Guana Tolomato Matanzas National Estuarine Research Reserve

SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

Contents

Indicators

Nutrients

Total Nitrogen - Discrete

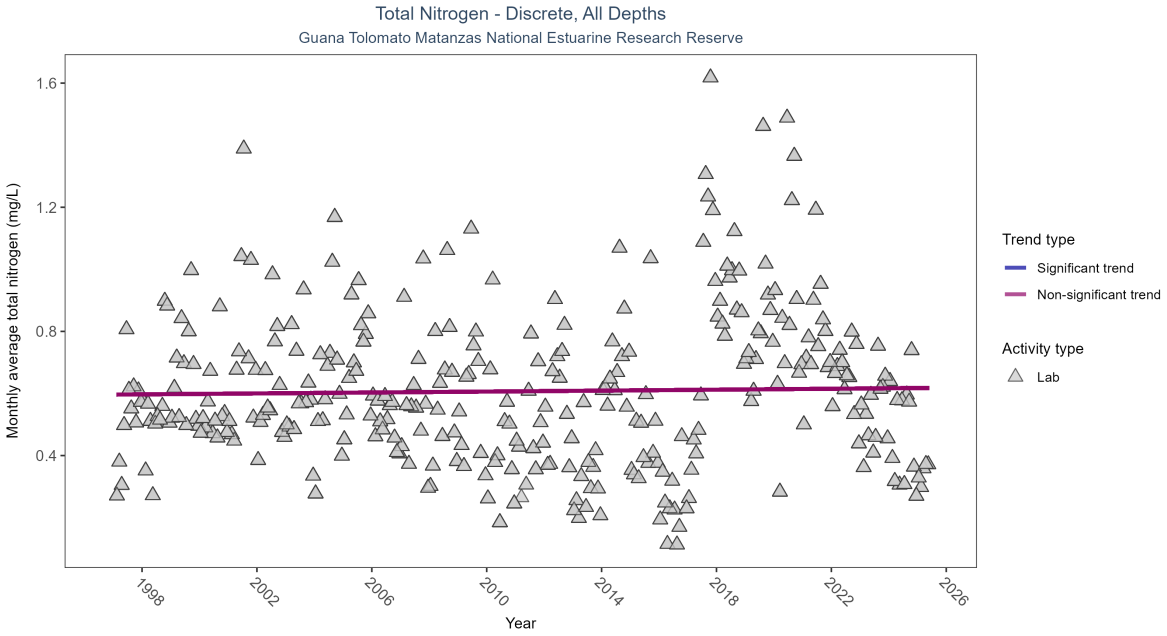

Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	No significant trend	6084	29	1997 - 2025	0.54799	0.02147	0.59633	0.00076	0.5963

Total nitrogen showed no detectable trend between 1997 and 2025.

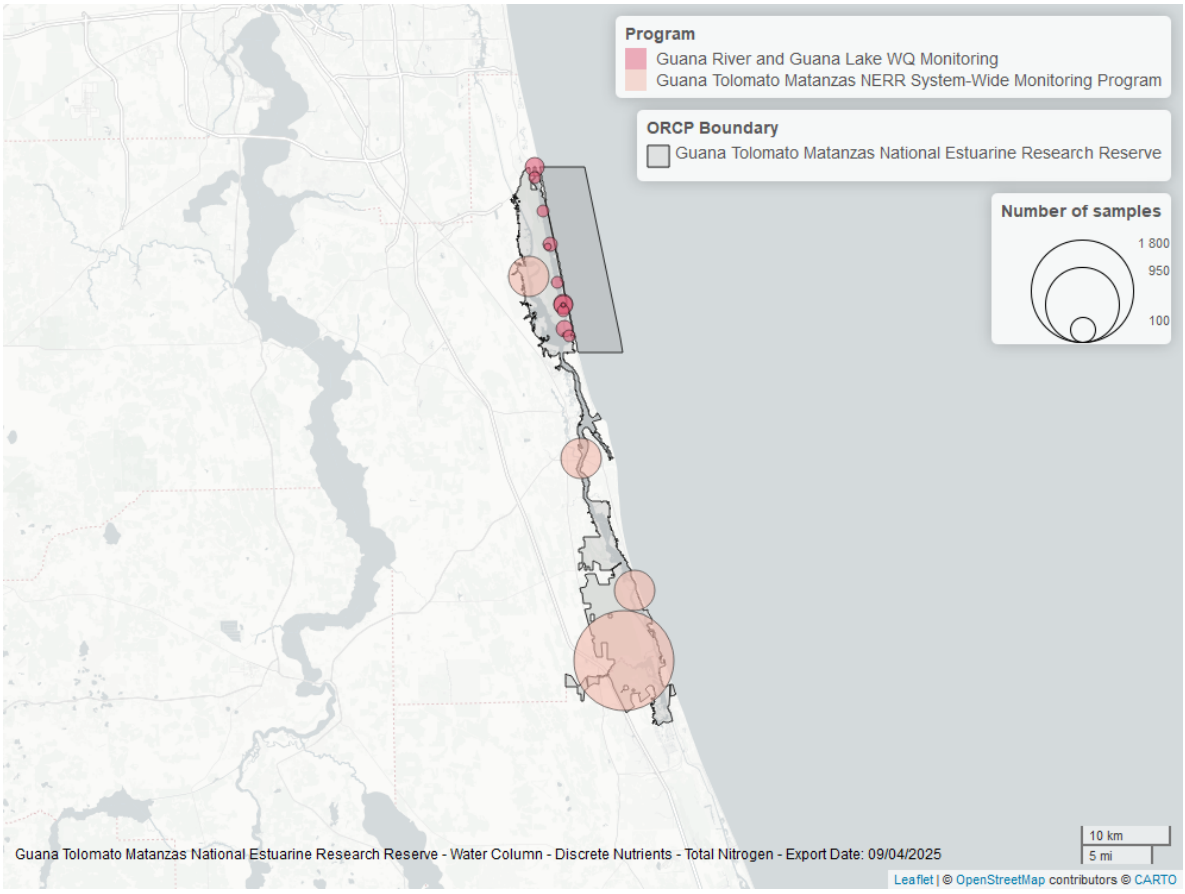

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

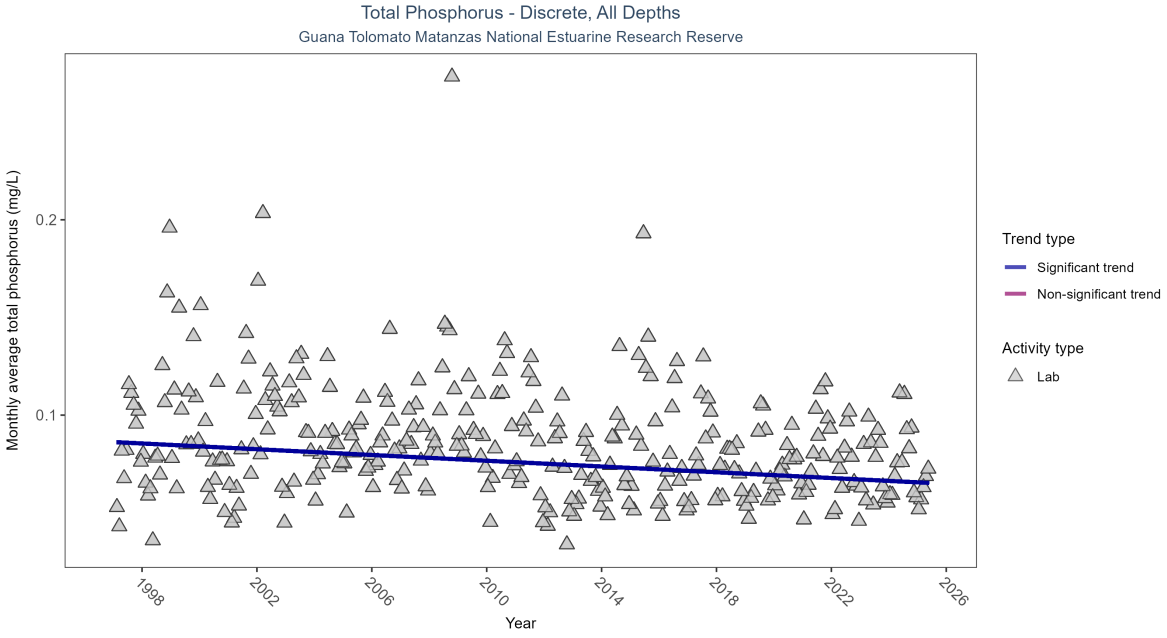

Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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 decreasing trend	9654	29	1997 - 2025	0.071	-0.21046	0.08622	-0.00074	0

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

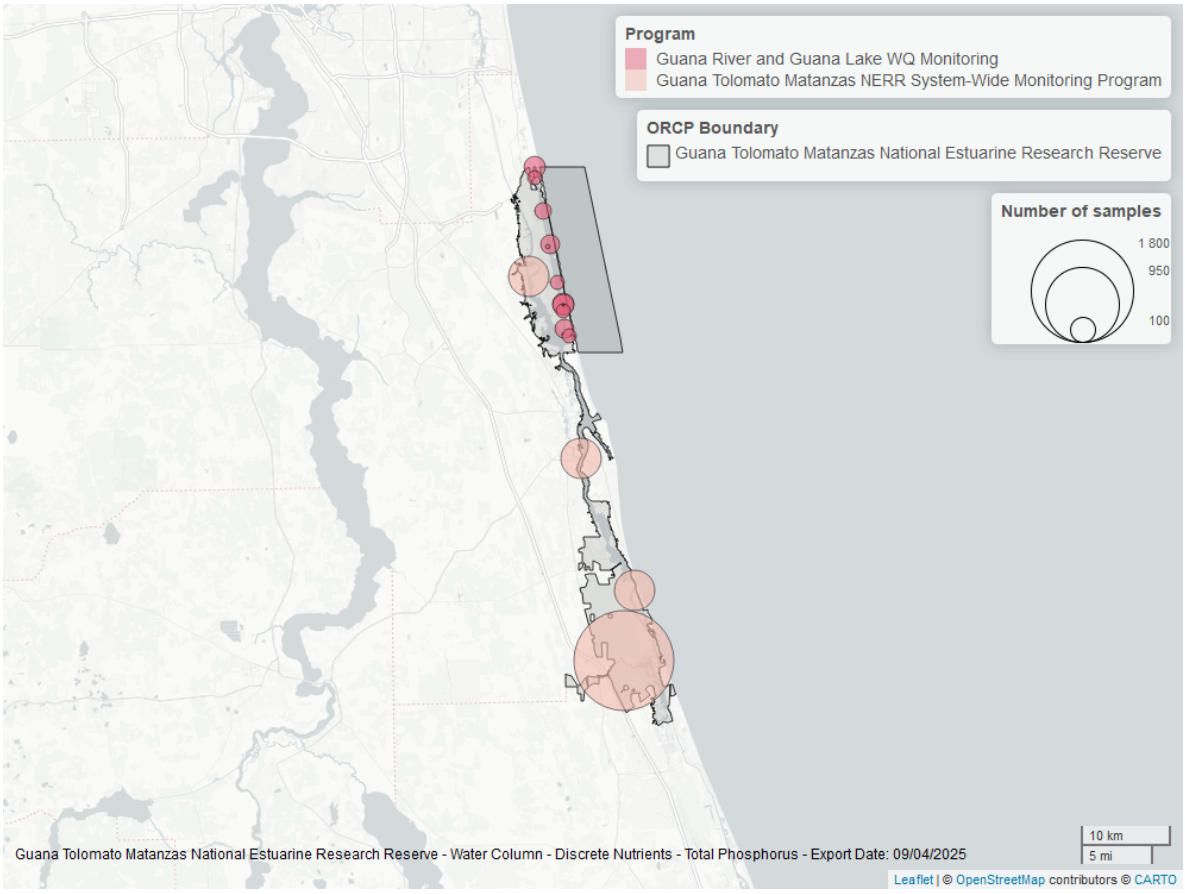

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

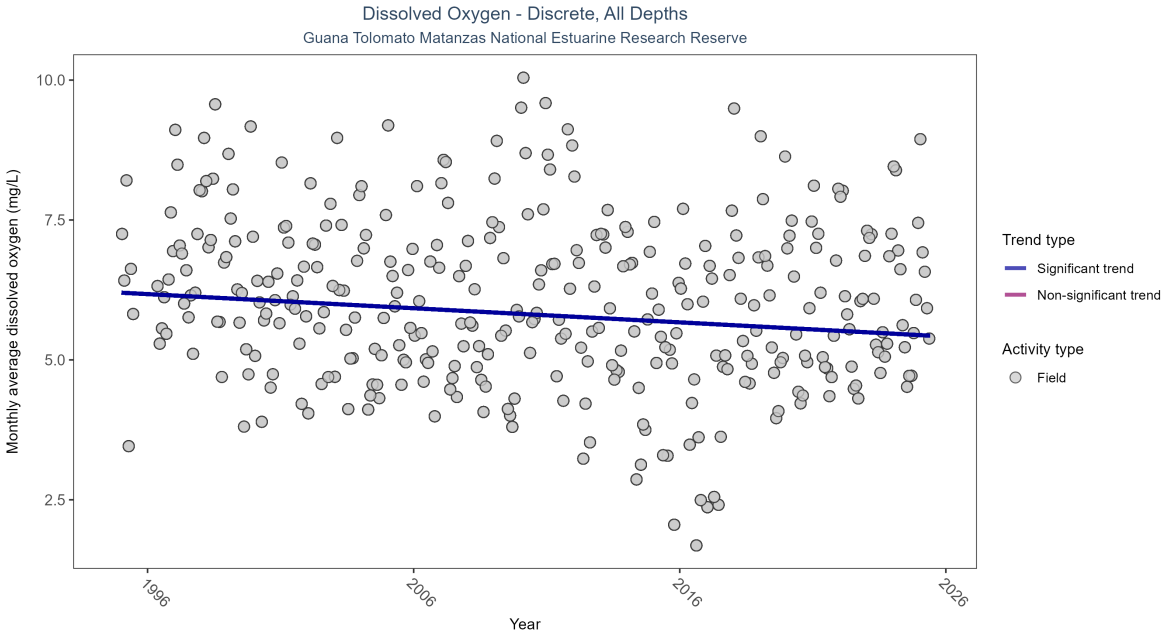

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	22598	31	1995 - 2025	6	-0.17006	6.20085	-0.02525	0

Monthly average dissolved oxygen decreased by 0.03 mg/L per year.

