Yellow River Marsh Aquatic Preserve

SEACAR Water Quality Analysis

Last compiled on 30 September, 2025

Contents

Indicators

Nutrients

Total Nitrogen - Discrete

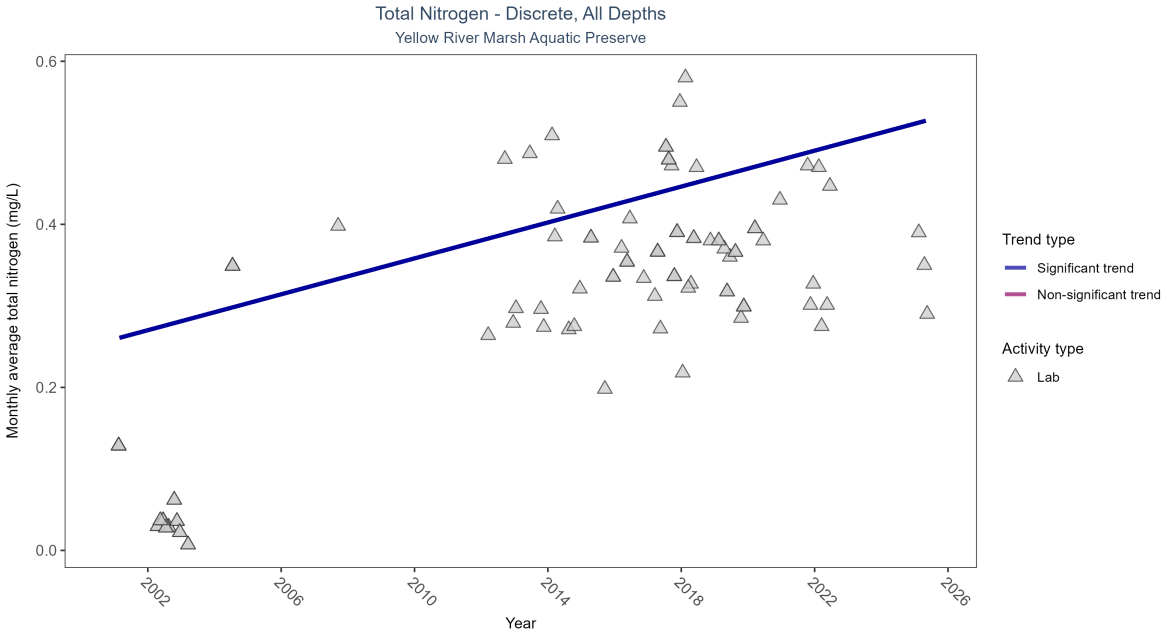

Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	109	17	2001 - 2025	0.322	0.2395	0.25912	0.01101	0.0281

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

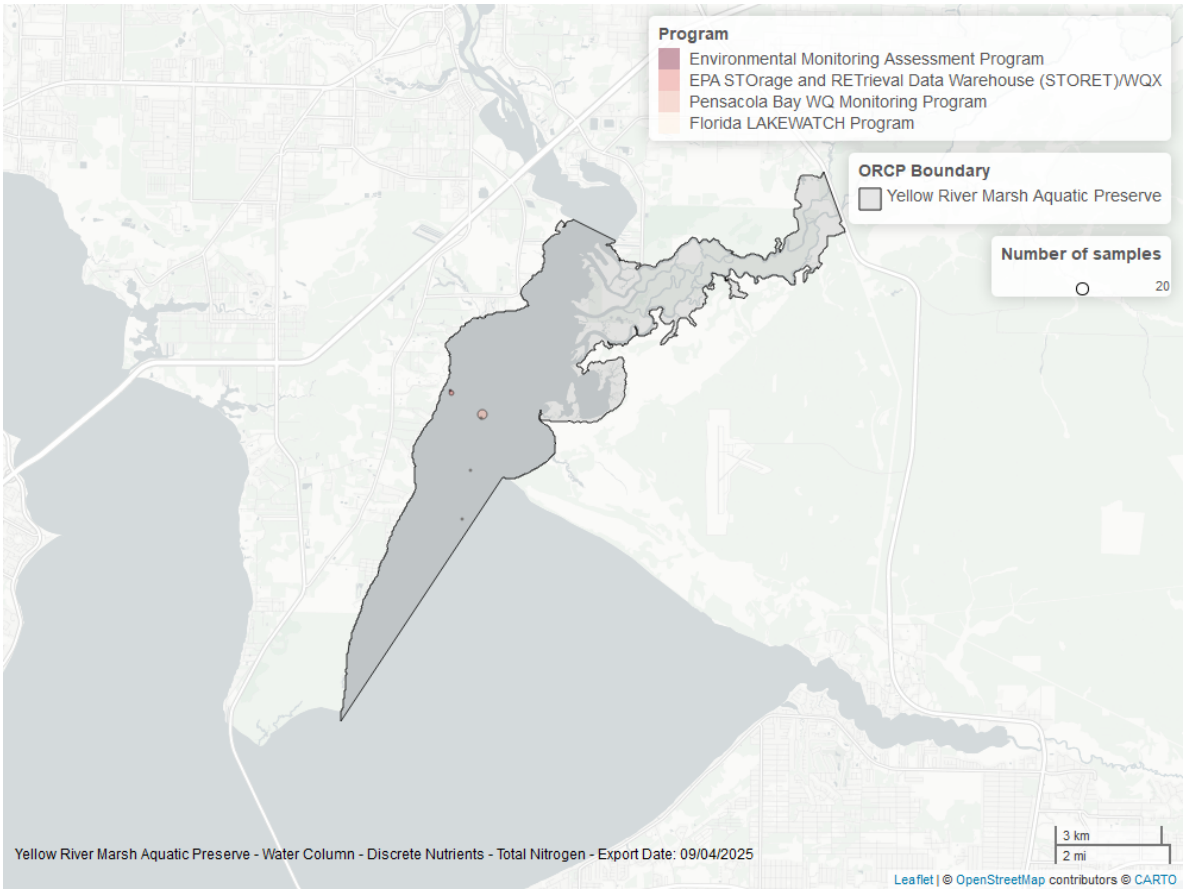

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

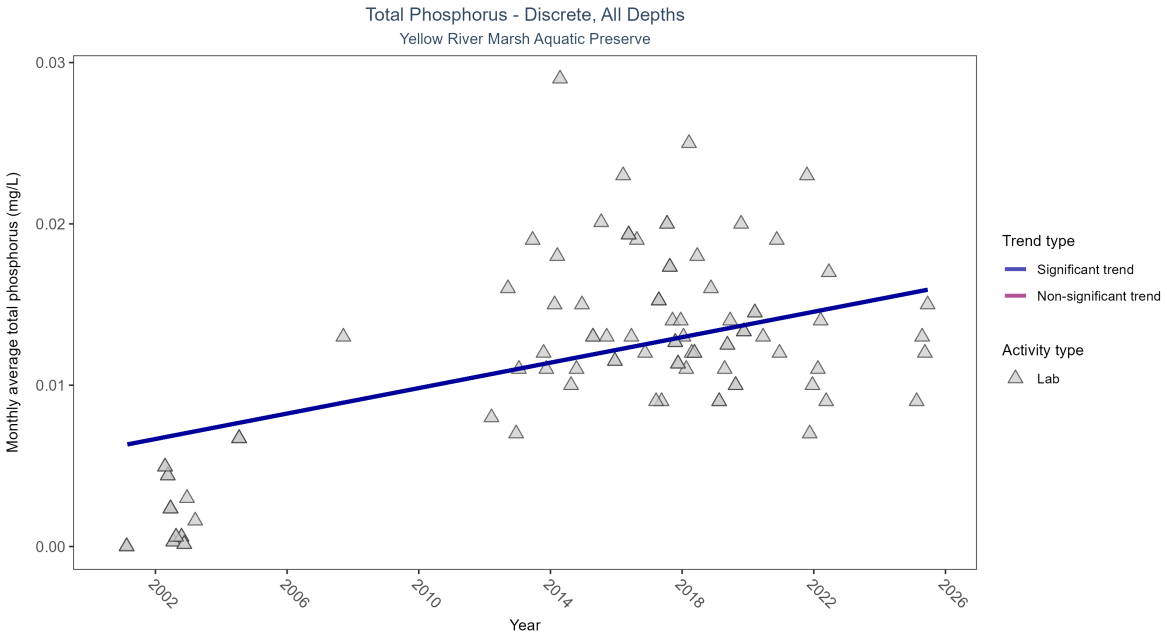

Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	107	17	2001 - 2025	0.012	0.27143	0.00627	0.00039	0.0186

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

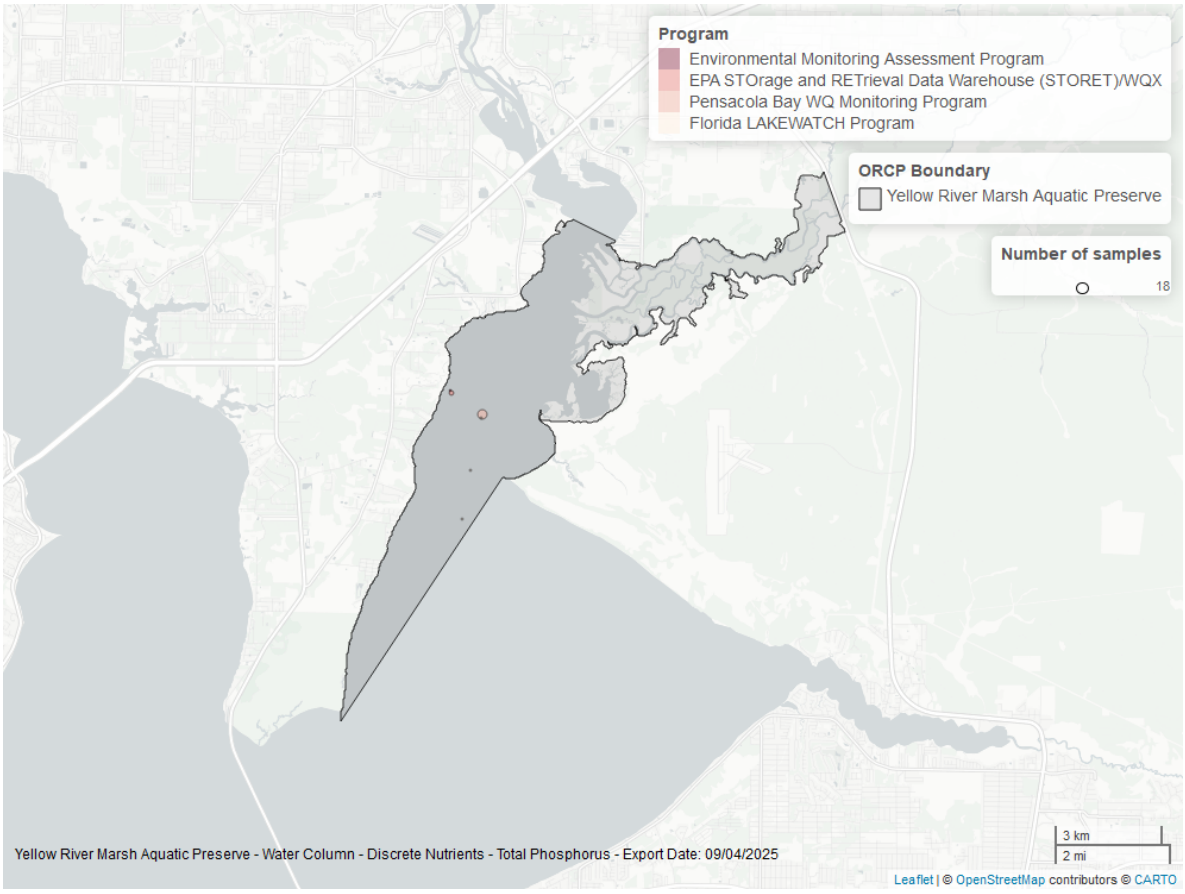

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

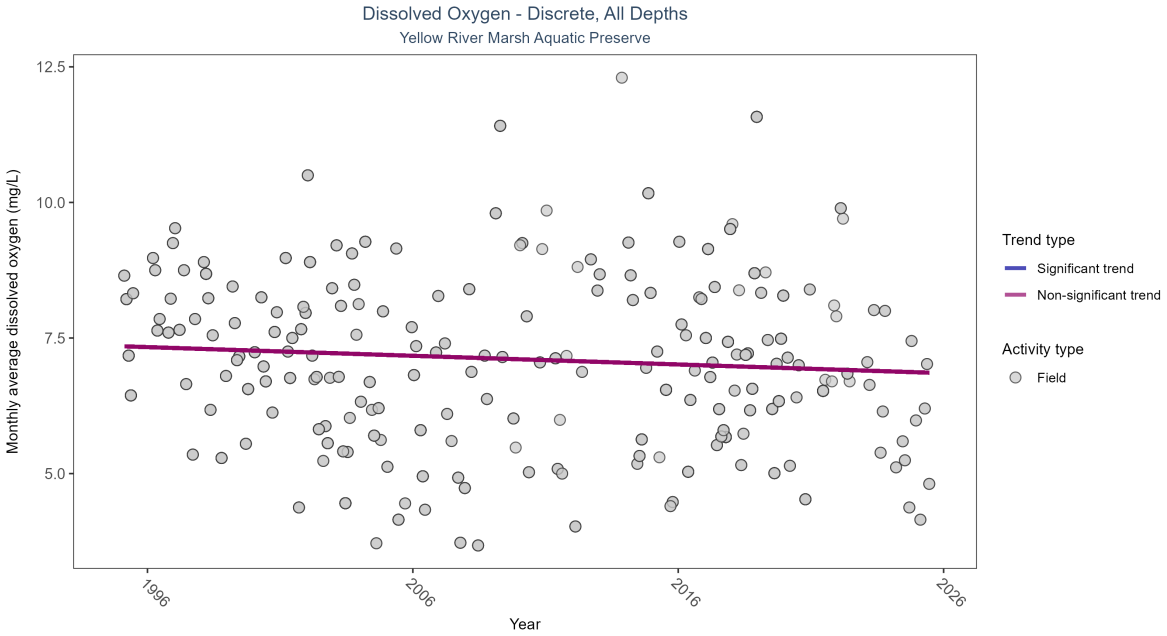

Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

Table 3: Seasonal Kendall-Tau Results for - Dissolved Oxygen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median Result Value	Tau	Sen Intercept	Sen Slope	P
Field	No significant trend	1119	31	1995 - 2025	7.2	-0.04825	7.34801	-0.016	0.1392

Dissolved oxygen showed no detectable trend between 1995 and 2025.

