Kristin Jacobs Coral Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 02 July, 2025

Contents

Funding & Acknowledgements

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Threshold Filtering

Threshold filters, following the guidance of Florida Department of Environmental Protection's (*FDEP*) Division of Environmental Assessment and Restoration (*DEAR*) are used to exclude specific results values from the SEACAR Analysis. Based on the threshold filters, Quality Assurance / Quality Control (*QAQC*) Flags are inserted into the *SEACAR_QAQCFlagCode* and *SEACAR_QAQC_Description* columns of the export data. The *Include* column indicates whether the *QAQC* Flag will also indicate that data are excluded from analysis. No data are excluded from the data export, but the analysis scripts can use the *Include* column to exclude data (1 to include, 0 to exclude).

Table 1: Continuous Water Quality threshold values

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Dissolved Oxygen	mg/L	-0.000001	50
Dissolved Oxygen Saturation	%	-0.000001	500
Salinity	ppt	-0.000001	70
Turbidity	NTU	-0.000001	4000
Water Temperature	Degrees C	-5.000000	45
pH	None	2.000000	14

Table 2: Discrete Water Quality threshold values

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Ammonia, Un-ionized (NH3)	mg/L	-	-
Ammonium, Filtered (NH4)	mg/L	-	-
Chlorophyll a, Corrected for Pheophytin	ug/L	-	-
Chlorophyll a, Uncorrected for Pheophytin	ug/L	-	-
Colored Dissolved Organic Matter	PCU	-	-

Parameter Name	*Units*	*Low Threshold*	*High Threshold*
Dissolved Oxygen	mg/L	-0.000001	25
Dissolved Oxygen Saturation	%	-0.000001	310
Fluorescent Dissolved Organic Matter	QSE	-	-
Light Extinction Coefficient	mˆ-1	-	-
NO2+3, Filtered	mg/L	-	-
Nitrate (NO3)	mg/L	-	-
Nitrite (NO2)	mg/L	-	-
Nitrogen, organic	mg/L	-	-
Phosphate, Filtered (PO4)	mg/L	-	-
Salinity	ppt	-0.000001	70
Secchi Depth	m	0.000001	50
Specific Conductivity	mS/cm	0.005000	100
Total Kjeldahl Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Nitrogen	mg/L	-	-
Total Phosphorus	mg/L	-	-
Total Suspended Solids	mg/L	-	-
Turbidity	NTU	-	-
Water Temperature	Degrees C	3.000000	40
pH	None	2.000000	13

Table 3: Quality Assurance Flags inserted based on threshold checks listed in Table 1 and 2

SEACAR QAQC Description	*Include*	*SEACAR QAQCFlagCode*
Exceeds maximum threshold	0	2Q
Below minimum threshold	0	4Q
Within threshold tolerance	1	6Q
No defined thresholds for this parameter	1	7Q

Value Qualifiers

Value qualifier codes included within the data are used to exclude certain results from the analysis. The data are retained in the data export files, but the analysis uses the *Include* column to filter the results.

STORET and WIN value qualifier codes

Value qualifier codes from *STORET* and *WIN* data are examined with the database and used to populate the *Include* column in data exports.

Table 4: Value Qualifier codes excluded from analysis

Qualifier Source	*Value Qualifier*	*Include*	*MDL*	*Description*
STORET-WIN	H	0	0	Value based on field kit determination; results may not be accurate
STORET-WIN	J	0	0	Estimated value
STORET-WIN	V	0	0	Analyte was detected at or above method detection limit
STORET-WIN	Y	0	0	Lab analysis from an improperly preserved sample; data may be inaccurate

Discrete Water Quality Value Qualifiers

The following value qualifiers are highlighted in the Discrete Water Quality section of this report. An exception is made for **Program 476** - *Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network* and data flagged with Value Qualifier **H** are included for this program only.

H - Value based on field kit determiniation; results may not be accurate. This code shall be used if a field screening test (e.g., field gas chromatograph data, immunoassay, or vendor-supplied field kit) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.

I - The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.

Q - Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

S - Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.

U - Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported

Systemwide Monitoring Program (SWMP) value qualifier codes

Value qualifier codes from the *SWMP* continuous program are examined with the database and used to populate the *Include* column in data exports. *SWMP* Qualifier Codes are indicated by *QualifierSource=SWMP*.

Table 5: SWMP Value Qualifier codes

Qualifier Source	*Value Qualifier*	*Include*	*Description*
SWMP	-1	1	Optional parameter not collected
SWMP	-2	0	Missing data
SWMP	-3	0	Data rejected due to QA/QC
SWMP	-4	0	Outside low sensor range
SWMP	-5	0	Outside high sensor range
SWMP	0	1	Passed initial QA/QC checks
SWMP	1	0	Suspect data
SWMP	2	1	Reserved for future use
SWMP	3	1	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	1	Historical: Pre-auto QA/QC
SWMP	5	1	Corrected data

Water Column

The water column habitat extends from the water's surface to the bottom sediments, and it's where fish, dolphins, crabs and people swim! So much life makes its home in the water column that the health of marine and coastal ecosystems, as well as human economies, depend on the condition of this vulnerable habitat. Local patterns of rainfall, temperature, winds and currents can rapidly change the condition of the water column, while global influences such as El Niño/La Niña, large-scale fluctuation in sea temperatures and climate change can have long-term effects. Inputs from the prosperity of our day-to-day lives including farming, mining and forestry, and emissions from power generation, automobiles and water treatment can also alter the health of the water column. Acting alone or together, each input can have complex and lasting effects on habitats and ecosystems.

SEACAR evaluates water column health with several essential parameters. These include nutrient surveys of nitrogen and phosphorus, and water quality assessments of salinity, dissolved oxygen, pH, and water temperature. Water clarity is evaluated with Secchi depth, turbidity, levels of chlorophyll a, total suspended solids, and colored dissolved organic matter. Additionally, the richness of nekton is indicated by the abundance of free-swimming fishes and macroinvertebrates like crabs and shrimps.

Seasonal Kendall-Tau Analysis

Indicators must have a minimum of five to ten years, depending on the habitat, of data within the geographic range of the analysis to be included in the analysis. Ten years of data are required for discrete parameters, and five years of data are required for continuous parameters. If there are insufficient years of data, the number of years of data available will be noted and labeled as "insufficient data to conduct analysis". Further, for the preferred Seasonal Kendall-Tau test, there must be data from at least two months in common across at least two consecutive years within the RCP managed area being analyzed. Values that pass both of these tests will be included in the analysis and be labeled as *Use_In_Analysis* = **TRUE**. Any that fail either test will be excluded from the analyses and labeled as *Use_In_Analysis* = **FALSE**. The points for all Water Column plots displayed in this section are monthly averages. Trend significance will be denoted as "Significant Trend" (when $p < 0.05$), or "Non-significant Trend" (when $p >= 0.05$). Any parameters with insufficient data to perform Seasonal Kendall-Tau test will have their monthly averages plotted without a corresponding trend line.

Water Quality - Discrete

The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_pH-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Salinity-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Turbidity-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2025-Mar-06.txt*

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

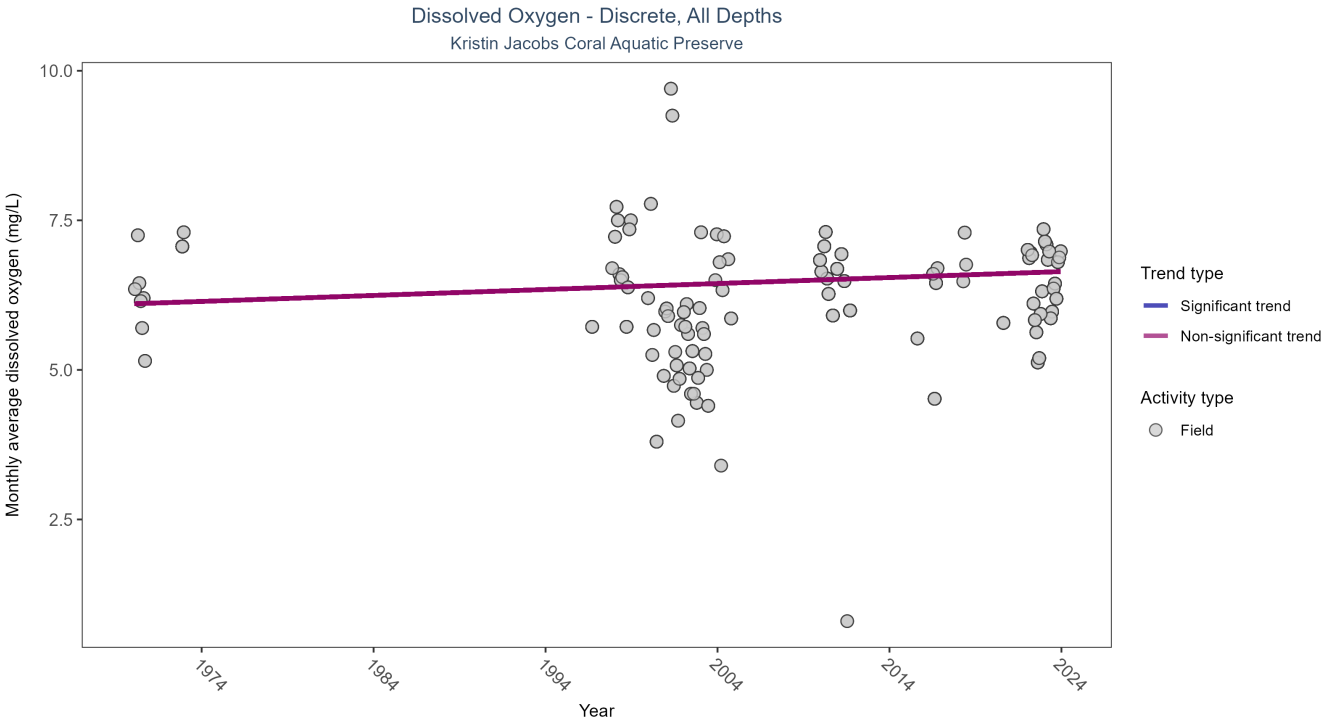

Figure 1: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

Table 6: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	No significant trend	742	20	1970 - 2023	6.49	0.0958	6.1046	0.01	0.3066

Dissolved oxygen showed no detectable trend between 1970 and 2023.

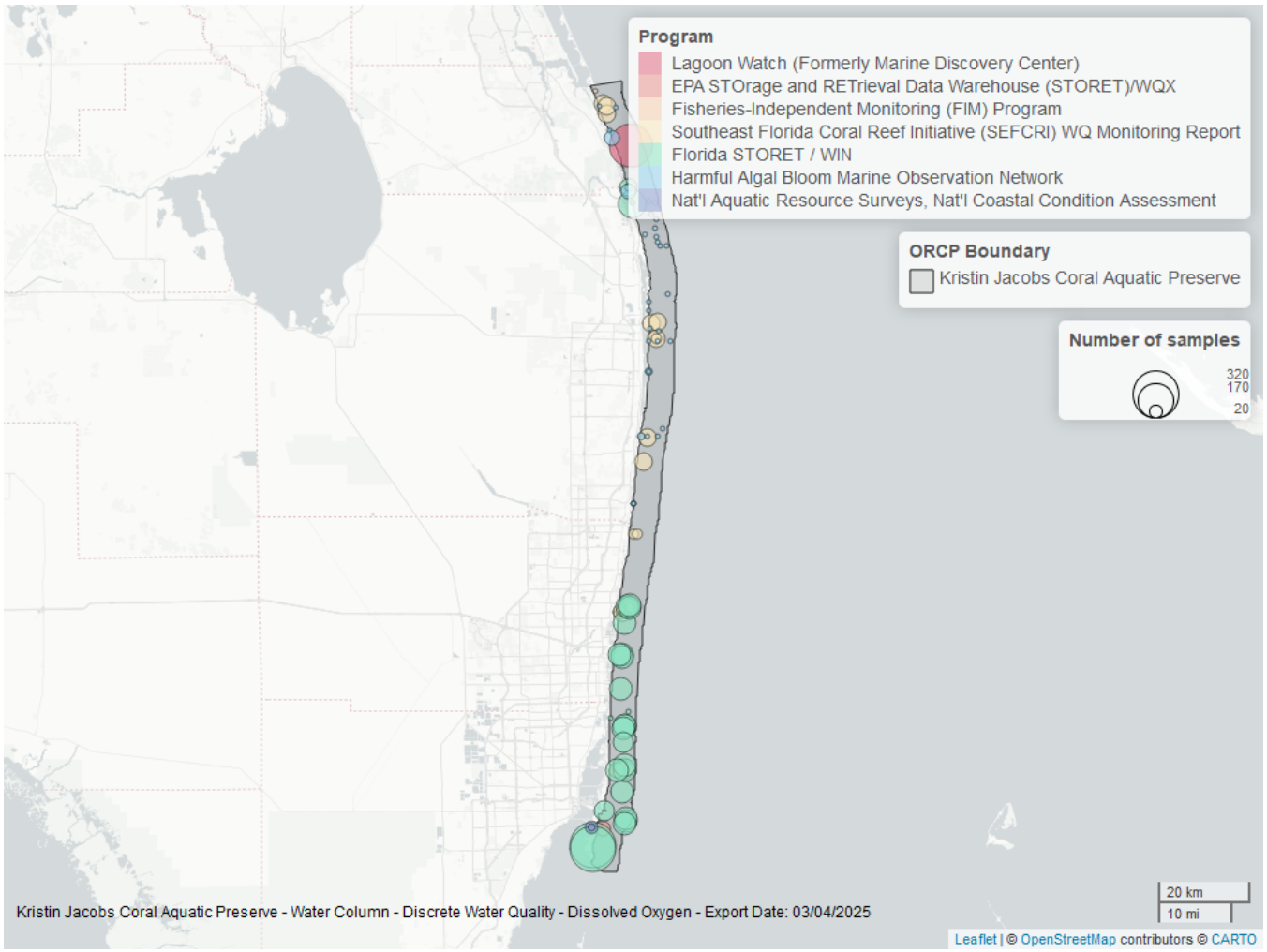

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 7: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	805	1996	2023
5058	266	2009	2011
3001	98	1999	2003
95	71	1972	2018
103	14	1970	1970
118	14	2015	2020
69	2	1998	1998

