

Biscayne Bay Aquatic Preserve

SEACAR Water Quality Analysis

Last compiled on 10 July, 2025

Contents

Indicators	2
Nutrients	2
Total Nitrogen - Discrete	2
Total Phosphorus - Discrete	4
Water Quality	6
Dissolved Oxygen - Discrete	6
Dissolved Oxygen - Continuous	8
Dissolved Oxygen Saturation - Discrete	10
Dissolved Oxygen Saturation - Continuous	12
Salinity - Discrete	14
Salinity - Continuous	16
Water Temperature - Discrete	18
Water Temperature - Continuous	20
pH - Discrete	22
pH - Continuous	24
Water Clarity	26
Turbidity - Discrete	26
Turbidity - Continuous	28
Total Suspended Solids - Discrete	30
Chlorophyll a, Uncorrected for Pheophytin - Discrete	32
Chlorophyll a, Corrected for Pheophytin - Discrete	34
Secchi Depth - Discrete	36
Colored Dissolved Organic Matter - Discrete	38

Indicators

Nutrients

Total Nitrogen - Discrete

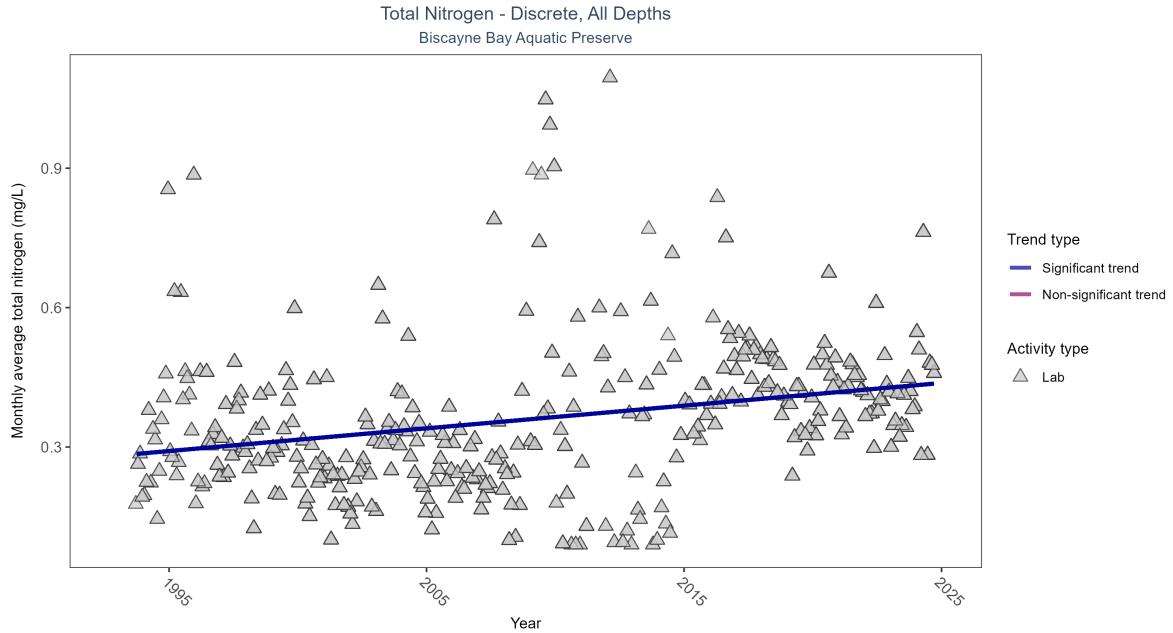


Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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	7918	32	1993 - 2024	0.334	0.22981	0.28157	0.00488	0

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

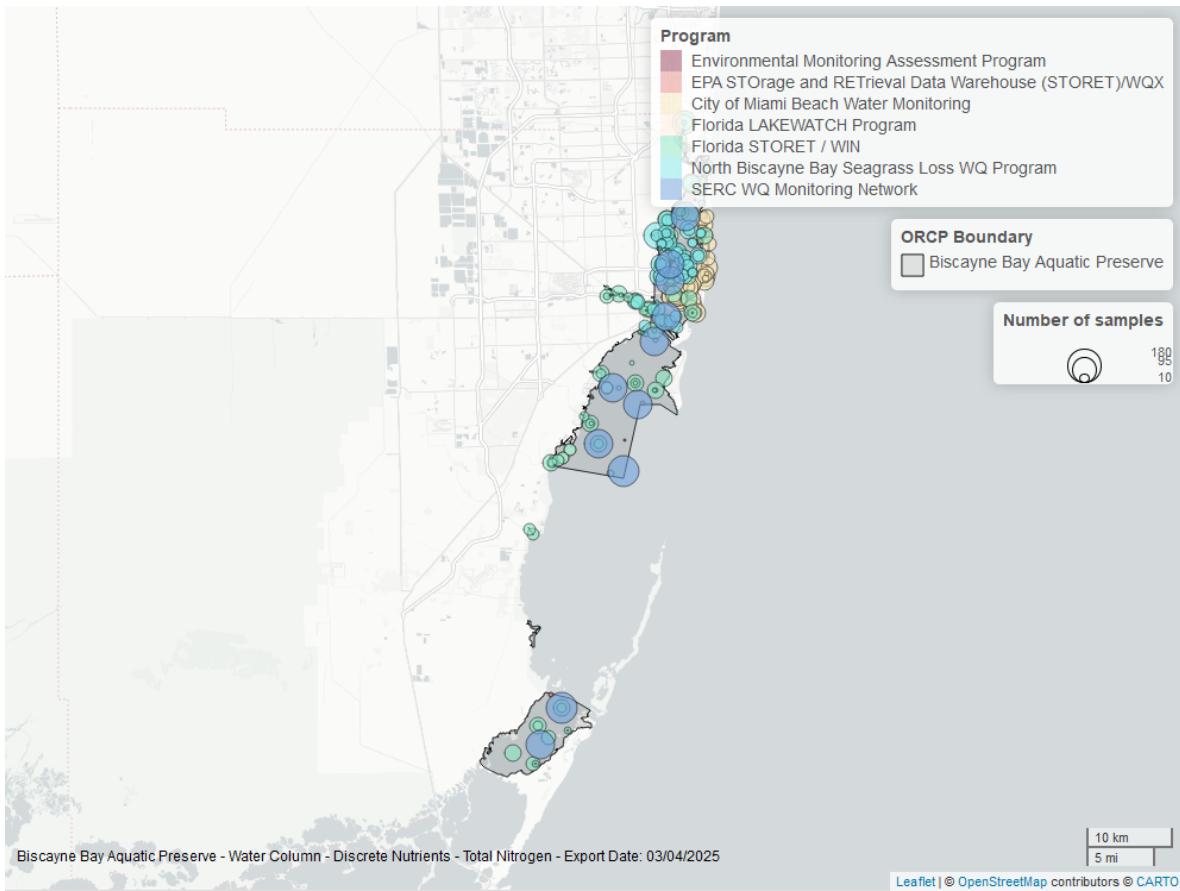


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Phosphorus - Discrete

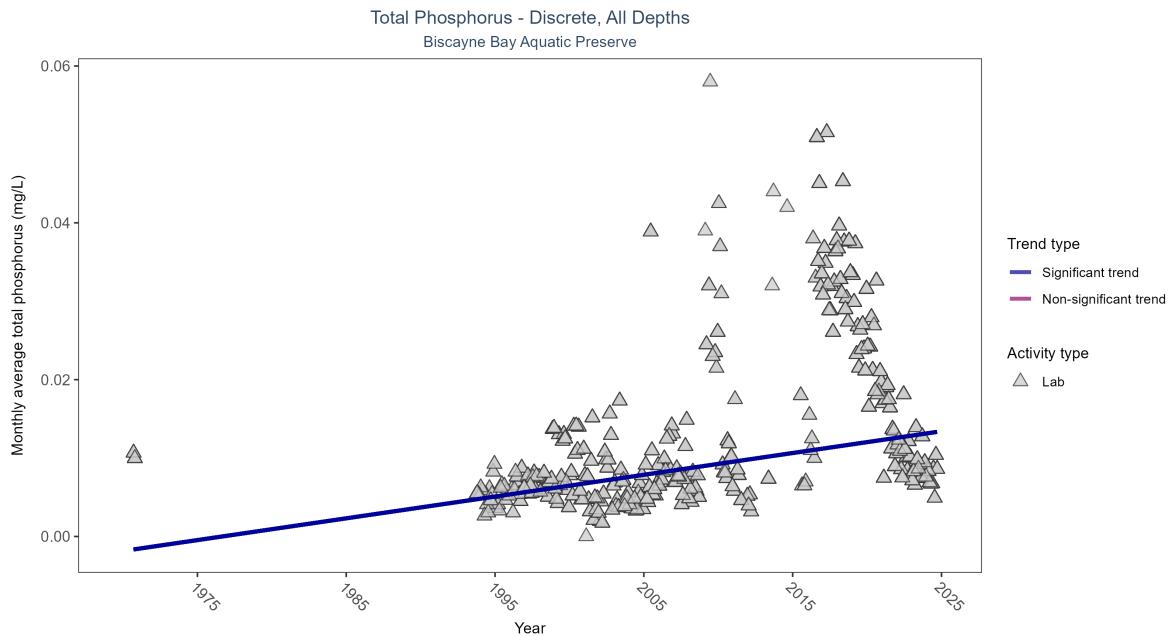


Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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	8031	33	1970 - 2024	0.009	0.36201	-0.00185	0.00028	0

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

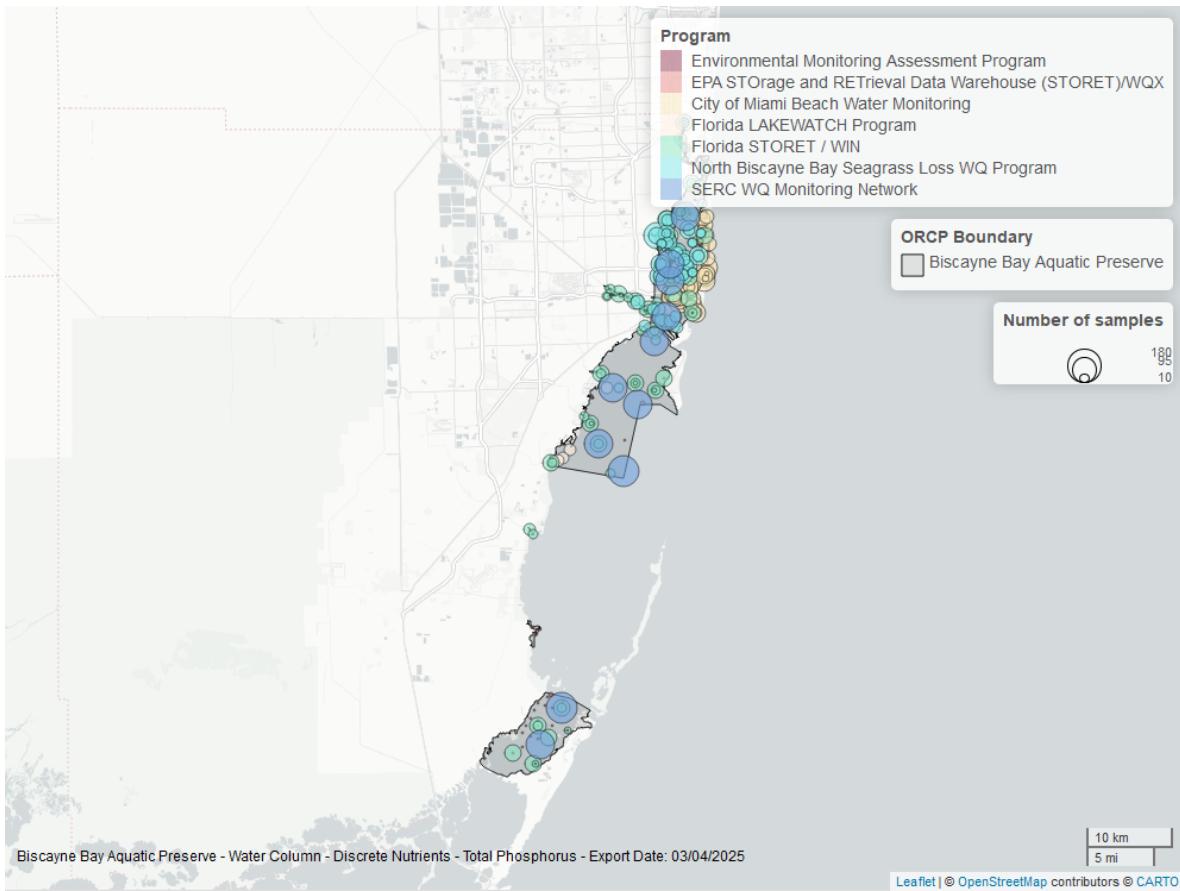


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Quality

Dissolved Oxygen - Discrete

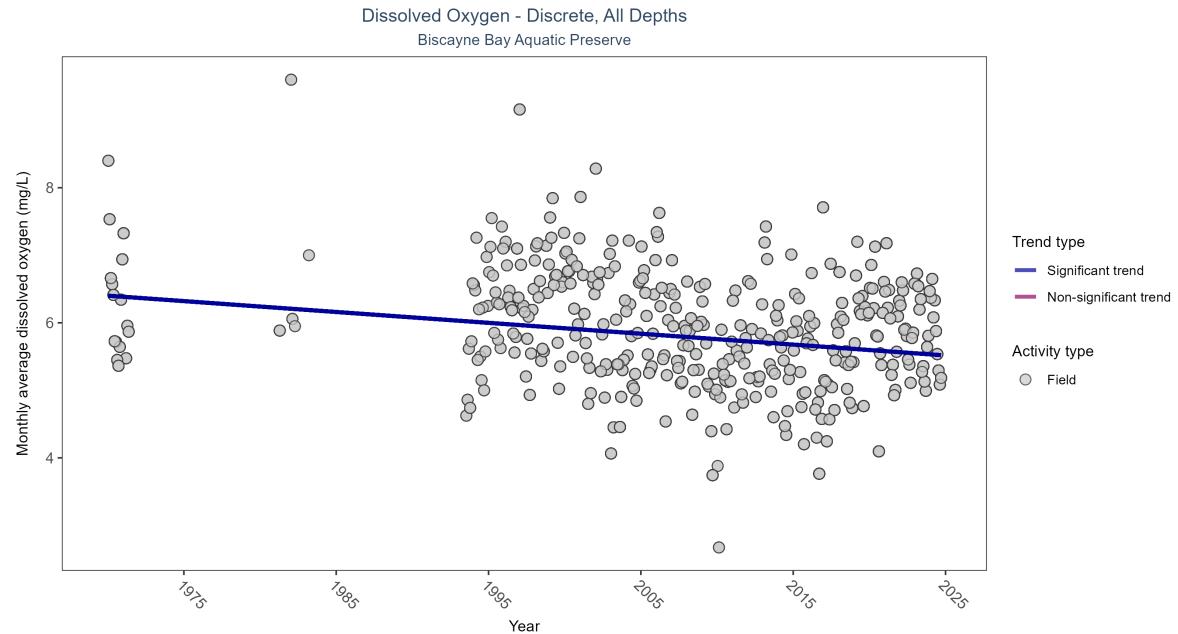


Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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	21185	37	1970 - 2024	6	-0.22906	6.40174	-0.0161	0