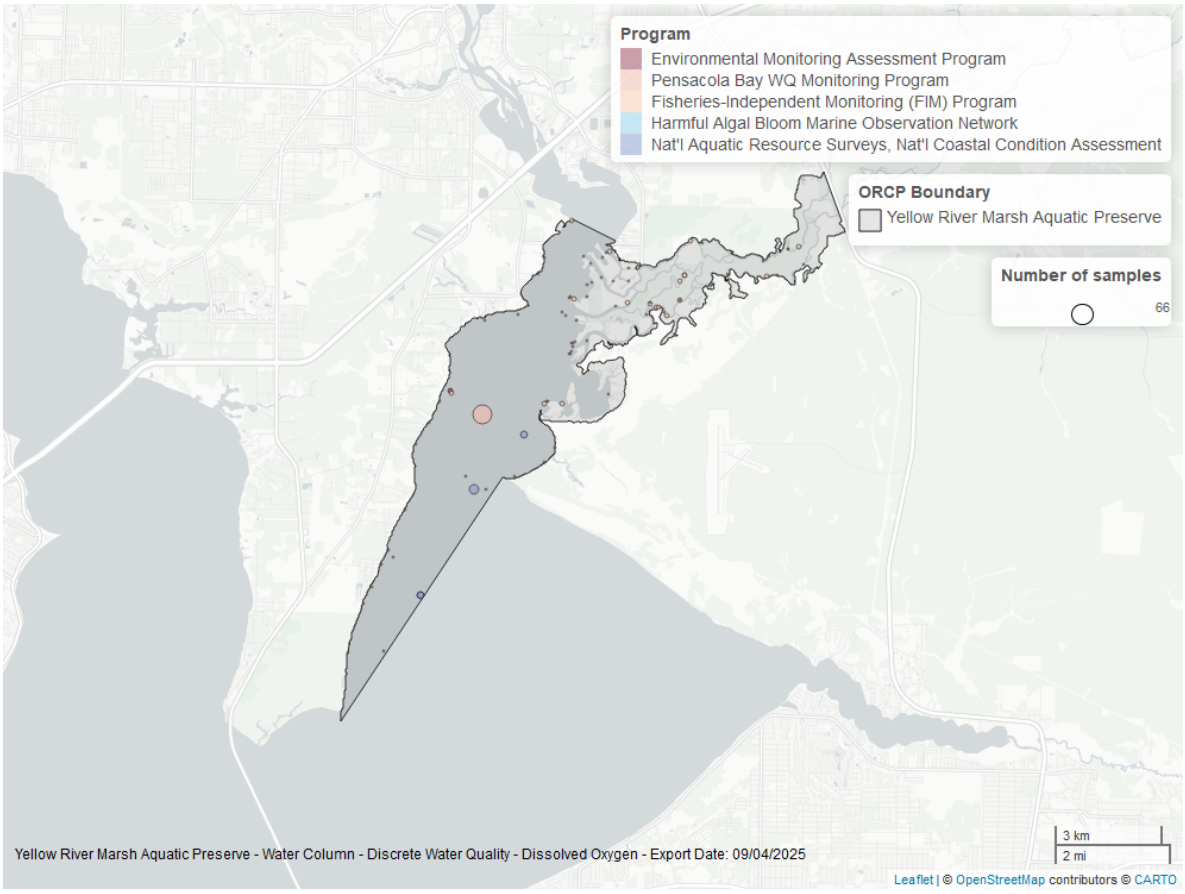

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

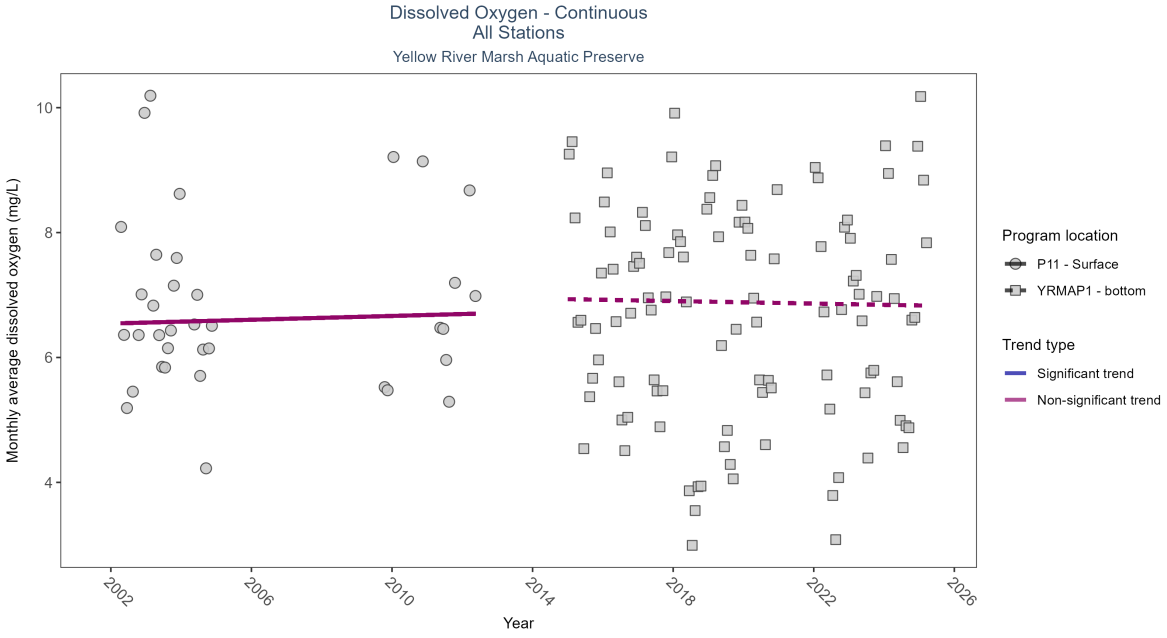

Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	No significant trend	267617	10	2015 - 2025	7.00	-0.04	6.93	-0.01	0.4884
P11	No significant trend	131	7	2002 - 2012	6.37	0.04	6.54	0.02	0.4884

No detectable change in monthly average dissolved oxygen was observed at two locations.

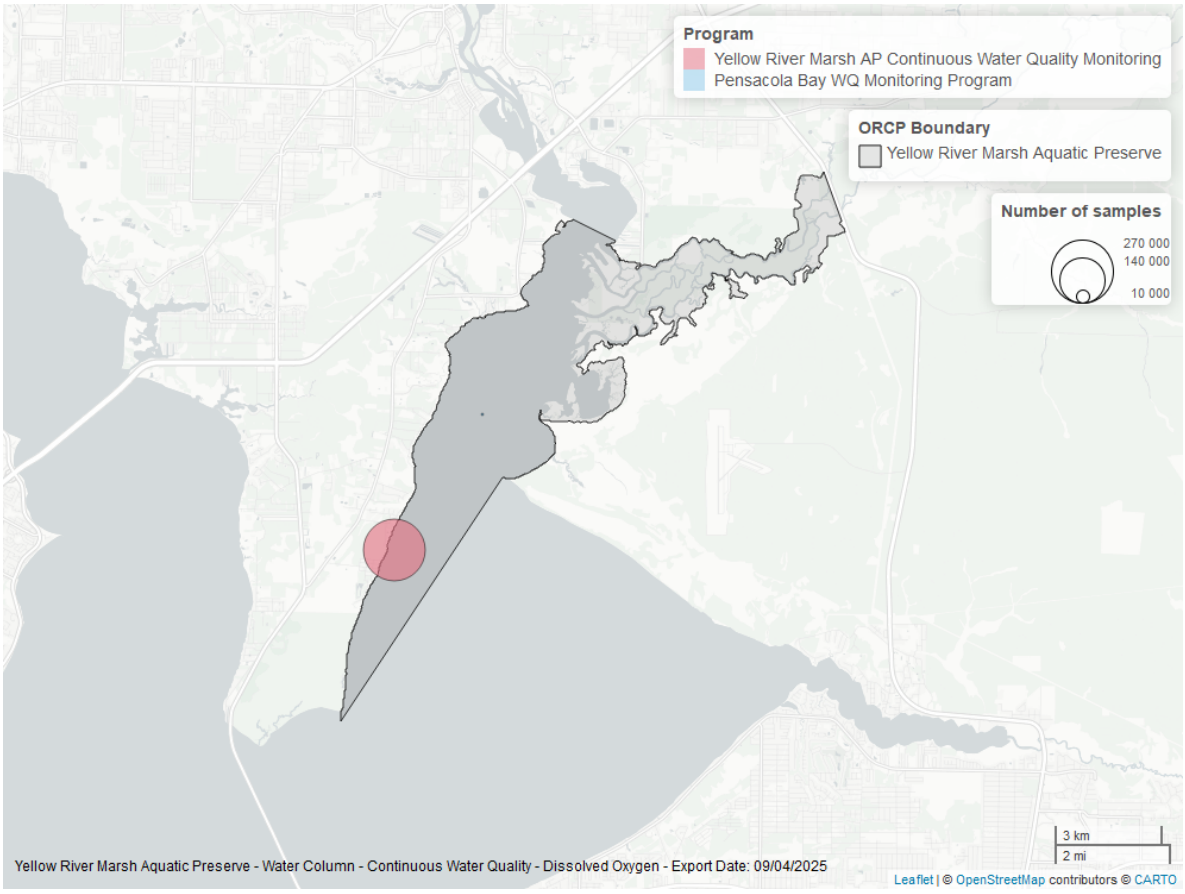

Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

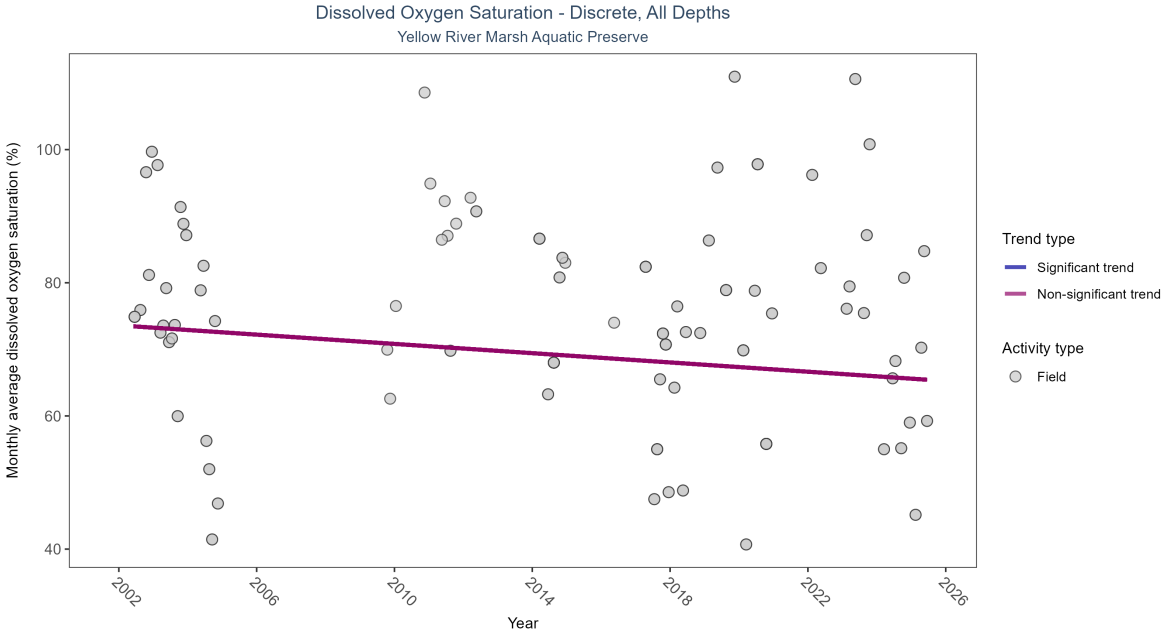

Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	183	17	2002 - 2025	75.6	-0.0935	73.60381	-0.34809	0.3327

Dissolved oxygen saturation showed no detectable trend between 2002 and 2025.

