

Apalachicola National Estuarine Research Reserve

SEACAR Water Quality Analysis

Last compiled on 10 July, 2025

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Indicators

Nutrients

Total Nitrogen - Discrete

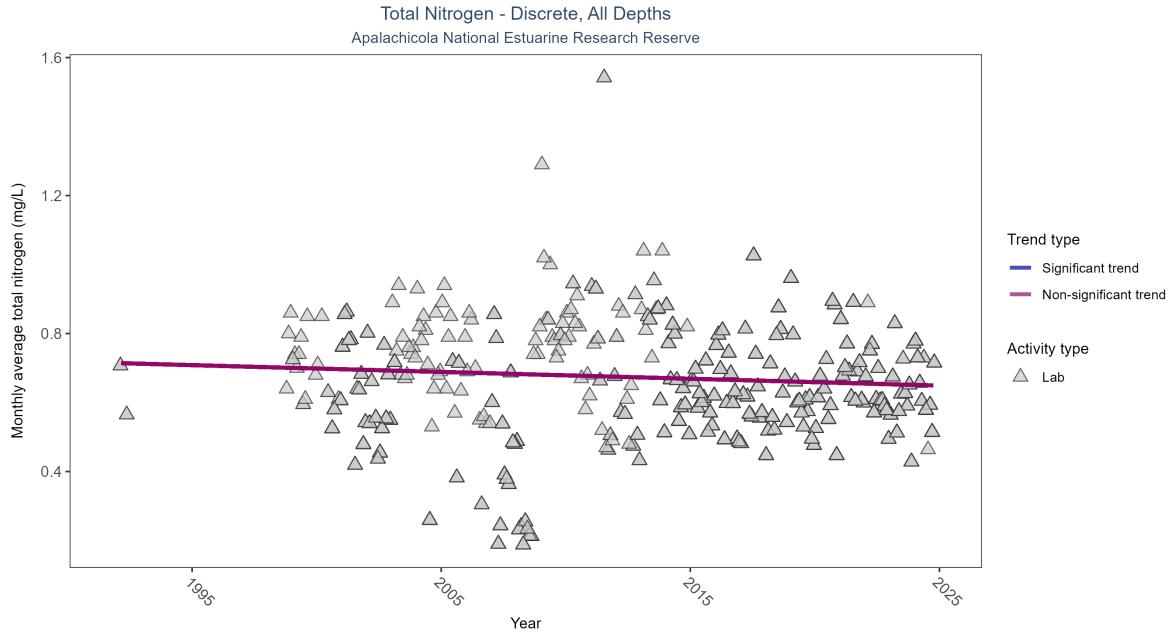


Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the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

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

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Lab	No significant trend	4227	28	1992 - 2024	0.63	-0.06907	0.71436	-0.00197	0.1237

Total nitrogen showed no detectable trend between 1992 and 2024.

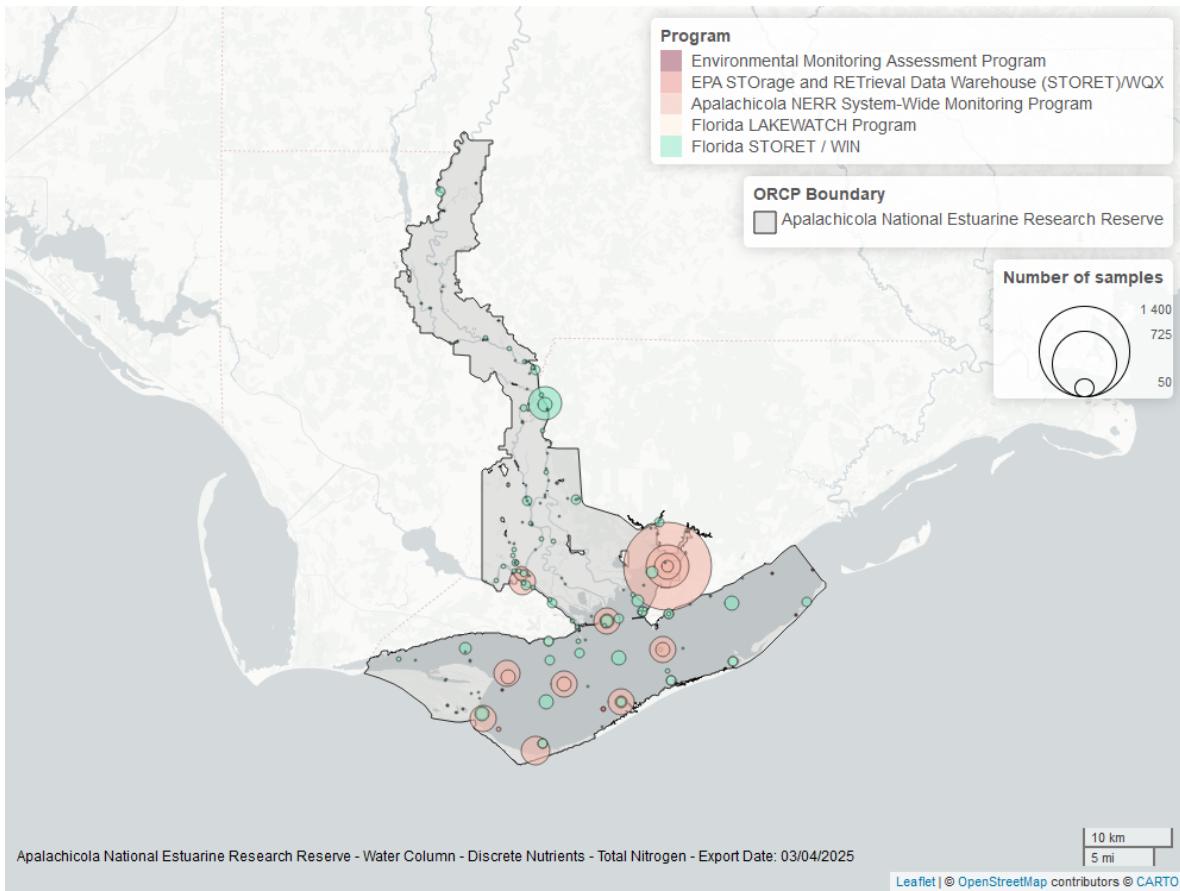


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

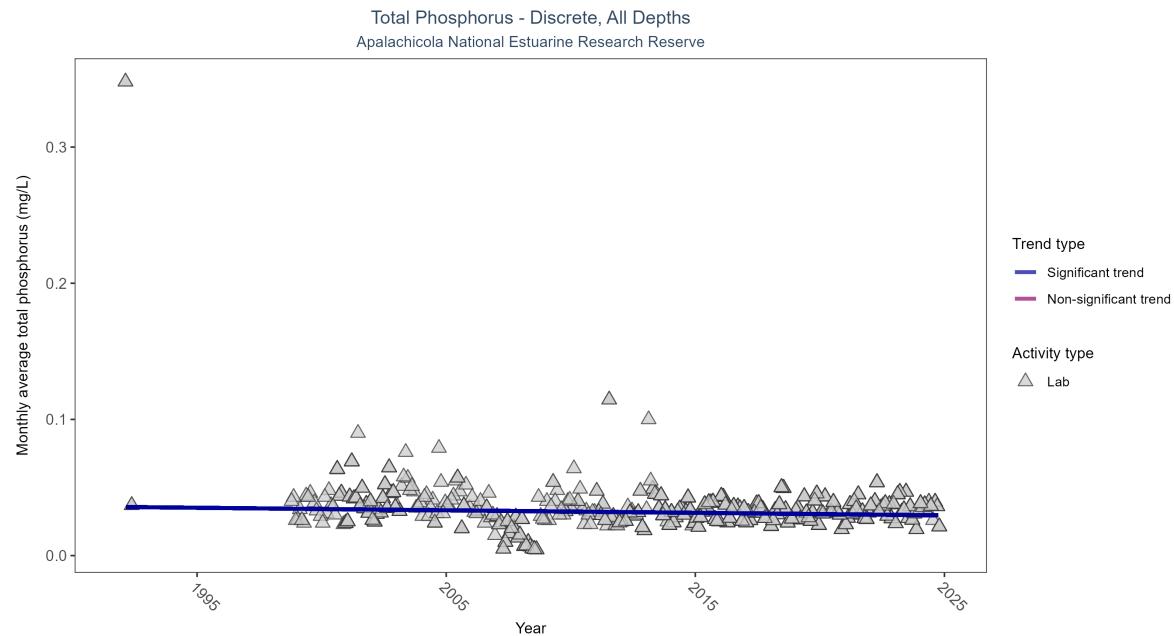


Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	4566	28	1992 - 2024	0.031	-0.11651	0.03569	-0.00019	0.0042

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

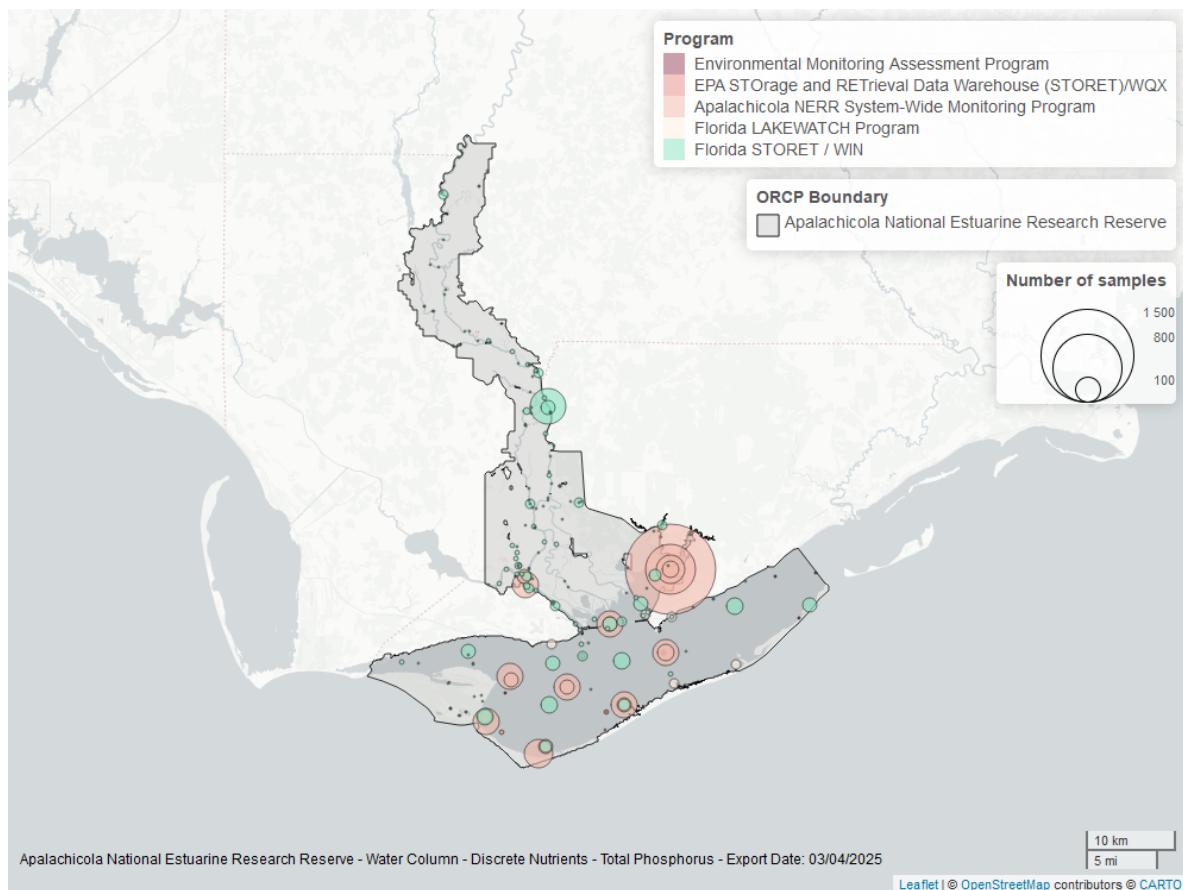


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

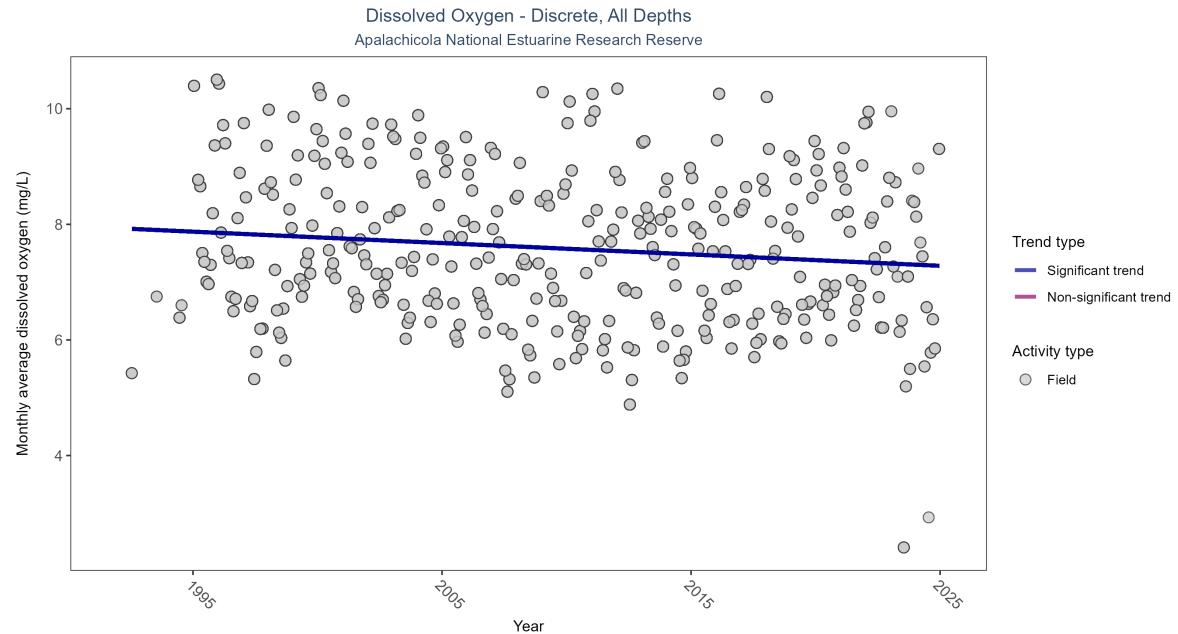


Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	Significantly decreasing trend	80895	33	1992 - 2024	7.5	-0.16117	7.93197	-0.01969	0

