend between 1997 and 2025.

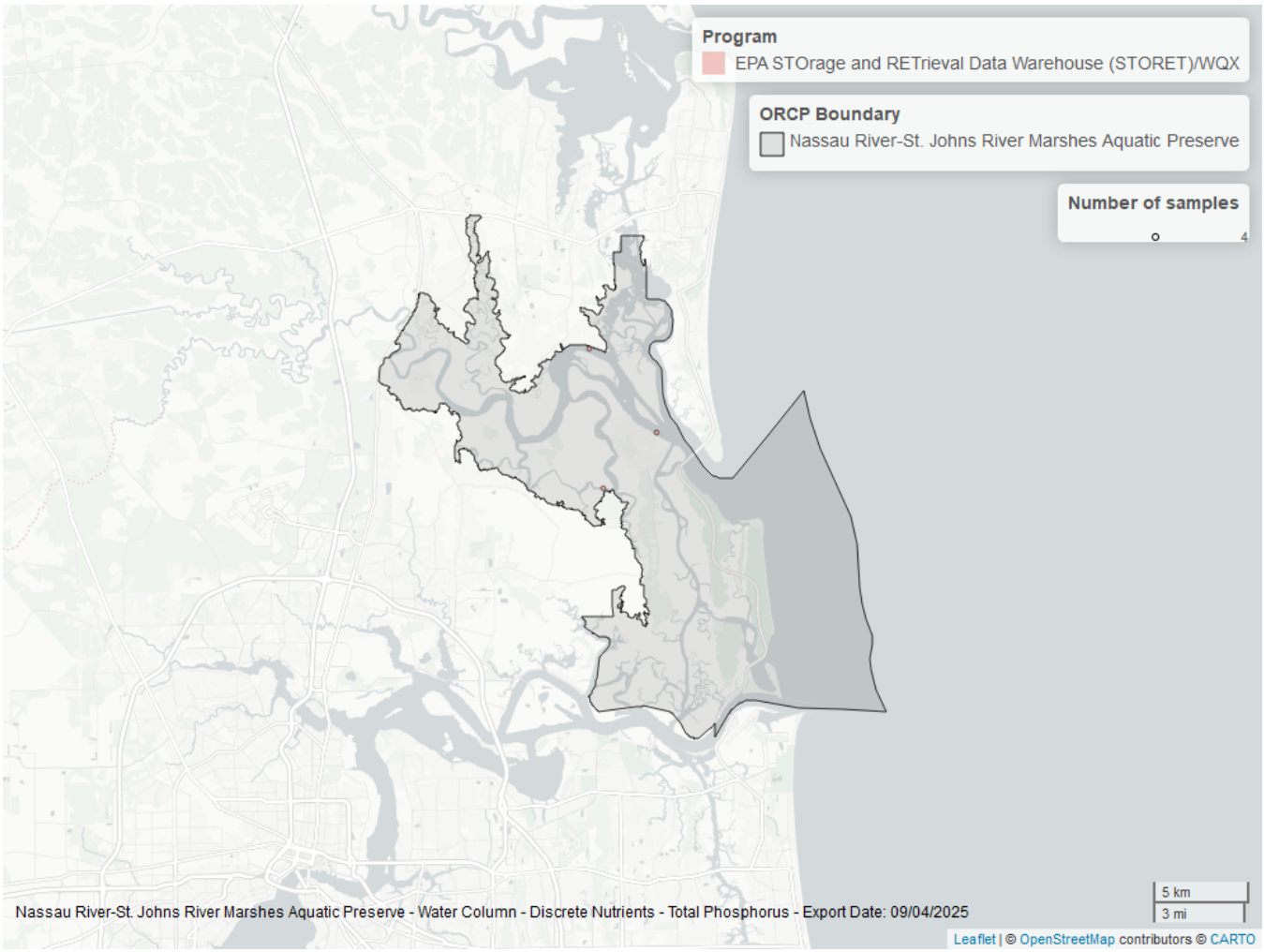

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1490	1997	2025
5016	81	2019	2025
103	12	2004	2015

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

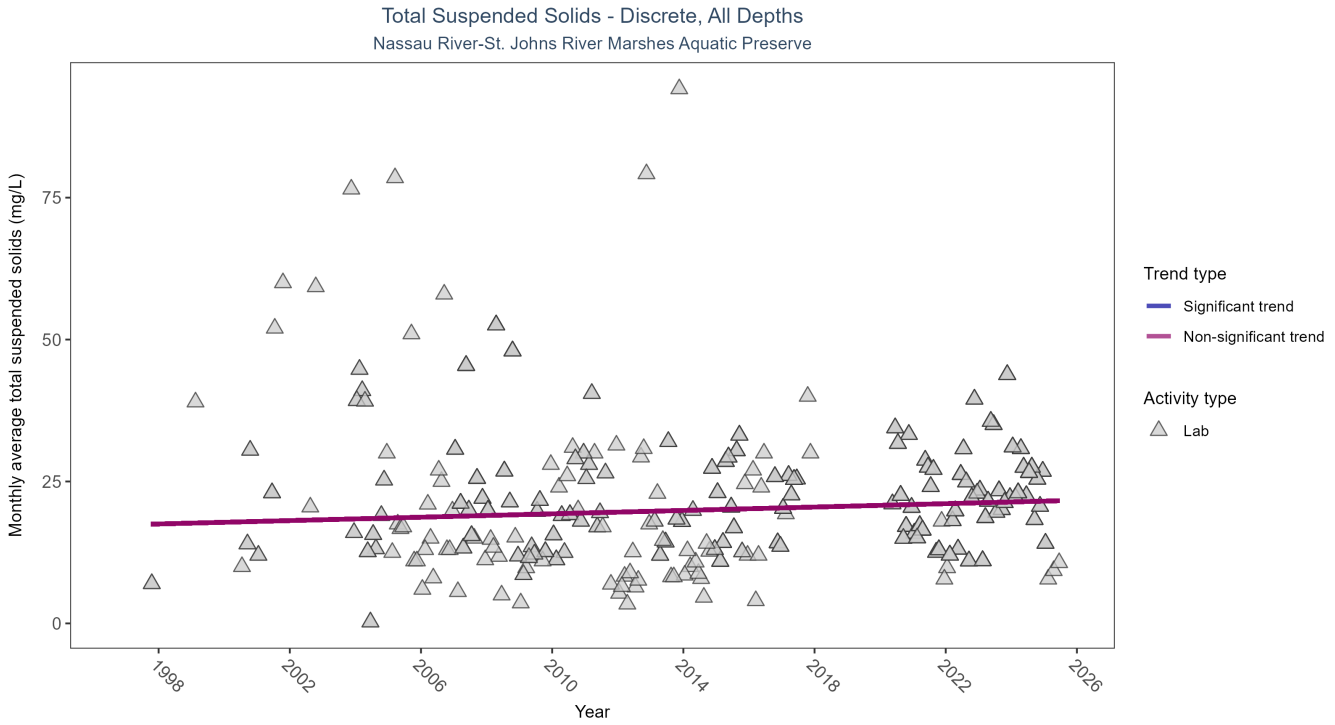

Figure 19: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included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

Table 24: 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	880	26	1997 - 2025	18	0.0623	17.3657	0.149	0.1986

Total suspended solids showed no detectable trend between 1997 and 2025.

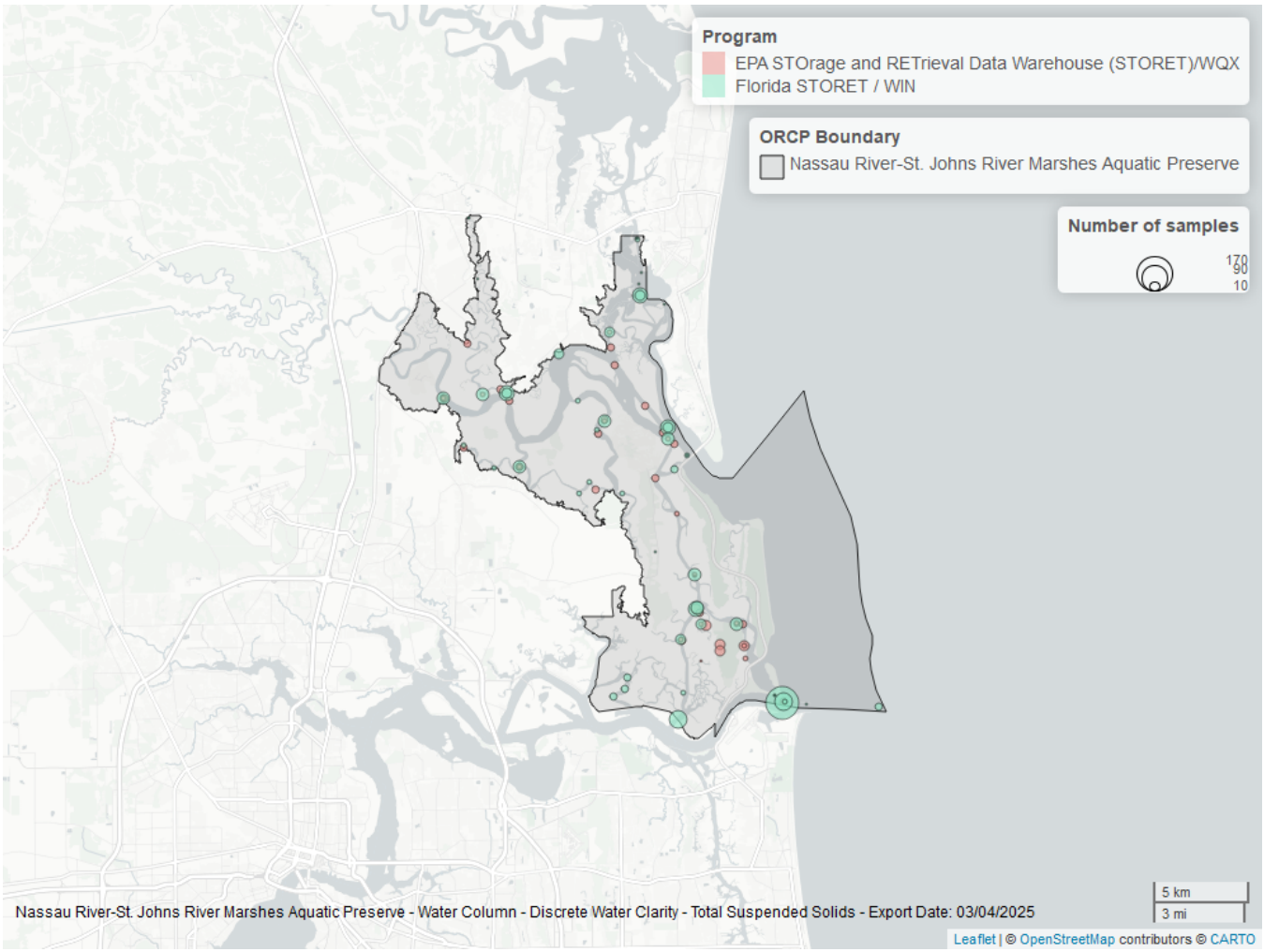

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	931	1997	2025

Program names:

