

# St. Andrews Aquatic Preserve

## SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

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# Indicators

## Nutrients

### Total Nitrogen - Discrete

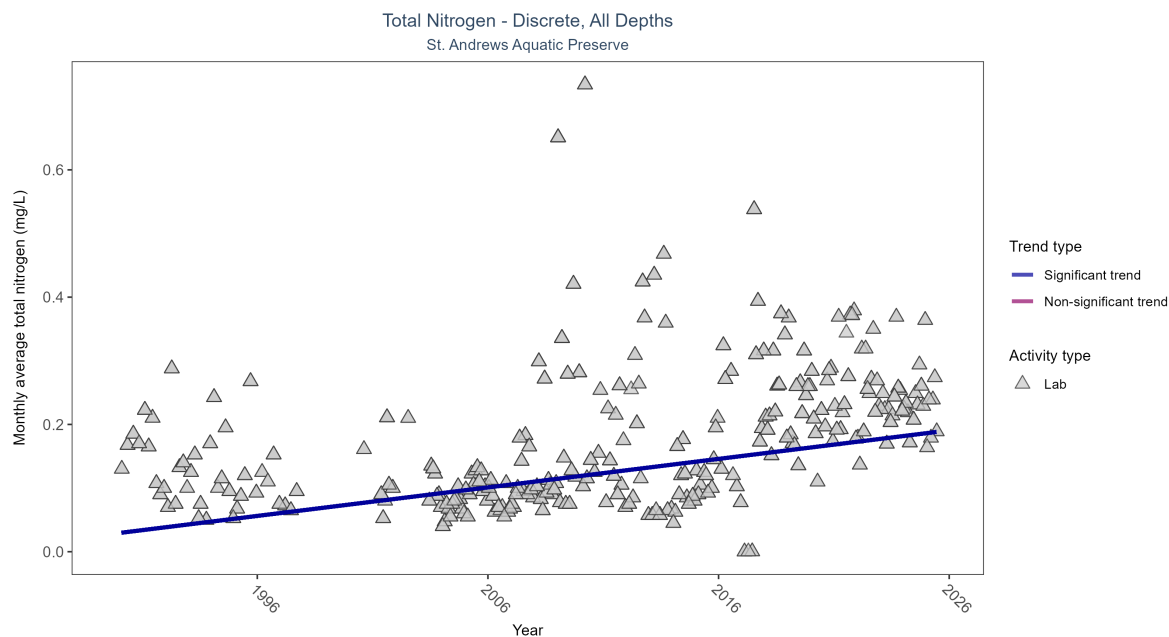


Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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 increasing trend	1161	34	1990 - 2025	0.18	0.34582	0.02935	0.00448	0

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

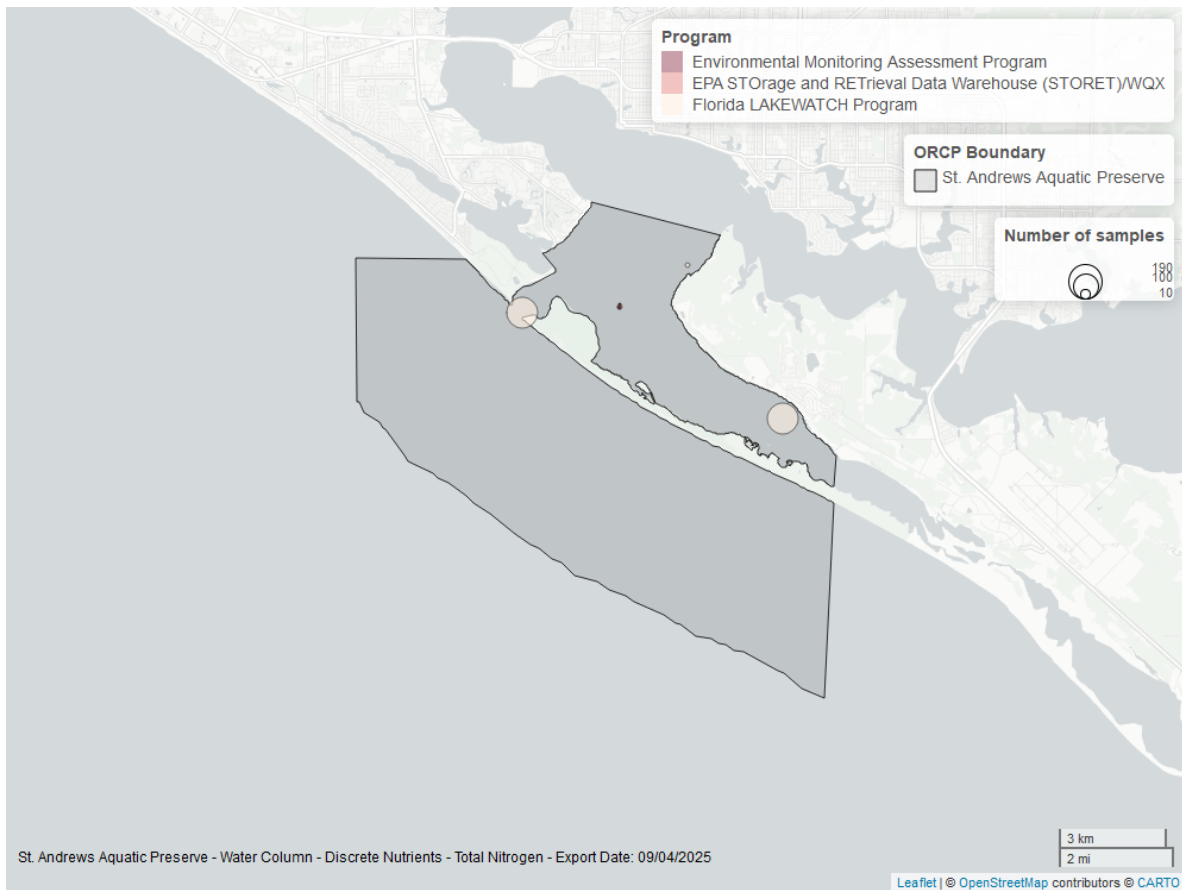


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Total Phosphorus - Discrete

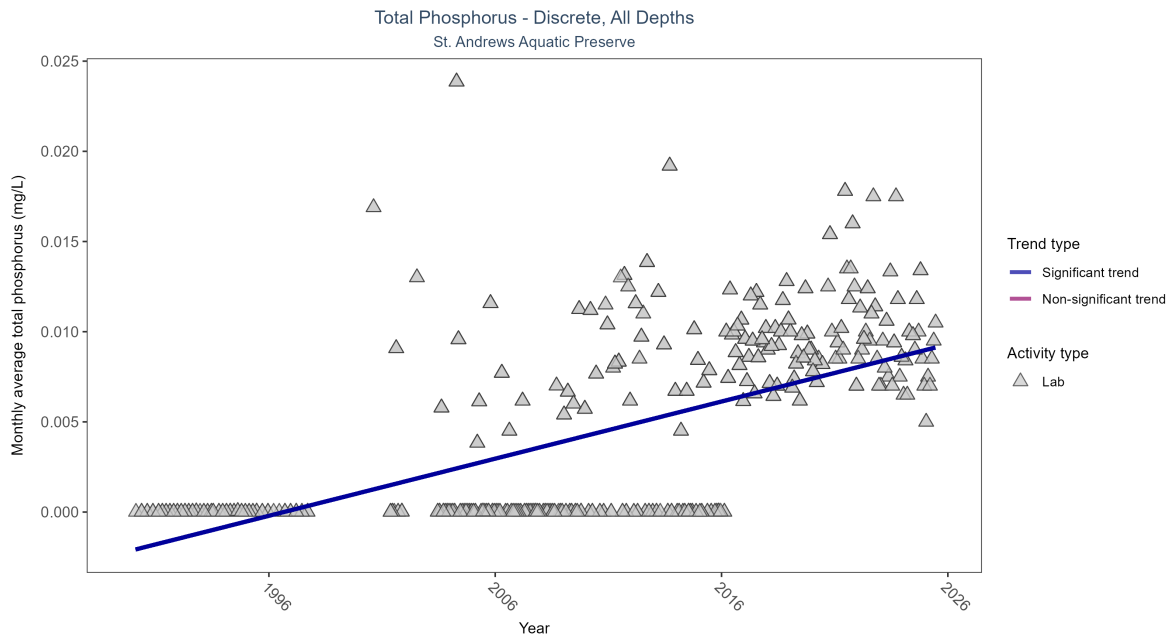


Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	Significantly increasing trend	978	34	1990 - 2025	0.008	0.45788	-0.00211	0.00032	0

