Apalachicola National Estuarine Research Reserve

SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

Contents

Indicators

Nutrients

Total Nitrogen - Discrete

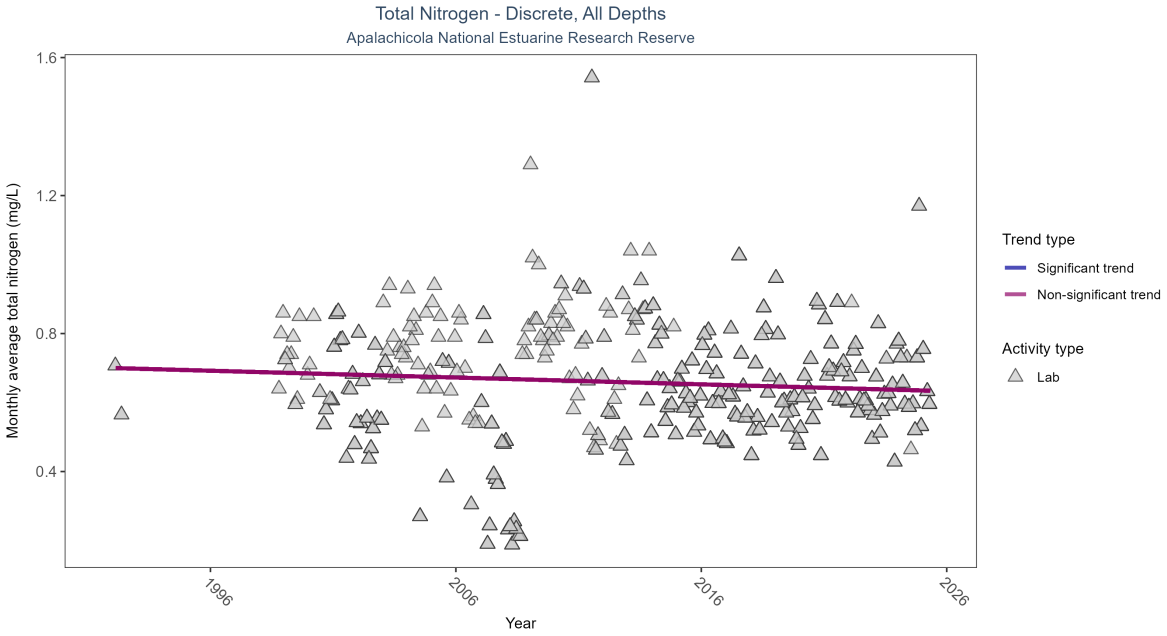

Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	4344	29	1992 - 2025	0.63	-0.07171	0.70011	-0.00197	0.0911

Total nitrogen showed no detectable trend between 1992 and 2025.

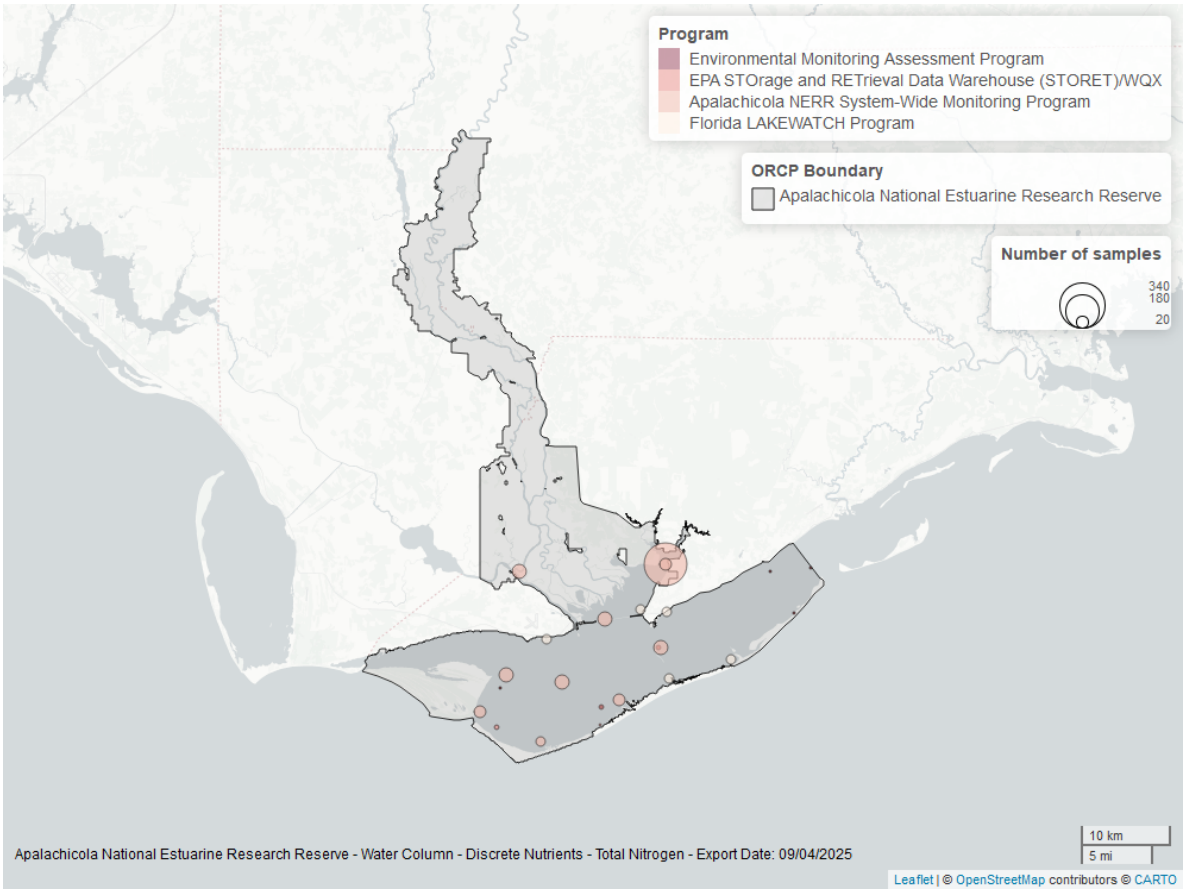

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

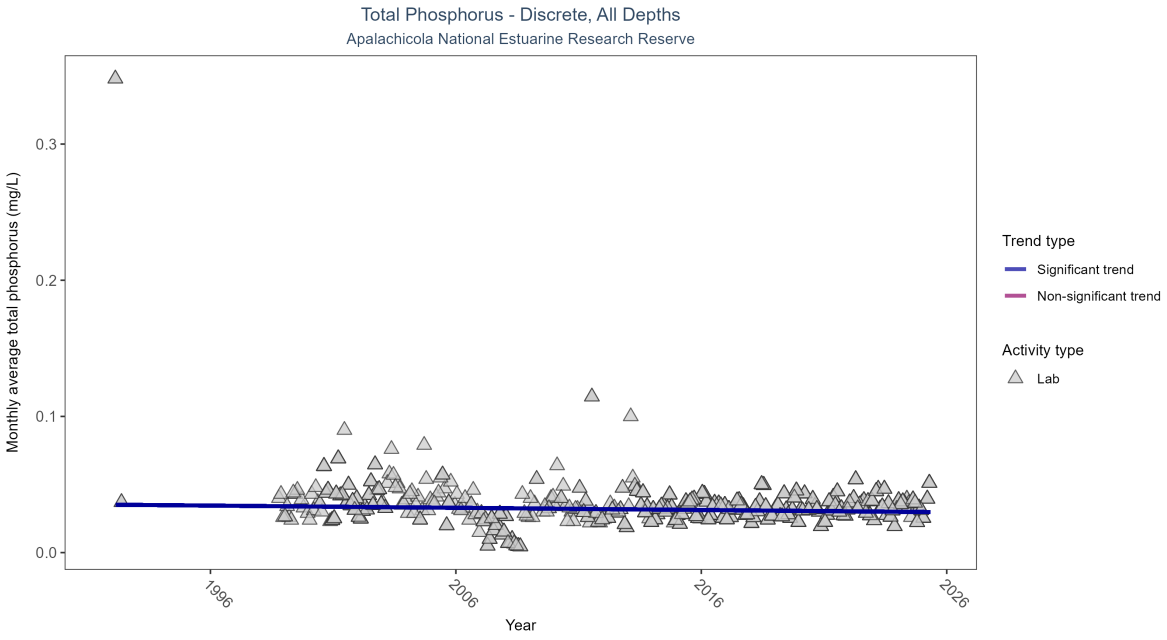

Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	4692	29	1992 - 2025	0.031	-0.09957	0.03517	-0.00016	0.014

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

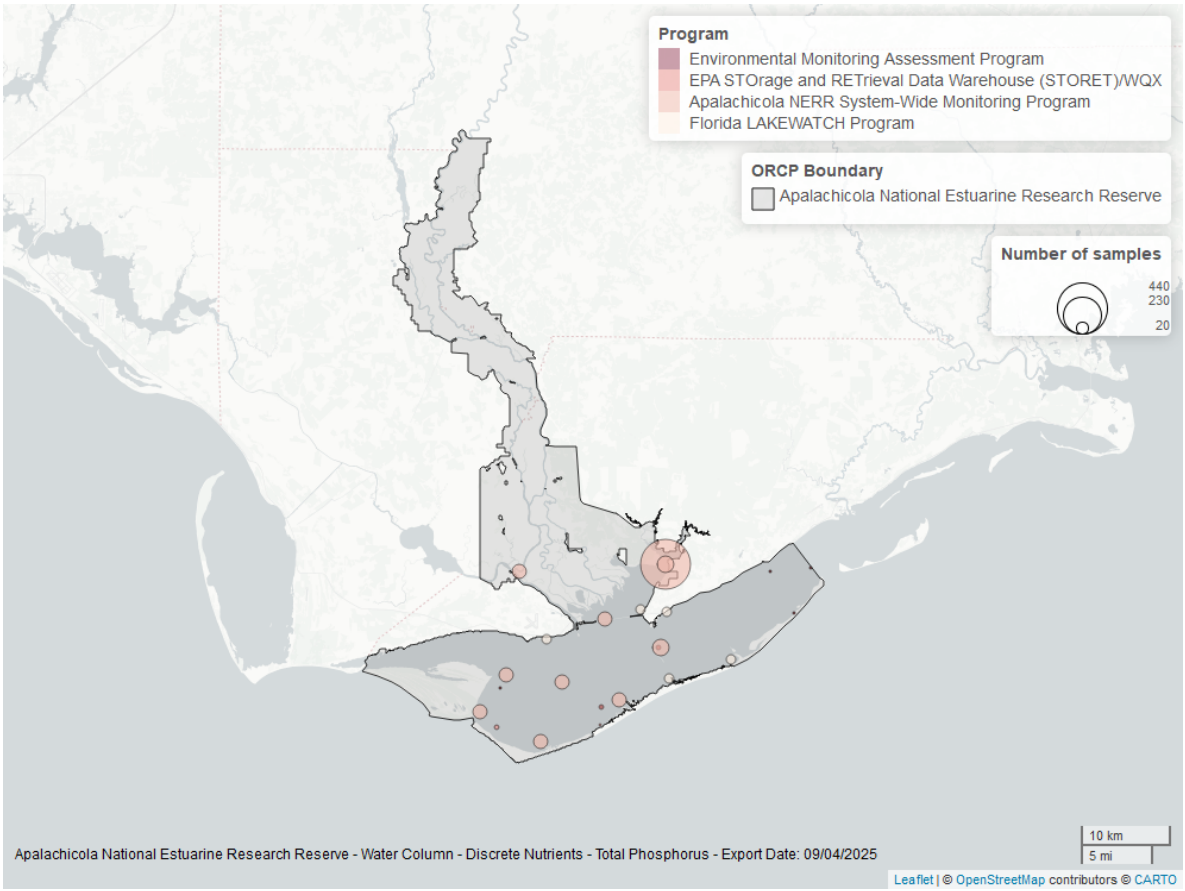

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

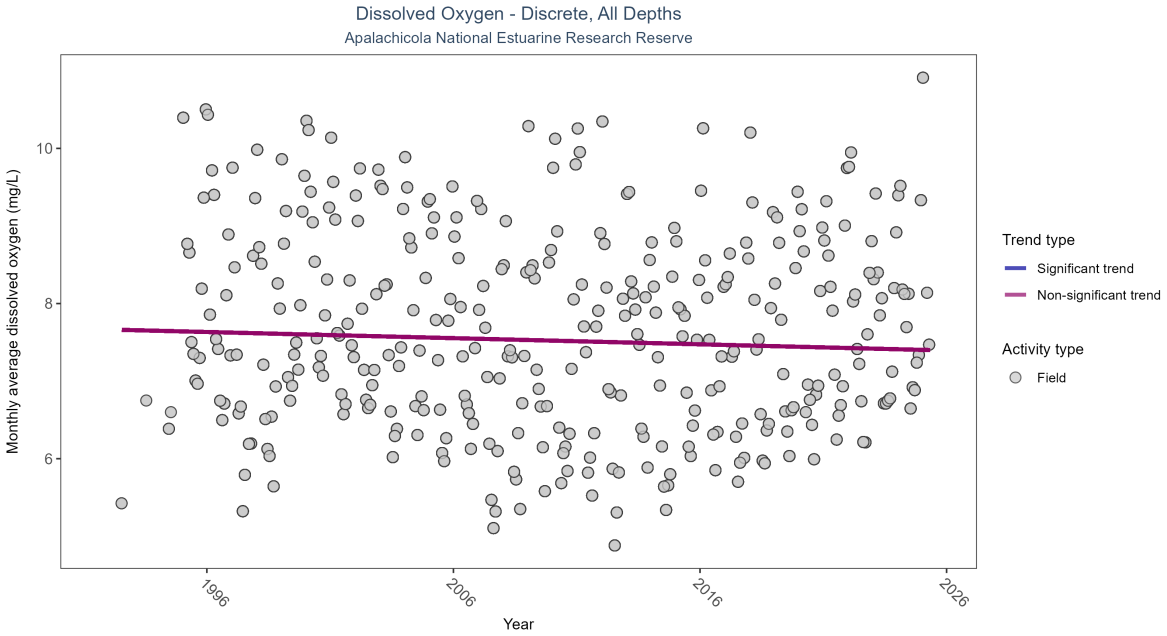

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	No significant trend	83315	34	1992 - 2025	7.5	-0.06921	7.66498	-0.00794	0.0582

Dissolved oxygen showed no detectable trend between 1992 and 2025.