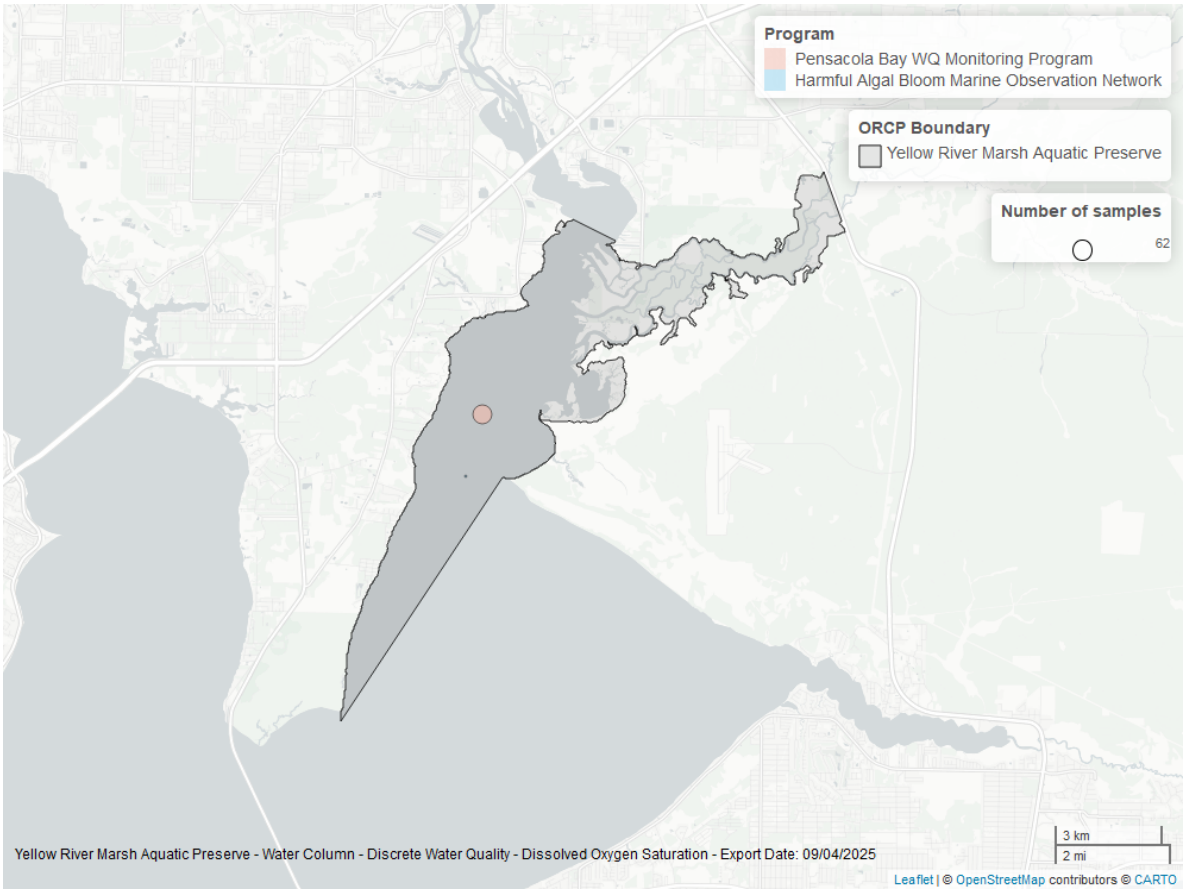

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

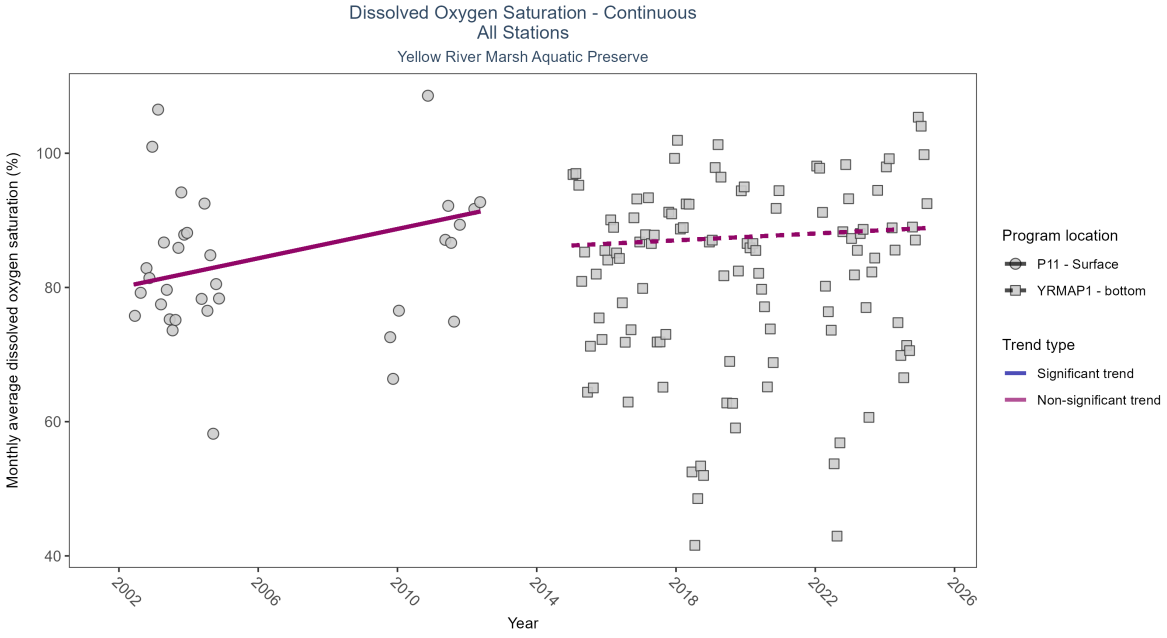

Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	No significant trend	273885	10	2015 - 2025	87.50	0.08	86.25	0.25	0.326
P11	No significant trend	126	7	2002 - 2012	79.93	0.09	79.97	1.09	0.7119

No detectable change in monthly average dissolved oxygen saturation was observed at two locations.

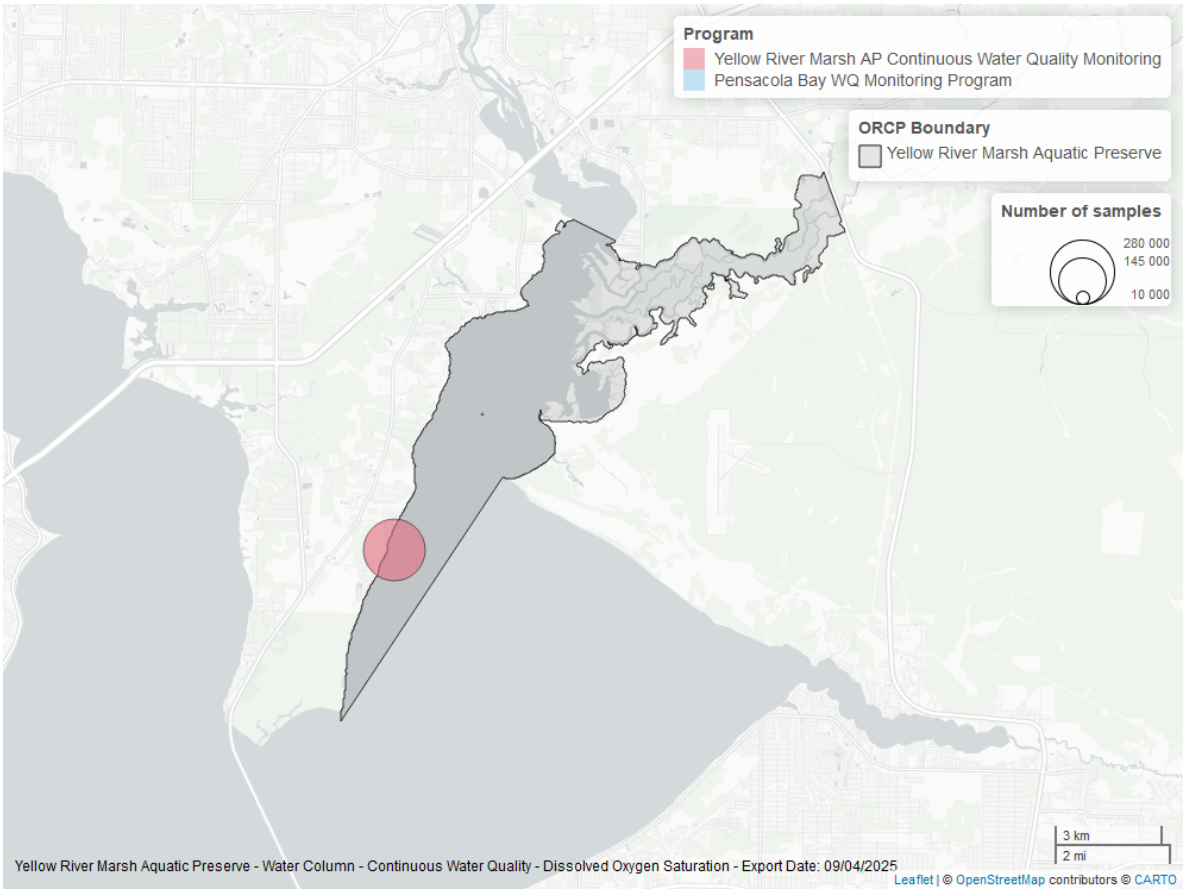

Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

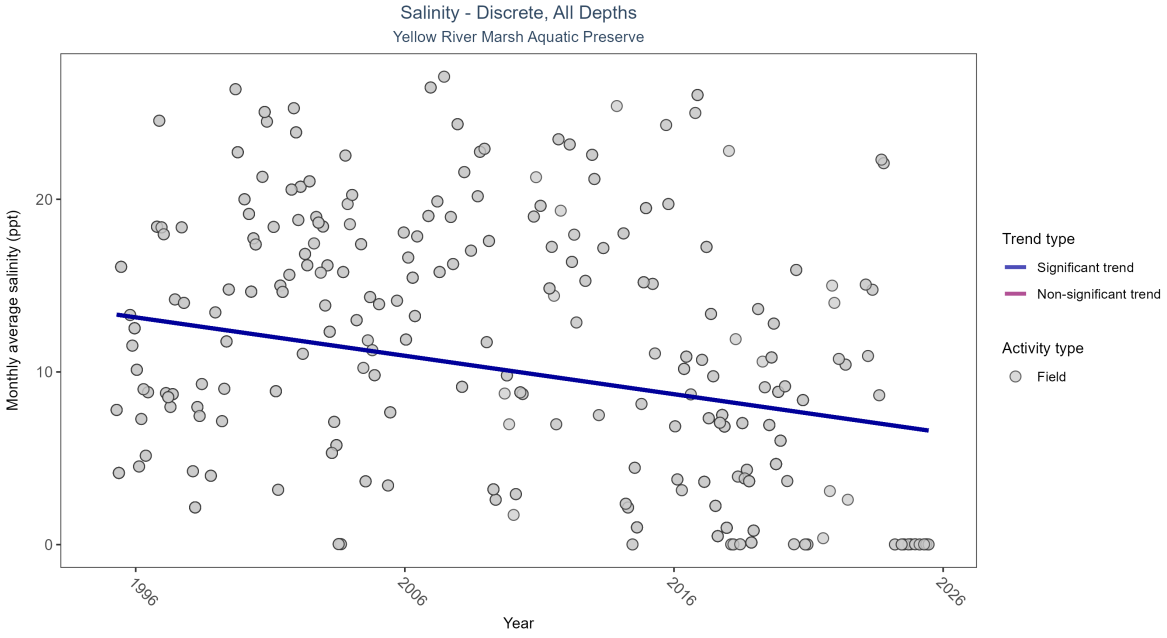

Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	Significantly decreasing trend	1252	31	1995 - 2025	11	-0.15102	13.38403	-0.2225	0.0011

Monthly average salinity decreased by 0.22 ppt per year.

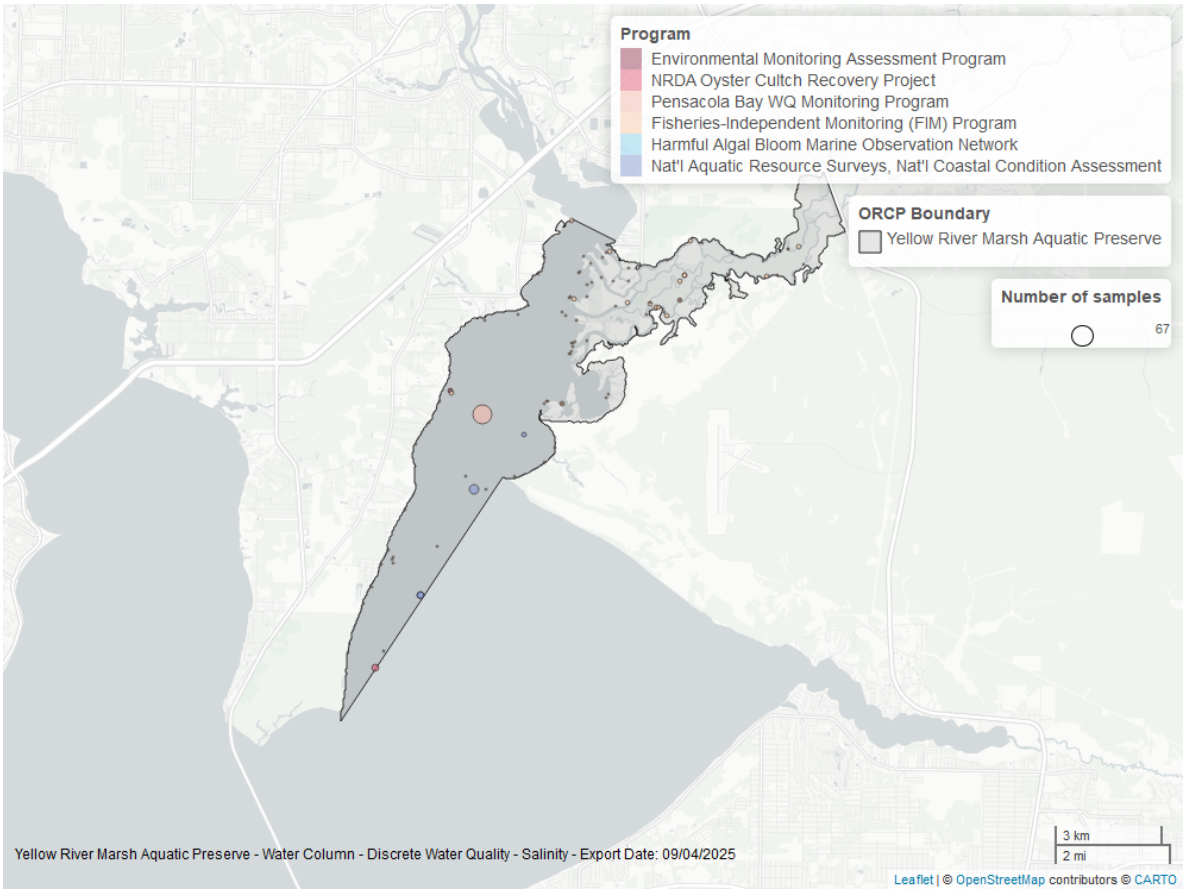

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

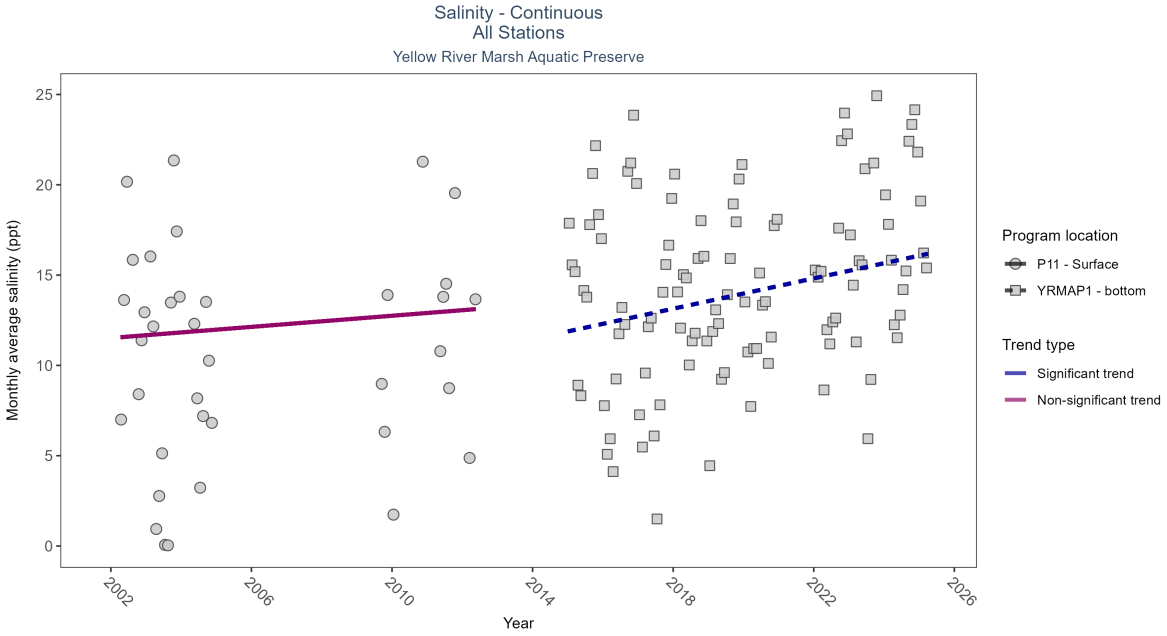

Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	Significantly increasing trend	284295	10	2015 - 2025	14.60	0.28	11.88	0.42	3e-04
P11	No significant trend	136	7	2002 - 2012	10.05	0.06	11.52	0.15	0.6499

At one program location, monthly average salinity increased by 0.42 ppt per year. No detectable change in monthly average salinity was observed at one location.