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

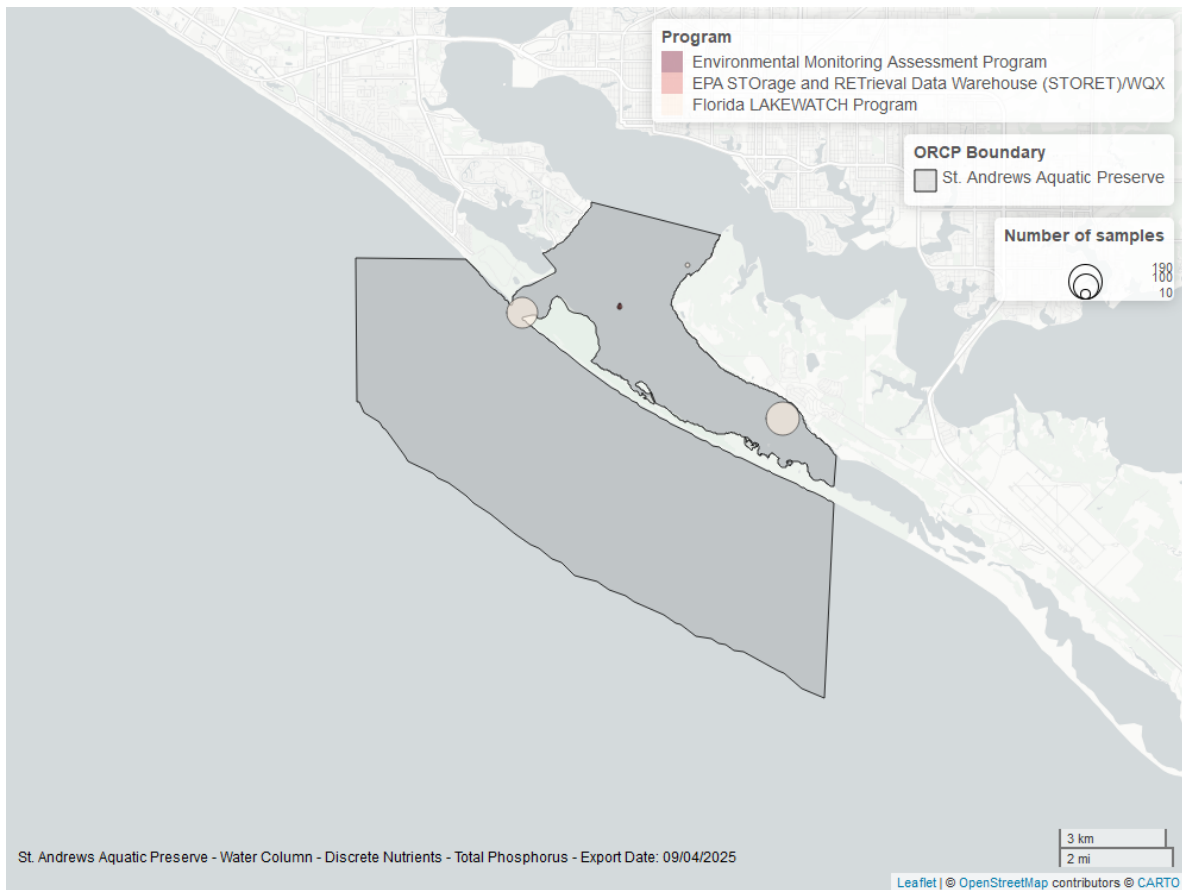


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Quality

### Dissolved Oxygen - Discrete

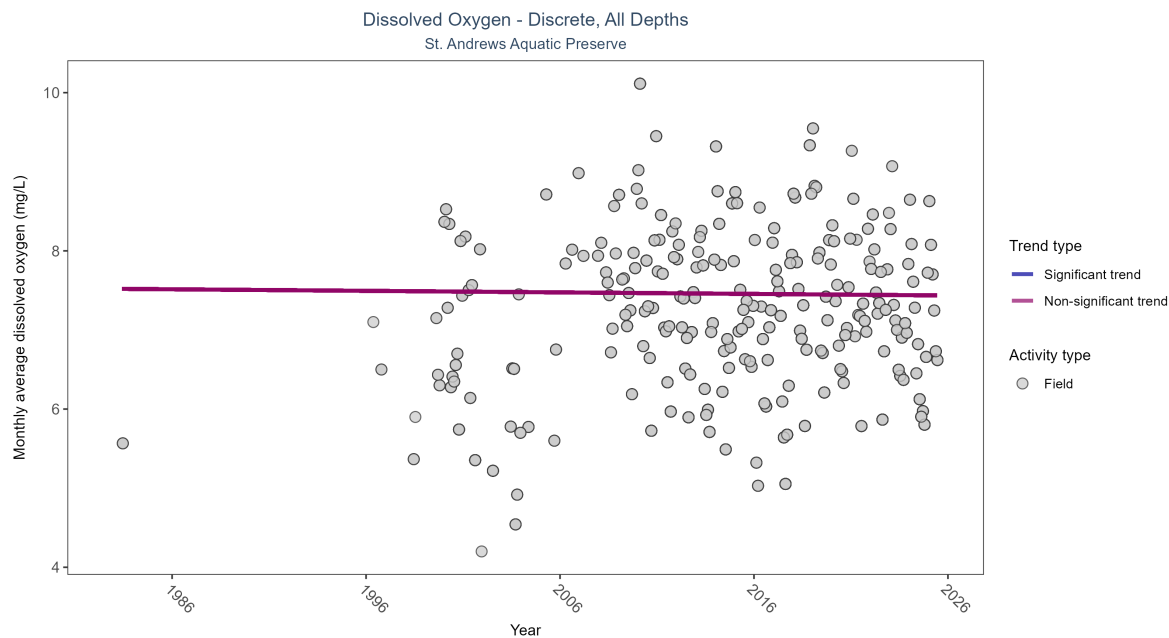


Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	No significant trend	2990	30	1983 - 2025	7.11	-0.01592	7.52009	-0.00196	0.7562

Dissolved oxygen showed no detectable trend between 1983 and 2025.

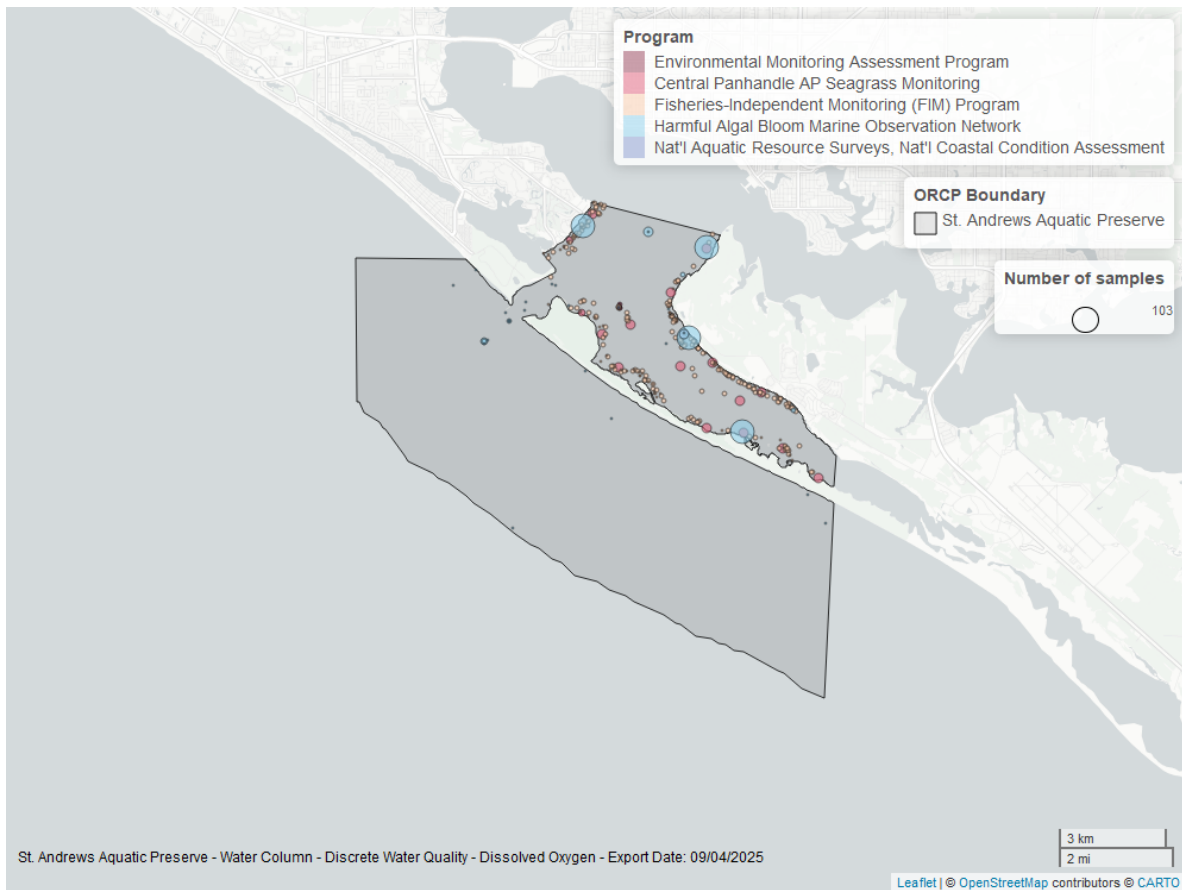


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Dissolved Oxygen Saturation - Discrete

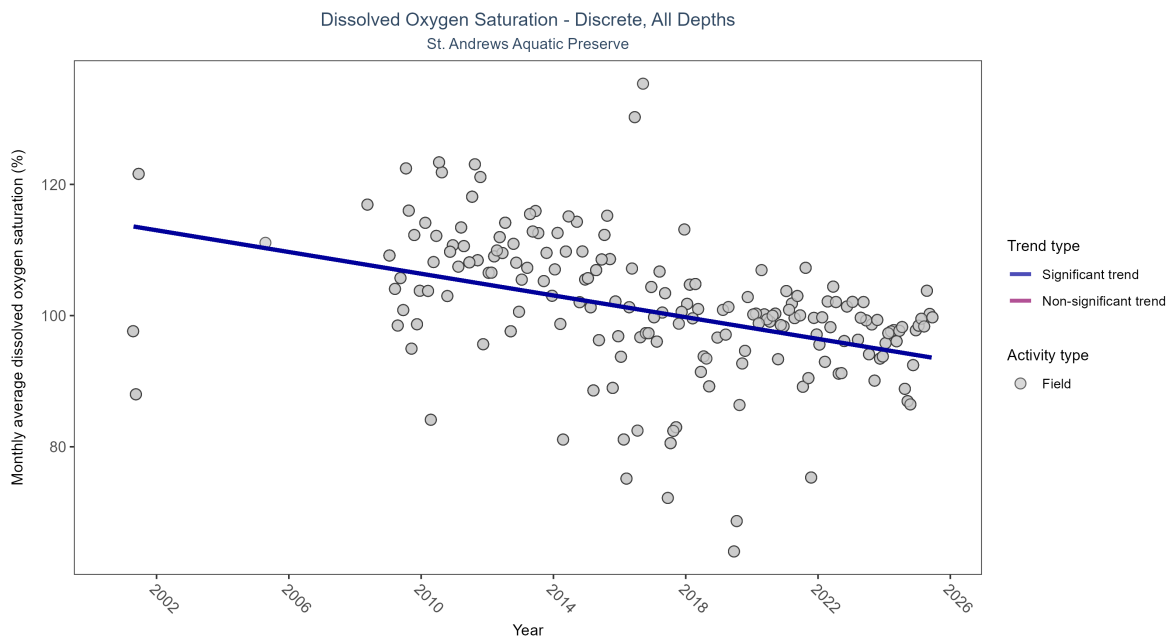


Figure 7: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles)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

Table 4: 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 decreasing trend	1101	20	2001 - 2025	101.2	-0.39603	113.8334	-0.82806	0

Monthly average dissolved oxygen saturation decreased by 0.83% per year.