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

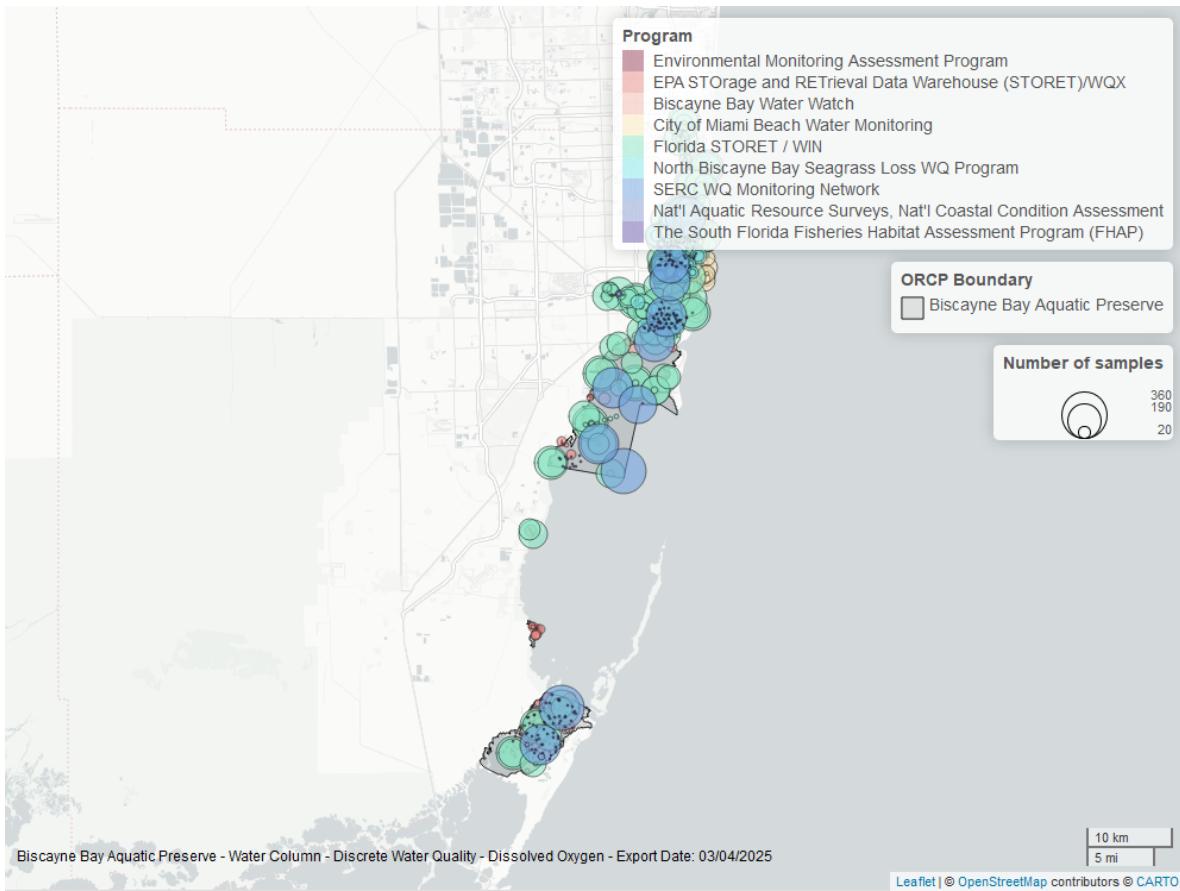


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen - Continuous

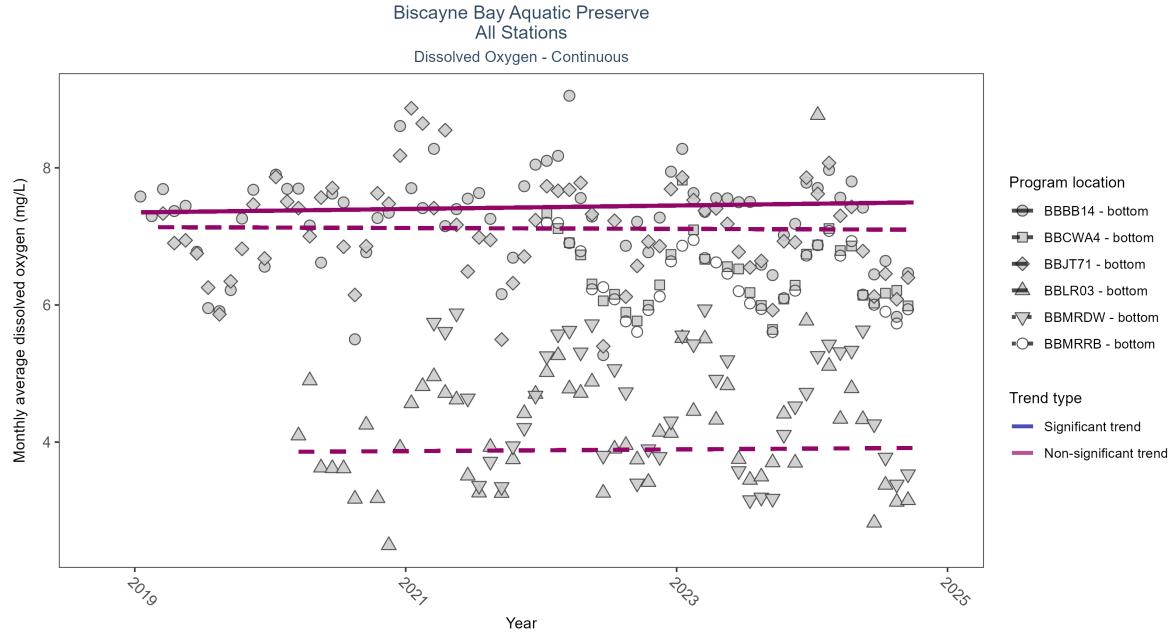


Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBB14	No significant trend	174312	6	2019 - 2024	7.2	0.06	7.35	0.03	0.5207
BBCWA4	Insufficient data to calculate trend	89025	3	2022 - 2024	6.5	-	-	-	-
BBJT71	No significant trend	192461	6	2019 - 2024	7.0	-0.02	7.14	-0.01	0.9051
BBLR03	No significant trend	148009	5	2020 - 2024	4.1	0.06	3.86	0.01	0.937
BBMRD	Insufficient data to calculate trend	92591	3	2022 - 2024	6.4	-	-	-	-
BBMRRB	Insufficient data to calculate trend	116315	4	2021 - 2024	4.5	-	-	-	-

No detectable change in monthly average dissolved oxygen was observed at three locations. There was insufficient data to fit a model for three locations.

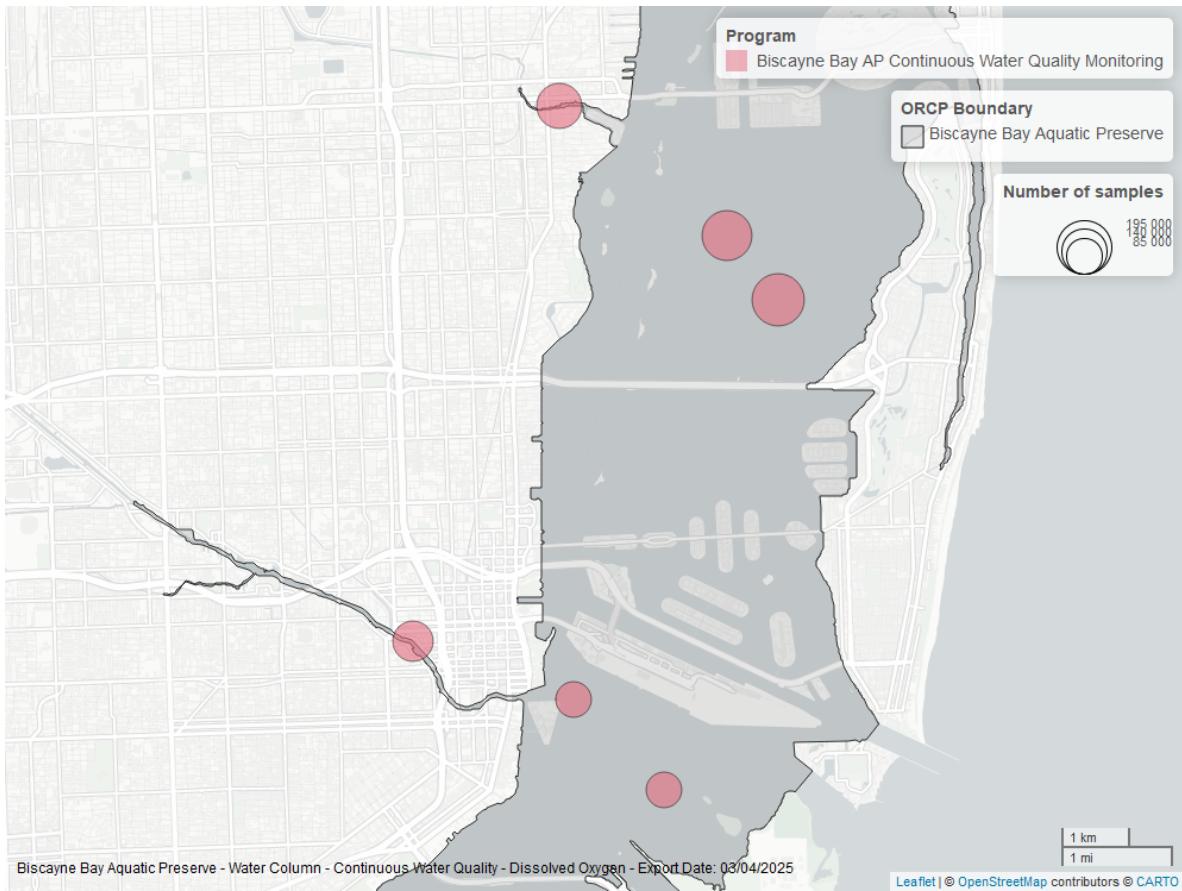


Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Discrete

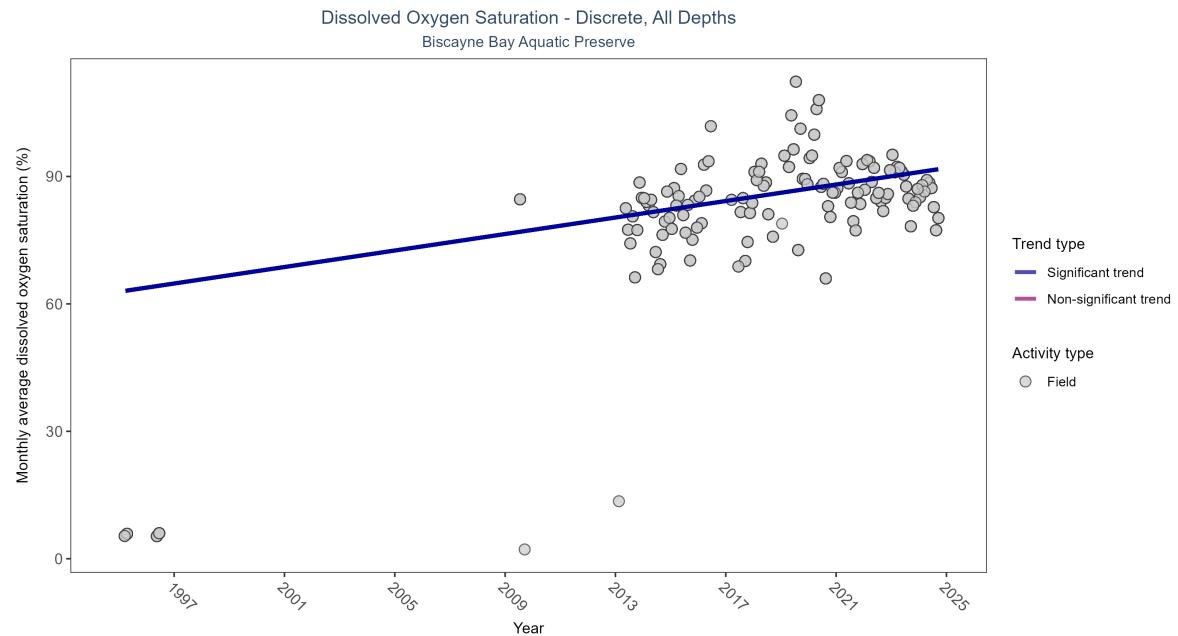


Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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	Significantly increasing trend	9895	15	1995 - 2024	90.3	0.33202	62.85345	0.97111	0

Monthly average dissolved oxygen saturation increased by 0.97% per year.

