Cape Romano-Ten Thousand Islands Aquatic Preserve

SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

Contents

Indicators

Nutrients

Total Nitrogen - Discrete

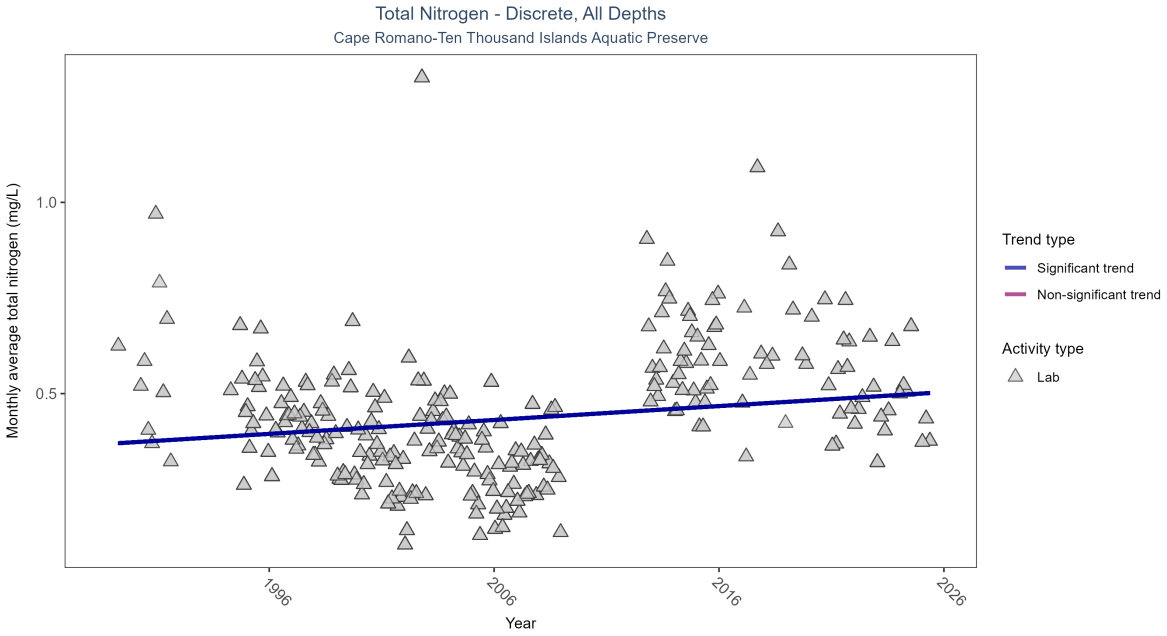

Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	Significantly increasing trend	2488	32	1989 - 2025	0.3761	0.13539	0.36927	0.00363	0.0019

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

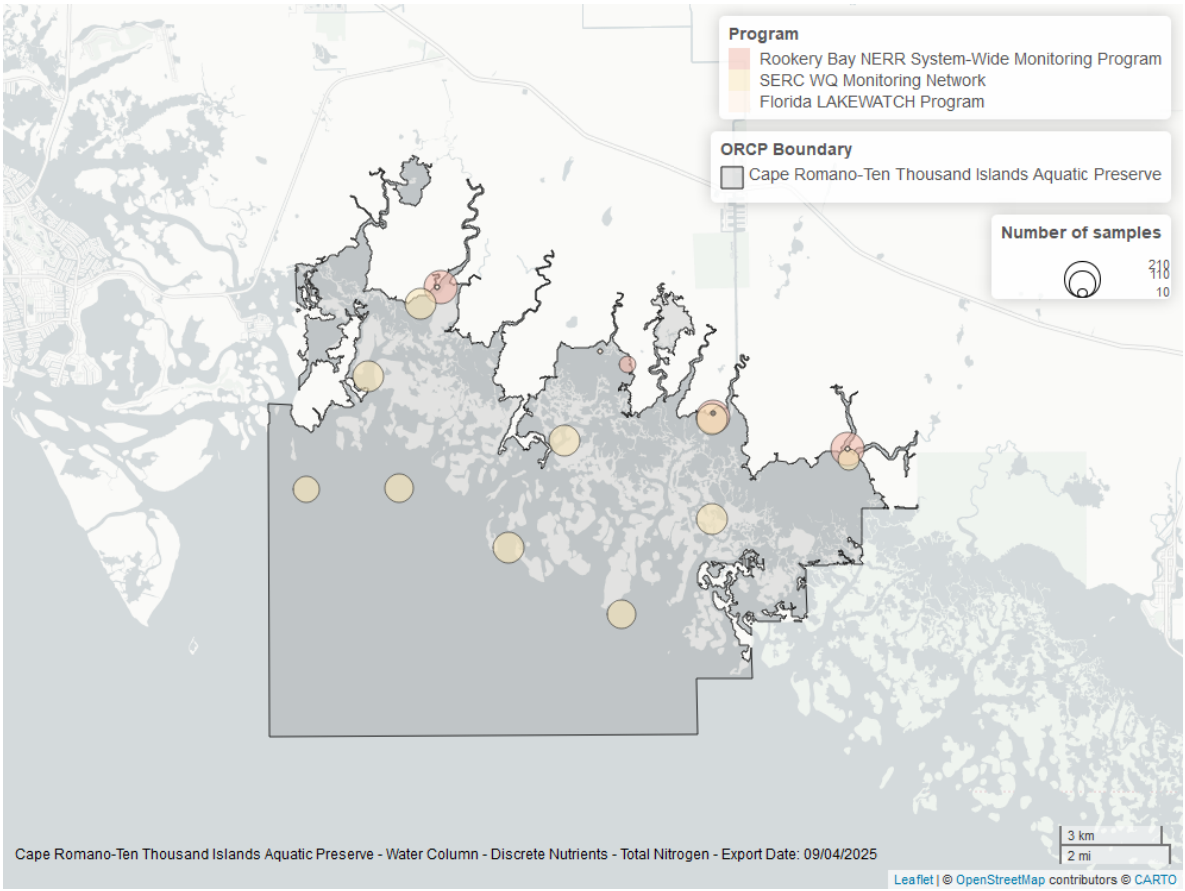

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

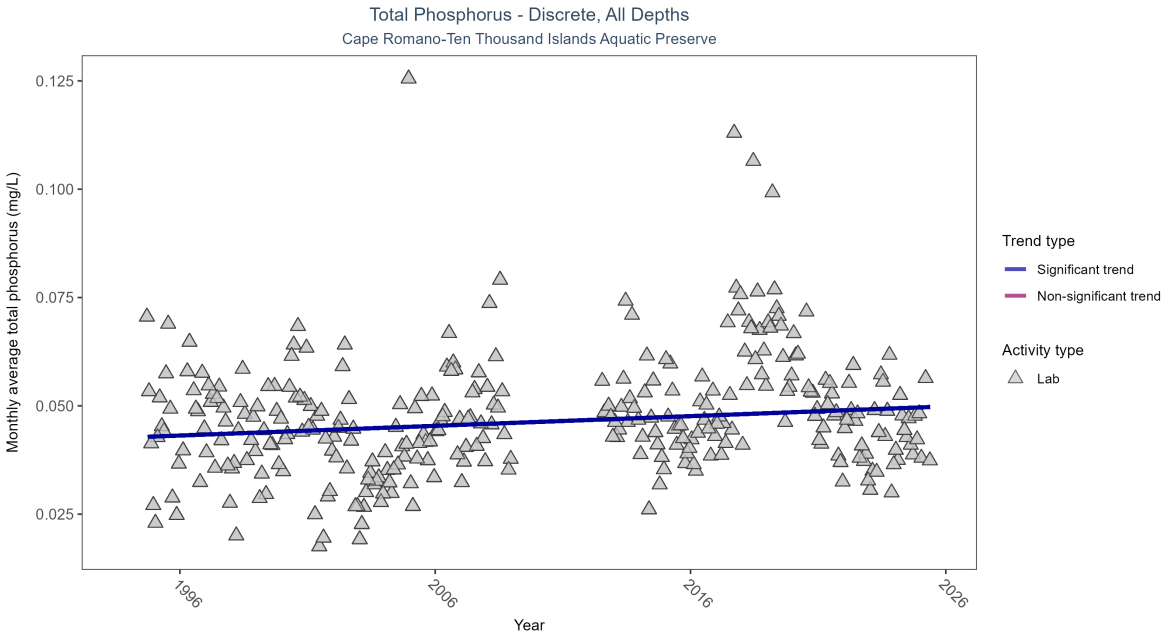

Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	2949	29	1994 - 2025	0.043	0.13644	0.0427	0.00022	7e-04

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

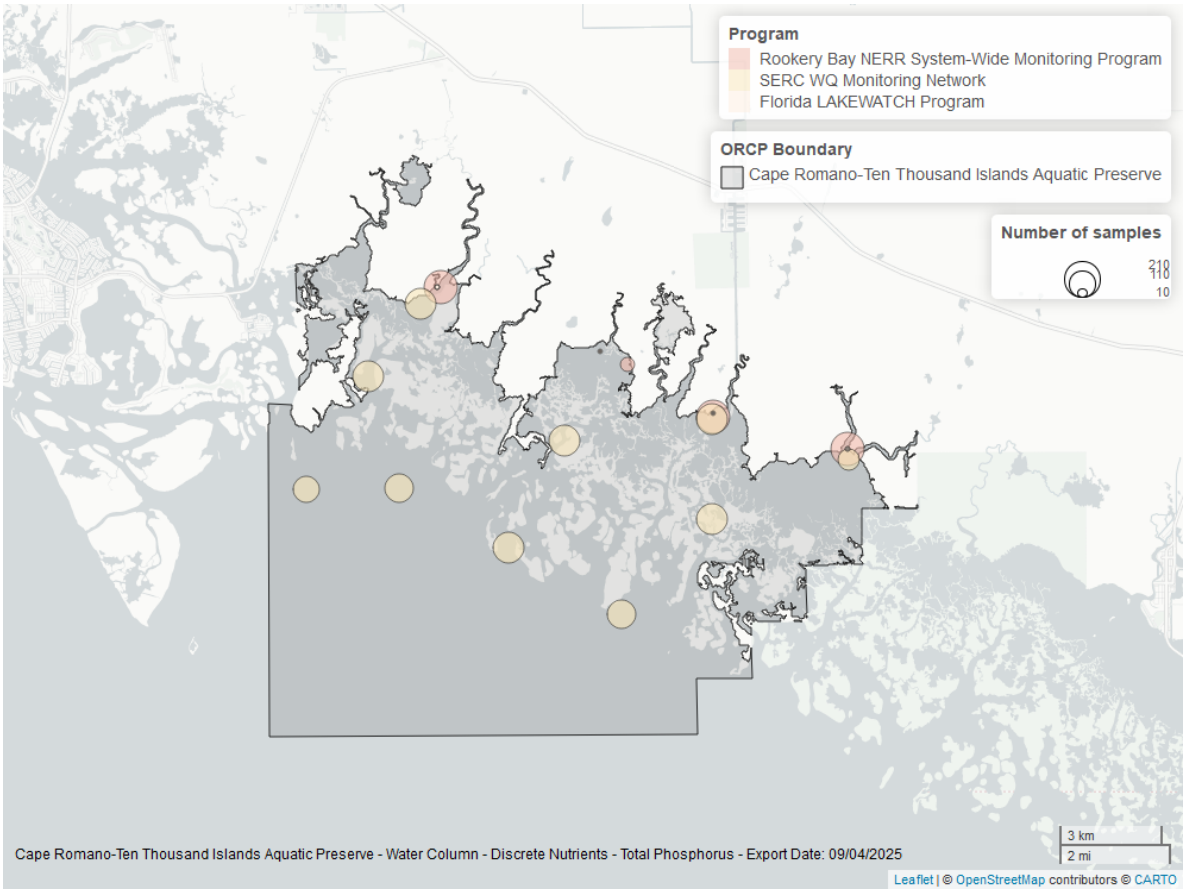

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

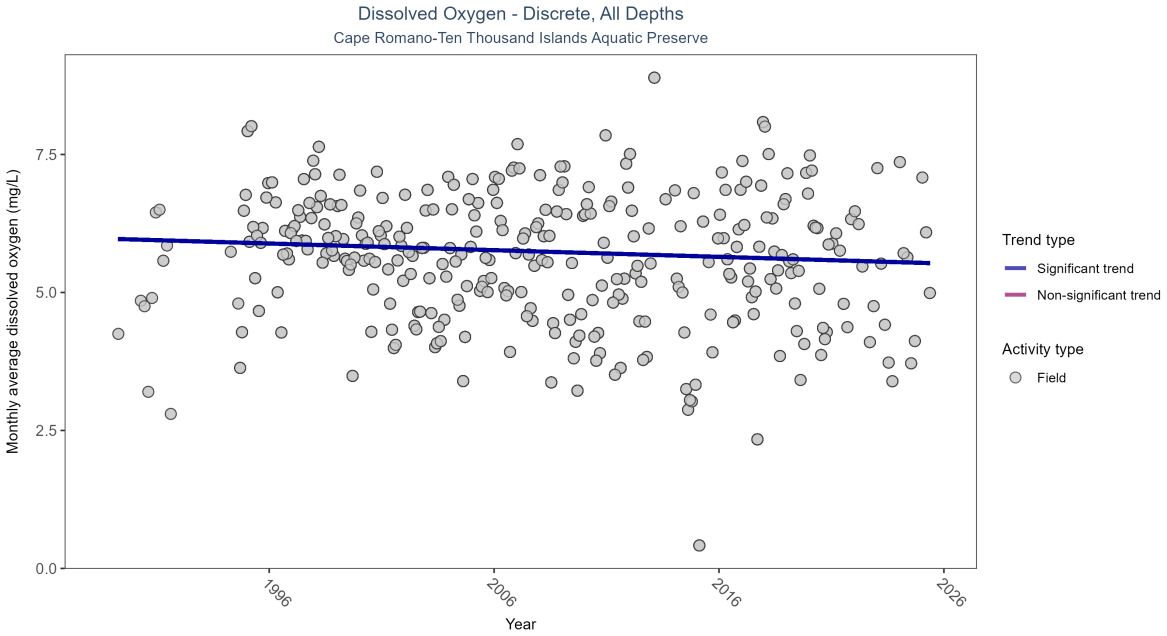

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	10661	35	1989 - 2025	5.8	-0.0869	5.97162	-0.01209	0.0258