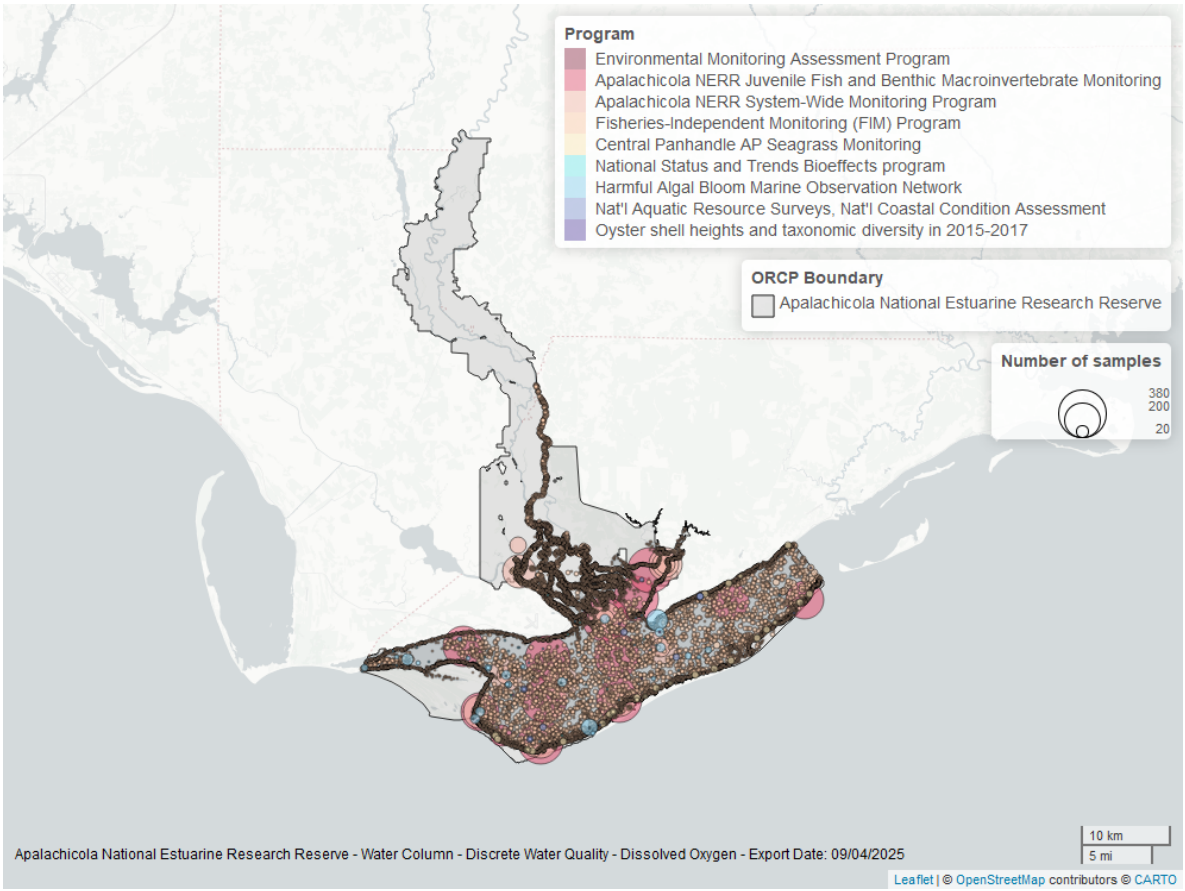

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

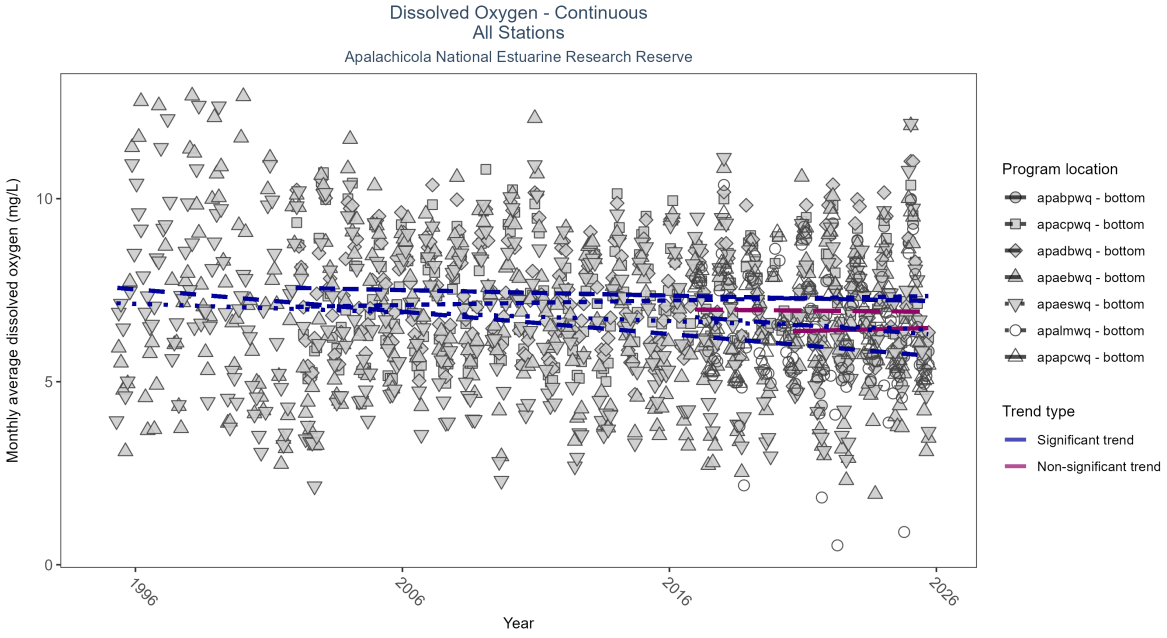

Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apapcwq	No significant trend	289558	10	2016 - 2025	6.8	-0.02	6.98	-0.01	0.8774
apaeswq	Significantly decreasing trend	733356	31	1995 - 2025	6.8	-0.13	7.15	-0.02	6e-04
apalmwq	Significantly decreasing trend	275414	10	2016 - 2025	6.3	-0.20	6.81	-0.05	0.0104
apadbwq	Significantly decreasing trend	641801	24	2002 - 2025	7.2	-0.14	7.56	-0.02	0.0012
apacpwq	Significantly increasing trend	636748	24	2002 - 2025	7.1	0.11	7.05	0.01	0.0064
apaebwq	Significantly decreasing trend	685348	31	1995 - 2025	6.8	-0.30	7.58	-0.06	0
apabpwq	No significant trend	170534	6	2020 - 2025	6.5	0.06	6.37	0.02	0.547

At one program location, monthly average dissolved oxygen increased by 0.01 mg/L per year. At four program locations, monthly average dissolved oxygen decreased between 0.02 and 0.06 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at two locations.

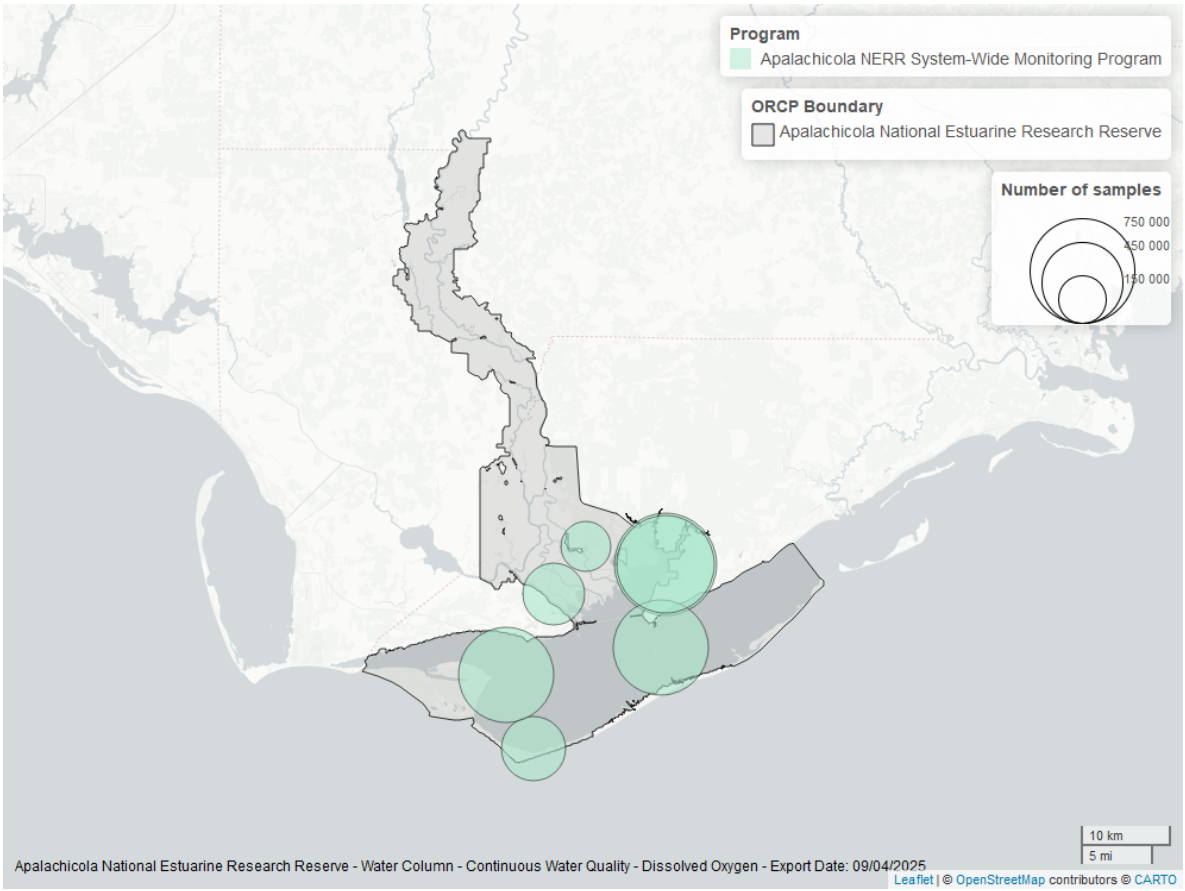

Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

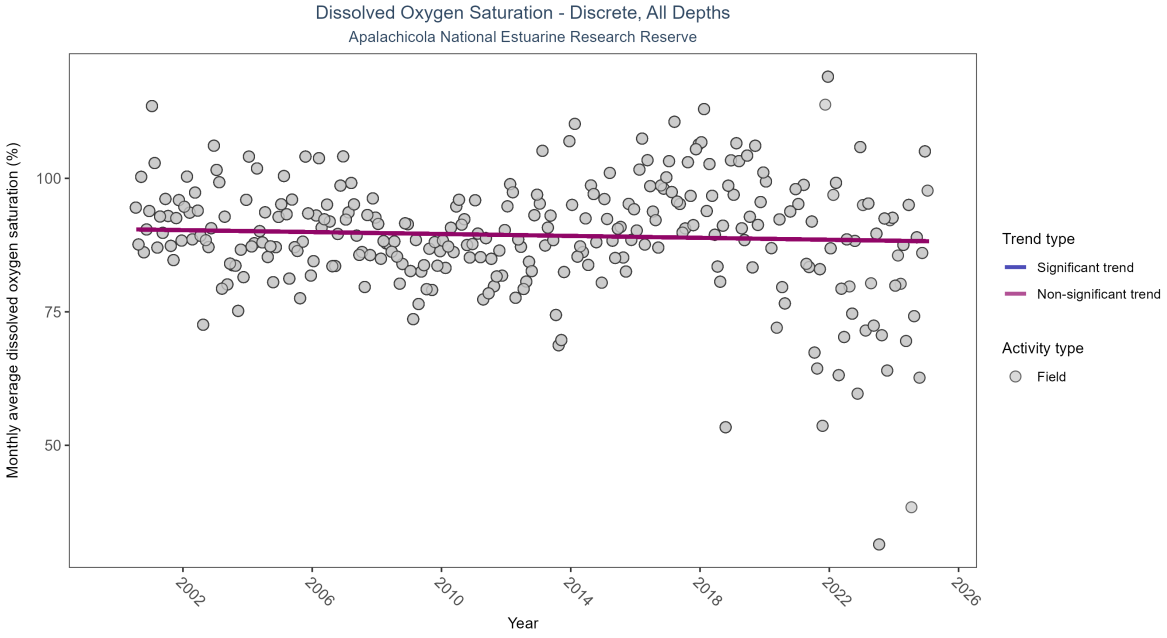

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	No significant trend	7037	26	2000 - 2025	91.5	-0.0551	90.47811	-0.08997	0.1842

Dissolved oxygen saturation showed no detectable trend between 2000 and 2025.