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

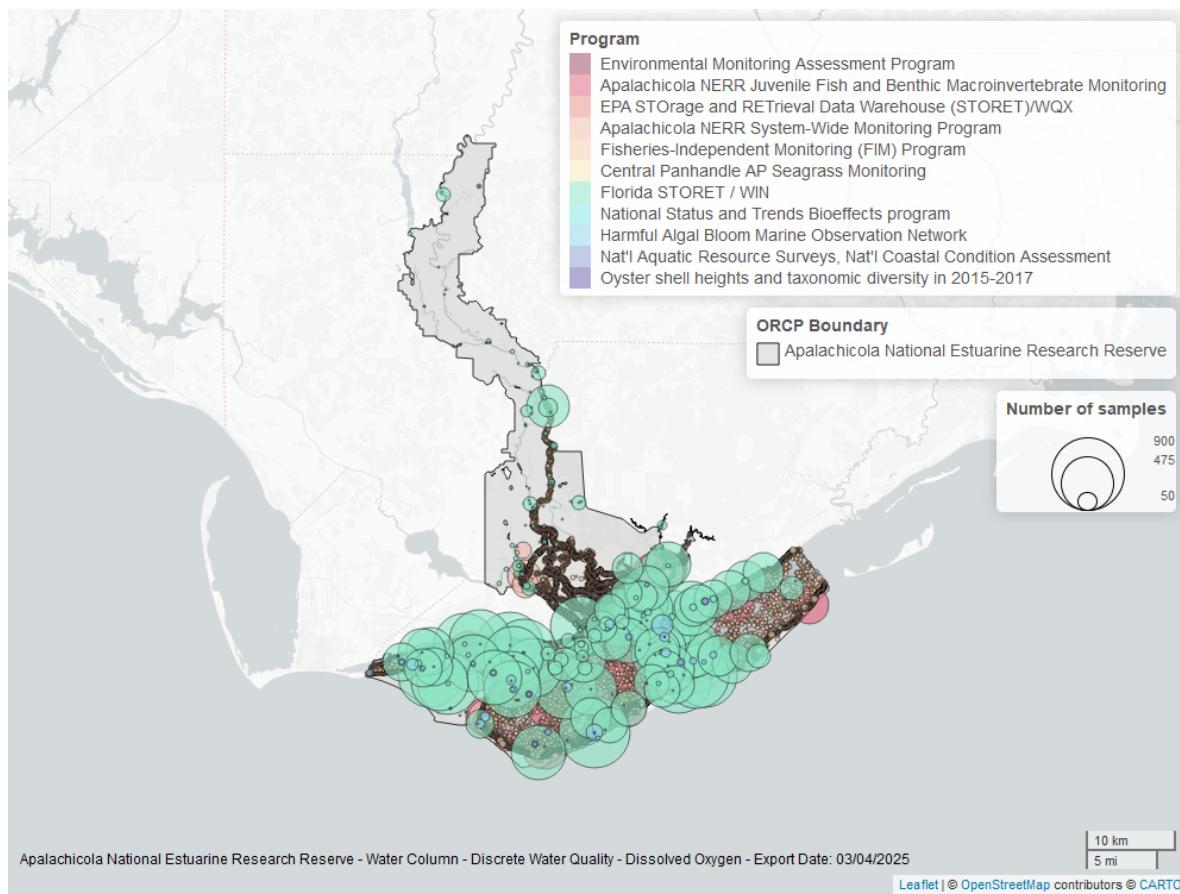


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

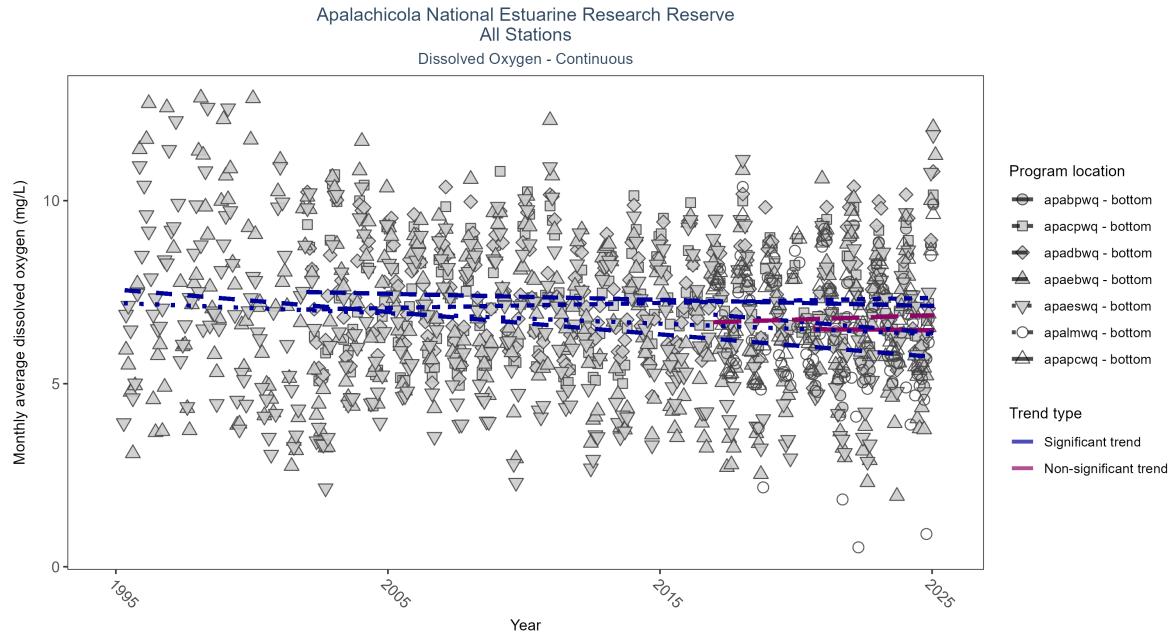


Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaeswq	Significantly decreasing trend	715193	31	1995 - 2025	6.8	-0.15	7.21	-0.03	0.0001
apaebwq	Significantly decreasing trend	665356	31	1995 - 2025	6.8	-0.28	7.57	-0.06	0
apapcwq	No significant trend	267810	10	2016 - 2025	6.9	0.07	6.66	0.02	0.3508
apadbwq	Significantly decreasing trend	621272	24	2002 - 2025	7.3	-0.15	7.50	-0.02	0.0006
apabpwq	No significant trend	149136	6	2020 - 2025	6.5	-0.05	6.50	-0.01	0.9354
apalmwq	Significantly decreasing trend	255049	10	2016 - 2025	6.3	-0.22	6.94	-0.06	0.0095
apacpwq	Significantly increasing trend	616896	24	2002 - 2025	7.1	0.12	7.03	0.01	0.0046

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.

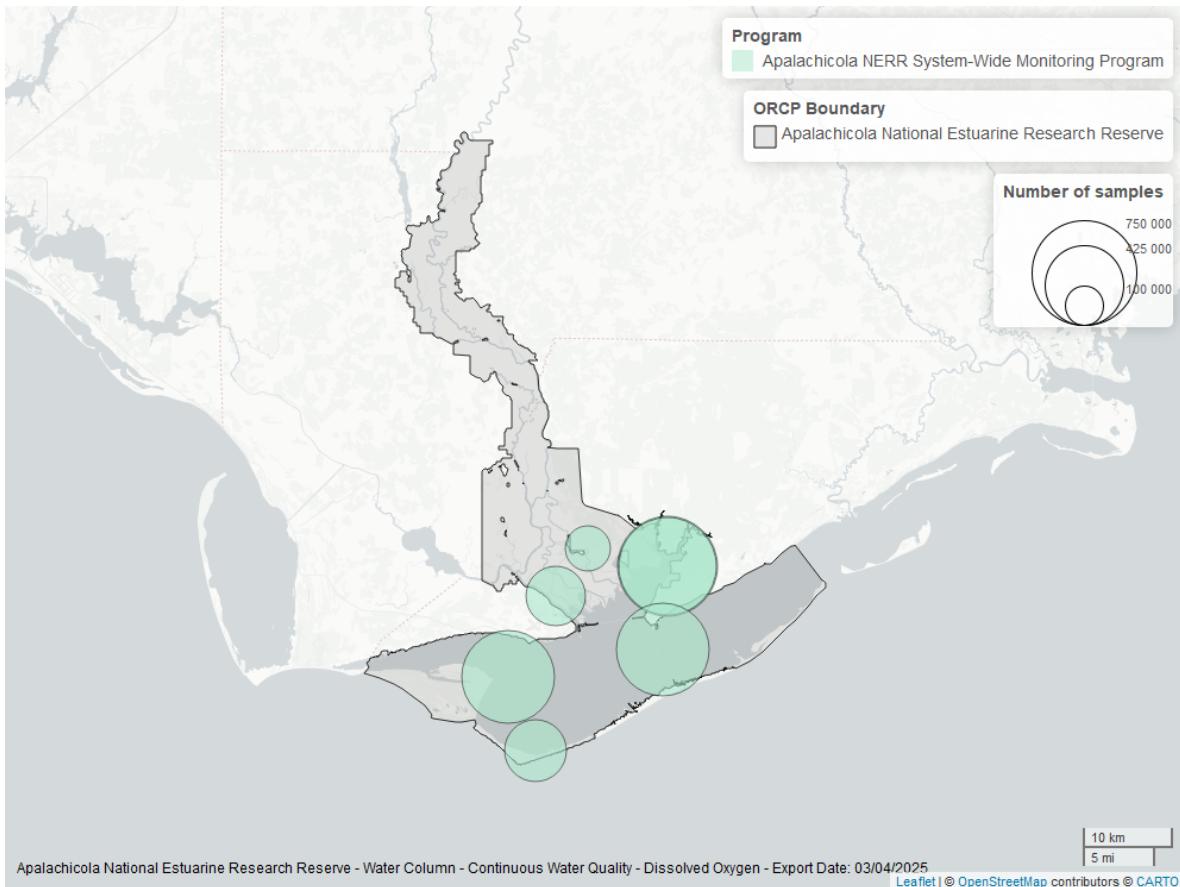


Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

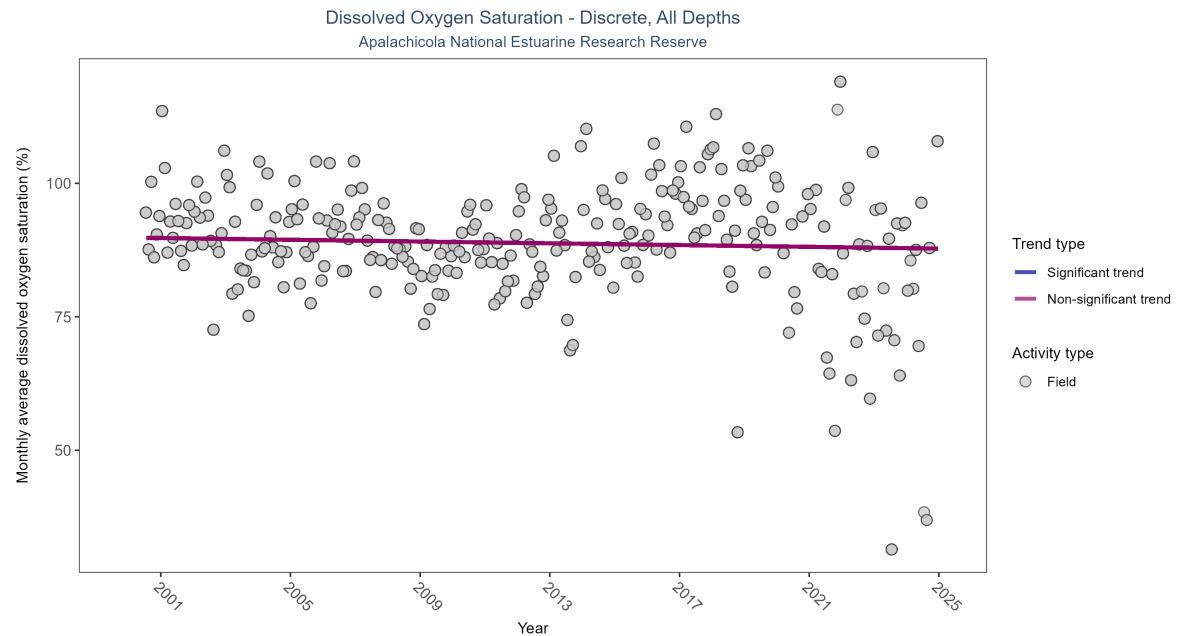


Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	7013	25	2000 - 2024	91.5	-0.04951	89.84157	-0.08251	0.2262

Dissolved oxygen saturation showed no detectable trend between 2000 and 2024.

