

Indian River-Malabar to Vero Beach Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 08 October, 2025

Contents

Funding & Acknowledgements	2
Threshold Filtering	2
Value Qualifiers	3
Water Column	5
Seasonal Kendall-Tau Analysis	5
Water Quality - Discrete	5
Chlorophyll a, Corrected for Pheophytin - Discrete	6
Chlorophyll a, Uncorrected for Pheophytin - Discrete	7
Colored Dissolved Organic Matter - Discrete	10
Dissolved Oxygen - Discrete	11
Dissolved Oxygen Saturation - Discrete	14
pH - Discrete	15
Salinity - Discrete	18
Secchi Depth - Discrete	20
Total Nitrogen - Discrete	22
Total Phosphorus - Discrete	24
Total Suspended Solids - Discrete	26
Turbidity - Discrete	28
Water Temperature - Discrete	31
Water Quality - Continuous	34
Dissolved Oxygen - Continuous	36
Dissolved Oxygen Saturation - Continuous	38
pH - Continuous	40
Salinity - Continuous	42
Turbidity - Continuous	44
Water Temperature - Continuous	46
Submerged Aquatic Vegetation	48
Parameters	48
Species	48
Notes	48
SAV Water Column Analysis	53
Oyster	55
Density	55
Natural	55
Percent Live	57
Natural	57
Shell Height	59

Natural	59
Species list	61
References	62

Funding & Acknowledgements

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

With respect to documents and information available from SEACAR DDI, neither the State of Florida nor the Florida Department of Environmental Protection makes any warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose arising out of the use or inability to use the data, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

This report was funded in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office for Coastal Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration. The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of their sub agencies.

Published: 2025-10-08



Threshold Filtering

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

Table 1: Continuous Water Quality threshold values

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

Table 2: Discrete Water Quality threshold values

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

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

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

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

Value Qualifiers

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

STORET and WIN value qualifier codes

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

Table 4: Value Qualifier codes excluded from analysis

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

Discrete Water Quality Value Qualifiers

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

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

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

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

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

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

Systemwide Monitoring Program (SWMP) value qualifier codes

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

Table 5: SWMP Value Qualifier codes

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

Water Column

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

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

Seasonal Kendall-Tau Analysis

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

Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2025-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

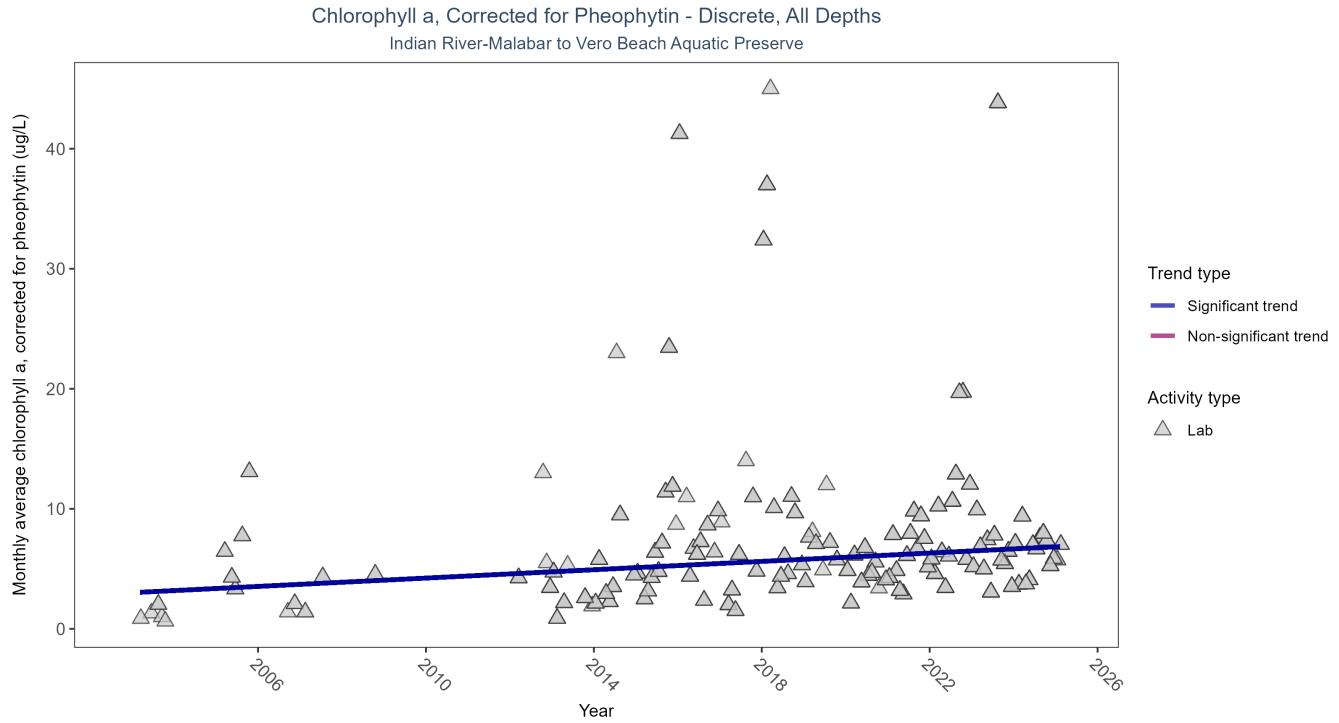


Figure 1: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	815	19	2003 - 2025	4.6458	0.2094	3.0122	0.1737	0.0015

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.17 µg/L per year, indicating a decrease in water clarity.

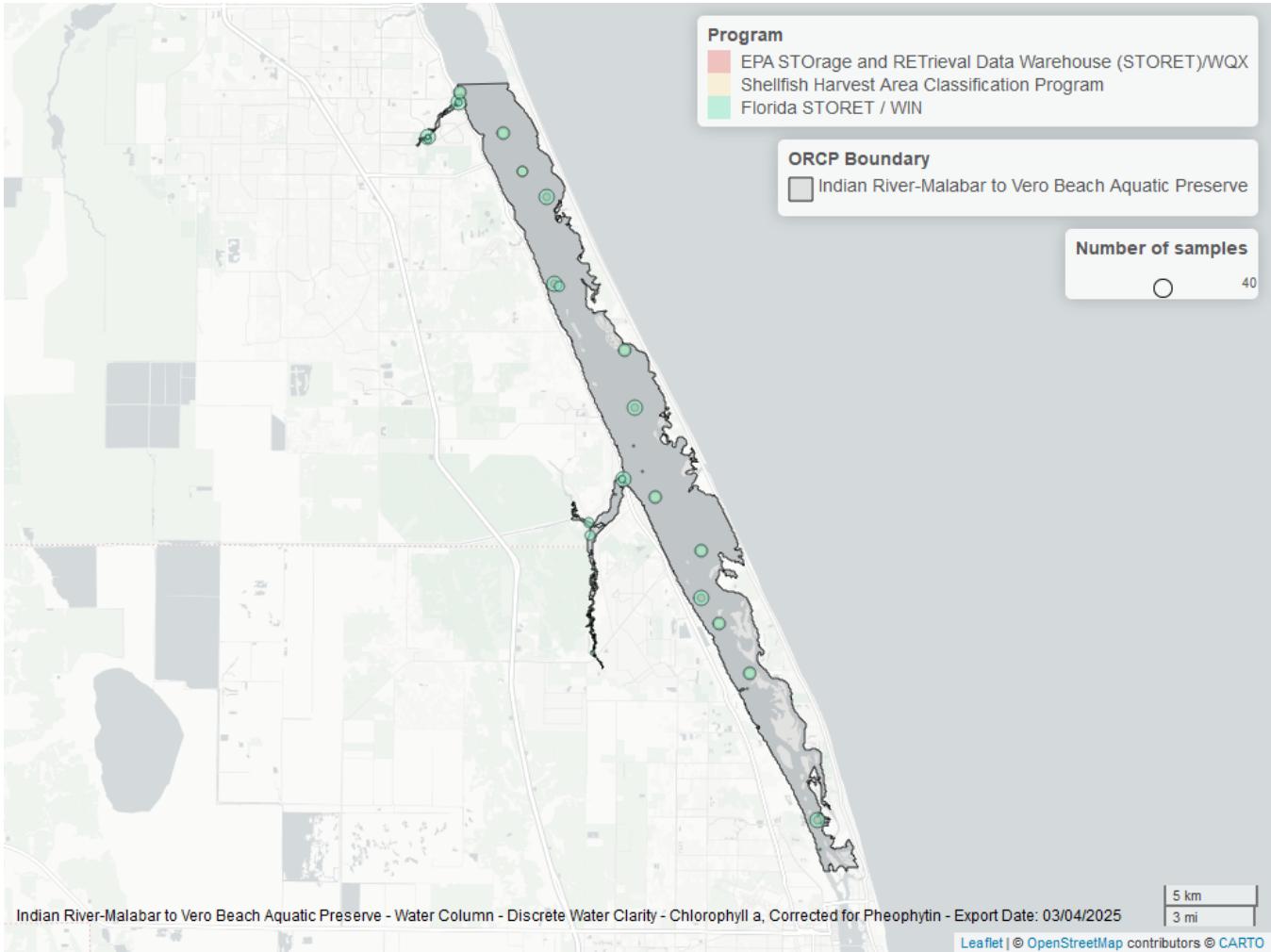


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

ProgramID	N_Data	YearMin	YearMax
5002	716	2003	2025
540	125	2016	2020

Program names:

540 - Shellfish Harvest Area Classification Program¹
 5002 - Florida STORET / WIN²

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

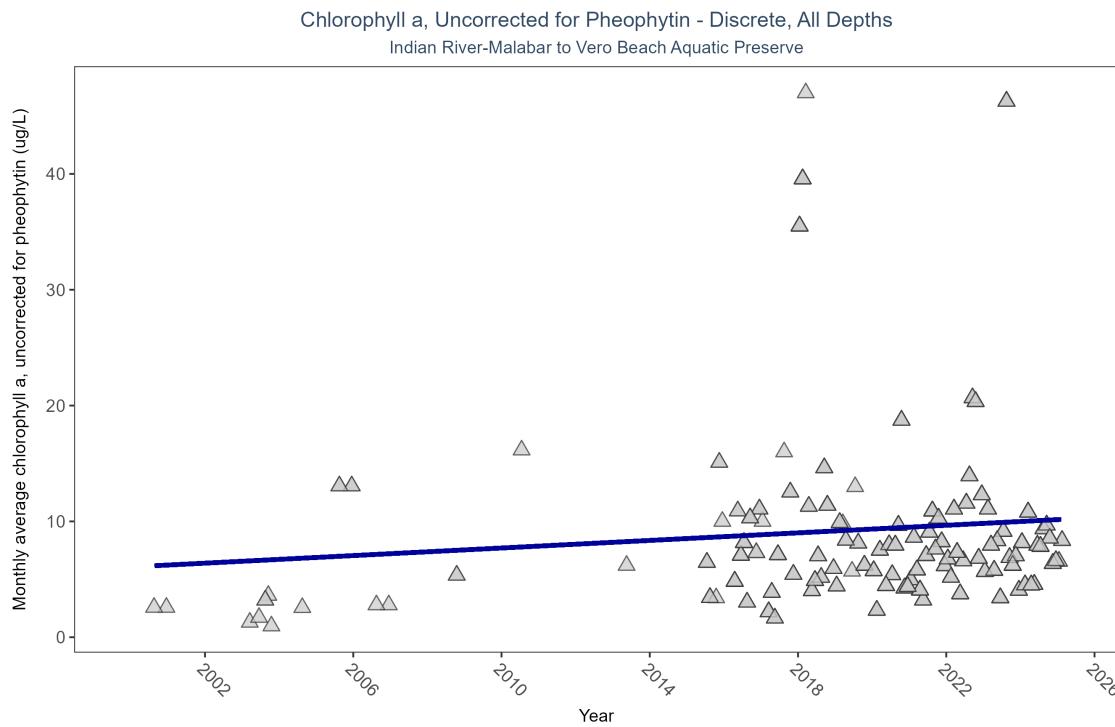


Figure 3: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	684	19	2000 - 2025	5.7019	0.1111	6.0671	0.1635	0.0315

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.16 $\mu\text{g}/\text{L}$ per year, indicating a decrease in water clarity.

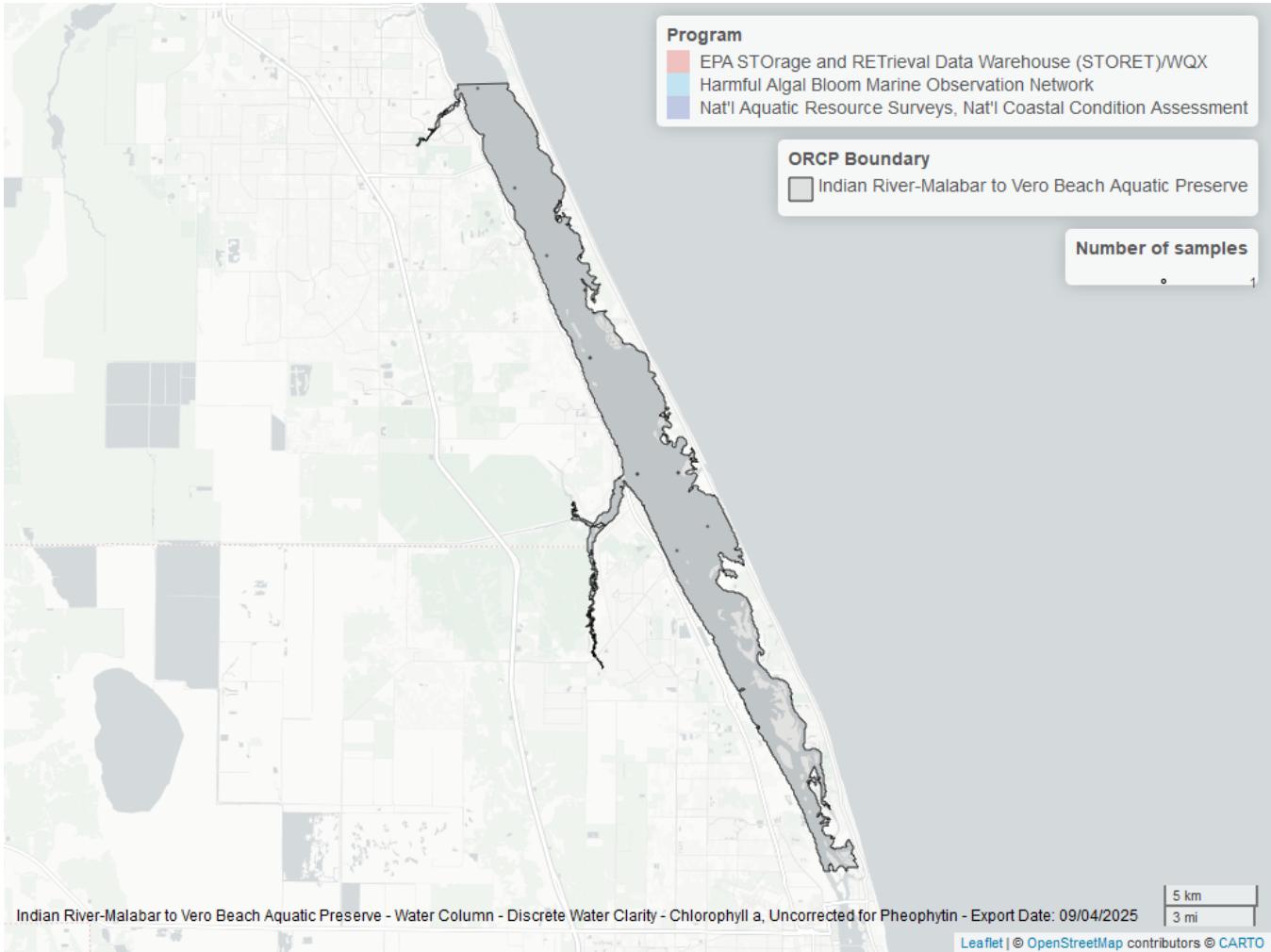


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	557	2003	2025
540	131	2016	2020
103	7	2000	2015
118	5	2000	2010
95	3	2018	2018

Program names:

95 - Harmful Algal Bloom Marine Observation Network³

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁵

540 - Shellfish Harvest Area Classification Program¹

5002 - Florida STORET / WIN²

Colored Dissolved Organic Matter - Discrete

Seasonal Kendall-Tau Trend Analysis

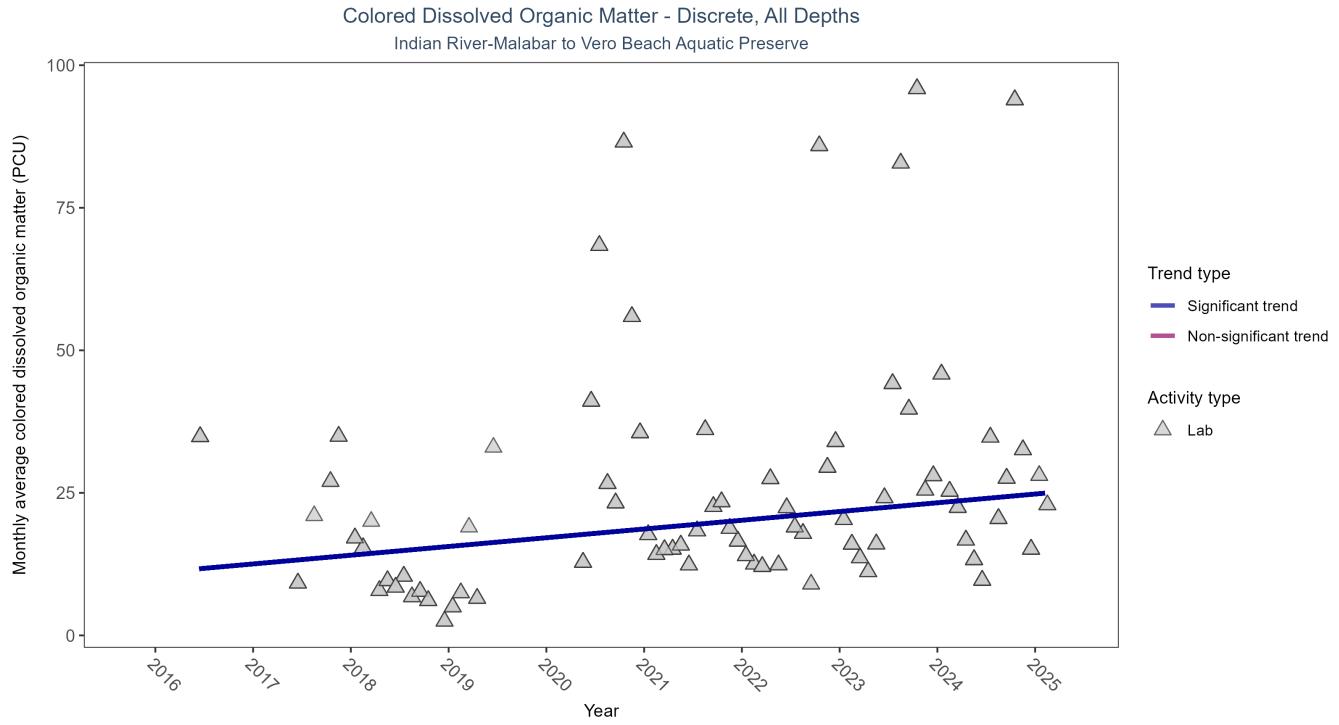


Figure 5: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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 increasing trend	550	10	2016 - 2025	14.365	0.2586	10.9993	1.5326	0.0096

Monthly average colored dissolved organic matter increased by 1.53 PCU per year, indicating a decrease in water clarity.

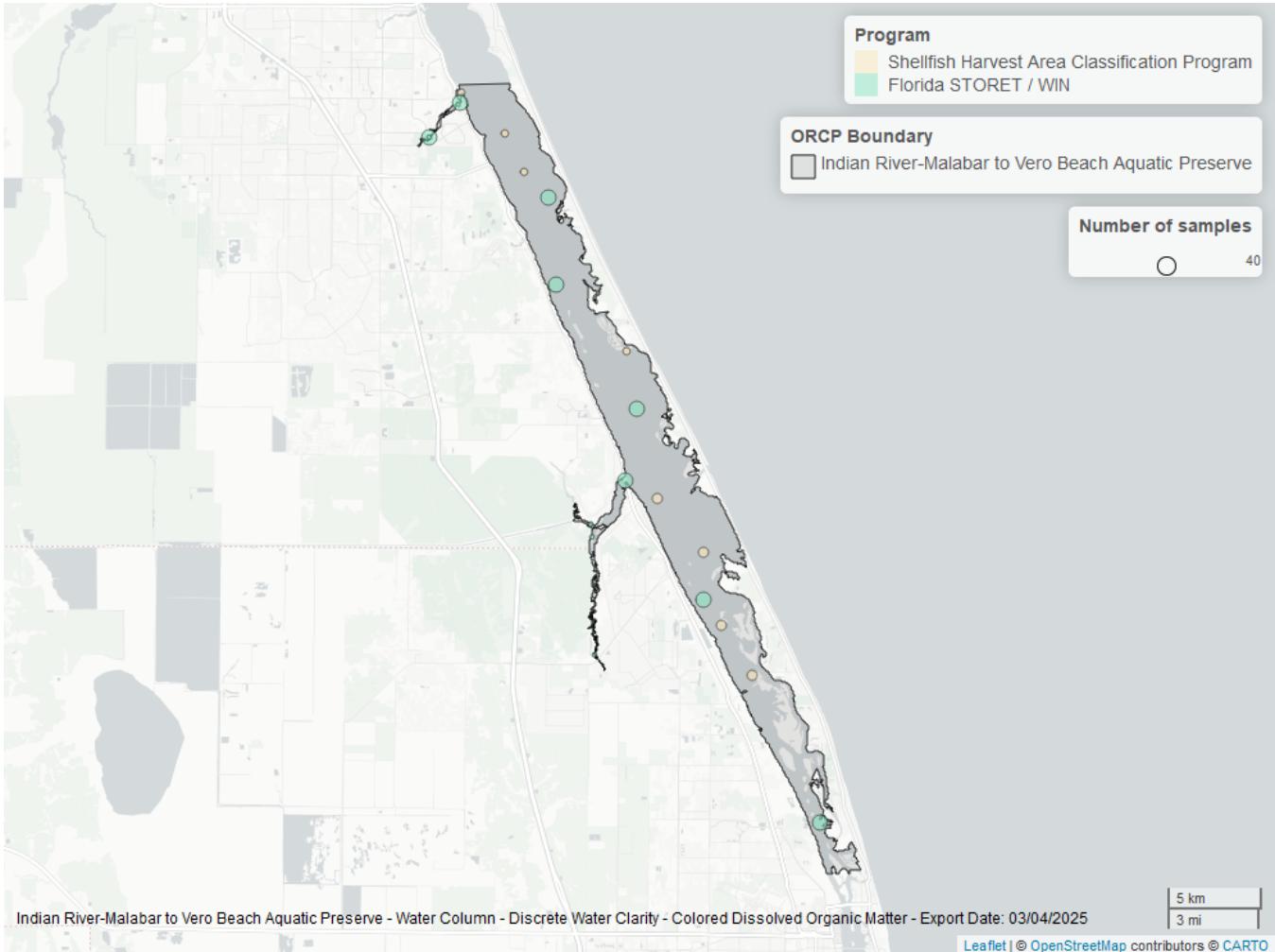


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	N_Data	YearMin	YearMax
5002	456	2020	2025
540	99	2016	2019