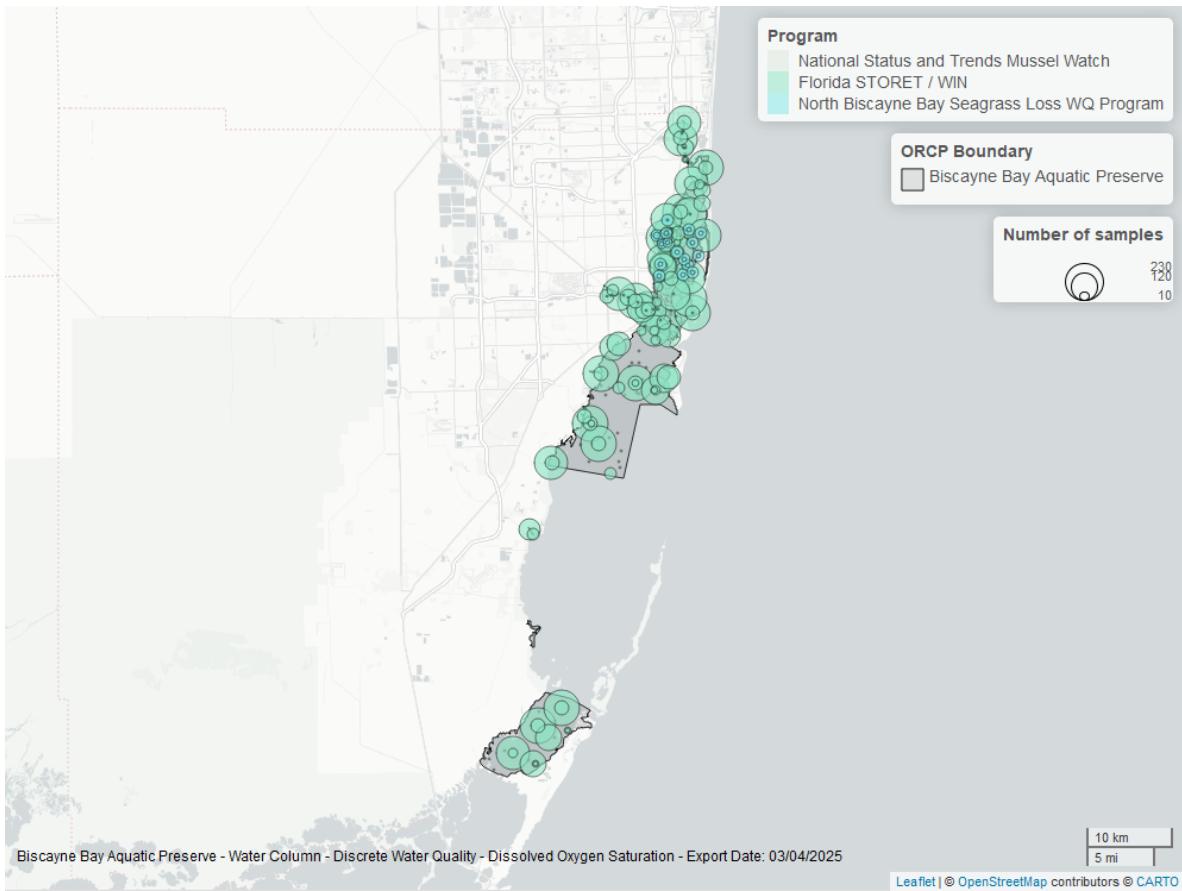


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

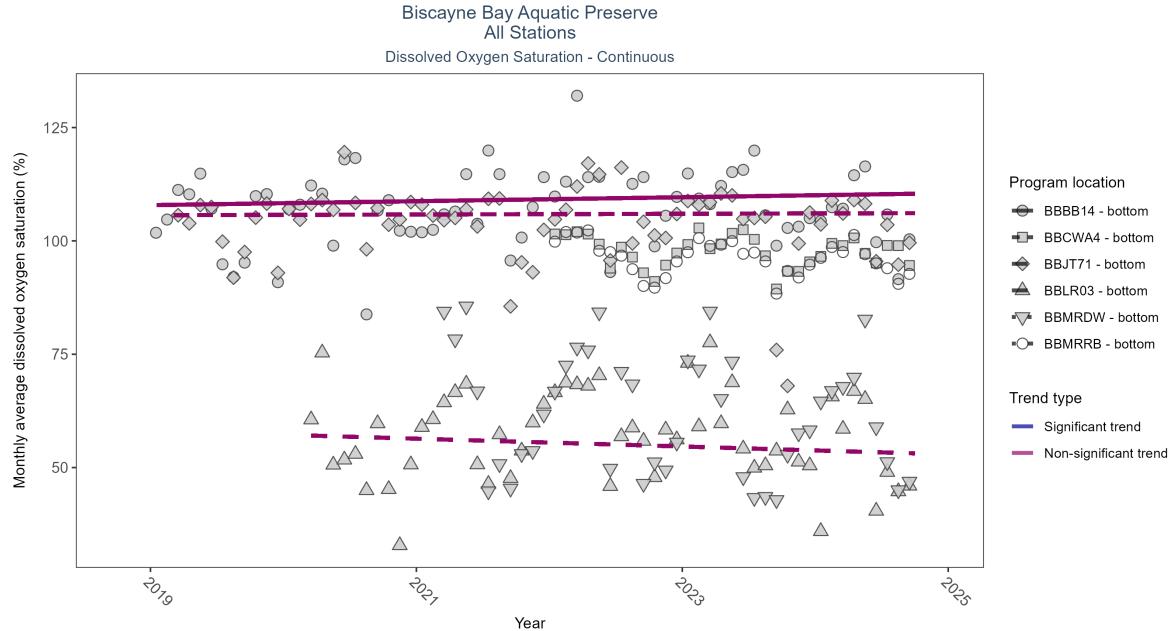


Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBBB14	No significant trend	174052	6	2019 - 2024	104.8	0.1	107.88	0.44	0.3209
BBCWA4	Insufficient data to calculate trend	92748	3	2022 - 2024	97.4	-	-	-	-
BBJT71	No significant trend	193612	6	2019 - 2024	101.8	0.03	105.66	0.08	0.8116
BBLR03	No significant trend	148008	5	2020 - 2024	56.4	-0.1	57.24	-0.86	0.3845
BBMRRB	Insufficient data to calculate trend	92599	3	2022 - 2024	95.7	-	-	-	-
BBMRDW	Insufficient data to calculate trend	116316	4	2021 - 2024	60.0	-	-	-	-

No detectable change in monthly average dissolved oxygen saturation was observed at three locations. There was insufficient data to fit a model for three locations.

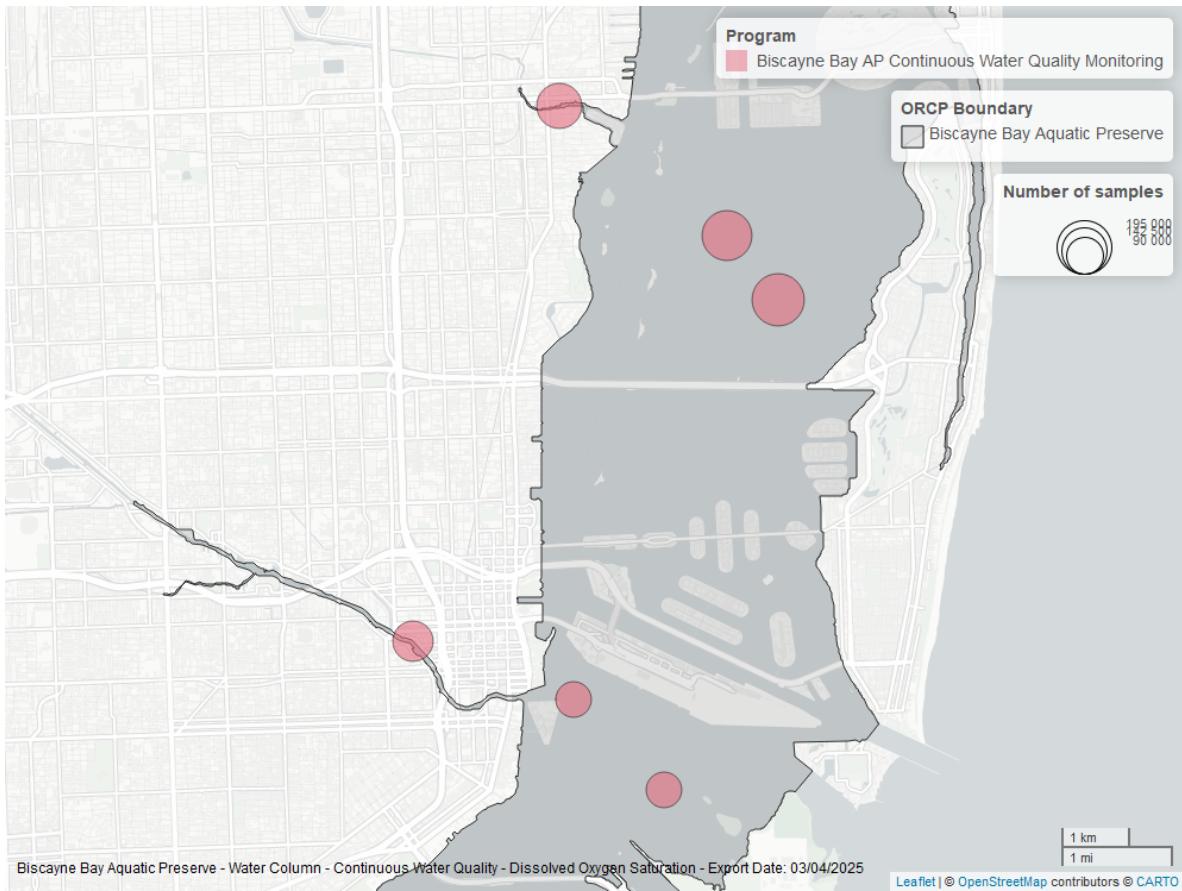


Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Discrete

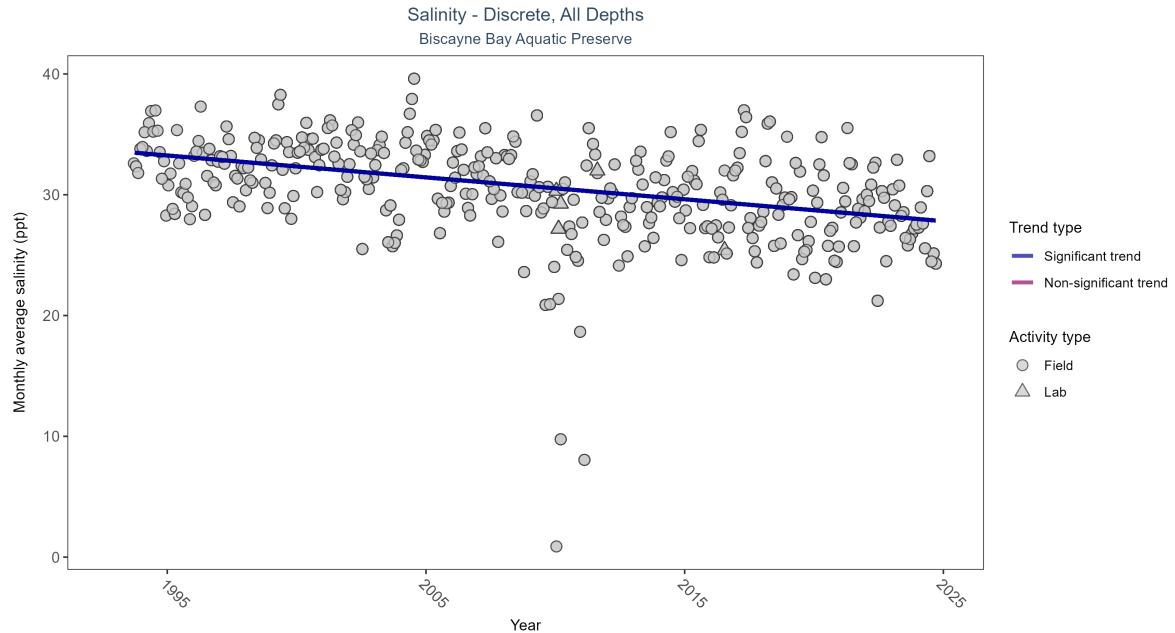


Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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	23969	32	1993 - 2024	32	-0.4135	33.61132	-0.18122	0

Monthly average salinity decreased by 0.18 ppt per year.