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

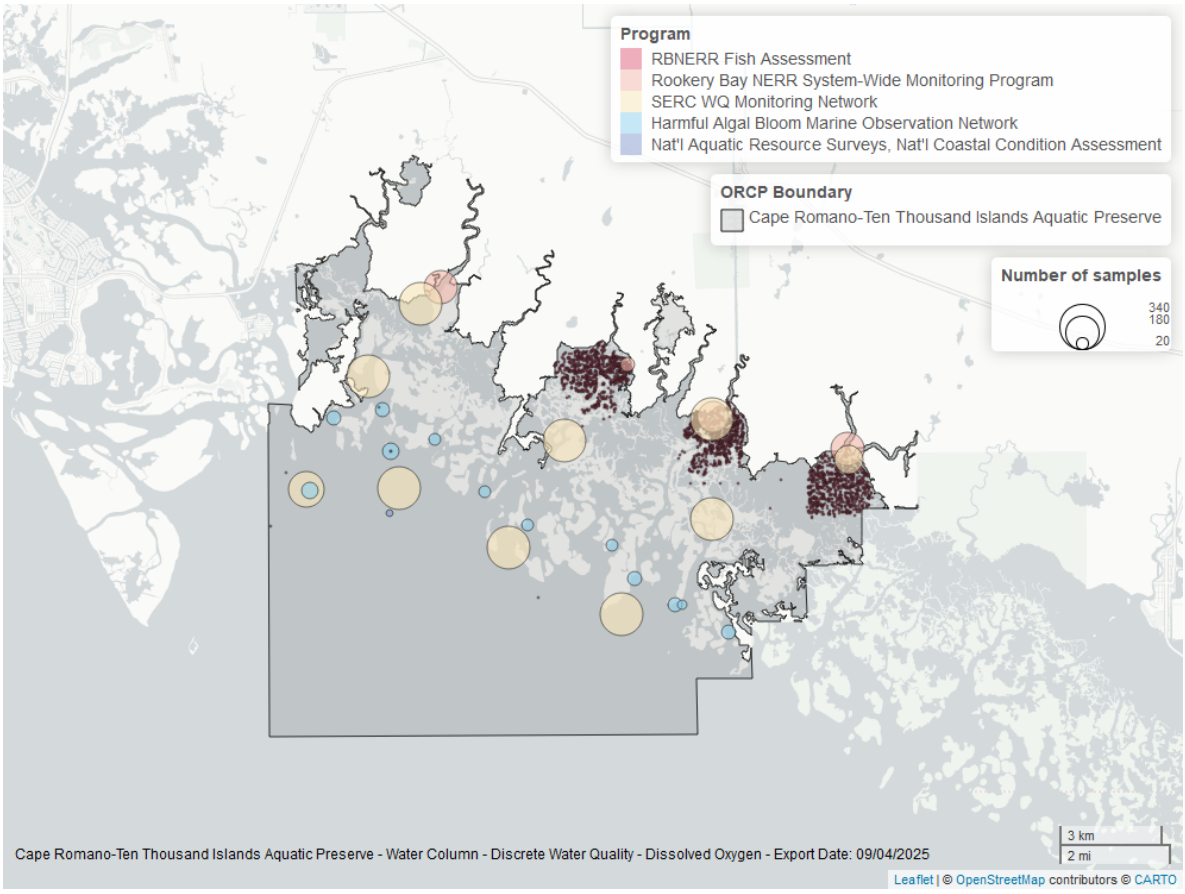

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

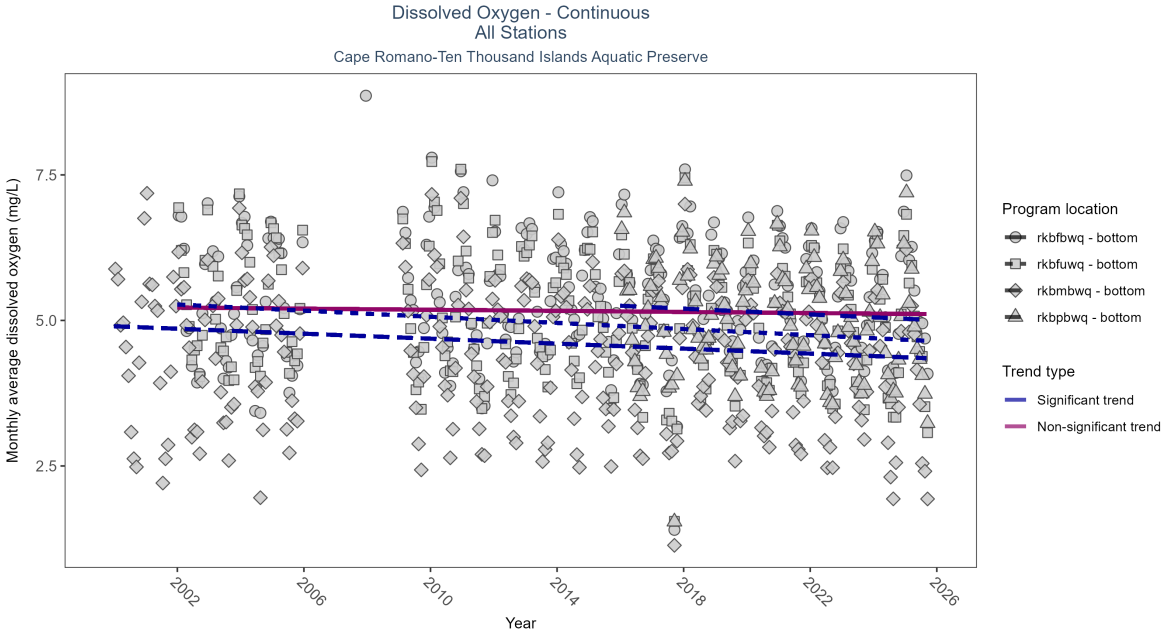

Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
rkbmbwq	Significantly decreasing trend	644227	23	2000 - 2025	4.4	-0.26	4.90	-0.02	0
rkbfbwq	No significant trend	589693	22	2002 - 2025	5.4	-0.04	5.22	0.00	0.4095
rkbpbwq	Significantly decreasing trend	320370	10	2016 - 2025	4.9	-0.17	5.25	-0.02	0.0248
rkbfuwq	Significantly decreasing trend	621074	21	2002 - 2025	5.1	-0.31	5.27	-0.03	0

At three program locations, monthly average dissolved oxygen decreased between 0.02 and 0.03 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at one location.

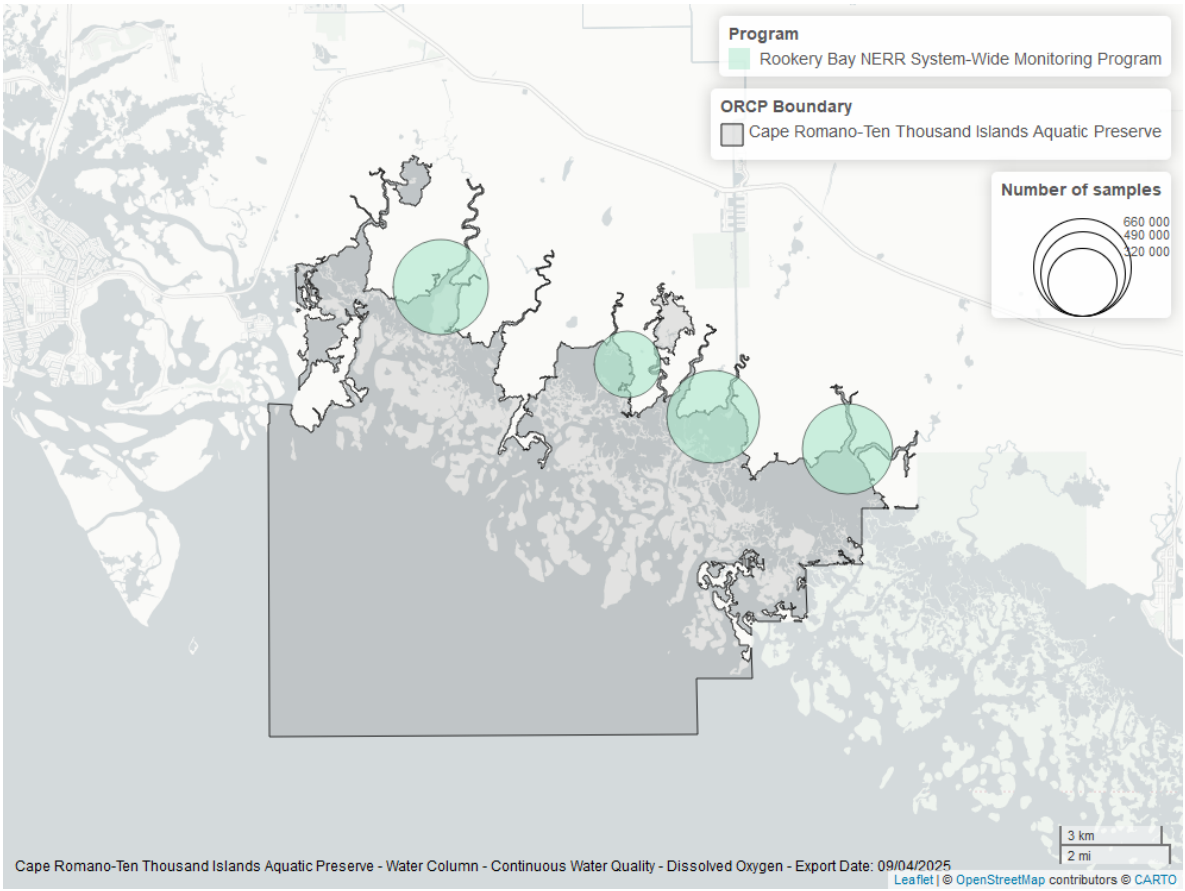

Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

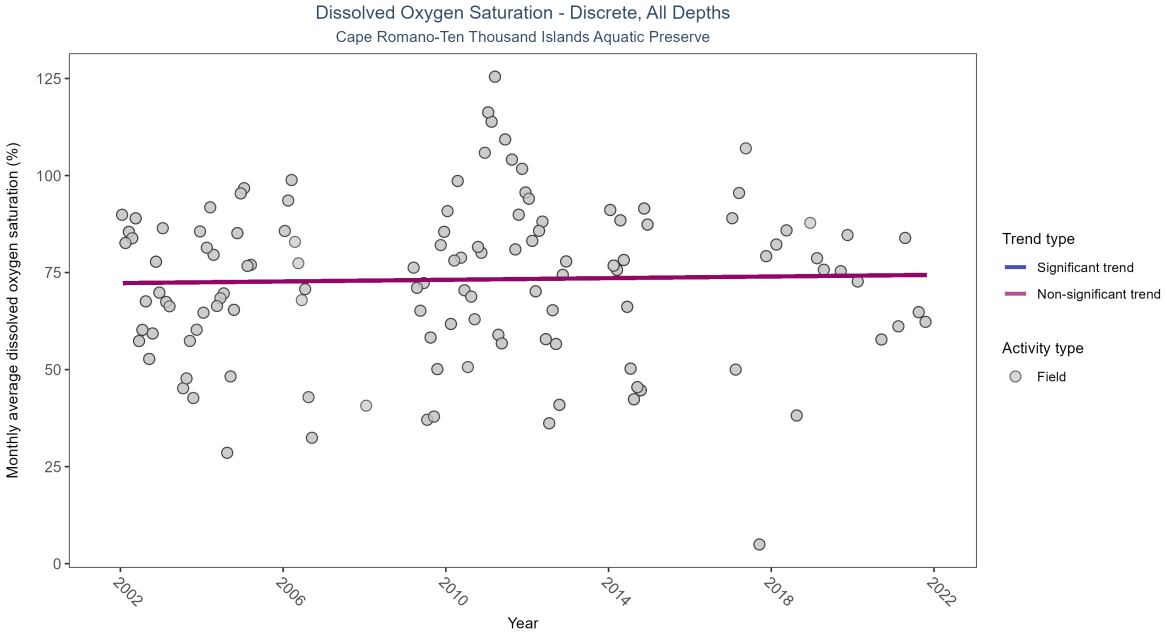

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	No significant trend	570	16	2002 - 2021	74.75	0.04946	72.28418	0.10625	0.597

Dissolved oxygen saturation showed no detectable trend between 2002 and 2021.

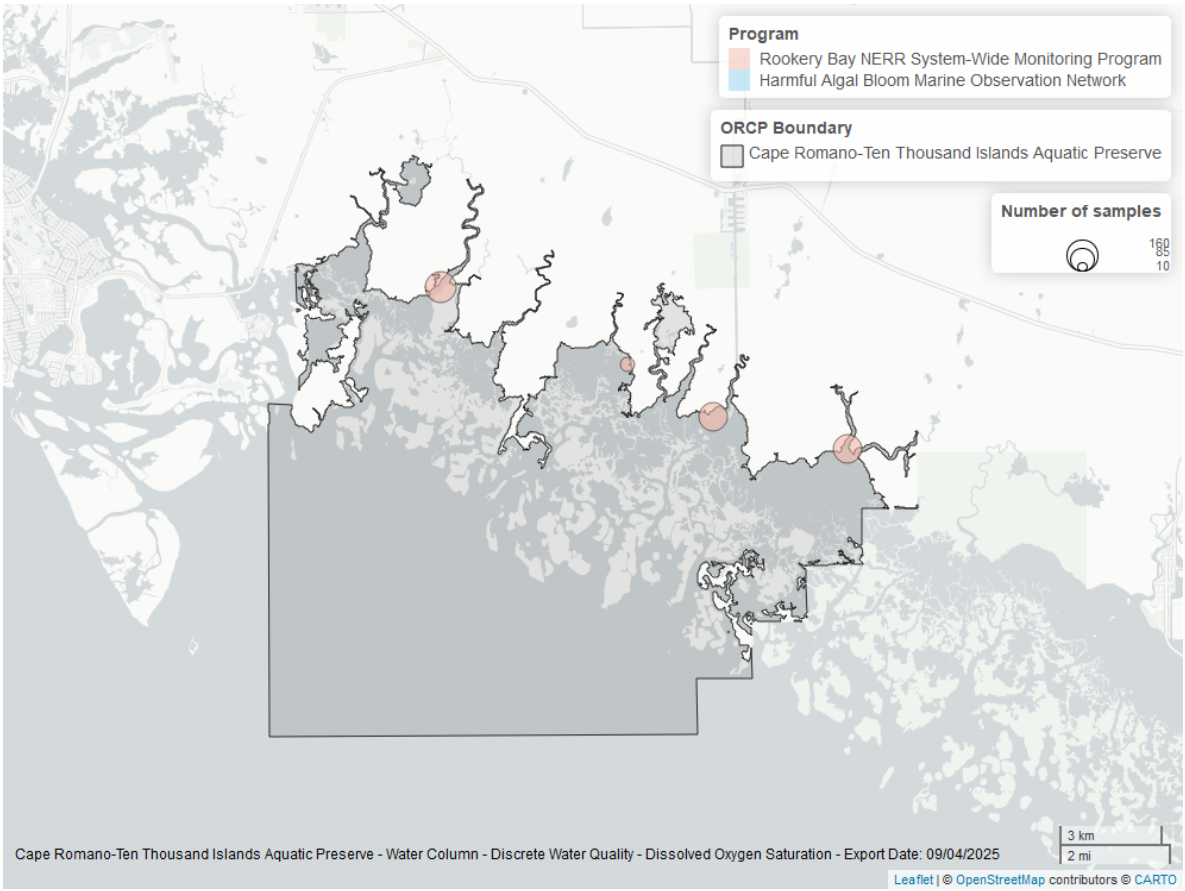

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

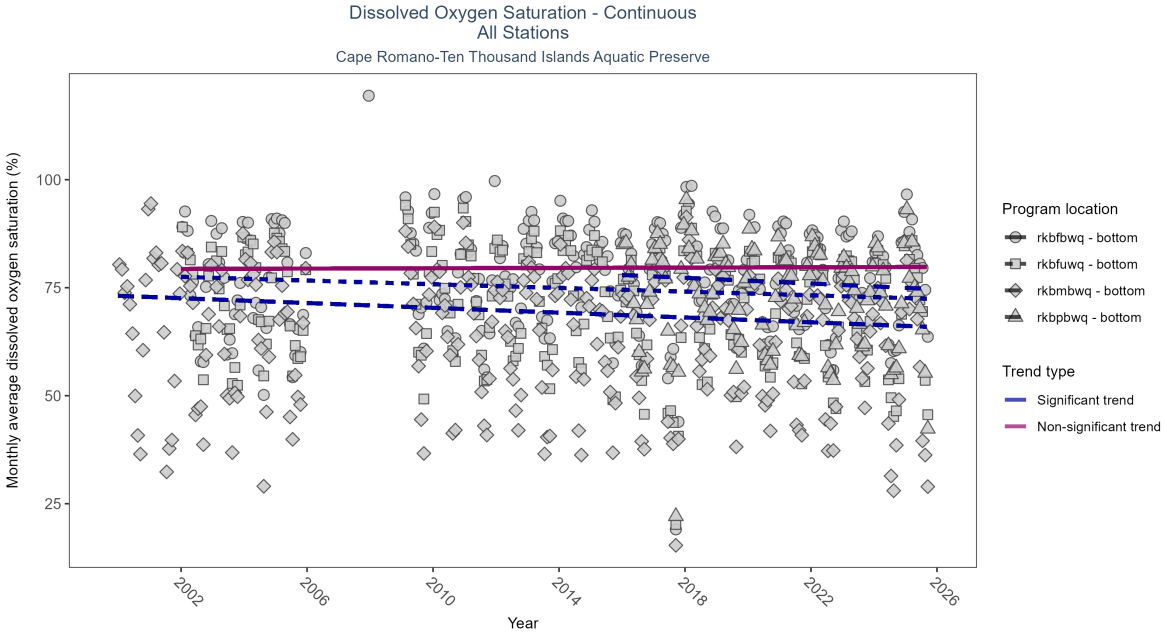

Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
rkbfbwq	No significant trend	593999	22	2002 - 2025	78.8	0.02	79.35	0.02	0.7199
rkbfuwq	Significantly decreasing trend	621333	21	2002 - 2025	72.5	-0.23	77.51	-0.21	0
rkbpbwq	Significantly decreasing trend	322002	10	2016 - 2025	72.7	-0.18	77.95	-0.33	0.0186
rkbmbwq	Significantly decreasing trend	650551	23	2000 - 2025	65.2	-0.23	73.13	-0.28	0

At three program locations, monthly average dissolved oxygen saturation decreased between 0.21 and 0.33% per year. No detectable change in monthly average dissolved oxygen saturation was observed at one location.