5002 - Florida STORET / WIN[1]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

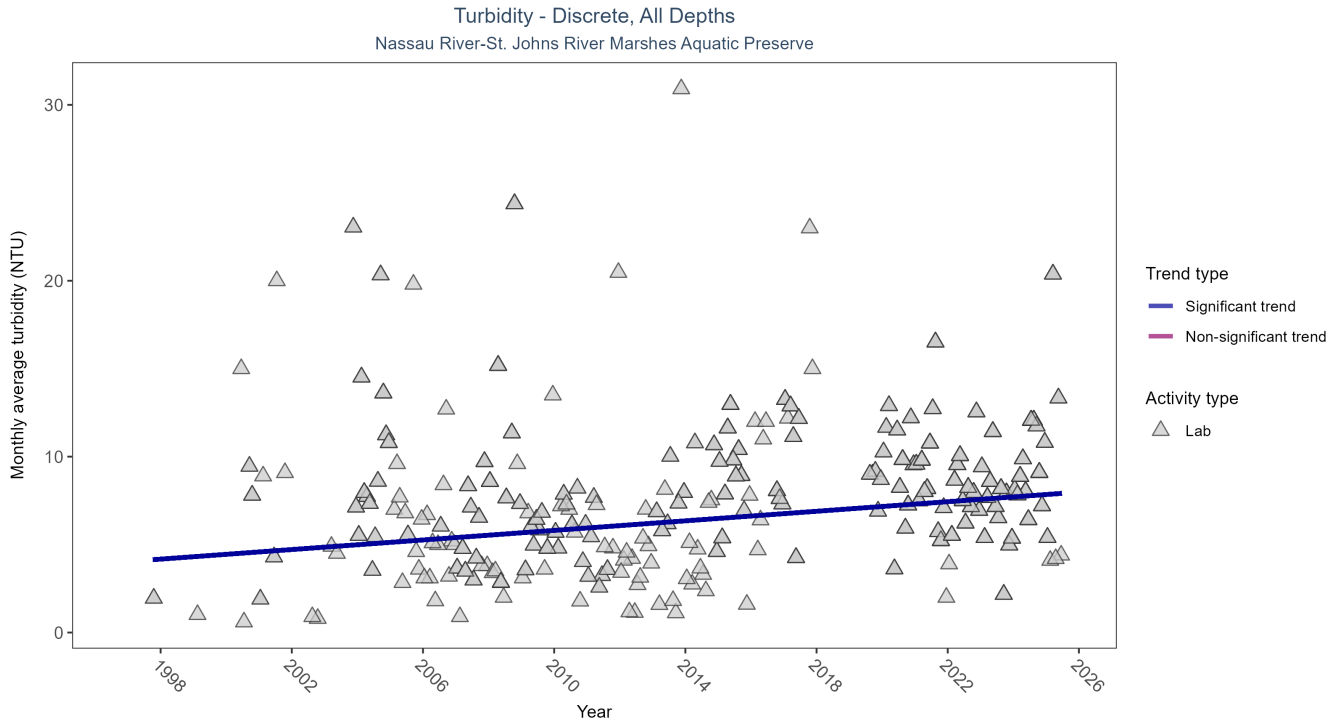

Figure 21: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 26: 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 increasing trend	1042	27	1997 - 2025	7.1	0.1774	4.038	0.136	0.0001

Monthly average turbidity increased by 0.14 NTU per year, indicating a decrease in water clarity.

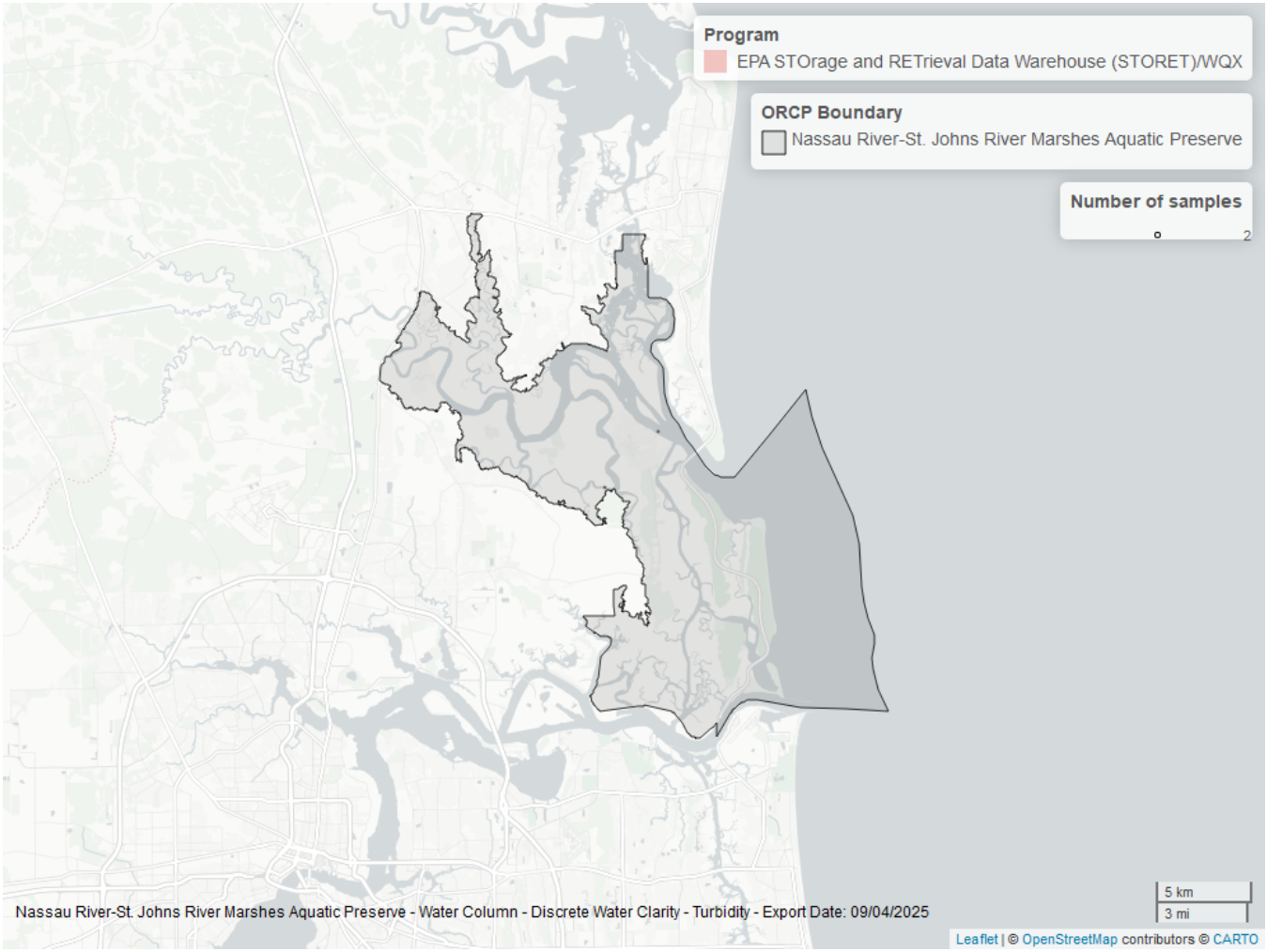

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	983	1997	2025
5016	82	2019	2025
103	4	2005	2006