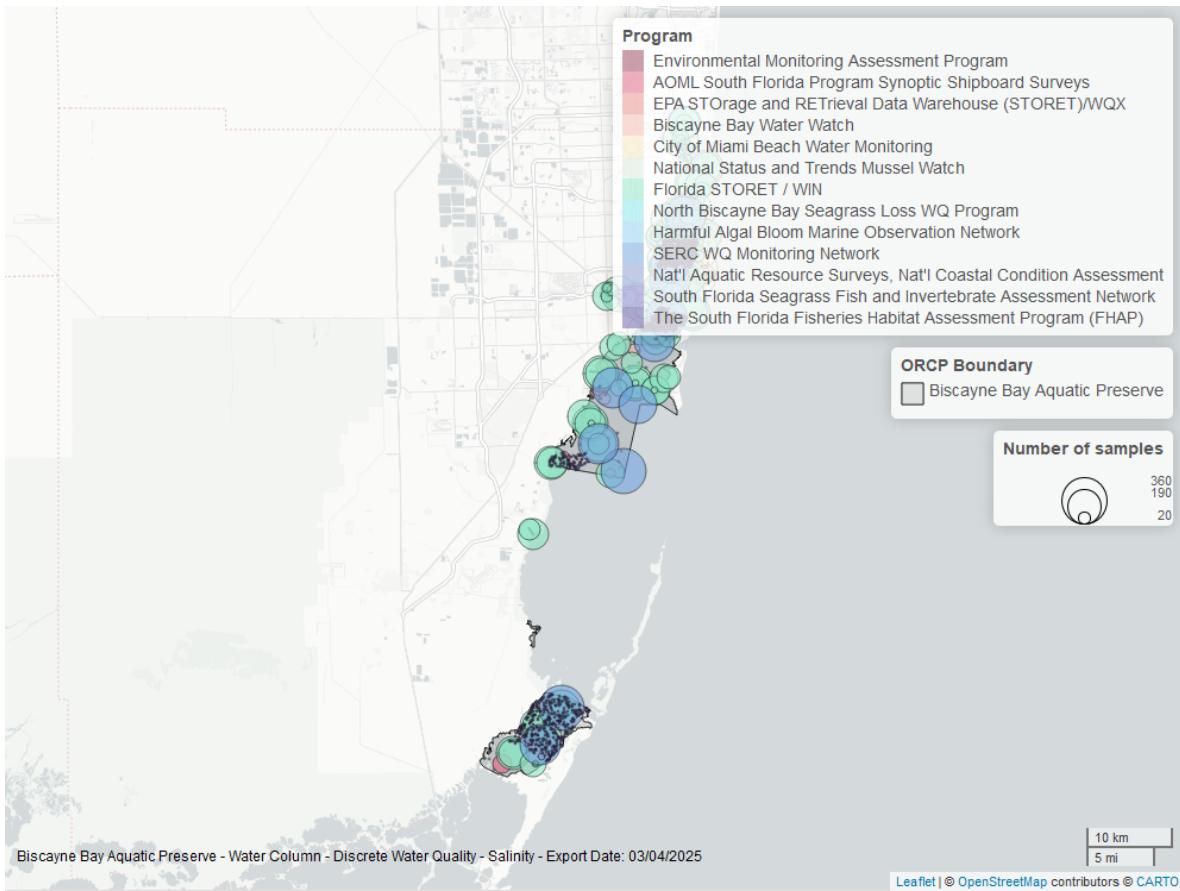


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

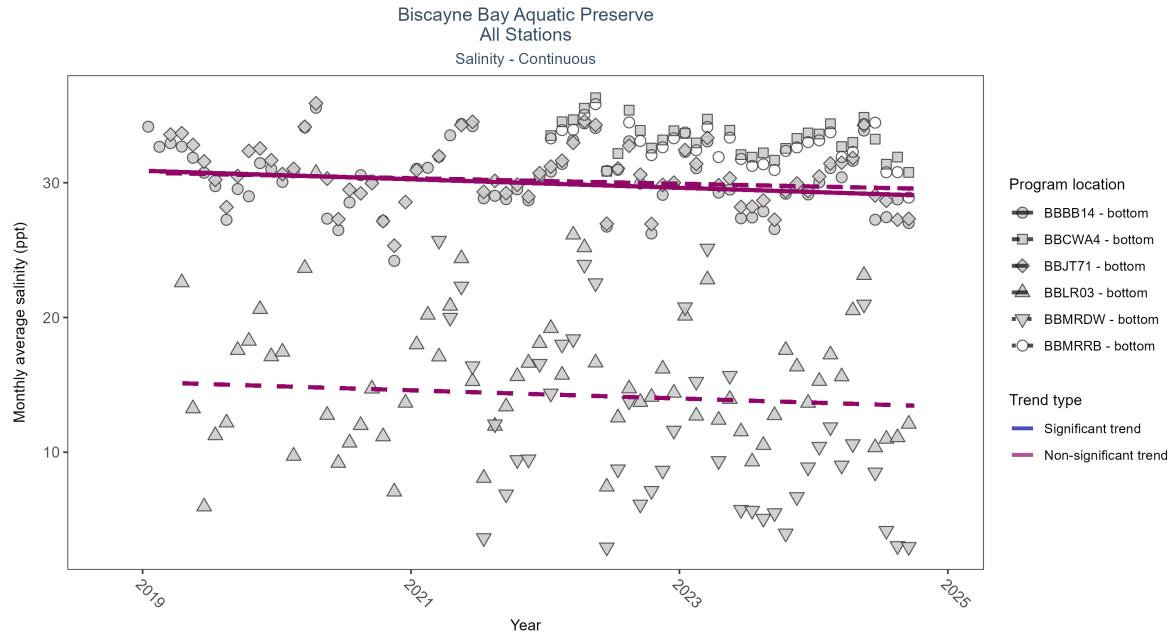


Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBBB14	No significant trend	163926	6	2019 - 2024	30.1	-0.23	30.89	-0.32	0.0507
BBCWA4	Insufficient data to calculate trend	87140	3	2022 - 2024	33.4	-	-	-	-
BBJT71	No significant trend	178697	6	2019 - 2024	30.8	-0.16	30.75	-0.2	0.1225
BBLR03	No significant trend	168006	6	2019 - 2024	16.2	-0.15	15.2	-0.3	0.1616
BBMRD	Insufficient data to calculate trend	92599	3	2022 - 2024	33.0	-	-	-	-
BBMRRB	Insufficient data to calculate trend	114444	4	2021 - 2024	9.0	-	-	-	-

No detectable change in monthly average salinity was observed at three locations. There was insufficient data to fit a model for three locations.

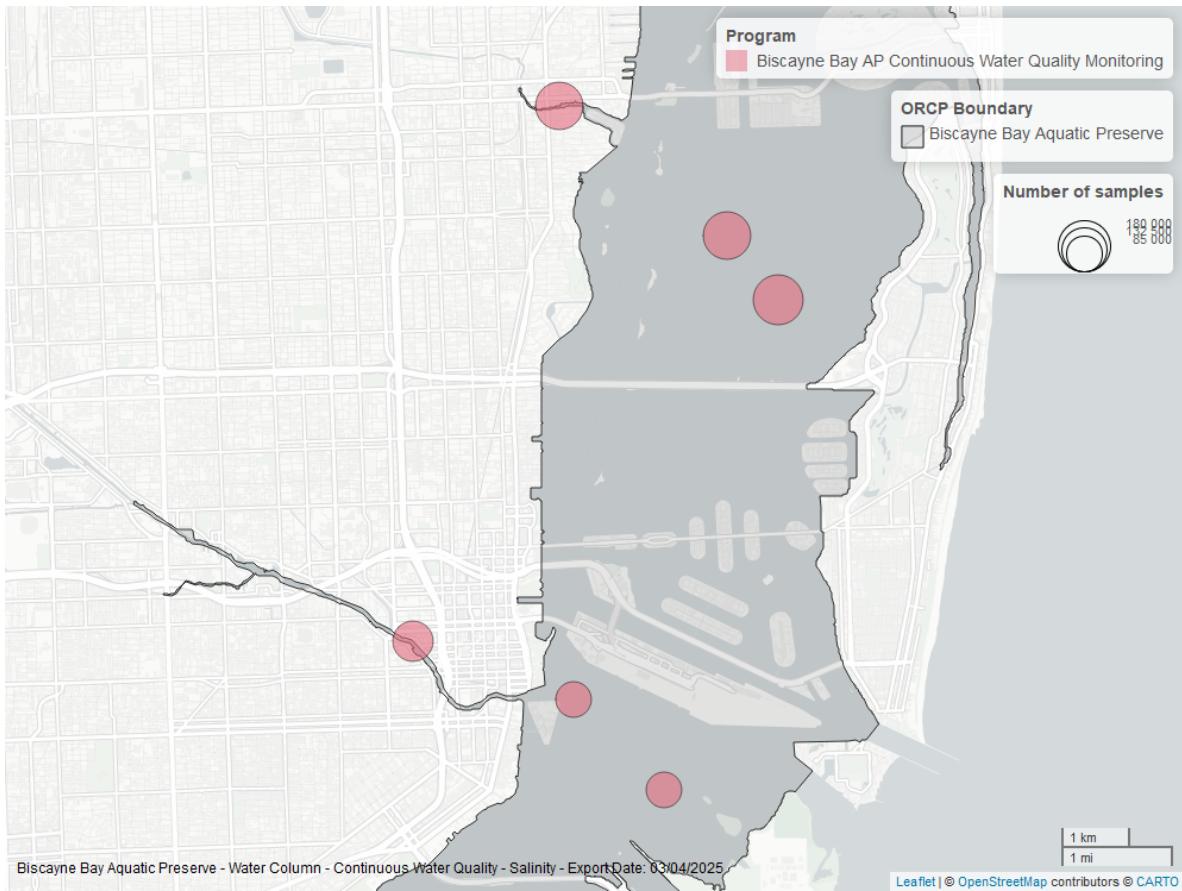


Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Discrete

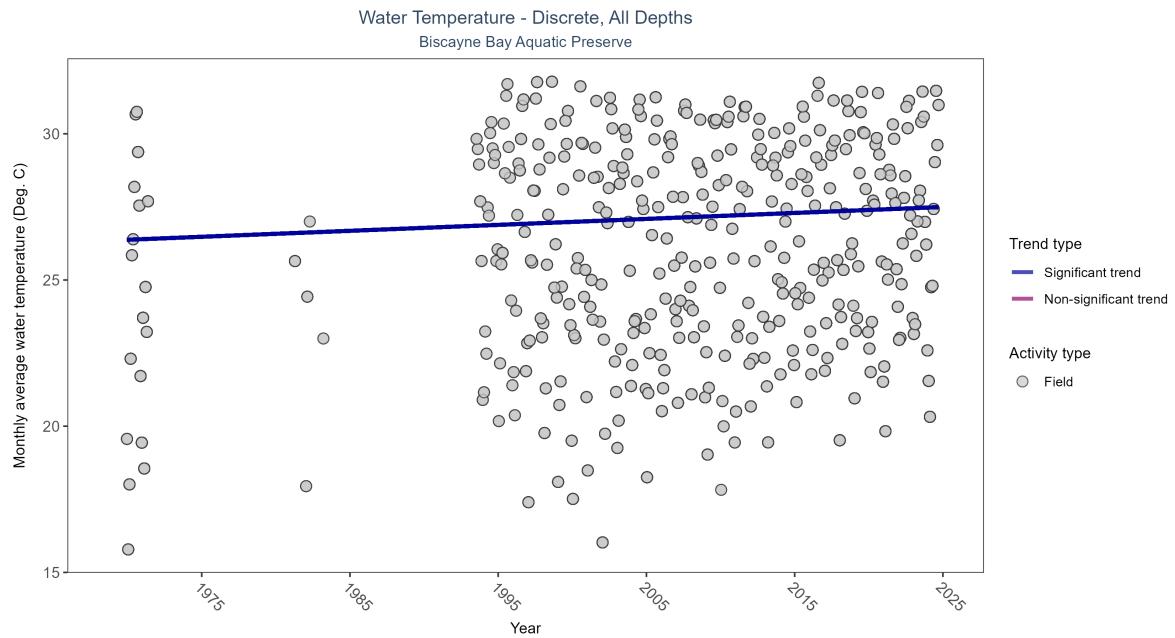


Figure 17: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in 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	Significantly increasing trend	25079	38	1969 - 2024	27	0.13097	26.35587	0.02038	0.0002

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

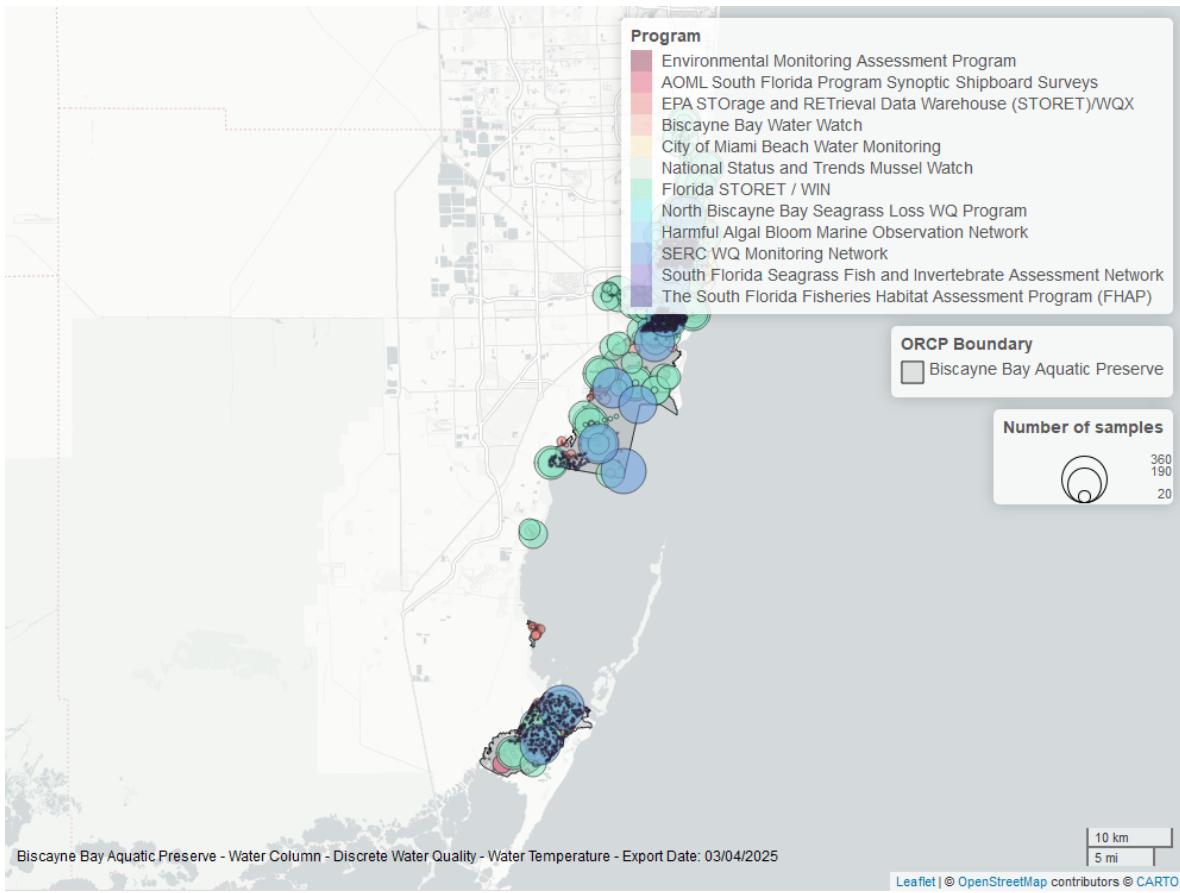


Figure 18: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

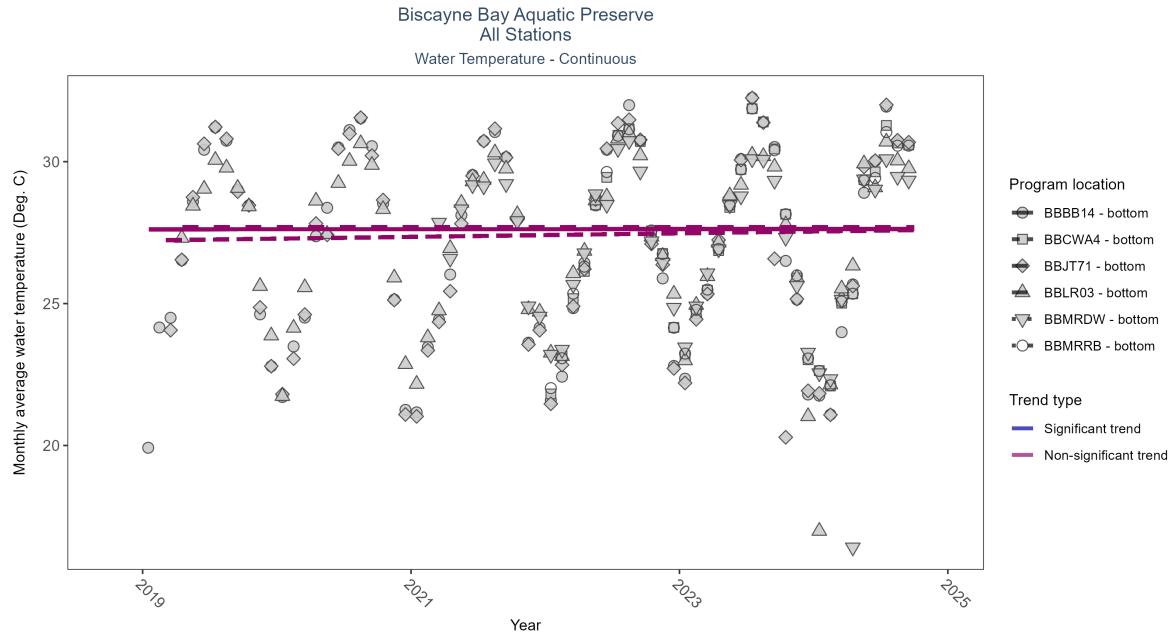


Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBB14	No significant trend	174424	6	2019 - 2024	27.3	0.01	27.62	0	0.9534
BBCWA4	Insufficient data to calculate trend	93693	3	2022 - 2024	27.3	-	-	-	-
BBJT71	No significant trend	193964	6	2019 - 2024	27.5	0.05	27.22	0.06	0.6336
BBLR03	No significant trend	174275	6	2019 - 2024	27.9	-0.02	27.69	0	1
BBMRRB	Insufficient data to calculate trend	93407	3	2022 - 2024	27.4	-	-	-	-
BBMRDW	Insufficient data to calculate trend	116327	4	2021 - 2024	27.9	-	-	-	-

No detectable change in monthly average water temperature was observed at three locations. There was insufficient data to fit a model for three locations.