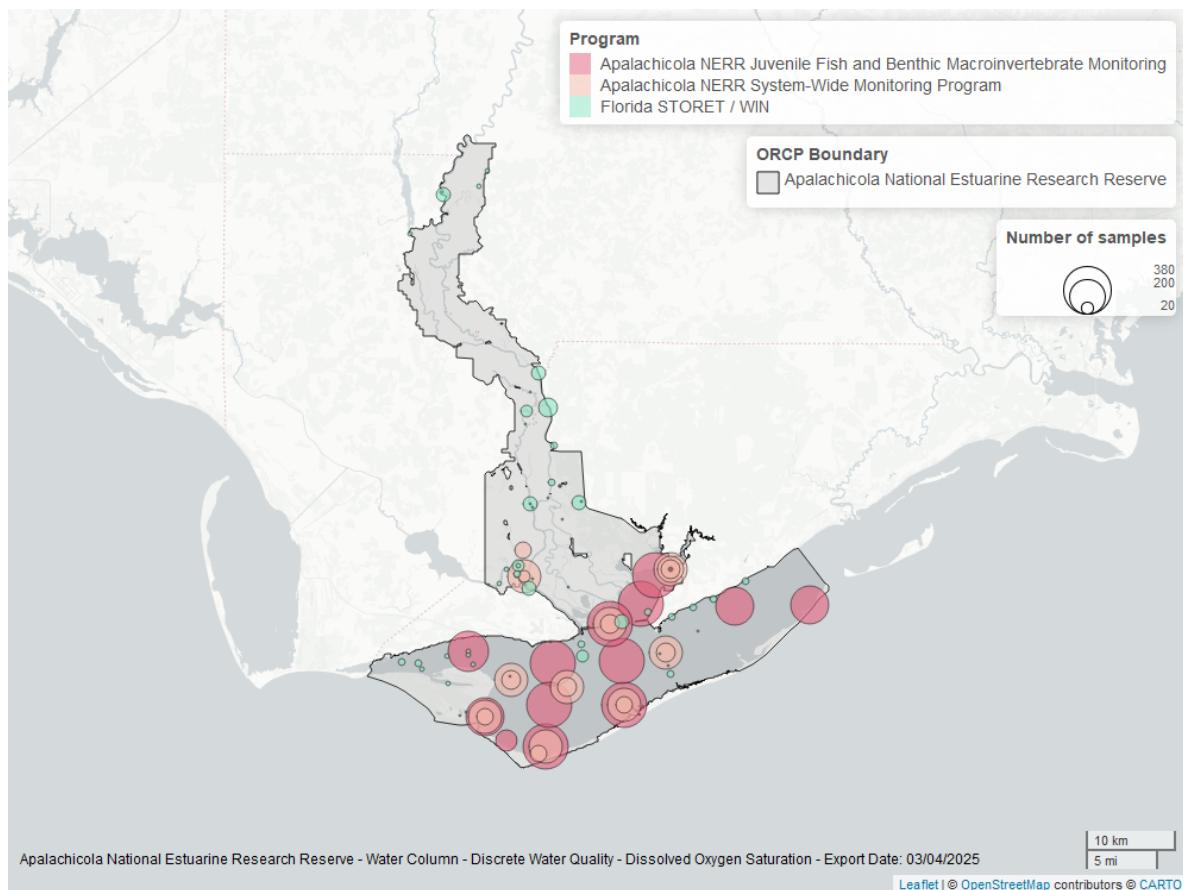


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

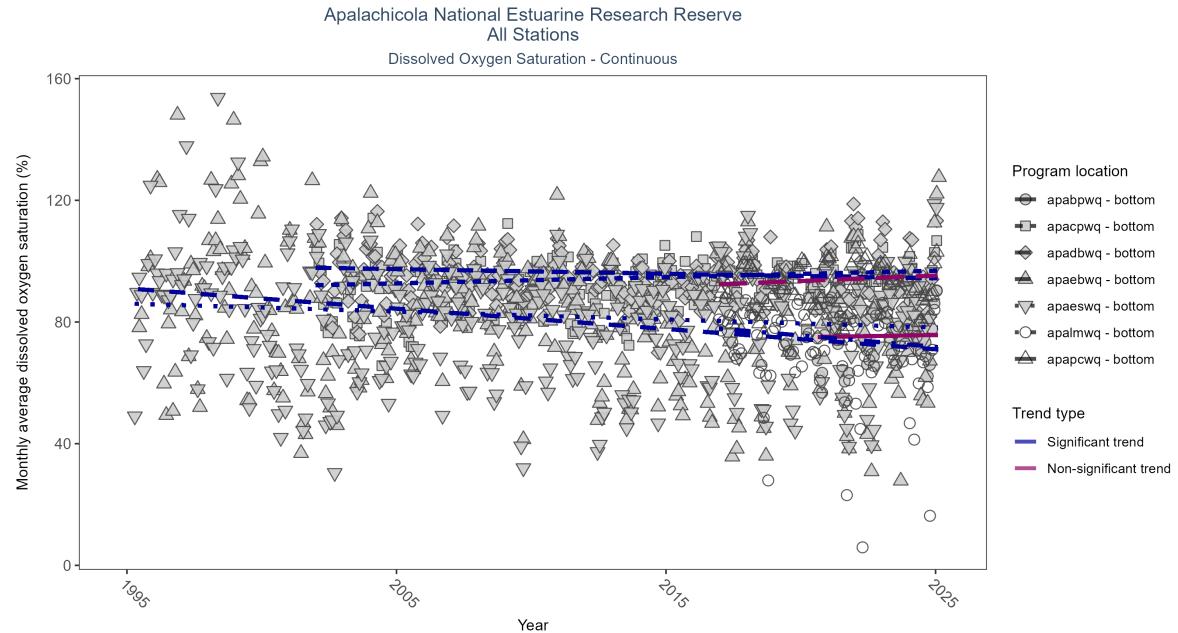


Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apadbwq	Significantly decreasing trend	624721	24	2002 - 2025	94.7	-0.10	97.83	-0.15	0.0247
apalmwq	Significantly decreasing trend	255585	10	2016 - 2025	74.7	-0.22	78.57	-0.75	0.0078
apacpwq	Significantly increasing trend	618424	24	2002 - 2025	94.2	0.16	92.07	0.21	0.0001
apaebwq	Significantly decreasing trend	661181	31	1995 - 2025	84.8	-0.25	91.06	-0.67	0
apapcwq	No significant trend	271266	10	2016 - 2025	94.1	0.11	92.05	0.35	0.1565
apabpwq	No significant trend	149136	6	2020 - 2025	76.5	0.07	74.97	0.15	0.4654
apaeswq	Significantly decreasing trend	716357	31	1995 - 2025	84.2	-0.11	86.07	-0.26	0.0045

At one program location, monthly average dissolved oxygen saturation increased by 0.21% per year. At four program locations, monthly average dissolved oxygen saturation decreased between 0.15 and 0.75% per year. No detectable change in monthly average dissolved oxygen saturation was observed at two locations.

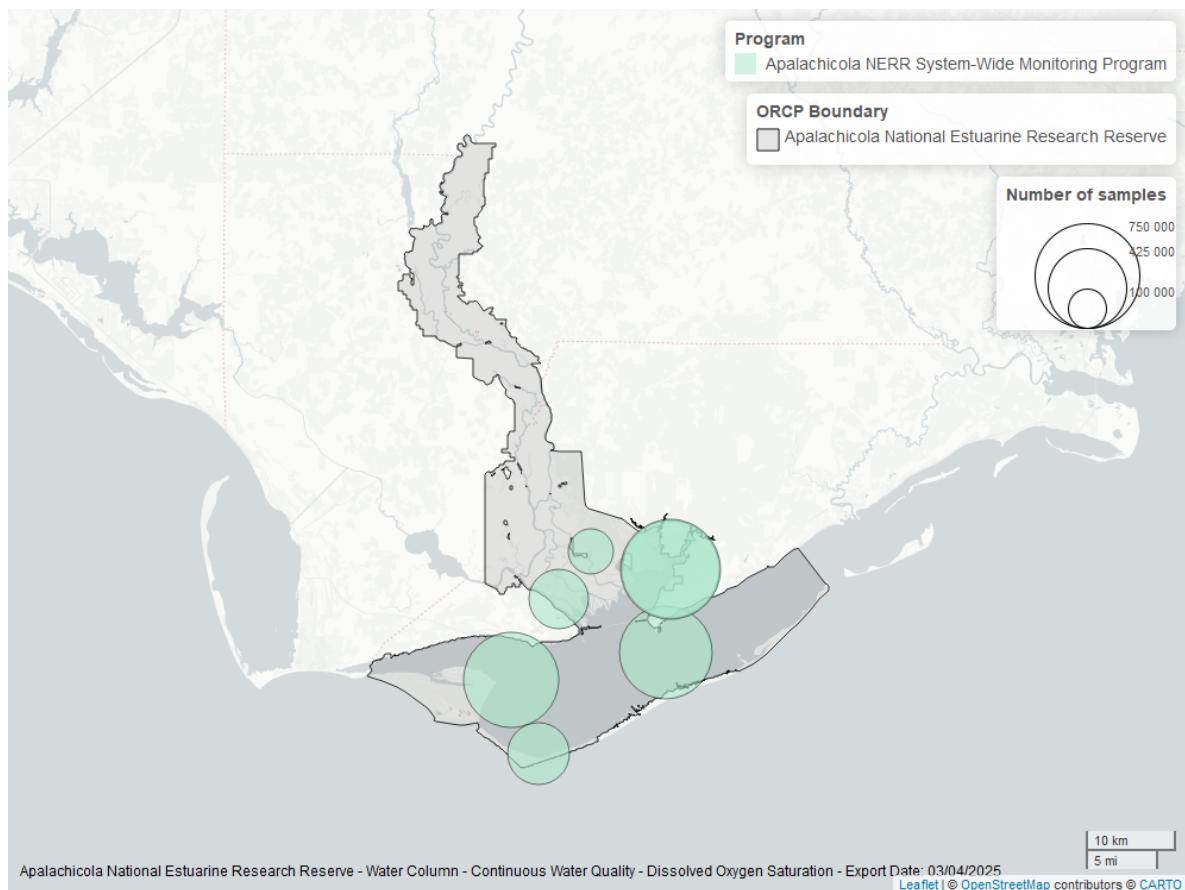


Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

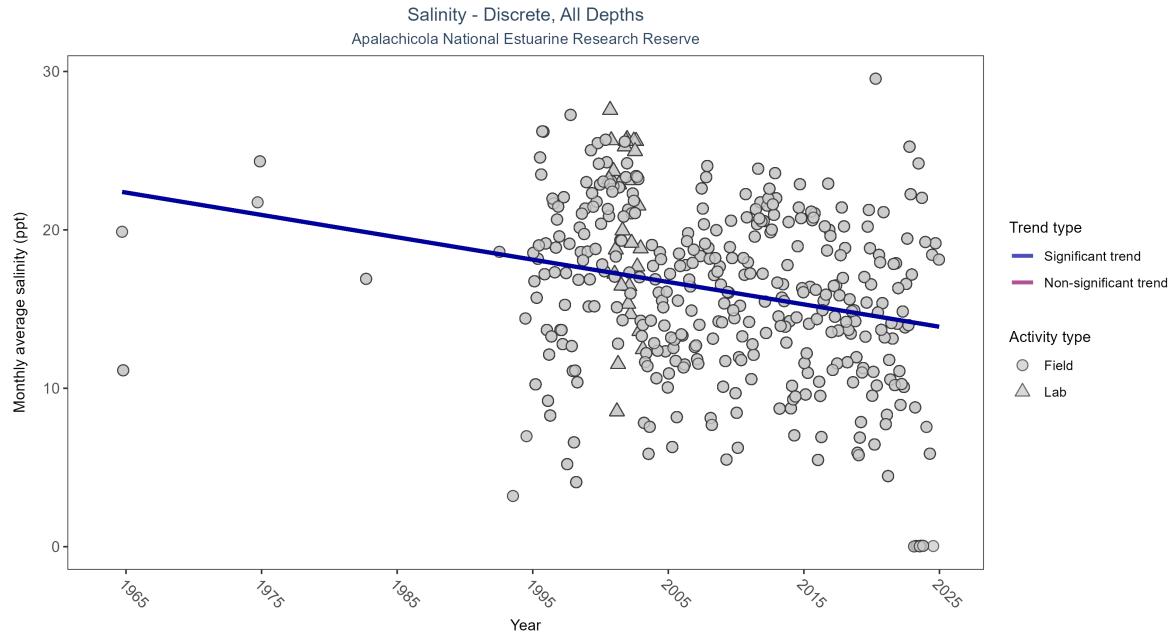


Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	93661	36	1964 - 2024	16.79	-0.2034	22.49707	-0.14119	0

Monthly average salinity decreased by 0.14 ppt per year.

