Apalachicola 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	m^-1	-	-
NO2+3, Filtered	mg/L	-	-
Nitrate (NO3)	mg/L	-	-
Nitrite (NO2)	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO4)	mg/L	-	-
Salinity	ppt	-0.000001	70
Secchi Depth	m	0.000001	50
Specific Conductivity	mS/cm	0.005000	100
Total Kjeldahl Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Phosphorus	mg/L	-	-
Total Suspended Solids	mg/L	-	-
Turbidity	NTU	-	-
Water Temperature	Degrees C	3.000000	40
pH	None	2.000000	13

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

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

Value Qualifiers

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

STORET and WIN value qualifier codes

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

Table 4: Value Qualifier codes excluded from analysis

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

Discrete Water Quality Value Qualifiers

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

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

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

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

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

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

Systemwide Monitoring Program (SWMP) value qualifier codes

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

Table 5: SWMP Value Qualifier codes

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

Water Column

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

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

Seasonal Kendall-Tau Analysis

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

Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2025-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

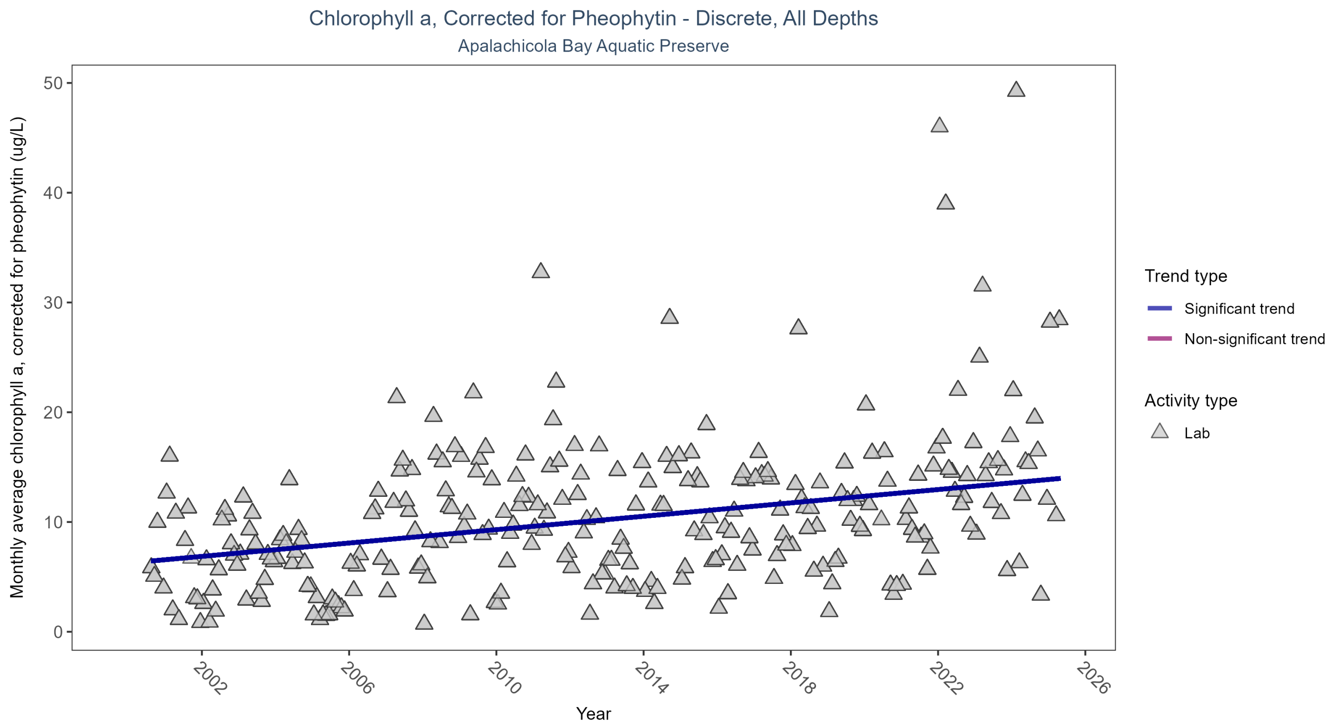

Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	7610	26	2000 - 2025	8.7	0.2926	6.2582	0.3046	0

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.3 µg/L per year, indicating a decrease in water clarity.

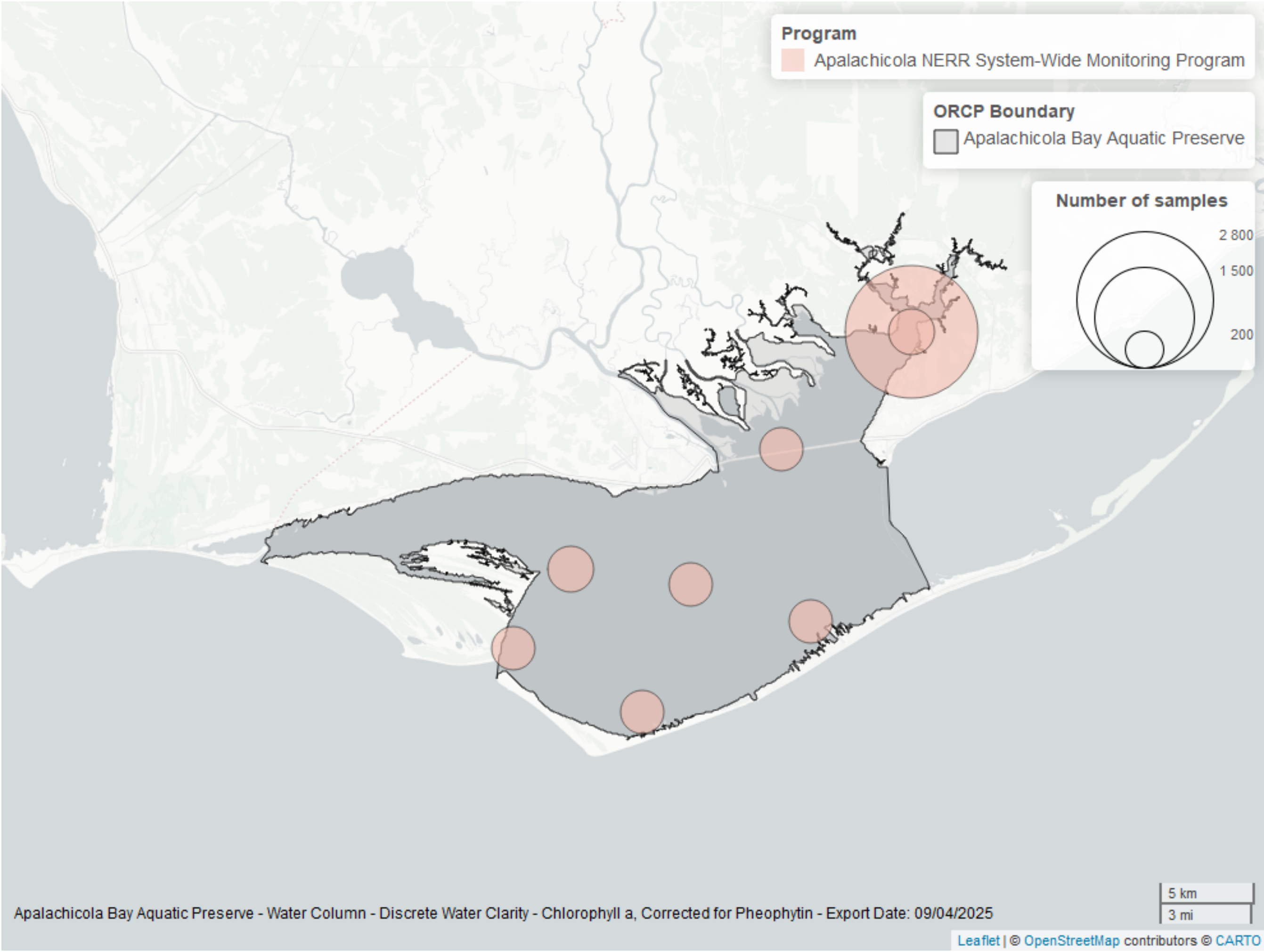

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
355	7217	2002	2025
5002	499	2000	2024

Program names:

355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

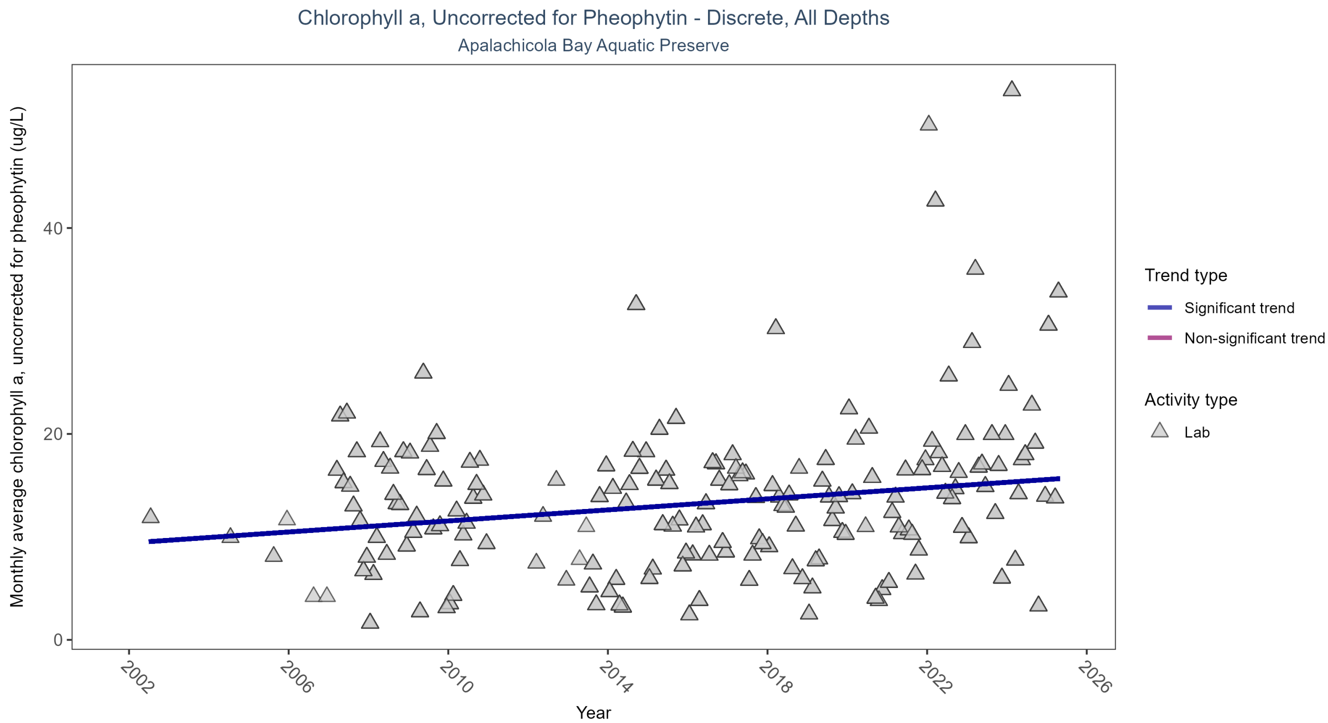

Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	Significantly increasing trend	4068	22	2002 - 2025	12	0.1839	9.4056	0.268	0.0007

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.27 µg/L per year, indicating a decrease in water clarity.

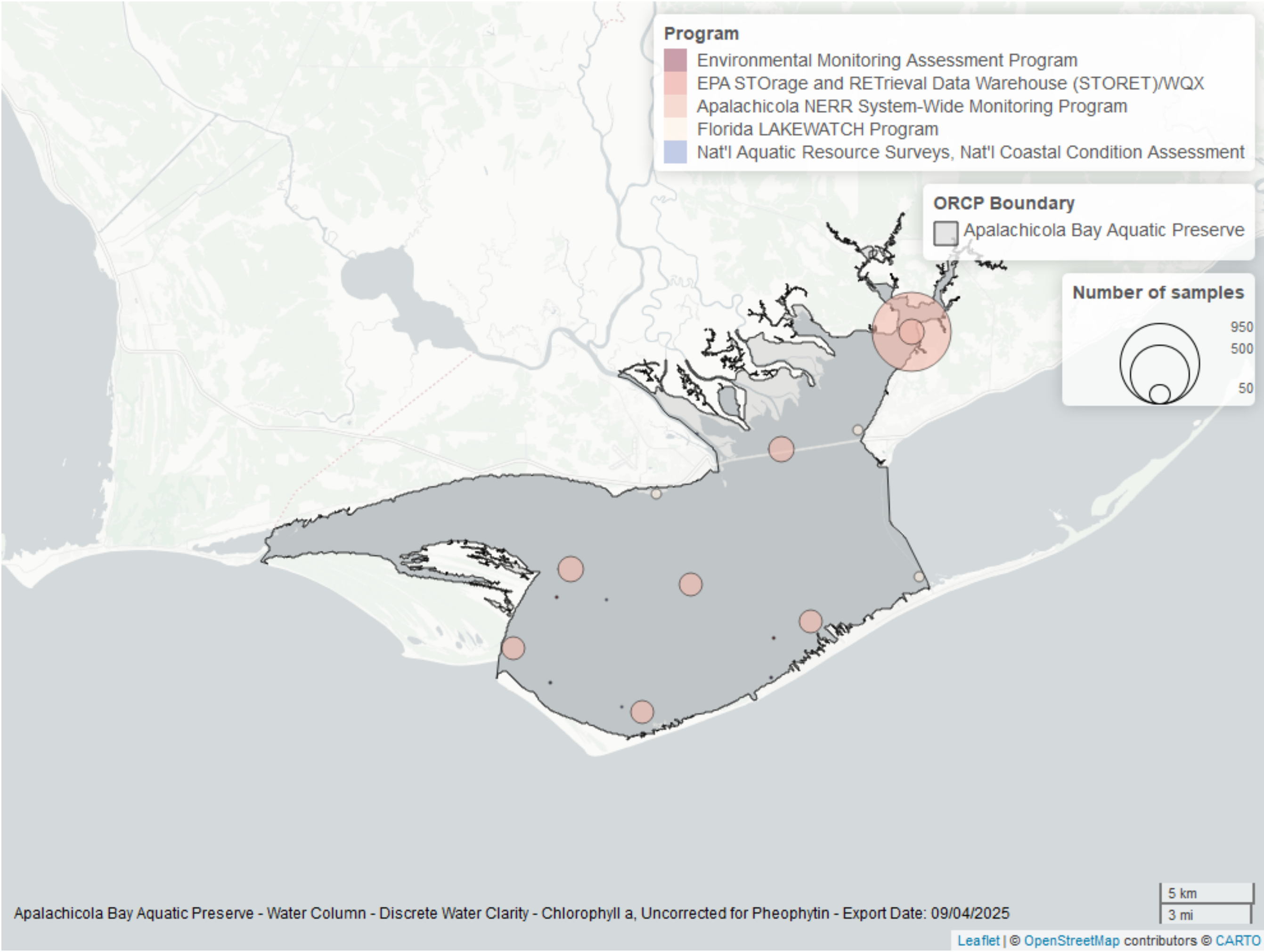

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
355	4095	2007	2025
5002	63	2012	2024
514	51	2007	2008
103	9	2002	2015
118	5	2005	2010
115	2	2002	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[5]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
514 - Florida LAKEWATCH Program[6]
5002 - Florida STORET / WIN[2]

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

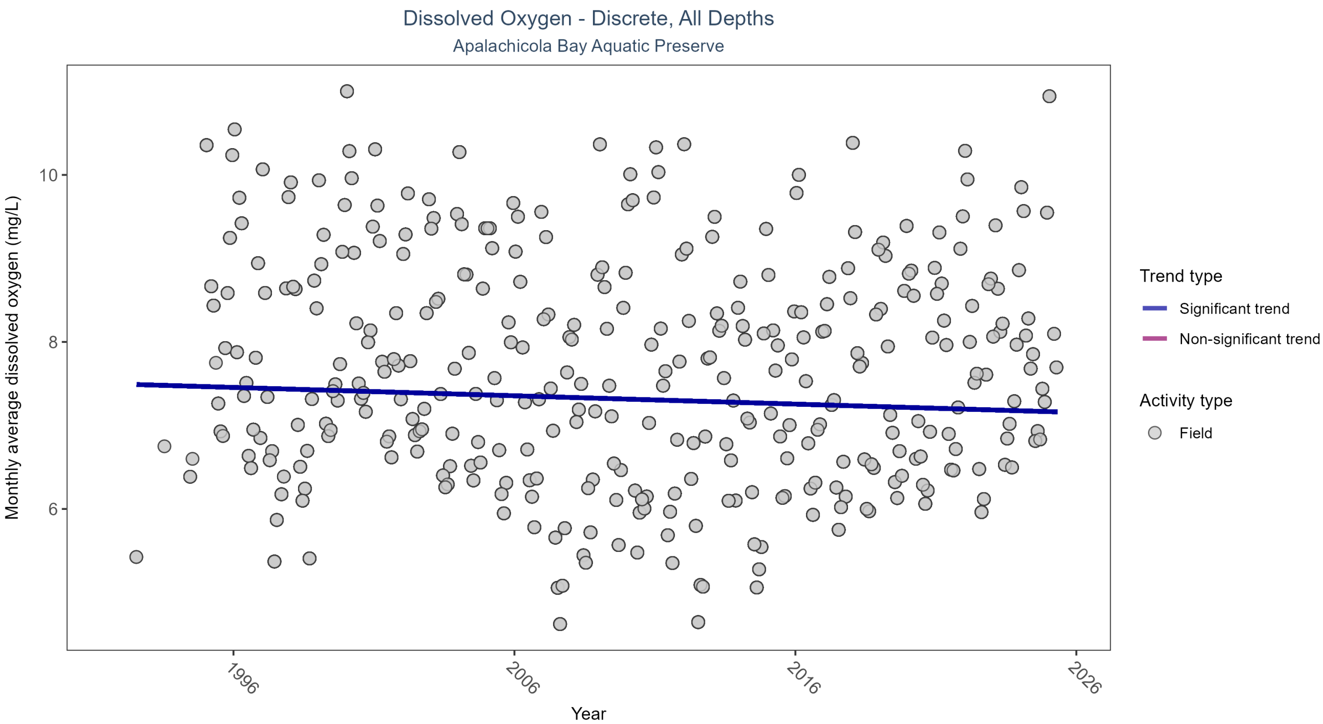

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	54142	34	1992 - 2025	7.5	-0.0849	7.495	-0.01	0.0216

Monthly average dissolved oxygen decreased by 0.01 mg/L per year.

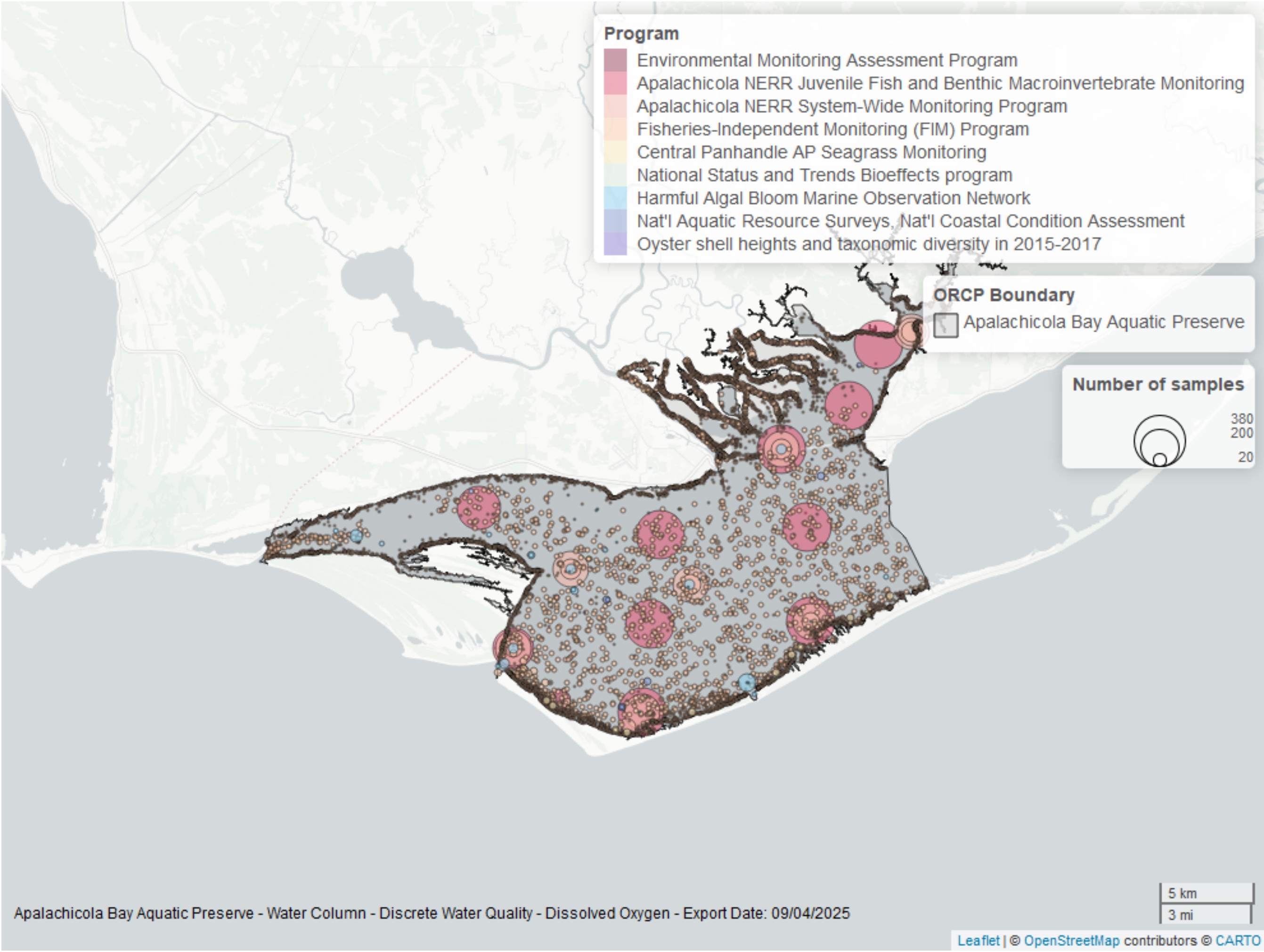

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	26244	1998	2024
5002	21946	1995	2024
129	3505	2000	2024
355	3020	2003	2025
95	256	1995	2018
557	121	2006	2023
118	52	2005	2020
115	16	1992	2004
103	15	2015	2015
119	14	1994	1994
5071	3	2017	2017

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[8]

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[5]
119 - National Status and Trends Bioeffects program[9]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
5002 - Florida STORET / WIN[2]
5071 - Oyster shell heights and taxonomic diversity in 2015-2017 among previously documented oiled and non-oiled reefs in Louisiana, Alabama, and the Florida panhandle[12]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

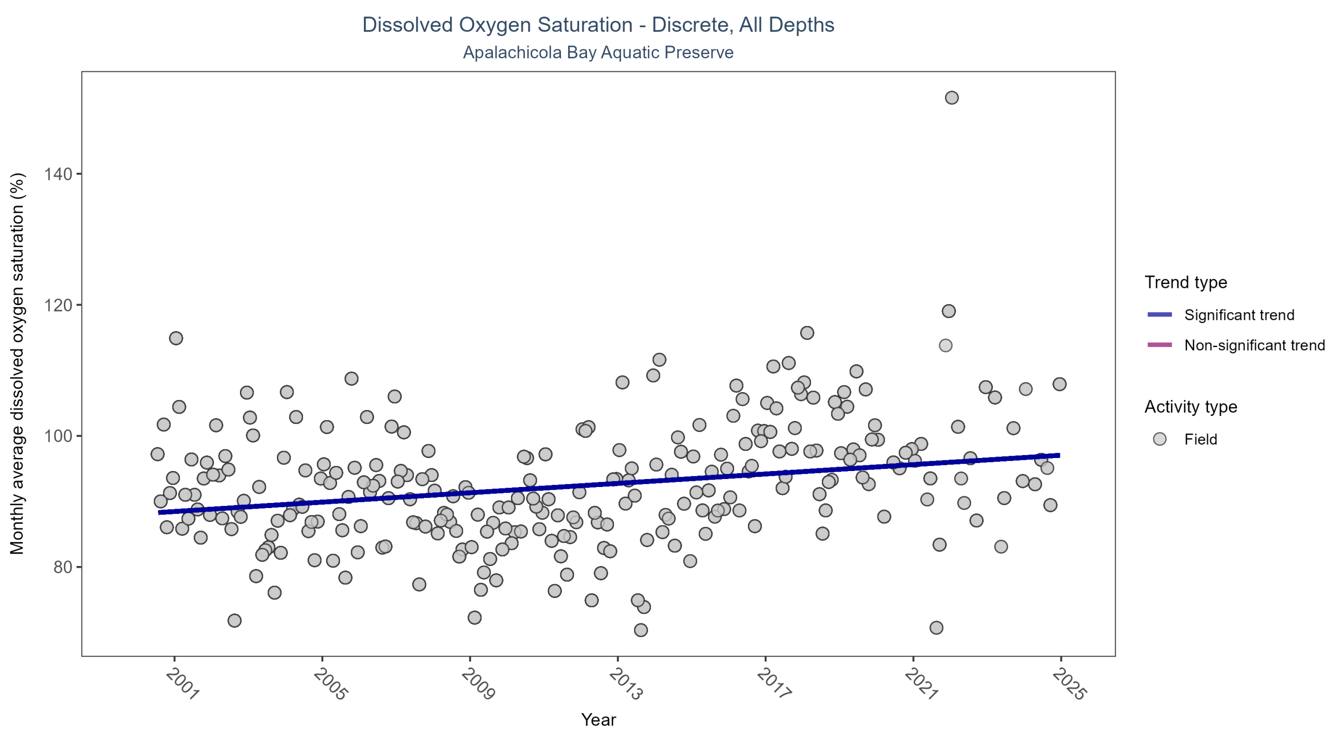

Figure 7: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	Significantly increasing trend	5544	25	2000 - 2024	92.8	0.2182	88.1057	0.3579	0

Monthly average dissolved oxygen saturation increased by 0.36% per year.