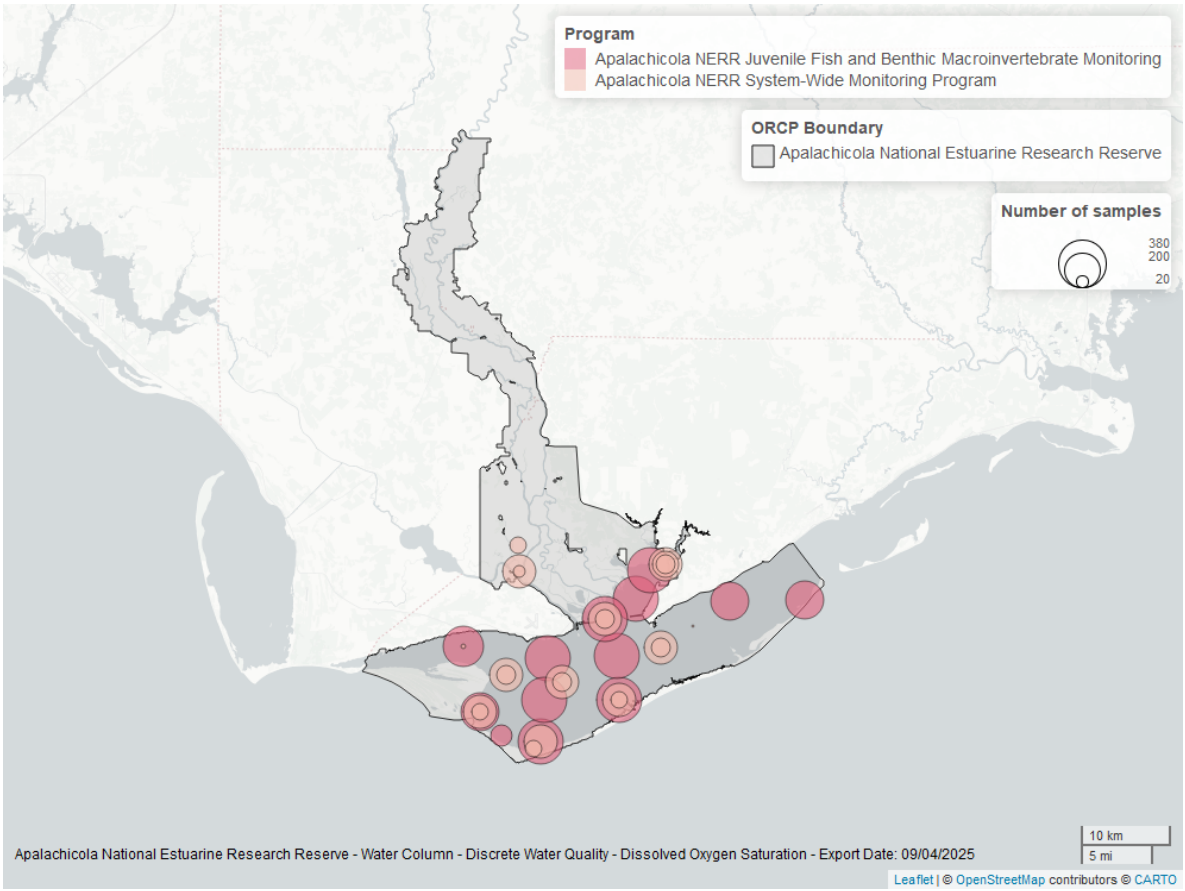

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

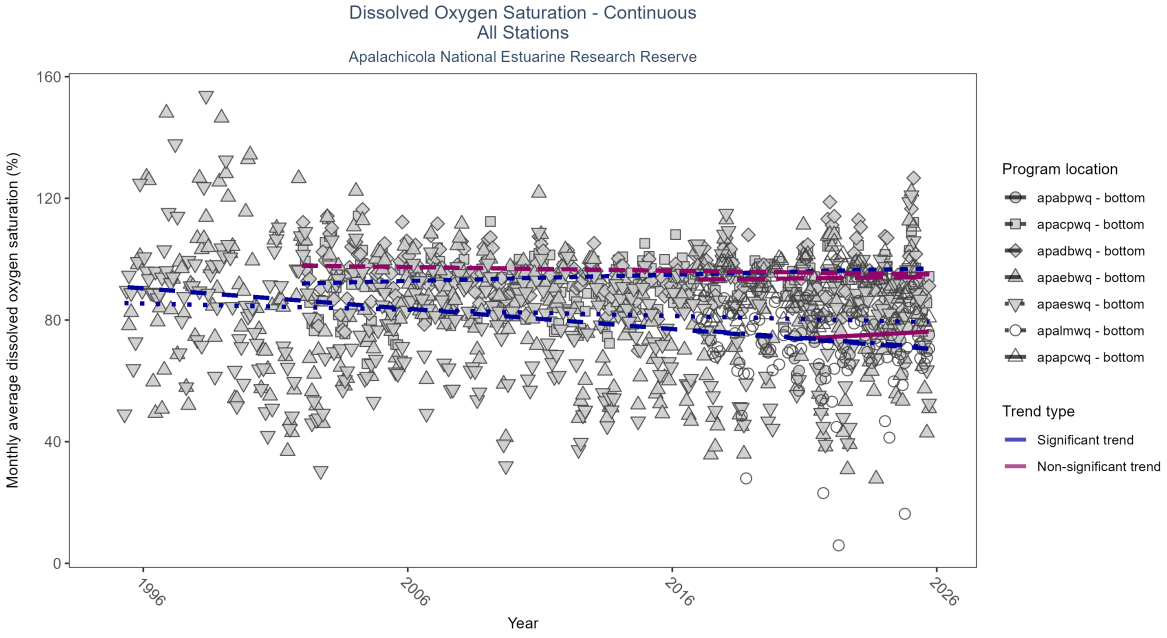

Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apabpwq	No significant trend	170534	6	2020 - 2025	76.2	0.17	73.51	0.47	0.1238
apalmwq	Significantly decreasing trend	275950	10	2016 - 2025	74.6	-0.21	77.22	-0.64	0.0073
apaebwq	Significantly decreasing trend	681137	31	1995 - 2025	84.5	-0.26	91.05	-0.67	0
apacpwq	Significantly increasing trend	638276	24	2002 - 2025	94.1	0.17	92.01	0.21	1e-04
apapcwq	No significant trend	293014	10	2016 - 2025	93.9	0.03	93.21	0.10	0.6435
apaeswq	Significantly decreasing trend	734556	31	1995 - 2025	84.2	-0.09	85.63	-0.21	0.0172
apadbwq	No significant trend	645250	24	2002 - 2025	94.7	-0.08	97.86	-0.12	0.0663

At one program location, monthly average dissolved oxygen saturation increased by 0.21% per year. At three program locations, monthly average dissolved oxygen saturation decreased between 0.21 and 0.67% per year. No detectable change in monthly average dissolved oxygen saturation was observed at three locations.

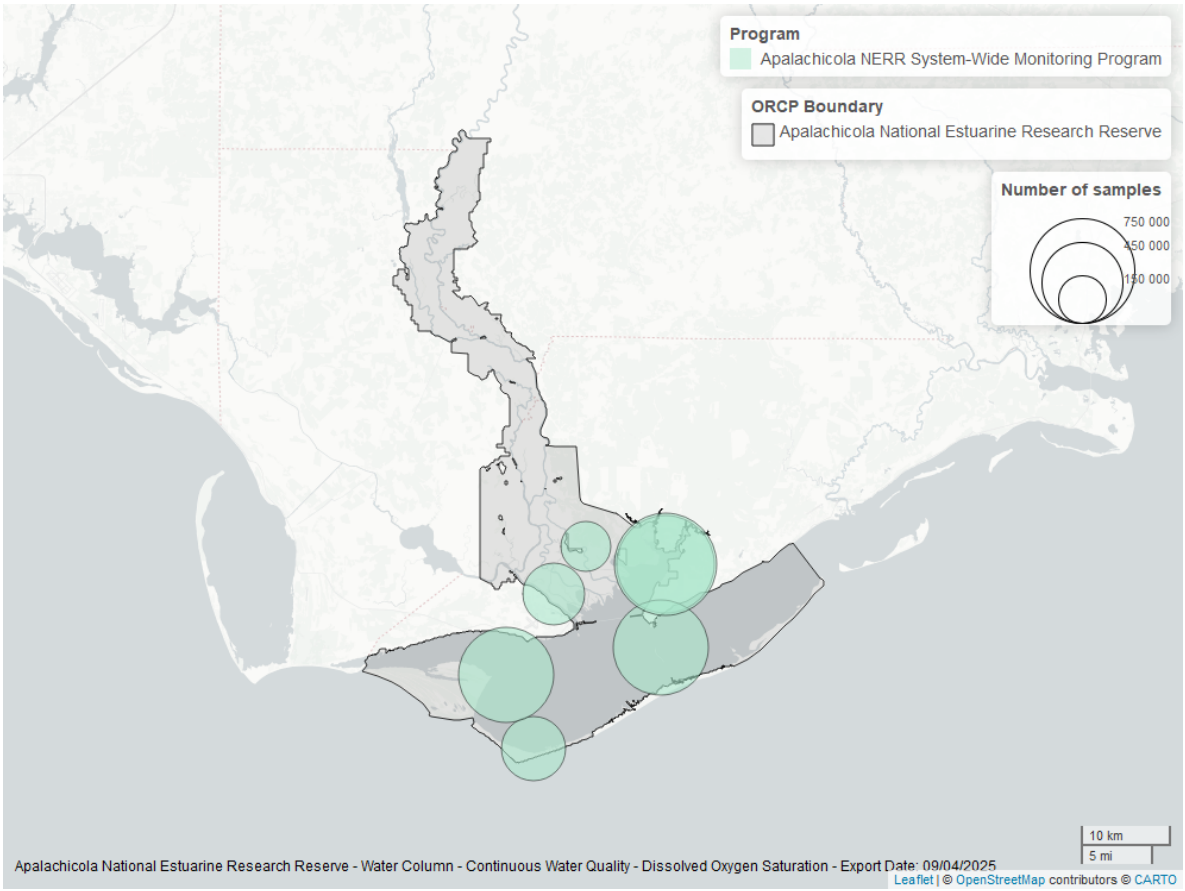

Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

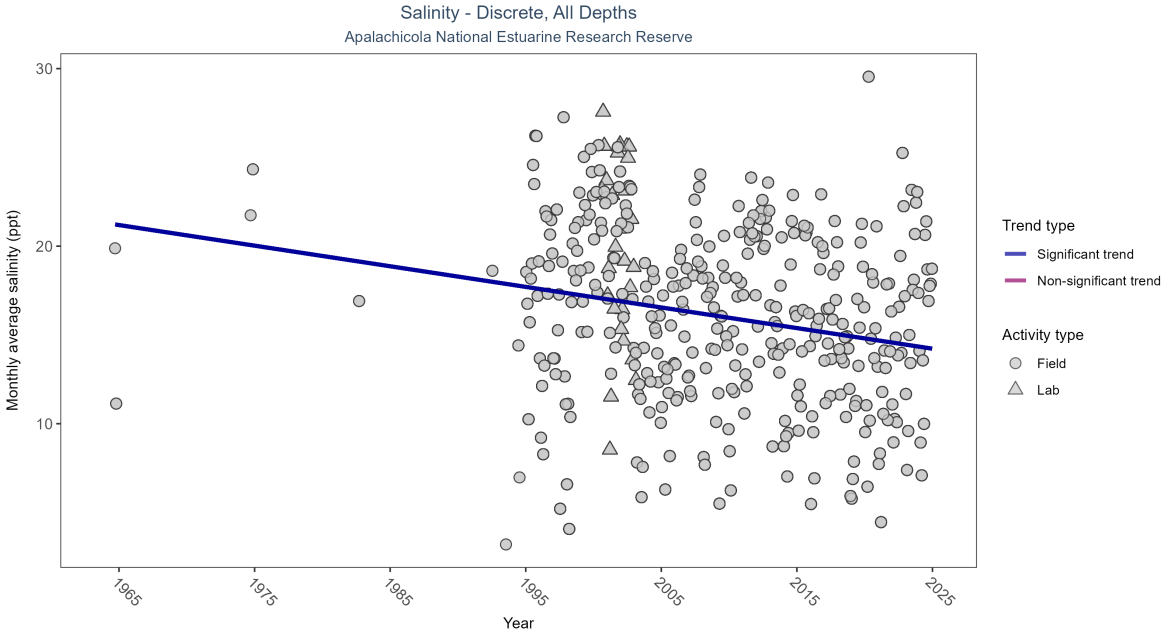

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	96041	36	1964 - 2024	16.8	-0.18087	21.30476	-0.11606	0

Monthly average salinity decreased by 0.12 ppt per year.

