Cockroach Bay 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

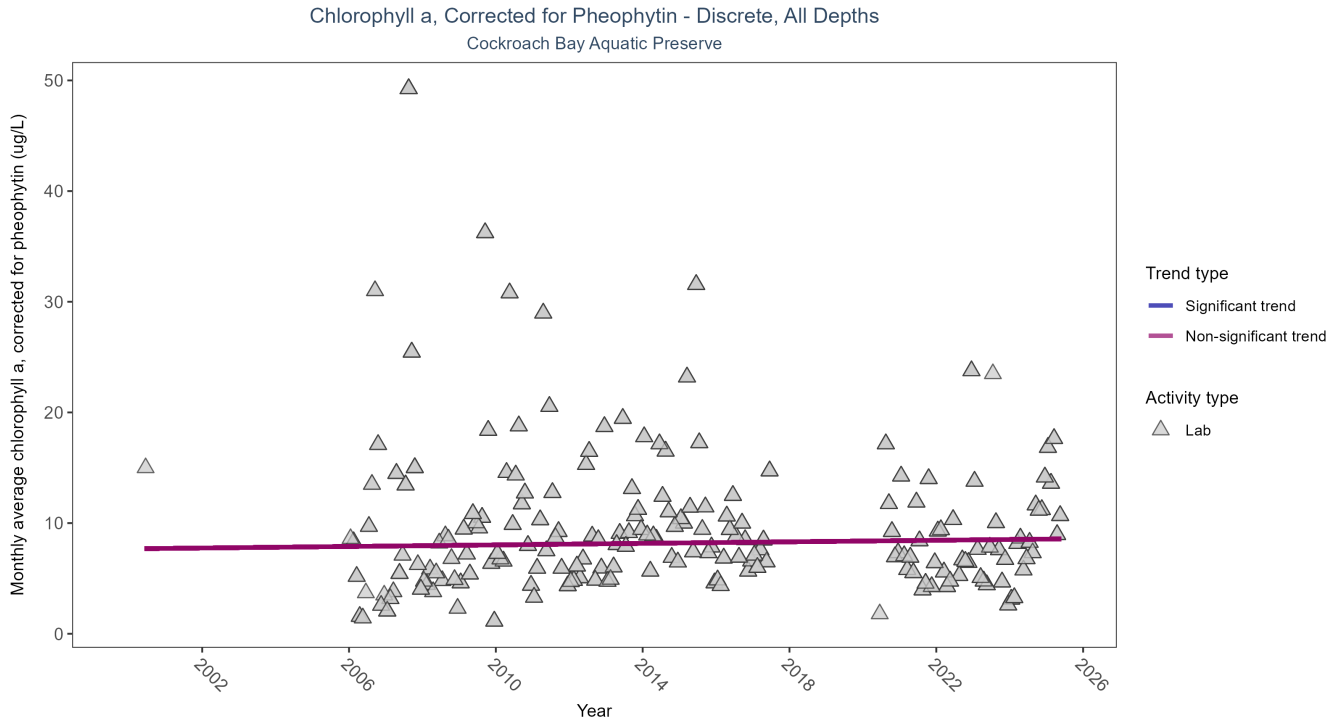

Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	No significant trend	914	19	2000 - 2025	6.4	0.0361	7.6778	0.035	0.4903

Chlorophyll a, corrected for pheophytin, showed no detectable trend between 2000 and 2025.

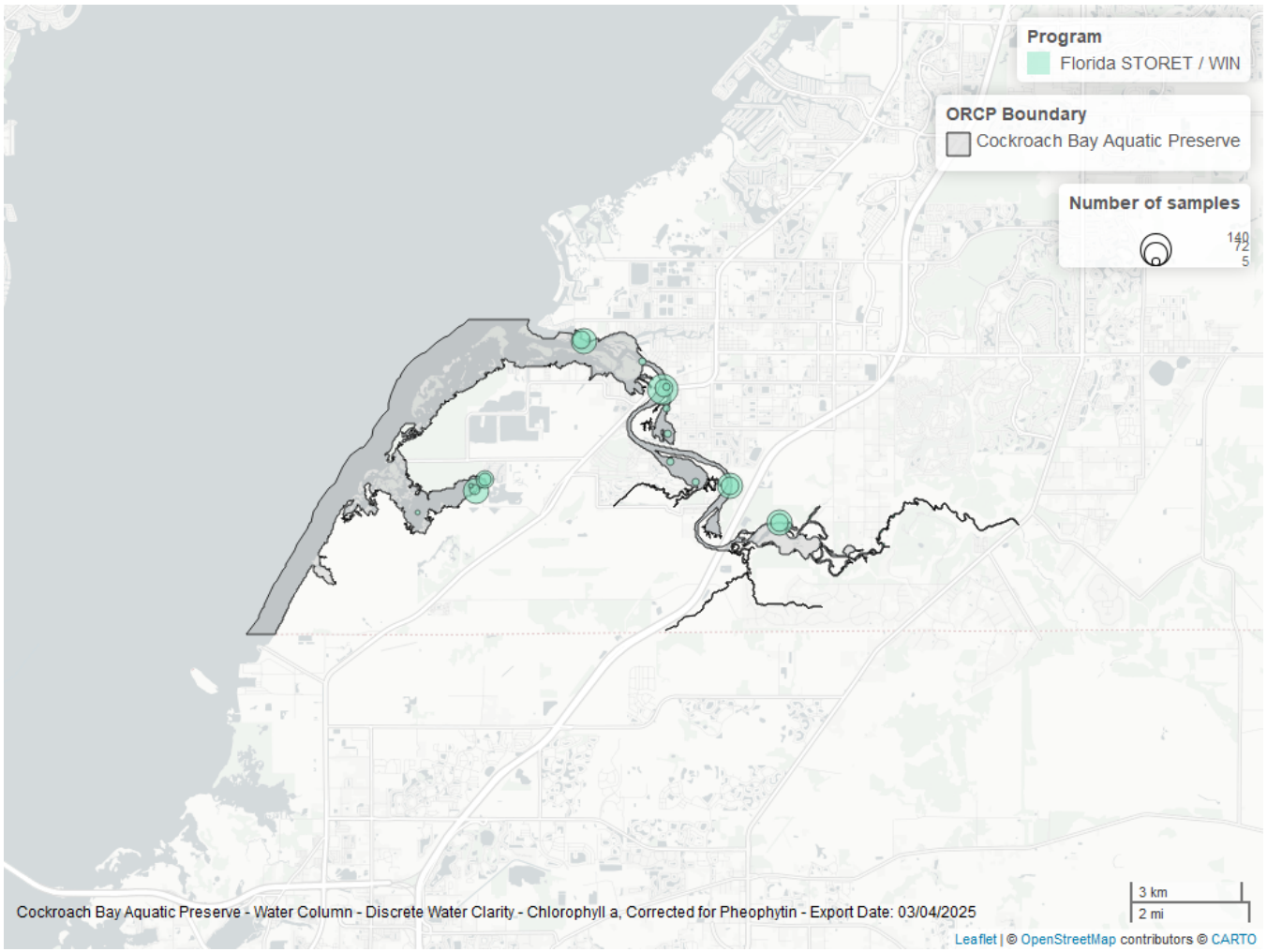

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	938	2000	2025

Program names:

5002 - Florida STORET / WIN[1]

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

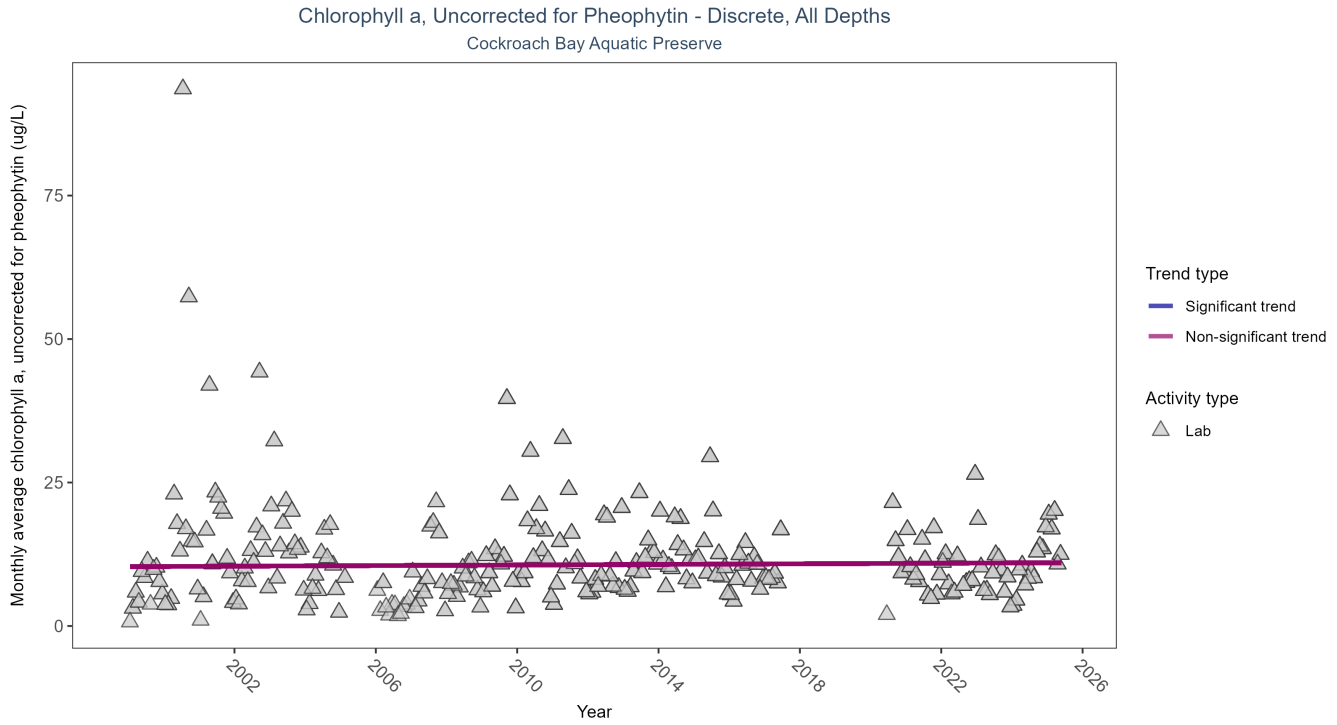

Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	1001	25	1999 - 2025	7.6	0.0264	10.3436	0.026	0.4874

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 1999 and 2025.

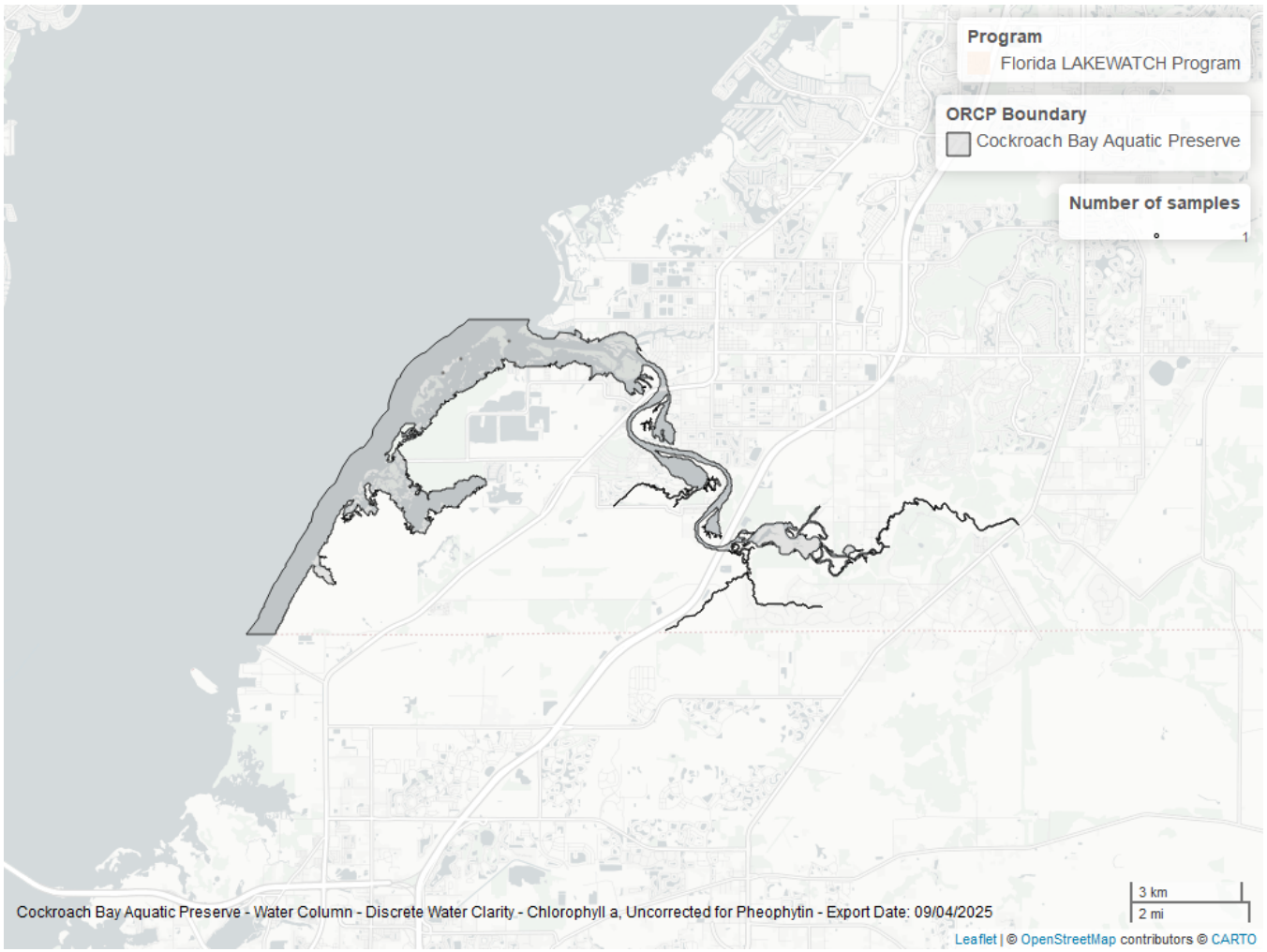

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1008	1999	2025
514	4	2001	2001
103	1	2015	2015

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[2]
514 - Florida LAKEWATCH Program[3]
5002 - Florida STORET / WIN[1]

Colored Dissolved Organic Matter - Discrete

Seasonal Kendall-Tau Trend Analysis

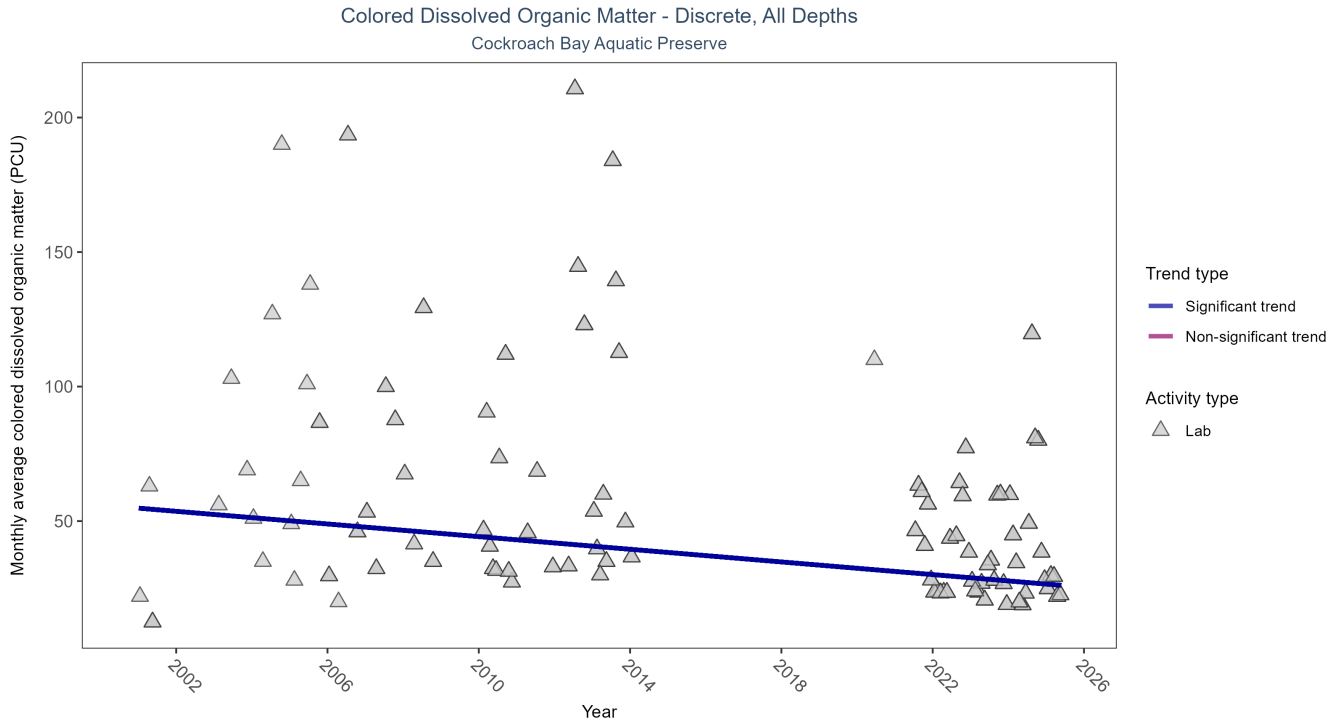

Figure 5: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly decreasing trend	360	18	2001 - 2025	36.95	-0.2699	54.813	-1.1761	0.0018

Monthly average colored dissolved organic matter decreased by 1.18 PCU per year, indicating an increase in water clarity.

