

# Rookery Bay National Estuarine Research Reserve

## SEACAR Water Quality Analysis

Last compiled on 10 July, 2025

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# Indicators

## Nutrients

### Total Nitrogen - Discrete

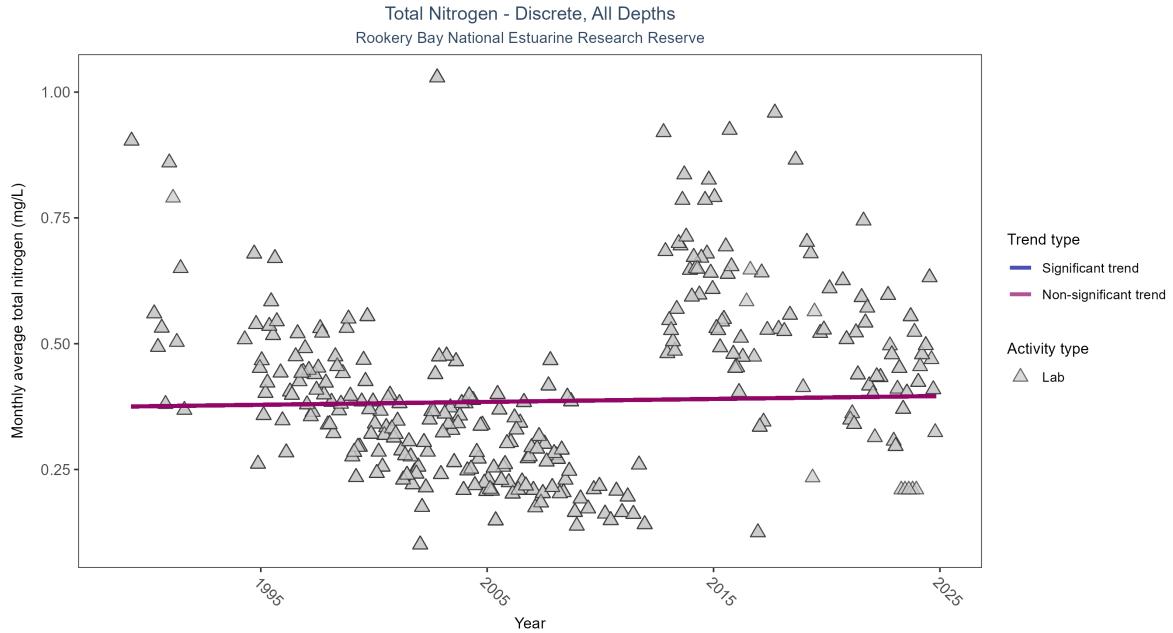


Figure 1: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the 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 | 5321         | 34              | 1989 - 2024      | 0.3184              | 0.01762 | 0.37507       | 0.00058   | 0.7234 |

Total nitrogen showed no detectable trend between 1989 and 2024.

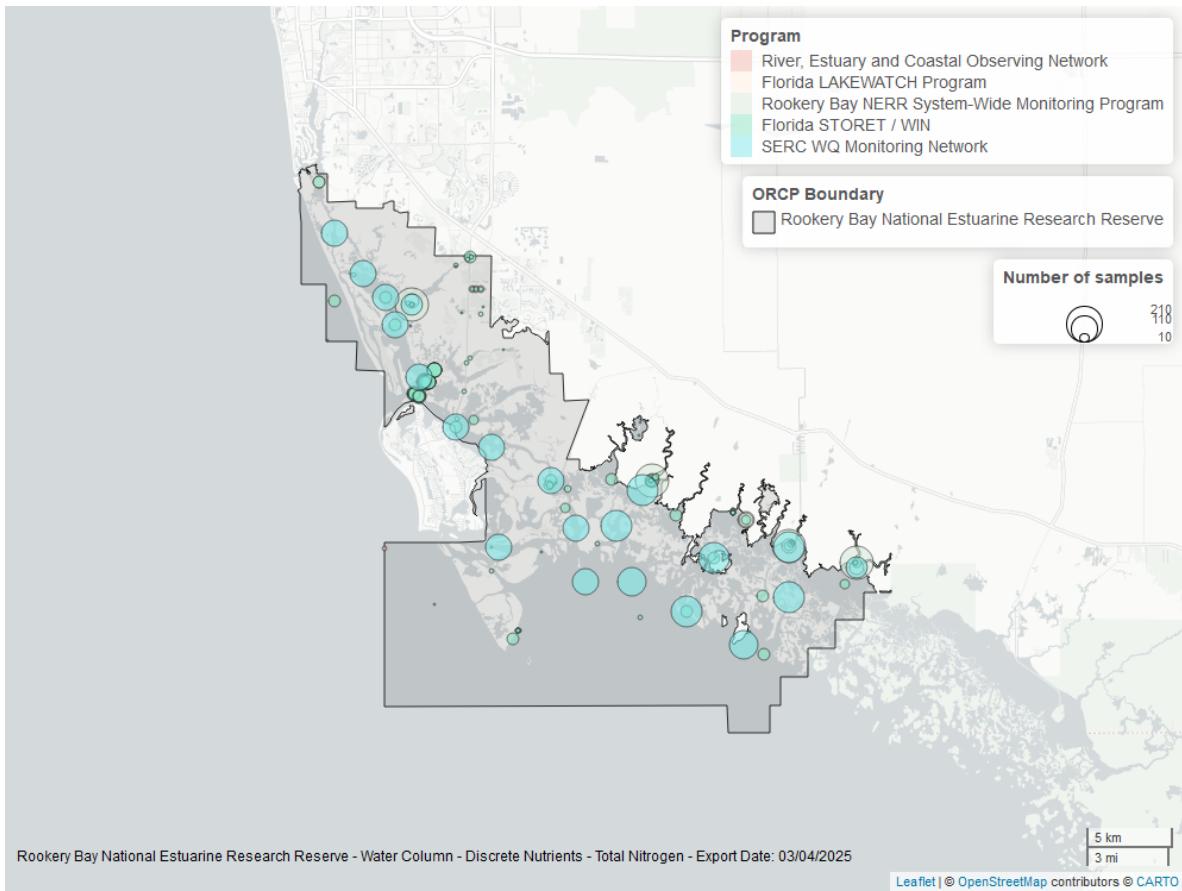


Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Total Phosphorus - Discrete

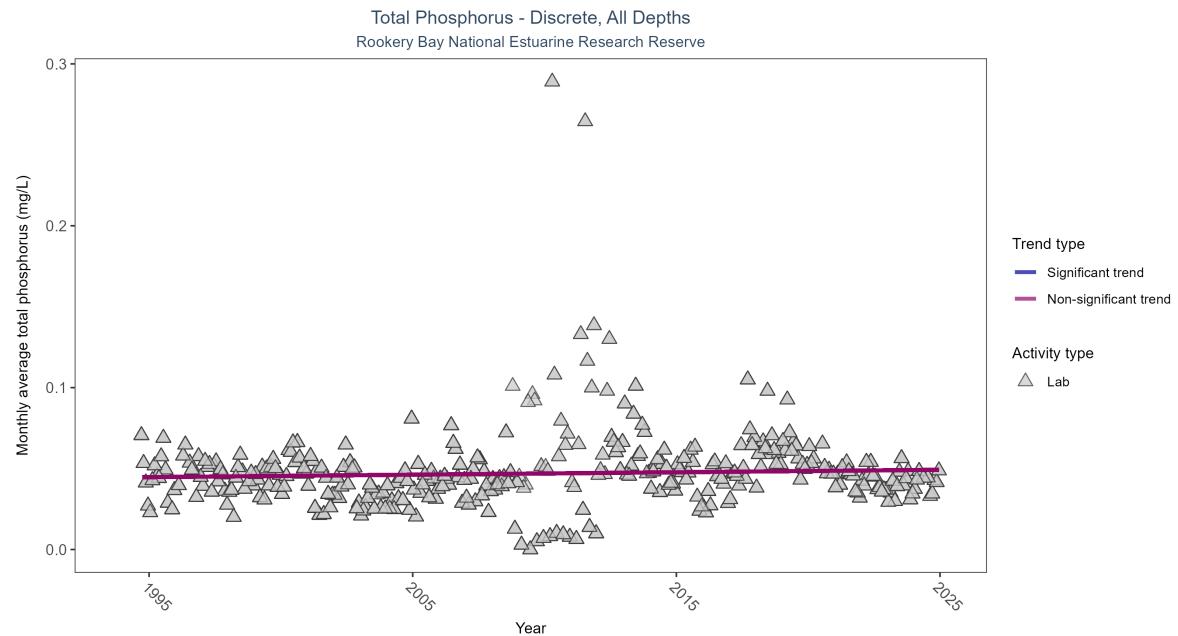


Figure 3: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in 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           | No significant trend | 5570         | 31              | 1994 - 2024      | 0.04                | 0.07283 | 0.04454       | 0.00015   | 0.0537 |

Total phosphorus showed no detectable trend between 1994 and 2024.

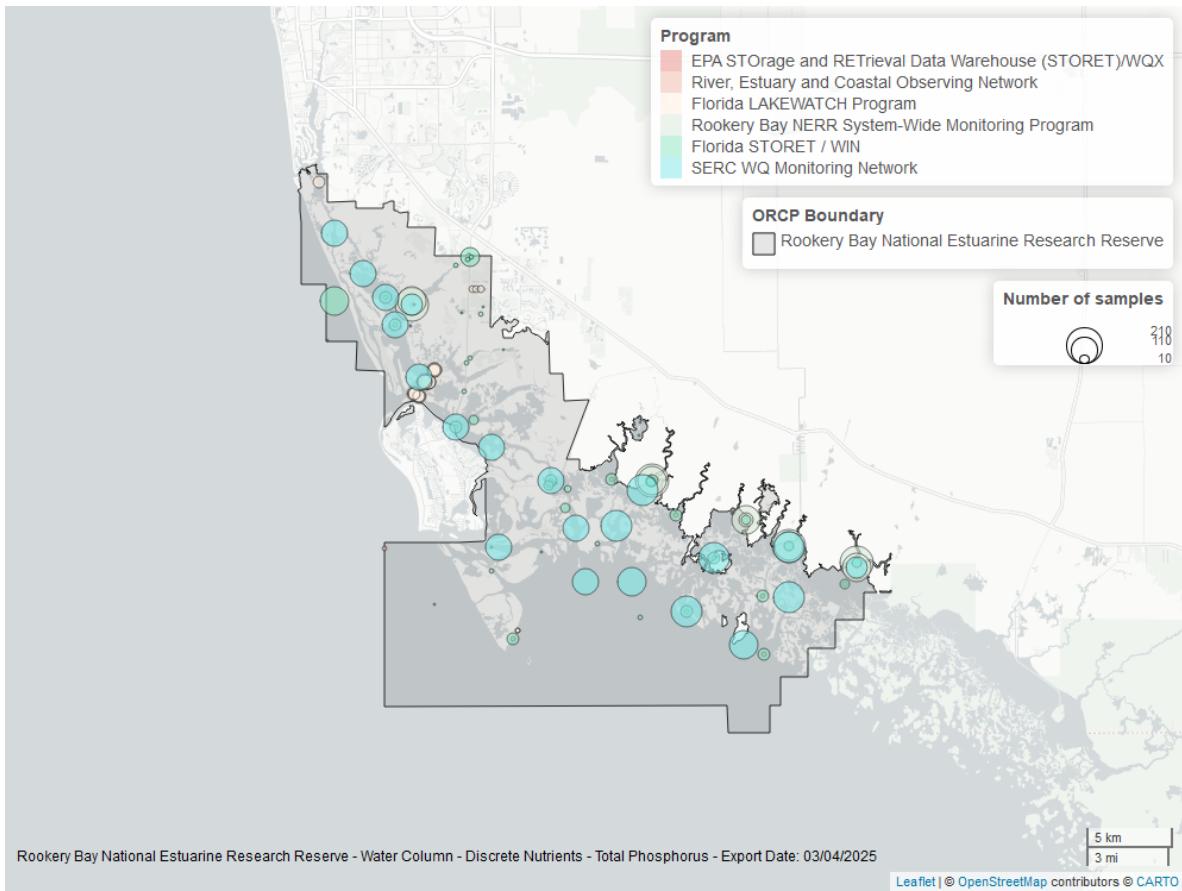


Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Quality

### Dissolved Oxygen - Discrete

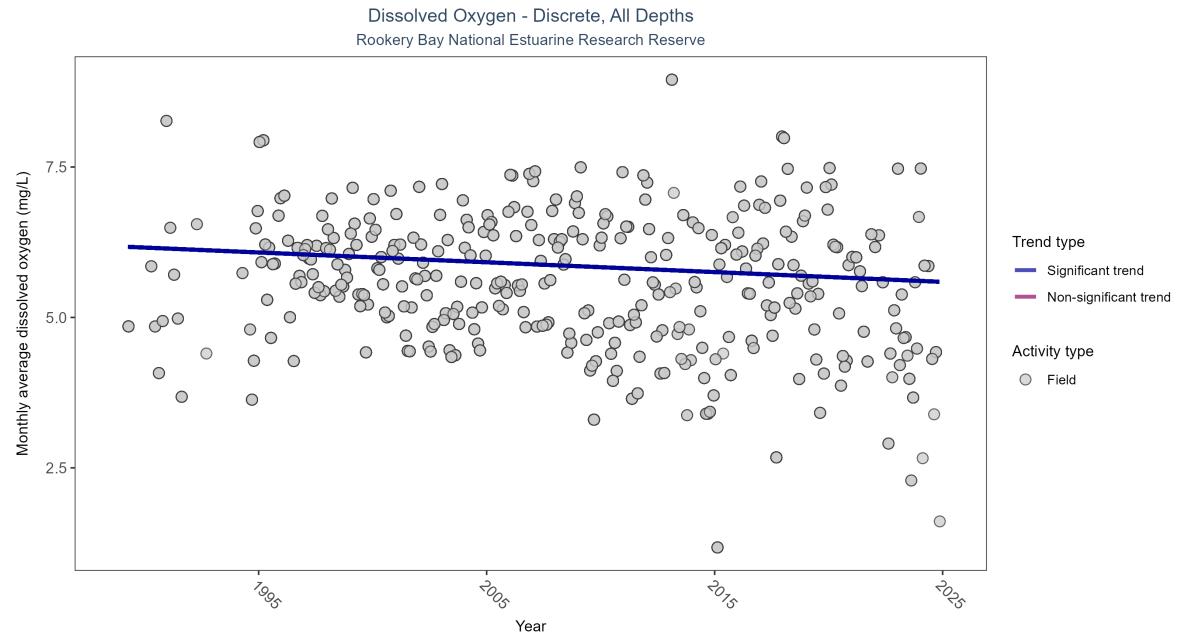


Figure 5: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

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 | 15353        | 35              | 1989 - 2024      | 5.8                 | -0.12565 | 6.17748       | -0.0163   | 0.0006 |

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

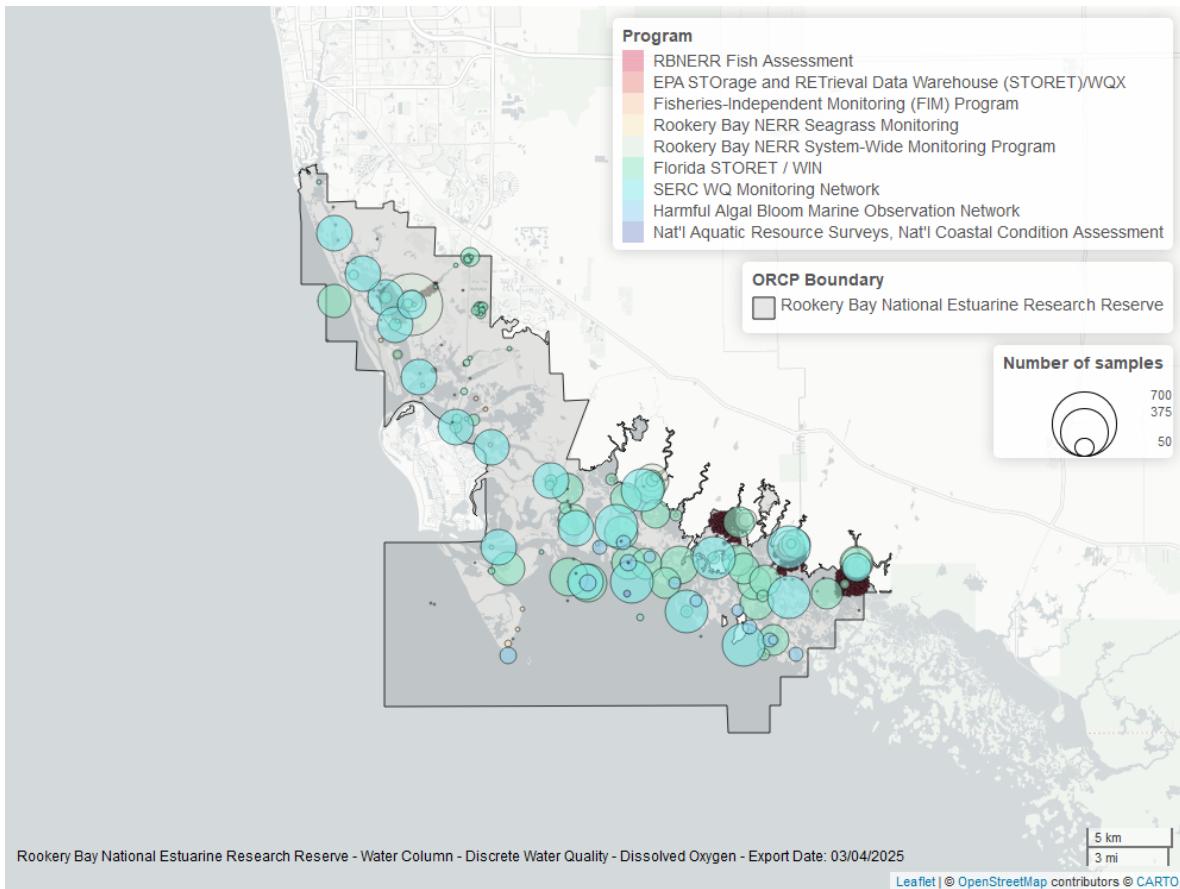


Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Dissolved Oxygen - Continuous