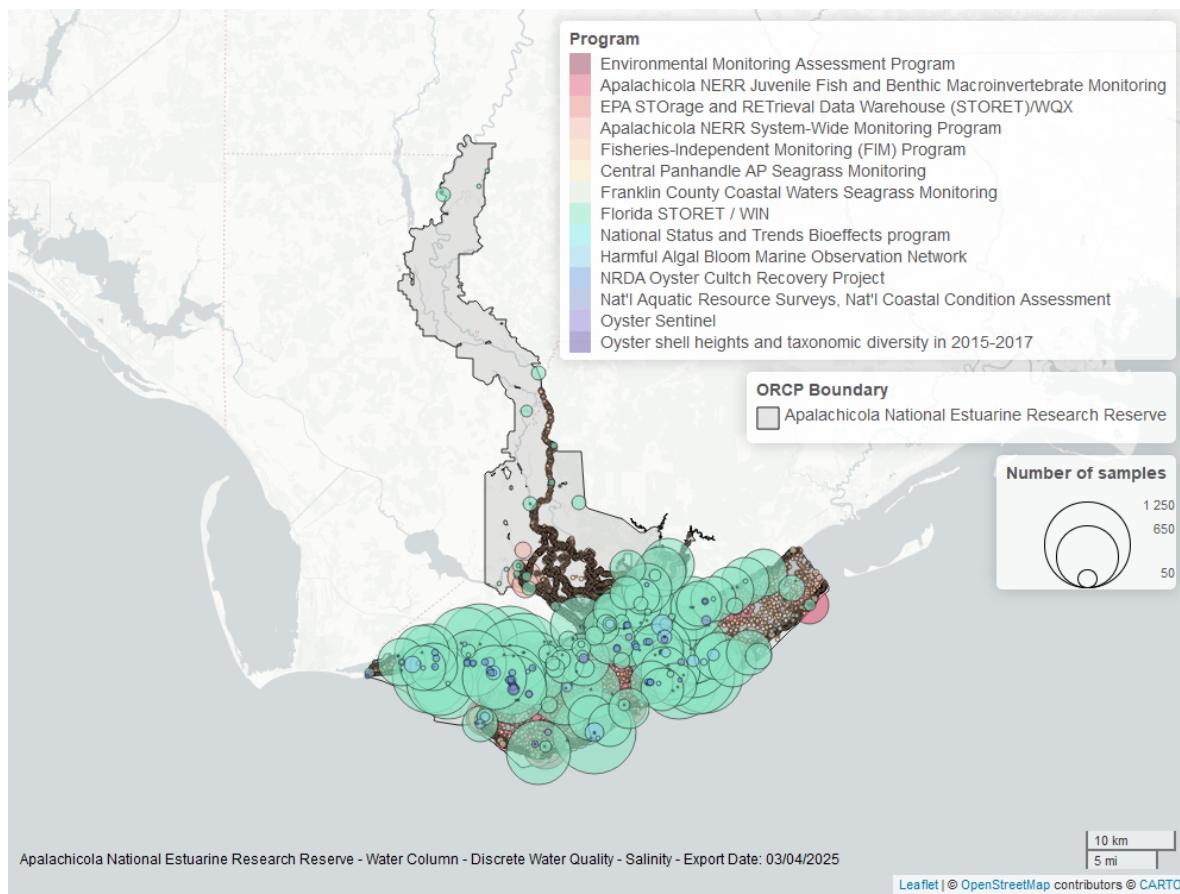


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

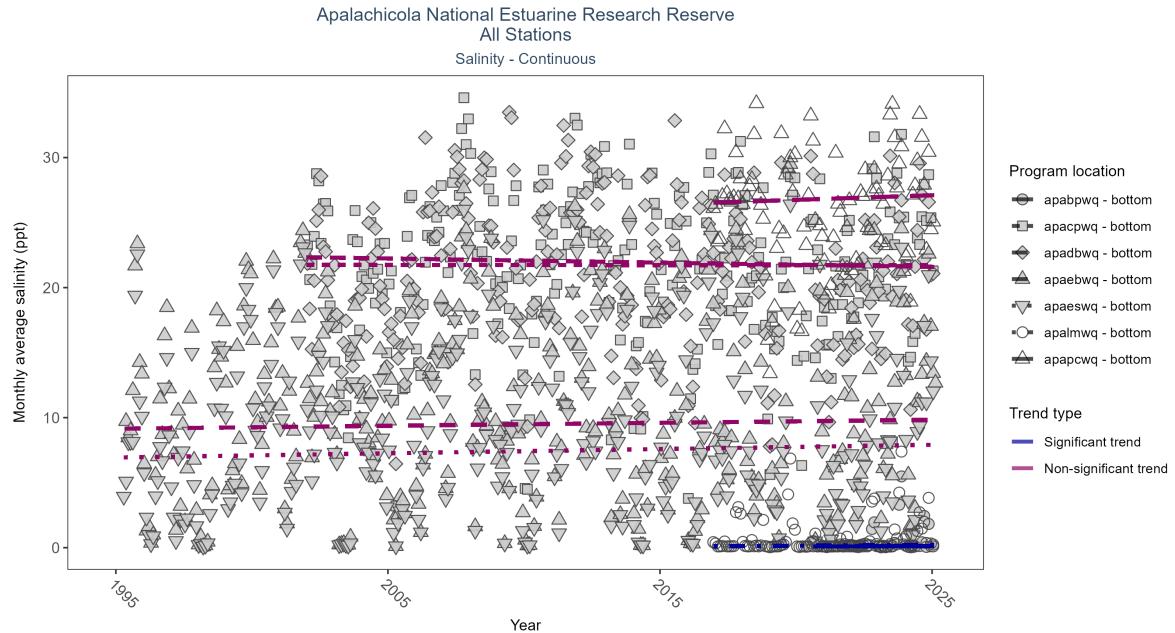


Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apadbwq	No significant trend	619355	24	2002 - 2025	22.1	-0.03	22.34	-0.03	0.4371
apalmwq	Significantly increasing trend	270761	10	2016 - 2025	0.1	0.23	0.09	0.01	0.0063
apaebwq	No significant trend	747149	31	1995 - 2025	9.9	0.04	9.14	0.02	0.3059
apaeswq	No significant trend	759370	31	1995 - 2025	7.6	0.05	6.93	0.03	0.1724
apapcwq	No significant trend	270115	10	2016 - 2025	26.8	0.03	26.46	0.07	0.7038
apacpwq	No significant trend	631122	24	2002 - 2025	22.5	0.00	21.74	0.00	0.9876
apabpwq	Significantly increasing trend	151688	6	2020 - 2025	0.1	0.28	0.09	0.01	0.0161

At two program locations, monthly average salinity increased by 0.01 ppt per year. No detectable change in monthly average salinity was observed at five locations.

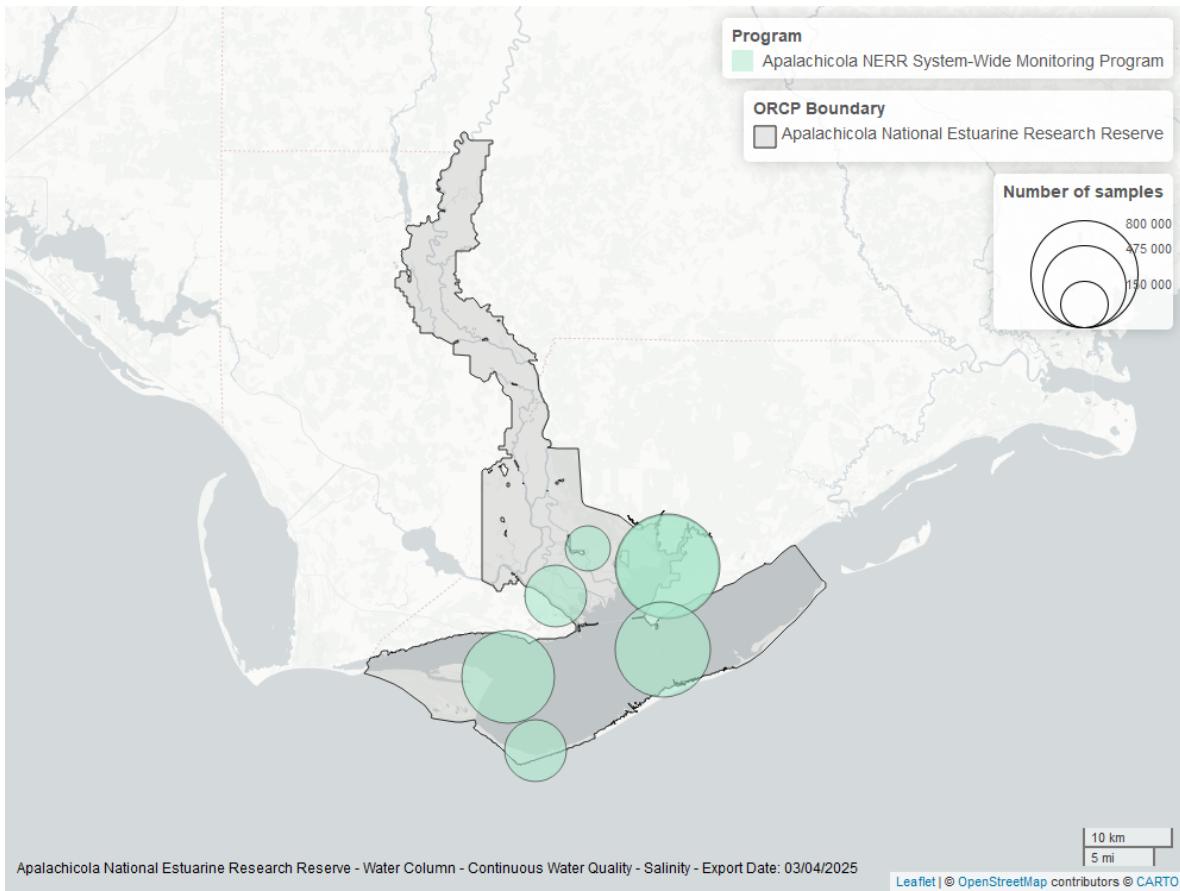


Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

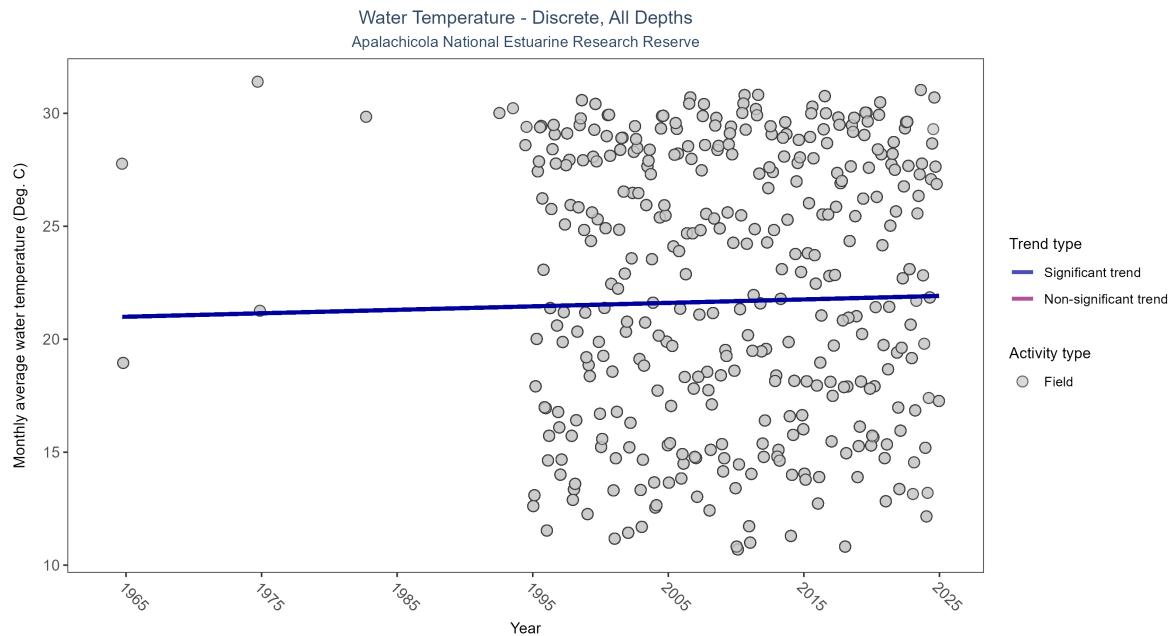


Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	93895	36	1964 - 2024	23.4	0.08605	20.9793	0.01535	0.0222

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

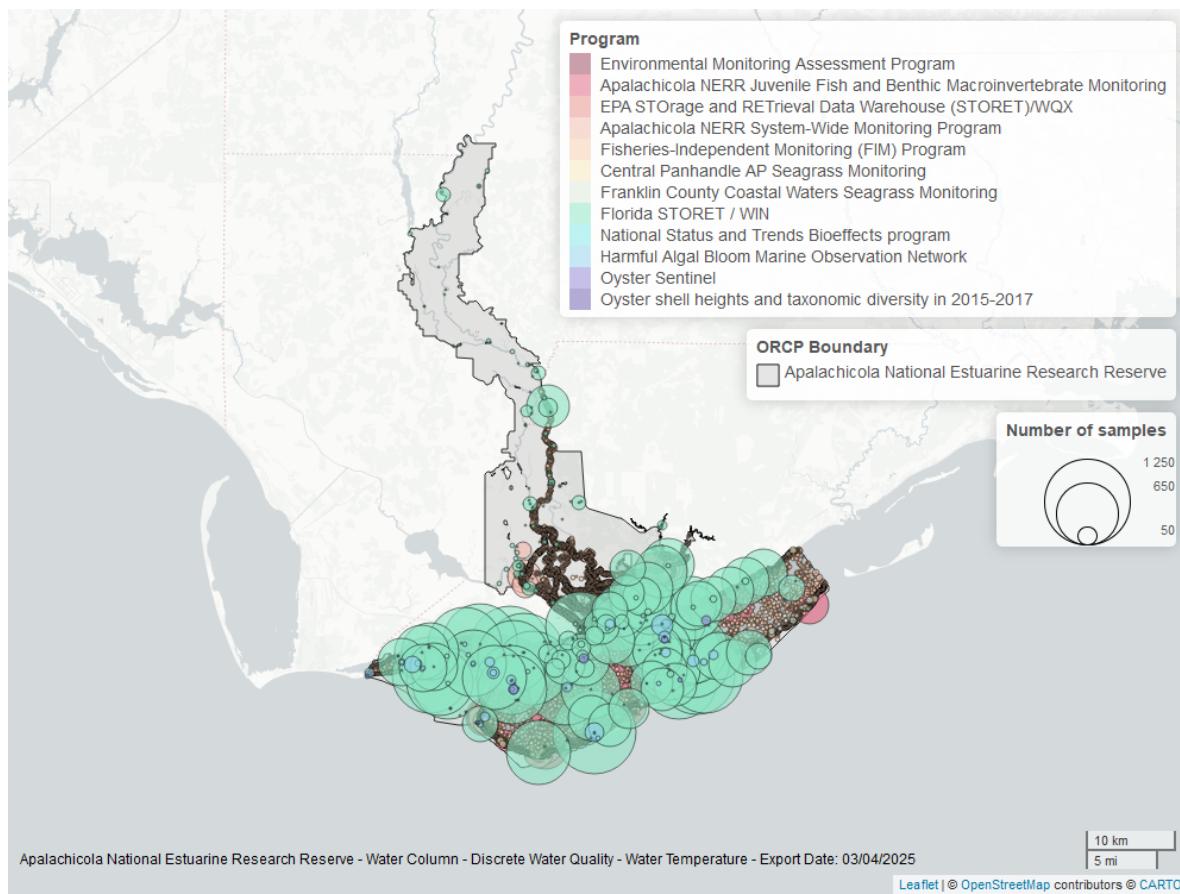


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

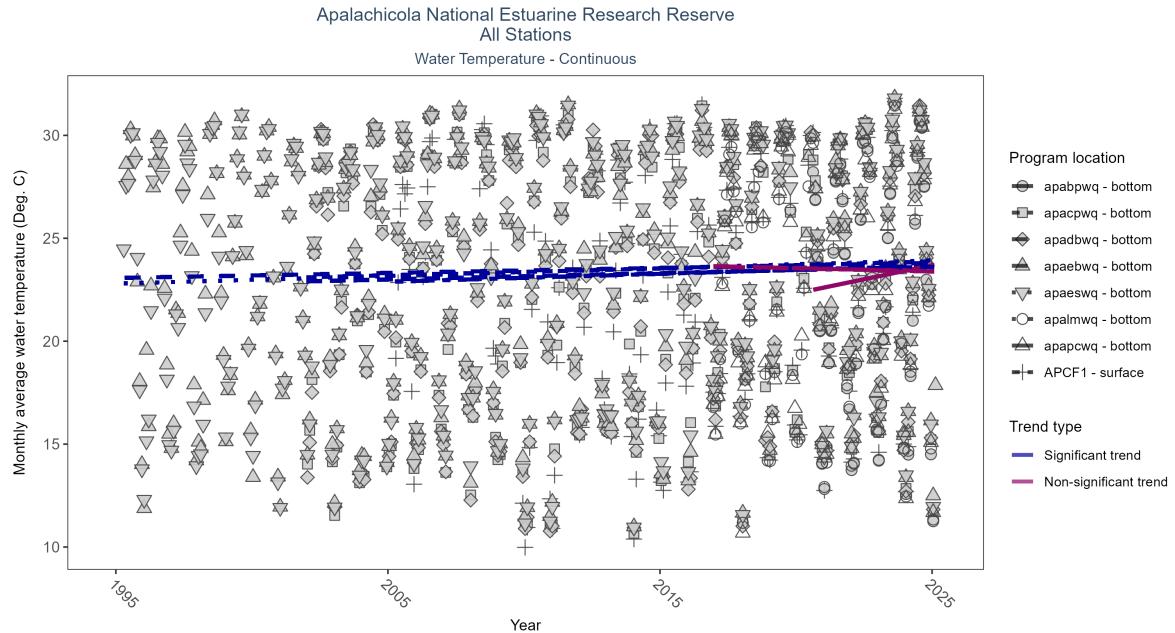


Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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	1331232	20	2005 - 2024	23.5	0.12	22.89	0.04	0.0284
apaebwq	Significantly increasing trend	762203	31	1995 - 2025	24.2	0.15	23.07	0.02	0.0001
apalmwq	No significant trend	273020	10	2016 - 2025	22.6	-0.03	23.64	-0.02	0.7038
apaeswq	Significantly increasing trend	768616	31	1995 - 2025	24.2	0.19	22.80	0.04	0
apadbwq	Significantly increasing trend	644531	24	2002 - 2025	23.3	0.14	22.90	0.03	0.0011
apacpwq	Significantly increasing trend	670115	24	2002 - 2025	23.5	0.15	23.10	0.03	0.0004
apabpwq	No significant trend	151688	6	2020 - 2025	22.5	0.17	22.32	0.27	0.2237
apapcwq	No significant trend	273607	10	2016 - 2025	23.1	-0.06	23.68	-0.03	0.468

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.