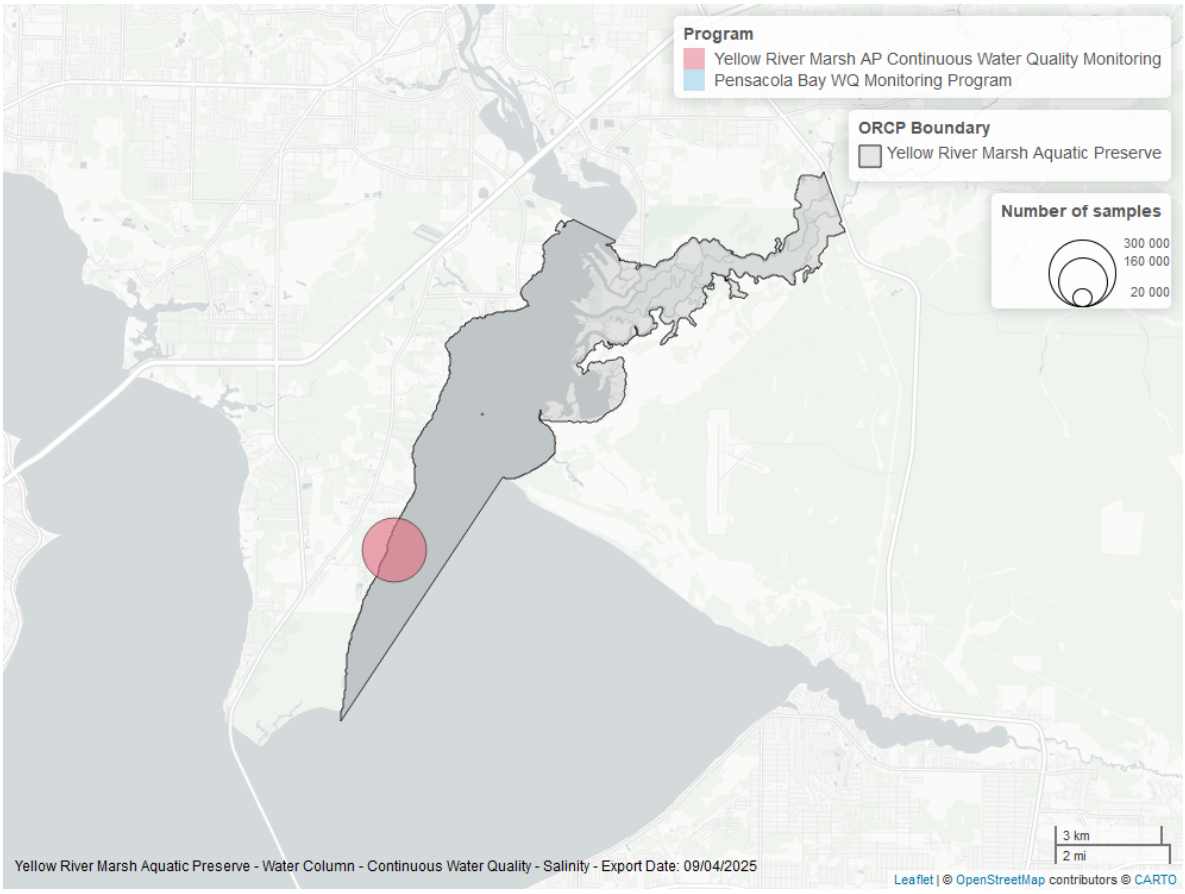

Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

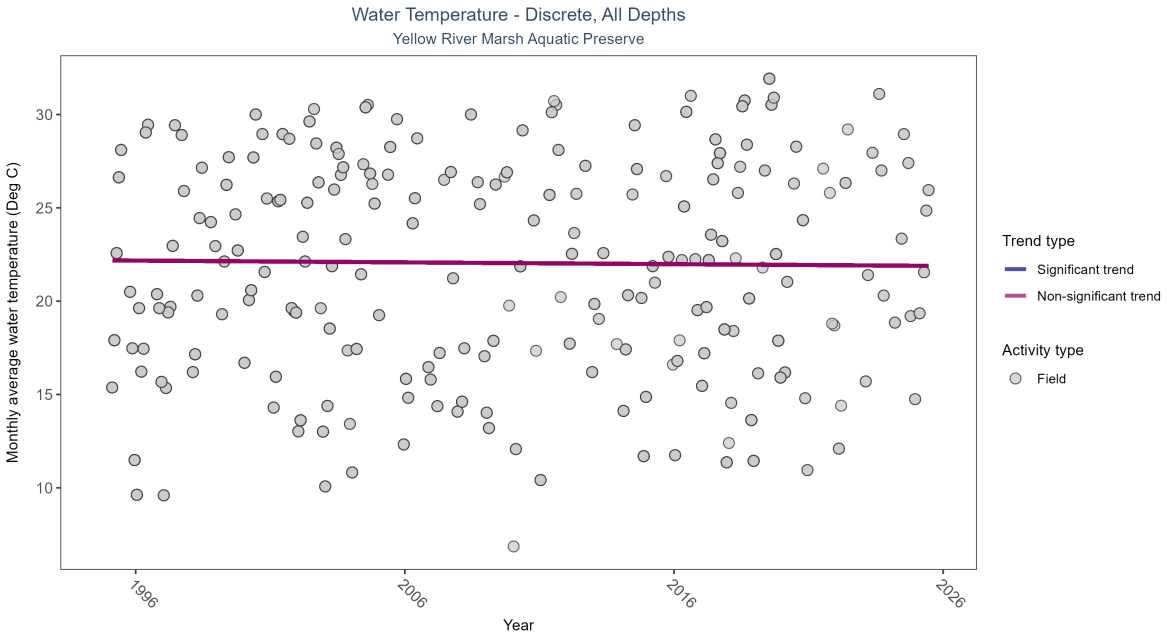

Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	No significant trend	1245	31	1995 - 2025	22	-0.0128	22.18306	-0.00955	0.6147

Water temperature showed no detectable trend between 1995 and 2025.

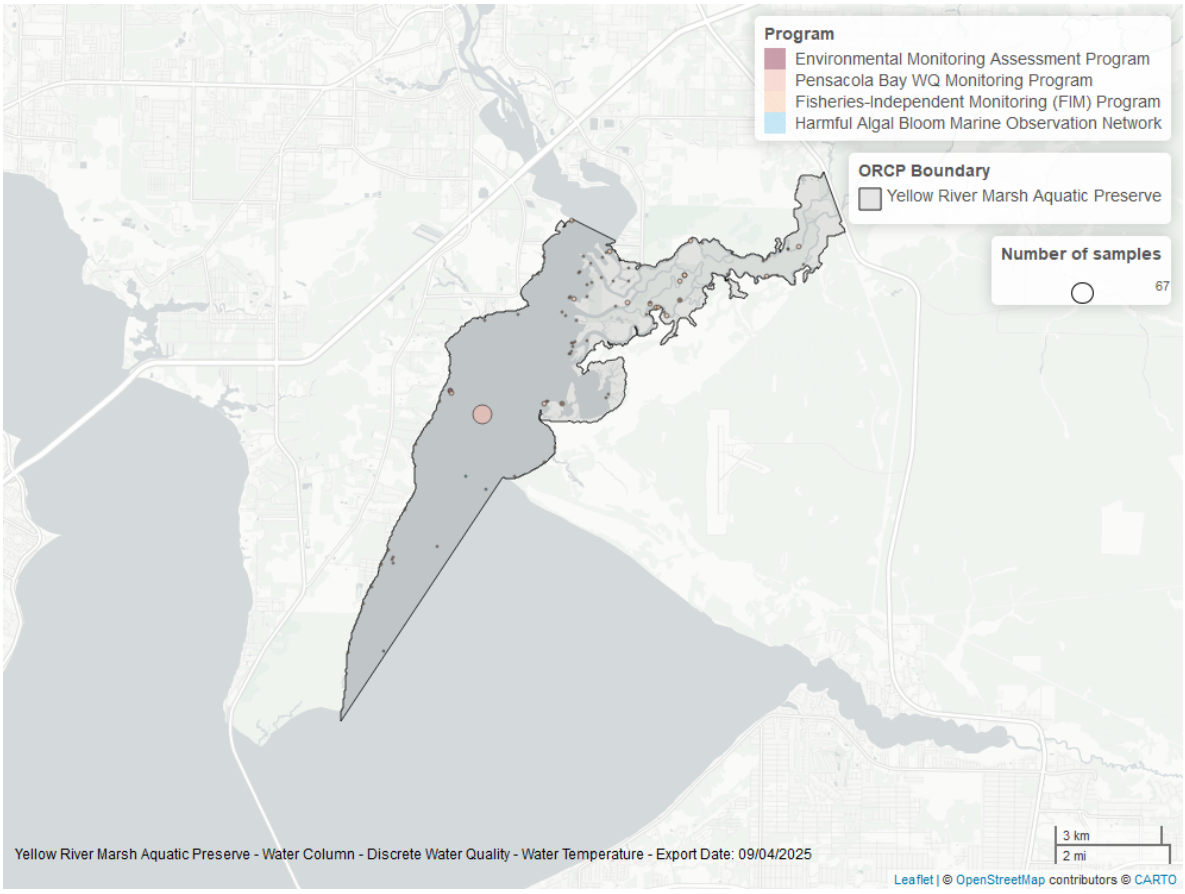

Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

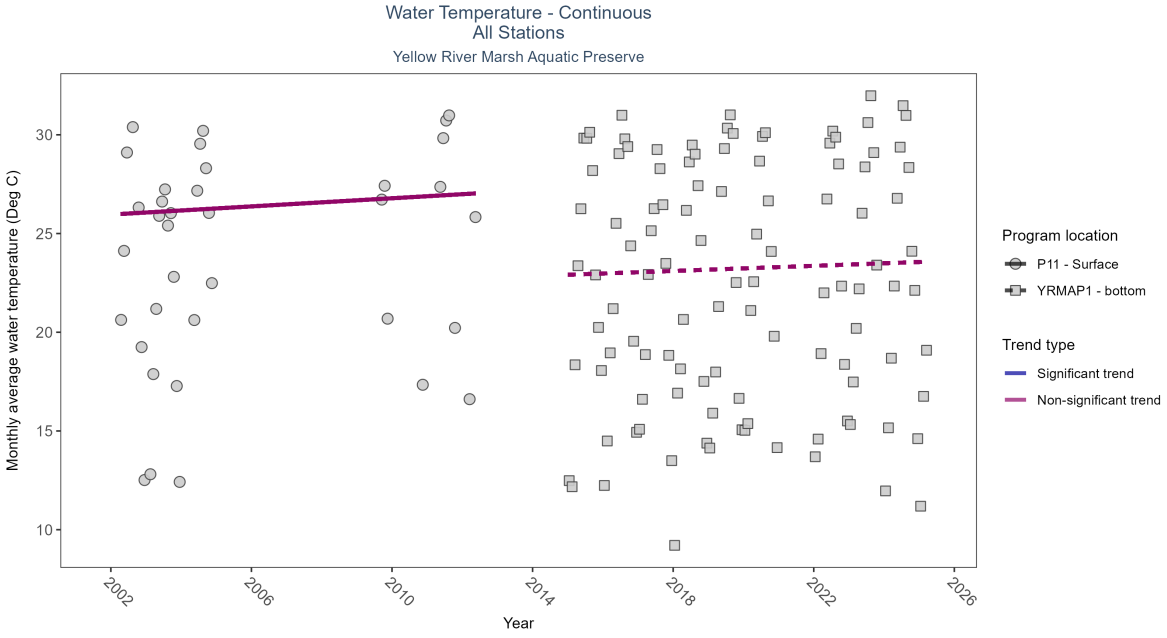

Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	No significant trend	309064	10	2015 - 2025	22.80	0.11	22.91	0.06	0.1403
P11	No significant trend	136	7	2002 - 2012	26.22	0.13	25.96	0.10	0.496

No detectable change in monthly average water temperature was observed at two locations.