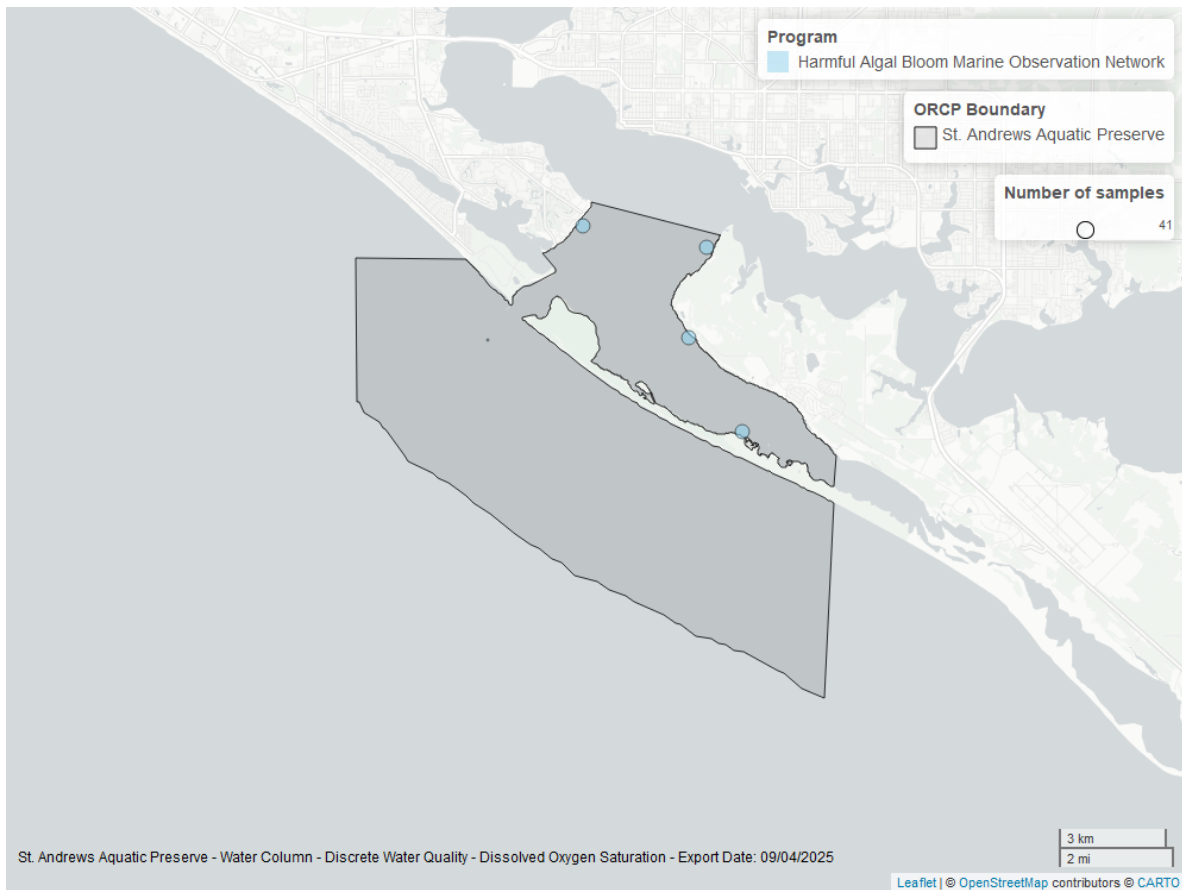


Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Salinity - Discrete

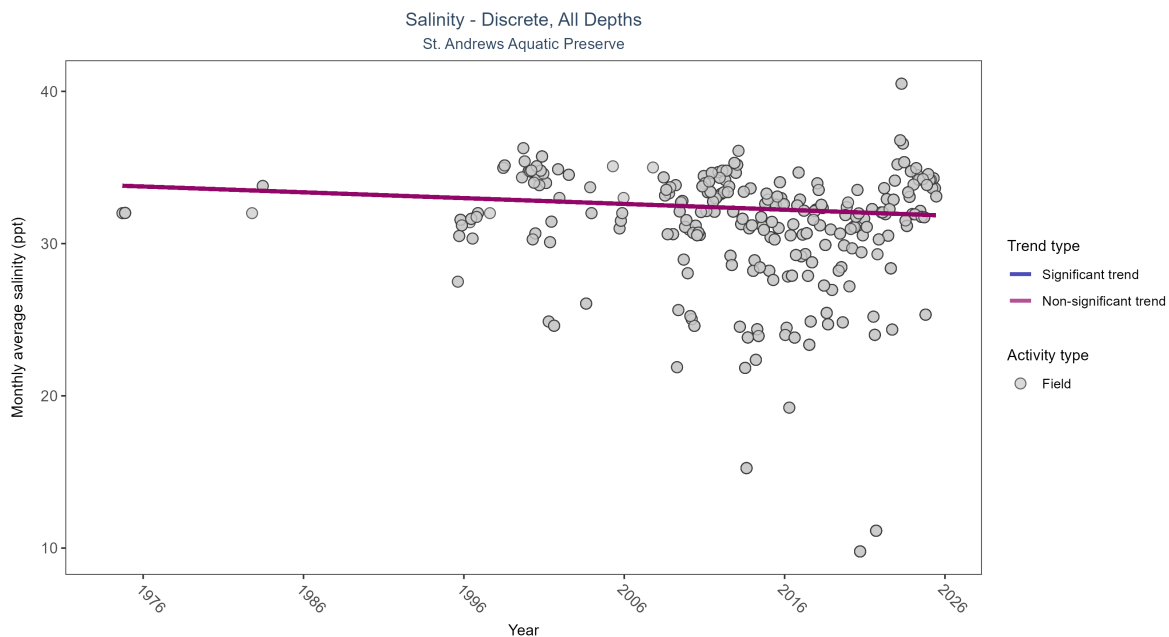


Figure 9: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (triangles) are both included in the plot.

Table 5: 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	No significant trend	2716	32	1974 - 2025	31.9	-0.0769	33.82687	-0.03815	0.0515

Salinity showed no detectable trend between 1974 and 2025.