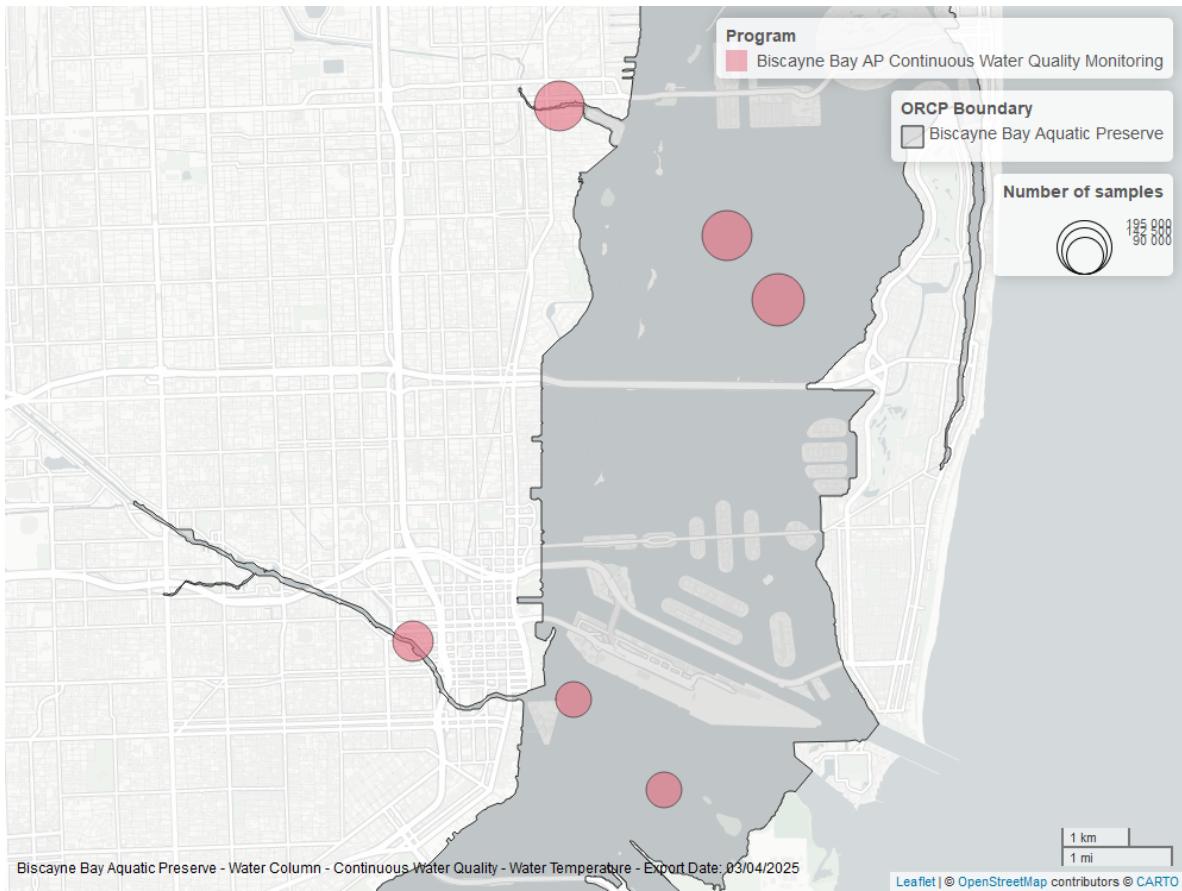


Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Discrete

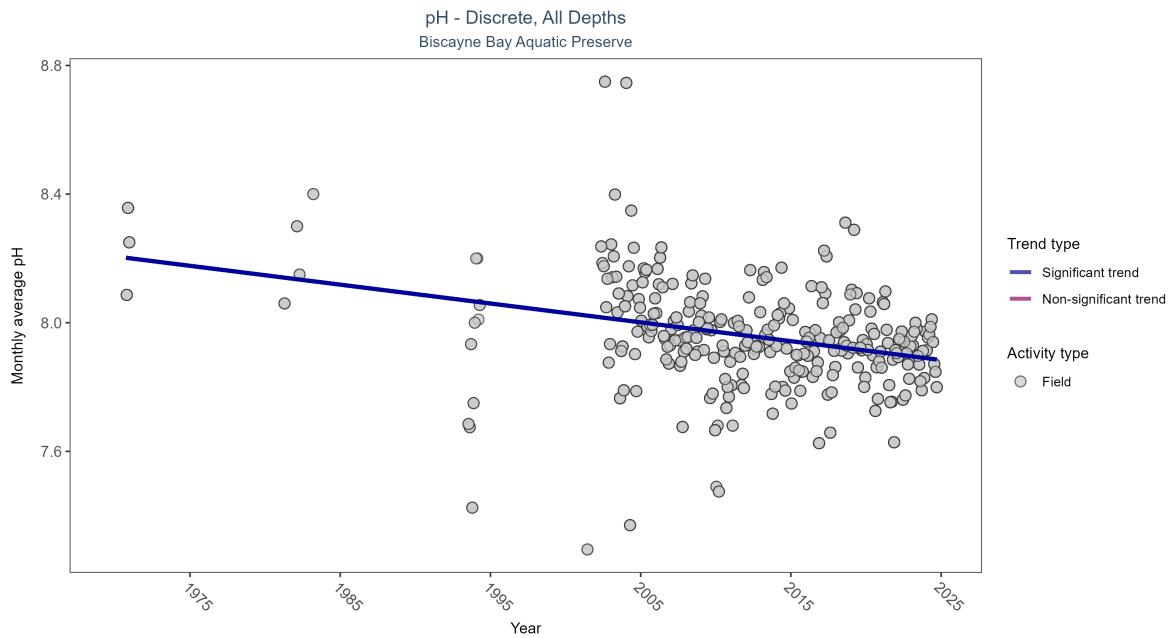


Figure 21: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	17425	30	1970 - 2024	7.97	-0.28914	8.20631	-0.00586	0

Monthly average pH decreased by 0.01 pH units per year.

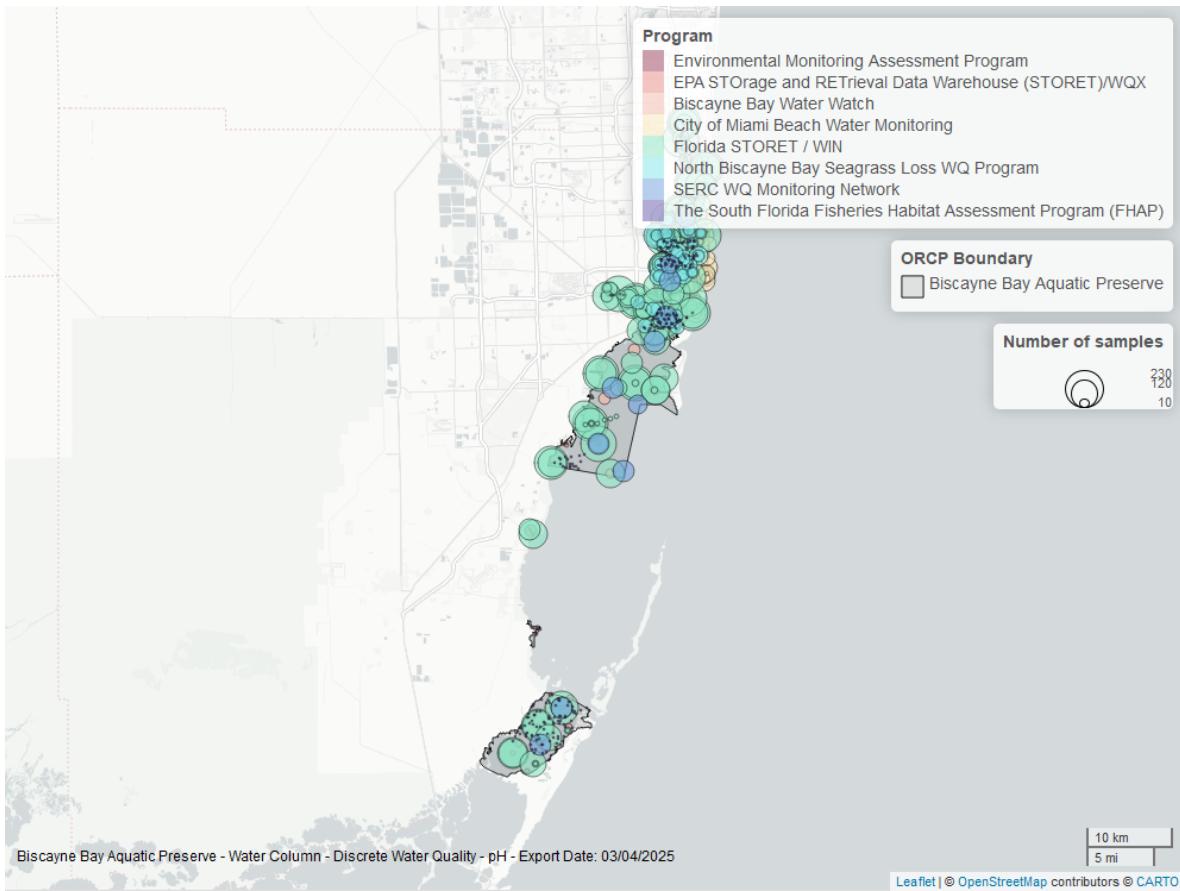


Figure 22: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

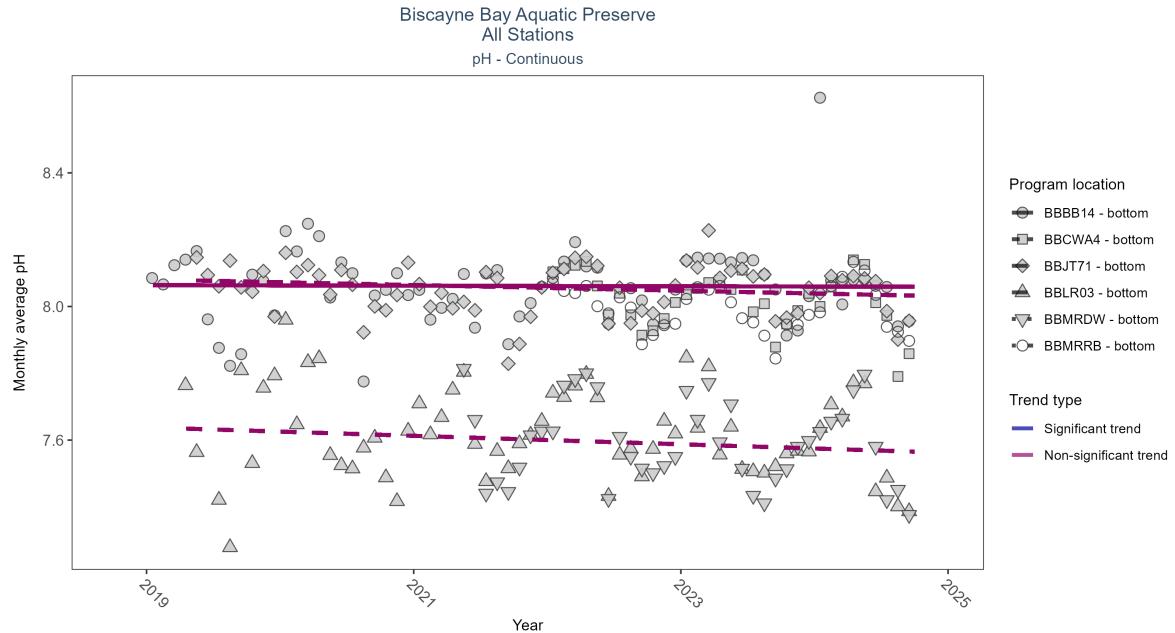


Figure 23: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBBB14	No significant trend	170239	6	2019 - 2024	8.1	-0.03	8.06	0	0.9534
BBCWA4	Insufficient data to calculate trend	92930	3	2022 - 2024	8.0	-	-	-	-
BBJT71	No significant trend	180871	6	2019 - 2024	8.1	-0.21	8.08	-0.01	0.062
BBLR03	No significant trend	163519	6	2019 - 2024	7.6	-0.18	7.64	-0.01	0.1354
BBMRD	Insufficient data to calculate trend	92643	3	2022 - 2024	8.0	-	-	-	-
BBMRRB	Insufficient data to calculate trend	111368	4	2021 - 2024	7.6	-	-	-	-

No detectable change in monthly average pH was observed at three locations. There was insufficient data to fit a model for three locations.