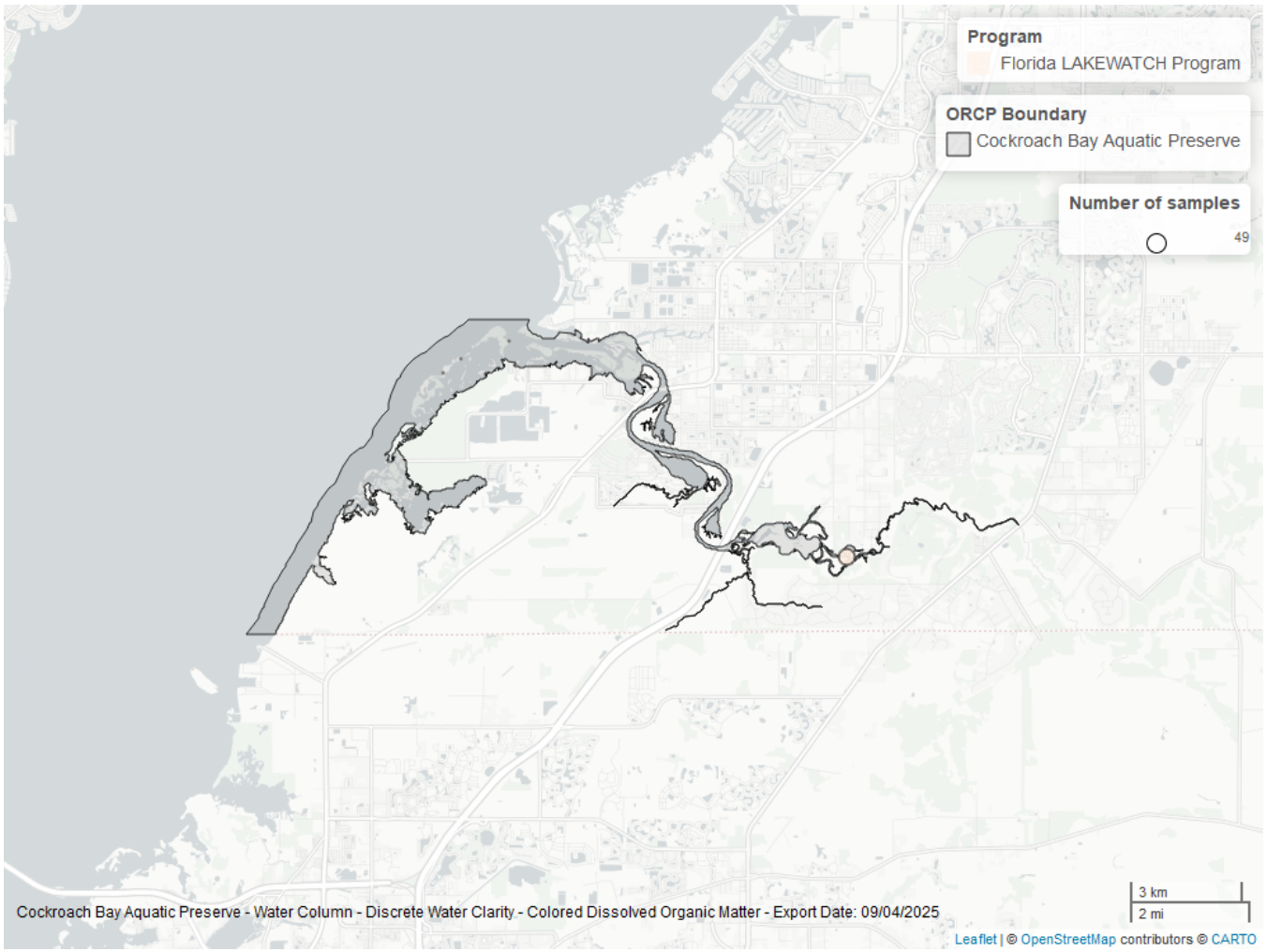

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	230	2020	2025
514	130	2001	2014

Program names:

514 - Florida LAKEWATCH Program[3]
5002 - Florida STORET / WIN[1]

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

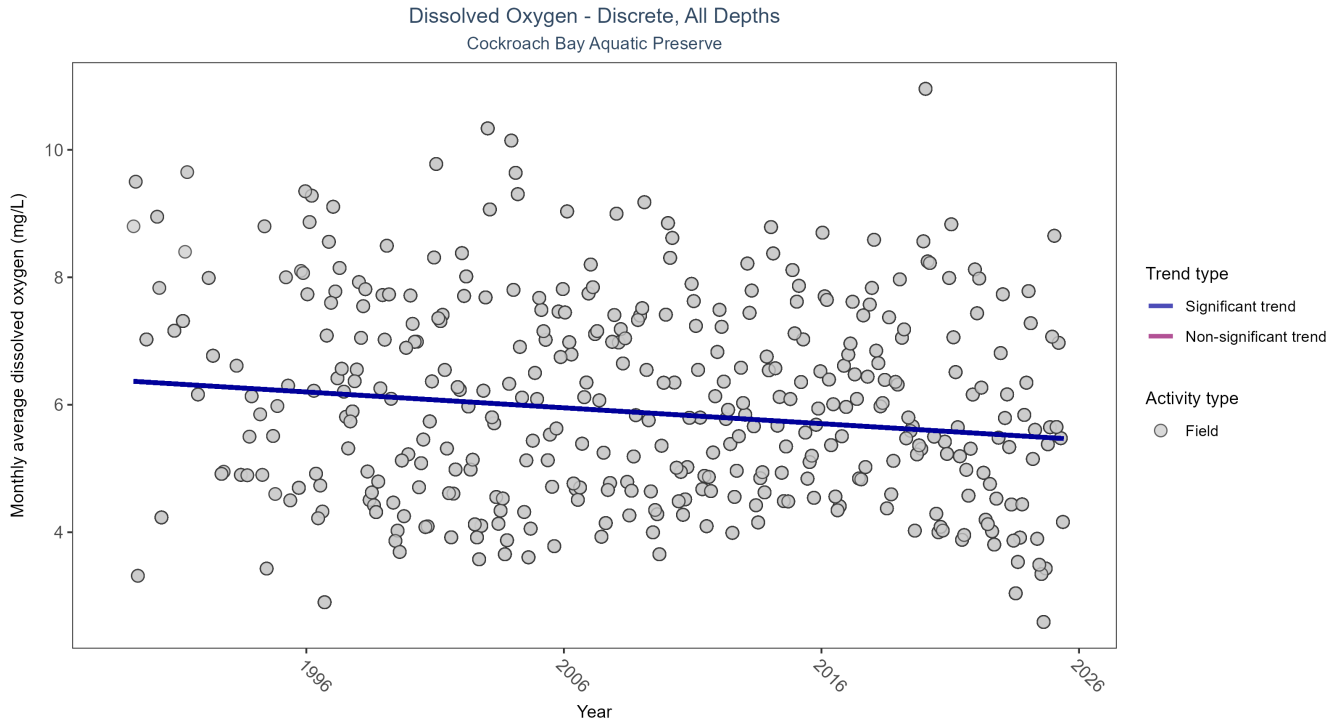

Figure 7: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	Significantly decreasing trend	26005	37	1989 - 2025	5.3	-0.1834	6.3749	-0.0249	0

Monthly average dissolved oxygen decreased by 0.02 mg/L per year.

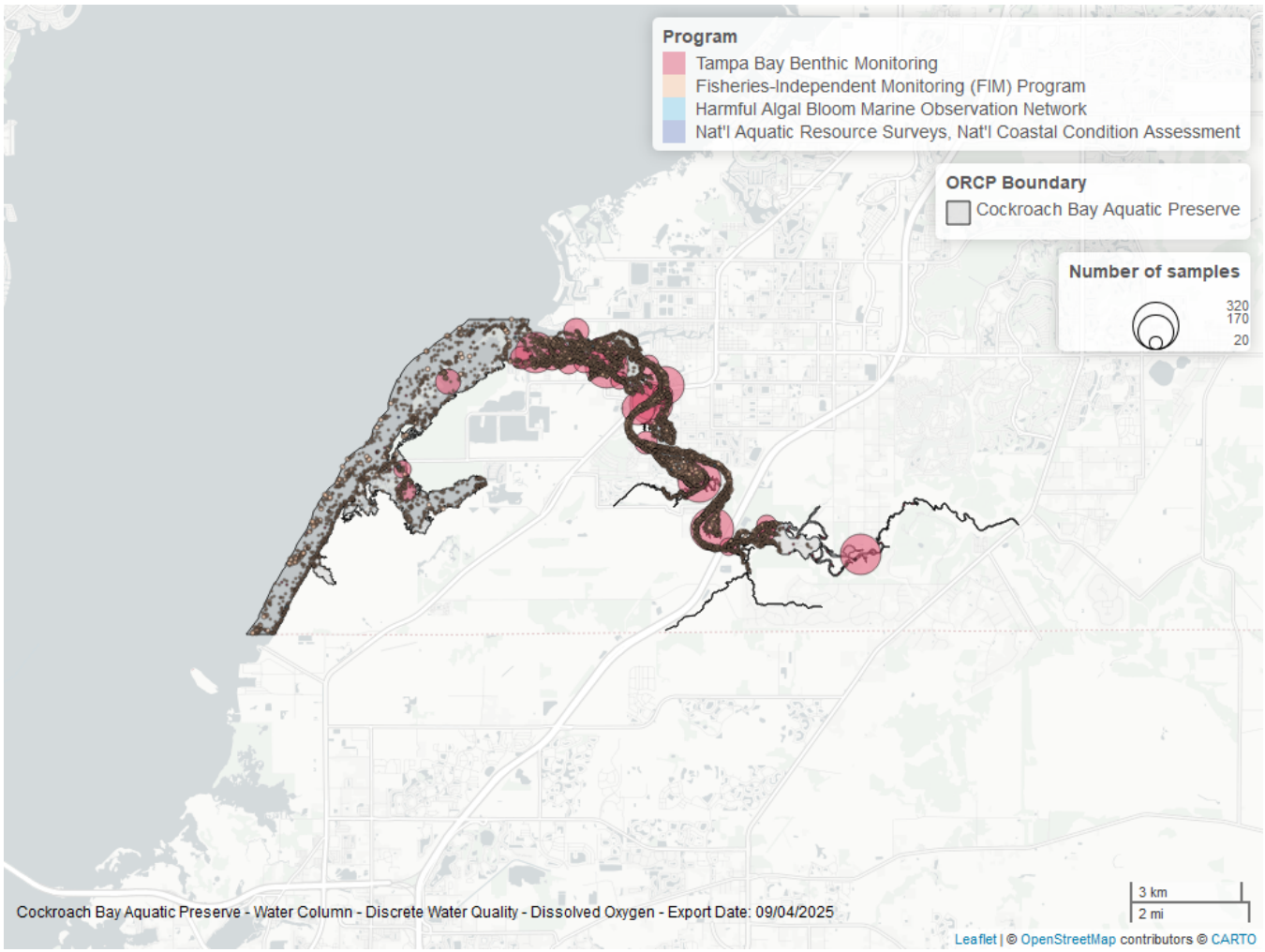

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	14646	1989	2024
5002	7651	1999	2025
4067	4024	1993	2022
95	8	2005	2014
103	2	2015	2015
118	2	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[4]
95 - Harmful Algal Bloom Marine Observation Network[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[2]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[6]
4067 - Tampa Bay Benthic Monitoring[7]
5002 - Florida STORET / WIN[1]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

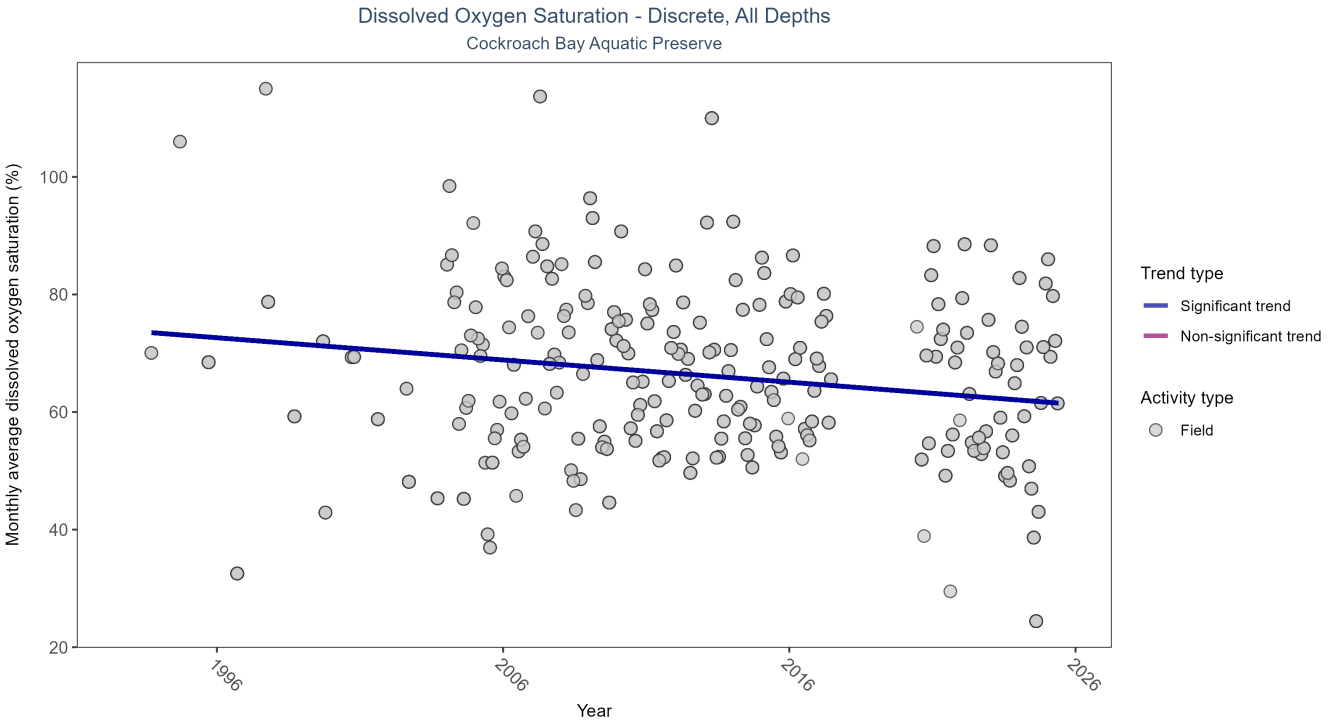

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles)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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly decreasing trend	11190	31	1993 - 2025	59.4	-0.1787	73.7733	-0.3781	0.0001

Monthly average dissolved oxygen saturation decreased by 0.38% per year.

