

Indian River-Malabar to Vero Beach Aquatic Preserve

SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

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Indicators

Nutrients

Total Nitrogen - Discrete

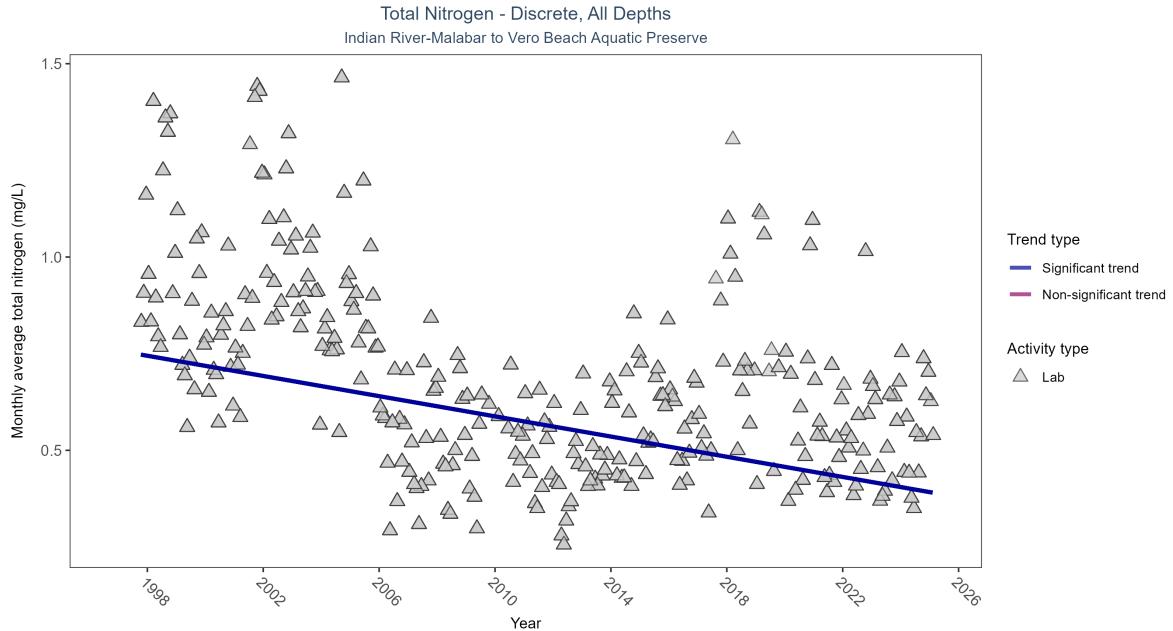


Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the plot.

Table 1: Seasonal Kendall-Tau Results for - Total Nitrogen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly decreasing trend	3268	29	1997 - 2025	0.6441	-0.33202	0.75767	-0.01306	0

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

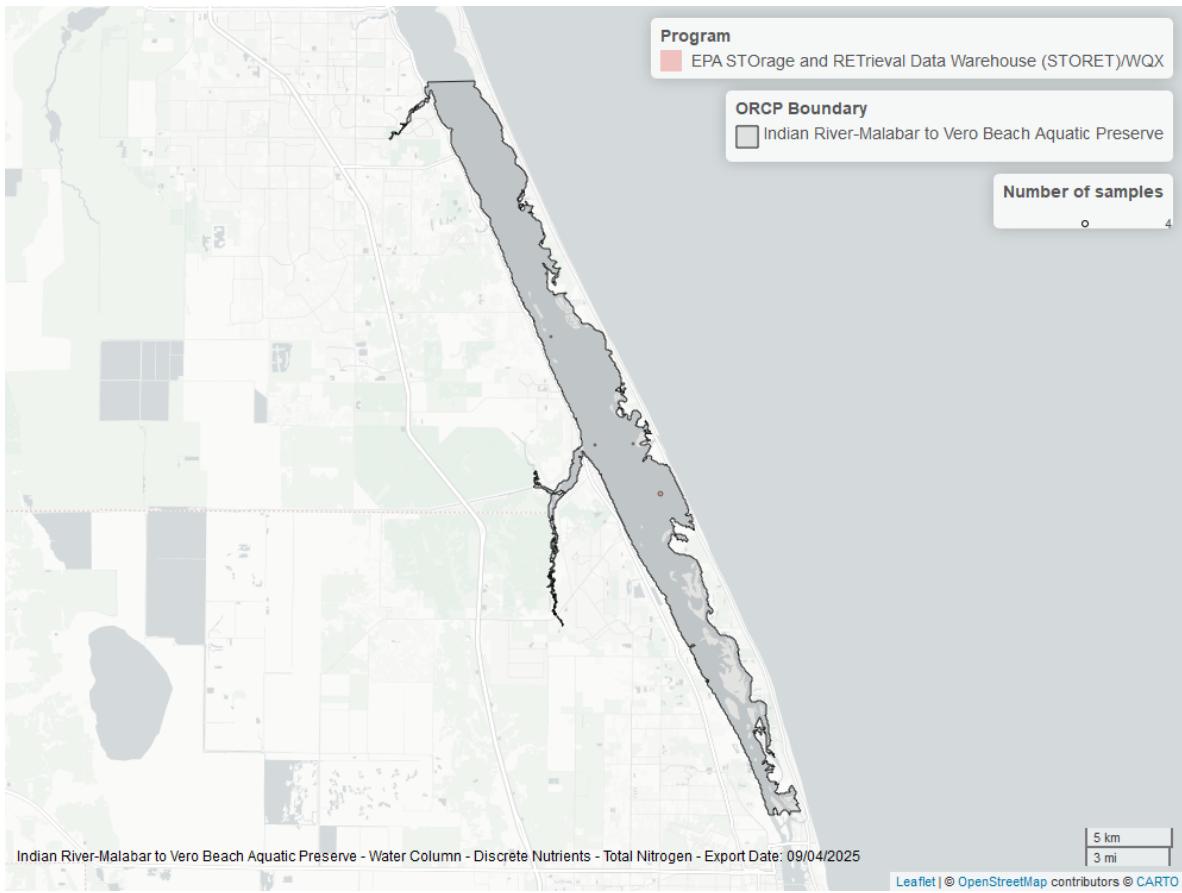


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

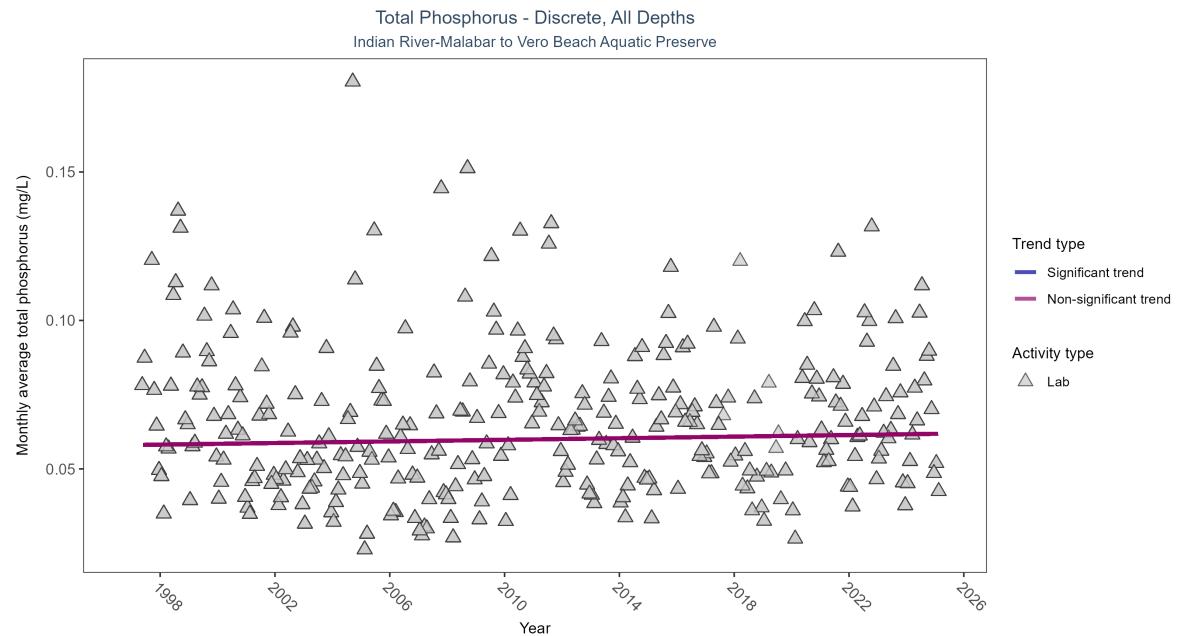


Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in the plot.

Table 2: Seasonal Kendall-Tau Results for - Total Phosphorus

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	No significant trend	6601	29	1997 - 2025	0.054	0.04888	0.05804	0.00013	0.2115

Total phosphorus showed no detectable trend between 1997 and 2025.

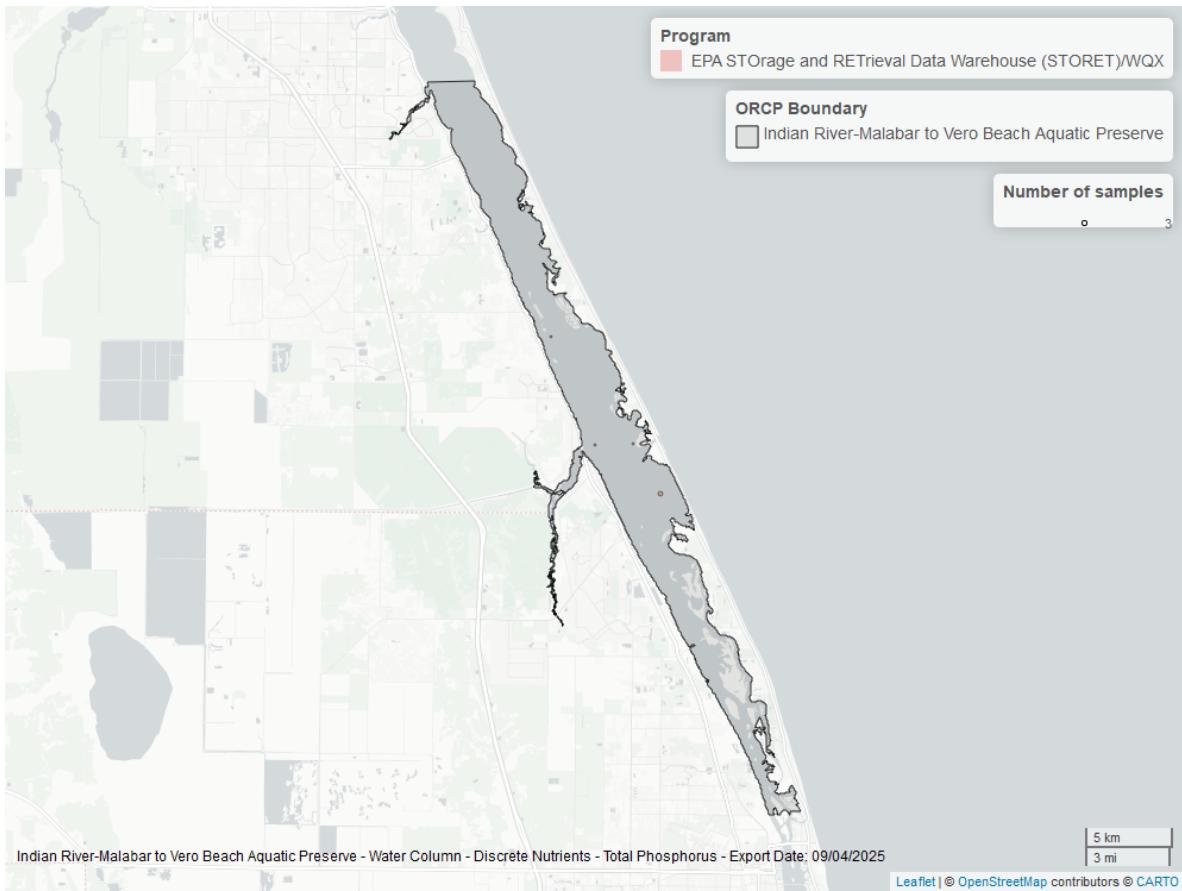


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

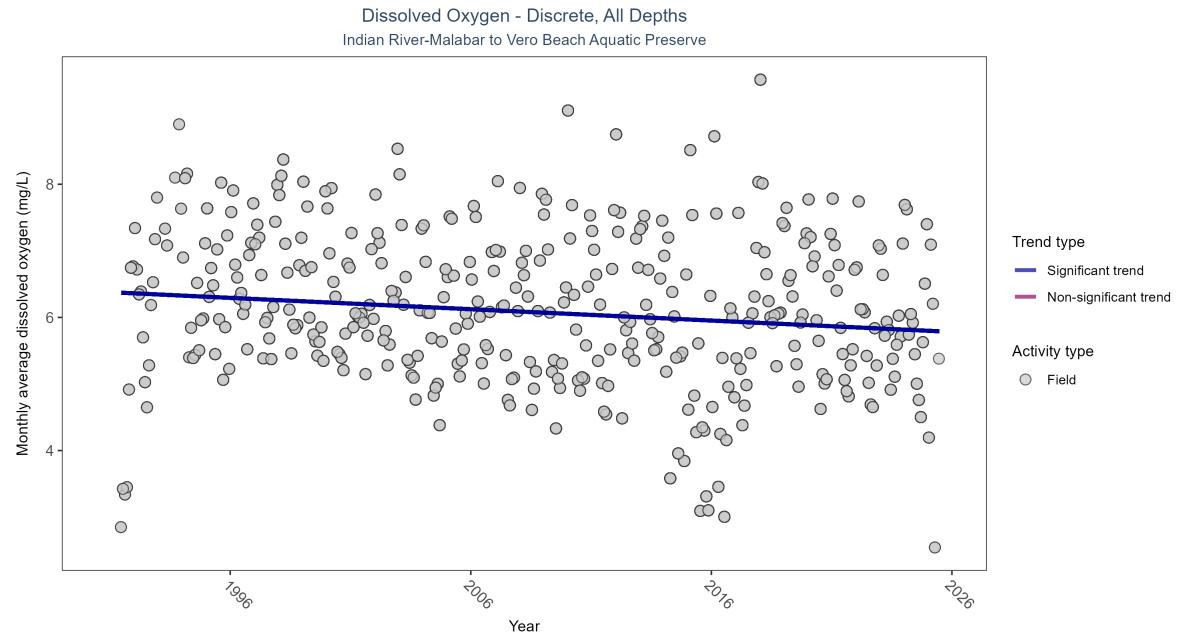


Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

Table 3: Seasonal Kendall-Tau Results for - Dissolved Oxygen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	Significantly decreasing trend	58119	35	1991 - 2025	6.2	-0.16942	6.37866	-0.01704	0