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[1]
95 - Harmful Algal Bloom Marine Observation Network[2]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[4]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]

5002 - Florida STORET / WIN[6]
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report[7]

Dissolved Oxygen Saturation - Discrete

Seasonal Kendall-Tau Trend Analysis

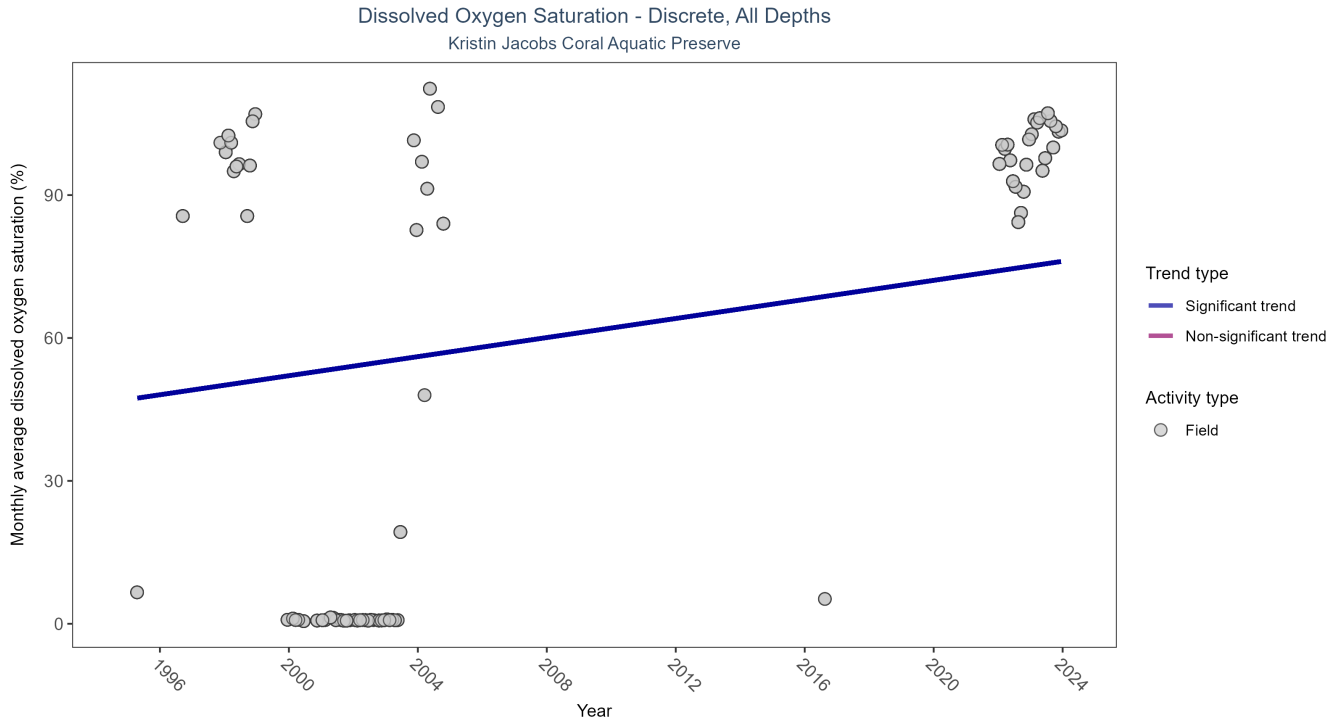

Figure 3: Scatter plot of monthly average dissolved oxygen saturation over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen saturation values measured in the field (circles) are included in the plot.

Table 8: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen Saturation

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly increasing trend	378	13	1995 - 2023	97.85	0.3286	47.077	1.0009	0.0019

Monthly average dissolved oxygen saturation increased by 1% per year.

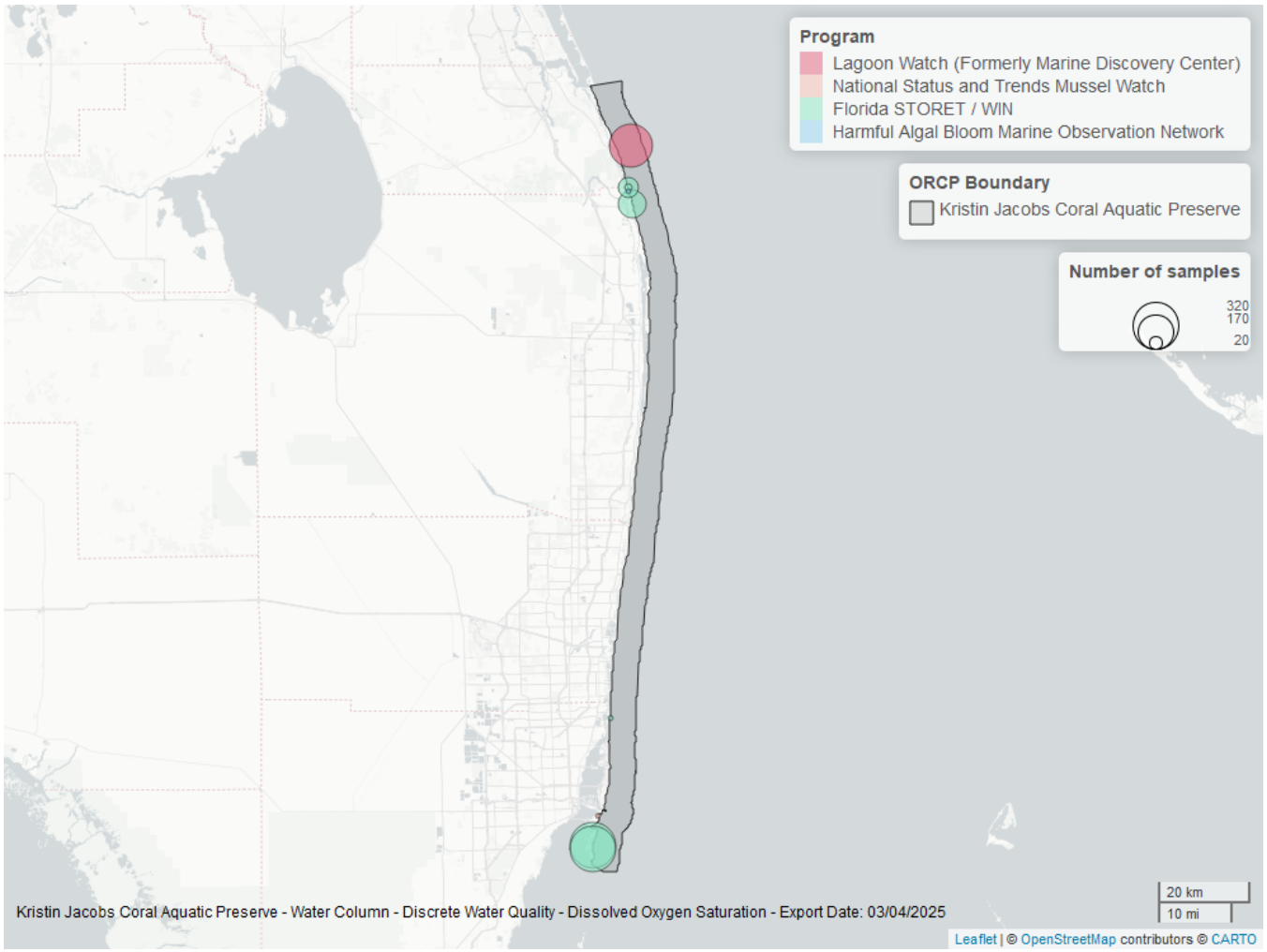

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 9: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	277	1996	2023
3001	98	1999	2003
102	2	1995	1995
95	1	2016	2016

Program names:

95 - Harmful Algal Bloom Marine Observation Network[2]
102 - National Status and Trends Mussel Watch[8]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]
5002 - Florida STORET / WIN[6]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

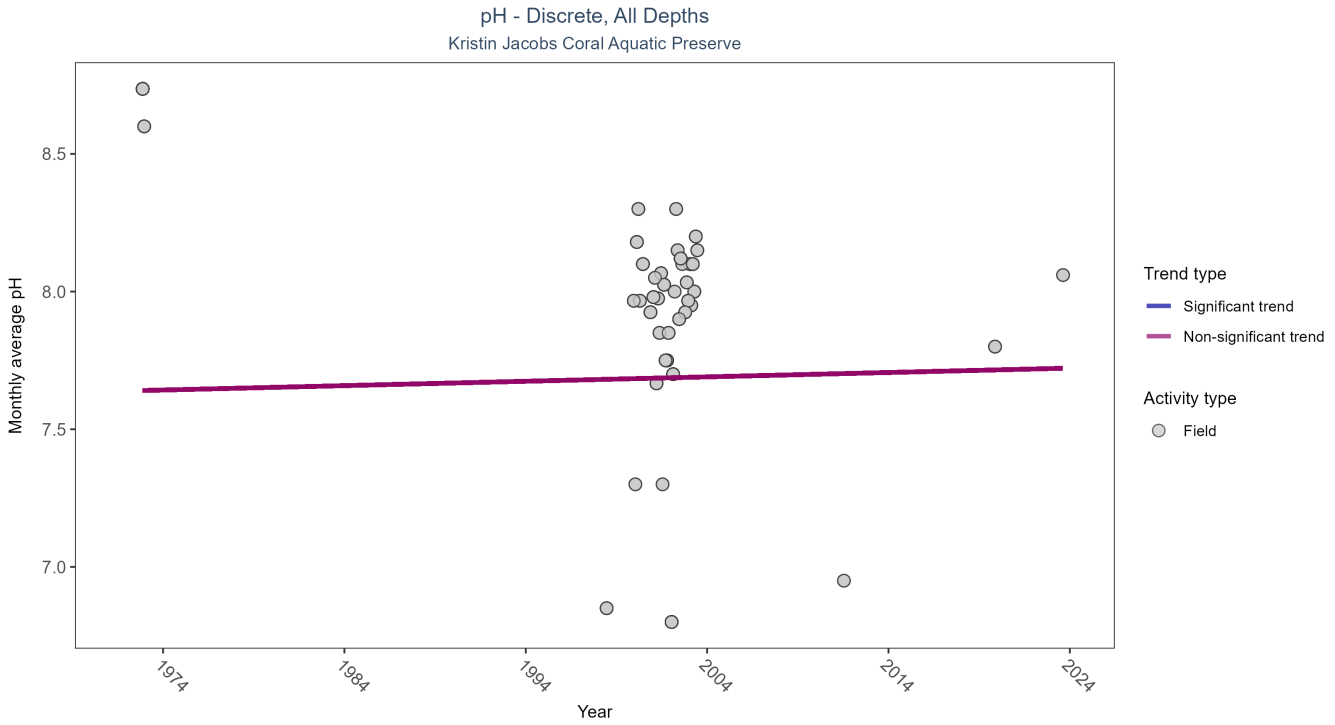

Figure 5: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

Table 10: Seasonal Kendall-Tau Trend Analysis for pH

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	No significant trend	172	10	1972 - 2023	8.2	0.0833	7.6392	0.0016	0.9124

pH showed no detectable trend between 1972 and 2023.