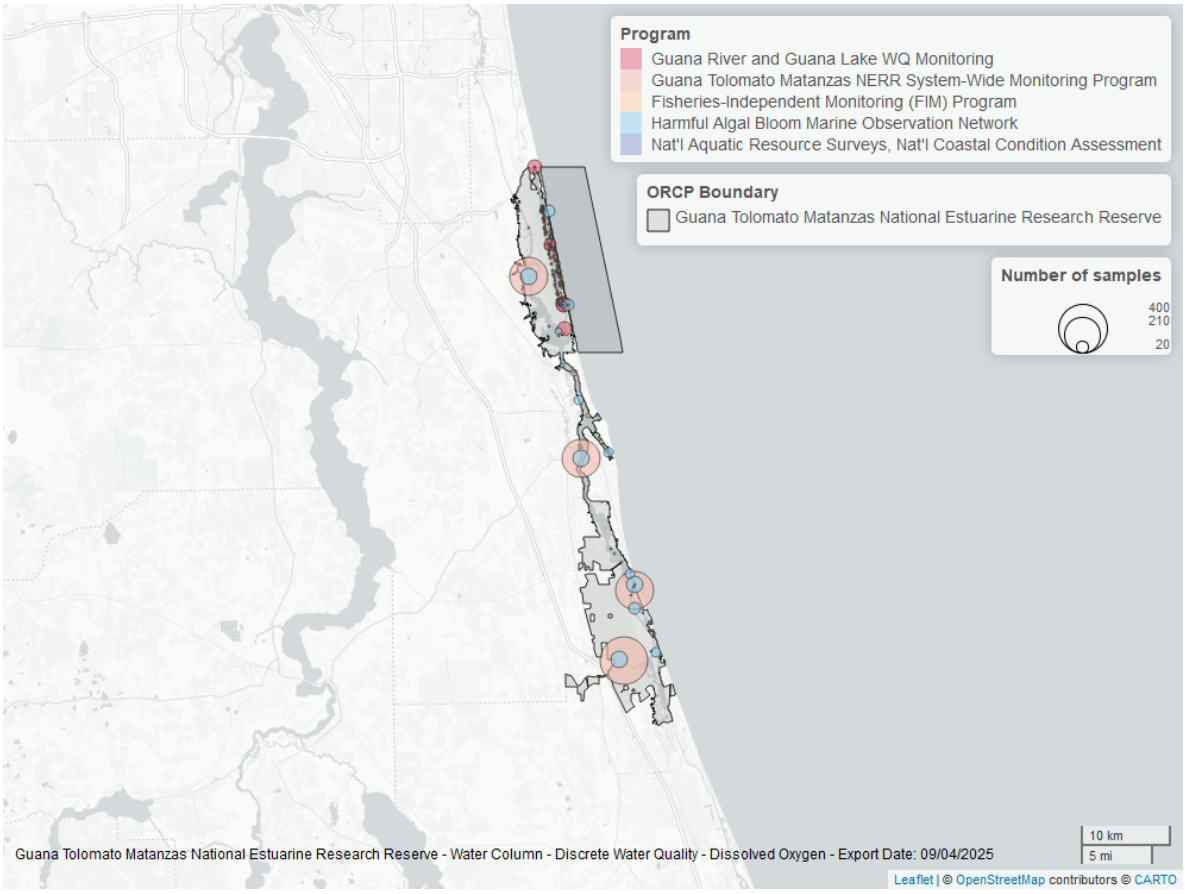

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

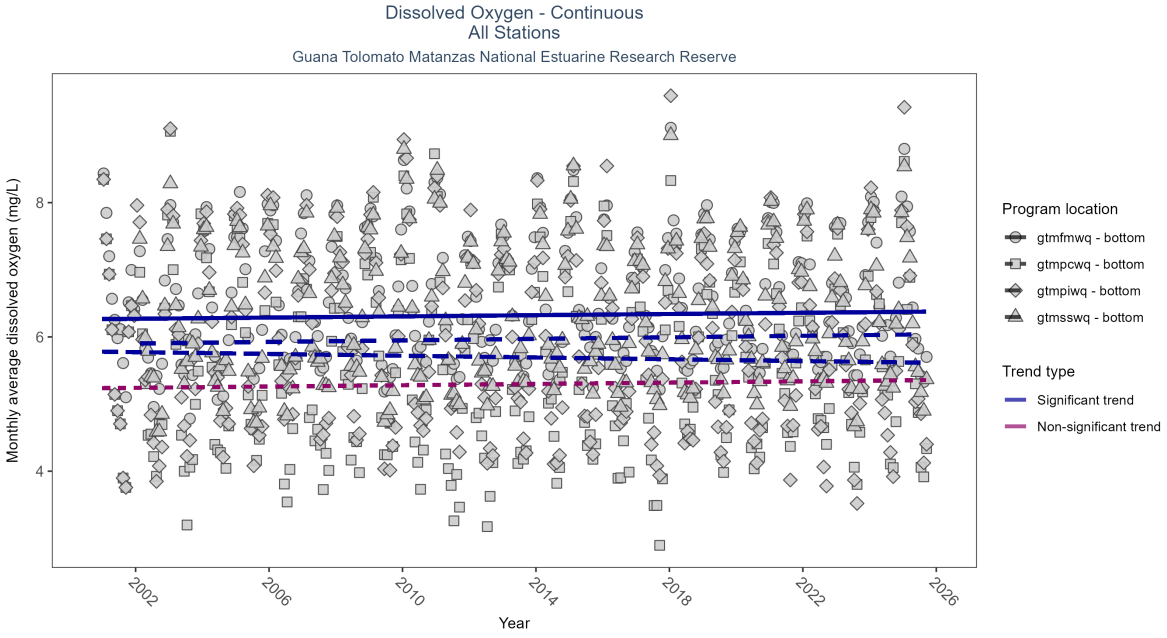

Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmfmwq	Significantly increasing trend	703785	25	2001 - 2025	6.4	0.09	6.27	0.00	0.0266
gtmpiwq	Significantly decreasing trend	685087	25	2001 - 2025	5.8	-0.09	5.78	-0.01	0.037
gtmsswq	Significantly increasing trend	684715	24	2002 - 2025	6.3	0.09	5.90	0.01	0.0424
gtmpcwq	No significant trend	721785	25	2001 - 2025	5.5	0.05	5.24	0.00	0.251

At two program locations, monthly average dissolved oxygen increased by less than 0.01 mg/L per year at one site and by 0.01 mg/L per year at the other. At one program location, monthly average dissolved oxygen decreased by 0.01 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at one location.

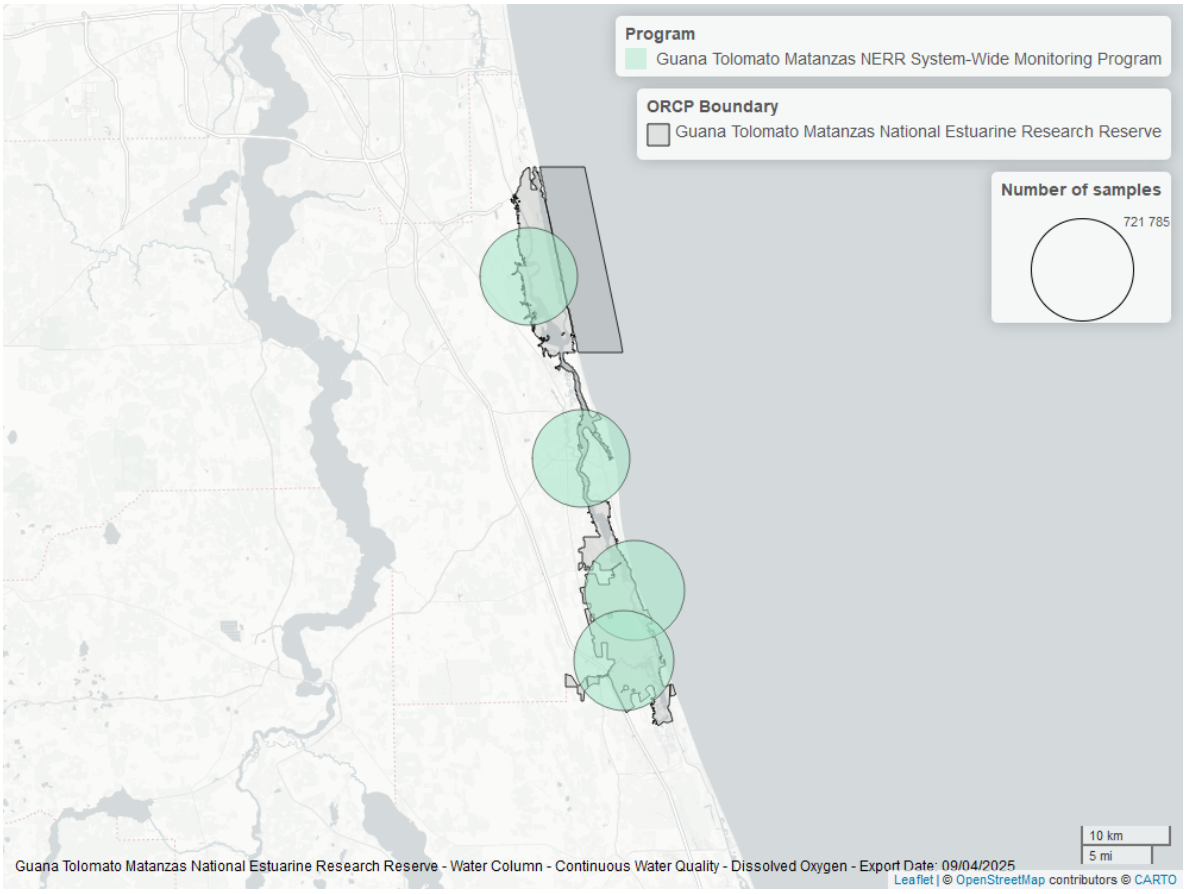

Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

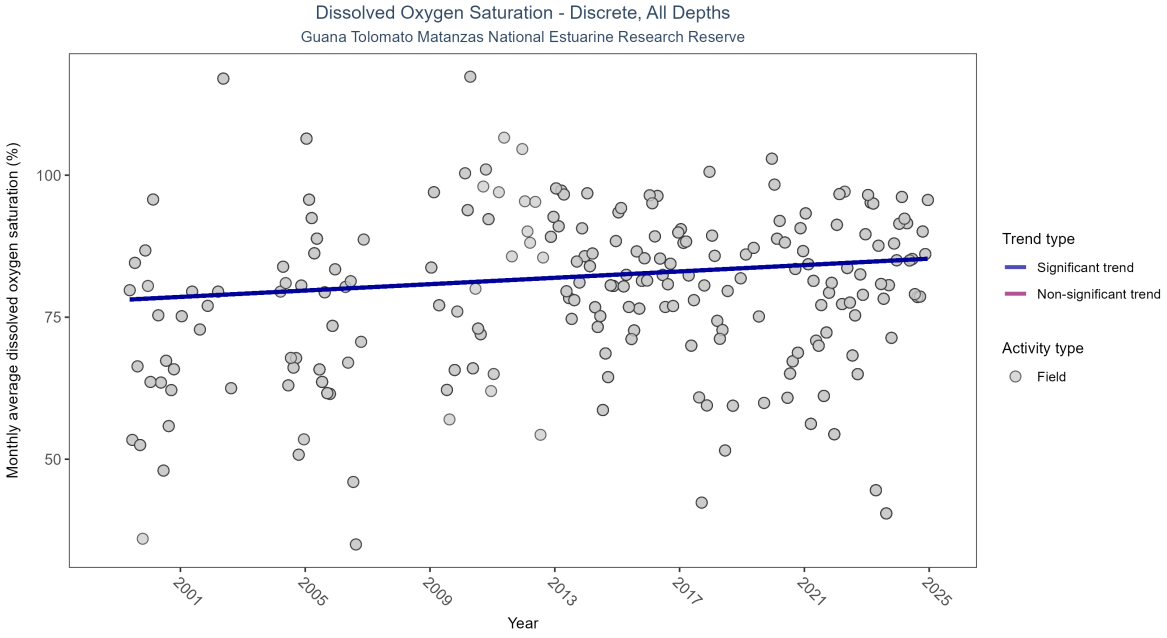

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	2506	23	1999 - 2024	81.6	0.1326	78.00961	0.28034	0.0083

Monthly average dissolved oxygen saturation increased by 0.28% per year.

