Lignumvitae Key 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*

Chlorophyll a, Uncorrected for Pheophytin - Discrete

Seasonal Kendall-Tau Trend Analysis

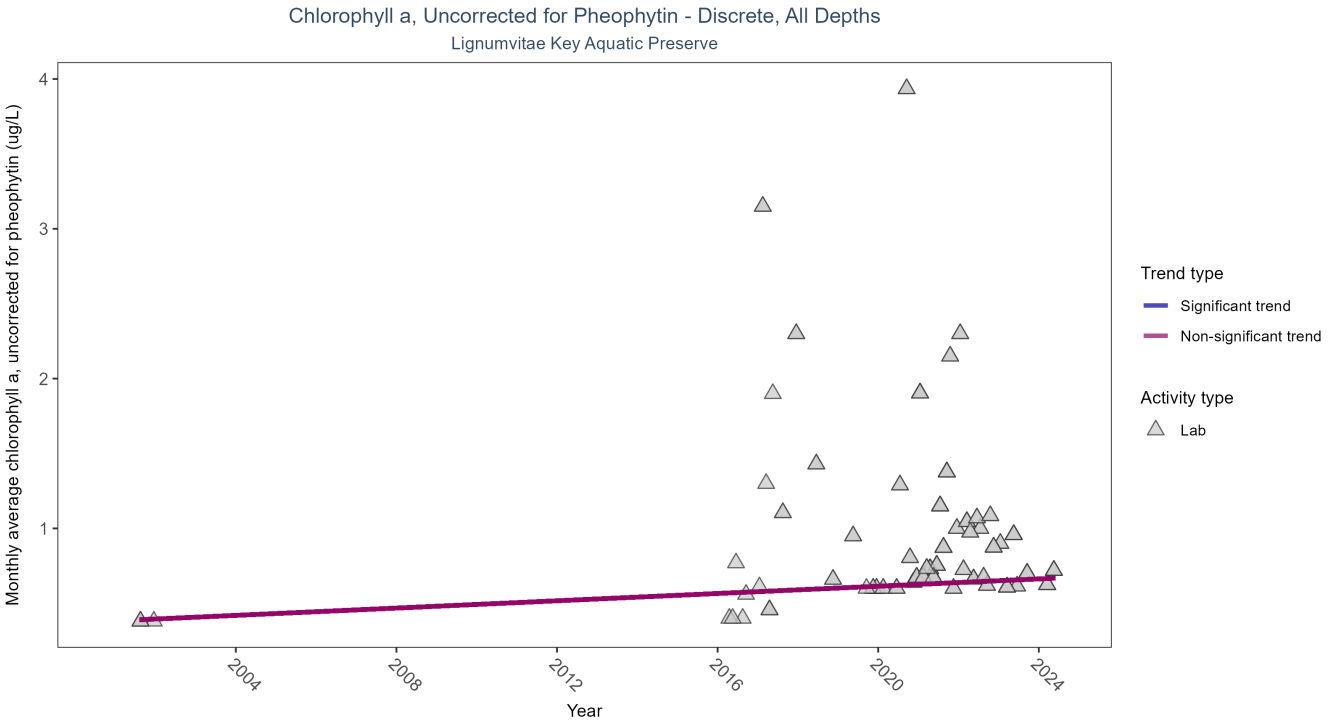

Figure 1: Scatter plot of monthly average levels of chlorophyll a, uncorrected for pheophytin, over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only laboratory-analyzed chlorophyll a (triangles) is included in the plot.

Table 6: Seasonal Kendall-Tau Trend Analysis for Chlorophyll a, Uncorrected for Pheophytin

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	No significant trend	166	10	2001 - 2024	0.7	0.1047	0.3831	0.0122	0.4367

Chlorophyll a, uncorrected for pheophytin, showed no detectable trend between 2001 and 2024.