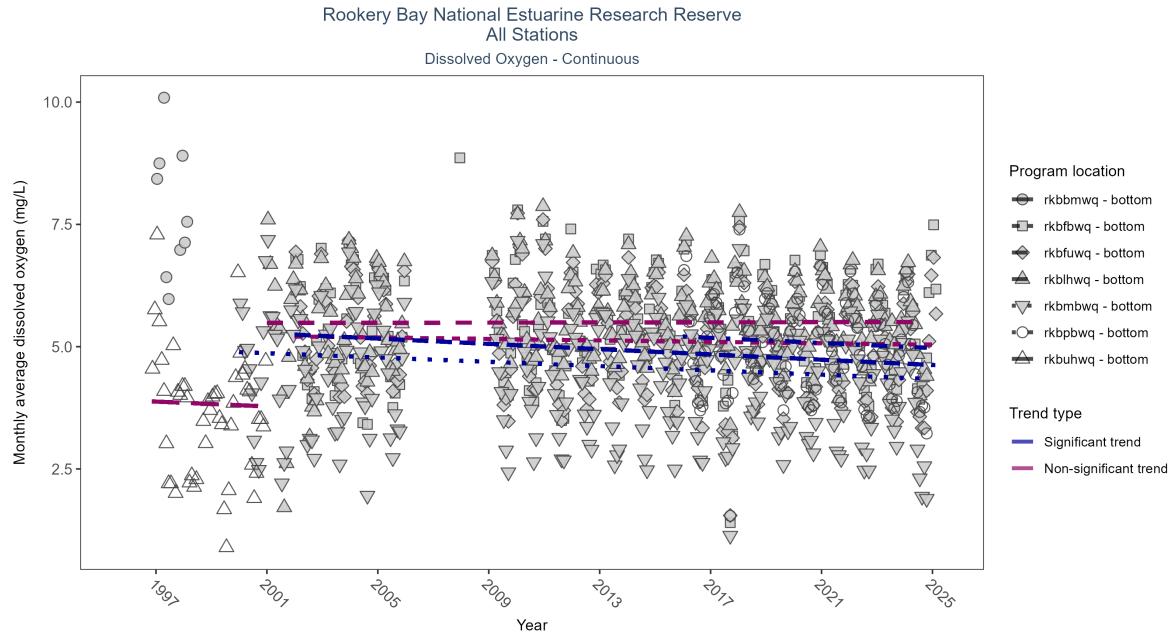


Figure 7: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | No significant trend                 | 570320       | 22              | 2002 - 2025      | 5.4                 | -0.06 | 5.21          | -0.01     | 0.1935 |
| rkbfwq           | Significantly decreasing trend       | 605519       | 21              | 2002 - 2025      | 5.1                 | -0.32 | 5.25          | -0.03     | 0      |
| rkbmwq           | Insufficient data to calculate trend | 10441        | 2               | 1997 - 1998      | 7.2                 | -     | -             | -         | -      |
| rkbhwq           | No significant trend                 | 570691       | 21              | 2001 - 2024      | 5.5                 | 0     | 5.48          | 0         | 0.8577 |
| rkbmbwq          | Significantly decreasing trend       | 613238       | 22              | 2000 - 2024      | 4.4                 | -0.26 | 4.89          | -0.02     | 0      |
| rkbpbwq          | Significantly decreasing trend       | 289726       | 9               | 2016 - 2024      | 4.9                 | -0.18 | 5.21          | -0.03     | 0.0246 |
| rkbuhwq          | No significant trend                 | 58164        | 5               | 1996 - 2000      | 3.6                 | 0.01  | 3.9           | -0.02     | 1      |

At three program locations, monthly average dissolved oxygen decreased between 0.02 and 0.03 mg/L per year. No detectable change in monthly average dissolved oxygen was observed at three locations. There was insufficient data to fit a model for one location.

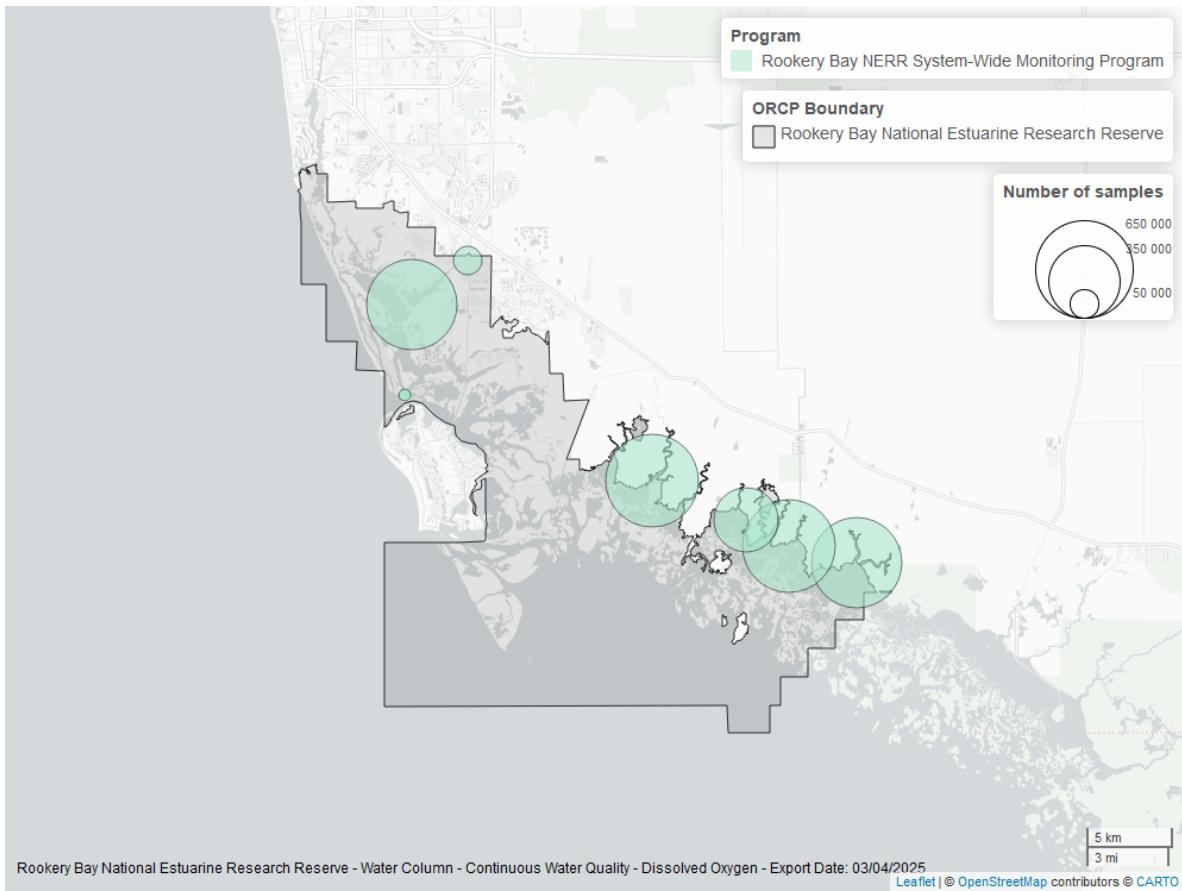


Figure 8: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Dissolved Oxygen Saturation - Discrete

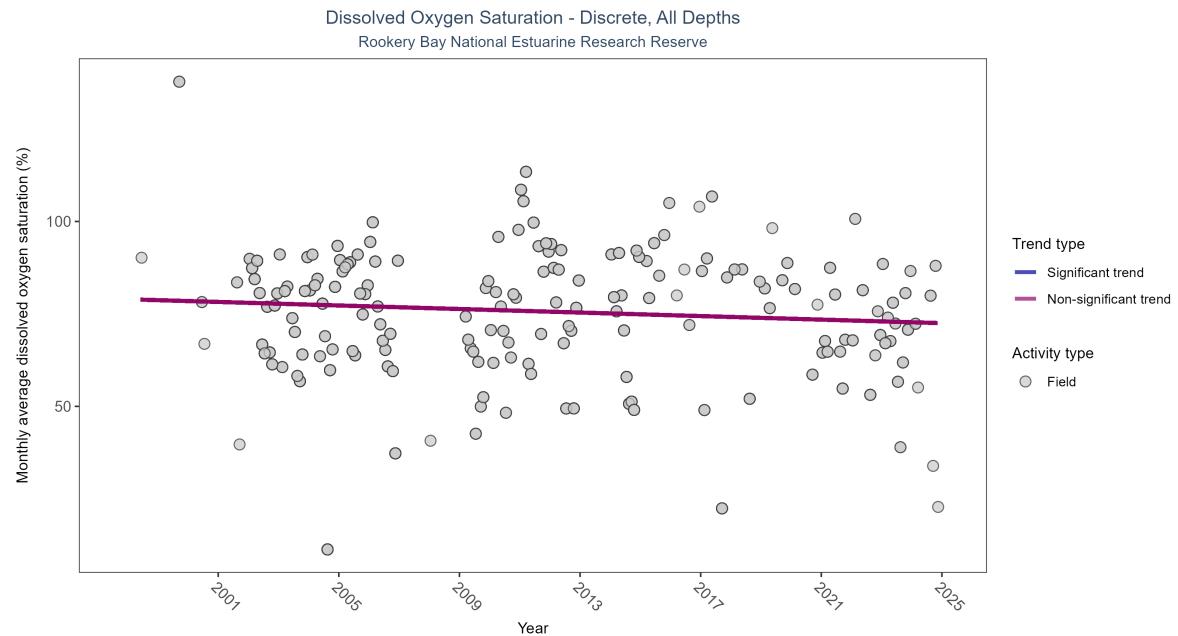


Figure 9: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) 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 | 1402         | 25              | 1998 - 2024      | 78                  | -0.08825 | 78.95521      | -0.23906  | 0.1253 |

Dissolved oxygen saturation showed no detectable trend between 1998 and 2024.

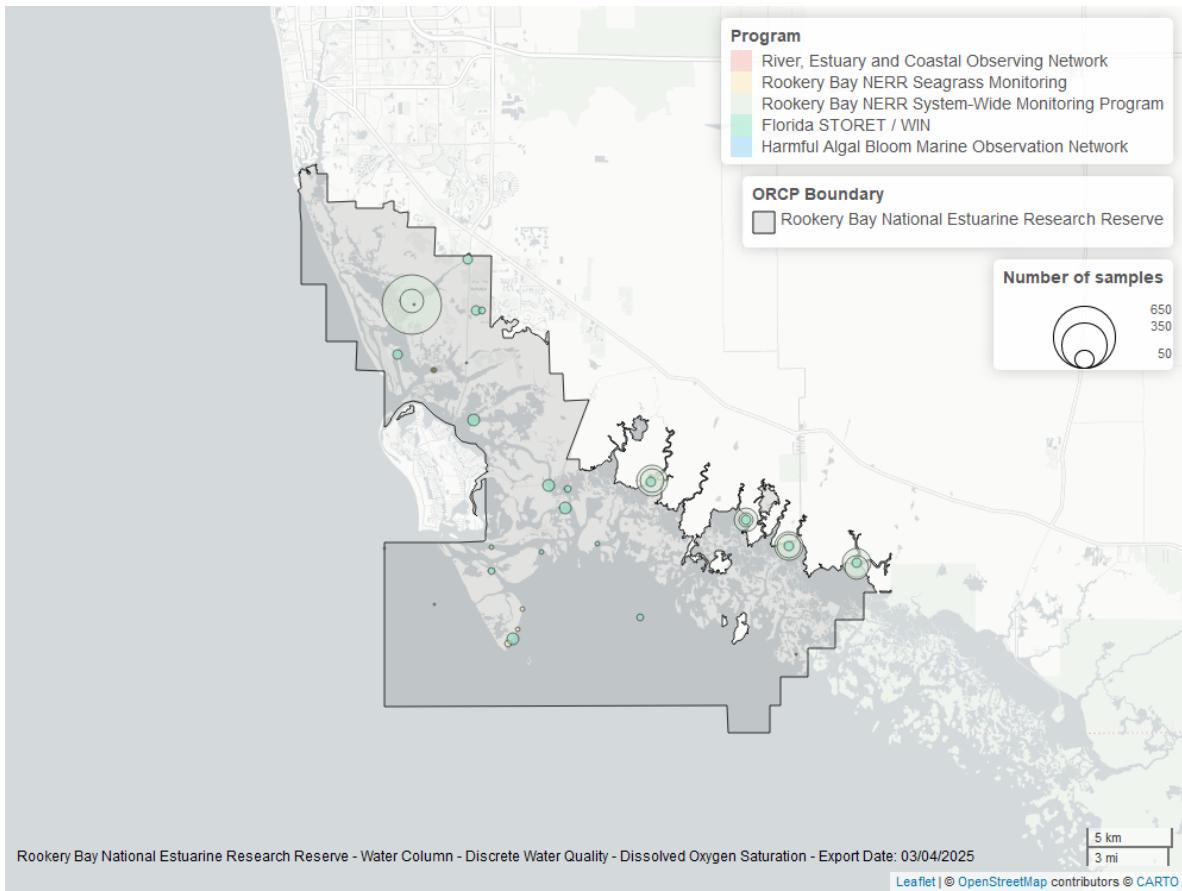


Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Dissolved Oxygen Saturation - Continuous

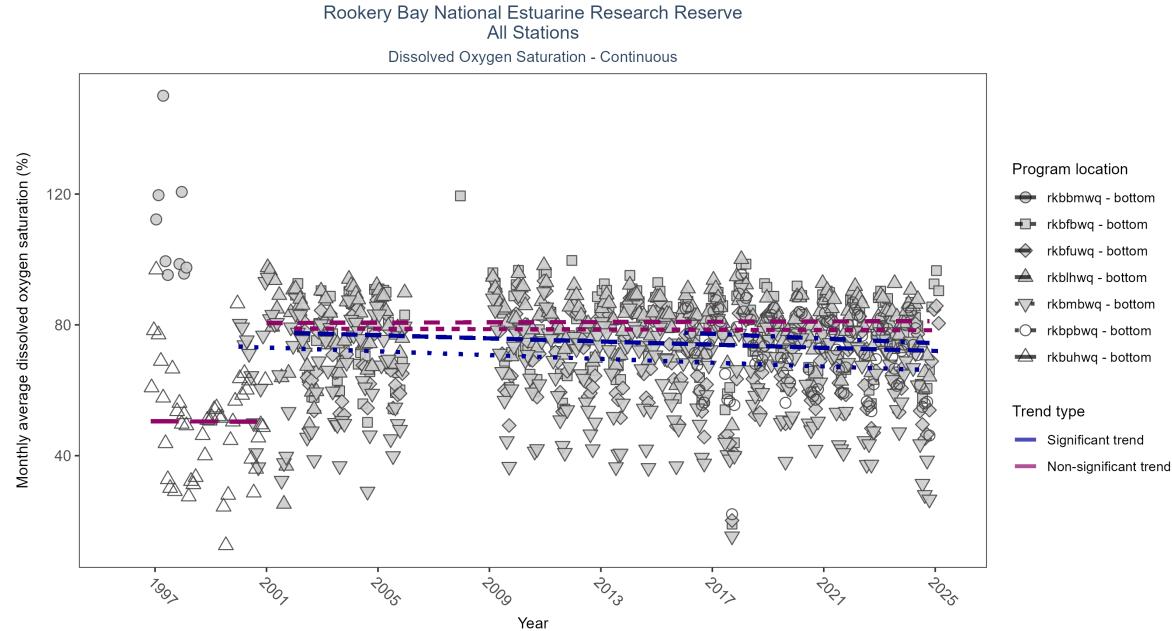


Figure 11: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | No significant trend                 | 574626       | 22              | 2002 - 2025      | 78.7                | -0.01 | 78.85         | -0.02     | 0.7862 |
| rkbbmwq          | Insufficient data to calculate trend | 10441        | 2               | 1997 - 1998      | 102.4               | -     | -             | -         | -      |
| rkbfuwq          | Significantly decreasing trend       | 605778       | 21              | 2002 - 2025      | 72.4                | -0.25 | 77.54         | -0.24     | 0      |
| rkblhwq          | No significant trend                 | 583009       | 21              | 2001 - 2024      | 81.7                | 0.02  | 80.58         | 0.02      | 0.554  |
| rkbpbwq          | Significantly decreasing trend       | 291357       | 9               | 2016 - 2024      | 72.3                | -0.18 | 77.6          | -0.36     | 0.0289 |
| rkbmhwq          | Significantly decreasing trend       | 619562       | 22              | 2000 - 2024      | 65.1                | -0.23 | 73.35         | -0.29     | 0      |
| rkbuhwq          | No significant trend                 | 58164        | 5               | 1996 - 2000      | 49.7                | 0     | 50.53         | -0.02     | 1      |

At three program locations, monthly average dissolved oxygen saturation decreased between 0.24 and 0.36% per year. No detectable change in monthly average dissolved oxygen saturation was observed at three locations. There was insufficient data to fit a model for one location.