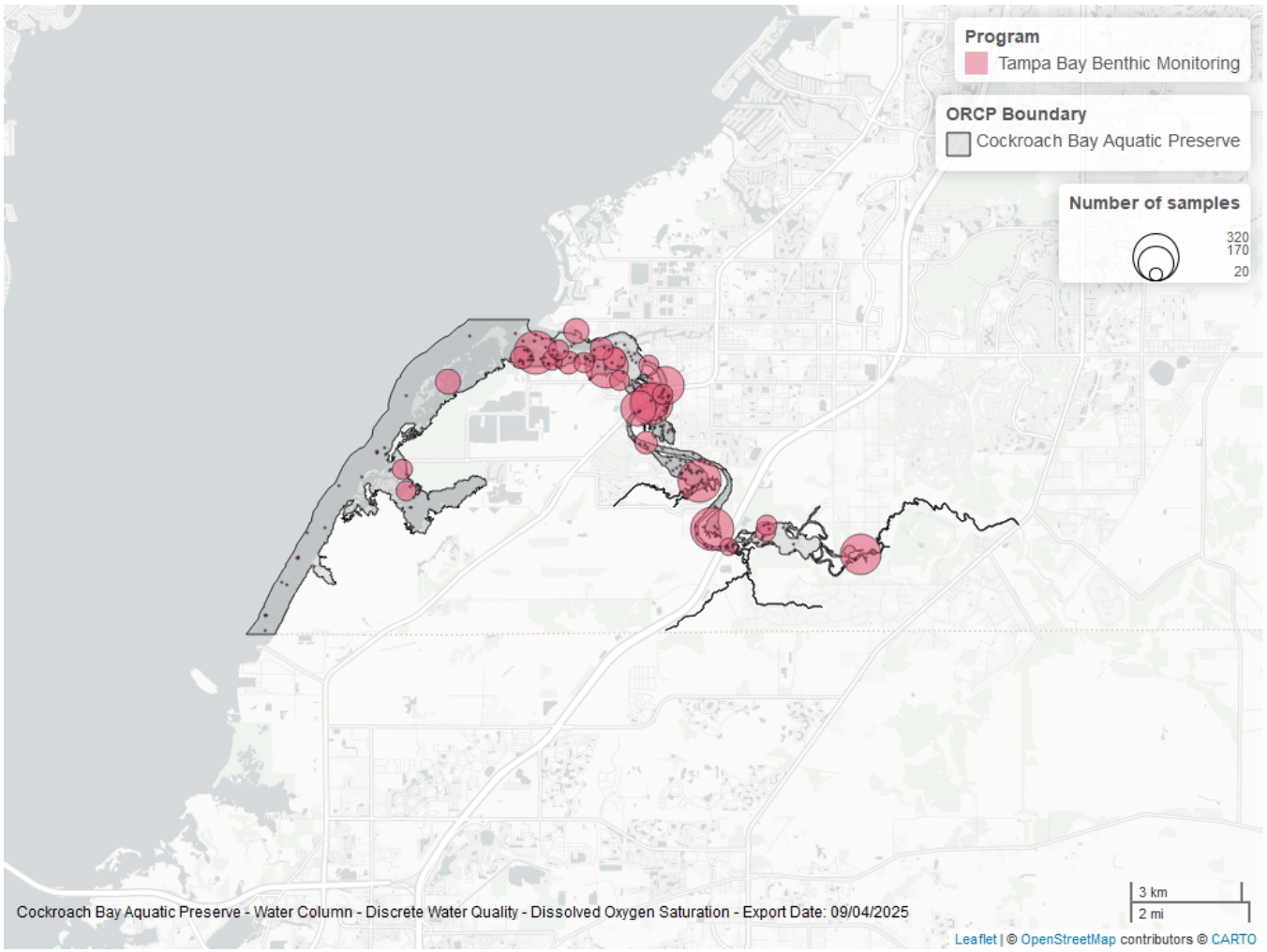

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	7410	2004	2025
4067	4107	1993	2022

Program names:

4067 - Tampa Bay Benthic Monitoring[7]
5002 - Florida STORET / WIN[1]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

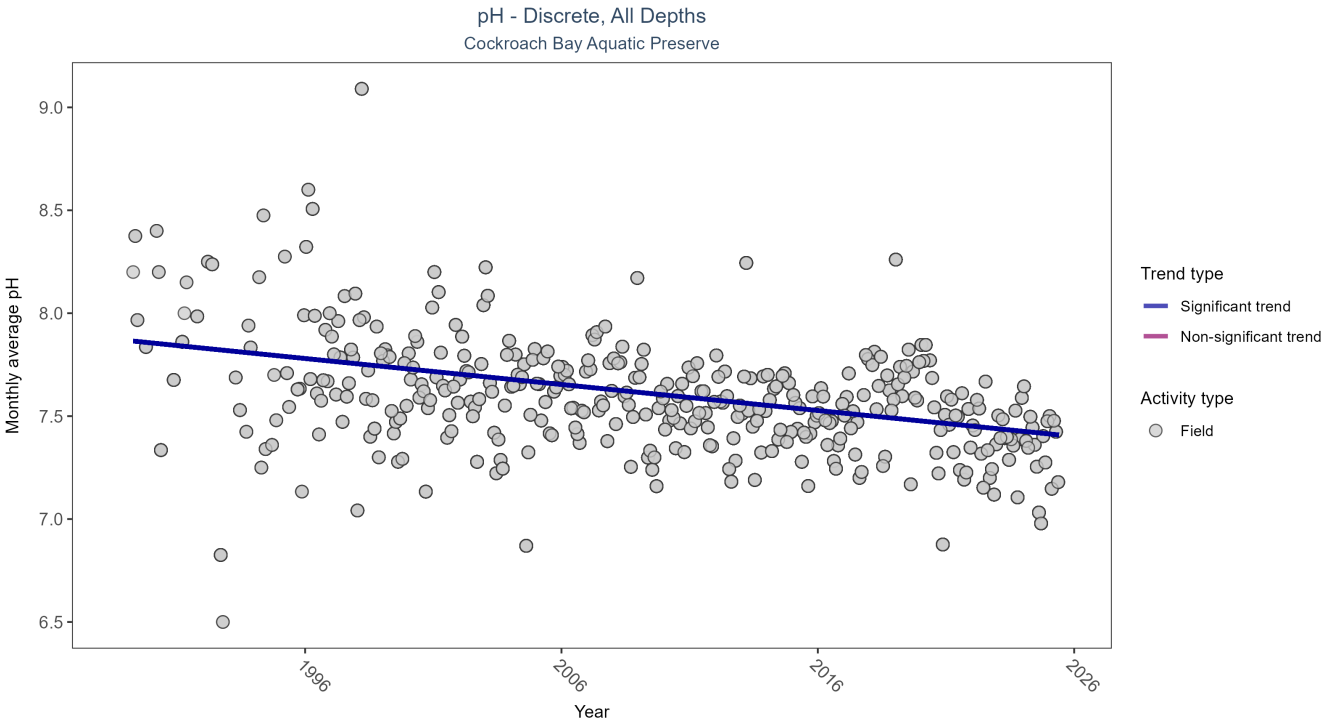

Figure 11: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	Significantly decreasing trend	25181	37	1989 - 2025	7.5	-0.3525	7.8683	-0.0126	0

Monthly average pH decreased by 0.01 pH units per year.

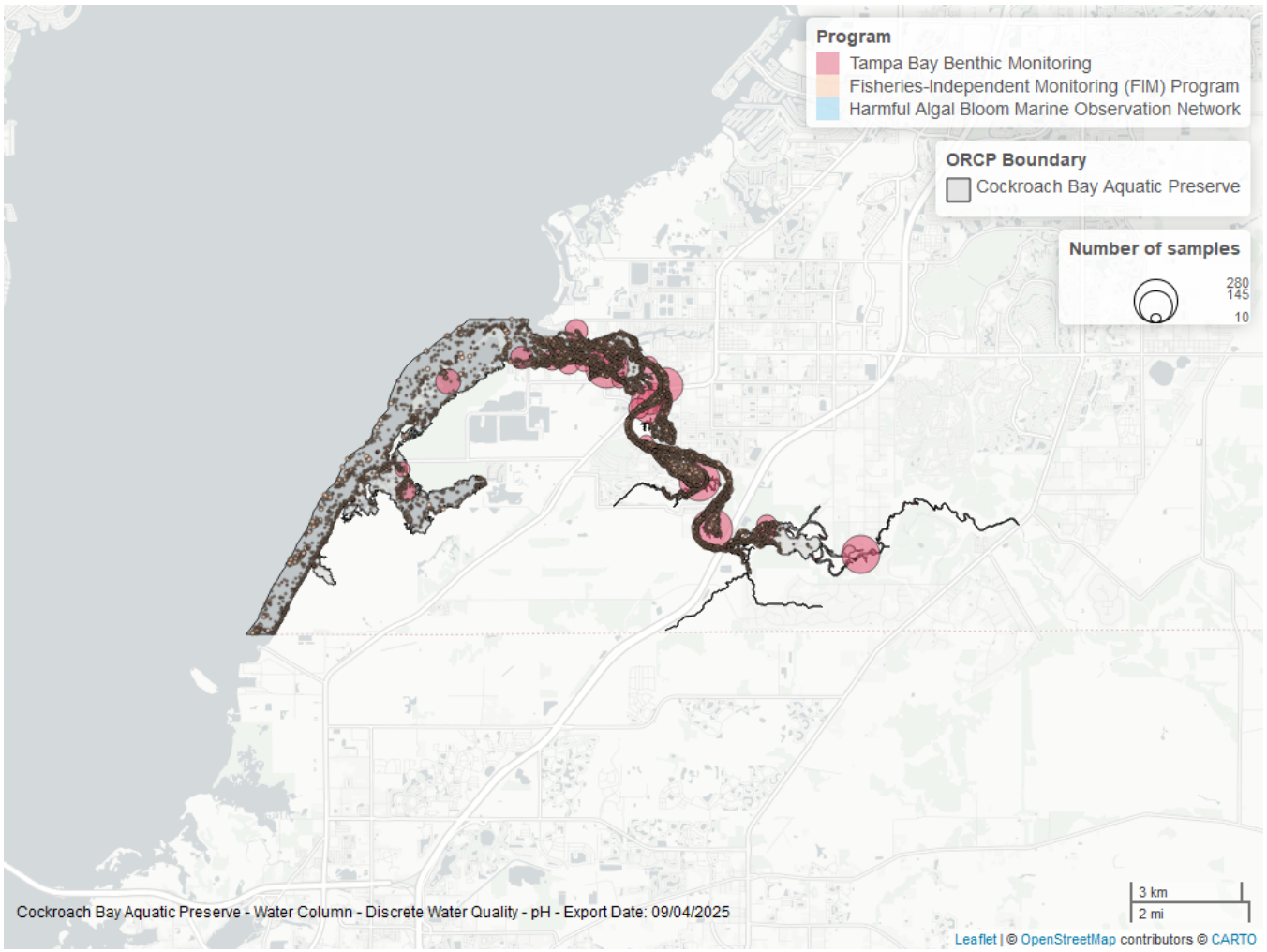

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	14648	1989	2024
5002	7642	1999	2025
4067	3078	1993	2022
103	3	2015	2015
95	1	2011	2011

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[4]
95 - Harmful Algal Bloom Marine Observation Network[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[2]
4067 - Tampa Bay Benthic Monitoring[7]
5002 - Florida STORET / WIN[1]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

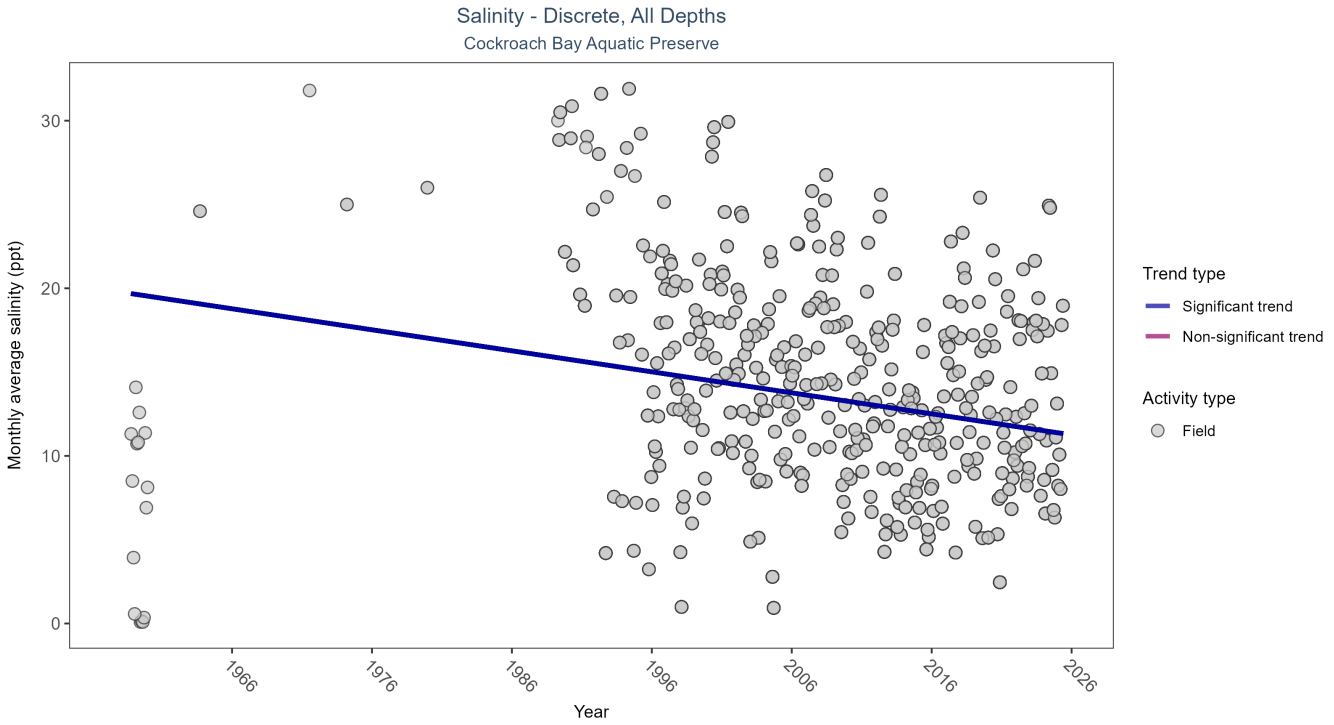

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	26040	43	1958 - 2025	12.3	-0.153	19.7808	-0.1254	0

Monthly average salinity decreased by 0.13 ppt per year.

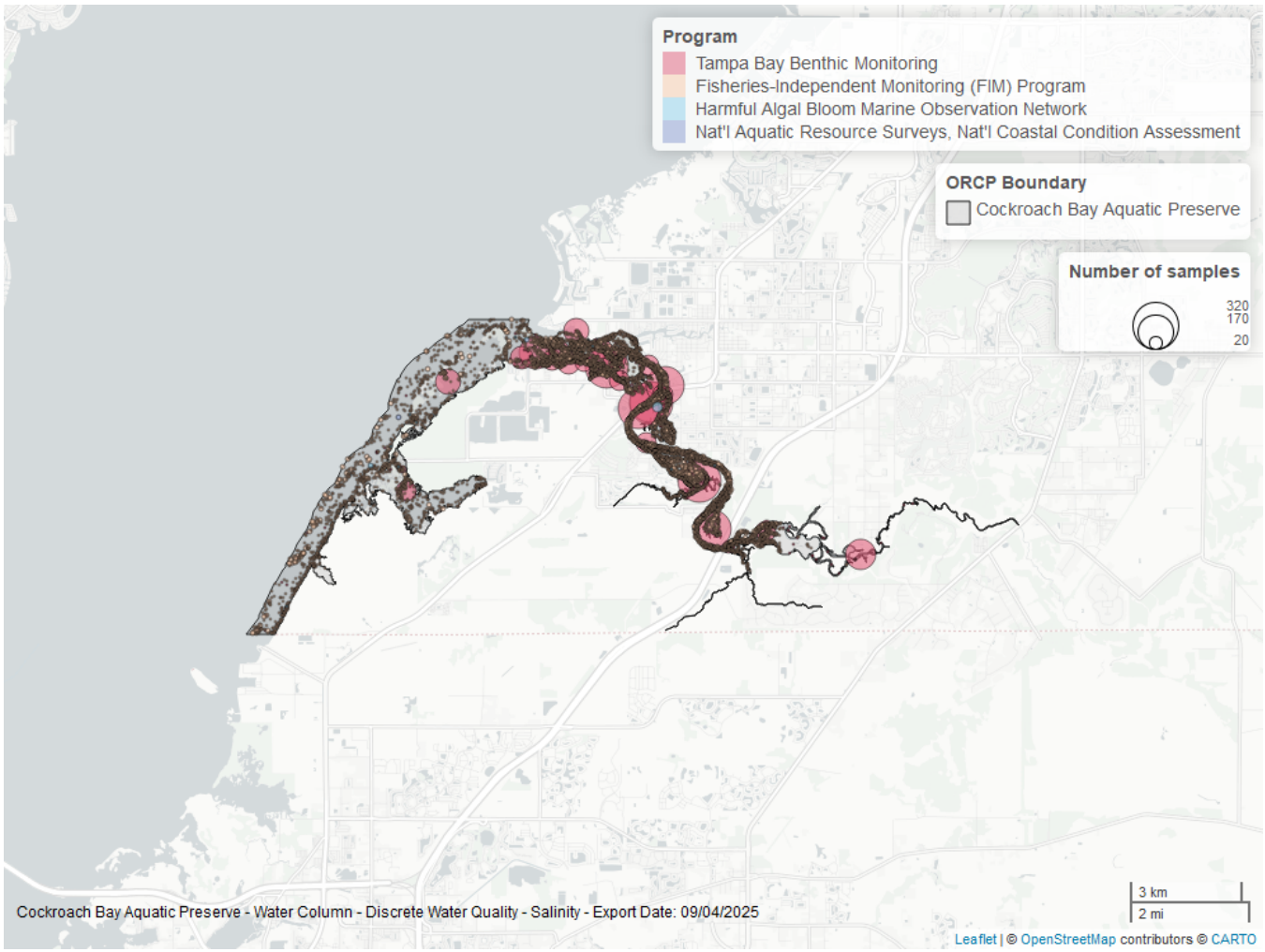

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	14725	1989	2024
5002	7638	1999	2025
4067	3742	1993	2022
95	32	1958	2014
118	3	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[4]
95 - Harmful Algal Bloom Marine Observation Network[5]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[6]
4067 - Tampa Bay Benthic Monitoring[7]
5002 - Florida STORET / WIN[1]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