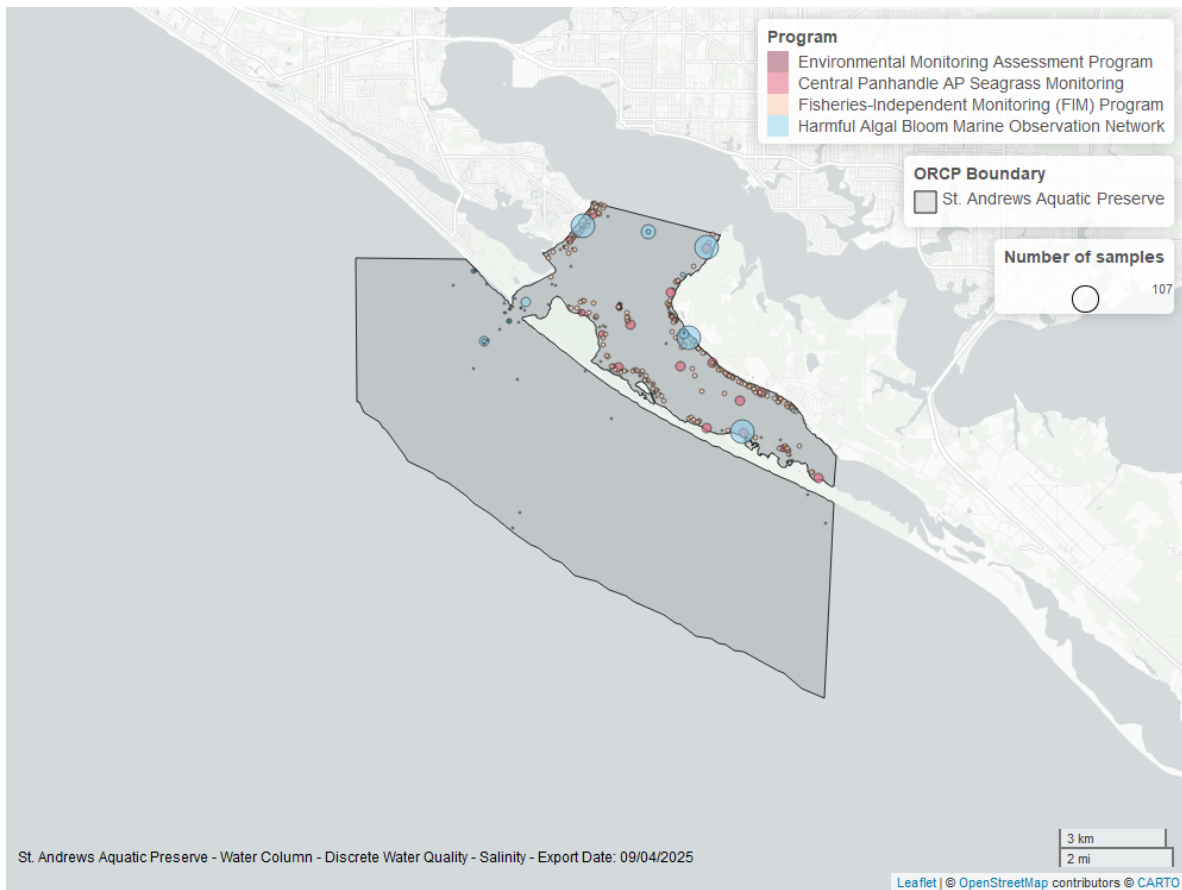


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Temperature - Discrete

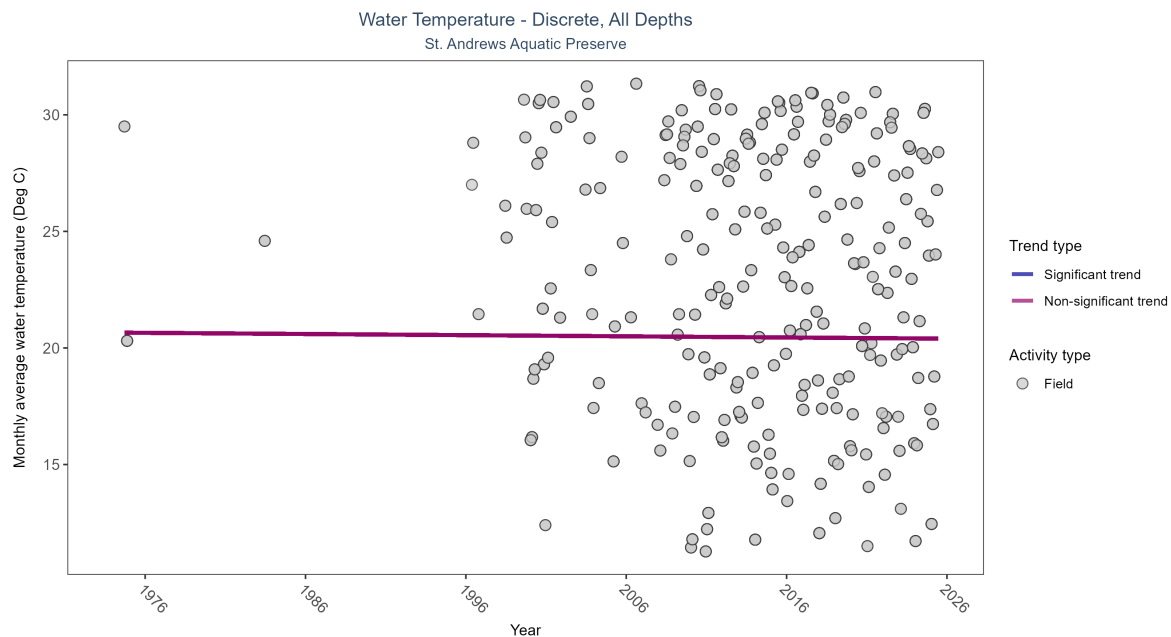


Figure 11: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in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

Table 6: 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	No significant trend	3070	31	1974 - 2025	25.4	-0.01491	20.65837	-0.00498	0.7489

Water temperature showed no detectable trend between 1974 and 2025.

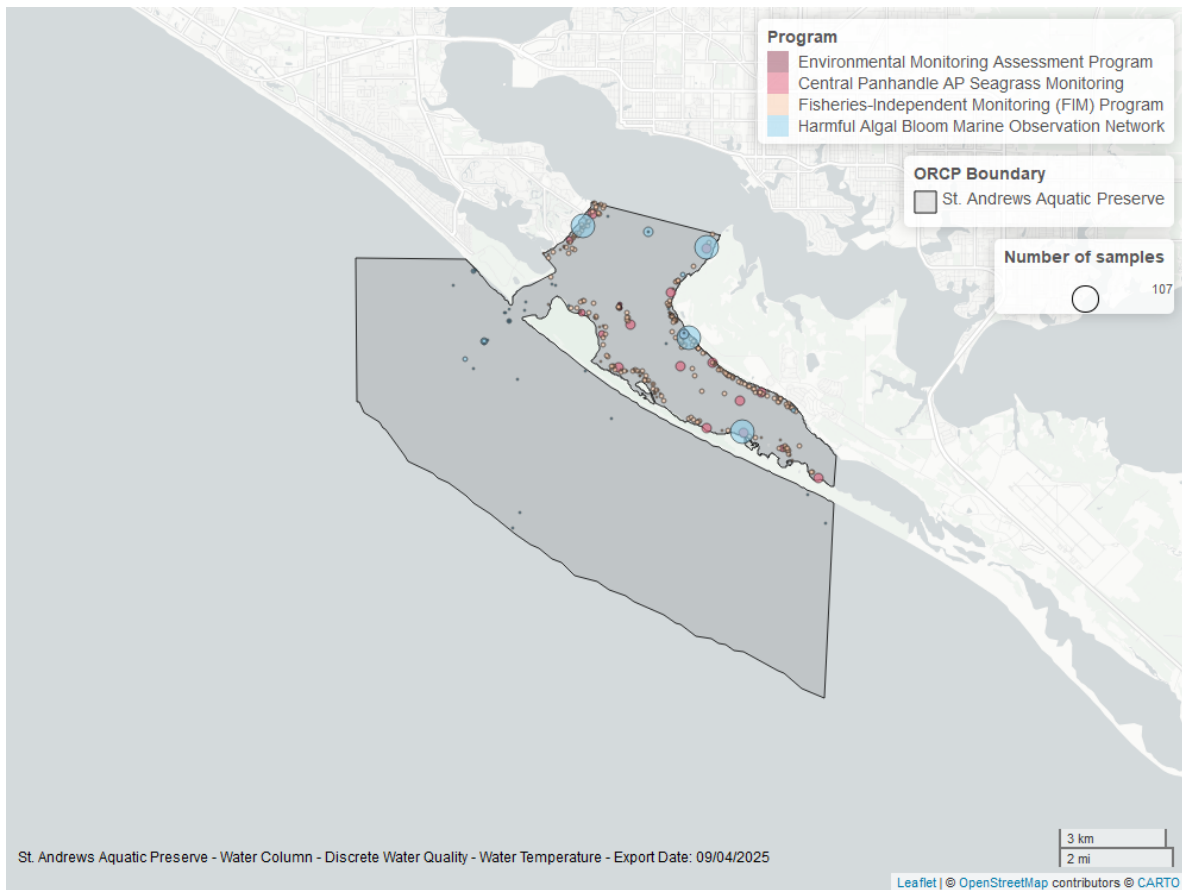


Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## pH - Discrete

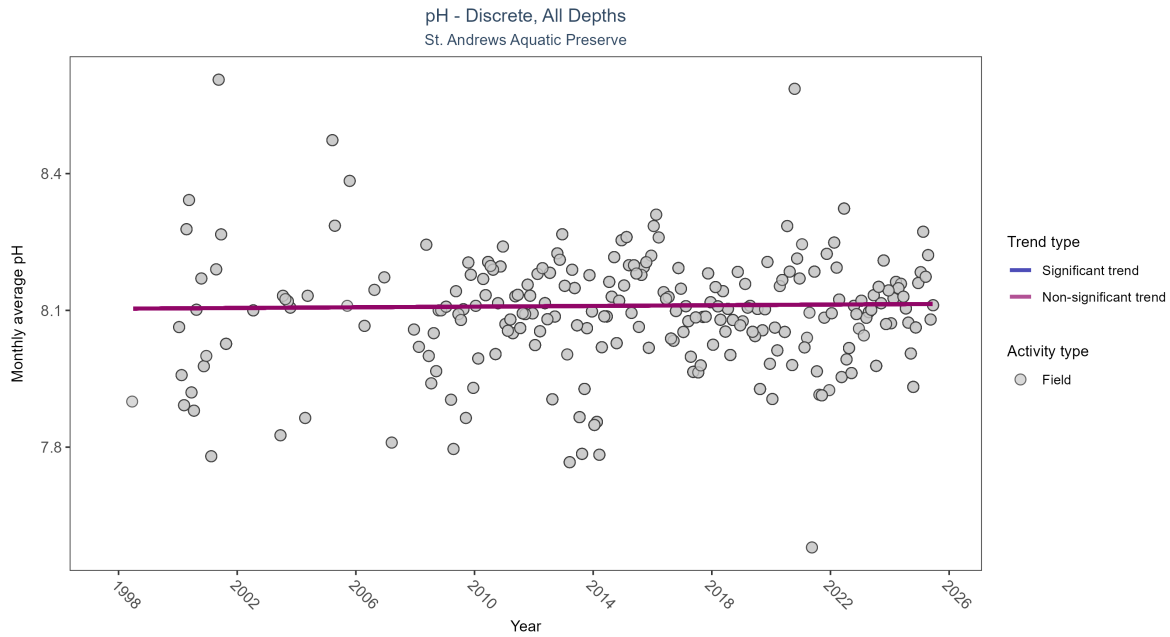


Figure 13: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 7: 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	No significant trend	2853	27	1998 - 2025	8.1	0.02455	8.10372	0.00038	0.6537

pH showed no detectable trend between 1998 and 2025.