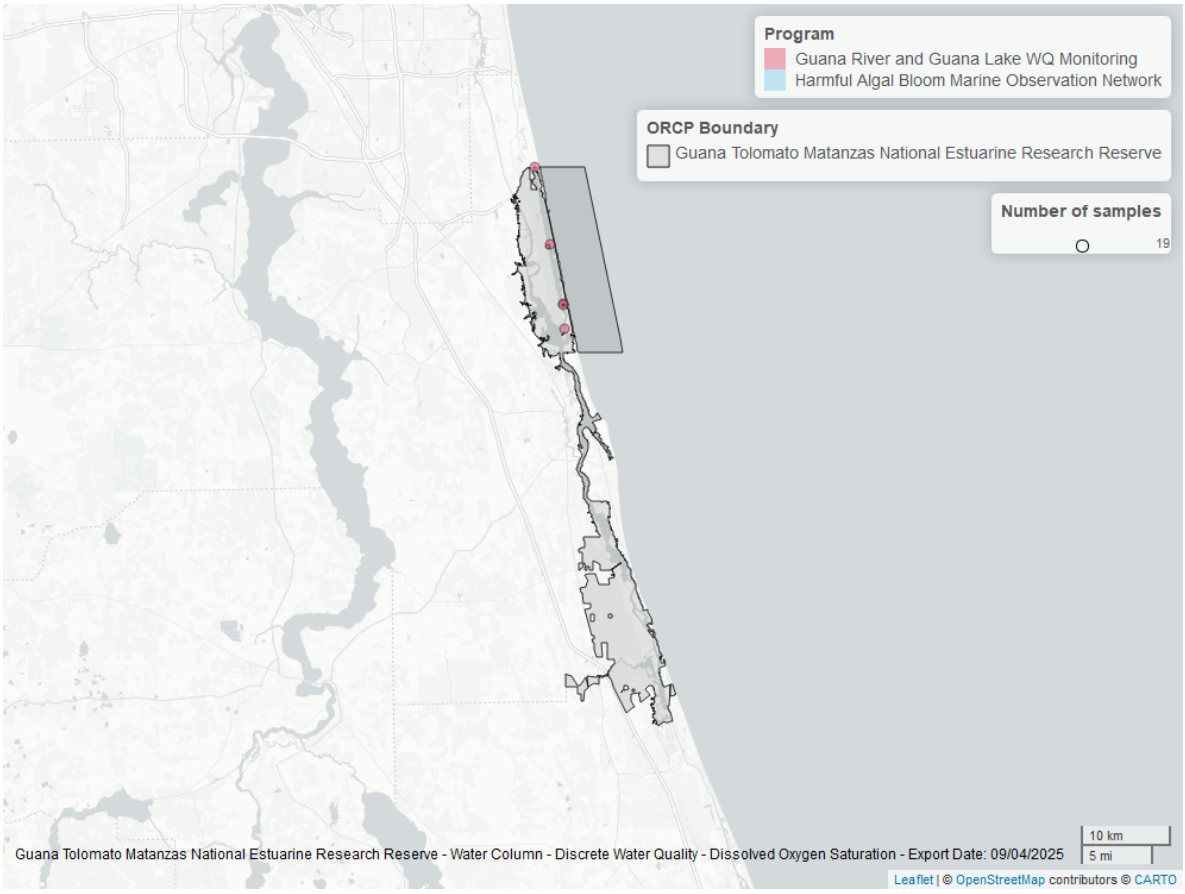

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

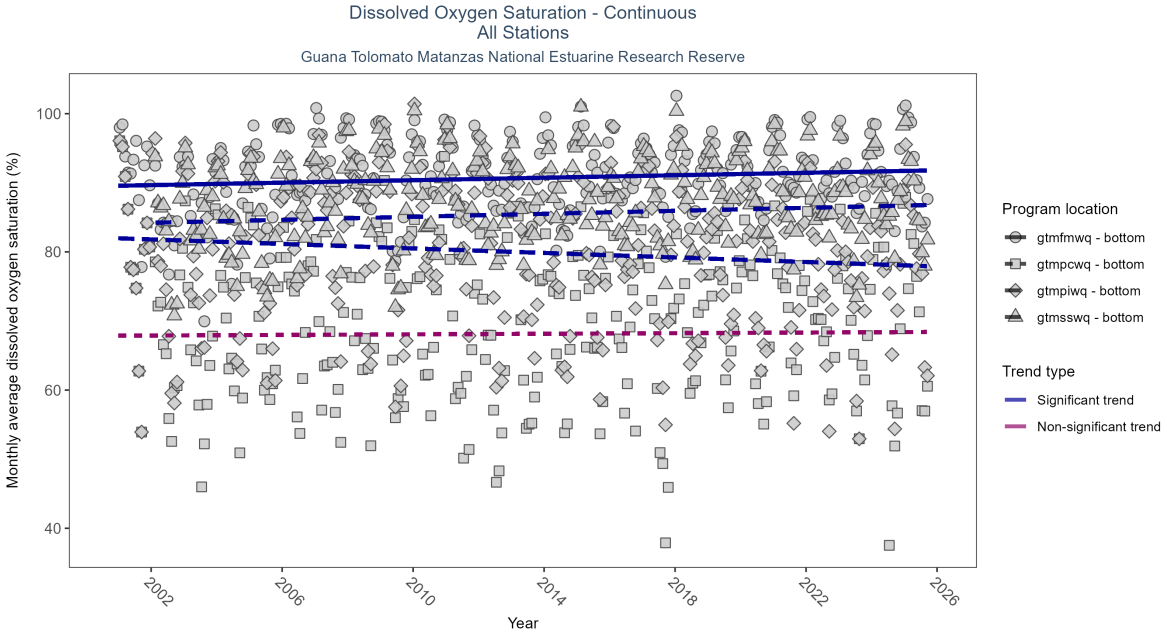

Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmfmwq	Significantly increasing trend	716828	25	2001 - 2025	92.7	0.16	89.57	0.09	1e-04
gtmsswq	Significantly increasing trend	690652	24	2002 - 2025	89.4	0.15	84.21	0.11	6e-04
gtmpcwq	No significant trend	723278	25	2001 - 2025	71.4	0.01	67.88	0.02	0.6851
gtmpiwq	Significantly decreasing trend	690905	25	2001 - 2025	82.2	-0.17	81.97	-0.16	0

At two program locations, monthly average dissolved oxygen saturation increased by 0.09% per year at one site and by 0.11% per year at the other. At one program location, monthly average dissolved oxygen saturation decreased by 0.16% per year. No detectable change in monthly average dissolved oxygen saturation was observed at one location.

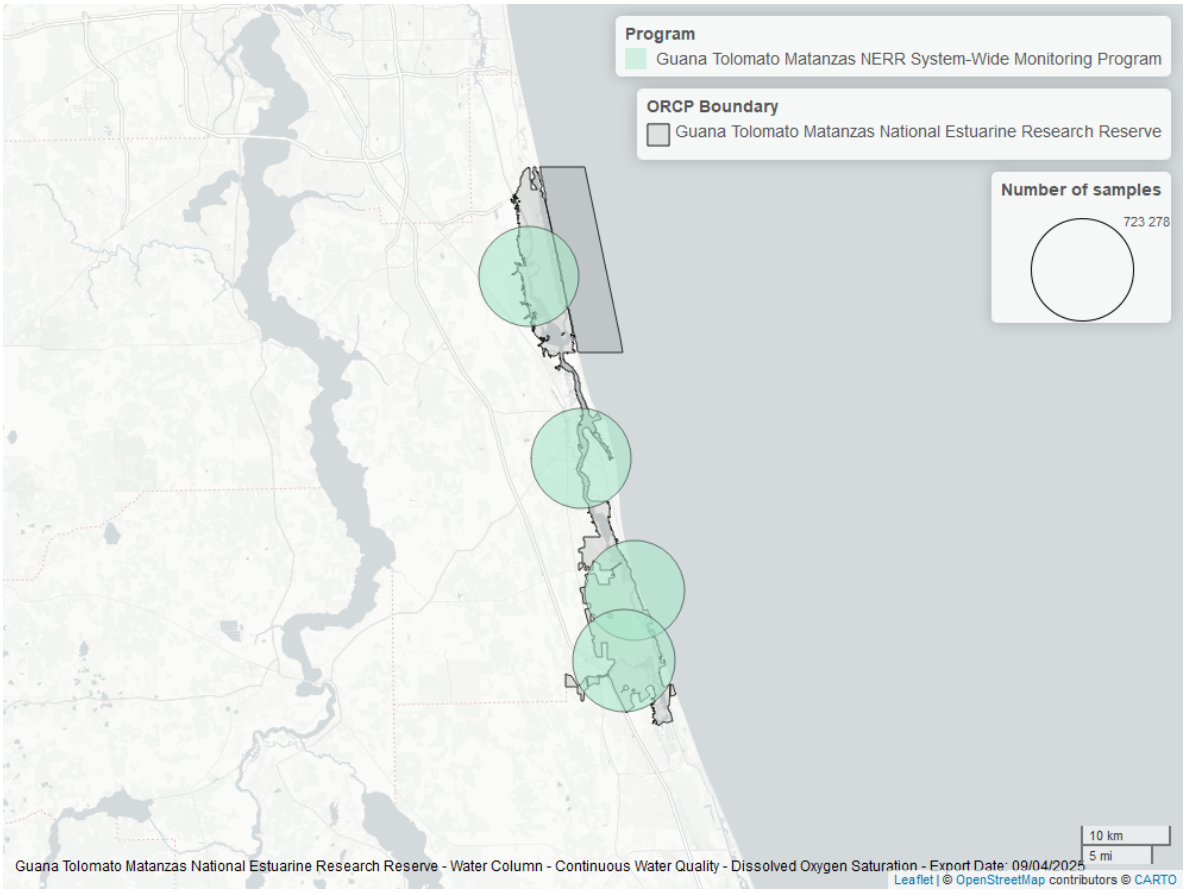

Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

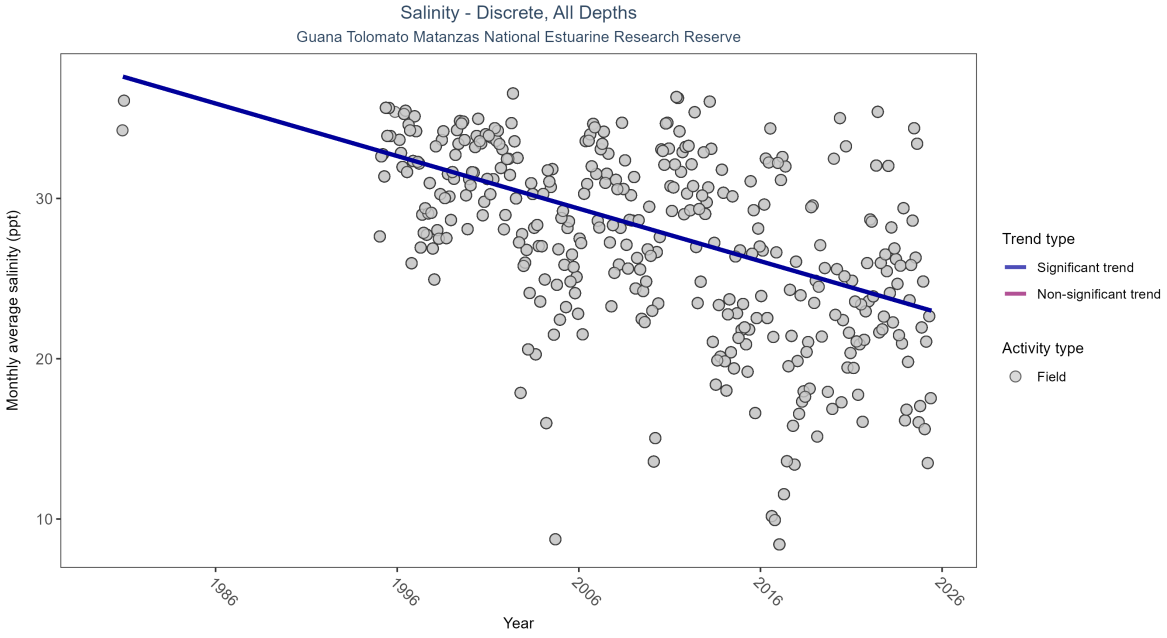

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	26001	32	1980 - 2025	31.7	-0.37842	37.89414	-0.328	0

Monthly average salinity decreased by 0.33 ppt per year.