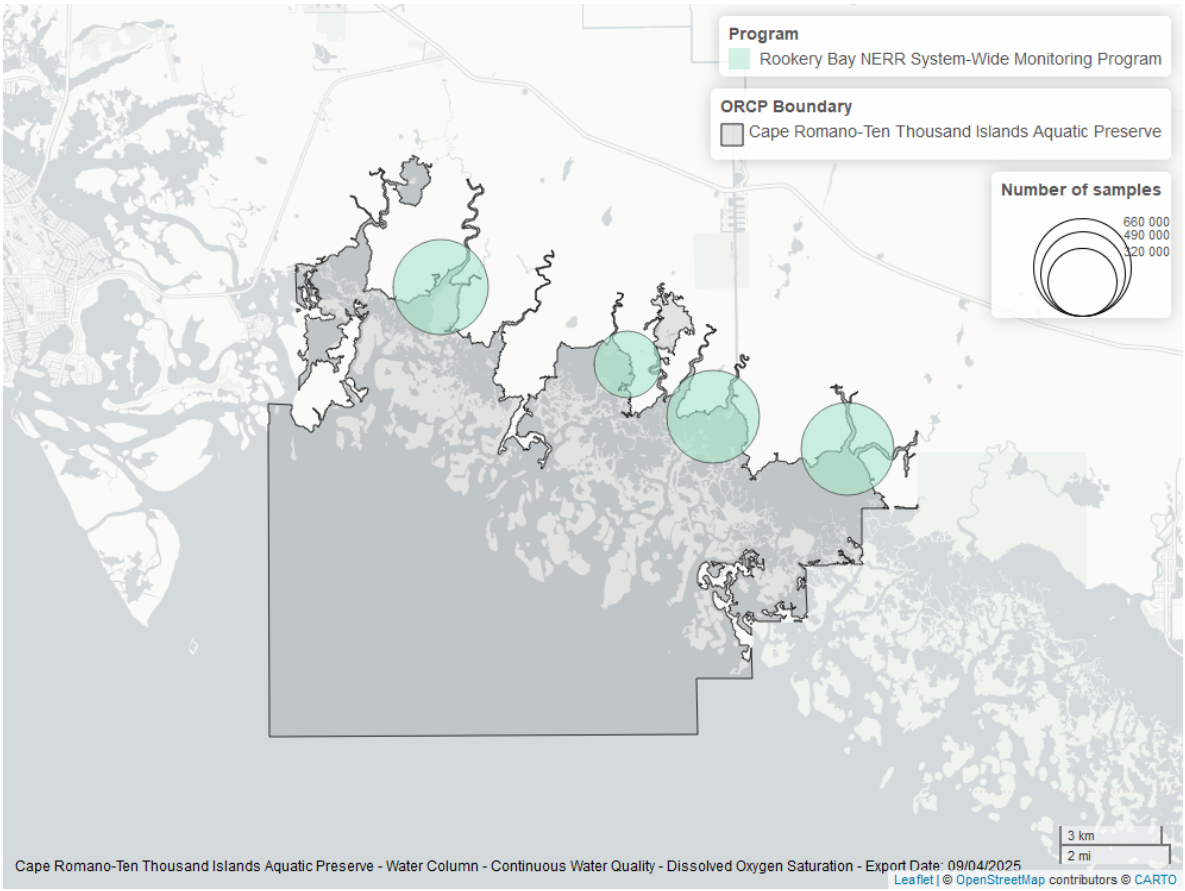

Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

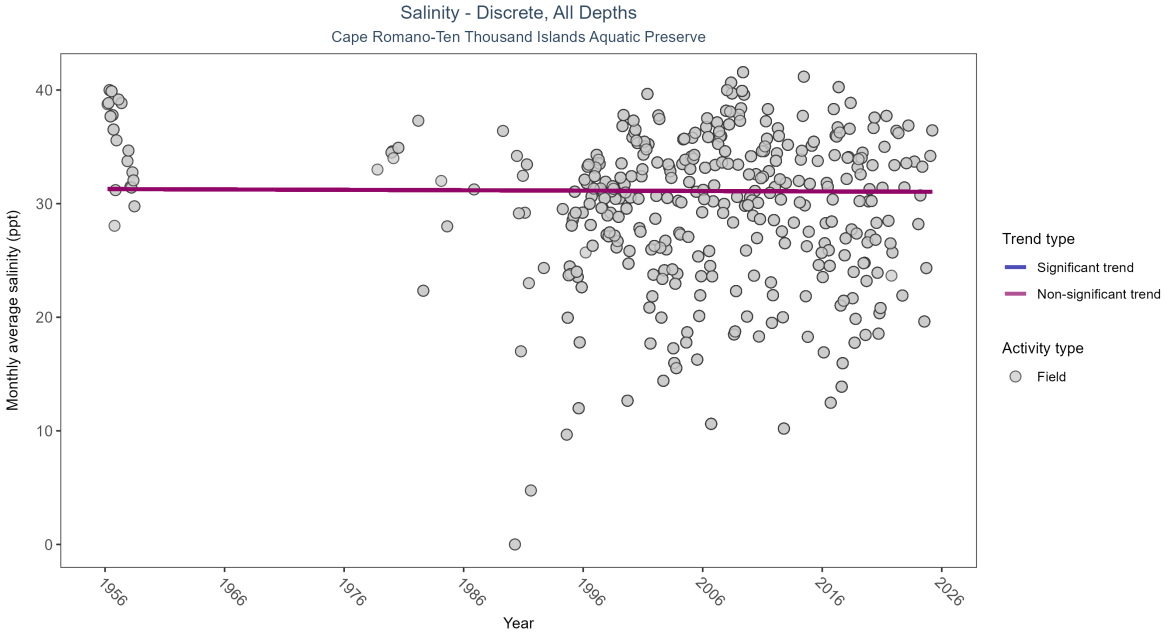

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	No significant trend	11012	45	1956 - 2025	31.9	-0.00719	31.28366	-0.00347	0.8862

Salinity showed no detectable trend between 1956 and 2025.

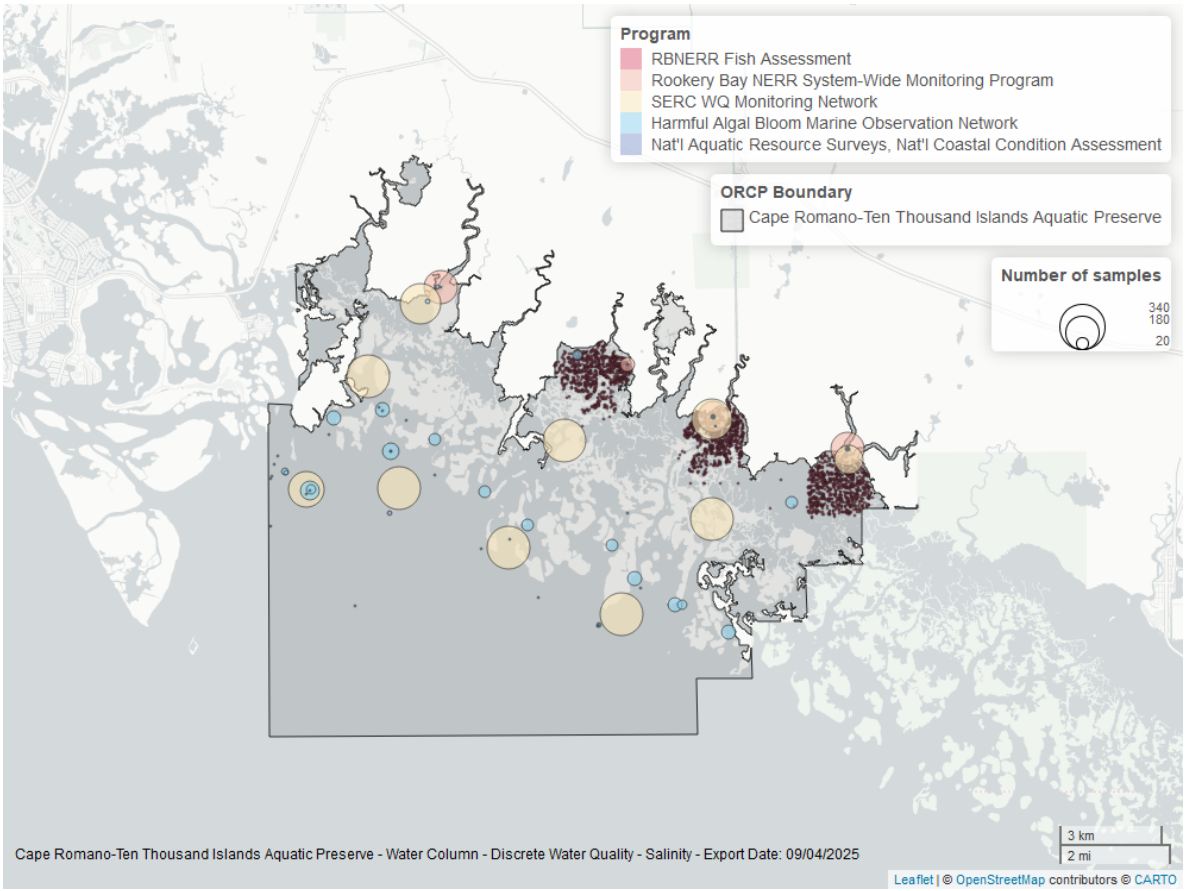

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

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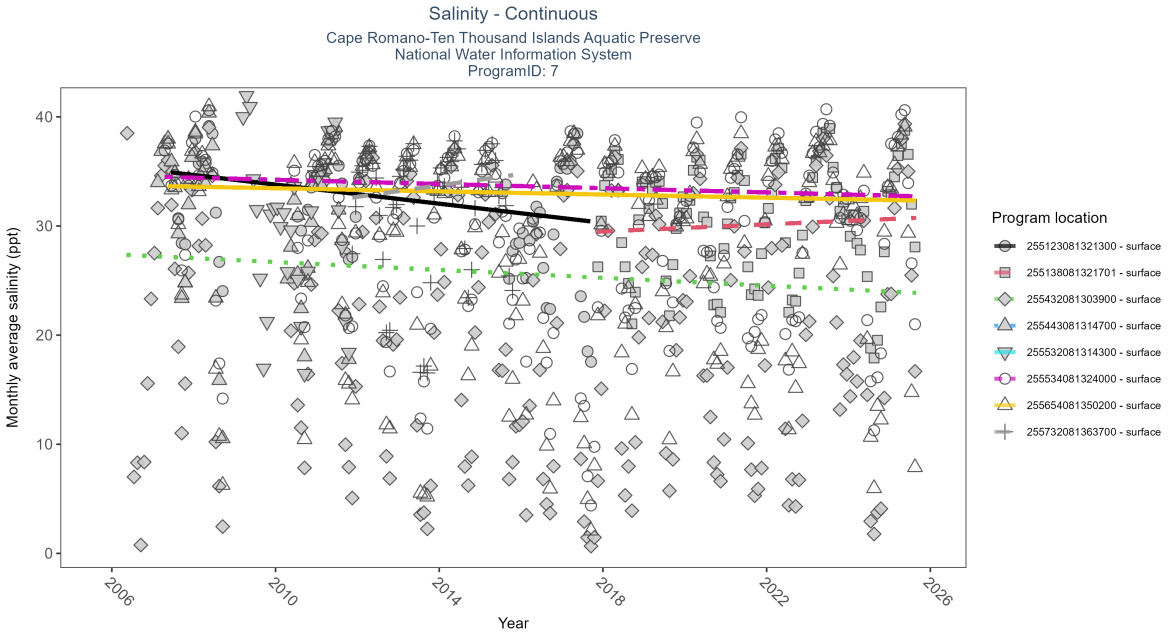

Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 8: Seasonal Kendall-Tau Results for All Stations - Salinity

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
255534081324000	No significant trend	5981	18	2007 - 2025	32	-0.08	34.53	-0.1	0.1072
255432081303900	Significantly decreasing trend	6288	19	2006 - 2025	22	-0.14	27.42	-0.18	0.0072
255123081321300	Significantly decreasing trend	1809	8	2007 - 2017	32	-0.23	35.11	-0.44	0.0182
255654081350200	No significant trend	6002	18	2007 - 2025	32	-0.07	33.68	-0.07	0.1714
255138081321701	No significant trend	2809	9	2017 - 2025	32	0.09	29.34	0.16	0.3216
255732081363700	No significant trend	1434	5	2011 - 2015	34	0.25	32.15	0.52	0.0955
255532081314300	Insufficient data to calculate trend	902	3	2009 - 2011	31	-	-	-	-
255443081314700	Insufficient data to calculate trend	1465	4	2007 - 2011	32	-	-	-	-

At three program locations, monthly average salinity decreased between 0.07 and 0.44 ppt per year. No detectable change in monthly average salinity was observed at seven locations. There was insufficient data to fit a model for two locations.