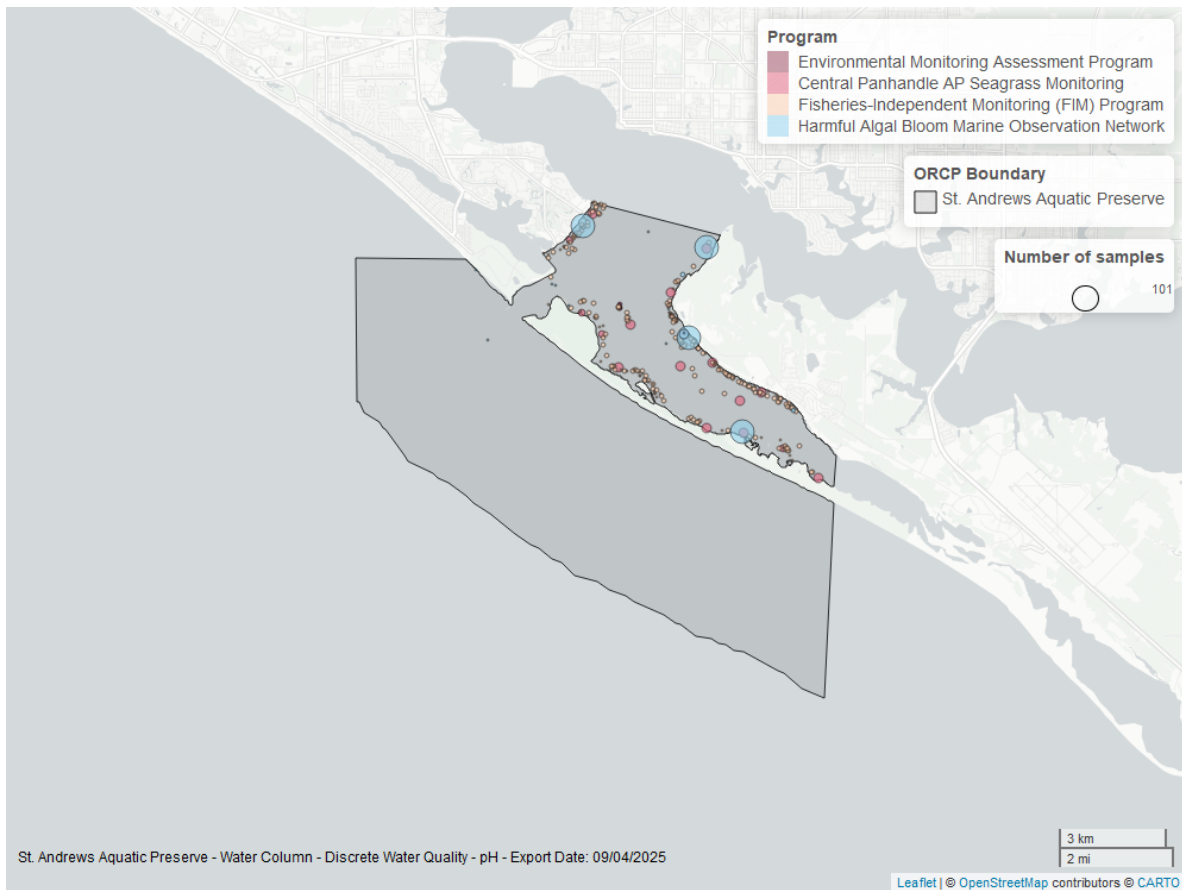


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Clarity

### Turbidity - Discrete

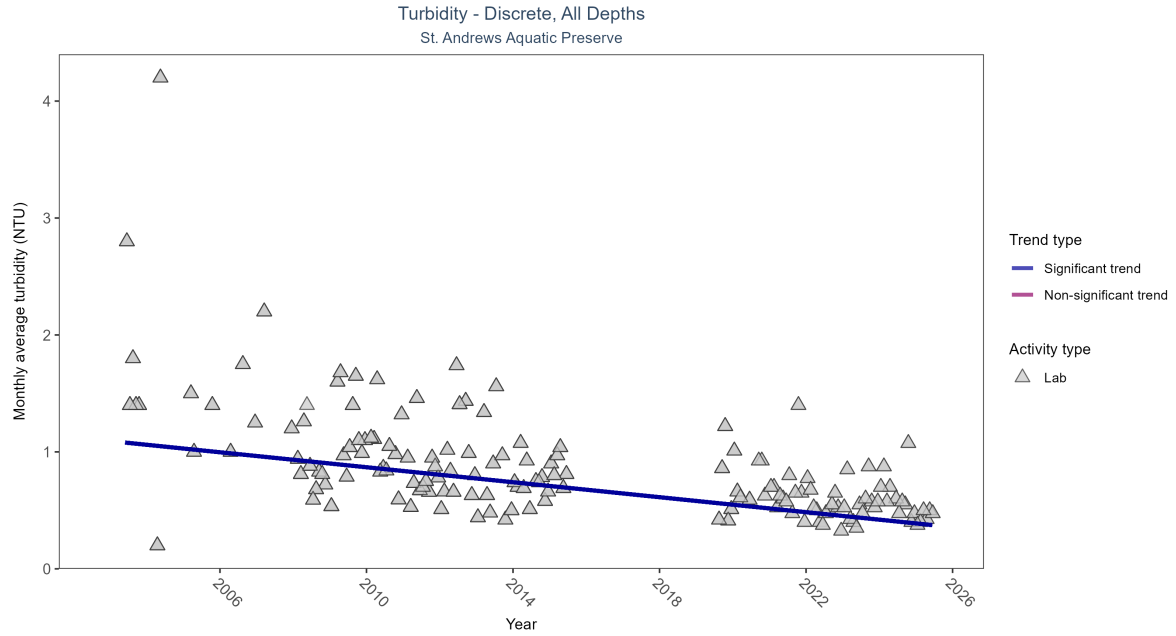


Figure 15: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 8: 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	639	20	2003 - 2025	0.75	-0.47213	1.09285	-0.03202	0

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



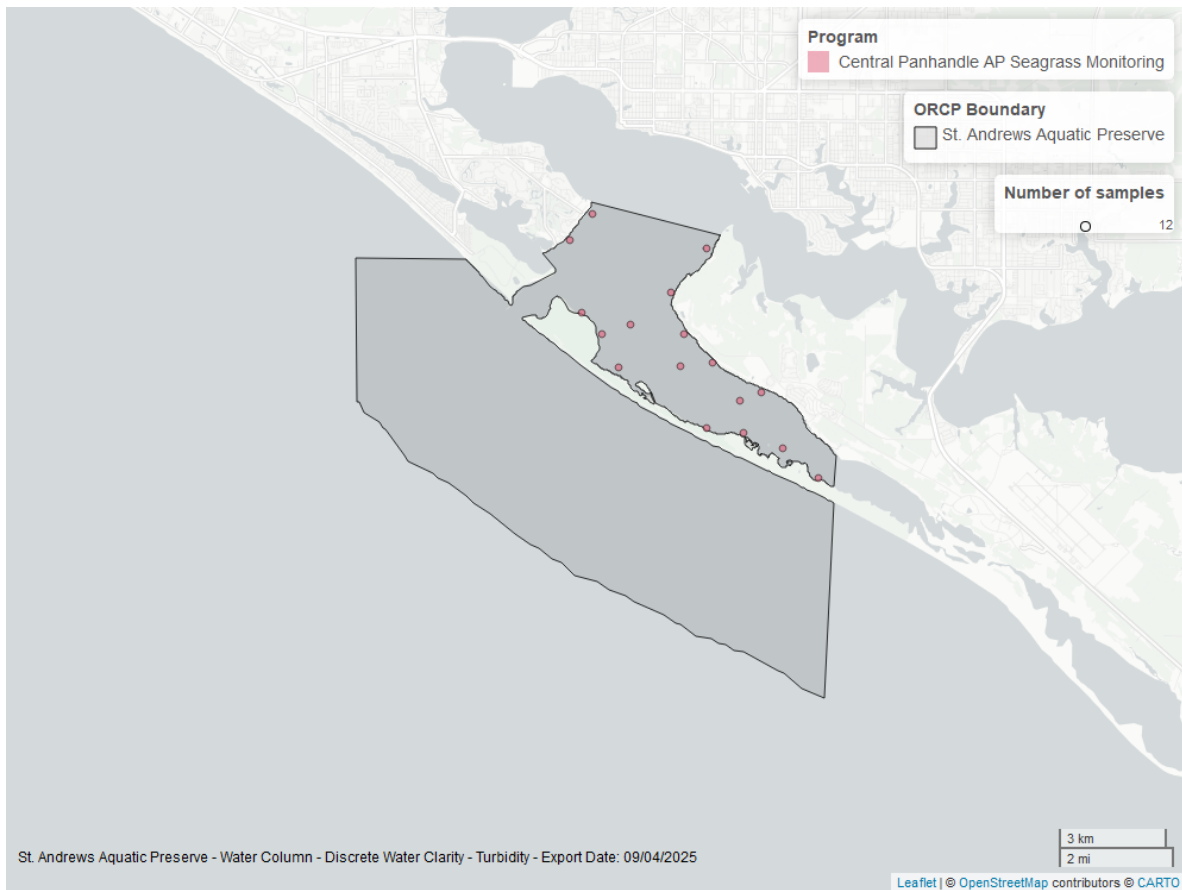


Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Total Suspended Solids - Discrete