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

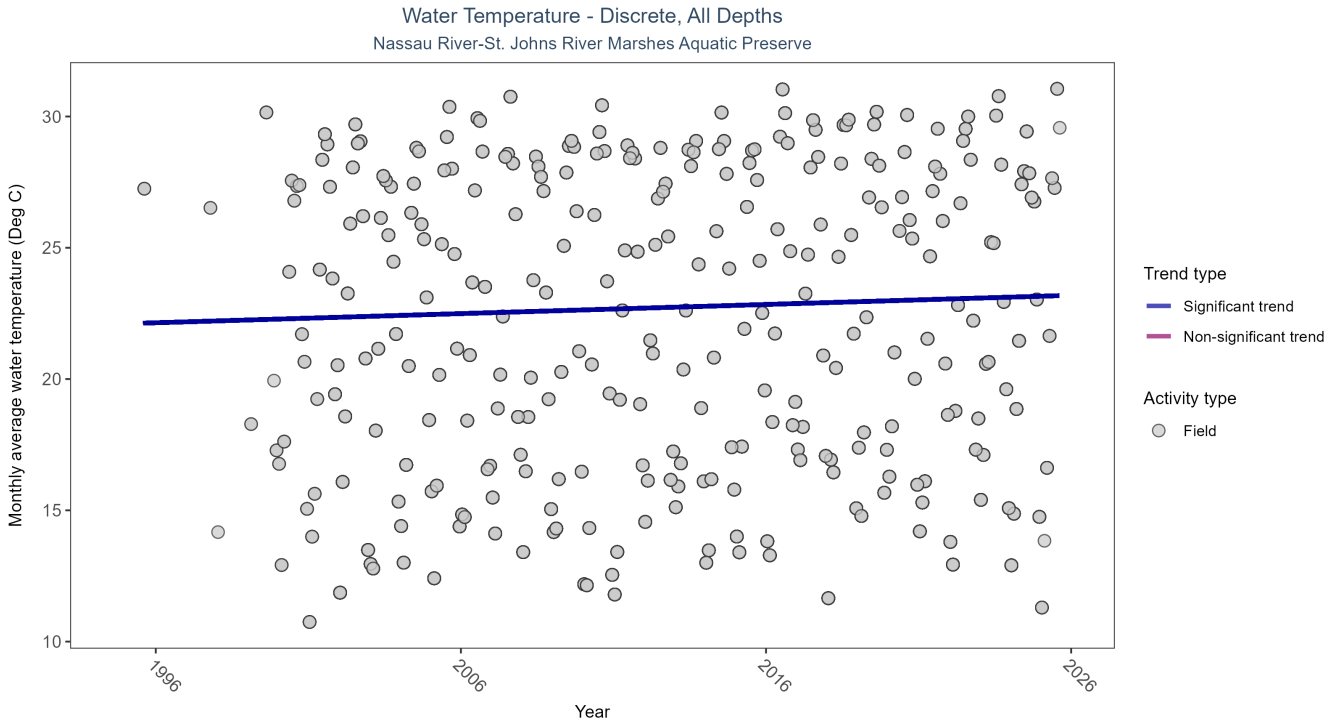

Figure 23: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 28: 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	22815	30	1995 - 2025	23	0.1299	22.1092	0.0348	0.0013

Monthly average water temperature increased by 0.03°C per year.

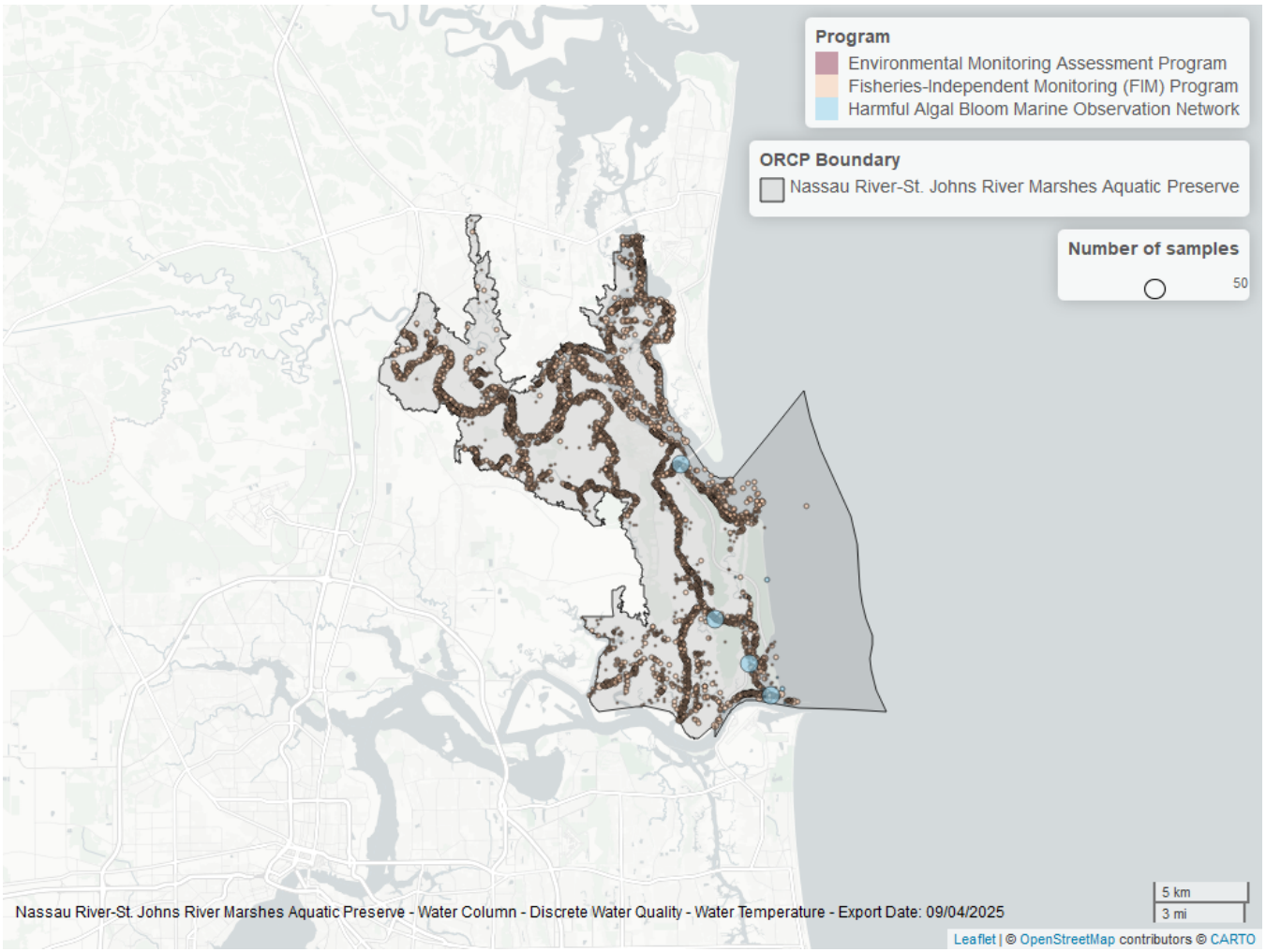

Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	19834	2001	2024
5002	2692	1997	2025
95	212	2007	2018
5016	81	2019	2025
115	4	1995	1995

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
95 - Harmful Algal Bloom Marine Observation Network[6]
115 - Environmental Monitoring Assessment Program[7]
5002 - Florida STORET / WIN[1]
5016 - NEAP Monthly Water Quality Monitoring[2]

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NE-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NE-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_pH_NE-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NE-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NE-2025-Sep-19.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NE-2025-Sep-19.txt*

Continuous monitoring locations in Nassau River-St. Johns River Marshes Aquatic Preserve

Table 30: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
7	02231291	3	FALSE	DO , TempW
5006	NECI	3	FALSE	DO , DOS , pH , Sal , Turb , TempW
5006	NEHM	4	FALSE	DO , DOS , pH , Sal , Turb , TempW
5006	NEKD	8	TRUE	DO , DOS , pH , Sal , Turb , TempW
5006	NELC	7	TRUE	DO , DOS , pH , Sal , Turb , TempW
5006	NENR	3	FALSE	DO , DOS , pH , Sal , Turb , TempW
5061	NCB19020038	5	TRUE	DO , DOS , pH , Sal , Turb , TempW
5061	NCBARD16	2	FALSE	DO , DOS , pH , Sal , Turb , TempW
5061	NCBNRCM	5	TRUE	DO , DOS , pH , Sal , Turb , TempW

Program names:

7 - National Water Information System[8]
5006 - Northeast Aquatic Preserves Continuous Water Quality Monitoring[9]
5061 - St. Johns River Water Management District Continuous Water Quality Programs[10]

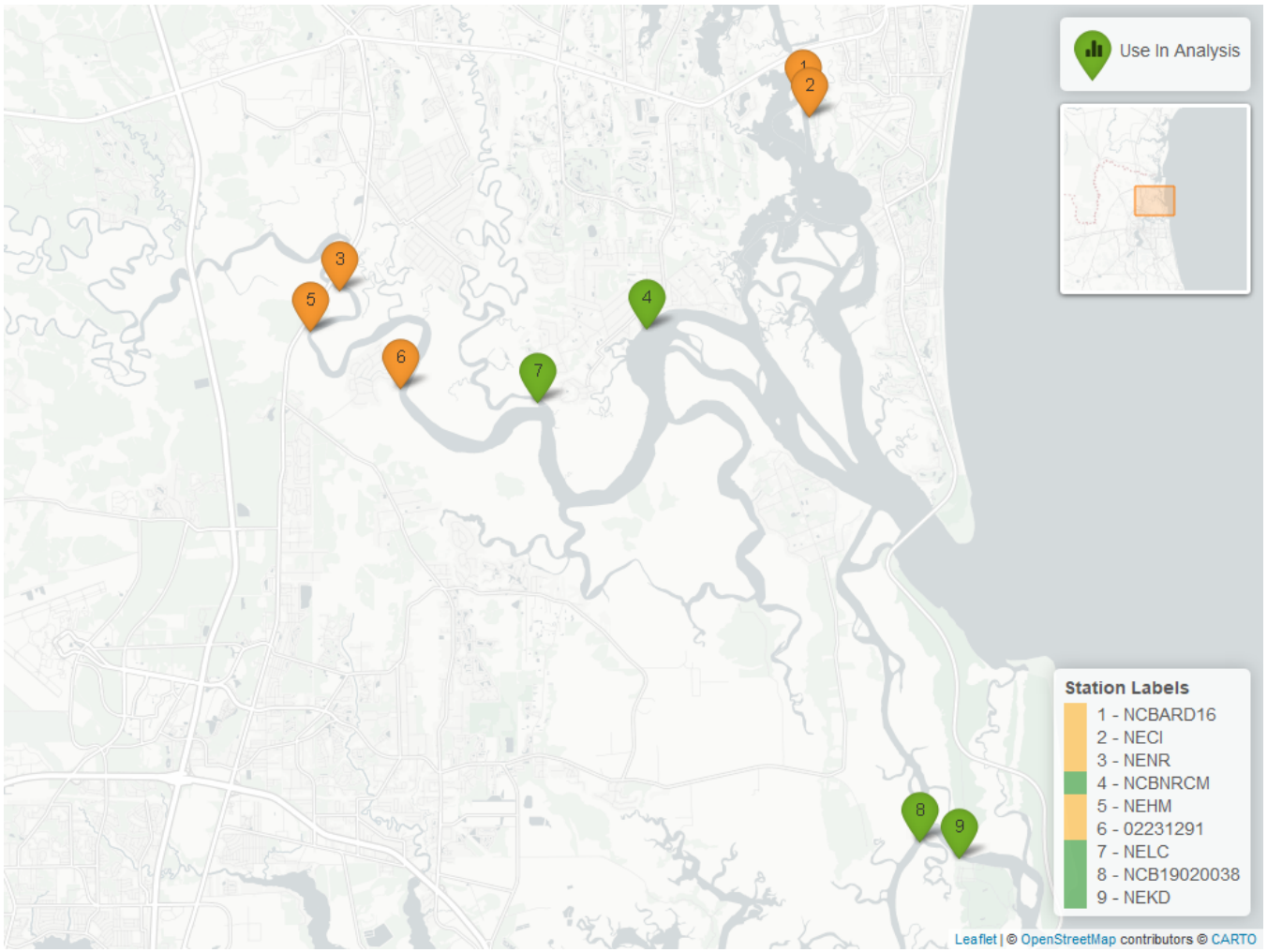

Figure 25: Map showing continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