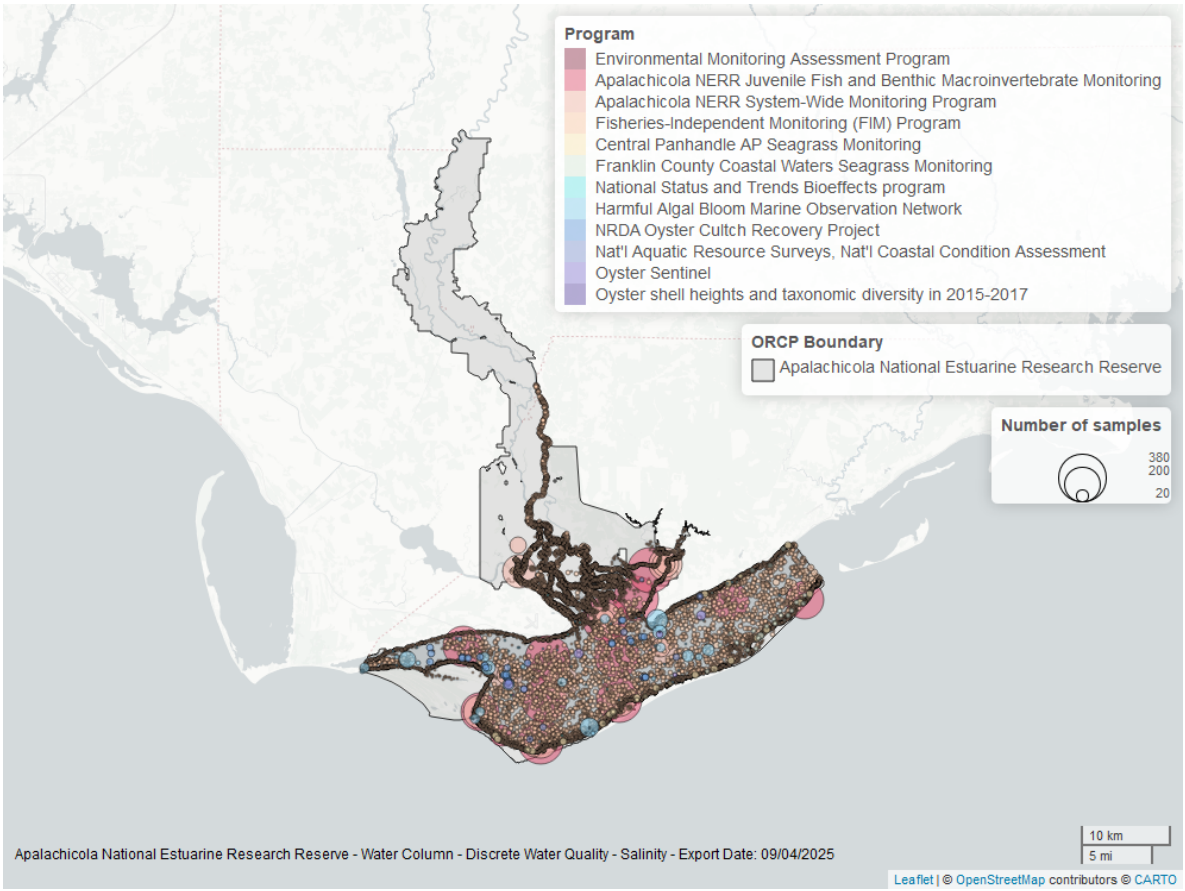

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

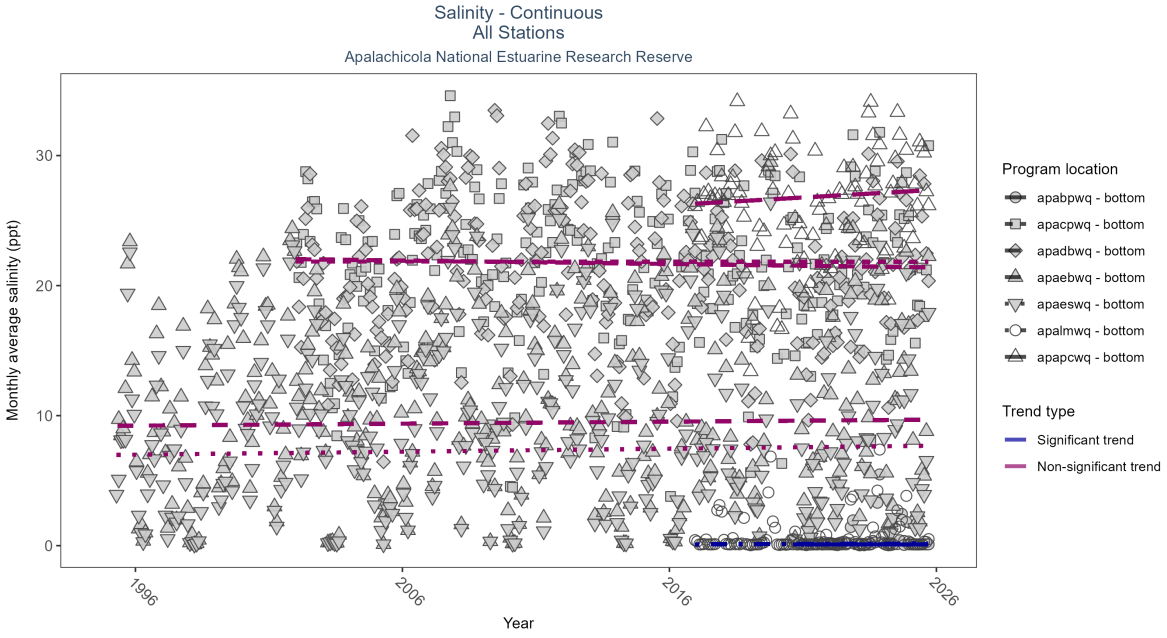

Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apalmwq	Significantly increasing trend	291127	10	2016 - 2025	0.1	0.18	0.09	0.01	0.0204
apaeswq	No significant trend	778085	31	1995 - 2025	7.3	0.04	6.97	0.02	0.2995
apapcwq	No significant trend	291880	10	2016 - 2025	27.0	0.08	26.18	0.12	0.3086
apaebwq	No significant trend	768387	31	1995 - 2025	9.7	0.03	9.21	0.02	0.4613
apacpwq	No significant trend	652892	24	2002 - 2025	22.3	0.00	21.85	0.00	1
apadbwq	No significant trend	640362	24	2002 - 2025	22.2	-0.03	22.03	-0.03	0.5212
apabpwq	Significantly increasing trend	173086	6	2020 - 2025	0.1	0.26	0.09	0.00	0.0254

At two program locations, monthly average salinity increased by less than 0.01 ppt per year at one site and by 0.01 ppt per year at the other. No detectable change in monthly average salinity was observed at five locations.

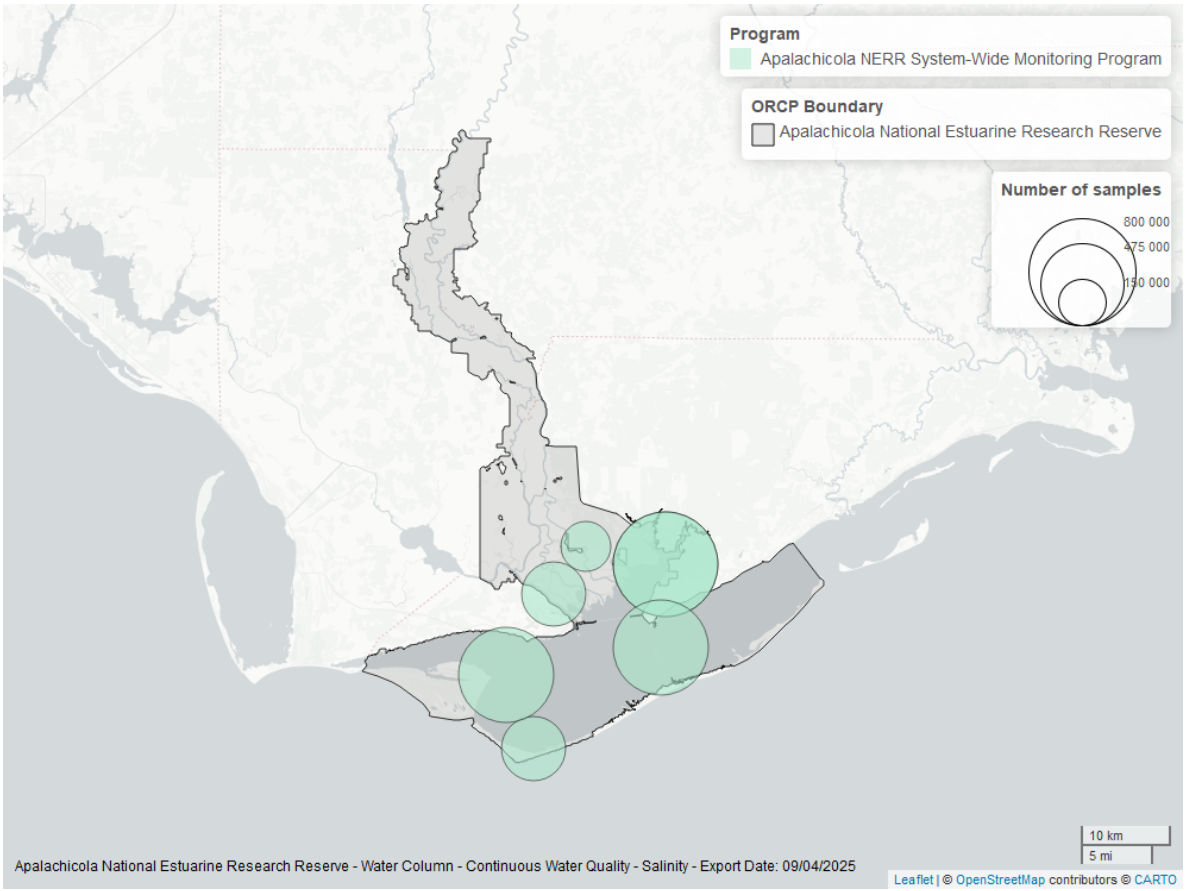

Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

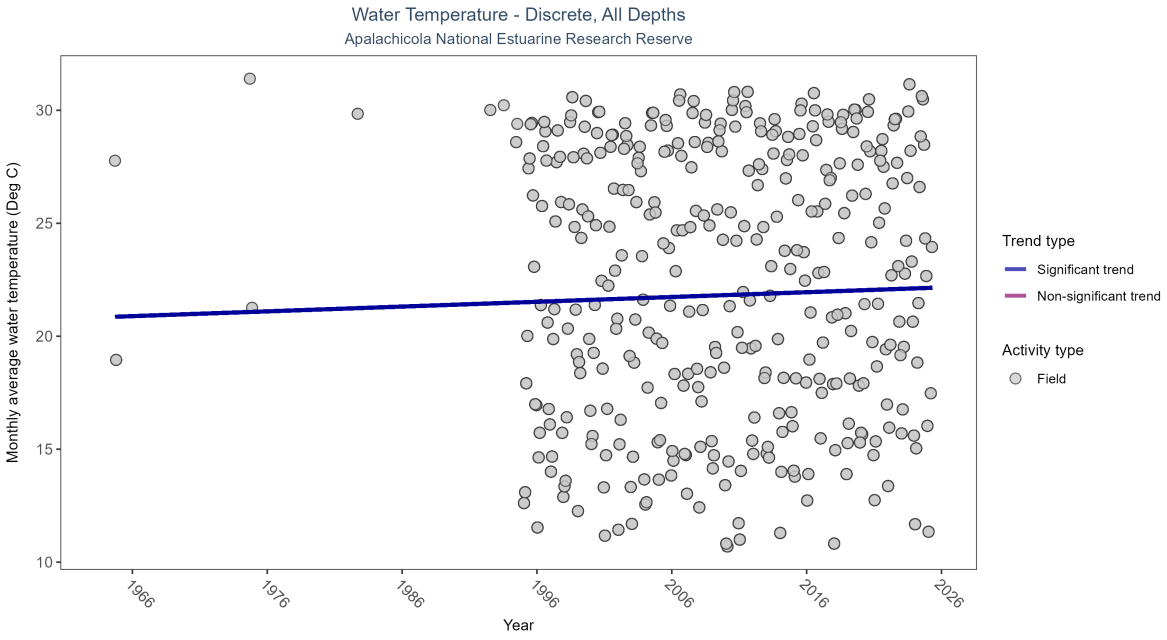

Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	96337	37	1964 - 2025	23.4	0.12928	20.84681	0.02117	4e-04

Monthly average water temperature increased by 0.02°C per year.

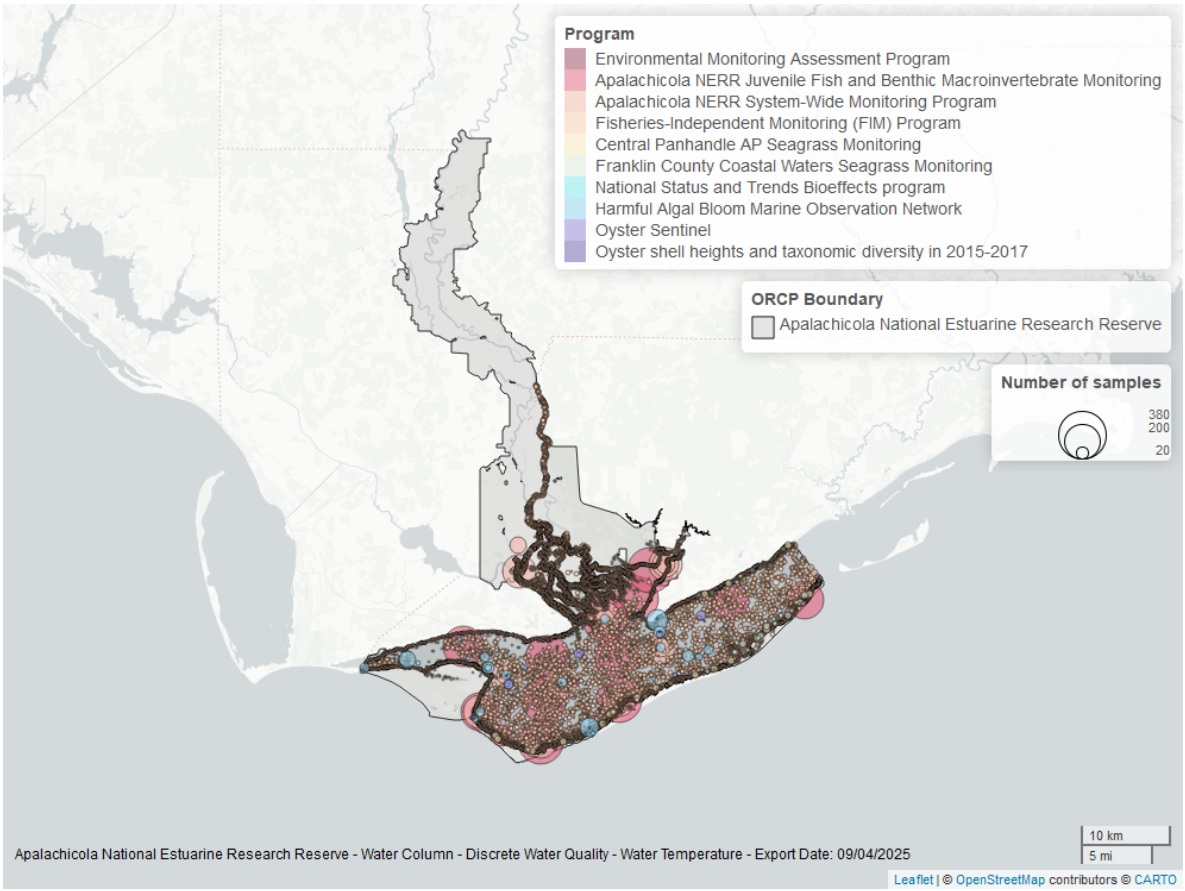

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

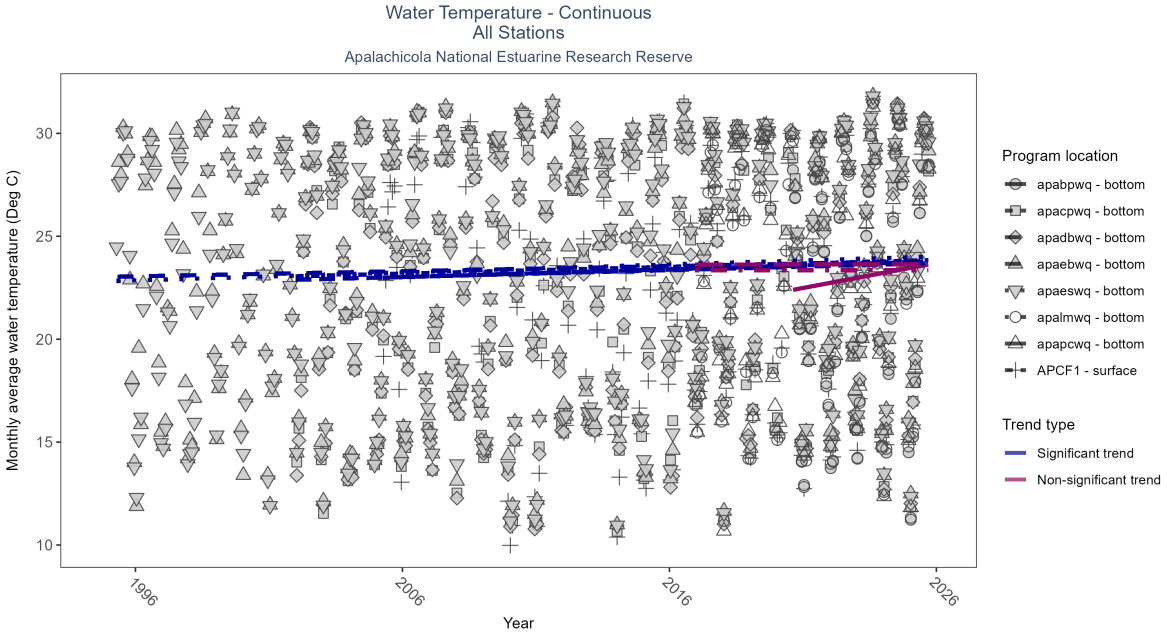

Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
APCF1	Significantly increasing trend	1391382	21	2005 - 2025	23.3	0.12	22.98	0.04	0.0259
apaeswq	Significantly increasing trend	787341	31	1995 - 2025	24.2	0.20	22.82	0.04	0
apapcwq	No significant trend	295378	10	2016 - 2025	23.4	0.00	23.62	0.00	0.9754
apalmwq	No significant trend	293385	10	2016 - 2025	22.9	0.00	23.35	0.00	1
apabpwq	No significant trend	173086	6	2020 - 2025	22.8	0.20	22.24	0.24	0.0708
apadbwq	Significantly increasing trend	666370	24	2002 - 2025	23.5	0.17	22.89	0.03	1e-04
apaebwq	Significantly increasing trend	783431	31	1995 - 2025	24.3	0.16	23.03	0.02	0
apacpwq	Significantly increasing trend	691886	24	2002 - 2025	23.6	0.17	23.05	0.03	1e-04

At five program locations, monthly average water temperature increased between 0.02 and 0.04°C per year. No detectable change in monthly average water temperature was observed at three locations.