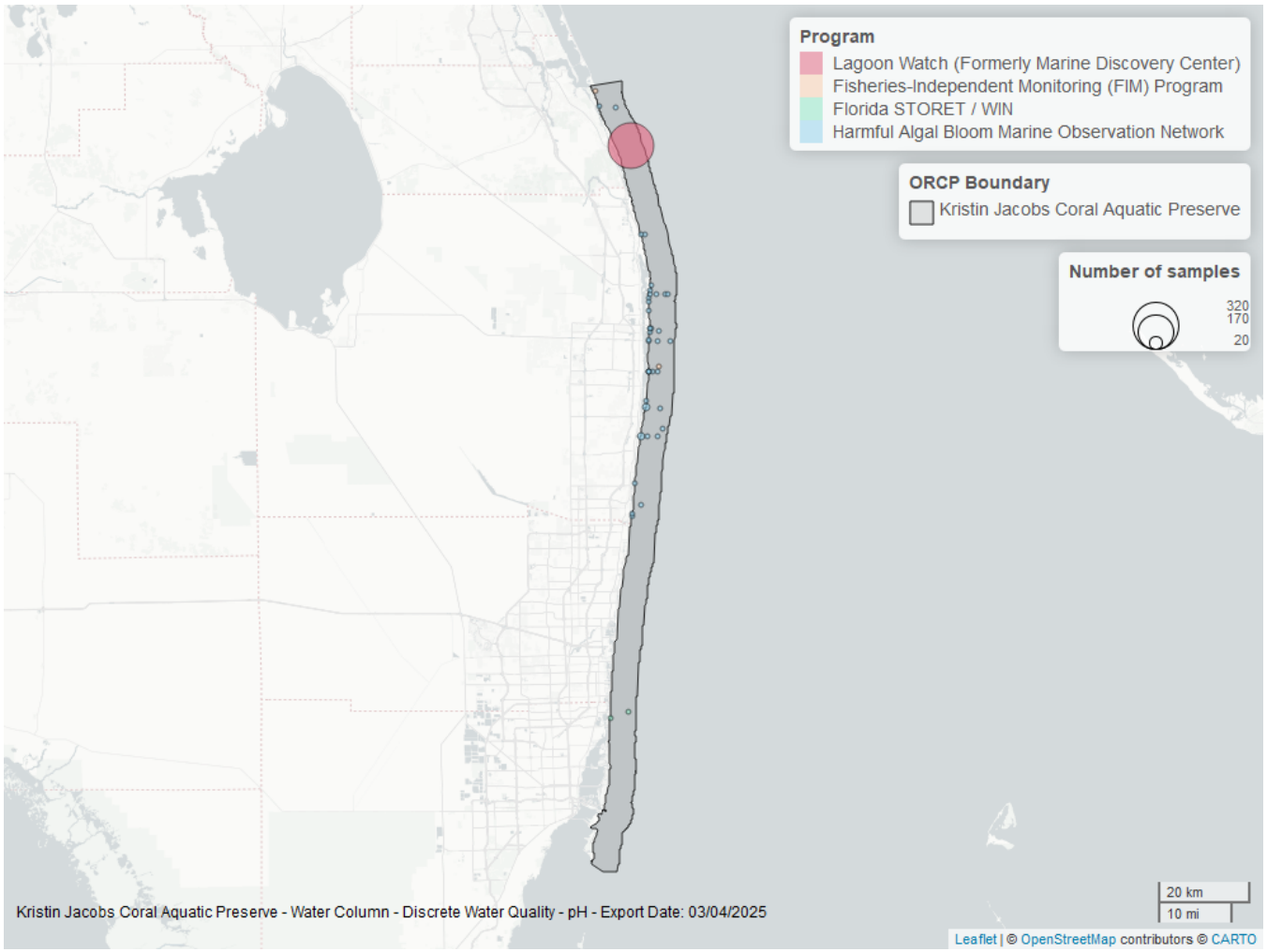

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
3001	103	1999	2003
95	65	1972	1972
69	4	1998	2019
5002	2	2011	2023

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[1]
95 - Harmful Algal Bloom Marine Observation Network[2]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]
5002 - Florida STORET / WIN[6]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

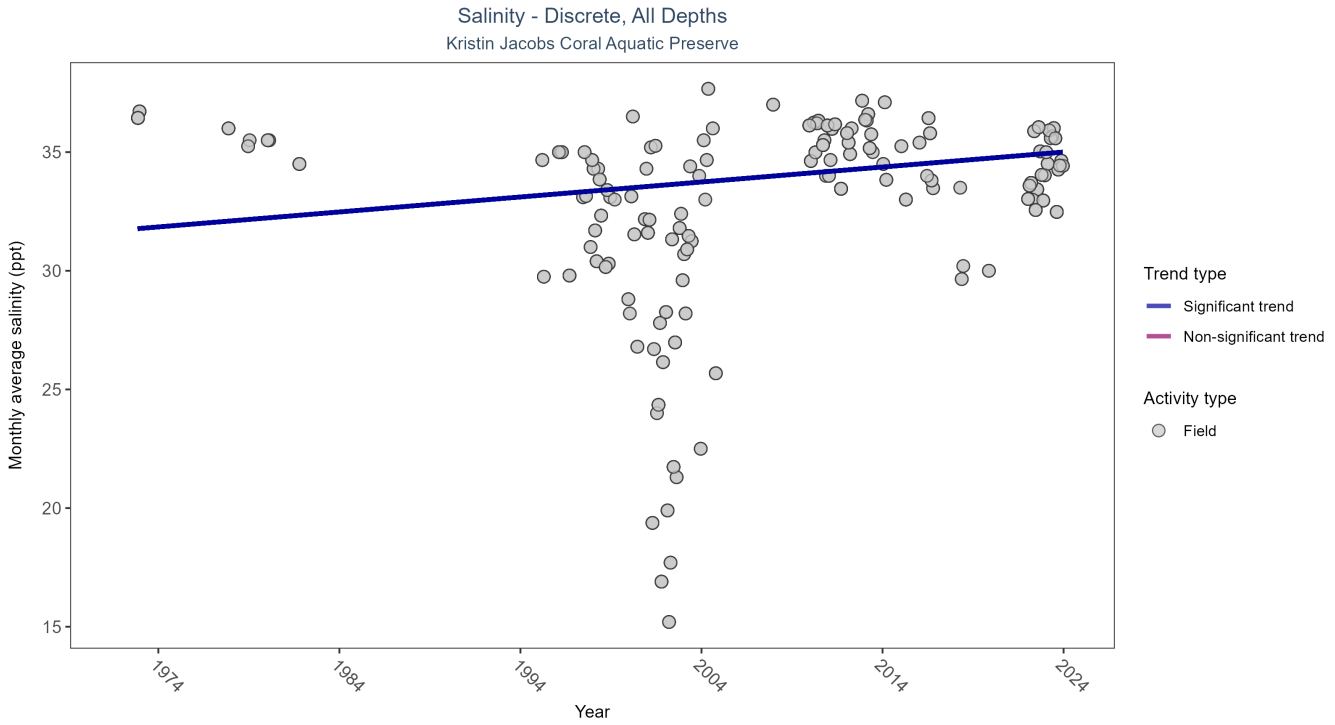

Figure 7: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (triangles) are both included in the plot.

Table 12: Seasonal Kendall-Tau Trend Analysis for Salinity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
All	Significantly increasing trend	908	30	1972 - 2023	35.5	0.1761	31.721	0.0631	0.0138

Monthly average salinity increased by 0.06 ppt per year.

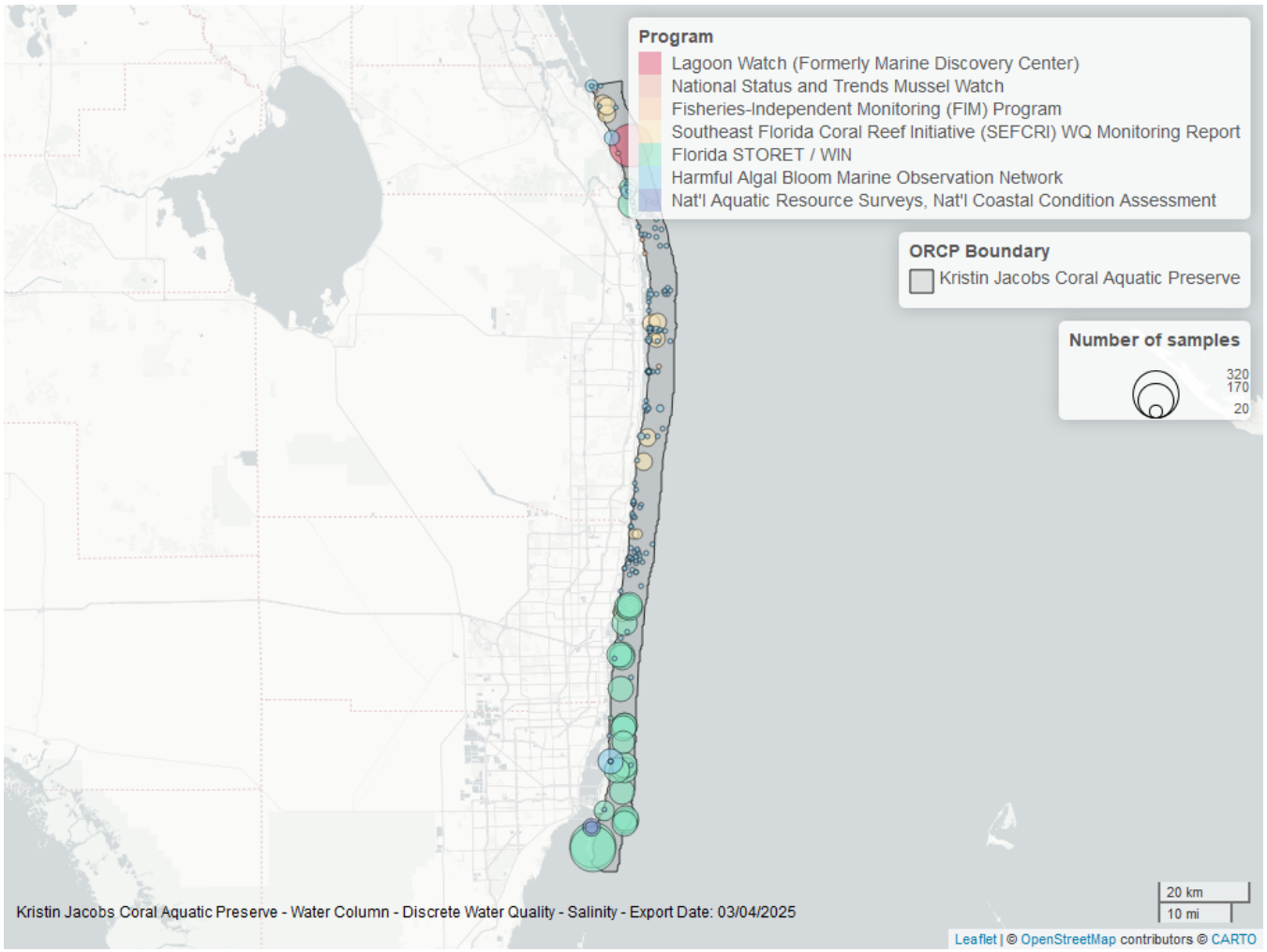

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	922	1996	2023
5058	266	2009	2011
95	230	1972	2018
3001	102	1999	2003
118	23	2015	2020
69	10	1997	2019
102	2	1995	1995

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[1]
95 - Harmful Algal Bloom Marine Observation Network[2]
102 - National Status and Trends Mussel Watch[8]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[4]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]

5002 - Florida STORET / WIN[6]
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report[7]