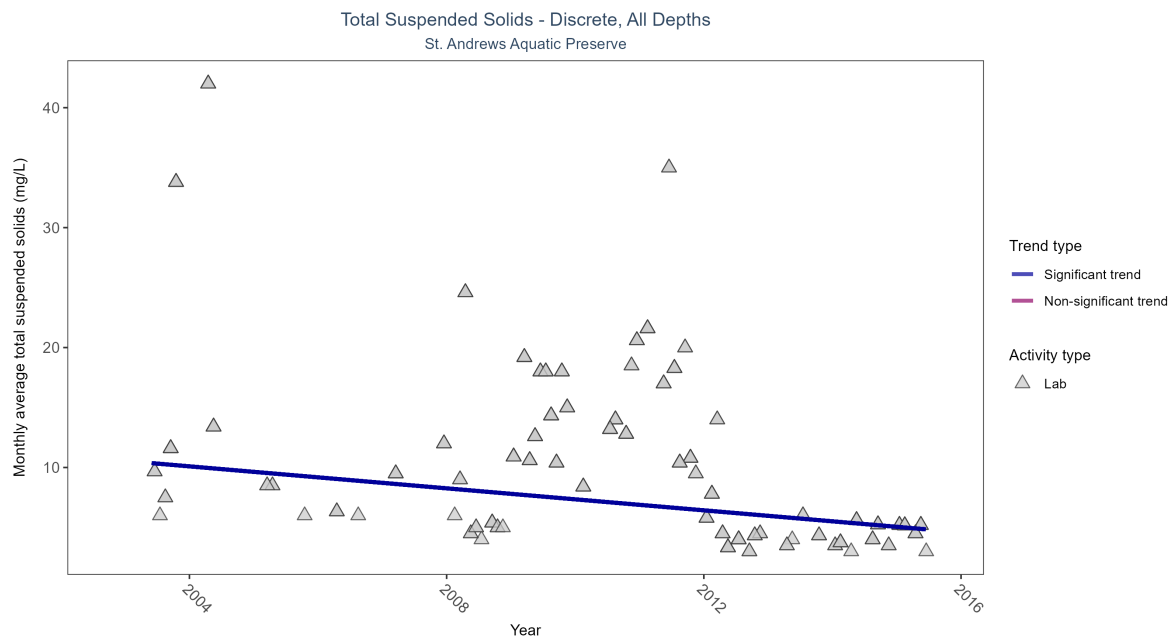


Figure 17: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included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

Table 9: 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	263	13	2003 - 2015	9	-0.23727	10.55284	-0.45833	0.004

Monthly average total suspended solids decreased by 0.46 mg/L per year, indicating an increase in water clarity.

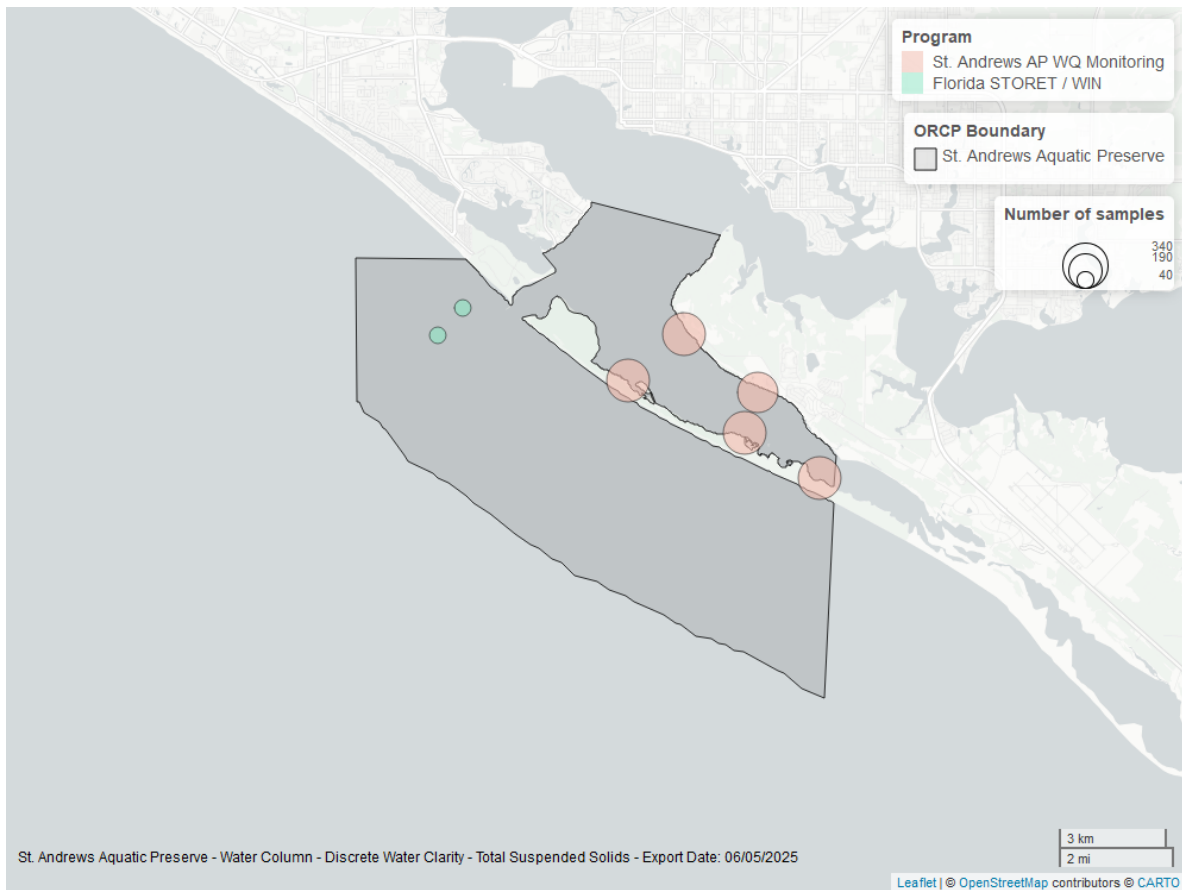


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Chlorophyll a, Uncorrected for Pheophytin - Discrete

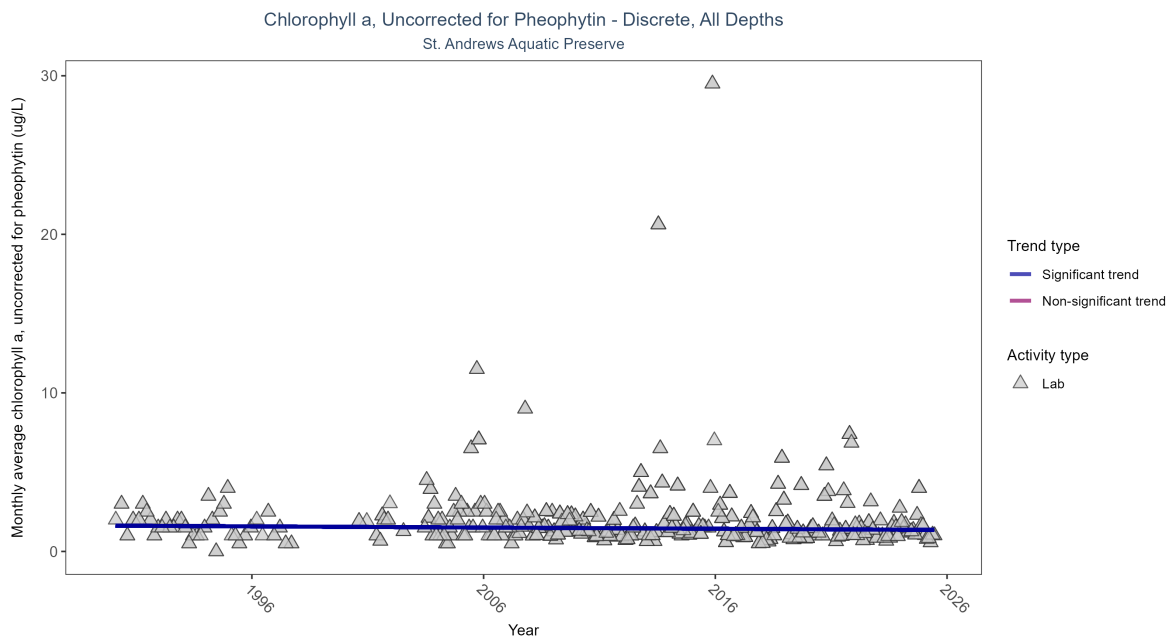


Figure 19: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles)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

Table 10: 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 decreasing trend	1220	34	1990 - 2025	1.3	-0.08936	1.62605	-0.0075	0.0435

Monthly average chlorophyll a, uncorrected for pheophytin, decreased by 0.01  $\mu\text{g/L}$  per year, indicating an increase in water clarity.

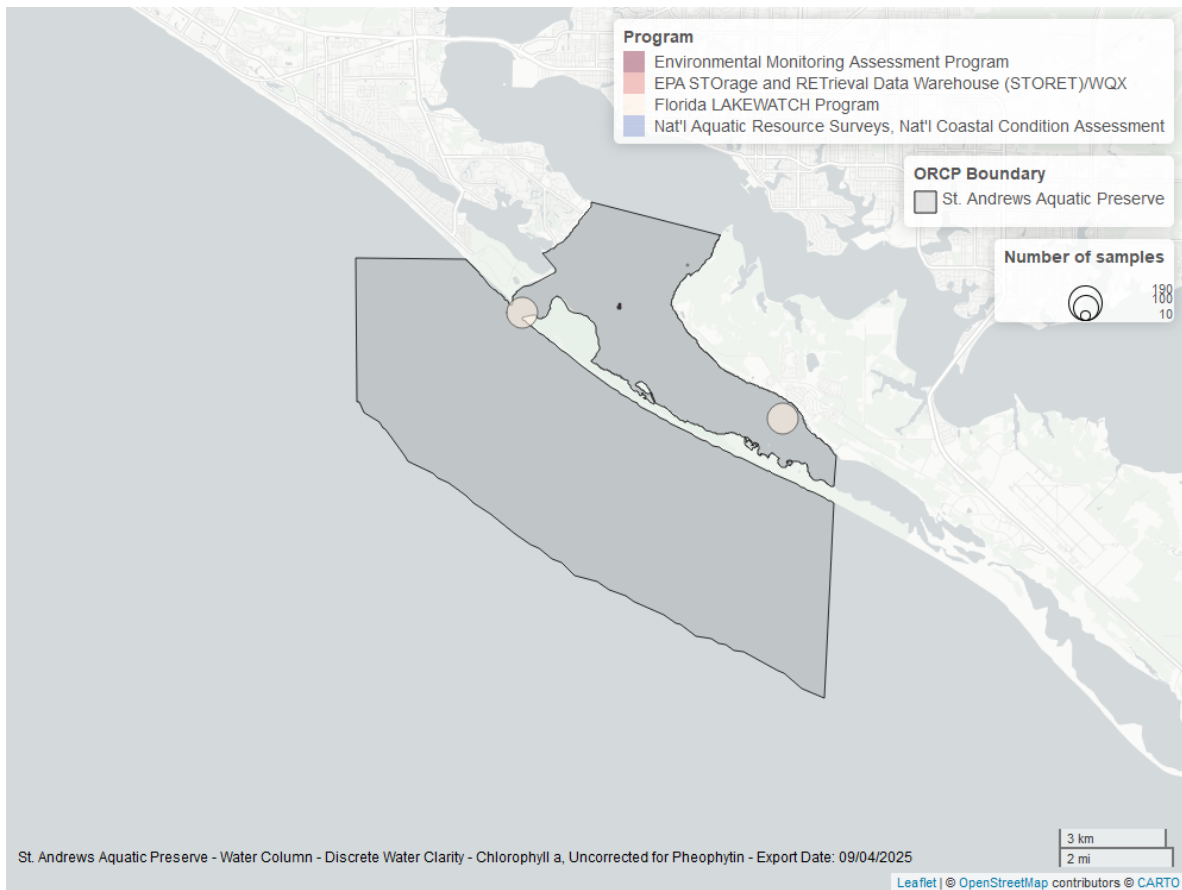


Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Chlorophyll a, Corrected for Pheophytin - Discrete