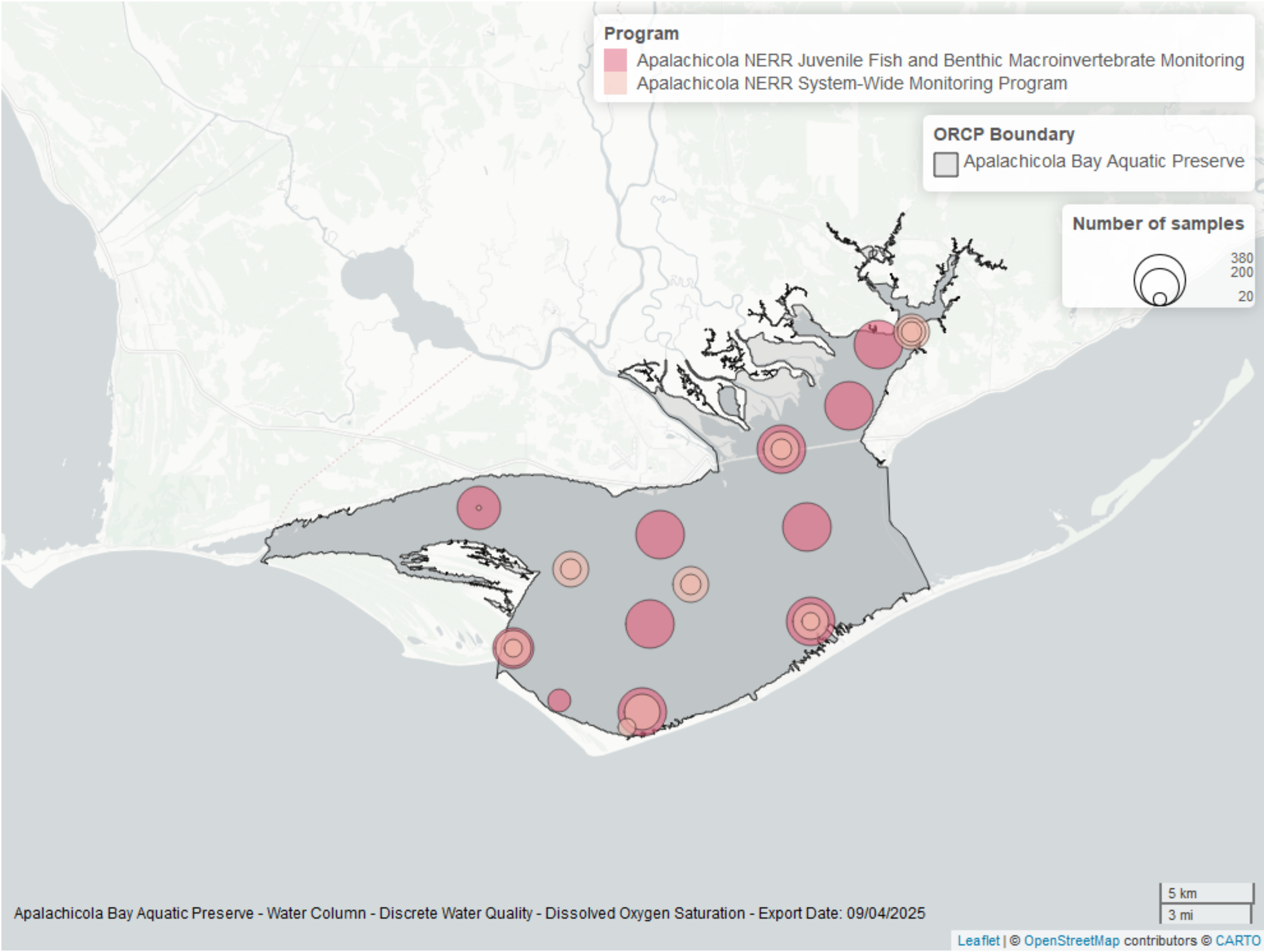

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
129	3491	2000	2024
355	1935	2003	2023
5002	145	2003	2024

Program names:

129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

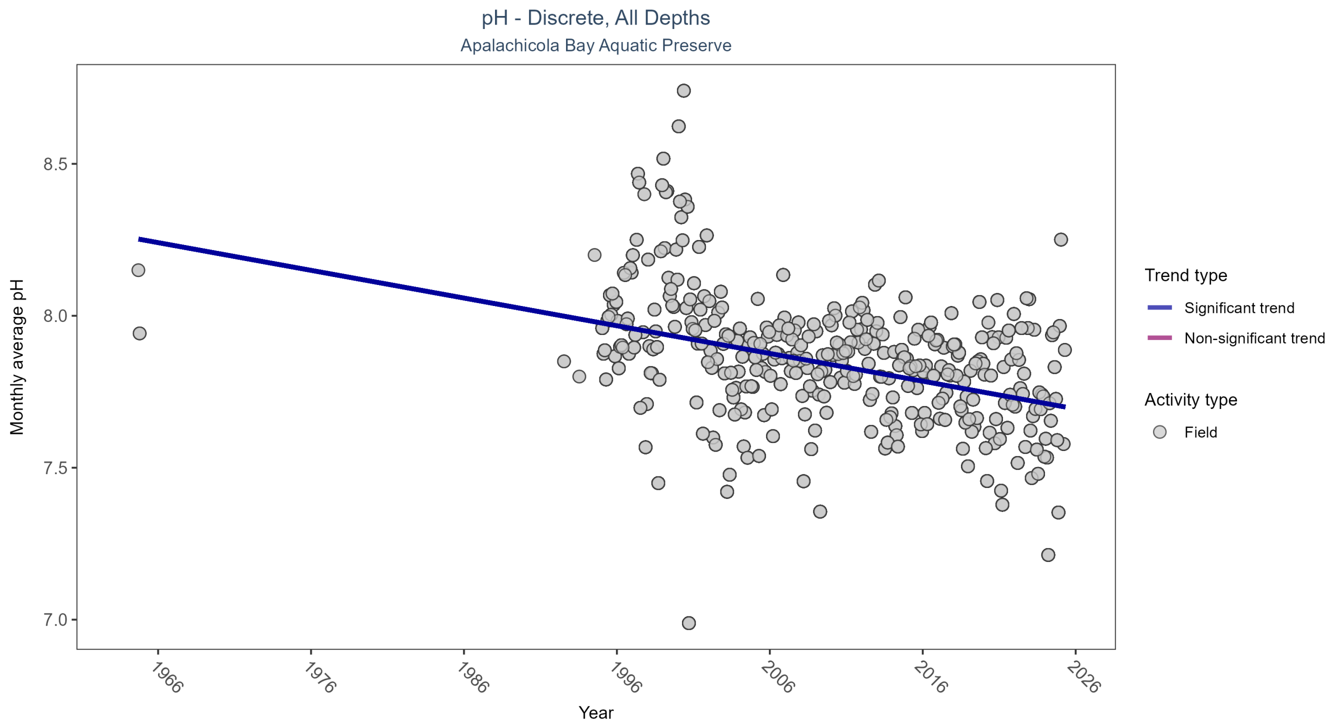

Figure 9: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	42657	35	1964 - 2025	8	-0.3007	8.259	-0.0091	0

Monthly average pH decreased by 0.01 pH units per year.

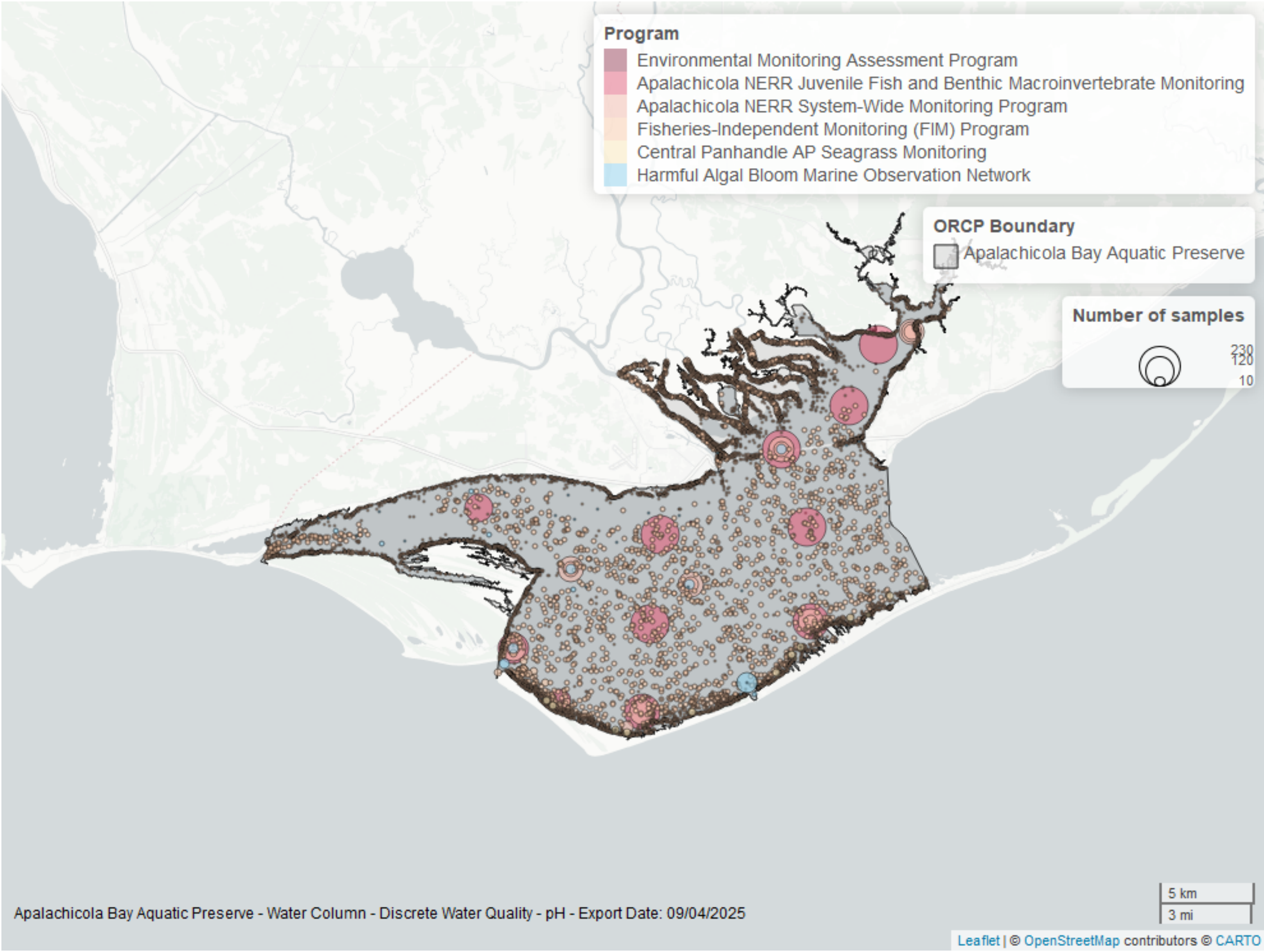

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	26292	1998	2024
5002	12908	1995	2024
355	2066	2011	2025
129	2063	2000	2024
95	184	1964	2018
557	110	2006	2023
103	16	2015	2015
115	16	1992	2004

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[8]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]

355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
5002 - Florida STORET / WIN[2]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

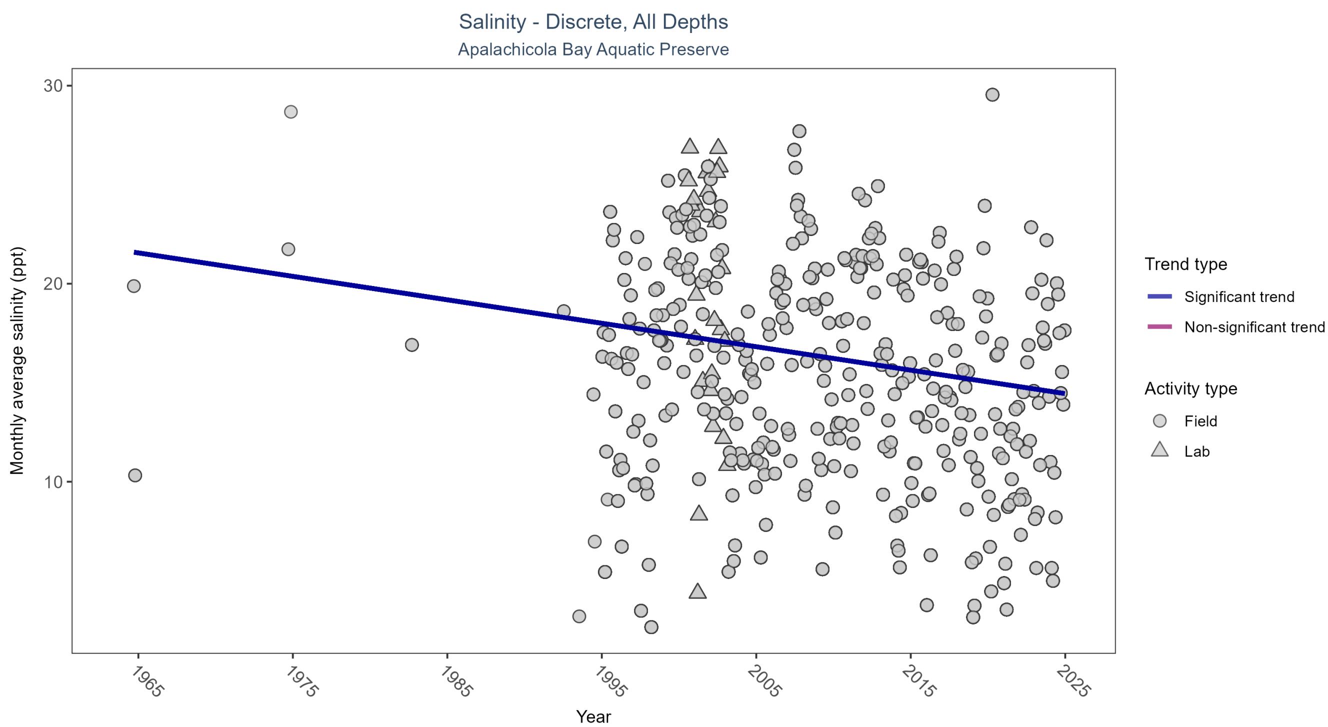

Figure 11: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	Significantly decreasing trend	63140	36	1964 - 2024	15.8	-0.1655	21.6742	-0.1184	0

Monthly average salinity decreased by 0.12 ppt per year.

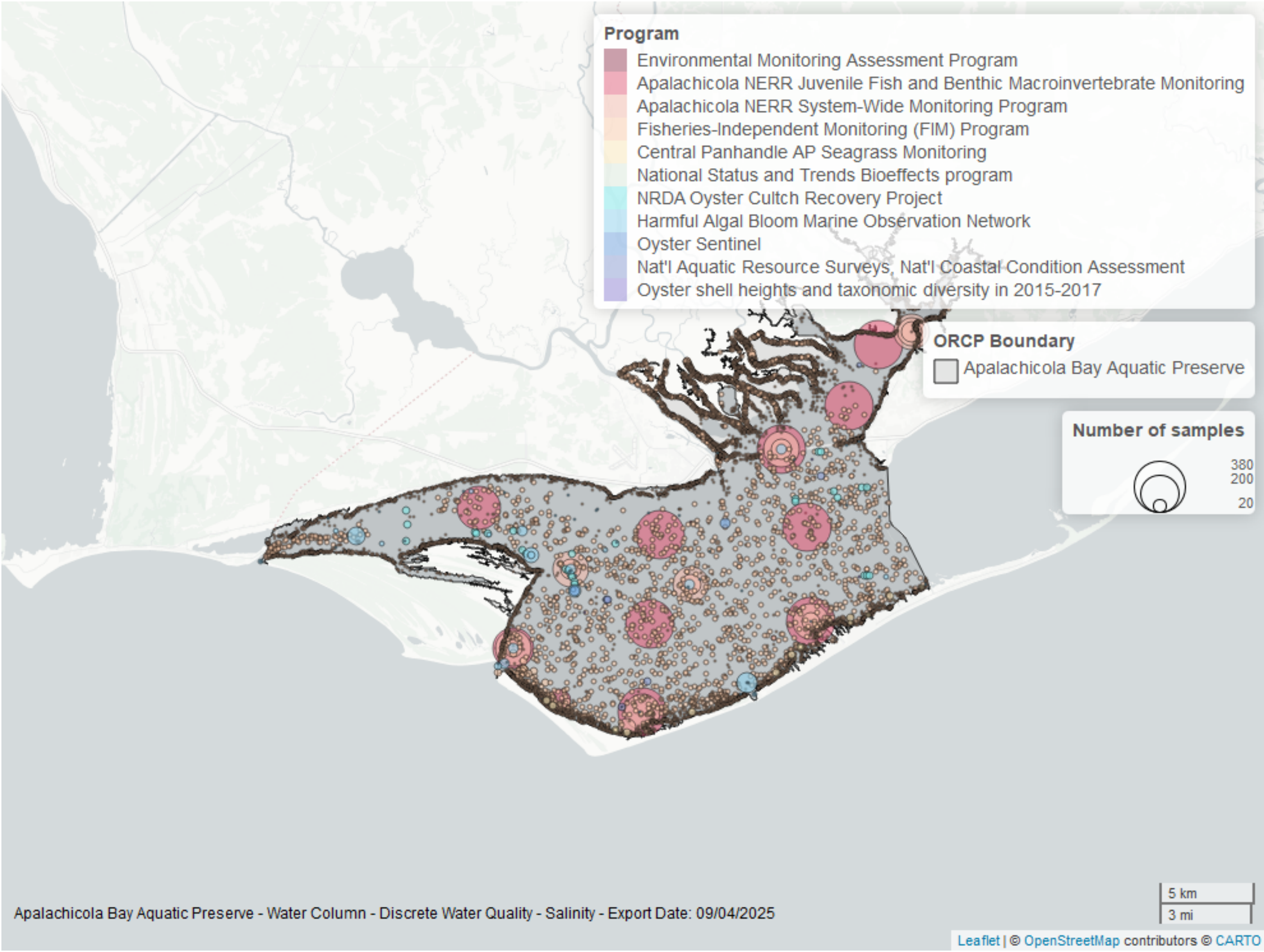

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	30352	1995	2024
69	26432	1998	2024
129	3510	2000	2024
355	2923	2003	2024
95	373	1964	2018
4044	280	2007	2023
557	121	2006	2023
118	57	2015	2020
456	33	2005	2013
115	16	1992	2004
119	14	1994	1994
5071	3	2017	2017

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]

95 - Harmful Algal Bloom Marine Observation Network[8]
115 - Environmental Monitoring Assessment Program[4]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[5]
119 - National Status and Trends Bioeffects program[9]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
456 - Oyster Sentinel[13]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
4044 - NRDA Oyster Cultch Recovery Project[14]
5002 - Florida STORET / WIN[2]
5071 - Oyster shell heights and taxonomic diversity in 2015-2017 among previously documented oiled and non-oiled reefs in Louisiana, Alabama, and the Florida panhandle[12]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

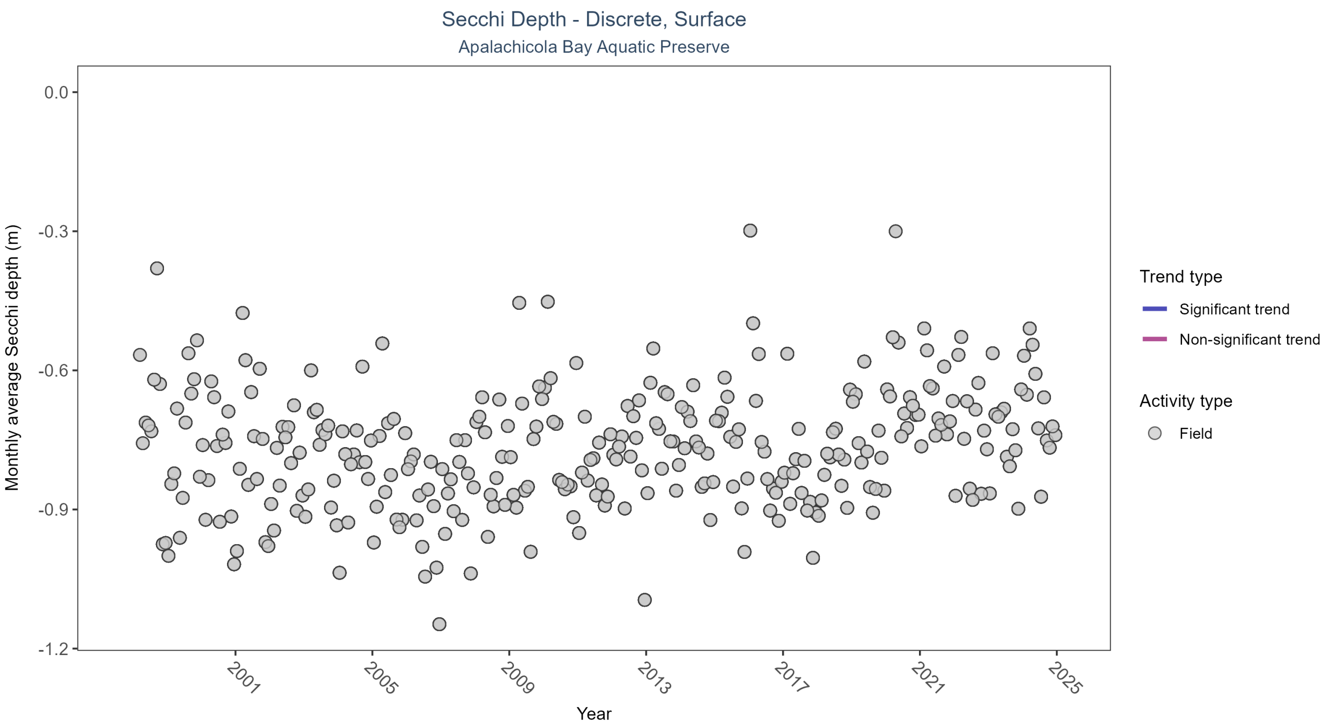

Figure 13: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	28798	30	1992 - 2024	-0.8	0.1614	-0.8645	0.0039	0.0001

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

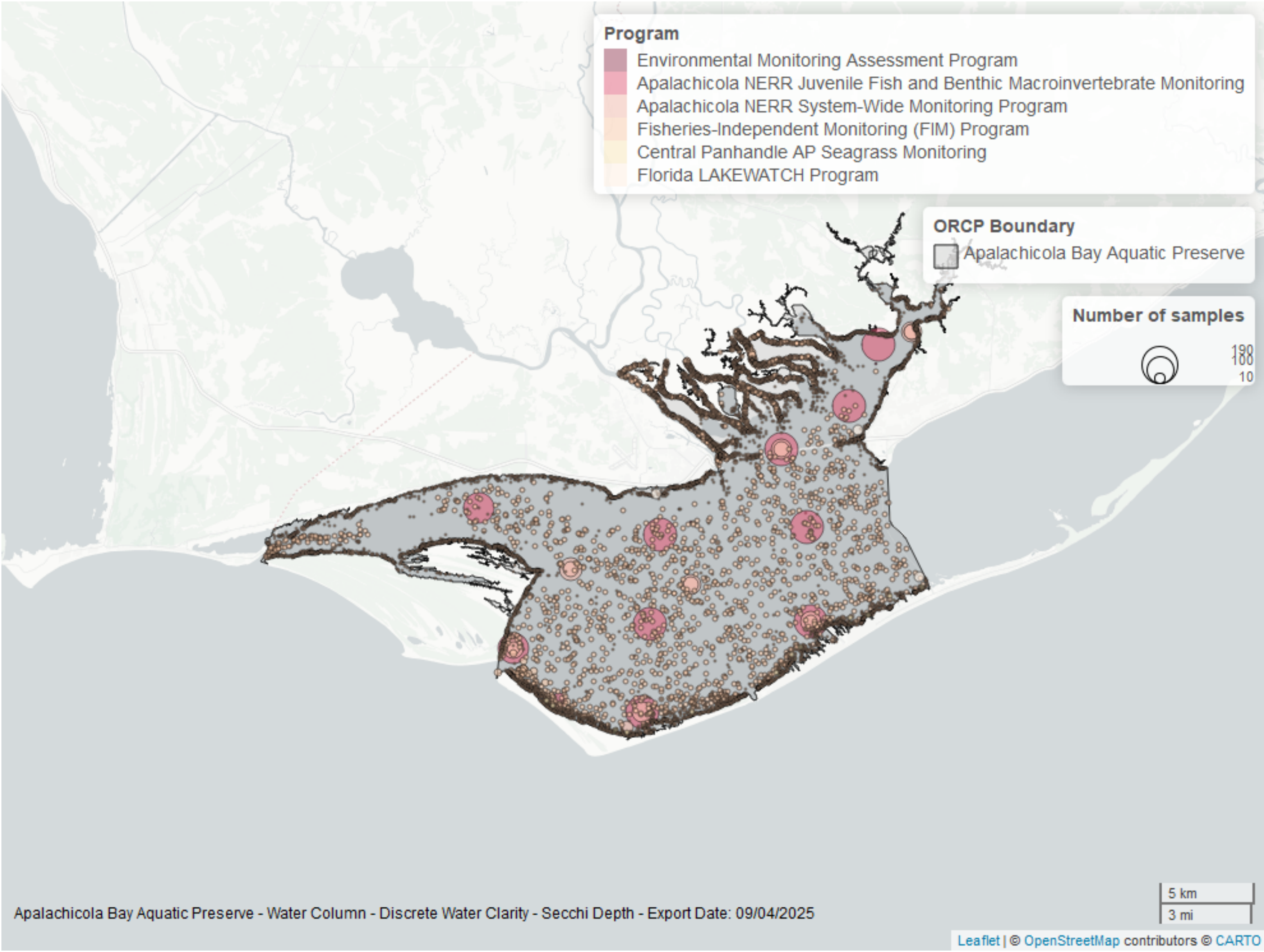

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
69	26148	1998	2024
129	1734	2000	2024
355	731	2011	2019
557	67	2006	2023
5002	60	2012	2024
514	48	2007	2008
115	6	1992	2004
103	4	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]