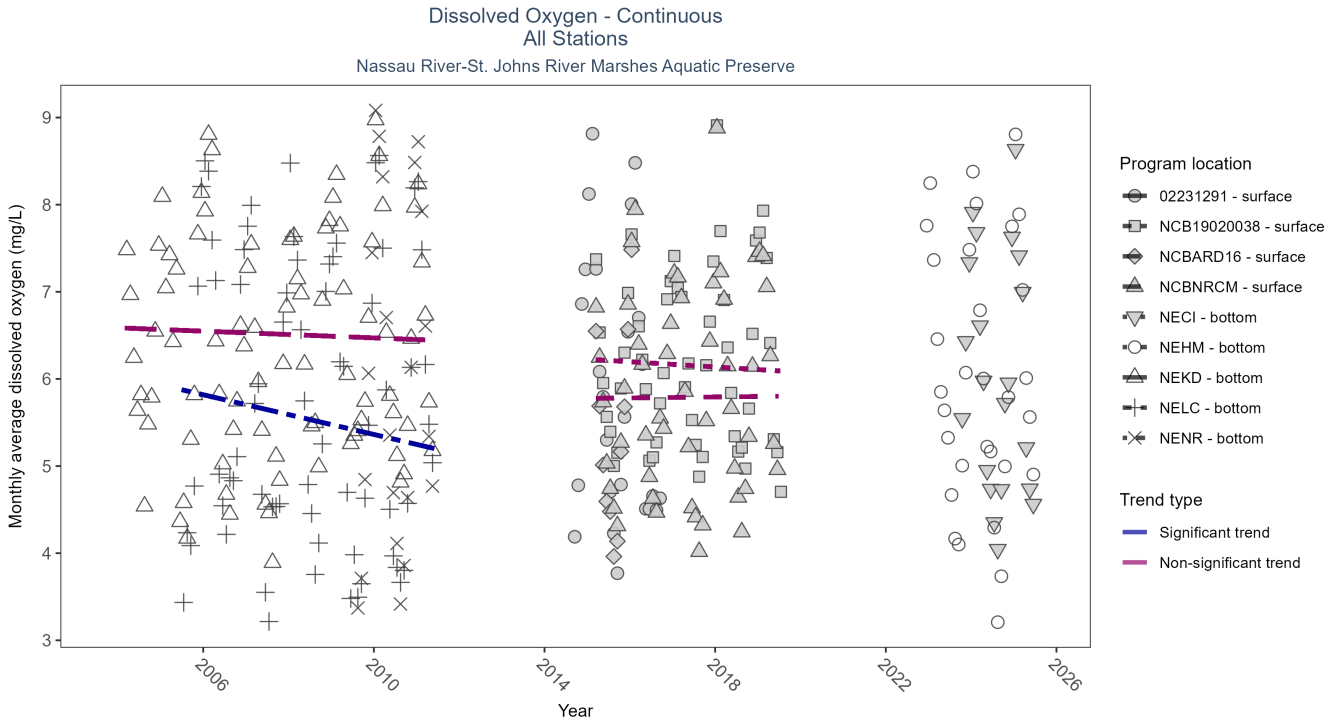

Figure 26: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 31: 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
02231291	Insufficient data to calculate trend	689	3	2014 - 2016	5.70	-	-	-	-
NECI	Insufficient data to calculate trend	54461	3	2023 - 2025	6.20	-	-	-	-
NEHM	Insufficient data to calculate trend	85227	4	2022 - 2025	5.90	-	-	-	-
NEKD	No significant trend	110958	8	2004 - 2011	6.40	-0.04	6.59	-0.02	0.56
NCBNRCM	No significant trend	35477	5	2015 - 2019	5.79	0.05	5.78	0.01	0.8
NENR	Insufficient data to calculate trend	31438	3	2009 - 2011	5.80	-	-	-	-
NELC	Significantly decreasing trend	95860	7	2005 - 2011	5.60	-0.34	5.93	-0.11	0
NCB19020038	No significant trend	34476	5	2015 - 2019	6.16	-0.03	6.23	-0.03	0.61
NCBARD16	Insufficient data to calculate trend	7417	2	2015 - 2016	5.08	-	-	-	-

At one program location, monthly average dissolved oxygen decreased by 0.11 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at three locations. There was insufficient data to fit a model for five locations.