Program names:

540 - Shellfish Harvest Area Classification Program¹
 5002 - Florida STORET / WIN²

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

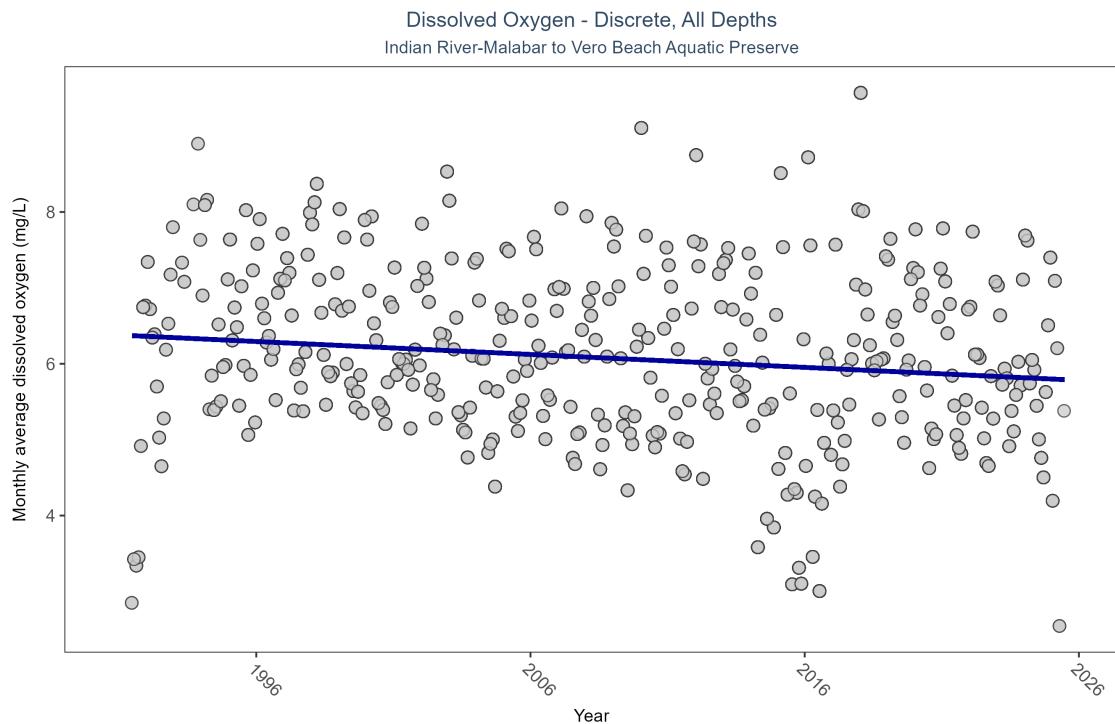


Figure 7: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	58119	35	1991 - 2025	6.2	-0.1694	6.3787	-0.017	0

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

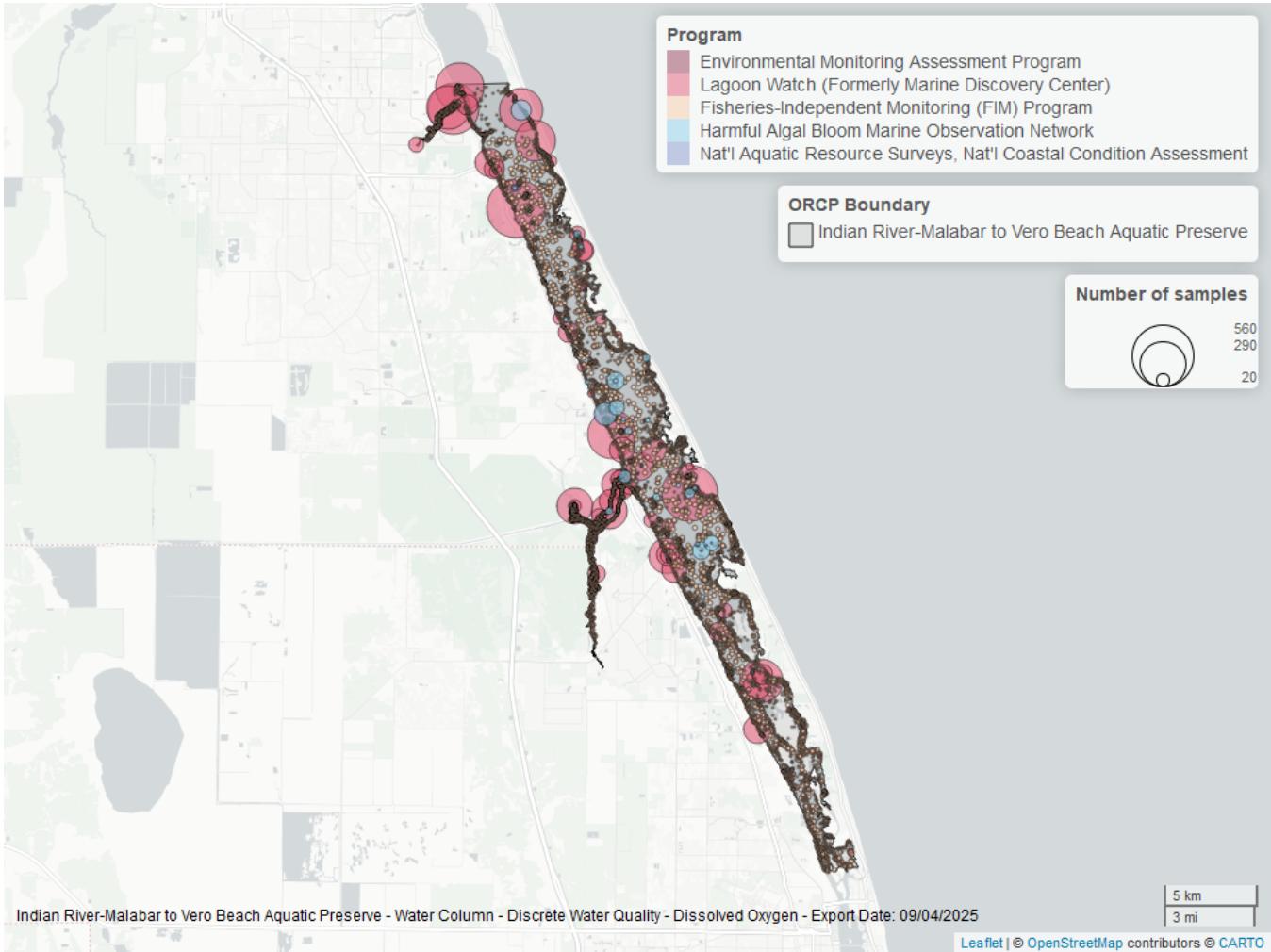


Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
5002	29888	1991	2025
69	20379	1991	2024
3001	6309	1991	2023
3013	1145	2003	2024
95	494	1996	2018
540	127	2016	2020
115	28	1994	1995
118	15	2000	2021
103	4	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁶

95 - Harmful Algal Bloom Marine Observation Network³

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴

115 - Environmental Monitoring Assessment Program⁷

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁵

540 - Shellfish Harvest Area Classification Program¹

3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸

3013 - Seagrass (SJRWMD)⁹

5002 - Florida STORET / WIN²

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

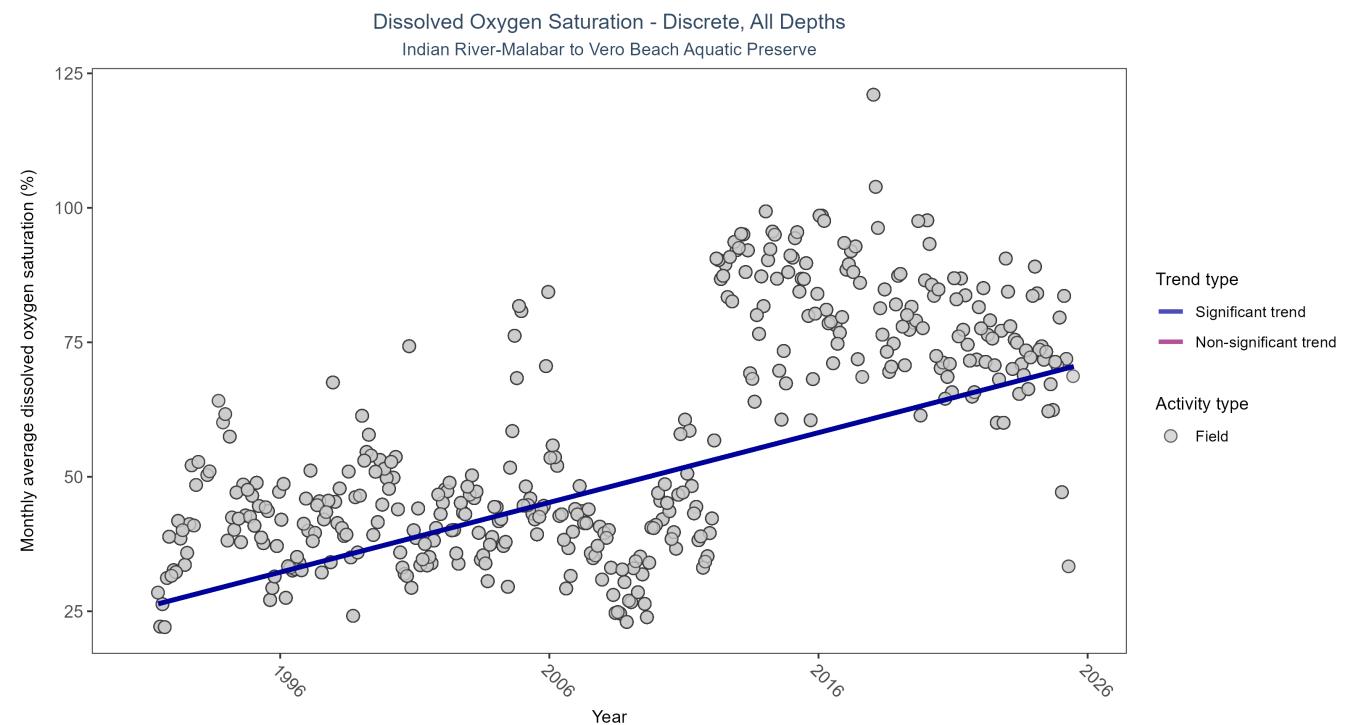


Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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 increasing trend	13694	35	1991 - 2025	69.327	0.3981	25.7772	1.2973	0

Monthly average dissolved oxygen saturation increased by 1.3% per year.

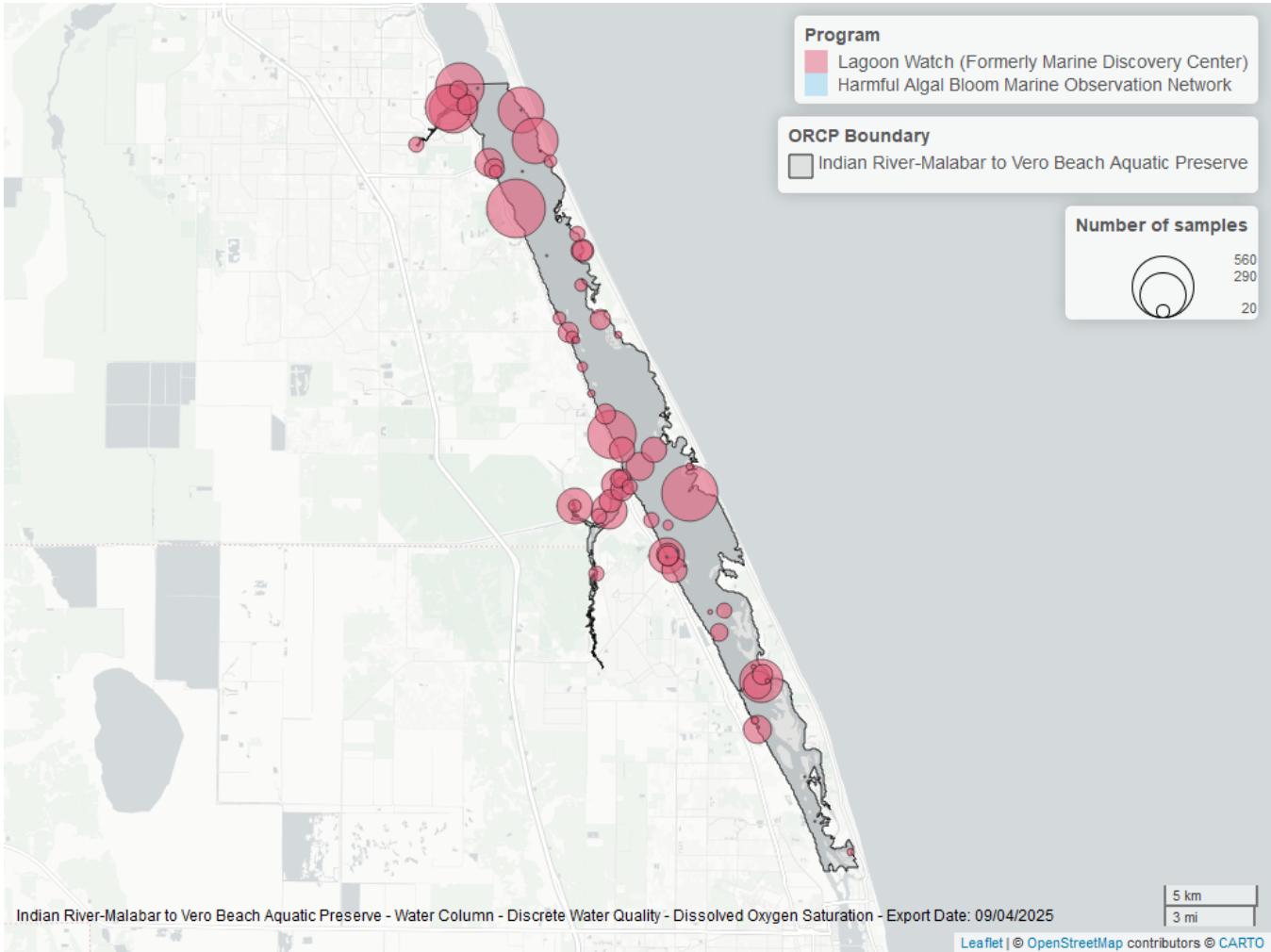


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	N_Data	YearMin	YearMax
5002	6606	1991	2025
3001	6486	1991	2024
3013	608	2012	2024
95	5	2016	2018

Program names:

- 95 - Harmful Algal Bloom Marine Observation Network³
- 3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸
- 3013 - Seagrass (SJRWMD)⁹
- 5002 - Florida STORET / WIN²

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

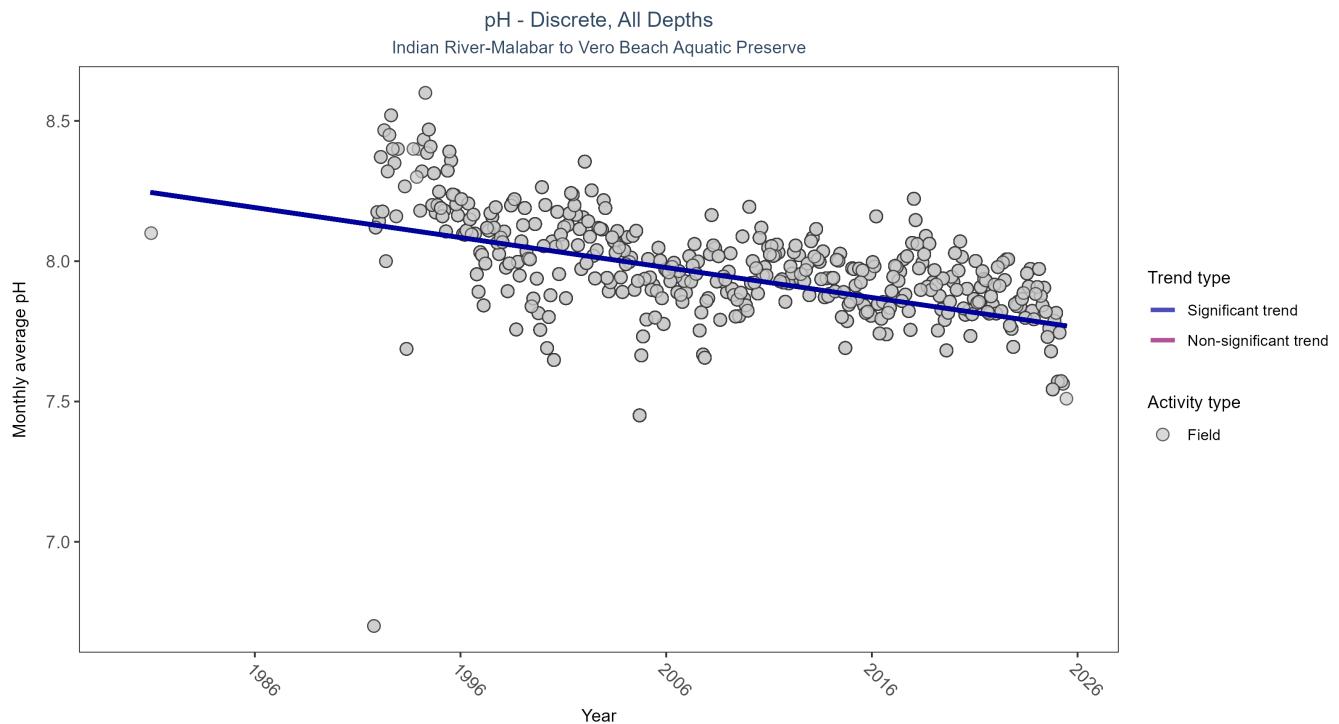


Figure 11: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	49288	36	1980 - 2025	8	-0.4627	8.2552	-0.0107	0

Monthly average pH decreased by 0.01 pH units per year.

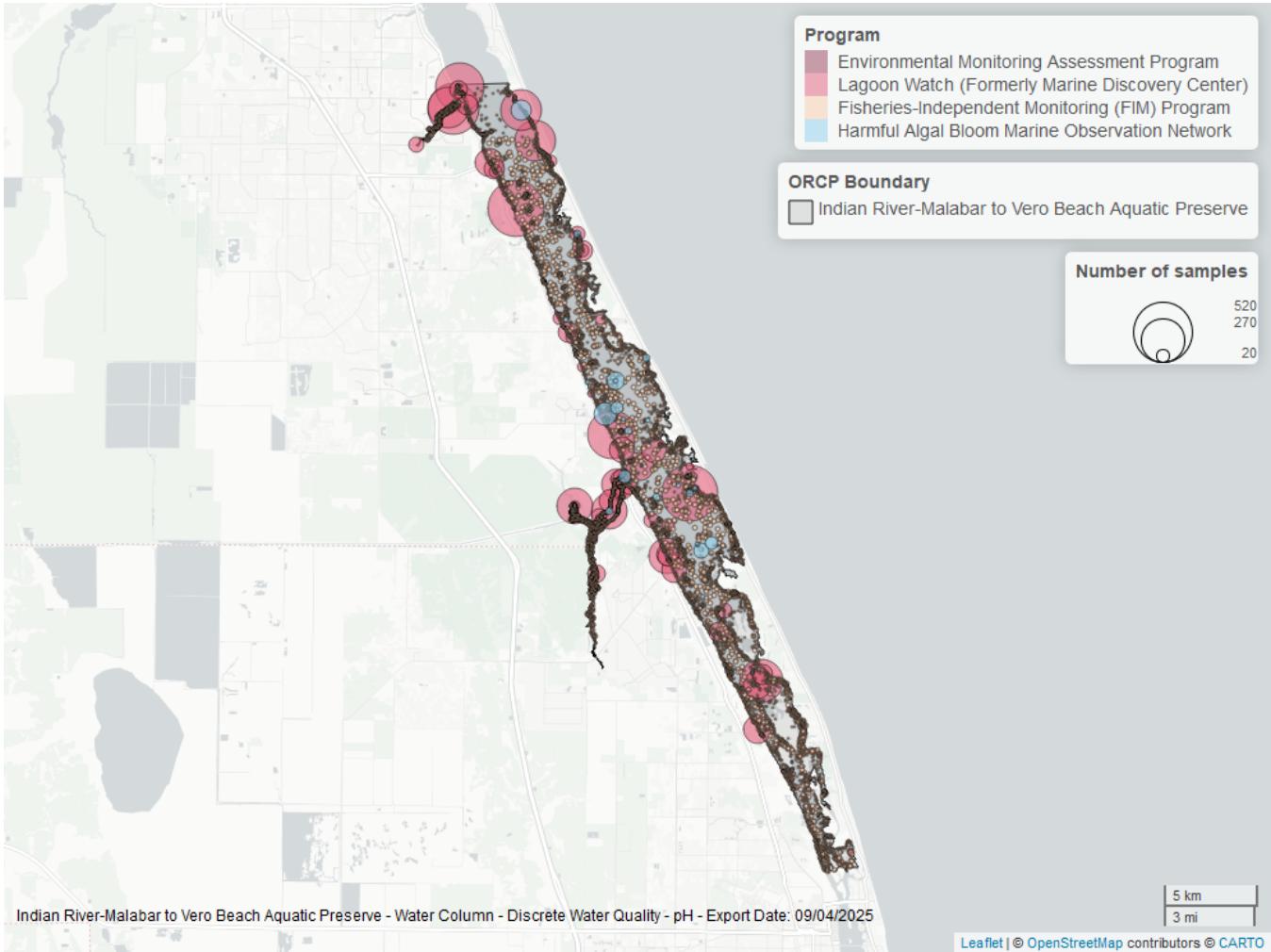


Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	22322	1995	2025
69	20384	1991	2024
3001	6078	1991	2024
3013	1157	2003	2024
95	454	1980	2018
540	119	2016	2020
115	22	1994	1995
103	4	2015	2015

Program names:

- 69 - Fisheries-Independent Monitoring (FIM) Program⁶
- 95 - Harmful Algal Bloom Marine Observation Network³
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴
- 115 - Environmental Monitoring Assessment Program⁷

- 540 - Shellfish Harvest Area Classification Program¹
 3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸
 3013 - Seagrass (SJRWMD)⁹
 5002 - Florida STORET / WIN²

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

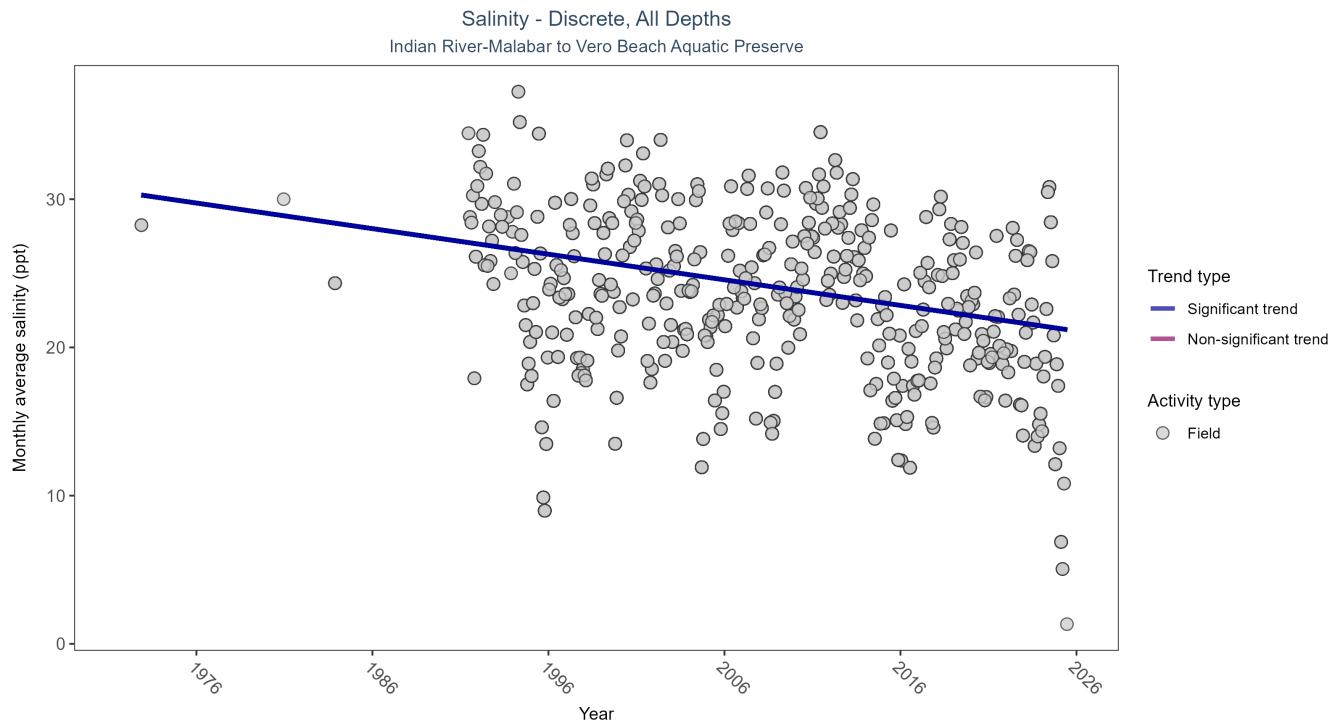


Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	61253	38	1972 - 2025	26	-0.2494	30.4304	-0.1726	0

Monthly average salinity decreased by 0.17 ppt per year.