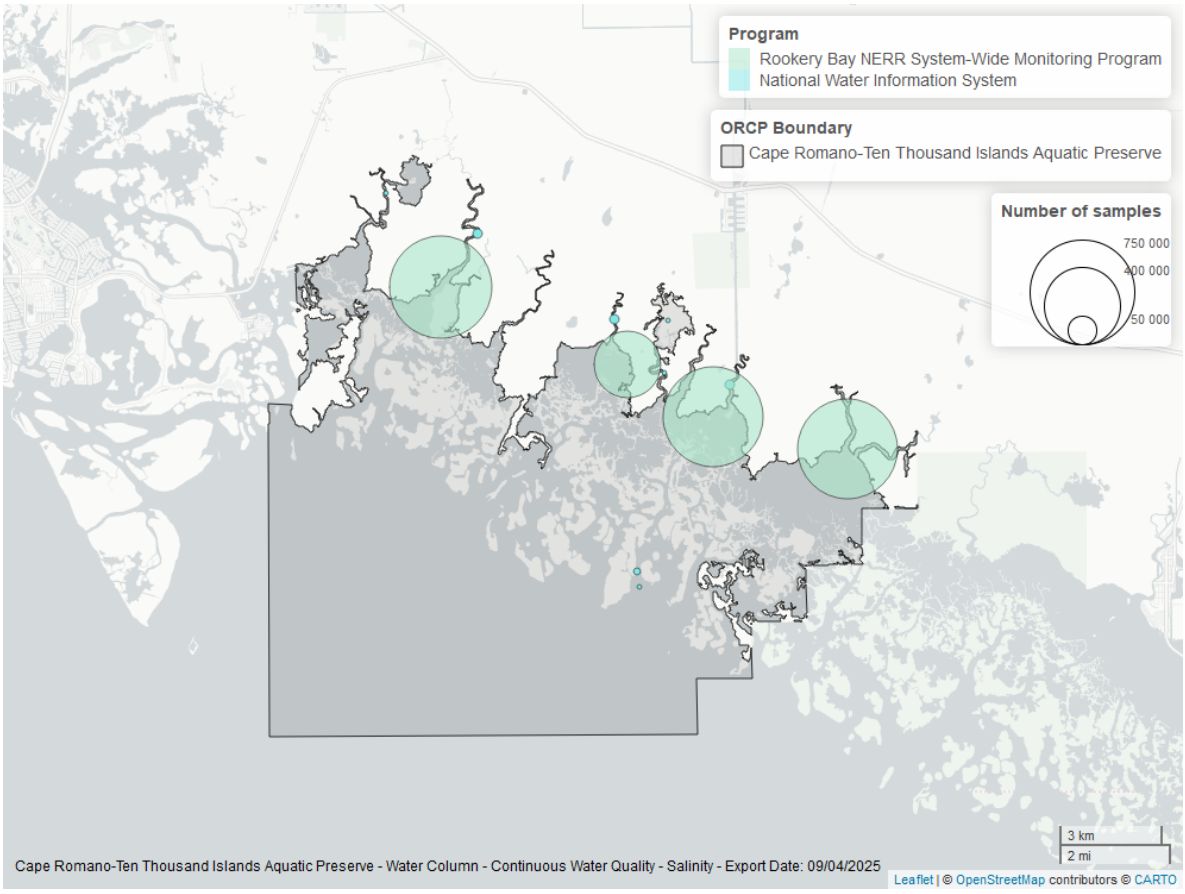

Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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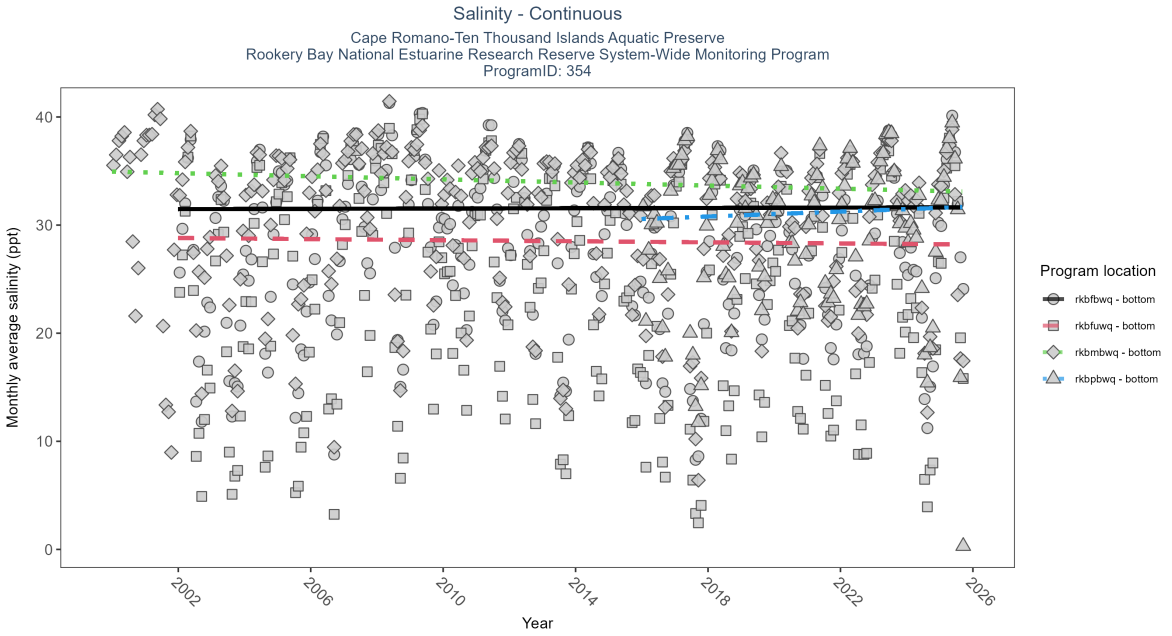

Figure 17: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 9: Seasonal Kendall-Tau Results for All Stations - Salinity

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
rkbfuwq	No significant trend	701628	24	2002 - 2025	26.2	-0.02	28.81	-0.03	0.6384
rkbpbwq	No significant trend	320685	10	2016 - 2025	30.5	0.06	30.56	0.11	0.4435
rkbfbwq	No significant trend	688966	24	2002 - 2025	29.8	0.01	31.48	0.01	0.8256
rkbmbwq	Significantly decreasing trend	725814	26	2000 - 2025	33.3	-0.11	34.95	-0.07	0.0073

At three program locations, monthly average salinity decreased between 0.07 and 0.44 ppt per year. No detectable change in monthly average salinity was observed at seven locations. There was insufficient data to fit a model for two locations.

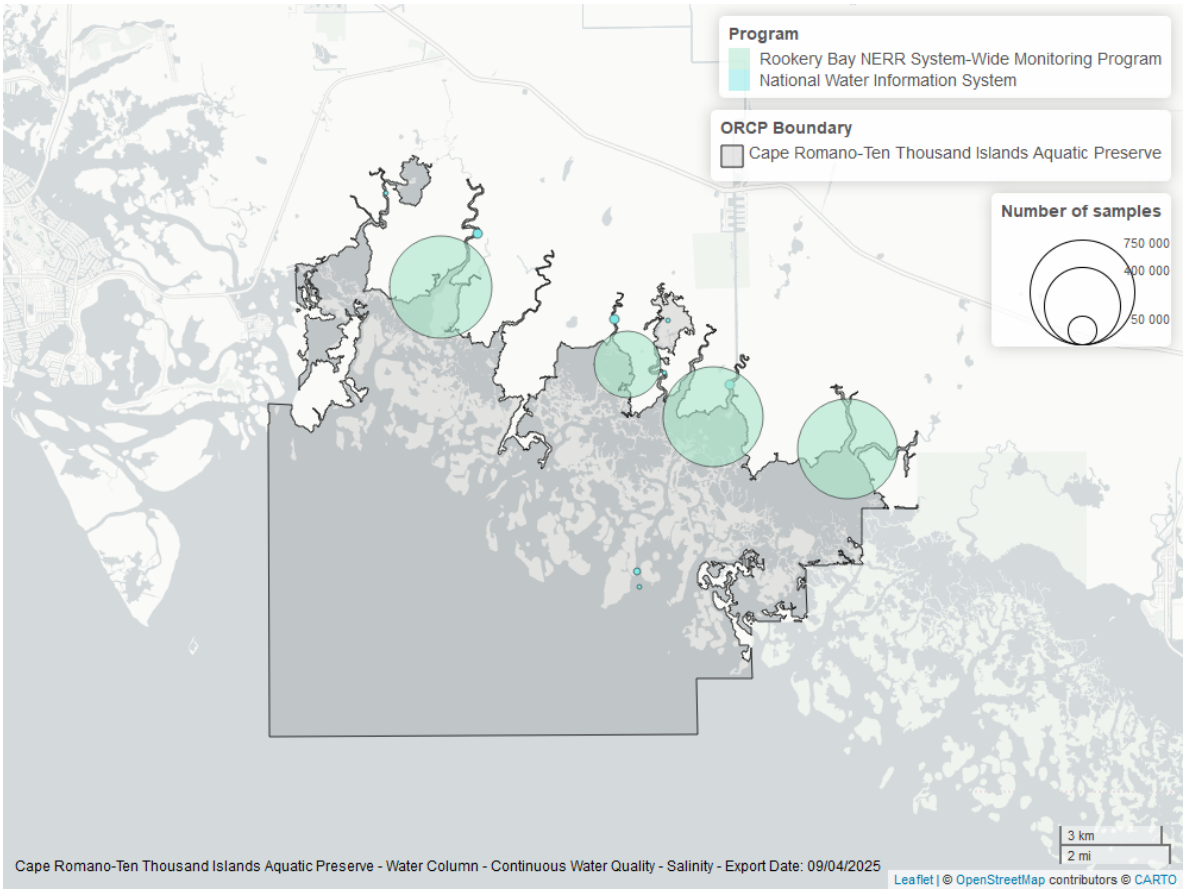

Figure 18: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

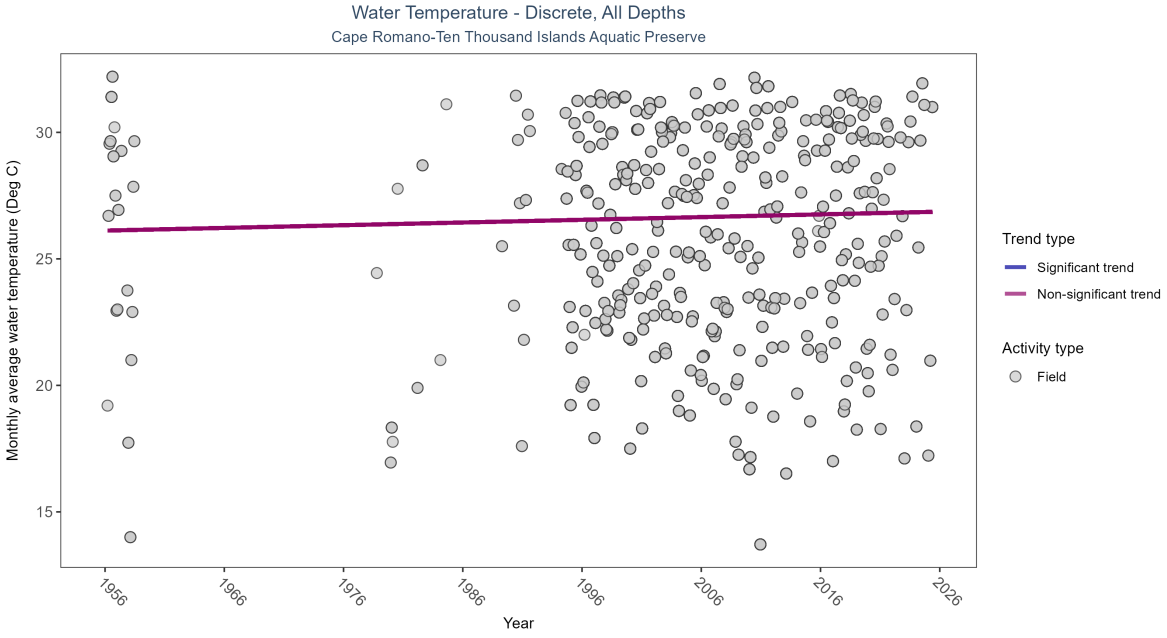

Figure 19: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 10: 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	11167	43	1956 - 2025	26.7	0.05909	26.11692	0.01067	0.1019

Water temperature showed no detectable trend between 1956 and 2025.

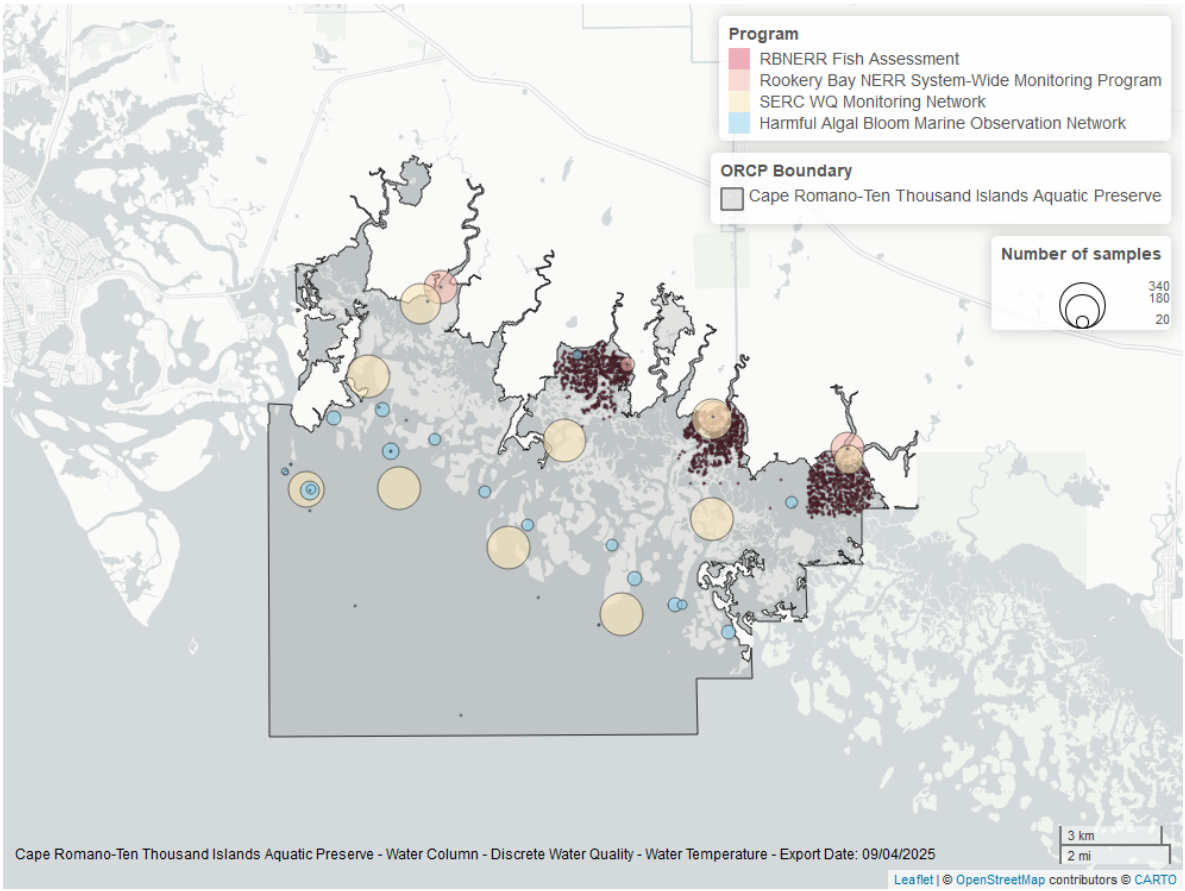

Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

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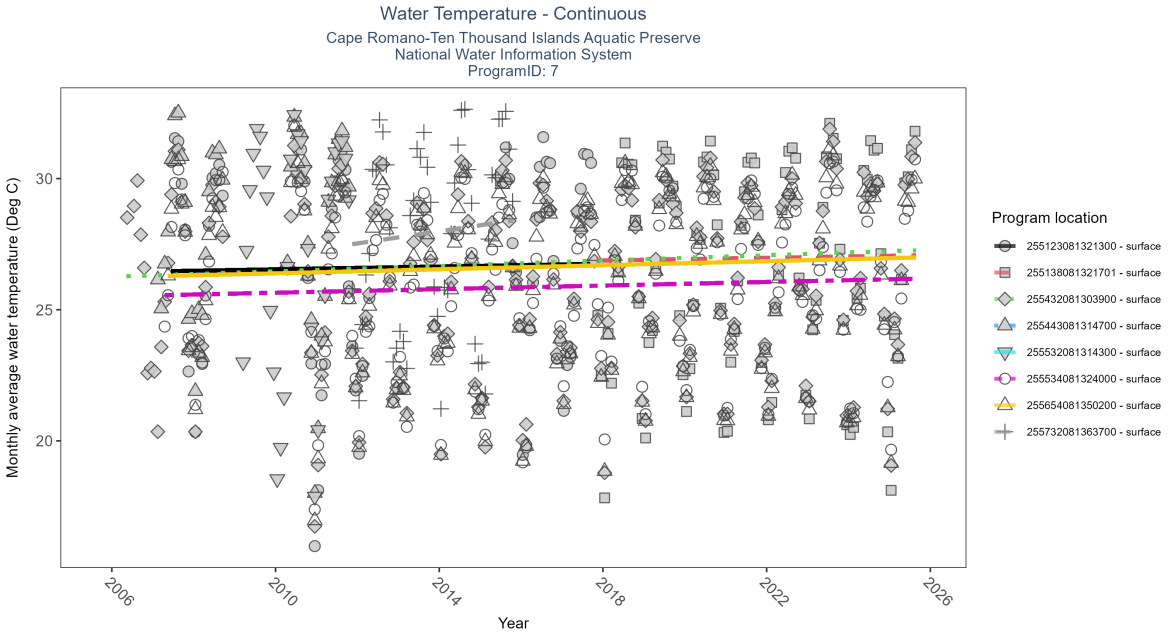

Figure 21: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 11: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
255534081324000	Significantly increasing trend	6044	18	2007 - 2025	26.7	0.14	25.55	0.03	0.0051
255654081350200	Significantly increasing trend	6041	18	2007 - 2025	26.8	0.13	26.27	0.04	0.0123
255138081321701	No significant trend	2827	9	2017 - 2025	27.2	0.06	26.85	0.03	0.4855
255432081303900	Significantly increasing trend	6347	19	2006 - 2025	27.0	0.17	26.26	0.05	5e-04
255123081321300	No significant trend	1818	8	2007 - 2017	27.3	0.1	26.46	0.03	0.3843
255732081363700	No significant trend	1435	5	2011 - 2015	28.4	0.24	27.3	0.23	0.1149
255532081314300	Insufficient data to calculate trend	906	3	2009 - 2011	29.3	-	-	-	-
255443081314700	Insufficient data to calculate trend	2011	4	2007 - 2011	29.3	-	-	-	-

At six program locations, monthly average water temperature increased between 0.03 and 0.07°C per year. No detectable change in monthly average water temperature was observed at four locations. There was insufficient data to fit a model for two locations.