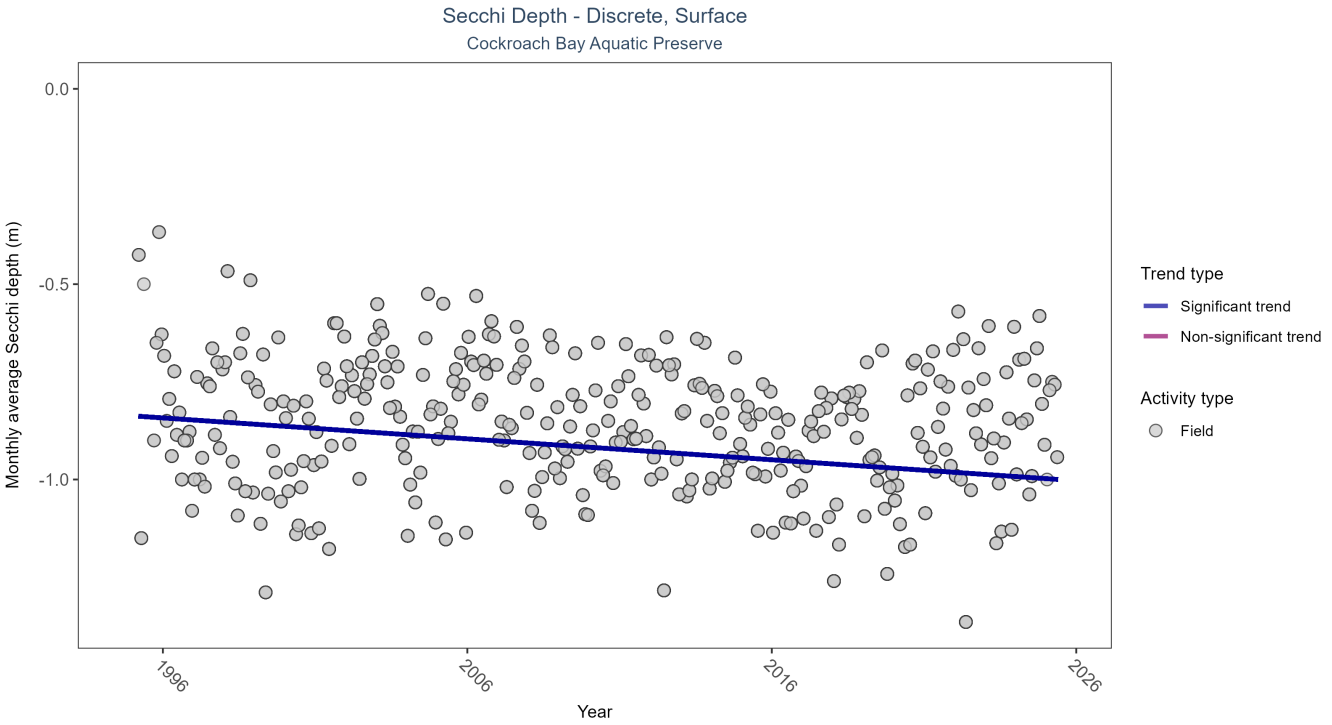

Figure 15: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	14685	31	1995 - 2025	-0.8	-0.1713	-0.837	-0.0054	0

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

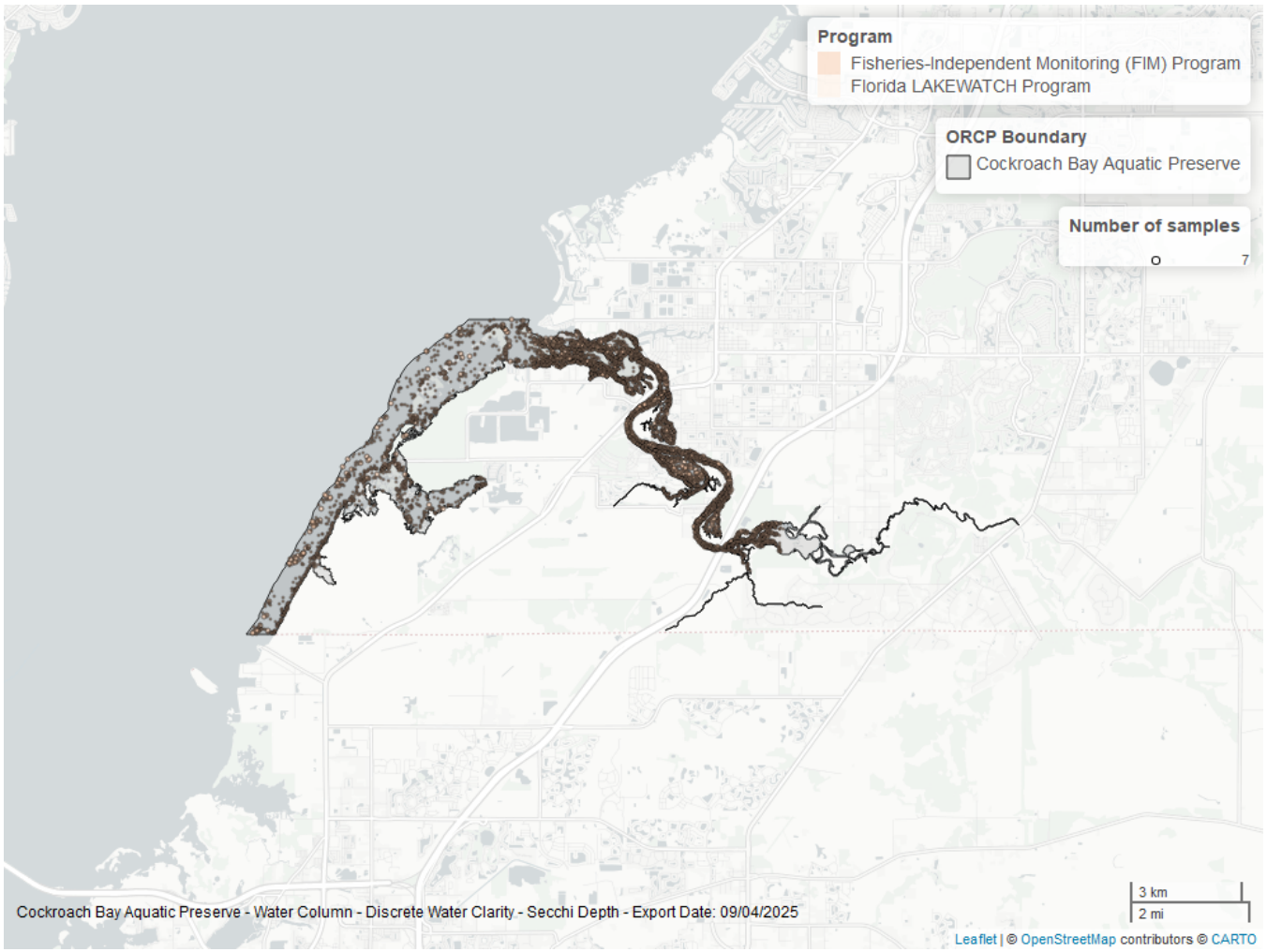

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	13651	1995	2024
5002	1030	1999	2025
514	4	2001	2001

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[4]
514 - Florida LAKEWATCH Program[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

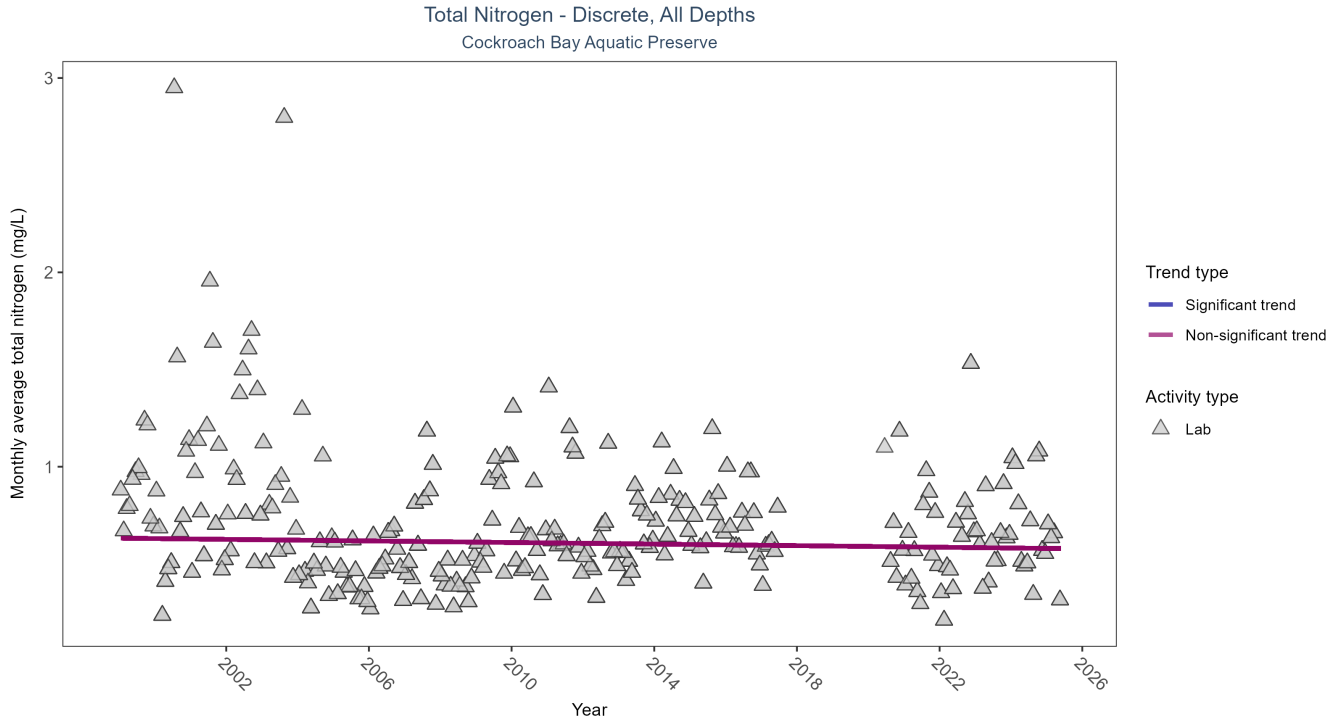

Figure 17: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	No significant trend	1495	25	1999 - 2025	0.619	-0.0561	0.6322	-0.002	0.2009

Total nitrogen showed no detectable trend between 1999 and 2025.

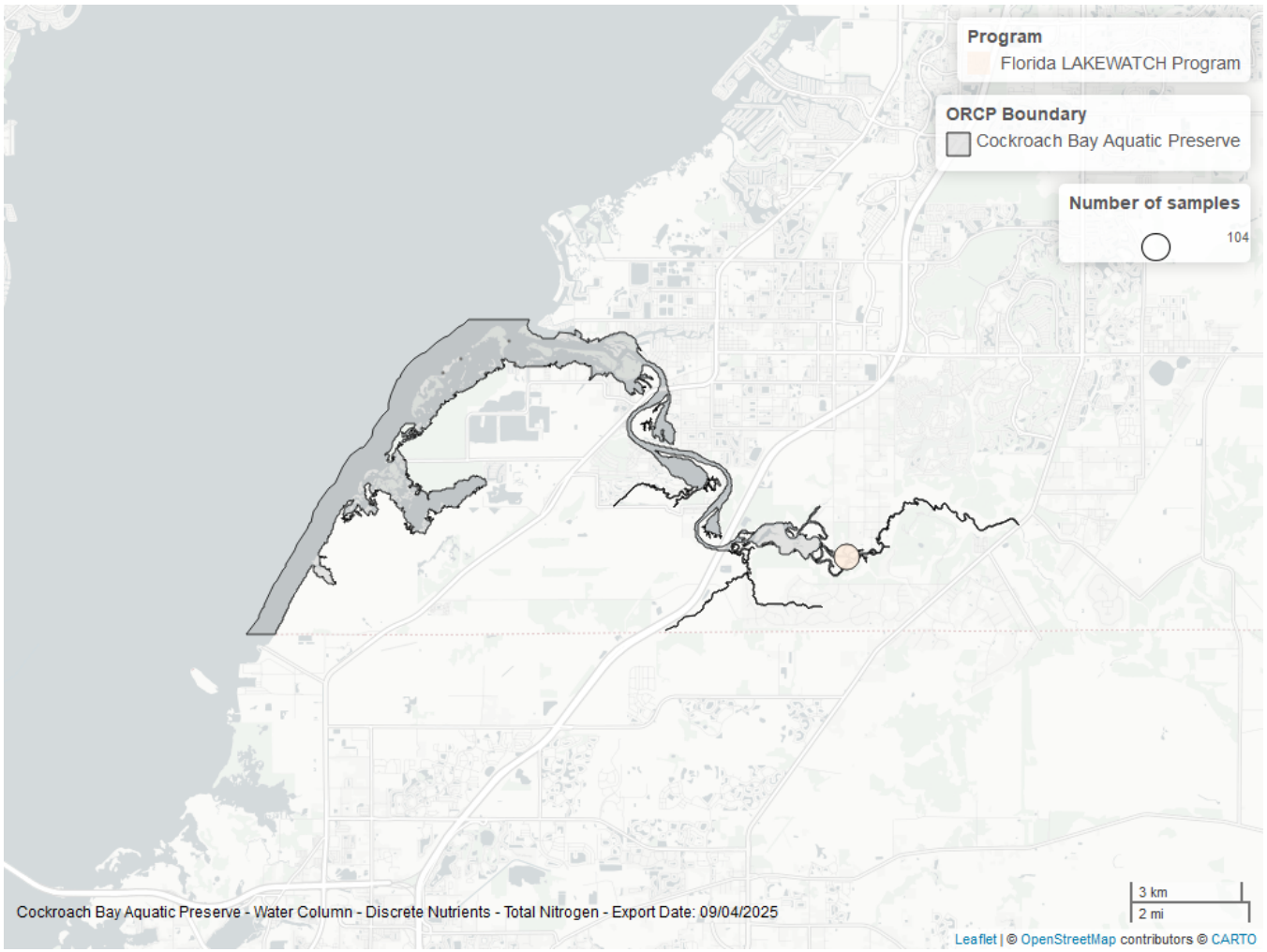

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1204	1999	2025
514	300	2000	2014

Program names:

514 - Florida LAKEWATCH Program[3]
5002 - Florida STORET / WIN[1]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

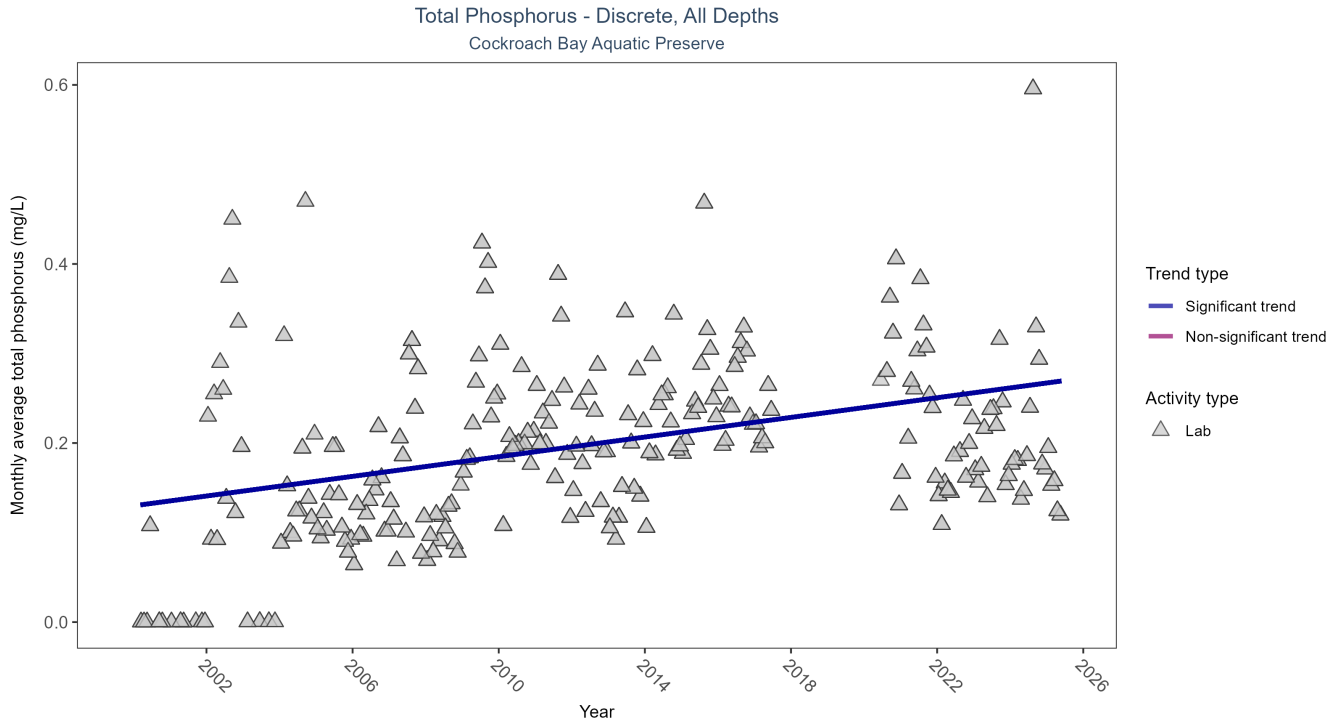

Figure 19: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly increasing trend	1309	24	2000 - 2025	0.201	0.3154	0.1298	0.0055	0