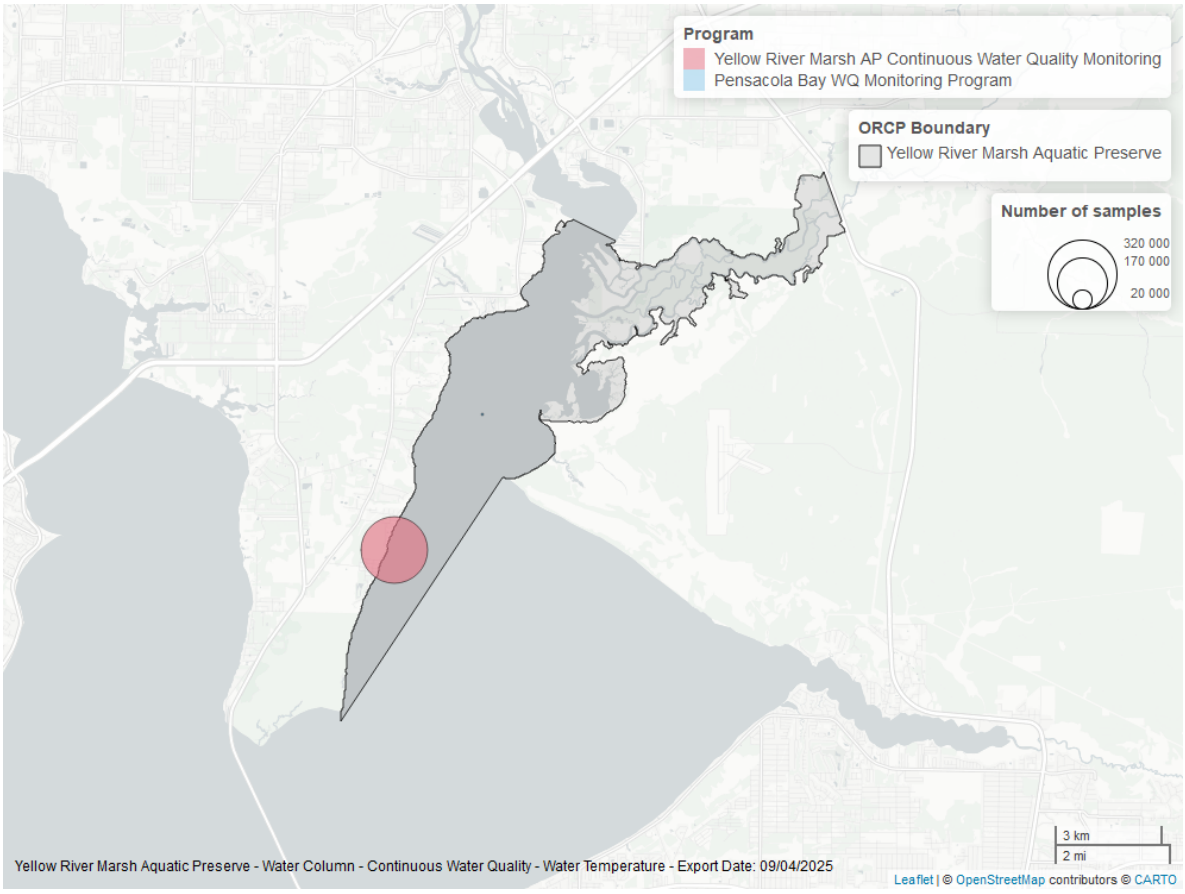

Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

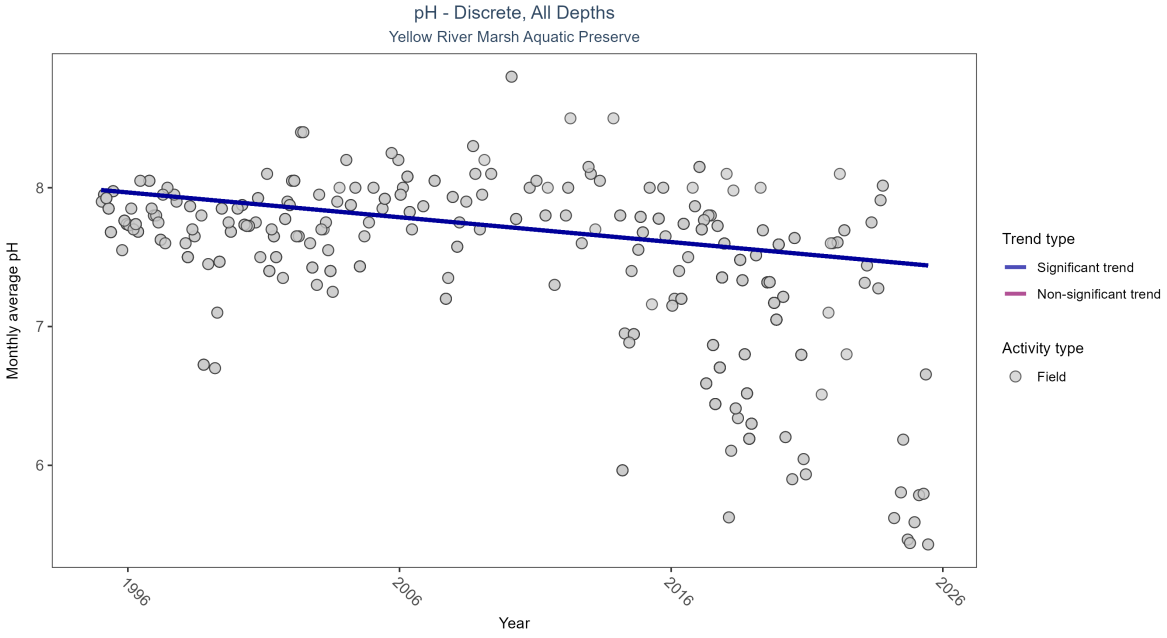

Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	751	31	1995 - 2025	7.64	-0.20867	7.98375	-0.01786	0

Monthly average pH decreased by 0.02 pH units per year.

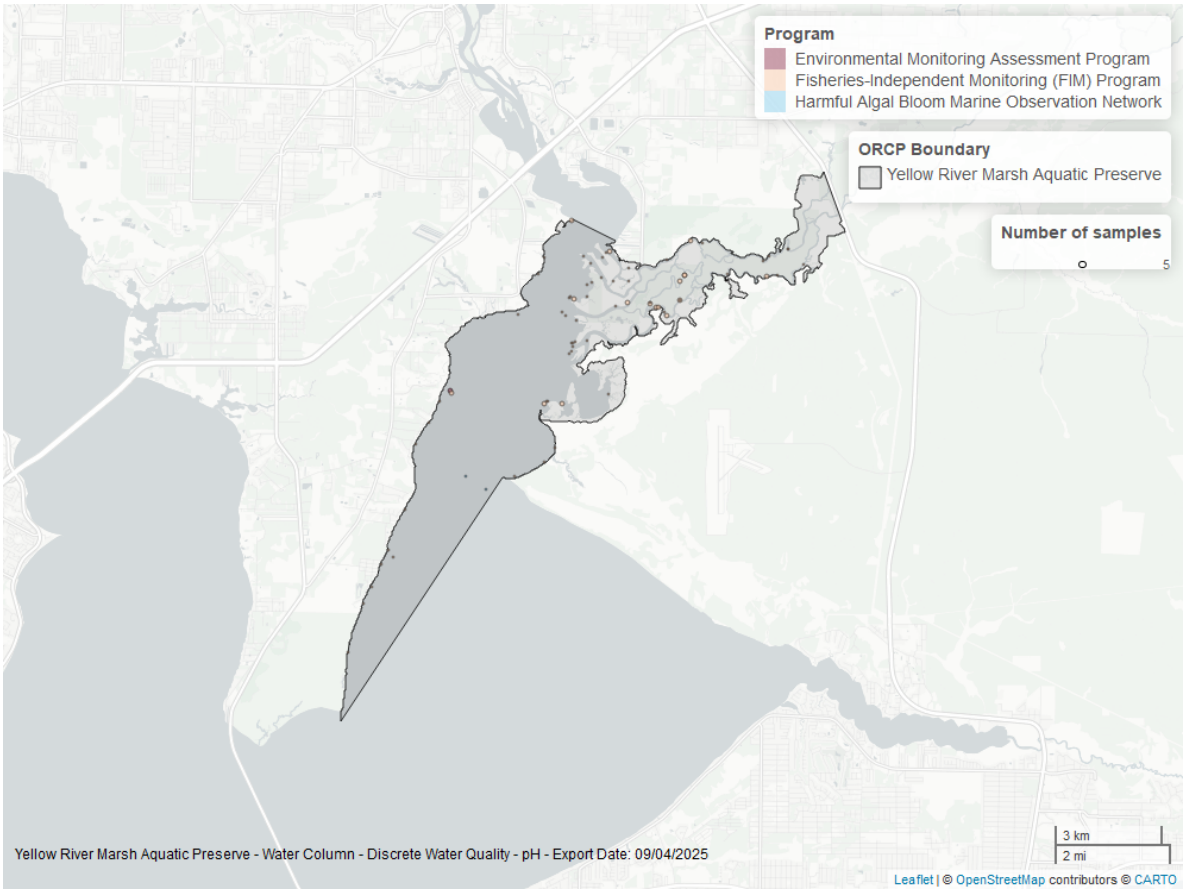

Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

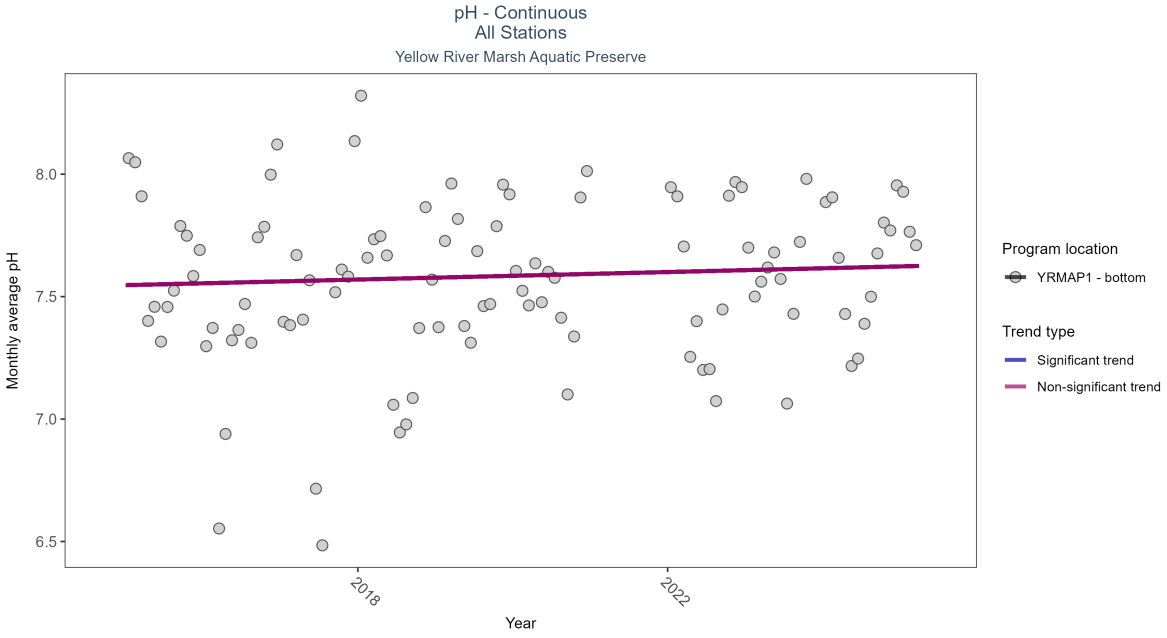

Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	No significant trend	282641	10	2015 - 2025	7.6	0.09	7.55	0.01	0.2568

No detectable change in monthly average pH was observed at one location.

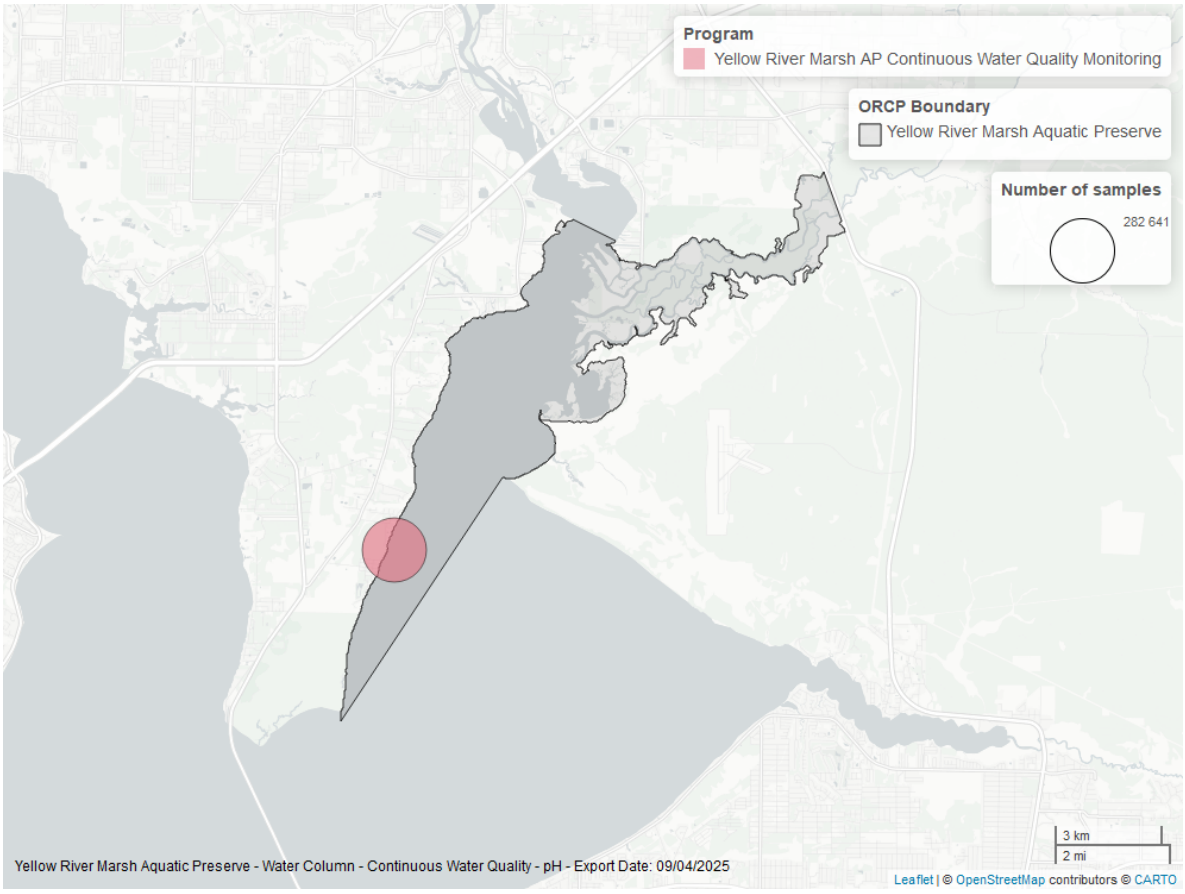

Figure 24: Map showing location of ph continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