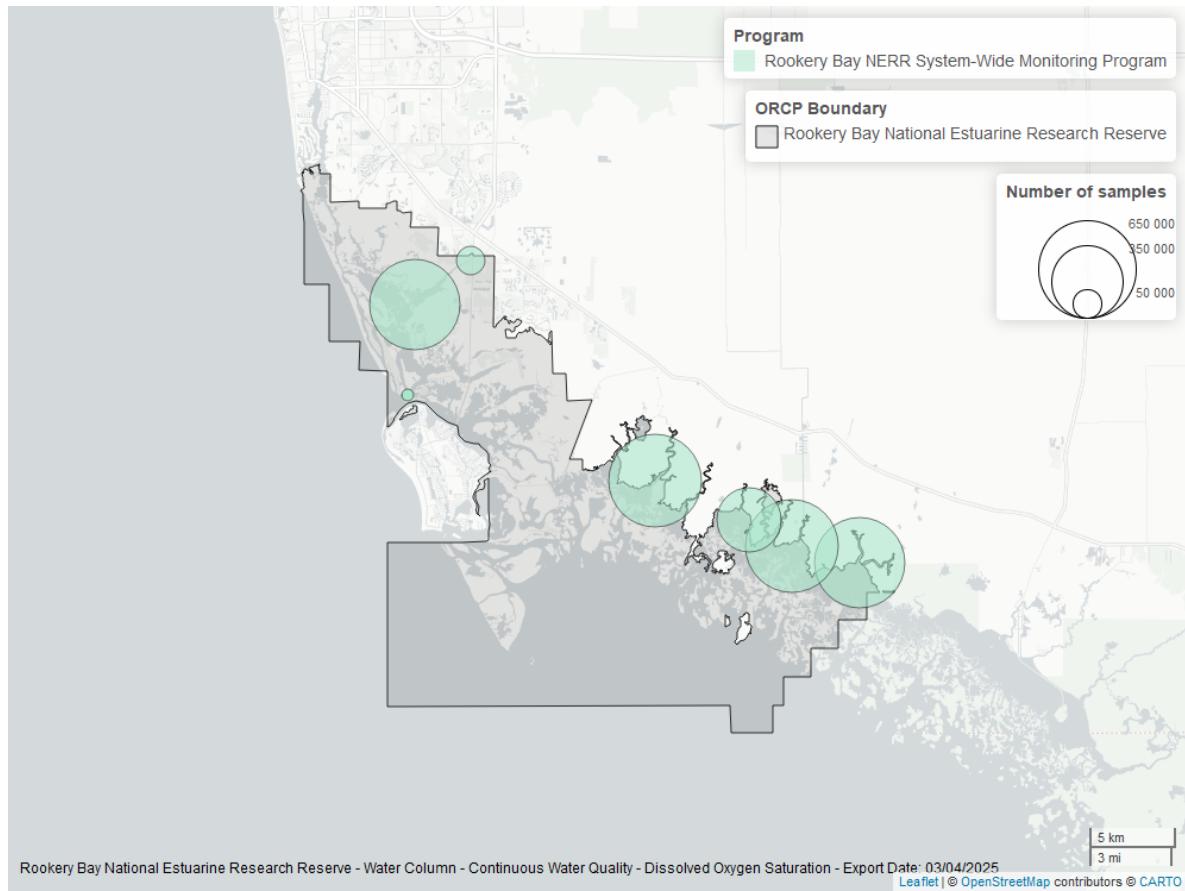


Figure 12: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Salinity - Discrete

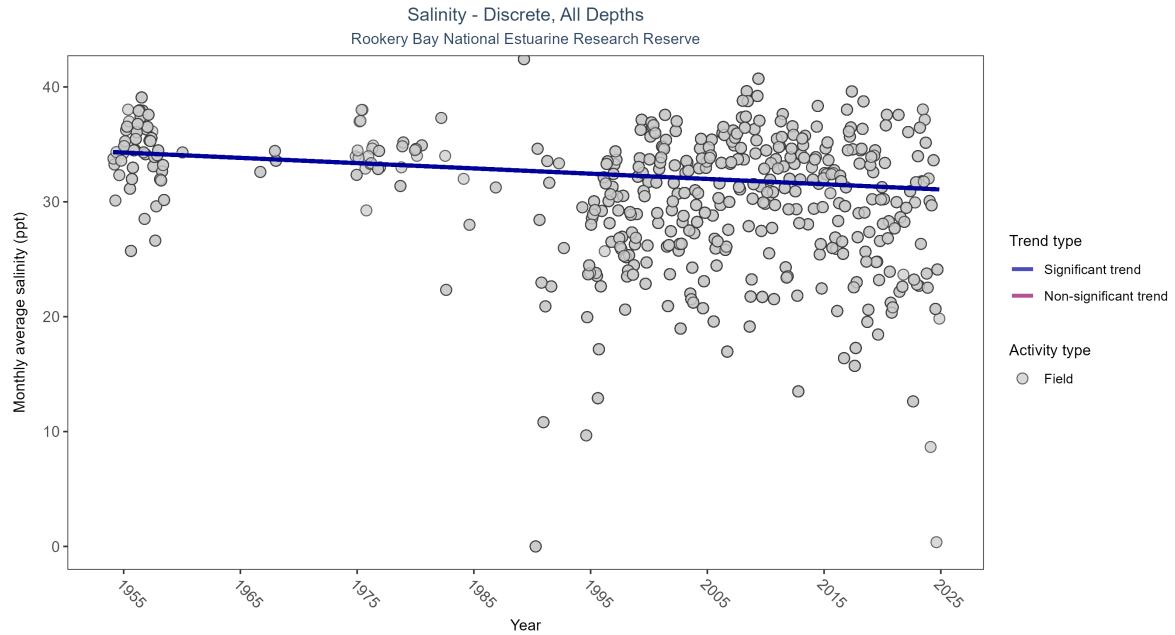


Figure 13: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the 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 | 16814        | 53              | 1954 - 2024      | 32.7                | -0.15884 | 34.33127      | -0.0459   | 0 |

Monthly average salinity decreased by 0.05 ppt per year.

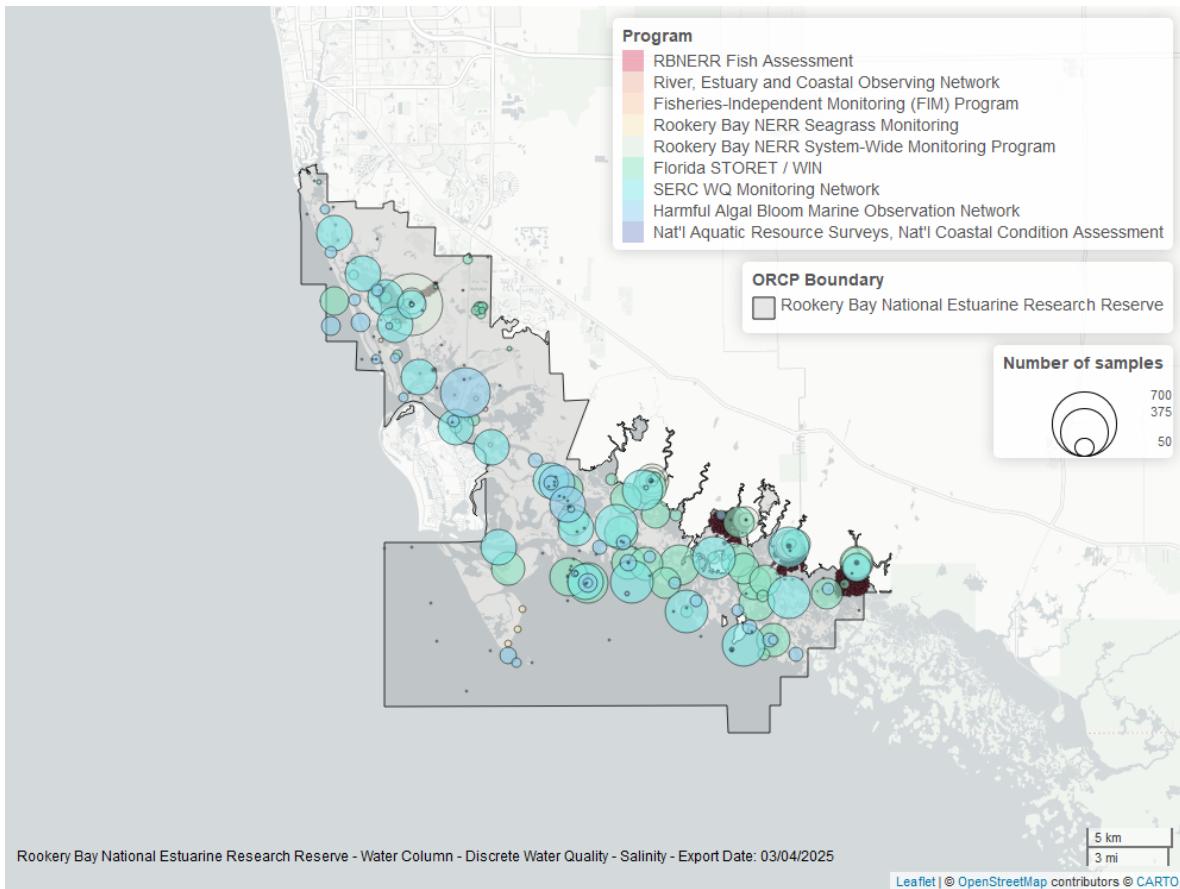


Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

#### Salinity - Continuous

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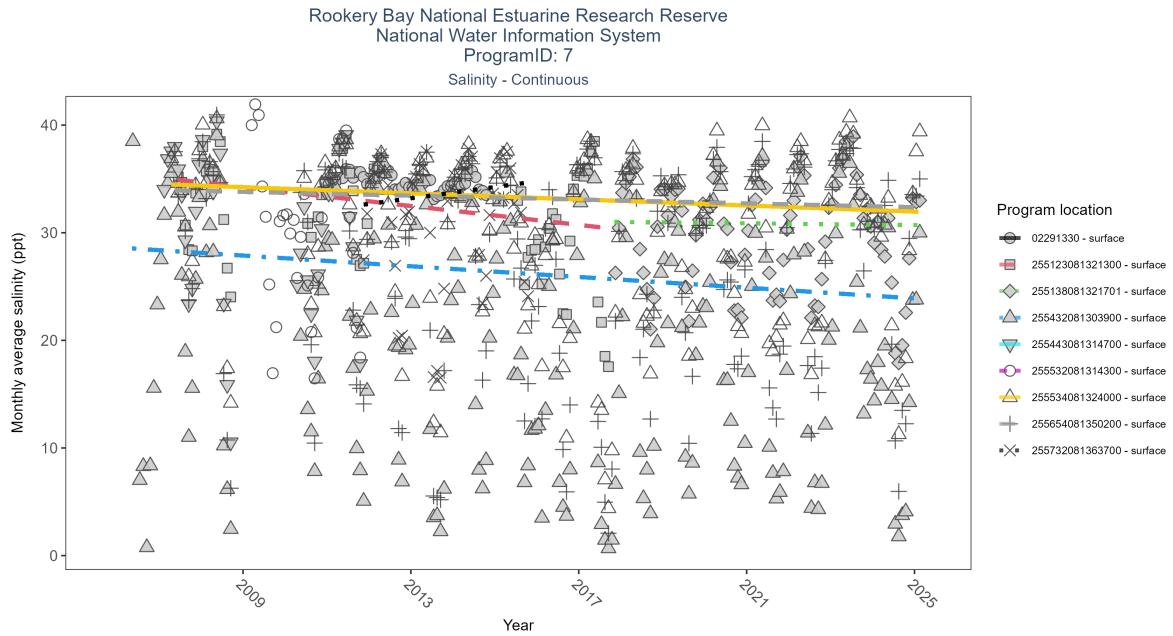


Figure 15: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau   | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| 255532081314300  | Insufficient data to calculate trend | 902          | 3               | 2009 - 2011      | 31                  | -     | -             | -         | -      |
| 255534081324000  | Significantly decreasing trend       | 5789         | 18              | 2007 - 2025      | 32                  | -0.12 | 34.52         | -0.14     | 0.021  |
| 255654081350200  | No significant trend                 | 5802         | 18              | 2007 - 2025      | 32                  | -0.09 | 33.97         | -0.09     | 0.076  |
| 255732081363700  | No significant trend                 | 1434         | 5               | 2011 - 2015      | 34                  | 0.25  | 32.15         | 0.52      | 0.0955 |
| 02291330         | Insufficient data to calculate trend | 1697         | 4               | 2011 - 2014      | 35                  | -     | -             | -         | -      |
| 255443081314700  | Insufficient data to calculate trend | 1465         | 4               | 2007 - 2011      | 32                  | -     | -             | -         | -      |
| 255432081303900  | Significantly decreasing trend       | 6087         | 19              | 2006 - 2025      | 21                  | -0.2  | 28.63         | -0.25     | 0.0002 |
| 255138081321701  | No significant trend                 | 2608         | 9               | 2017 - 2025      | 31                  | -0.04 | 31.04         | -0.04     | 0.6868 |
| 255123081321300  | Significantly decreasing trend       | 1809         | 8               | 2007 - 2017      | 32                  | -0.23 | 35.11         | -0.44     | 0.0182 |

At one program location, monthly average salinity increased by 2.06 ppt per year. At five program locations, monthly average salinity decreased between 0.08 and 0.44 ppt per year. No detectable change in monthly average salinity was observed at six locations. There was insufficient data to fit a model for four locations.