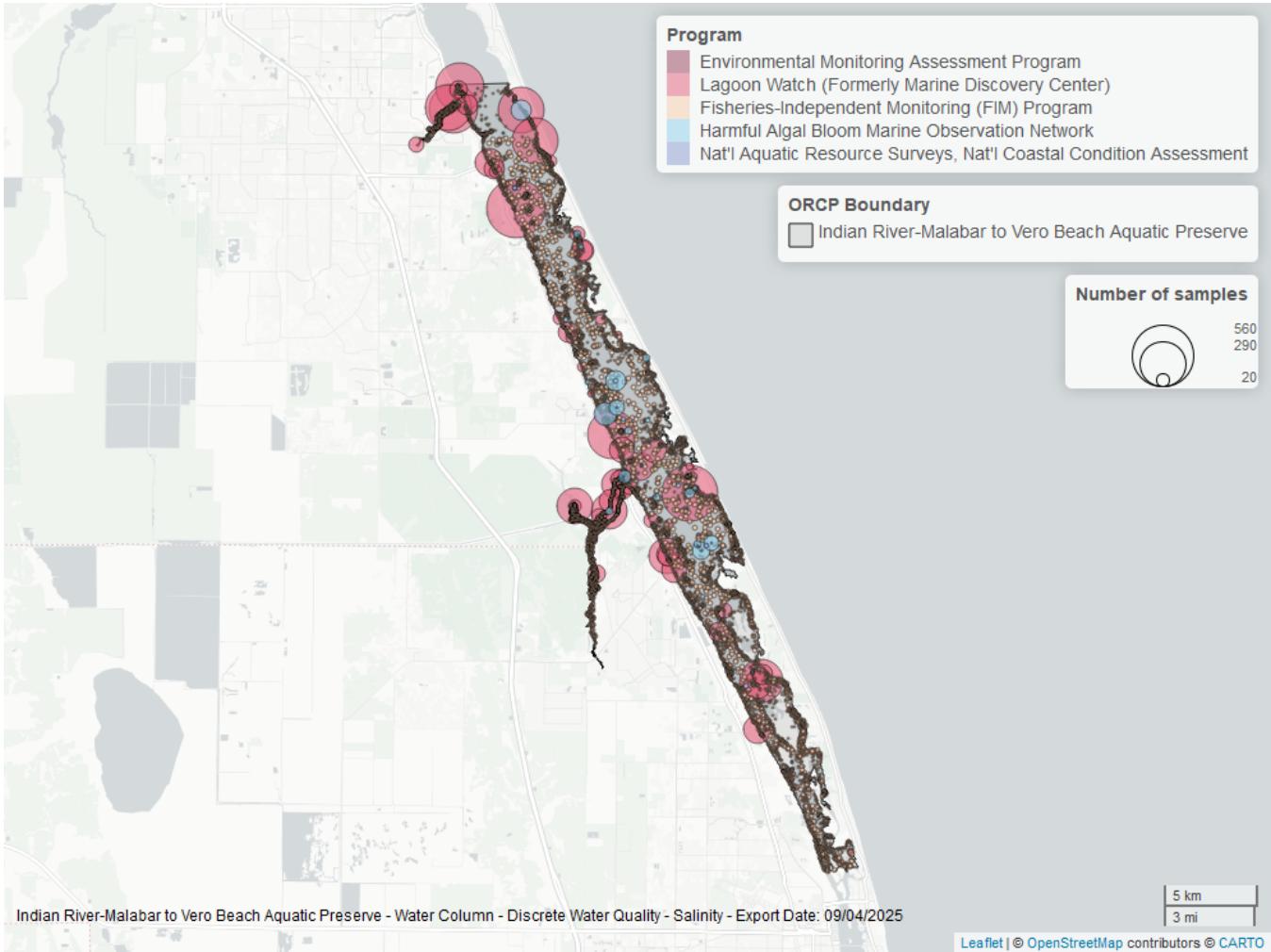


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
5002	32639	1991	2025
69	20449	1991	2024
3001	6437	1991	2024
3013	1161	2003	2024
95	527	1972	2018
540	127	2016	2020
115	25	1994	1995
118	10	2015	2021

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program⁶

95 - Harmful Algal Bloom Marine Observation Network³

115 - Environmental Monitoring Assessment Program⁷

118 - National Aquatic Resource Surveys, National Coastal Condition Assessment⁵

- 540 - Shellfish Harvest Area Classification Program¹
 3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸
 3013 - Seagrass (SJRWMD)⁹
 5002 - Florida STORET / WIN²

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

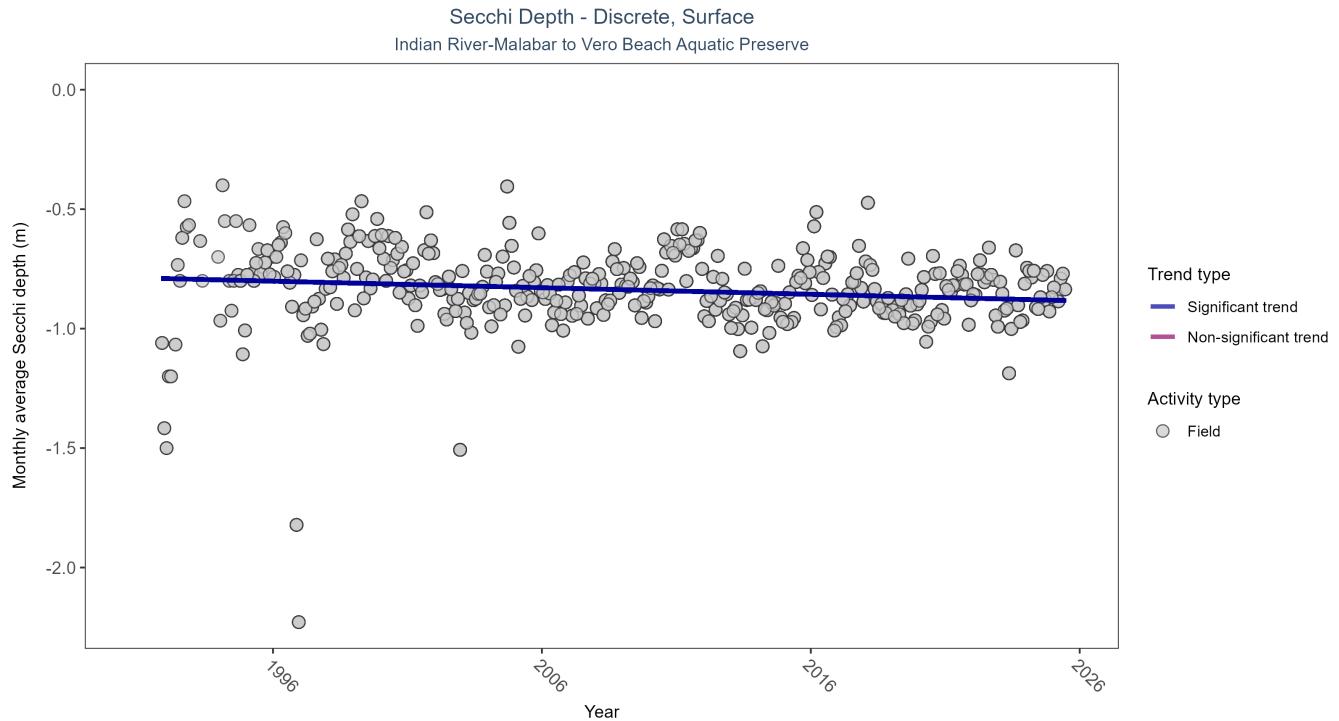


Figure 15: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	28587	35	1991 - 2025	-0.8	-0.1257	-0.7876	-0.0027	0.0004

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

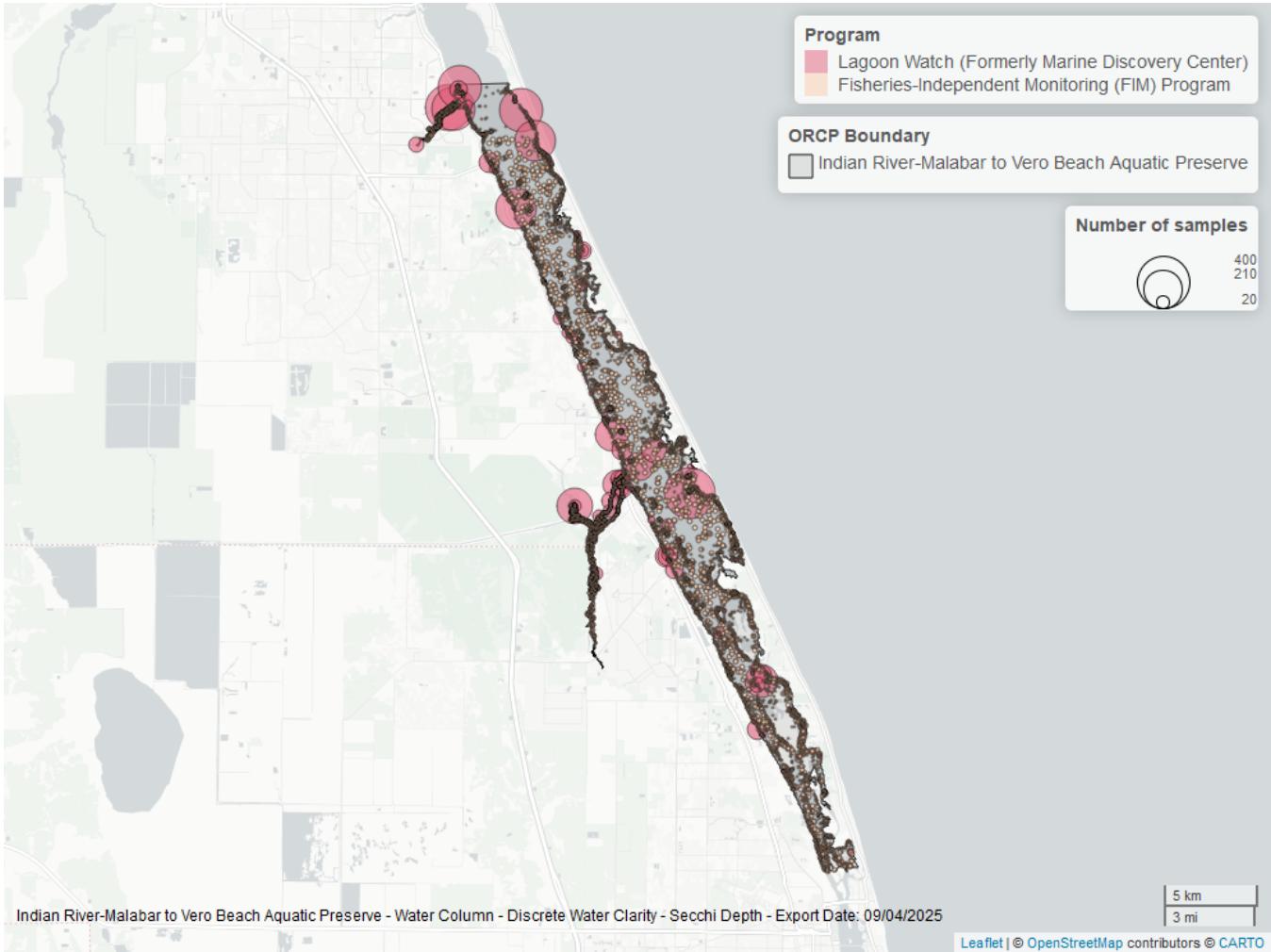


Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
69	20285	1995	2024
3001	4198	1991	2024
5002	3132	2005	2025
3013	1167	2003	2024
103	14	1995	2015

Program names:

- 69 - Fisheries-Independent Monitoring (FIM) Program⁶
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴
- 3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸
- 3013 - Seagrass (SJRWMD)⁹
- 5002 - Florida STORET / WIN²

Total Nitrogen - Discrete

Total Nitrogen Calculation:

The logic for calculated Total Nitrogen was provided by Kevin O'Donnell and colleagues at FDEP (with the help of Jay Silvanima, Watershed Monitoring Section). The following logic is used, in this order, based on the availability of specific nitrogen components.

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

Additional Information:

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

Seasonal Kendall-Tau Trend Analysis

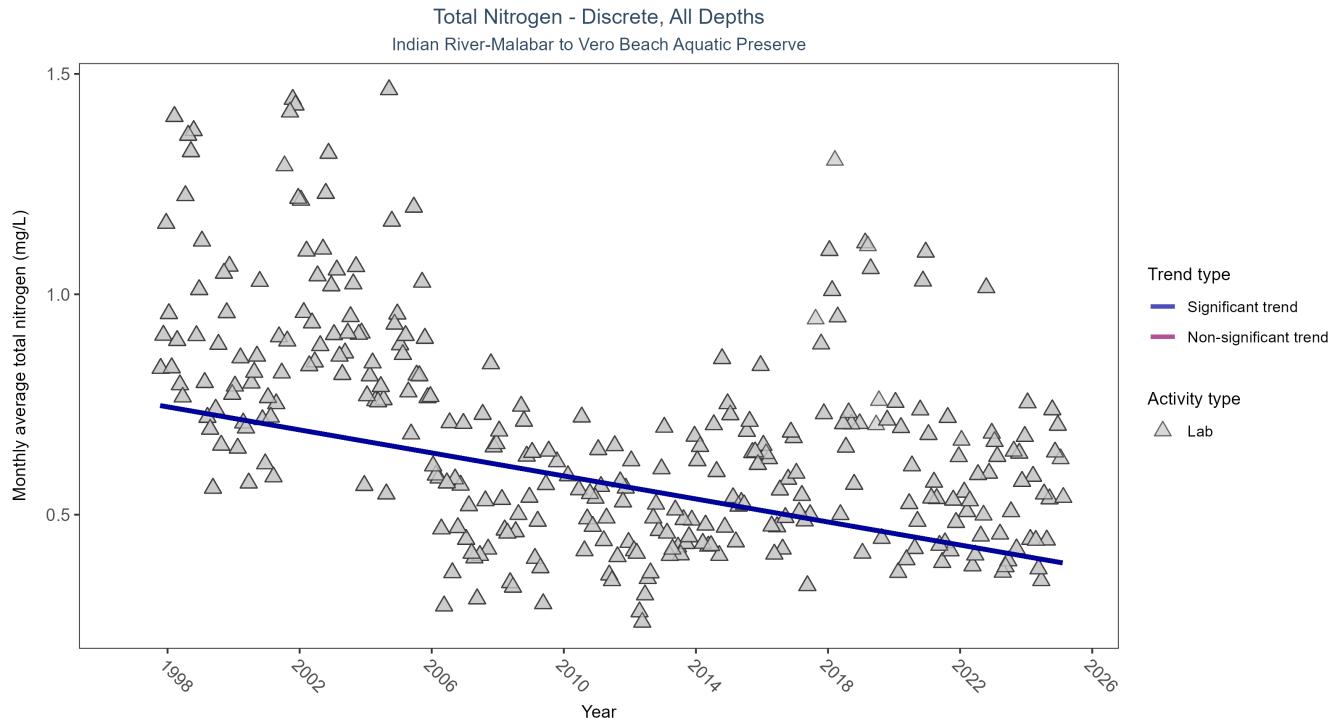


Figure 17: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the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

Table 22: Seasonal Kendall-Tau Trend Analysis for Total Nitrogen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly decreasing trend	3268	29	1997 - 2025	0.6441	-0.332	0.7577	-0.0131	0

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

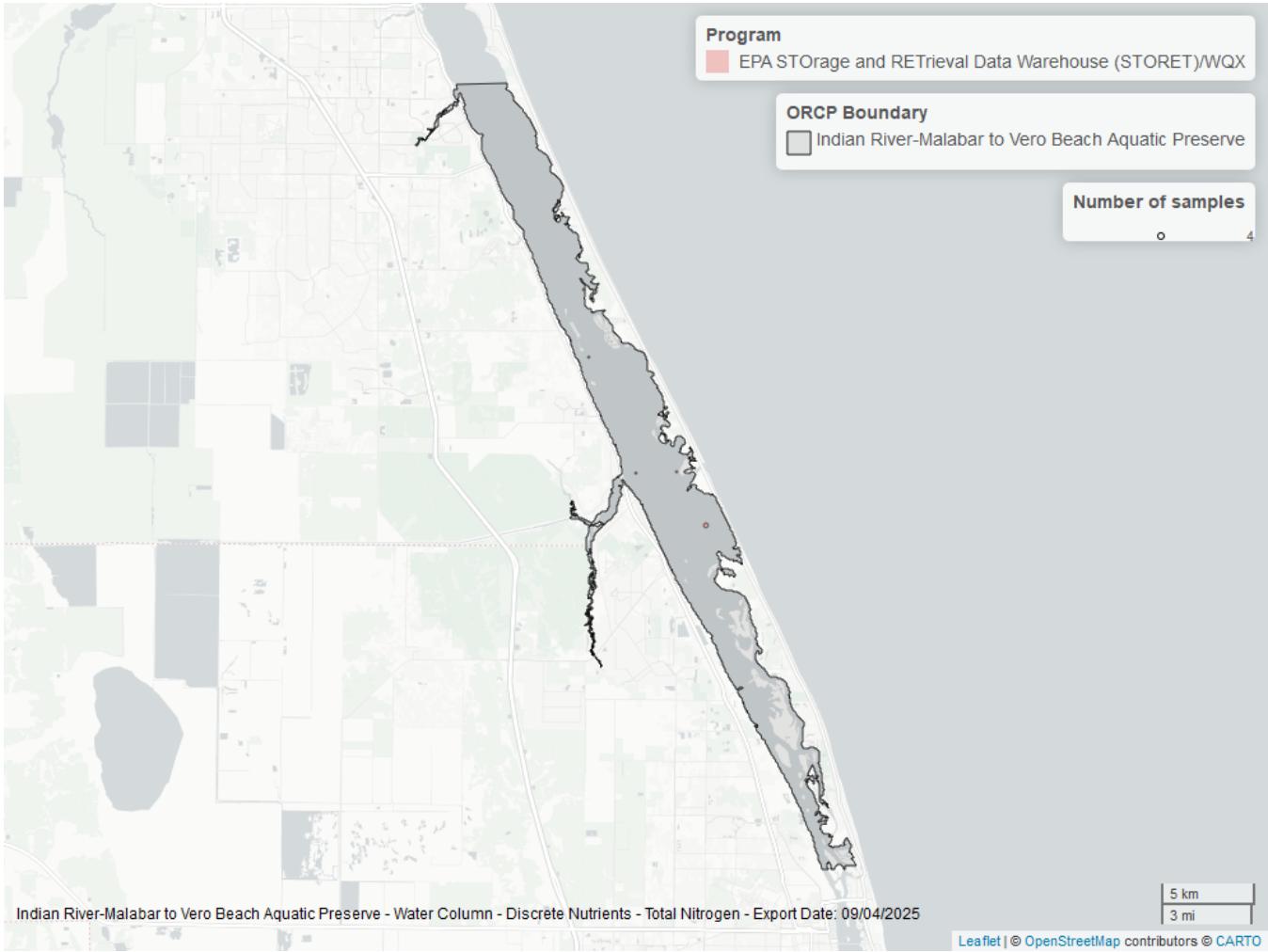


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	3134	1997	2025
540	123	2016	2020
103	11	2000	2006

Program names:

- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴
- 540 - Shellfish Harvest Area Classification Program¹
- 5002 - Florida STORET / WIN²

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

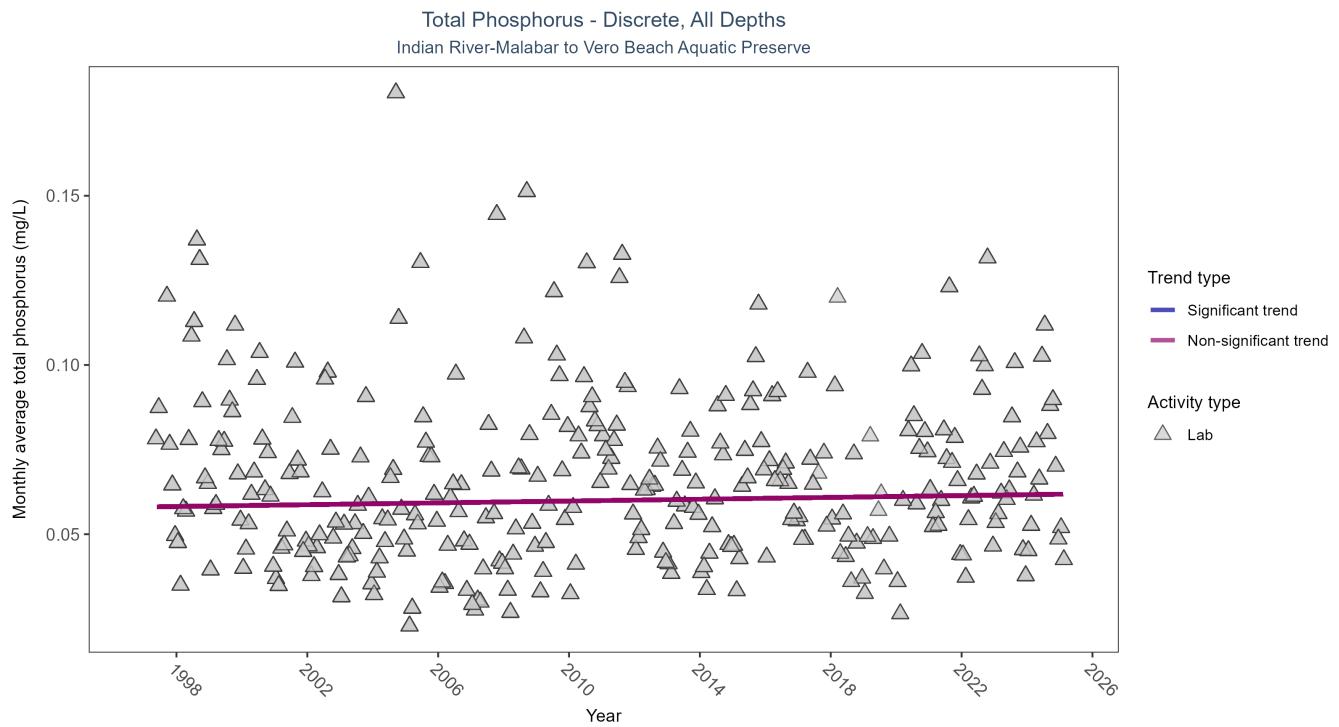


Figure 19: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included 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	No significant trend	6601	29	1997 - 2025	0.054	0.0489	0.058	0.0001	0.2115

Total phosphorus showed no detectable trend between 1997 and 2025.