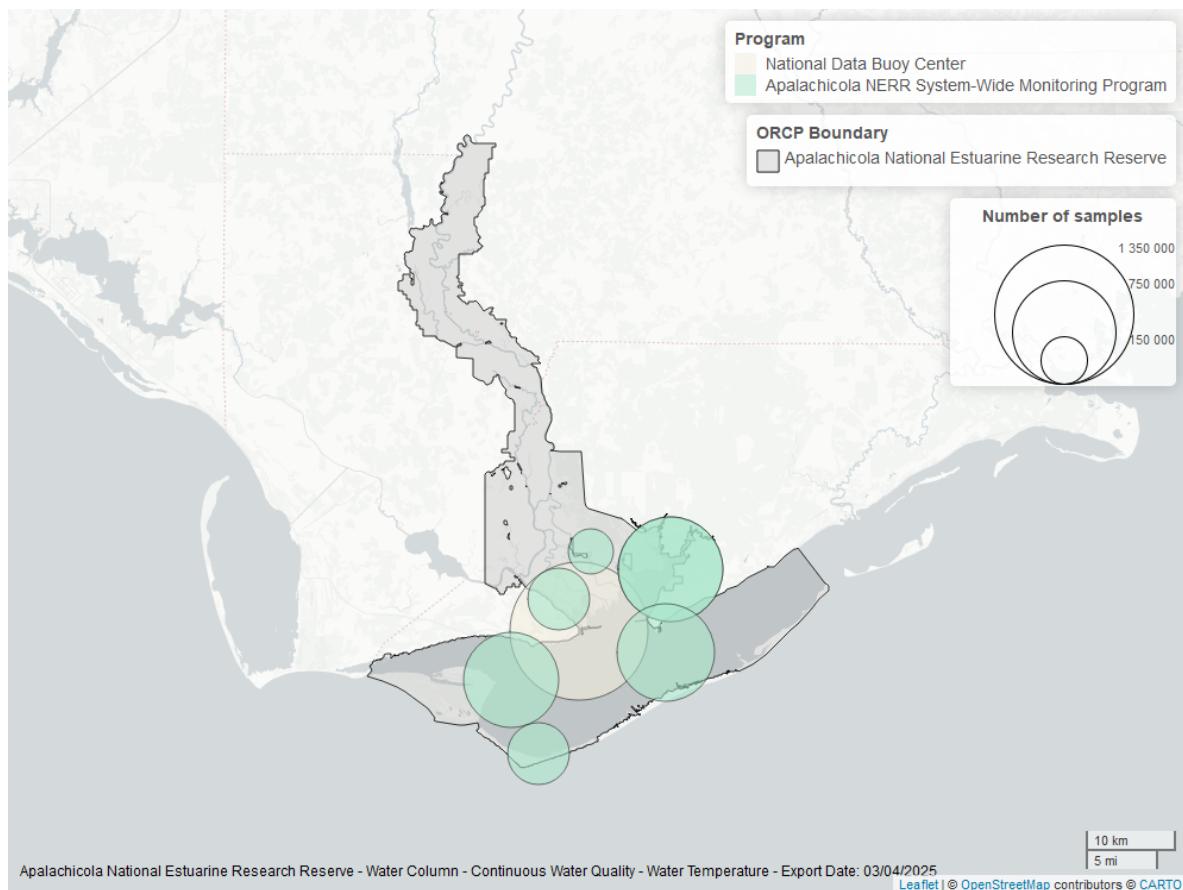


Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

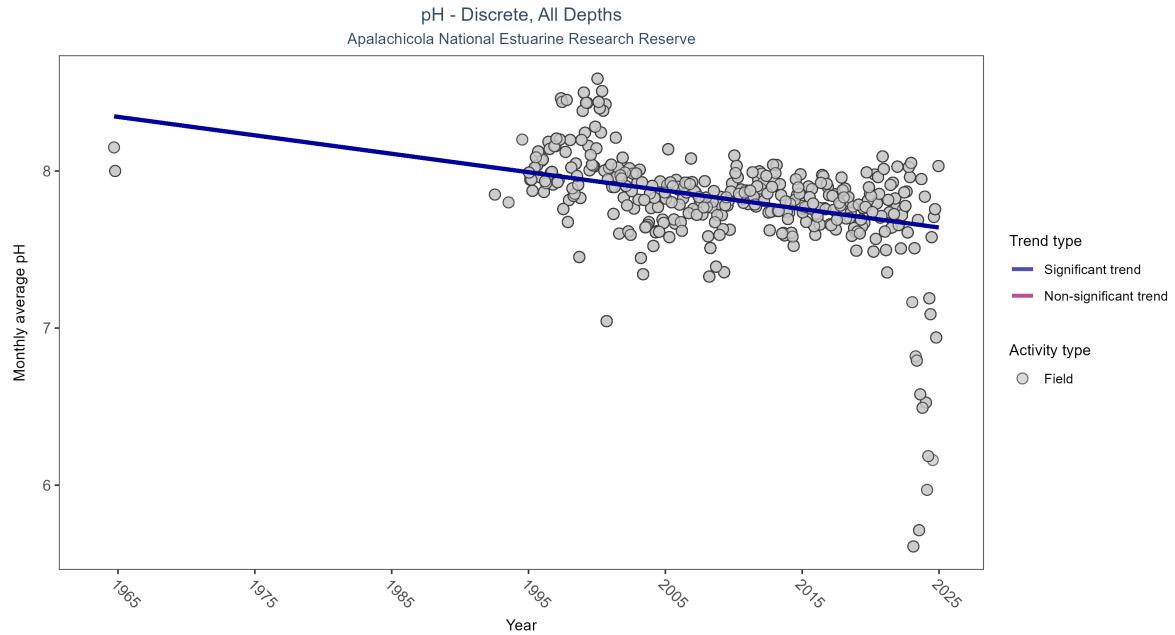


Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	65162	34	1964 - 2024	7.95	-0.3672	8.35625	-0.01174	0

Monthly average pH decreased by 0.01 pH units per year.

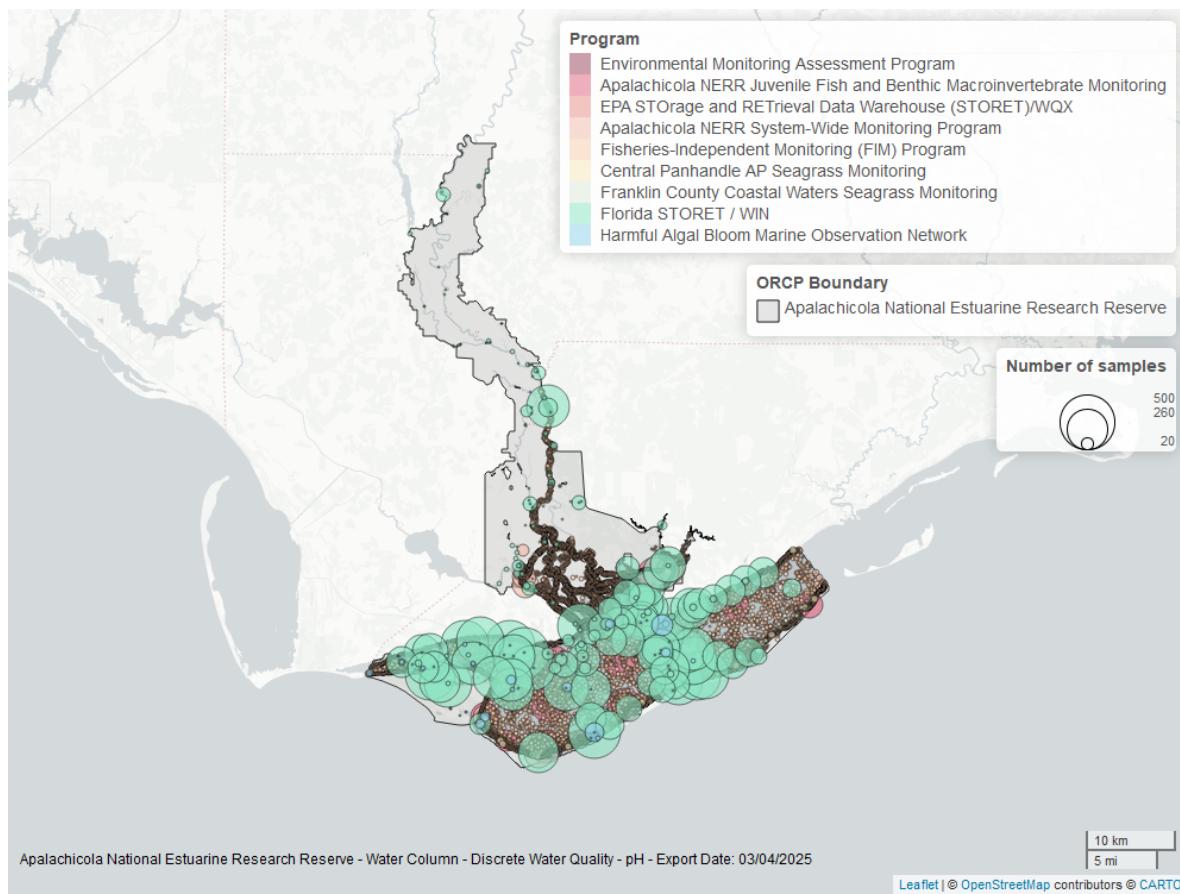


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

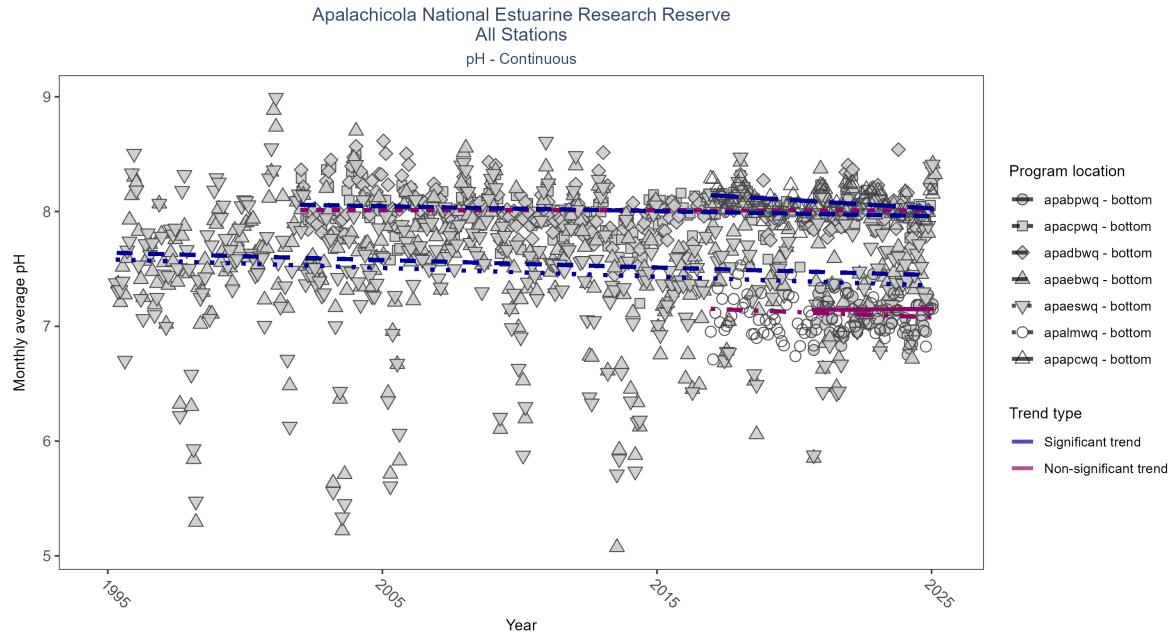


Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaebwq	Significantly decreasing trend	717948	31	1995 - 2025	7.6	-0.11	7.64	-0.01	0.0029
apalmwq	No significant trend	263183	10	2016 - 2025	7.1	-0.07	7.16	-0.01	0.4267
apaeswq	Significantly decreasing trend	719429	31	1995 - 2025	7.5	-0.12	7.58	-0.01	0.0011
apadbwq	Significantly decreasing trend	602330	24	2002 - 2025	8.0	-0.14	8.06	0.00	0.0019
apacpwq	No significant trend	614654	24	2002 - 2025	8.0	-0.01	8.01	0.00	0.9137
apabpwq	No significant trend	150448	6	2020 - 2025	7.1	-0.01	7.14	0.00	1
apapcqw	Significantly decreasing trend	267739	10	2016 - 2025	8.1	-0.28	8.16	-0.01	0.0006

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

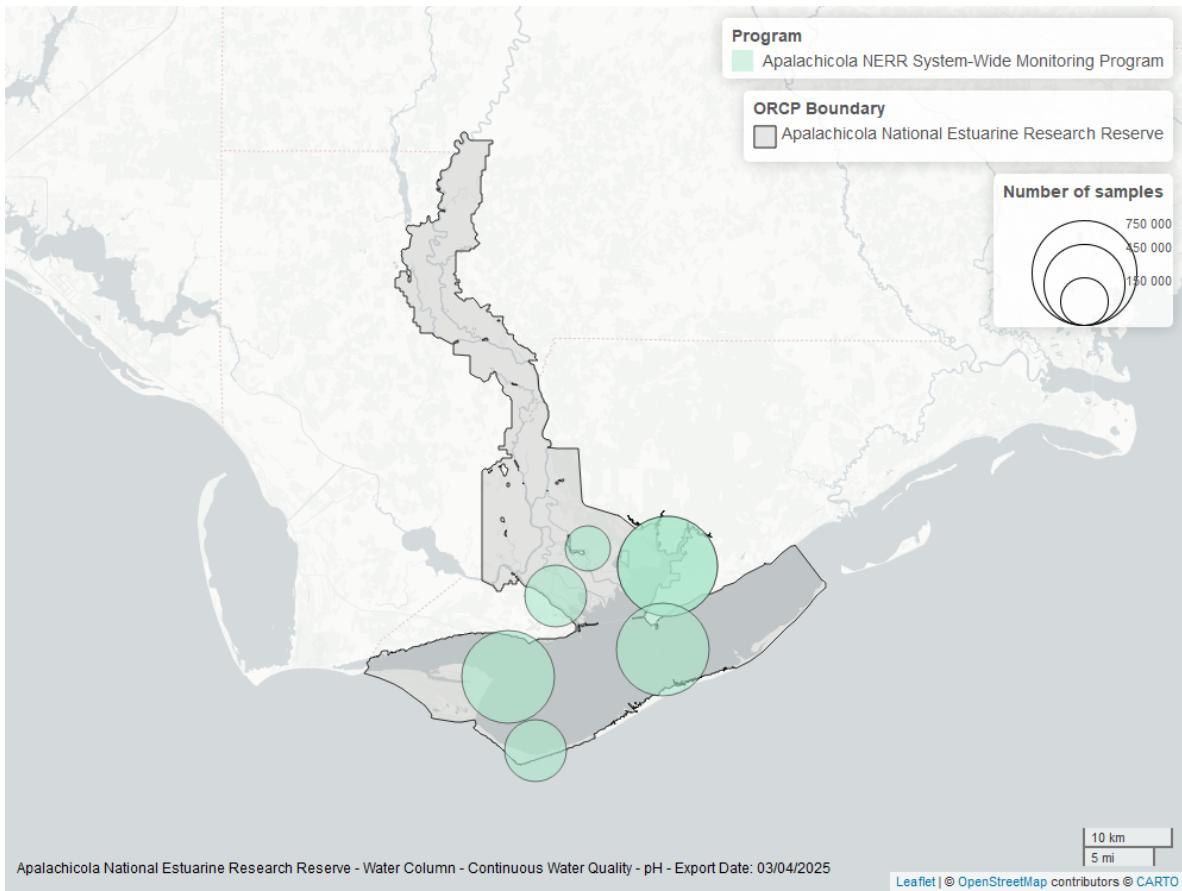


Figure 24: Map showing location of pH continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