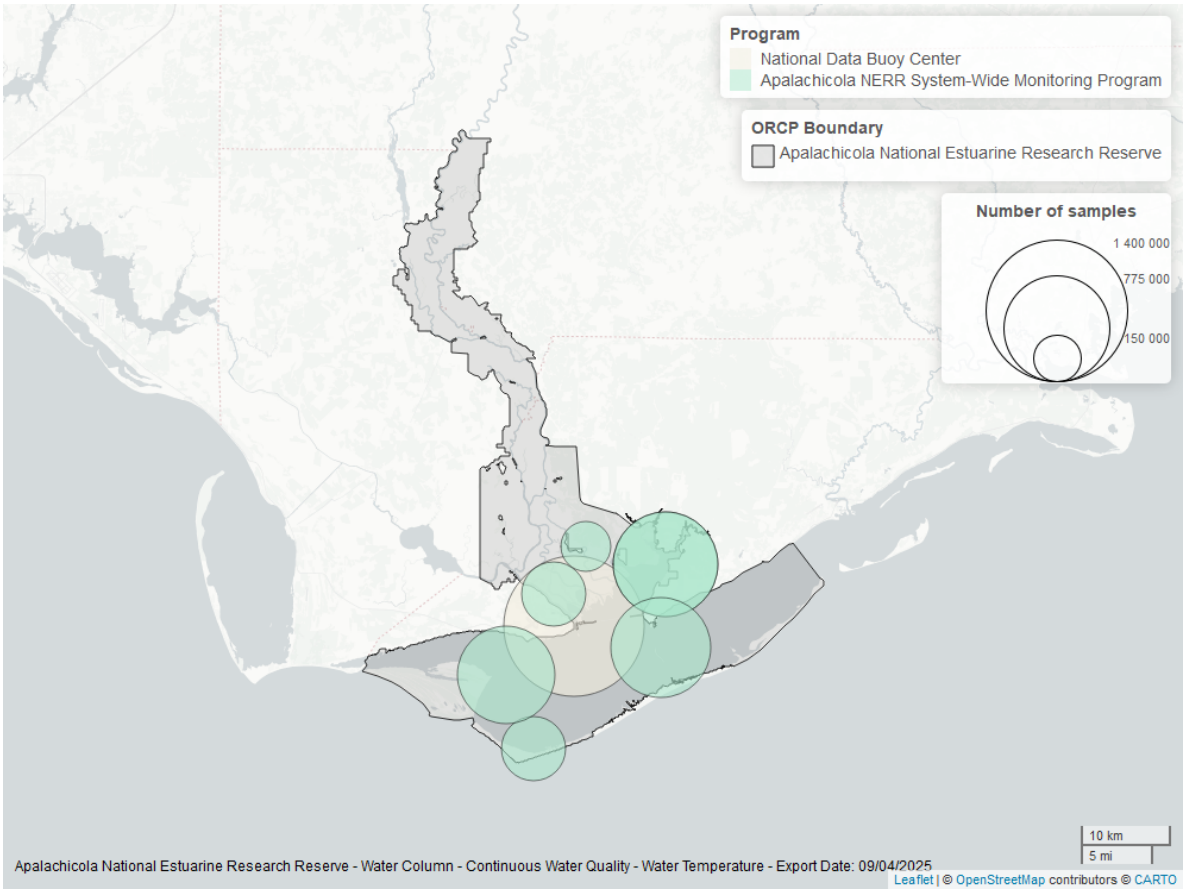

Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

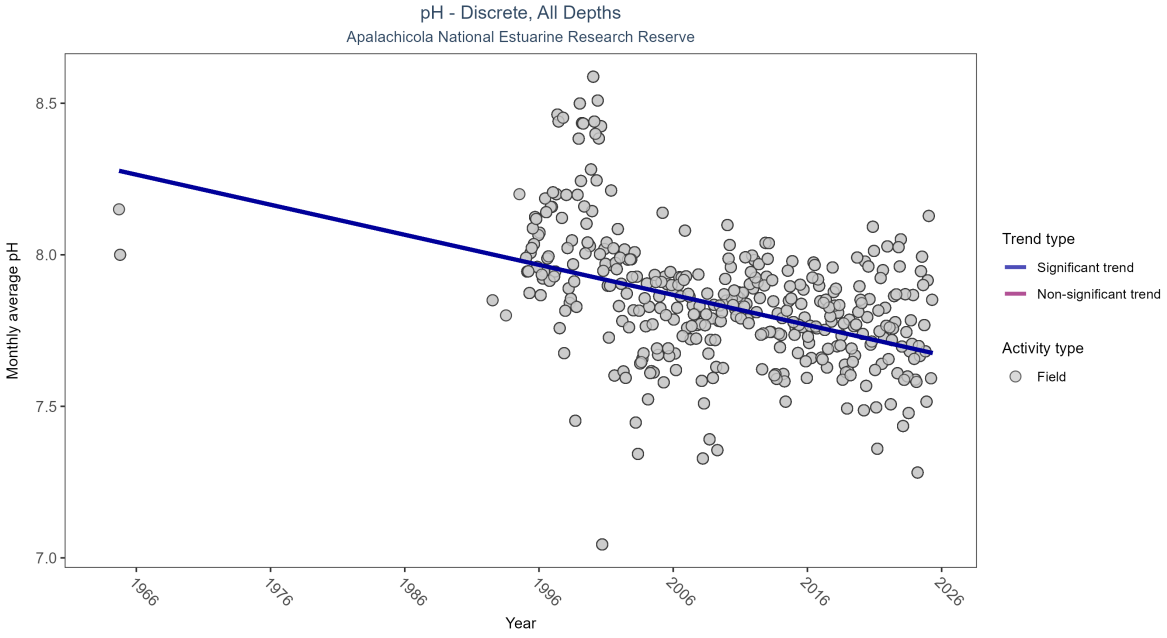

Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	67538	35	1964 - 2025	7.98	-0.32824	8.28421	-0.00992	0

Monthly average pH decreased by 0.01 pH units per year.

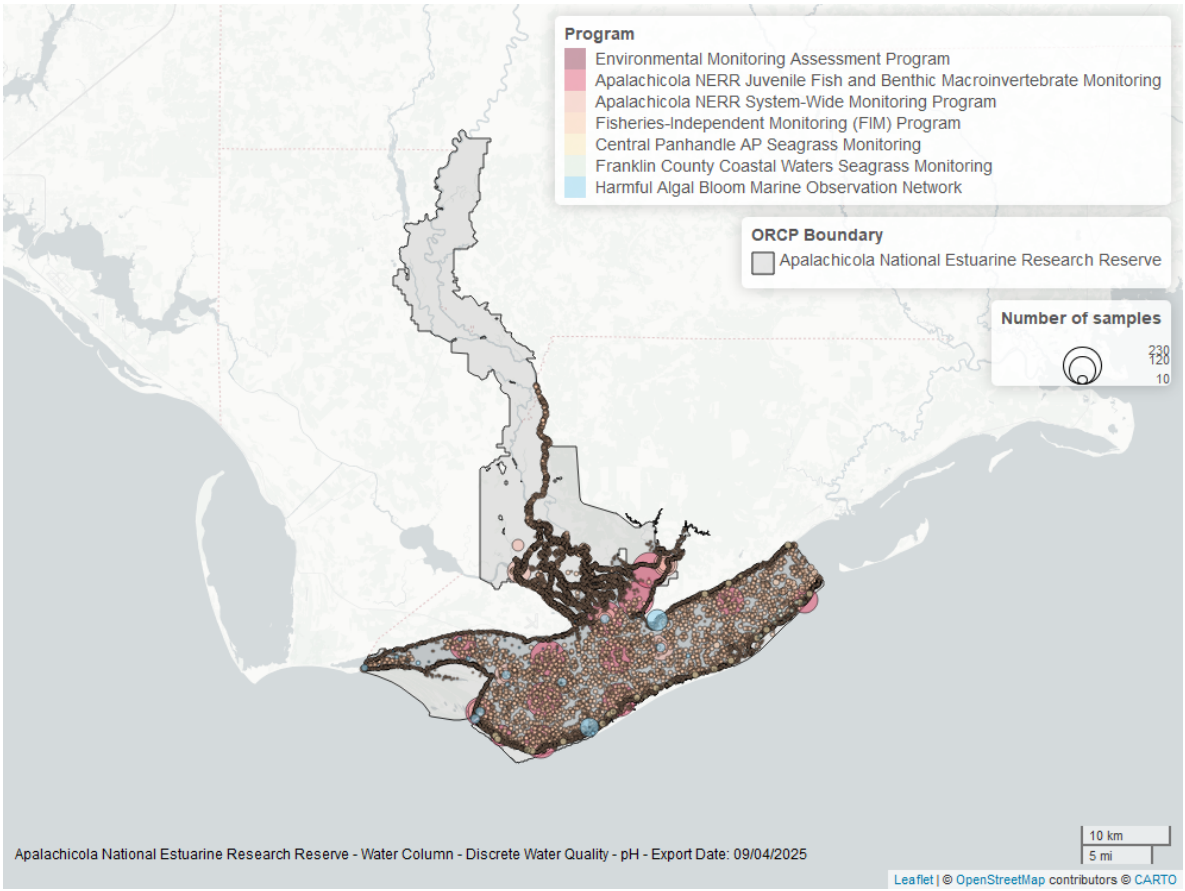

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

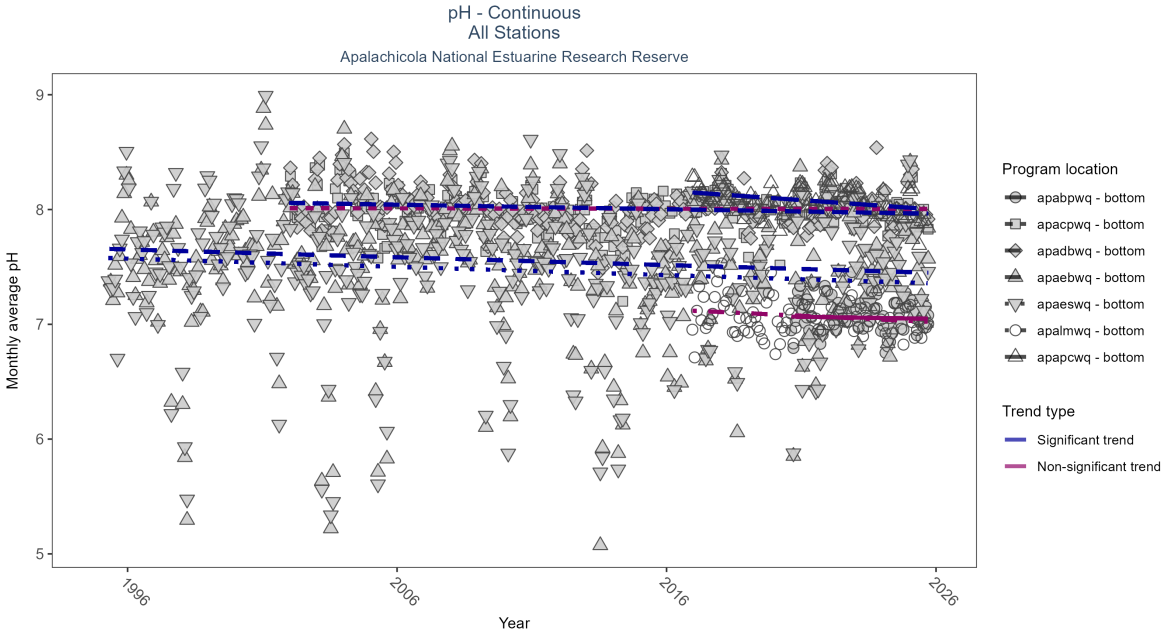

Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaeswq	Significantly decreasing trend	736038	31	1995 - 2025	7.5	-0.12	7.58	-0.01	0.0011
apadbwq	Significantly decreasing trend	623515	24	2002 - 2025	8.0	-0.13	8.06	0.00	0.0031
apalmwq	No significant trend	283547	10	2016 - 2025	7.1	-0.13	7.13	-0.01	0.1156
apapcwq	Significantly decreasing trend	289516	10	2016 - 2025	8.1	-0.34	8.16	-0.02	0
apabpwq	No significant trend	171276	6	2020 - 2025	7.1	-0.05	7.07	0.00	0.8409
apaebwq	Significantly decreasing trend	738964	31	1995 - 2025	7.6	-0.12	7.66	-0.01	9e-04
apacpwq	No significant trend	636294	24	2002 - 2025	8.0	-0.02	8.01	0.00	0.7052

At four program locations, monthly average pH decreased between less than 0.01 and 0.02 pH units per year. No detectable change in monthly average pH was observed at three locations.