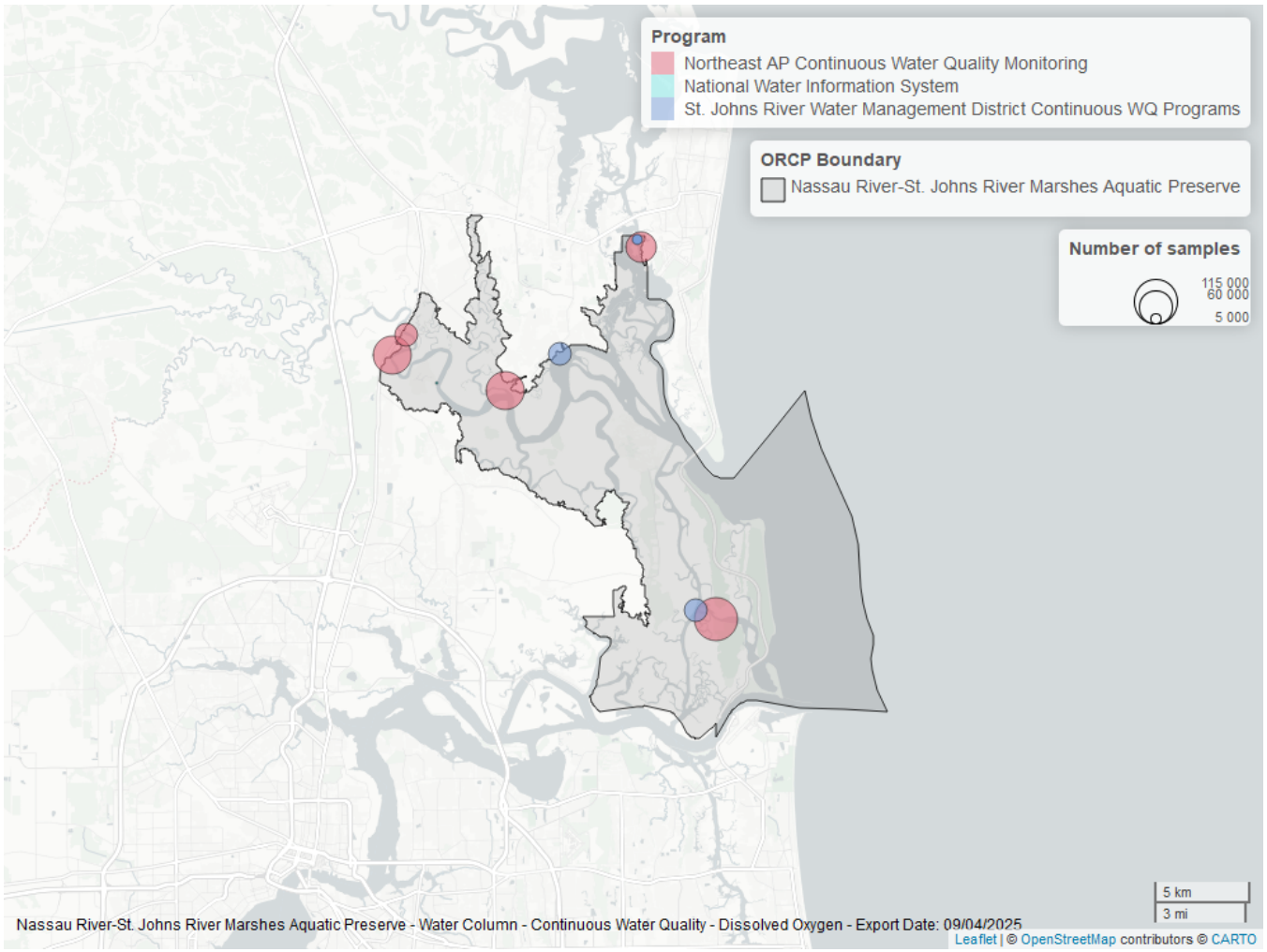

Figure 27: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

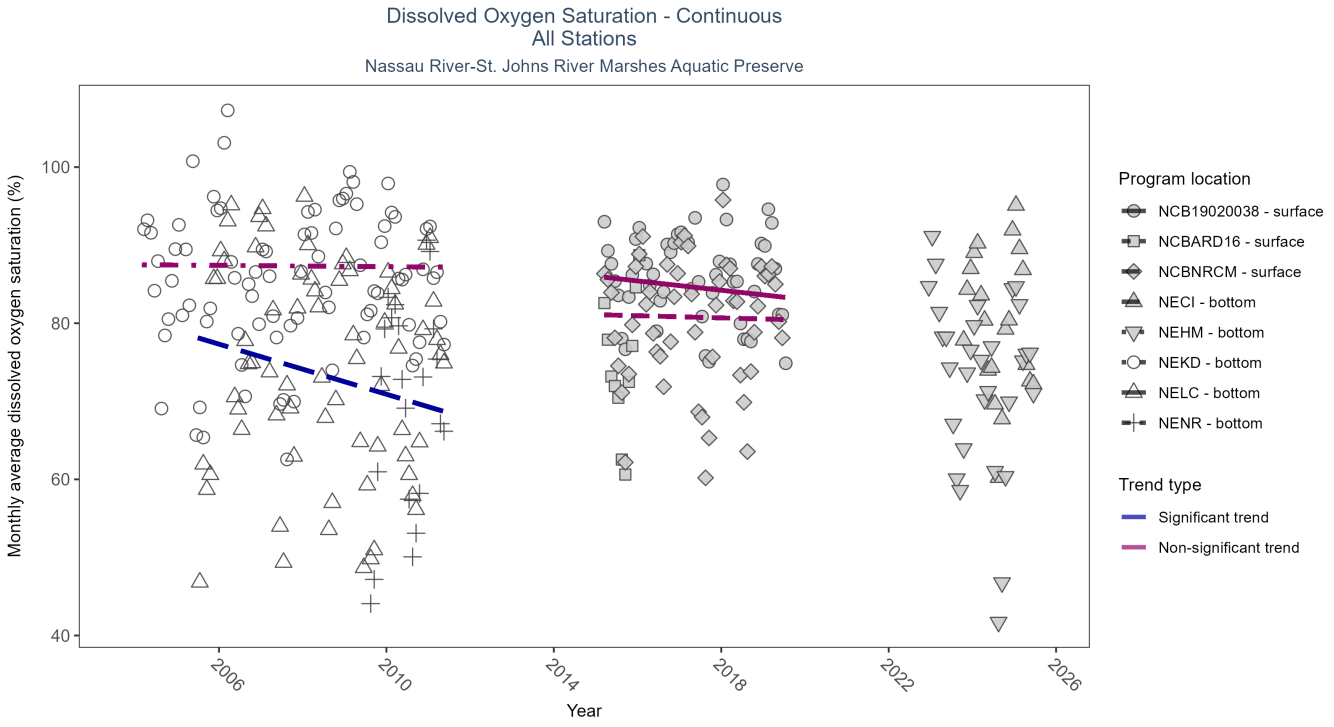

Figure 28: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 32: 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
NEHM	Insufficient data to calculate trend	85226	4	2022 - 2025	74.60	-	-	-	-
NECI	Insufficient data to calculate trend	54808	3	2023 - 2025	82.40	-	-	-	-
NEKD	No significant trend	110983	8	2004 - 2011	89.10	0	87.49	-0.04	0.93
NENR	Insufficient data to calculate trend	31438	3	2009 - 2011	73.20	-	-	-	-
NELC	Significantly decreasing trend	95868	7	2005 - 2011	77.90	-0.27	78.93	-1.6	0.01
NCBNRCM	No significant trend	35240	5	2015 - 2019	82.06	-0.05	81.1	-0.14	0.8
NCB19020038	No significant trend	34438	5	2015 - 2019	87.06	-0.16	86.02	-0.6	0.13
NCBARD16	Insufficient data to calculate trend	7417	2	2015 - 2016	74.44	-	-	-	-

At one program location, monthly average dissolved oxygen saturation decreased by 1.60% per year. No detectable change in monthly average dissolved oxygen saturation was observed at three locations. There was insufficient data to fit a model for four locations.