514 - Florida LAKEWATCH Program[6]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
5002 - Florida STORET / WIN[2]

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

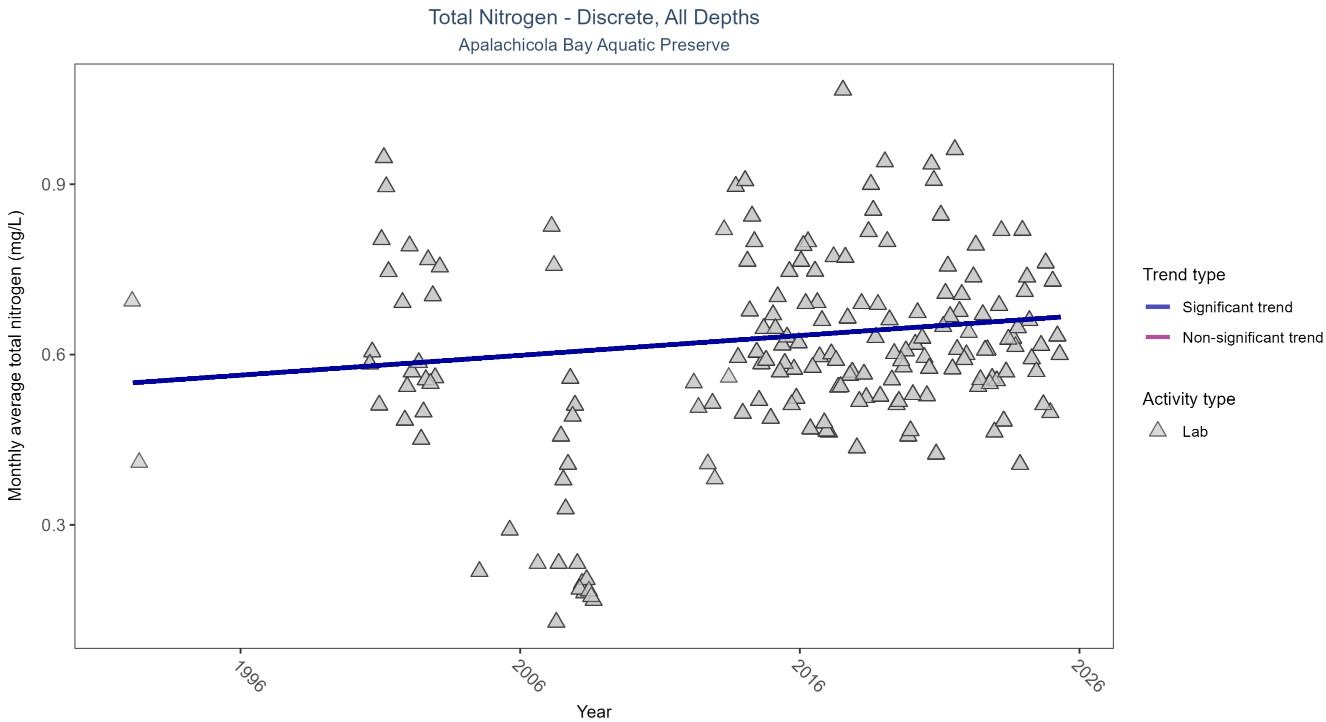

Figure 15: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	Significantly increasing trend	3337	24	1992 - 2025	0.62	0.1331	0.5498	0.0035	0.0157

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

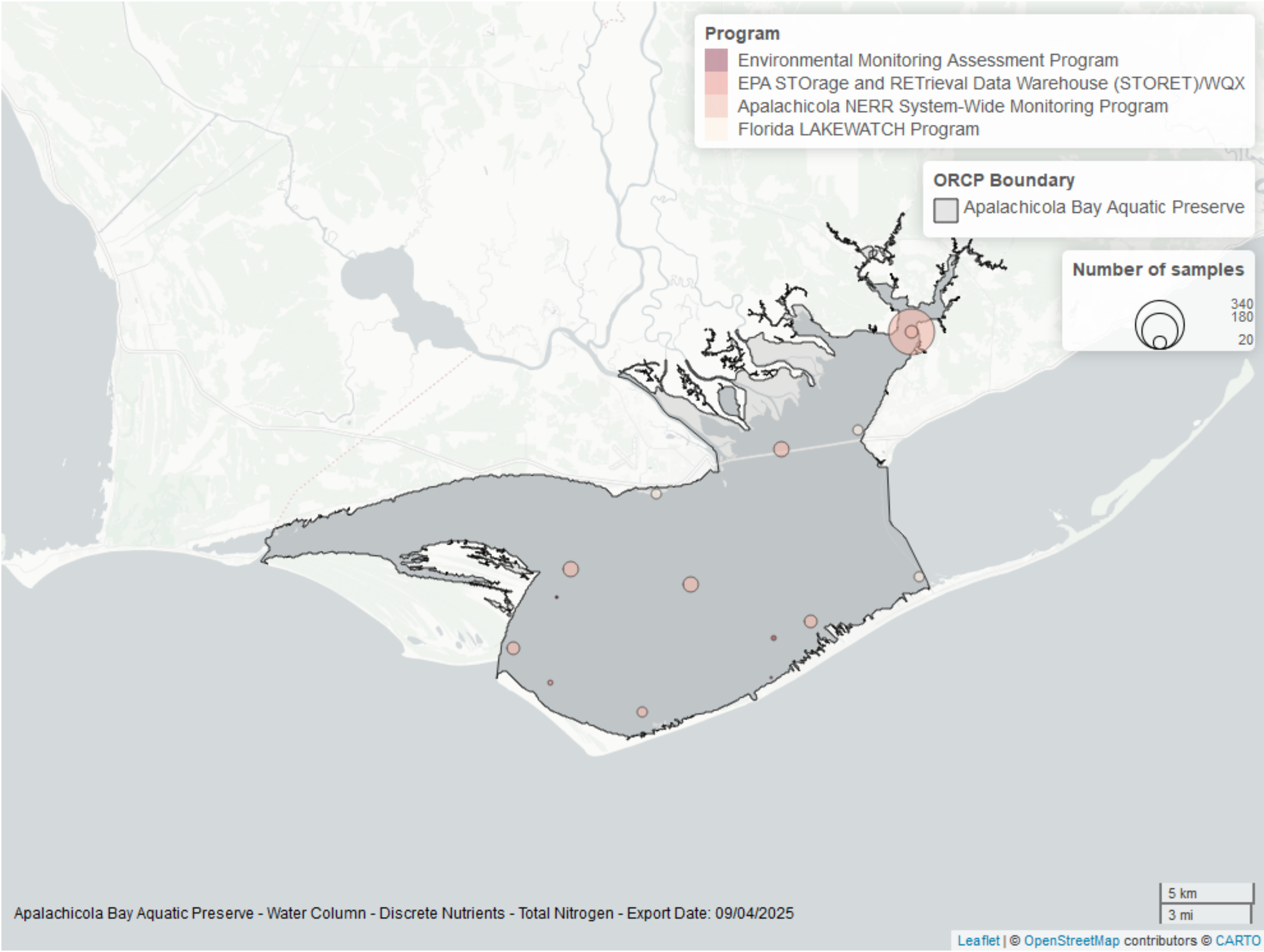

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
355	2871	2013	2025
5002	420	1992	2024
514	50	2007	2008
103	11	2002	2006
115	2	2002	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
514 - Florida LAKEWATCH Program[6]
5002 - Florida STORET / WIN[2]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

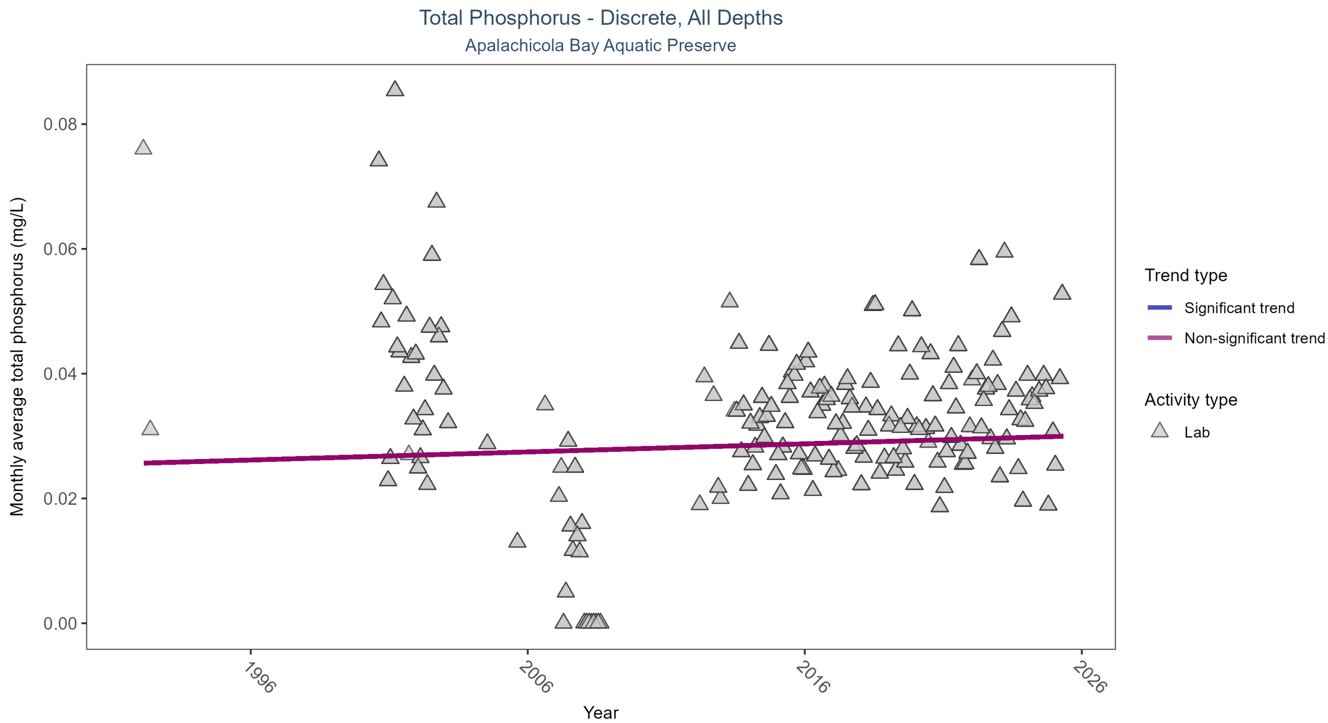

Figure 17: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included 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	3625	24	1992 - 2025	0.031	0.0584	0.0256	0.0001	0.3311

Total phosphorus showed no detectable trend between 1992 and 2025.

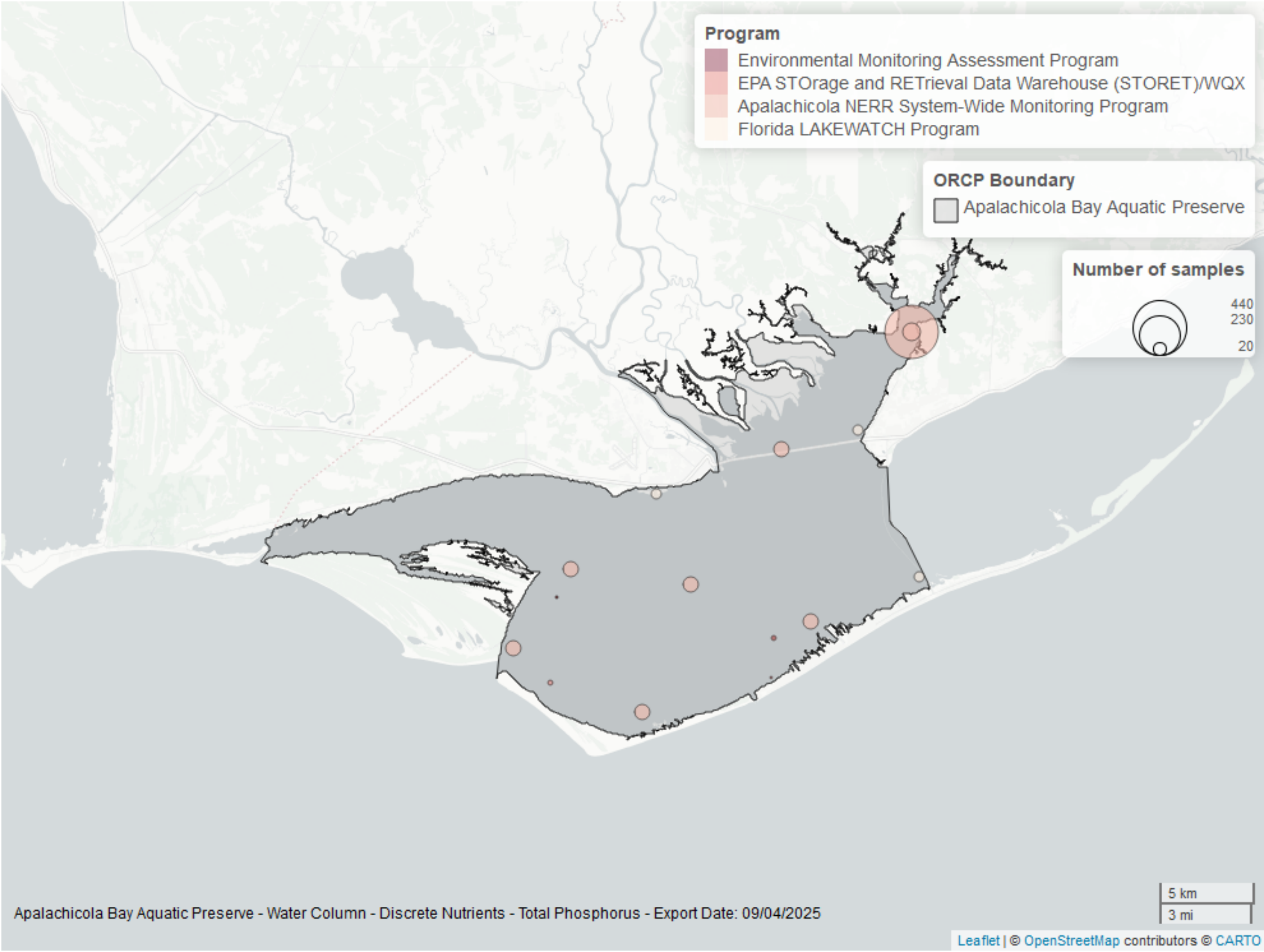

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
355	3162	2013	2025
5002	496	1992	2024
514	50	2007	2008
103	14	2002	2015
115	2	2002	2004

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
115 - Environmental Monitoring Assessment Program[4]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
514 - Florida LAKEWATCH Program[6]
5002 - Florida STORET / WIN[2]

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

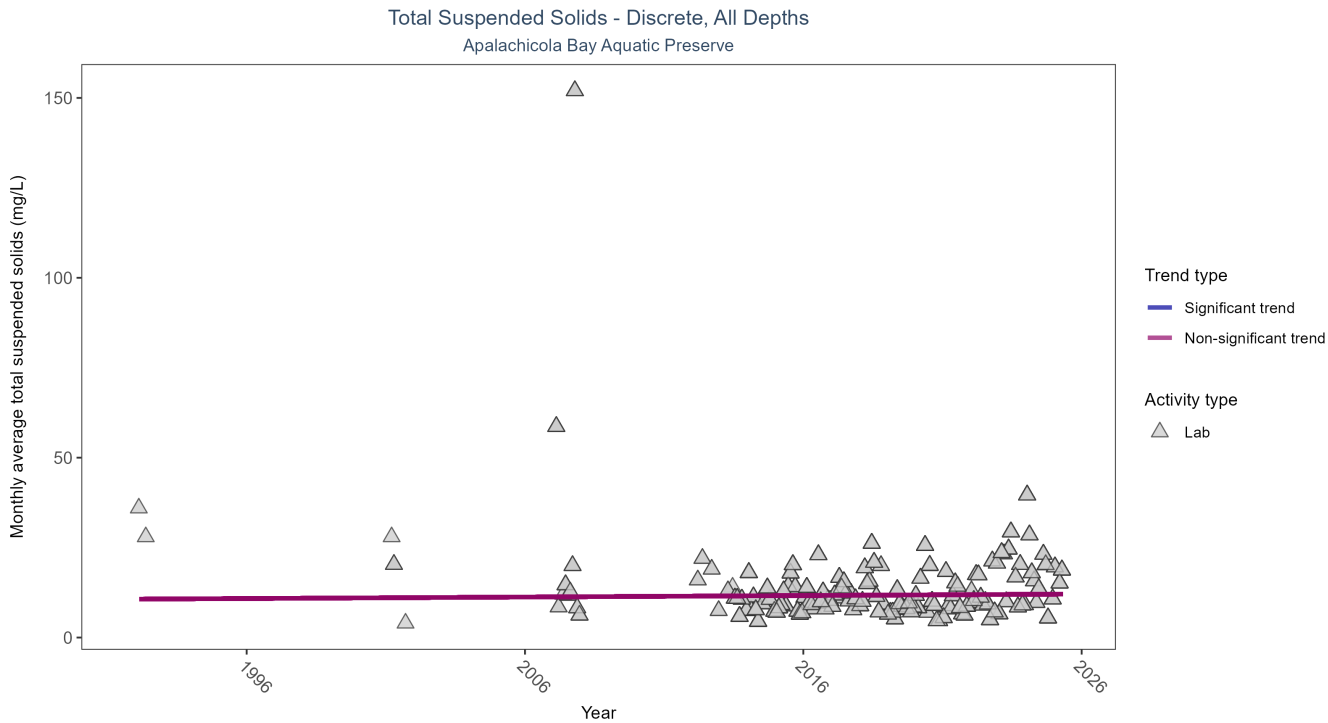

Figure 19: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	3211	17	1992 - 2025	10	0.0237	10.6773	0.0415	0.8033

Total suspended solids showed no detectable trend between 1992 and 2025.

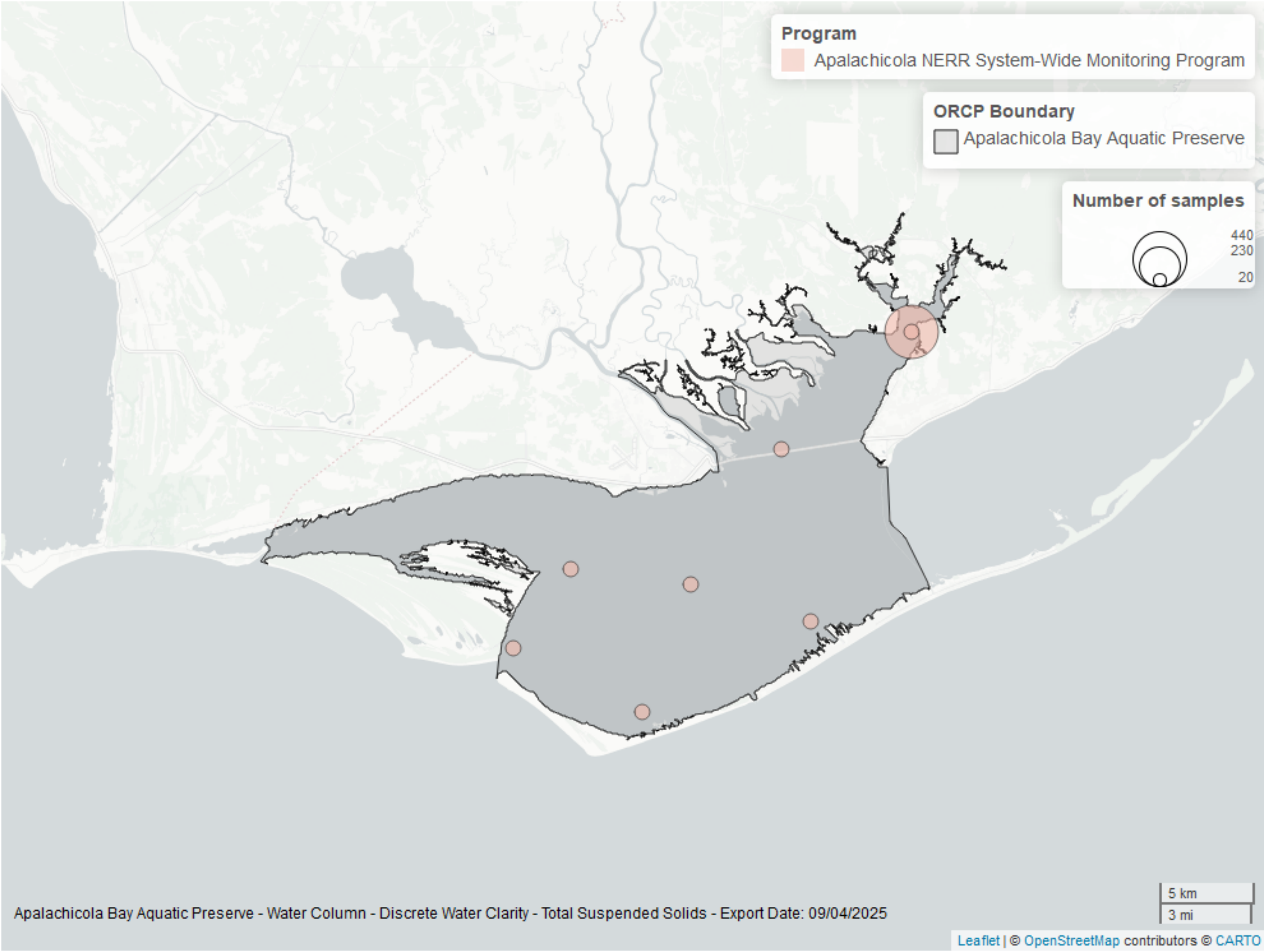

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
355	3256	2013	2025
5002	119	1992	2024

Program names:

355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

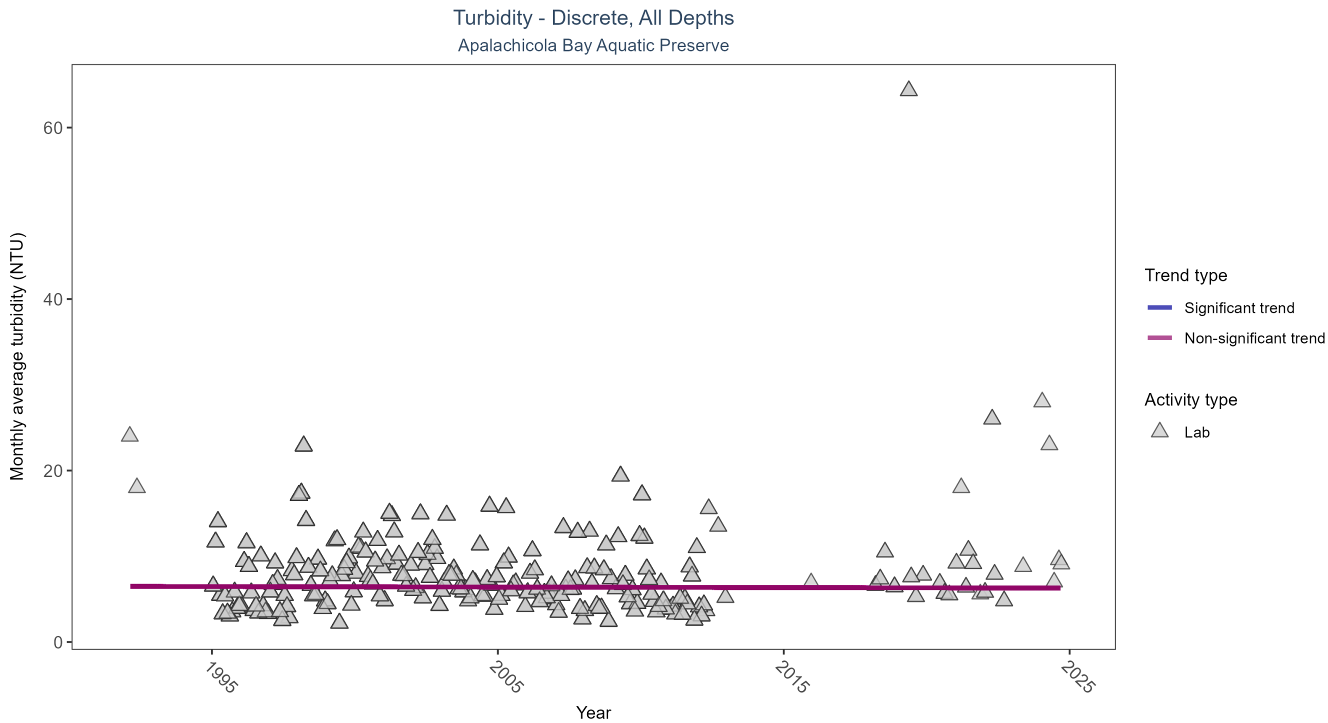

Figure 21: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	No significant trend	15523	27	1992 - 2024	5.6	-0.0153	6.4878	-0.006	0.8103

Turbidity showed no detectable trend between 1992 and 2024.