Secchi Depth - Discrete

Seasonal Kendall-Tau Trend Analysis

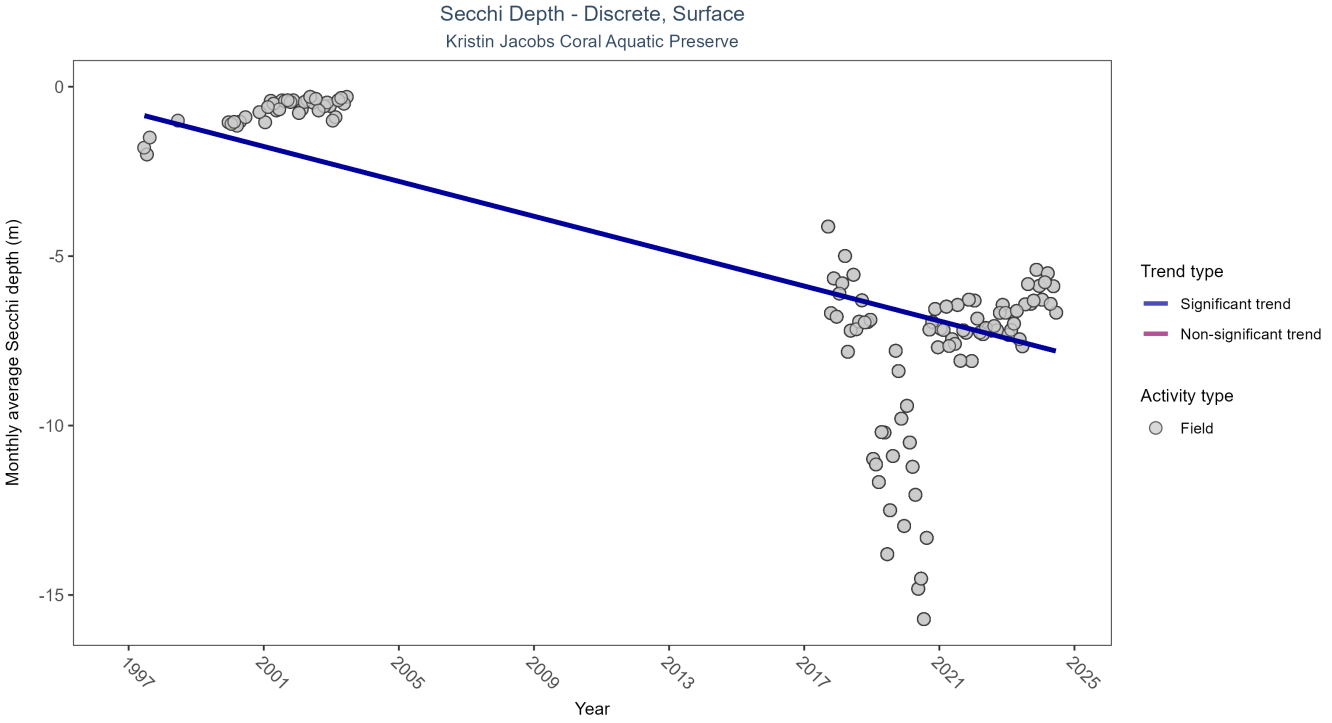

Figure 9: Scatter plot of monthly average Secchi depth over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Secchi depth is only measured in the field (circles).

Table 14: Seasonal Kendall-Tau Trend Analysis for Secchi Depth

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly decreasing trend	8962	15	1997 - 2024	-6.1	-0.2976	-0.7336	-0.2575	0

Monthly average Secchi depth became deeper by 0.26 m per year, indicating an increase in water clarity.

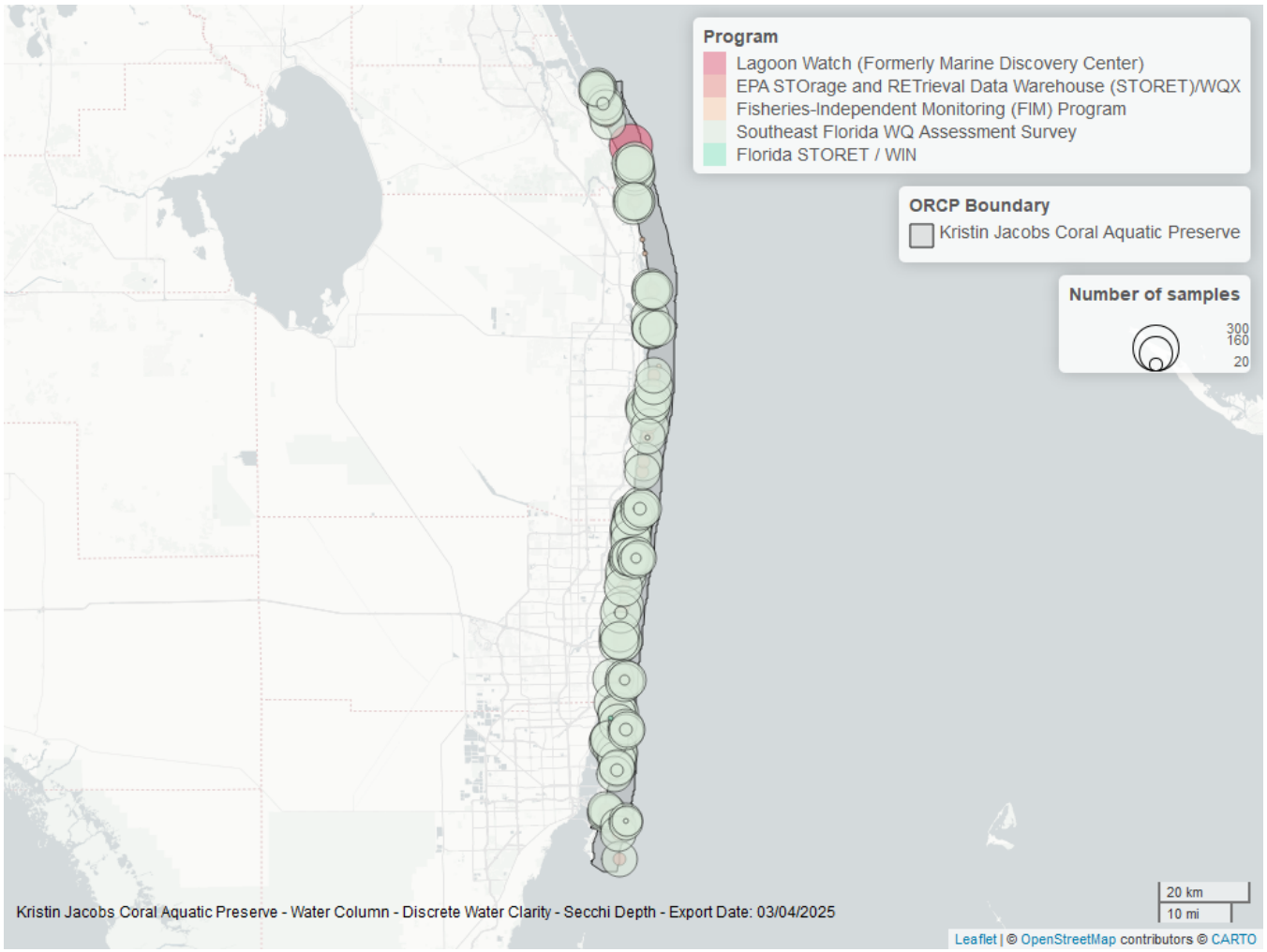

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
5033	7903	2017	2024
103	961	2020	2021
3001	99	1999	2003
69	10	1997	2019
5002	1	2023	2023

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[1]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]
5002 - Florida STORET / WIN[6]
5033 - Southeast Florida Water Quality Assessment Survey[9]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

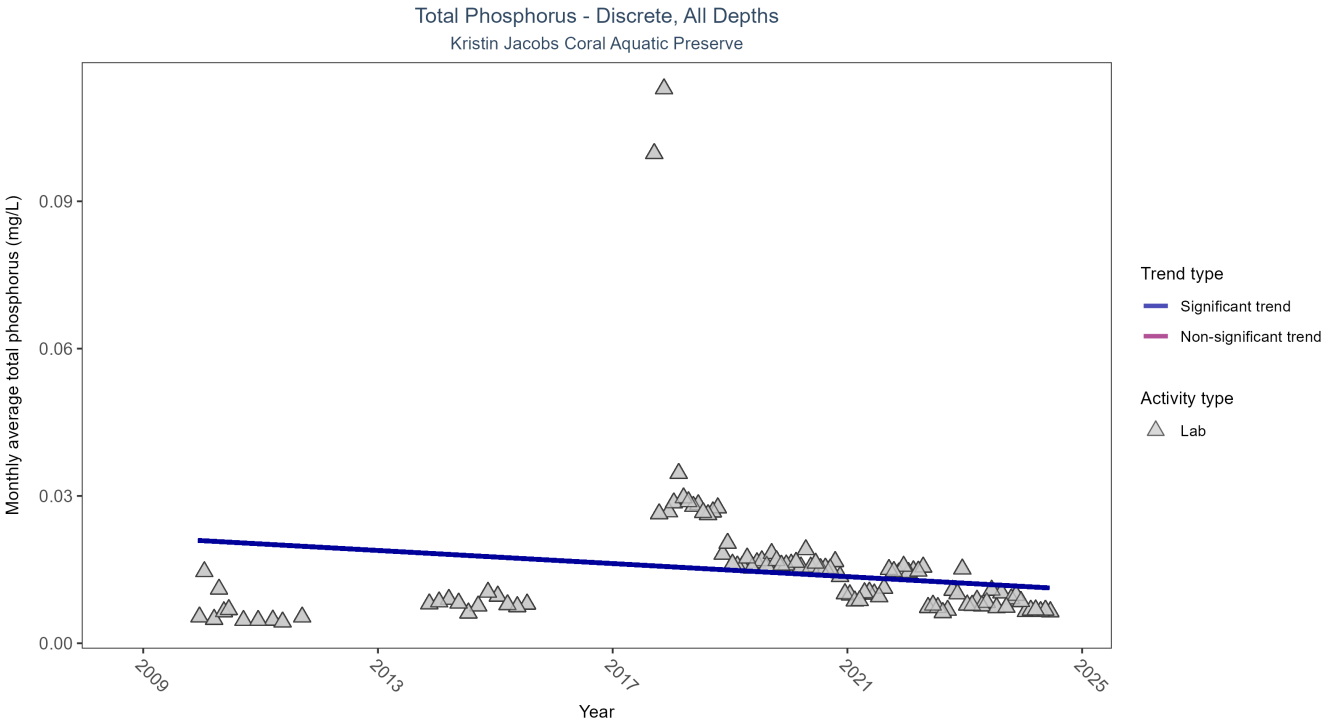

Figure 11: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included in the plot.

Table 16: Seasonal Kendall-Tau Trend Analysis for Total Phosphorus

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Significantly decreasing trend	17322	14	2009 - 2024	0.014	-0.294	0.0216	-0.0007	0.0034

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

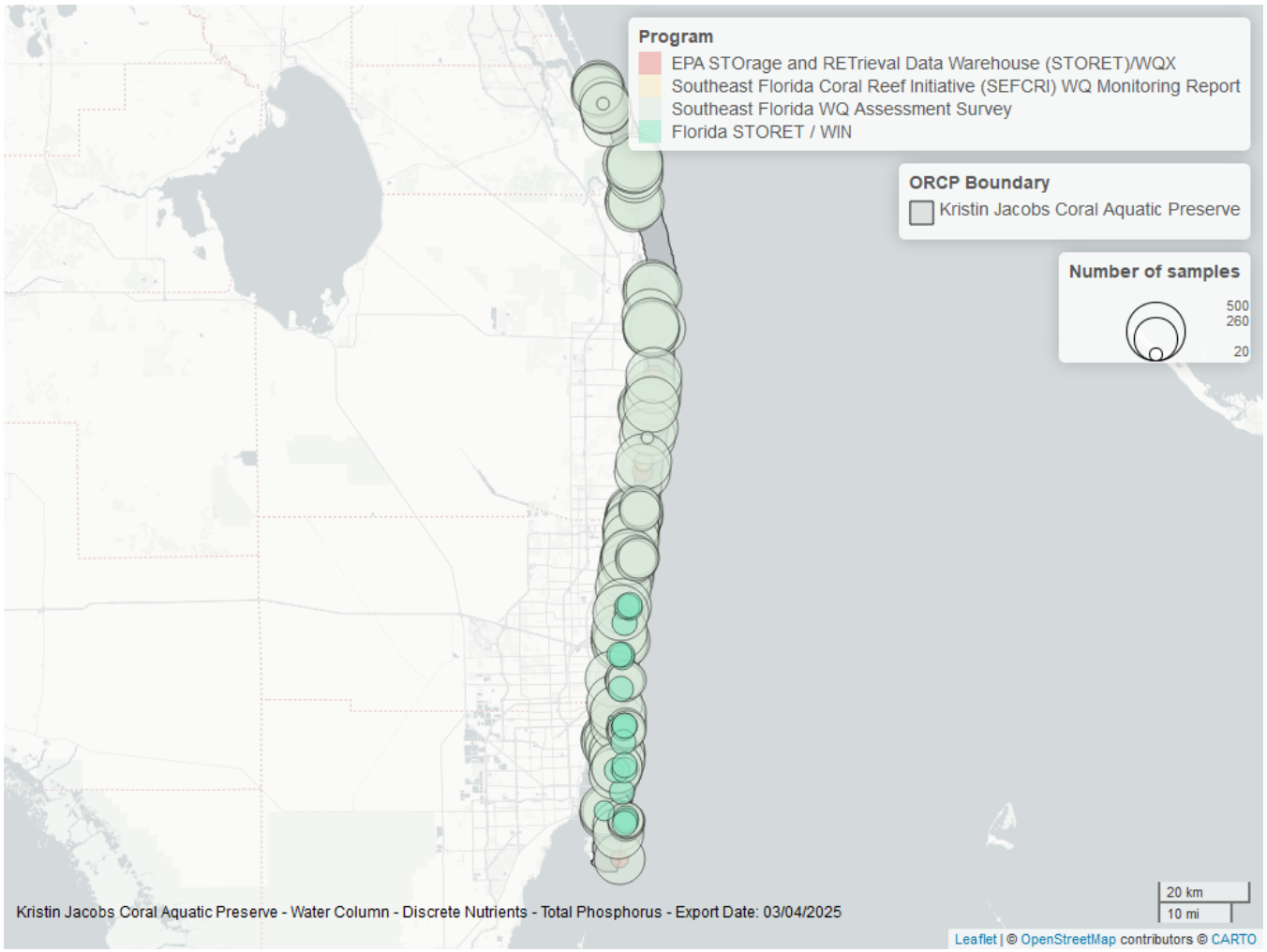

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5033	15486	2017	2024
103	1846	2020	2021
5002	665	2013	2023
5058	268	2009	2011