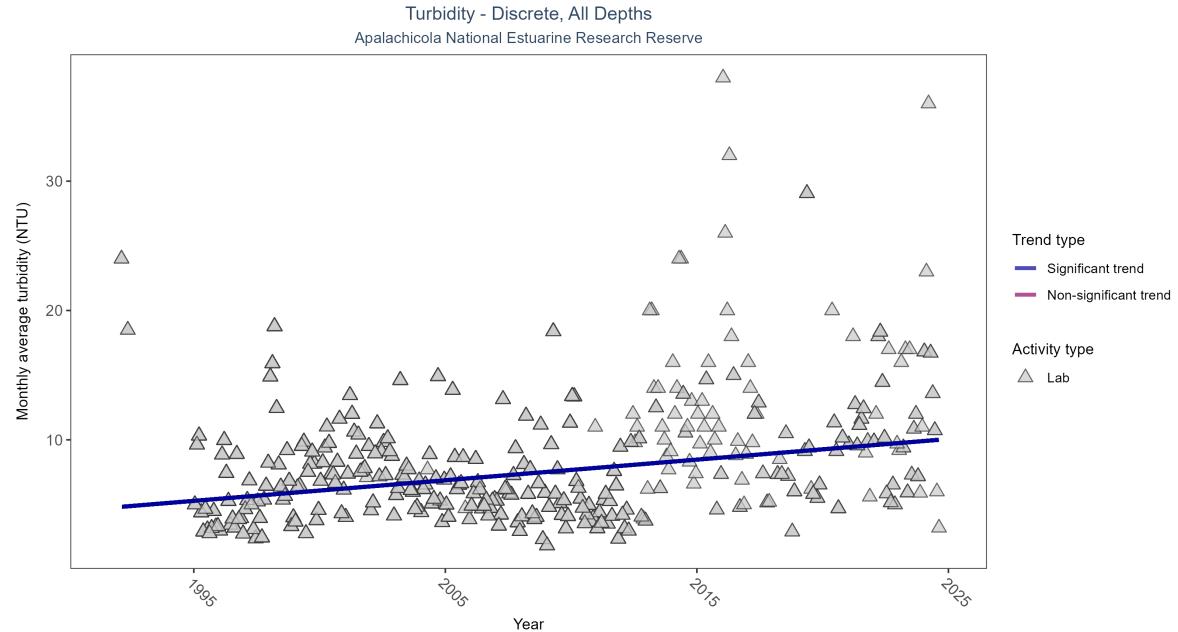


Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	22964	31	1992 - 2024	5.1	0.24931	4.80129	0.15943	0

Monthly average turbidity increased by 0.16 NTU per year, indicating a decrease in water clarity.

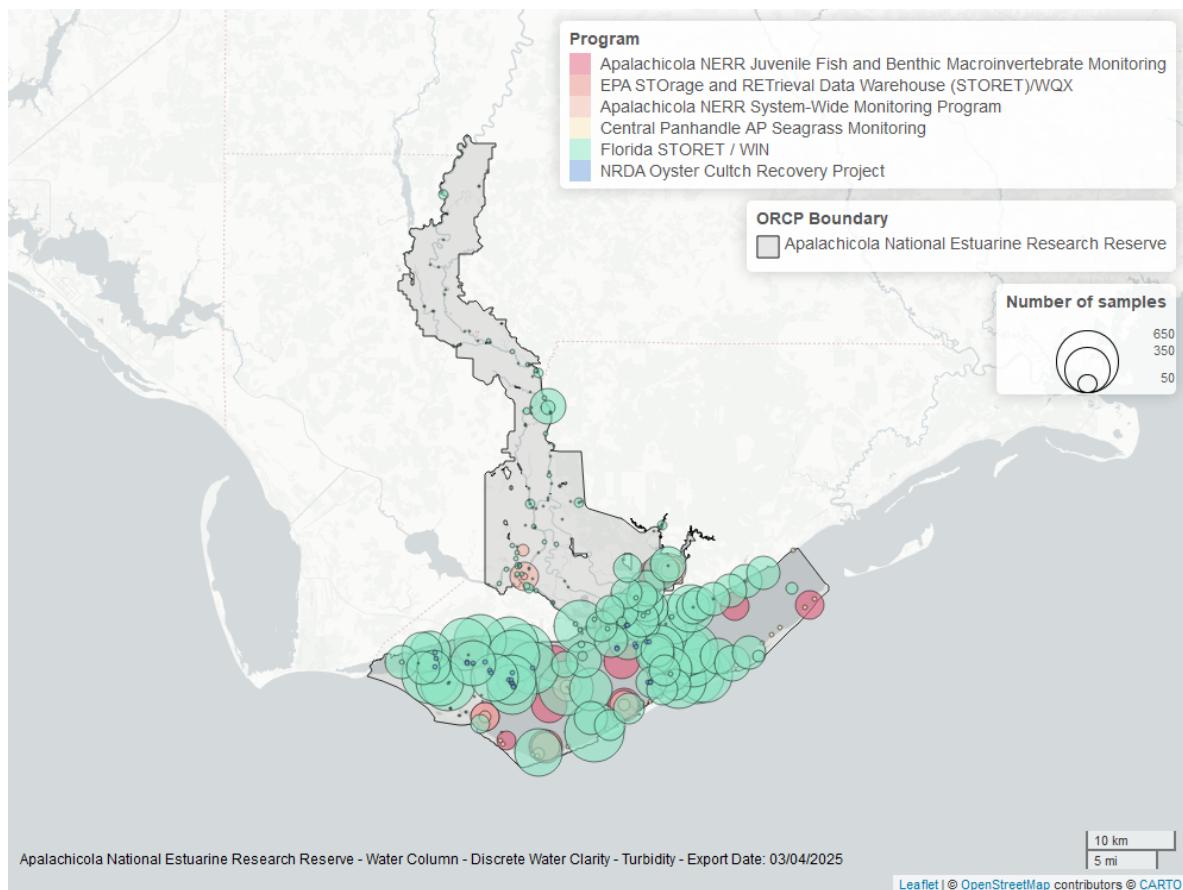


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

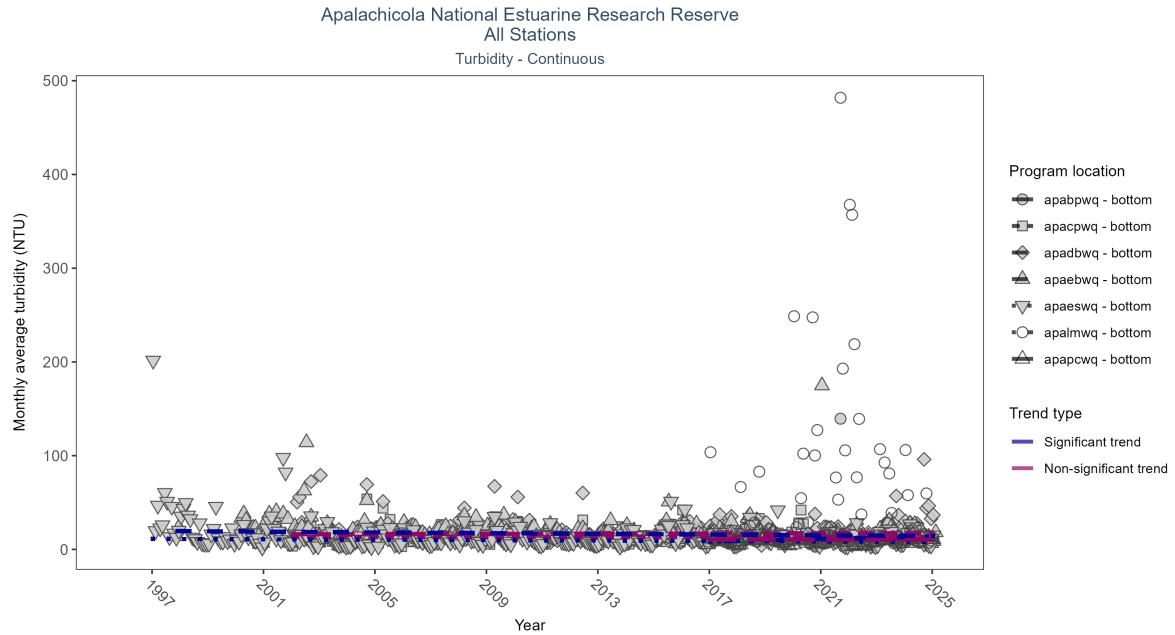


Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
apaebwq	Significantly decreasing trend	635704	27	1997 - 2025	13	-0.19	19.68	-0.19	0
apaeswq	Significantly decreasing trend	703229	30	1996 - 2025	9	-0.15	11.32	-0.11	0.0002
apacpwq	No significant trend	628175	24	2002 - 2025	8	-0.01	13.20	-0.01	0.8662
apabpwq	No significant trend	151683	6	2020 - 2025	11	0.09	10.12	0.19	0.6851
apadbwq	No significant trend	605643	24	2002 - 2025	10	0.04	16.11	0.05	0.3209
apalmwq	Significantly increasing trend	245206	10	2016 - 2025	12	0.20	7.63	0.70	0.0173
apapcwq	No significant trend	258576	10	2016 - 2025	7	-0.03	10.47	-0.03	0.7795

At one program location, monthly average turbidity increased by 0.70 NTU per year. At two program locations, monthly average turbidity decreased by 0.11 NTU per year at one site and by 0.19 NTU per year at the other. No detectable change in monthly average turbidity was observed at four locations.