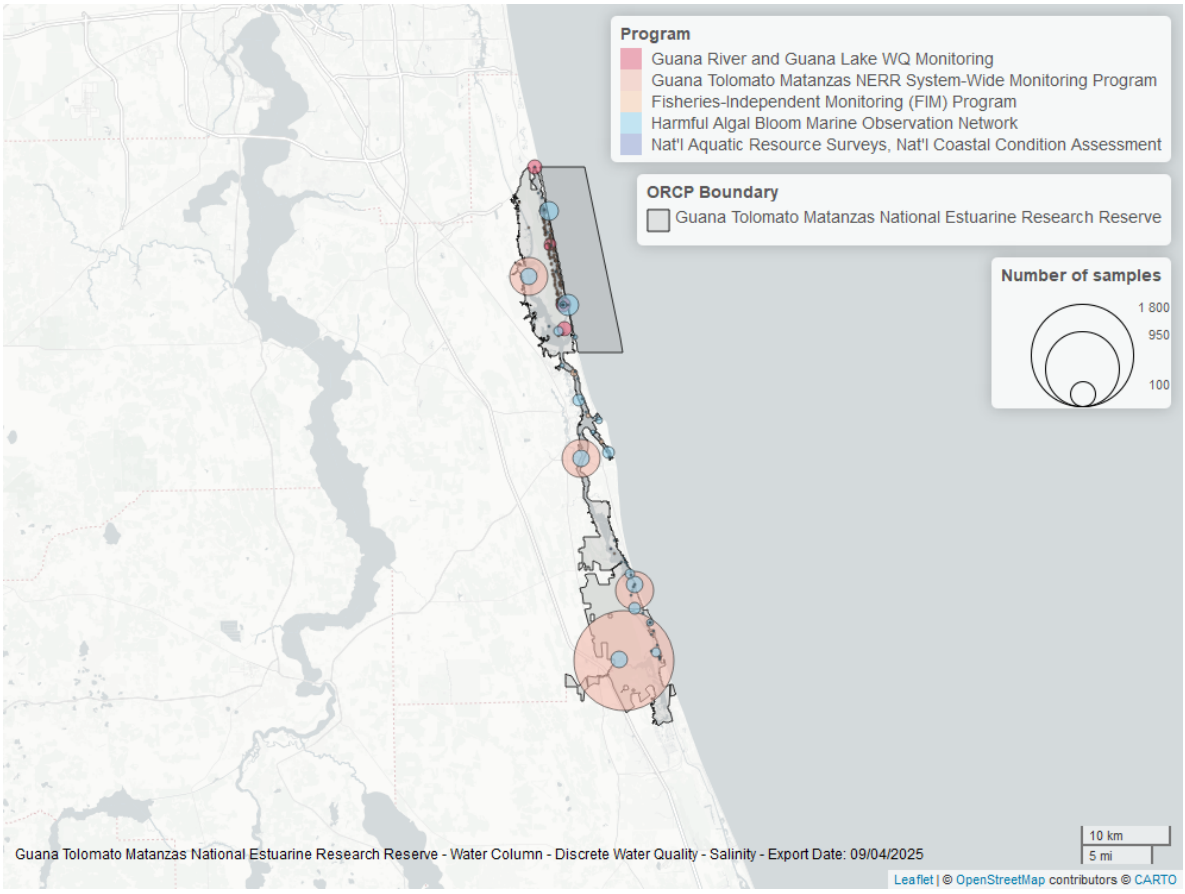

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

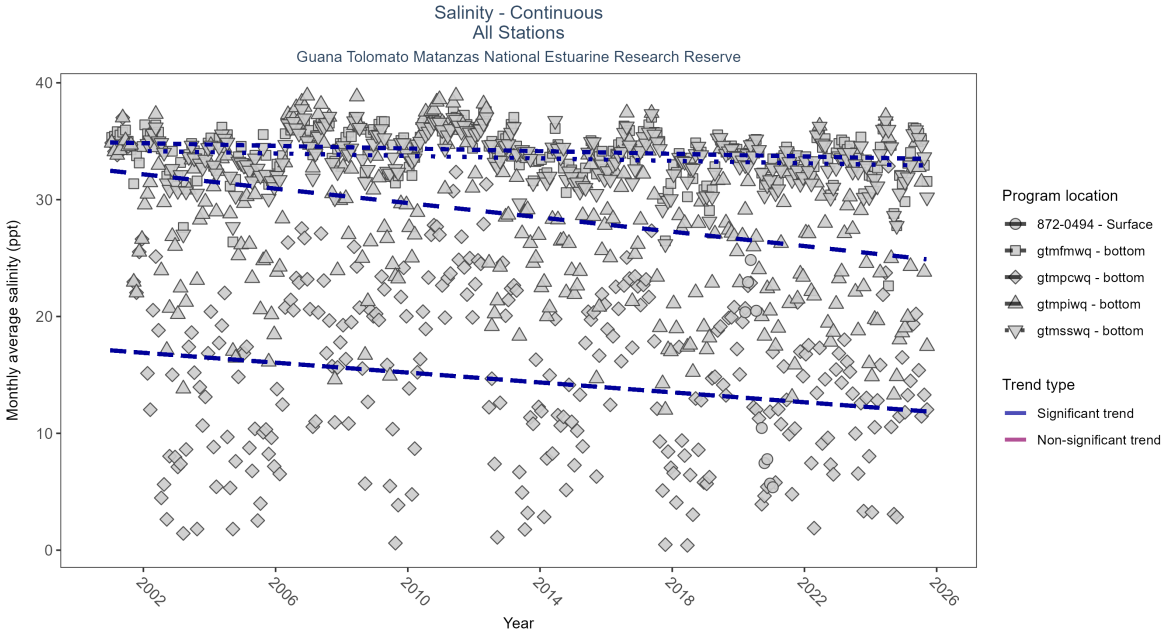

Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmfmwq	Significantly decreasing trend	691675	25	2001 - 2025	34.40	-0.16	34.89	-0.06	1e-04
gtmpcwq	Significantly decreasing trend	731565	25	2001 - 2025	16.60	-0.14	17.1	-0.21	0.0013
gtmsswq	Significantly decreasing trend	669355	24	2002 - 2025	33.90	-0.12	34.16	-0.05	0.0051
gtmpiwq	Significantly decreasing trend	689204	25	2001 - 2025	27.90	-0.26	32.47	-0.31	0
872-0494	Insufficient data to calculate trend	34918	2	2020 - 2021	8.99	-	-	-	-

At four program locations, monthly average salinity decreased between 0.05 and 0.31 ppt per year. There was insufficient data to fit a model for one location.

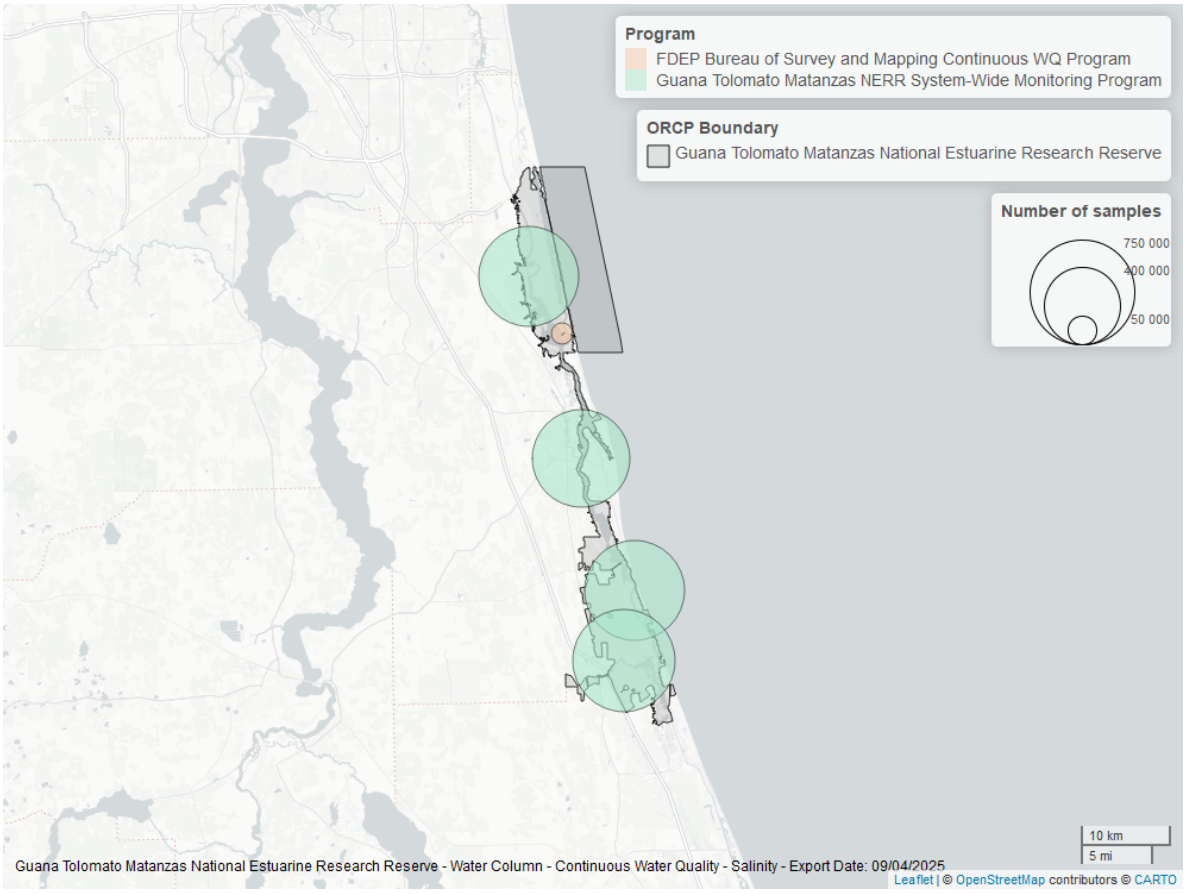

Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

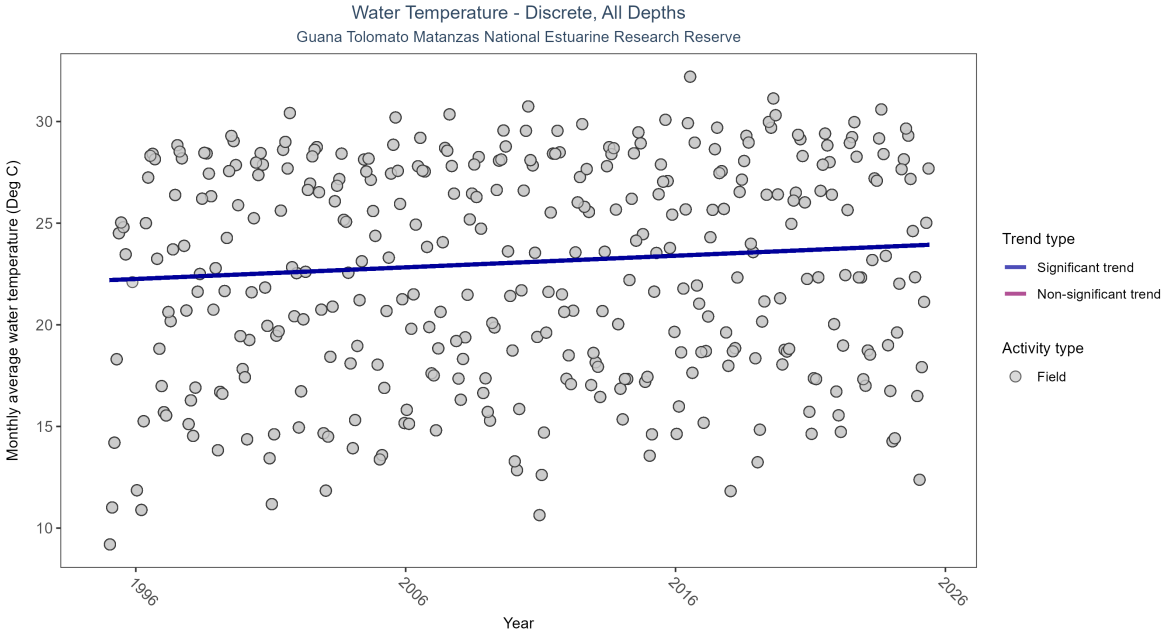

Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	25499	31	1995 - 2025	23.3	0.22385	22.19797	0.05715	0

Monthly average water temperature increased by 0.06°C per year.

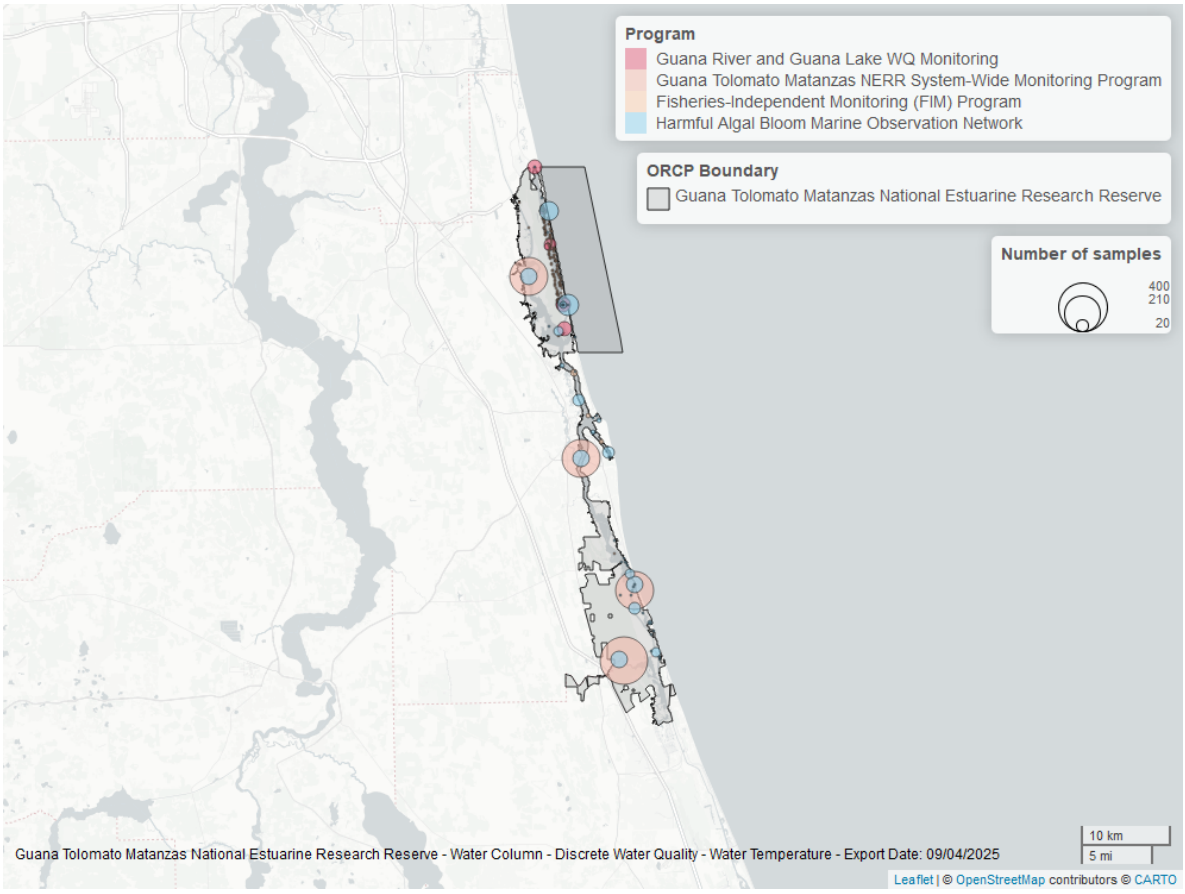

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

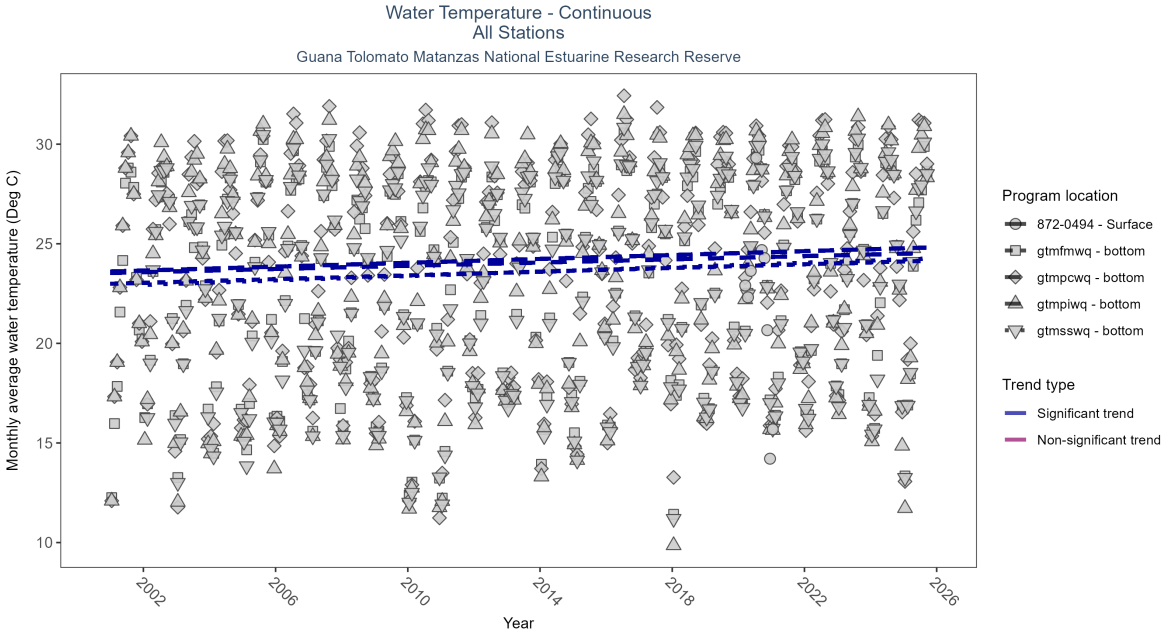

Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmpiwq	Significantly increasing trend	739497	25	2001 - 2025	24.30	0.2	23.53	0.04	0
gtmpcwq	Significantly increasing trend	740131	25	2001 - 2025	24.40	0.17	23.61	0.05	0
gtmfmwq	Significantly increasing trend	736711	25	2001 - 2025	23.80	0.23	22.99	0.05	0
gtmsswq	Significantly increasing trend	702992	24	2002 - 2025	23.90	0.24	22.94	0.06	0
872-0494	Insufficient data to calculate trend	35473	2	2020 - 2021	22.34	-	-	-	-

At four program locations, monthly average water temperature increased between 0.04 and 0.06°C per year. There was insufficient data to fit a model for one location.