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

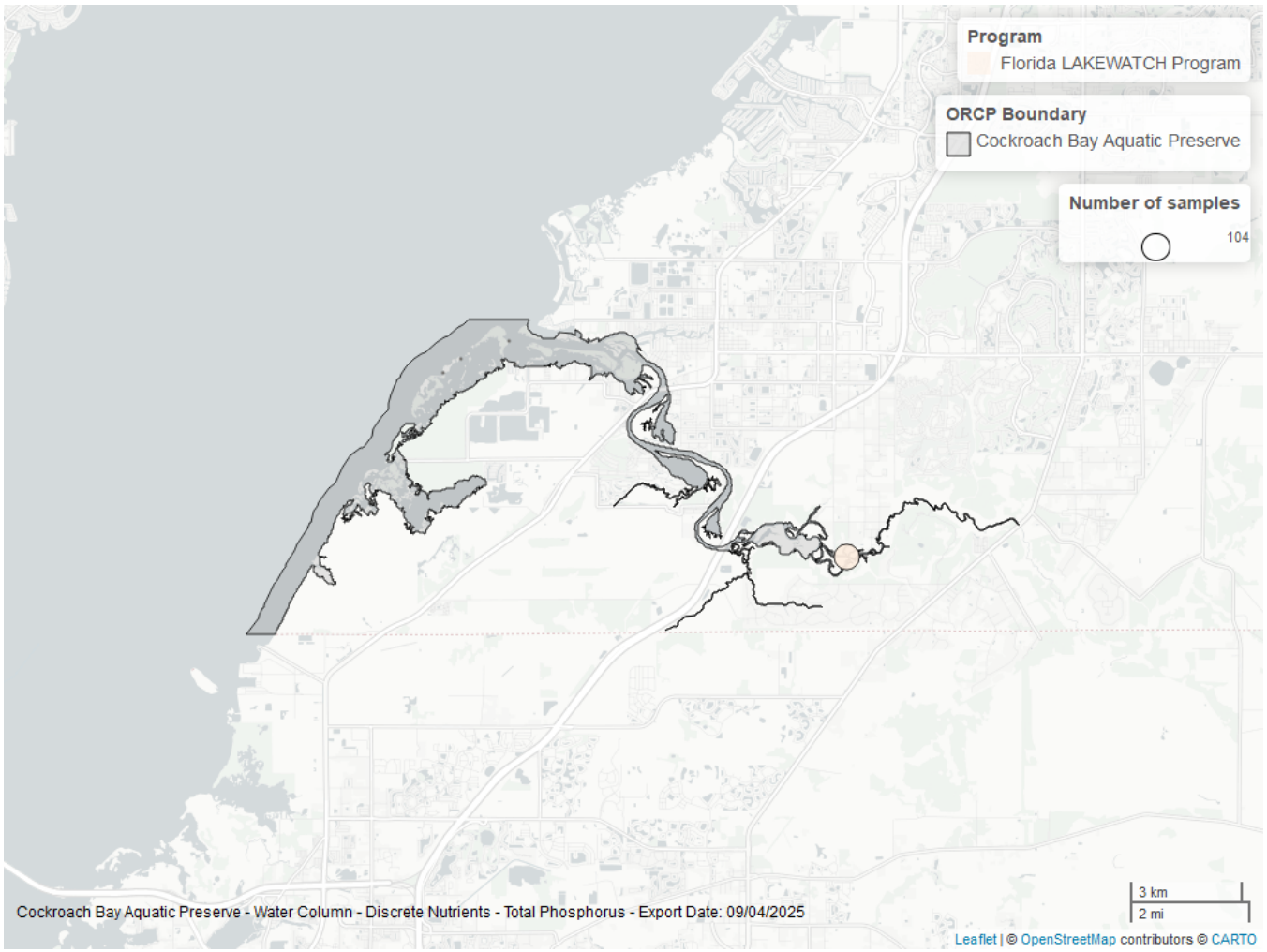

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1021	2000	2025
514	304	2000	2014
103	1	2015	2015

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[2]
514 - Florida LAKEWATCH Program[3]
5002 - Florida STORET / WIN[1]

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

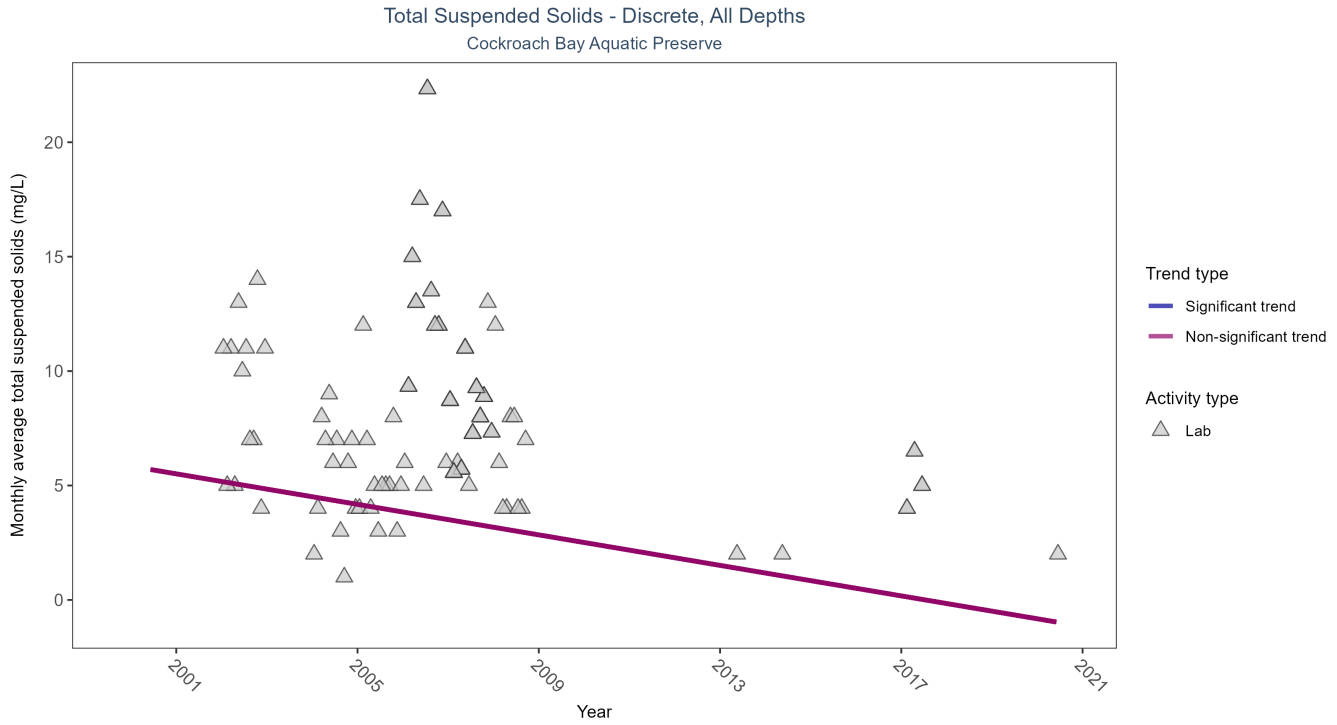

Figure 21: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	155	11	2000 - 2020	7	-0.0987	5.8429	-0.3333	0.1349

Total suspended solids showed no detectable trend between 2000 and 2020.

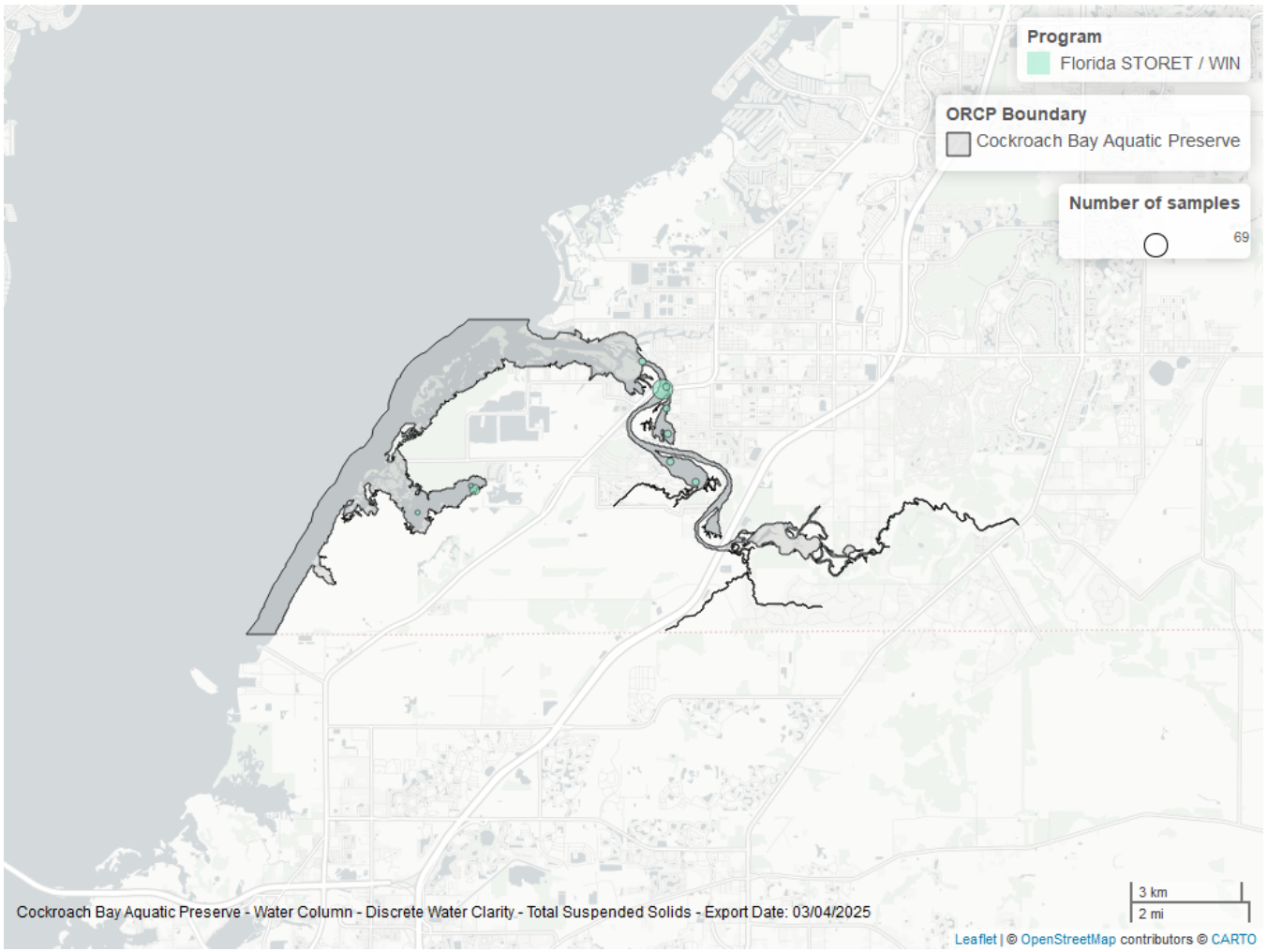

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	155	2000	2020

Program names:

5002 - Florida STORET / WIN[1]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

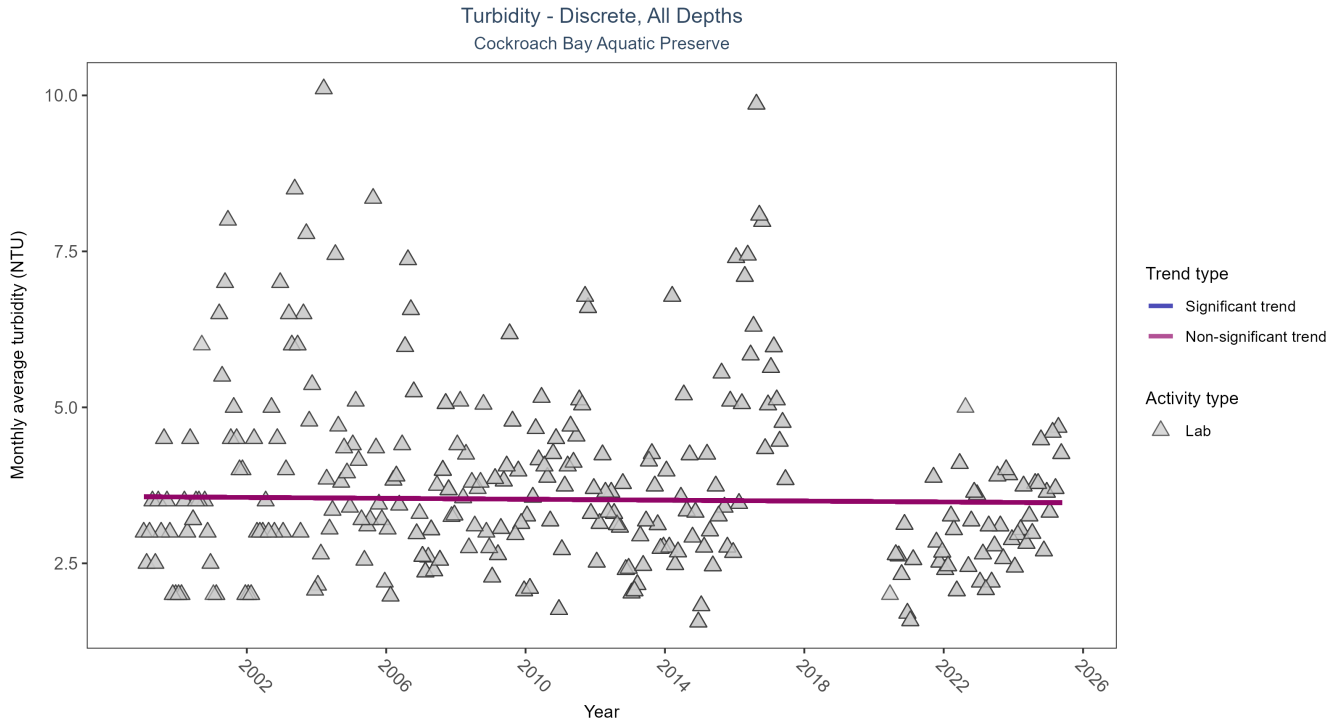

Figure 23: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	1074	25	1999 - 2025	3.1	-0.0216	3.5673	-0.0036	0.6335

Turbidity showed no detectable trend between 1999 and 2025.

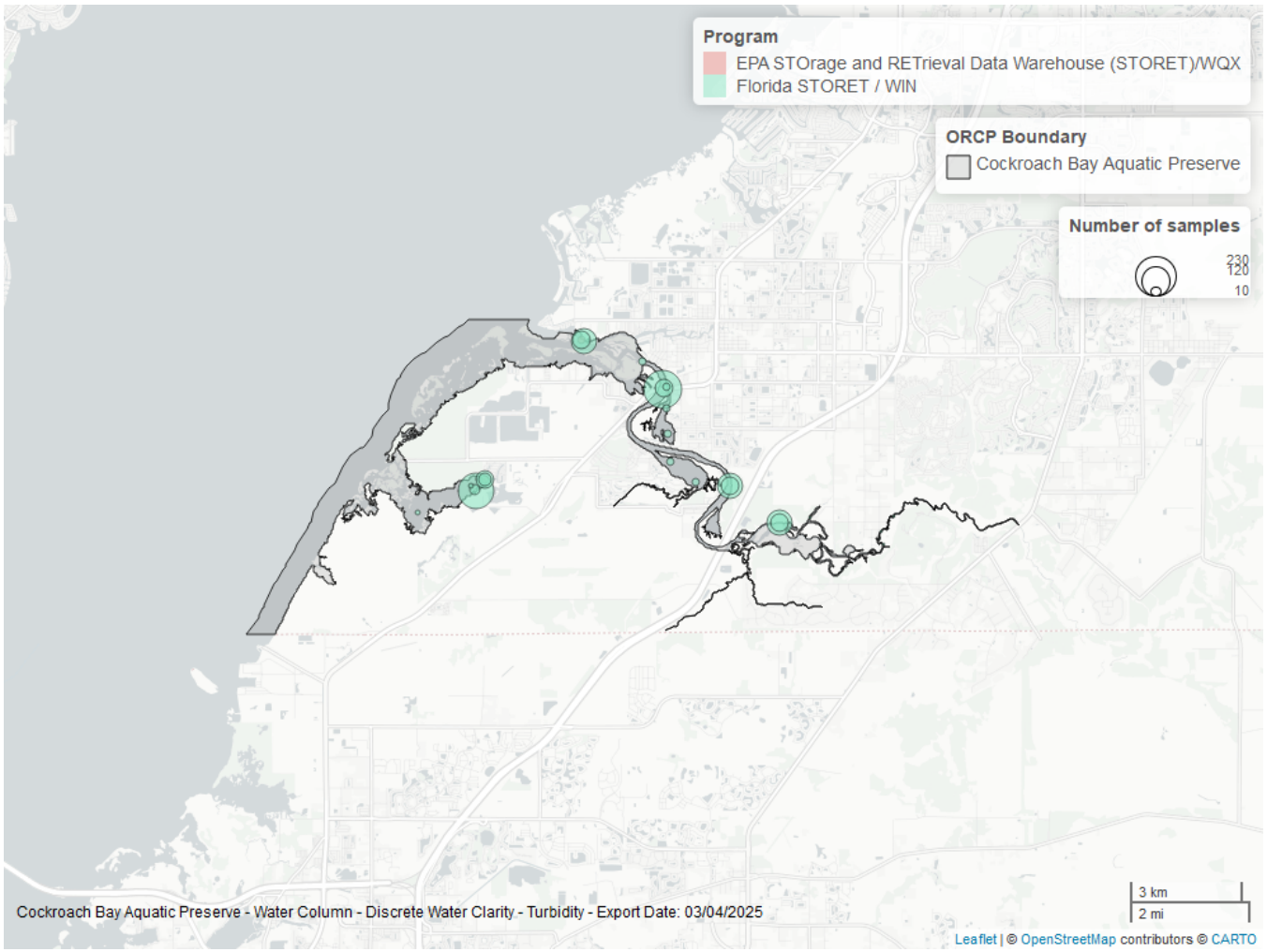

Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1115	1999	2025

Program names:

5002 - Florida STORET / WIN[1]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

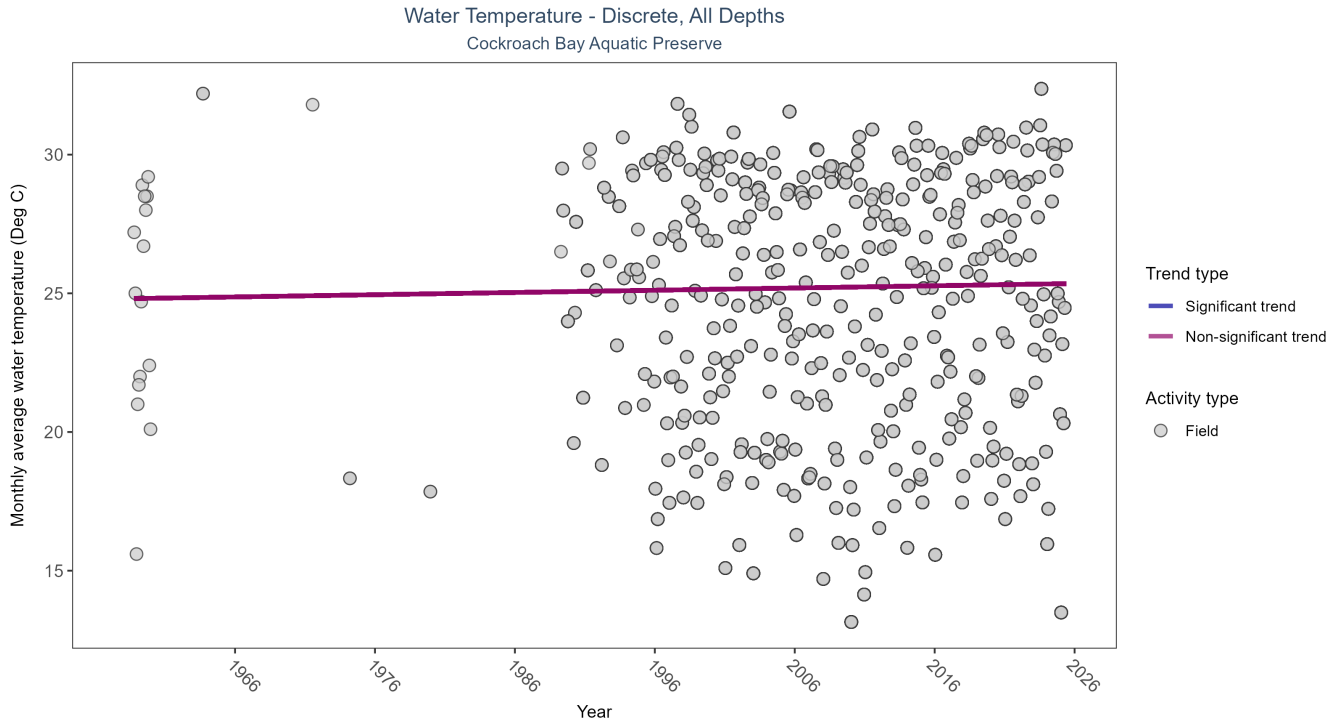

Figure 25: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	No significant trend	26264	43	1958 - 2025	26.48	0.0384	24.8045	0.0081	0.2929

Water temperature showed no detectable trend between 1958 and 2025.

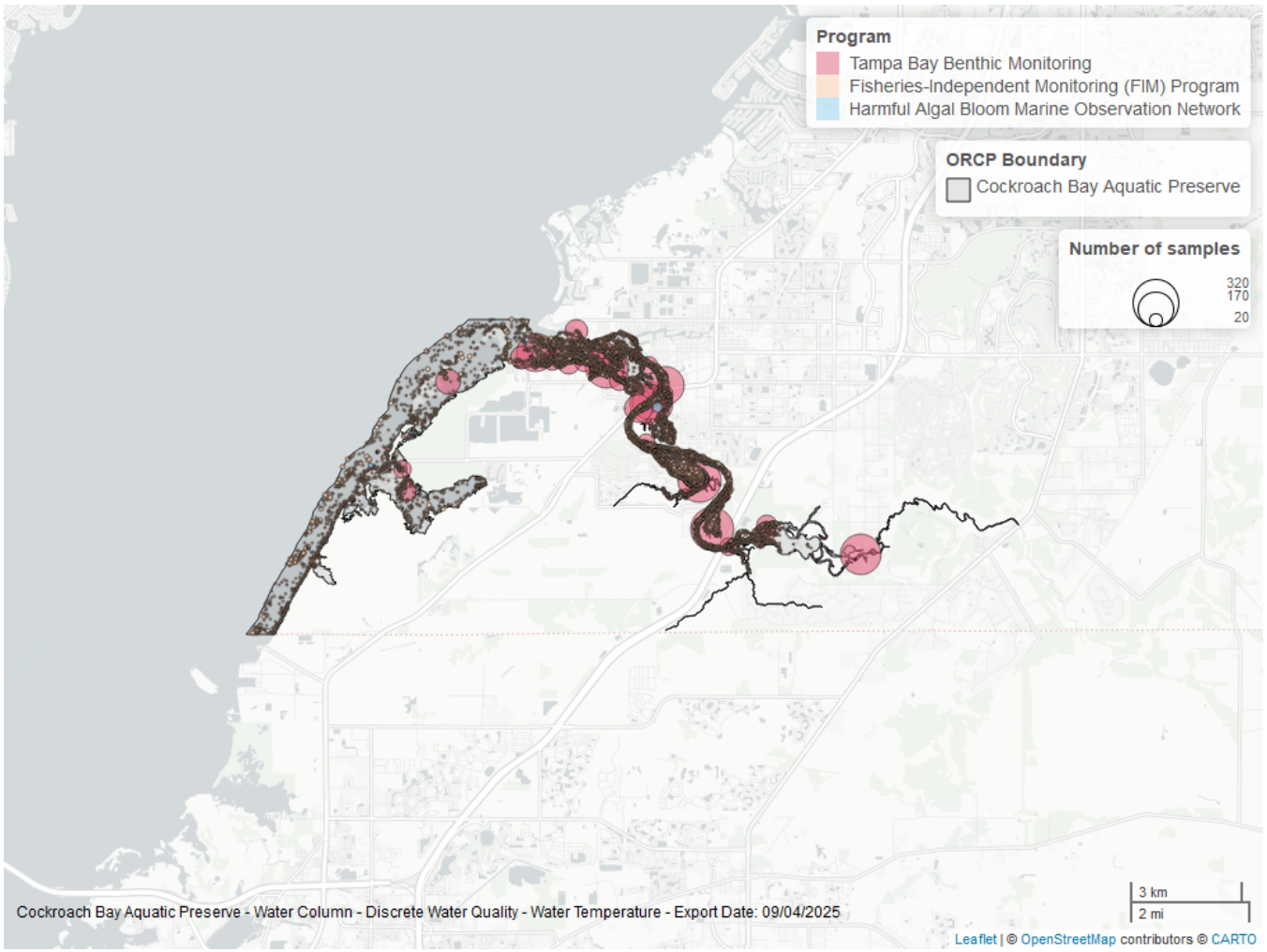

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	14756	1989	2024
5002	7663	1999	2025
4067	3854	1993	2022
95	31	1958	2014

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[4]
95 - Harmful Algal Bloom Marine Observation Network[5]
4067 - Tampa Bay Benthic Monitoring[7]
5002 - Florida STORET / WIN[1]

Submerged Aquatic Vegetation

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

Submerged aquatic vegetation (*SAV*) refers to plants and plant-like macroalgae species that live entirely underwater. The two primary categories of *SAV* inhabiting Florida estuaries are *benthic macroalgae* and *seagrasses*. They often grow together in dense beds or meadows that carpet the seafloor. *Macroalgae* include multicellular species of green, red and brown algae that often live attached to the substrate by a holdfast. They tend to grow quickly and can tolerate relatively high nutrient levels, making them a threat to seagrasses and other benthic habitats in areas with poor water quality. In contrast, *seagrasses* are grass-like, vascular, flowering plants that are attached to the seafloor by extensive root systems. *Seagrasses* occur throughout the coastal areas of Florida, including protected bays and lagoons as well as deeper offshore waters on the continental shelf. *Seagrasses* have taken advantage of the broad, shallow shelf and clear water to produce two of the most extensive seagrass beds anywhere in continental North America.

Parameters

Percent Cover measures the fraction of an area of seafloor that is covered by SAV, usually estimated by evaluating multiple small areas of seafloor. Percent cover is often estimated for total SAV, individual types of vegetation (seagrass, attached algae, drift algae) and individual species.

Frequency of Occurrence was calculated as the number of times a taxon was observed in a year divided by the number of sampling events, multiplied by 100. Analysis is conducted at the quadrat level and is inclusive of all quadrats (i.e., quadrats evaluated using Braun-Blanquet, modified Braun-Blanquet, and percent cover."

Species

Turtle grass (*Thalassia testudinum*) is the largest of the Florida seagrasses, with longer, thicker blades and deeper root structures than any of the other seagrasses. It is considered a climax seagrass species.

Shoal grass (*Halodule wrightii*) is an early colonizer of vegetated areas and usually grows in water too shallow for other species except *widgeon grass*. It can often tolerate larger salinity ranges than other seagrass species. *Shoal grass* is characterized by thin, flat blades, that are narrower than *turtle grass* blades.

Manatee grass (*Syringodium filiforme*) is easily recognizable because its leaves are thin and cylindrical instead of the flat, ribbon-like form shared by many other seagrass species. The leaves can grow up to half a meter in length. *Manatee grass* is usually found in mixed seagrass beds or small, dense monospecific patches.

Widgeon grass (*Ruppia maritima*) grows in both fresh and salt water and is widely distributed throughout Florida's estuaries in less saline areas, particularly in inlets along the east coast. This species resembles *shoal grass* in certain environments but can be identified by the pointed tips of its leaves.

Three species of *Halophila spp.* are found in Florida - **Star grass** (*Halophila engelmannii*), **Paddle grass** (*Halophila decipiens*), and **Johnson's seagrass** (*Halophila johnsonii*). These are smaller, more fragile seagrasses than other Florida species and are considered ephemeral. They grow along a single long rhizome, with short blades. These species are not well-studied, although surveys are underway to define their ecological roles.

Notes

Star grass, *Paddle grass*, and *Johnson's seagrass* will be grouped together and listed as **Halophila spp.** in the following managed areas. This is because several surveys did not specify to the species level:

- Banana River Aquatic Preserve
- Indian River-Malabar to Vero Beach Aquatic Preserve
- Indian River-Vero Beach to Ft. Pierce Aquatic Preserve
- Jensen Beach to Jupiter Inlet Aquatic Preserve
- Loxahatchee River-Lake Worth Creek Aquatic Preserve
- Mosquito Lagoon Aquatic Preserve

- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

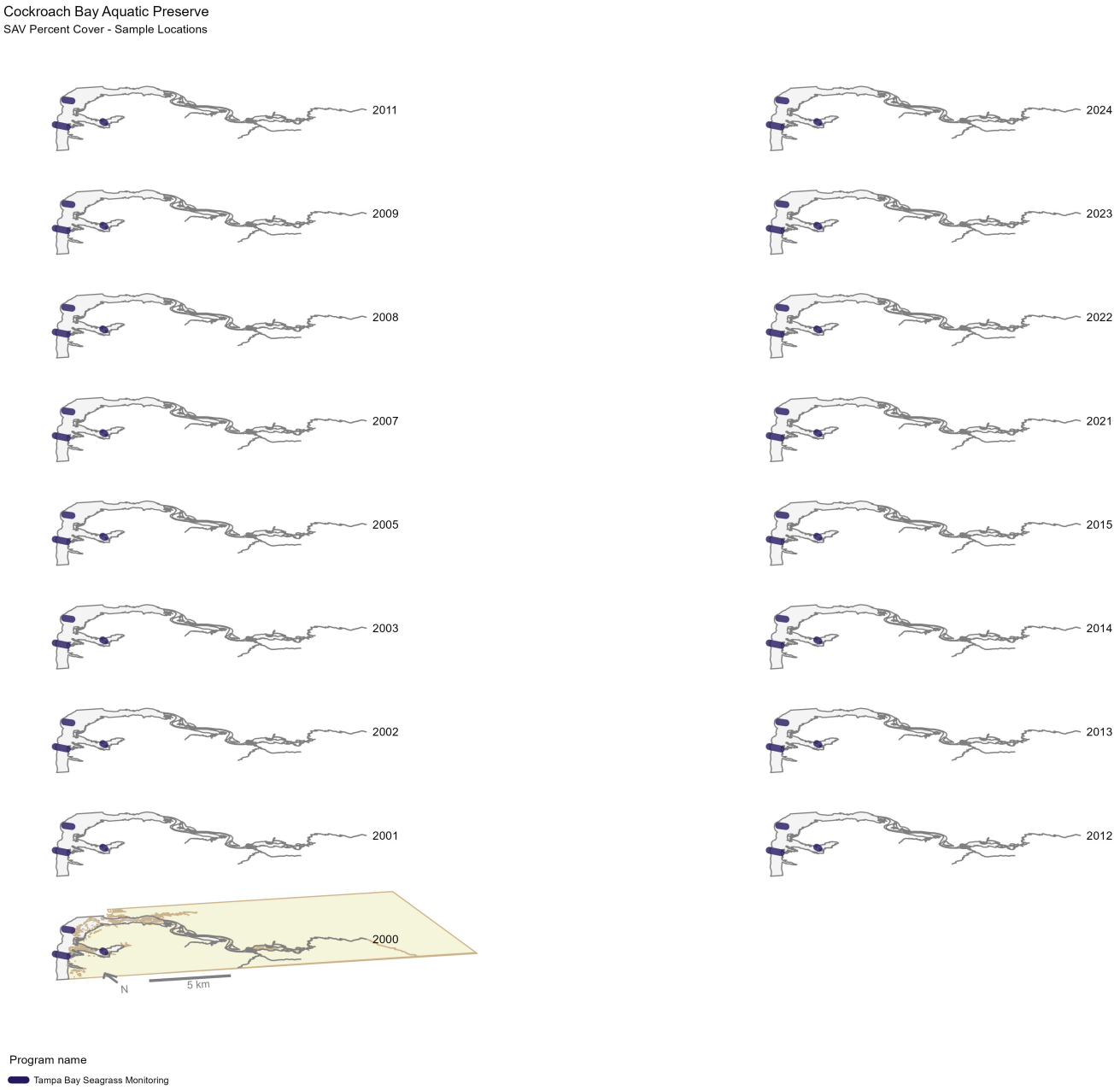

Figure 27: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Cockroach Bay Aquatic Preserve* by Program name.

Click here to view spatio-temporal plots on GitHub.