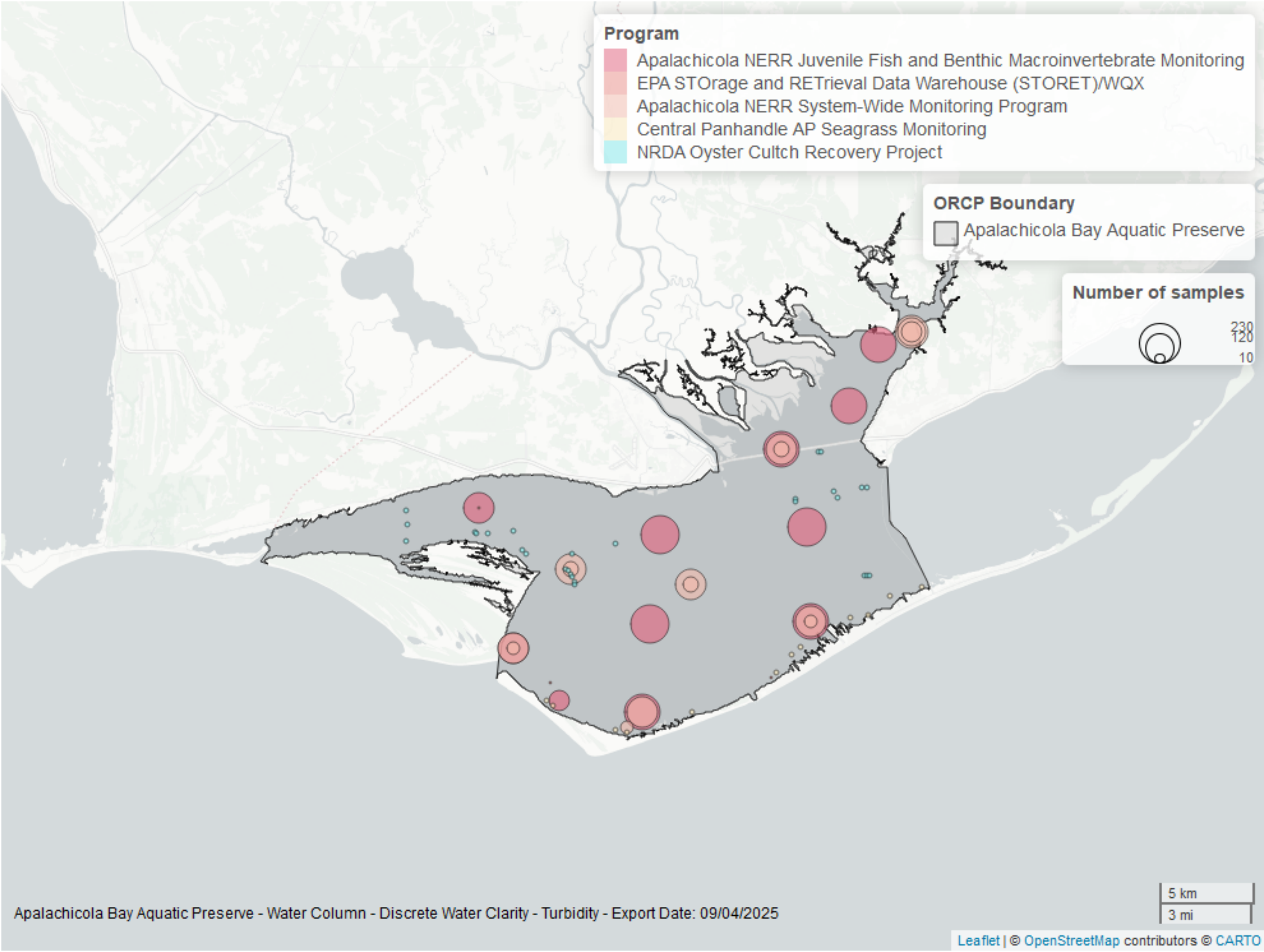

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	15522	1992	2024
129	2042	2000	2024
355	1446	2004	2019
4044	112	2021	2023
557	41	2022	2023
103	3	2005	2006

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
4044 - NRDA Oyster Cultch Recovery Project[14]
5002 - Florida STORET / WIN[2]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

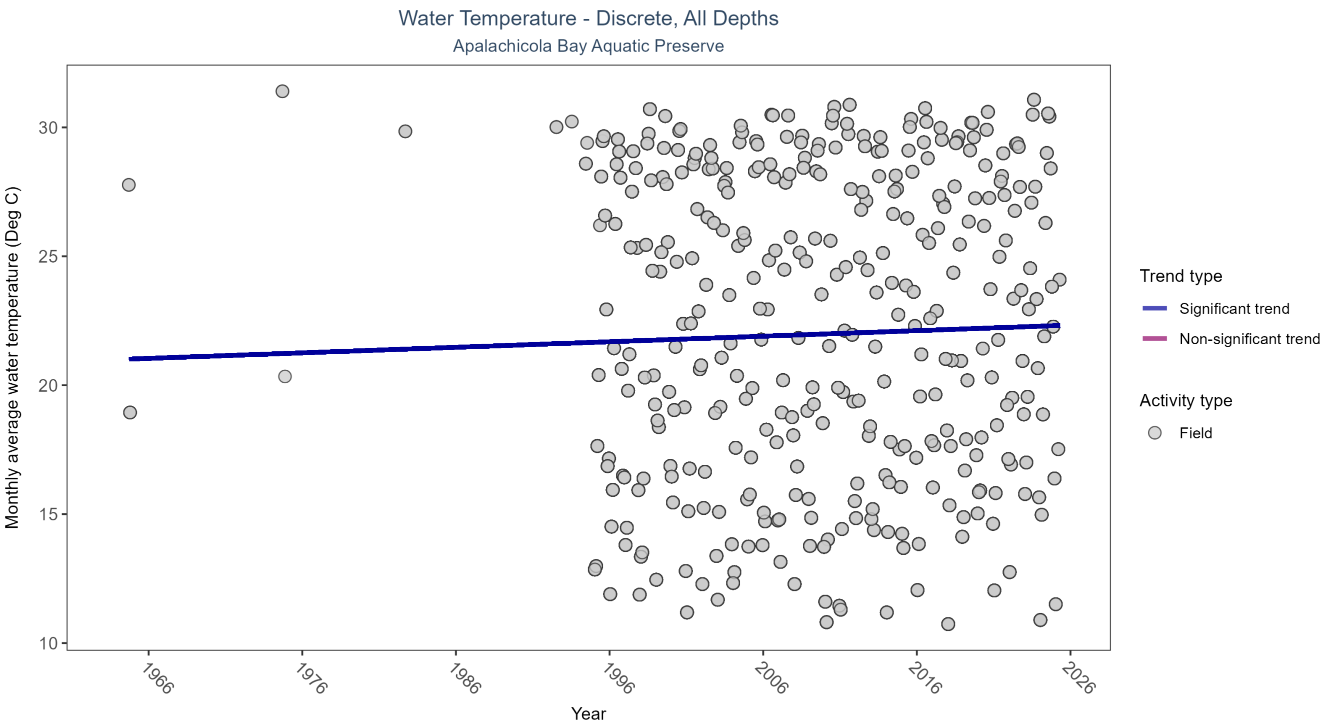

Figure 23: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	63038	37	1964 - 2025	24	0.1063	20.9975	0.0215	0.004

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

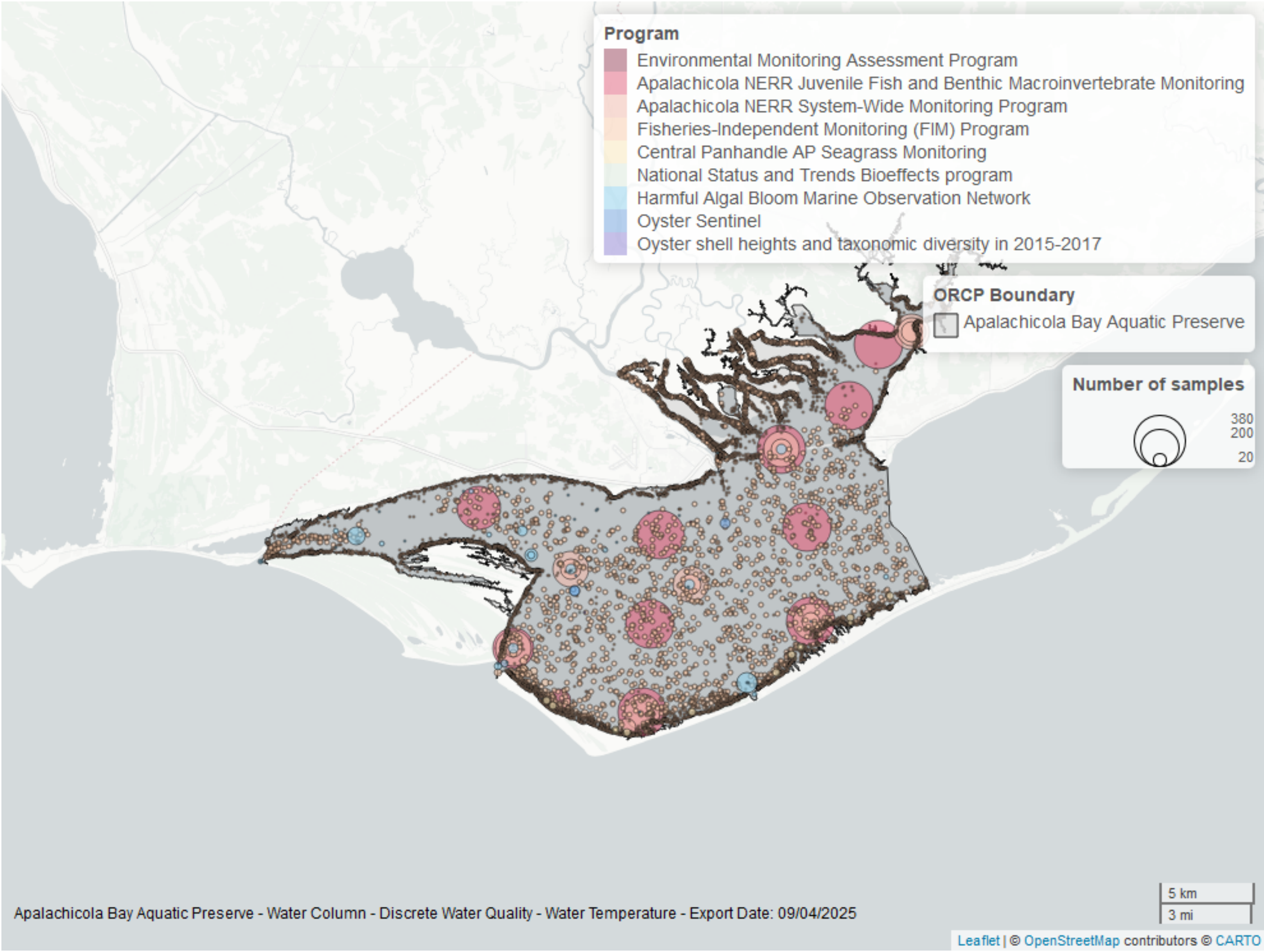

Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	30500	1995	2024
69	26523	1998	2024
129	3504	2000	2024
355	3022	2003	2025
95	332	1964	2018
557	121	2006	2023
456	33	2005	2013
115	16	1992	2004
119	14	1994	1994
5071	3	2017	2017

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[8]
115 - Environmental Monitoring Assessment Program[4]

119 - National Status and Trends Bioeffects program[9]
129 - Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring[10]
355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]
456 - Oyster Sentinel[13]
557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
5002 - Florida STORET / WIN[2]
5071 - Oyster shell heights and taxonomic diversity in 2015-2017 among previously documented oiled and non-oiled reefs in Louisiana, Alabama, and the Florida panhandle[12]

Water Quality - Continuous

The following files were used in the continuous analysis:

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

Continuous monitoring locations in Apalachicola Bay Aquatic Preserve

Table 30: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
355	apadbwq	24	TRUE	DO , DOS , pH , Sal , Turb , TempW
355	apaebwq	29	TRUE	Turb
355	apaebwq	31	TRUE	DO , DOS , pH , Sal , TempW
355	apaeswq	30	TRUE	Turb
355	apaeswq	31	TRUE	DO , DOS , pH , Sal , TempW
355	apalmwq	10	TRUE	DO , DOS , pH , Sal , Turb , TempW
355	apapcwq	10	TRUE	DO , DOS , pH , Sal , Turb , TempW

Program names:

355 - Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program[1]

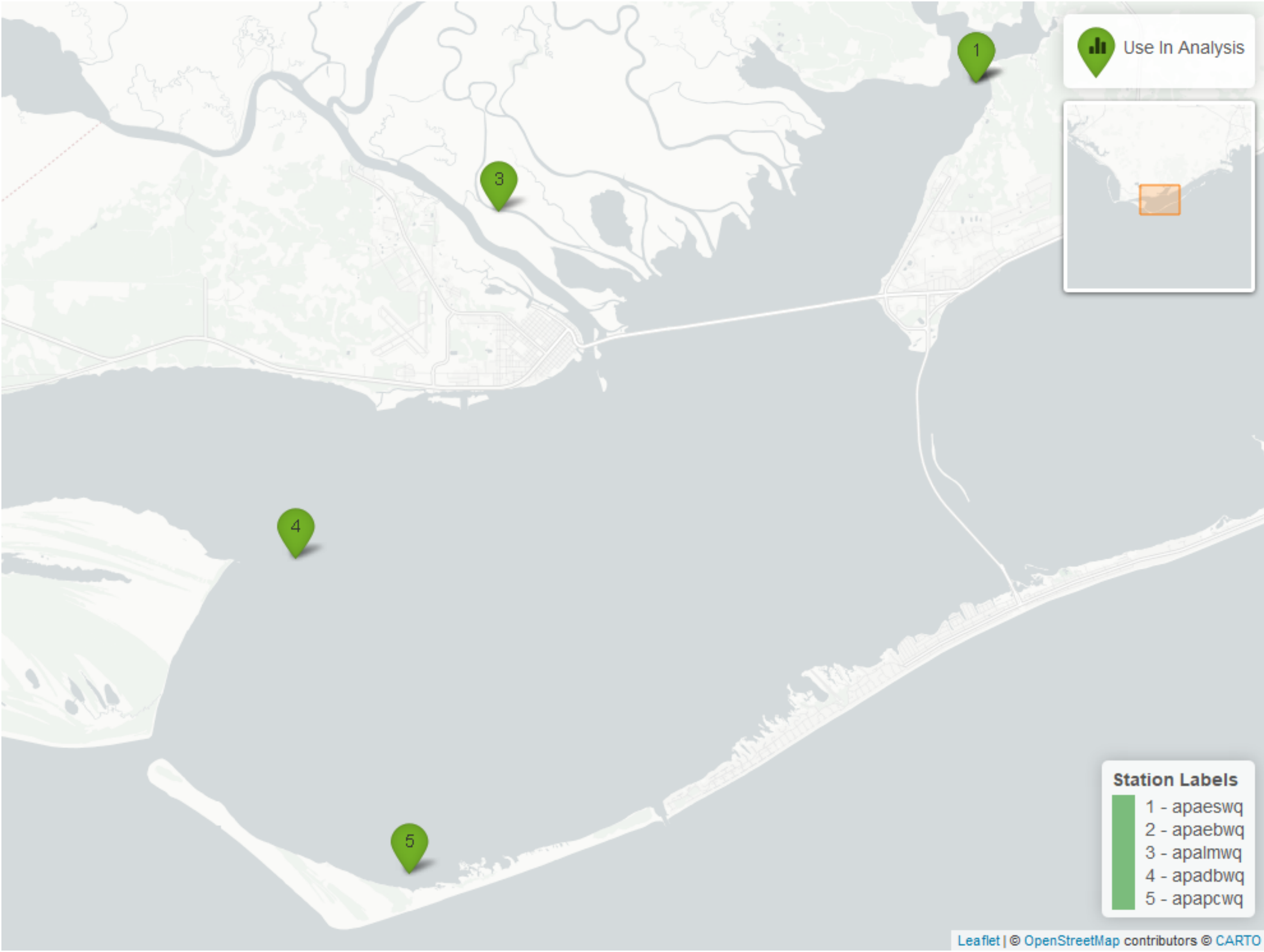

Figure 25: Map showing continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

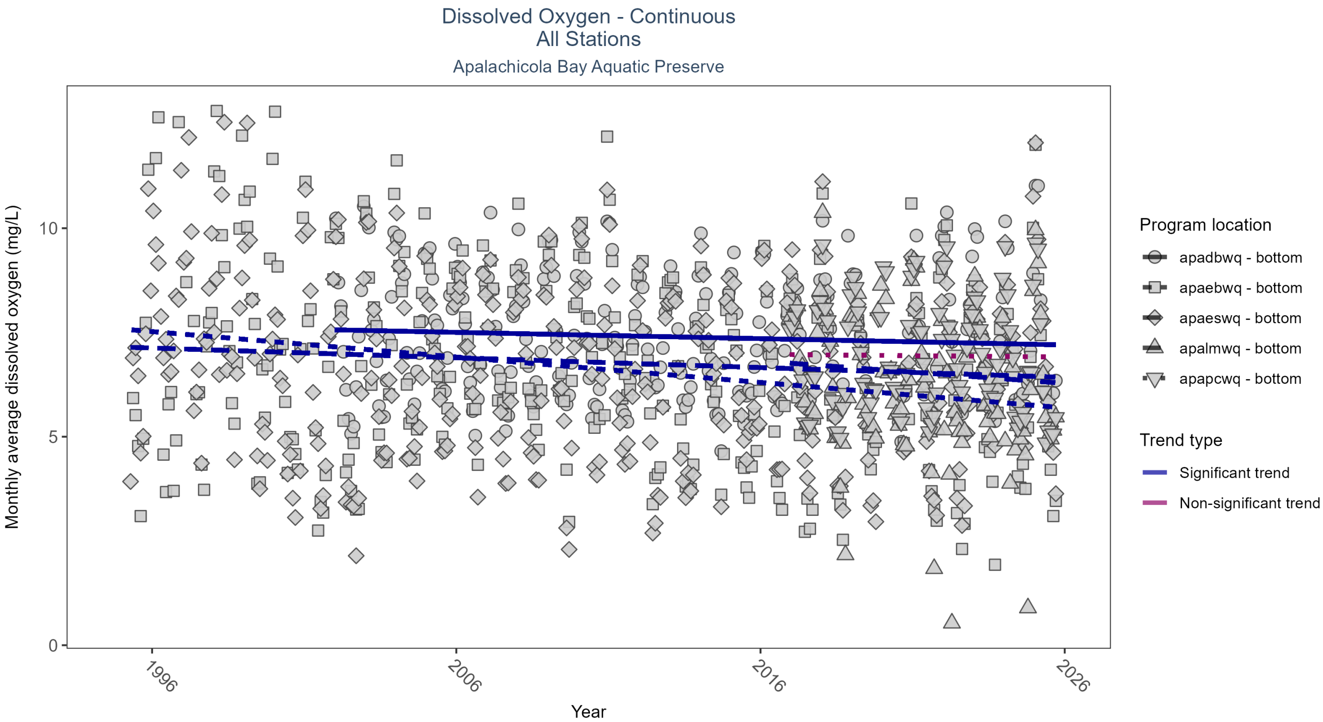

Figure 26: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apapcwq	No significant trend	289558	10	2016 - 2025	6.8	-0.02	6.98	-0.01	0.88
apaeswq	Significantly decreasing trend	733356	31	1995 - 2025	6.8	-0.13	7.15	-0.02	0.00
apalmwq	Significantly decreasing trend	275414	10	2016 - 2025	6.3	-0.20	6.81	-0.05	0.01
apadbwq	Significantly decreasing trend	641801	24	2002 - 2025	7.2	-0.14	7.56	-0.02	0.00
apaebwq	Significantly decreasing trend	685348	31	1995 - 2025	6.8	-0.30	7.58	-0.06	0.00

At four program locations, monthly average dissolved oxygen decreased between 0.02 and 0.06 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at one location.

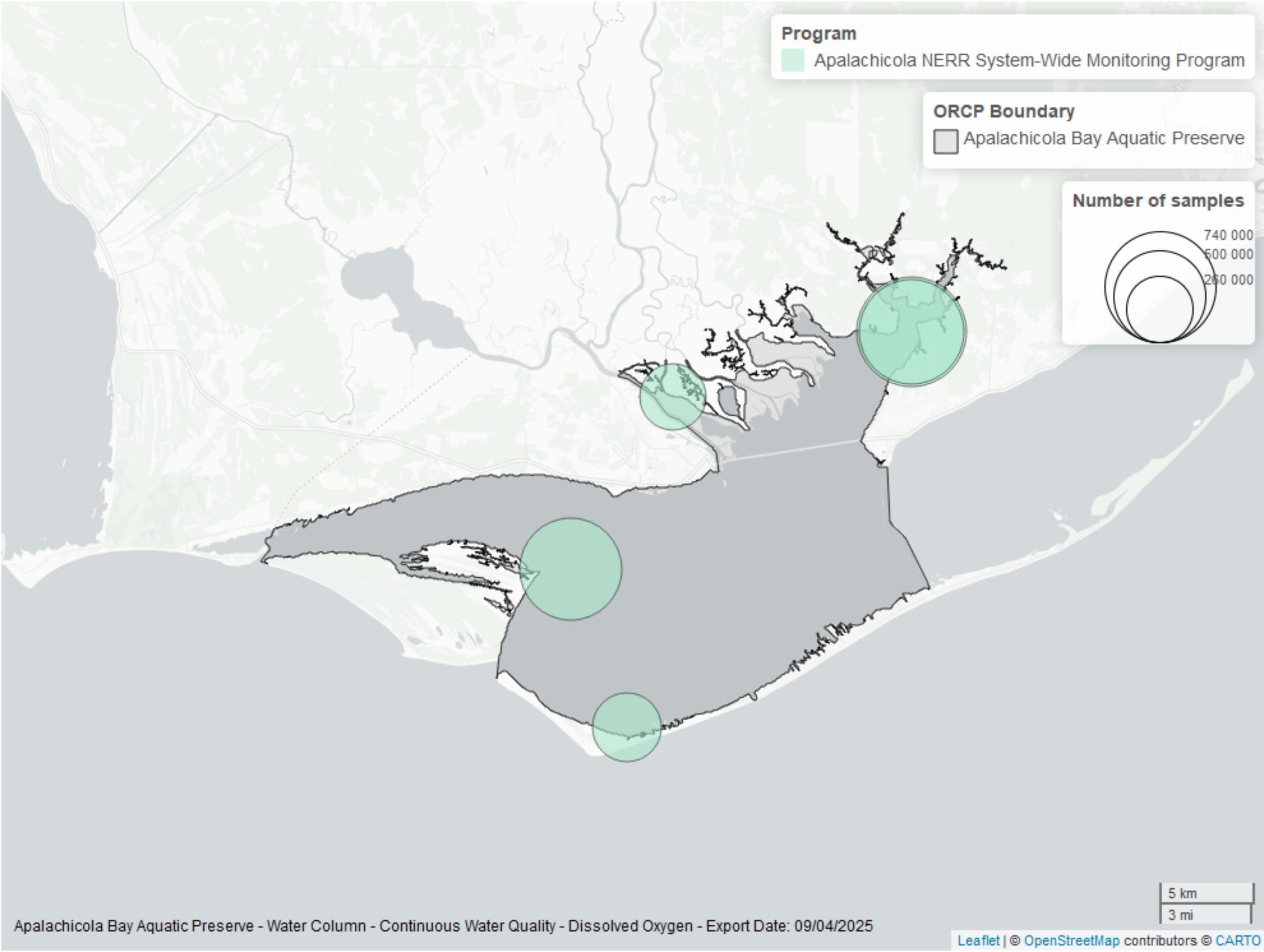

Figure 27: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

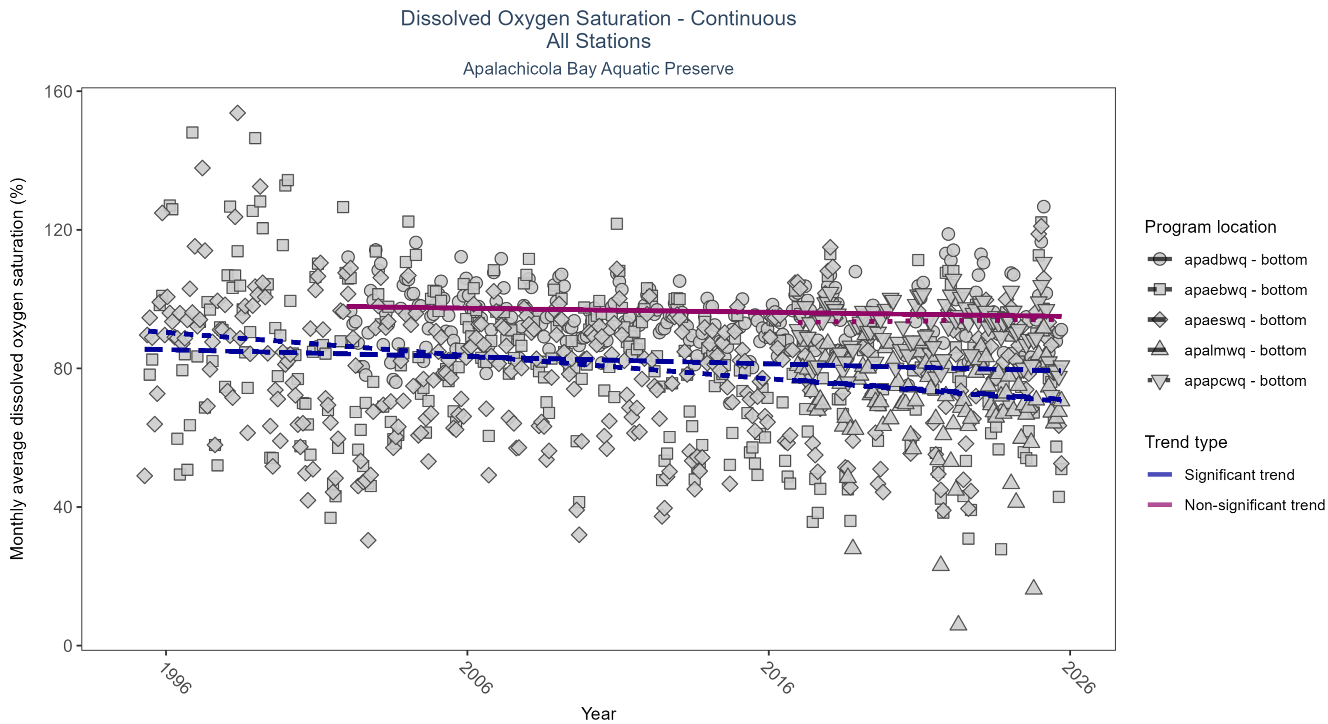

Figure 28: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apalmwq	Significantly decreasing trend	275950	10	2016 - 2025	74.6	-0.21	77.22	-0.64	0.01
apaebwq	Significantly decreasing trend	681137	31	1995 - 2025	84.5	-0.26	91.05	-0.67	0.00
apapcwq	No significant trend	293014	10	2016 - 2025	93.9	0.03	93.21	0.10	0.64
apaeswq	Significantly decreasing trend	734556	31	1995 - 2025	84.2	-0.09	85.63	-0.21	0.02
apadbwq	No significant trend	645250	24	2002 - 2025	94.7	-0.08	97.86	-0.12	0.07

At three program locations, monthly average dissolved oxygen saturation decreased between 0.21 and 0.67% per year. No detectable change in monthly average dissolved oxygen saturation was observed at two locations.