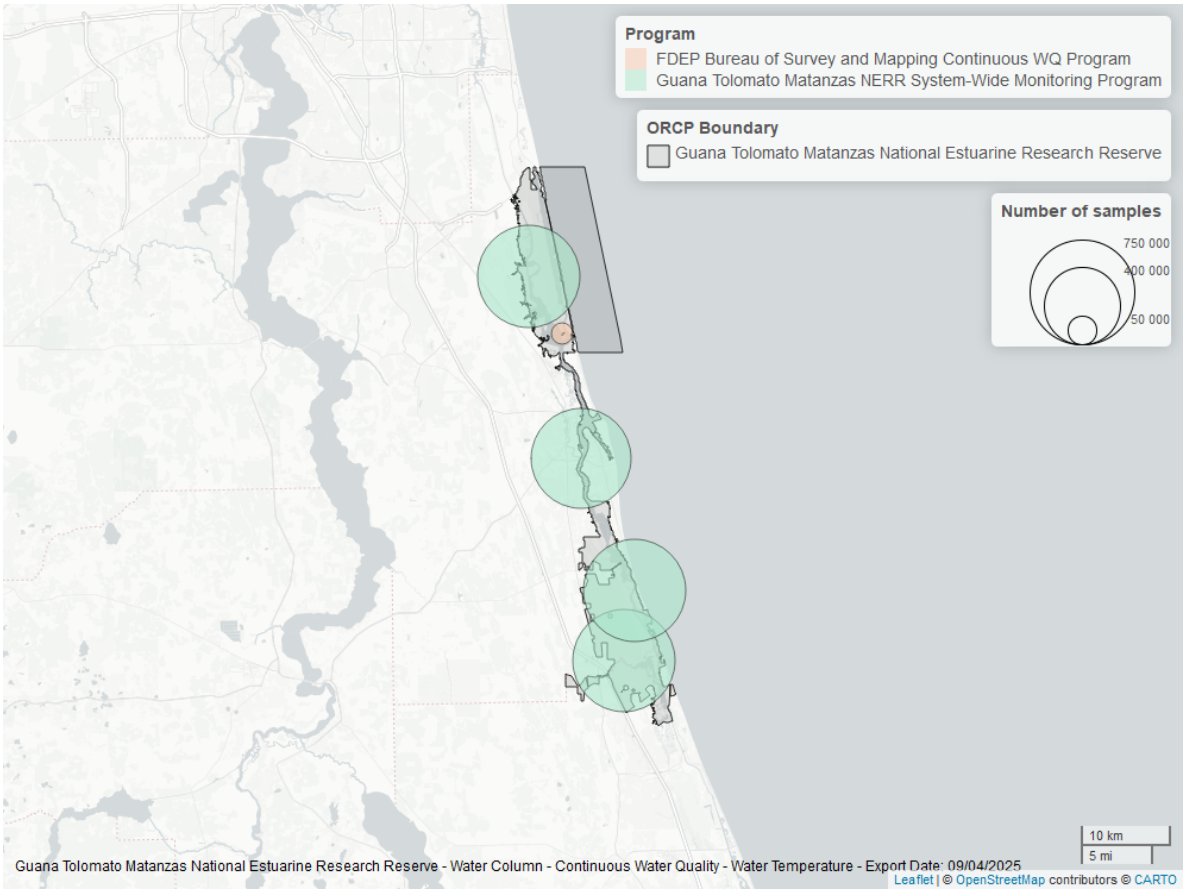

Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

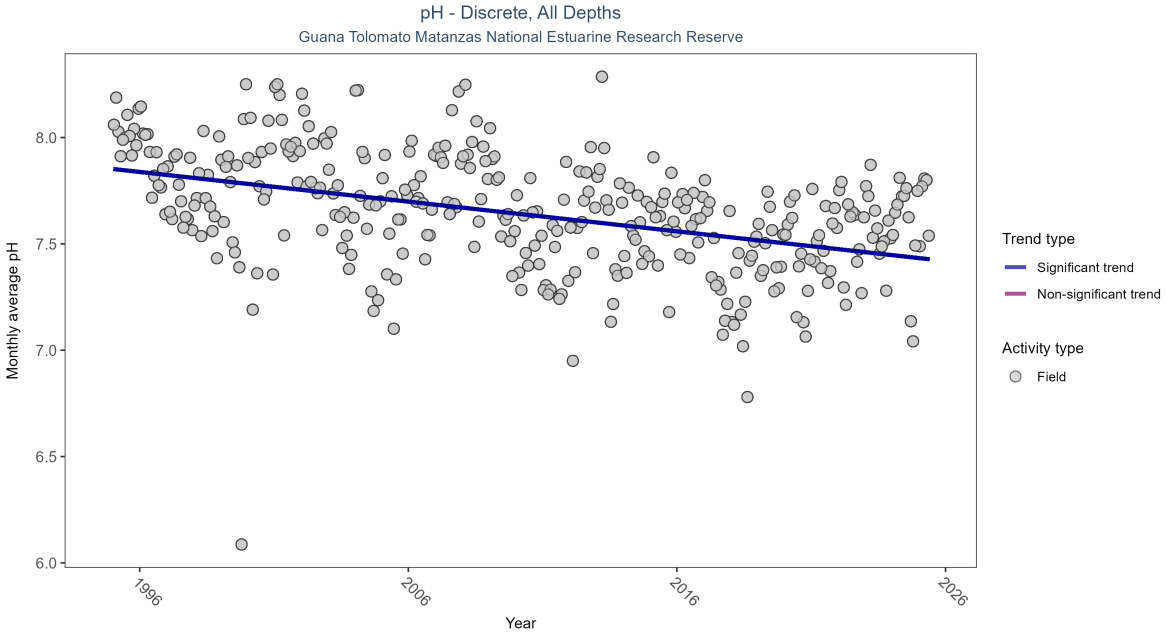

Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	18867	31	1995 - 2025	7.8	-0.36688	7.85216	-0.01396	0

Monthly average pH decreased by 0.01 pH units per year.

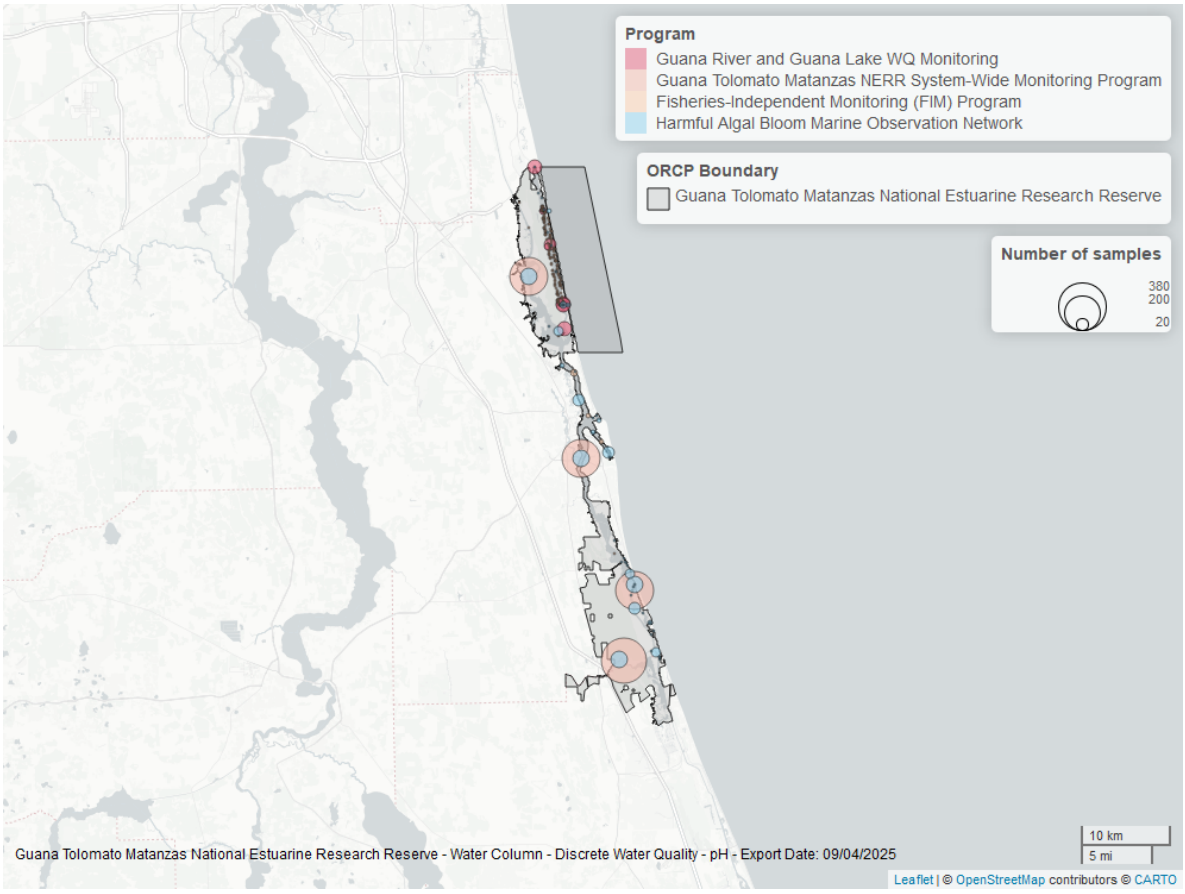

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

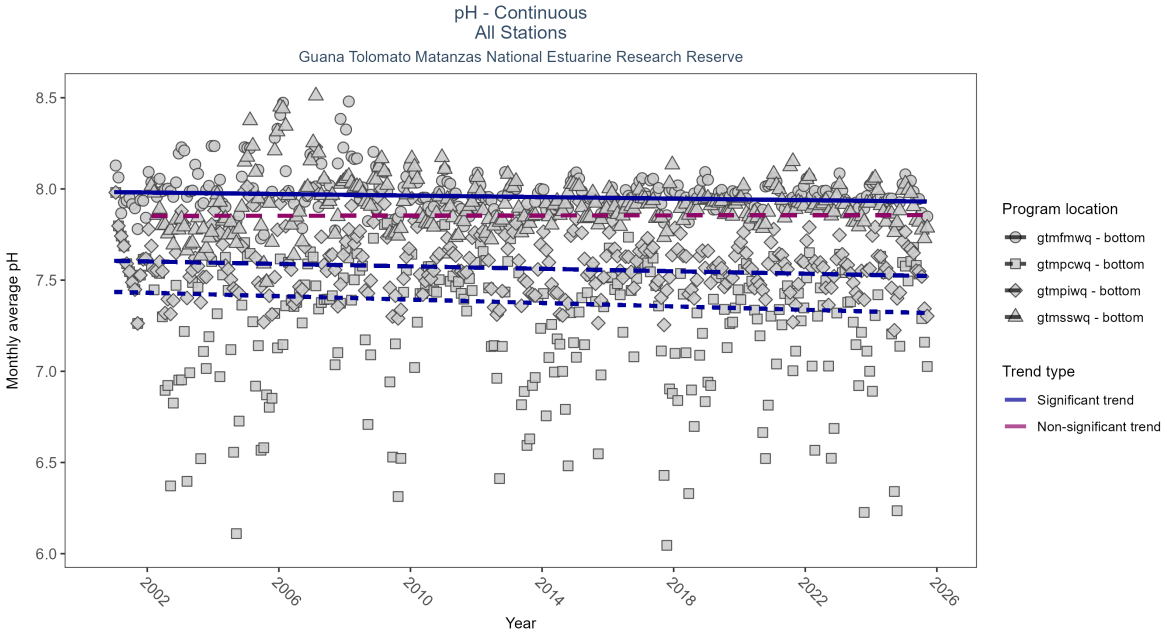

Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmfmwq	Significantly decreasing trend	687856	25	2001 - 2025	8.0	-0.15	7.98	0	4e-04
gtmpiwq	Significantly decreasing trend	682135	25	2001 - 2025	7.6	-0.17	7.61	0	0
gtmpcwq	Significantly decreasing trend	716012	25	2001 - 2025	7.4	-0.10	7.44	0	0.0191
gtmsswq	No significant trend	660421	24	2002 - 2025	7.9	0.00	7.85	0	0.8399

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

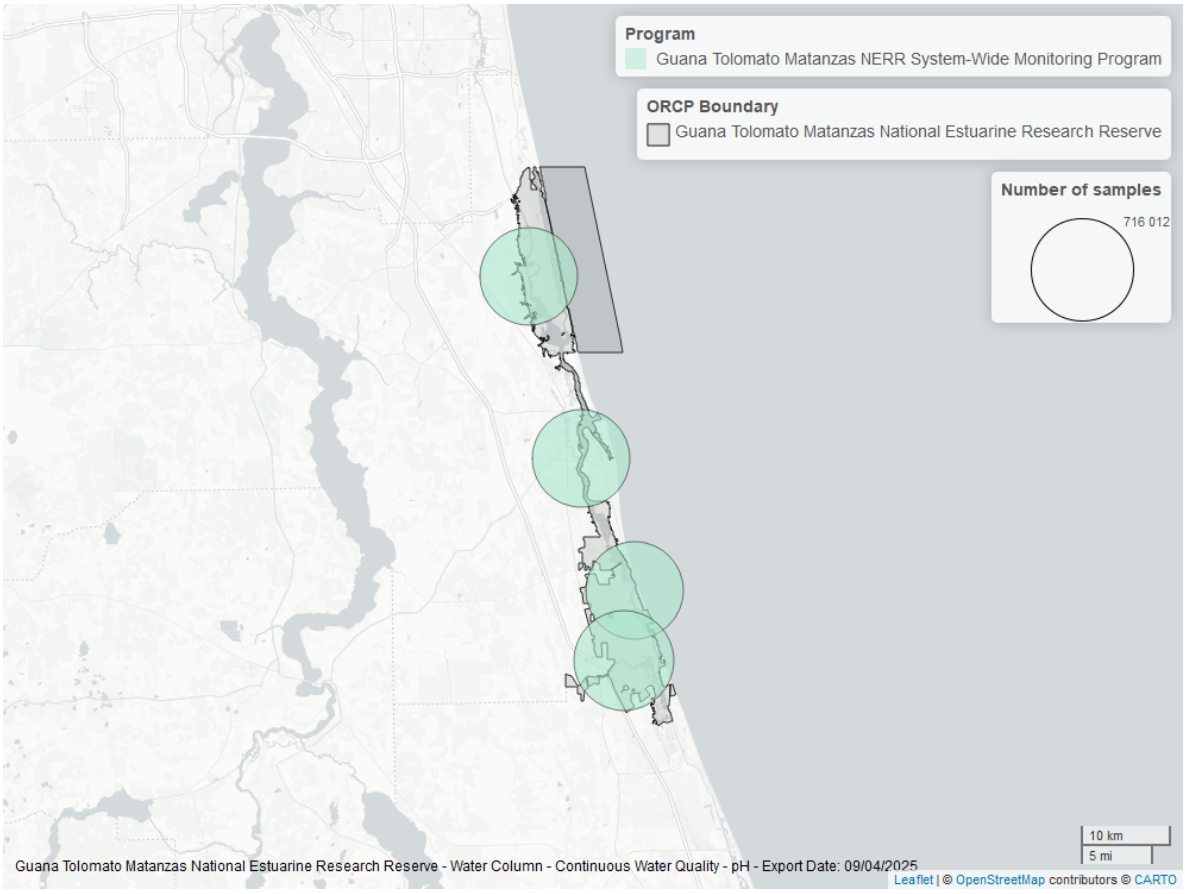

Figure 24: Map showing location of ph continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