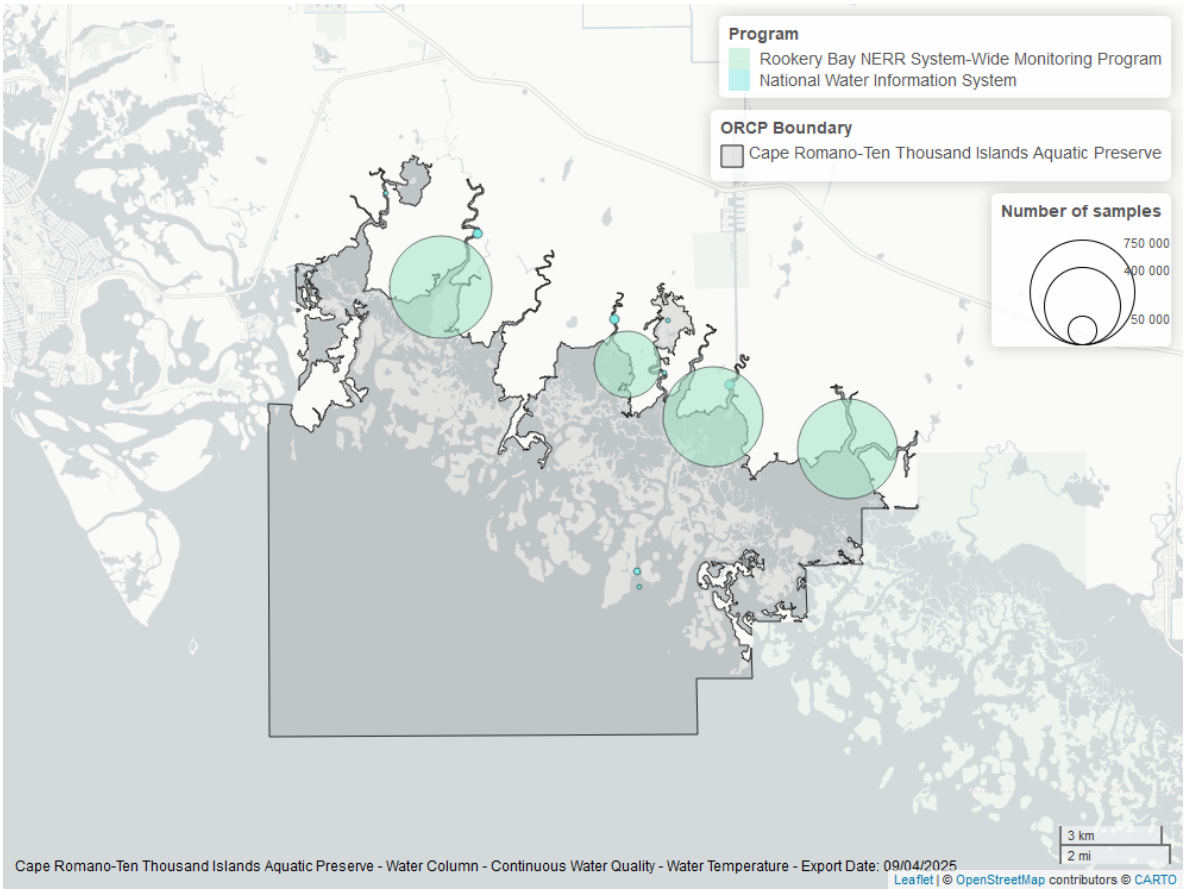

Figure 22: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

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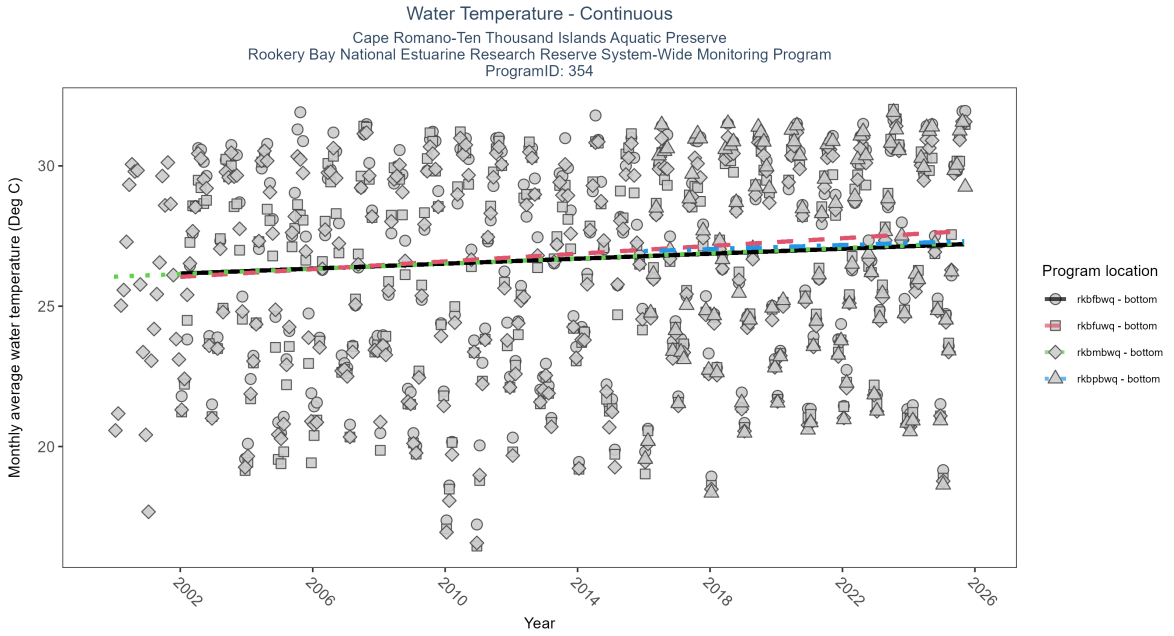

Figure 23: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 12: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Program Location	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
rkbfuwq	Significantly increasing trend	712059	24	2002 - 2025	27.0	0.27	26.05	0.07	0
rkbpbwq	No significant trend	323585	10	2016 - 2025	27.5	0.08	26.96	0.04	0.2983
rkbmbwq	Significantly increasing trend	749141	26	2000 - 2025	26.9	0.26	26.05	0.05	0
rkbfbwq	Significantly increasing trend	704805	24	2002 - 2025	27.0	0.24	26.16	0.04	0

At six program locations, monthly average water temperature increased between 0.03 and 0.07°C per year. No detectable change in monthly average water temperature was observed at four locations. There was insufficient data to fit a model for two locations.

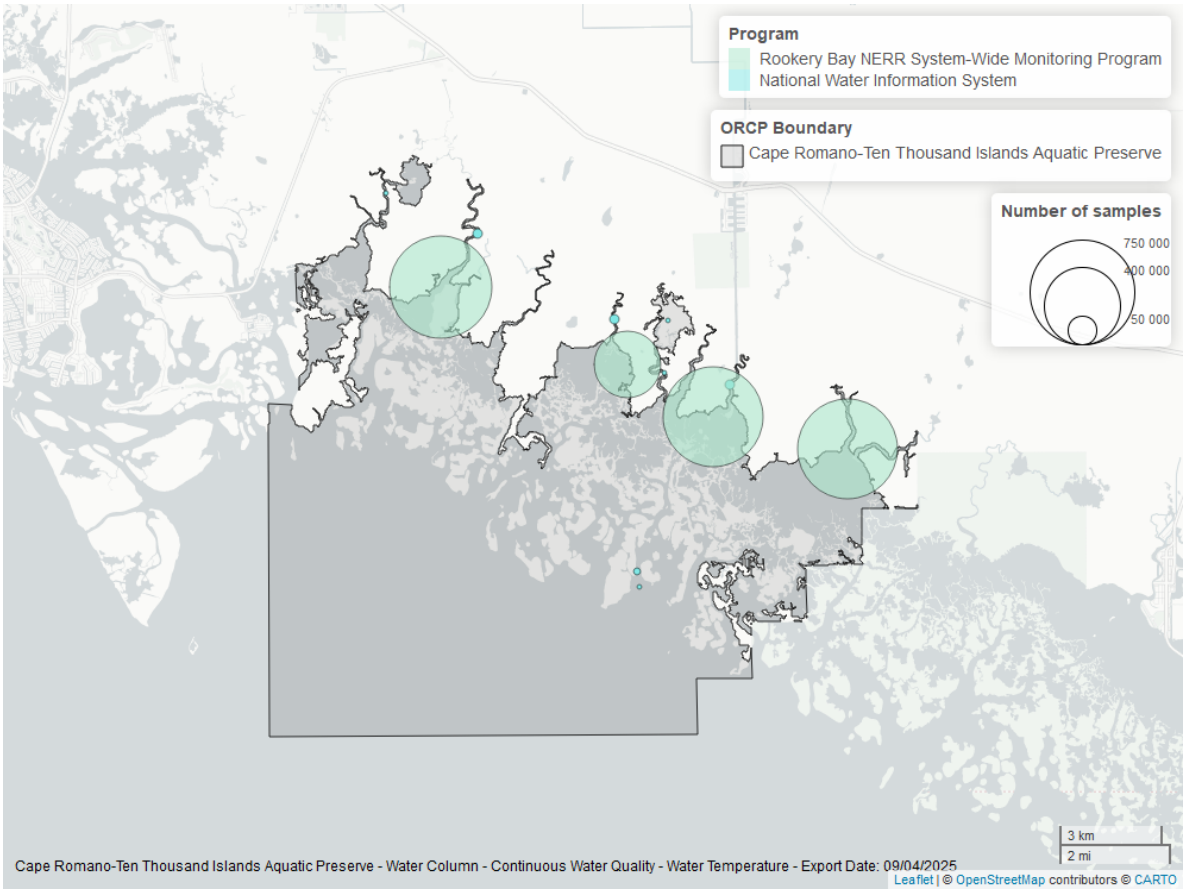

Figure 24: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

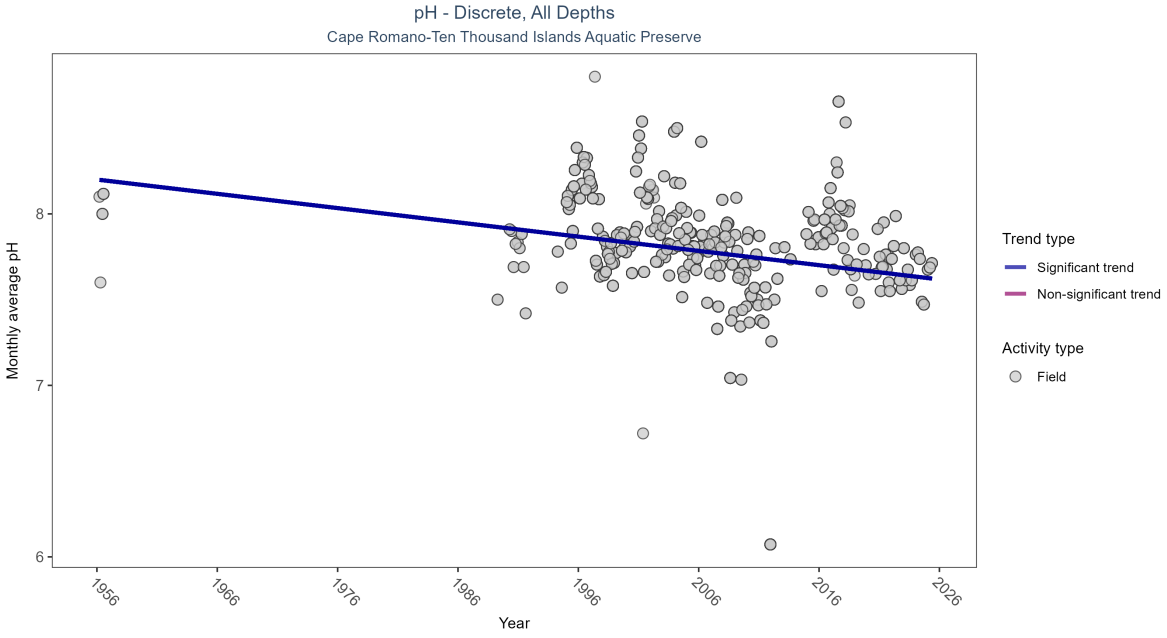

Figure 25: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 13: 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	4573	36	1956 - 2025	7.87	-0.23972	8.20019	-0.00832	0

Monthly average pH decreased by 0.01 pH units per year.