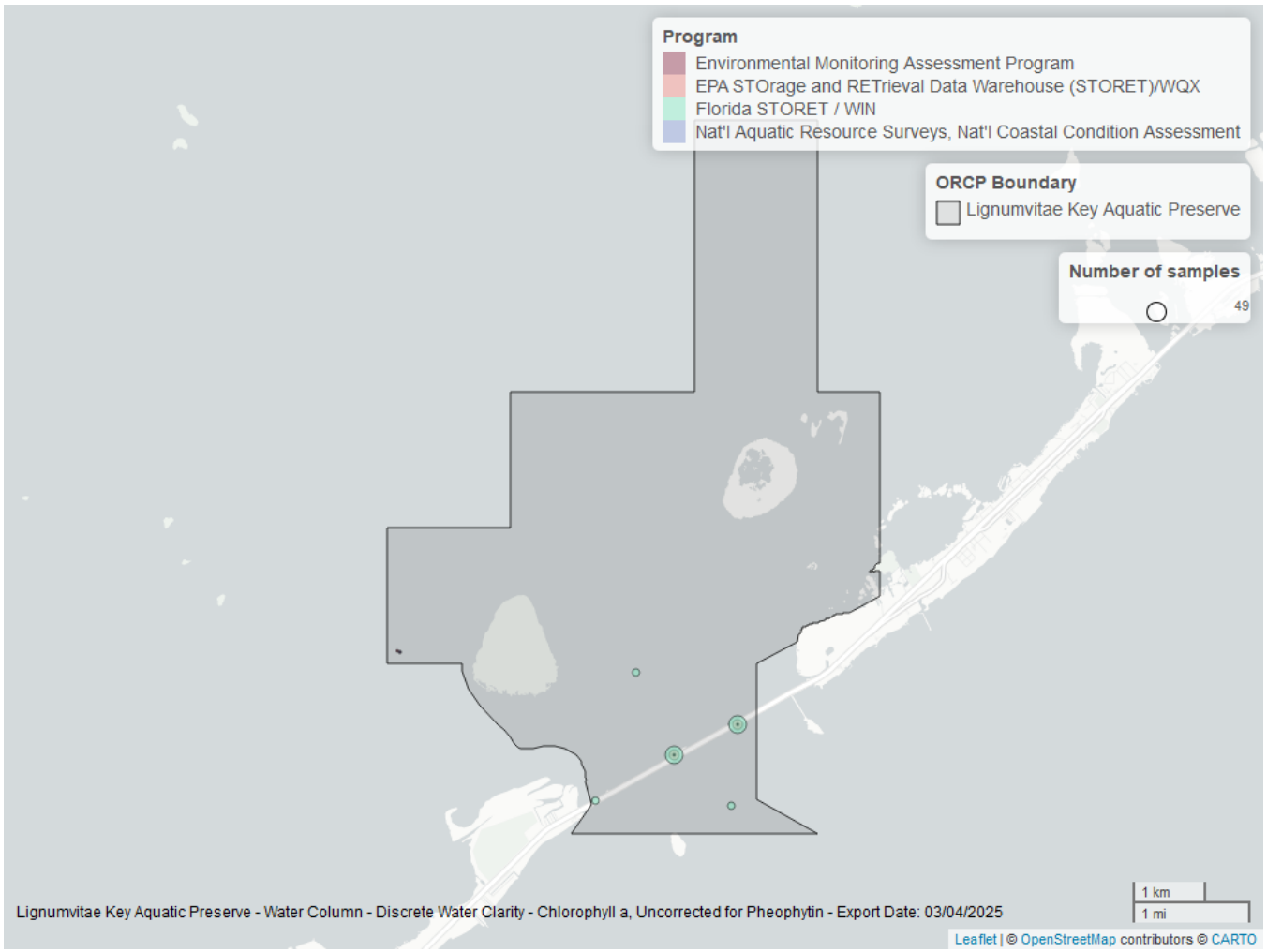

Figure 2: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 7: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	129	2016	2024
103	42	2001	2021
118	1	2001	2001
115	1	2001	2001