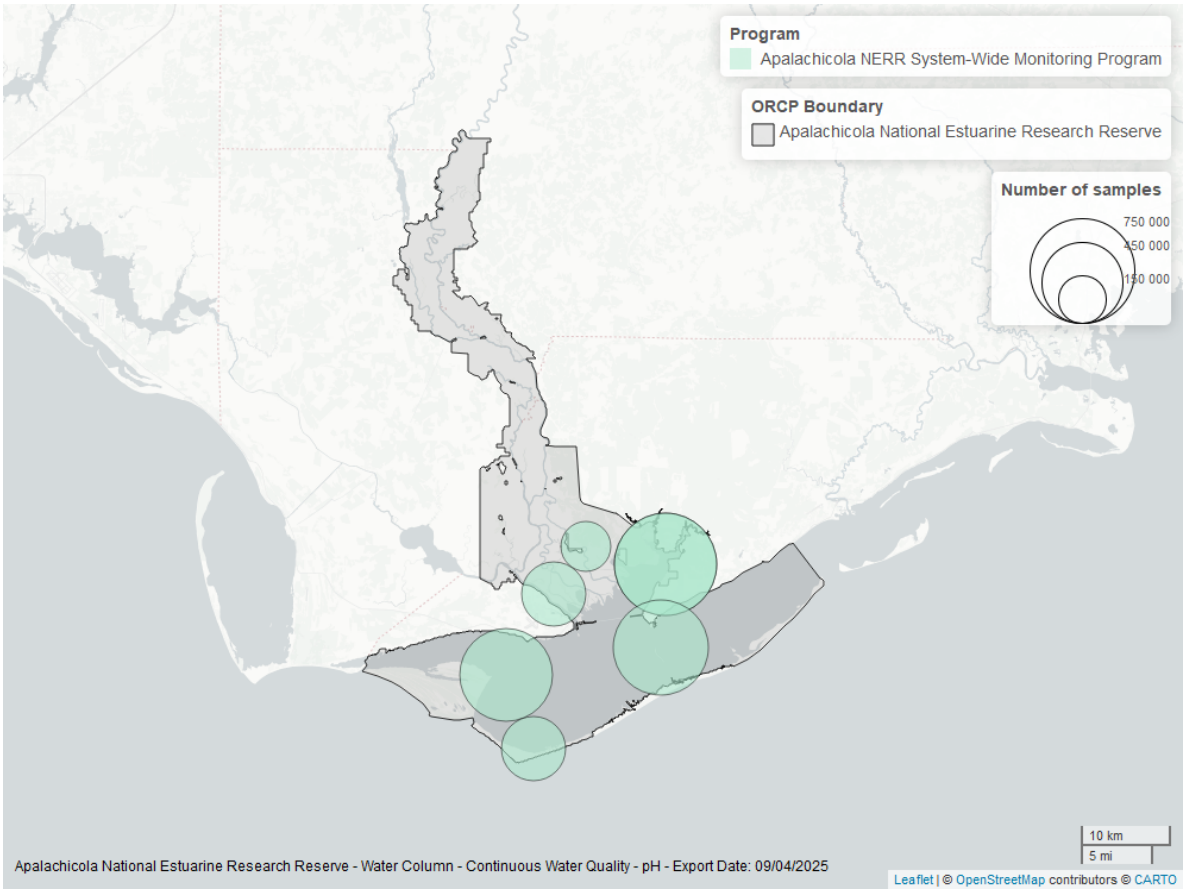

Figure 24: Map showing location of ph continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

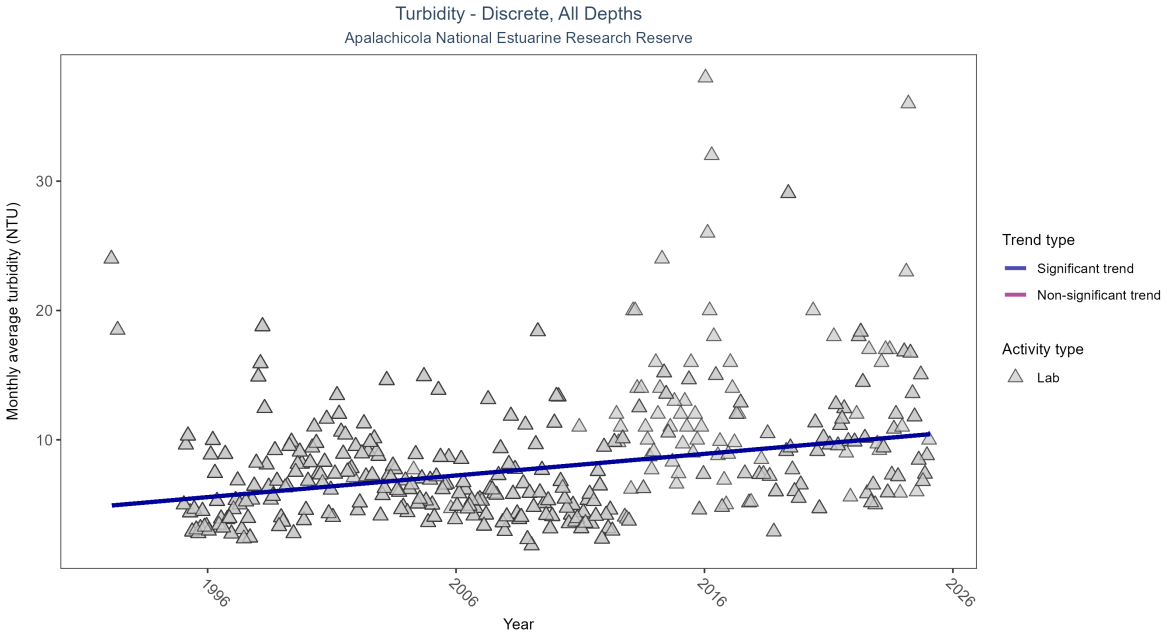

Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	22988	32	1992 - 2025	5.1	0.26871	4.9	0.16728	0

Monthly average turbidity increased by 0.17 NTU per year, indicating a decrease in water clarity.

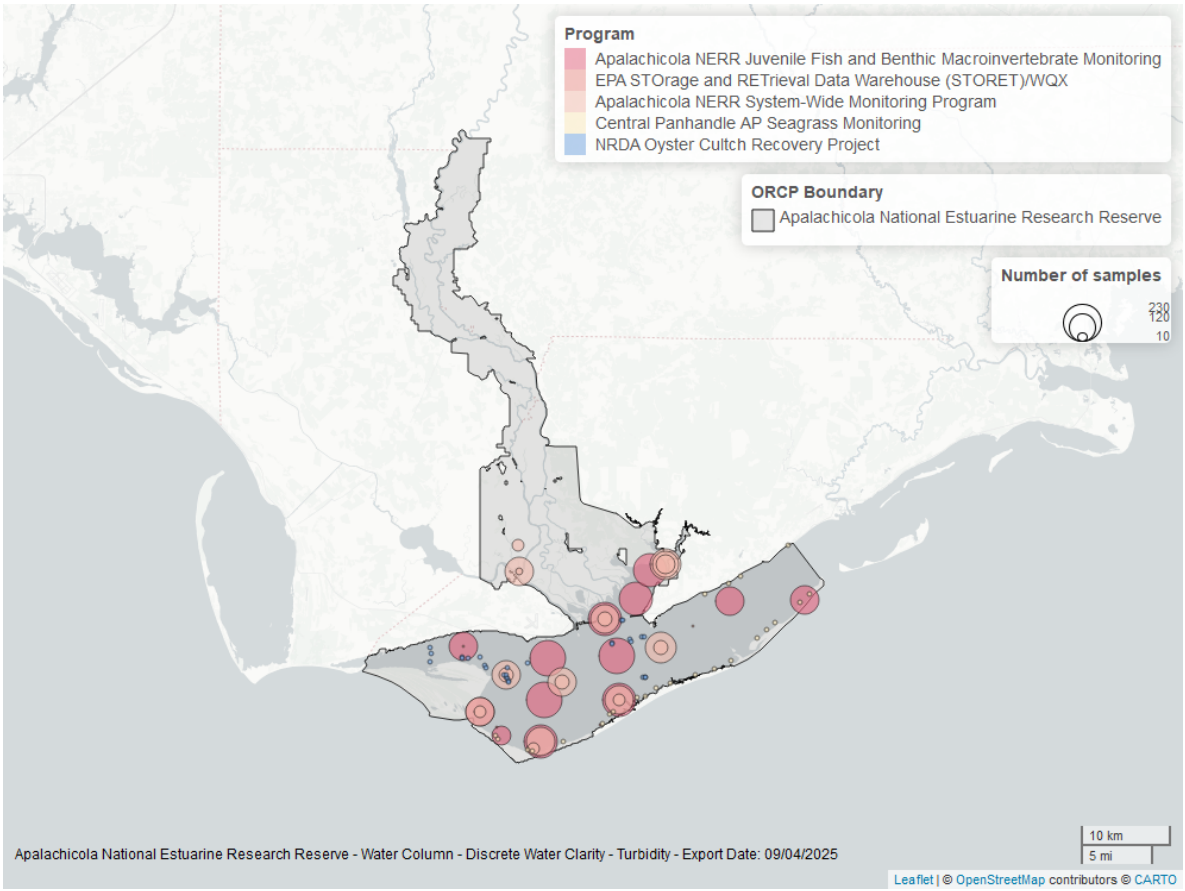

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

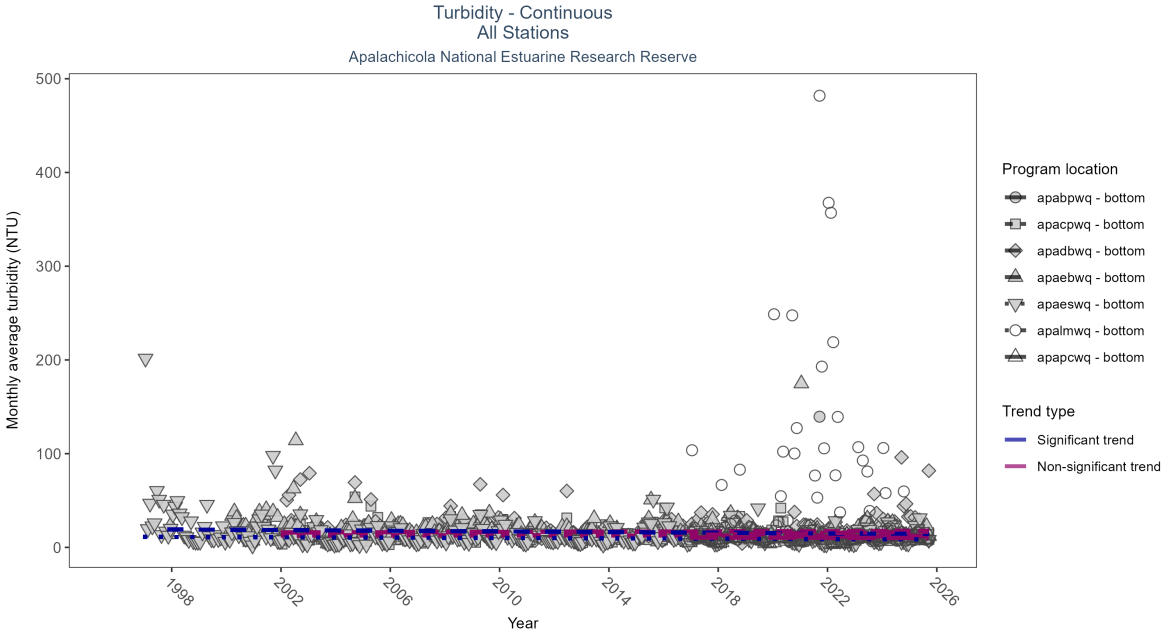

Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaeswq	Significantly decreasing trend	721945	30	1996 - 2025	9	-0.13	11.29	-0.09	0.0012
apapcwq	No significant trend	280348	10	2016 - 2025	7	-0.05	10.67	-0.08	0.5527
apalmwq	No significant trend	261636	10	2016 - 2025	12	0.13	13.14	0.36	0.111
apaebwq	Significantly decreasing trend	656935	27	1997 - 2025	13	-0.17	19.33	-0.18	0
apadbwq	No significant trend	625446	24	2002 - 2025	10	0.06	16.00	0.07	0.2189
apacpwq	No significant trend	649942	24	2002 - 2025	8	-0.02	12.90	-0.02	0.6917
apabpwq	No significant trend	173080	6	2020 - 2025	11	0.05	11.31	0.11	0.7379

At two program locations, monthly average turbidity decreased by 0.09 NTU per year at one site and by 0.18 NTU per year at the other. No detectable change in monthly average turbidity was observed at five locations.

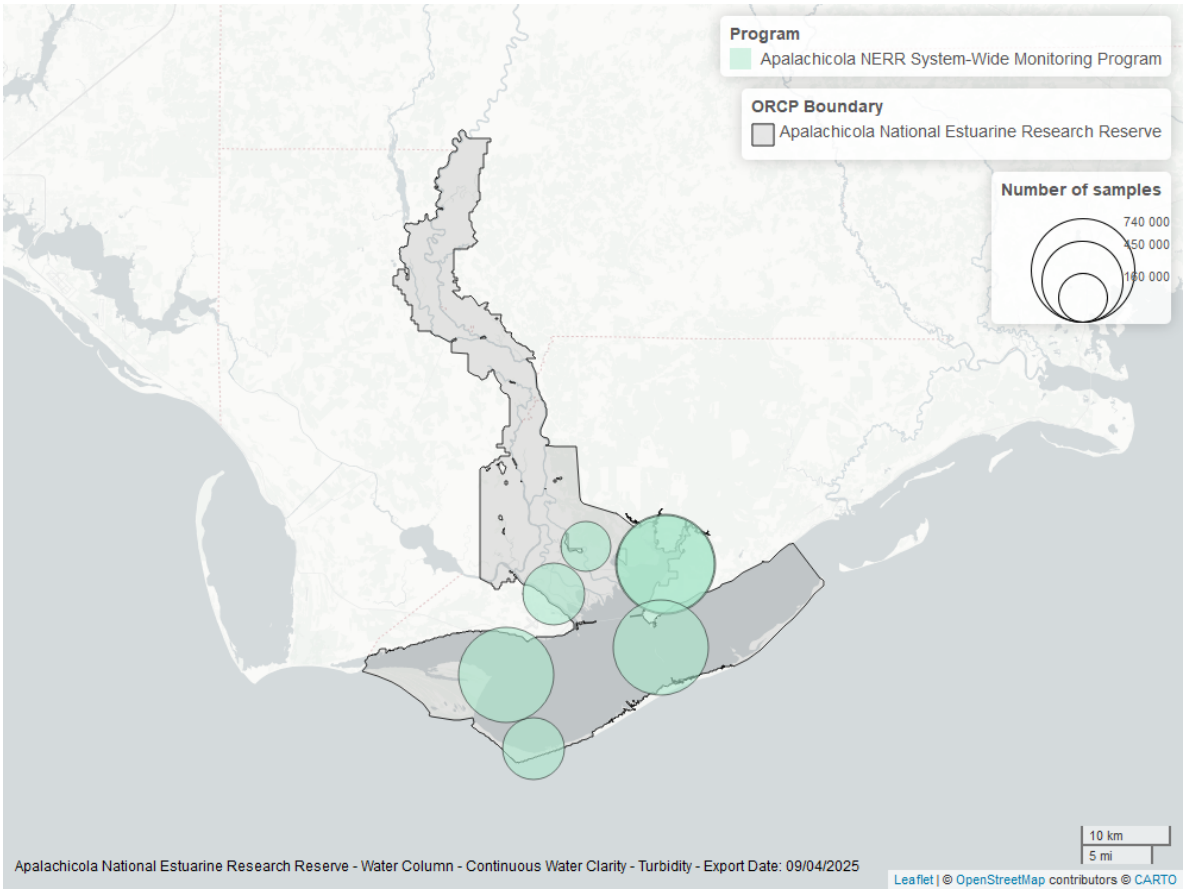

Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

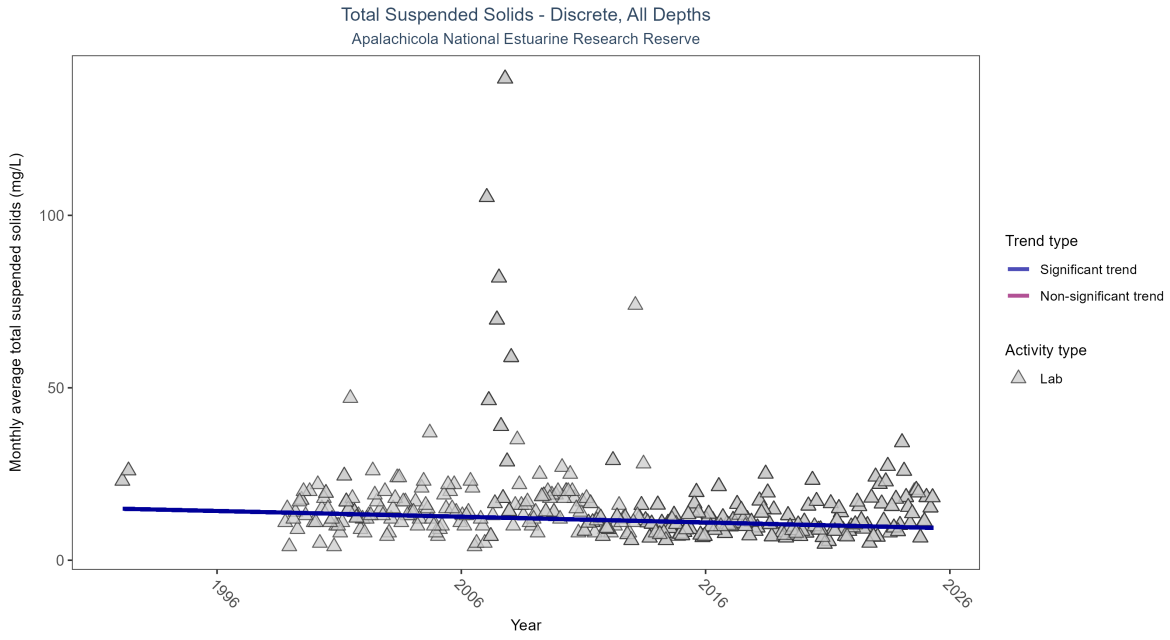

Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	4183	29	1992 - 2025	10	-0.17823	14.94787	-0.16667	0