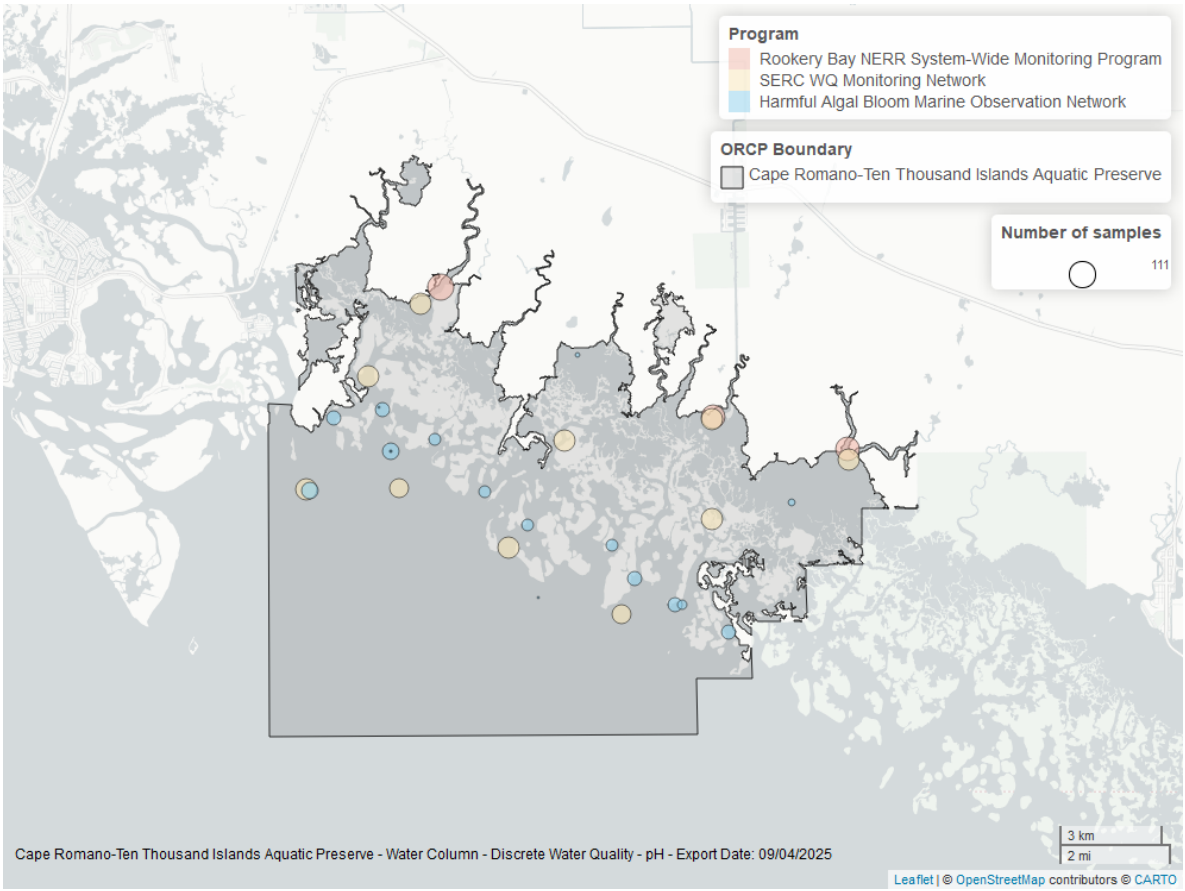

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

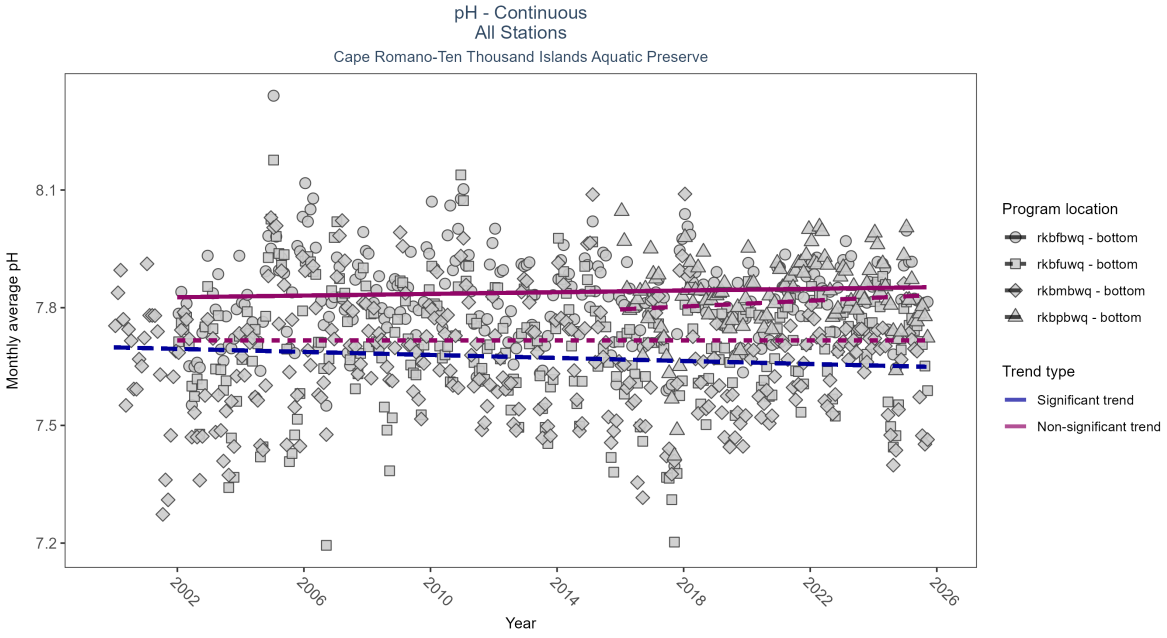

Figure 27: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 14: 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
rkbmbwq	Significantly decreasing trend	714491	26	2000 - 2025	7.7	-0.09	7.70	0	0.0236
rkbpbwq	No significant trend	313866	10	2016 - 2025	7.8	0.11	7.80	0	0.1547
rkbfuwq	No significant trend	673674	24	2002 - 2025	7.7	0.00	7.72	0	0.9823
rkbfbwq	No significant trend	656468	24	2002 - 2025	7.8	0.06	7.83	0	0.1501

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

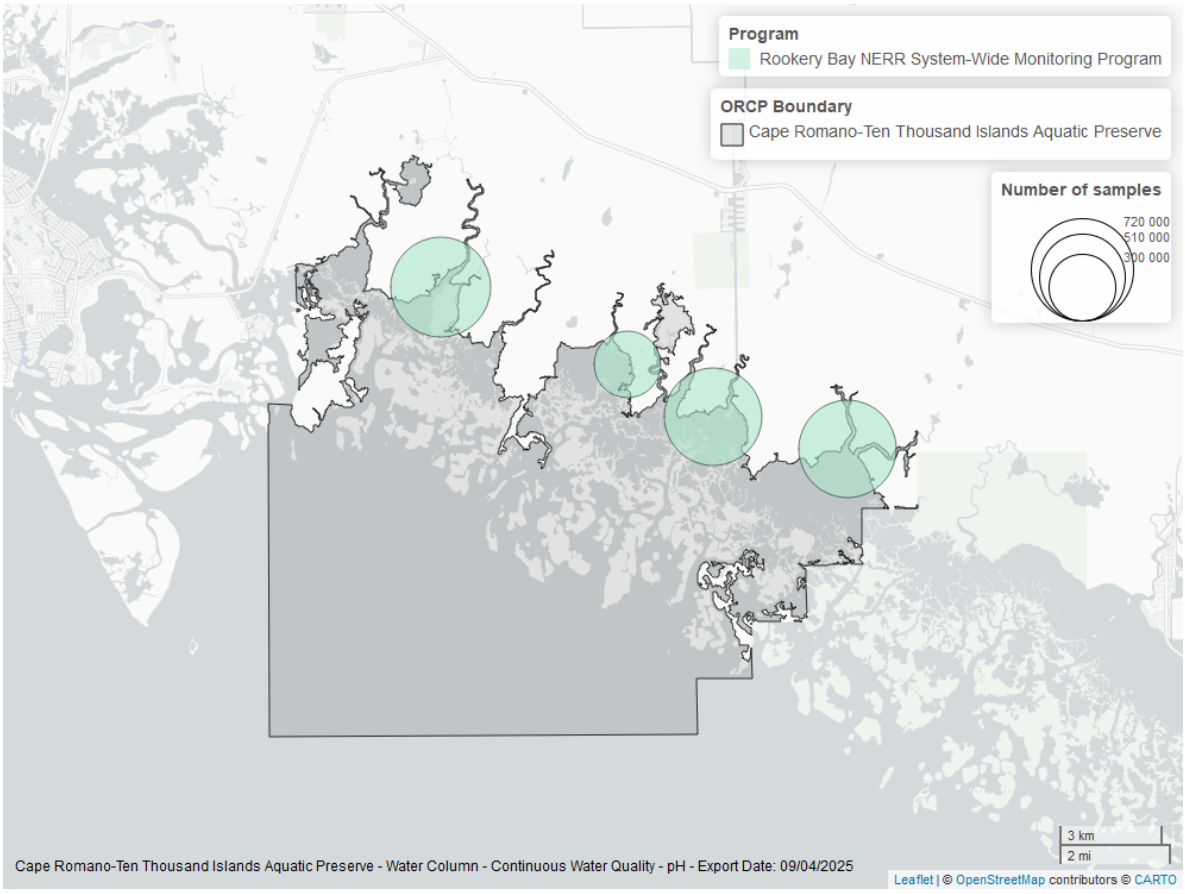

Figure 28: Map showing location of ph continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

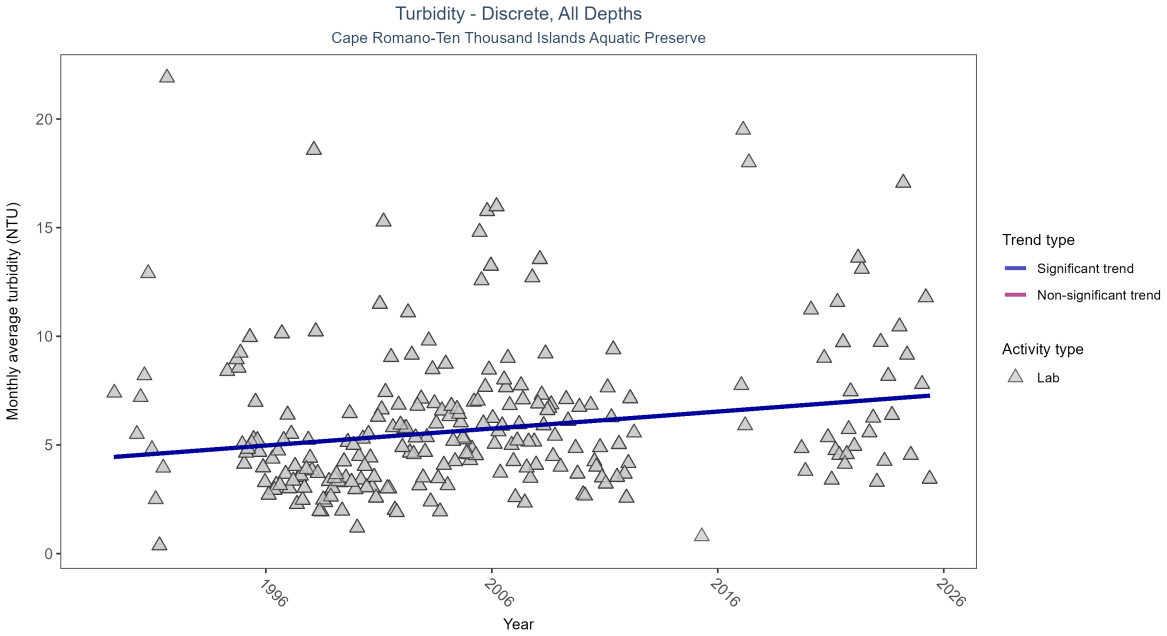

Figure 29: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 15: 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	4672	31	1989 - 2025	4	0.15564	4.42636	0.07812	5e-04

Monthly average turbidity increased by 0.08 NTU per year, indicating a decrease in water clarity.

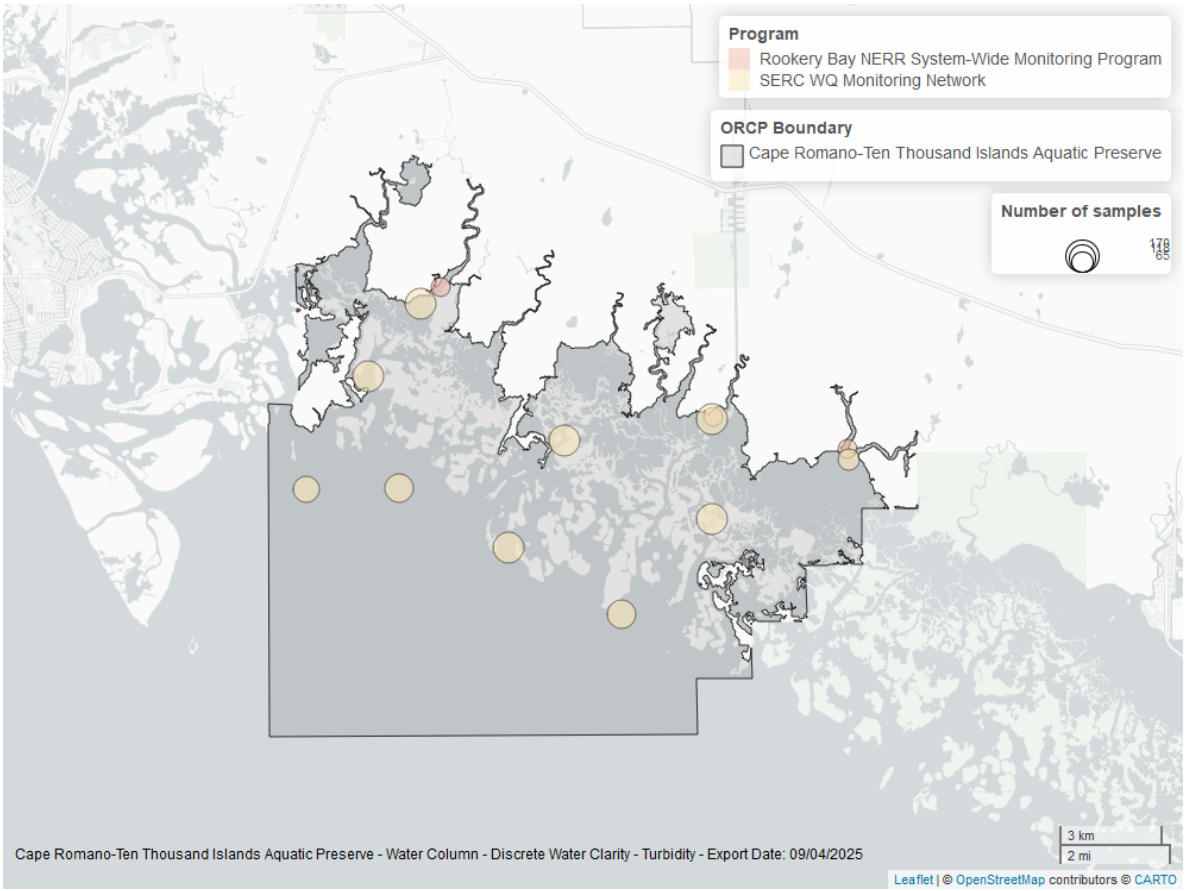

Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

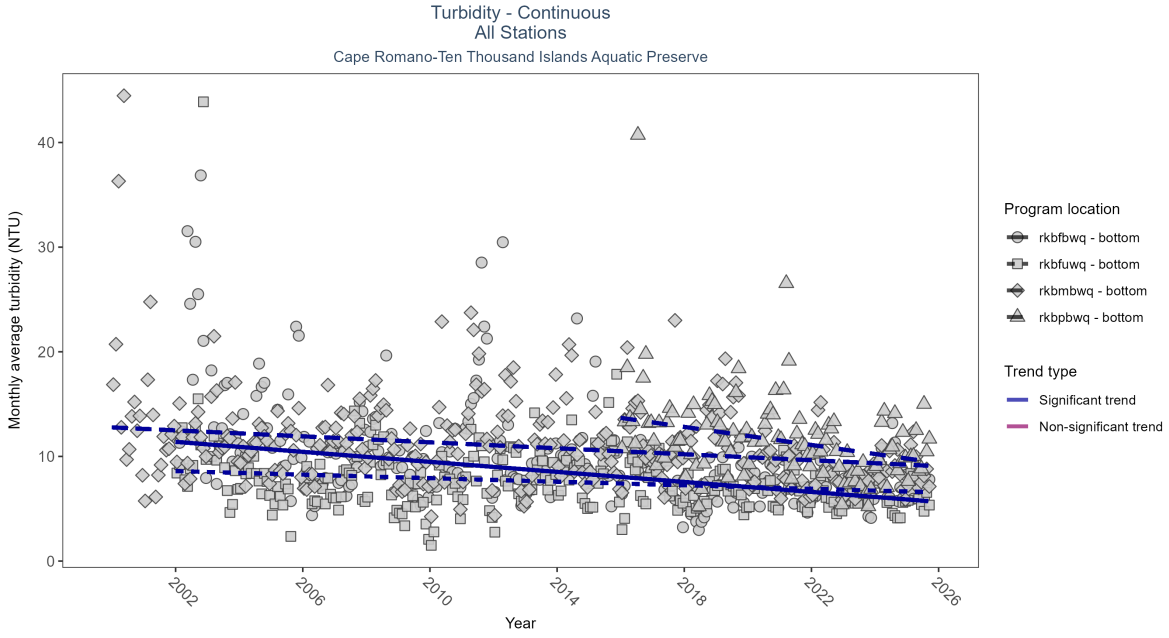

Figure 31: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 16: 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
rkbfuwq	Significantly decreasing trend	642336	24	2002 - 2025	6	-0.21	8.60	-0.08	0
rkbpbwq	Significantly decreasing trend	317056	10	2016 - 2025	9	-0.34	13.68	-0.43	0
rkbfbwq	Significantly decreasing trend	668705	24	2002 - 2025	7	-0.40	11.40	-0.24	0
rkbmbwq	Significantly decreasing trend	701426	26	2000 - 2025	9	-0.24	12.78	-0.14	0

At four program locations, monthly average turbidity decreased between 0.08 and 0.43 NTU per year.