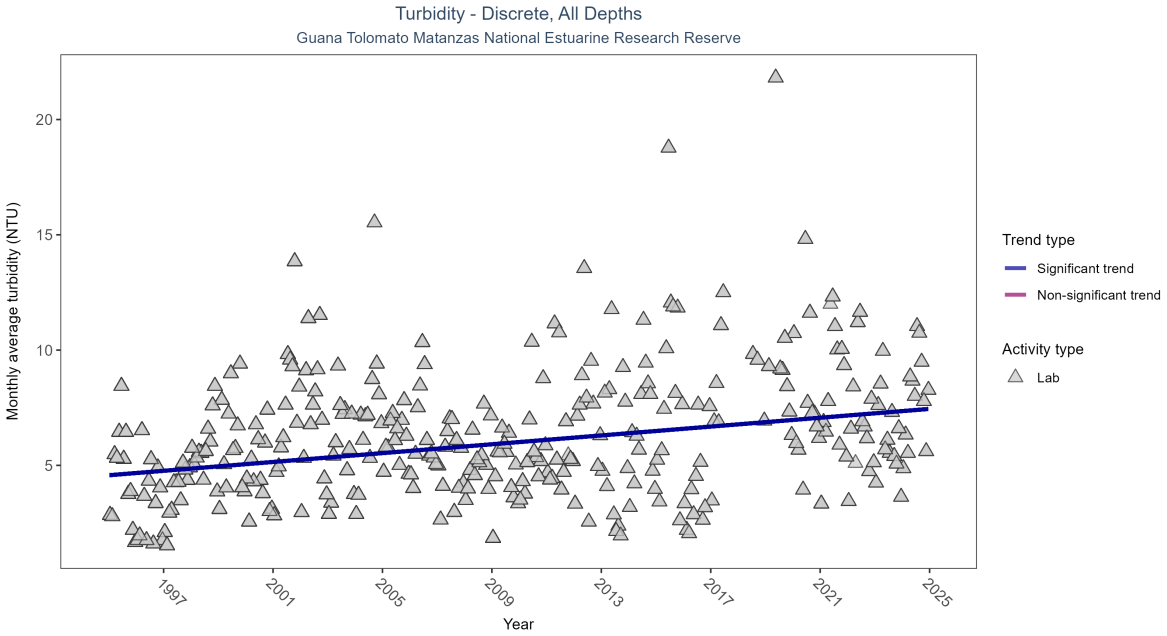

Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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 increasing trend	14877	30	1995 - 2024	4.5	0.25627	4.57195	0.09592	0

Monthly average turbidity increased by 0.1 NTU per year, indicating a decrease in water clarity.

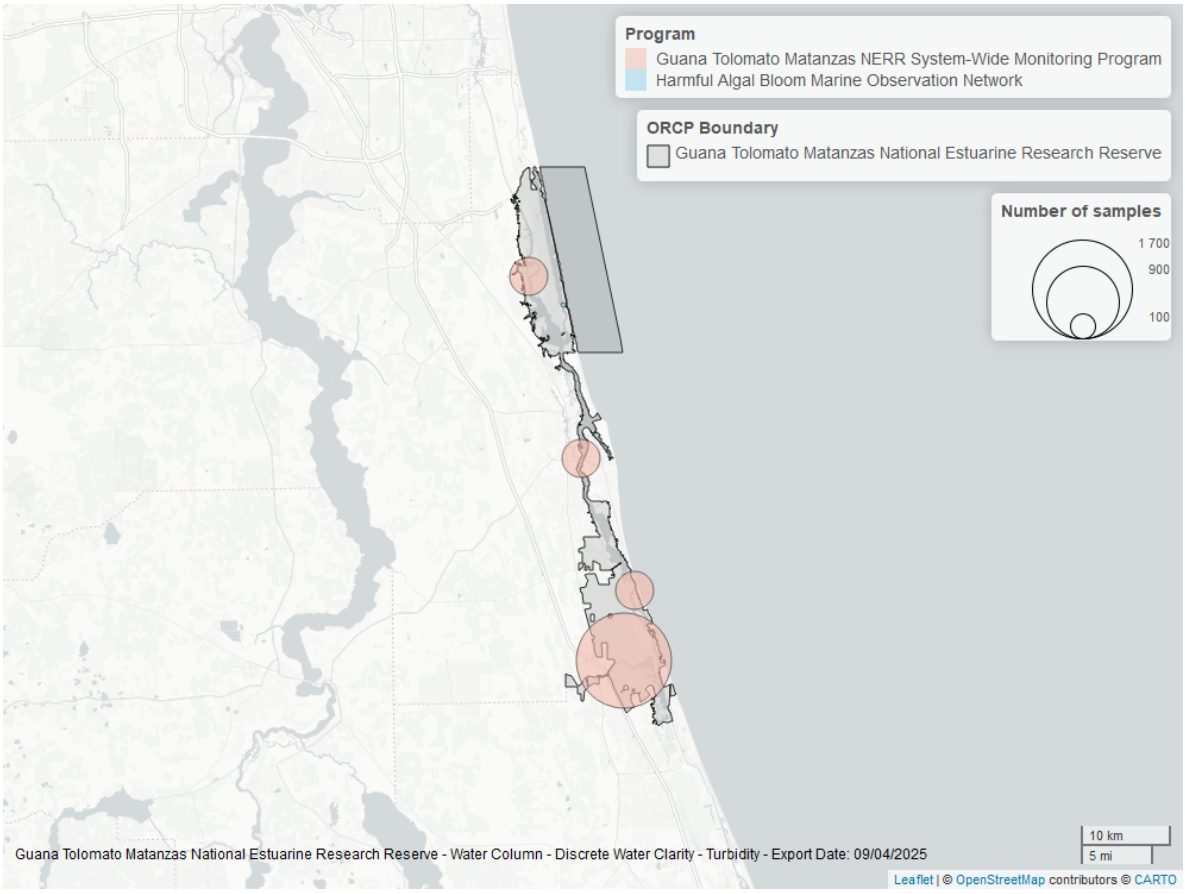

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

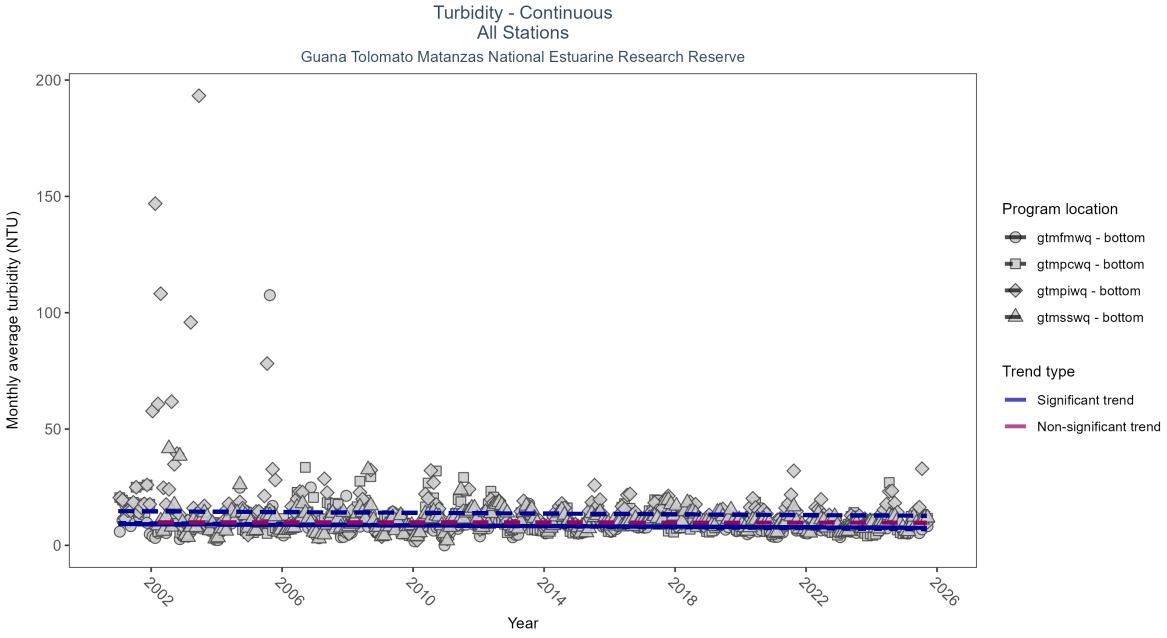

Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
gtmpcwq	Significantly decreasing trend	707002	25	2001 - 2025	9	-0.17	9.57	-0.11	1e-04
gtmsswq	No significant trend	655978	24	2002 - 2025	9	-0.01	9.89	-0.01	0.8029
gtmpiwq	Significantly decreasing trend	665212	25	2001 - 2025	10	-0.10	14.70	-0.08	0.0107
gtmfmwq	Significantly decreasing trend	702940	25	2001 - 2025	7	-0.12	9.14	-0.07	0.003

At three program locations, monthly average turbidity decreased between 0.07 and 0.11 NTU per year. No detectable change in monthly average turbidity was observed at one location.

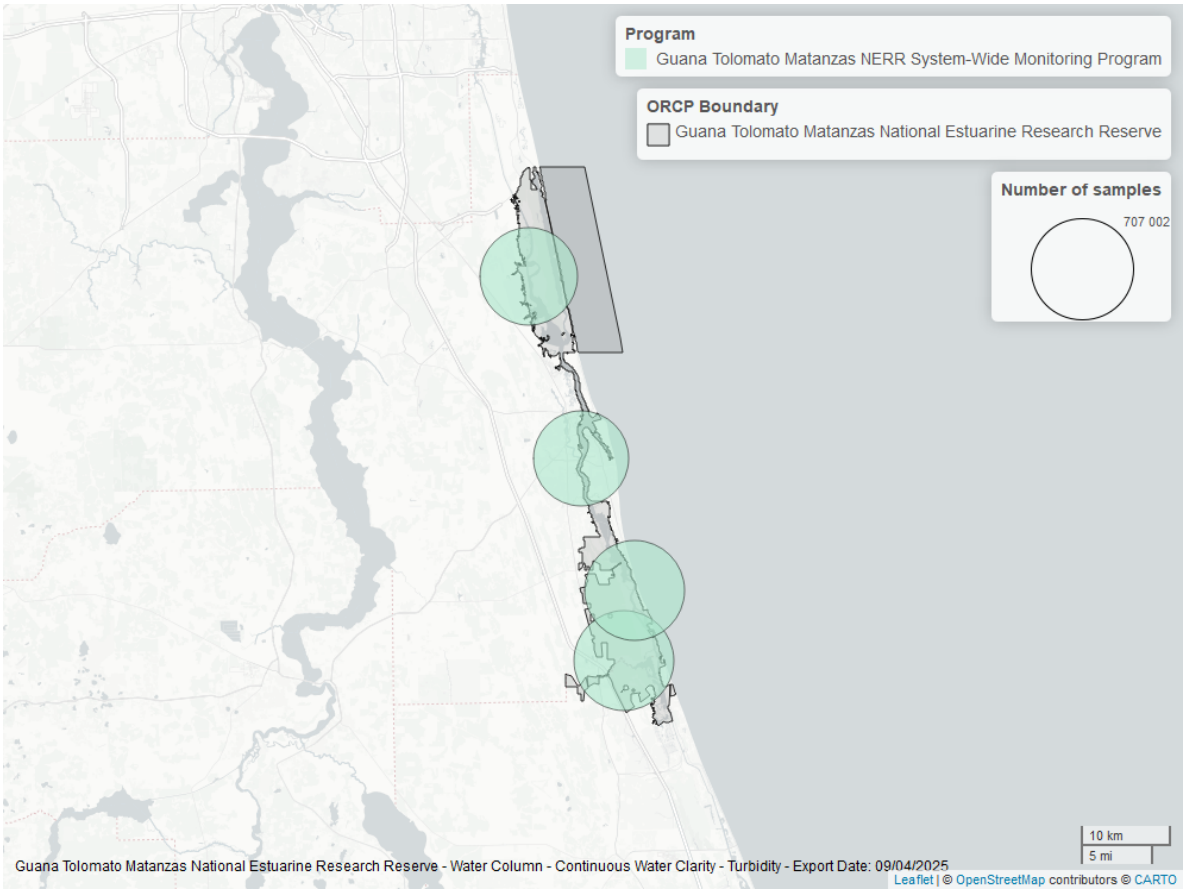

Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

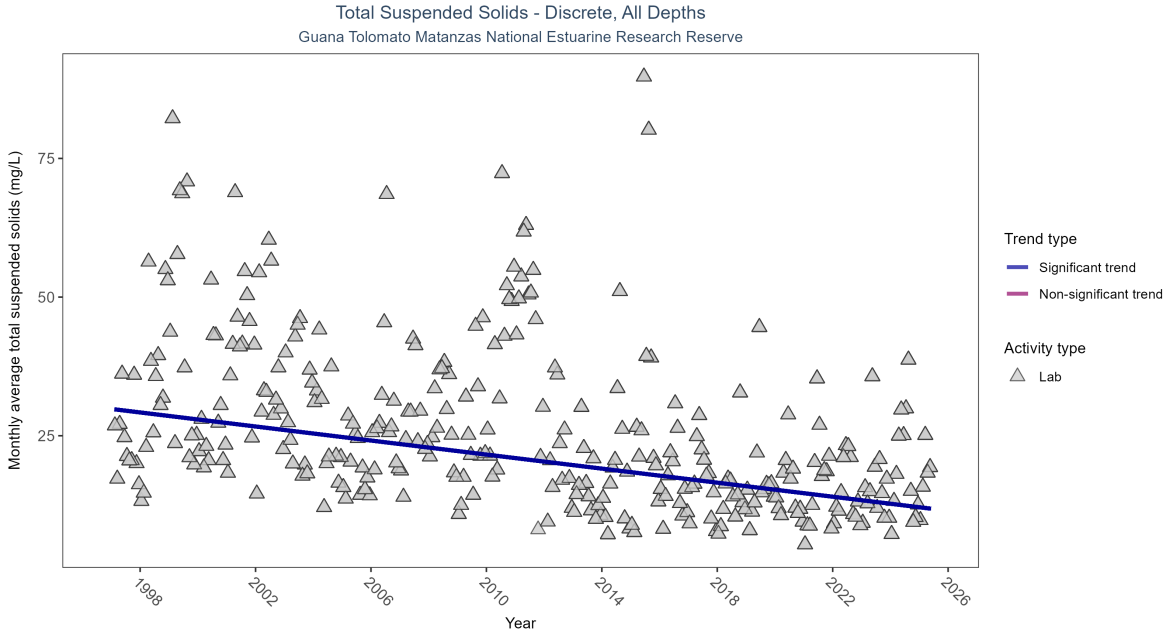

Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	5181	29	1997 - 2025	17	-0.38374	29.8329	-0.63307	0

Monthly average total suspended solids decreased by 0.63 mg/L per year, indicating an increase in water clarity.