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

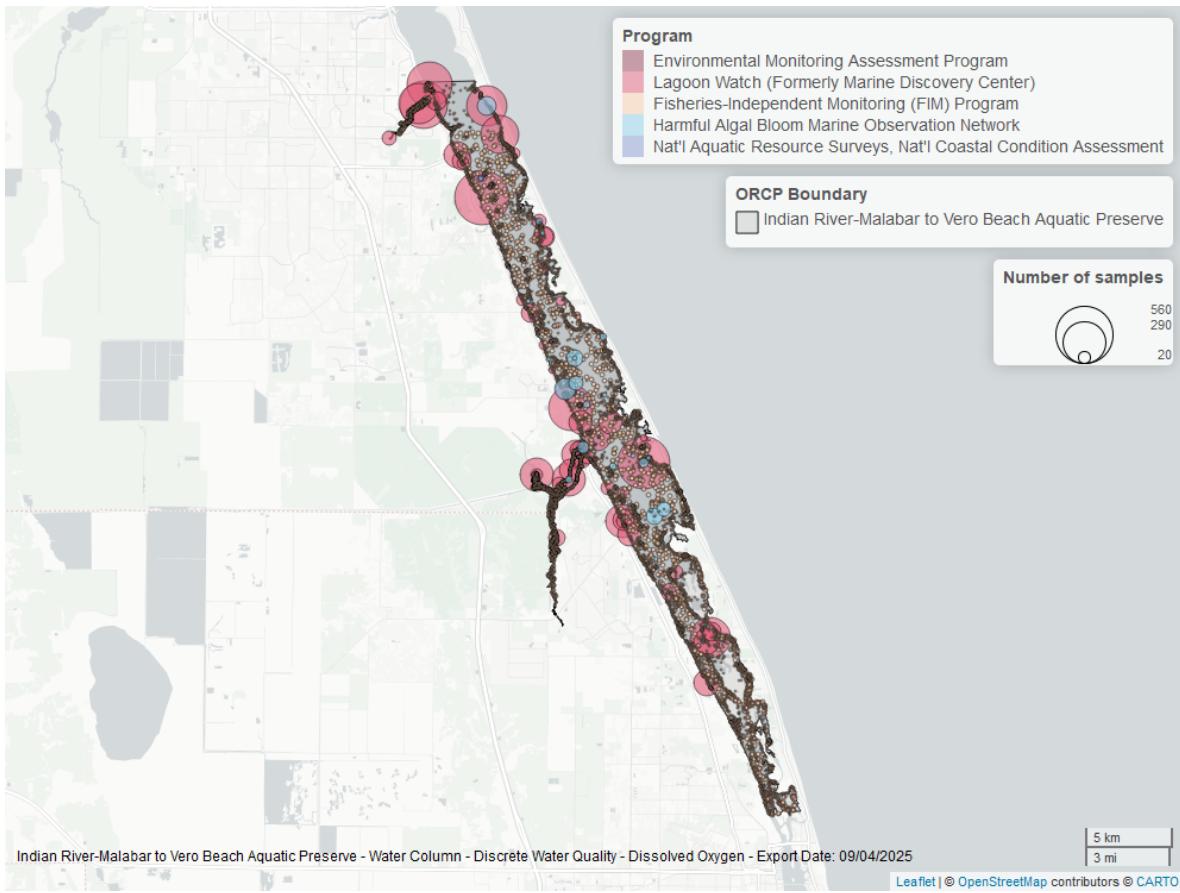


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

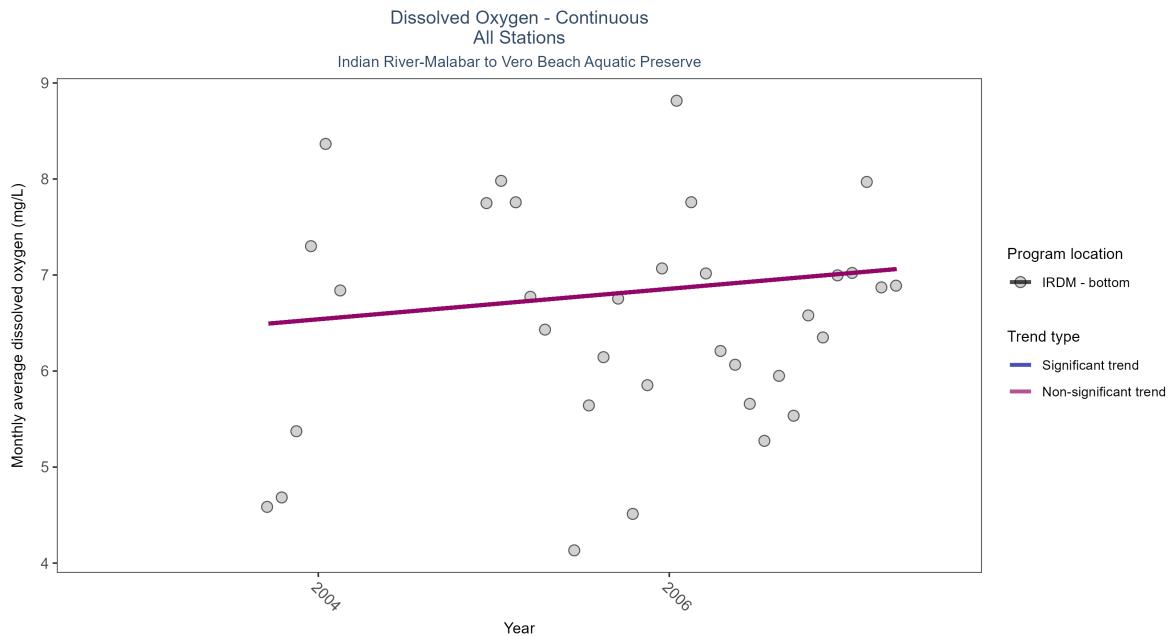


Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 4: Seasonal Kendall-Tau Results - Dissolved Oxygen

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	39746	5	2003 - 2007	6.5	0.15	6.38	0.16	0.4674

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

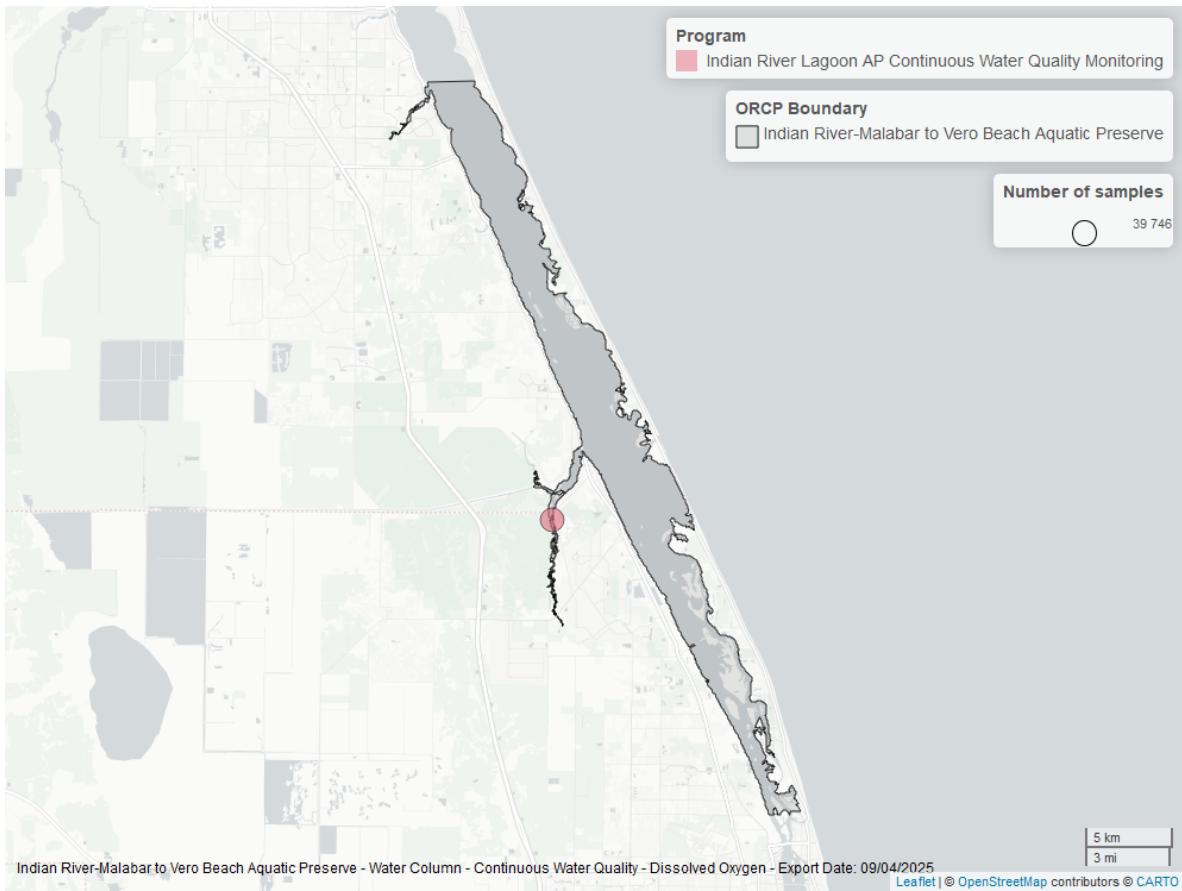


Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

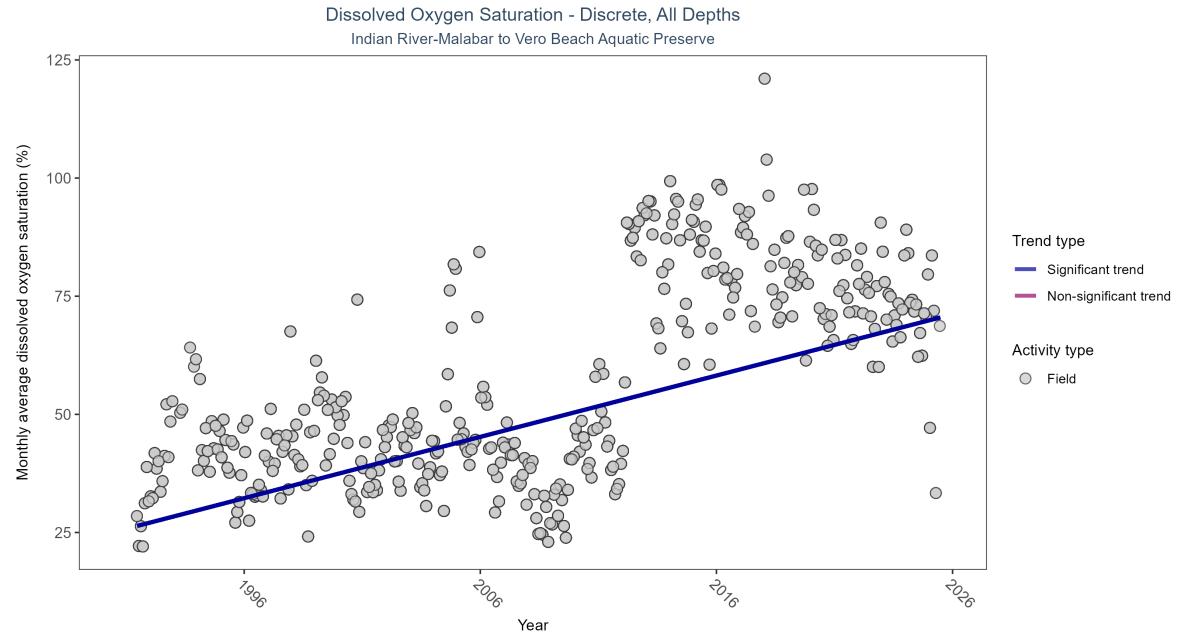


Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles)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

Table 5: Seasonal Kendall-Tau Results for - Dissolved Oxygen Saturation

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	Significantly increasing trend	13694	35	1991 - 2025	69.327	0.39812	25.77716	1.29727	0