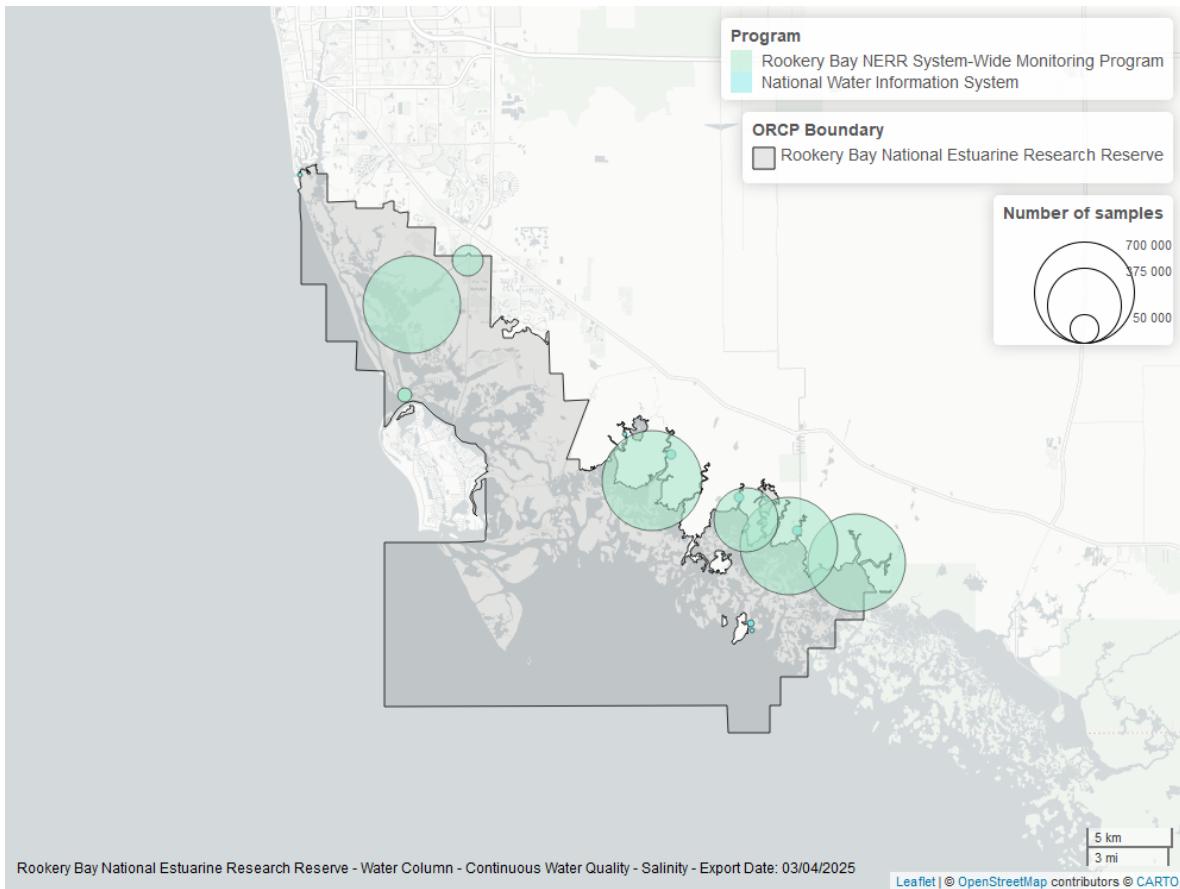


Figure 16: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

**Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program - 354**

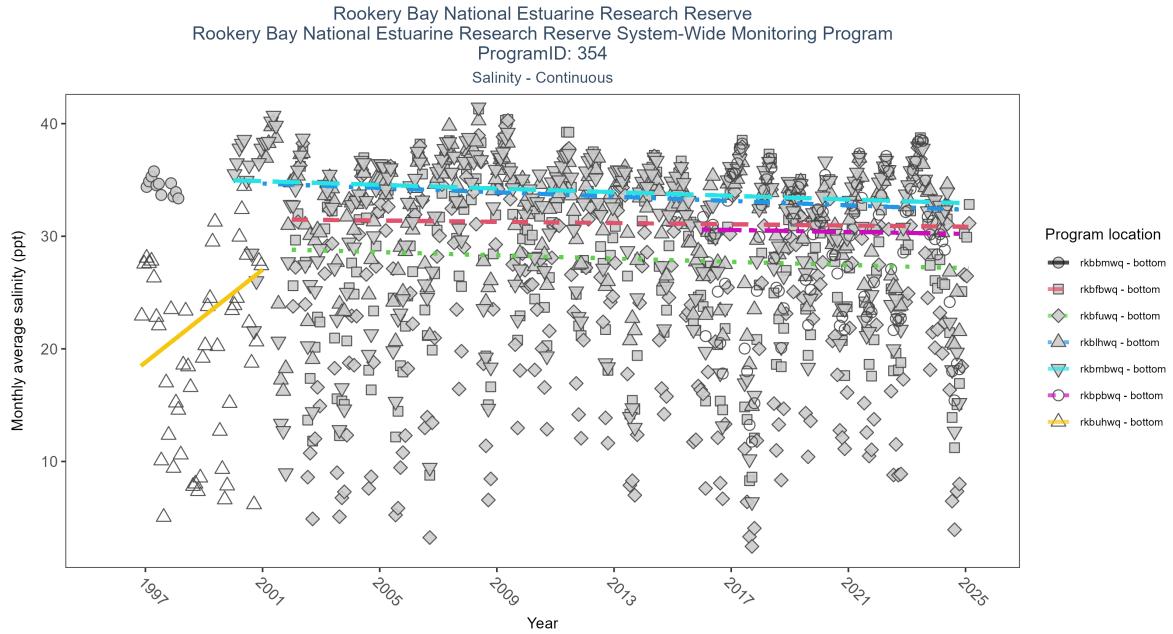


Figure 17: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau   | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | No significant trend                 | 669593       | 24              | 2002 - 2025      | 29.6                | -0.03 | 31.48         | -0.03     | 0.4738 |
| rkbmhwq          | Insufficient data to calculate trend | 12256        | 2               | 1997 - 1998      | 34.5                | -     | -             | -         | -      |
| rkbfuwq          | No significant trend                 | 686073       | 24              | 2002 - 2025      | 26.0                | -0.06 | 28.81         | -0.07     | 0.1476 |
| rkbmbwq          | Significantly decreasing trend       | 694825       | 25              | 2000 - 2024      | 33.3                | -0.12 | 34.97         | -0.08     | 0.0032 |
| rkbhwq           | Significantly decreasing trend       | 657842       | 24              | 2001 - 2024      | 33.1                | -0.16 | 34.68         | -0.1      | 0.0001 |
| rkbpbwq          | No significant trend                 | 290041       | 9               | 2016 - 2024      | 30.2                | -0.01 | 30.6          | -0.04     | 0.9243 |
| rkbuhwq          | Significantly increasing trend       | 68446        | 5               | 1996 - 2000      | 21.1                | 0.31  | 16.74         | 2.06      | 0.0358 |

At one program location, monthly average salinity increased by 2.06 ppt per year. At five program locations, monthly average salinity decreased between 0.08 and 0.44 ppt per year. No detectable change in monthly average salinity was observed at six locations. There was insufficient data to fit a model for four locations.

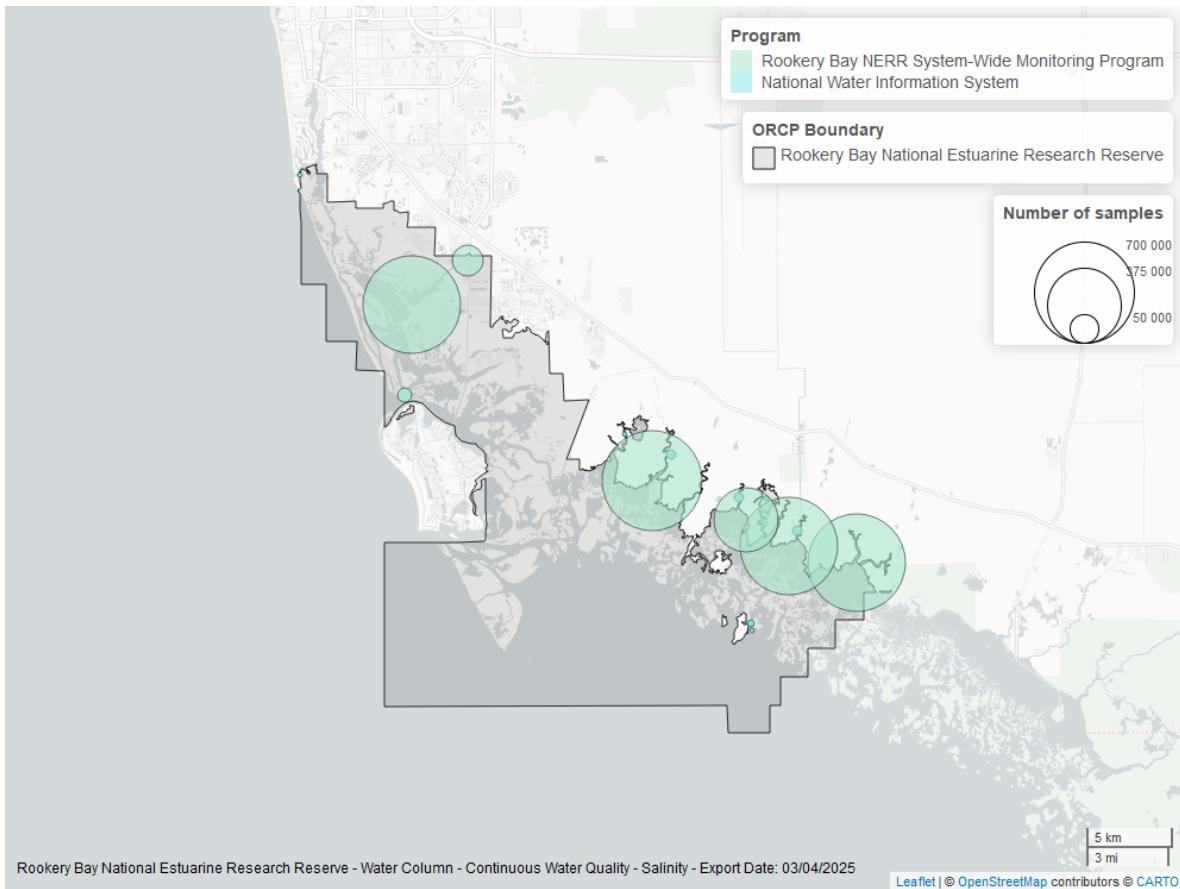


Figure 18: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Temperature - Discrete

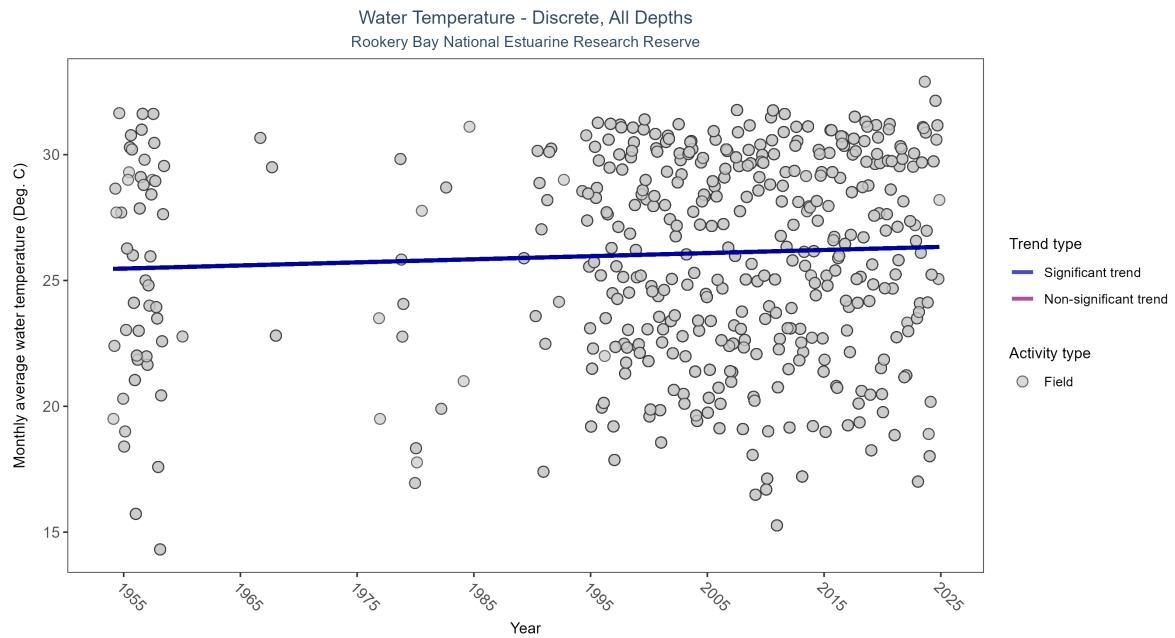


Figure 19: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in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

Table 10: Seasonal Kendall-Tau Results for - Water Temperature

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau     | Sen Intercept | Sen Slope | P      |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|---------|---------------|-----------|--------|
| Field         | Significantly increasing trend | 16851        | 50              | 1954 - 2024      | 26.65               | 0.10449 | 25.46109      | 0.01232   | 0.0018 |

Monthly average water temperature increased by  $0.01^{\circ}\text{C}$  per year.

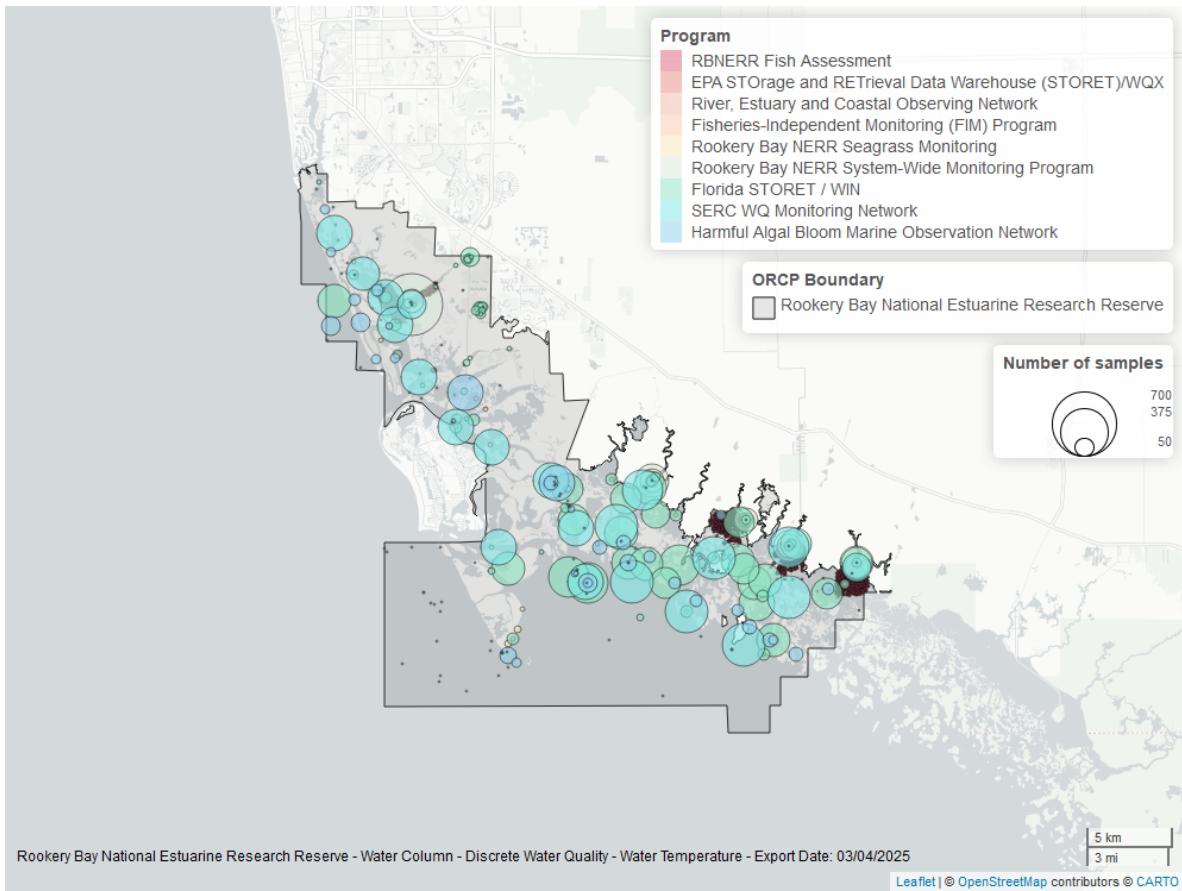


Figure 20: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

#### Water Temperature - Continuous

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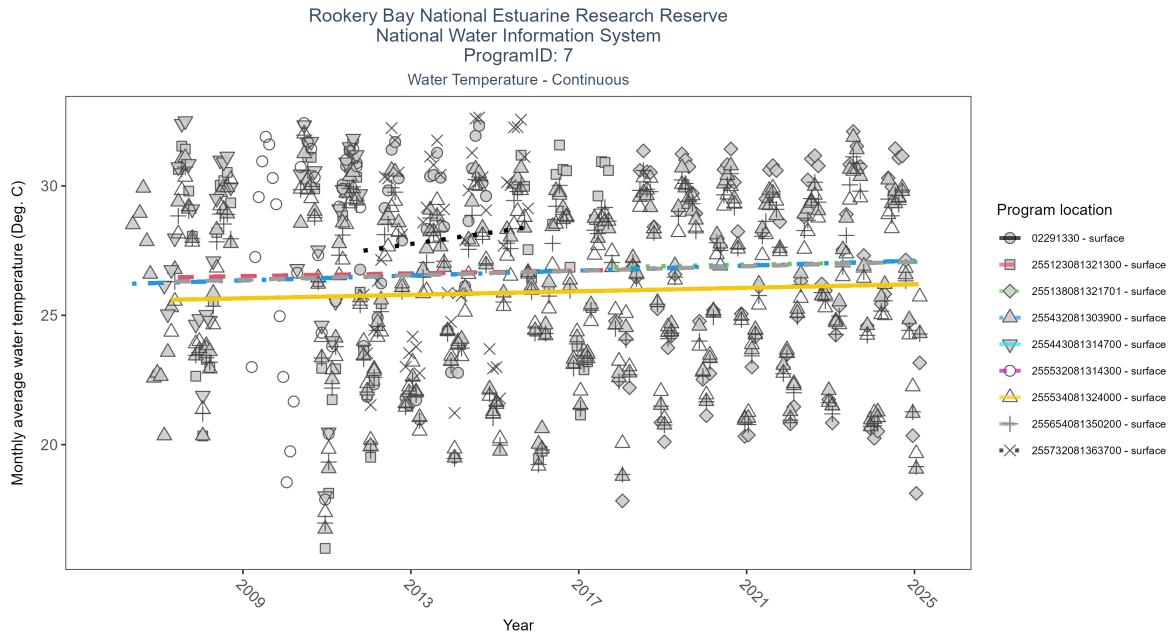


Figure 21: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau  | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|------|---------------|-----------|--------|
| 255443081314700  | Insufficient data to calculate trend | 2011         | 4               | 2007 - 2011      | 29.30               | -    | -             | -         | -      |
| 255532081314300  | Insufficient data to calculate trend | 906          | 3               | 2009 - 2011      | 29.30               | -    | -             | -         | -      |
| 255534081324000  | Significantly increasing trend       | 5845         | 18              | 2007 - 2025      | 26.60               | 0.14 | 25.59         | 0.03      | 0.0103 |
| 255654081350200  | Significantly increasing trend       | 5840         | 18              | 2007 - 2025      | 26.75               | 0.14 | 26.29         | 0.04      | 0.0087 |
| 255732081363700  | No significant trend                 | 1435         | 5               | 2011 - 2015      | 28.40               | 0.24 | 27.3          | 0.23      | 0.1149 |
| 02291330         | Insufficient data to calculate trend | 1901         | 4               | 2011 - 2014      | 28.30               | -    | -             | -         | -      |
| 255432081303900  | Significantly increasing trend       | 6146         | 19              | 2006 - 2025      | 27.00               | 0.16 | 26.21         | 0.05      | 0.0025 |
| 255123081321300  | No significant trend                 | 1818         | 8               | 2007 - 2017      | 27.30               | 0.1  | 26.46         | 0.03      | 0.3843 |
| 255138081321701  | No significant trend                 | 2626         | 9               | 2017 - 2025      | 27.00               | 0.07 | 26.85         | 0.03      | 0.5456 |