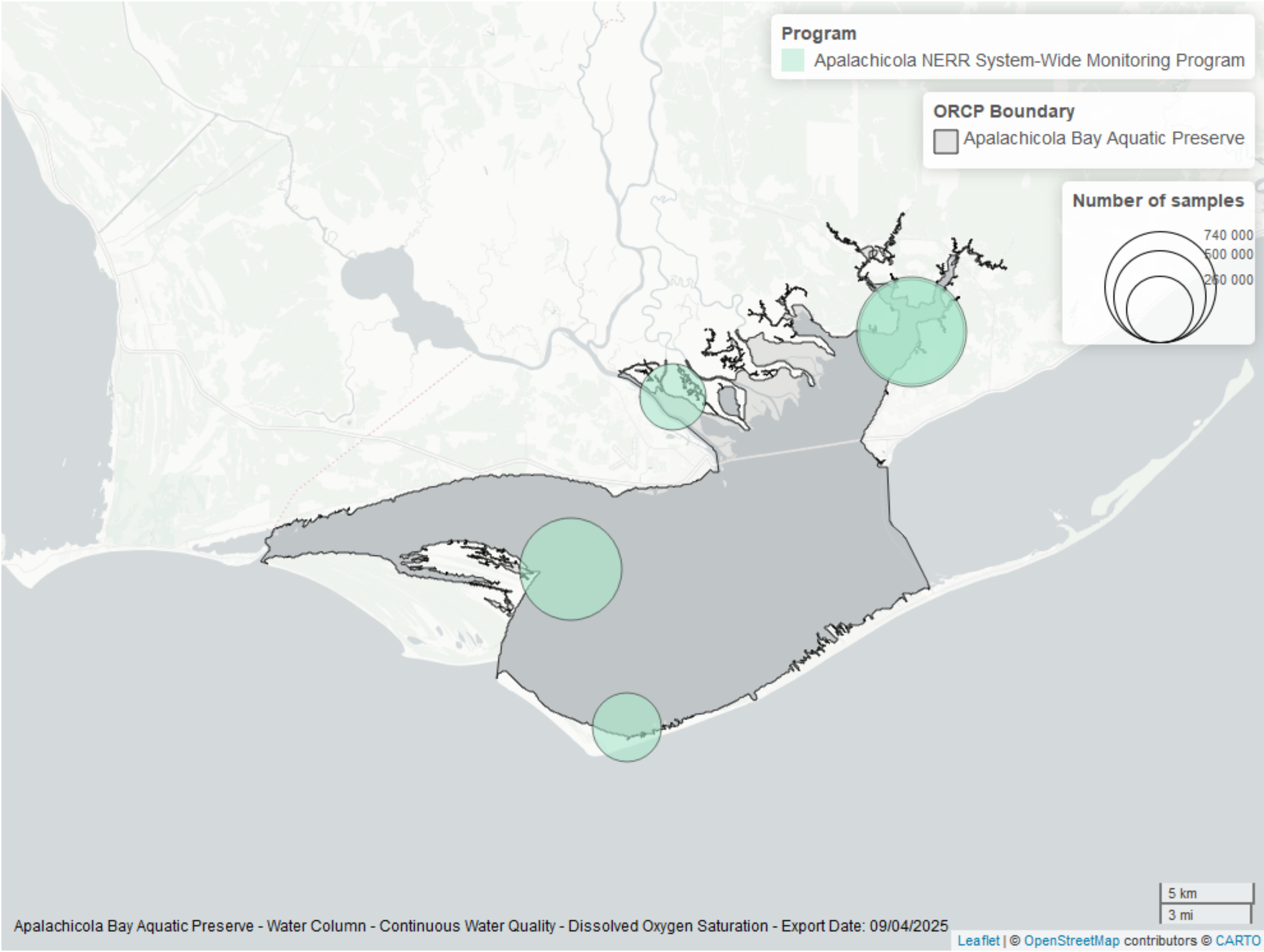

Figure 29: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

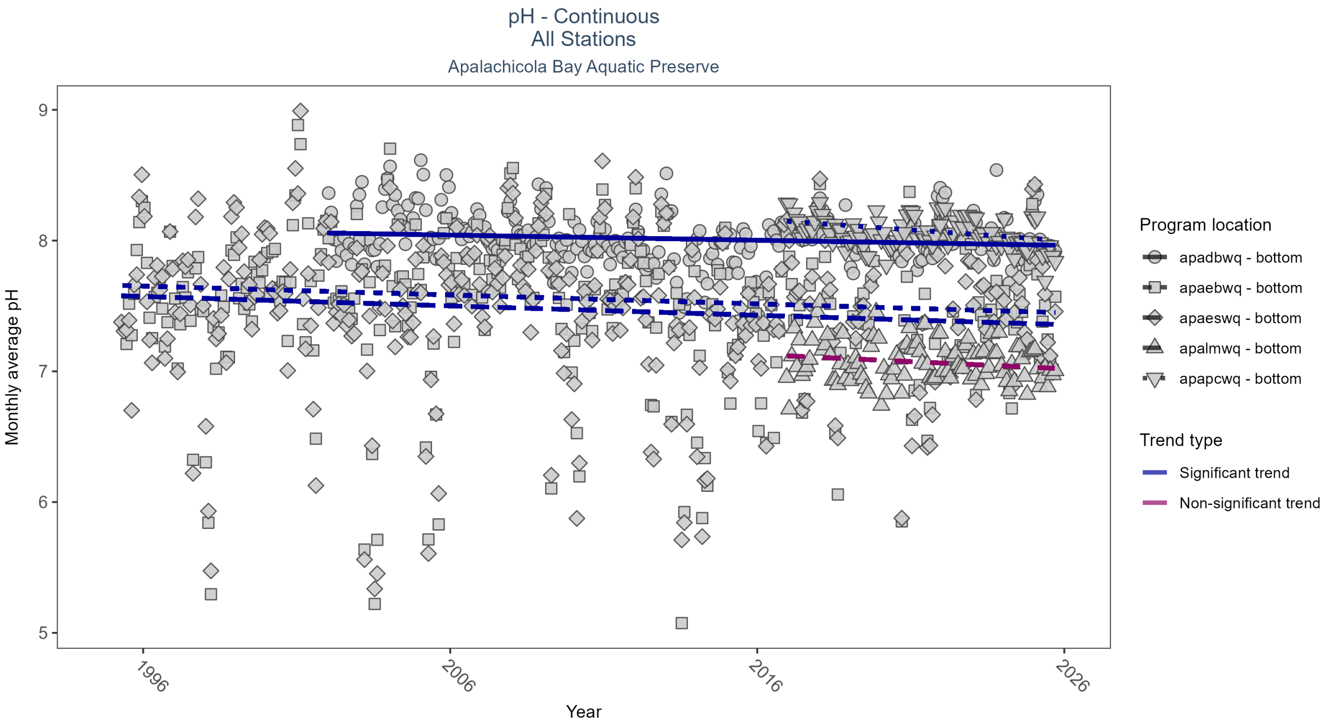

Figure 30: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaeswq	Significantly decreasing trend	736038	31	1995 - 2025	7.5	-0.12	7.58	-0.01	0.00
apadbwq	Significantly decreasing trend	623515	24	2002 - 2025	8.0	-0.13	8.06	0.00	0.00
apalmwq	No significant trend	283547	10	2016 - 2025	7.1	-0.13	7.13	-0.01	0.12
apapcwq	Significantly decreasing trend	289516	10	2016 - 2025	8.1	-0.34	8.16	-0.02	0.00
apaebwq	Significantly decreasing trend	738964	31	1995 - 2025	7.6	-0.12	7.66	-0.01	0.00

At four program locations, monthly average pH decreased between less than 0.01 and 0.02 pH units per year. No detectable change in monthly average pH was observed at one location.

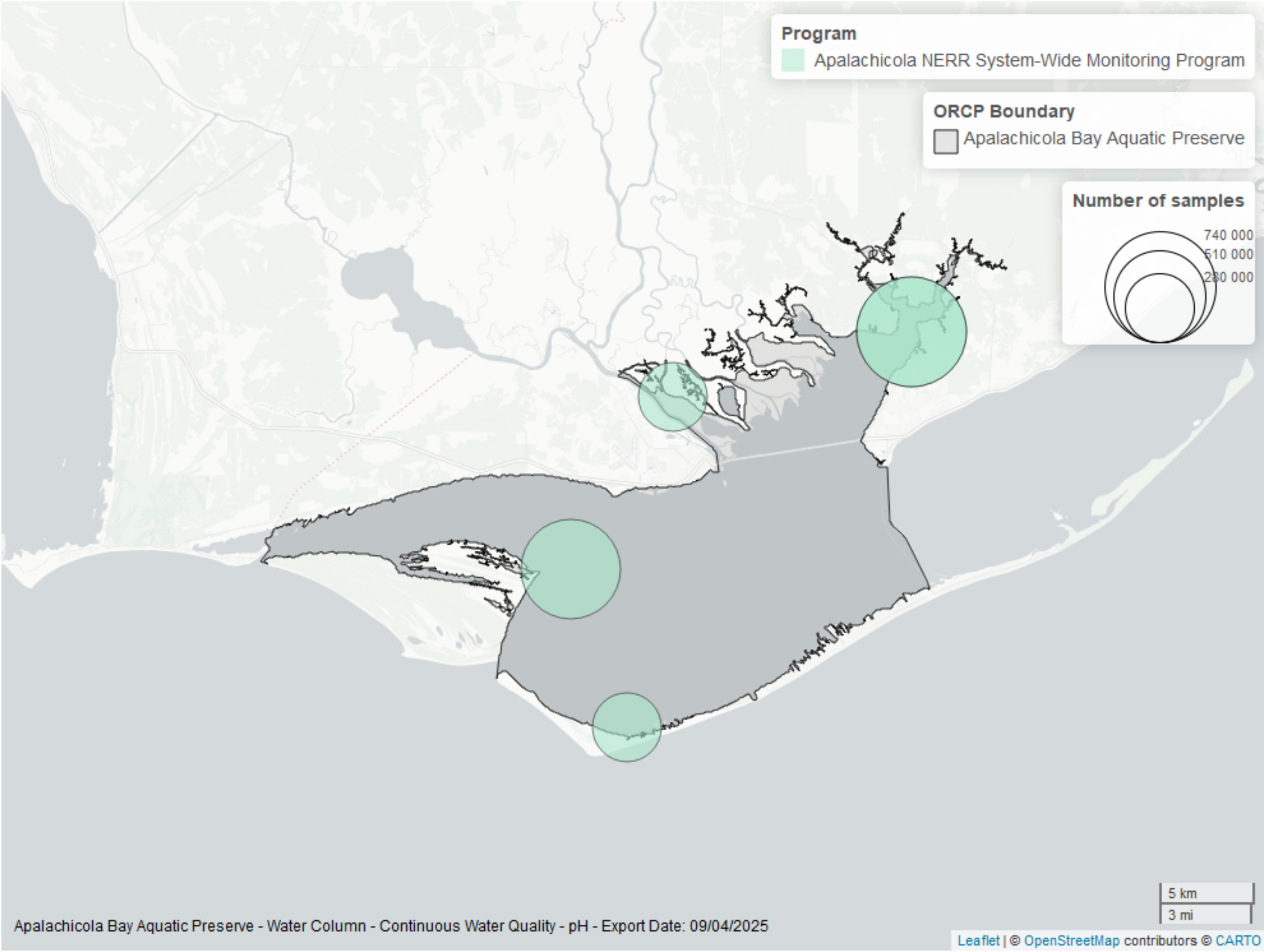

Figure 31: Map showing location of ph continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

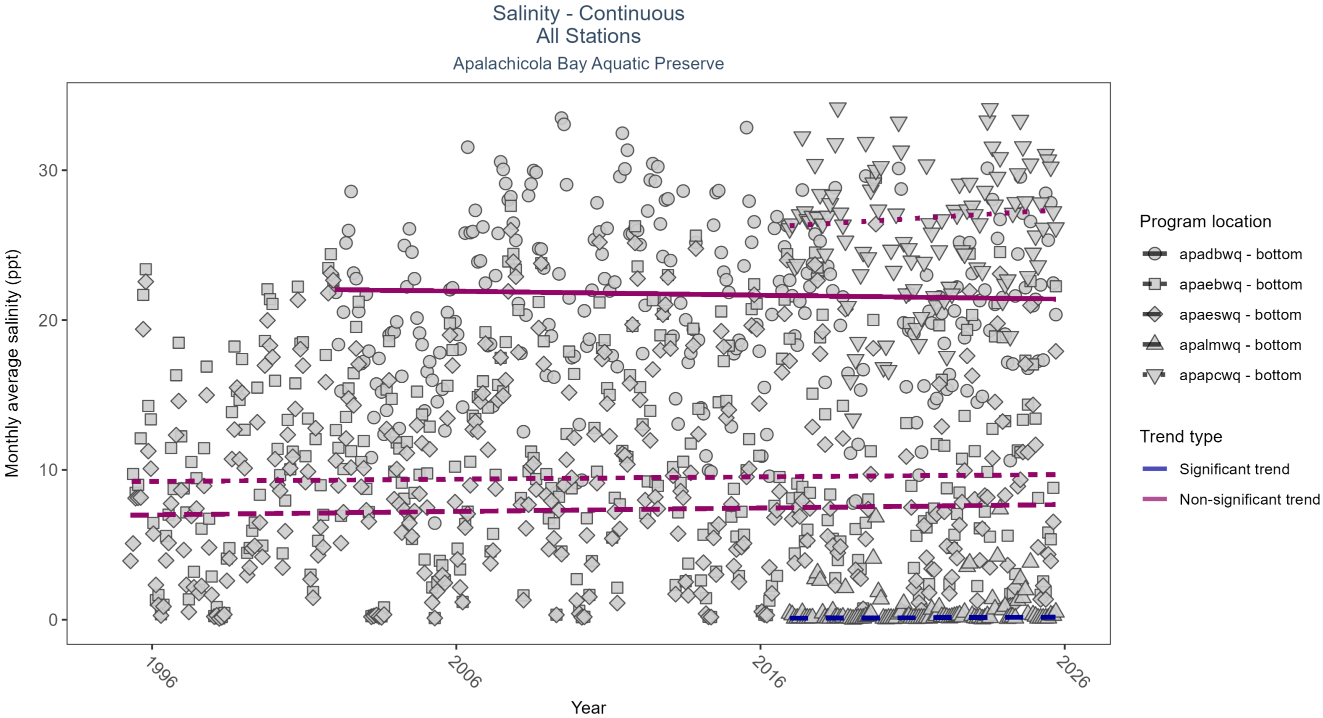

Figure 32: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apalmwq	Significantly increasing trend	291127	10	2016 - 2025	0.1	0.18	0.09	0.01	0.02
apaeswq	No significant trend	778085	31	1995 - 2025	7.3	0.04	6.97	0.02	0.30
apapcwq	No significant trend	291880	10	2016 - 2025	27.0	0.08	26.18	0.12	0.31
apaebwq	No significant trend	768387	31	1995 - 2025	9.7	0.03	9.21	0.02	0.46
apadbwq	No significant trend	640362	24	2002 - 2025	22.2	-0.03	22.03	-0.03	0.52

At one program location, monthly average salinity increased by 0.01 ppt per year. No detectable change in monthly average salinity was observed at four locations.

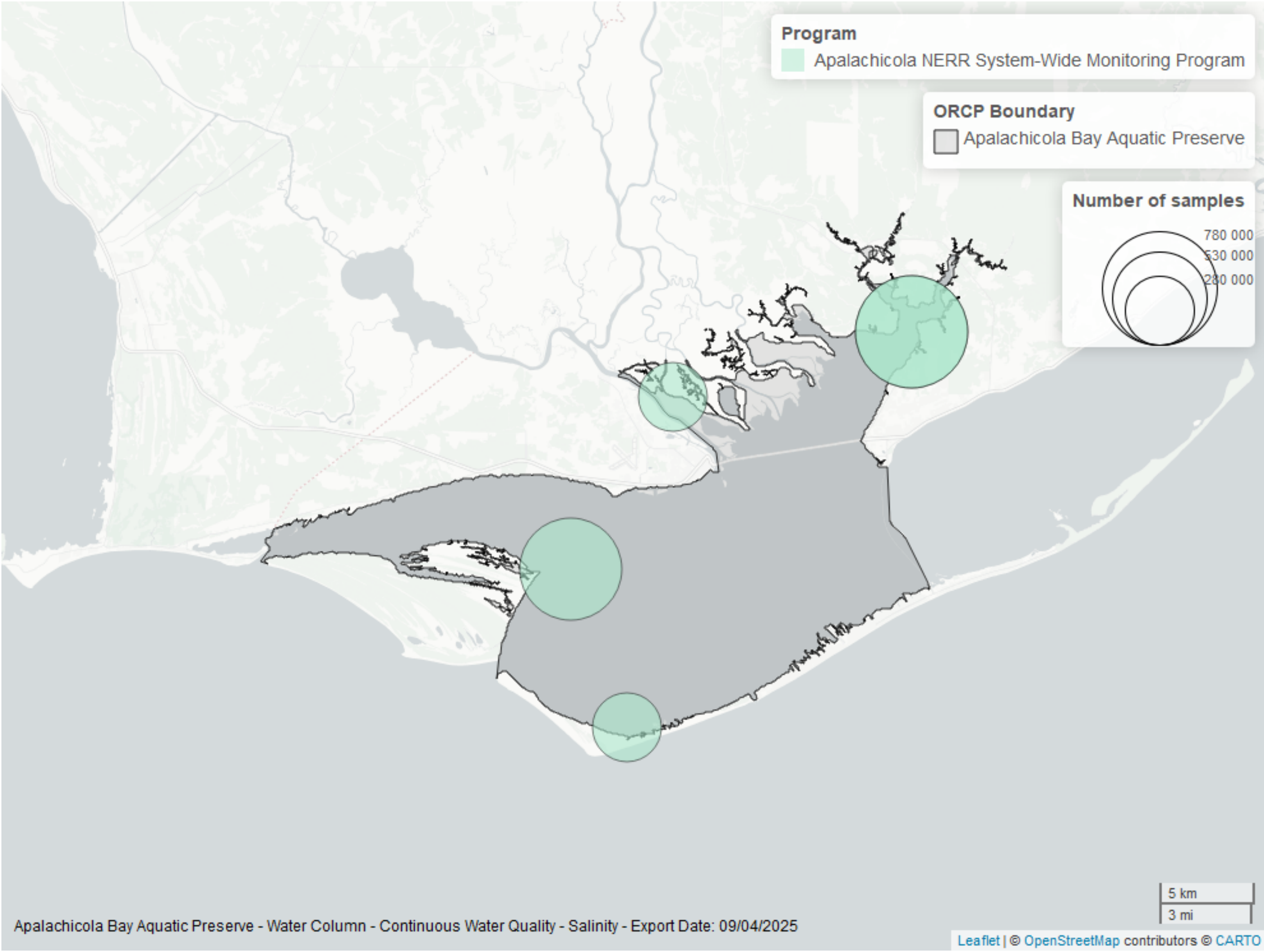

Figure 33: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

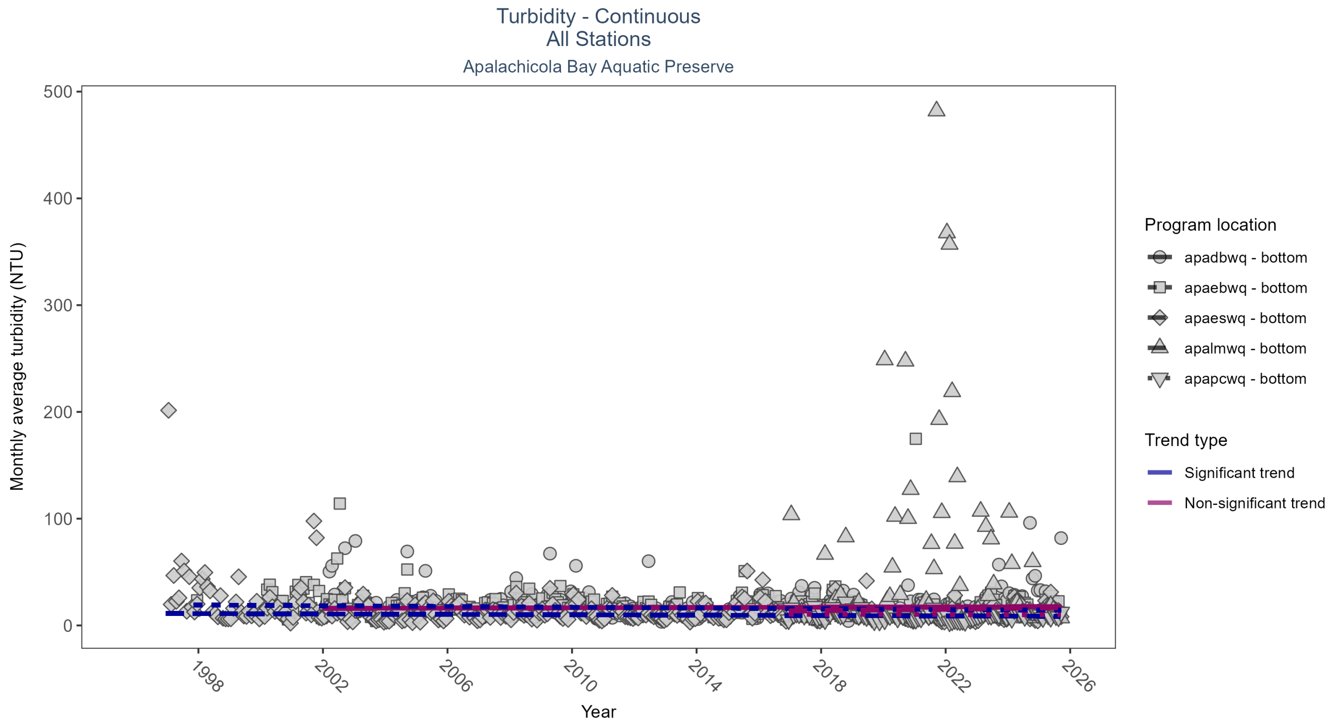

Figure 34: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaeswq	Significantly decreasing trend	721945	30	1996 - 2025	9	-0.13	11.29	-0.09	0.00
apapcwq	No significant trend	280348	10	2016 - 2025	7	-0.05	10.67	-0.08	0.55
apalmwq	No significant trend	261636	10	2016 - 2025	12	0.13	13.14	0.36	0.11
apaebwq	Significantly decreasing trend	656935	27	1997 - 2025	13	-0.17	19.33	-0.18	0.00
apadbwq	No significant trend	625446	24	2002 - 2025	10	0.06	16.00	0.07	0.22

At two program locations, monthly average turbidity decreased by 0.09 NTU per year at one site and by 0.18 NTU per year at the other. No detectable change in monthly average turbidity was observed at three locations.