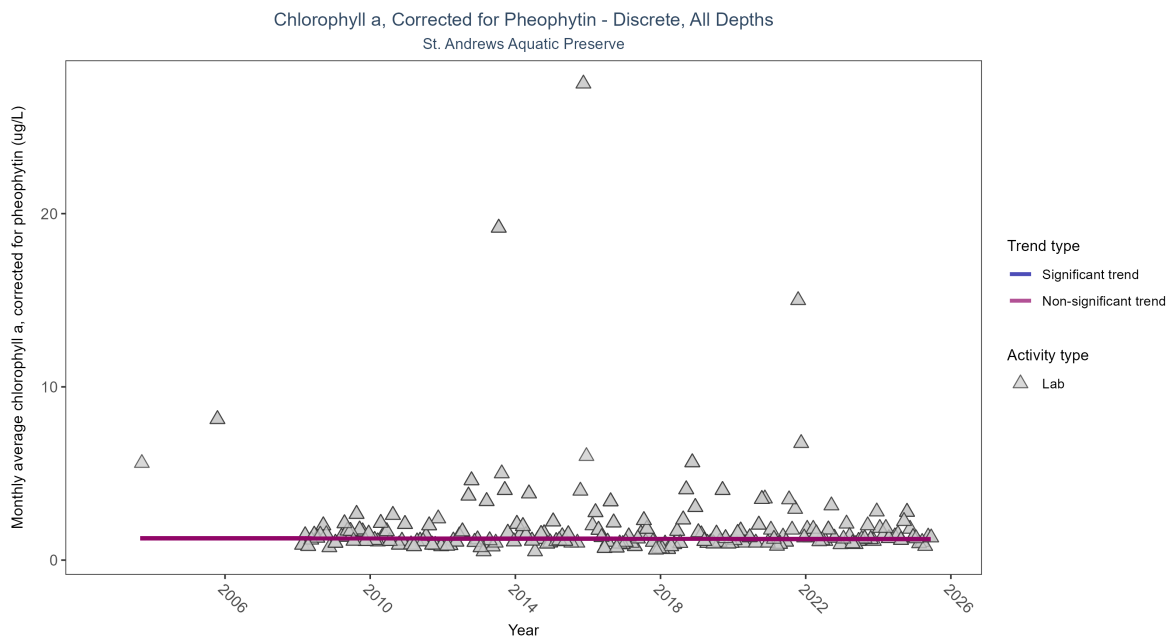


Figure 21: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

Table 11: 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	No significant trend	880	20	2003 - 2025	1.2	-0.01042	1.26512	-0.0025	0.7933

Chlorophyll a, corrected for pheophytin, showed no detectable trend between 2003 and 2025.

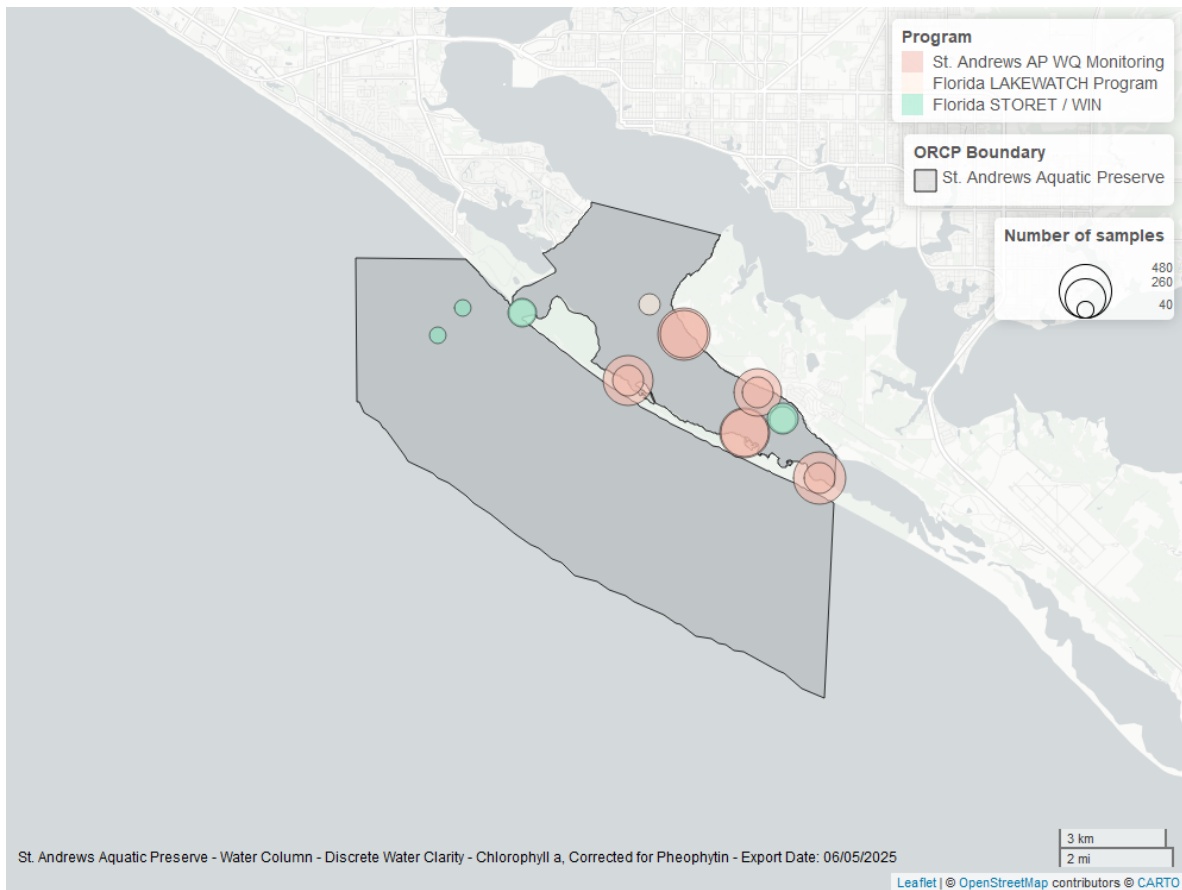


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Secchi Depth - Discrete

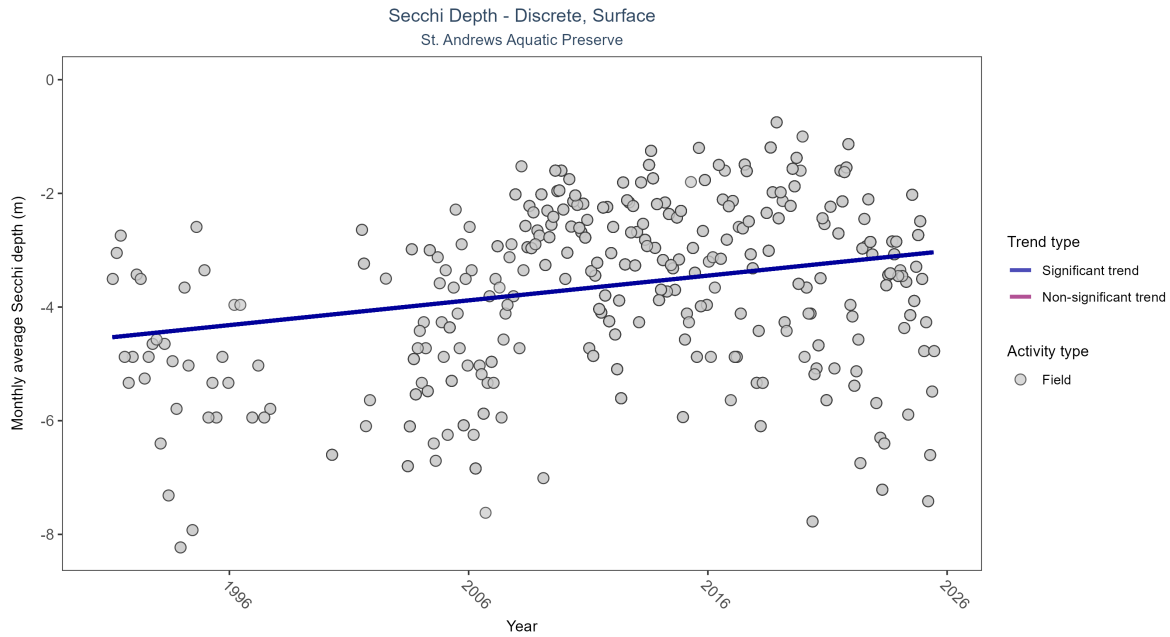


Figure 23: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 12: 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 increasing trend	2357	33	1991 - 2025	-2.59083	0.16616	-4.5357	0.04354	0

Monthly average Secchi depth became shallower by 0.04 m per year, indicating a decrease in water clarity.