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

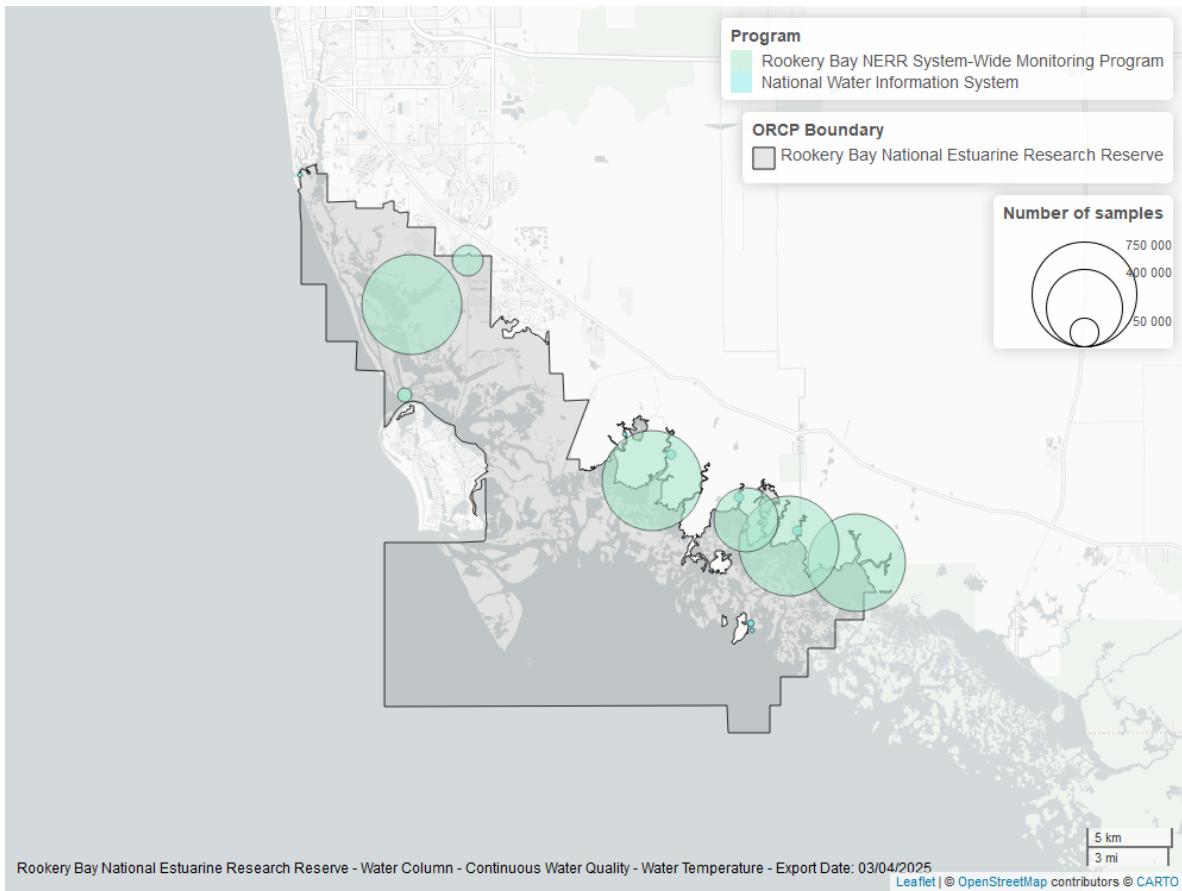


Figure 22: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

**Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program - 354**

Rookery Bay National Estuarine Research Reserve  
 Rookery Bay National Estuarine Research Reserve System-Wide Monitoring Program  
 ProgramID: 354  
 Water Temperature - Continuous

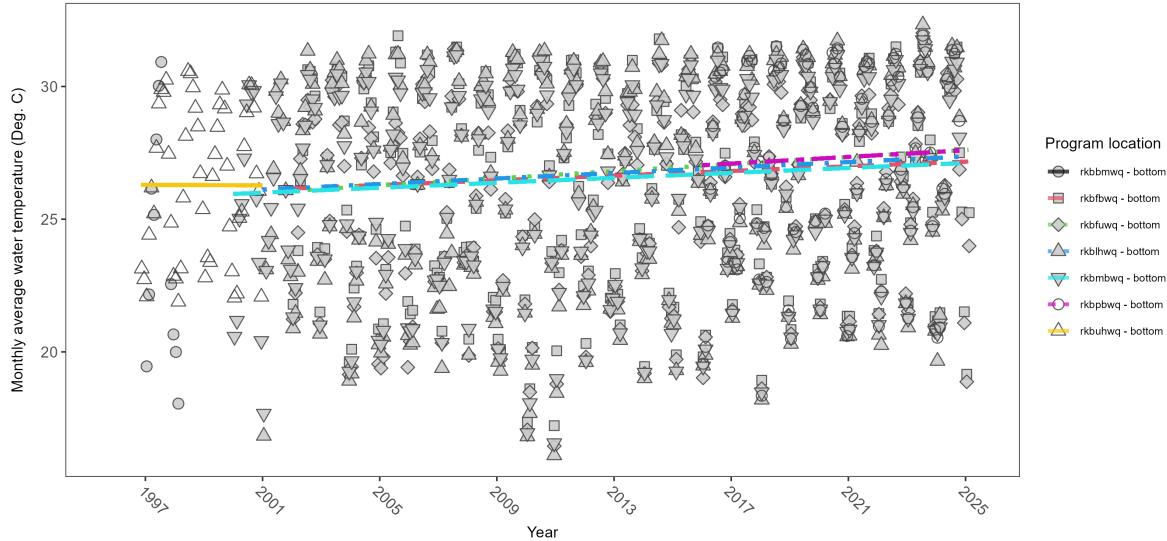


Figure 23: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

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

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau   | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | Significantly increasing trend       | 685432       | 24              | 2002 - 2025      | 27.0                | 0.23  | 26.15         | 0.04      | 0      |
| rkbbmwq          | Insufficient data to calculate trend | 12610        | 2               | 1997 - 1998      | 23.8                | -     | -             | -         | -      |
| rkbfuwq          | Significantly increasing trend       | 696504       | 24              | 2002 - 2025      | 26.9                | 0.26  | 26.07         | 0.07      | 0      |
| rkblhwq          | Significantly increasing trend       | 68894        | 24              | 2001 - 2024      | 27.0                | 0.25  | 26.12         | 0.05      | 0      |
| rkmbbwq          | Significantly increasing trend       | 718152       | 25              | 2000 - 2024      | 26.9                | 0.26  | 25.95         | 0.05      | 0      |
| rkpbpwq          | No significant trend                 | 292925       | 9               | 2016 - 2024      | 27.6                | 0.14  | 27.03         | 0.06      | 0.0711 |
| rkbuhwq          | No significant trend                 | 68971        | 5               | 1996 - 2000      | 26.8                | -0.01 | 26.3          | -0.01     | 1      |

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

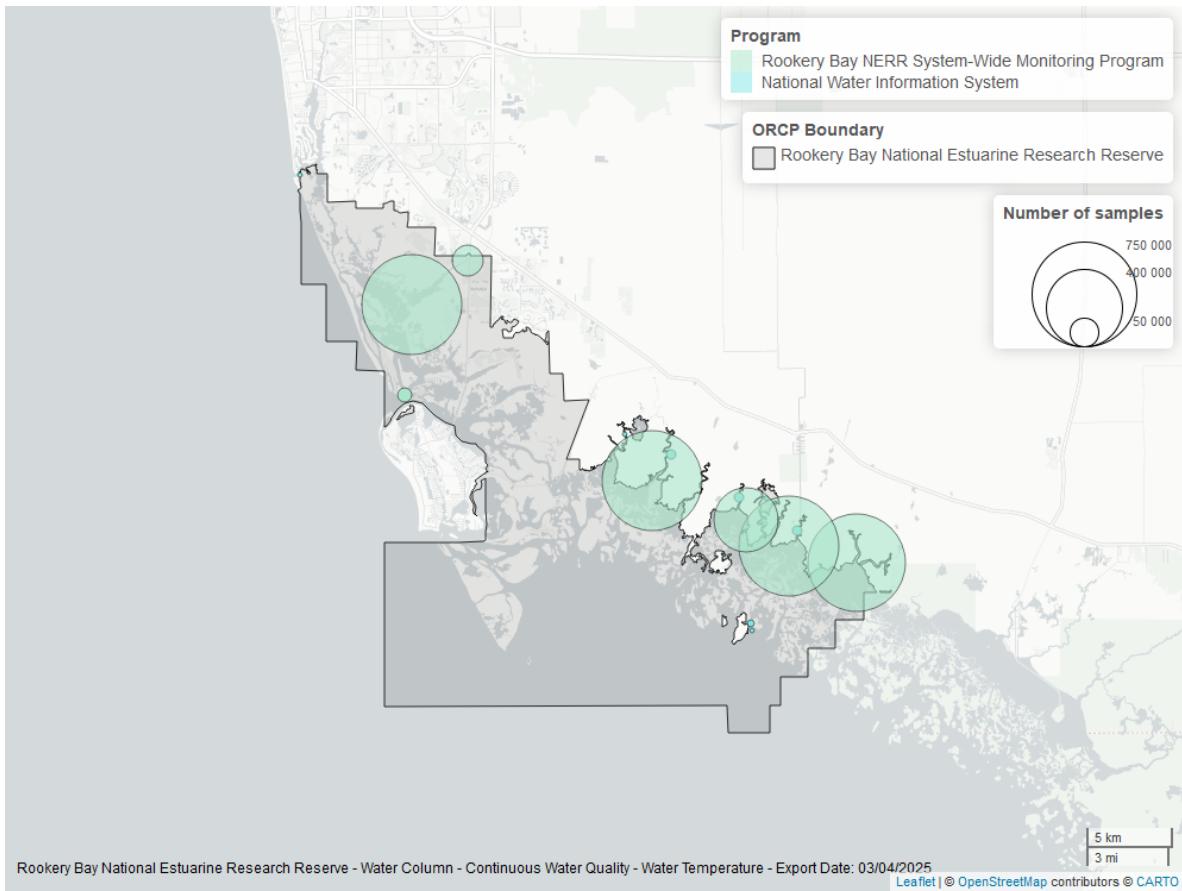


Figure 24: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## pH - Discrete

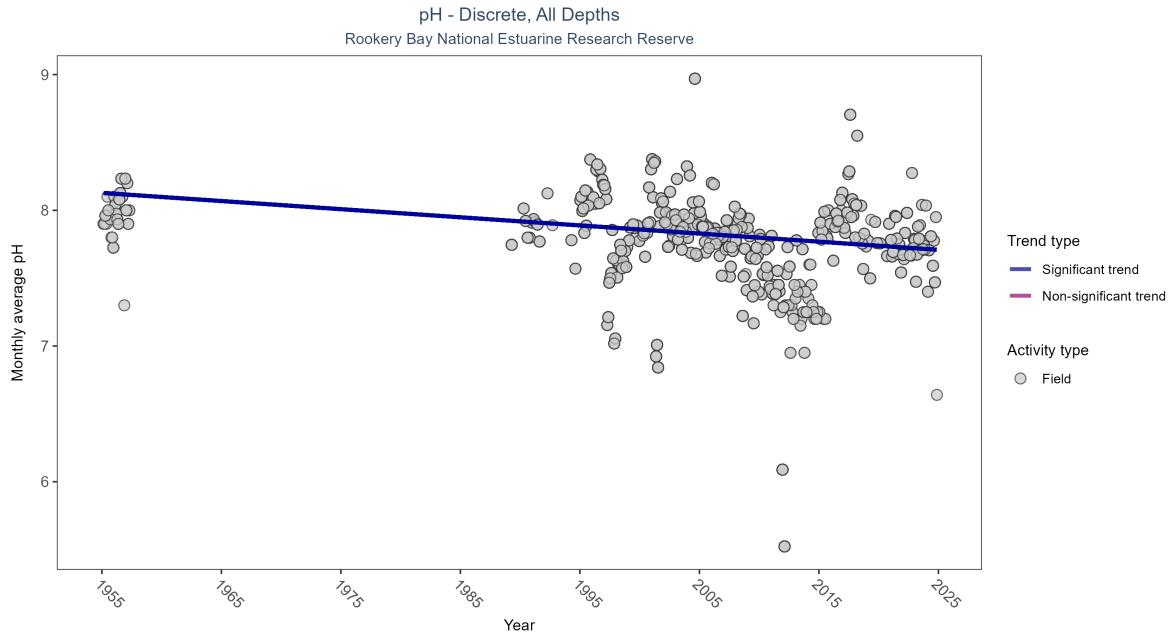


Figure 25: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 13: Seasonal Kendall-Tau Results for - pH

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau      | Sen Intercept | Sen Slope | P |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|----------|---------------|-----------|---|
| Field         | Significantly decreasing trend | 7368         | 38              | 1955 - 2024      | 7.86                | -0.22392 | 8.12825       | -0.00599  | 0 |

Monthly average pH decreased by 0.01 pH units per year.

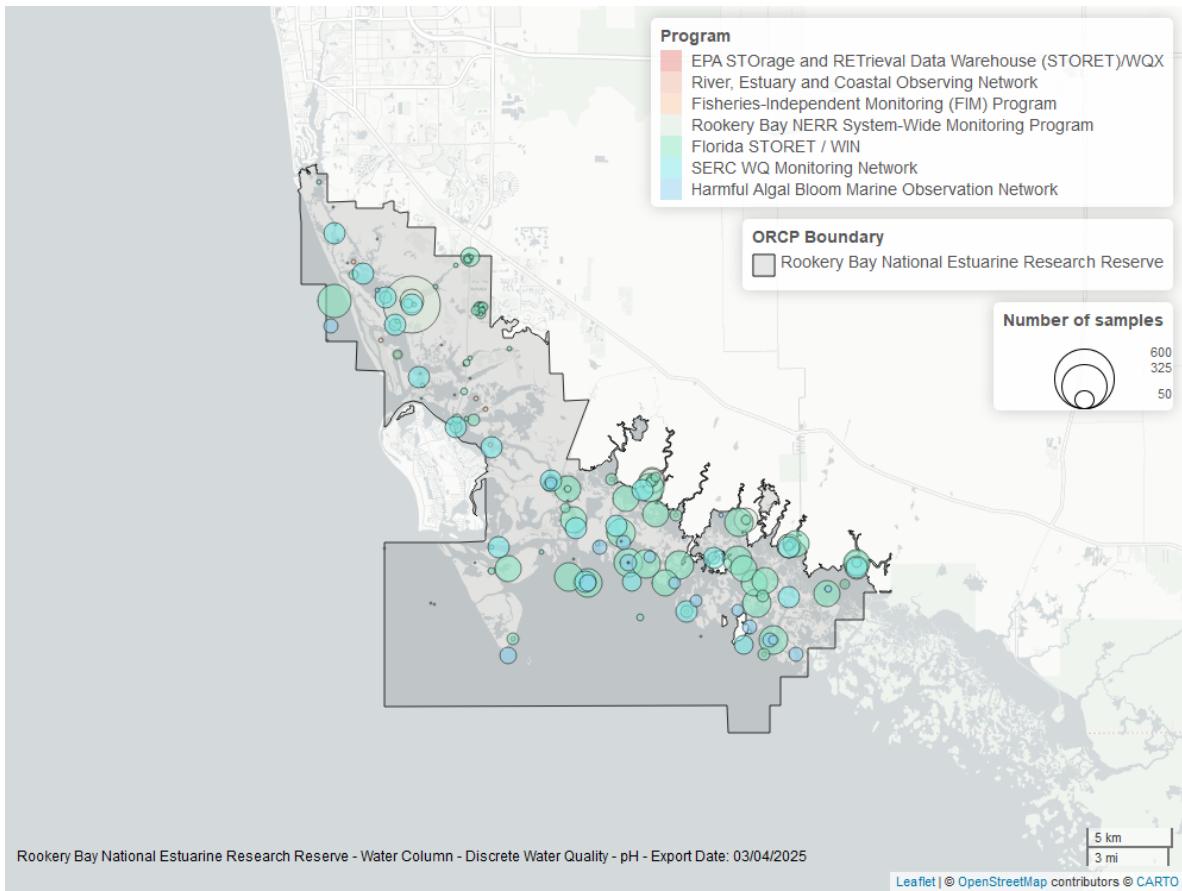


Figure 26: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## pH - Continuous