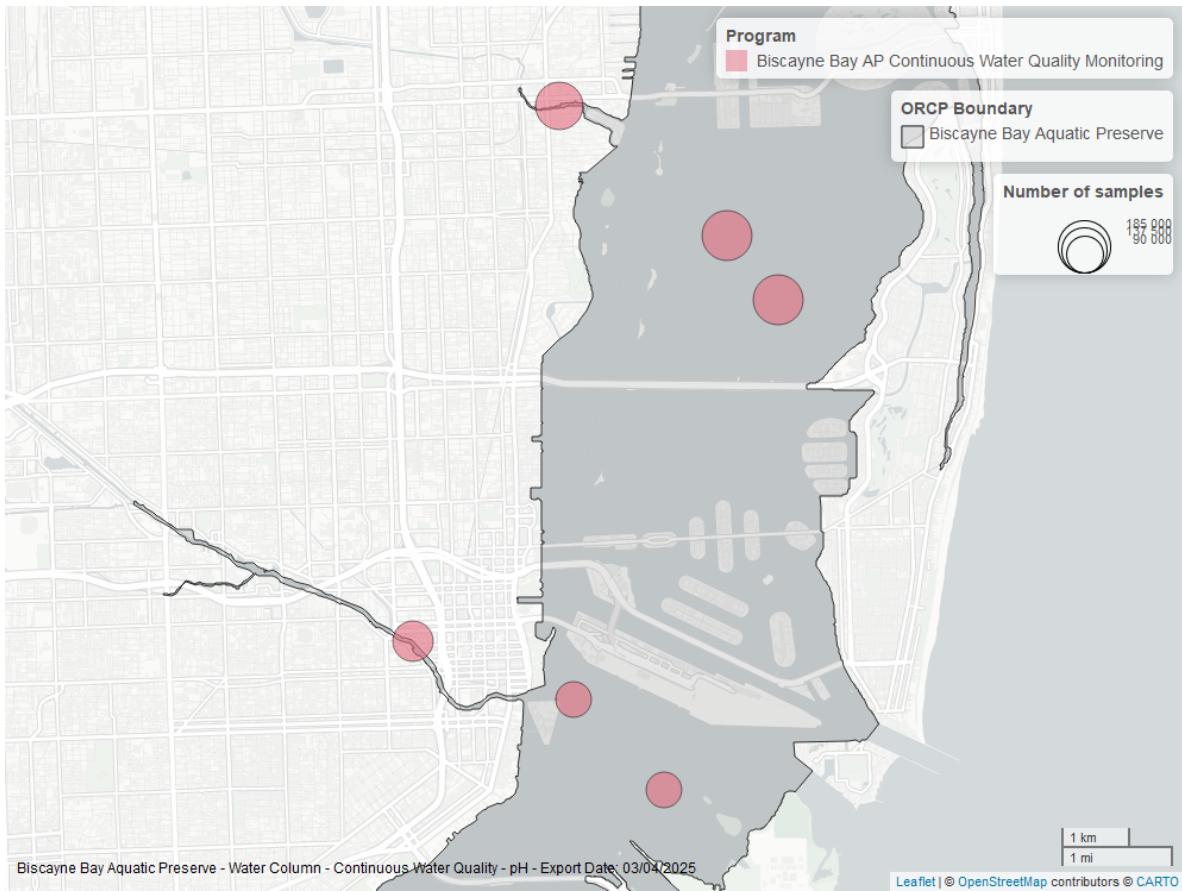


Figure 24: Map showing location of ph continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Clarity

Turbidity - Discrete

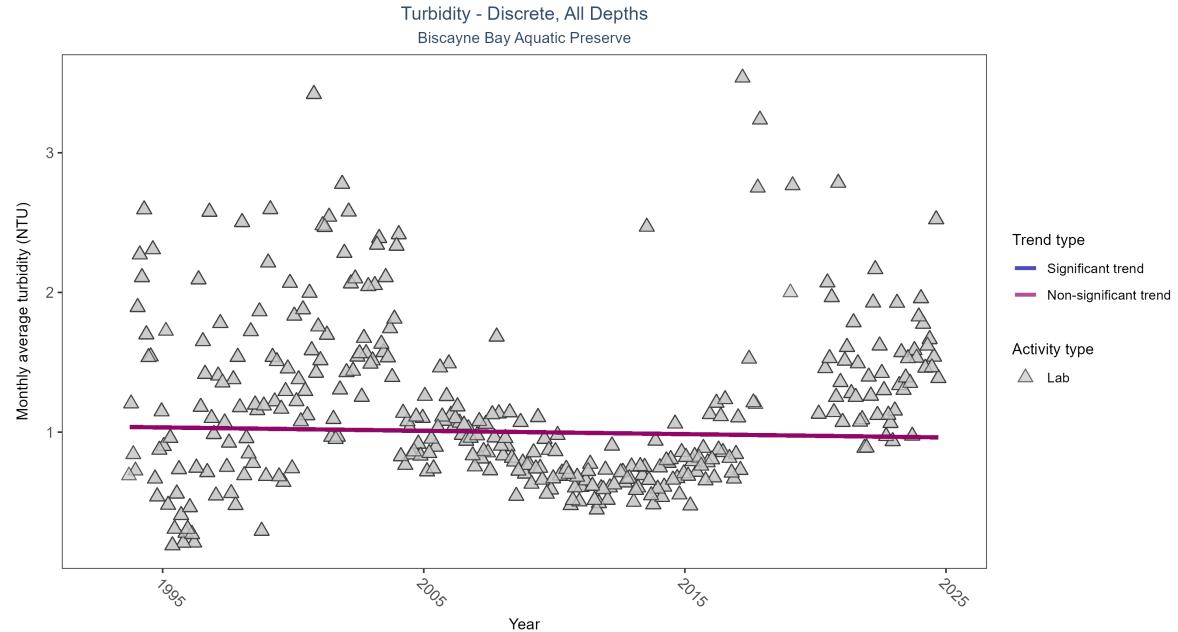


Figure 25: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

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	11884	31	1993 - 2024	0.8	-0.02702	1.03829	-0.0024	0.4931

Turbidity showed no detectable trend between 1993 and 2024.

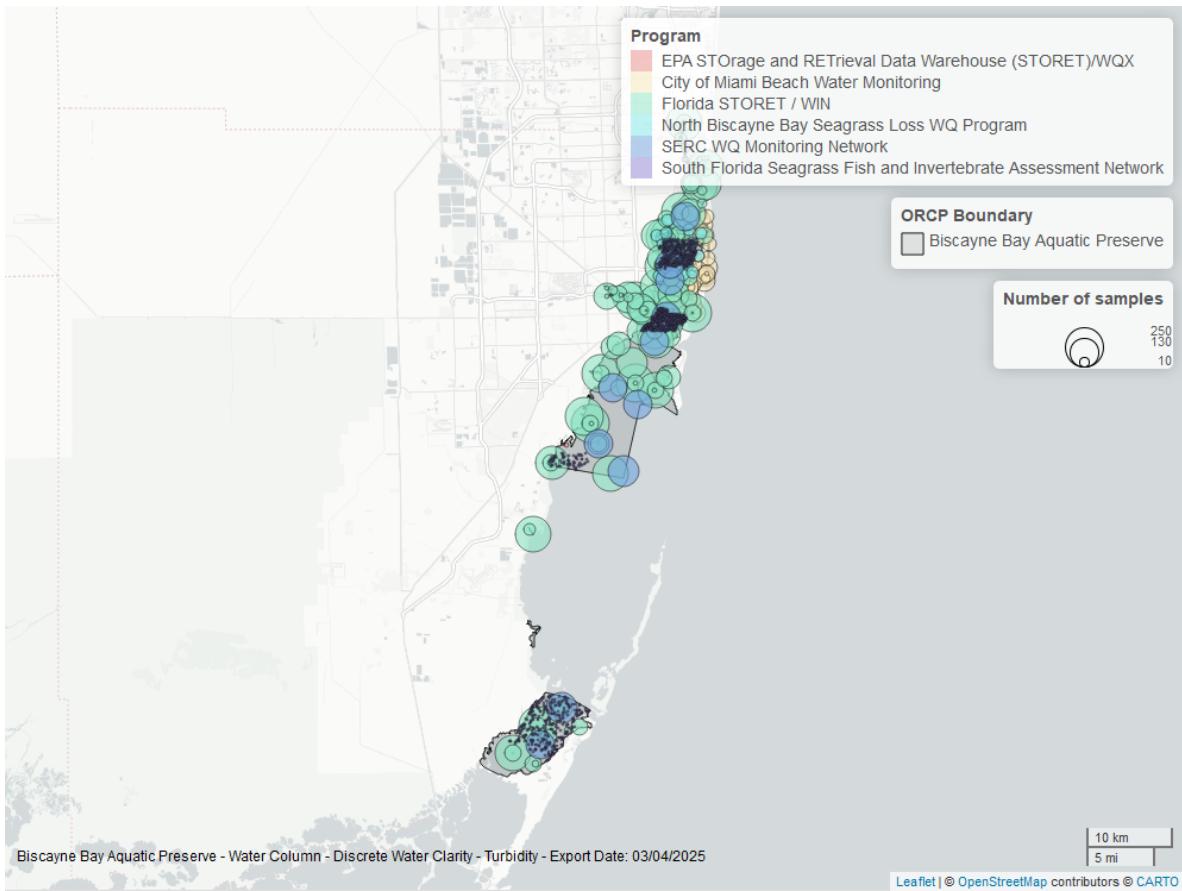


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

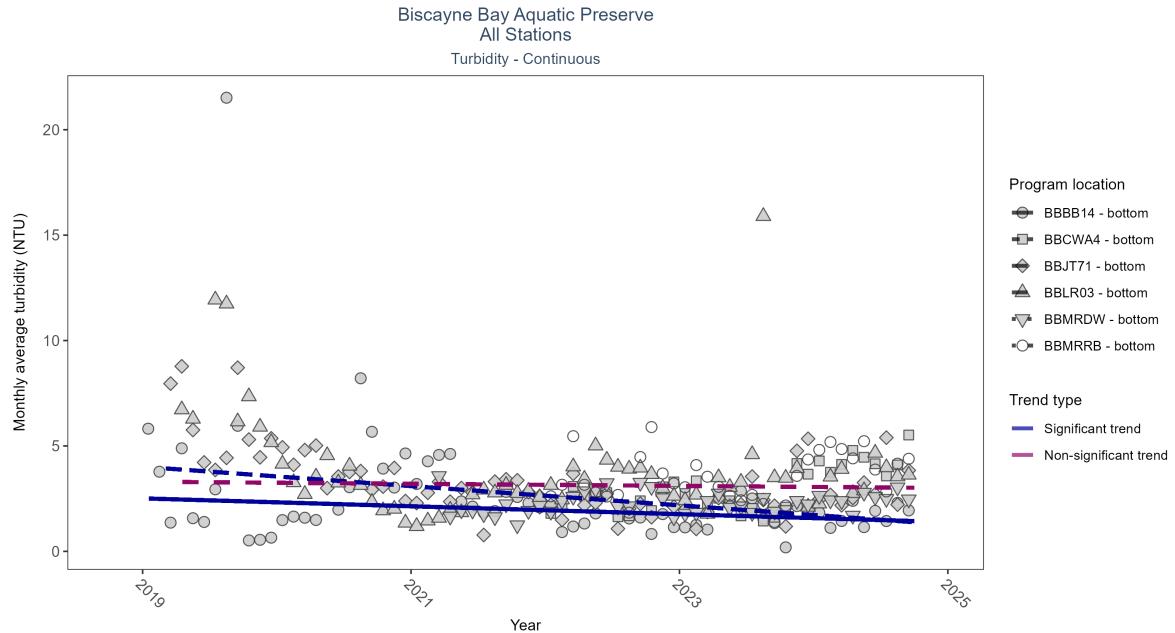


Figure 27: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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
BBB14	Significantly decreasing trend	163375	6	2019 - 2024	2	-0.3	2.51	-0.19	0.0061
BBCWA4	Insufficient data to calculate trend	90269	3	2022 - 2024	3	-	-	-	-
BBJT71	Significantly decreasing trend	186564	6	2019 - 2024	3	-0.46	4.01	-0.46	0
BBLR03	No significant trend	170459	6	2019 - 2024	3	-0.04	3.3	-0.05	0.6187
BBMRD	Insufficient data to calculate trend	91453	3	2022 - 2024	3	-	-	-	-
BBMRRB	Insufficient data to calculate trend	116032	4	2021 - 2024	2	-	-	-	-

At two program locations, monthly average turbidity decreased by 0.19 NTU per year at one site and by 0.46 NTU per year at the other. No detectable change in monthly average turbidity was observed at one location. There was insufficient data to fit a model for three locations.

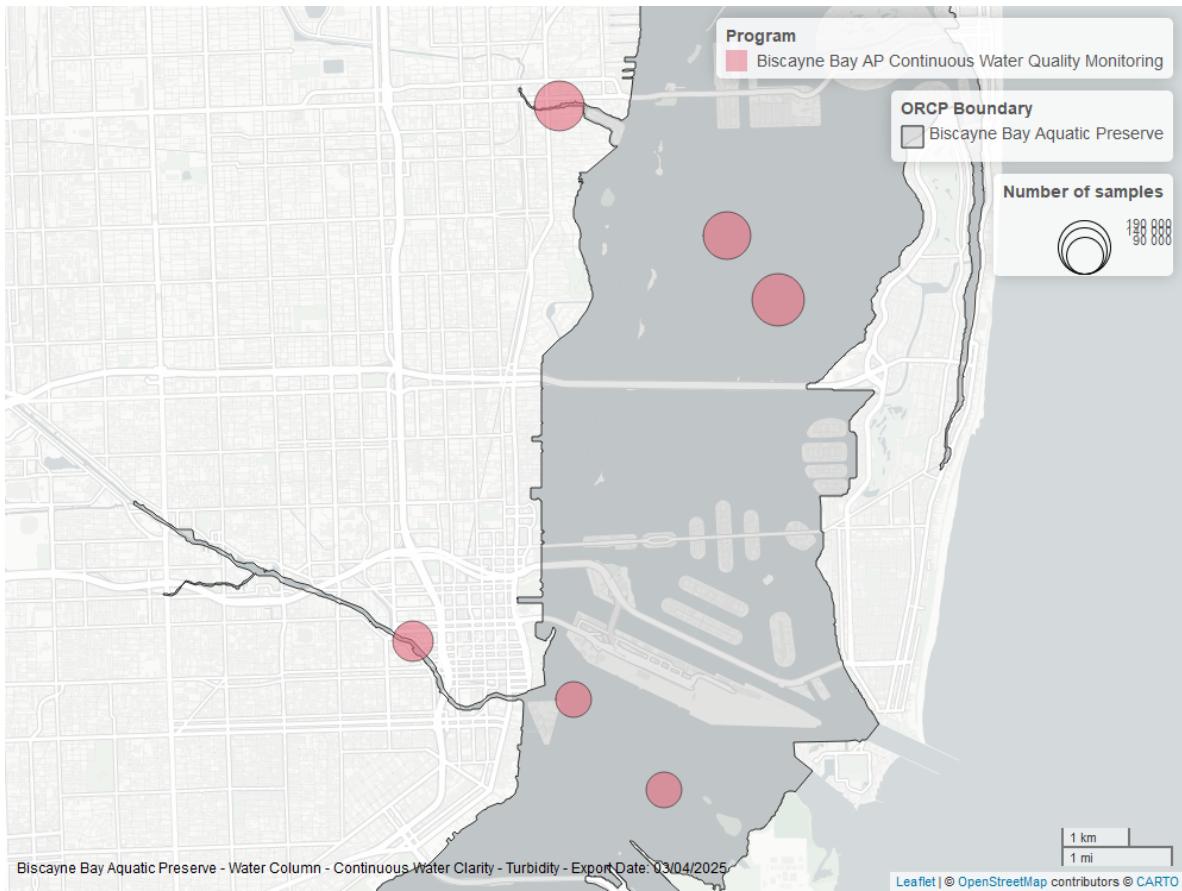


Figure 28: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Total Suspended Solids - Discrete

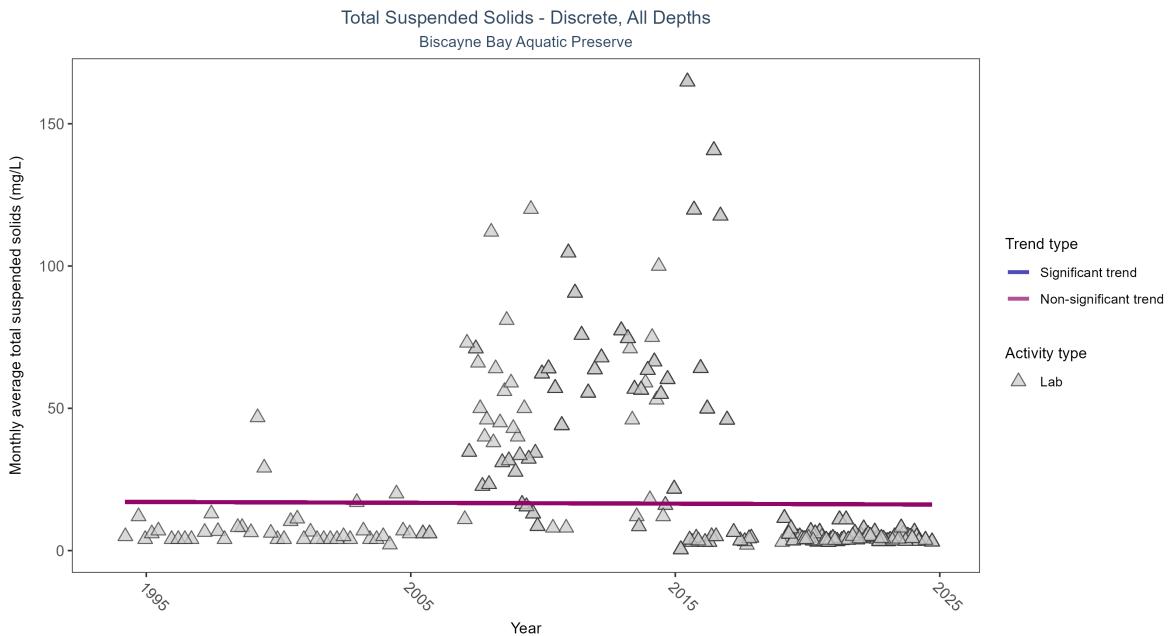


Figure 29: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included 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	2221	29	1994 - 2024	4.9	-0.15956	17.13541	-0.03081	0.2724

Total suspended solids showed no detectable trend between 1994 and 2024.