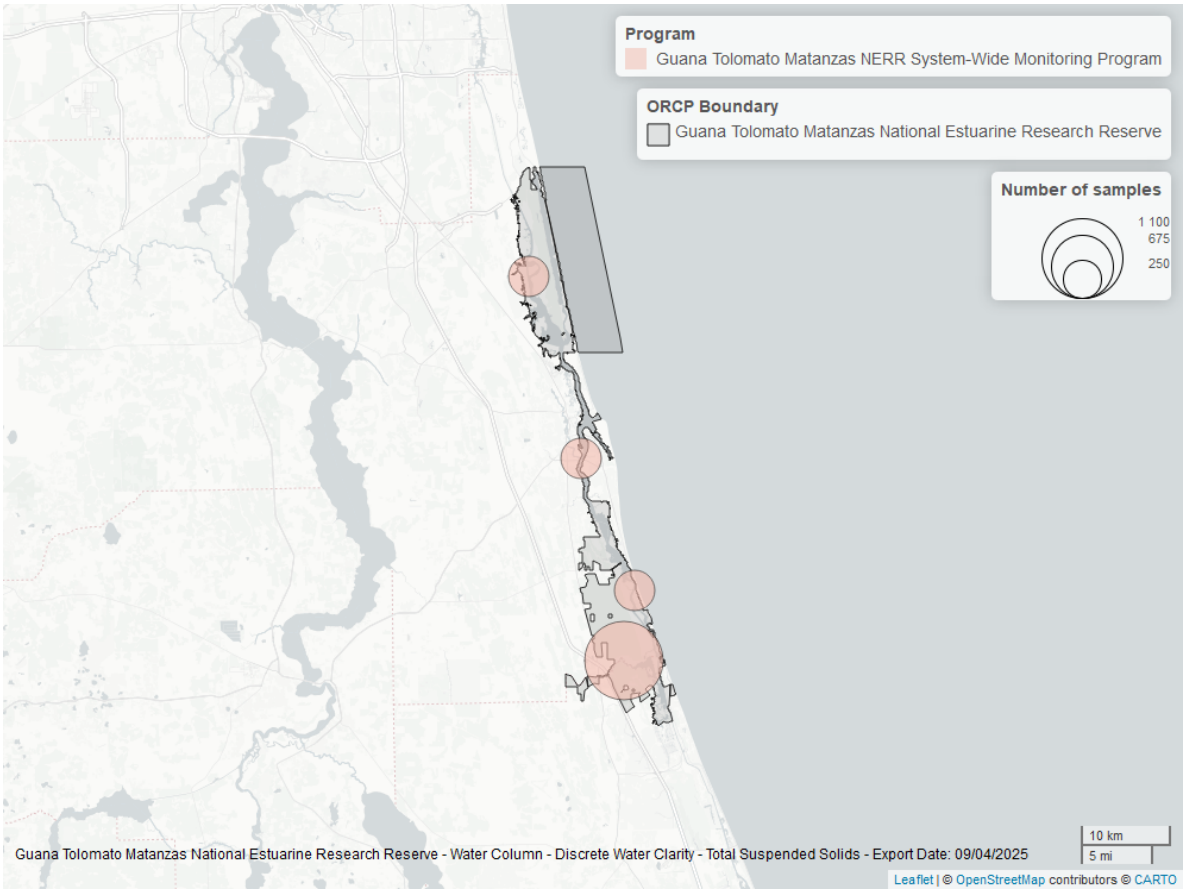

Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

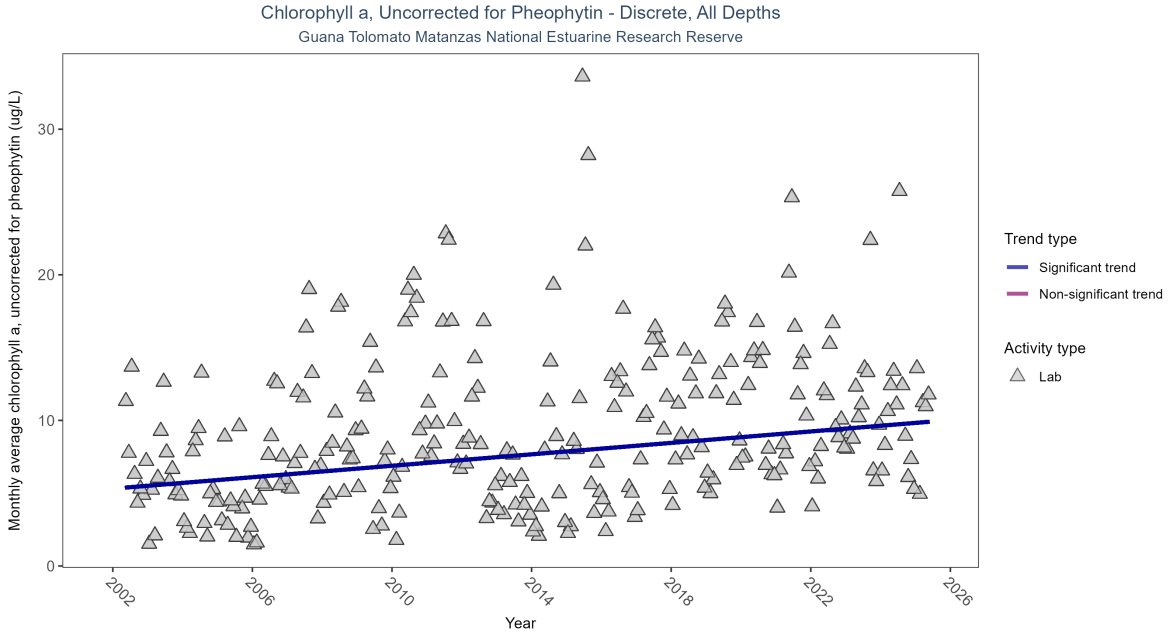

Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	6450	24	2002 - 2025	6.2	0.26174	5.31184	0.19634	0

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.2 µg/L per year, indicating a decrease in water clarity.

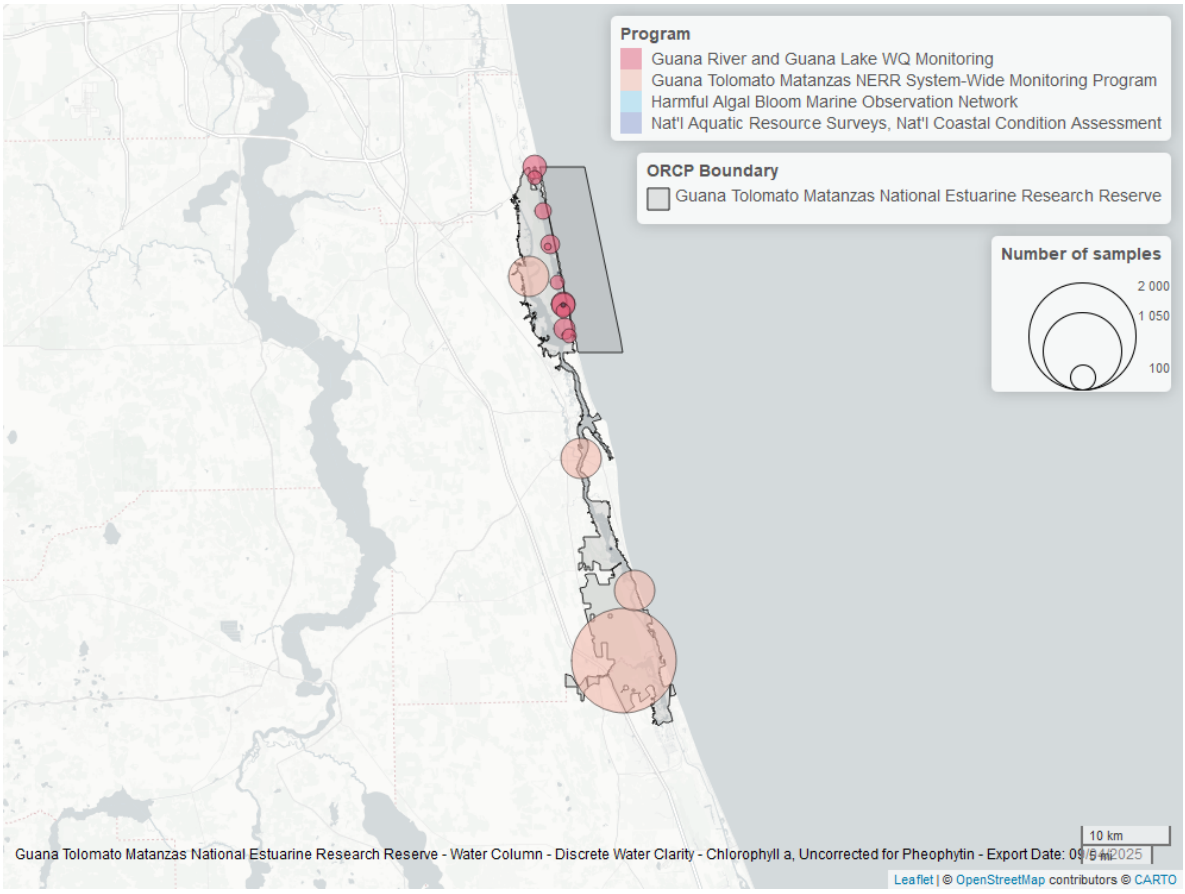

Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

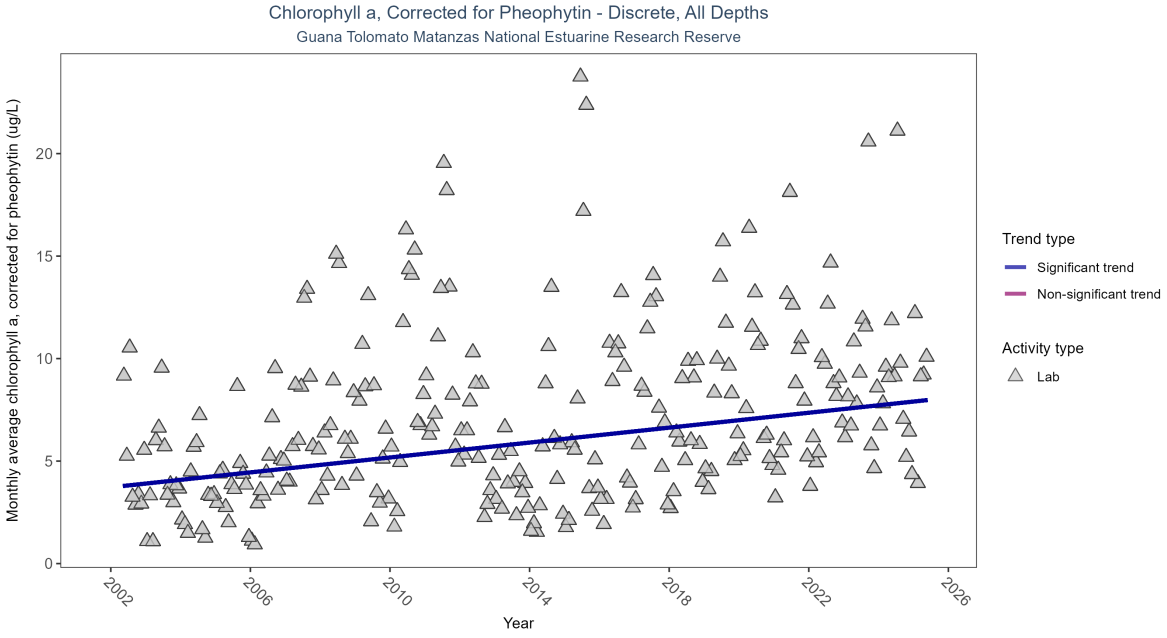

Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	8243	24	2002 - 2025	4.7	0.3187	3.72118	0.18184	0

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.18 µg/L per year, indicating a decrease in water clarity.