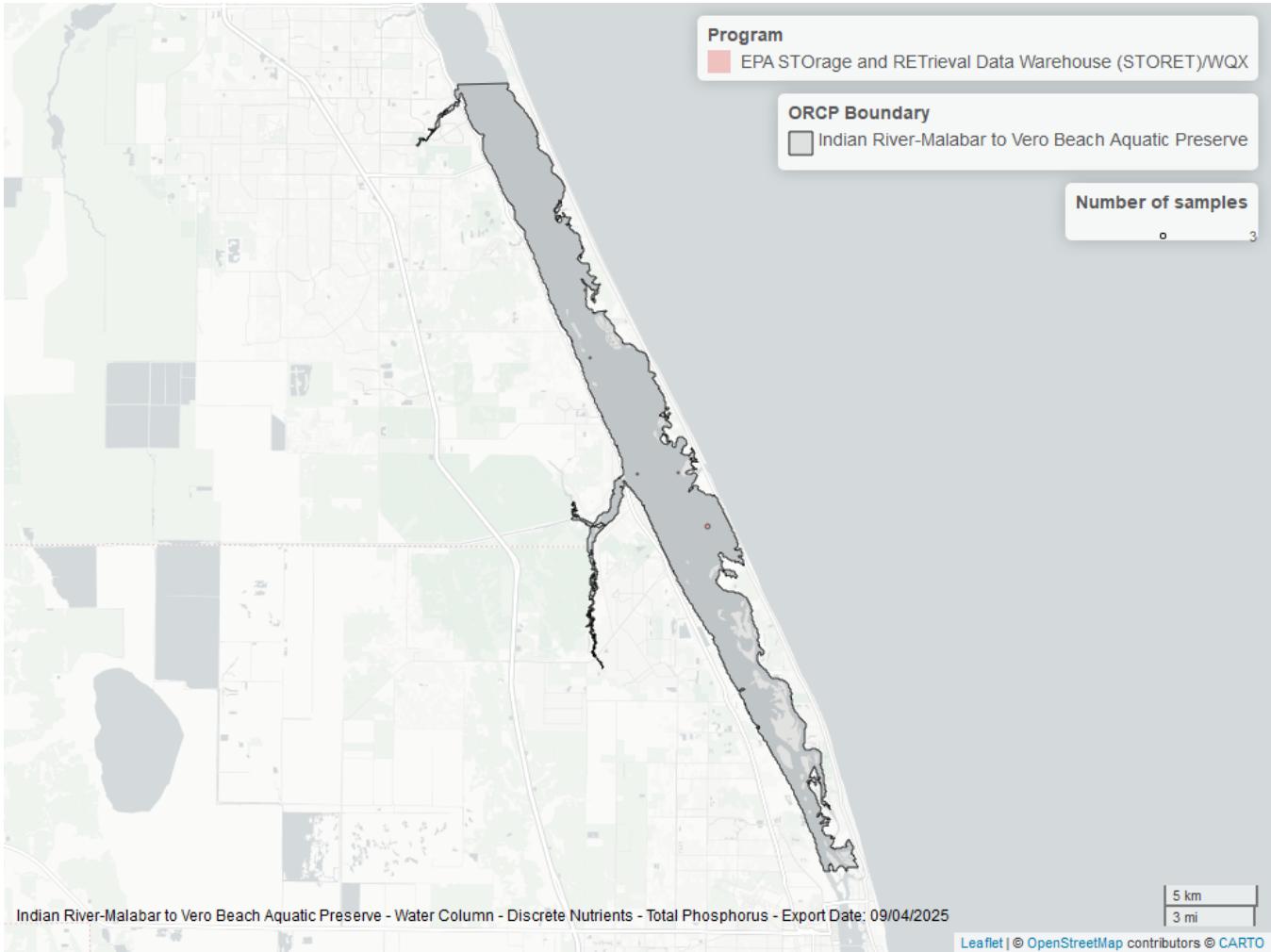


Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	6570	1997	2025
540	127	2016	2020
103	12	2000	2015

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴

540 - Shellfish Harvest Area Classification Program¹

5002 - Florida STORET / WIN²

Total Suspended Solids - Discrete

Seasonal Kendall-Tau Trend Analysis

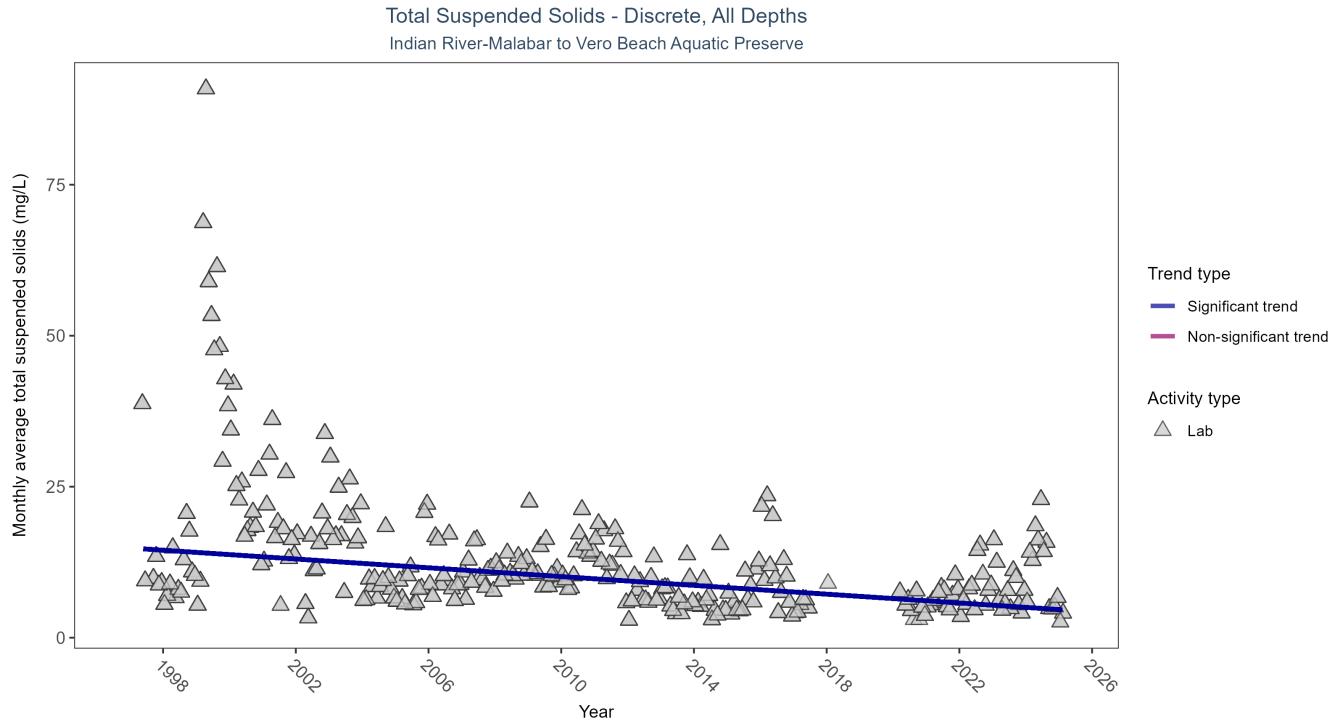


Figure 21: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	Significantly decreasing trend	3378	28	1997 - 2025	9	-0.3643	14.8492	-0.364	0

Monthly average total suspended solids decreased by 0.36 mg/L per year, indicating an increase in water clarity.

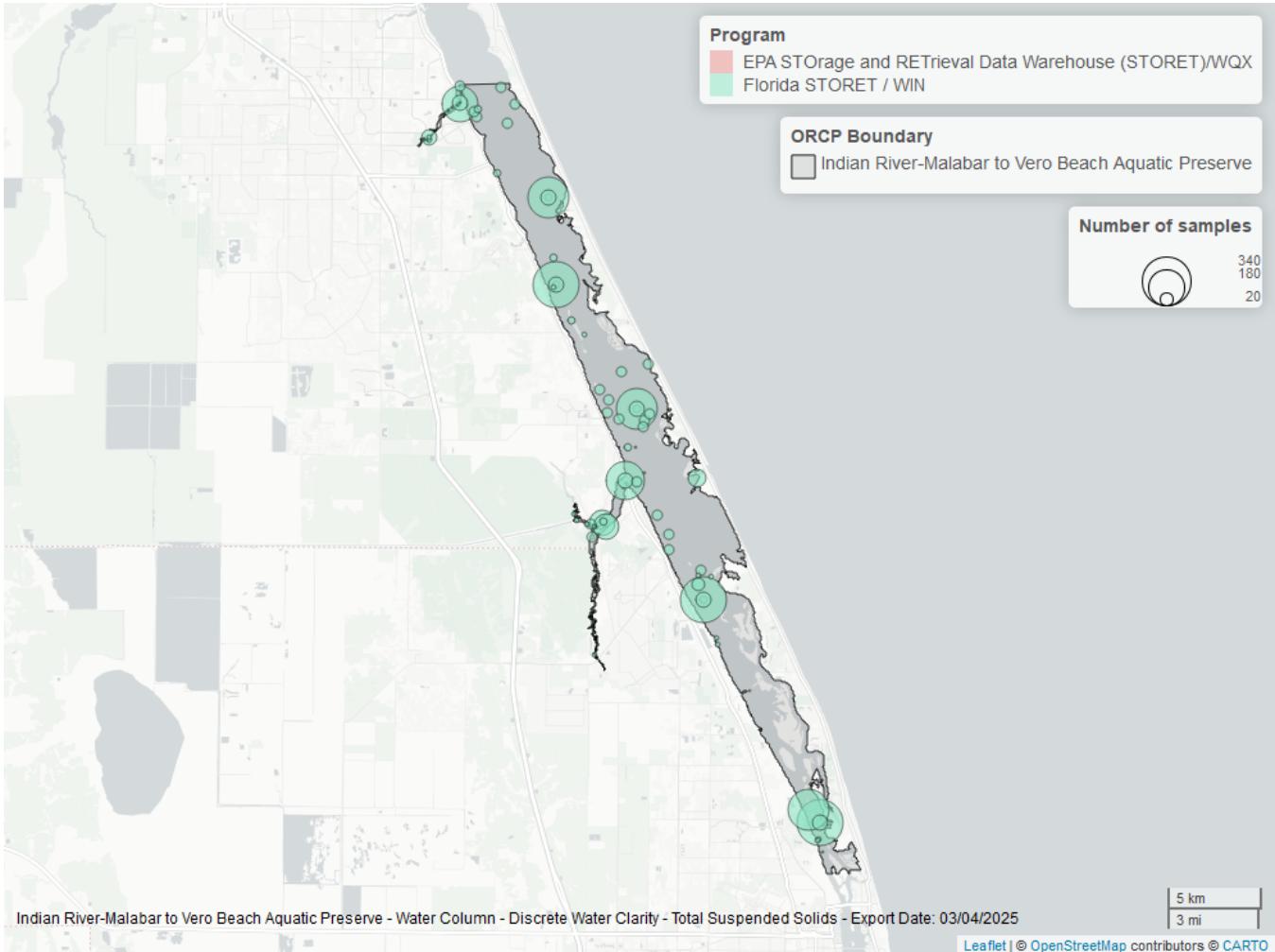


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	N_Data	YearMin	YearMax
5002	3432	1997	2025

Program names:

5002 - Florida STORET / WIN²

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

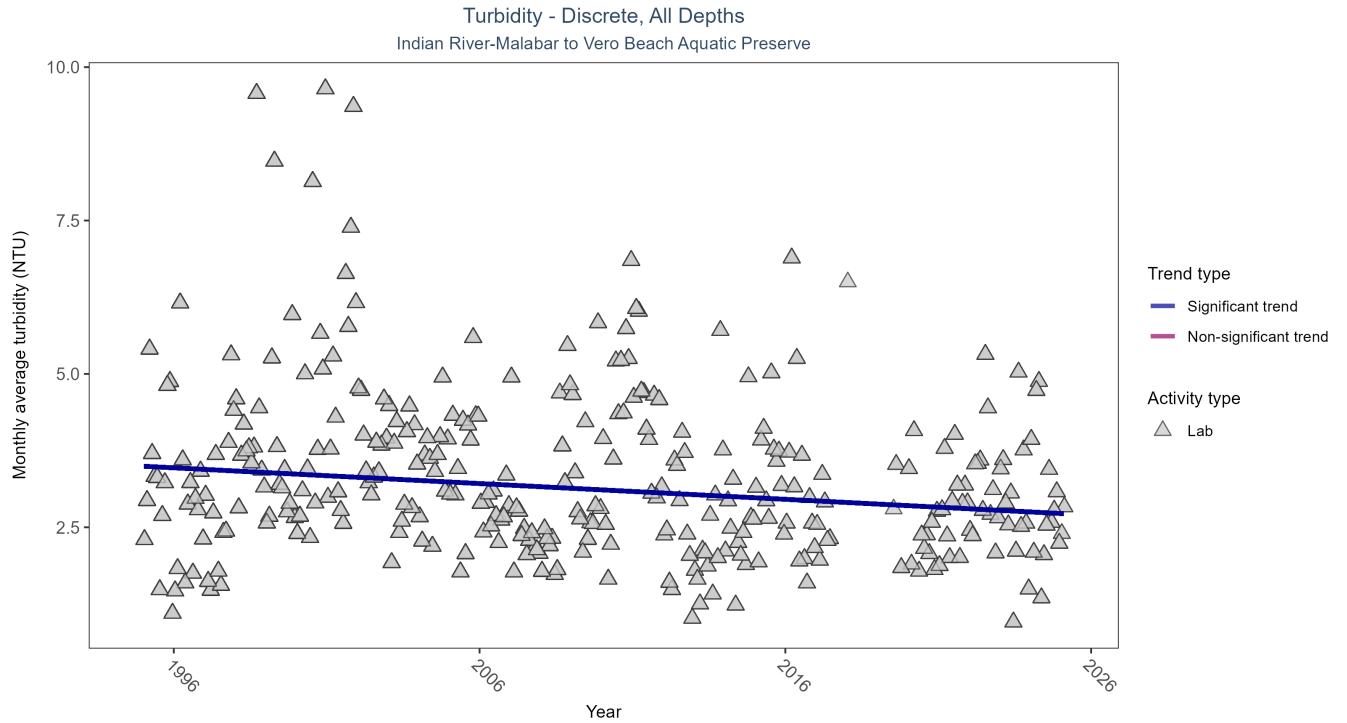


Figure 23: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	Significantly decreasing trend	14526	31	1995 - 2025	2.8	-0.1498	3.4949	-0.0257	0.0002

Monthly average turbidity decreased by 0.03 NTU per year, indicating an increase in water clarity.

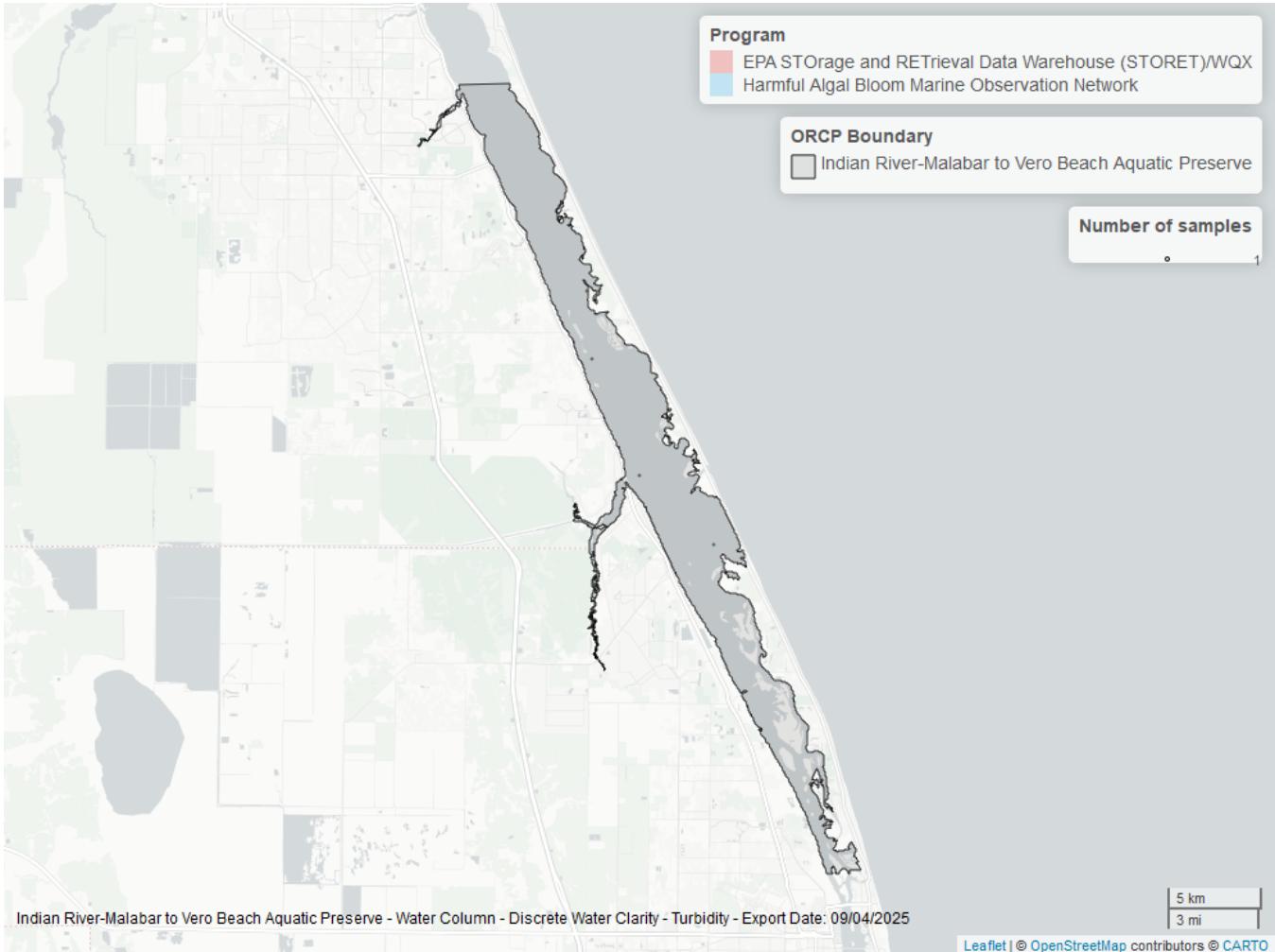


Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
5002	15094	1995	2025
3013	938	2004	2019
540	29	2019	2020
103	3	2005	2006
95	1	2008	2008

Program names:

- 95 - Harmful Algal Bloom Marine Observation Network³
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX⁴
- 540 - Shellfish Harvest Area Classification Program¹
- 3013 - Seagrass (SJRWMD)⁹
- 5002 - Florida STORET / WIN²

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

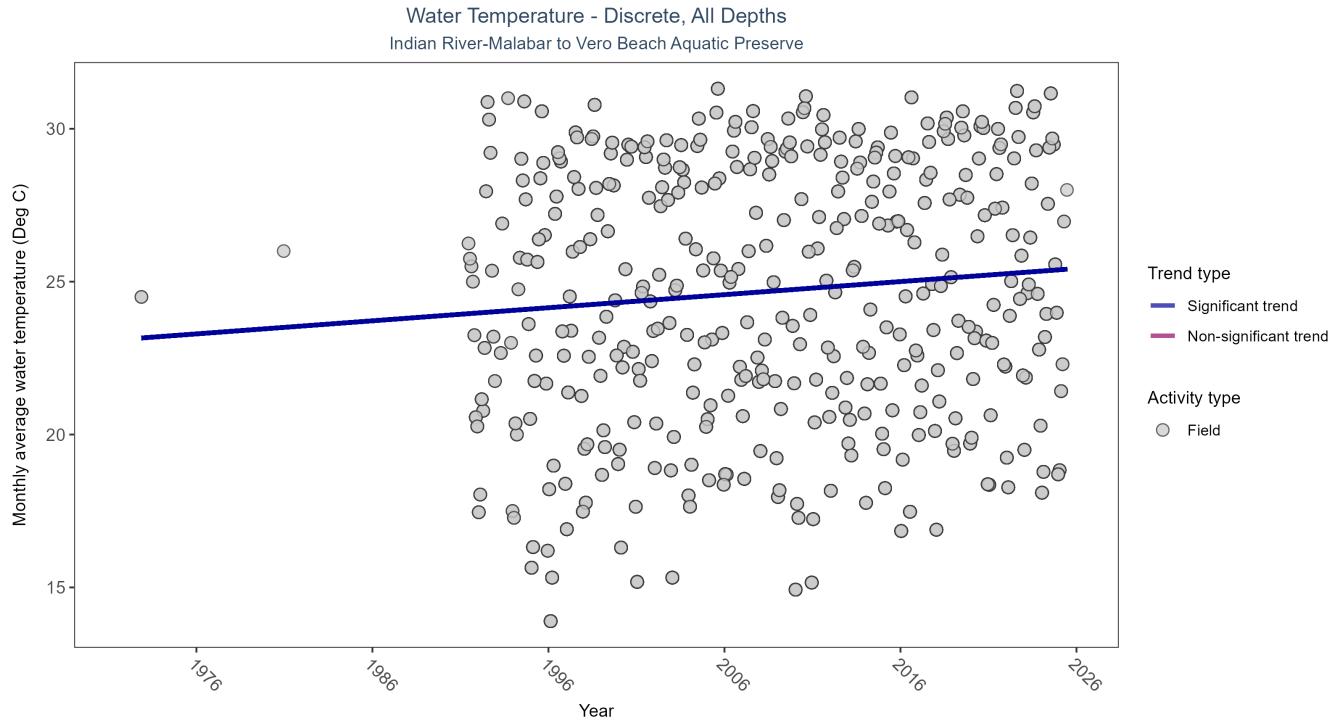


Figure 25: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in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

Table 30: Seasonal Kendall-Tau Trend Analysis for Water Temperature

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly increasing trend	60359	37	1972 - 2025	25.5	0.2384	23.1204	0.0428	0

Monthly average water temperature increased by 0.04°C per year.