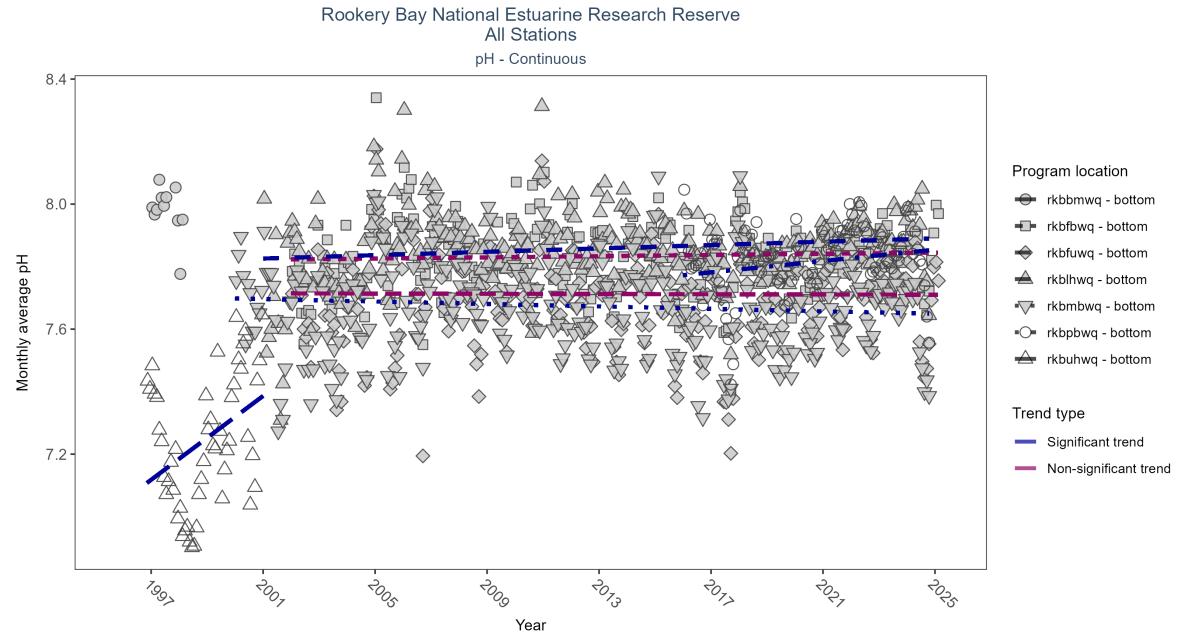


Figure 27: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 14: Seasonal Kendall-Tau Results - pH

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau   | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | No significant trend                 | 637095       | 24              | 2002 - 2025      | 7.8                 | 0.05  | 7.82          | 0         | 0.2345 |
| rkbmhwq          | Insufficient data to calculate trend | 12610        | 2               | 1997 - 1998      | 8.0                 | -     | -             | -         | -      |
| rkbfuwq          | No significant trend                 | 660818       | 24              | 2002 - 2025      | 7.7                 | -0.01 | 7.71          | 0         | 0.7945 |
| rkbhwq           | Significantly increasing trend       | 629829       | 24              | 2001 - 2024      | 7.9                 | 0.14  | 7.83          | 0         | 0.001  |
| rkbmbwq          | Significantly decreasing trend       | 683502       | 25              | 2000 - 2024      | 7.7                 | -0.09 | 7.7           | 0         | 0.0346 |
| rkbpbwq          | Significantly increasing trend       | 283219       | 9               | 2016 - 2024      | 7.8                 | 0.2   | 7.77          | 0.01      | 0.0176 |
| rkbuhwq          | Significantly increasing trend       | 65814        | 5               | 1996 - 2000      | 7.2                 | 0.37  | 7.05          | 0.07      | 0.0081 |

At three program locations, monthly average pH increased between less than 0.01 and 0.07 pH units per year. At one program location, monthly average pH decreased by less than 0.01 pH units per year. No detectable change in monthly average pH was observed at two locations. There was insufficient data to fit a model for one location.

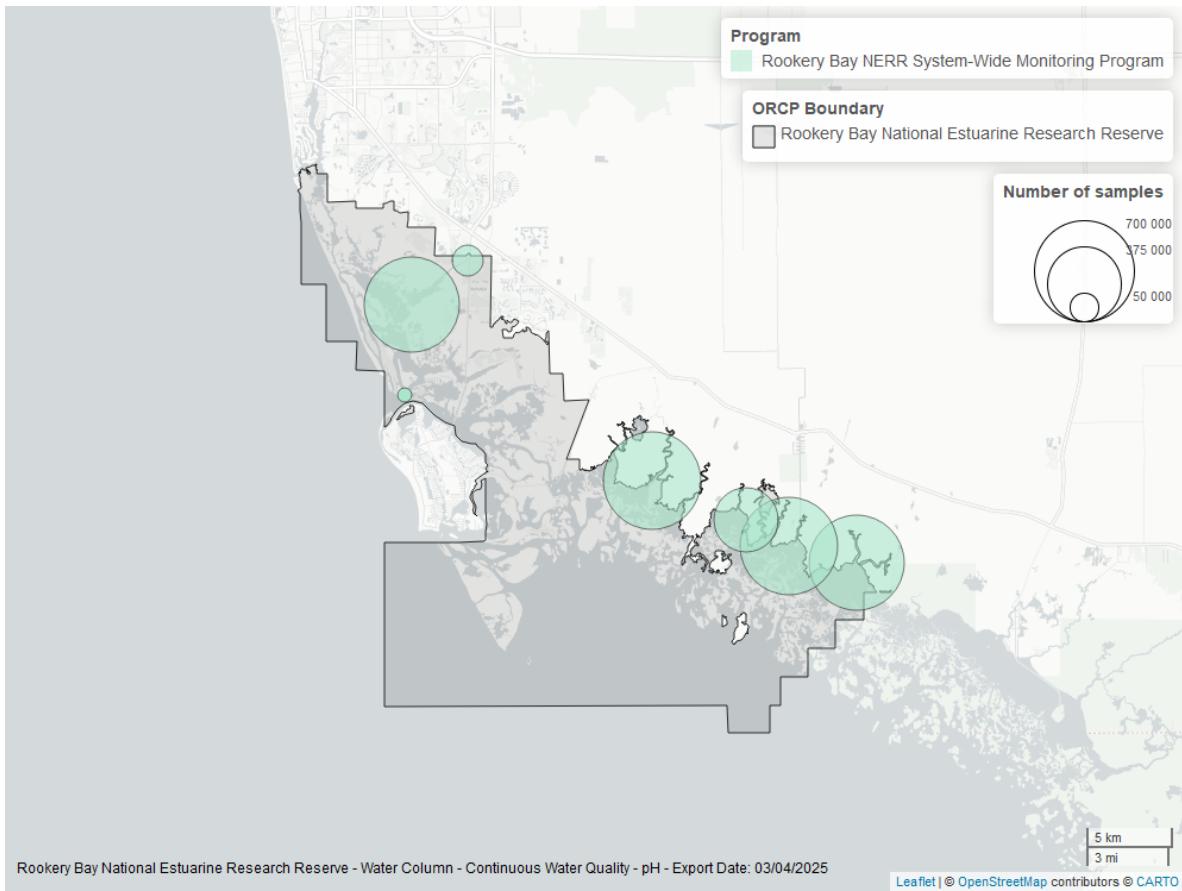


Figure 28: Map showing location of ph continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Water Clarity

### Turbidity - Discrete

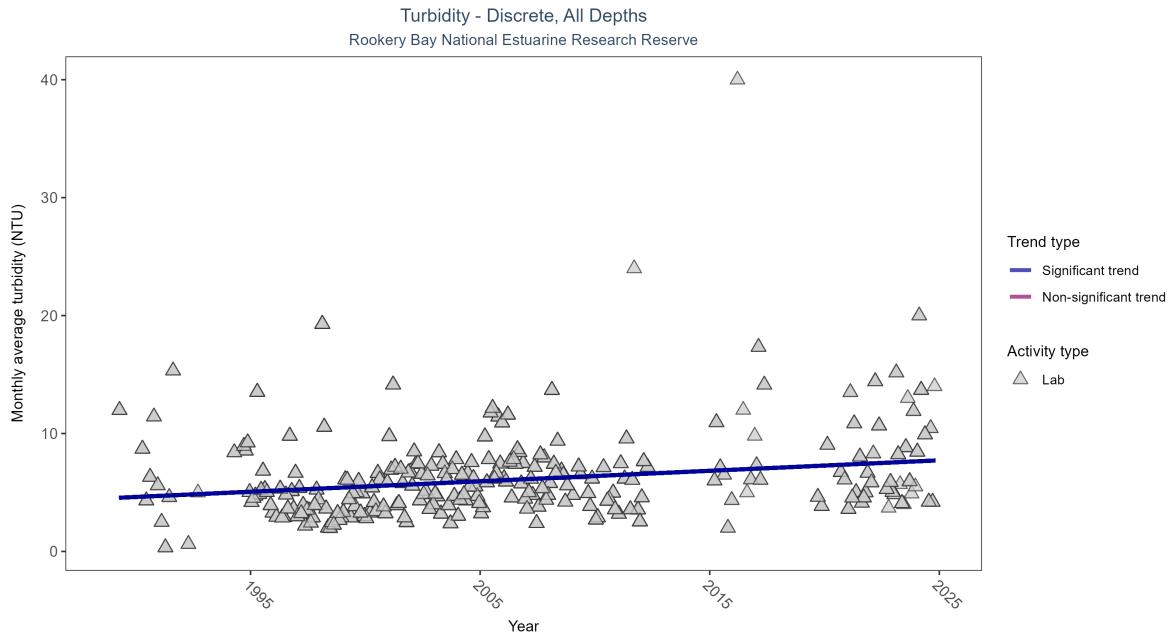


Figure 29: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 15: Seasonal Kendall-Tau Results for - Turbidity

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau     | Sen Intercept | Sen Slope | P |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|---------|---------------|-----------|---|
| Lab           | Significantly increasing trend | 6383         | 32              | 1989 - 2024      | 4.365               | 0.20838 | 4.52982       | 0.08879   | 0 |

Monthly average turbidity increased by 0.09 NTU per year, indicating a decrease in water clarity.

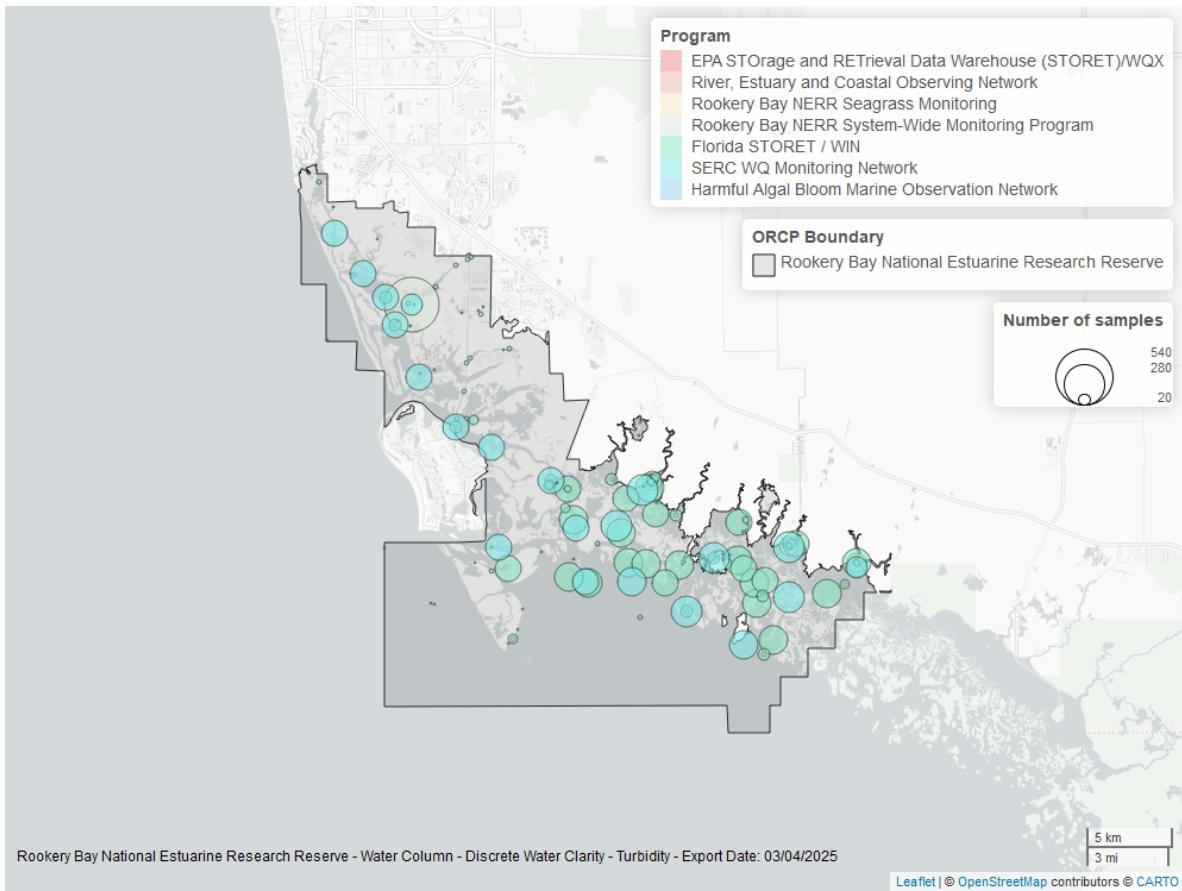


Figure 30: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Turbidity - Continuous

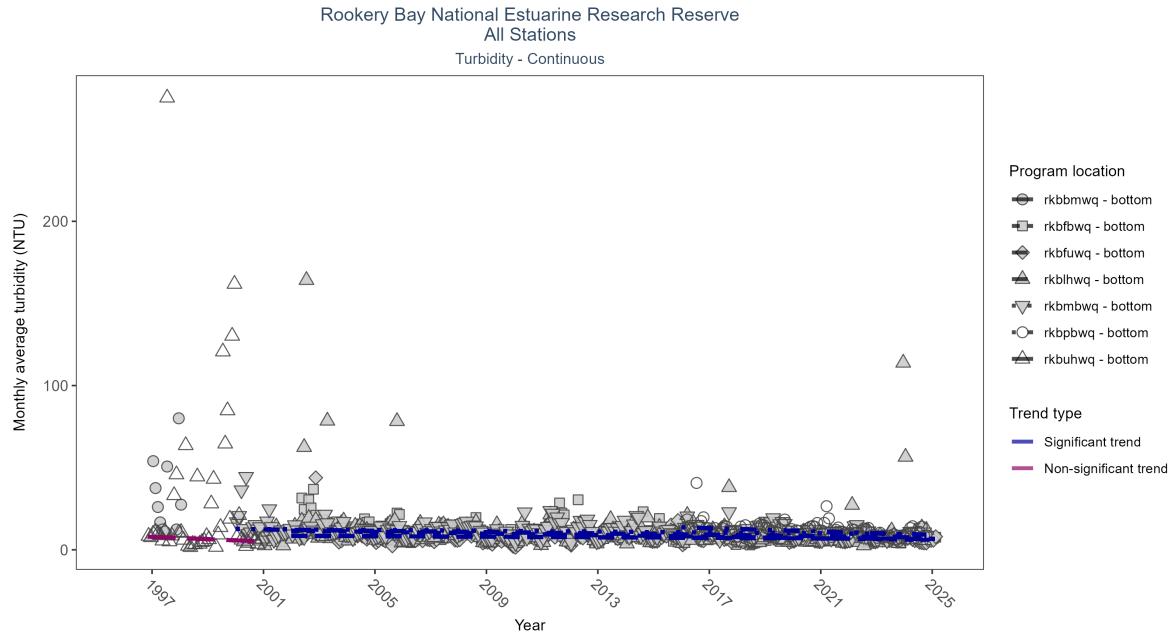


Figure 31: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 16: Seasonal Kendall-Tau Results - Turbidity

| Program Location | Statistical Trend                    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau   | Sen Intercept | Sen Slope | P      |
|------------------|--------------------------------------|--------------|-----------------|------------------|---------------------|-------|---------------|-----------|--------|
| rkbfbwq          | Significantly decreasing trend       | 649336       | 24              | 2002 - 2025      | 7                   | -0.39 | 11.61         | -0.24     | 0      |
| rkbmhwq          | Insufficient data to calculate trend | 10654        | 2               | 1997 - 1998      | 11                  | -     | -             | -         | -      |
| rkbfuwq          | Significantly decreasing trend       | 626788       | 24              | 2002 - 2025      | 6                   | -0.2  | 8.53          | -0.08     | 0      |
| rkbllhwq         | Significantly decreasing trend       | 605017       | 24              | 2001 - 2024      | 8                   | -0.27 | 12.4          | -0.2      | 0      |
| rkbmbwq          | Significantly decreasing trend       | 670439       | 25              | 2000 - 2024      | 9                   | -0.22 | 12.74         | -0.13     | 0      |
| rkbpbwq          | Significantly decreasing trend       | 286433       | 9               | 2016 - 2024      | 10                  | -0.37 | 13.71         | -0.51     | 0      |
| rkbuhwq          | No significant trend                 | 61608        | 5               | 1996 - 2000      | 5                   | -0.11 | 8.57          | -0.7      | 0.5228 |

At five program locations, monthly average turbidity decreased between 0.08 and 0.51 NTU per year. No detectable change in monthly average turbidity was observed at one location. There was insufficient data to fit a model for one location.