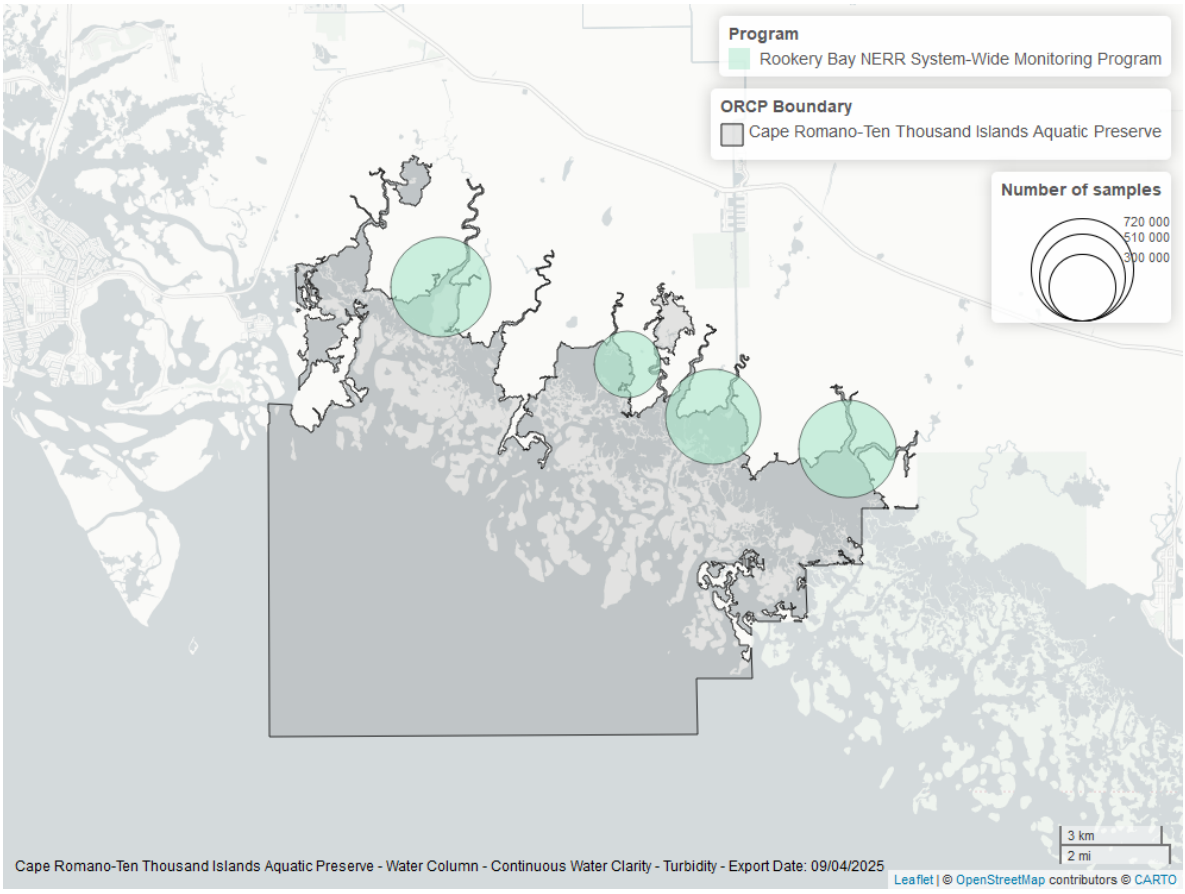

Figure 32: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

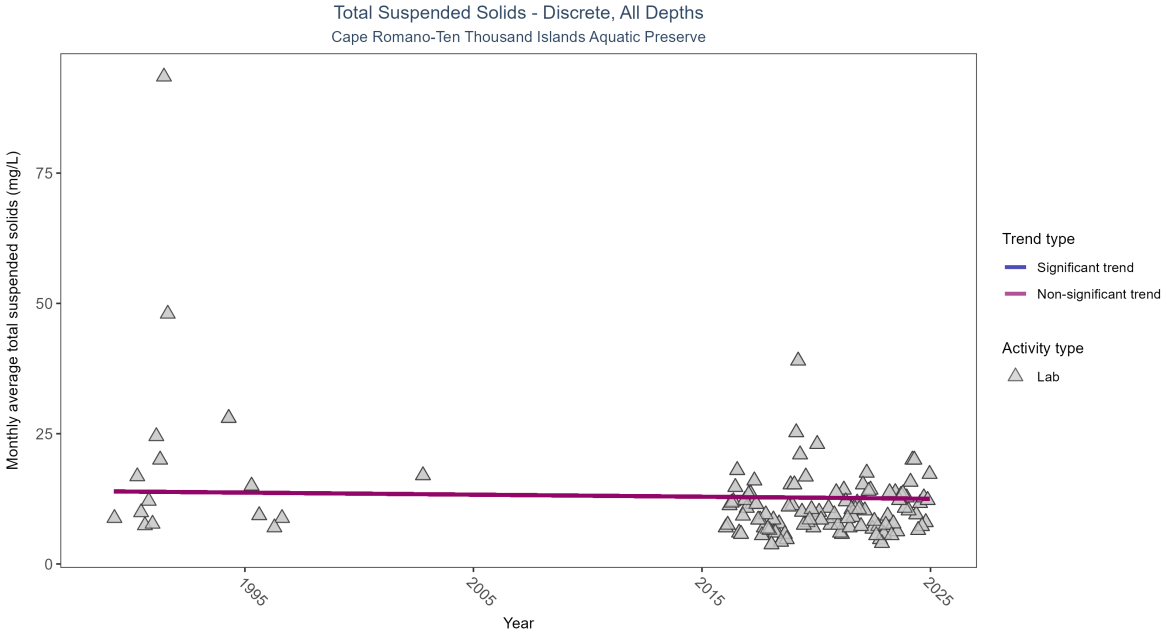

Figure 33: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included in the plot.

Table 17: 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	No significant trend	464	16	1989 - 2024	10	-0.0252	13.92995	-0.03929	0.5894

Total suspended solids showed no detectable trend between 1989 and 2024.

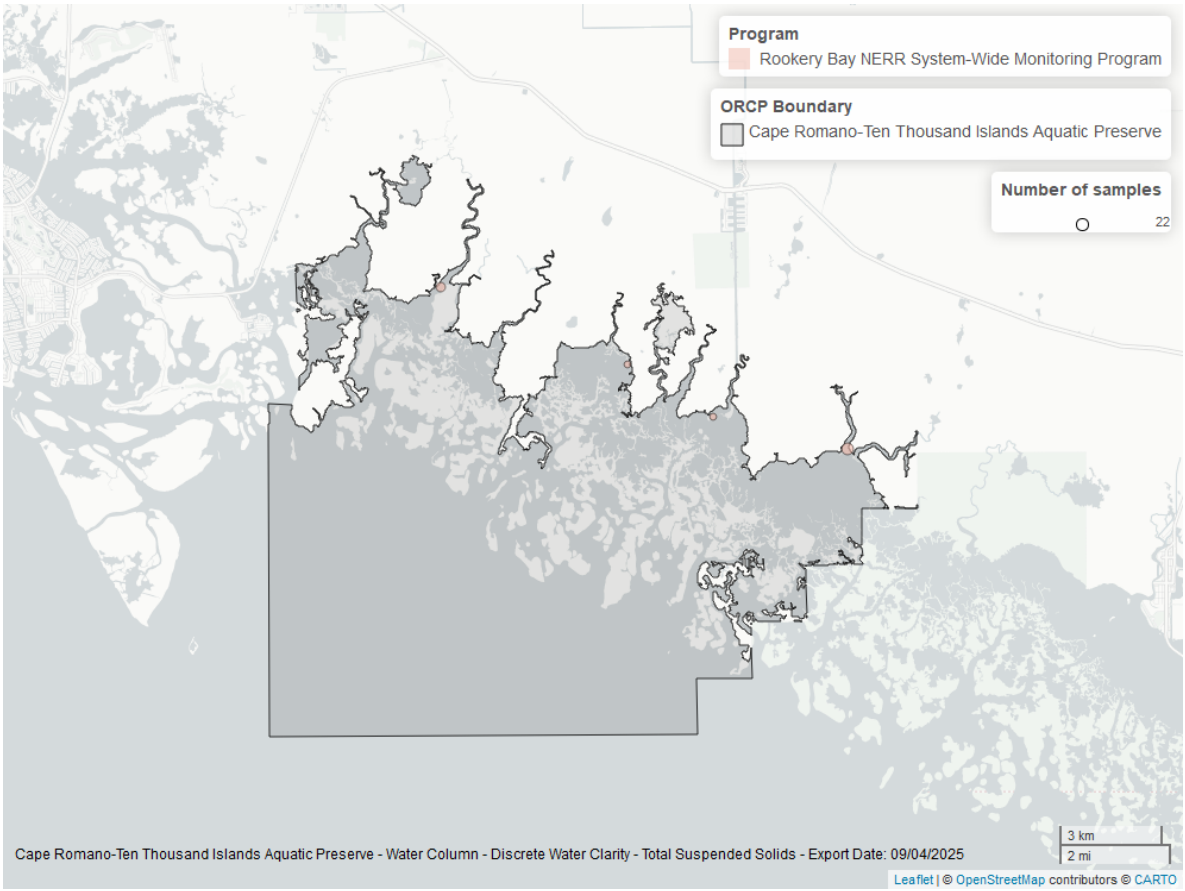

Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

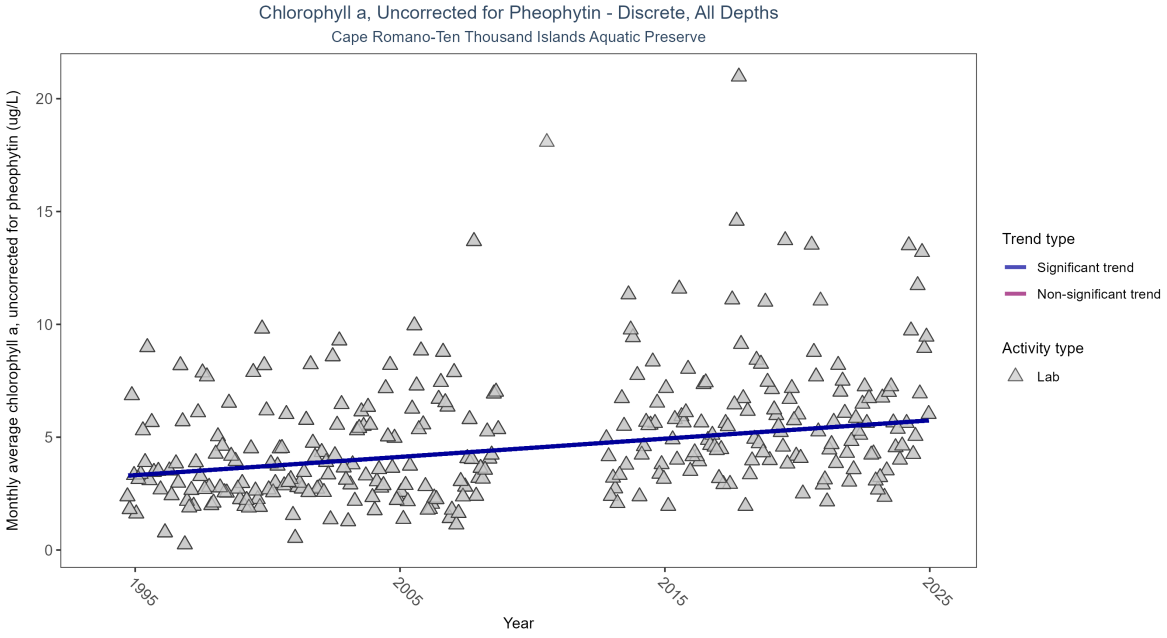

Figure 35: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

Table 18: 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	2153	29	1994 - 2024	3.6548	0.28021	3.23648	0.08088	0

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.08 µg/L per year, indicating a decrease in water clarity.

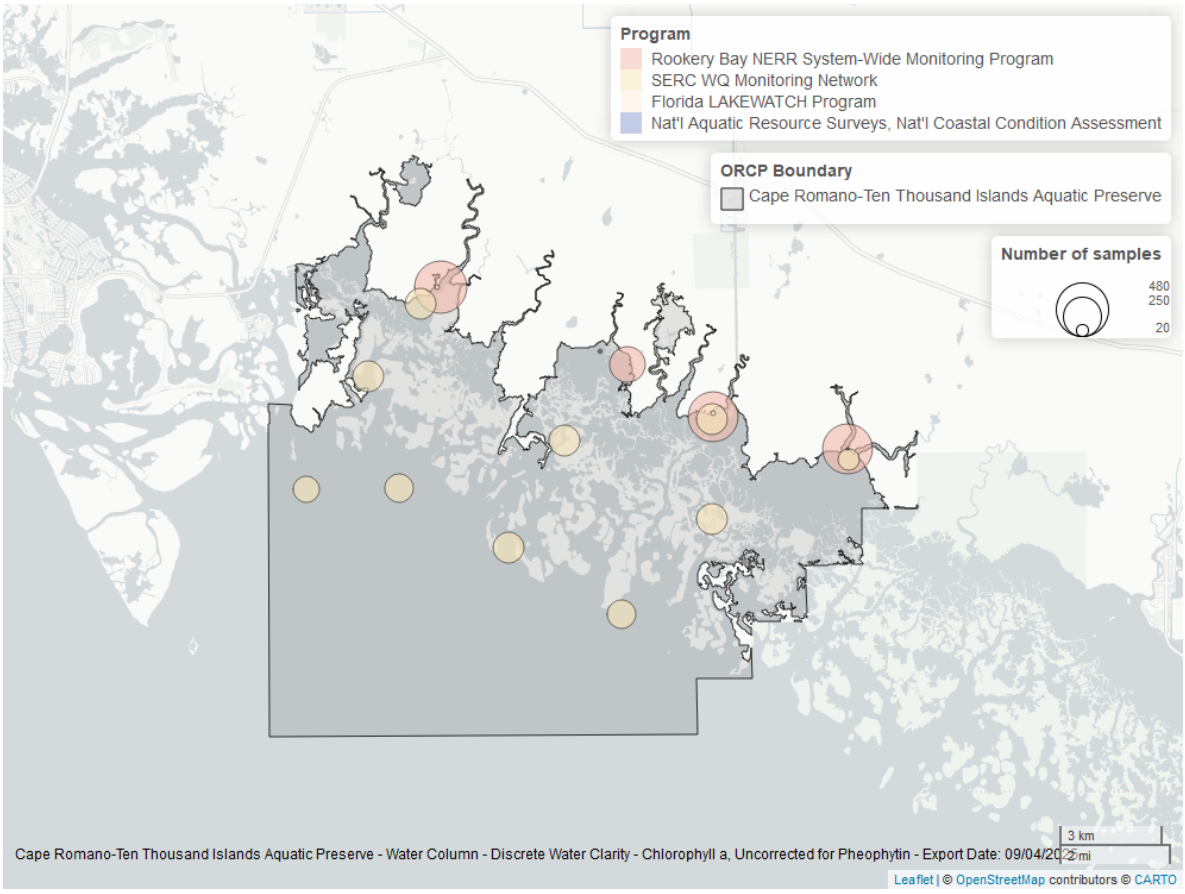

Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

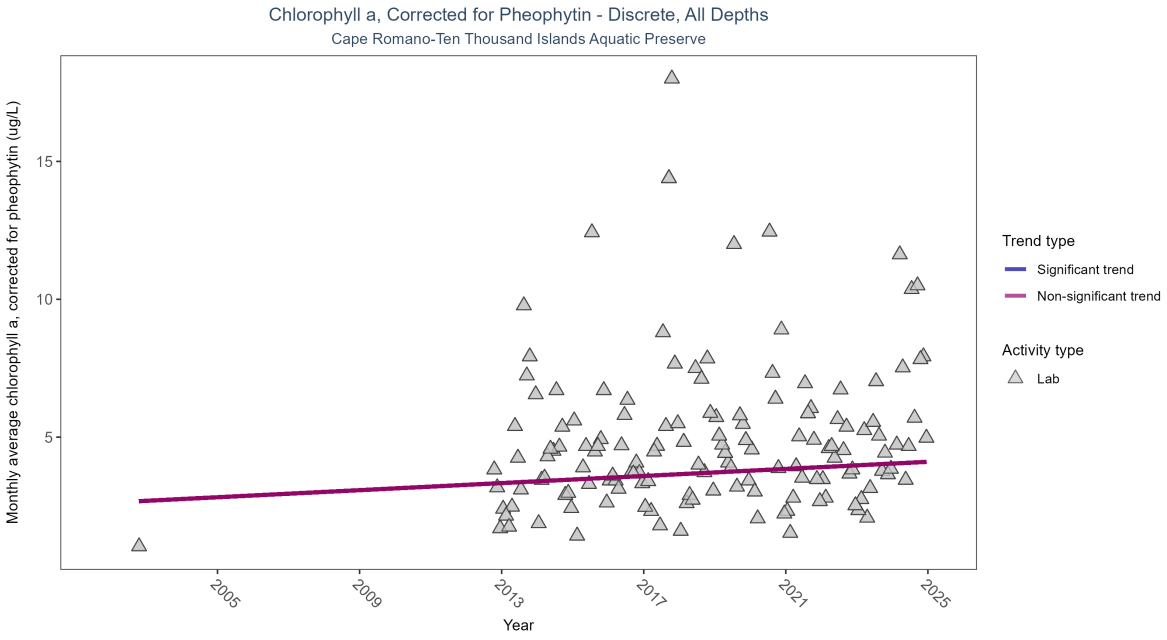

Figure 37: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles)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

Table 19: 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	619	14	2002 - 2024	3.8	0.1213	2.62765	0.06429	0.0596

Chlorophyll a, corrected for pheophytin, showed no detectable trend between 2002 and 2024.