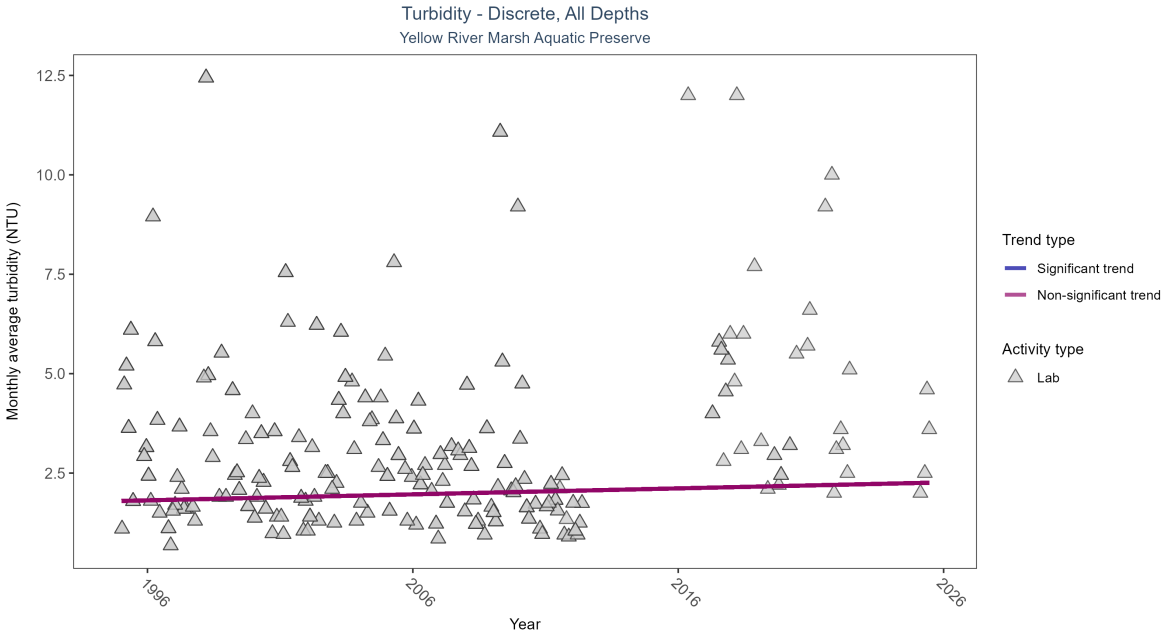

Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	No significant trend	593	26	1995 - 2025	2.5	0.08445	1.79891	0.01504	0.3945

Turbidity showed no detectable trend between 1995 and 2025.

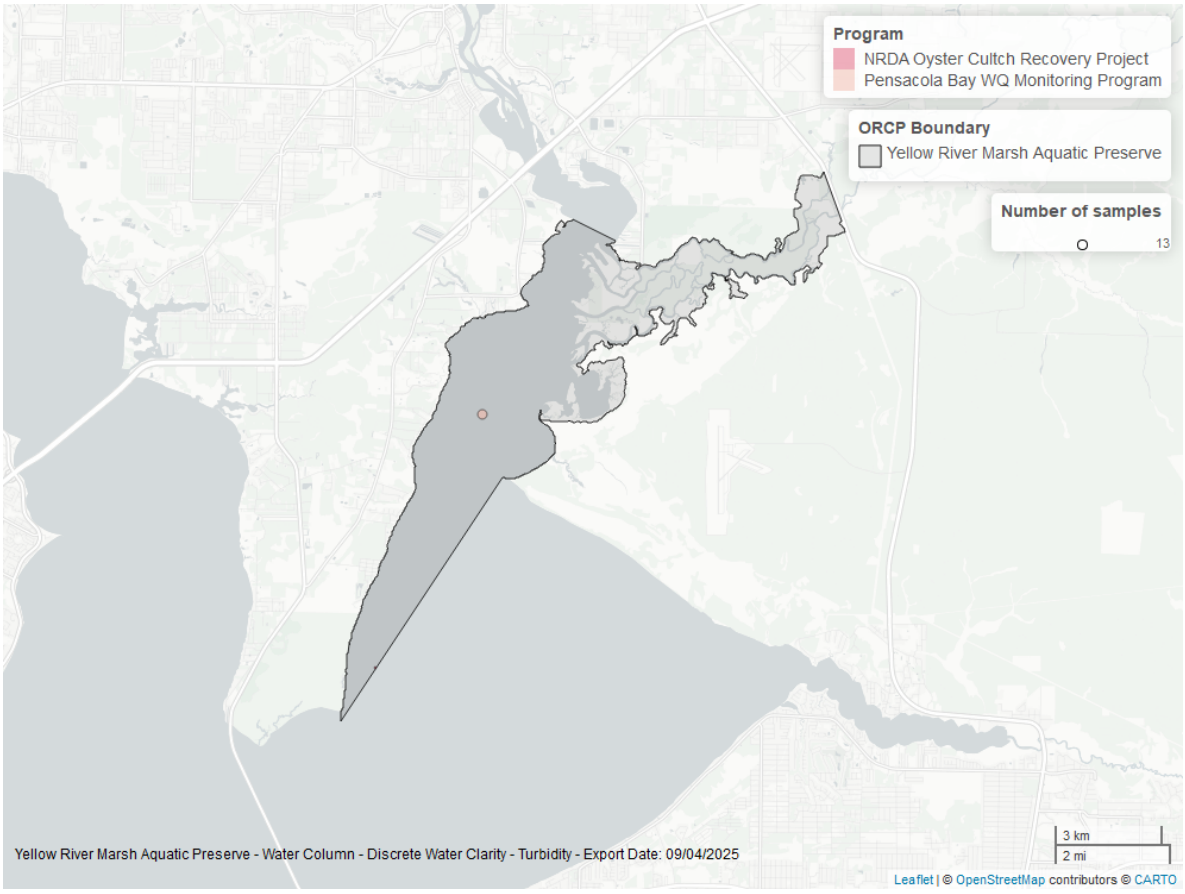

Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

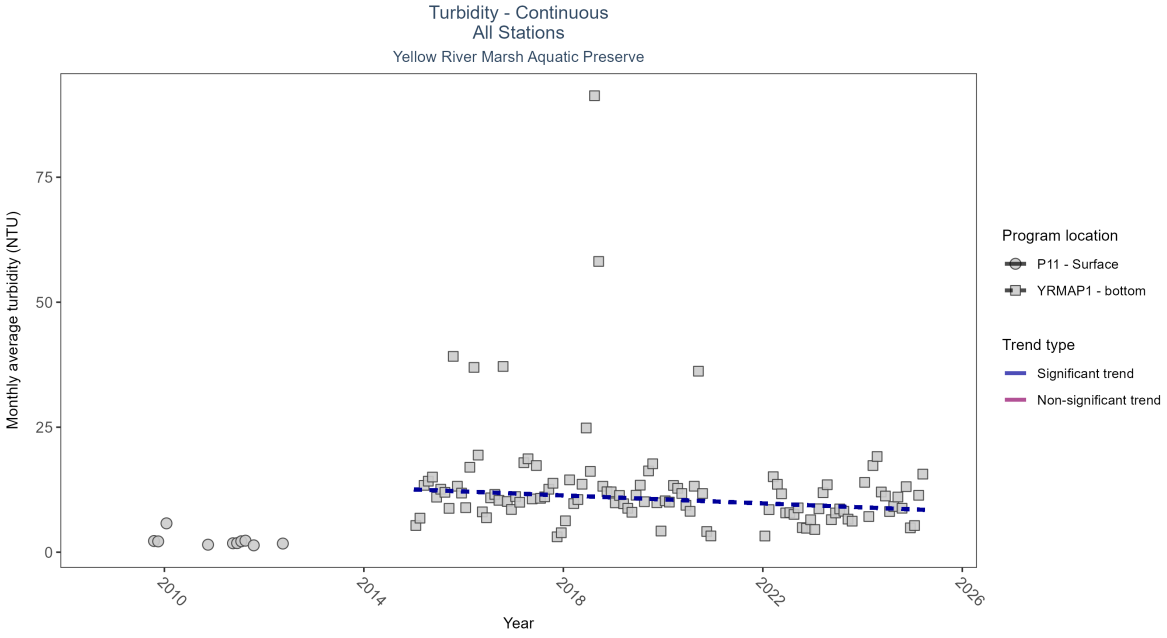

Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
YRMAP1	Significantly decreasing trend	296386	10	2015 - 2025	6	-0.22	12.55	-0.4	0.0056
P11	Insufficient data to calculate trend	37	4	2009 - 2012	2	-	-	-	-

At one program location, monthly average turbidity decreased by 0.40 NTU per year. There was insufficient data to fit a model for one location.

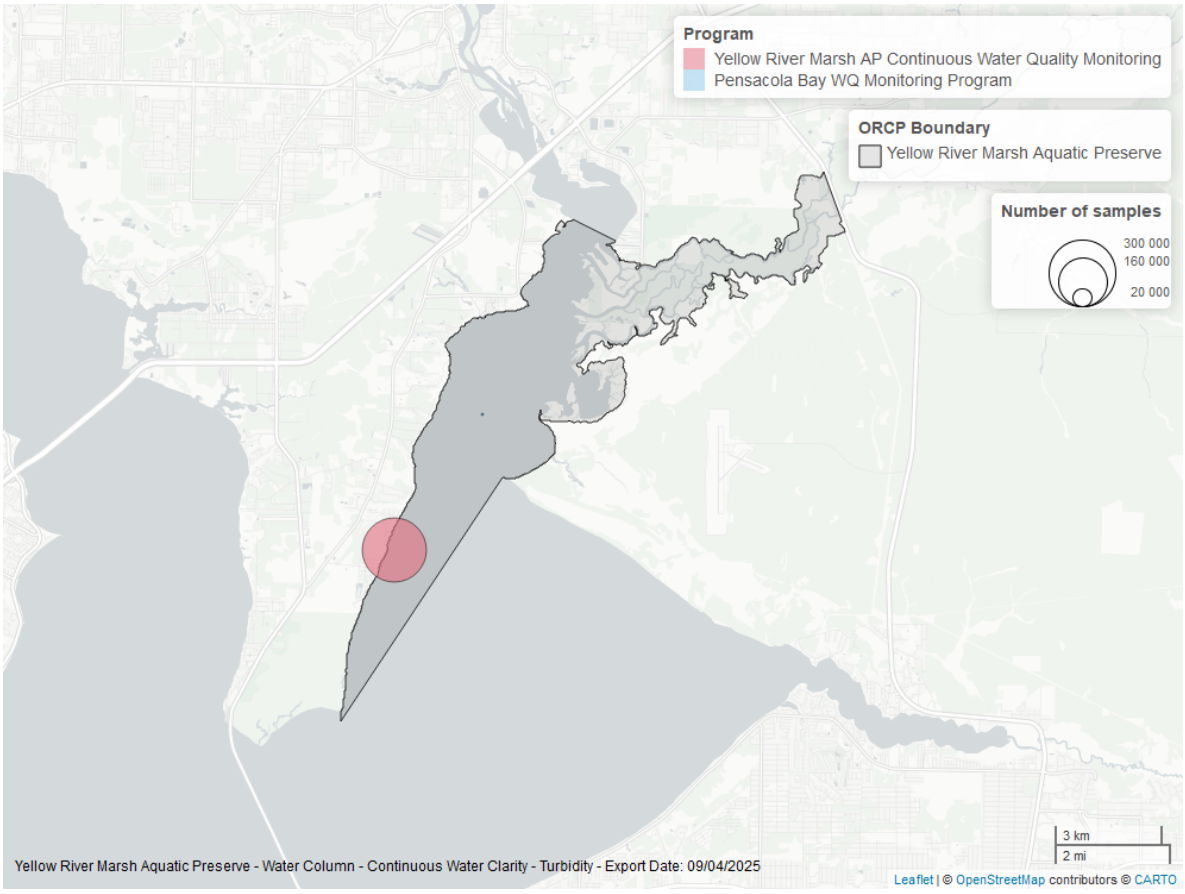

Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

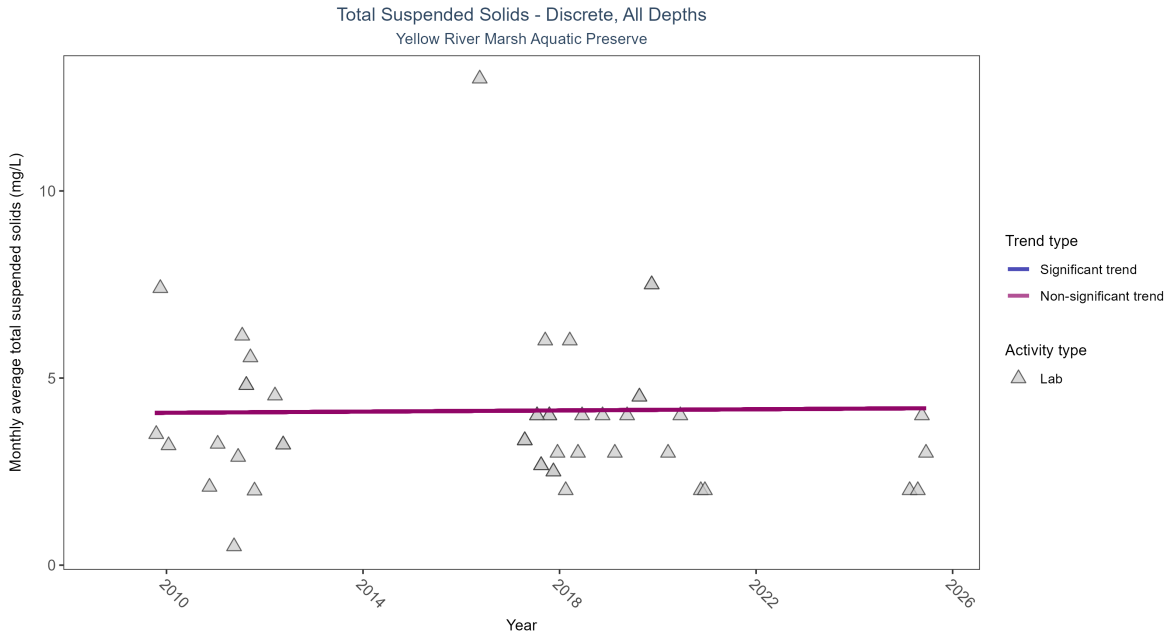

Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	No significant trend	49	10	2009 - 2025	3.24	-0.00877	4.06369	0.00786	0.7404

Total suspended solids showed no detectable trend between 2009 and 2025.