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[3]
5002 - Florida STORET / WIN[4]

Dissolved Oxygen - Discrete

Seasonal Kendall-Tau Trend Analysis

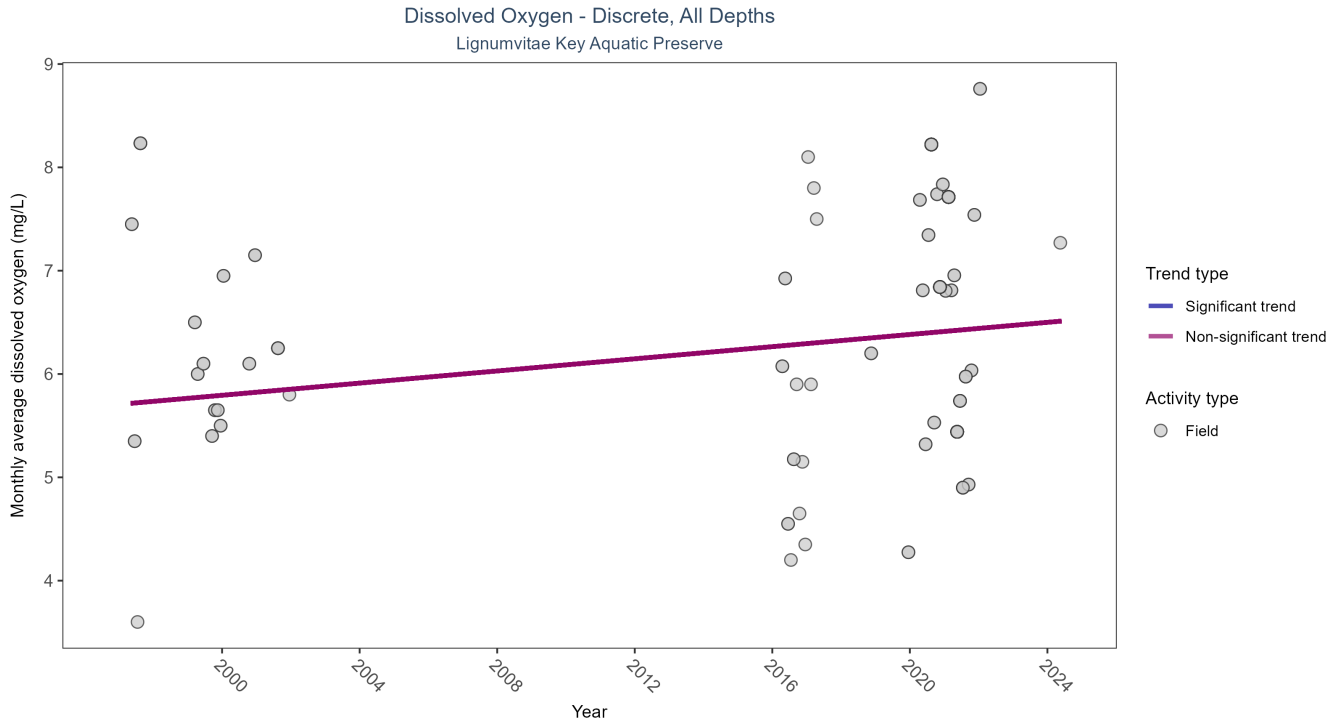

Figure 3: Scatter plot of monthly average dissolved oxygen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only dissolved oxygen values measured in the field (circles) are included in the plot.

Table 8: 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	216	12	1997 - 2024	6.795	0.1748	5.7059	0.0294	0.3413

Dissolved oxygen showed no detectable trend between 1997 and 2024.