Sampling locations by Program:

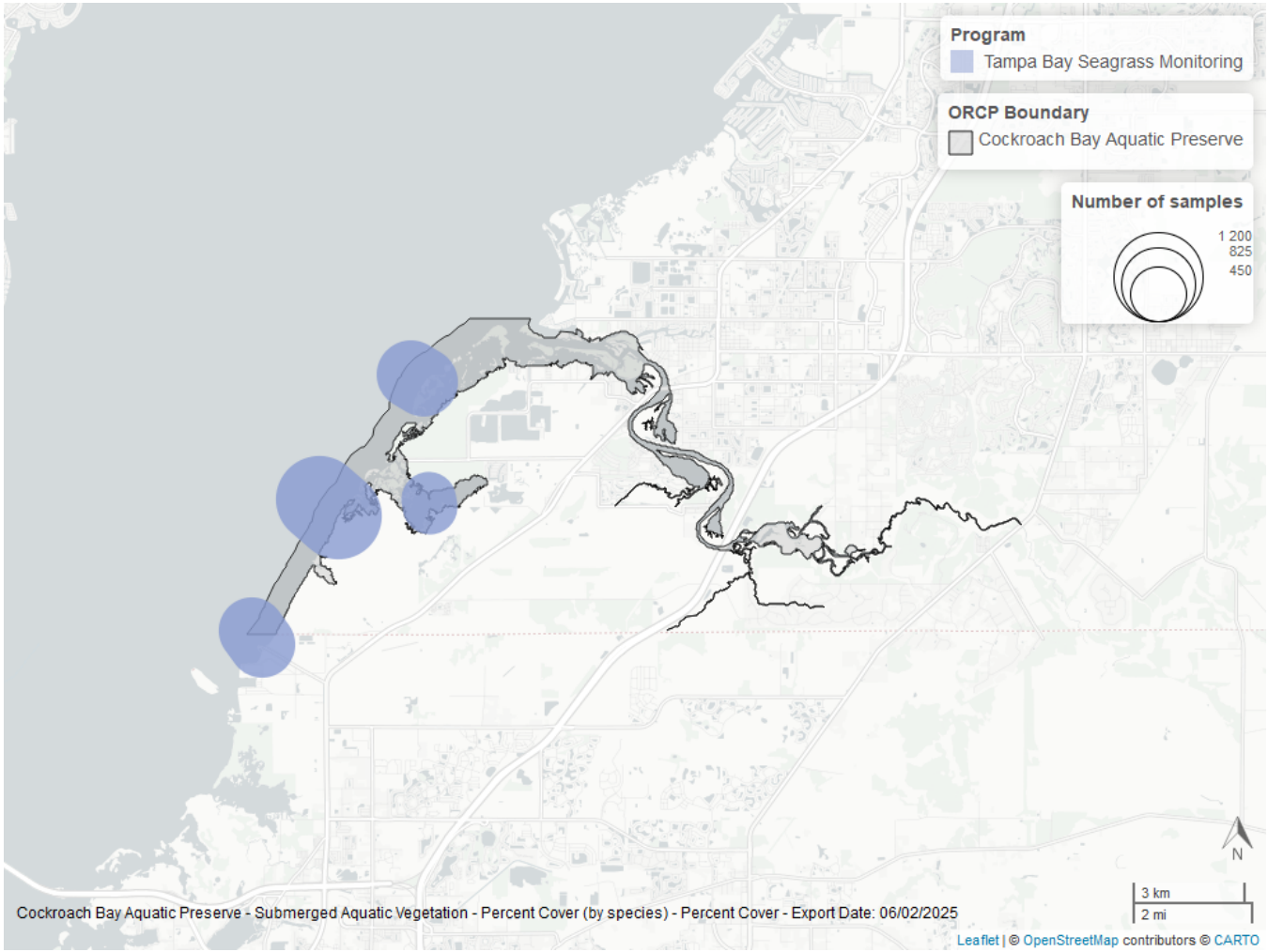

Figure 28: Map showing SAV sampling sites within the boundaries of *Cockroach Bay Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 32: Program Information for Submerged Aquatic Vegetation

ProgramID	*N-Data*	*YearMin*	*YearMax*	*method*	*Sample Locations*
565	1912	2000	2024	Braun Blanquet	4

Program names:

565 - Tampa Bay Seagrass Monitoring[8]

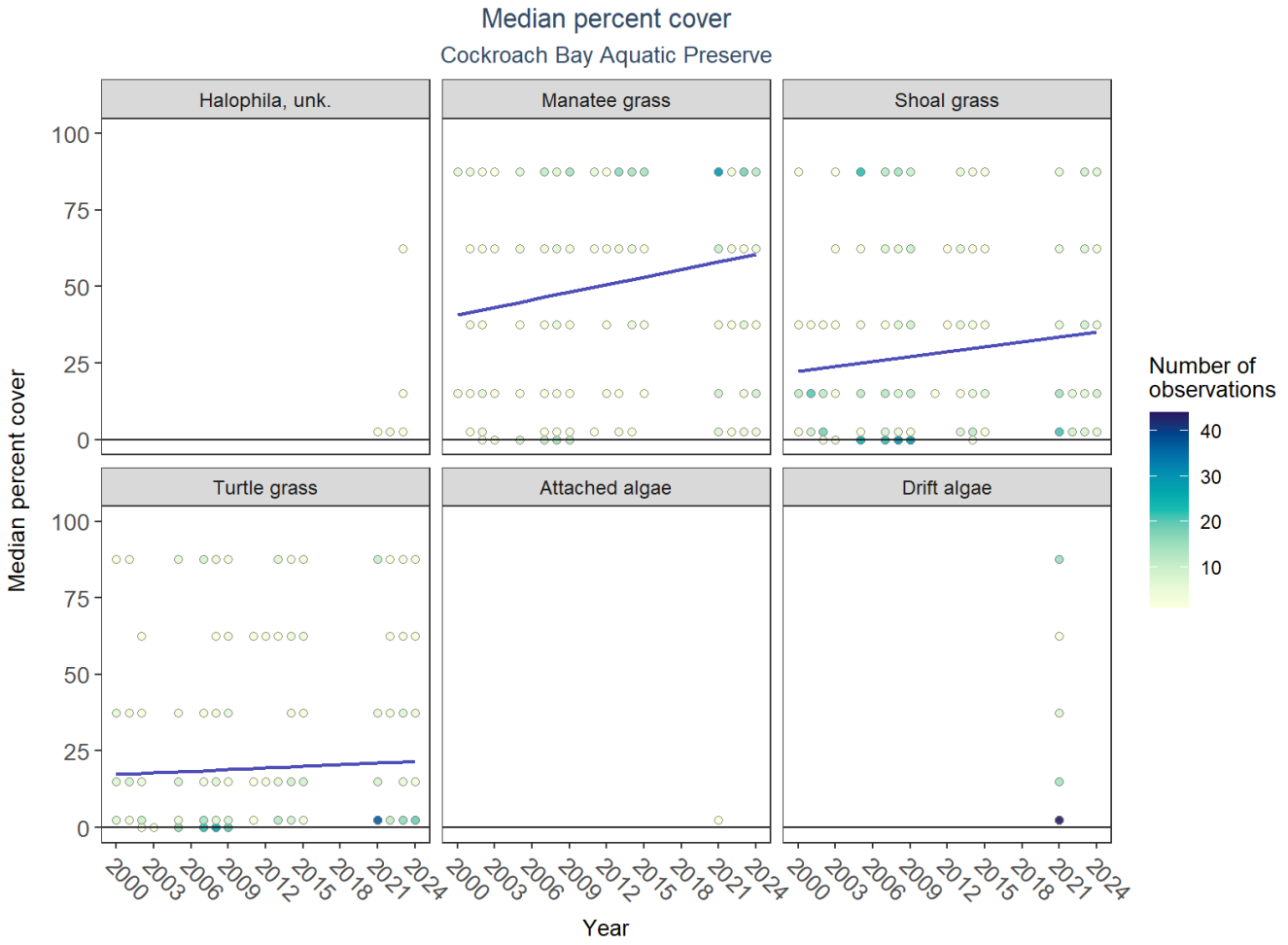

Figure 29: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

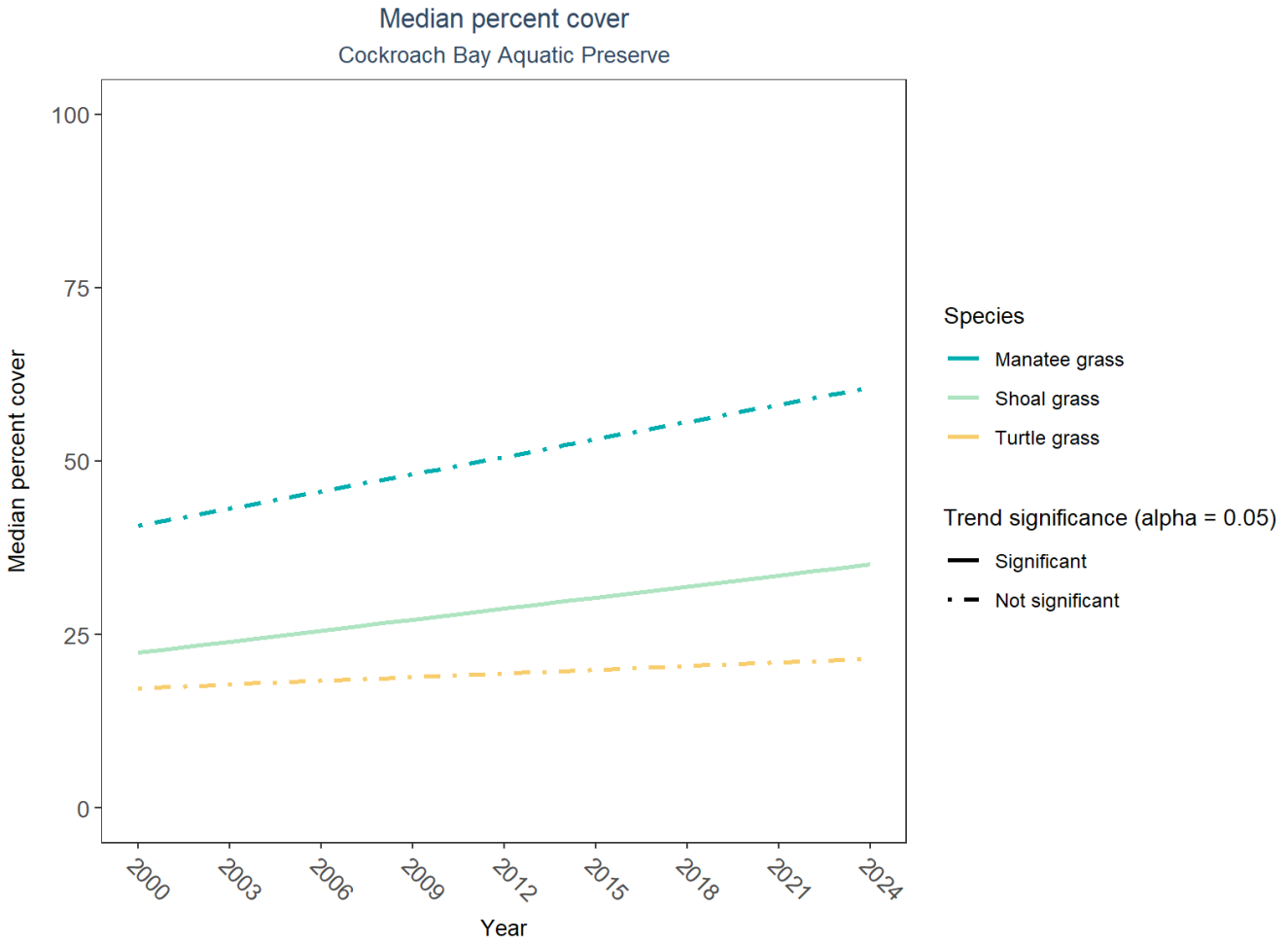

Figure 30: Trends in median percent cover for various seagrass species in Cockroach Bay Aquatic Preserve - simplified

Table 33: Percent Cover Trend Analysis for Cockroach Bay Aquatic Preserve

CommonName	*Trend Significance (0.05)*	*Period of Record*	*LME-Intercept*	*LME-Slope*	*p*
Attached algae	Insufficient data to calculate trend	-	-	-	-
Drift algae	Insufficient data to calculate trend	-	-	-	-
Shoal grass	Significantly increasing trend	2000 - 2024	19.22102	0.5294588	0.0159142
No grass in quadrat	Model did not fit the available data	2000 - 2024	-	-	-
Manatee grass	No significant trend	2000 - 2024	35.77772	0.8256682	0.0760965
Turtle grass	No significant trend	2000 - 2024	16.24161	0.1751174	0.4248074
Halophila, unk.	Insufficient data to calculate trend	-	-	-	-

An annual increase in percent cover was observed for shoal grass (0.5%). No detectable change in percent cover was observed for manatee grass and turtle grass. Trends in percent cover could not be evaluated for unknown *Halophila*, attached algae, and drift algae due to insufficient data.

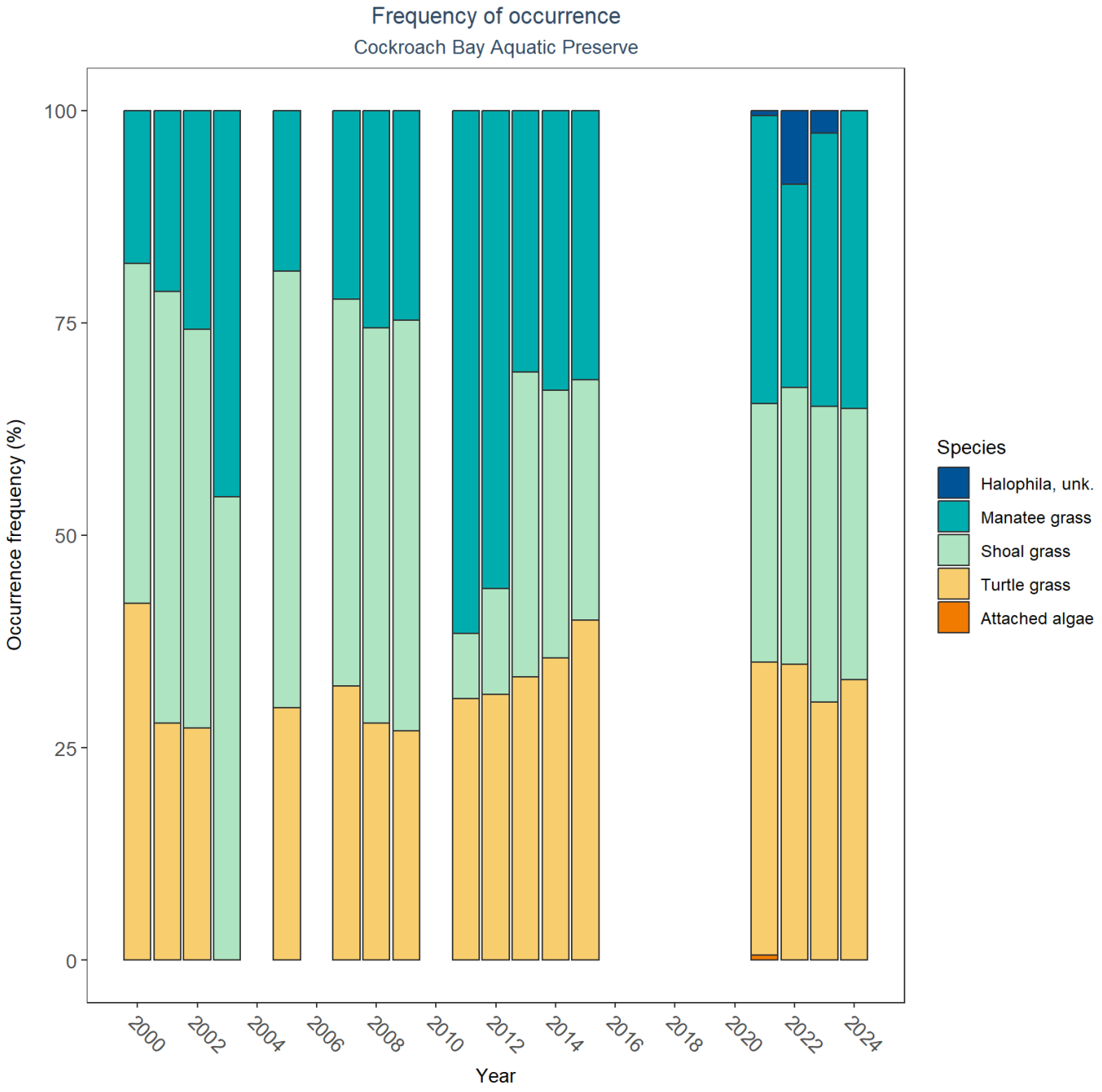

Figure 31: Frequency of occurrence for various seagrass species in Cockroach Bay Aquatic Preserve

SAV Water Column Analysis

The following parameters are available for Cockroach Bay Aquatic Preserve within the SAV_WC_Report:

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

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

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

Nekton

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

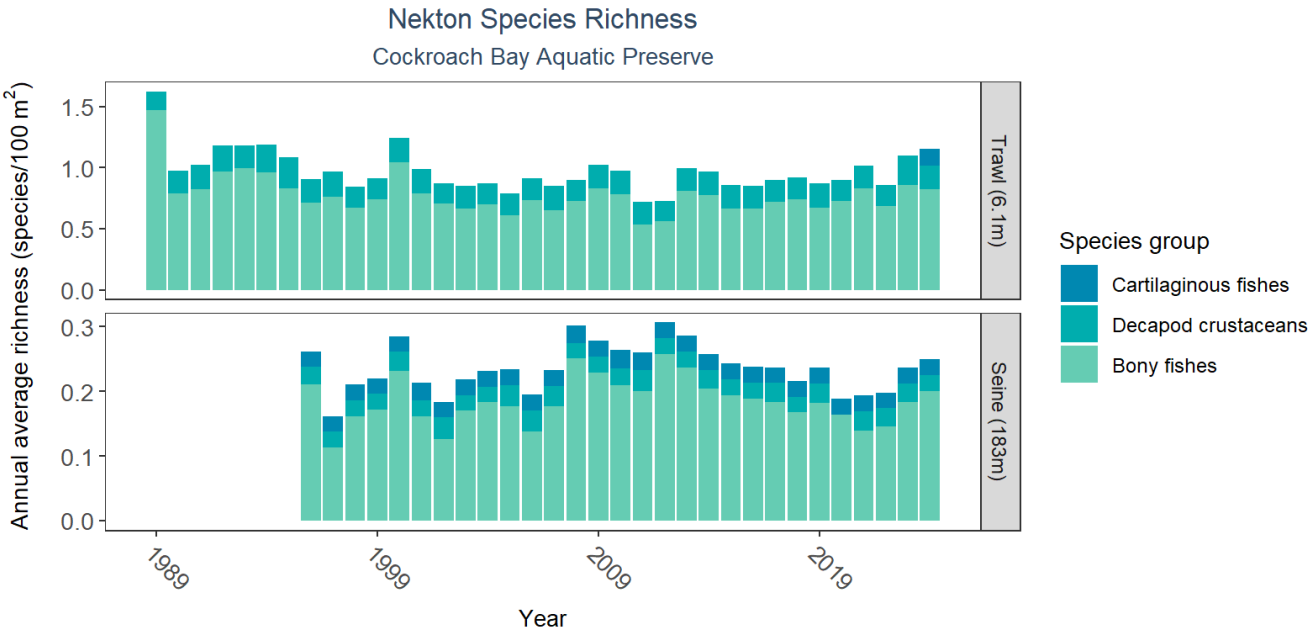

Figure 32: Bar graph(s) of annual average nekton richness over time for species groups occurring in at least 1% of samples. The bar colors represent species groups including bony fishes, cartilaginous fishes, decapod crustaceans (e.g., shrimps, crabs, and lobsters), and cephalopods (e.g., squid). Gear types and sizes are indicated in the panel label.