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[6]
5033 - Southeast Florida Water Quality Assessment Survey[9]
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report[7]

Turbidity - Discrete

Seasonal Kendall-Tau Trend Analysis

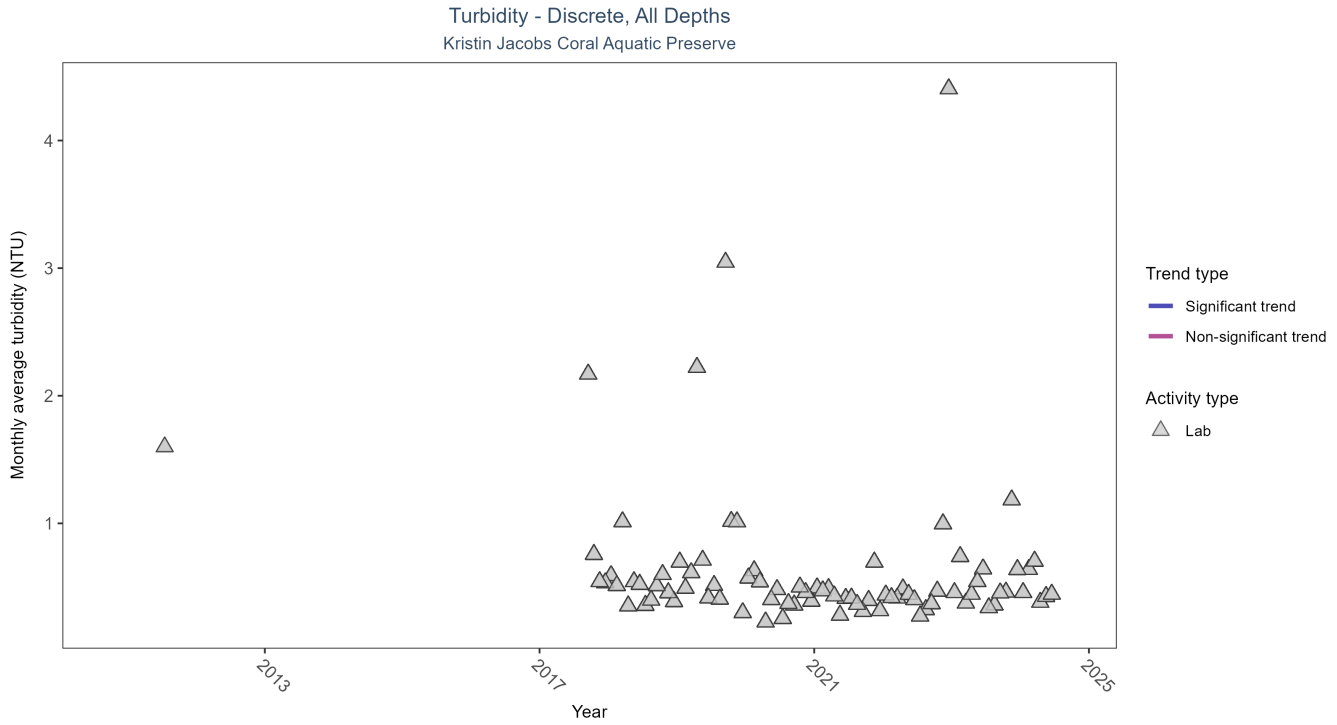

Figure 13: Scatter plot of monthly average turbidity over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only turbidity values measured in the laboratory (triangles) are included in the plot.

Table 18: Seasonal Kendall-Tau Trend Analysis for Turbidity

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	Insufficient data to calculate trend	15580	9	2011 - 2024	0.3	-	-	-	-

There was insufficient data to fit a model for turbidity.

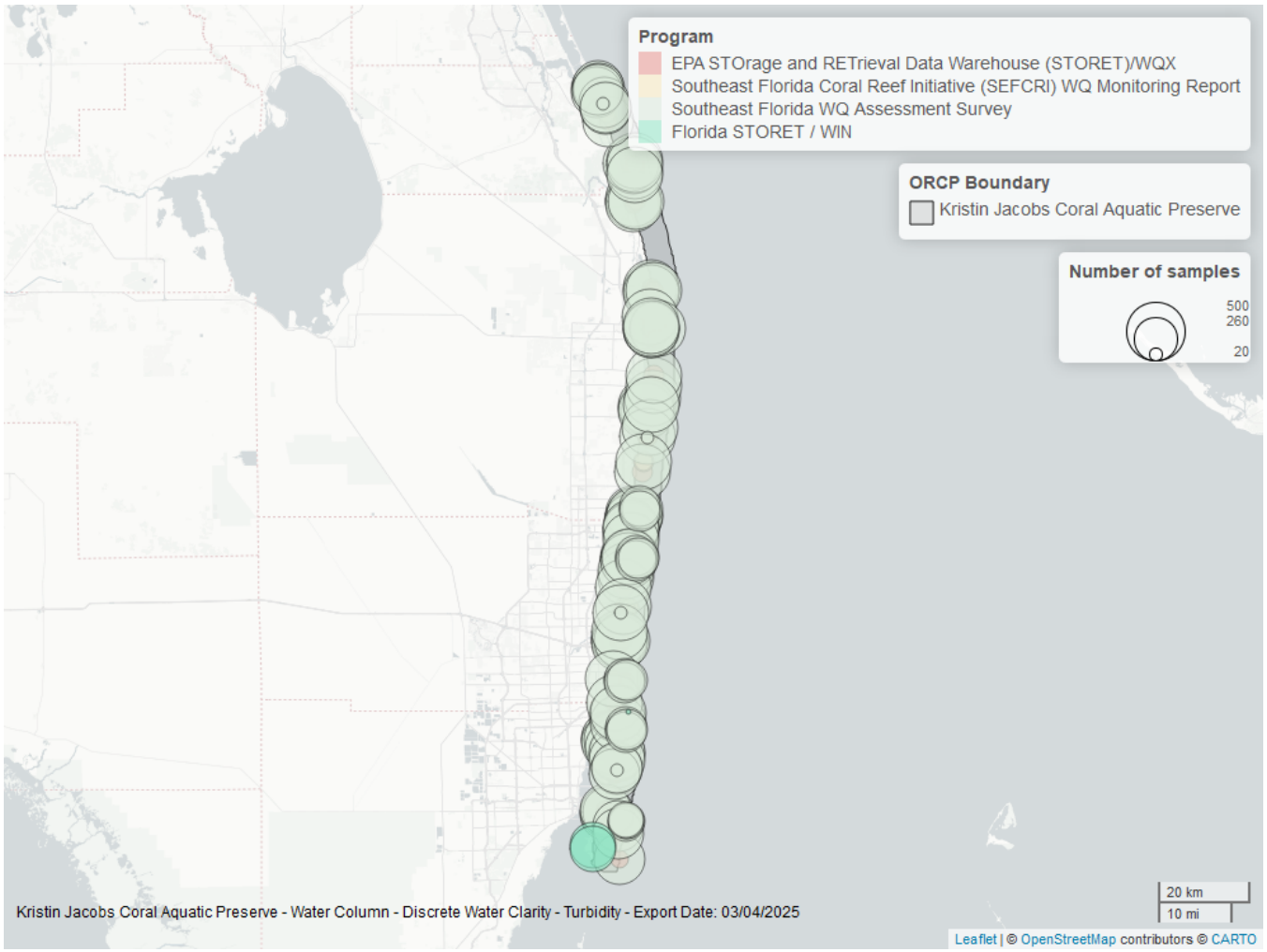

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5033	15603	2017	2024
103	1846	2020	2021
5058	264	2009	2011
5002	210	2011	2023

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
5002 - Florida STORET / WIN[6]
5033 - Southeast Florida Water Quality Assessment Survey[9]
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report[7]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

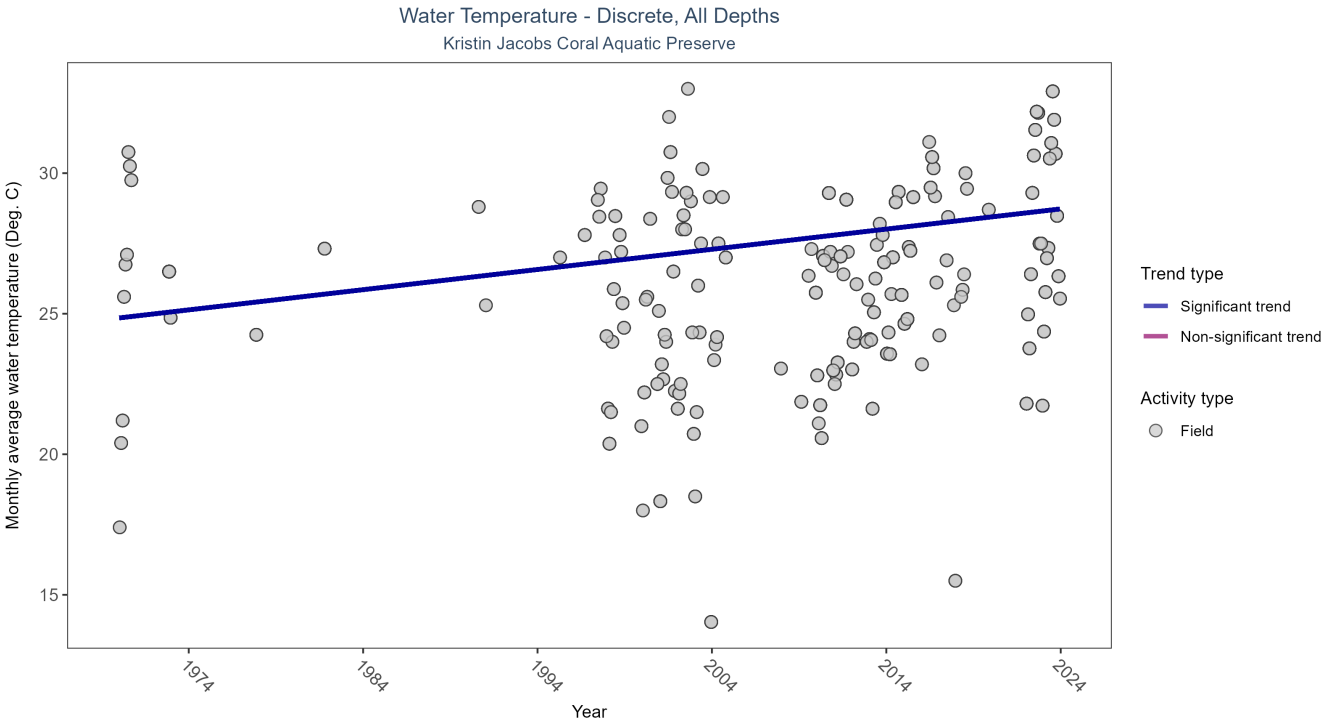

Figure 15: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 20: Seasonal Kendall-Tau Trend Analysis for Water Temperature

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Field	Significantly increasing trend	1580	30	1970 - 2023	26.5824	0.2894	24.8491	0.0718	0

Monthly average water temperature increased by 0.07°C per year.