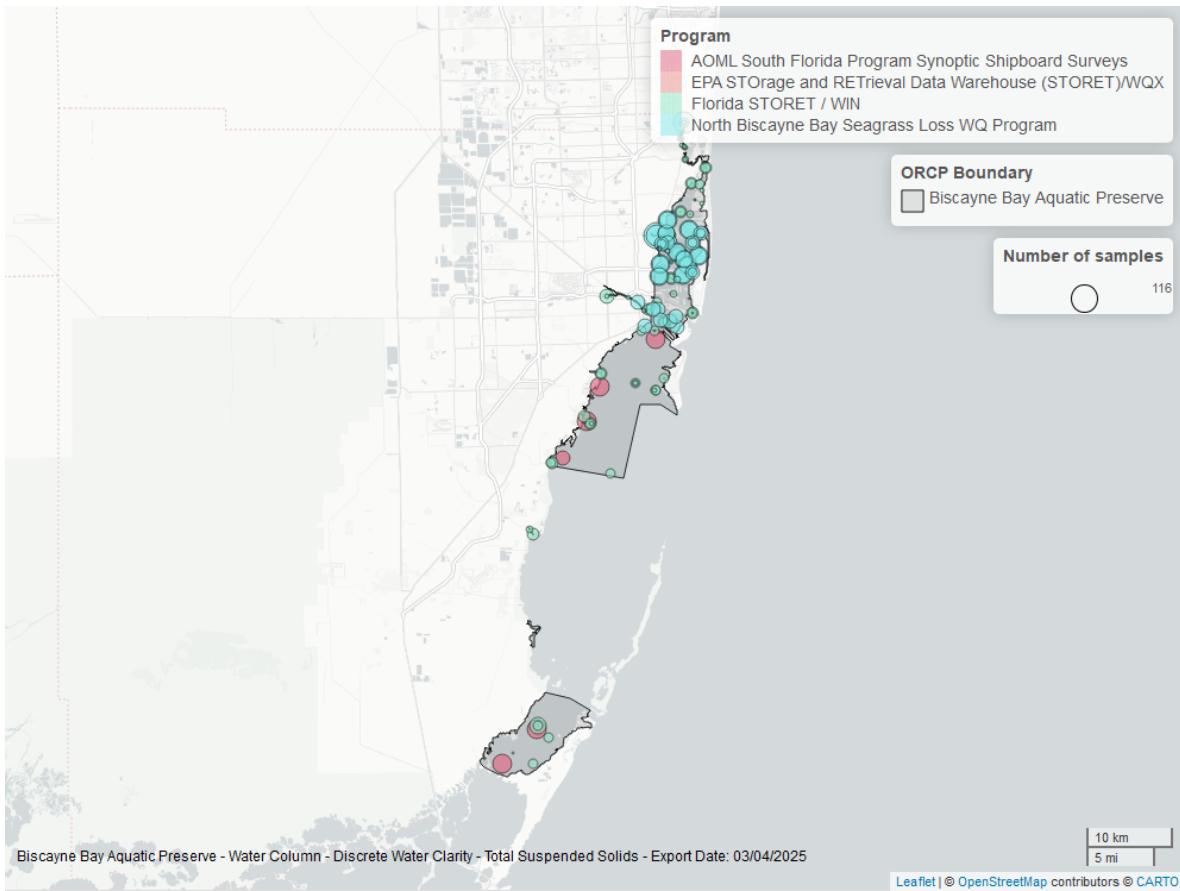


Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Uncorrected for Pheophytin - Discrete

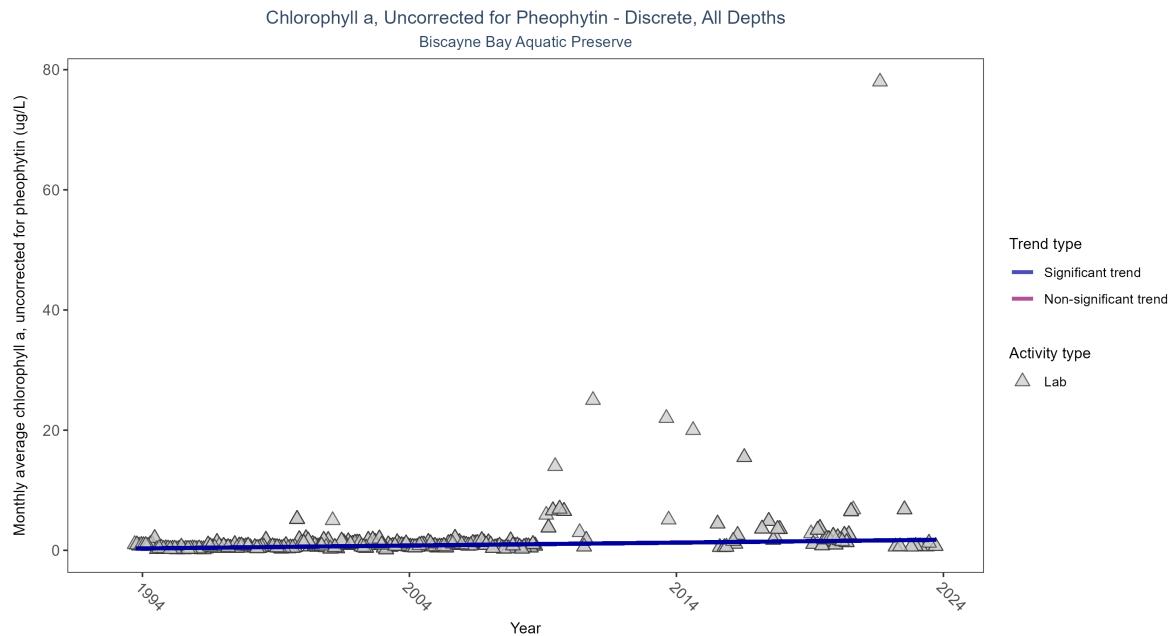


Figure 31: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	Significantly increasing trend	2254	28	1993 - 2023	0.66655	0.39038	0.26493	0.04843	0

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.05 µg/L per year, indicating a decrease in water clarity.

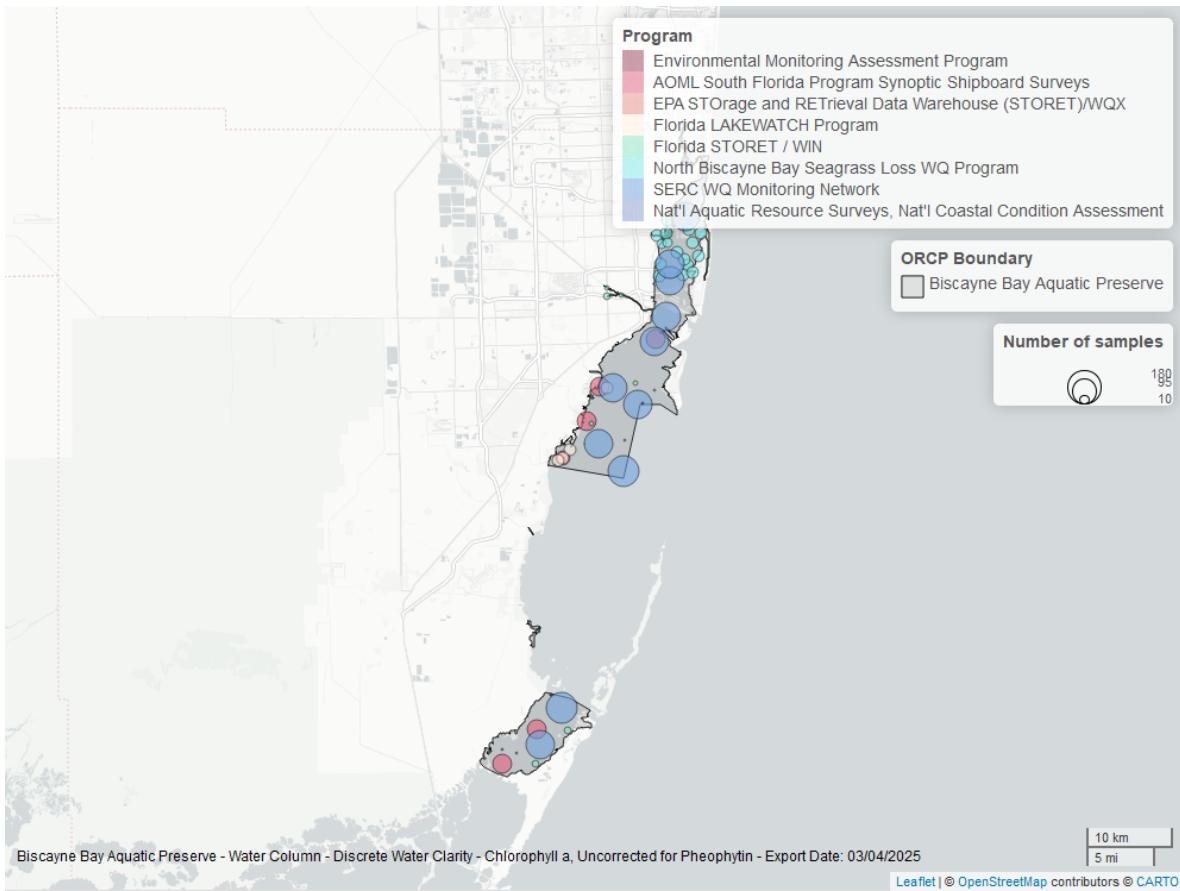


Figure 32: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Chlorophyll a, Corrected for Pheophytin - Discrete

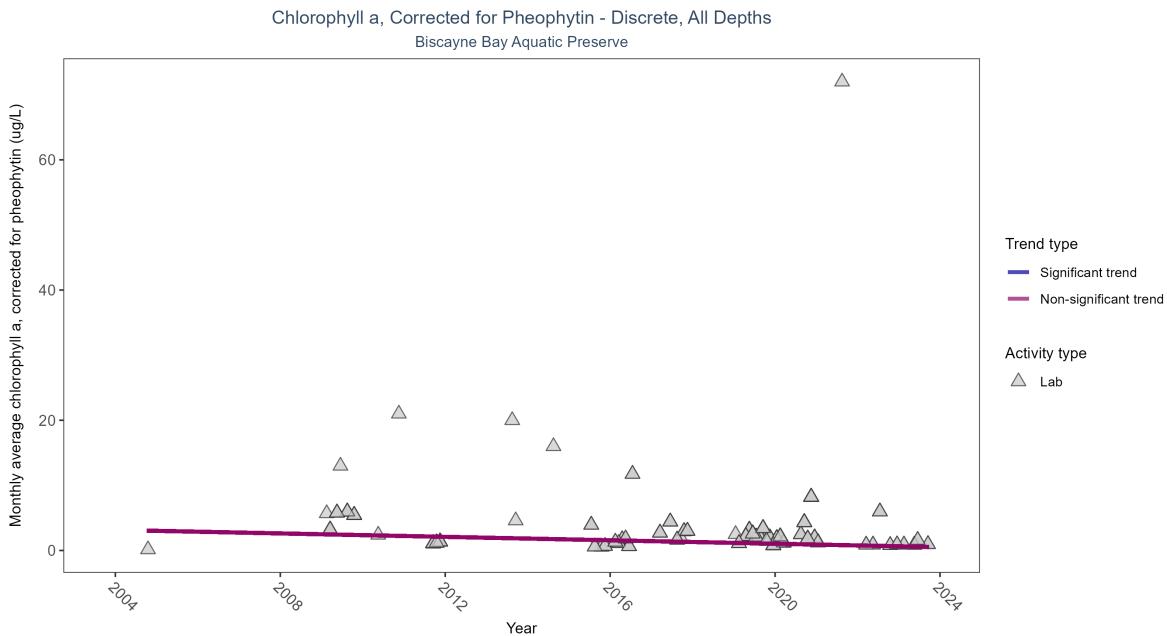


Figure 33: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) 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	No significant trend	470	14	2004 - 2023		1.4	-0.18454	3.14798	-0.13185	0.1713

Chlorophyll a, corrected for pheophytin, showed no detectable trend between 2004 and 2023.