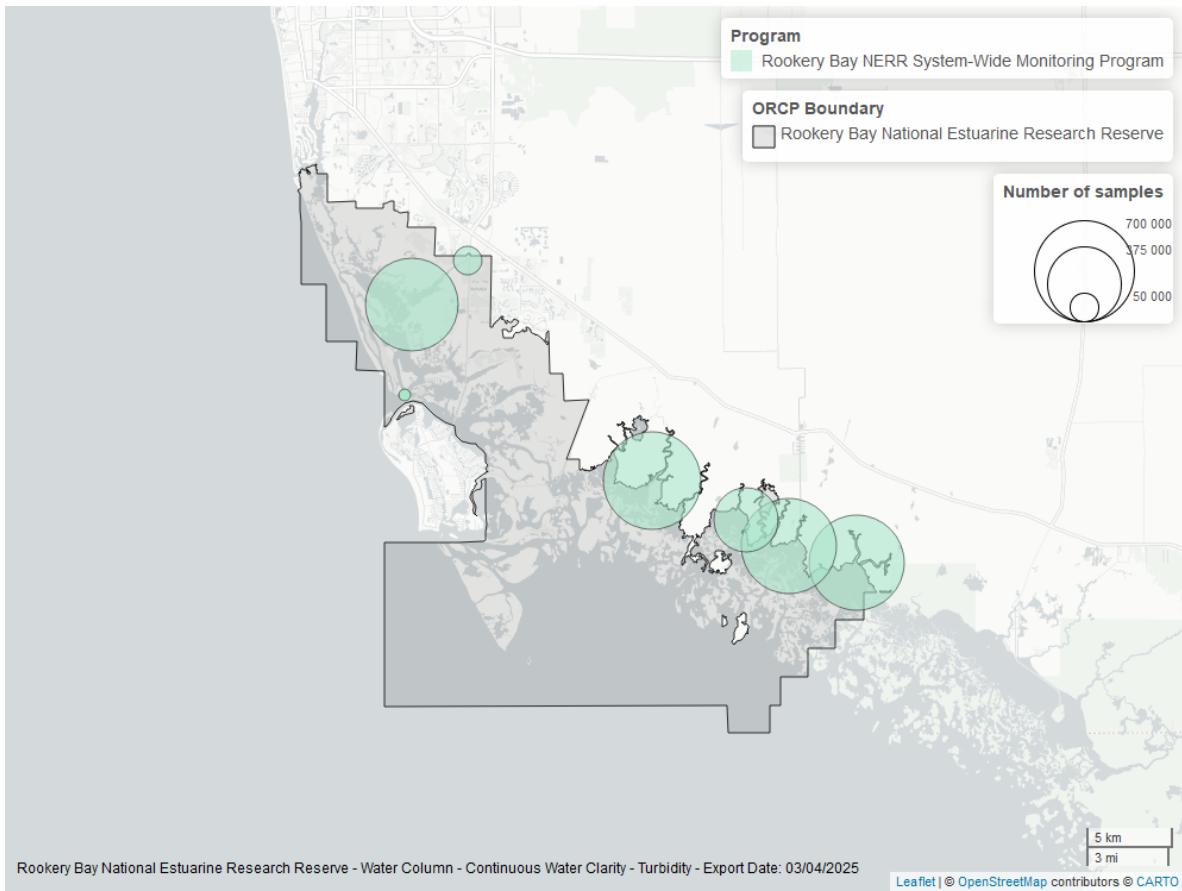


Figure 32: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Total Suspended Solids - Discrete

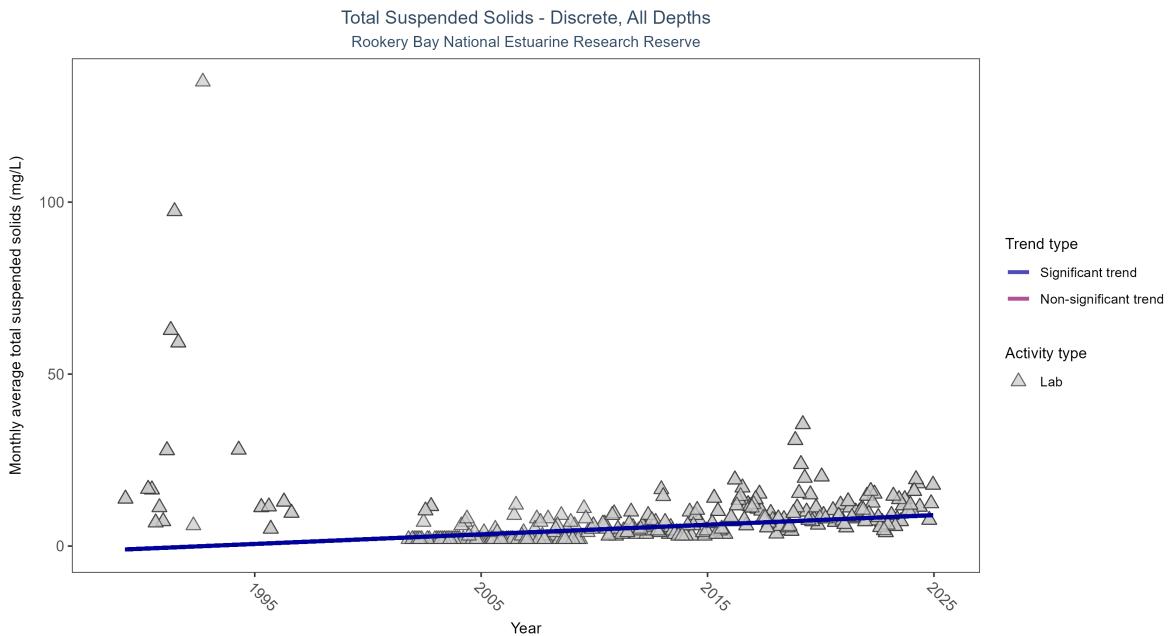


Figure 33: Scatter plot of monthly average total suspended solids (TSS) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only TSS values obtained from laboratory analyses (triangles) are included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

Table 17: Seasonal Kendall-Tau Results for - Total Suspended Solids

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau | Sen Intercept | Sen Slope | P       |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|-----|---------------|-----------|---------|
| Lab           | Significantly increasing trend | 861          | 31              | 1989 - 2024      |                     | 8   | 0.37853       | -1.05486  | 0.27889 |

Monthly average total suspended solids increased by 0.28 mg/L per year, indicating a decrease in water clarity.

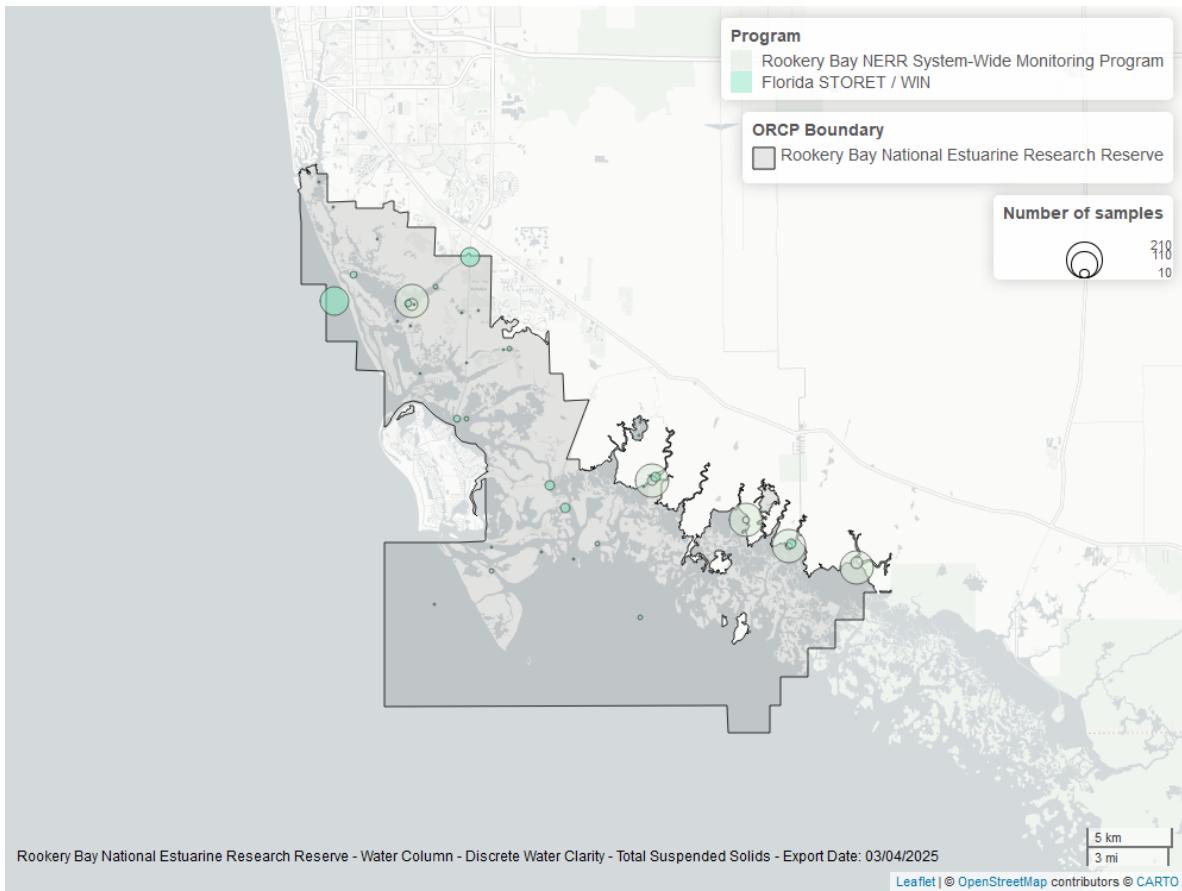


Figure 34: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Chlorophyll a, Uncorrected for Pheophytin - Discrete

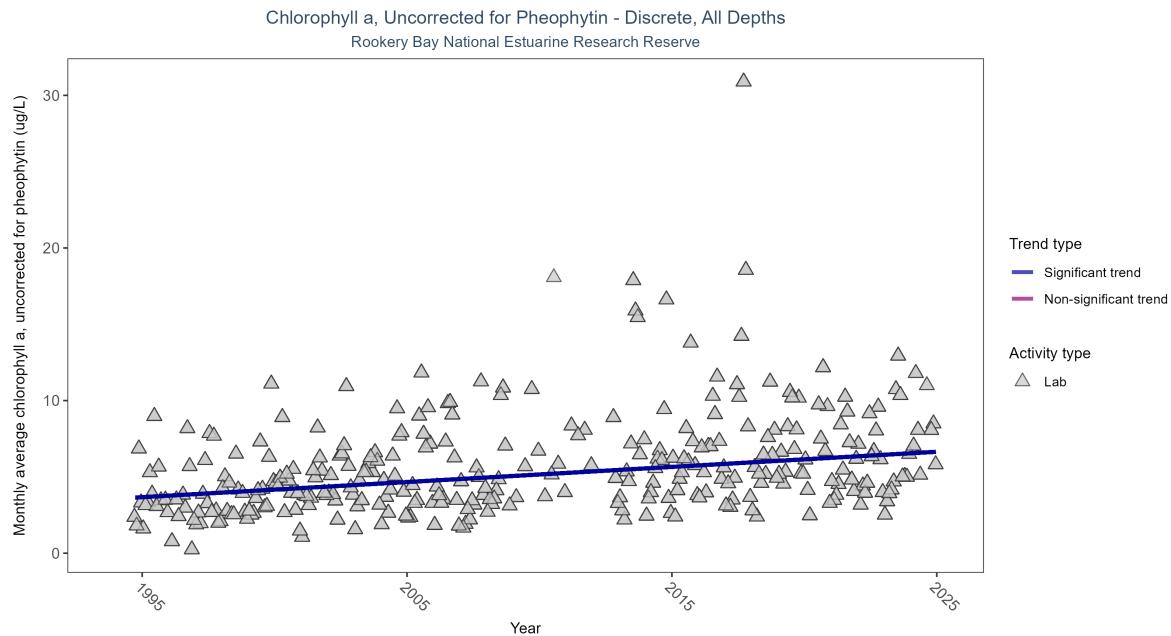


Figure 35: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles)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

Table 18: Seasonal Kendall-Tau Results for - Chlorophyll a, Uncorrected for Pheophytin

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau     | Sen Intercept | Sen Slope | P |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|---------|---------------|-----------|---|
| Lab           | Significantly increasing trend | 5345         | 31              | 1994 - 2024      | 4.4                 | 0.33575 | 3.57244       | 0.09916   | 0 |

Monthly average chlorophyll a, uncorrected for pheophytin, increased by 0.1  $\mu\text{g/L}$  per year, indicating a decrease in water clarity.

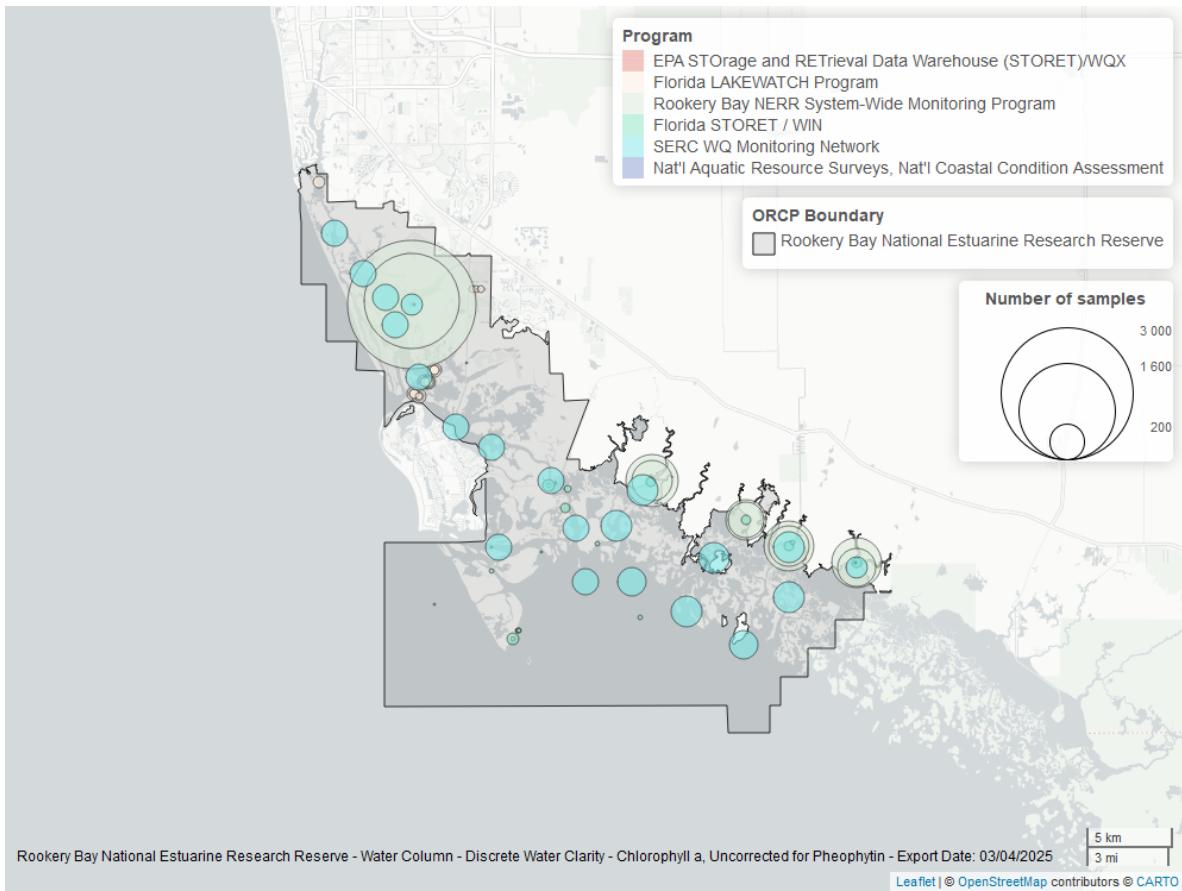


Figure 36: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Chlorophyll a, Corrected for Pheophytin - Discrete

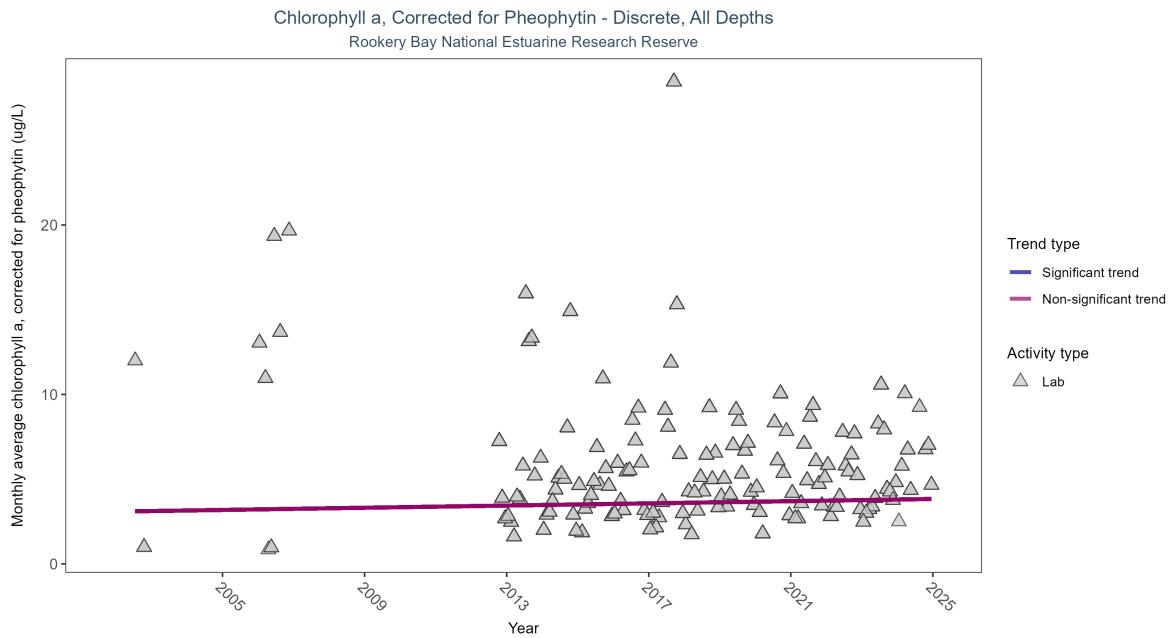


Figure 37: Scatter plot of monthly average levels of chlorophyll a, corrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles)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