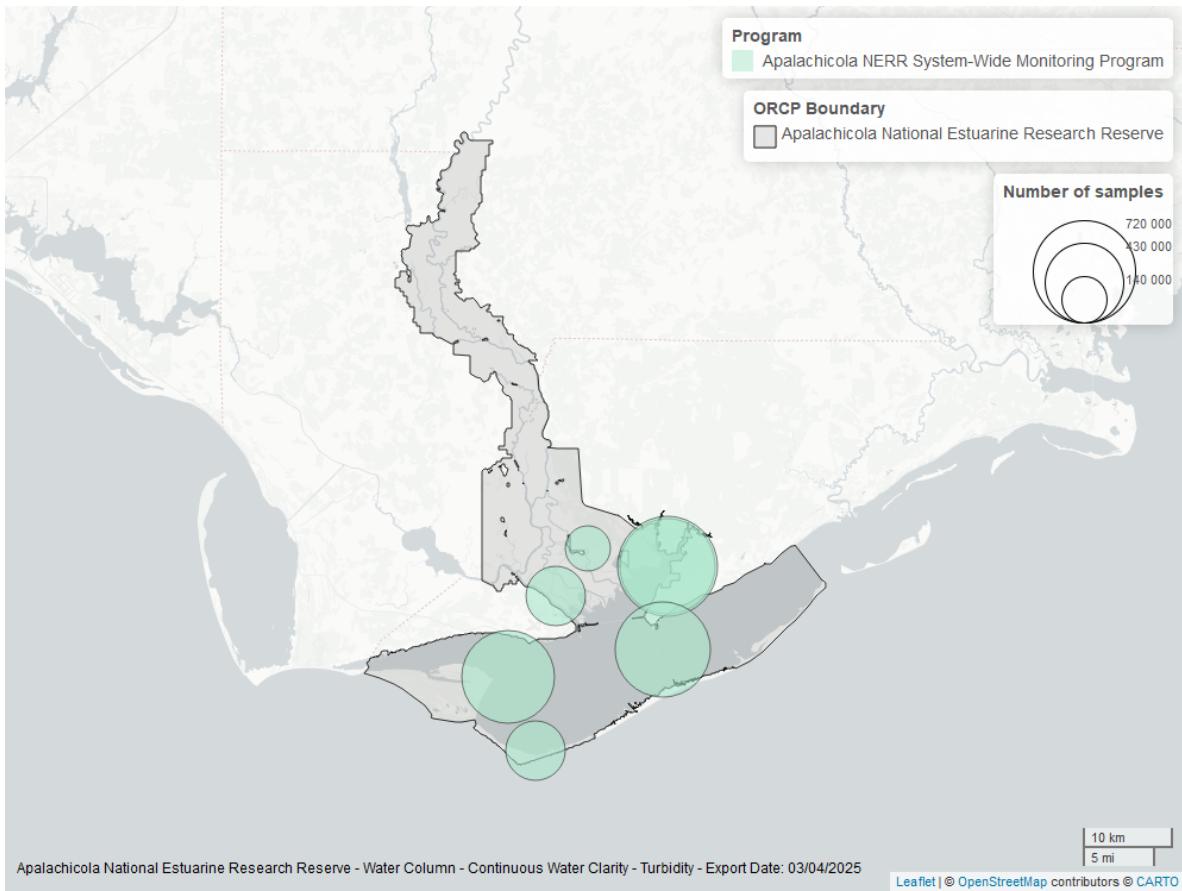


Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

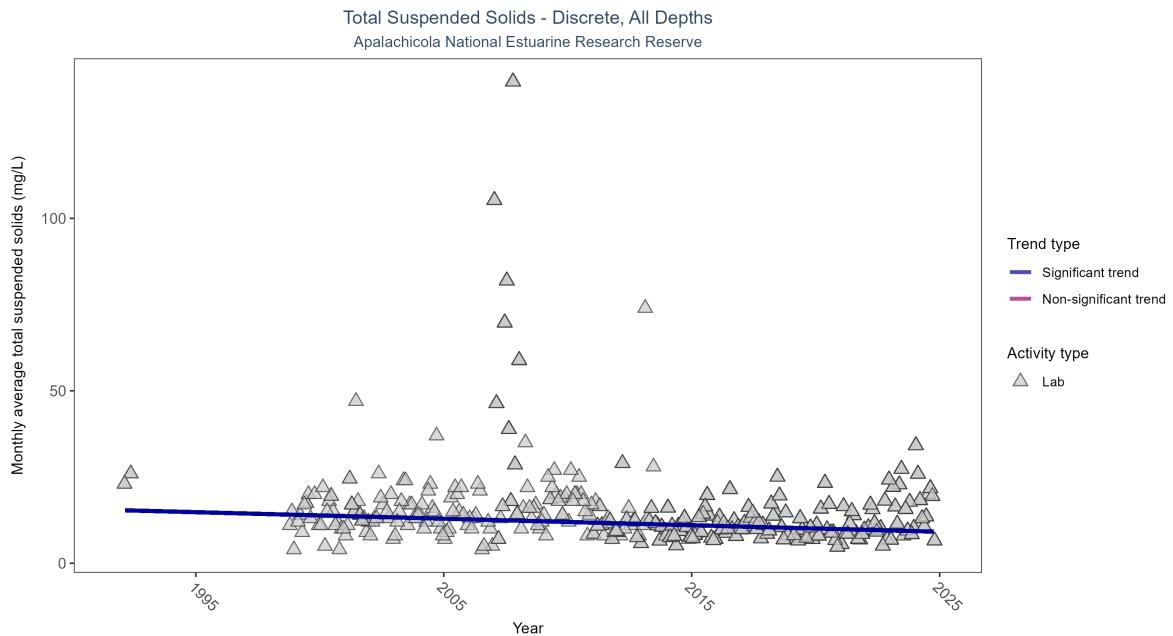


Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	4038	28	1992 - 2024		10	-0.20031	15.37229	-0.18939	0

Monthly average total suspended solids decreased by 0.19 mg/L per year, indicating an increase in water clarity.

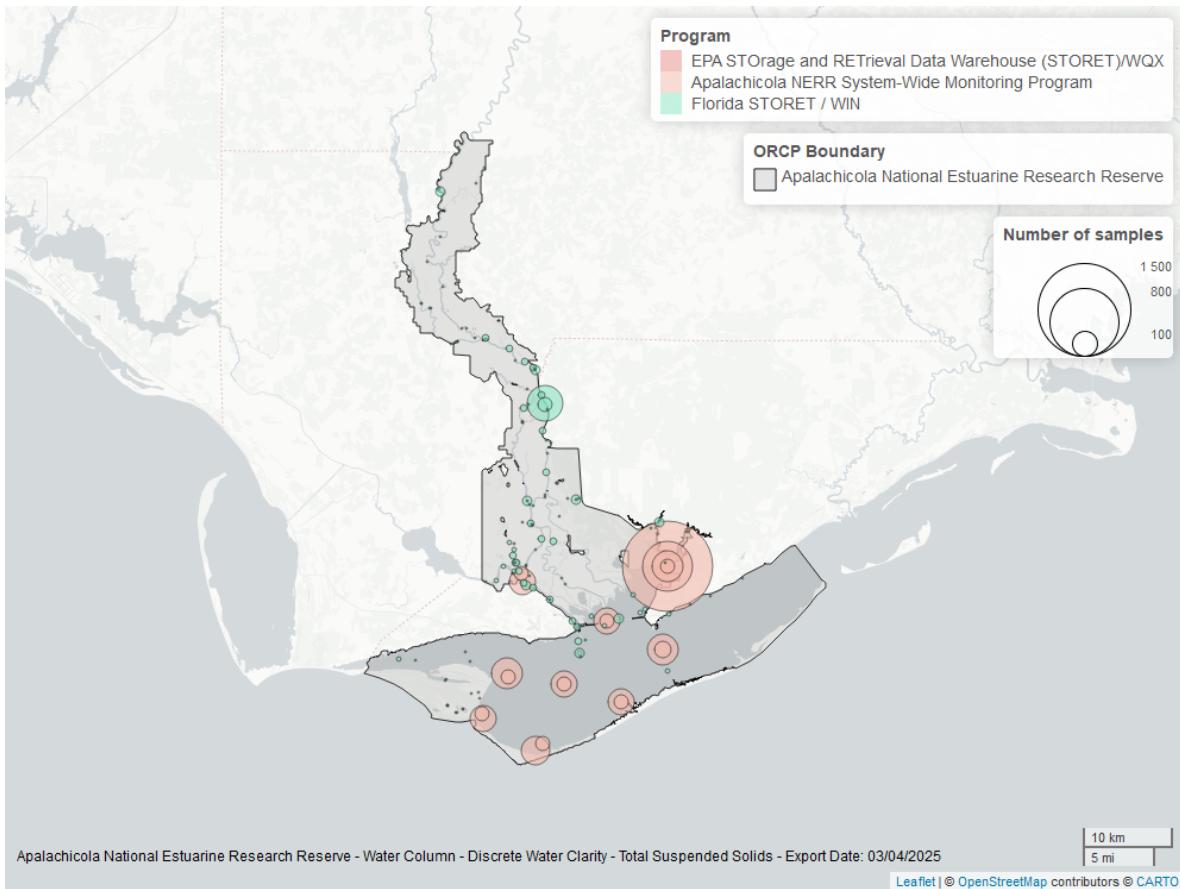


Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

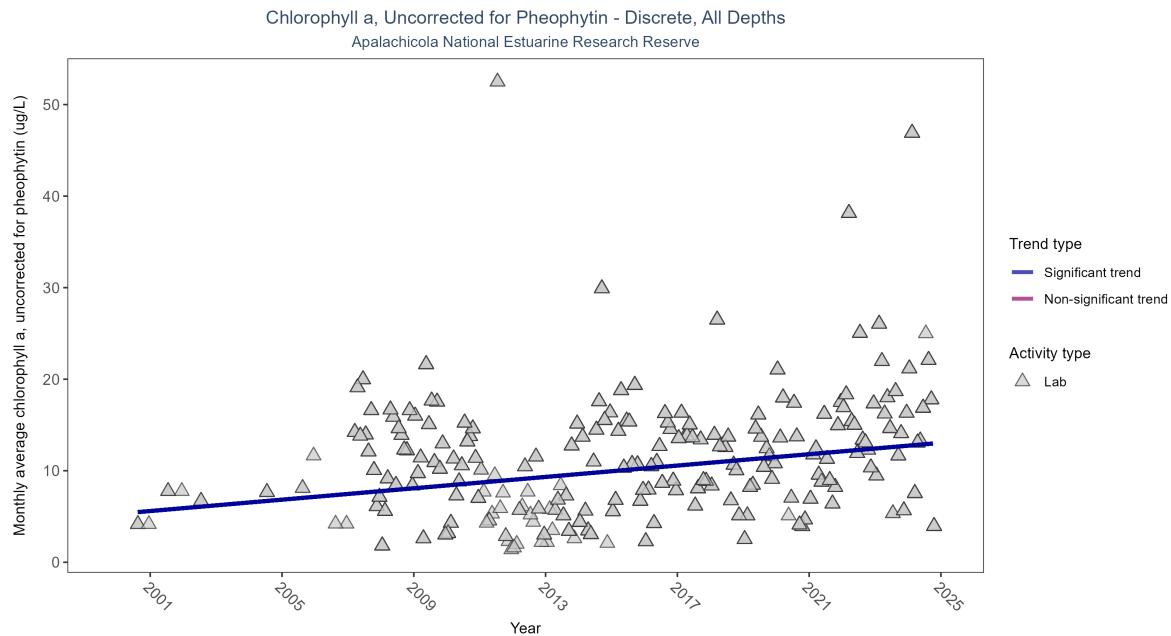


Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	4773	24	2000 - 2024	10	0.19315	5.28634	0.31038	0.0001

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.31 $\mu\text{g/L}$ per year, indicating a decrease in water clarity.

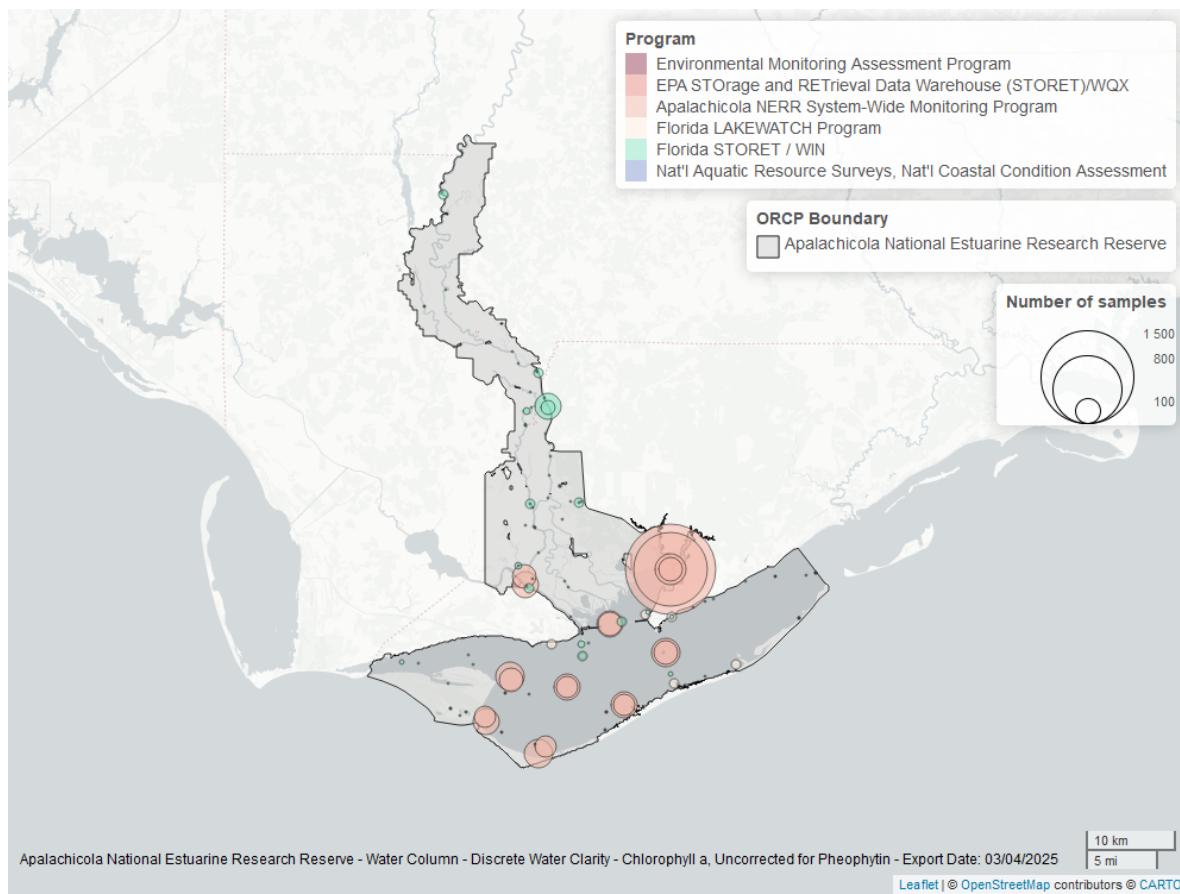


Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

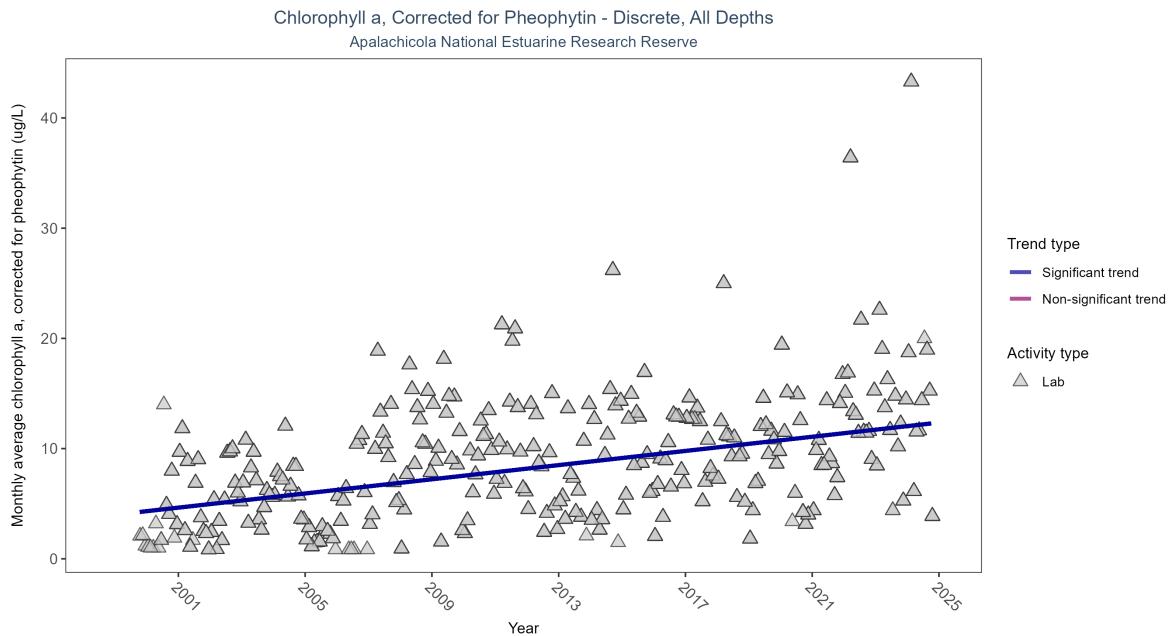


Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	9047	26	1999 - 2024	7.6	0.34228	4.00057	0.3215	0