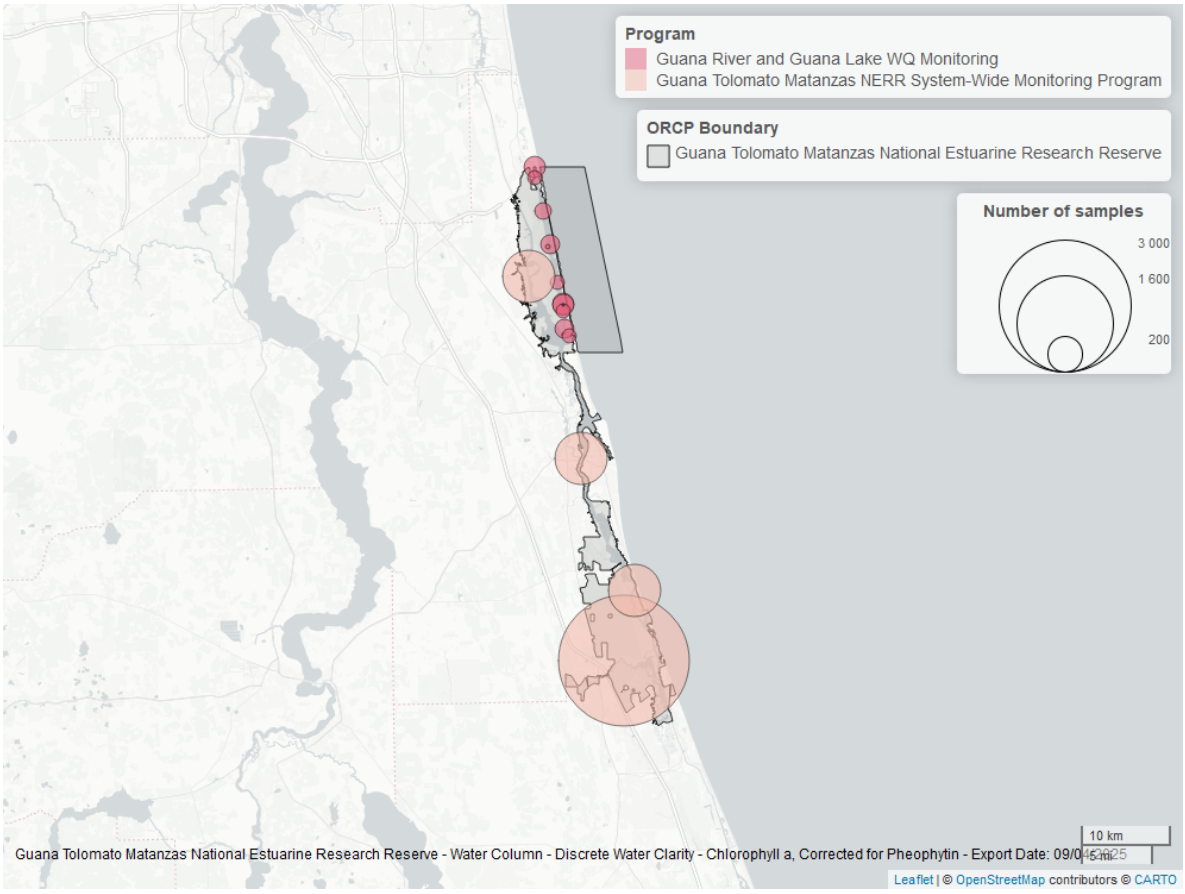

Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

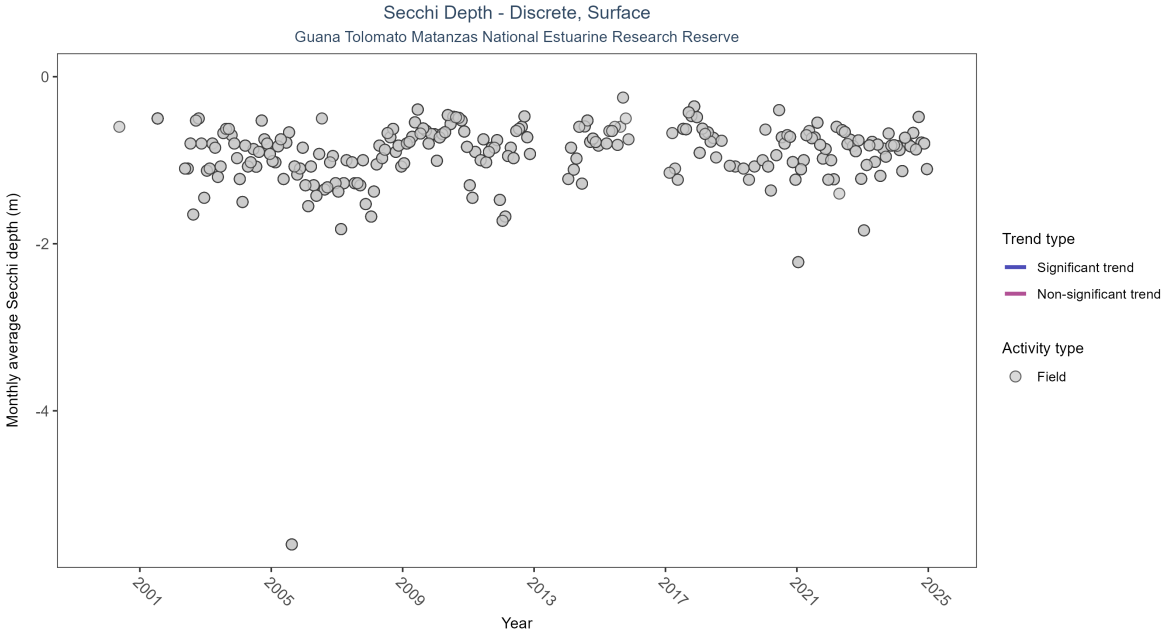

Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	No significant trend	2995	25	1999 - 2024	-0.8	0.05784	-0.8596	0.00208	0.2391

Secchi depth showed no detectable trend between 1999 and 2024.

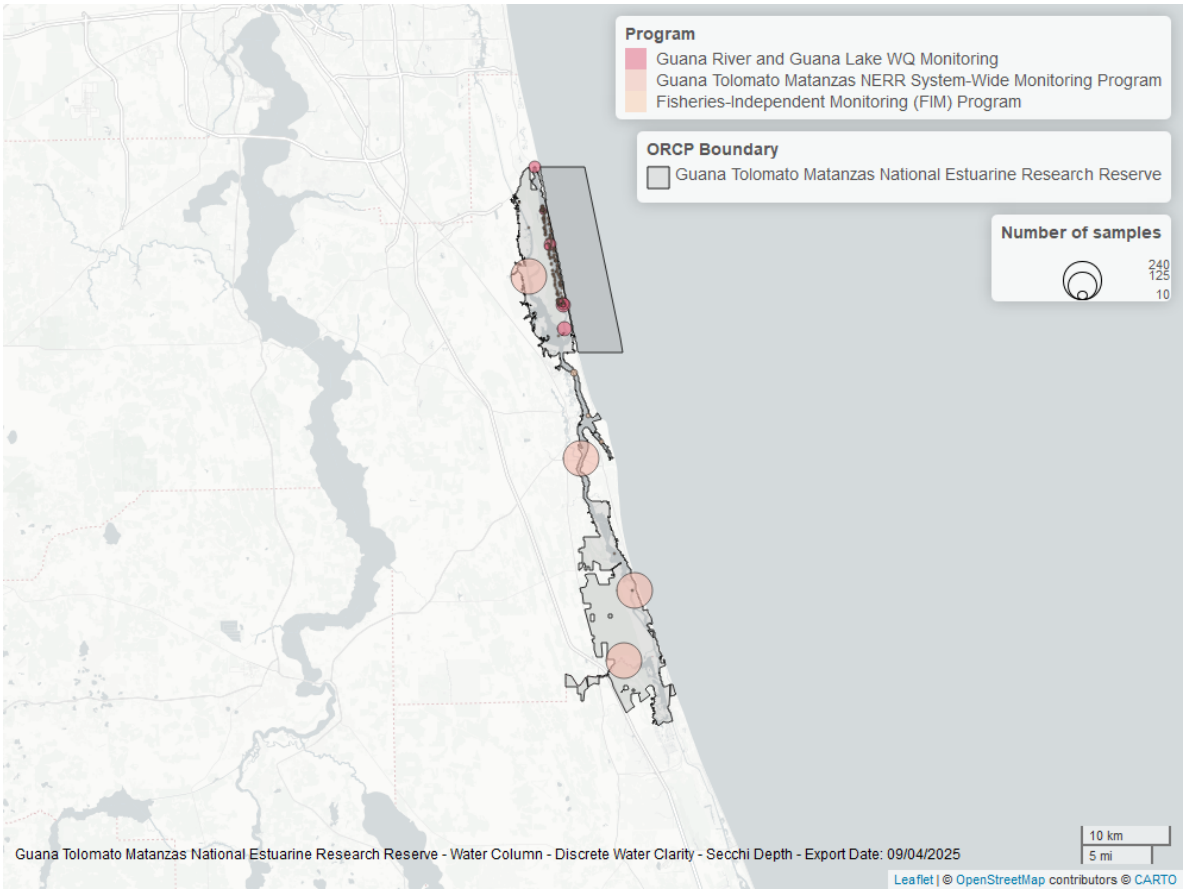

Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

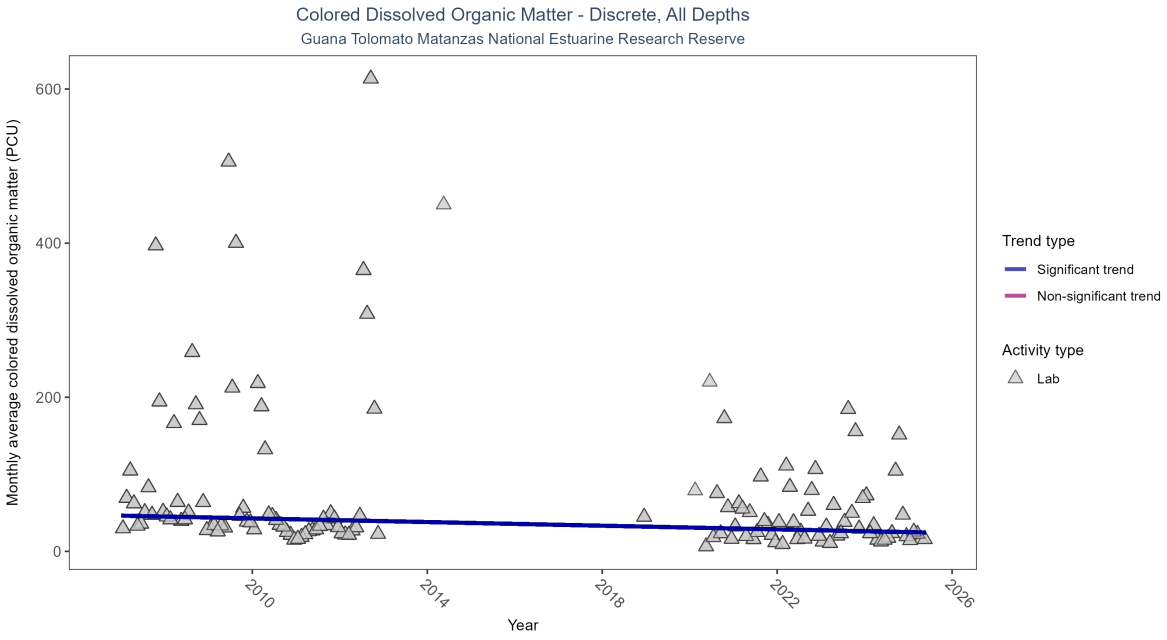

Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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 decreasing trend	1939	14	2007 - 2025	33	-0.24373	46.36942	-1.18828	3e-04

Monthly average colored dissolved organic matter decreased by 1.19 PCU per year, indicating an increase in water clarity.

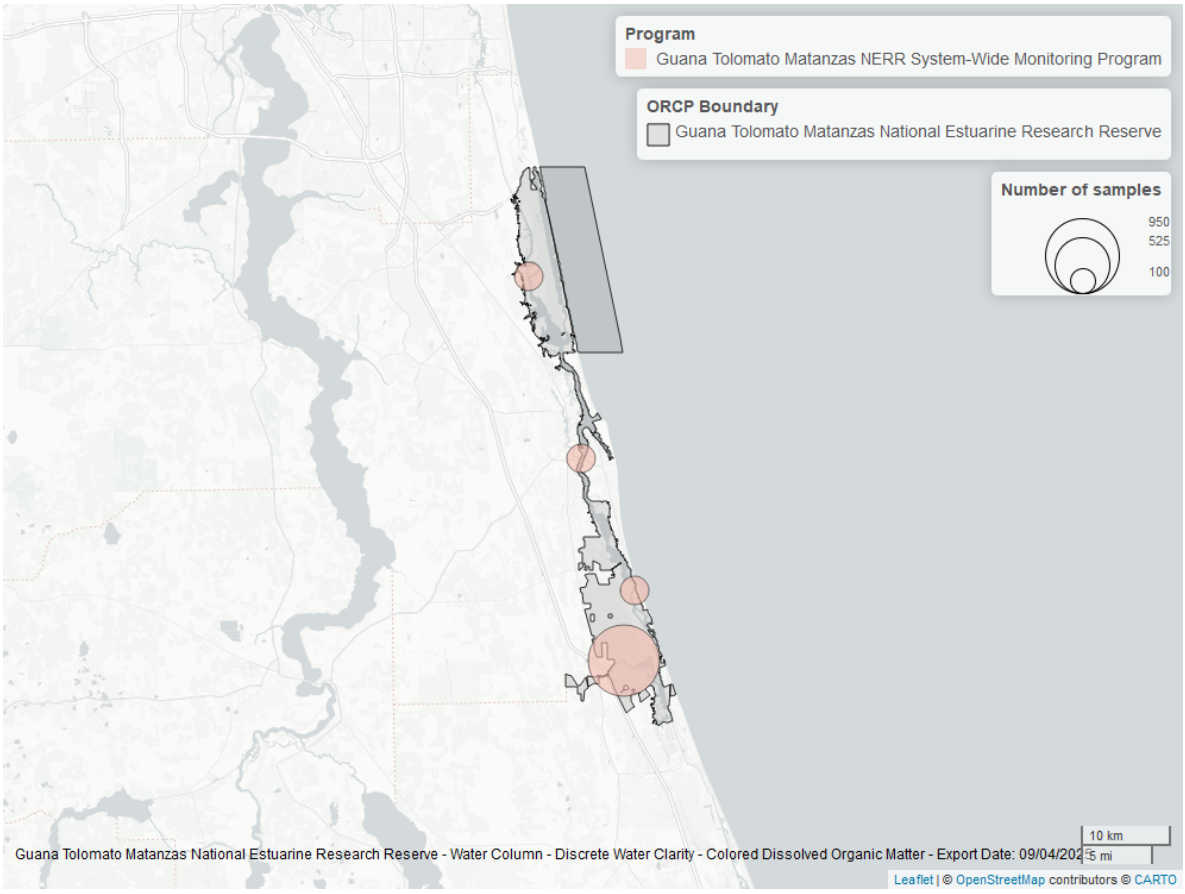

Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Guana Tolomato Matanzas National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.