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

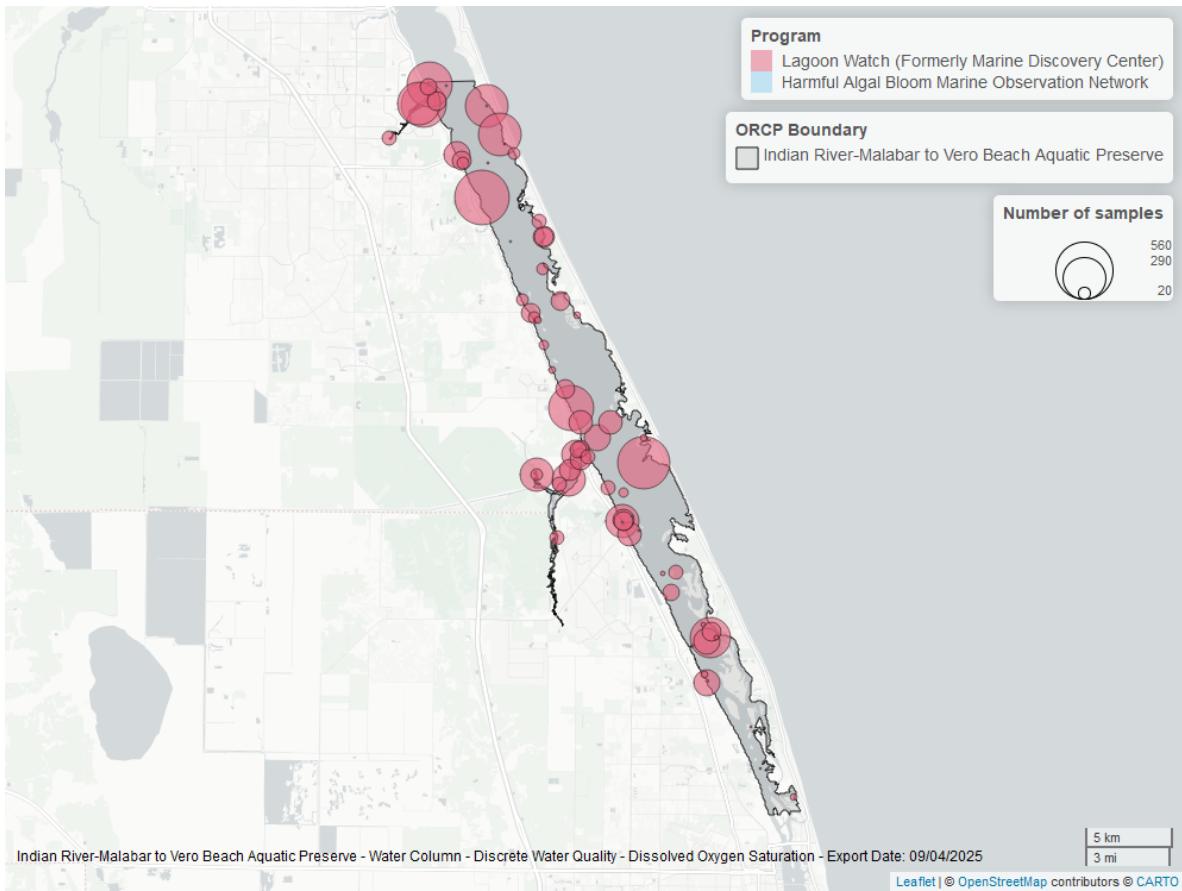


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

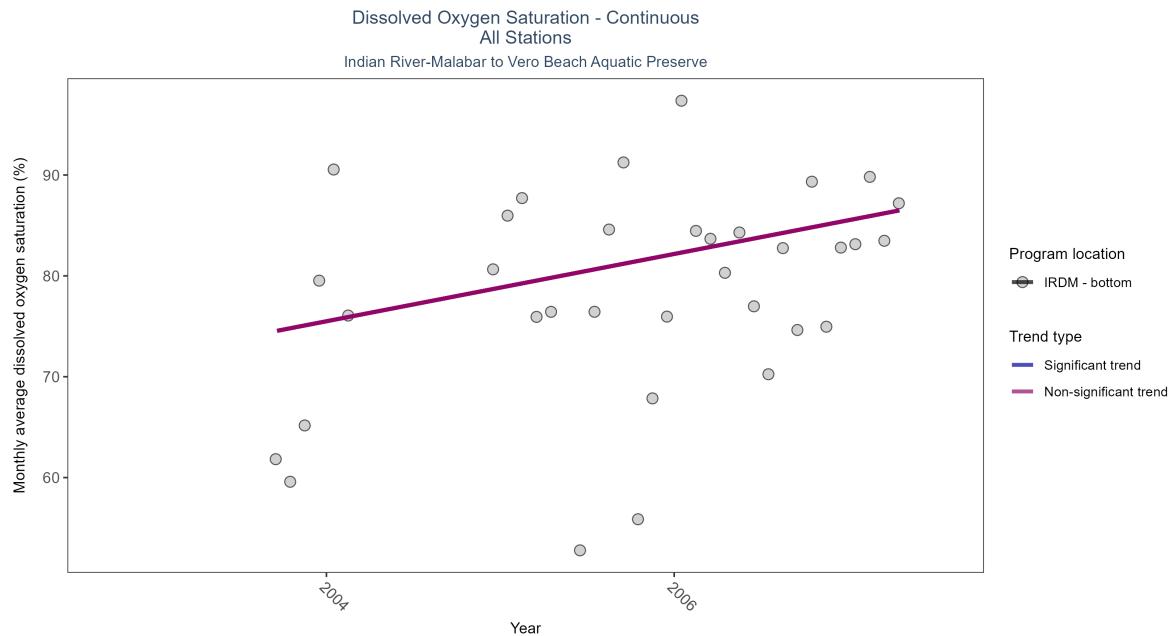


Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 6: Seasonal Kendall-Tau Results - Dissolved Oxygen Saturation

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	39746	5	2003 - 2007	77.7	0.29	72.16	3.34	0.1099

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

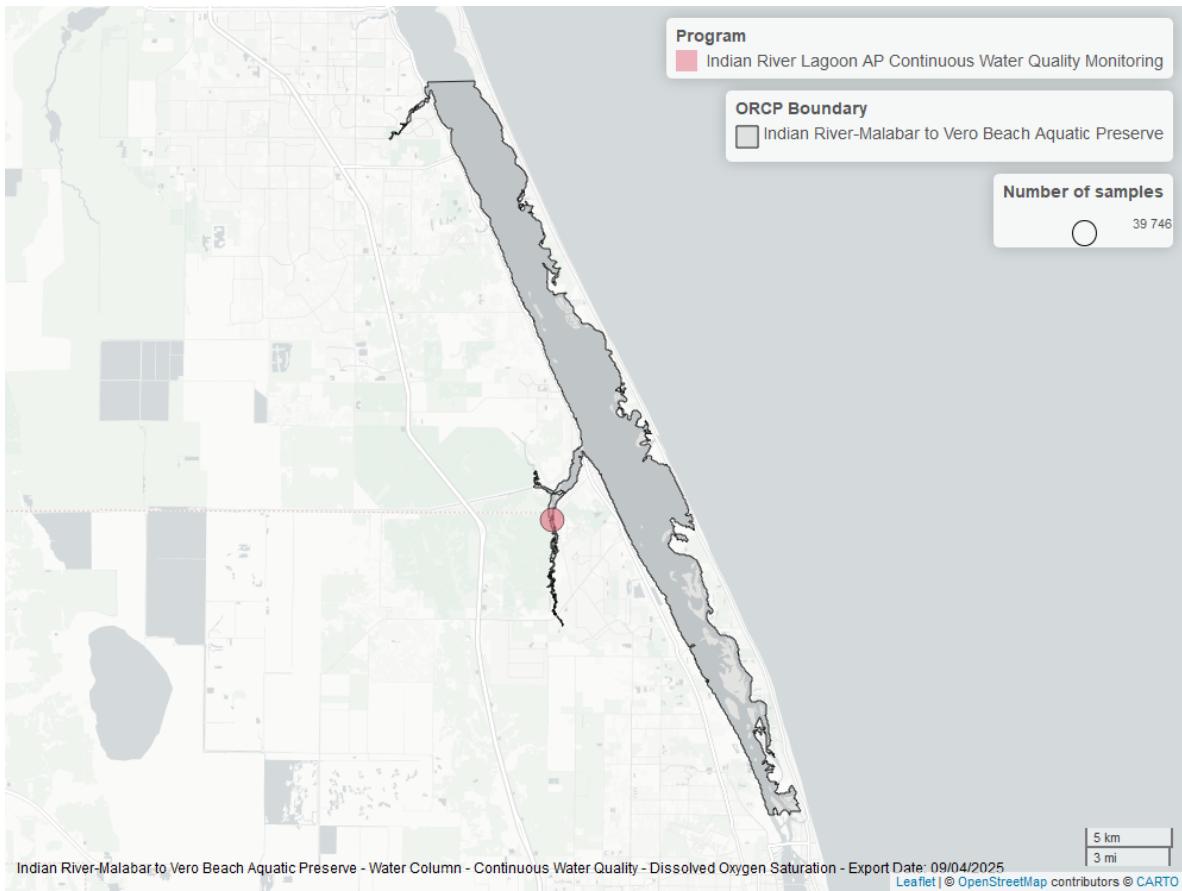


Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

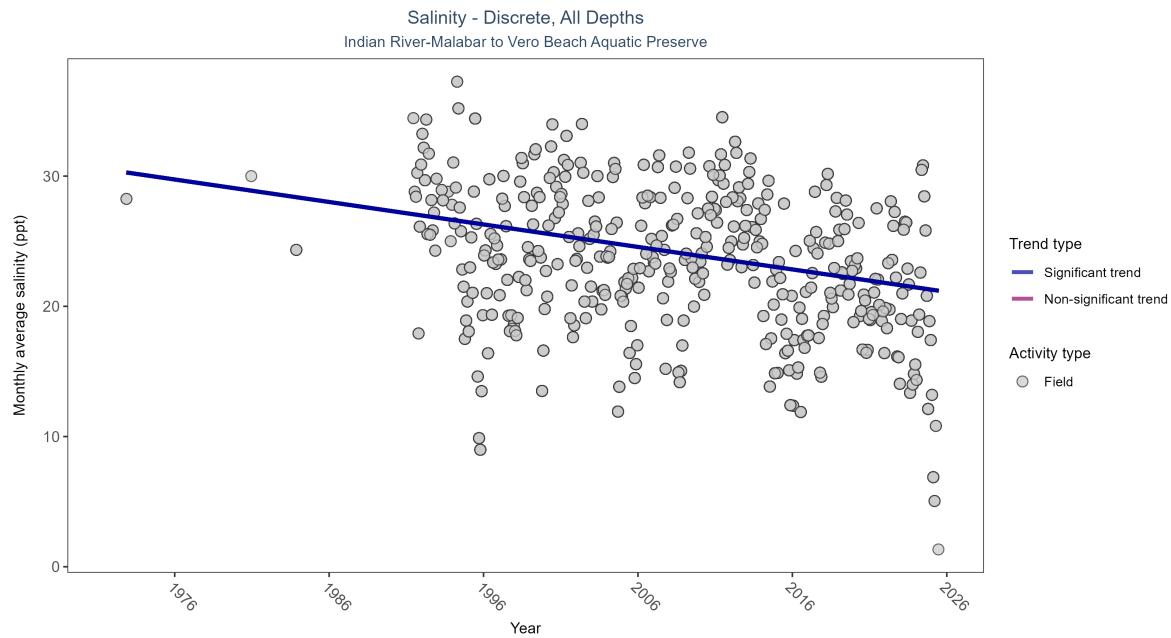


Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (triangles) are both included in the plot.

Table 7: Seasonal Kendall-Tau Results for - Salinity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
All	Significantly decreasing trend	61253	38	1972 - 2025	26	-0.24936	30.43039	-0.17264	0

Monthly average salinity decreased by 0.17 ppt per year.

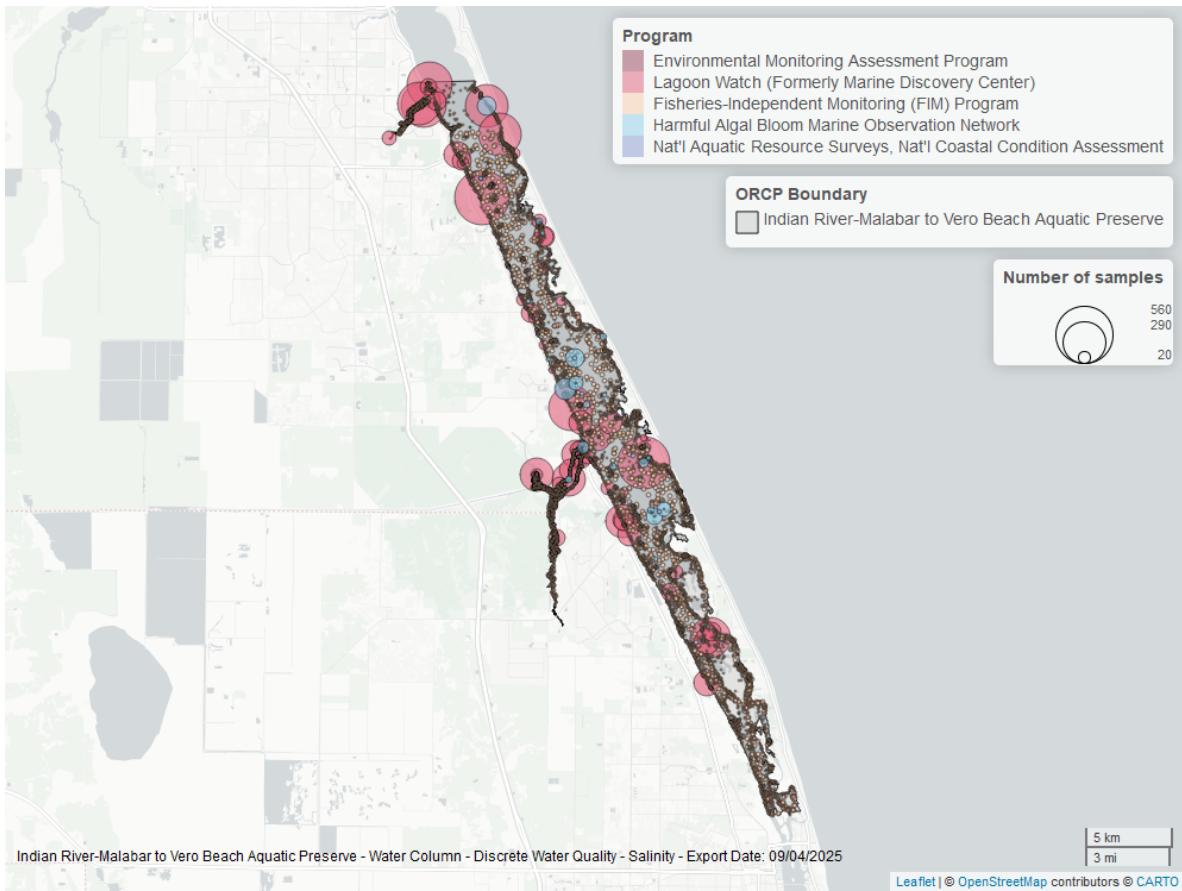


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

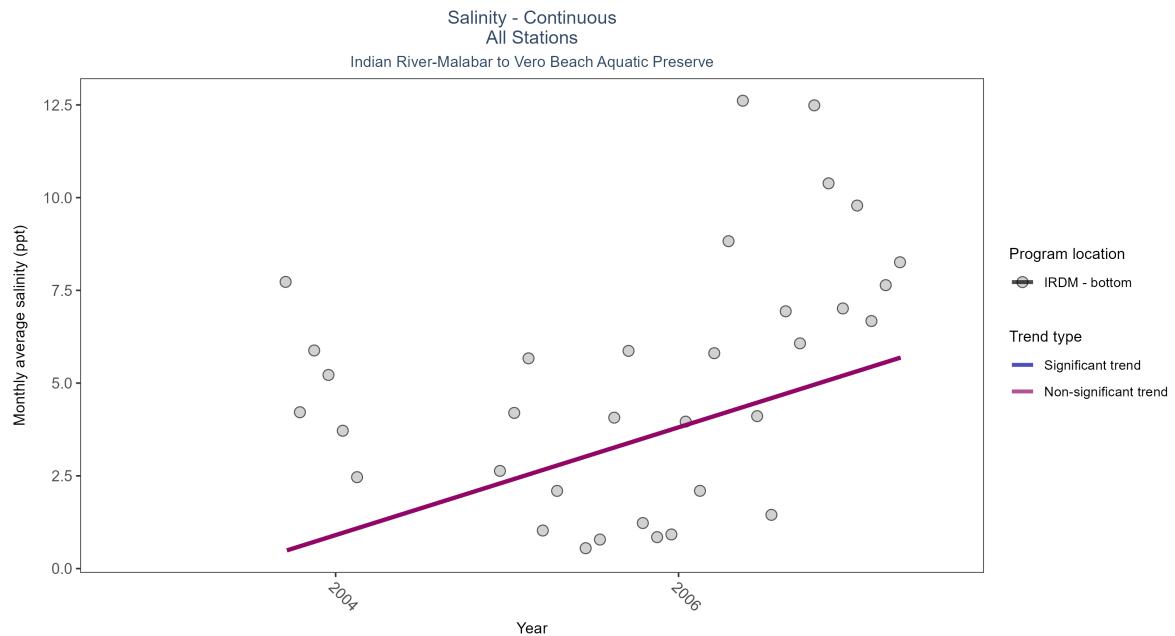


Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 8: Seasonal Kendall-Tau Results - Salinity