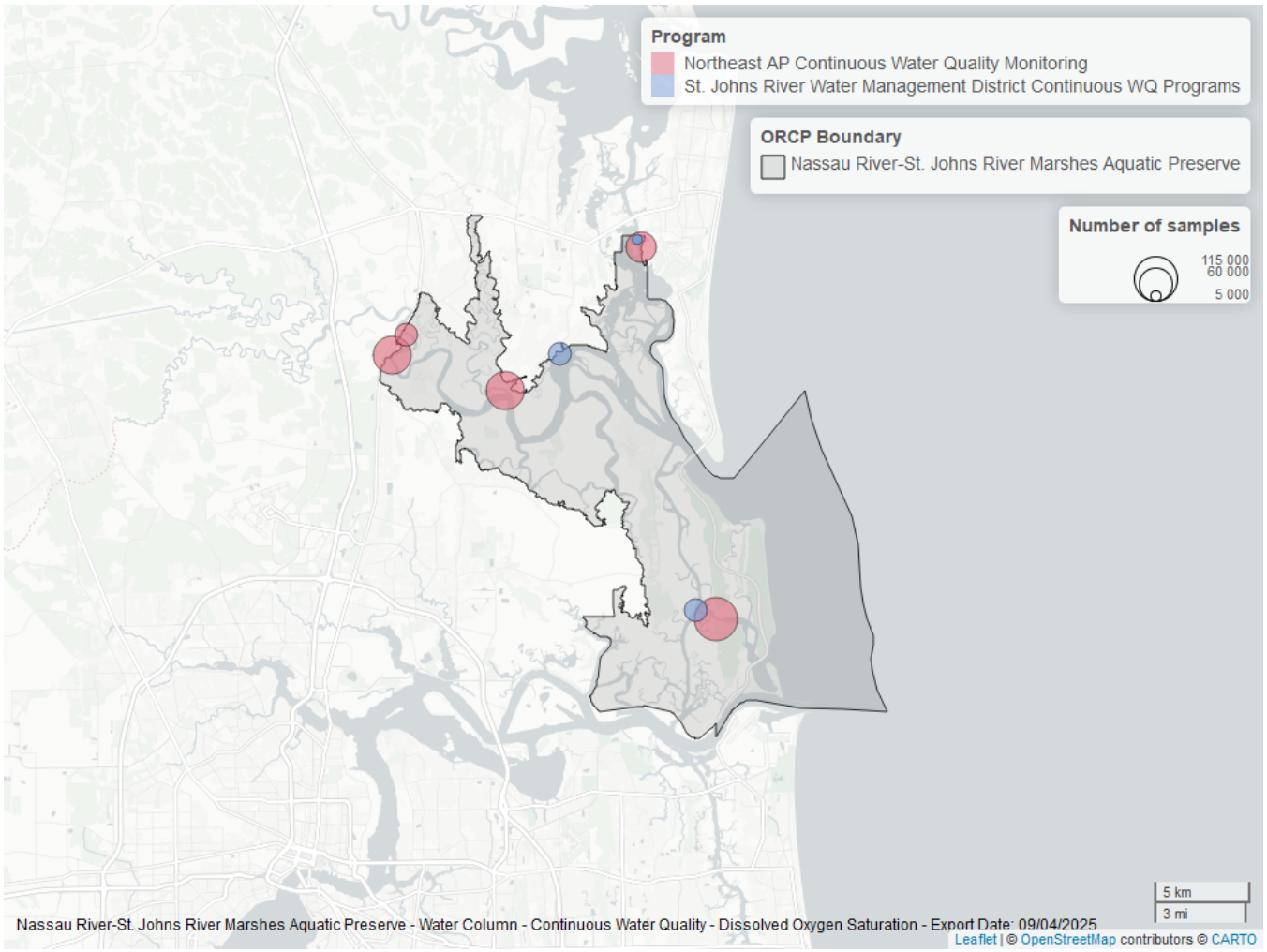

Figure 29: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

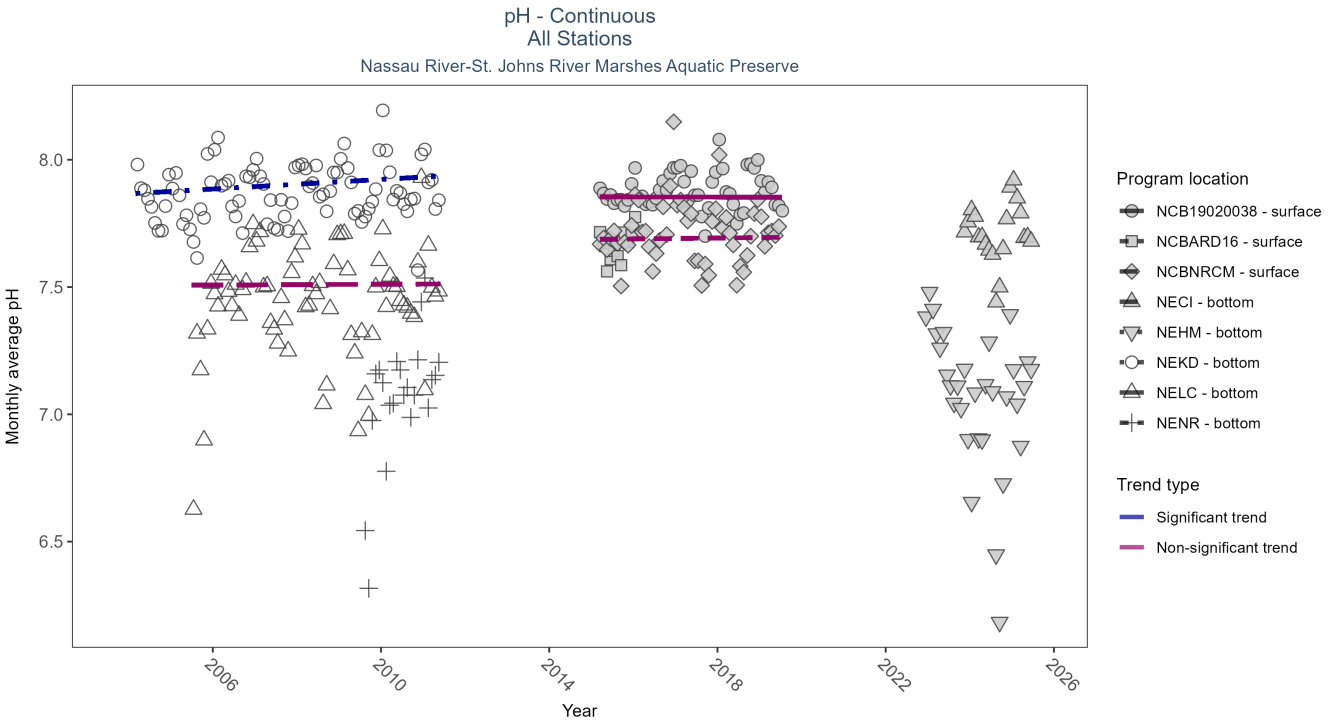

Figure 30: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 33: 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
NECI	Insufficient data to calculate trend	52513	3	2023 - 2025	7.70	-	-	-	-
NEHM	Insufficient data to calculate trend	87193	4	2022 - 2025	7.10	-	-	-	-
NEKD	Significantly increasing trend	113471	8	2004 - 2011	7.90	0.19	7.87	0.01	0.05
NENR	Insufficient data to calculate trend	31438	3	2009 - 2011	7.10	-	-	-	-
NCB19020038	No significant trend	34405	5	2015 - 2019	7.88	-0.01	7.85	0	1
NELC	No significant trend	96488	7	2005 - 2011	7.50	0.02	7.51	0	0.91
NCBNRCM	No significant trend	35819	5	2015 - 2019	7.72	-0.01	7.69	0	0.93
NCBARD16	Insufficient data to calculate trend	6952	2	2015 - 2016	7.66	-	-	-	-

At one program location, monthly average pH increased by 0.01 pH units per year. No detectable change in monthly average pH was observed at three locations. There was insufficient data to fit a model for four locations.

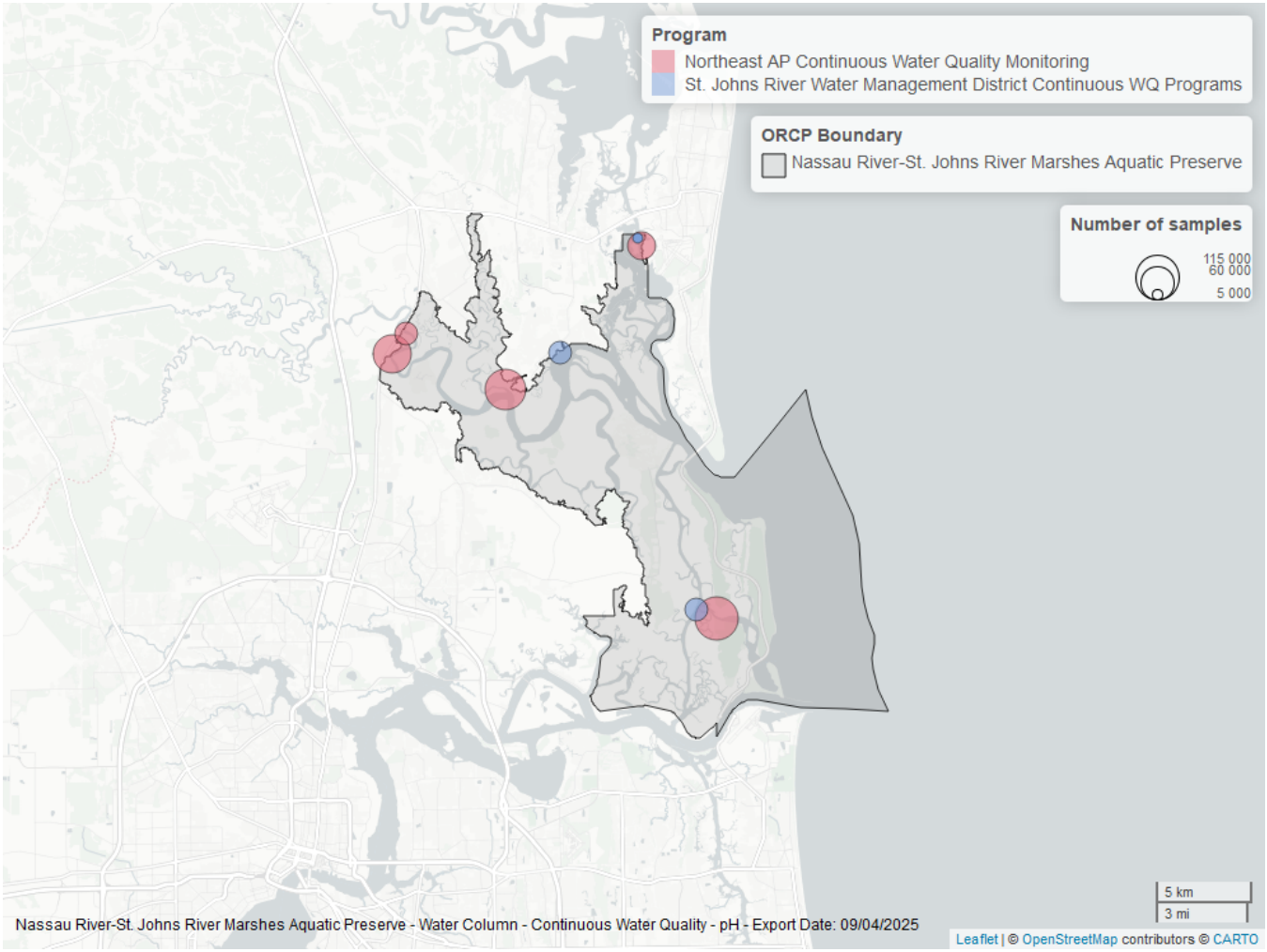

Figure 31: Map showing location of ph continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

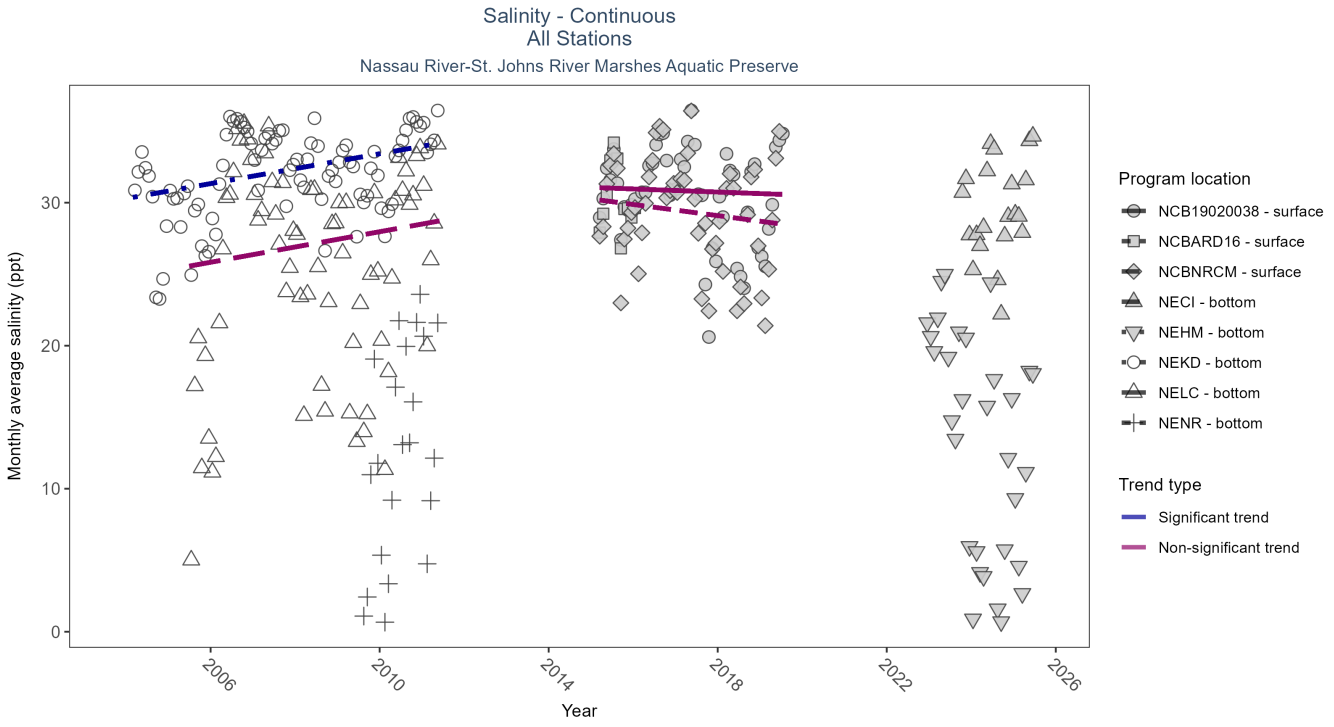

Figure 32: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 34: 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
NEHM	Insufficient data to calculate trend	88721	4	2022 - 2025	14.40	-	-	-	-
NEKD	Significantly increasing trend	118328	8	2004 - 2011	33.20	0.31	30.29	0.52	0
NECI	Insufficient data to calculate trend	54462	3	2023 - 2025	29.60	-	-	-	-
NCB19020038	No significant trend	34438	5	2015 - 2019	31.75	-0.06	31.07	-0.11	1
NCBNRCM	No significant trend	35411	5	2015 - 2019	30.29	-0.12	30.26	-0.39	0.55
NENR	Insufficient data to calculate trend	31438	3	2009 - 2011	12.40	-	-	-	-
NELC	No significant trend	100339	7	2005 - 2011	27.90	0.09	25.3	0.53	0.44
NCBARD16	Insufficient data to calculate trend	7418	2	2015 - 2016	30.07	-	-	-	-

At one program location, monthly average salinity increased by 0.52 ppt per year. No detectable change in monthly average salinity was observed at three locations. There was insufficient data to fit a model for four locations.