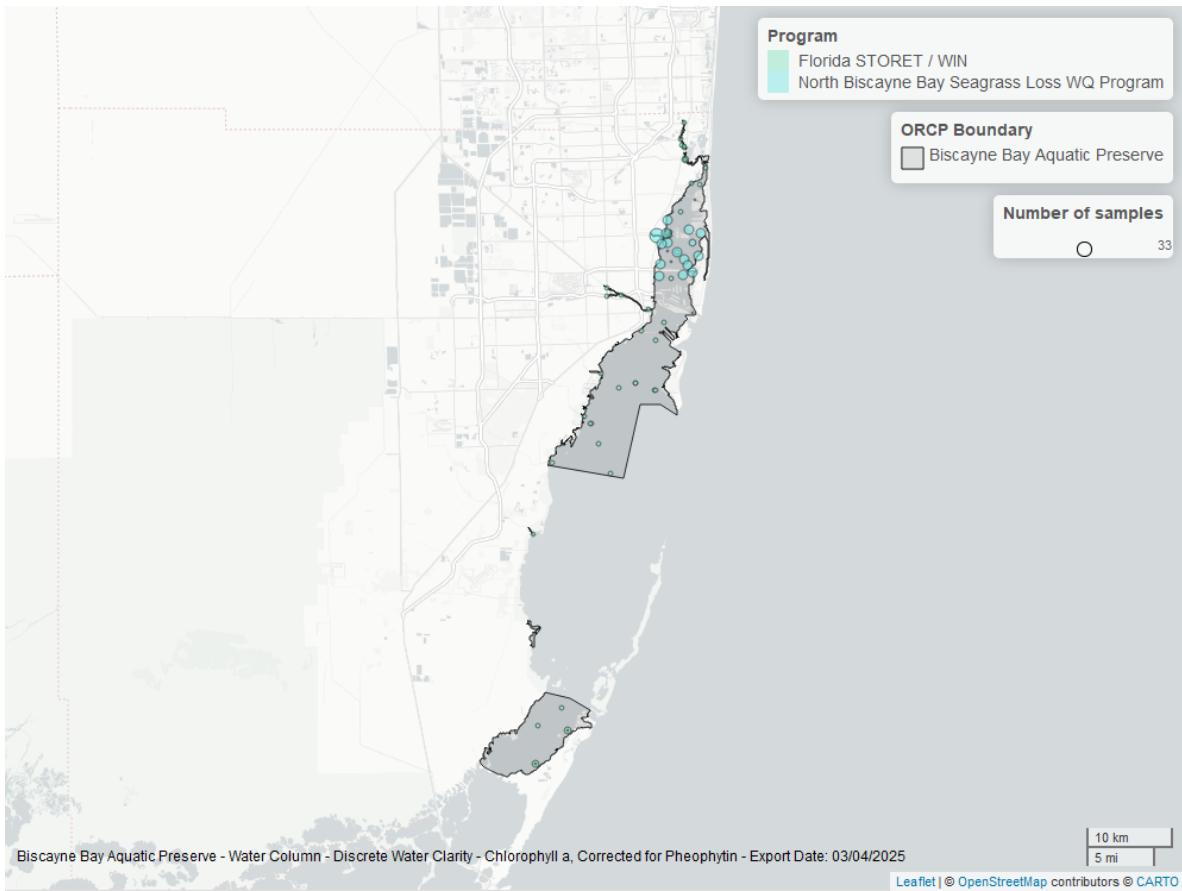


Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Secchi Depth - Discrete

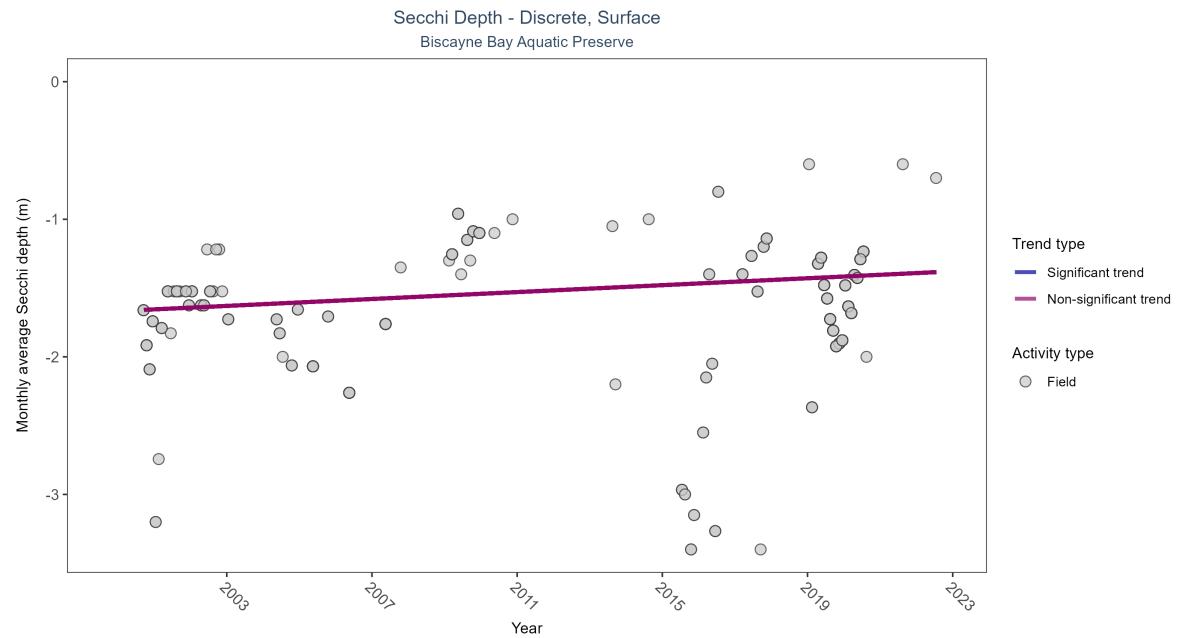


Figure 35: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

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	No significant trend	686	19	2000 - 2022	-1.52402	0.11555	-1.66756	0.01256	0.3365

Secchi depth showed no detectable trend between 2000 and 2022.

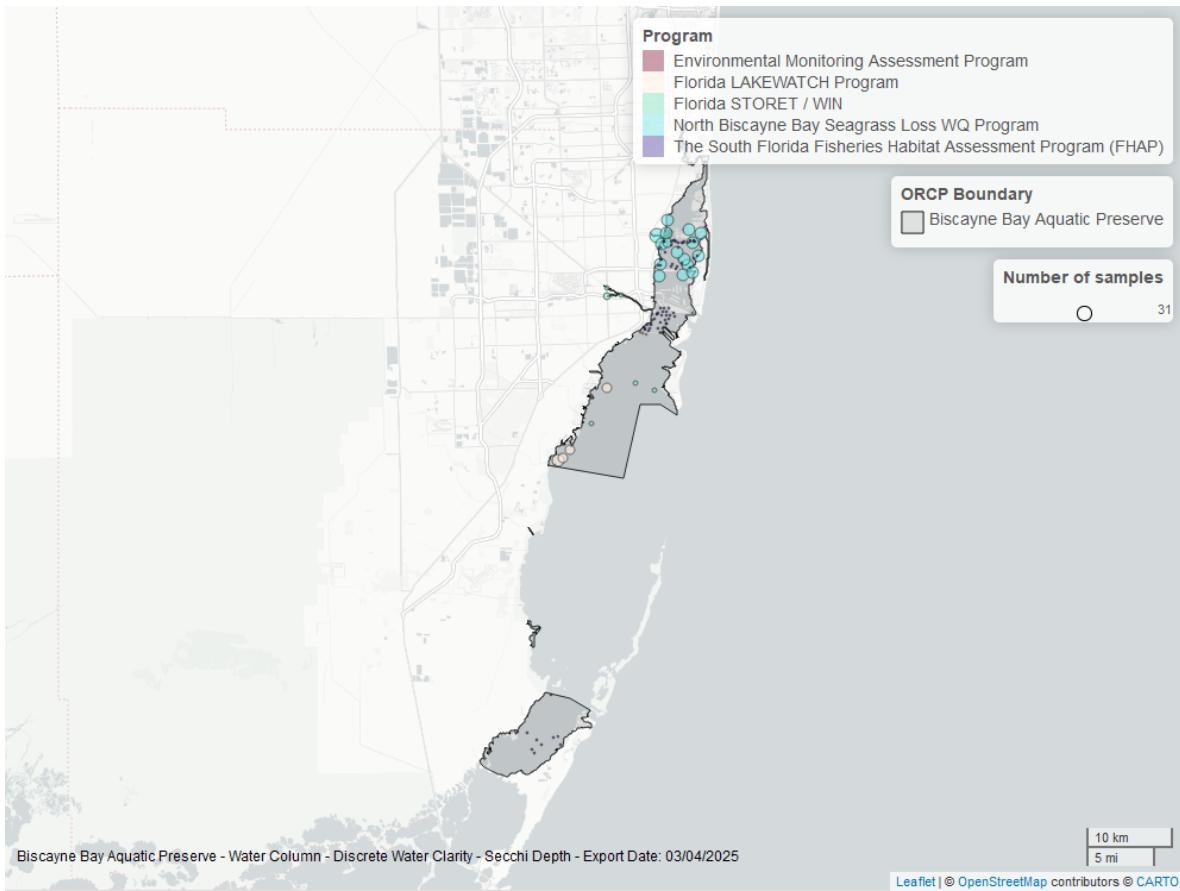


Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Colored Dissolved Organic Matter - Discrete

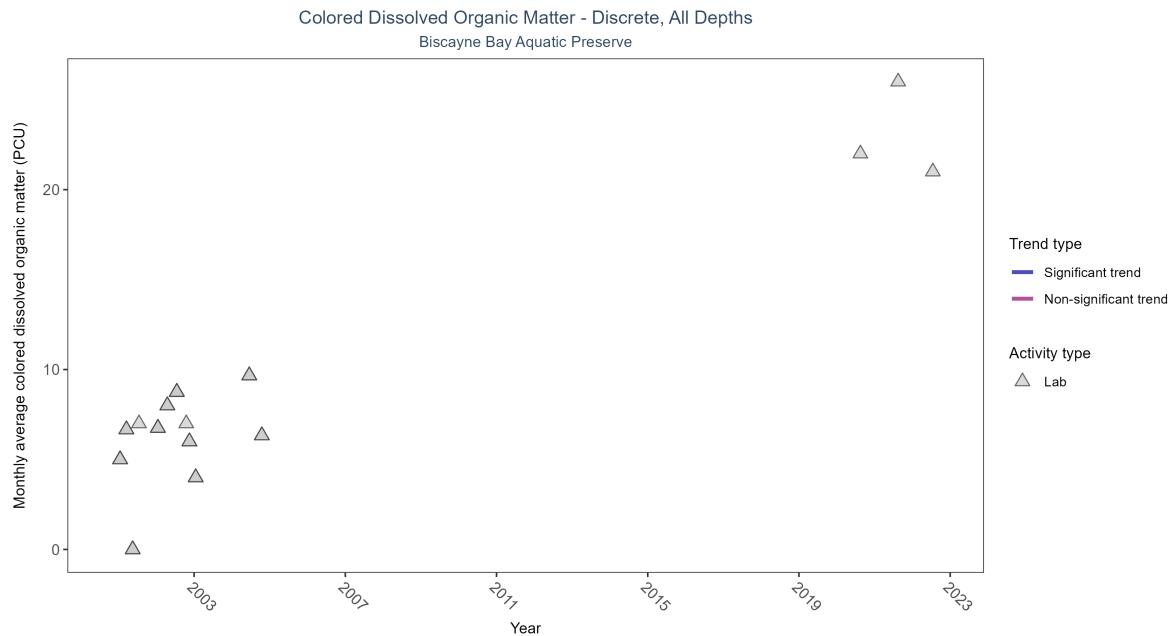


Figure 37: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the 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	38	7	2001 - 2022	7	-	-	-	-

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

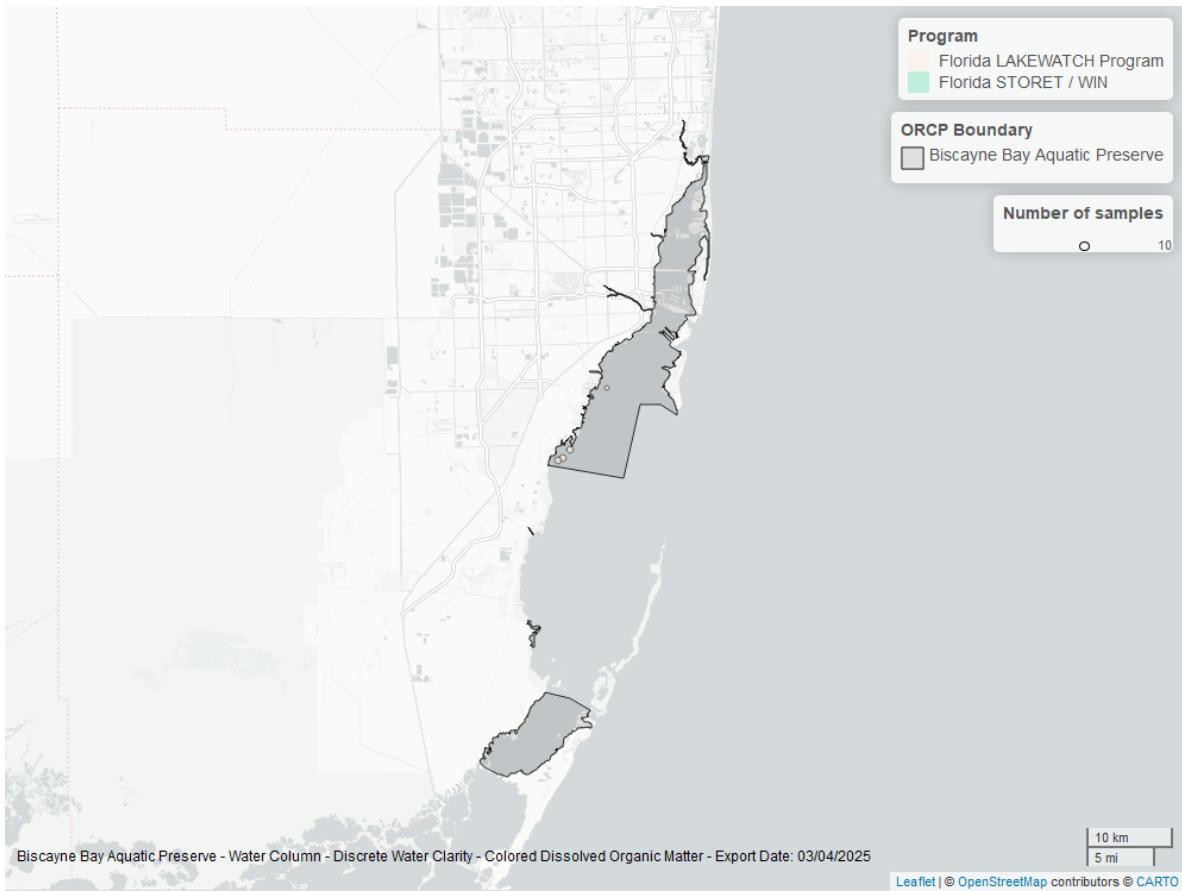


Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Biscayne Bay Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.