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	43791	5	2003 - 2007	3.9	0.45	-0.55	1.45	0.0588

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

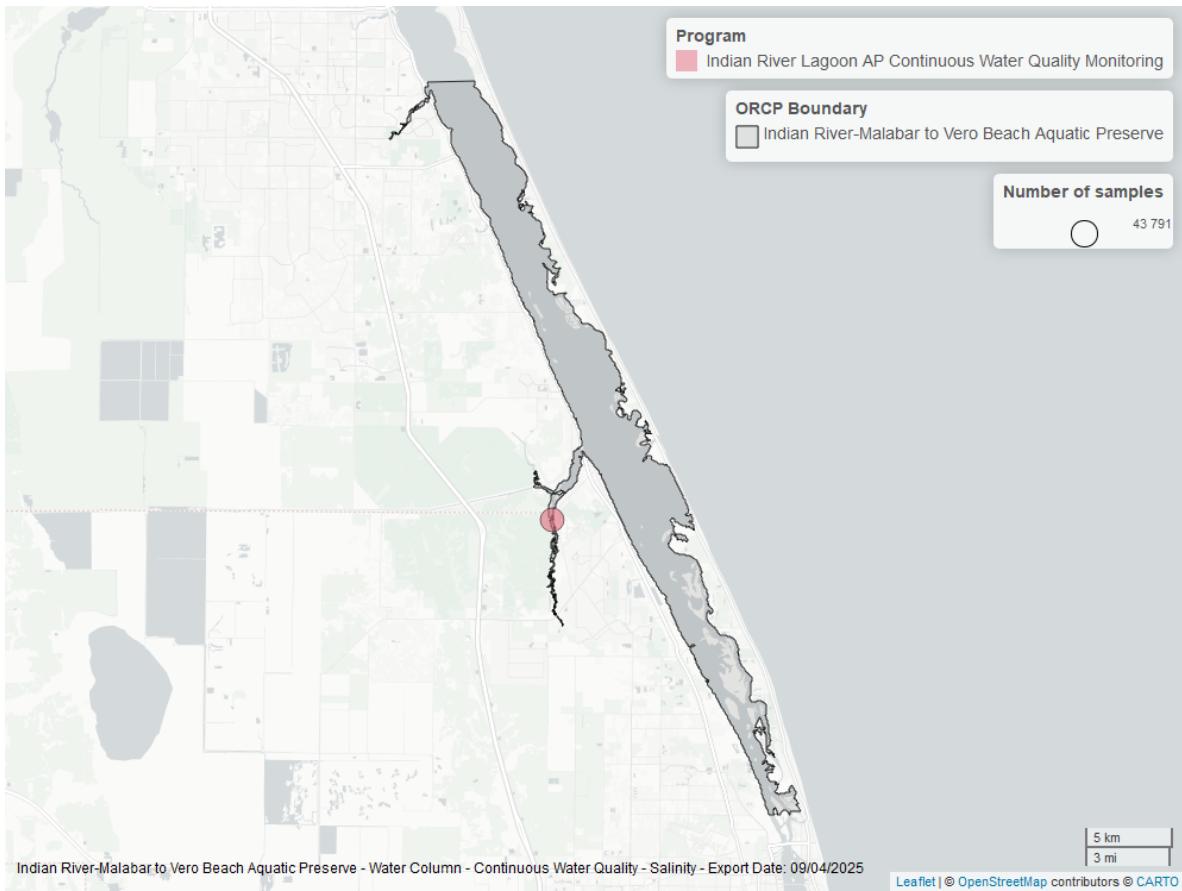


Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

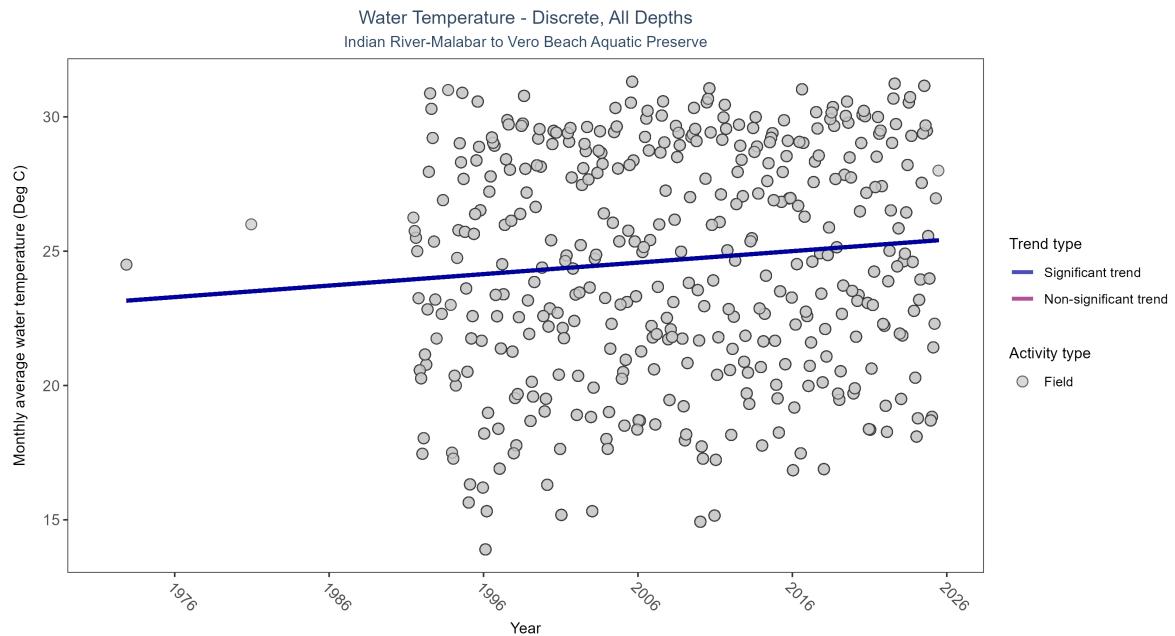


Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 9: Seasonal Kendall-Tau Results for - Water Temperature

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	Significantly increasing trend	60359	37	1972 - 2025	25.5	0.23844	23.12037	0.04277	0

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

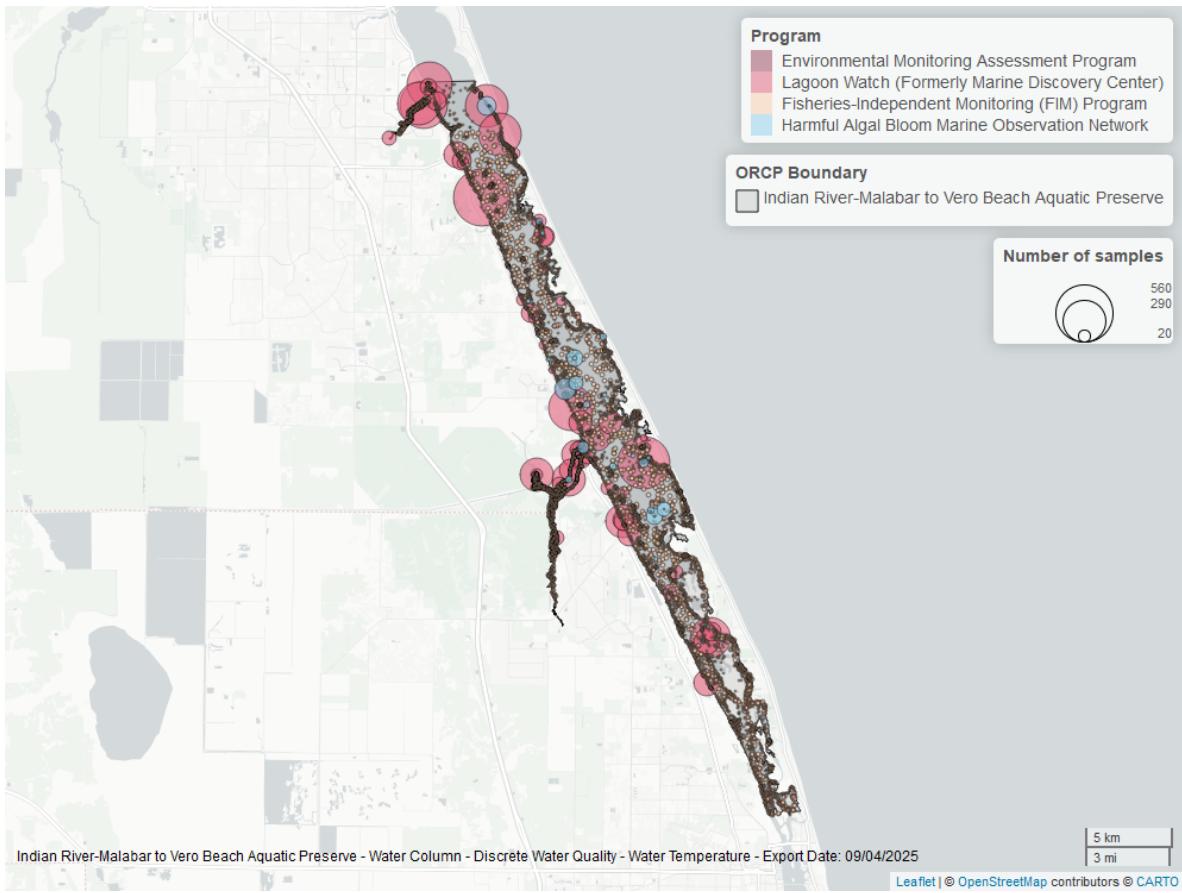


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

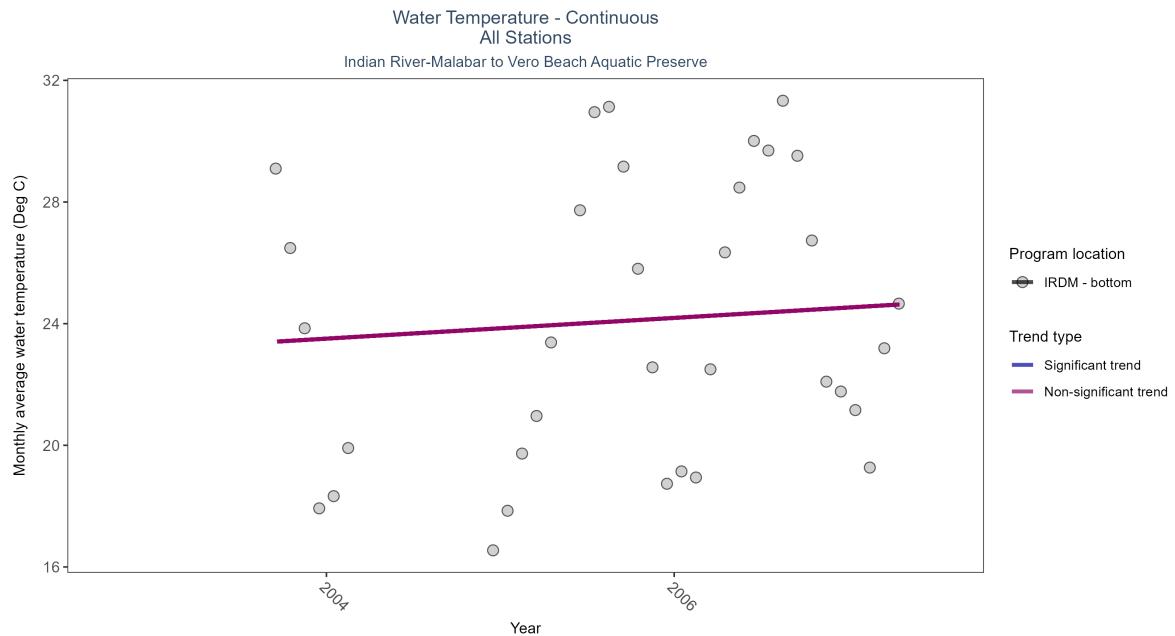


Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 10: Seasonal Kendall-Tau Results - Water Temperature

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	43791	5	2003 - 2007	23.5	0.29	23.17	0.34	0.1908