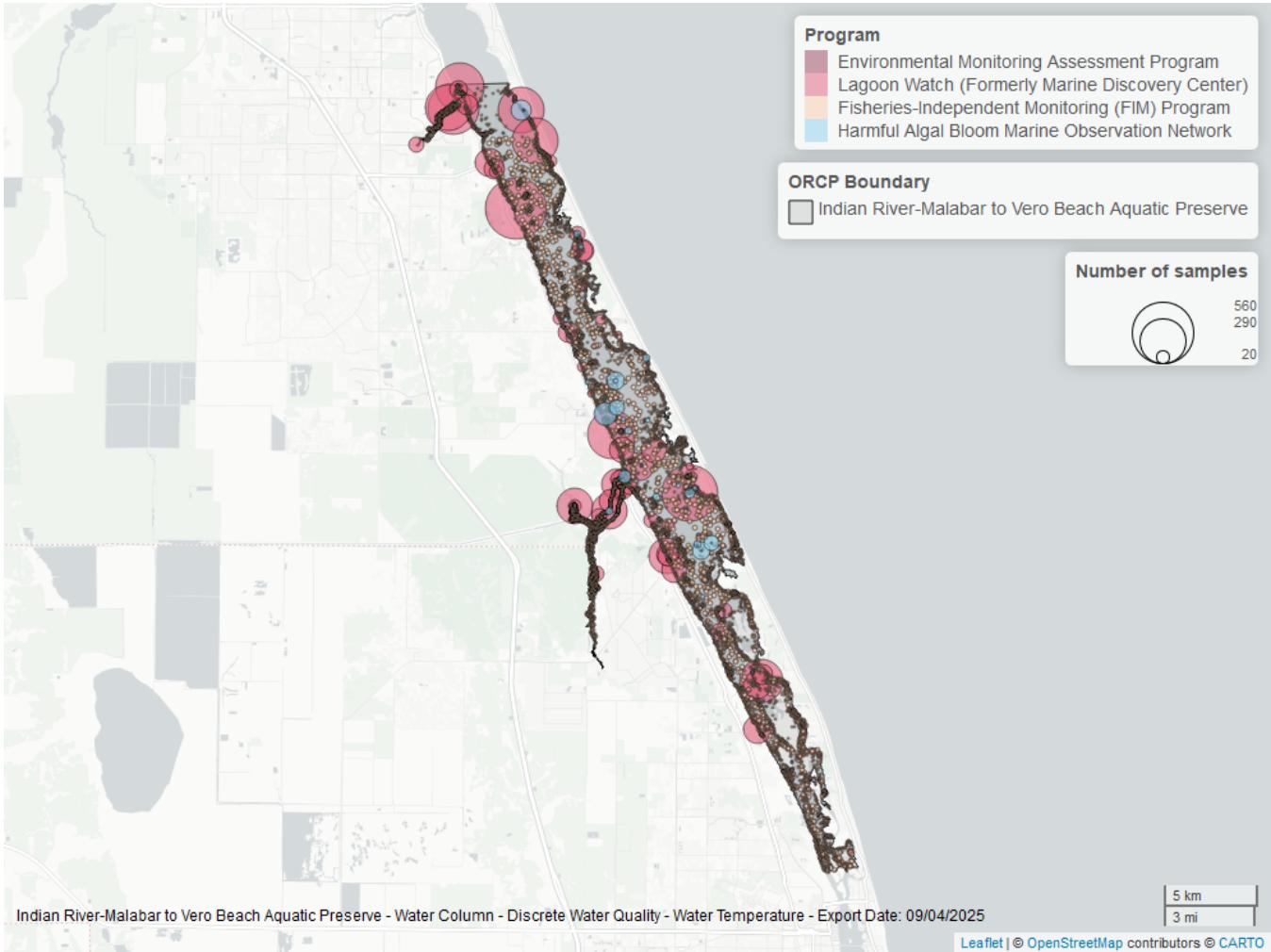


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
5002	33112	1991	2025
69	20453	1991	2024
3001	6463	1991	2024
3013	1153	2003	2024
95	509	1972	2018
540	127	2016	2020
115	25	1994	1995

Program names:

- 69 - Fisheries-Independent Monitoring (FIM) Program⁶
- 95 - Harmful Algal Bloom Marine Observation Network³
- 115 - Environmental Monitoring Assessment Program⁷
- 540 - Shellfish Harvest Area Classification Program¹
- 3001 - Lagoon Watch (Formerly Marine Discovery Center)⁸

3013 - Seagrass (SJRWMD)⁹
5002 - Florida STORET / WIN²

Water Quality - Continuous

The following files were used in the continuous analysis:

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

Continuous monitoring locations in Indian River-Malabar to Vero Beach Aquatic Preserve

Table 32: Station overview for Continuous parameters by Program

<i>ProgramID</i>	<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
5005	IRDM	5	TRUE	DO , DOS , pH , Sal , Turb , TempW

Program names:

5005 - Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring¹⁰

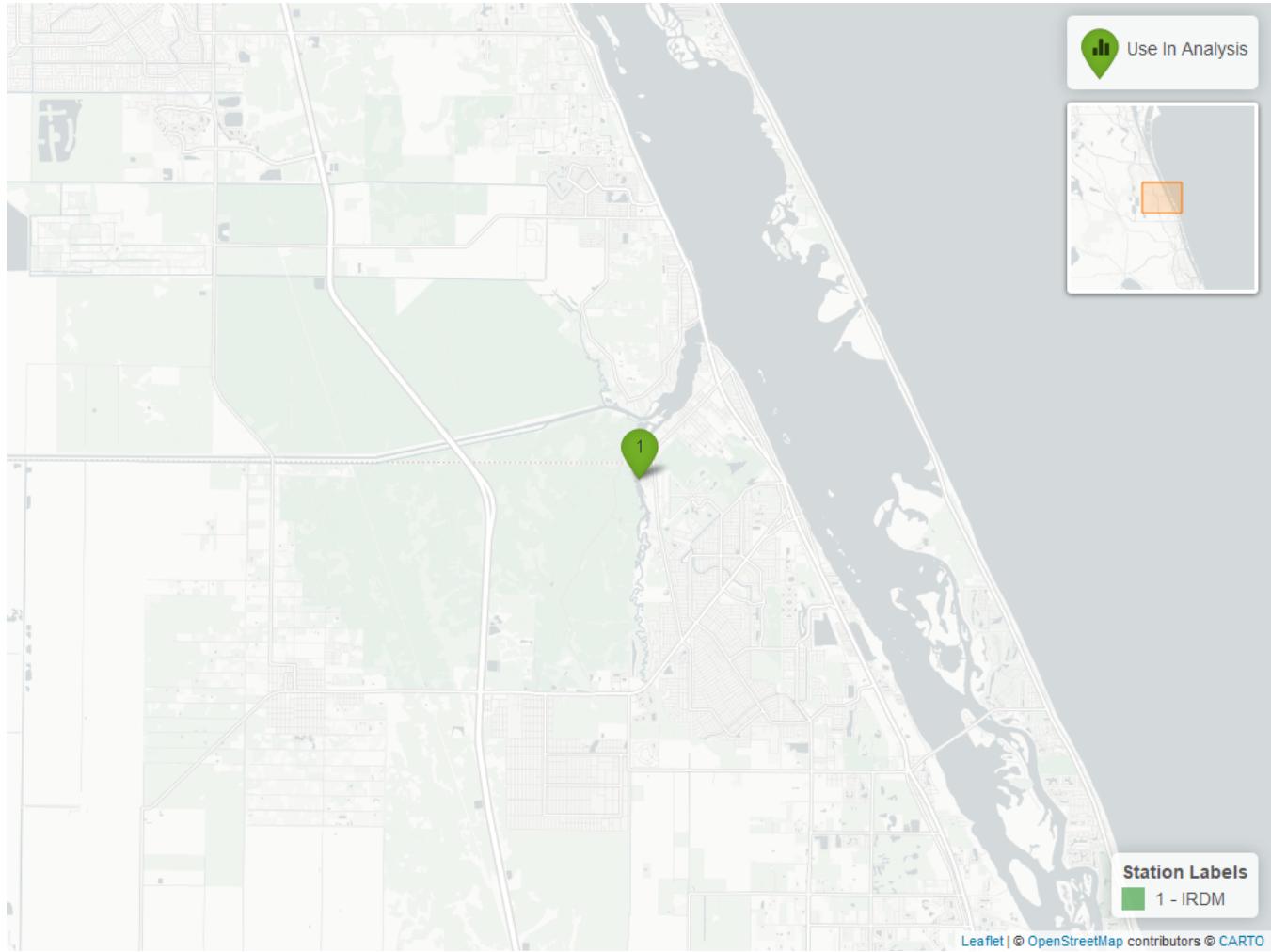


Figure 27: Map showing continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

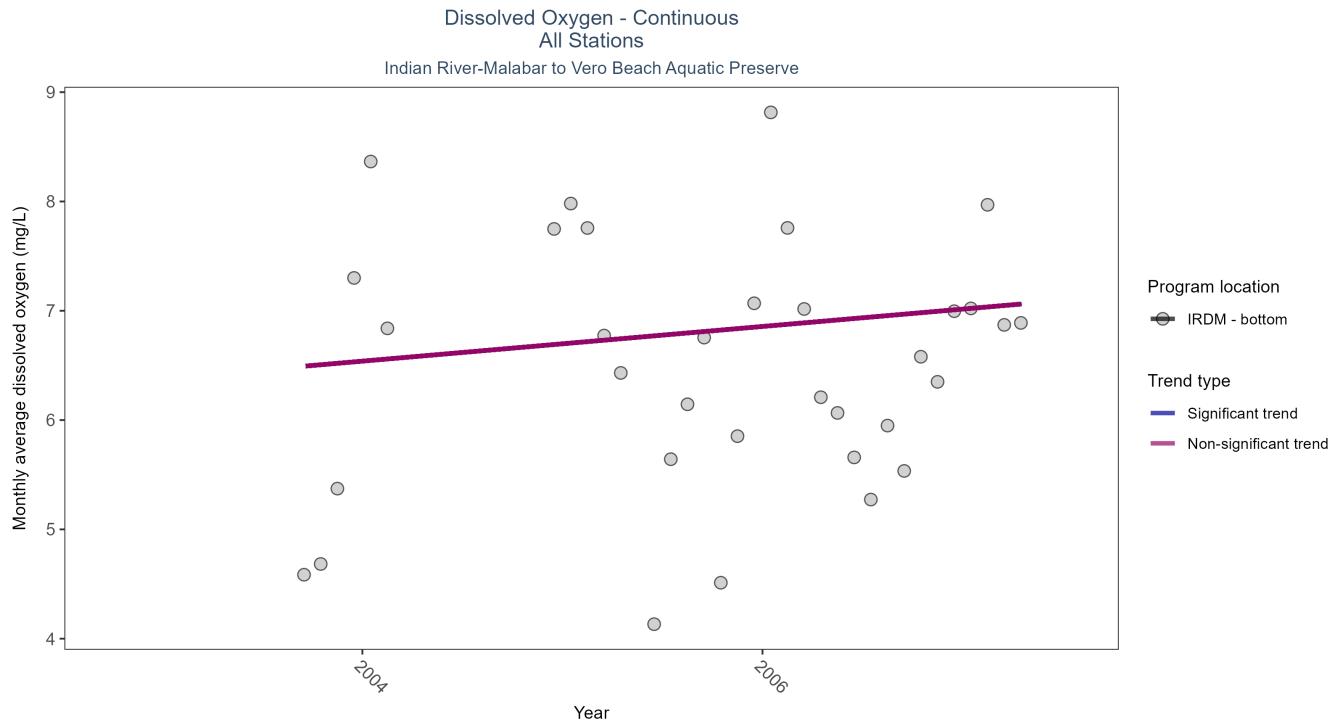


Figure 28: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 33: Seasonal Kendall-Tau Results for Dissolved Oxygen - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
IRDM	No significant trend	39746	5	2003 - 2007	6.5	0.15	6.38	0.16	0.47

No detectable change in monthly average dissolved oxygen was observed at one location.

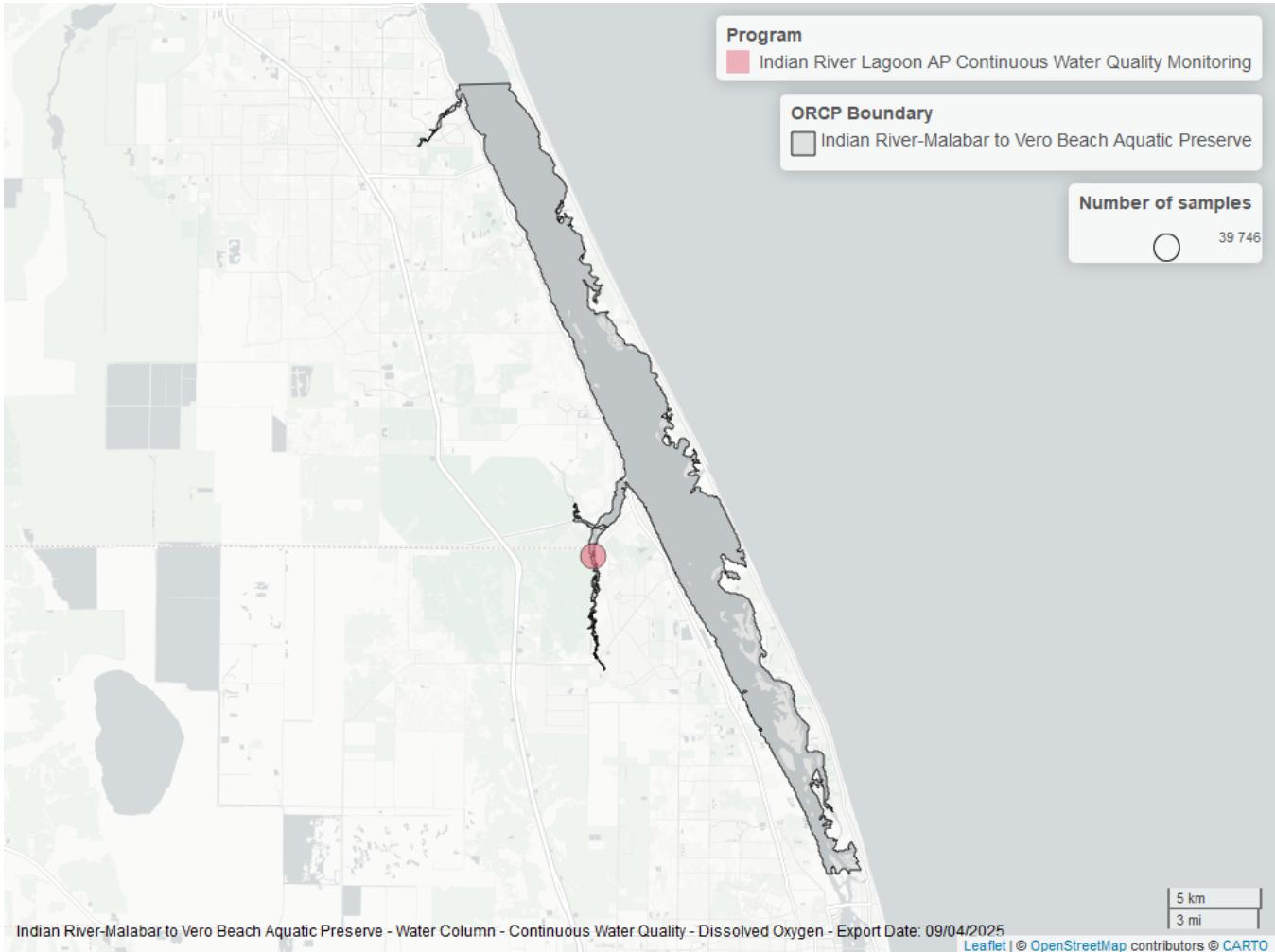


Figure 29: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

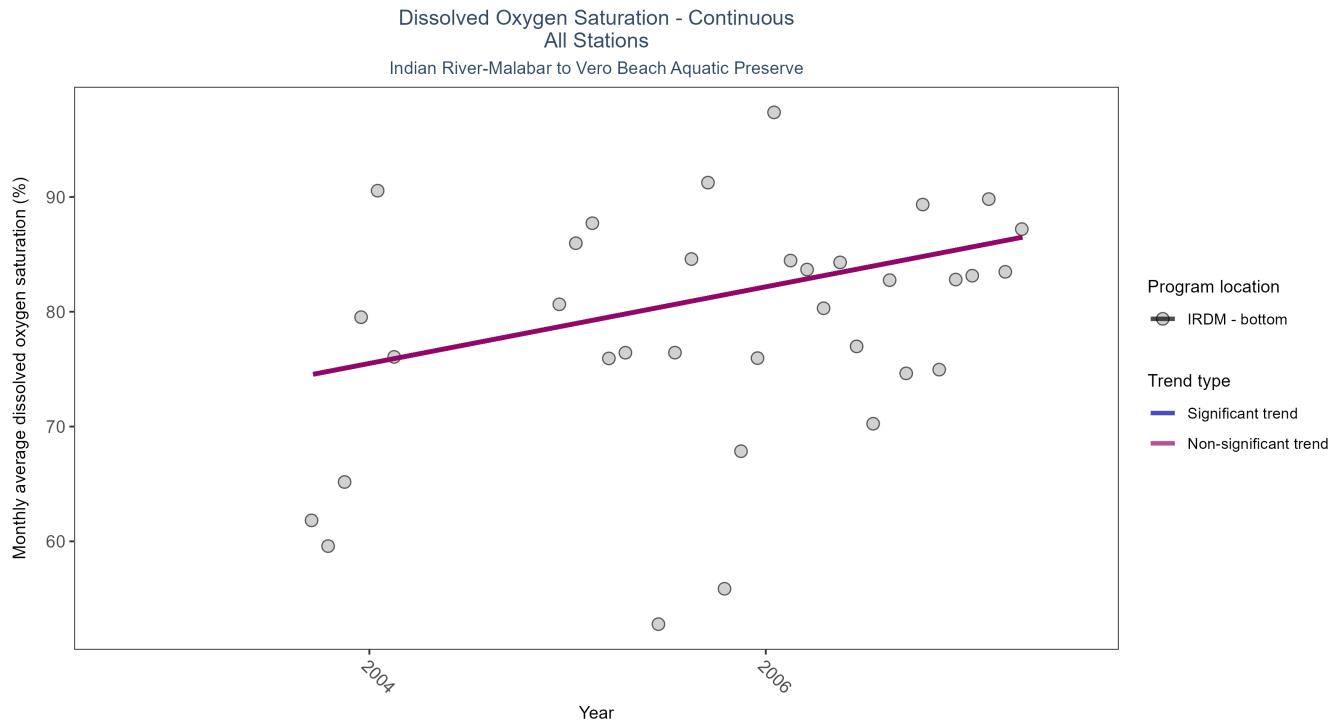


Figure 30: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 34: 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
IRDM	No significant trend	39746	5	2003 - 2007	77.7	0.29	72.16	3.34	0.11

No detectable change in monthly average dissolved oxygen saturation was observed at one location.