Monthly average total suspended solids decreased by 0.17 mg/L per year, indicating an increase in water clarity.

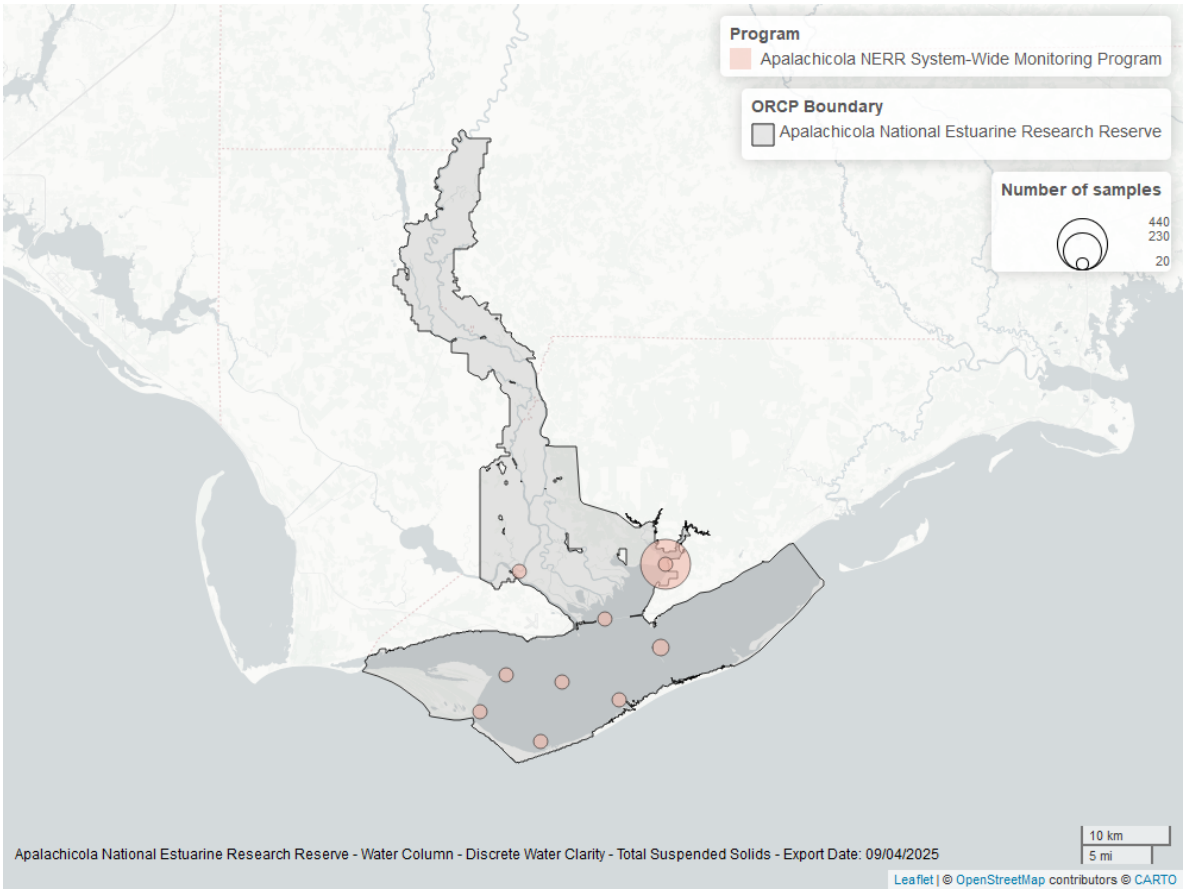

Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

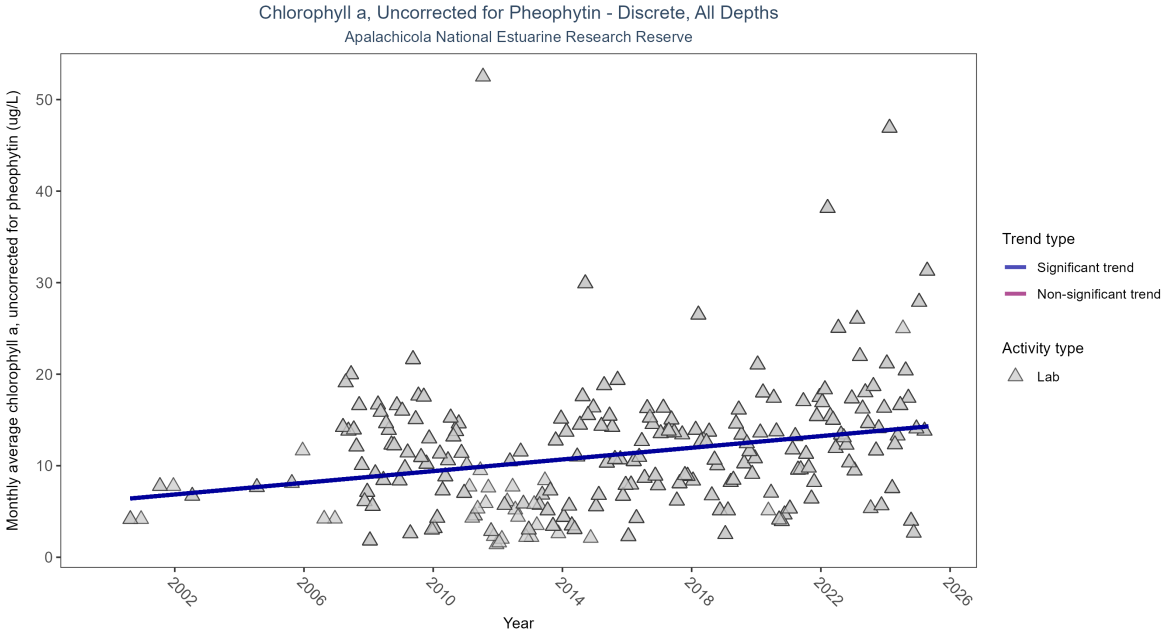

Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	4903	25	2000 - 2025	10	0.19774	6.22108	0.3189	1e-04

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.32 µg/L per year, indicating a decrease in water clarity.

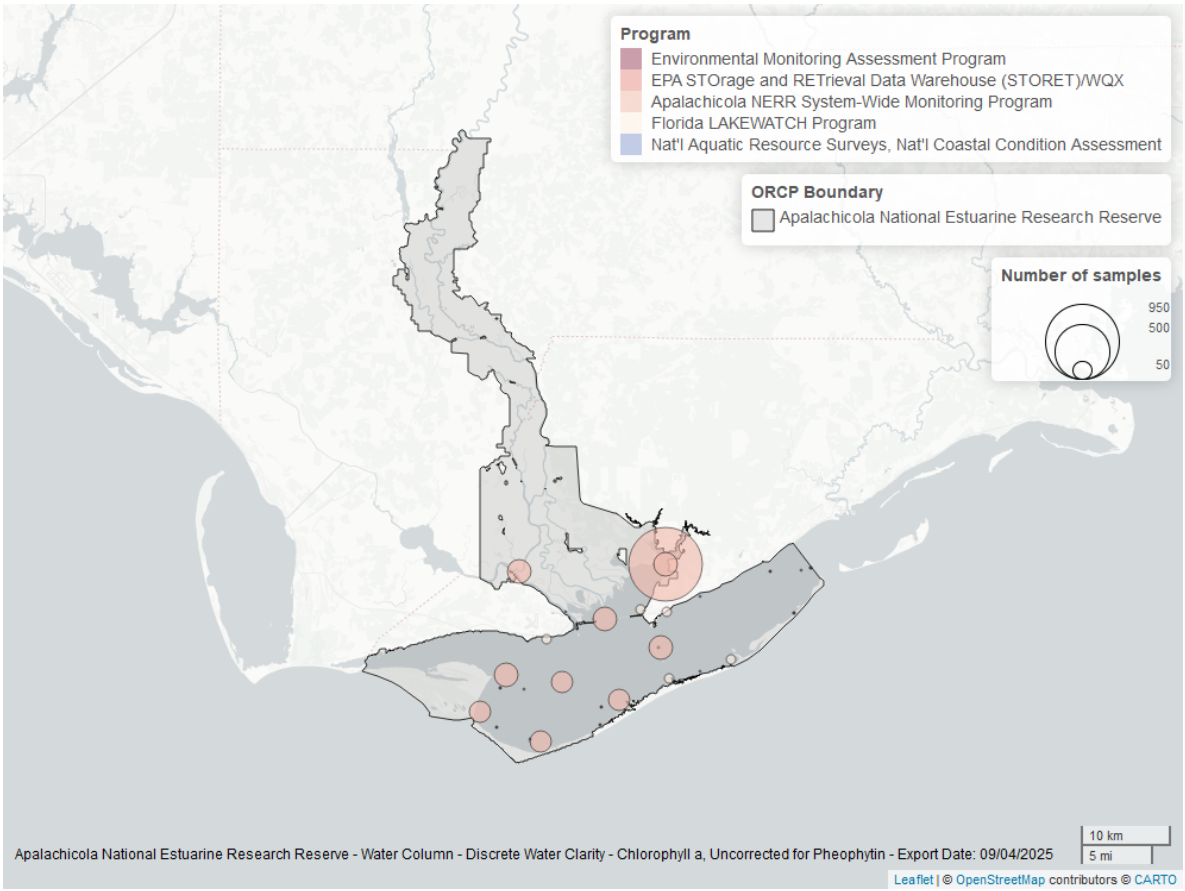

Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

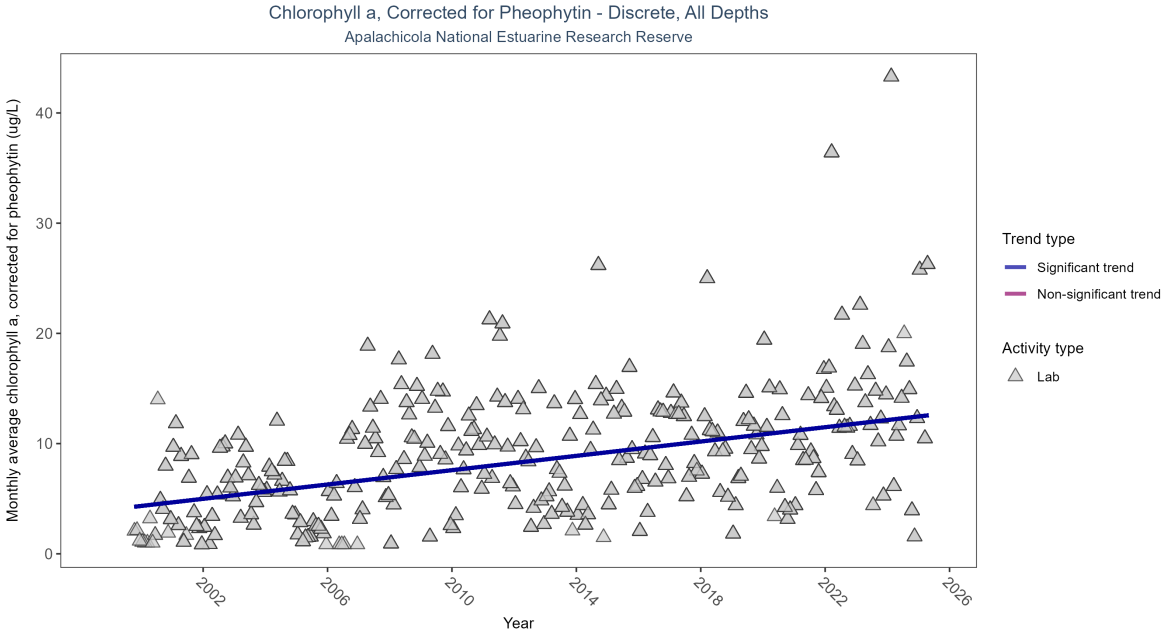

Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	9193	27	1999 - 2025	7.7	0.34185	4.01379	0.32492	0

Monthly average chlorophyll a, corrected for pheophytin, increased by 0.32 µg/L per year, indicating a decrease in water clarity.