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

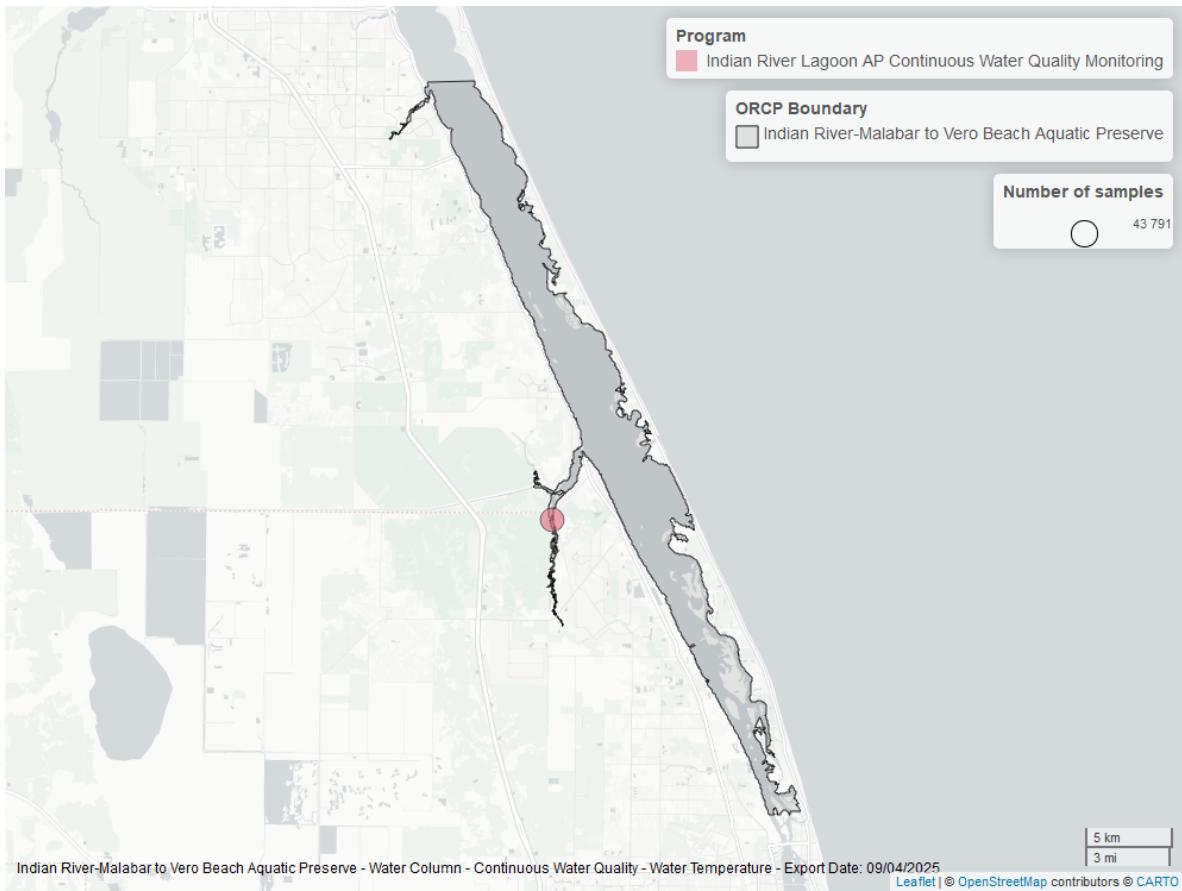


Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

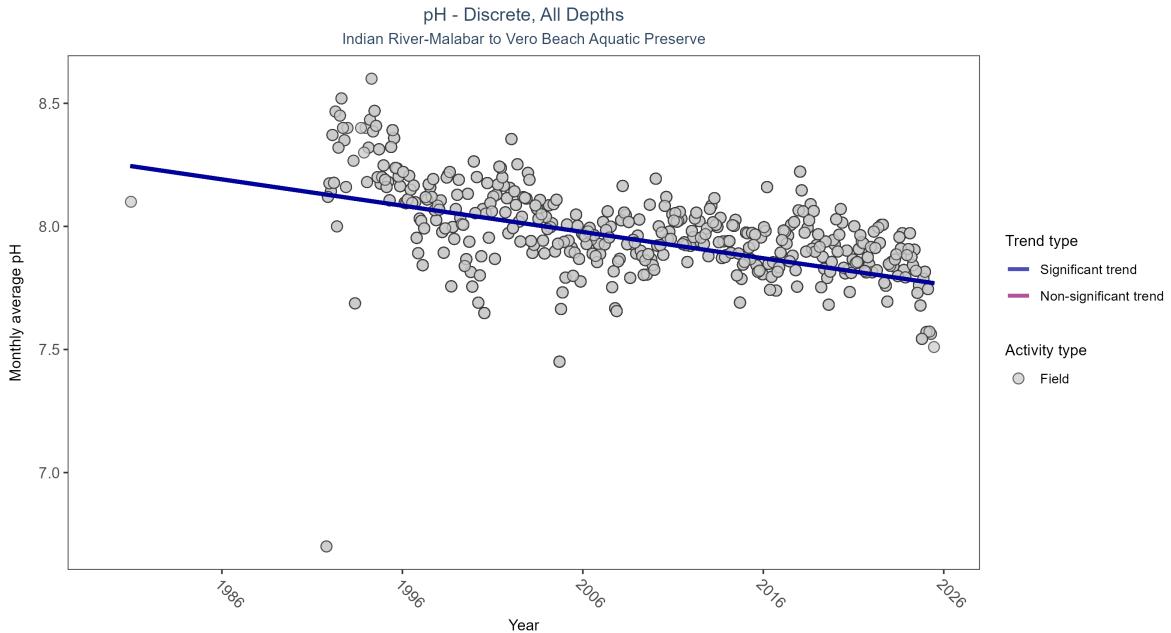


Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 11: Seasonal Kendall-Tau Results for - pH

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	Significantly decreasing trend	49288	36	1980 - 2025	8	-0.4627	8.25521	-0.01069	0

Monthly average pH decreased by 0.01 pH units per year.

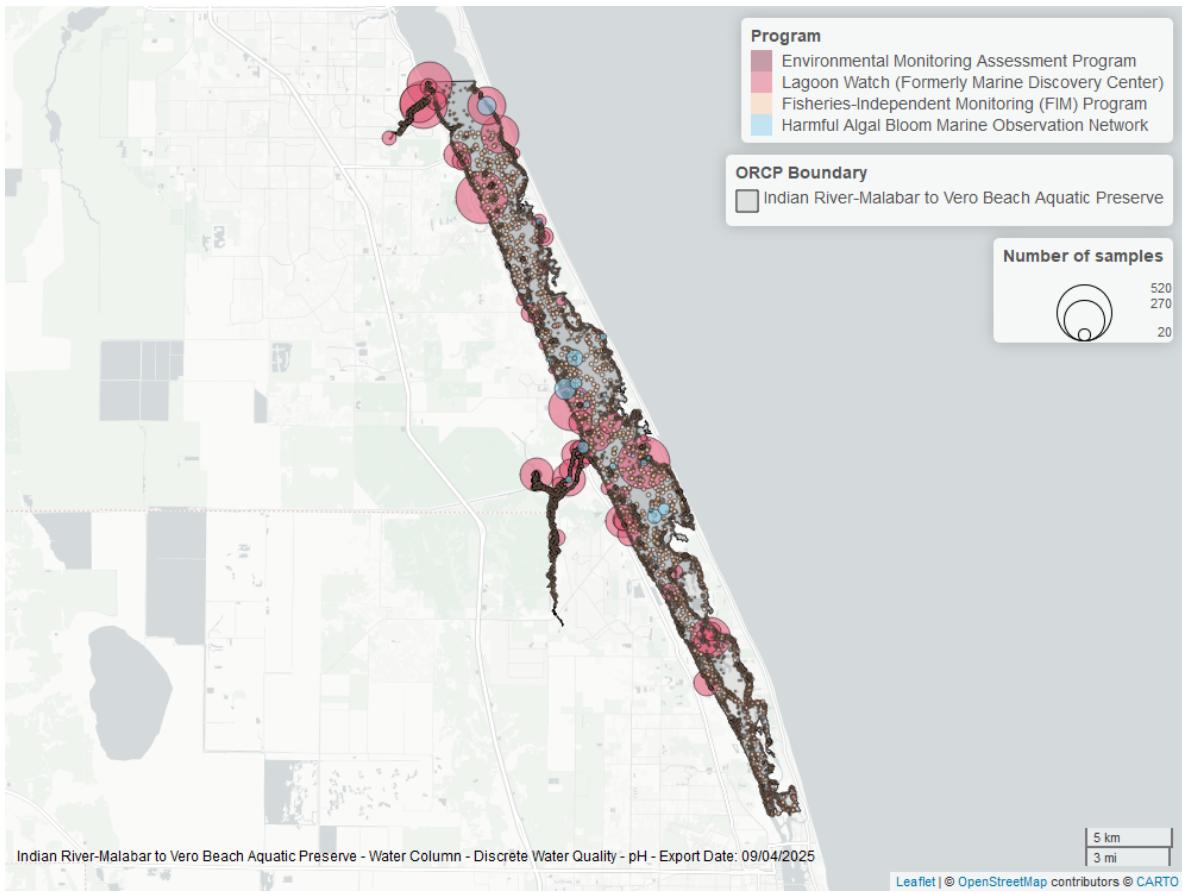


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

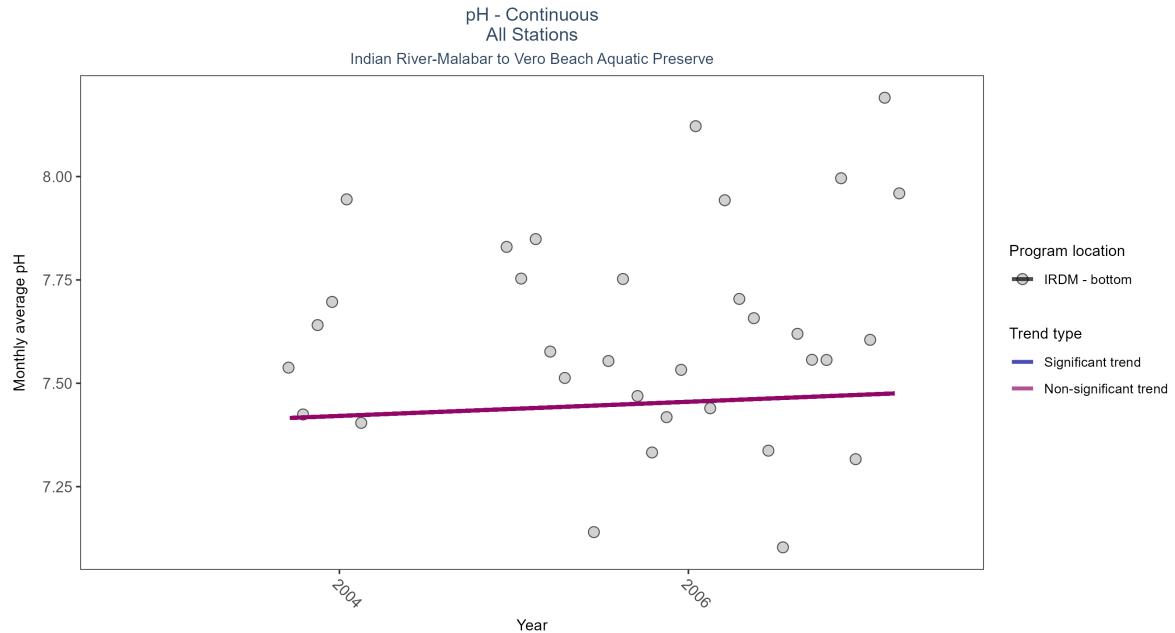


Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 12: Seasonal Kendall-Tau Results - pH

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	38184	5	2003 - 2007	7.6	0.15	7.4	0.02	0.6535

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

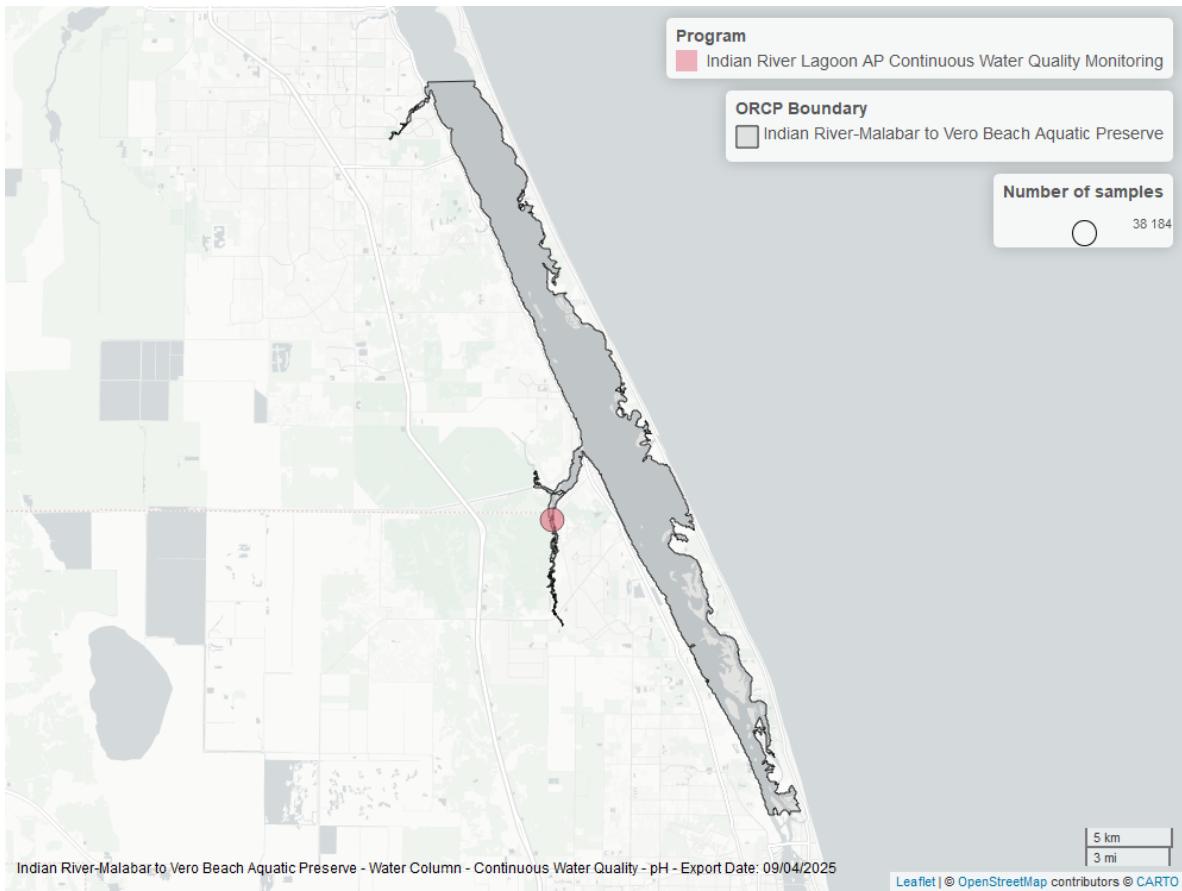


Figure 24: Map showing location of ph continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