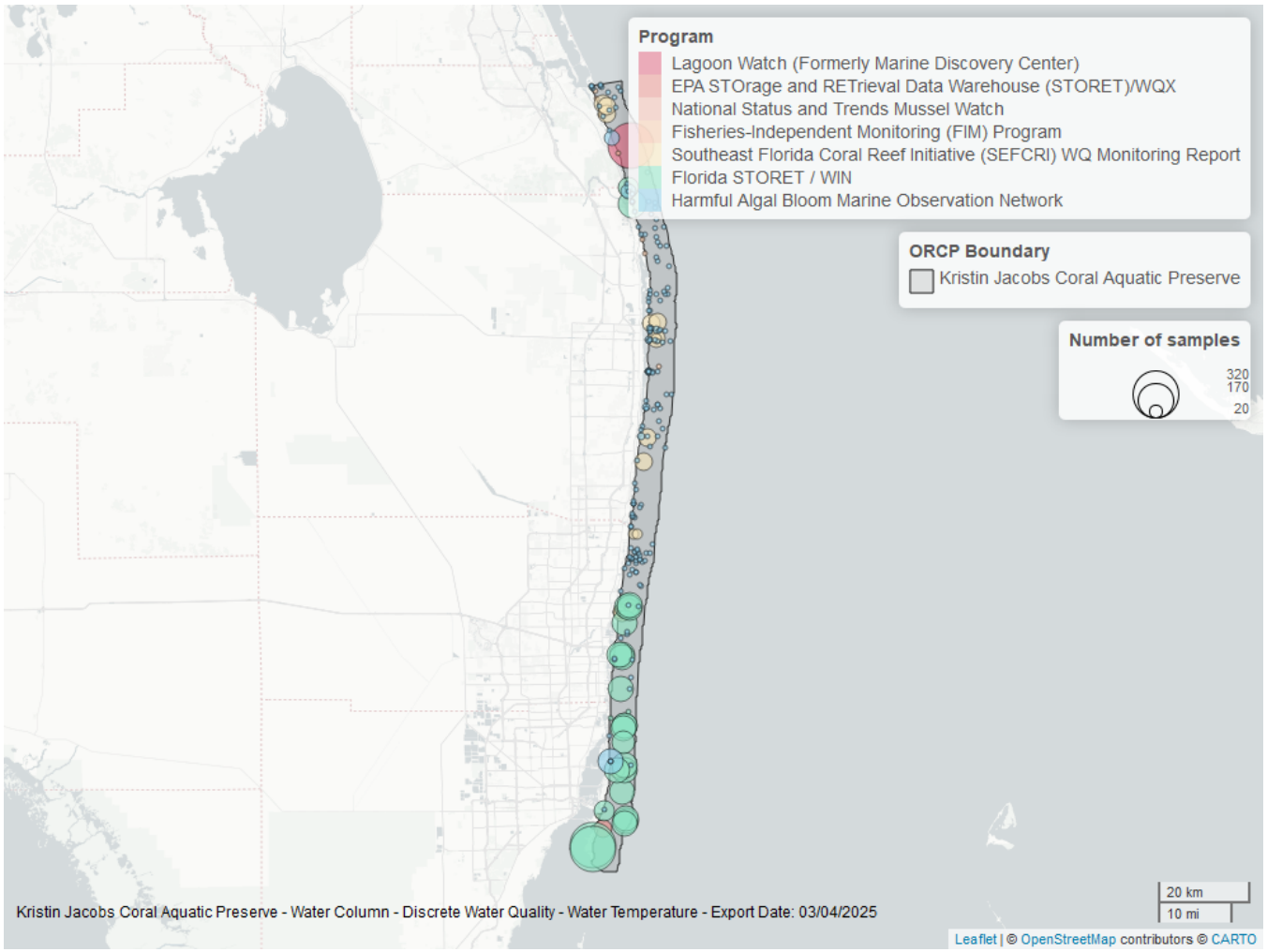

Figure 16: Map showing location of discrete water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	926	1996	2023
5058	266	2009	2011
95	258	1972	2018
3001	104	1999	2003
103	17	1970	1970
69	10	1997	2019
102	2	1995	1995

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[1]
95 - Harmful Algal Bloom Marine Observation Network[2]
102 - National Status and Trends Mussel Watch[8]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[3]
3001 - Lagoon Watch (Formerly Marine Discovery Center)[5]

5002 - Florida STORET / WIN[6]
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report[7]

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_SE-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_SE-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_pH_SE-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_SE-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_SE-2025-Mar-06.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_SE-2025-Mar-06.txt*

Continuous monitoring locations in Kristin Jacobs Coral Aquatic Preserve

Table 22: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
5	LKWF1	41	TRUE	TempW
986	1	10	TRUE	TempW
986	2	10	TRUE	TempW
986	3	10	TRUE	TempW
986	4	10	TRUE	TempW
986	5	10	TRUE	TempW
986	6	10	TRUE	TempW
986	84	16	TRUE	TempW
986	85	16	TRUE	TempW
986	86	16	TRUE	TempW
986	87	16	TRUE	TempW
986	88	16	TRUE	TempW
986	89	16	TRUE	TempW
986	90	16	TRUE	TempW
986	91	16	TRUE	TempW
986	92	16	TRUE	TempW
986	93	16	TRUE	TempW
986	94	16	TRUE	TempW
986	95	16	TRUE	TempW
986	96	6	TRUE	TempW
986	97	13	TRUE	TempW
986	98	13	TRUE	TempW

Program names:

5 - National Data Buoy Center[10]
986 - Water Temperature on Coral Reefs in the Florida Keys[11]

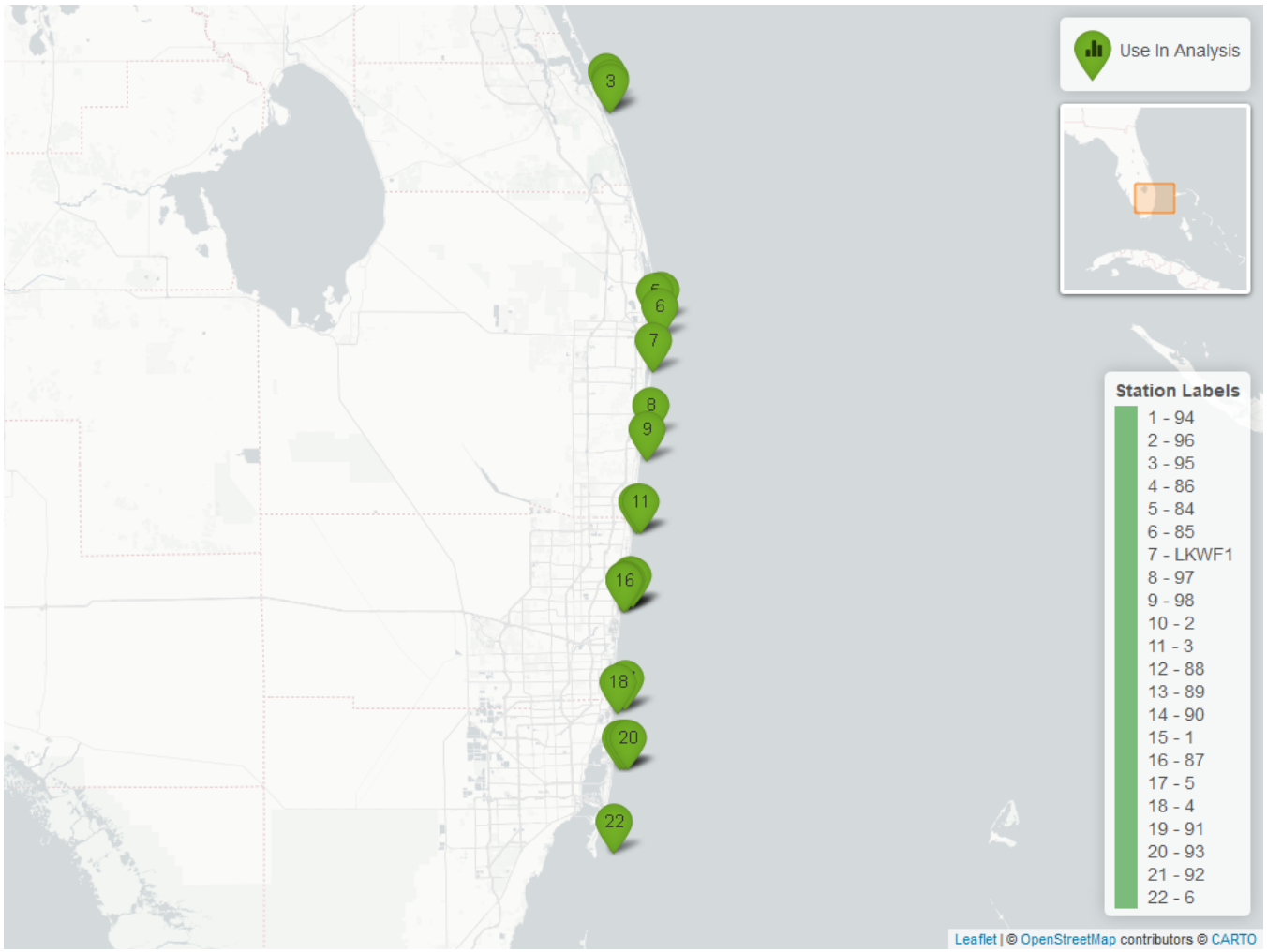

Figure 17: Map showing continuous water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Water Temperature - Continuous - Program 5

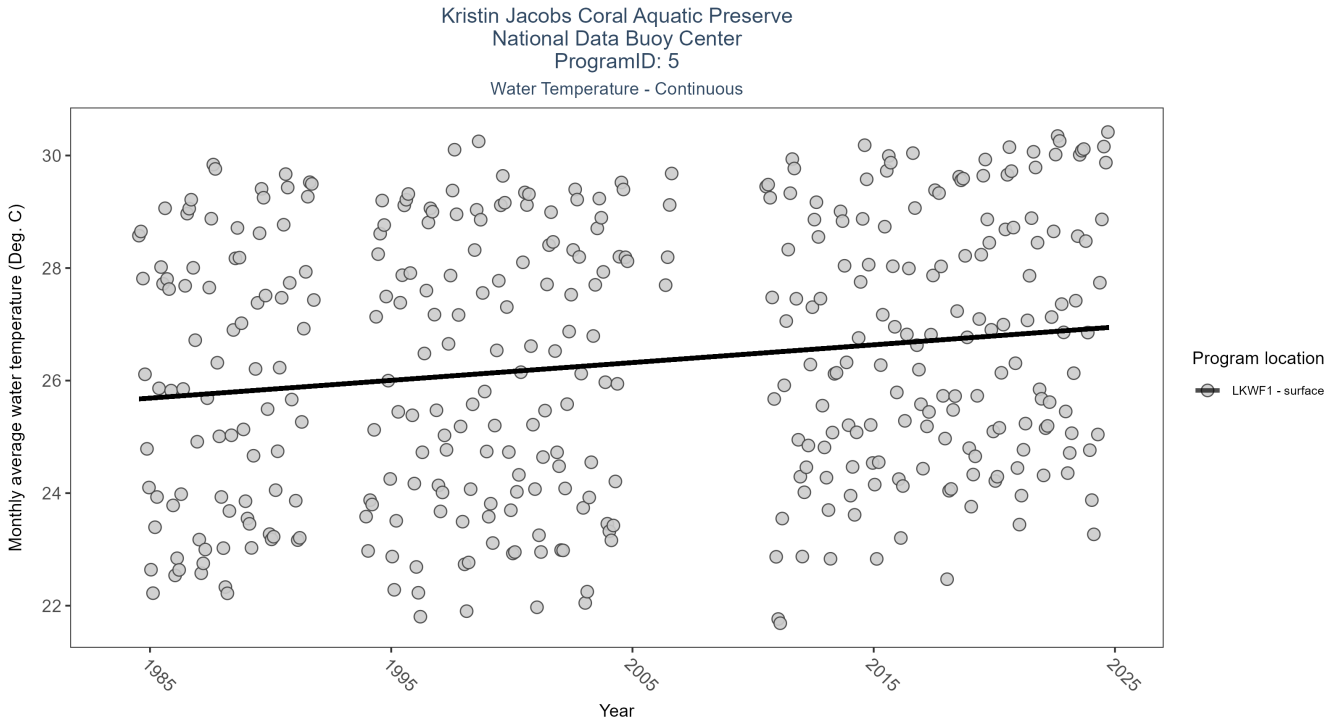

Figure 18: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 23: Seasonal Kendall-Tau Results for Water Temperature - Program 5

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
LKWF1	Significantly increasing trend	1268849	36	1984 - 2024	26.5	0.42	25.66	0.03	0

At nineteen program locations, monthly average water temperature increased between 0.03 and 0.09°C per year. No detectable change in monthly average water temperature was observed at three locations.