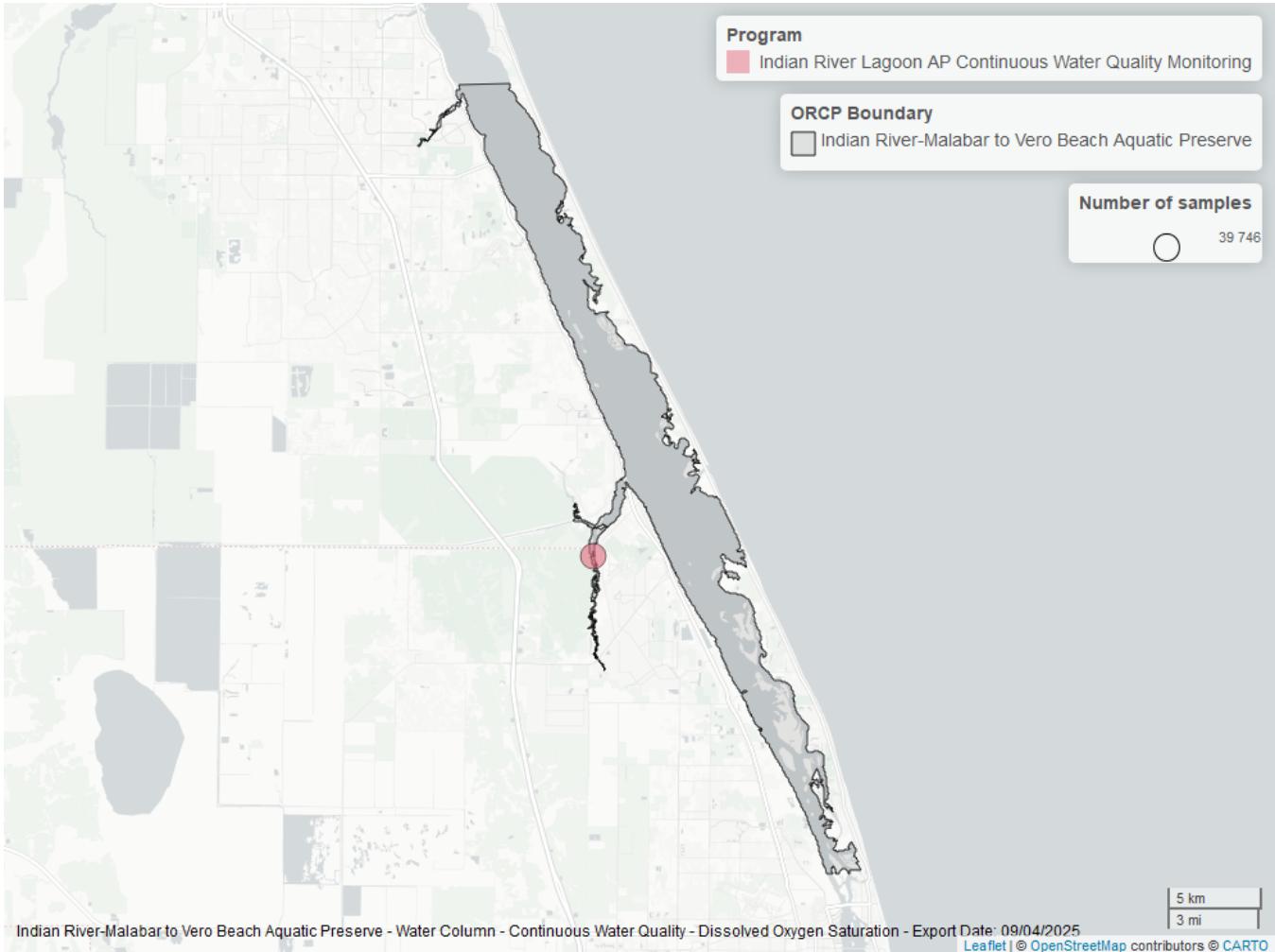


Figure 31: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

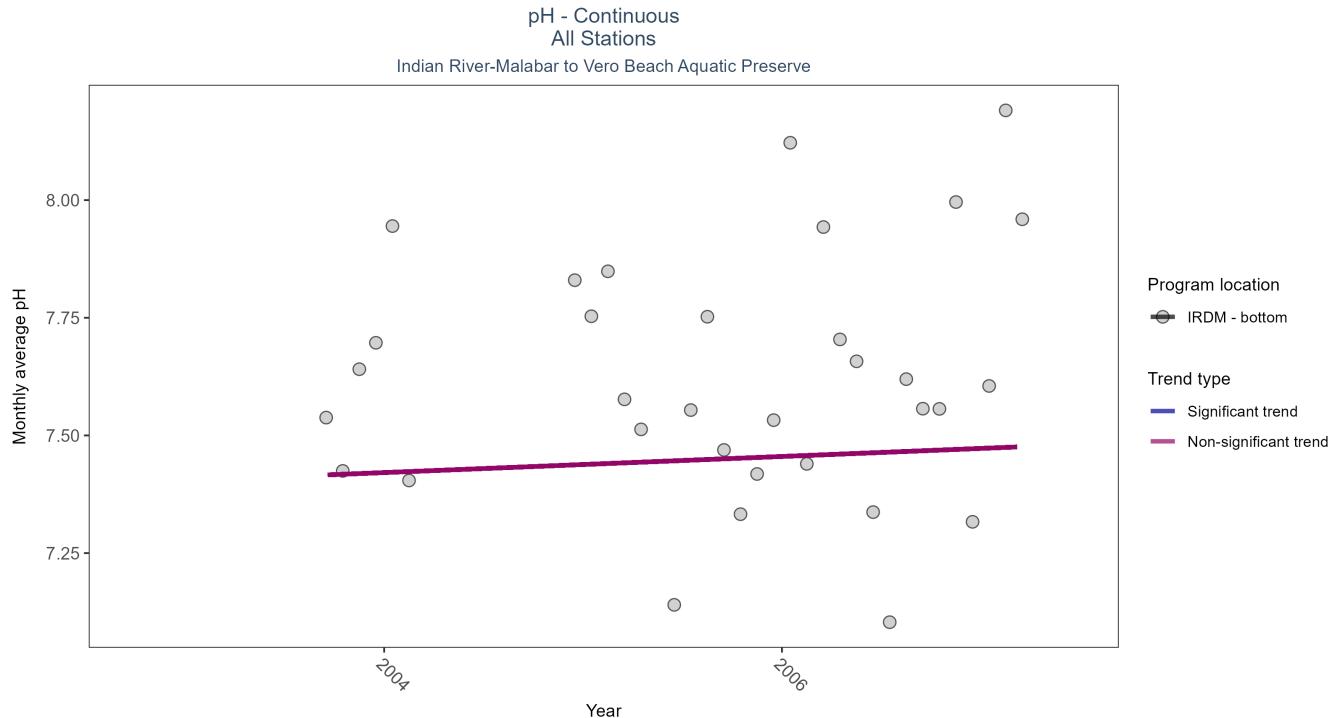


Figure 32: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 35: 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
IRDM	No significant trend	38184	5	2003 - 2007	7.6	0.15	7.4	0.02	0.65

No detectable change in monthly average pH was observed at one location.

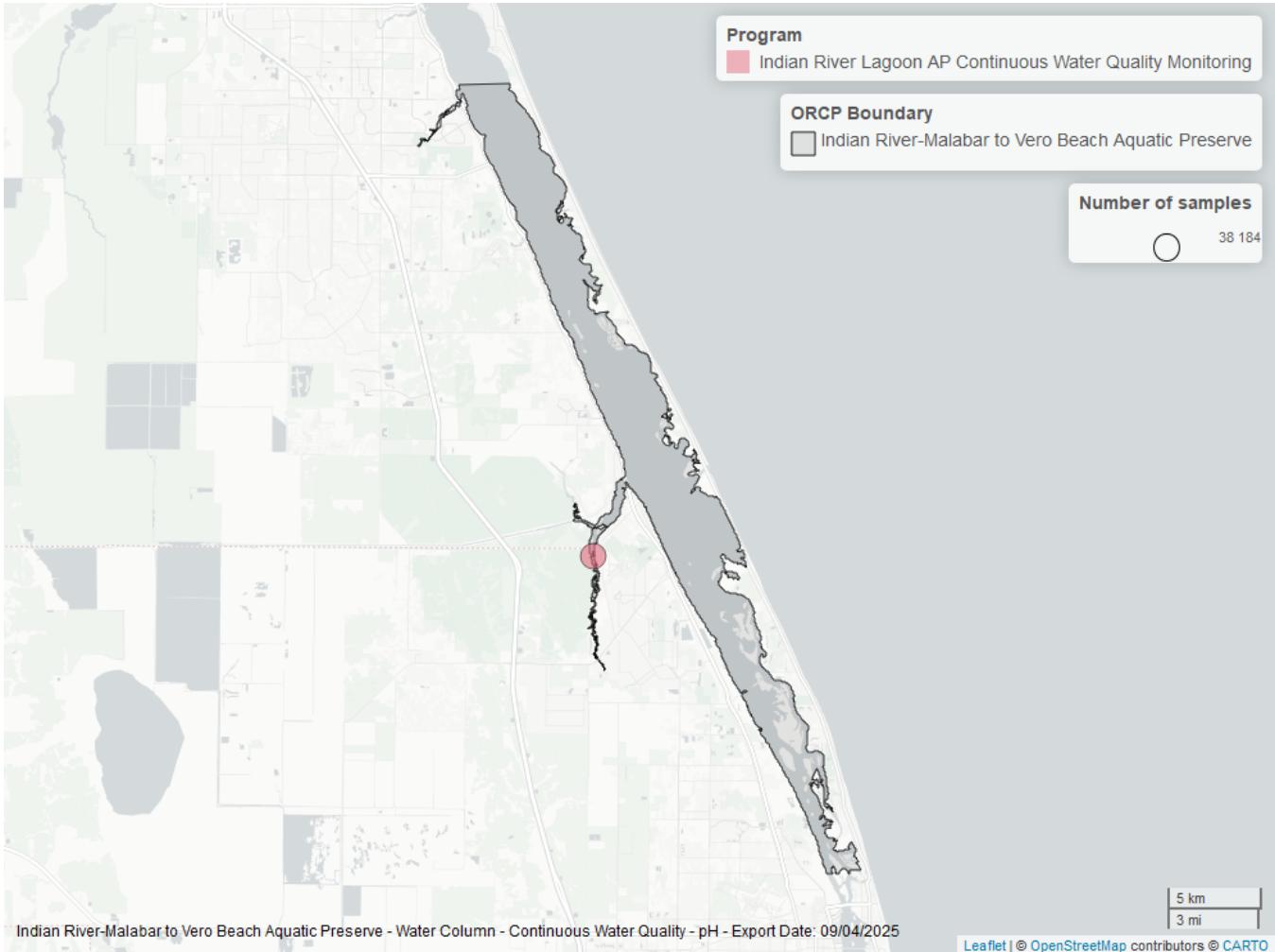


Figure 33: Map showing location of ph continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

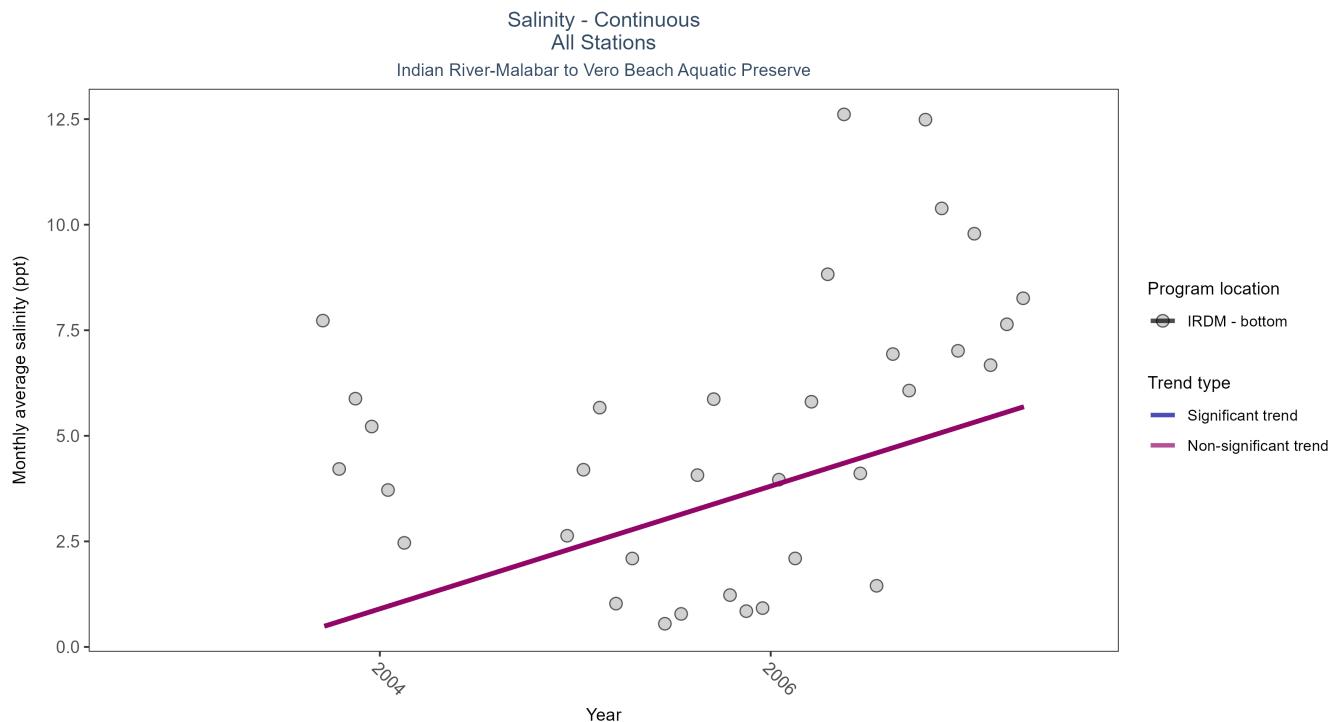


Figure 34: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 36: 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
IRDM	No significant trend	43791	5	2003 - 2007	3.9	0.45	-0.55	1.45	0.06

No detectable change in monthly average salinity was observed at one location.

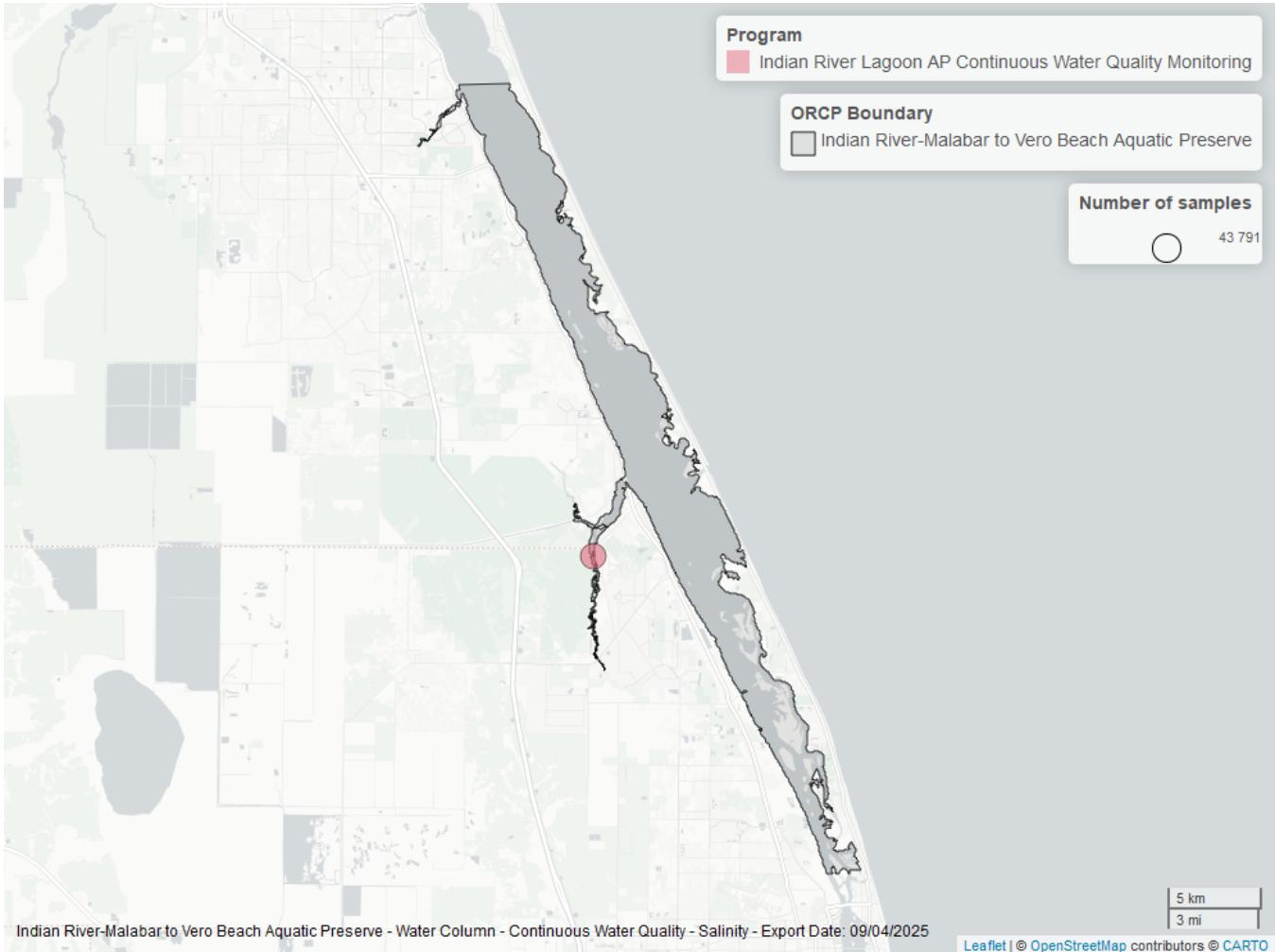


Figure 35: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

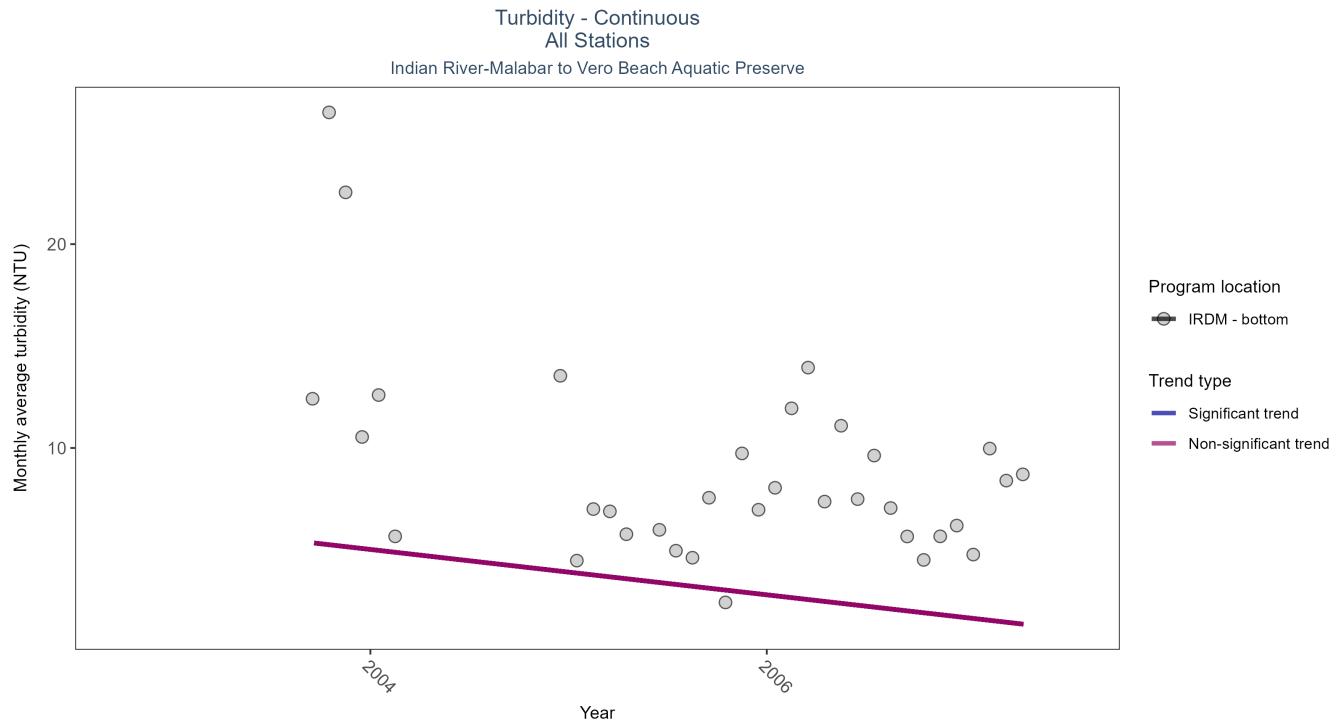


Figure 36: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 37: 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
IRDM	No significant trend	39124	5	2003 - 2007	5	0.05	6.13	-1.11	0.88

No detectable change in monthly average turbidity was observed at one location.

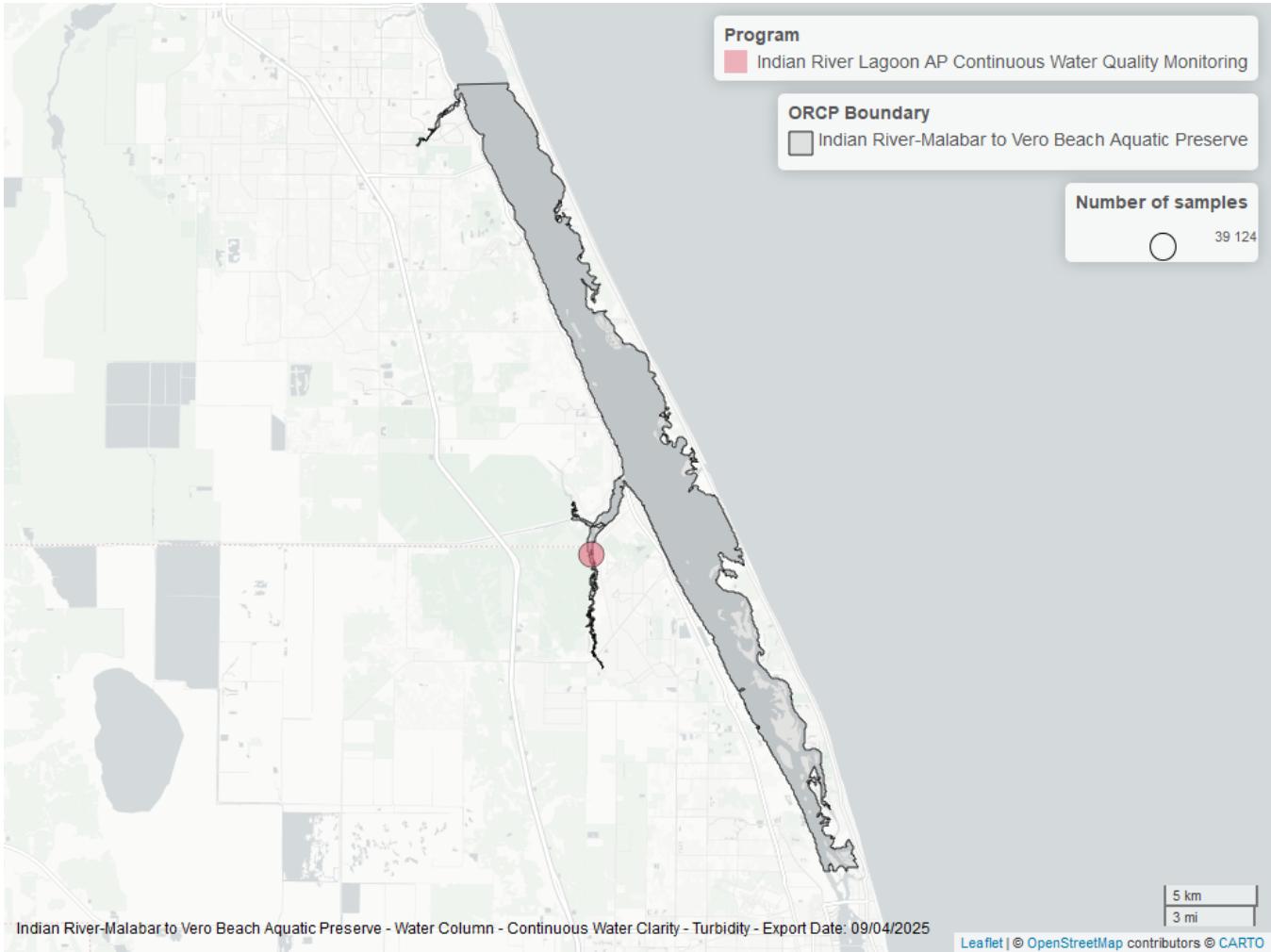


Figure 37: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

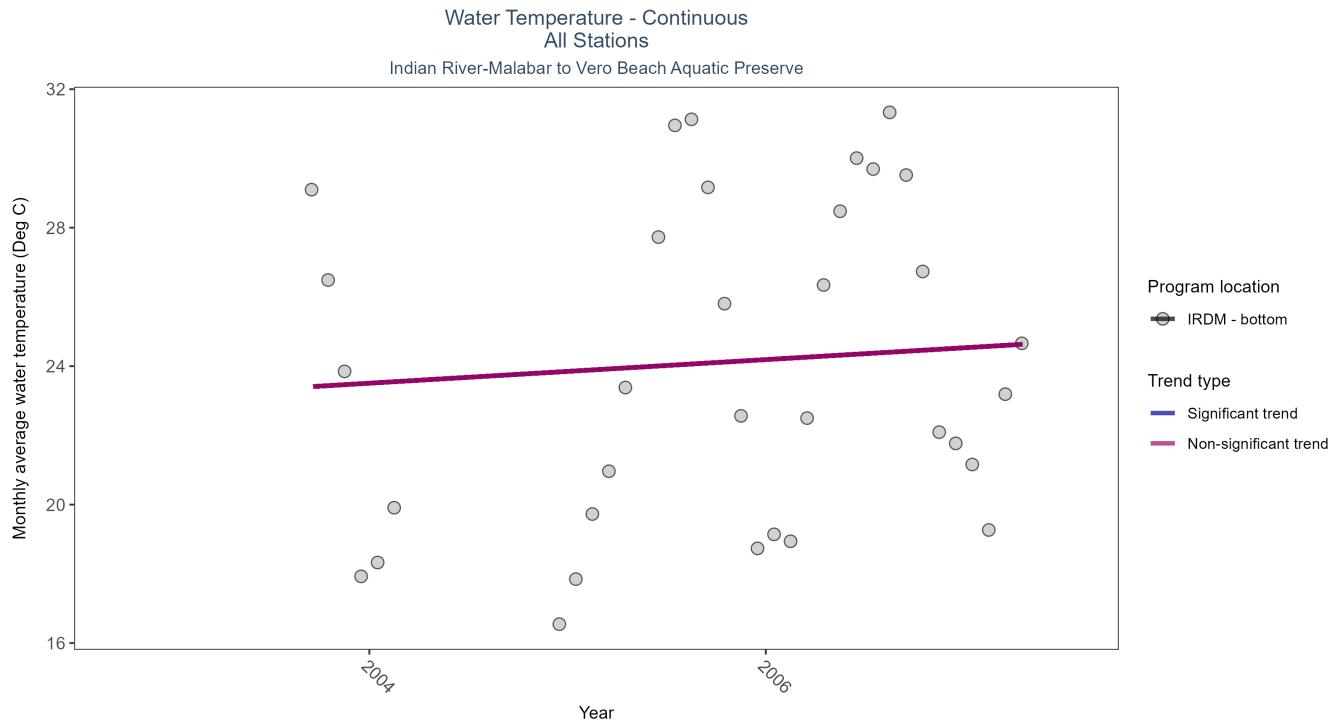


Figure 38: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 38: 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
IRDM	No significant trend	43791	5	2003 - 2007	23.5	0.29	23.17	0.34	0.19

No detectable change in monthly average water temperature was observed at one location.