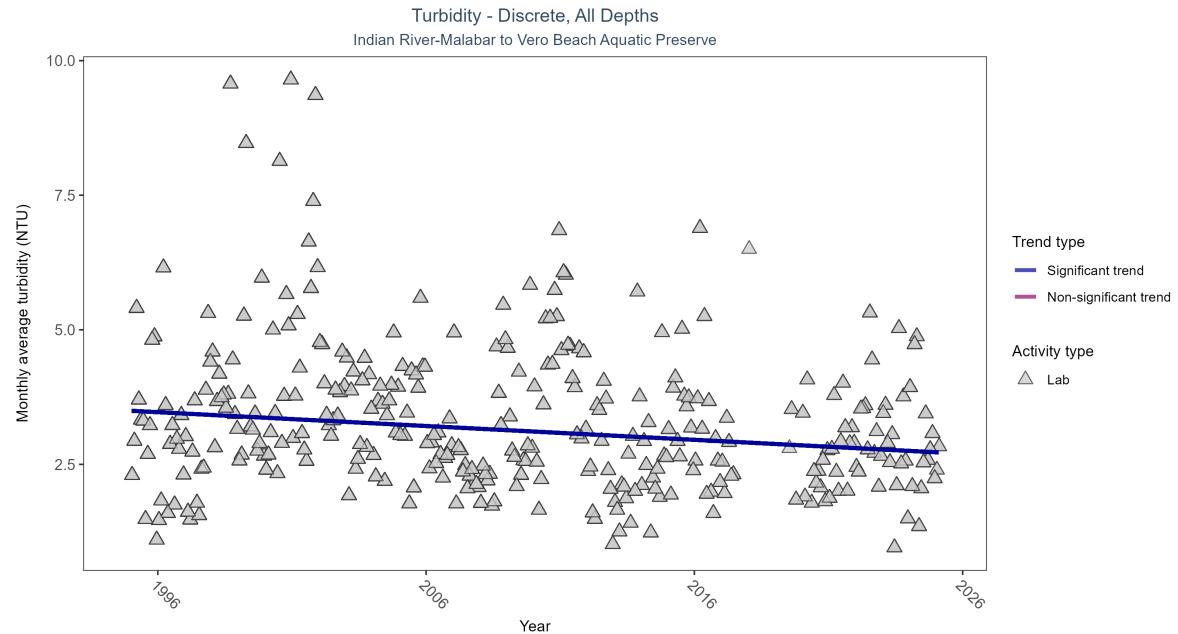


Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 13: Seasonal Kendall-Tau Results for - Turbidity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly decreasing trend	14526	31	1995 - 2025	2.8	-0.14982	3.49492	-0.02567	2e-04

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

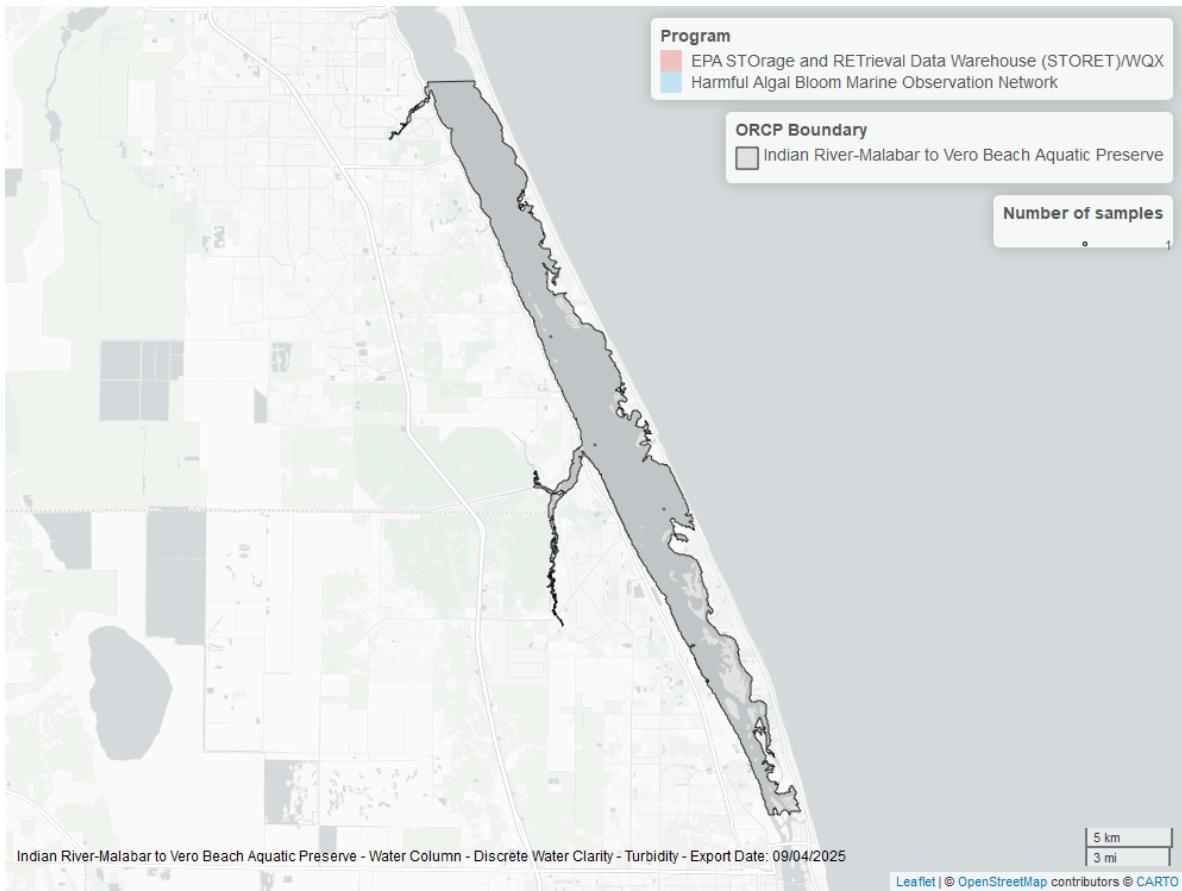


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

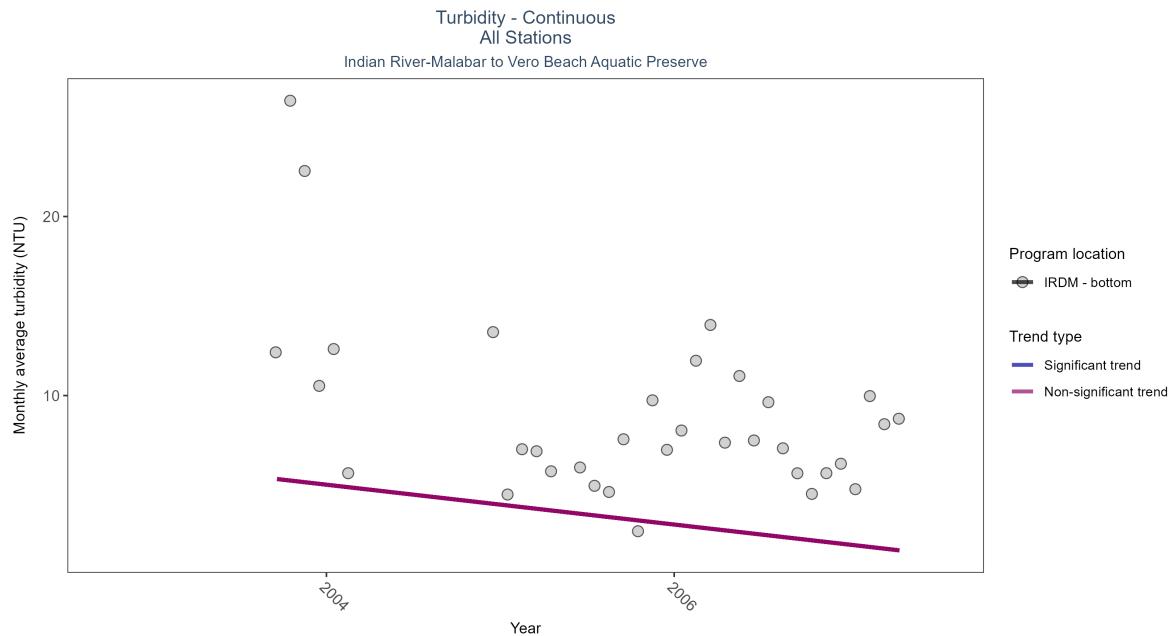


Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 14: Seasonal Kendall-Tau Results - Turbidity

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
IRDM	No significant trend	39124	5	2003 - 2007	5	0.05	6.13	-1.11	0.8844

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

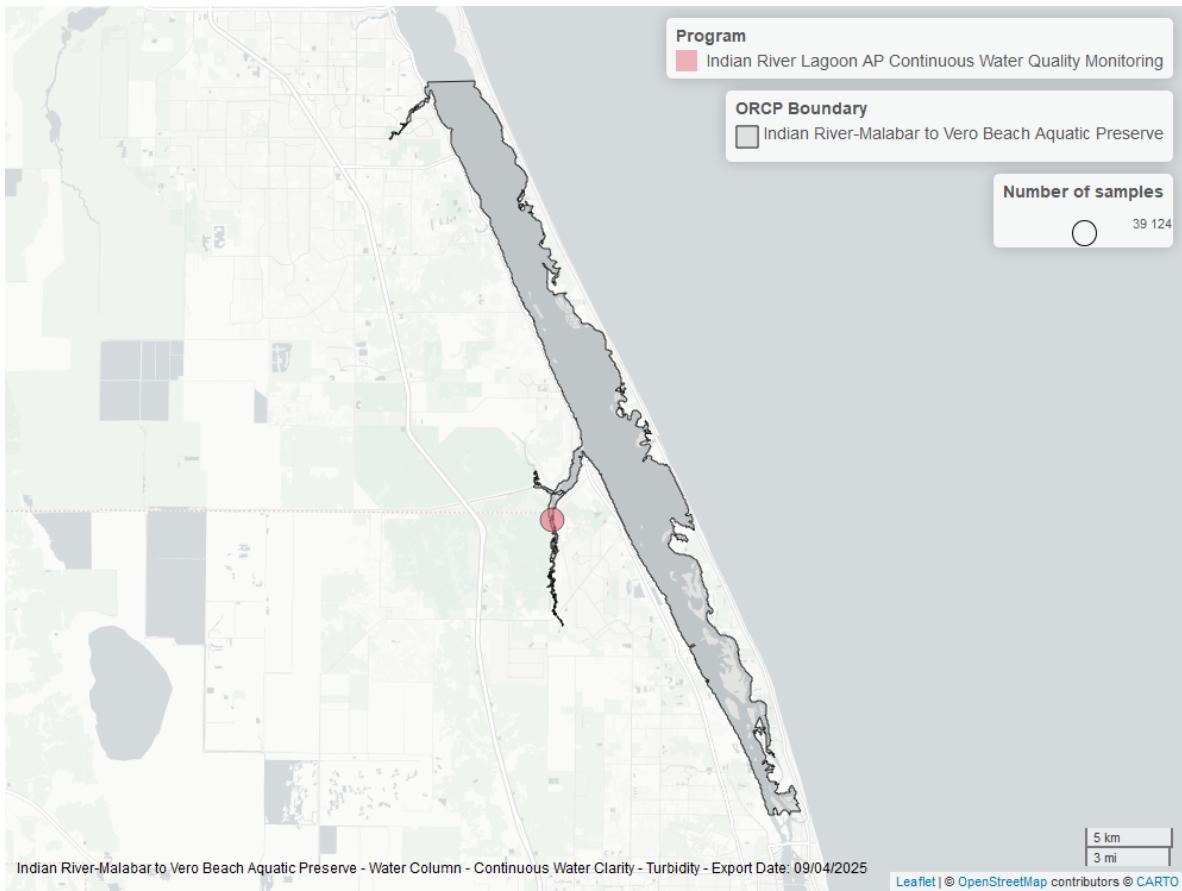


Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

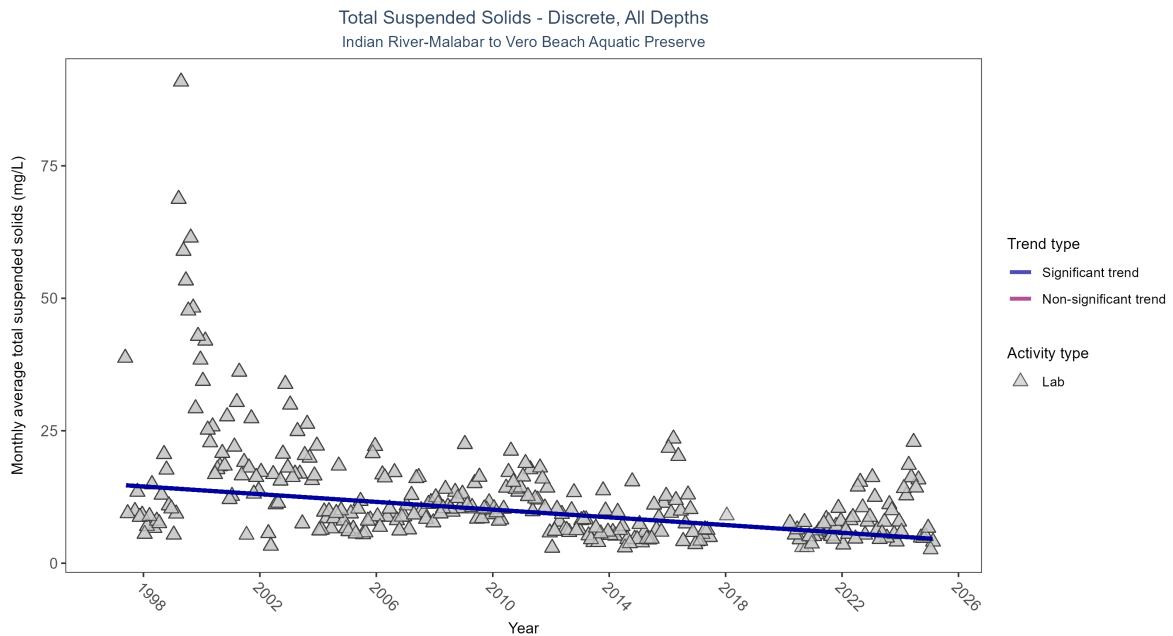


Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included in the plot.