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

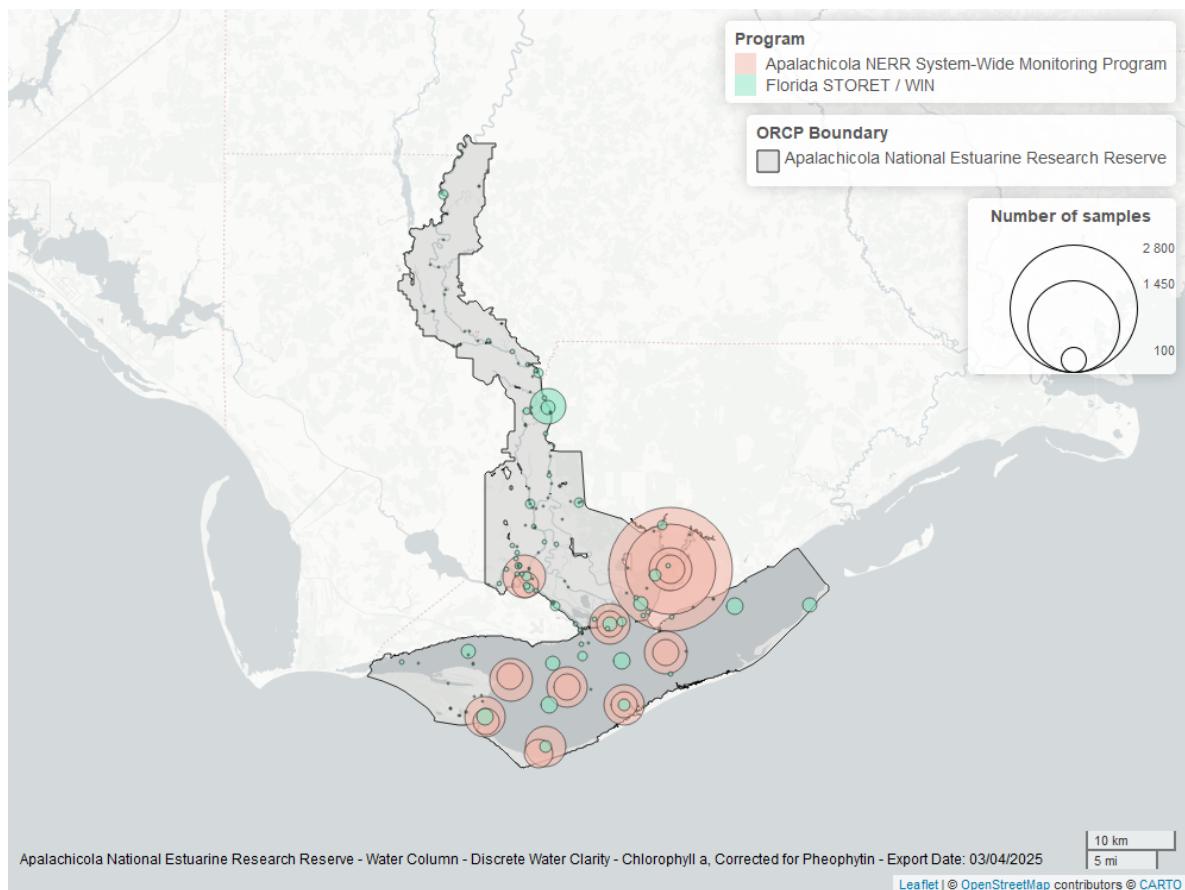


Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

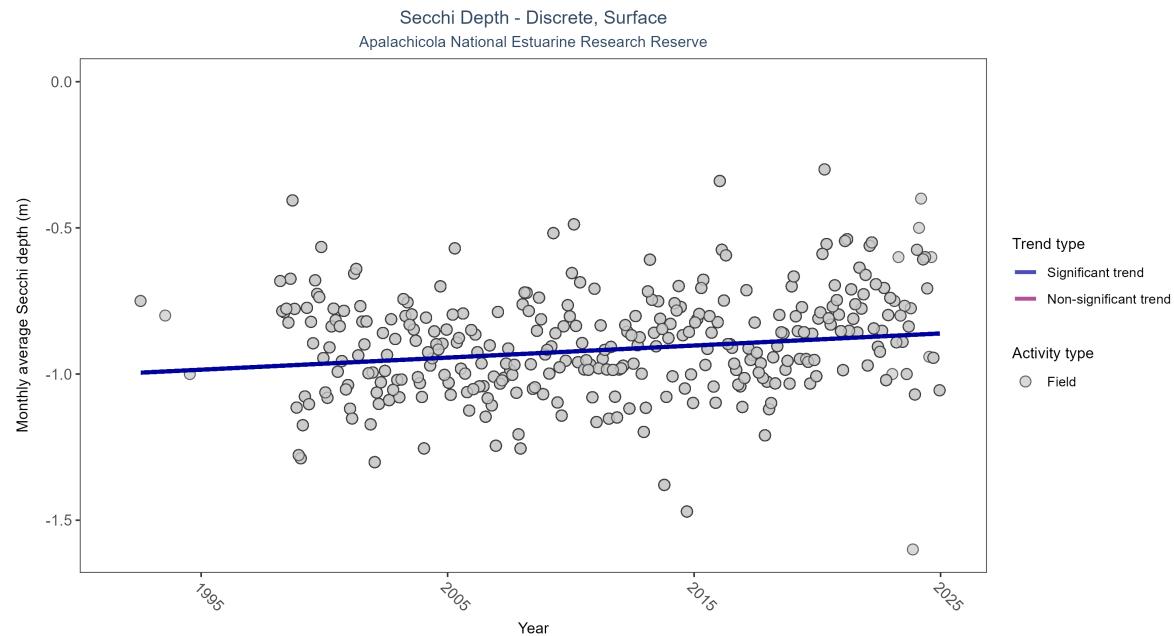


Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	45190	30	1992 - 2024	-0.8	0.15466	-0.99753	0.00413	0.0001

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

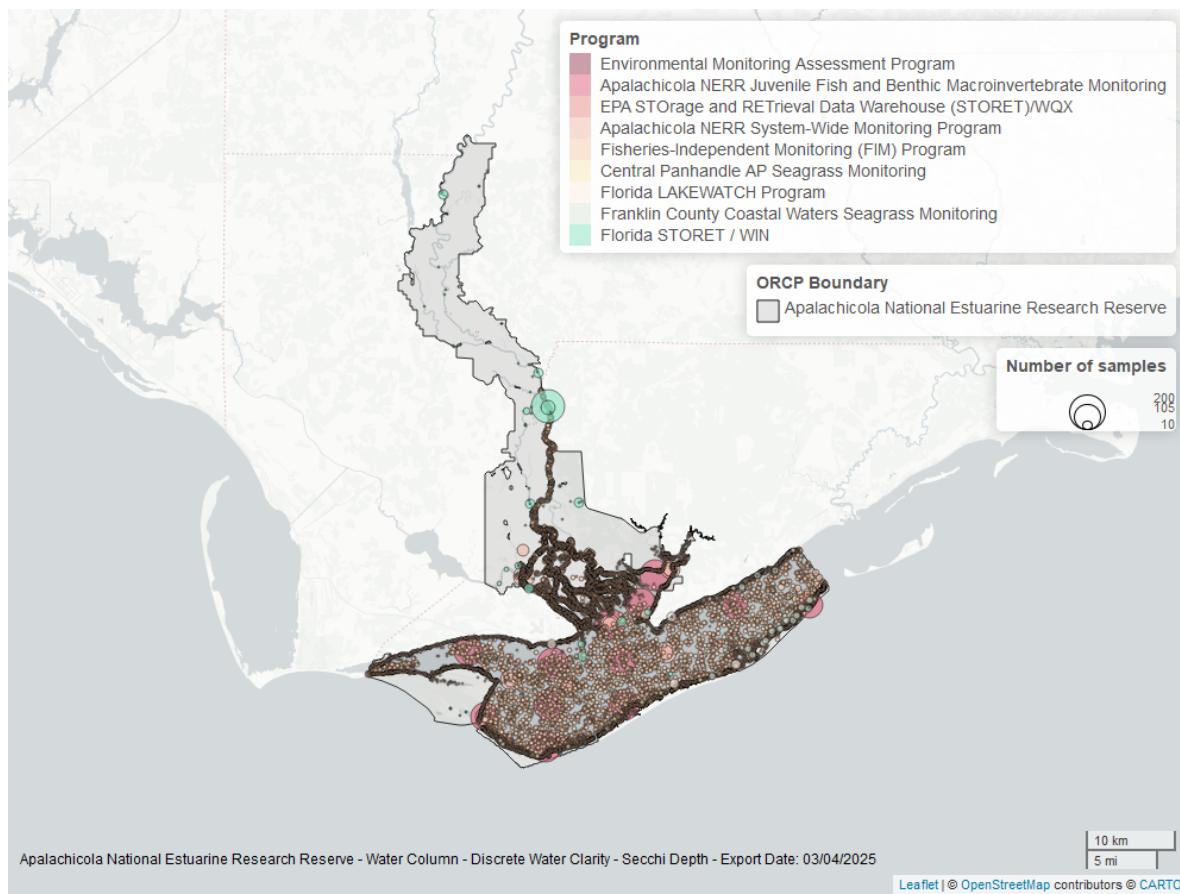


Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

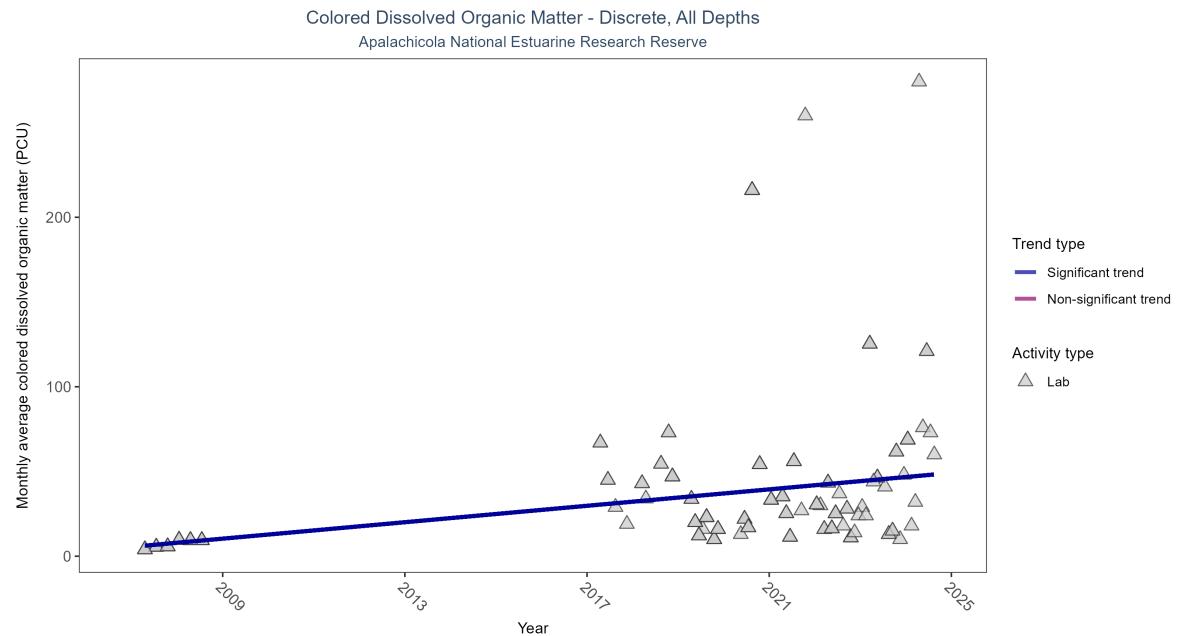


Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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	161	10	2007 - 2024	22	0.23062	5.51717	2.42381	0.0029

Monthly average colored dissolved organic matter increased by 2.42 PCU per year, indicating a decrease in water clarity.

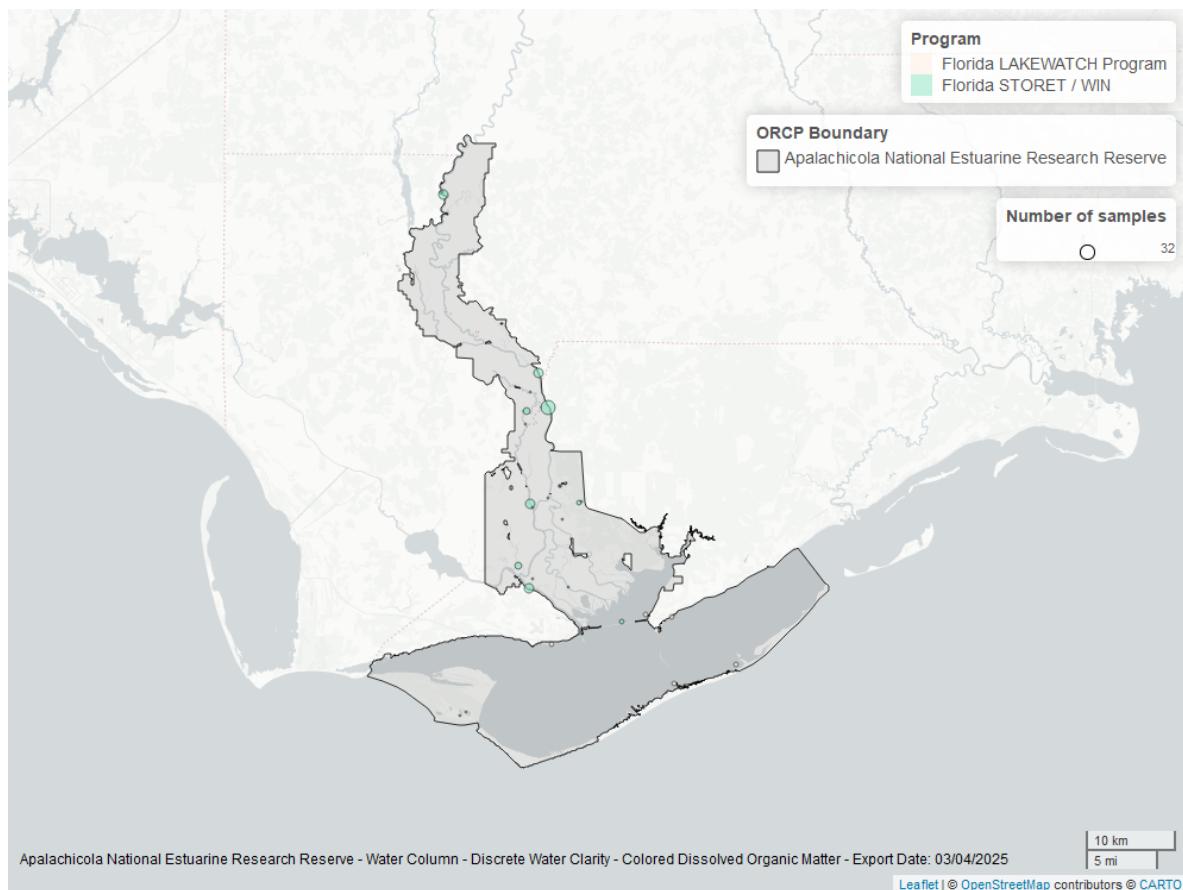


Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Apalachicola National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.