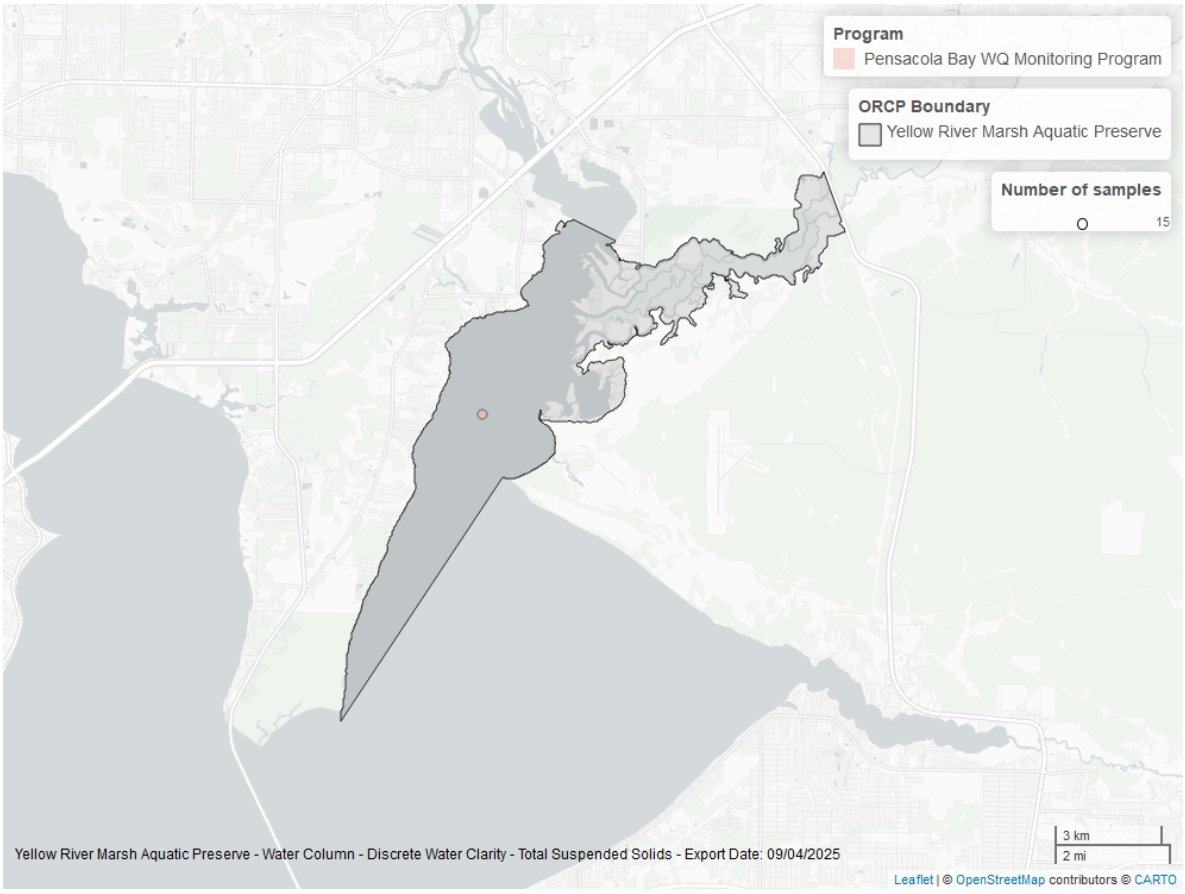

Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

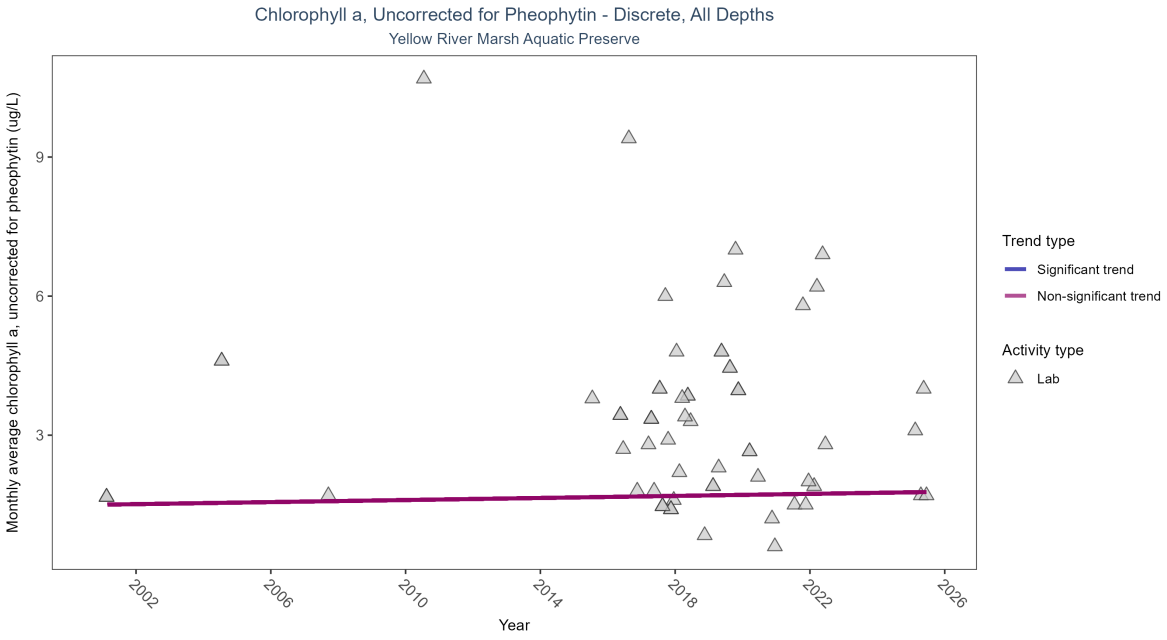

Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	No significant trend	68	13	2001 - 2025	2.8	0.05035	1.50098	0.01111	0.9342

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 2001 and 2025.

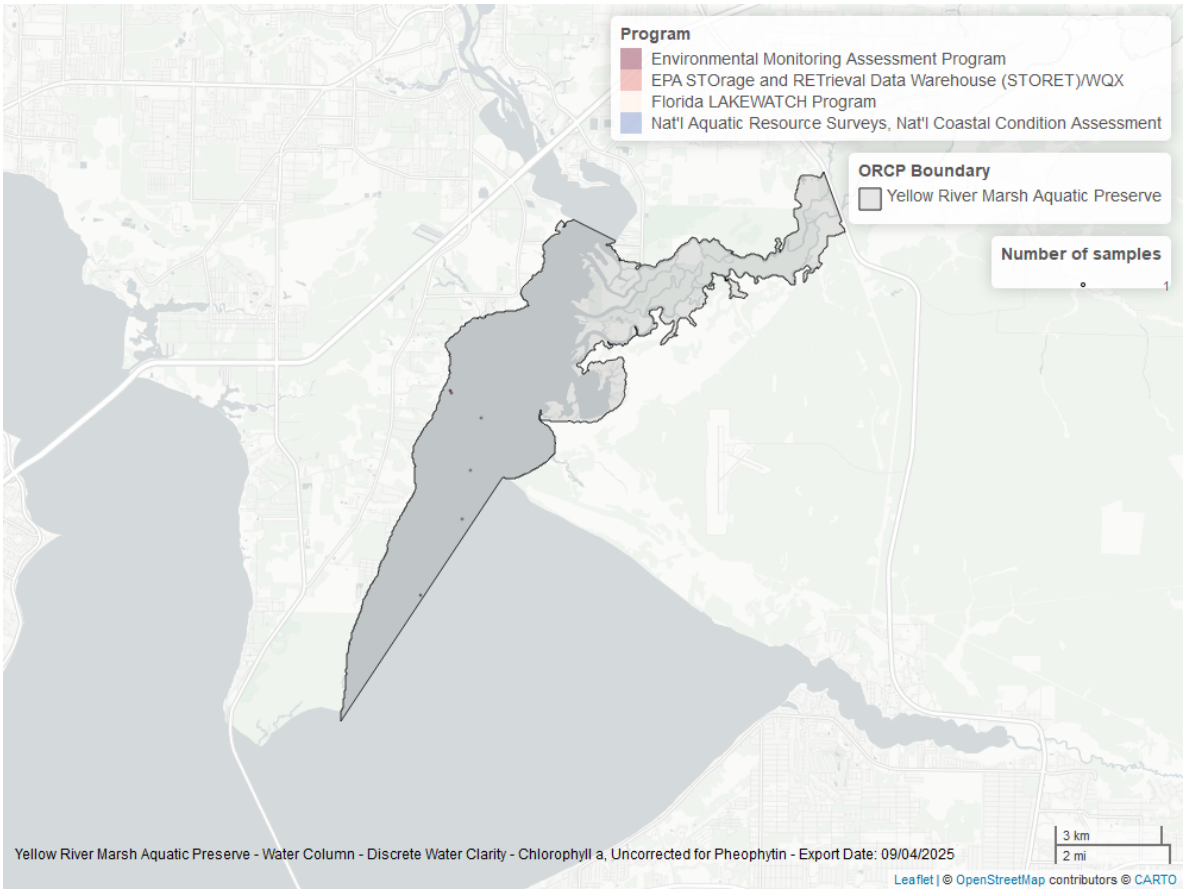

Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

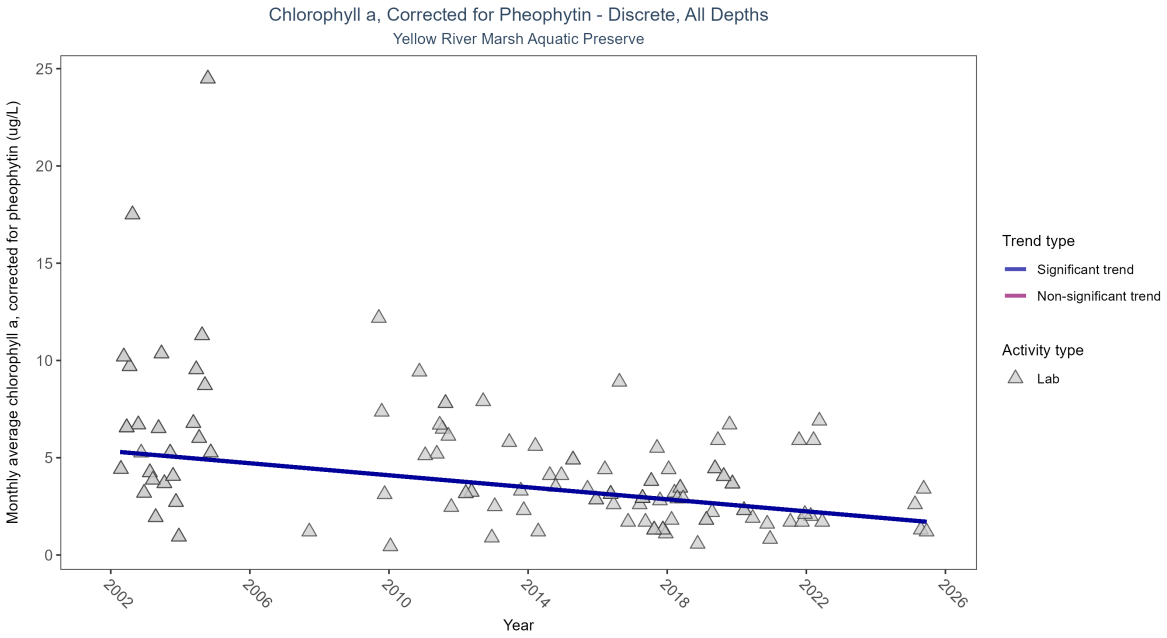

Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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 decreasing trend	146	19	2002 - 2025	3.60685	-0.31104	5.33533	-0.15458	0

Monthly average chlorophyll a, corrected for pheophytin, decreased by 0.15 µg/L per year, indicating an increase in water clarity.