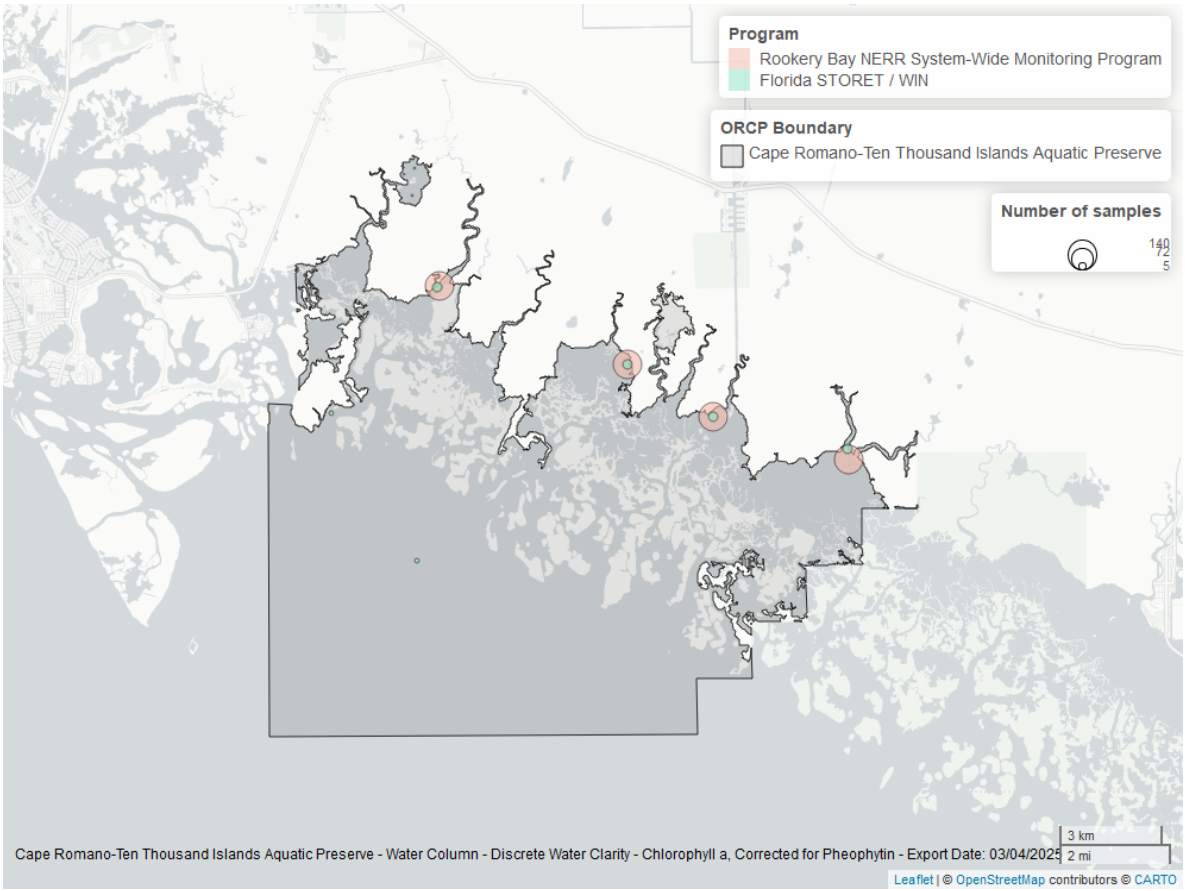

Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

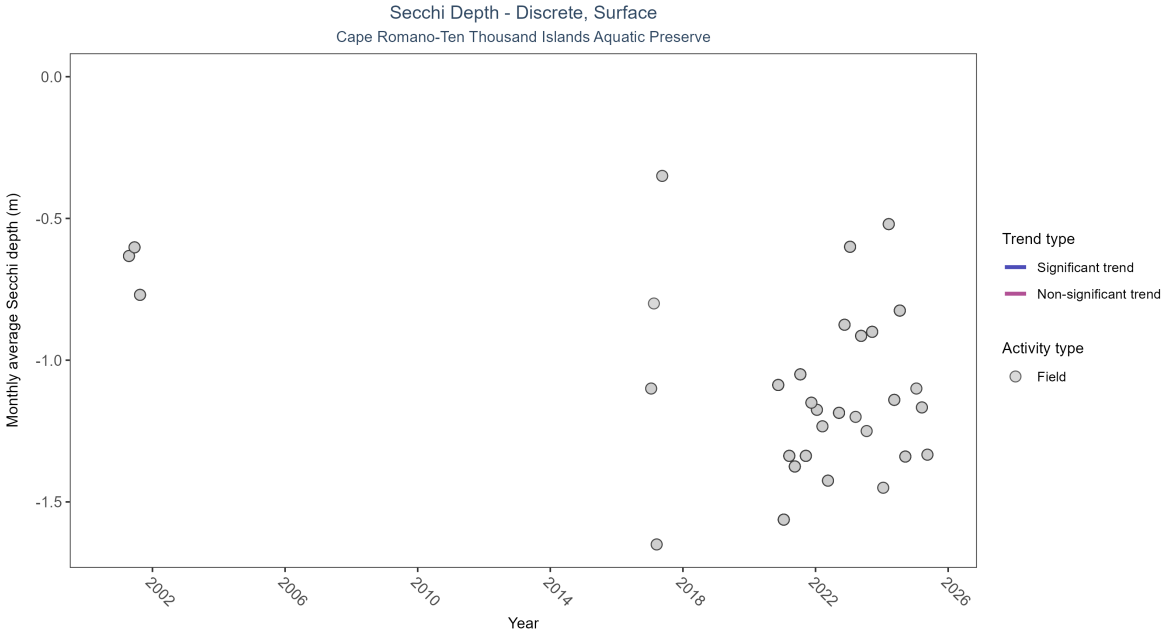

Figure 39: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 20: Seasonal Kendall-Tau 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	Insufficient data to calculate trend	215	9	2001 - 2025	-0.9	-	-	-	-

There was insufficient data to fit a model for Secchi depth.

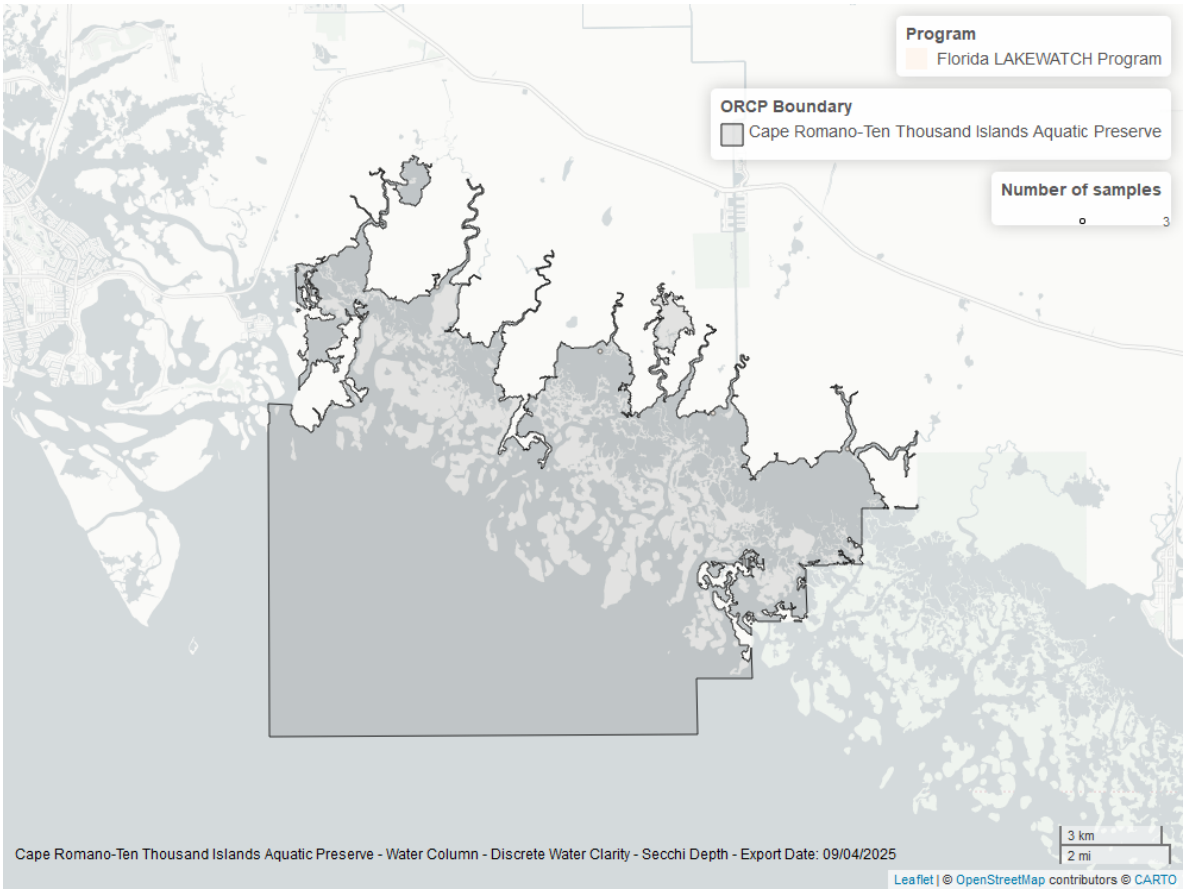

Figure 40: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

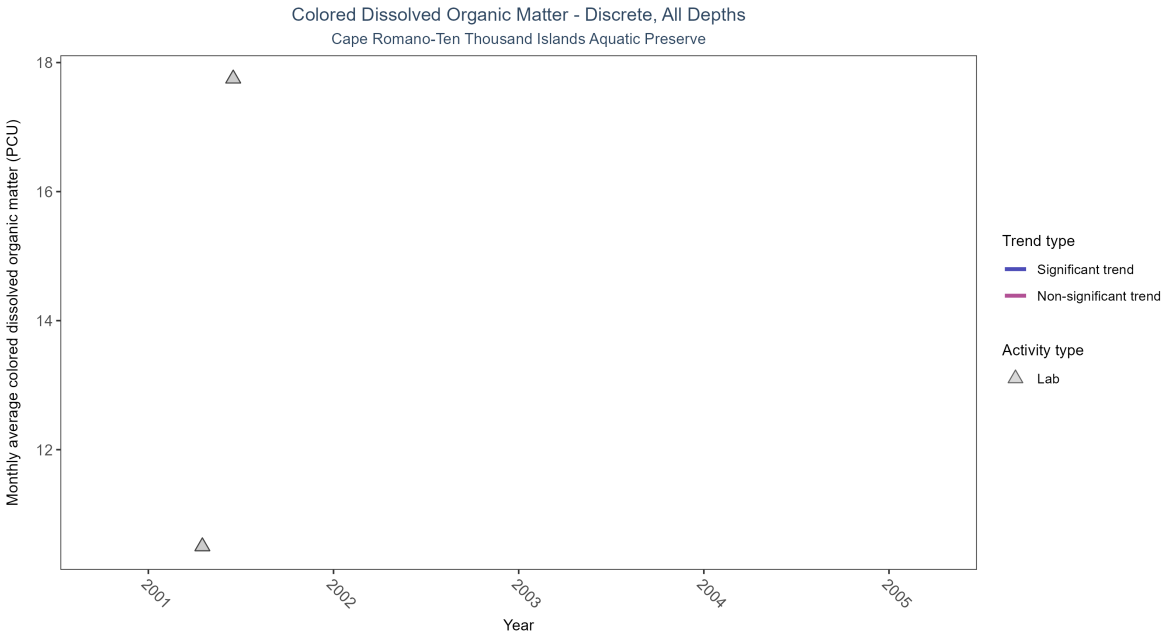

Figure 41: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the plot.

Table 21: 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	Insufficient data to calculate trend	8	1	2001 - 2001	13	-	-	-	-

There was insufficient data to fit a model for colored dissolved organic matter.

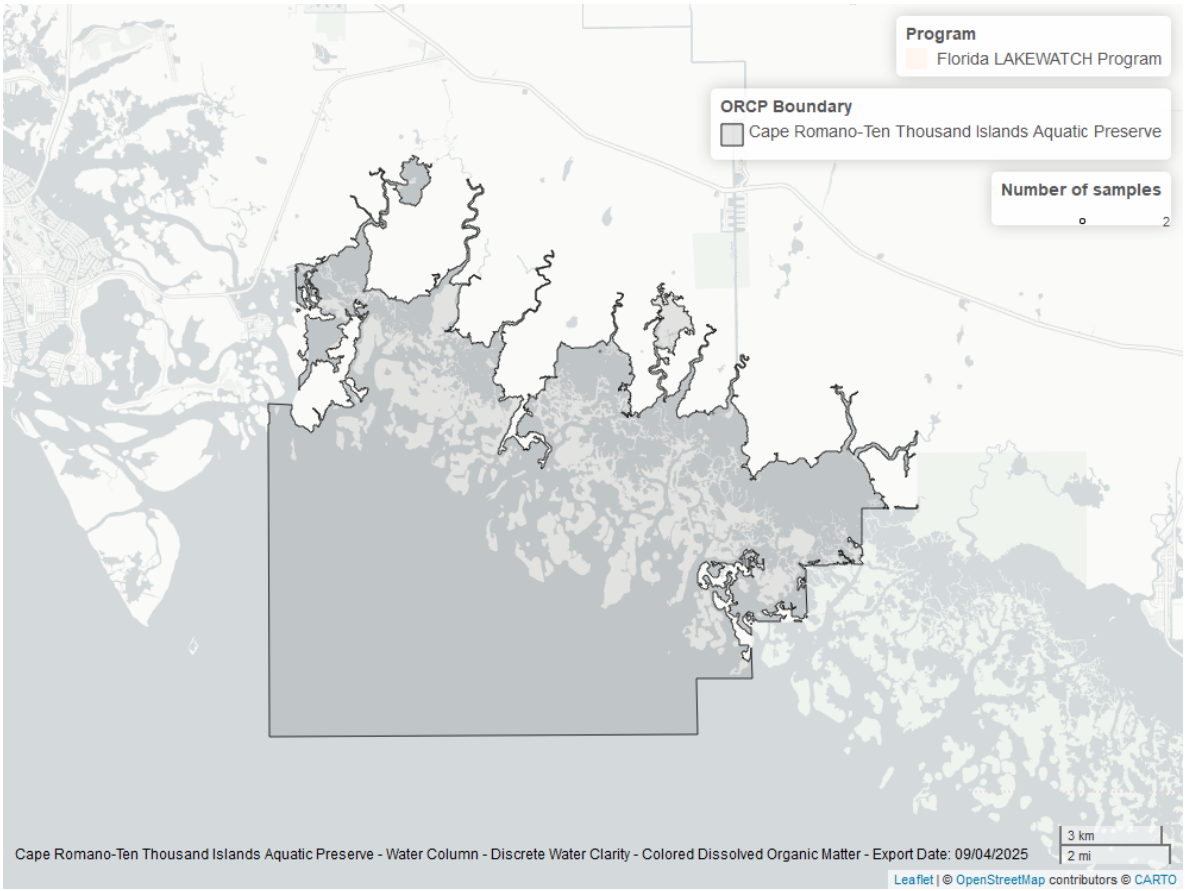

Figure 42: Map showing location of discrete water quality sampling locations within the boundaries of *Cape Romano-Ten Thousand Islands Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.