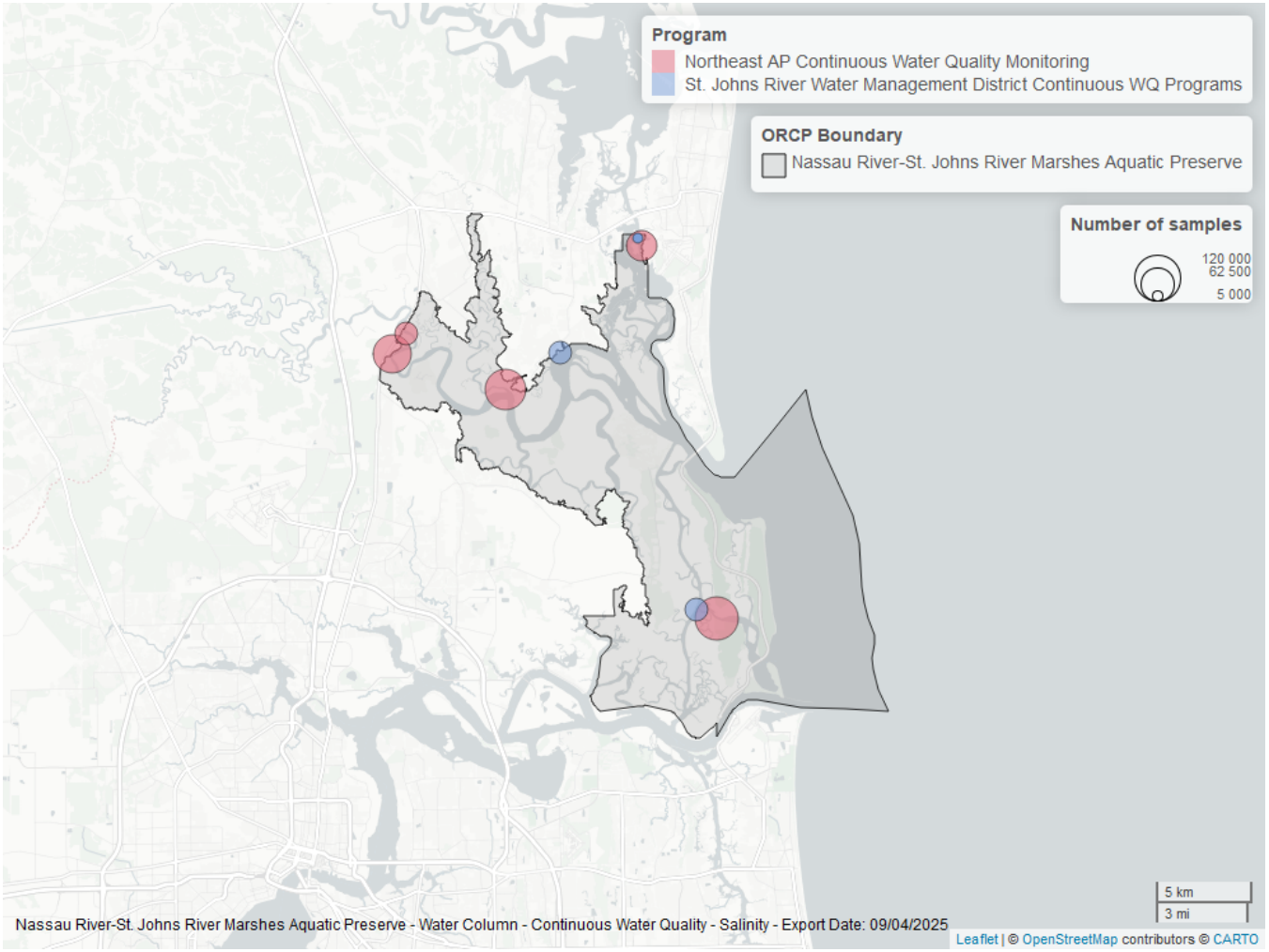

Figure 33: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

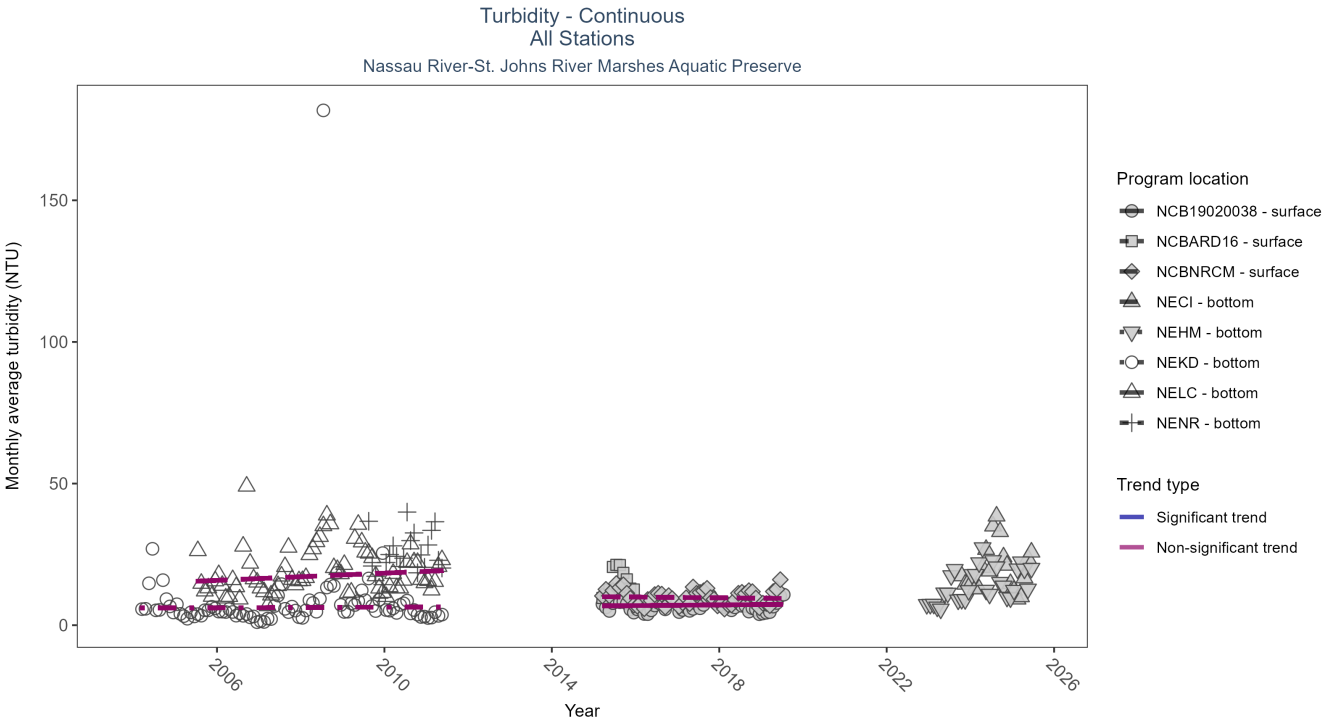

Figure 34: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 35: 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
NEHM	Insufficient data to calculate trend	83369	4	2022 - 2025	12.00	-	-	-	-
NECI	Insufficient data to calculate trend	53689	3	2023 - 2025	14.00	-	-	-	-
NEKD	No significant trend	114181	8	2004 - 2011	4.00	0.02	6.06	0.05	0.87
NCBNRCM	No significant trend	34696	5	2015 - 2019	8.64	-0.1	10.09	-0.14	0.6
NCB19020038	No significant trend	31407	5	2015 - 2019	5.77	-0.01	6.79	0.12	0.79
NENR	Insufficient data to calculate trend	31087	3	2009 - 2011	21.00	-	-	-	-
NELC	No significant trend	96153	7	2005 - 2011	15.00	0.16	15.18	0.64	0.15
NCBARD16	Insufficient data to calculate trend	7385	2	2015 - 2016	12.89	-	-	-	-

No detectable change in monthly average turbidity was observed at four locations. There was insufficient data to fit a model for four locations.