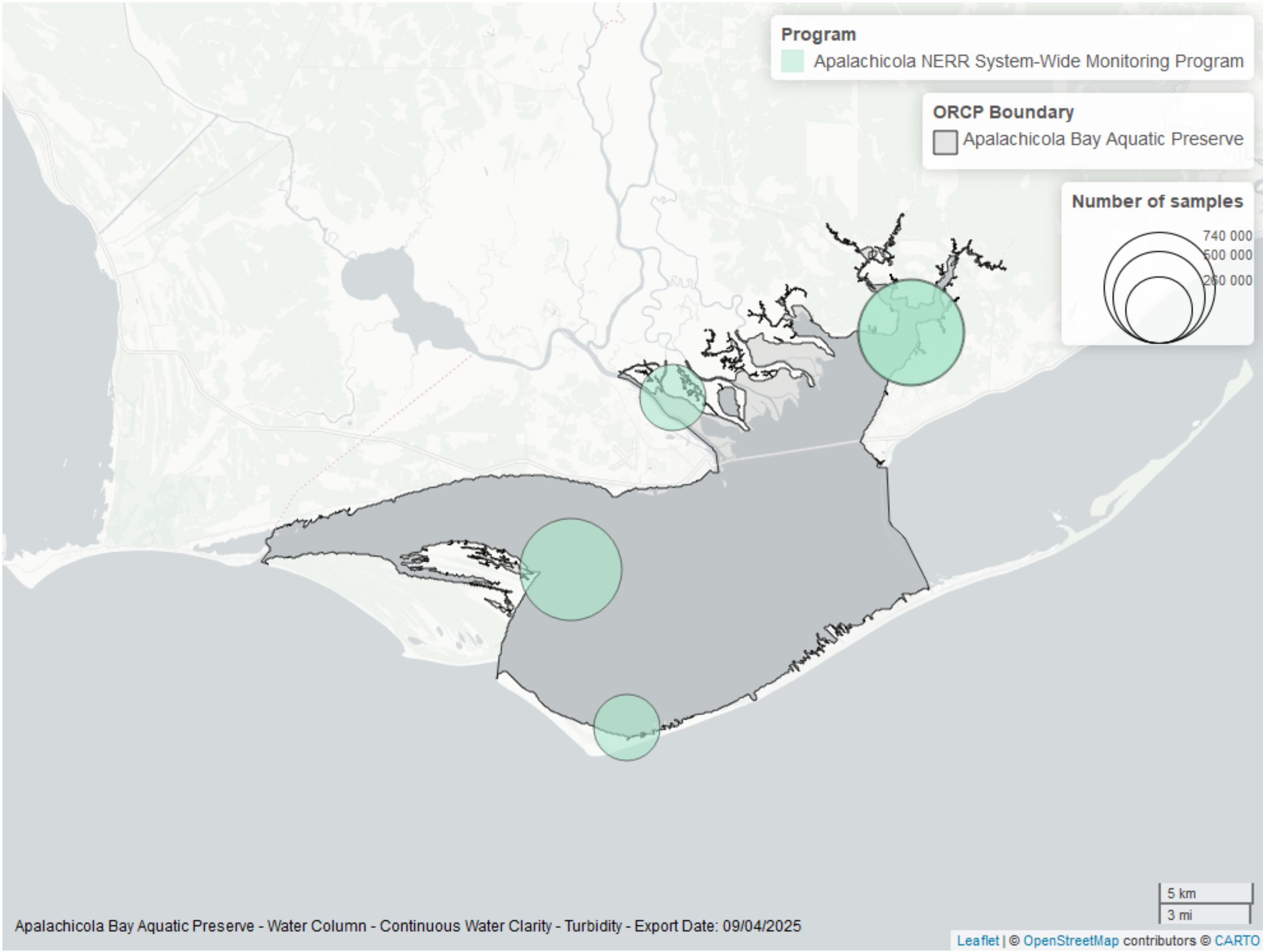

Figure 35: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

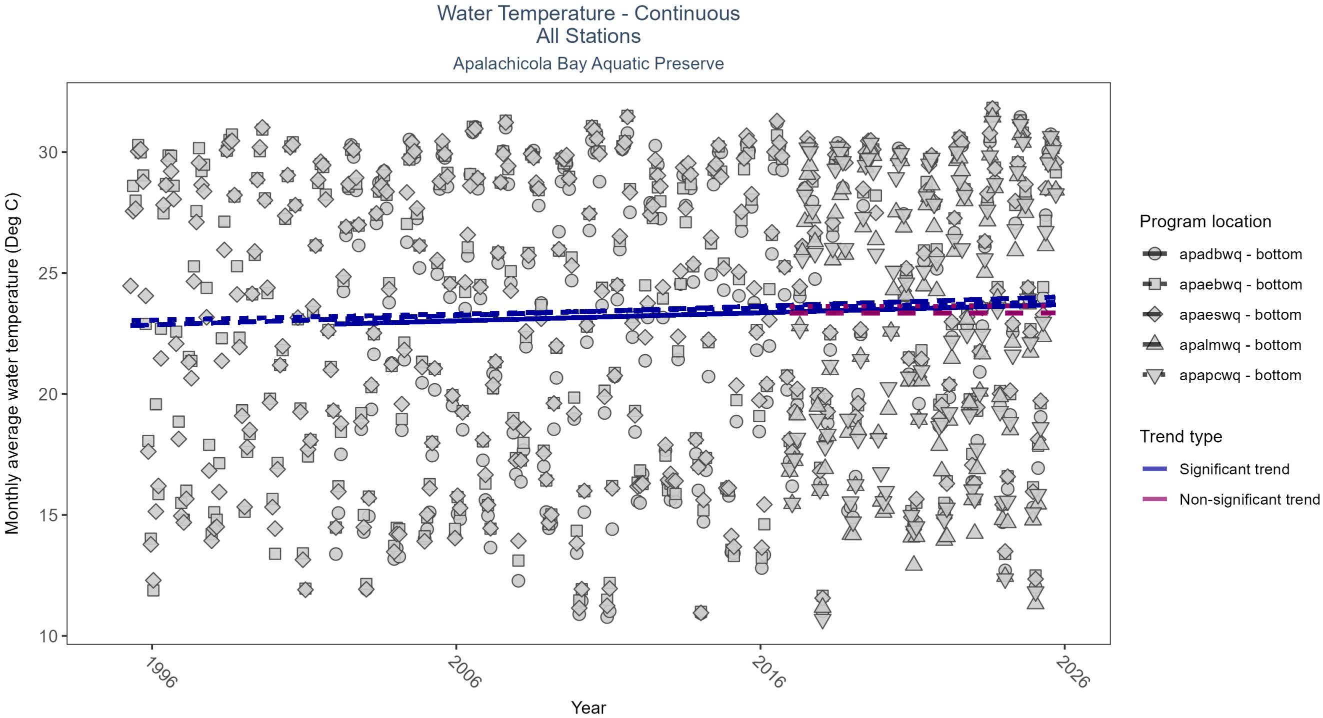

Figure 36: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apapcwq	No significant trend	295378	10	2016 - 2025	23.4	0.00	23.62	0.00	0.98
apalmwq	No significant trend	293385	10	2016 - 2025	22.9	0.00	23.35	0.00	1.00
apaeswq	Significantly increasing trend	787341	31	1995 - 2025	24.2	0.20	22.82	0.04	0.00
apadbwq	Significantly increasing trend	666370	24	2002 - 2025	23.5	0.17	22.89	0.03	0.00
apaebwq	Significantly increasing trend	783431	31	1995 - 2025	24.3	0.16	23.03	0.02	0.00

At three program locations, monthly average water temperature increased between 0.02 and 0.04°C per year. No detectable change in monthly average water temperature was observed at two locations.

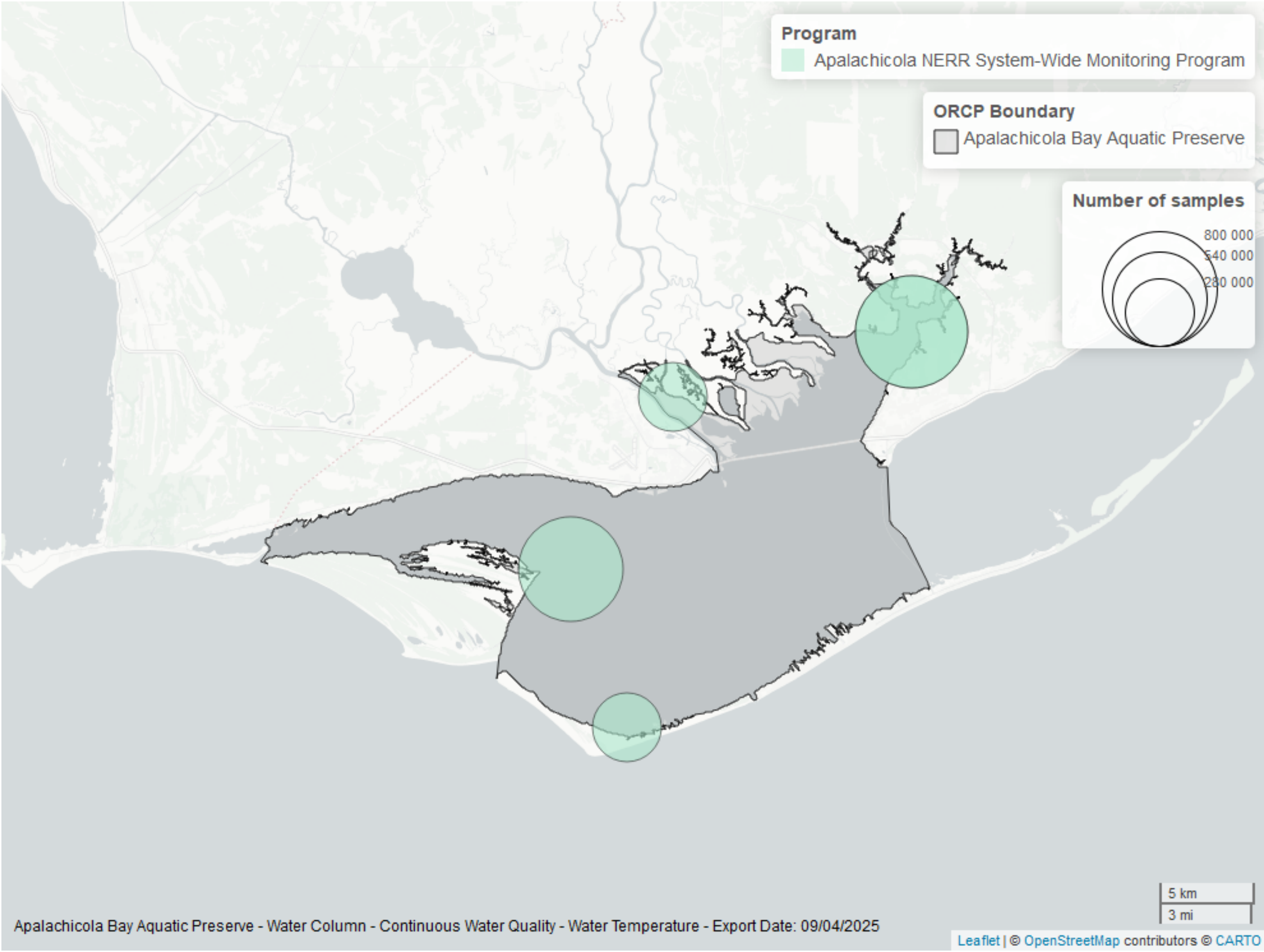

Figure 37: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Submerged Aquatic Vegetation

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

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

Parameters

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

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

Species

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

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

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

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

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

Notes

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

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

- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

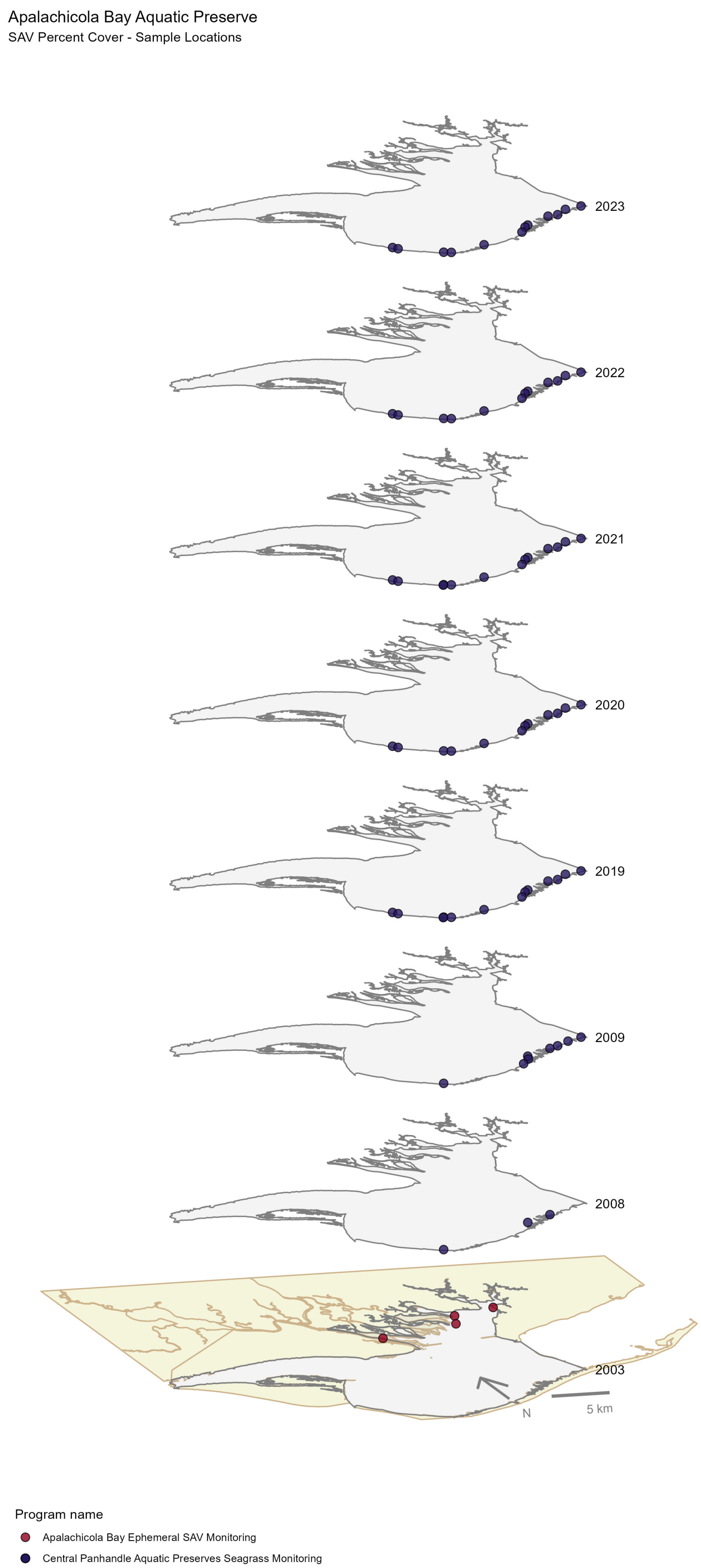

Figure 38: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Apalachicola Bay Aquatic Preserve* by Program name.

Click here to view spatio-temporal plots on GitHub.

Sampling locations by Program:

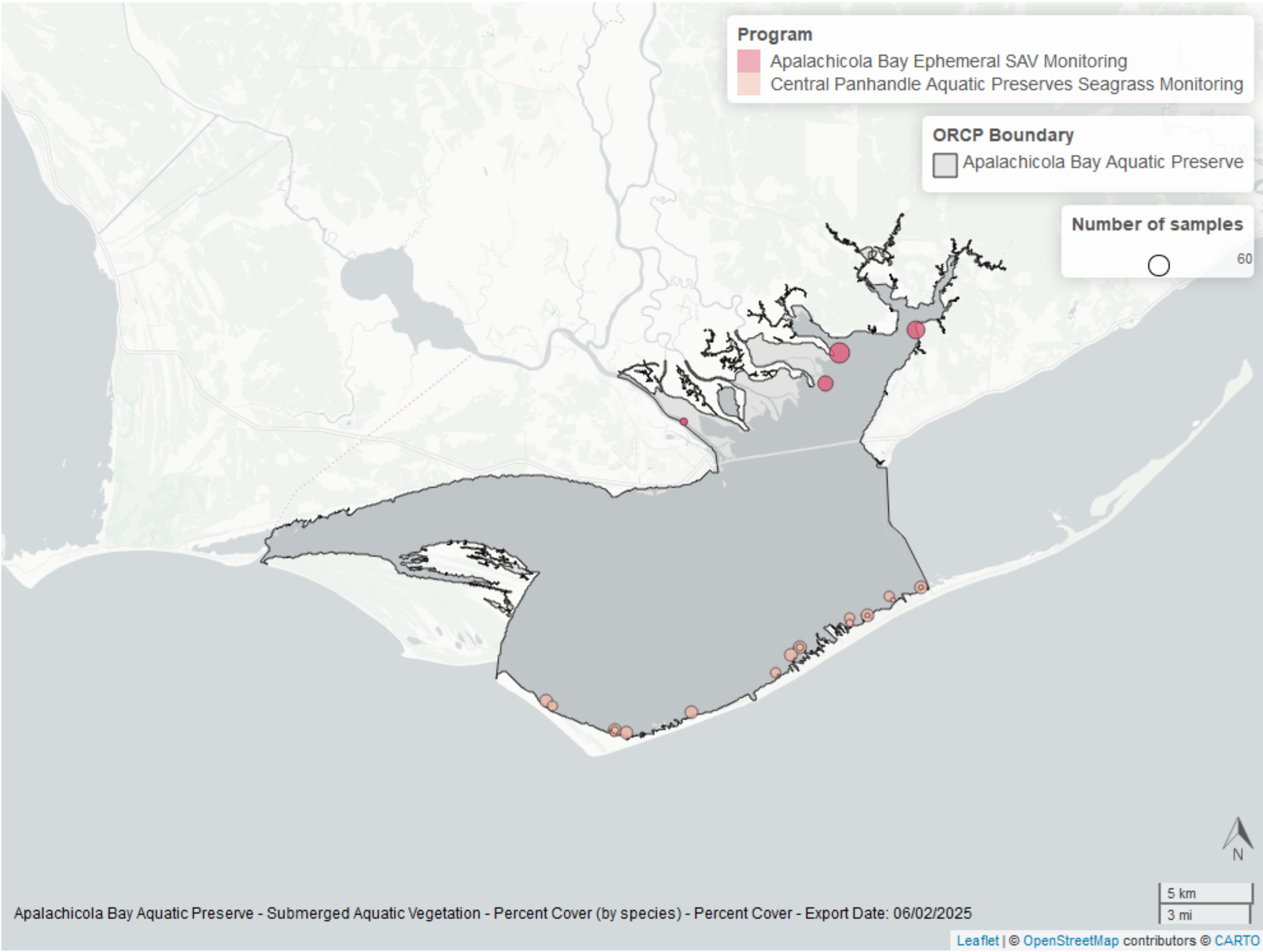

Figure 39: Map showing SAV sampling sites within the boundaries of *Apalachicola Bay Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 37: Program Information for Submerged Aquatic Vegetation

ProgramID	*N-Data*	*YearMin*	*YearMax*	*method*	*Sample Locations*
557	308	2008	2023	Braun Blanquet	21
997	79	2003	2003	Braun Blanquet	4
997	81	2003	2003	Percent Cover	4

Program names:

557 - Central Panhandle Aquatic Preserves Seagrass Monitoring[11]
997 - Apalachicola Bay Ephemeral SAV Monitoring[15]
997 - Apalachicola Bay Ephemeral SAV Monitoring[15]

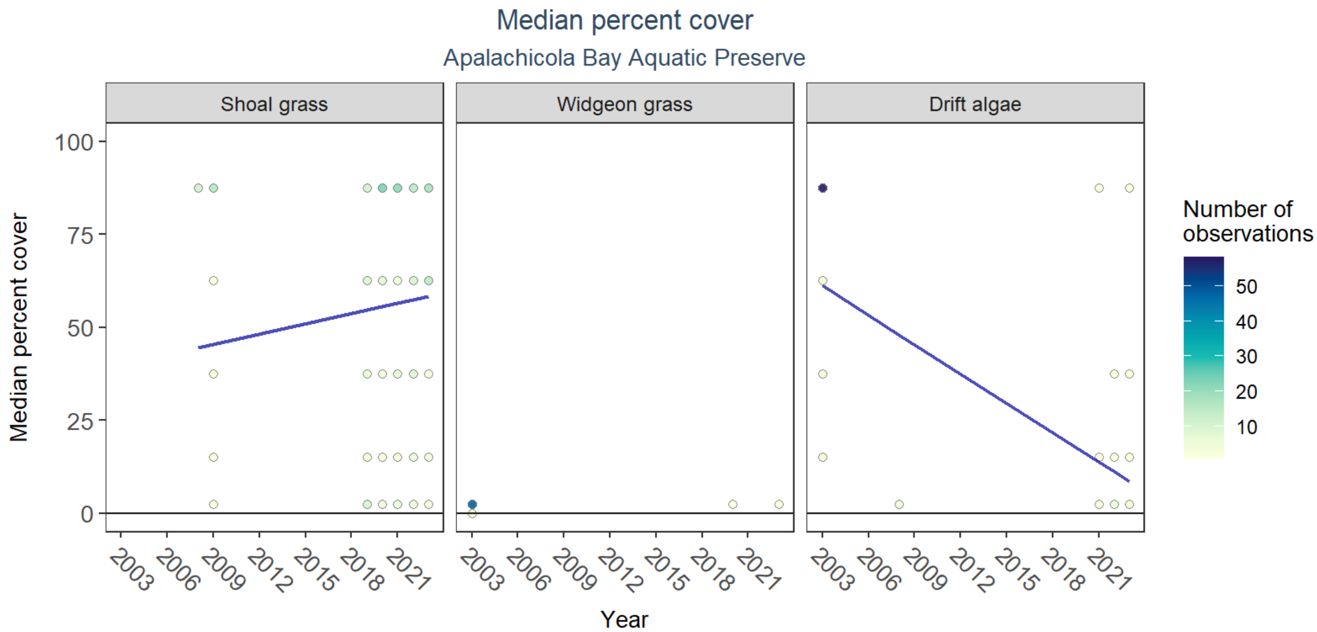

Figure 40: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

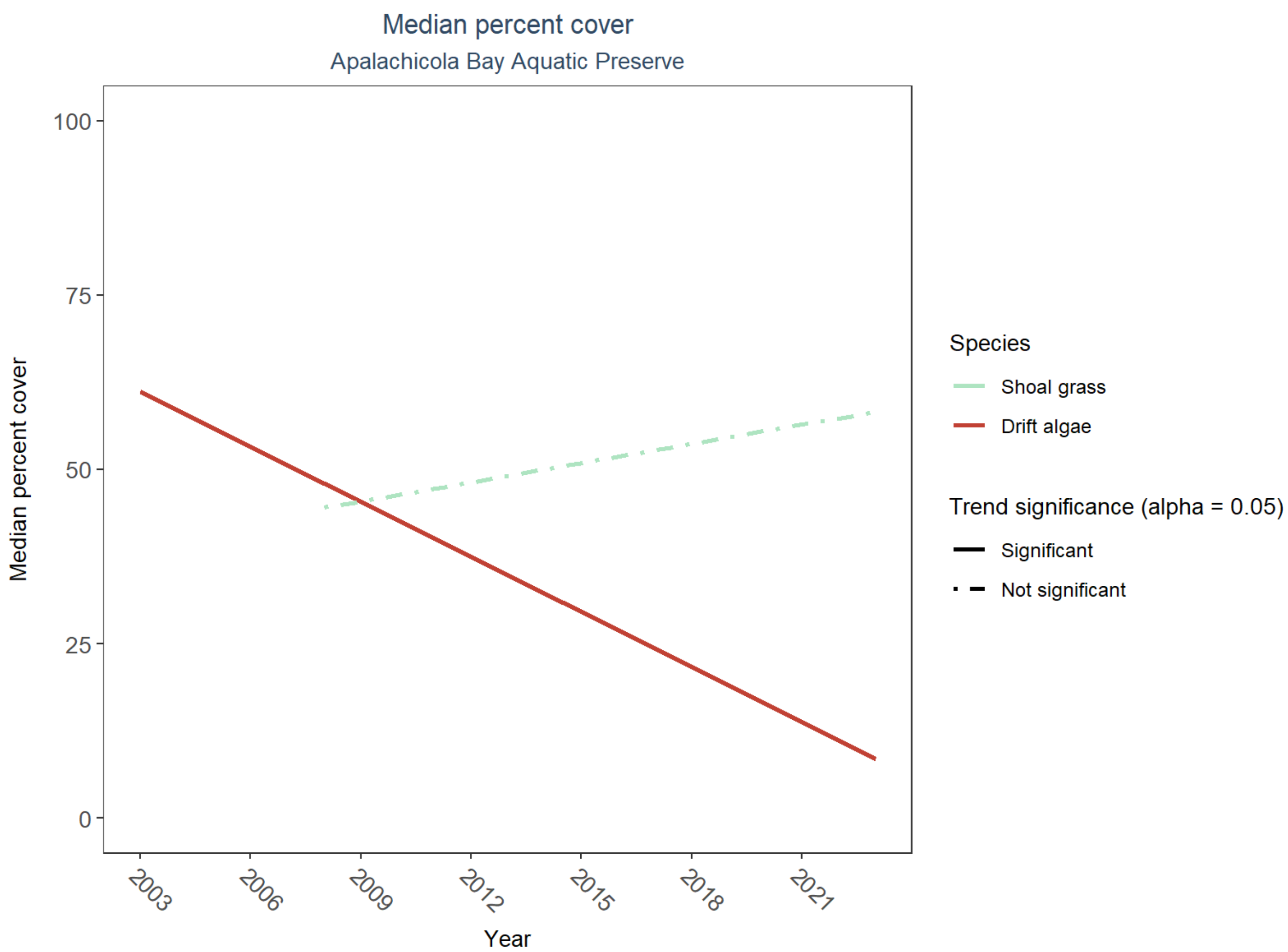

Figure 41: Trends in median percent cover for various seagrass species in Apalachicola Bay Aquatic Preserve - simplified

Table 38: Percent Cover Trend Analysis for Apalachicola Bay Aquatic Preserve

CommonName	*Trend Significance (0.05)*	*Period of Record*	*LME-Intercept*	*LME-Slope*	*p*
Drift algae	Significantly decreasing trend	2003 - 2023	84.82197	-2.6309601	0.0014345
Shoal grass	No significant trend	2008 - 2023	31.68993	0.9163933	0.4876112
No grass in quadrat	Model did not fit the available data	2003 - 2023	-	-	-
Widgeon grass	Insufficient data to calculate trend	-	-	-	-

An annual decrease in percent cover was observed for drift algae (-2.6%). No detectable change in percent cover was observed for shoal grass. Trends in percent cover could not be evaluated for widgeon grass due to insufficient data.