Table 15: Seasonal Kendall-Tau Results for - Total Suspended Solids

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly decreasing trend	3378	28	1997 - 2025	9	-0.36432	14.84918	-0.36397	0

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

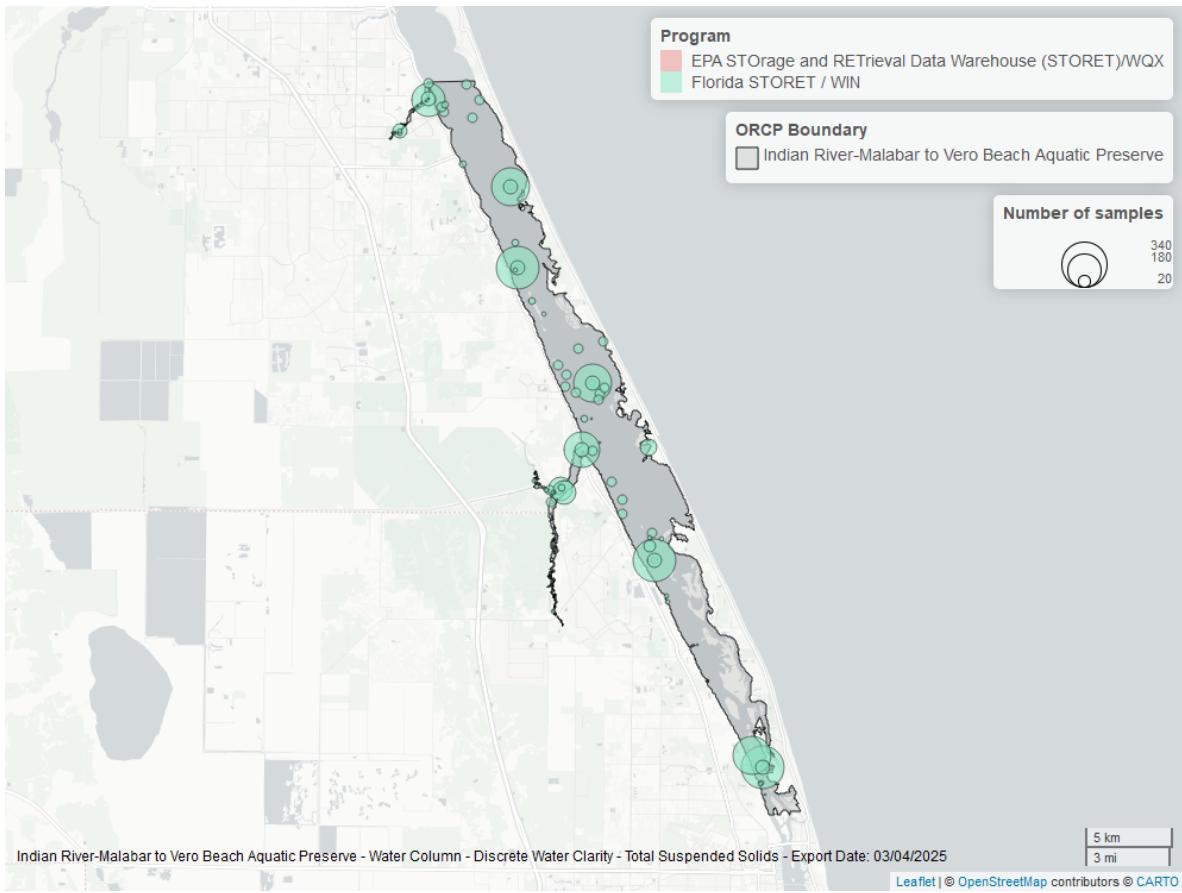


Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

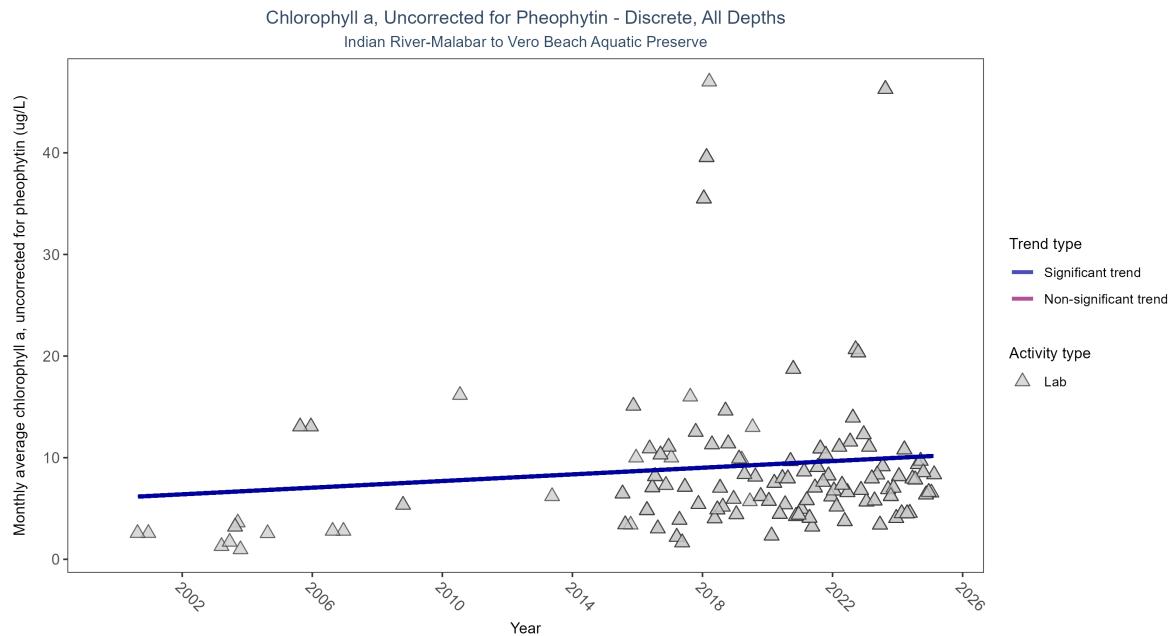


Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

Table 16: Seasonal Kendall-Tau Results for - Chlorophyll a, Uncorrected for Pheophytin

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly increasing trend	684	19	2000 - 2025	5.7019	0.11112	6.06708	0.16348	0.0315

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

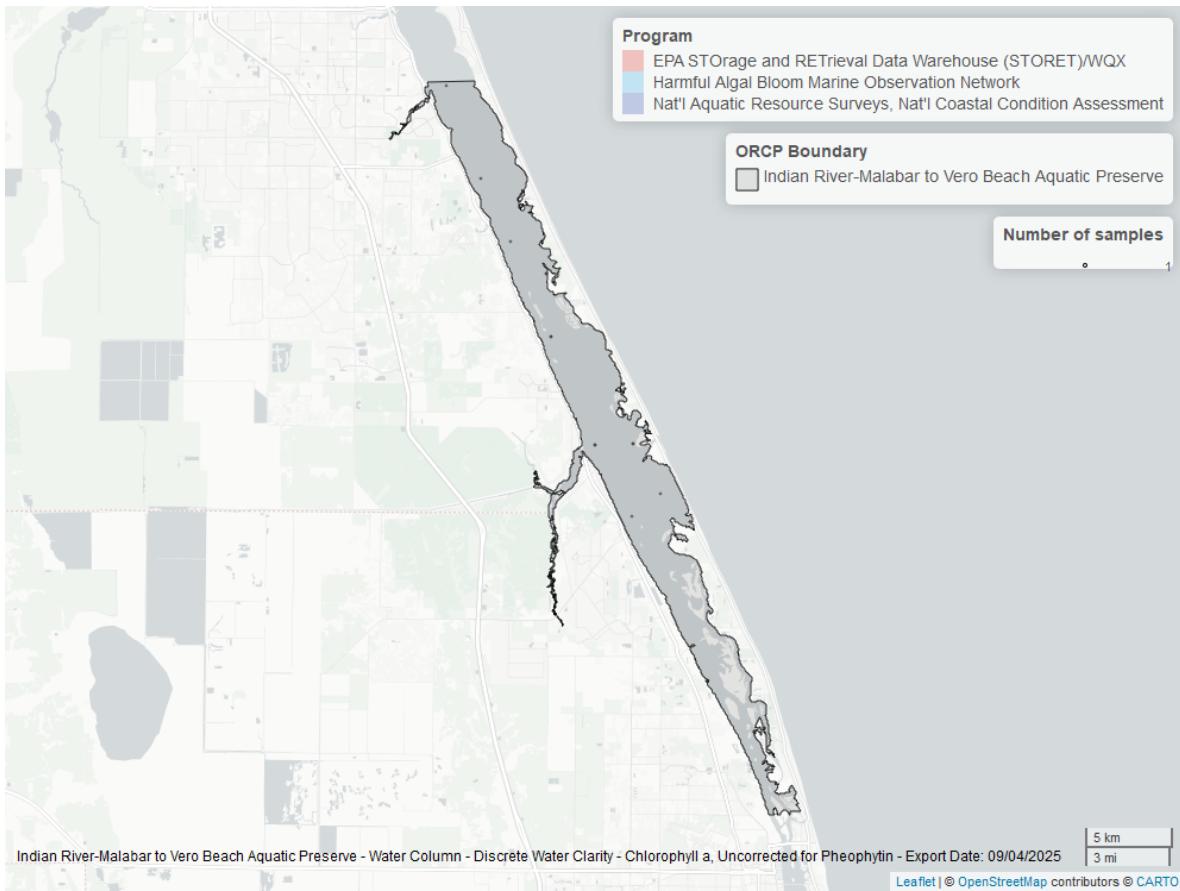


Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

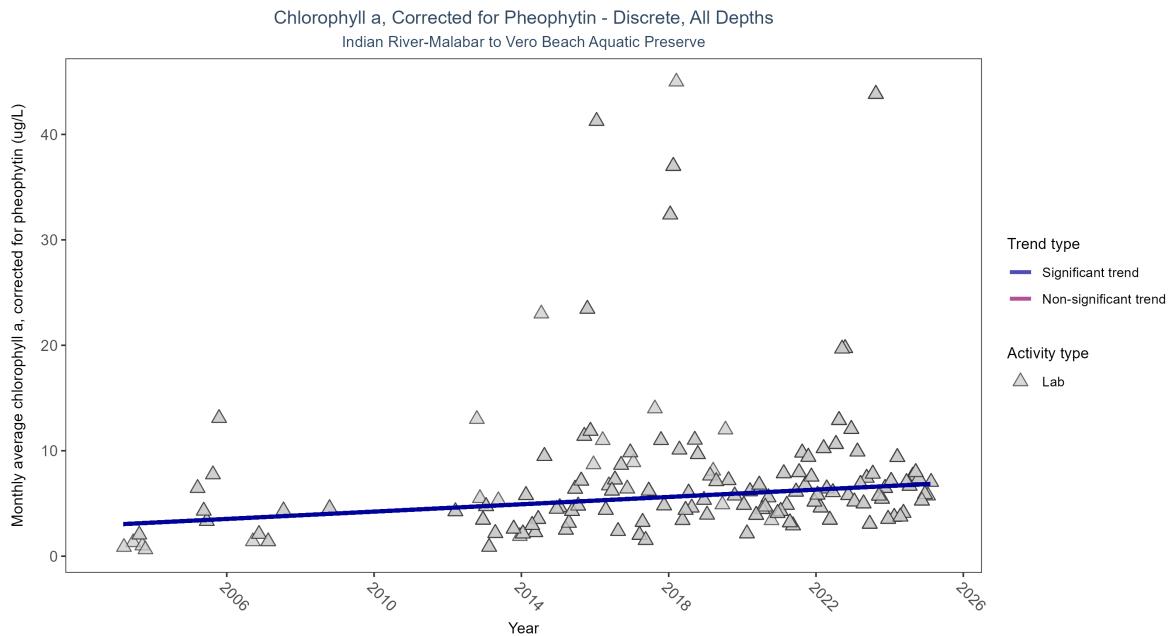


Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

Table 17: Seasonal Kendall-Tau Results for - Chlorophyll a, Corrected for Pheophytin

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly increasing trend	815	19	2003 - 2025	4.6458	0.20944	3.01215	0.1737	0.0015

Monthly average chlorophyll a, corrected for pheophytin, increased by $0.17 \mu\text{g/L}$ per year, indicating a decrease in water clarity.