Table 19: Seasonal Kendall-Tau Results for - Chlorophyll a, Corrected for Pheophytin

| Activity Type | Statistical Trend    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau     | Sen Intercept | Sen Slope | P      |
|---------------|----------------------|--------------|-----------------|------------------|---------------------|---------|---------------|-----------|--------|
| Lab           | No significant trend | 2209         | 15              | 2002 - 2024      | 4.1                 | 0.05669 | 3.08396       | 0.03235   | 0.3307 |

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

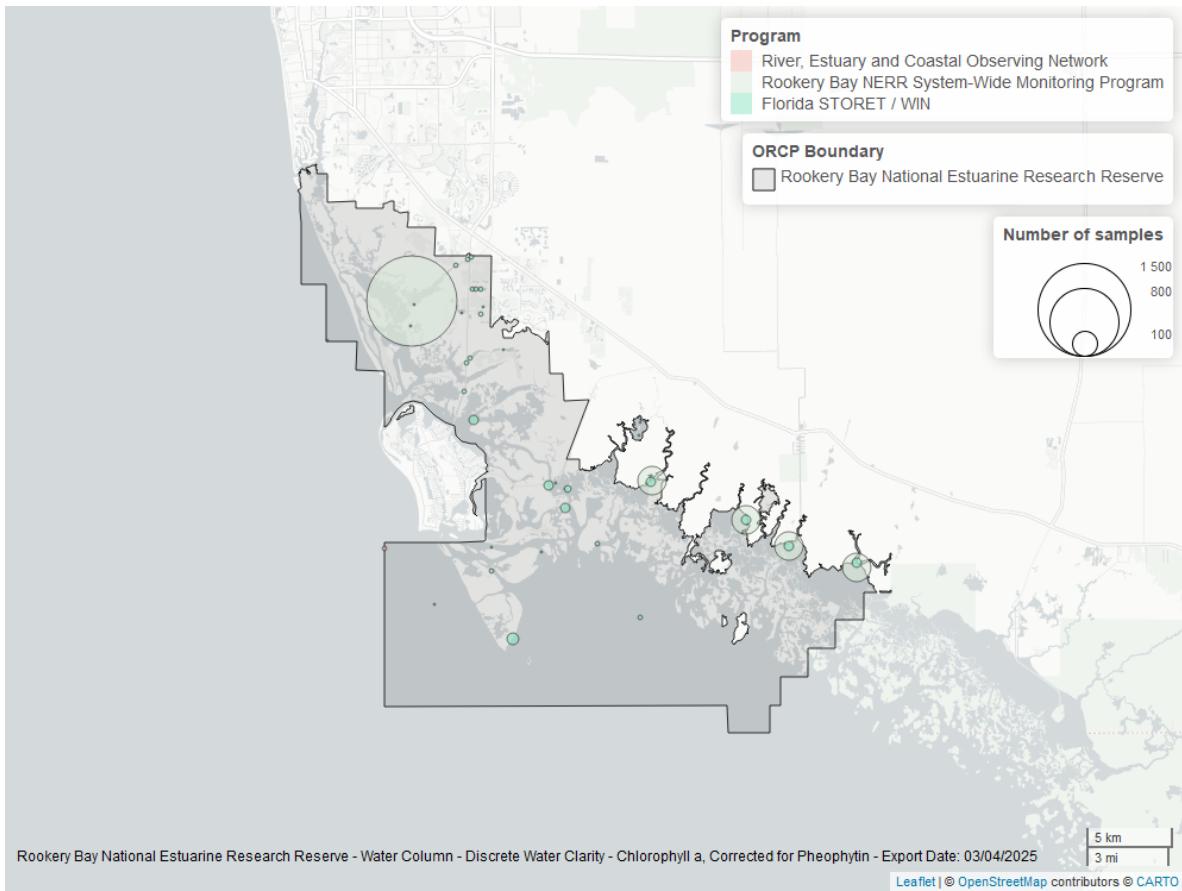


Figure 38: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Secchi Depth - Discrete

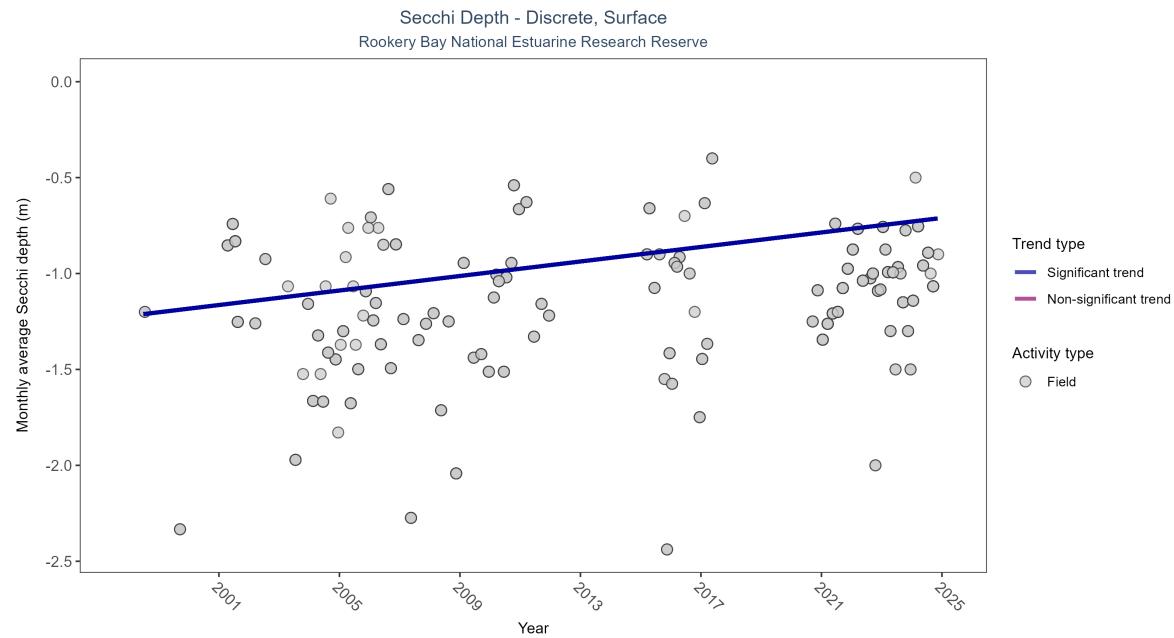


Figure 39: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 20: Seasonal Kendall-Tau Results for - Secchi Depth

| Activity Type | Statistical Trend              | Sample Count | Years with Data | Period of Record | Median Result Value | Tau     | Sen Intercept | Sen Slope | P      |
|---------------|--------------------------------|--------------|-----------------|------------------|---------------------|---------|---------------|-----------|--------|
| Field         | Significantly increasing trend | 768          | 21              | 1998 - 2024      | -1.06681            | 0.25644 | -1.22103      | 0.01892   | 0.0002 |

Monthly average Secchi depth became shallower by 0.02 m per year, indicating a decrease in water clarity.

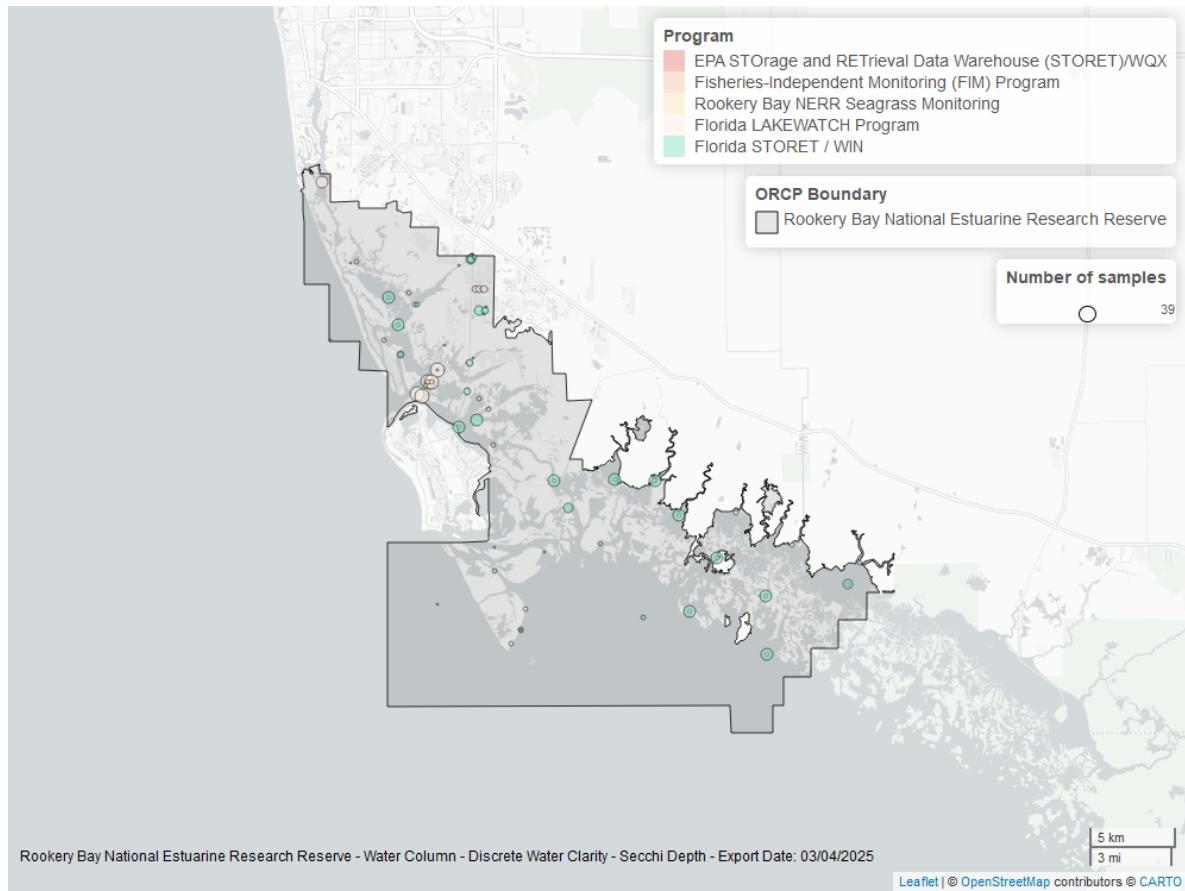


Figure 40: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

## Colored Dissolved Organic Matter - Discrete

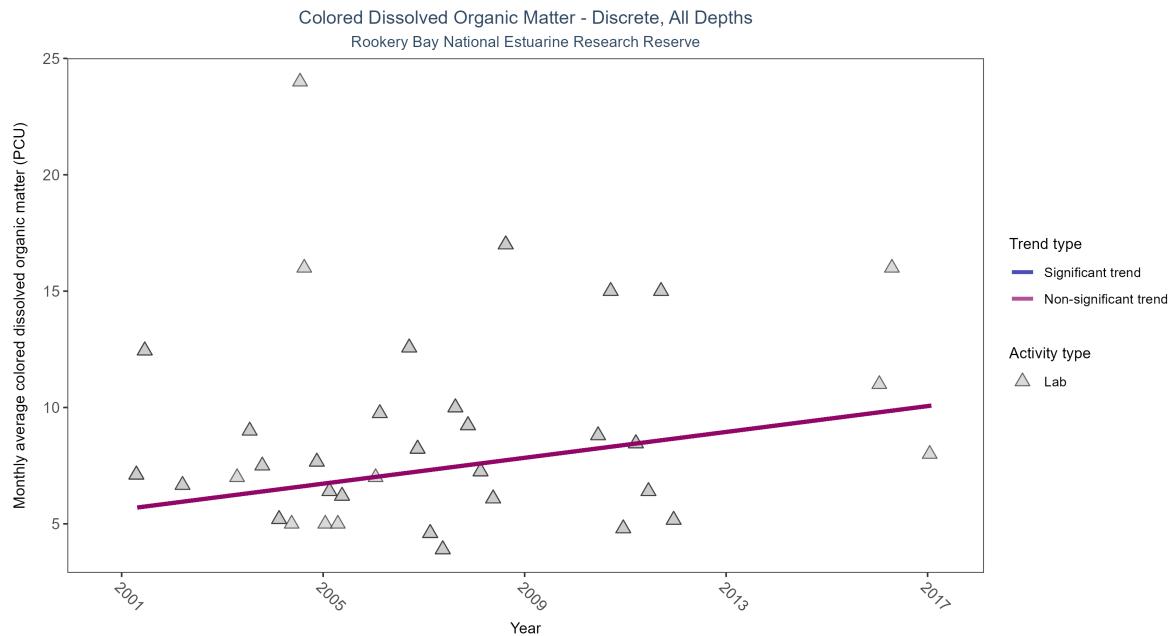


Figure 41: Scatter plot of monthly average colored dissolved organic matter (CDOM) over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed CDOM (triangles) is included in the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

Table 21: Seasonal Kendall-Tau Results for - Colored Dissolved Organic Matter

| Activity Type | Statistical Trend    | Sample Count | Years with Data | Period of Record | Median Result Value | Tau    | Sen Intercept | Sen Slope | P      |
|---------------|----------------------|--------------|-----------------|------------------|---------------------|--------|---------------|-----------|--------|
| Lab           | No significant trend | 193          | 12              | 2001 - 2017      | 8                   | 0.3619 | 5.61538       | 0.27778   | 0.1533 |

Colored dissolved organic matter showed no detectable trend between 2001 and 2017.

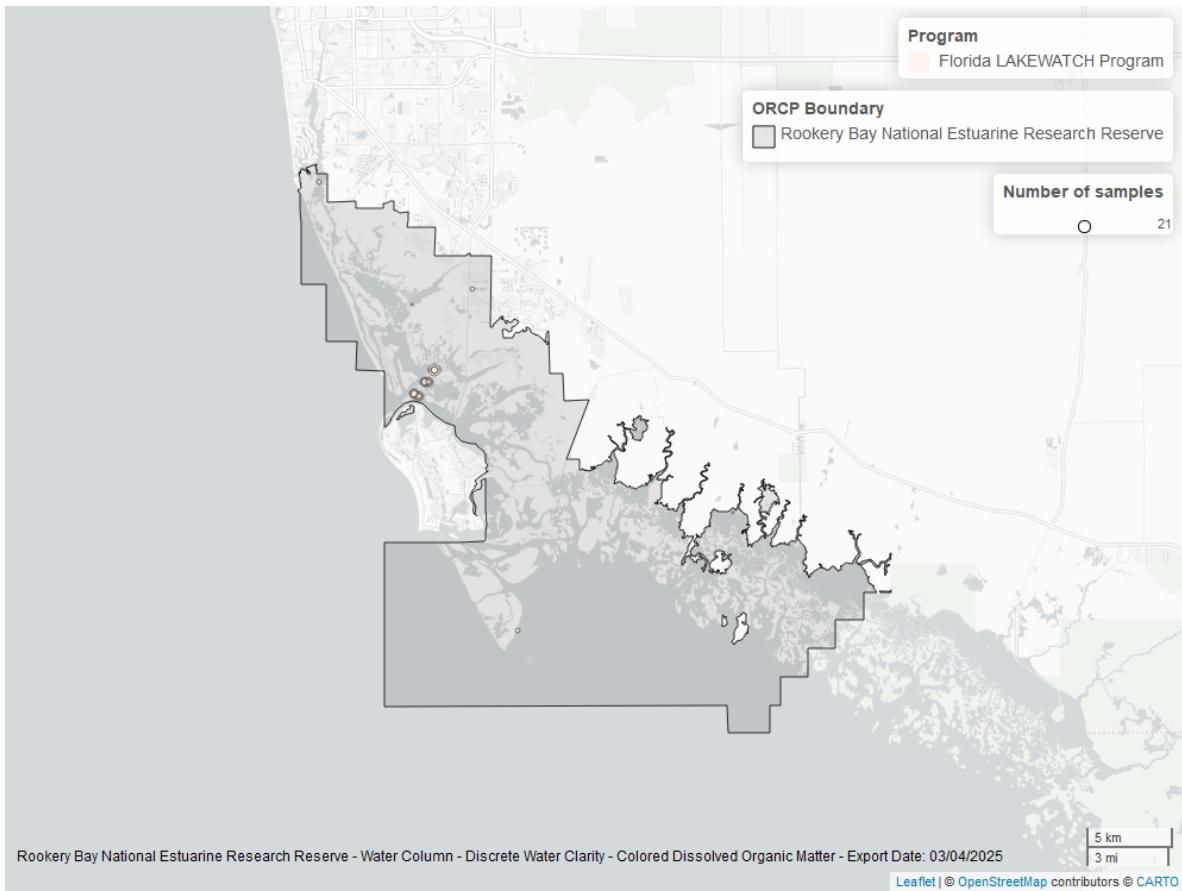


Figure 42: Map showing location of discrete water quality sampling locations within the boundaries of *Rookery Bay National Estuarine Research Reserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.