Table 34: Nekton Species Richness

Gear Type	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Trawl (6.1)	2967	36	1989 - 2024	0.3	0.50
Seine (183)	840	29	1996 - 2024	0.1	0.13

The median annual number of taxa was 0.10 based on 840 observations collected by 183-meter seine between 1996 and 2024, and the median annual number of taxa was 0.30 based on 2,967 observations collected by 6.1-meter trawl between 1989 and 2024.

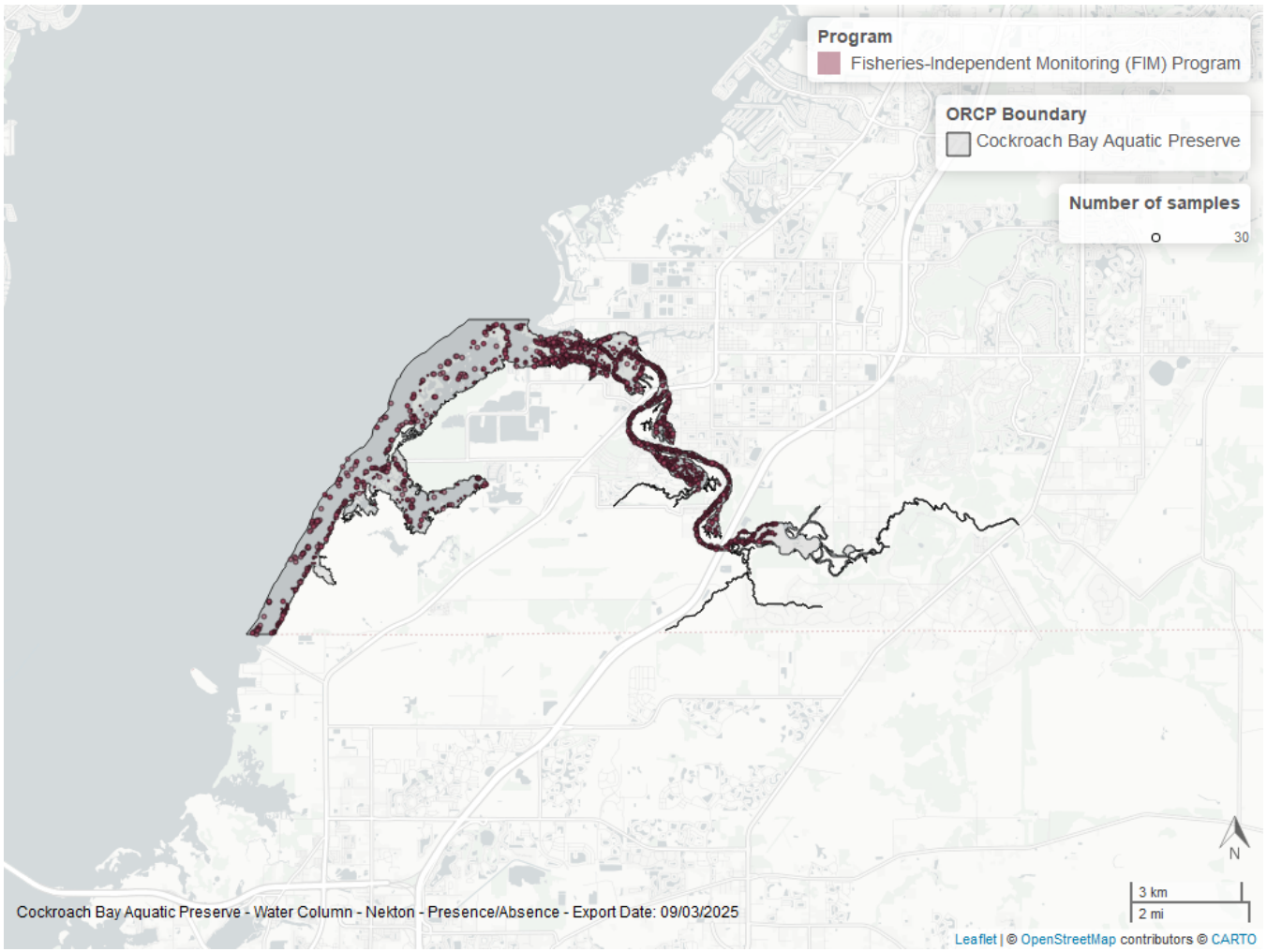

Figure 33: Map showing location of nekton sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Coastal Wetlands

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

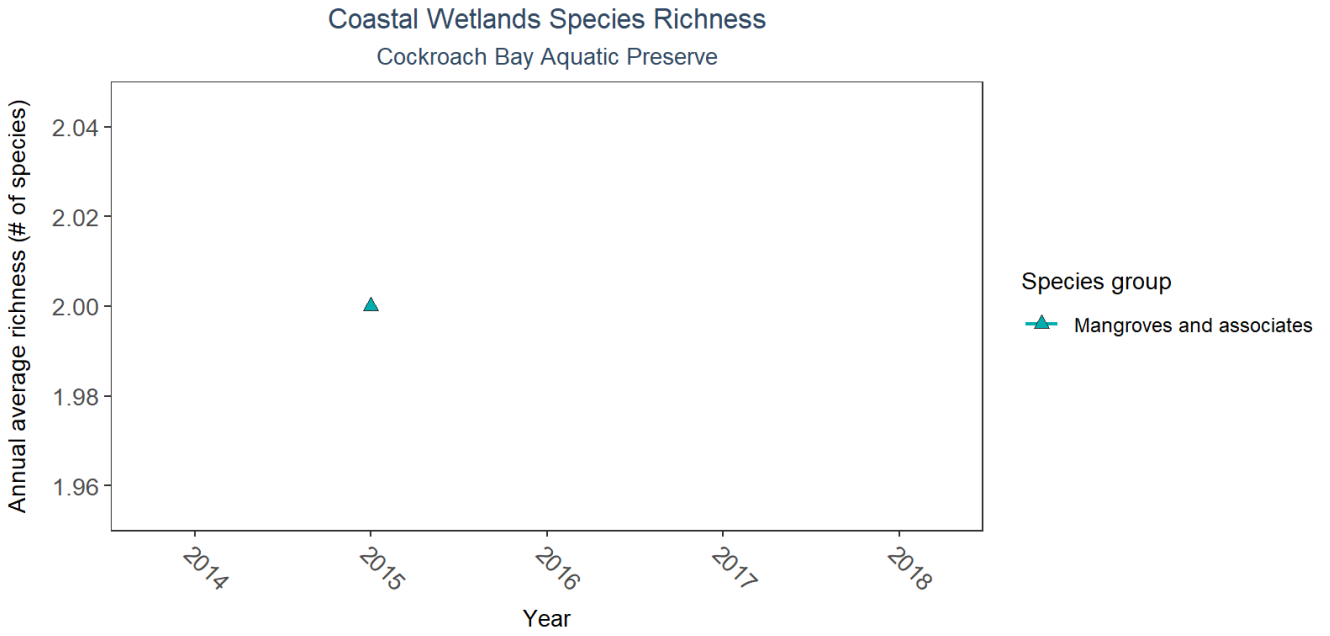

Figure 34: Line graph of annual average coastal wetlands species richness over time for mangroves and associates (triangles), marsh (squares), and marsh succulents (circles). If the time series by species group included more than one year of observations, a line connects data points for visualization.

Table 35: Coastal Wetlands Species Richness

Species Group	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Mangroves and associates	1	1	2015 - 2015	2	2

In the year 2015, 2 species were observed for *mangroves and associates* based on 1 observation.

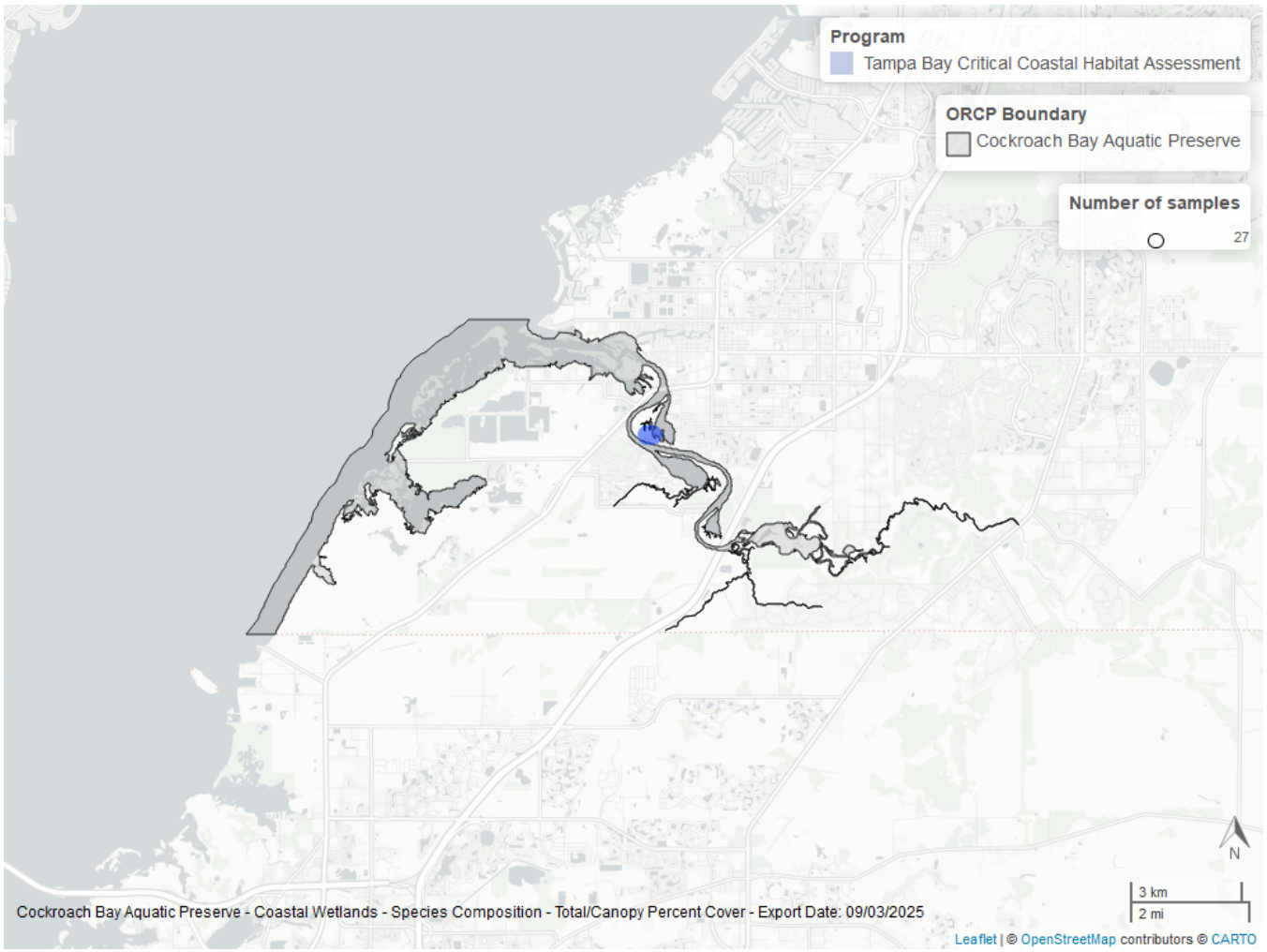

Figure 35: Map showing location of coastal wetlands sampling locations within the boundaries of *Cockroach Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

Acanthophora sp.[1]
Acanthostracion quadricornis[3]
Achirus lineatus[3]
Acrostichum aureum
Albula spp.[3]
Albula vulpes[3]
Aluterus schoepfii[3]
Ameiurus catus[3]
Ameiurus nebulosus[3]
Anarchopterus criniger[3]
Anchoa cubana[3]
Anchoa hepsetus[3]
Anchoa mitchilli[3]
Anchoa spp.[3]
Apalone ferox[3]
Archosargus probatocephalus[3]
Argopecten irradians
Argopecten spp.
Ariopsis felis[3]
Attached algae[1]
Bagre marinus[3]
Bairdiella chrysoura[3]
Bathygobius soporator[3]
Bathygobius spp.[3]
Brevoortia spp.[3]
Calamus arctifrons[3]
Calamus penna[3]
Callinectes ornatus[3]
Callinectes sapidus[3]
Callinectes spp.[3]
Caranx hippos[3]
Caranx latus[3]
Carcharhinus leucas[3]
Caulerpa prolifera[1]
Centropomus undecimalis[3]
Centropristis striata[3]
Chaetodipterus faber[3]
Chasmodes saburrae[3]
Chelonia mydas[3]
Chilomycterus schoepfii[3]
Chloroscombrus chrysurus[3]
Ctenogobius smaragdus[3]
Cynoscion arenarius[3]
Cynoscion nebulosus[3]
Cyprinodon variegatus[3]
Diapterus auratus[3]
Diodon holocanthus[3]
Diplodus holbrookii[3]
Dorosoma petenense[3]
Drift algae[1]
Drift red algae[1]
Echeneis naucrates[3]
Echeneis neucratoides[3]
Echeneis spp.[3]
Floridichthys carpio[3]
Fundulus grandis[3]
Fundulus seminolis[3]
Fundulus similis[3]
Gambusia holbrooki[3]
Gobiesox strumosus[3]
Gobionellus oceanicus[3]
Gobiosoma bosc[3]
Gobiosoma robustum[3]
Gobiosoma spp.[3]
Gracilaria sp.[1]
Haemulon plumierii[3]
Halodule wrightii[1]
Halophila sp.[1]
Halymenia sp.[1]
Harengula jaguana[3]
Hippocampus erectus[3]
Hippocampus zosterae[3]
Hypnea[1]
Hyporhamphus meeki[3]
Hyporhamphus spp.[3]
Hyporhamphus unifasciatus[3]
Hypsoblennius hentz[3]
Ictalurus punctatus[3]
Ictalurus spp.[3]
Lactophrys trigonus[3]
Lagodon rhomboides[3]
Laguncularia racemosa[2]
Leiostomus xanthurus[3]
Lepisosteus osseus[3]
Lepisosteus platyrhincus[3]
Lepomis macrochirus[3]
Lepomis punctatus[3]
Lepomis spp.[3]
Limulus polyphemus
Lophogobius cyprinoides[3]
Loricariidae spp.[3]
Lucania parva[3]
Lupinoblennius nicholsi[3]
Lutjanus griseus[3]
Lutjanus synagris[3]
Lyngbya sp.
Malaclemys terrapin[3]
Megalops atlanticus[3]
Menidia spp.[3]
Menippe mercenaria[3]
Menippe spp.[3]
Menticirrhus americanus[3]
Menticirrhus saxatilis[3]
Menticirrhus spp.[3]
Microgobius gulosus[3]
Microgobius thalassinus[3]
Micropogonias undulatus[3]
Micropterus salmoides[3]
Negaprion brevirostris[3]
Nicholsina usta[3]
No fish
No grass in quadrat[1]
Oligoplites saurus[3]
Opisthonema oglinum[3]
Opsanus beta[3]
Oreochromis aureus[3]
Orthopristis chrysoptera[3]
Other green algae[1]
Paraclinus marmoratus[3]
Paralichthys albigutta[3]
Penaeus duorarum[3]
Penaeus spp.[3]
Poecilia latipinna[3]
Pogonias cromis[3]
Portunus spp.[3]
Prionotus scitulus[3]
Prionotus tribulus[3]
Pseudemys peninsularis[3]
Pseudocrenilabrinae[3]
Pterygoplichthys disjunctivus[3]
Pterygoplichthys spp.[3]
Quercus geminata
Quercus virginiana
Rachycentron canadum[3]
Rhinoptera bonasus[3]
Rhizophora mangle[2]
Sabal palmetto
Sardinella aurita[3]
Sarotherodon melanotheron[3]
Schinus terebinthifolia
Sciaenops ocellatus[3]
Scomberomorus maculatus[3]
Selene vomer[3]
Serenoa repens
Sphoeroides nephelus[3]
Sphoeroides spengleri[3]
Sphyraena barracuda[3]
Sphyraena borealis[3]
Sphyrna tiburo[3]
Strongylura marina[3]
Strongylura notata[3]
Strongylura timucu[3]
Suaeda linearis[2]
Symphurus plagiusa[3]
Syngnathus floridae[3]
Syngnathus louisianae[3]
Syngnathus scovelli[3]
Synodus foetens[3]
Syringodium filiforme[1]
Thalassia testudinum[1]
Trachinotus carolinus[3]
Trachinotus falcatus[3]

Elops saurus[3]	Monacanthus ciliatus[3]	Trinectes maculatus[3]
Elops spp.[3]	Mugil cephalus[3]	Tylosurus crocodilus[3]
Epinephelus itajara[3]	Mugil curema[3]	Ulva[1]
Eucinostomus gula[3]	Mugil spp.[3]	Urophycis floridana[3]
Eucinostomus harengulus[3]	Mugil trichodon[3]	Yucca sp.
Eucinostomus spp.[3]	Mycteroperca microlepis[3]	Acanthophora sp.[1]
Eugerres plumieri[3]	Myrica cerifera	Acanthostracion quadricornis[3]

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