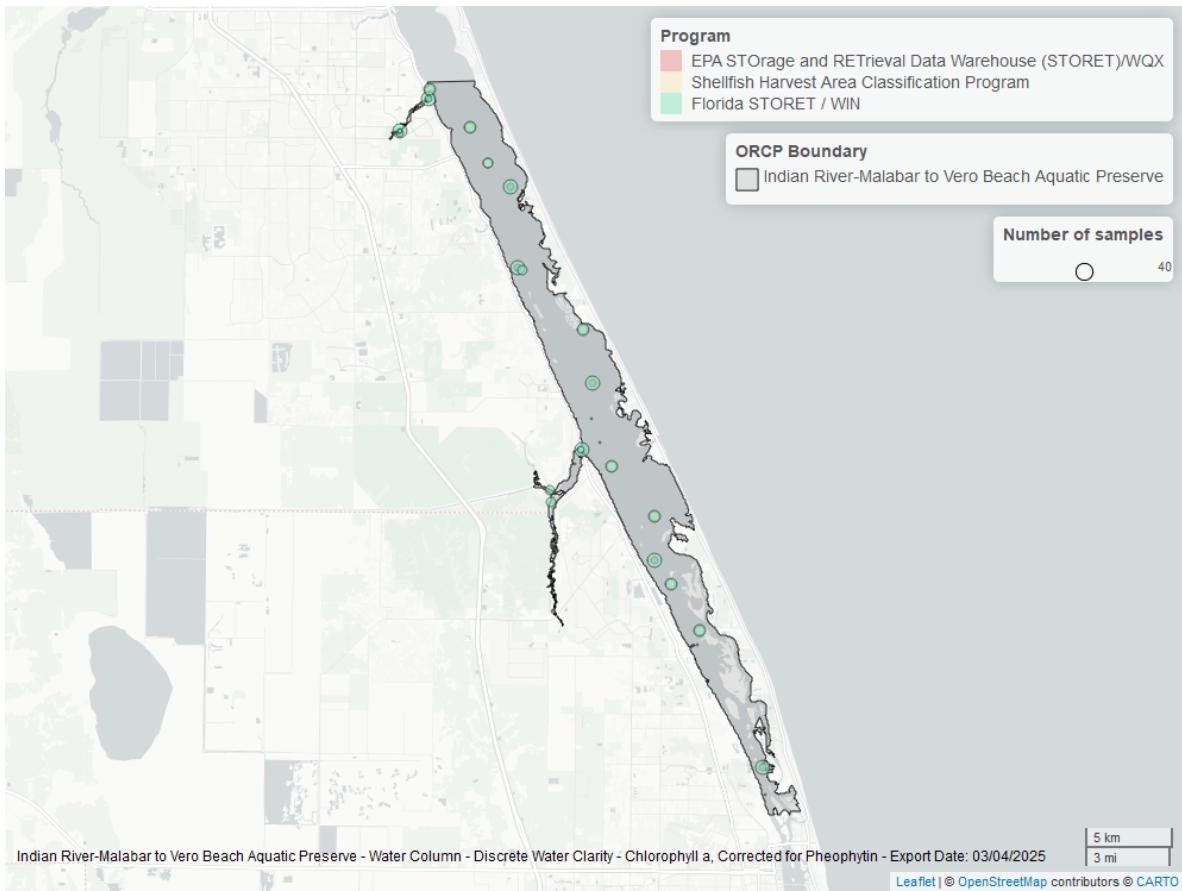


Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

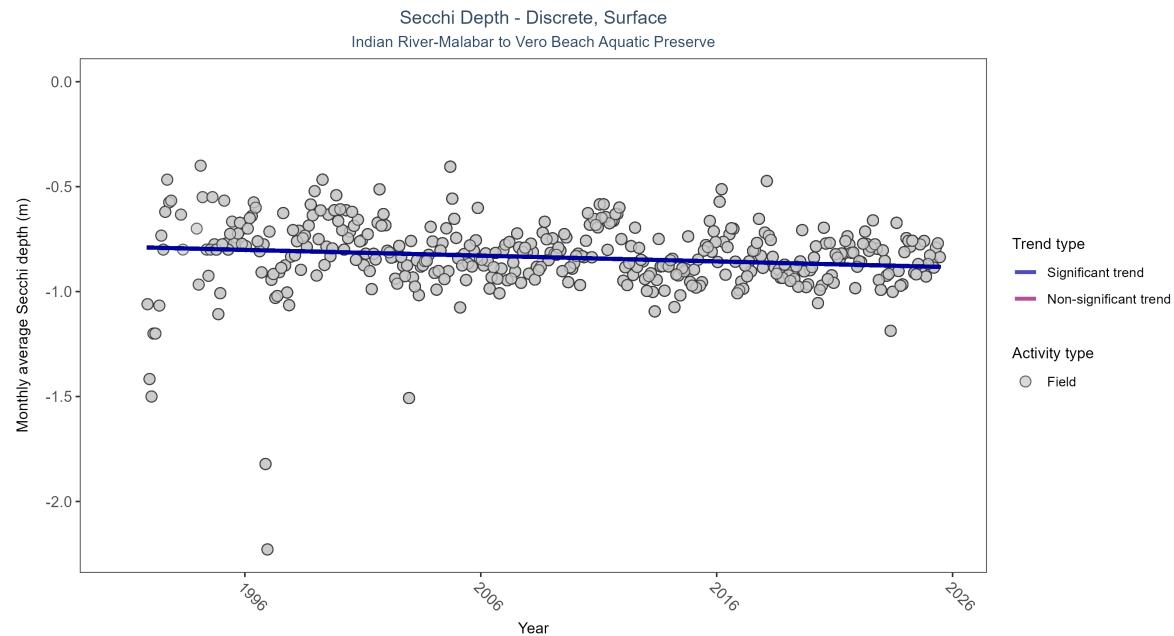


Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 18: Seasonal Kendall-Tau Results for - Secchi Depth

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	Significantly decreasing trend	28587	35	1991 - 2025	-0.8	-0.12572	-0.78762	-0.00275	4e-04

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

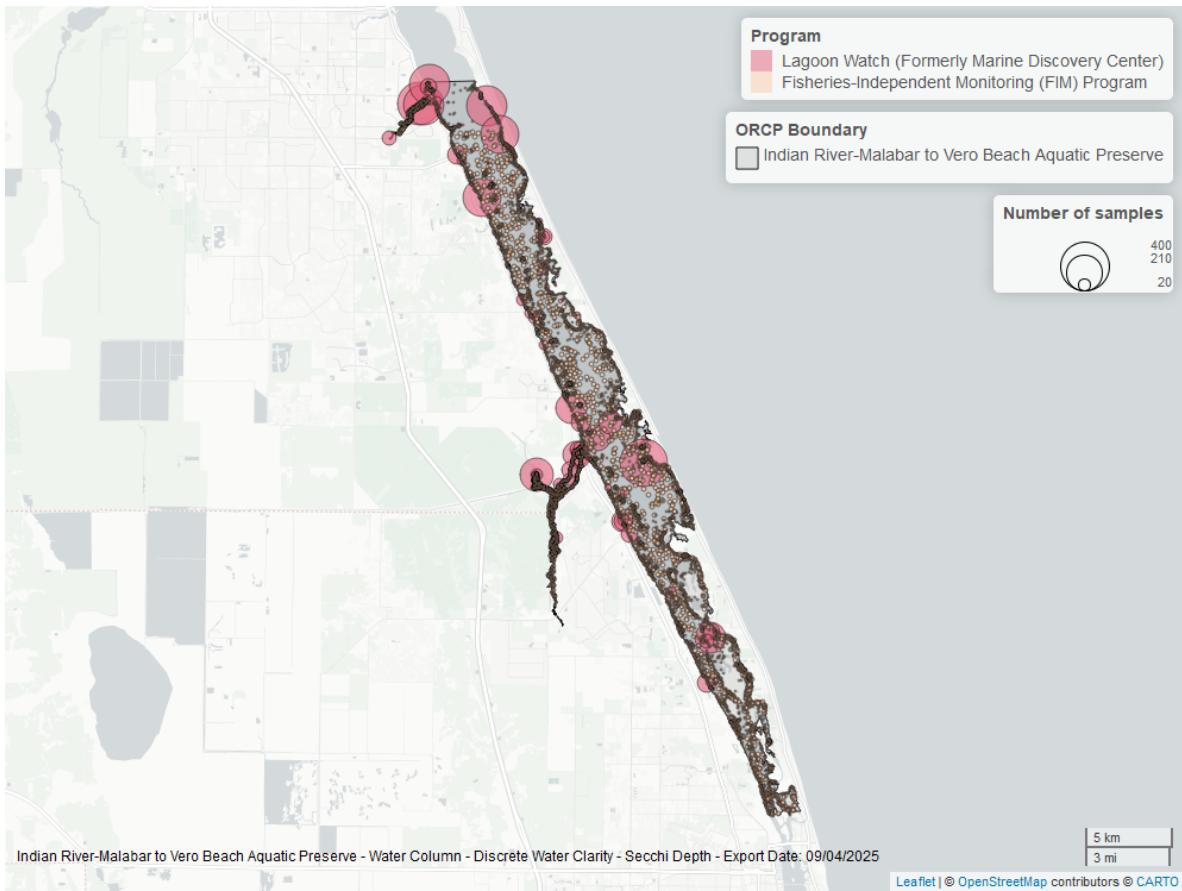


Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

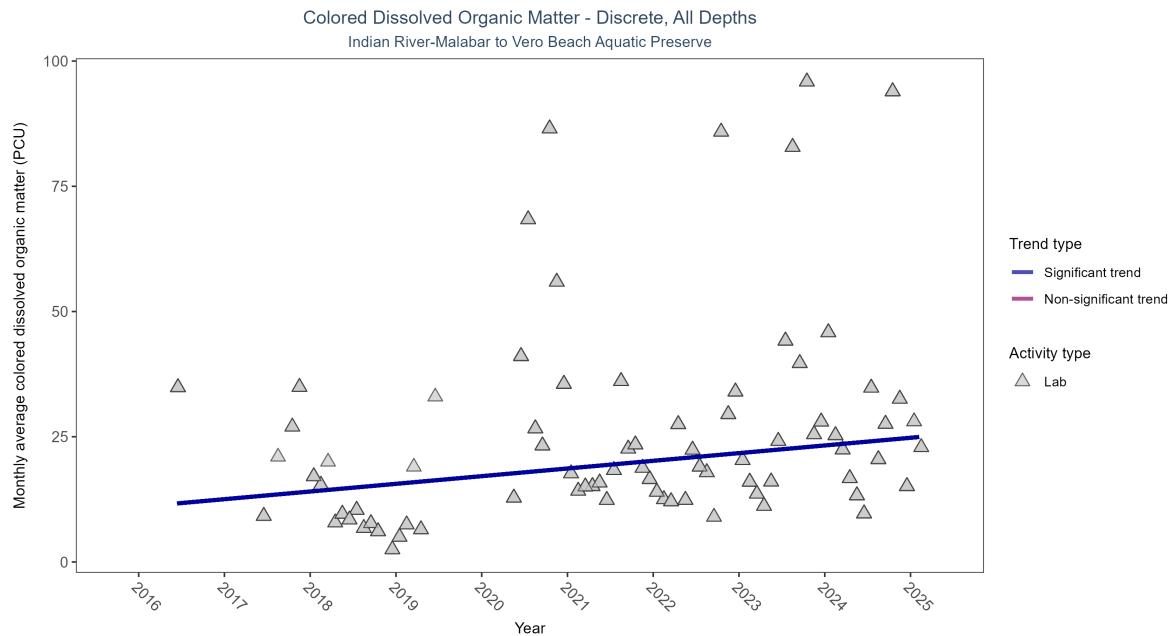


Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the plot.

Table 19: Seasonal Kendall-Tau Results for - Colored Dissolved Organic Matter

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	Significantly increasing trend	550	10	2016 - 2025	14.365	0.25865	10.99932	1.53262	0.0096

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

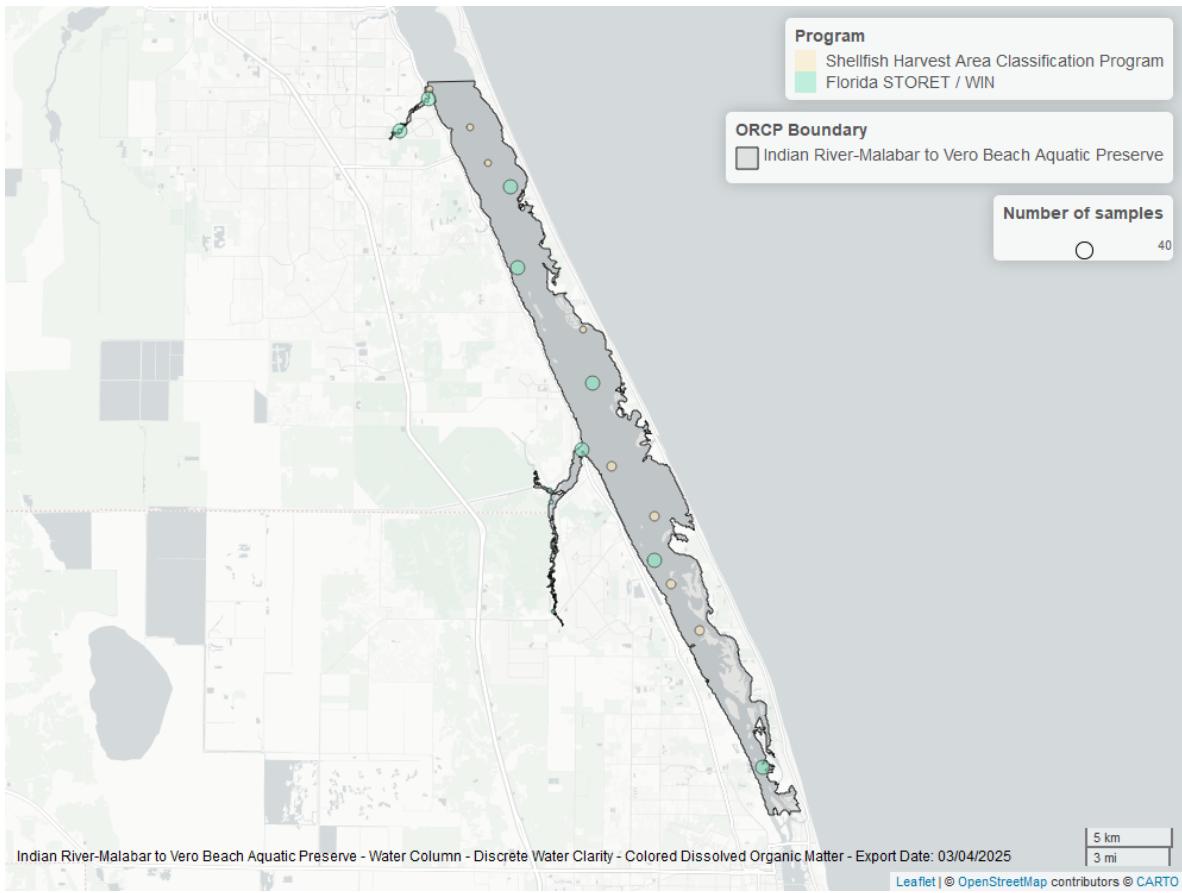


Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Indian River-Malabar to Vero Beach Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.