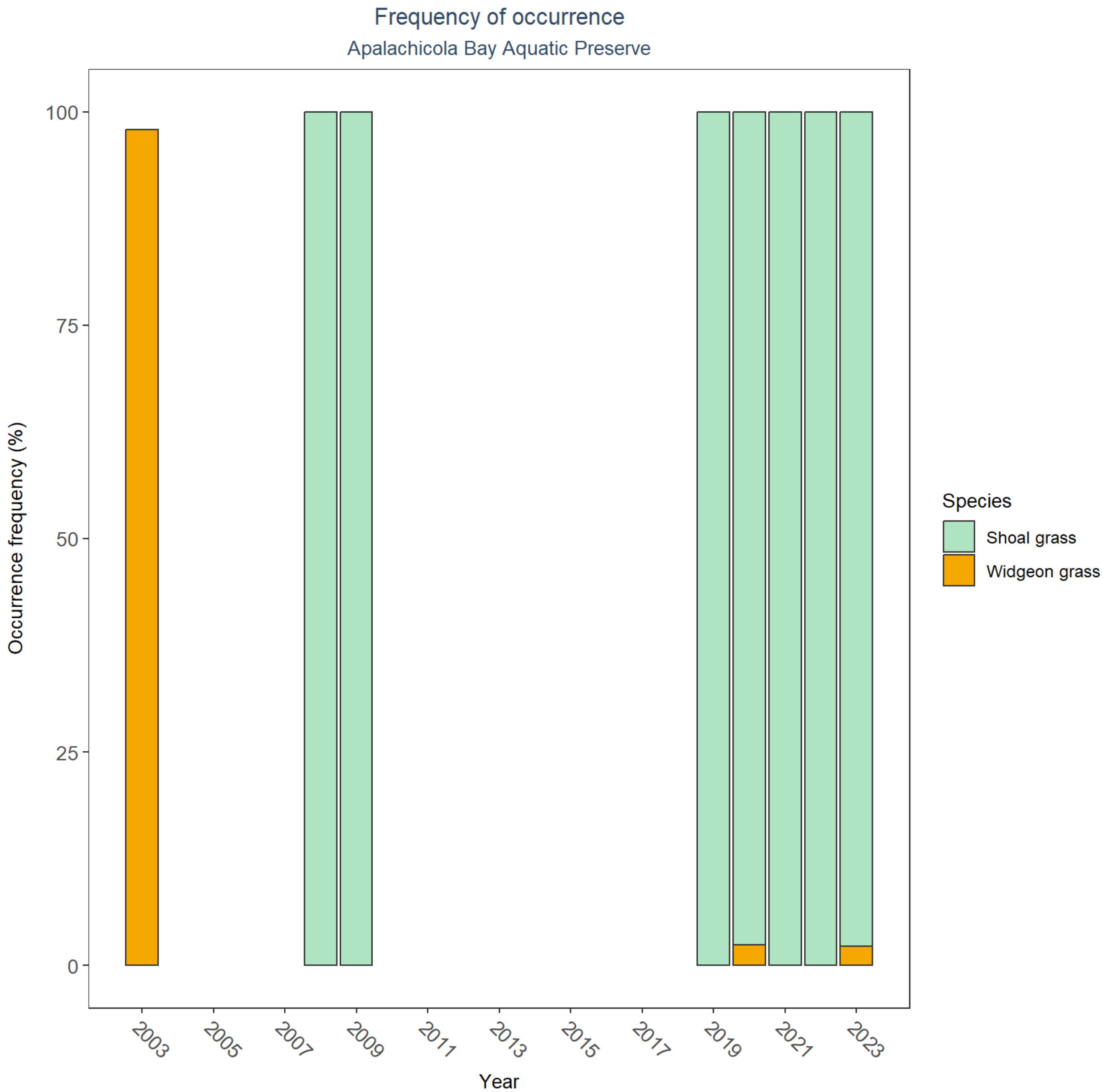

Figure 42: Frequency of occurrence for various seagrass species in Apalachicola Bay Aquatic Preserve

SAV Water Column Analysis

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

- 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**

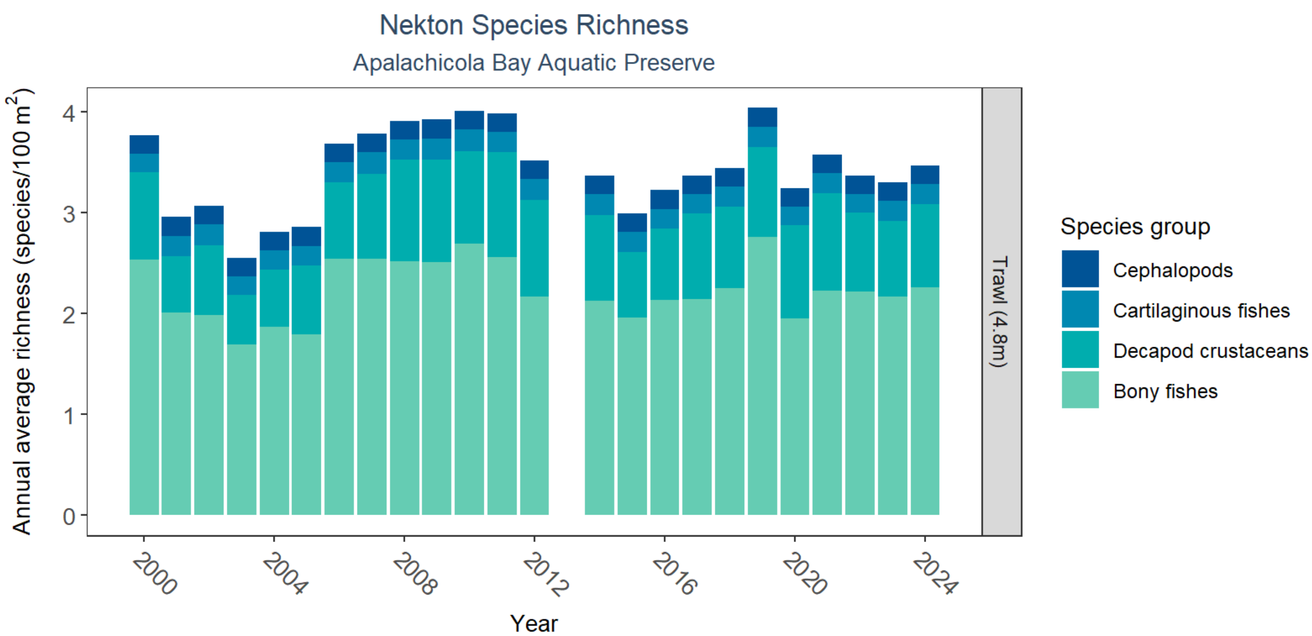

Figure 43: Bar graph(s) of annual average nekton richness over time for species groups occurring in at least 1% of samples. The bar colors represent species groups including bony fishes, cartilaginous fishes, decapod crustaceans (e.g., shrimps, crabs, and lobsters), and cephalopods (e.g., squid). Gear types and sizes are indicated in the panel label.

Table 39: Nekton Species Richness

Gear Type	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Trawl (4.8)	4967	24	2000 - 2024	0.74	1.13

The median annual number of taxa was 0.74 based on 4,967 observations collected by 4.8-meter trawl between 2000 and 2024.

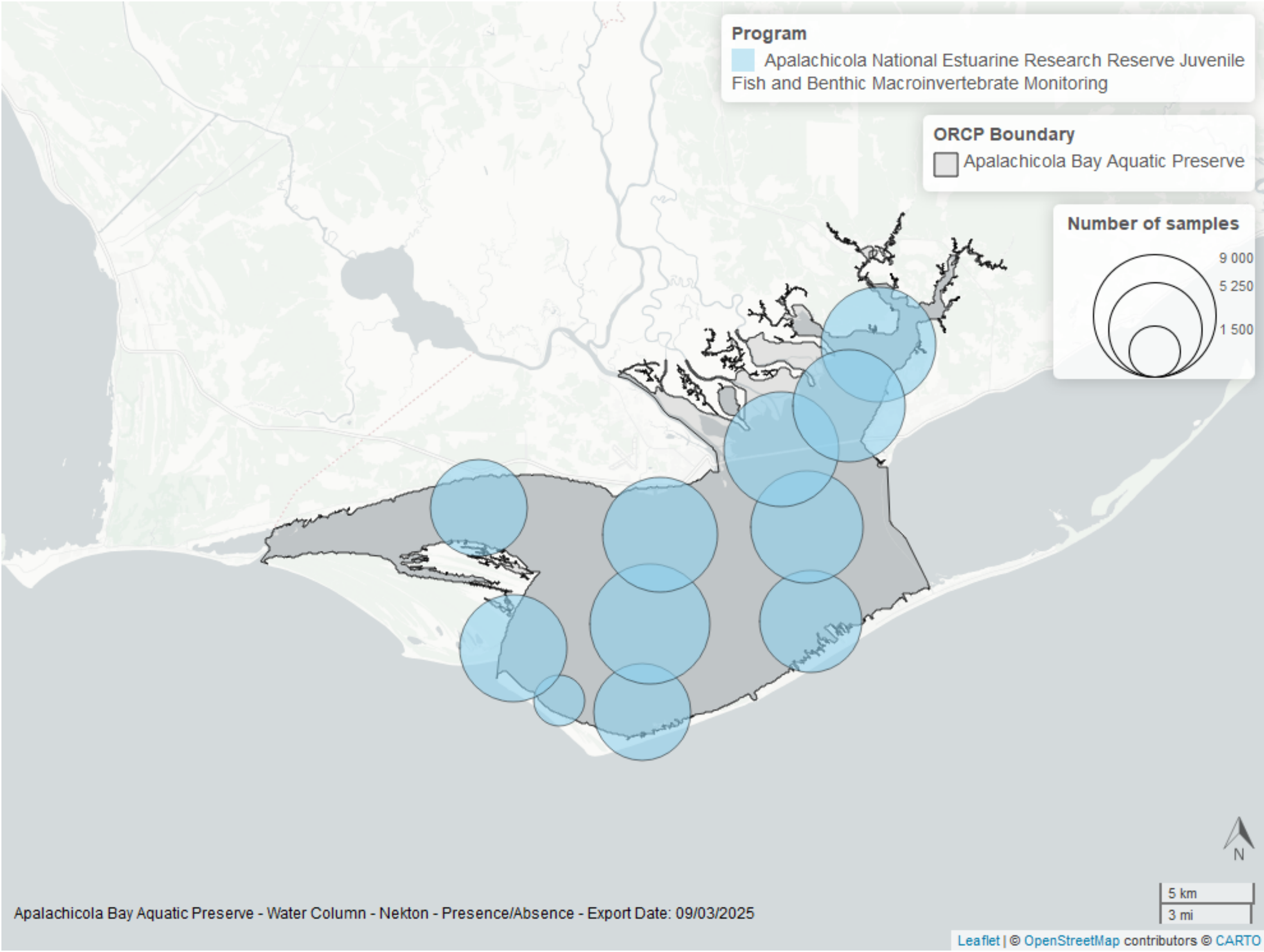

Figure 44: Map showing location of nekton sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Coastal Wetlands

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

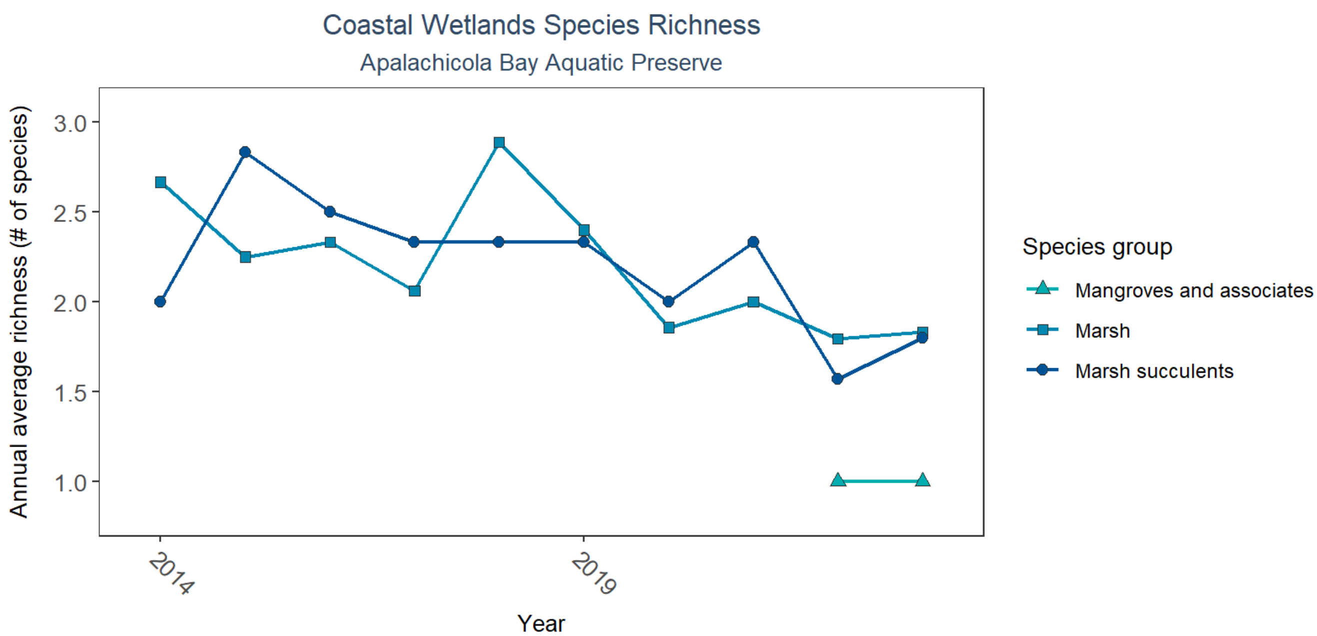

Figure 45: Line graph of annual average coastal wetlands species richness over time for mangroves and associates (triangles), marsh (squares), and marsh succulents (circles). If the time series by species group included more than one year of observations, a line connects data points for visualization.

Table 40: Coastal Wetlands Species Richness

Species Group	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Mangroves and associates	4	2	2022 - 2023	1.0	1.00
Marsh	144	10	2014 - 2023	1.5	2.08
Marsh succulents	56	10	2014 - 2023	3.0	2.20

Between 2022 and 2023, the median annual number of species for *mangroves and associates* was 1 based on 4 observations. Between 2014 and 2023, the median annual number of species for *marsh* was 1.5 based on 144 observations. Between 2014 and 2023, the median annual number of species for *marsh succulents* was 3 based on 56 observations.

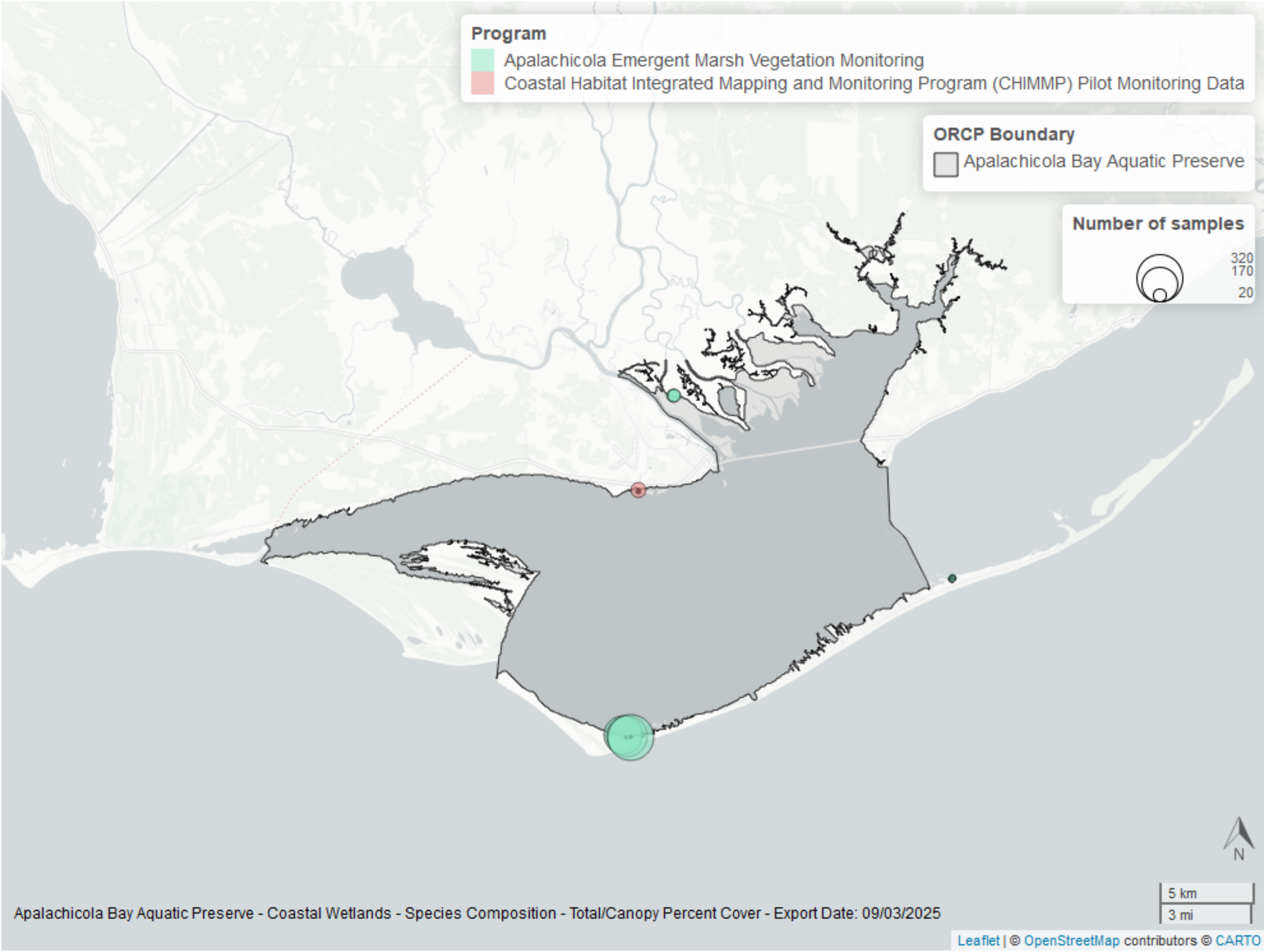

Figure 46: Map showing location of coastal wetlands sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Oyster

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

Density

Natural

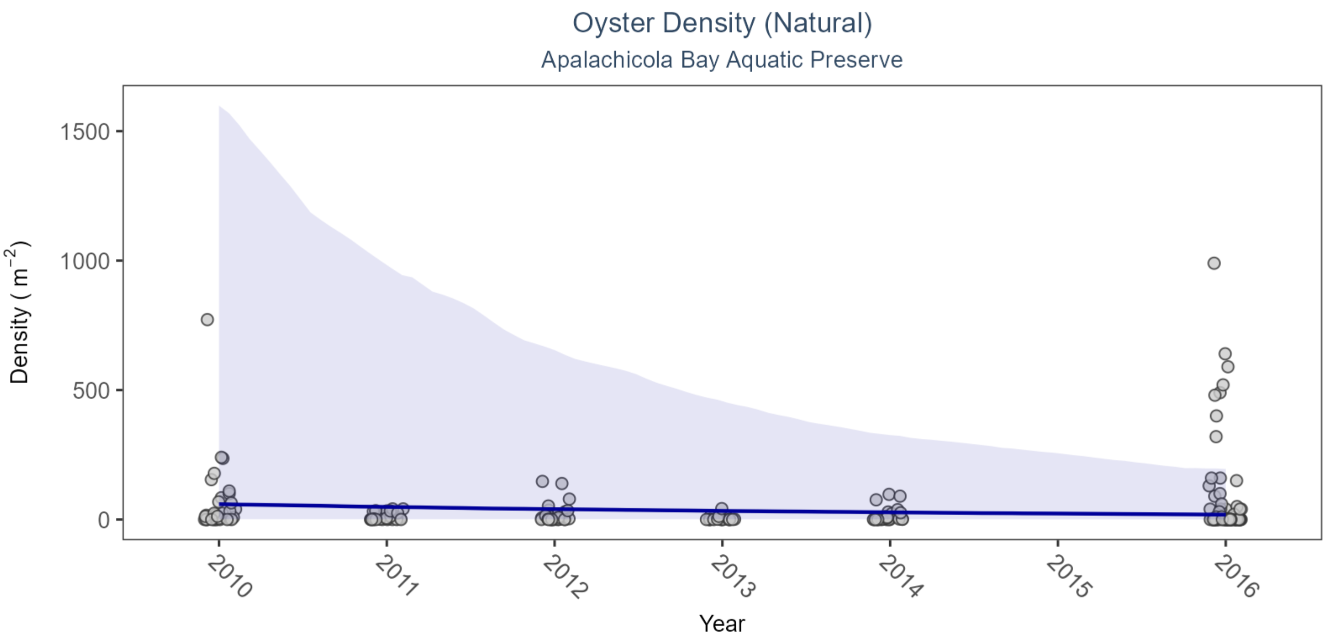

Figure 47: Scatter plot of oyster density over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 41: Model results for Oyster Density - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Natural	Significantly decreasing trend	-6.43	40.37	-0.08 to -225.39

For natural reefs, density decreased by an average of 6.61 oysters per square meter per year. For restored reefs, density decreased by an average of 5.53 oysters per square meter per year.

Restored

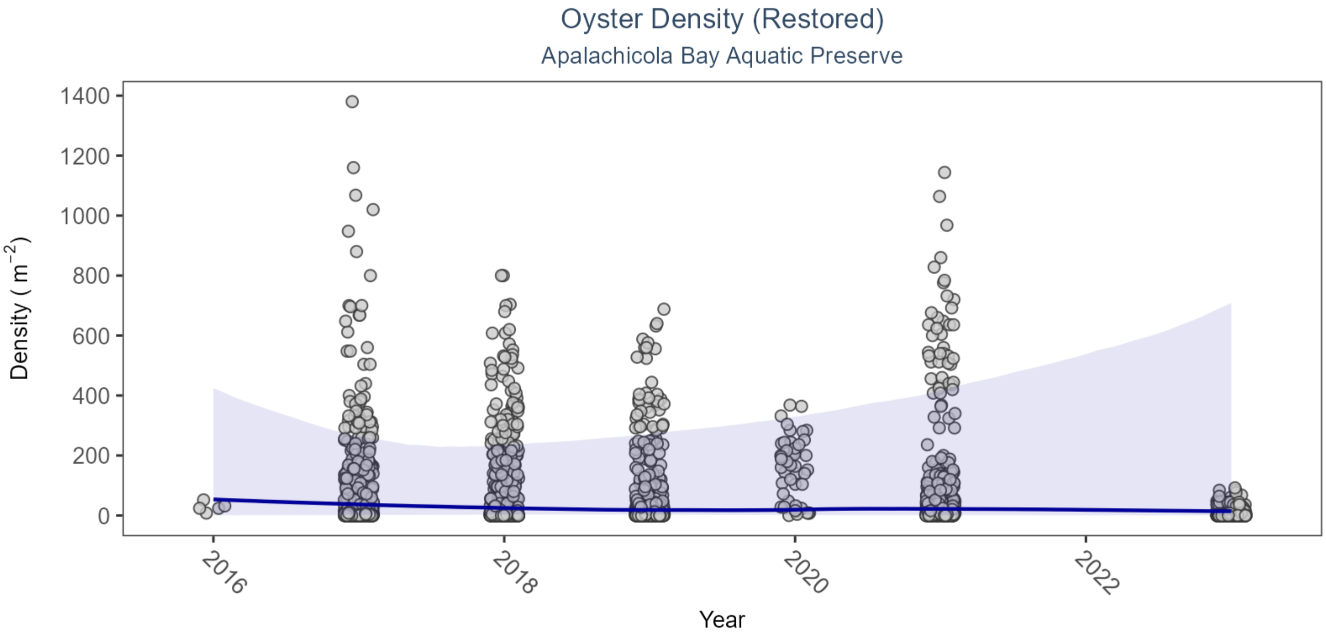

Figure 48: Scatter plot of oyster density over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 42: Model results for Oyster Density - Restored

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Restored	No significant change	-5.99	28.88	-0.05 to 32.28

For natural reefs, density decreased by an average of 6.61 oysters per square meter per year. For restored reefs, density decreased by an average of 5.53 oysters per square meter per year.

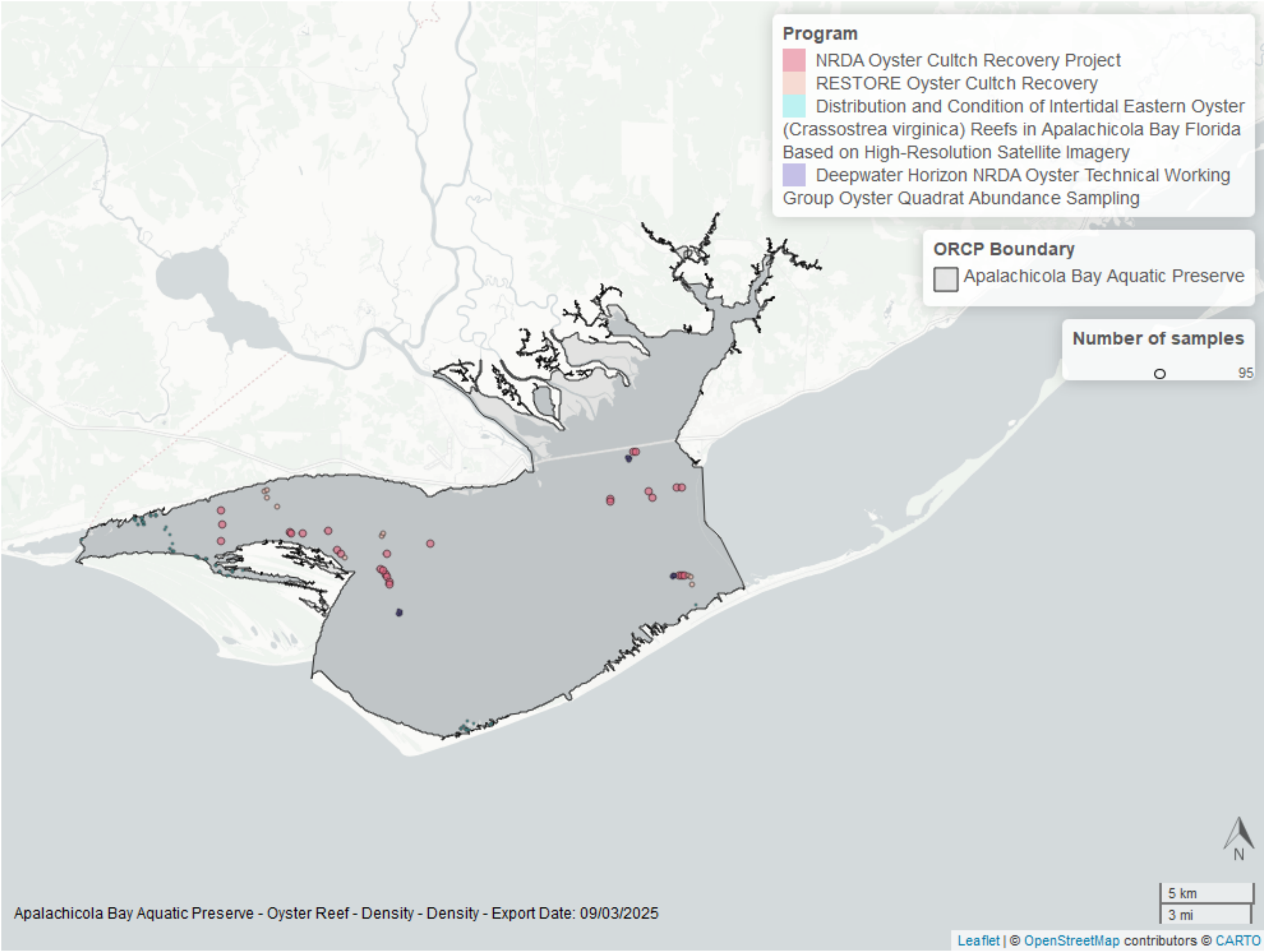

Figure 49: Map showing location of oyster density sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Percent Live

Natural

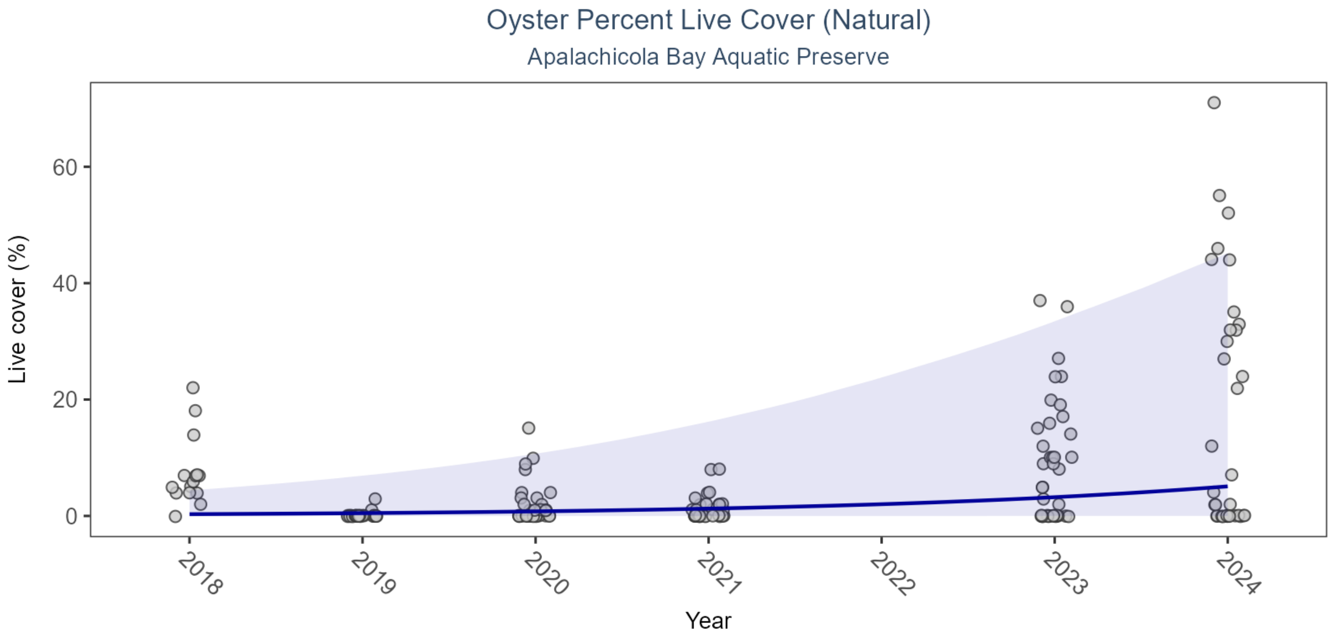

Figure 50: Scatter plot of percent live oysters over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 43: Model results for Oyster Percent Live - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Natural	Significantly increasing trend	0.87	2.72	0 to 6.81

For natural reefs, percent live cover increased by an average of 0.78% per year. For restored reefs, percent live cover decreased by an average of 2.14% per year.