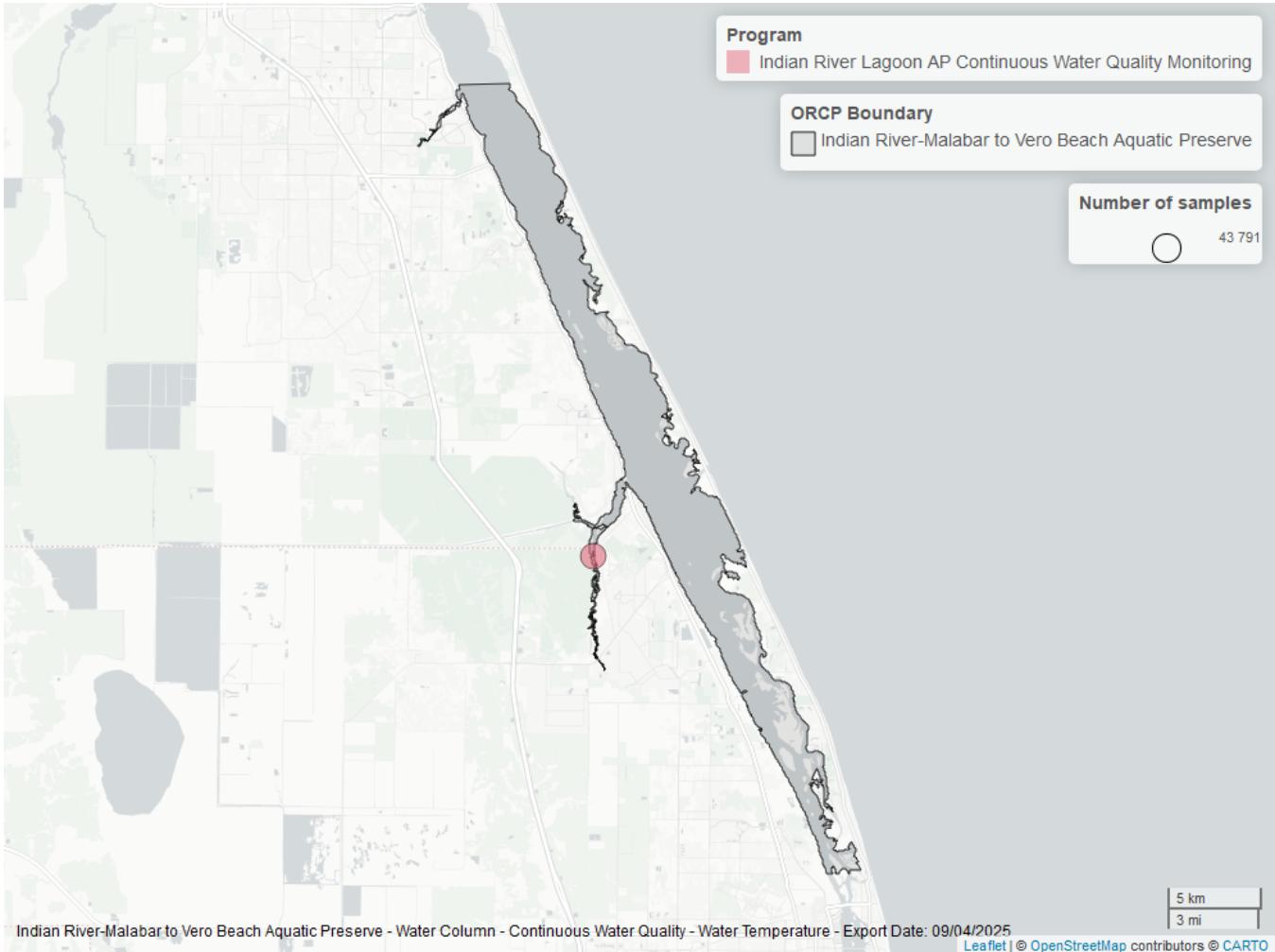


Figure 39: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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

Indian River-Malabar to Vero Beach Aquatic Preserve
SAV Percent Cover - Sample Locations



Program name
Seagrass (SJRWMD)

Figure 40: Maps showing the temporal scope of SAV sampling sites within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve* by Program name.

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

Sampling locations by Program:

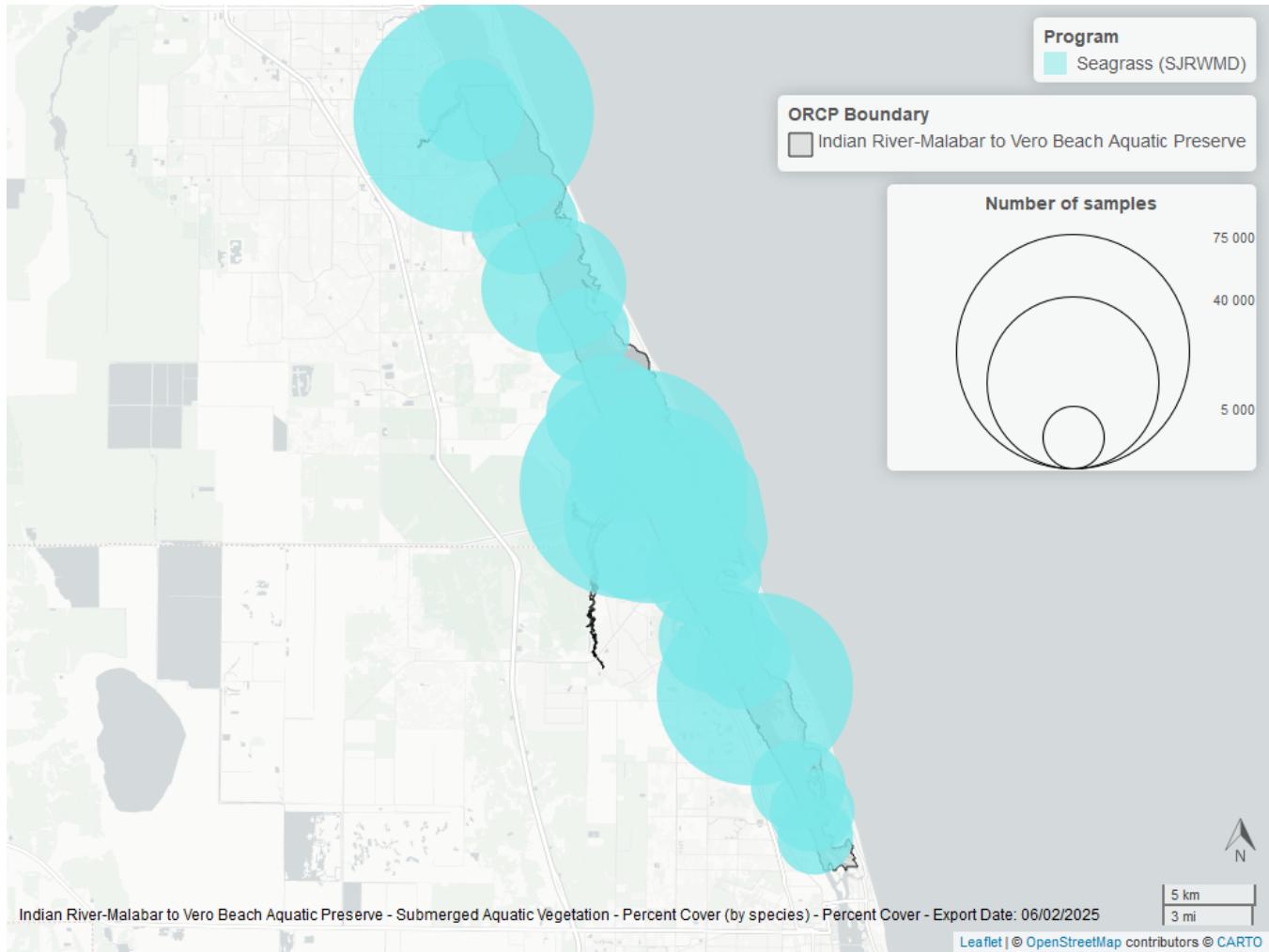


Figure 41: Map showing SAV sampling sites within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 39: Program Information for Submerged Aquatic Vegetation

ProgramID	N-Data	YearMin	YearMax	method	Sample Locations
3013	126887	1994	2024	Percent Cover	19
3013	149774	1994	2024	Percent Occurrence	19

Program names:

3013 - Seagrass (SJRWMD)⁹
3013 - Seagrass (SJRWMD)⁹

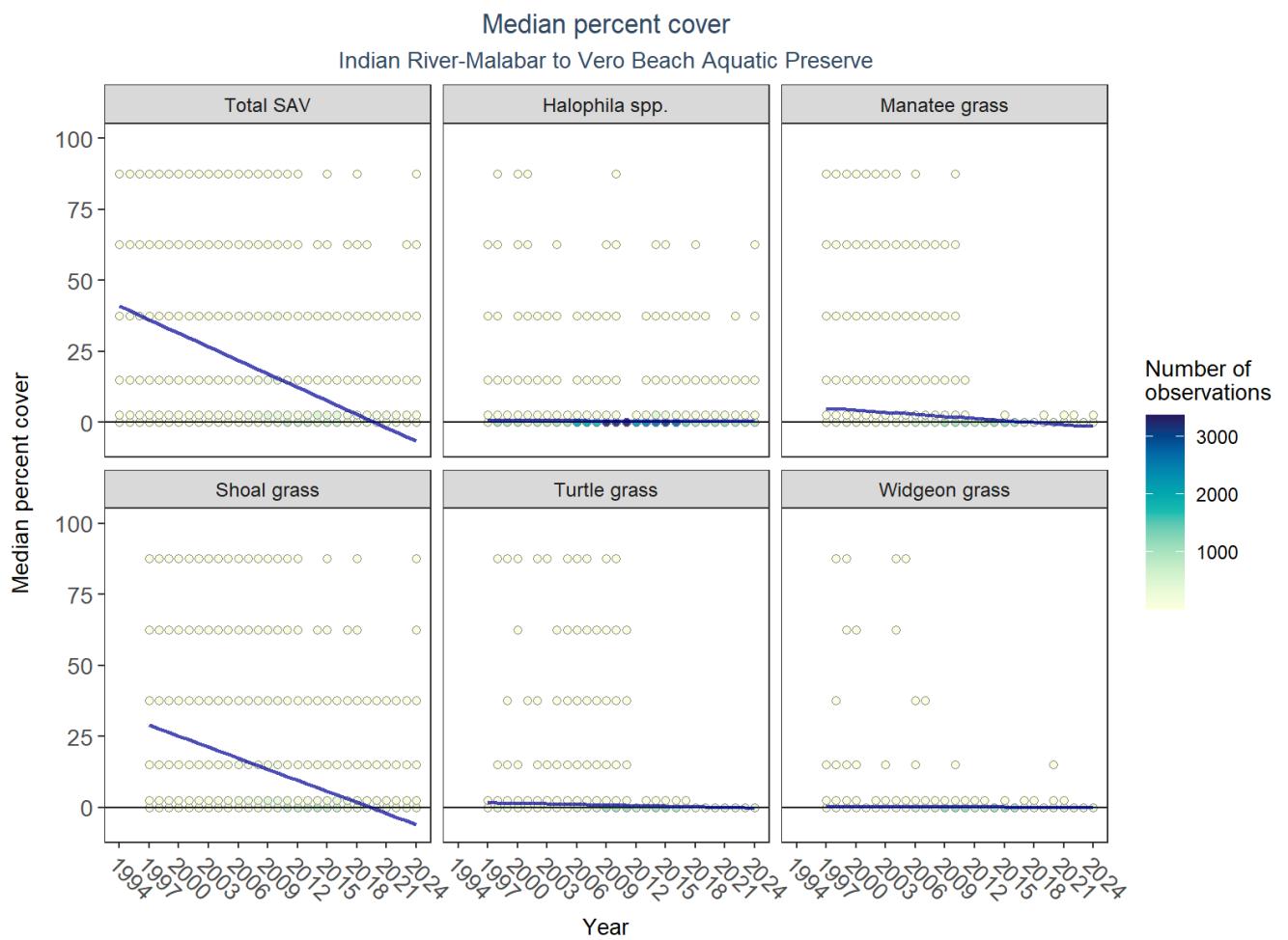


Figure 42: Scatter plots of median percent cover of submerged aquatic vegetation over time by group. Plots for time series that included five or more years of observations show the estimated trend as a blue line.

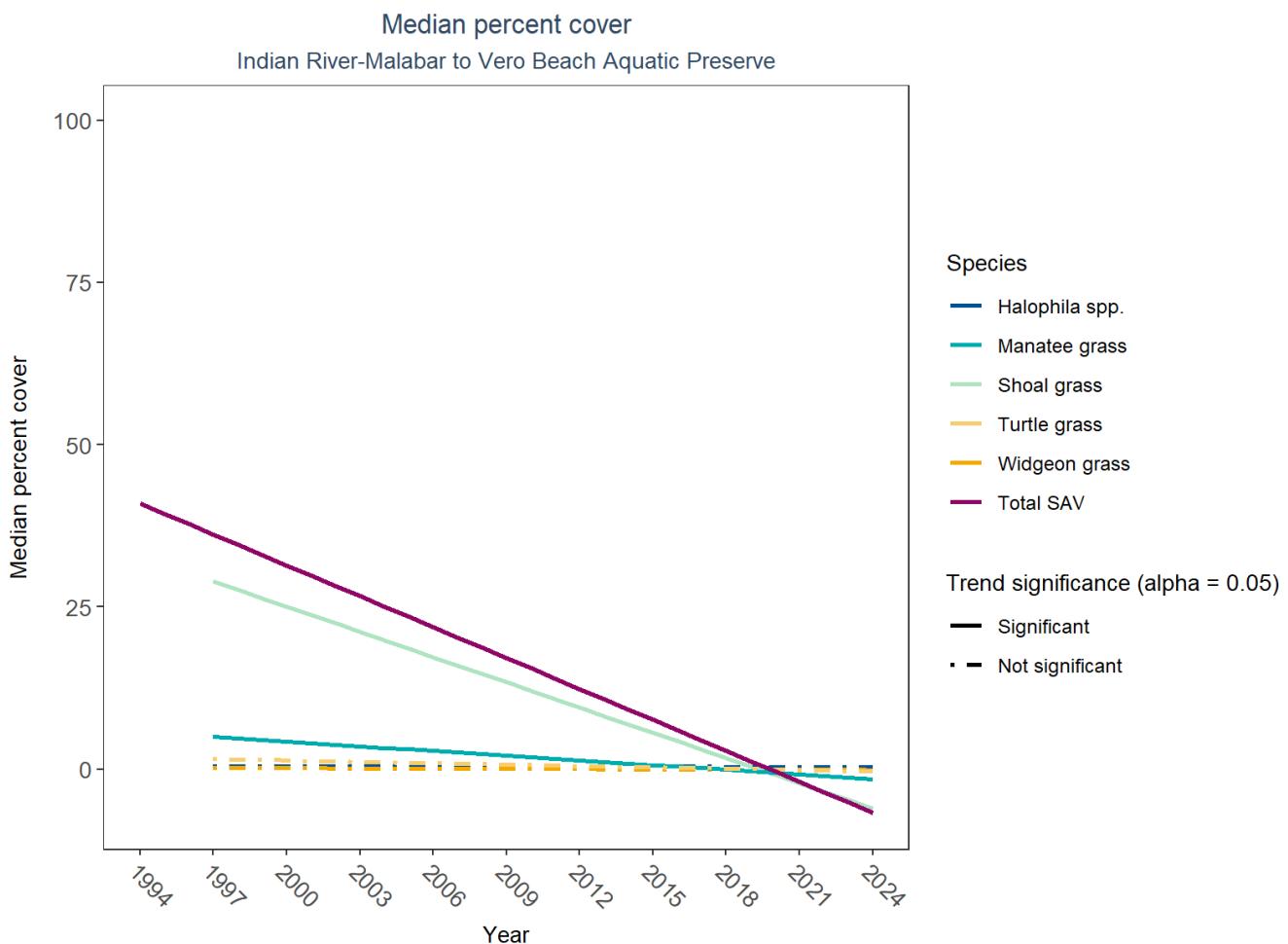


Figure 43: Trends in median percent cover for various seagrass species in Indian River-Malabar to Vero Beach Aquatic Preserve - simplified

Table 40: Percent Cover Trend Analysis for Indian River-Malabar to Vero Beach Aquatic Preserve

Common Name	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae	Insufficient data to calculate trend	-	-	-	-
Shoal grass	Significantly decreasing trend	1997 - 2024	32.8521341	-1.2960951	0.0000000
Halophila spp.	No significant trend	1997 - 2024	0.5326841	-0.0051771	0.4708257
Widgeon grass	No significant trend	1997 - 2024	0.2485512	-0.0116683	0.1026609
Manatee grass	Significantly decreasing trend	1997 - 2024	5.7114019	-0.2407392	0.0044428
Turtle grass	No significant trend	1997 - 2024	1.7773430	-0.0692777	0.0975863
Total SAV	Significantly decreasing trend	1994 - 2024	40.9489597	-1.5875642	0.0000000
Total seagrass	Insufficient data to calculate trend	-	-	-	-

Annual decreases in percent cover were observed for total SAV (-1.6%), manatee grass (-0.2%), and shoal grass (-1.3%). *Halophila* spp., turtle grass, and widgeon grass showed no detectable change in percent cover. Trends in percent cover could not be evaluated for total seagrass and drift algae due to insufficient data.

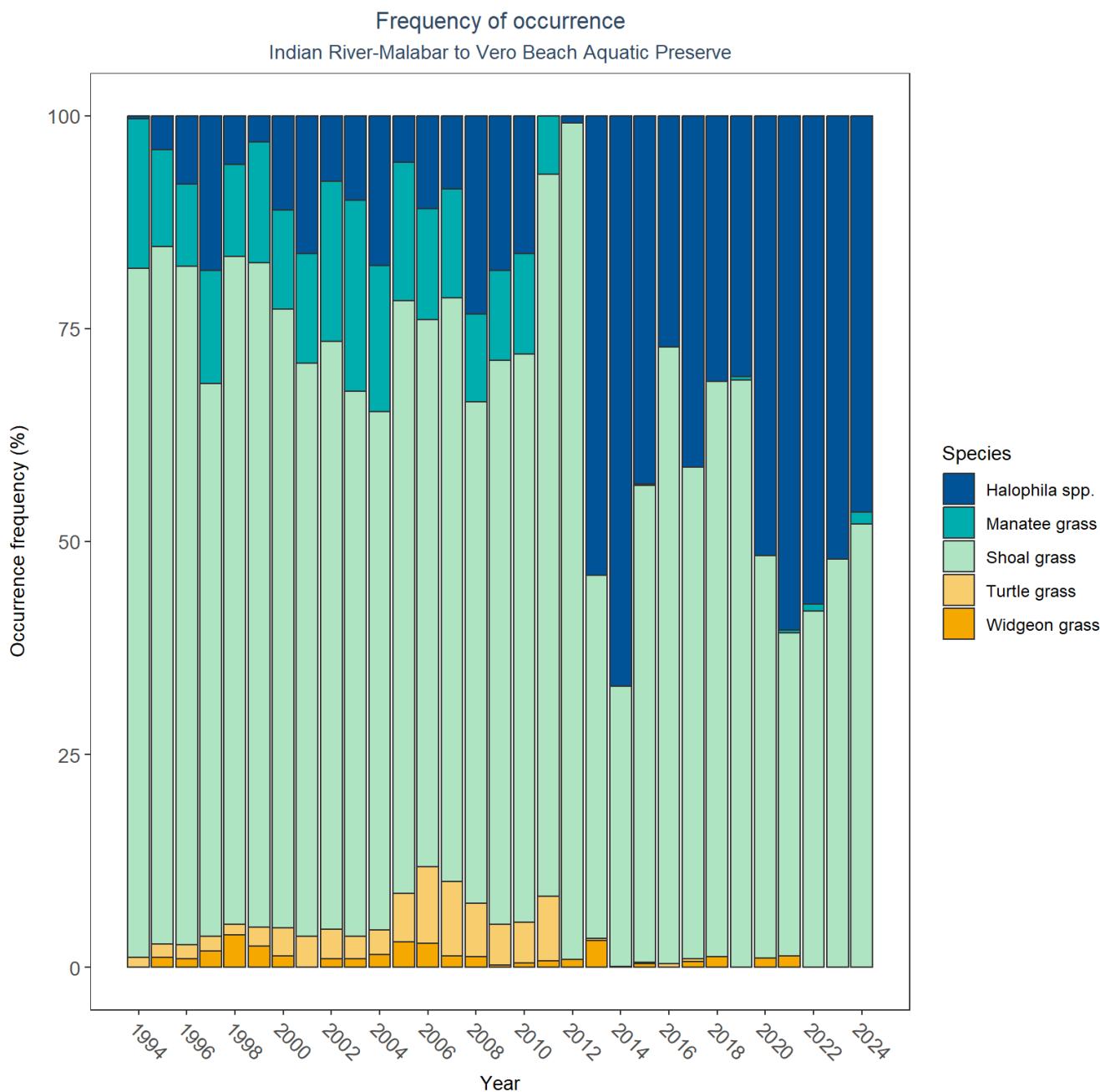


Figure 44: Frequency of occurrence for various seagrass species in Indian River-Malabar to Vero Beach Aquatic Preserve