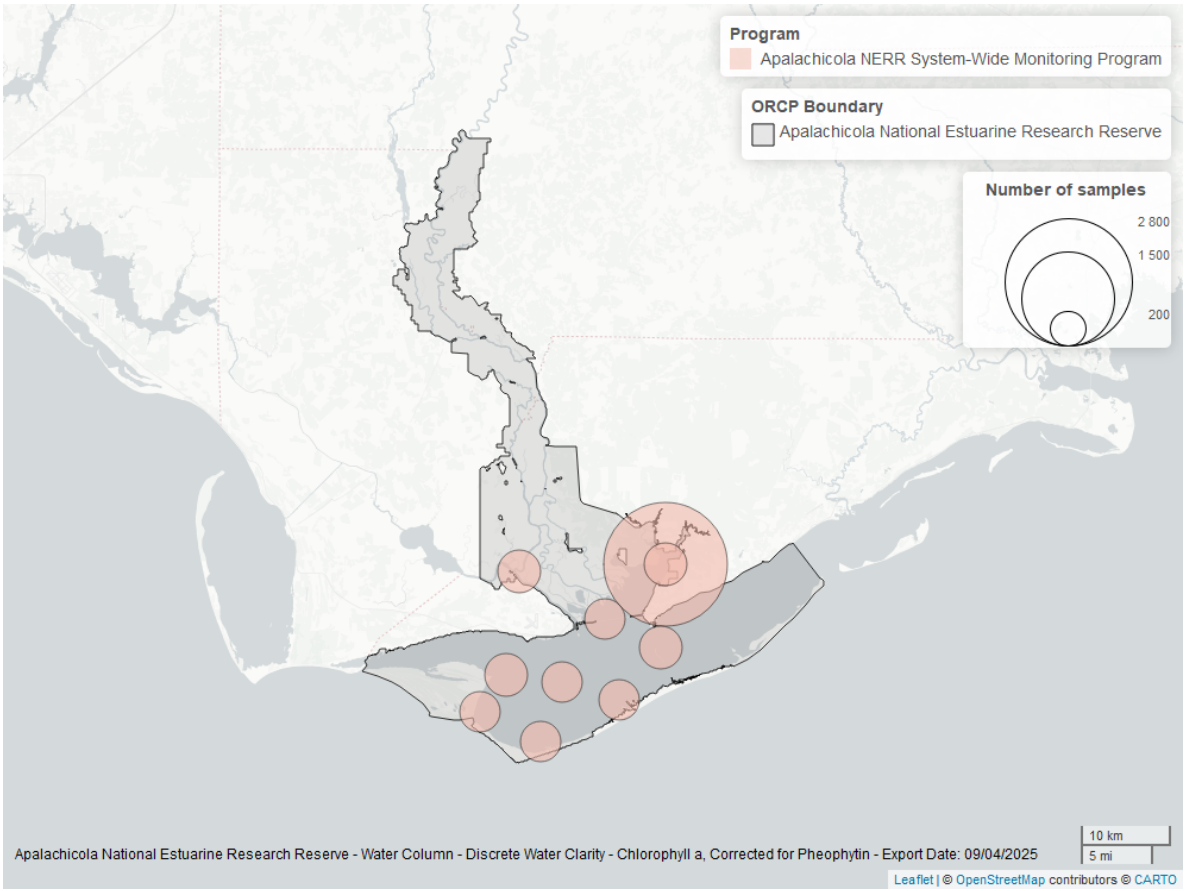

Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

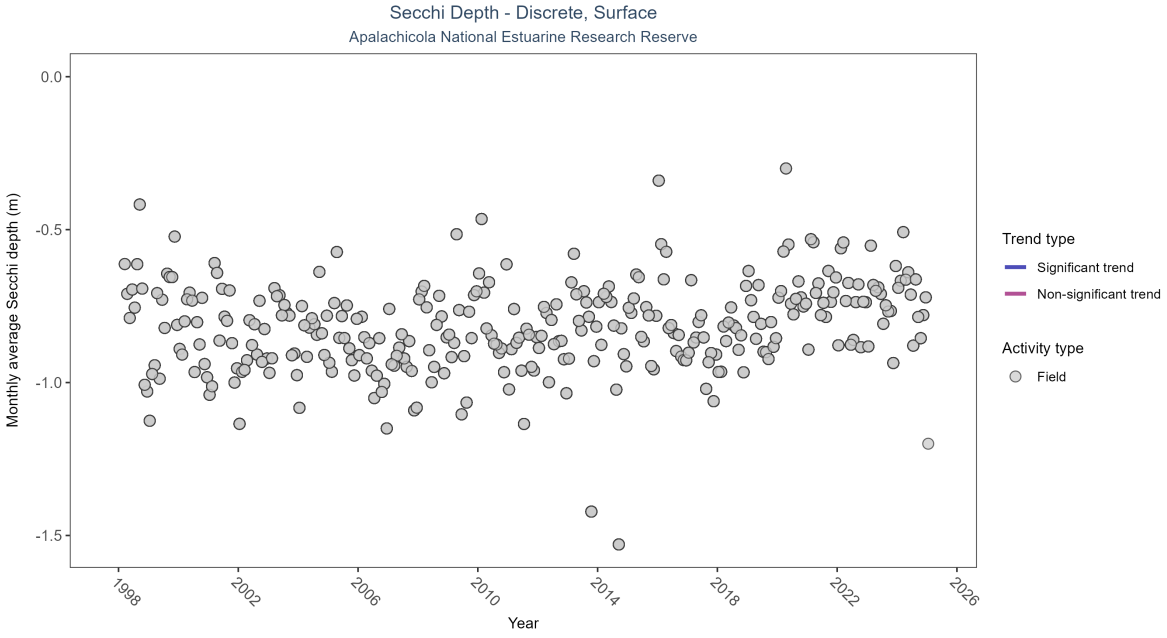

Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	Significantly increasing trend	47555	31	1992 - 2025	-0.8	0.18625	-0.99433	0.00481	0

Monthly average Secchi depth became shallower by less than 0.01 m per year, indicating a decrease in water clarity.

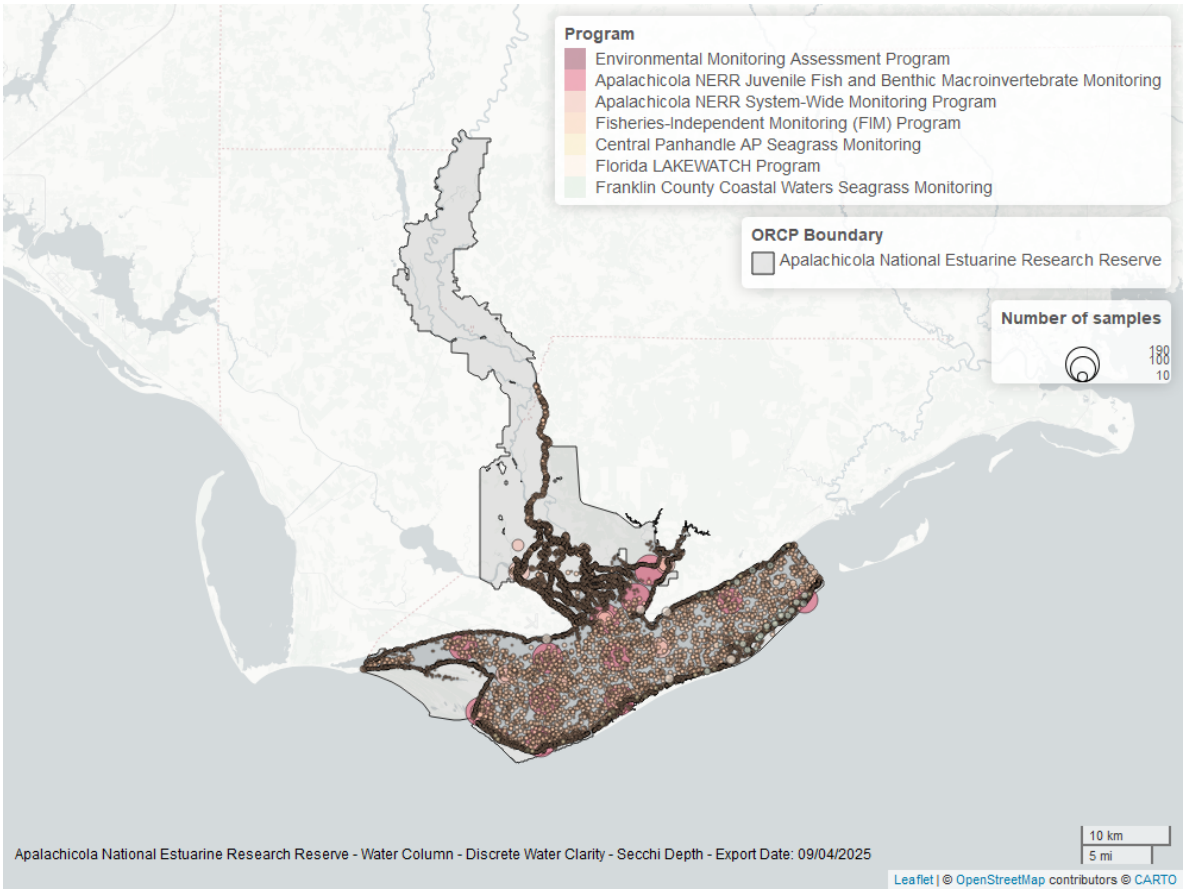

Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

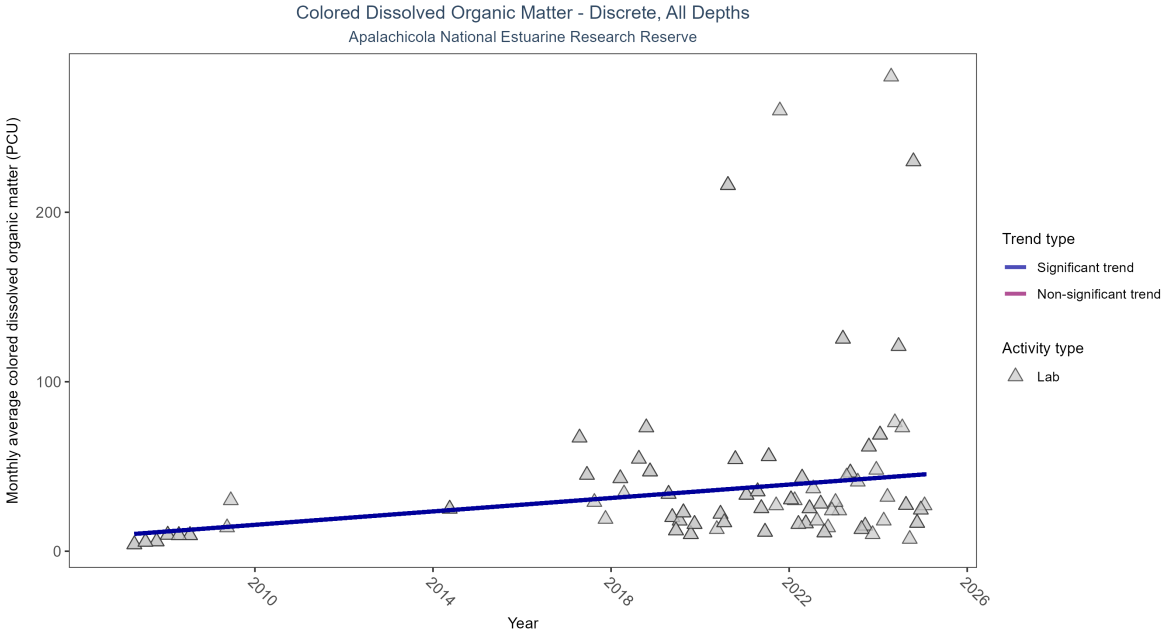

Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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 increasing trend	180	13	2007 - 2025	22	0.14586	9.63015	1.97995	0.0133

Monthly average colored dissolved organic matter increased by 1.98 PCU per year, indicating a decrease in water clarity.

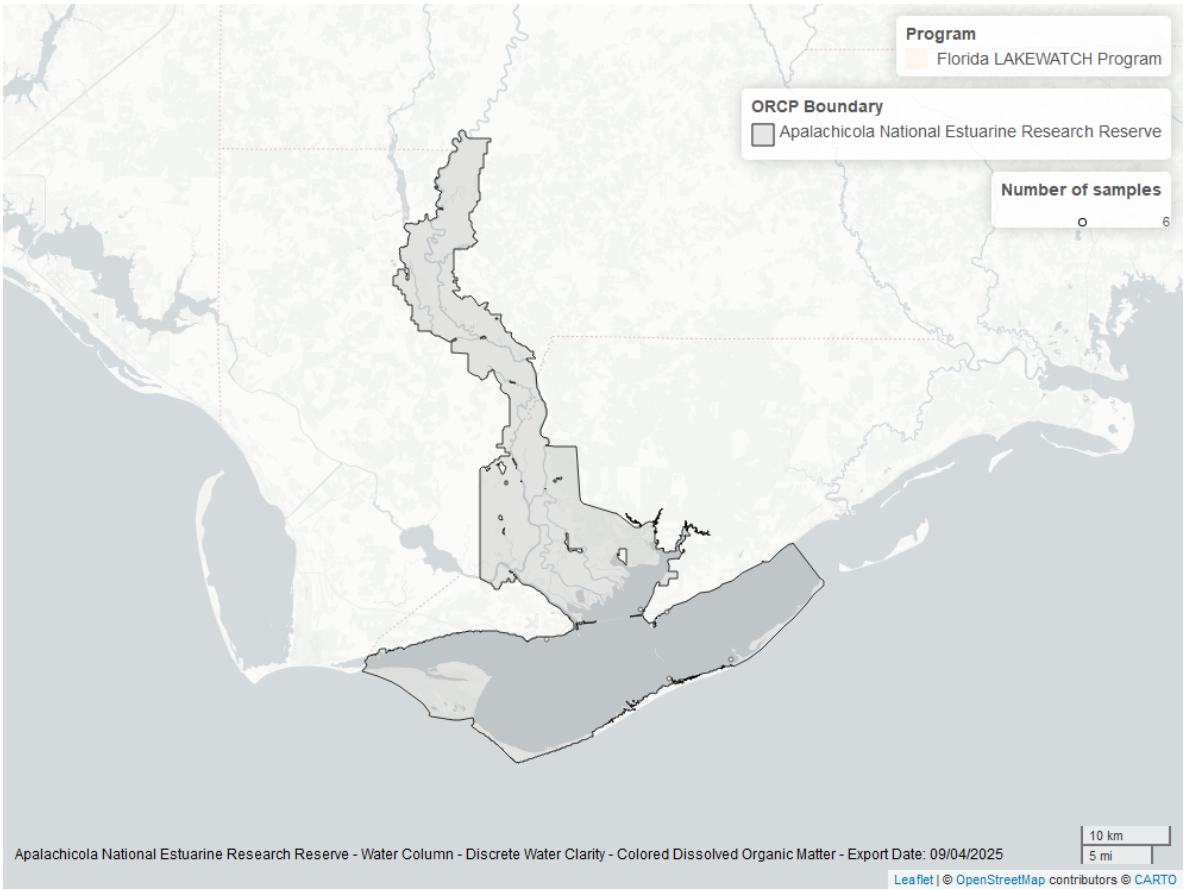

Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.