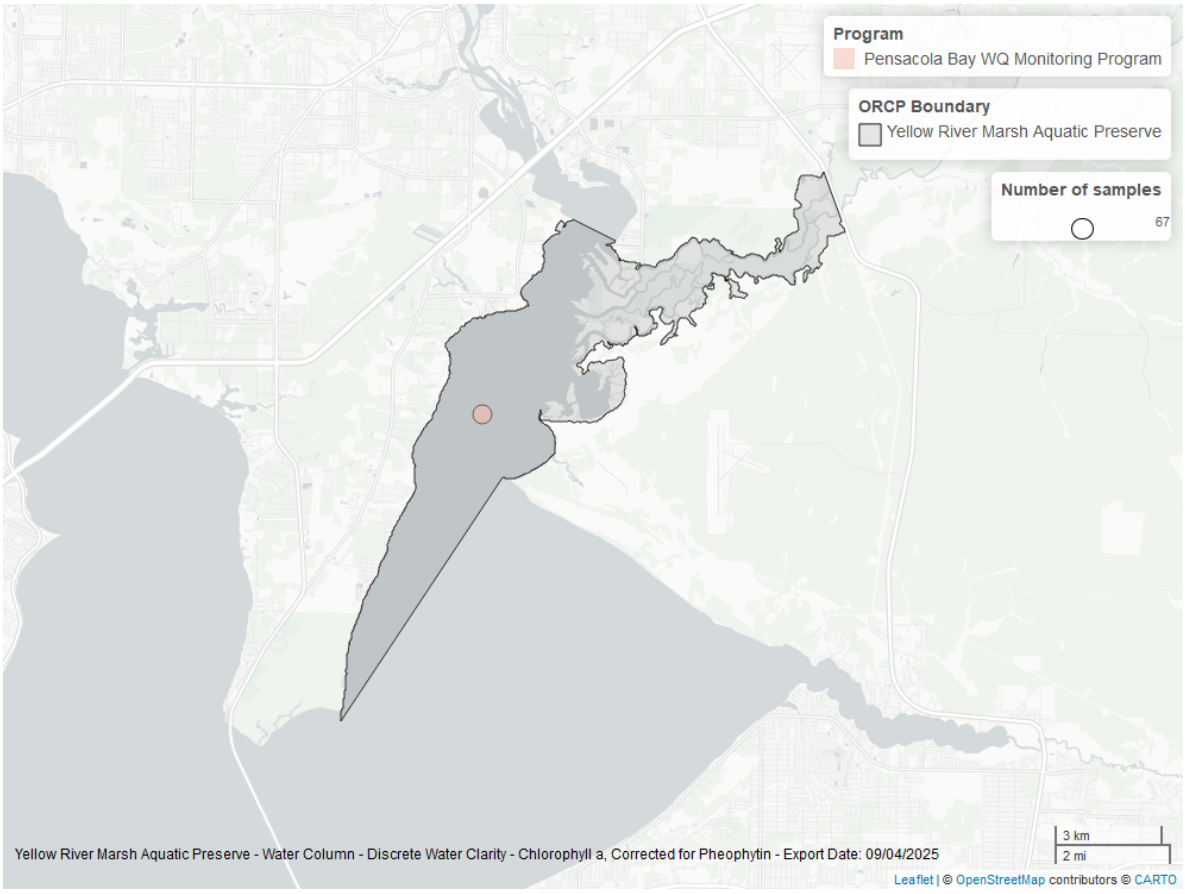

Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

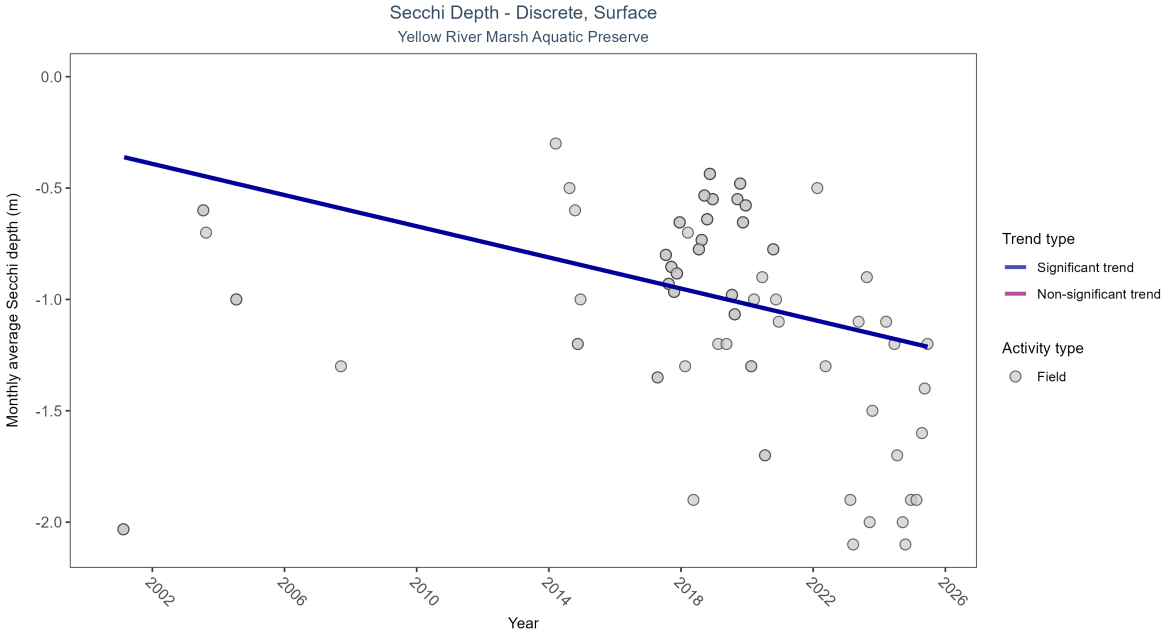

Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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 decreasing trend	242	14	2001 - 2025	-0.8	-0.32413	-0.35633	-0.035	0.0081

Monthly average Secchi depth became deeper by 0.04 m per year, indicating an increase in water clarity.

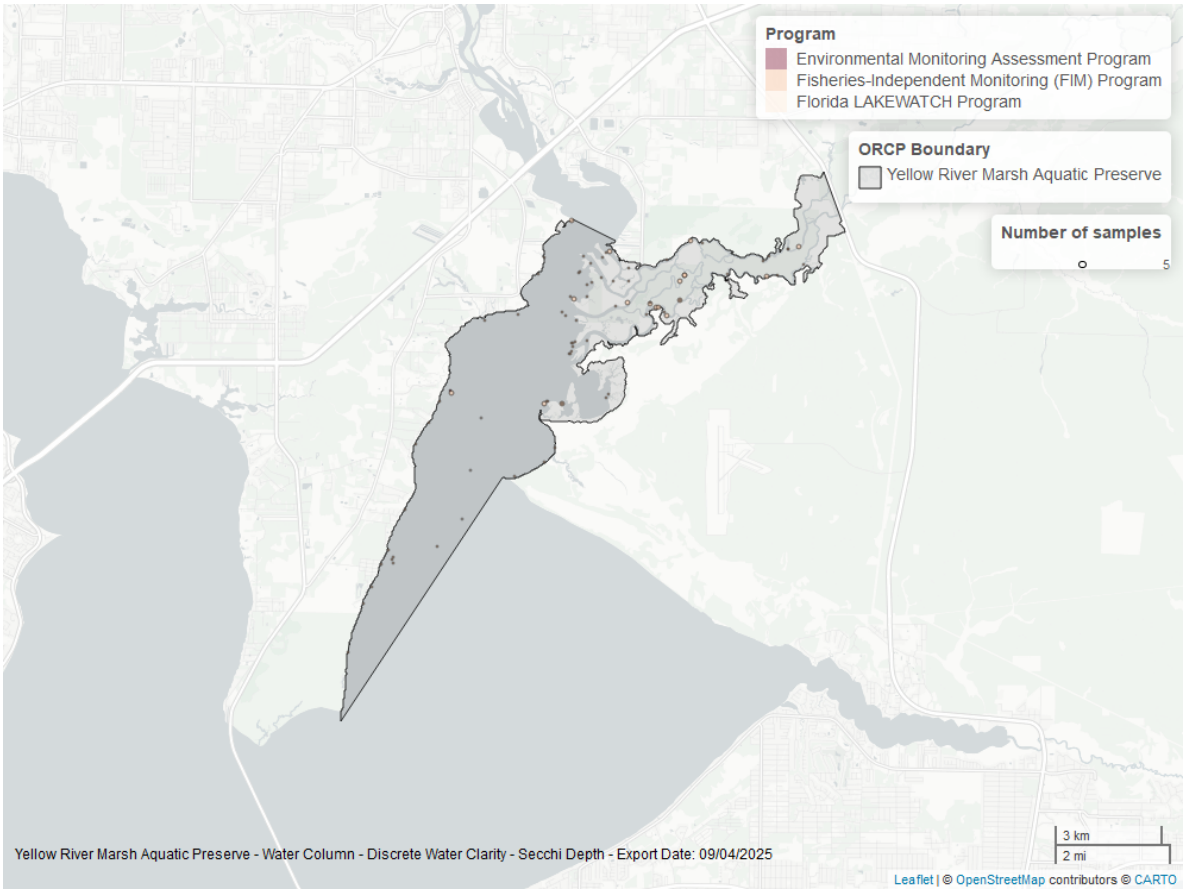

Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

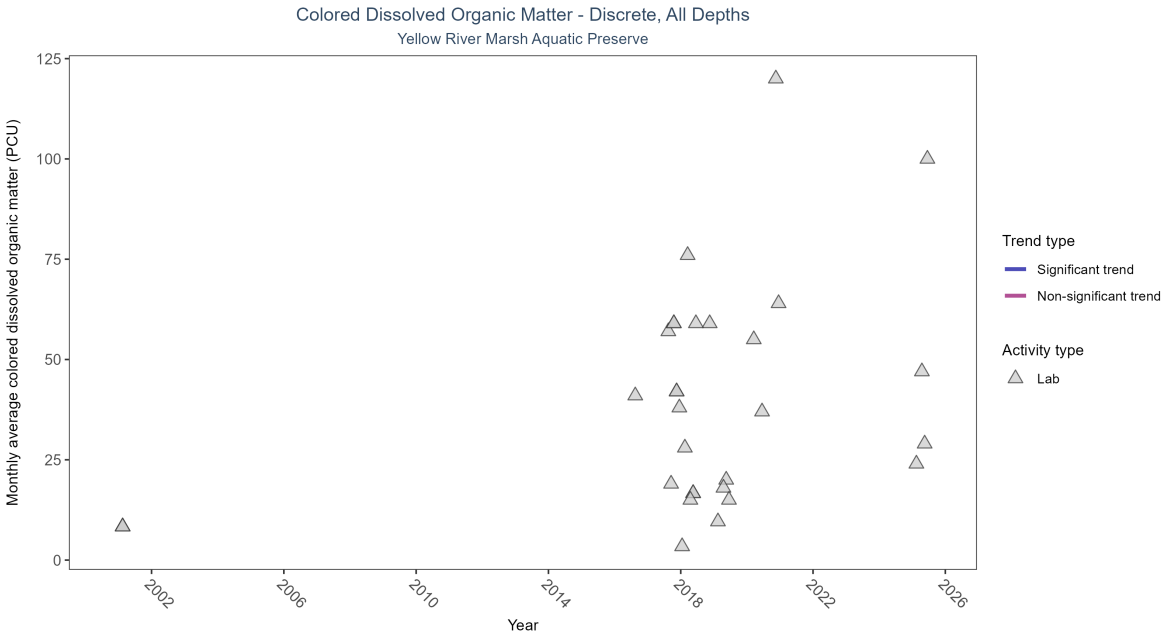

Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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	Insufficient data to calculate trend	31	7	2001 - 2025	28	-	-	-	-

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

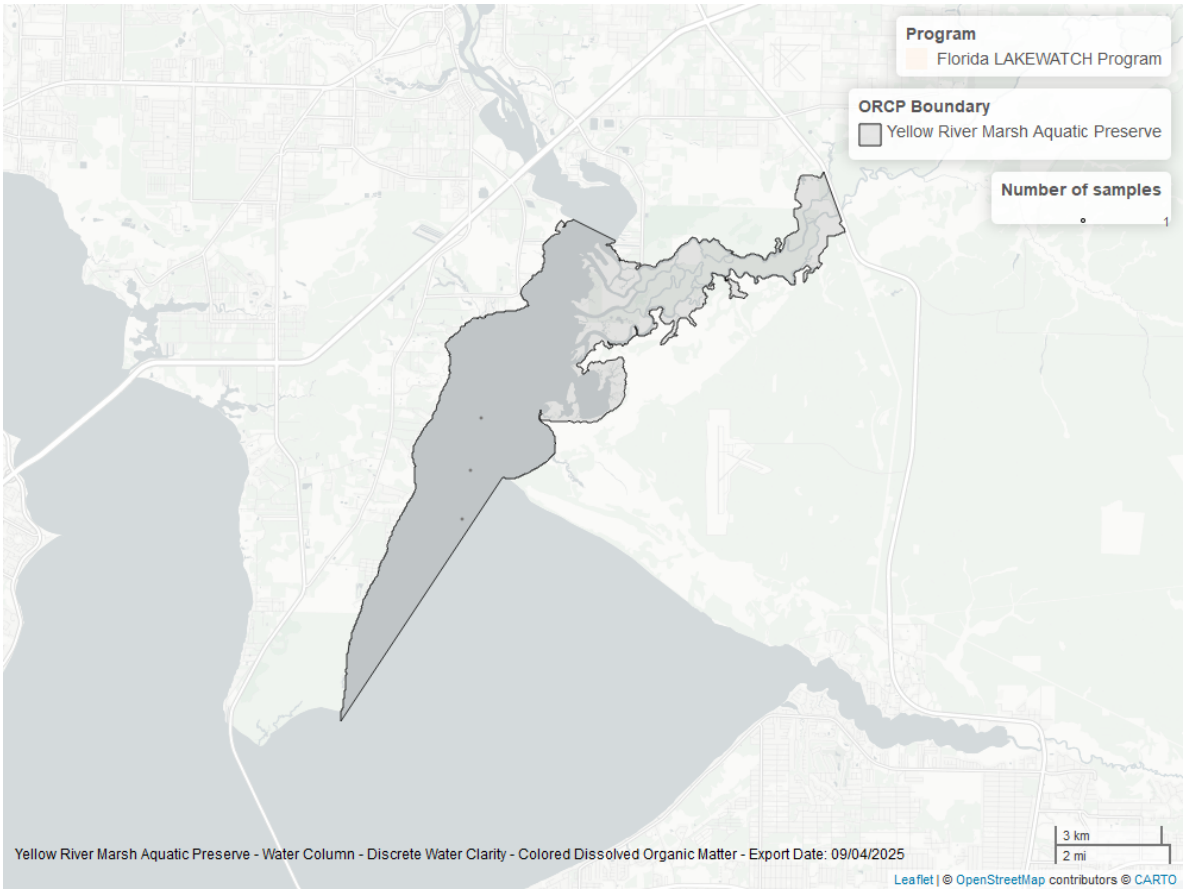

Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Yellow River Marsh Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.