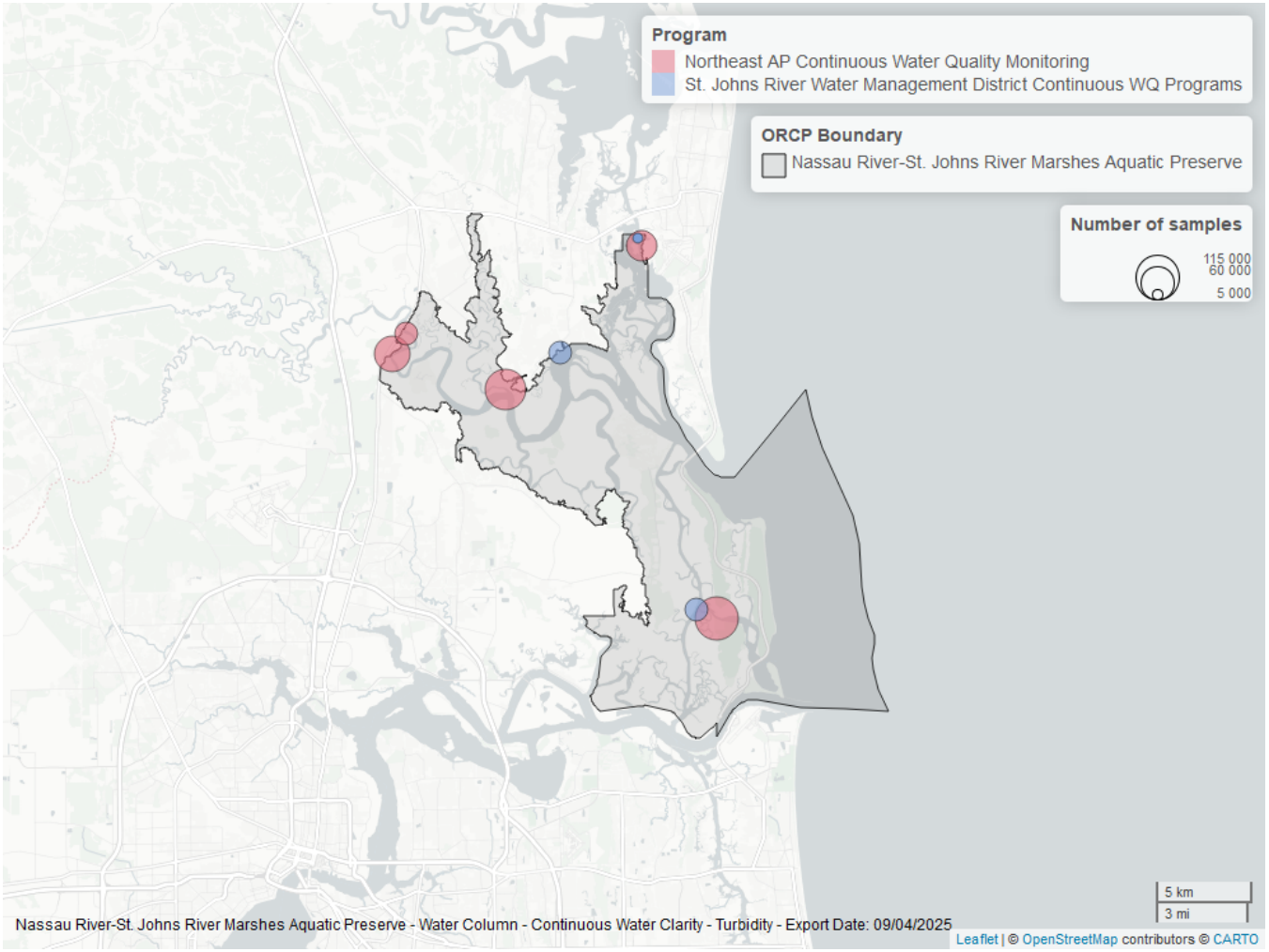

Figure 35: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

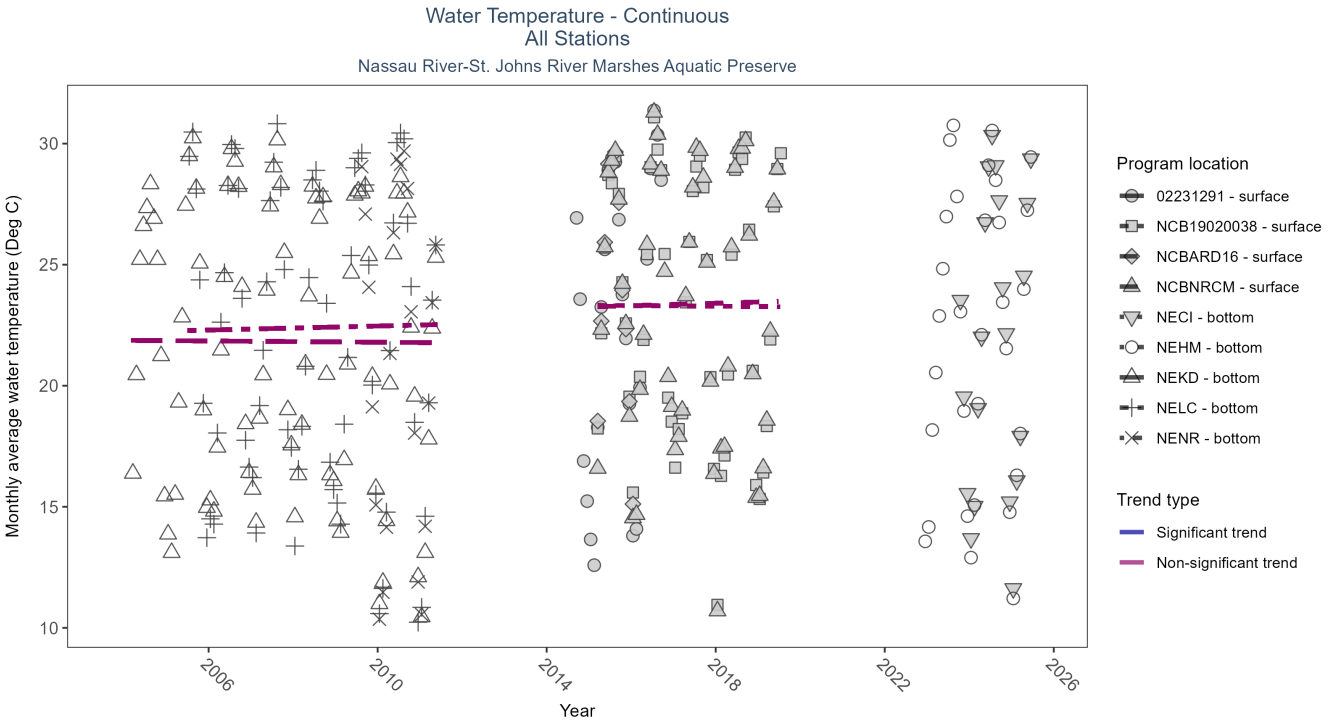

Figure 36: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 36: 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
02231291	Insufficient data to calculate trend	710	3	2014 - 2016	23.50	-	-	-	-
NEKD	No significant trend	118328	8	2004 - 2011	22.10	-0.04	21.88	-0.01	0.81
NECI	Insufficient data to calculate trend	54825	3	2023 - 2025	21.00	-	-	-	-
NEHM	Insufficient data to calculate trend	89130	4	2022 - 2025	22.80	-	-	-	-
NCB19020038	No significant trend	34483	5	2015 - 2019	24.78	-0.03	23.32	-0.01	1
NENR	Insufficient data to calculate trend	31438	3	2009 - 2011	22.00	-	-	-	-
NELC	No significant trend	100343	7	2005 - 2011	22.70	0.05	22.26	0.04	0.74
NCBNRCM	No significant trend	35817	5	2015 - 2019	24.03	0.07	23.26	0.05	0.67
NCBARD16	Insufficient data to calculate trend	7419	2	2015 - 2016	25.08	-	-	-	-

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

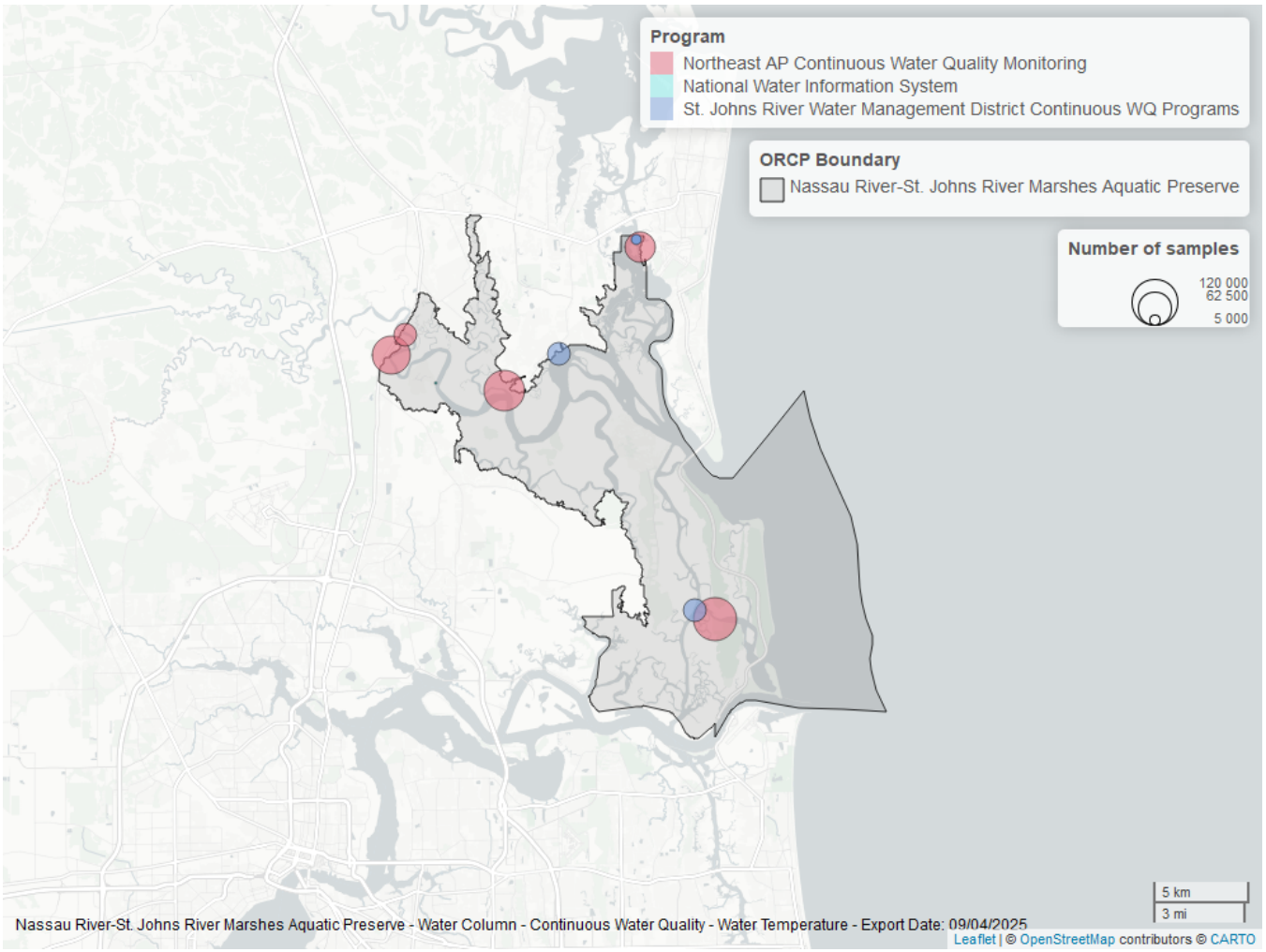

Figure 37: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Nassau River-St. Johns River Marshes Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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