Water Temperature - Continuous - Program 986

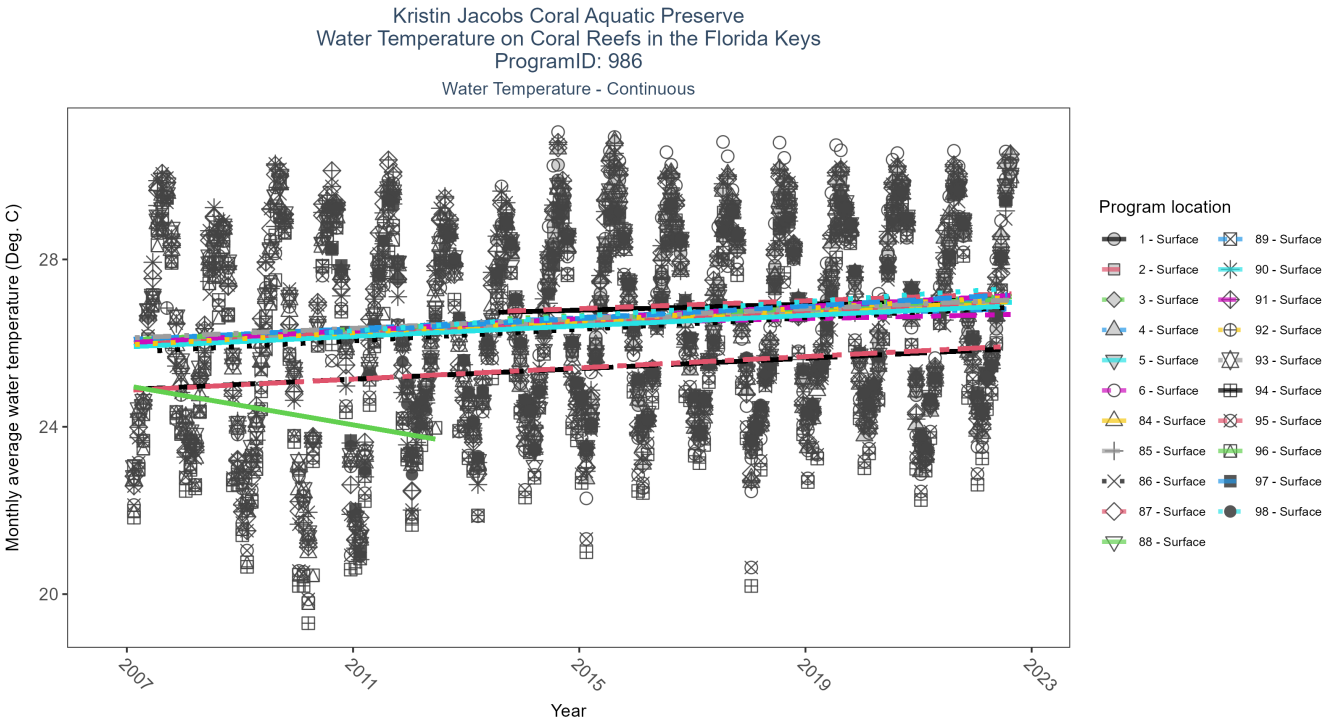

Figure 19: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 24: Seasonal Kendall-Tau Results for Water Temperature - Program 986

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
94	Significantly increasing trend	90265	16	2007 - 2022	25.55	0.28	24.89	0.06	0.00
87	Significantly increasing trend	108339	16	2007 - 2022	26.44	0.31	25.99	0.06	0.00
85	Significantly increasing trend	114214	16	2007 - 2022	26.26	0.34	25.99	0.07	0.00
1	No significant trend	65108	10	2013 - 2022	26.40	0.13	26.72	0.04	0.12
2	Significantly increasing trend	64486	10	2013 - 2022	26.72	0.26	26.73	0.05	0.00
90	Significantly increasing trend	97006	16	2007 - 2022	26.43	0.33	25.91	0.06	0.00
88	Significantly increasing trend	115305	16	2007 - 2022	26.35	0.34	26.08	0.06	0.00
95	Significantly increasing trend	102279	16	2007 - 2022	25.58	0.30	24.87	0.07	0.00
84	Significantly increasing trend	111153	16	2007 - 2022	26.32	0.36	25.94	0.07	0.00
93	Significantly increasing trend	106903	16	2007 - 2022	26.47	0.35	26.12	0.06	0.00
89	Significantly increasing trend	113809	16	2007 - 2022	26.28	0.35	26.08	0.07	0.00
5	Significantly increasing trend	51977	10	2013 - 2022	26.62	0.21	26.46	0.05	0.01
97	Significantly increasing trend	97533	13	2010 - 2022	26.45	0.38	26.21	0.08	0.00
92	Significantly increasing trend	111826	16	2007 - 2022	26.45	0.37	25.96	0.07	0.00
86	Significantly increasing trend	104767	16	2007 - 2022	26.16	0.36	25.78	0.07	0.00
91	Significantly increasing trend	102406	16	2007 - 2022	26.54	0.33	26.01	0.07	0.00
3	Significantly increasing trend	60887	10	2013 - 2022	26.65	0.25	26.54	0.06	0.00
4	Significantly increasing trend	68937	10	2013 - 2022	26.59	0.17	26.46	0.04	0.03
98	Significantly increasing trend	87973	13	2010 - 2022	26.40	0.39	26.21	0.09	0.00
96	No significant trend	25550	6	2007 - 2012	24.87	-0.25	24.98	-0.23	0.08
6	No significant trend	63582	10	2013 - 2022	26.77	0.09	26.42	0.03	0.26

At nineteen program locations, monthly average water temperature increased between 0.03 and 0.09°C per year. No detectable change in monthly average water temperature was observed at three locations.

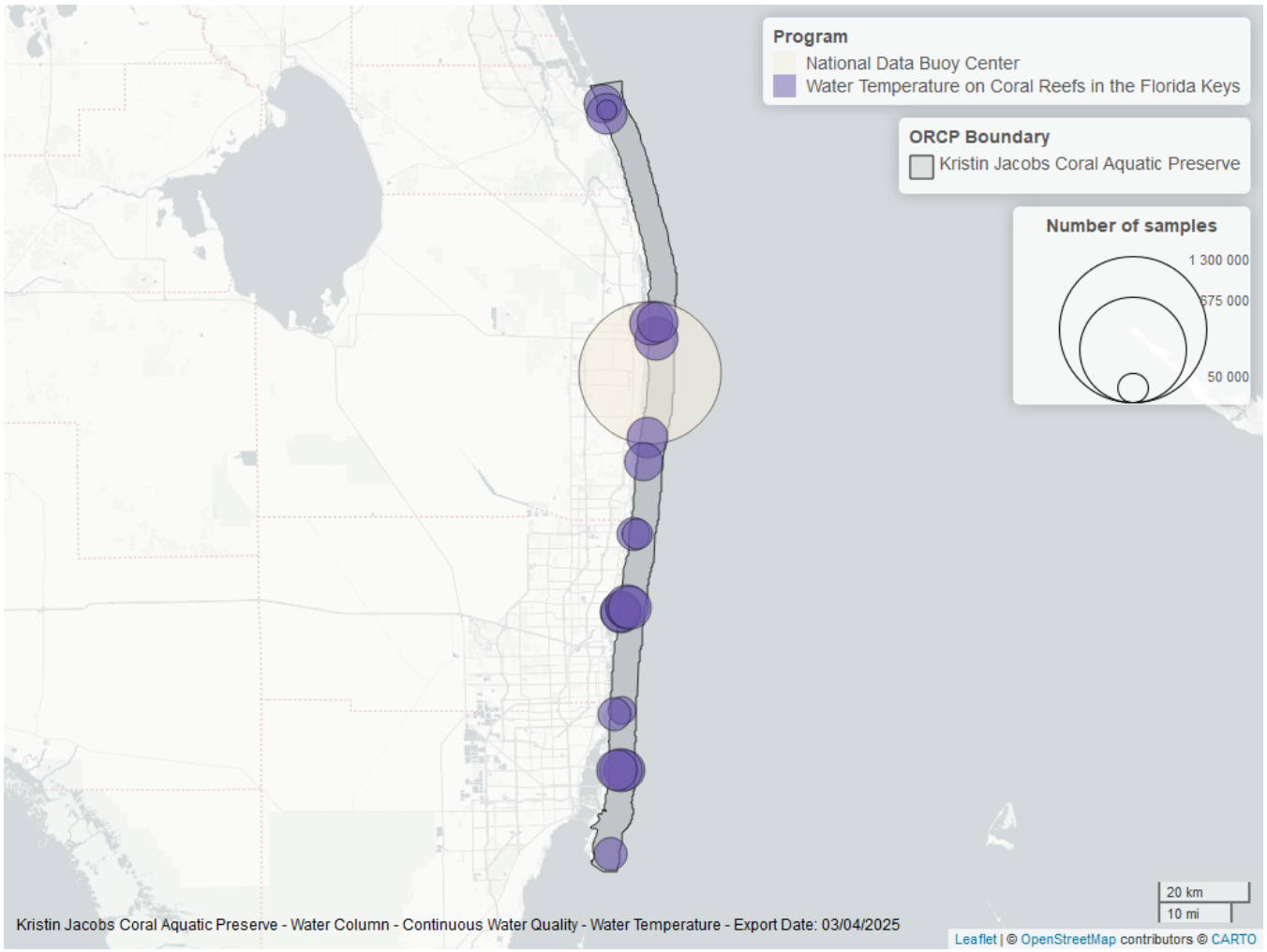

Figure 20: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Coral Reef

The data file used is: **All_CORAL_Parameters-2025-Mar-06.txt**

Percent Cover

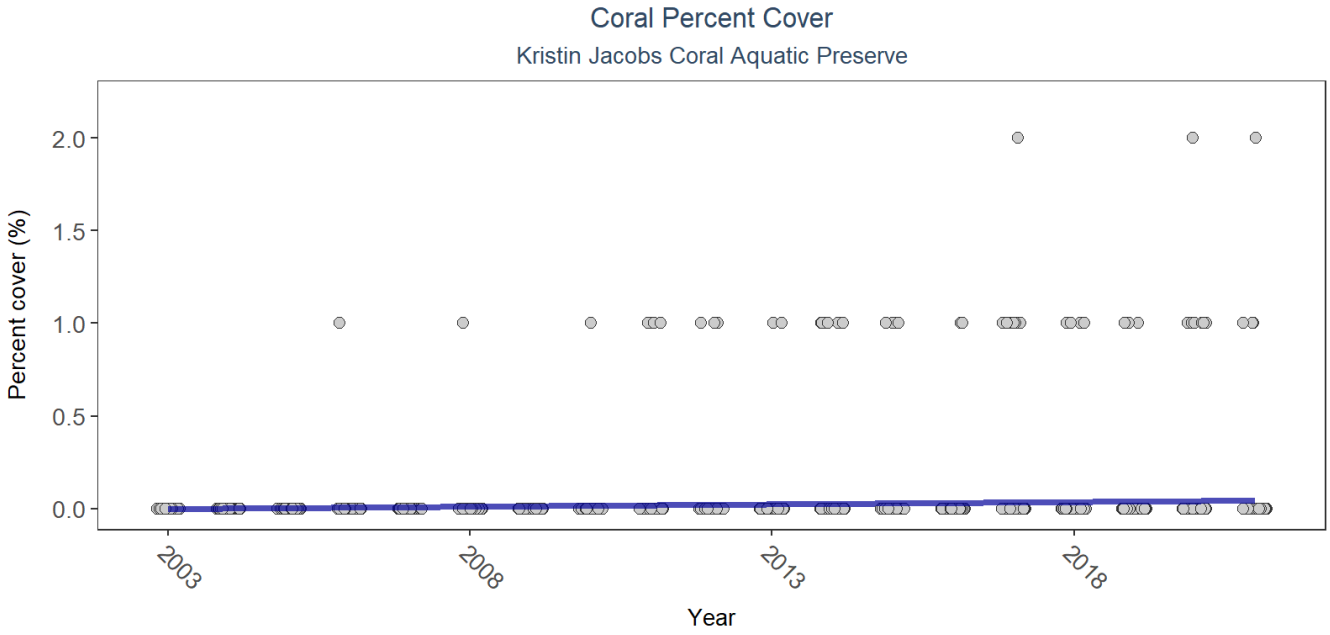

Figure 21: Scatter plot of live coral coverage over time as a percent of reef surface. Species groups include octocorals, milleporans, and scleractinians. If the time series included five or more years of observations, a significant (blue) or non-significant (magenta) trend line is also shown. Data points are jittered horizontally to reduce overlap.