SAV Water Column Analysis

The following parameters are available for Indian River-Malabar to Vero Beach 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](#)

Oyster

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

Density

Natural

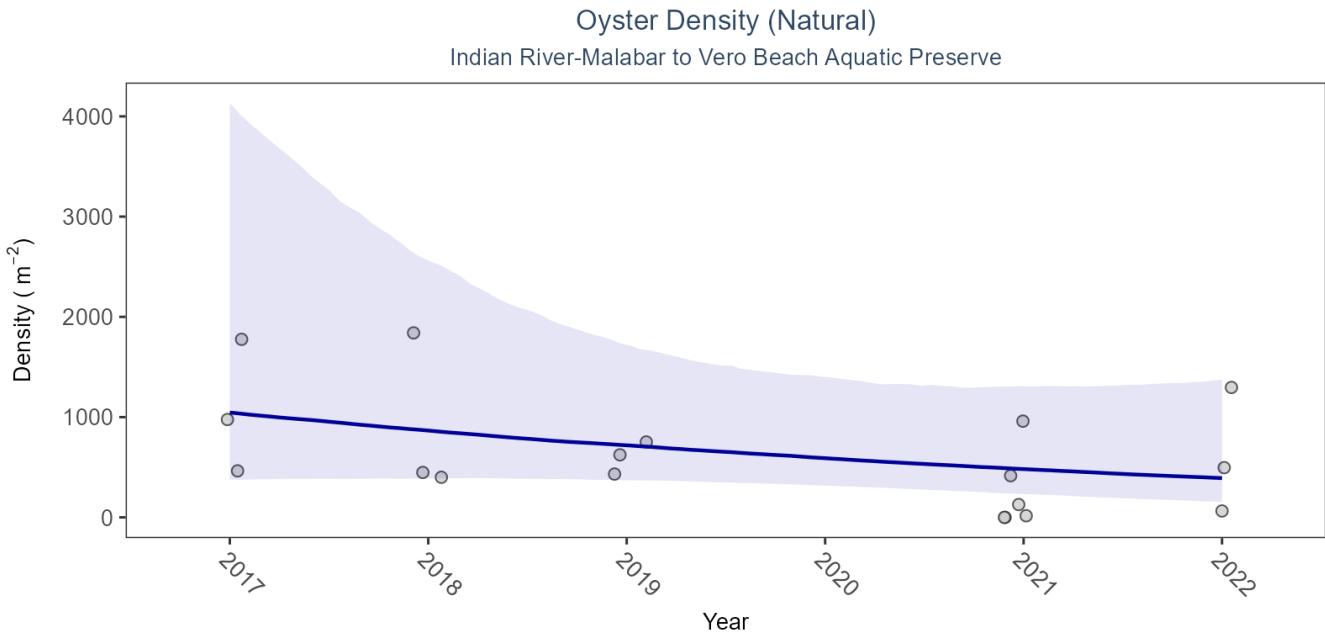


Figure 45: Scatter plot of oyster density over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 41: Model results for Oyster Density - Natural

Shell Type	Habitat Type	Trend Status	Estimate	Standard Error	Credible Interval
Live Oysters	Natural	Significantly decreasing trend	-130.86	278.08	-44.24 to -551.55

For natural reefs, density decreased by an average of 130.86 oysters per square meter per year.

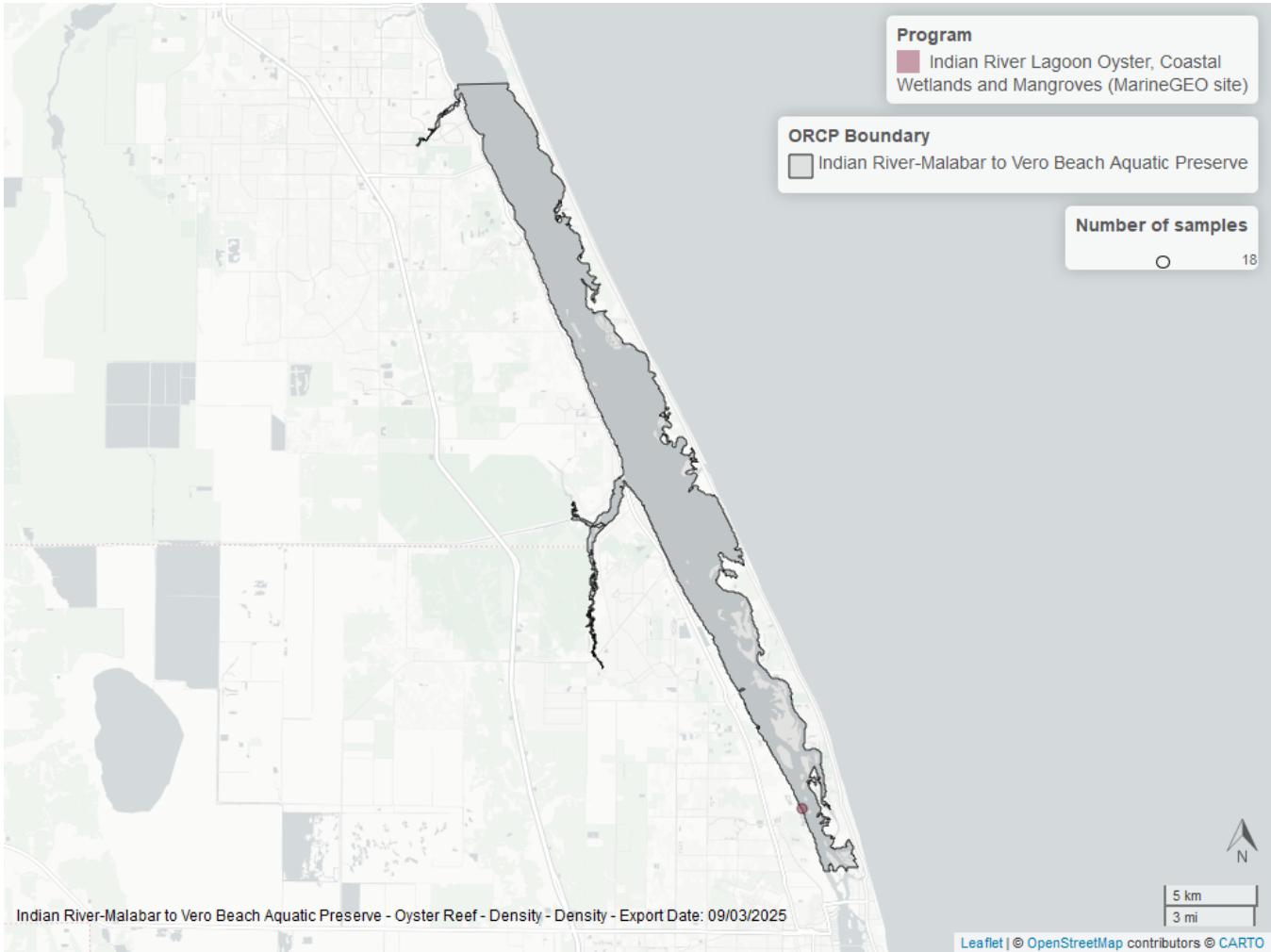


Figure 46: Map showing location of oyster density sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Percent Live

Natural

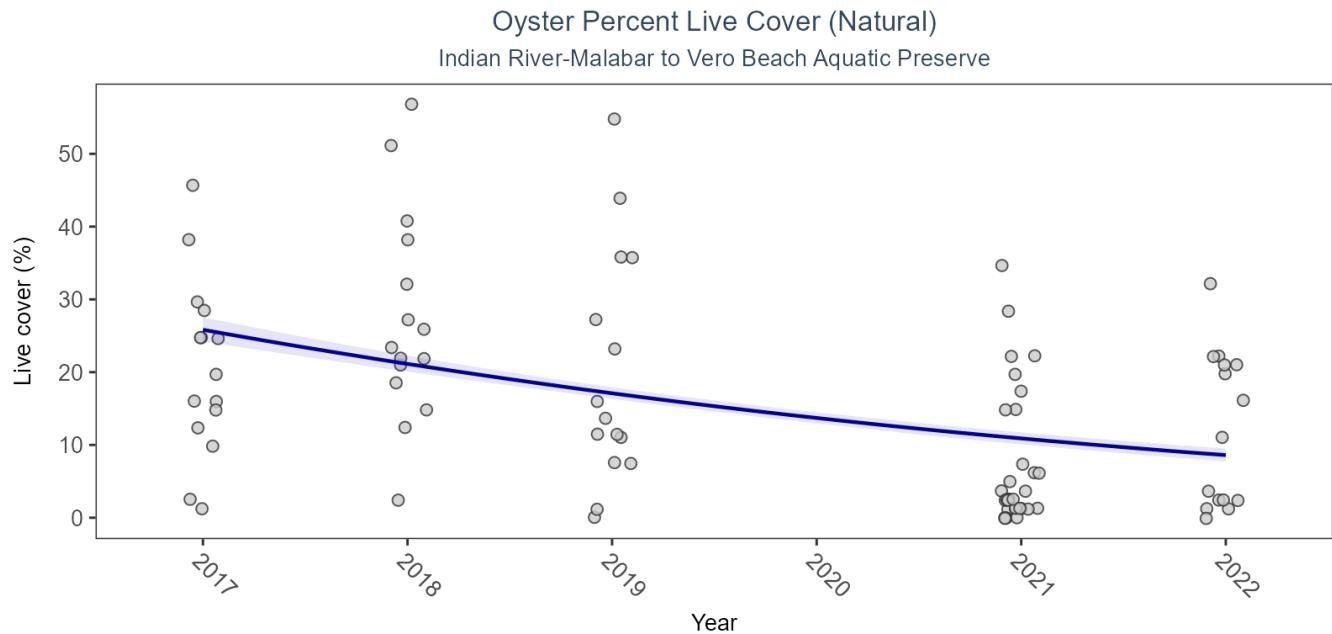


Figure 47: Scatter plot of percent live oysters over time. If the time series included five or more years with observations, an estimated trend (blue line) and a 95% credible interval (purple band) may also be plotted. Data points are jittered horizontally to reduce overlap.

Table 42: Model results for Oyster Percent Live - Natural

<i>Shell Type</i>	<i>Habitat Type</i>	<i>Trend Status</i>	<i>Estimate</i>	<i>Standard Error</i>	<i>Credible Interval</i>
Live Oysters	Natural	Significantly decreasing trend	-3.45	0.48	-3.29 to -3.61

For natural reefs, percent live cover decreased by an average of 3.45% per year.

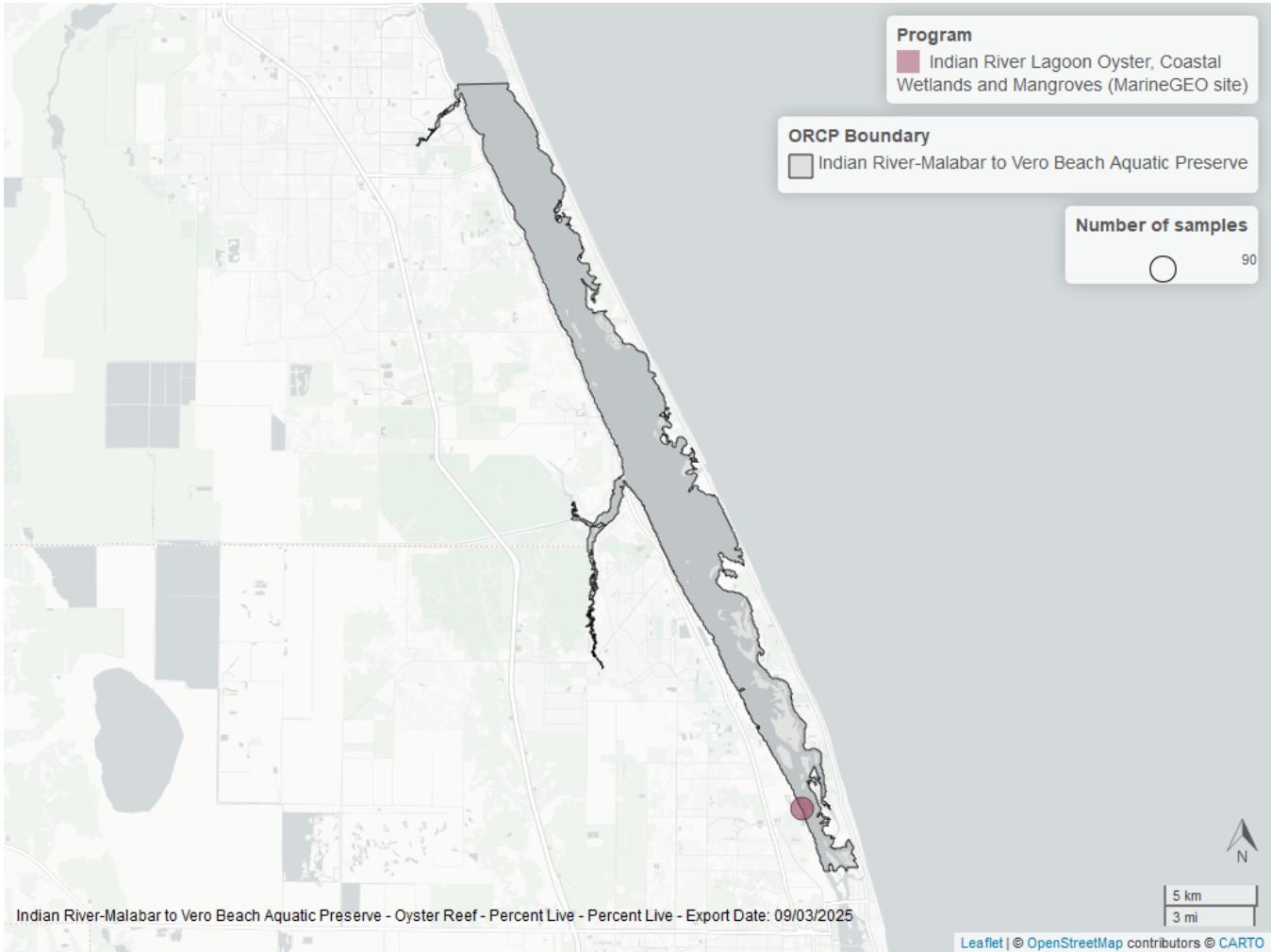


Figure 48: Map showing location of oyster percent live sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Shell Height

Natural

Oyster Size Class (Natural)
Indian River-Malabar to Vero Beach Aquatic Preserve

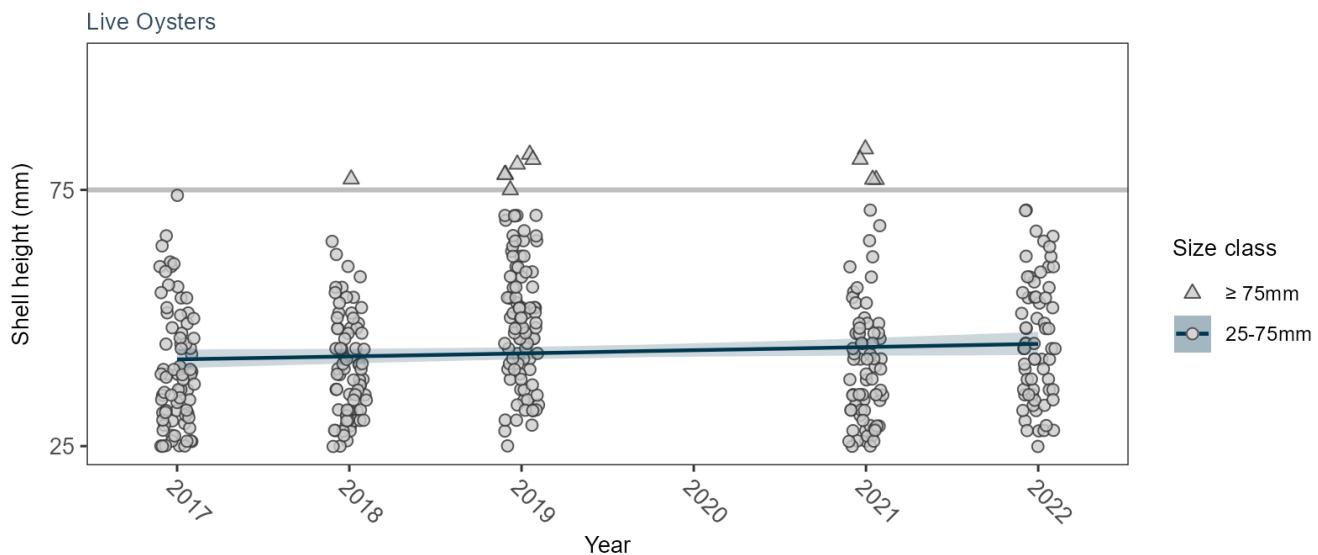


Table 43: Model results for Oyster Shell Height - Natural

<i>Shell Type</i>	<i>SizeClass</i>	<i>Habitat Type</i>	<i>Trend Status</i>	<i>Estimate</i>	<i>Standard Error</i>	<i>Credible Interval</i>
Dead Oyster Shells		Natural	-	-	-	-
Live Oysters		Natural	-	-	-	-
Live Oysters	>75mm	Natural	-	-	-	-
Live Oysters	25-75mm	Natural	No significant change	1.52	0.95	-0.16 to 3.54

For natural reefs, annual average live oyster shell height in the 25-75mm size class increased by 1.52 mm per year, and there was insufficient data to calculate a trend for live oysters in the >=75mm size class.

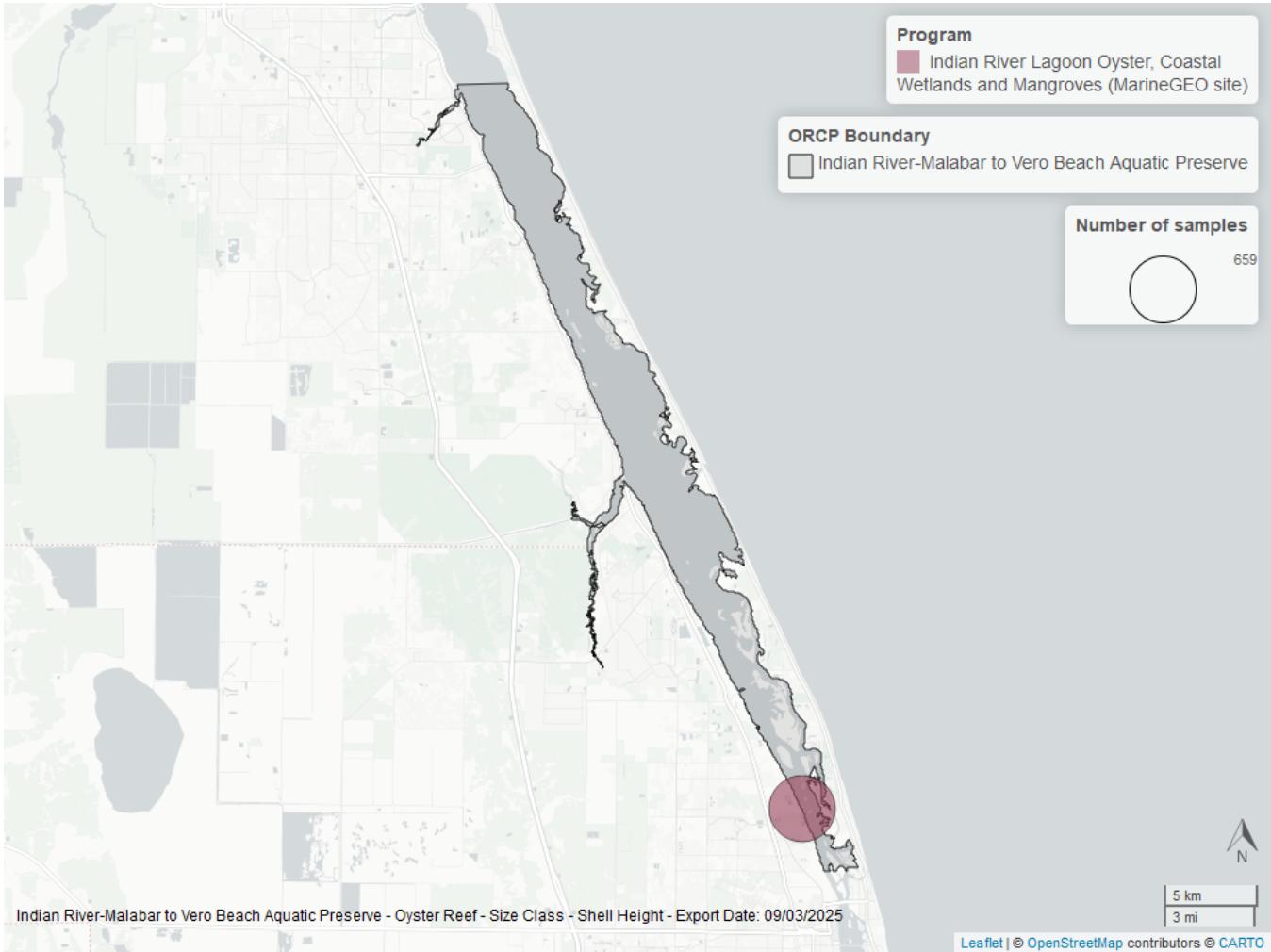


Figure 49: Map showing location of oyster shell height sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

Caulerpa ¹	Halophila engelmannii ¹	Thalassia testudinum ¹
Drift algae ¹	Halophila johnsonii ¹	Total SAV ¹
Halodule wrightii ¹	Ruppia maritima ¹	Total seagrass ¹
Halophila decipiens ¹	Syringodium filiforme ¹	Caulerpa ¹

1 - Submerged Aquatic Vegetation

References

1. Florida Department of Agriculture and Consumer Services (FDACS) - Division of Aquaculture. [Shellfish Harvest Area Classification Program](#). (2022).
2. Florida Department of Environmental Protection (DEP). [Florida STORET / WIN](#). (2024).
3. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). [Harmful Algal Bloom Marine Observation Network](#). (2018).
4. U.S. Environmental Protection Agency (EPA). [EPA STOrage and RETrieval Data Warehouse \(STORET\)/WQX](#). (2023).
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. Florida Fish and Wildlife Conservation Commission (FWC). [Fisheries-Independent Monitoring \(FIM\) Program](#). (2022).
7. U.S. Environmental Protection Agency (EPA); Office of Research and Development. [Environmental Monitoring Assessment Program](#). (2004).
8. Volusia County (Florida); Marine Discovery Center. [Lagoon Watch \(Formerly Marine Discovery Center\)](#). (2023).
9. St. Johns River Water Management District (SJRWMD). [Seagrass \(SJRWMD\)](#). (2023).
10. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Indian River Lagoon Aquatic Preserves. [Indian River Lagoon Aquatic Preserves Continuous Water Quality Monitoring](#). (2008).