Restored

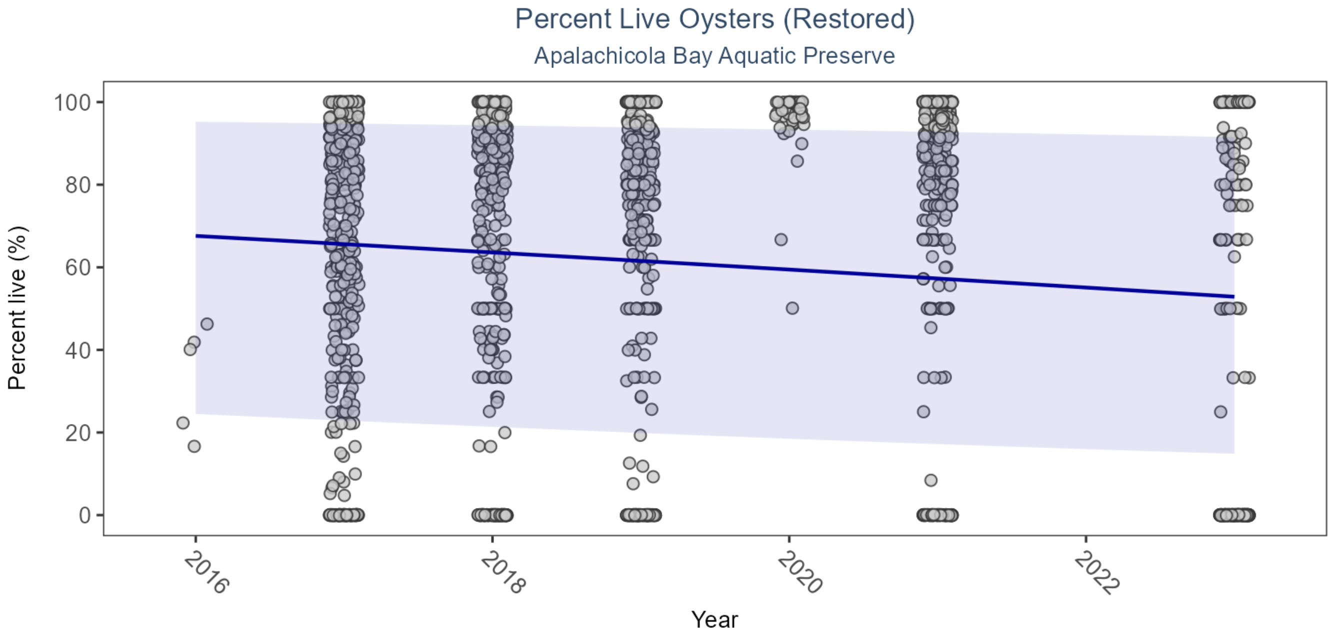

Figure 51: Scatter plot of percent live oysters over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 44: Model results for Oyster Percent Live - Restored

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oysters	Restored	Significantly decreasing trend	-2.15	36.27	-1.35 to -0.51

For natural reefs, percent live cover increased by an average of 0.78% per year. For restored reefs, percent live cover decreased by an average of 2.14% per year.

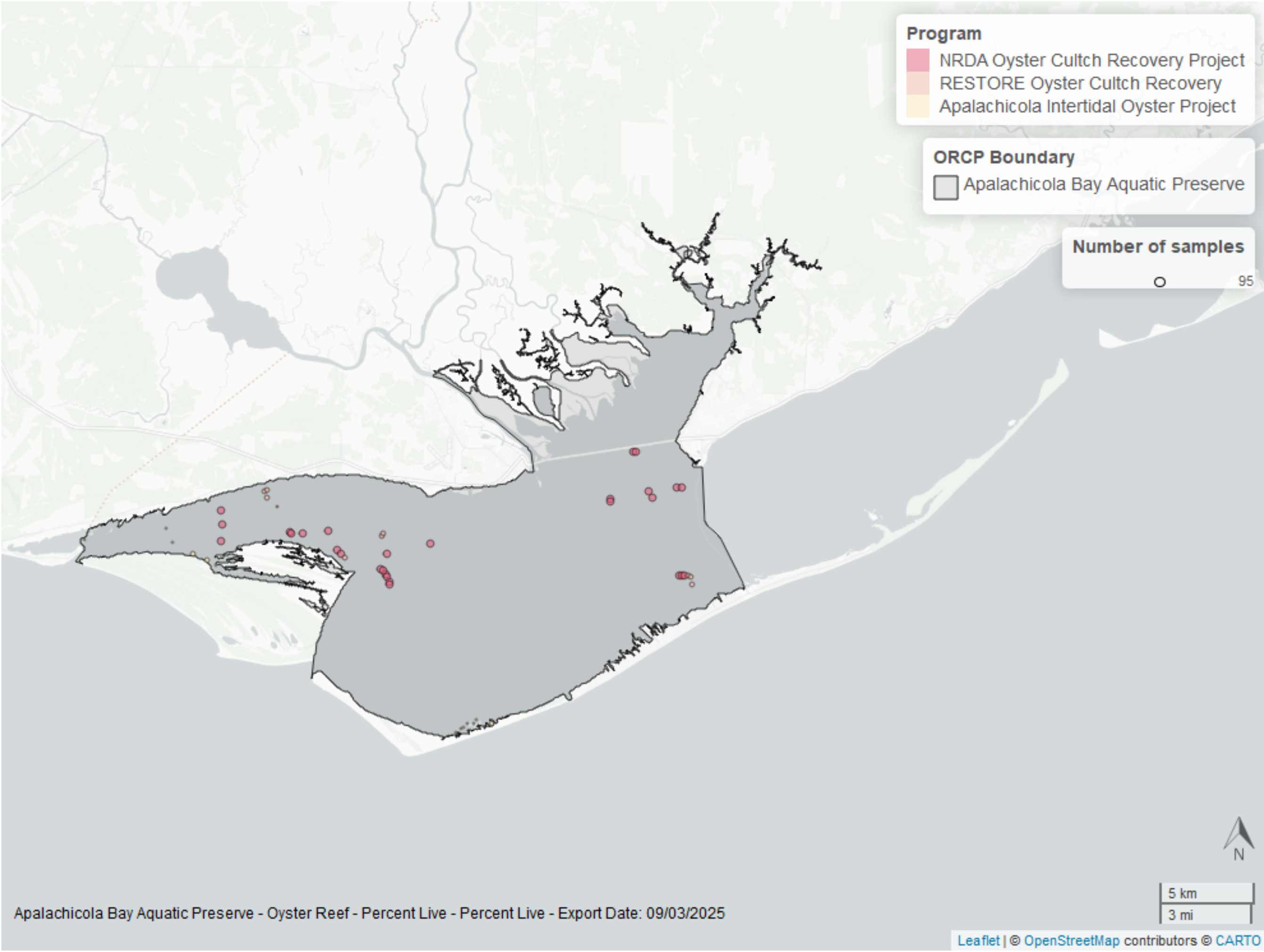

Figure 52: Map showing location of oyster percent live sampling locations within the boundaries of *Apalachicola Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

Acanthostracion lactrophyrs[3]
Acanthostracion quadricornis[3]
Acer rubrum
Acetabularia crenulata[1]
Acetes americanus[3]
Achelous gibbesii[3]
Achelous spinimanus[3]
Achirus lineatus[3]
Acipenser oxyrinchus[3]
Agalinis maritima
Albula vulpes[3]
Alosa alabamae[3]
Alosa chrysochloris[3]
Alosa spp.[3]
Alpheus armillatus[3]
Alpheus estuariensis[3]
Alpheus heterochaelis[3]
Alpheus normanni[3]
Alternanthera philoxeroides
Aluterus schoepfii[3]
Aluterus scriptus[3]
Aluterus spp.[3]
Amaranthus cannabinus
Ambidexter symmetricus[3]
Ameiurus catus[3]
Ameiurus natalis[3]
Ameiurus nebulosus[3]
Ameiurus spp.[3]
Amia calva[3]
Ampelaster carolinianus
Anarchopterus criniger[3]
Anchoa cubana[3]
Anchoa hepsetus[3]
Anchoa lyolepis[3]
Anchoa mitchilli[3]
Anchoa sp.[3]
Anchoa spp.[3]
Ancylopsetta quadrocellata[3]
Anguilla rostrata[3]
Aphredoderus sayanus[3]
Archosargus probatocephalus[3]
Ariopsis felis[3]
Aristida sp.
Astroscopus ygraecum[3]
Baccharis halimifolia
Bagre marinus[3]
Bairdiella chrysoura[3]
Bare substrate
Bathygobius soporator[3]
Batis maritima[2]
Belzebub faxoni[3]
Bidens mitis
Blutaparon vermiculare[2]
Bolboschoenus robustus
Galium tinctorium
Gambusia holbrooki[3]
Gerres cinereus[3]
Gobiesox strumosus[3]
Gobiidae spp.[3]
Gobioides broussonnetii[3]
Gobionellus oceanicus[3]
Gobionellus spp.[3]
Gobiosoma bosc[3]
Gobiosoma longipala[3]
Gobiosoma robustum[3]
Gobiosoma spp.[3]
Gracilaria sp.[1]
Gymnura micrura[3]
Haemulon aurolineatum[3]
Haemulon plumierii[3]
Halichoeres bivittatus[3]
Halodule wrightii[1]
Harengula jaguana[3]
Hemicaranx amblyrhynchus[3]
Hemipholis elongata
Hepatus epheliticus[3]
Heterandria formosa[3]
Hexapanopeus angustifrons[3]
Hippocampus erectus[3]
Hippocampus zosterae[3]
Hippolyte zostericola[3]
Hydrilla verticillata
Hydrocotyle umbellata
Hypanus americanus[3]
Hypanus sabinus[3]
Hypanus say[3]
Hypleurochilus geminatus[3]
Hypleurochilus spp.[3]
Hyporhamphus meeki[3]
Hyporhamphus spp.[3]
Hypsoblennius hentz[3]
Hypsoblennius ionthas[3]
Ictaluridae spp.[3]
Ictalurus furcatus[3]
Ictalurus punctatus[3]
Ictalurus spp.[3]
Ilex vomitoria
Ipomoea sagittata
Iris virginica
Iva frutescens
Juncus acuminatus[2]
Juncus roemerianus[2]
Juncus scirpoides[2]
Juncus spp.[2]
Juncus validus[2]
Kosteletzkya pentacarpos
Kyphosus sectatrix[3]
Lactophrys trigonus[3]
Pagurus pollicaris[3]
Pagurus spp.[3]
Palaemon floridanus[3]
Palaemon mundusnovus[3]
Palaemon pugio[3]
Palaemon spp.[3]
Palaemon vulgaris[3]
Panicum repens
Panicum virgatum
Panopeus herbstii[3]
Parablennius marmoreus[3]
Paralichthyidae spp.[3]
Paralichthys albigutta[3]
Paralichthys lethostigma[3]
Paralichthys spp.[3]
Paralichthys squamilentus[3]
Parapenaeus politus[3]
Paspalum vaginatum[2]
Pattalias palustre
Penaeidae[3]
Penaeus aztecus[3]
Penaeus duorarum[3]
Penaeus setiferus[3]
Penaeus sp.[3]
Penaeus spp.[3]
Peprilus burti[3]
Peprilus paru[3]
Peprilus spp.[3]
Percidae spp.[3]
Persea palustris
Persephona mediterranea[3]
Persicaria hydropiperoides
Petrolisthes armatus[3]
Phragmites berlandieri
Physalis angustifolia
Physostegia leptophylla
Pilumnus sayi[3]
Pinnixa spp.[3]
Poaceae sp.
Pogonias cromis[3]
Polygonum hydropiperoides
Polypremum procumbens
Pomatomus saltatrix[3]
Pomoxis nigromaculatus[3]
Pontederia cordata
Porichthys plectrodon[3]
Portunidae spp.[3]
Portunus sayi[3]
Potamogeton pusillus
Prionotus alatus[3]
Prionotus longispinosus[3]
Prionotus rubio[3]
Prionotus scitulus[3]
Prionotus spp.[3]

Borrichia frutescens
Bothidae spp.[3]
Brachyura[3]
Brevoortia spp.[3]
Brotula barbata[3]
Brown algae[1]
Calamus arctifrons[3]
Calappa ocellata[3]
Callinectes sapidus[3]
Callinectes similis[3]
Callinectes spp.[3]
Campsis radicans
Carangidae spp.[3]
Caranx crysos[3]
Caranx hippos[3]
Caranx latus[3]
Caranx ruber[3]
Caranx spp.[3]
Carcharhinus limbatus[3]
Carex hyalinolepis
Carex joorii
Carex sp.
Carpiodes carpio[3]
Centella asiatica
Centrarchidae spp.[3]
Centrarchus macropterus[3]
Centropristis ocyurus[3]
Centropristis philadelphica[3]
Centropristis striata[3]
Cephalanthus occidentalis
Ceratophyllum demersum
Chaetodipterus faber[3]
Chara spp.[1]
Chasmodes saburrae[3]
Chilomycterus schoepfii[3]
Chloroscombrus chrysurus[3]
Cicuta maculata
Citharichthys macrops[3]
Citharichthys sp.[3]
Citharichthys spilopterus[3]
Citharichthys spp.[3]
Cladium mariscus
Clibanarius vittatus[3]
Crinum americanum
Ctenogobius boleosoma[3]
Ctenogobius shufeldti[3]
Ctenogobius spp.[3]
Ctenogobius stigmaticus[3]
Ctenopharyngodon idella[3]
Cuapetes americanus[3]
Cynoscion arenarius[3]
Cynoscion nebulosus[3]
Cynoscion nothus[3]
Cynoscion spp.[3]
Cyperaceae sp.
Cyperus haspan
Cyperus sp.
Lactophrys triqueter[3]
Lagocephalus laevigatus[3]
Lagodon rhomboides[3]
Larimus fasciatus[3]
Latreutes parvulus[3]
Leander tenuicornis[3]
Legume sp.
Leiostomus xanthurus[3]
Lepisosteus oculatus[3]
Lepisosteus osseus[3]
Lepomis auritus[3]
Lepomis gulosus[3]
Lepomis macrochirus[3]
Lepomis microlophus[3]
Lepomis punctatus[3]
Lepomis spp.[3]
Leptochela serratorbita[3]
Libinia dubia[3]
Limonium carolinianum[2]
Limulus polyphemus
Lithadia granulosa[3]
Lobotes surinamensis[3]
Lolliguncula brevis[3]
Lucania parva[3]
Ludwigia repens
Luidia clathrata
Lutjanus campechanus[3]
Lutjanus griseus[3]
Lutjanus sp.[3]
Lutjanus spp.[3]
Lutjanus synagris[3]
Lycopus virginicus
Lysmata wurdemanni[3]
Lythrum lineare
Macrobrachium ohione[3]
Megalops atlanticus[3]
Melongena corona
Membras martinica[3]
Menidia beryllina[3]
Menidia sp.[3]
Menidia spp.[3]
Menippe mercenaria[3]
Menticirrhus americanus[3]
Menticirrhus littoralis[3]
Menticirrhus saxatilis[3]
Menticirrhus spp.[3]
Metoporhaphis calcarata[3]
Microgobius gulosus[3]
Microgobius microlepis[3]
Microgobius sp.[3]
Microgobius spp.[3]
Microgobius thalassinus[3]
Microphis brachyurus[3]
Micropogonias undulatus[3]
Micropterus salmoides[3]
Mikania scandens
Minytrema melanops[3]
Prionotus tribulus[3]
Processa hemphilli[3]
Ptilimnium capillaceum
Quercus marilandica
Quercus minima
Quercus muehlenbergii
Rachycentron canadum[3]
Raja eglanteria[3]
Remora remora[3]
Rhinoptera bonasus[3]
Rhithropanopeus harrisii[3]
Rhizophora mangle[2]
Rhizoprionodon terraenovae[3]
Rimapenaeus constrictus[3]
Rimapenaeus similis[3]
Rimapenaeus spp.[3]
Rumex verticillatus
Ruppia maritima[1]
Sabal palmetto
Sagittaria graminea
Salicornia ambigua[2]
Salvinia spp.
Sardinella aurita[3]
Saururus cernuus
Schoenoplectus americanus
Schoenoplectus californicus
Sciaenidae spp.[3]
Sciaenops ocellatus[3]
Scomberomorus maculatus[3]
Scorpaena brasiliensis[3]
Selene setapinnis[3]
Selene vomer[3]
Serraniculus pumilio[3]
Serranus subligarius[3]
Sesbania punicea
Sesbania vesicaria
Sesuvium portulacastrum[2]
Setaria parviflora
Sicyonia brevirostris[3]
Sicyonia dorsalis[3]
Sicyonia laevigata[3]
Smilax auriculata
Smilax bona-nox
Smilax walteri
Solidago sempervirens
Sparidae spp.[3]
Spartina alterniflora[2]
Spartina cynosuroides[2]
Spartina patens[2]
Sphoeroides nephelus[3]
Sphoeroides parvus[3]
Sphoeroides spengleri[3]
Sphoeroides spp.[3]
Sphyraena barracuda[3]
Sphyraena borealis[3]
Sphyraena guachancho[3]
Sphyraena spp.[3]

Cyprinidae spp.[3]	Monacanthus ciliatus[3]	Sphyrna tiburo[3]
Cyprinodon variegatus[3]	Morone chrysops x saxatilis[3]	Sporobolus virginicus[2]
Cyprinus carpio[3]	Morone hybrid[3]	Squilla empusa
Dasyatis sp.[3]	Morone saxatilis[3]	Stellifer lanceolatus[3]
Diapterus auratus[3]	Morone spp.[3]	Stenotomus caprinus[3]
Dichanthelium sp.	Moxostoma spp.[3]	Stephanolepis hispida[3]
Diplectrum bivittatum[3]	Mugil cephalus[3]	Strongylura marina[3]
Diplectrum formosum[3]	Mugil curema[3]	Strongylura notata[3]
Diplectrum spp.[3]	Mugil spp.[3]	Strongylura spp.[3]
Diplodus holbrookii[3]	Muhlenbergia capillaris	Strongylura timucu[3]
Distichlis spicata[2]	Mycteroperca microlepis[3]	Suaeda linearis[2]
Dormitator maculatus[3]	Mycteroperca phenax[3]	Syacium papillosum[3]
Dorosoma cepedianum[3]	Mycteroperca spp.[3]	Symphurus parvus[3]
Dorosoma petenense[3]	Myrica cerifera	Symphurus plagiusa[3]
Dorosoma spp.[3]	Myrophis punctatus[3]	Symphyotrichum tenuifolium
Drift algae[1]	Najas guadalupensis	Syngnathus floridae[3]
Dyspanopeus texanus[3]	Neopanope packardii[3]	Syngnathus louisianae[3]
Echeneis naucrates[3]	Neverita duplicata	Syngnathus scovelli[3]
Echeneis neucratoides[3]	Nicholsina usta[3]	Syngnathus spp.[3]
Echeneis spp.[3]	No fish	Synodus foetens[3]
Echiophis punctifer[3]	No grass in quadrat[1]	Synodus spp.[3]
Edrastima uniflora	Notemigonus crysoleucas[3]	Taxodium distichum
Eleocharis fallax	Notropis maculatus[3]	Toxicodendron radicans
Eleotris amblyopsis[3]	Notropis spp.[3]	Tozeuma carolinense[3]
Elopidae[3]	Oenothera simulans	Trachinotus carolinus[3]
Elops saurus[3]	Ogcocephalus corniger[3]	Trachinotus falcatus[3]
Elops smithi[3]	Ogcocephalus cubifrons[3]	Trichiurus lepturus[3]
Engraulidae spp.[3]	Ogcocephalus pantostictus[3]	Trinectes maculatus[3]
Enneacanthus gloriosus[3]	Ogcocephalus radiatus[3]	Tylosurus crocodilus[3]
Epinephelus spp.[3]	Ogyrides alphaerostris[3]	Tylosurus spp.[3]
Erotelis smaragdus[3]	Ogyrides hayi[3]	Typha latifolia
Etheostoma fusiforme[3]	Ogyrides sp.[3]	Typha sp.
Etropus crossotus[3]	Oligoplites saurus[3]	Typhaceae
Etropus cyclosquamus[3]	Ophichthidae[3]	Unidentified fish[3]
Etropus microstomus[3]	Ophichthus gomesii[3]	Unidentified shrimp[3]
Etropus spp.[3]	Ophidion holbrookii[3]	Urocaris longicaudata[3]
Eucinostomus argenteus[3]	Ophidion josephi[3]	Urophycis floridana[3]
Eucinostomus gula[3]	Ophioderma spp.	Urophycis regia[3]
Eucinostomus harengulus[3]	Ophiothrix (Ophiothrix) angulata	Vallisneria americana
Eucinostomus spp.[3]	Opisthonema oglinum[3]	Vigna luteola
Eurypanopeus depressus[3]	Opsanus beta[3]	Vitta usnea
Eustachys petraea	Opsopoeodus emiliae[3]	Woody debris
Filamentous algae[1]	Orthopristis chrysoptera[3]	Xanthidae sp.[3]
Fimbristylis spadicea	Osmundastrum cinnamomeum	Xanthidae spp.[3]
Fowlerichthys radiosus[3]	Ovalipes floridanus[3]	Xiphopenaeus kroyeri[3]
Fundulus grandis[3]	Ovalipes ocellatus[3]	Zannichellia palustris
Fundulus similis[3]	Ovalipes spp.[3]	Acanthostracion lactrophyrs[3]
Fundulus spp.[3]	Pagurus longicarpus[3]	Acanthostracion quadricornis[3]

1 - Submerged Aquatic Vegetation, 2 - Coastal Wetlands, 3 - Nekton

References

1. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Apalachicola National Estuarine Research Reserve. Apalachicola National Estuarine Research Reserve System-Wide Monitoring Program. (2024).
2. Florida Department of Environmental Protection (DEP). Florida STORET / WIN. (2024).
3. U.S. Environmental Protection Agency (EPA). EPA STOrage and RETrieval Data Warehouse (STORET)/WQX. (2023).
4. U.S. Environmental Protection Agency (EPA); Office of Research and Development. Environmental Monitoring Assessment Program. (2004).
5. U.S. Environmental Protection Agency (EPA); Office of Water; National Oceanic and Atmospheric Administration (NOAA); U.S. Geological Survey (USGS); U.S. Fish and Wildlife Service (USFWS); National Estuary Program (NEP); coastal states. National Aquatic Resource Surveys, National Coastal Condition Assessment. (2021).
6. University of Florida (UF); Institute of Food and Agricultural Sciences. Florida LAKEWATCH Program. (2024).
7. Florida Fish and Wildlife Conservation Commission (FWC). Fisheries-Independent Monitoring (FIM) Program. (2022).
8. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). Harmful Algal Bloom Marine Observation Network. (2018).
9. National Oceanic and Atmospheric Administration (NOAA); National Centers for Coastal Ocean Science's Center for Coastal Monitoring and Assessment. National Status and Trends Bioeffects program. (1994).
10. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Apalachicola National Estuarine Research Reserve. Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring. (2023).
11. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Central Panhandle Aquatic Preserves. Central Panhandle Aquatic Preserves Seagrass Monitoring. (2023).
12. Alabama Center for Ecological Resilience (ACER). Oyster shell heights and taxonomic diversity in 2015-2017 among previously documented oiled and non-oiled reefs in Louisiana, Alabama, and the Florida panhandle. (2017).
13. Oyster Sentinel. Oyster Sentinel . (2016).
14. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Central Panhandle Aquatic Preserves. NRDA Oyster Cultch Recovery Project. (2024).
15. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Apalachicola National Estuarine Research Reserve. Apalachicola Bay Ephemeral SAV Monitoring. (2004).