Table 25: Coral Percent Cover

Statistical Trend	Period of Record	LME Intercept	LME Slope	p
Significantly increasing trend	2003 - 2021	-5.52423	0.00276	0.00002

Annual average percent cover increased by less than 0.01%.

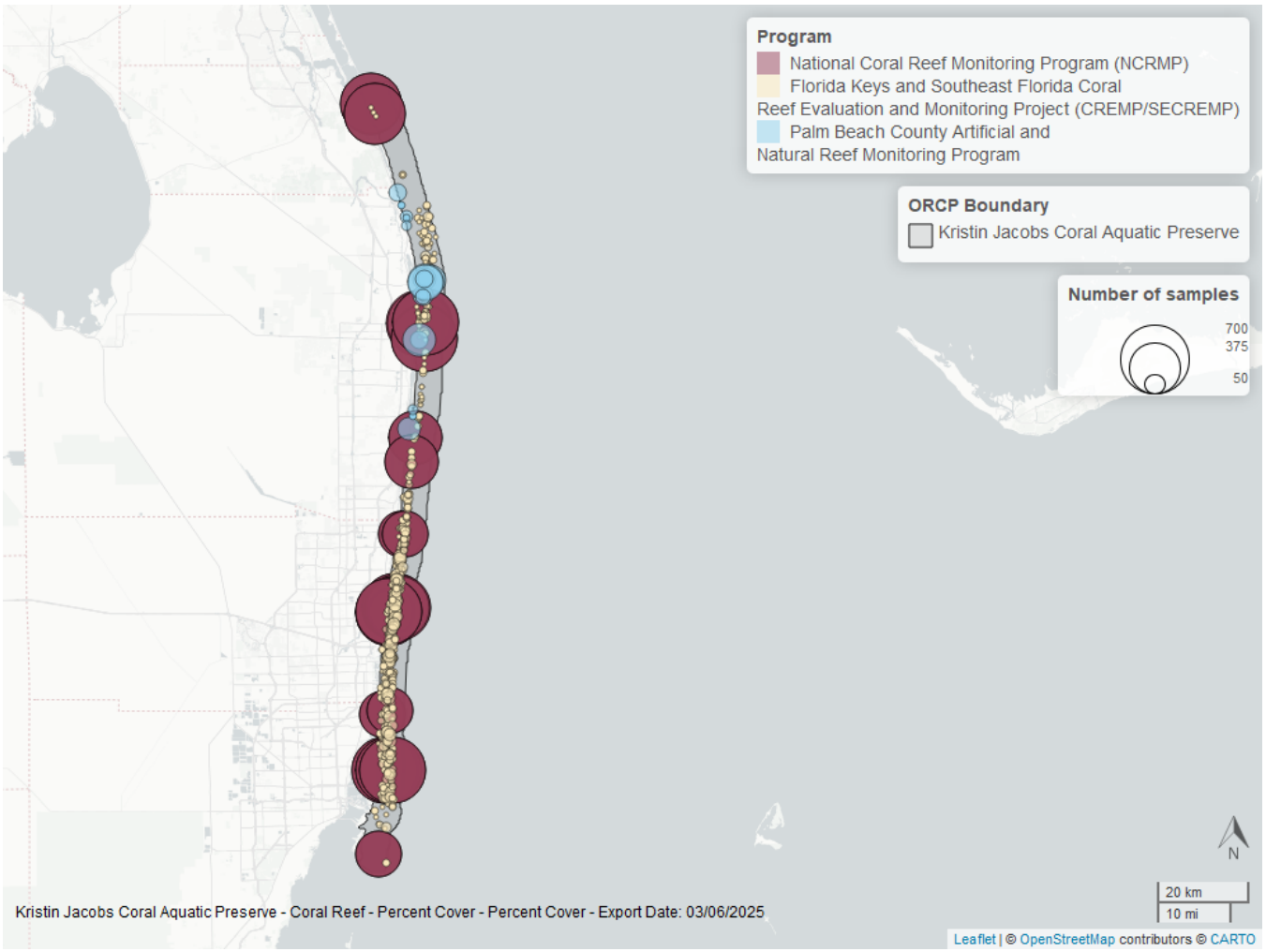

Figure 22: Map showing location of coral percent cover sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species Richness

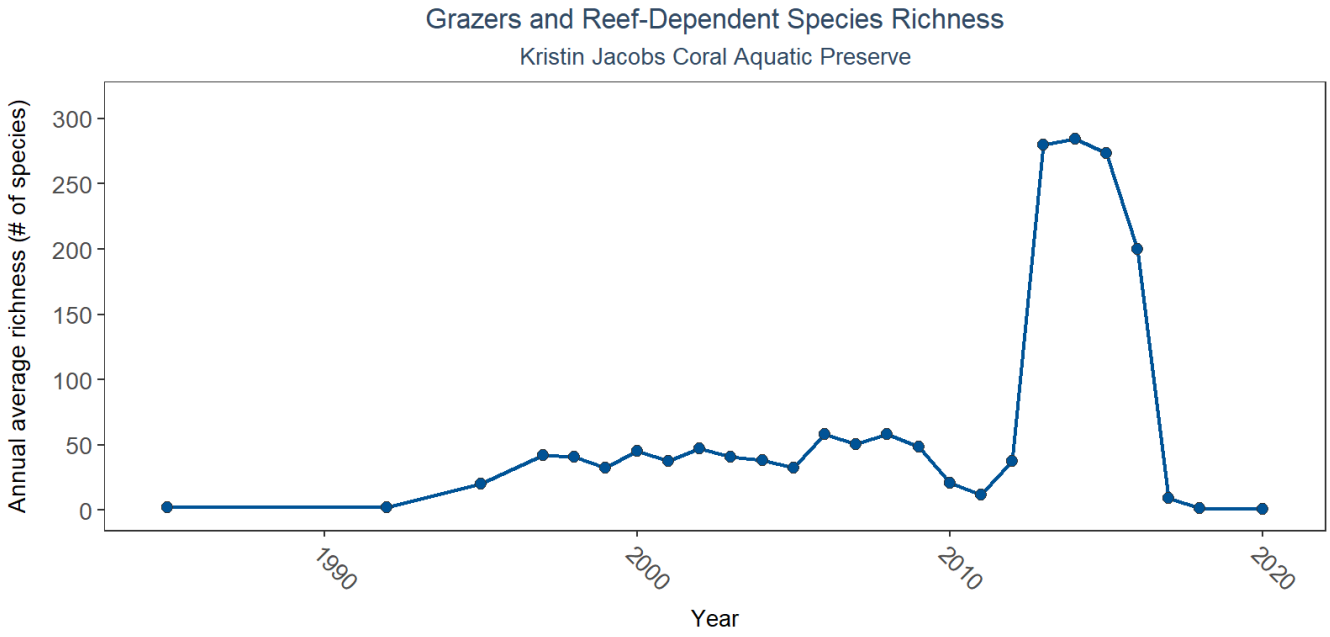

Figure 23: Line graph of annual average species richness of grazers and reef-dependent species over time. If the time series included more than one year of observations, a line connects the data points for visualization.

Table 26: Coral Species Richness

Sample Count	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
3686	26	1985 - 2020	294	193.8752

The median annual number of taxa was 294 based on 3,686 observations collected between 1985 and 2020.

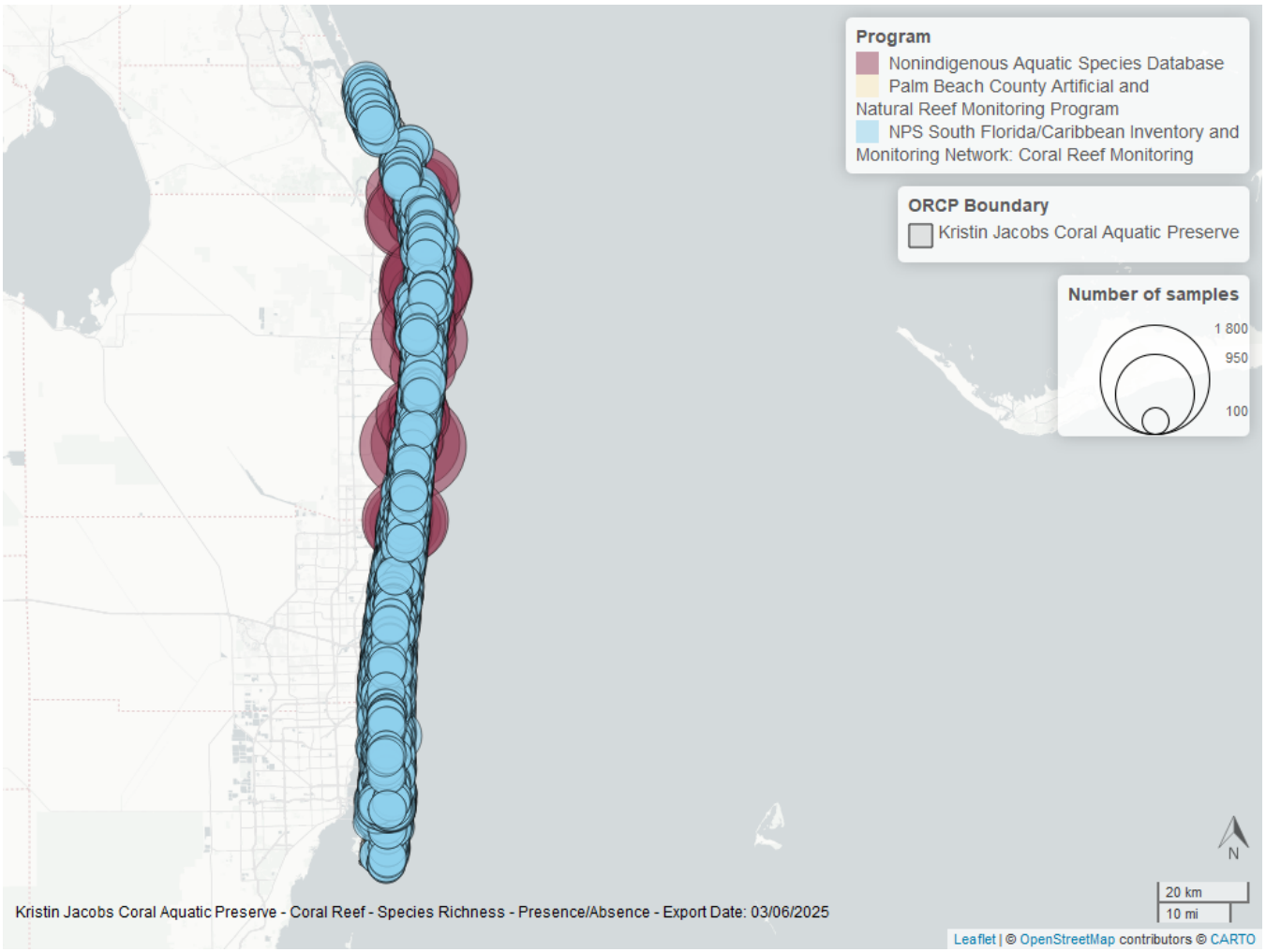

Figure 24: Map showing location of coral species richness sampling locations within the boundaries of *Kristin Jacobs Coral Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

1 - Coral Reef - Species Richness, 2 - Coral Reef - Percent Cover

References

1. Florida Fish and Wildlife Conservation Commission (FWC). Fisheries-Independent Monitoring (FIM) Program. (2022).
2. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). Harmful Algal Bloom Marine Observation Network. (2018).
3. U.S. Environmental Protection Agency (EPA). EPA STOrage and RETrieval Data Warehouse (STORET)/WQX. (2023).
4. U.S. Environmental Protection Agency (EPA); Office of Water; National Oceanic and Atmospheric Administration (NOAA); U.S. Geological Survey (USGS); U.S. Fish and Wildlife Service (USFWS); National Estuary Program (NEP); coastal states. National Aquatic Resource Surveys, National Coastal Condition Assessment. (2021).
5. Volusia County (Florida); Marine Discovery Center. Lagoon Watch (Formerly Marine Discovery Center). (2023).
6. Florida Department of Environmental Protection (DEP). Florida STORET / WIN. (2024).
7. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Coral Reef Conservation Program. Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report. (2011).
8. National Oceanic and Atmospheric Administration (NOAA); Center for Coastal Monitoring and Assessment. National Status and Trends Mussel Watch. (2000).
9. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Coral Reef Conservation Program. Southeast Florida Water Quality Assessment Survey . (2024).
10. National Oceanic and Atmospheric Administration (NOAA); National Data Buoy Center. National Data Buoy Center. (2024).
11. Florida Fish and Wildlife Conservation Commision (FWC); Florida Wildlife Research Institute (FWRI). Water Temperature on Coral Reefs in the Florida Keys. (2022).