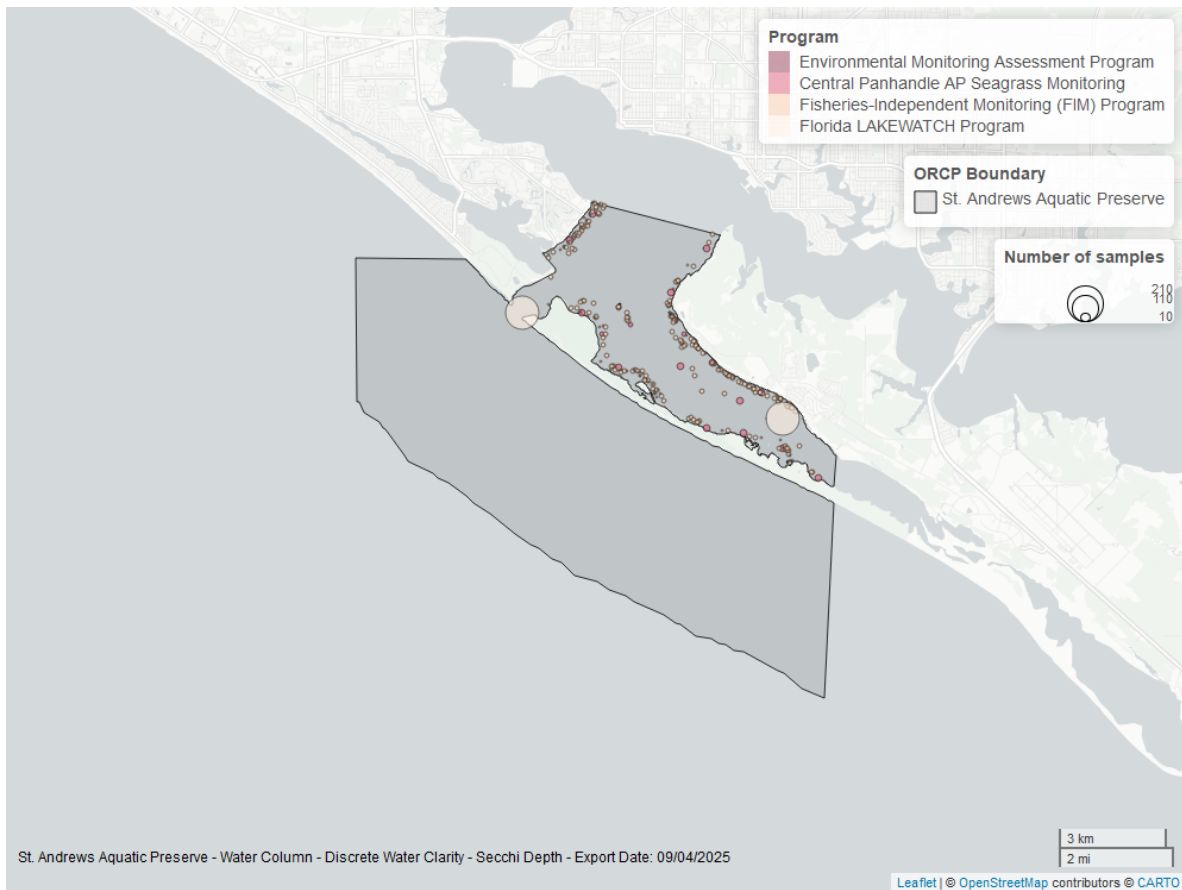


Figure 24: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Colored Dissolved Organic Matter - Discrete

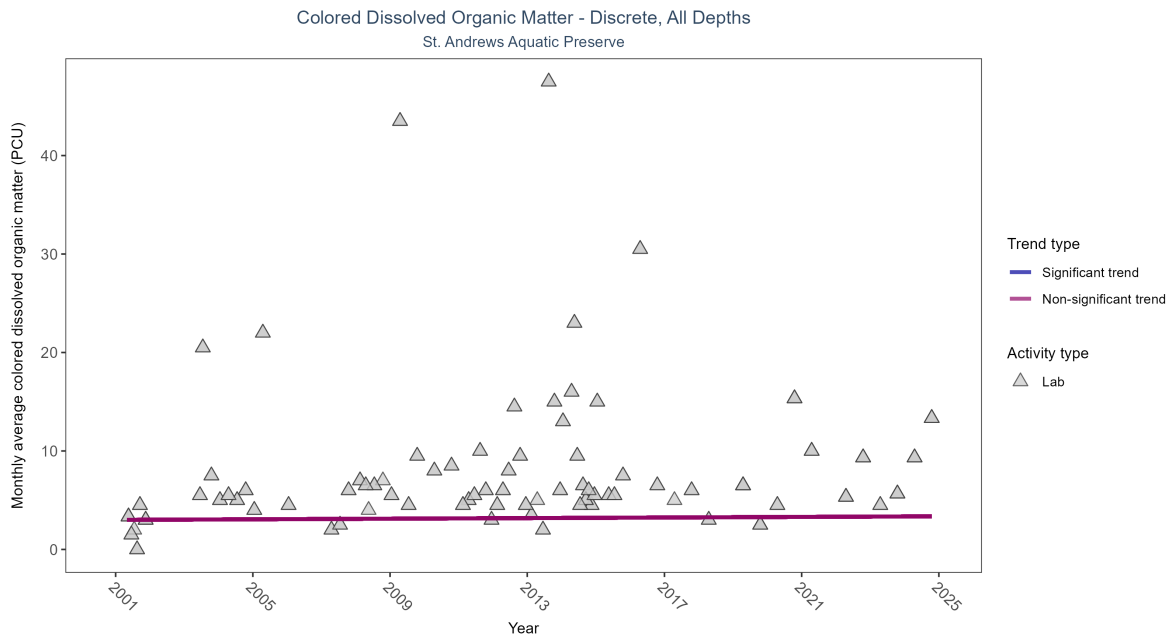


Figure 25: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the plot.

Table 13: 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	No significant trend	164	23	2001 - 2024	6	0.19591	3	0.01515	0.6403

Colored dissolved organic matter showed no detectable trend between 2001 and 2024.

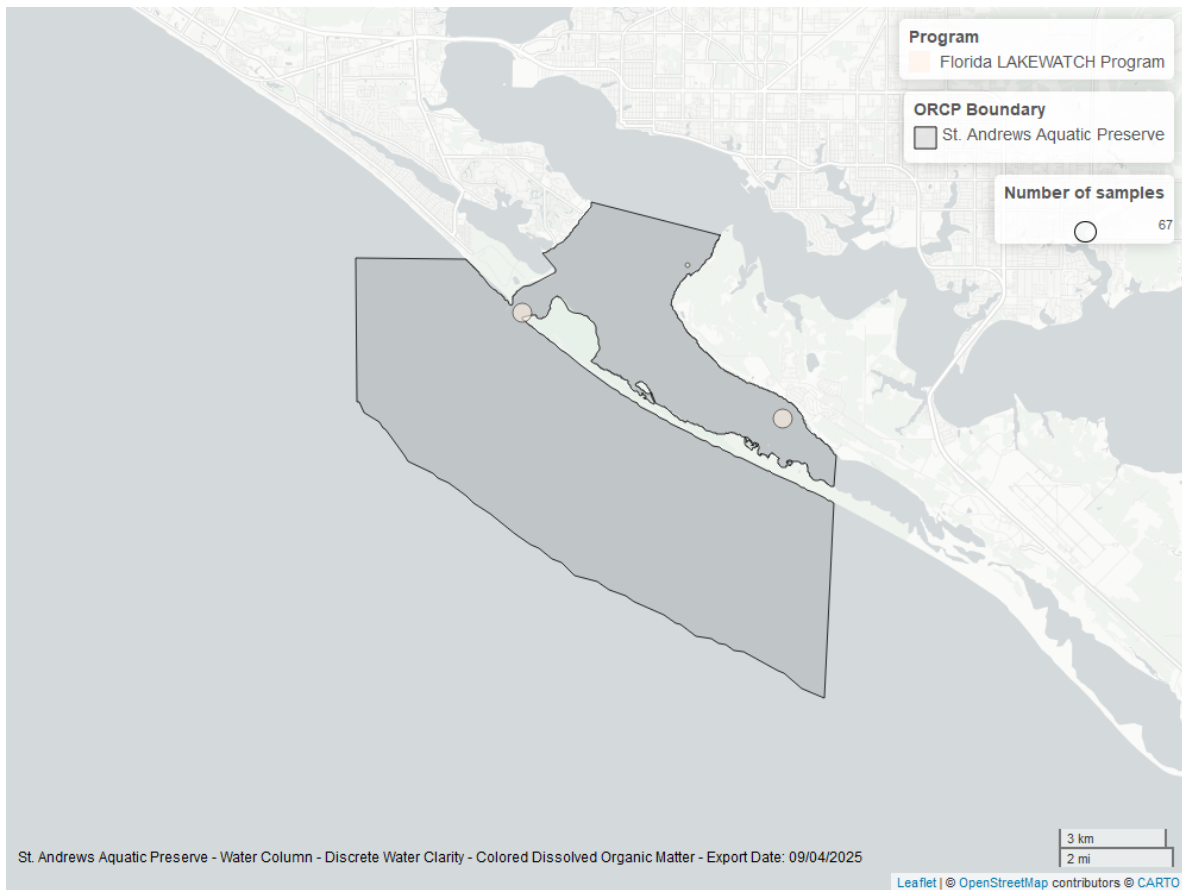


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *St. Andrews Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.