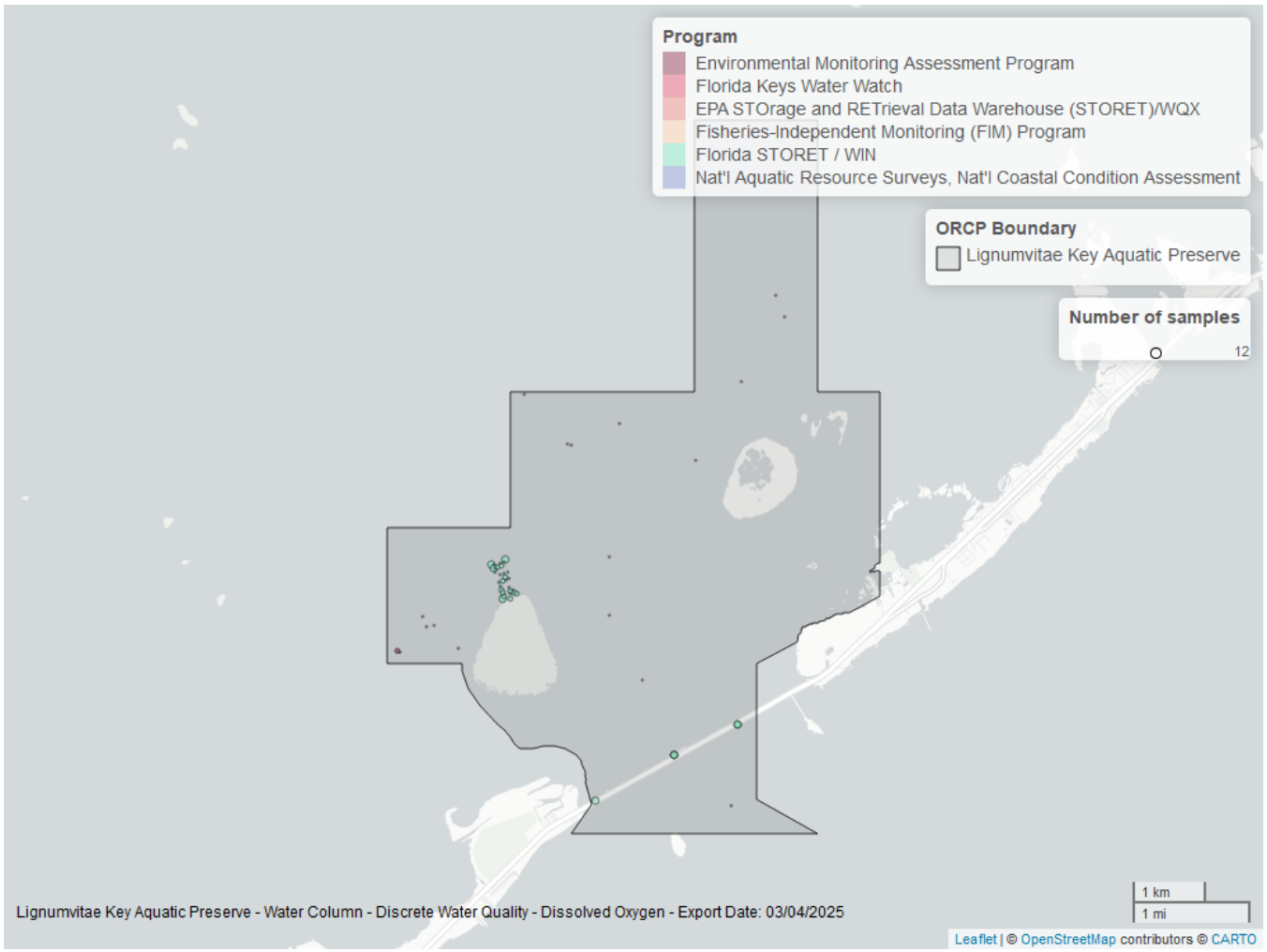

Figure 4: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 9: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	170	2016	2024
69	28	1997	2000
3000	9	2016	2017
103	8	2021	2021
115	4	2001	2001
118	1	2001	2001

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[3]
3000 - Florida Keys Water Watch[6]
5002 - Florida STORET / WIN[4]

pH - Discrete

Seasonal Kendall-Tau Trend Analysis

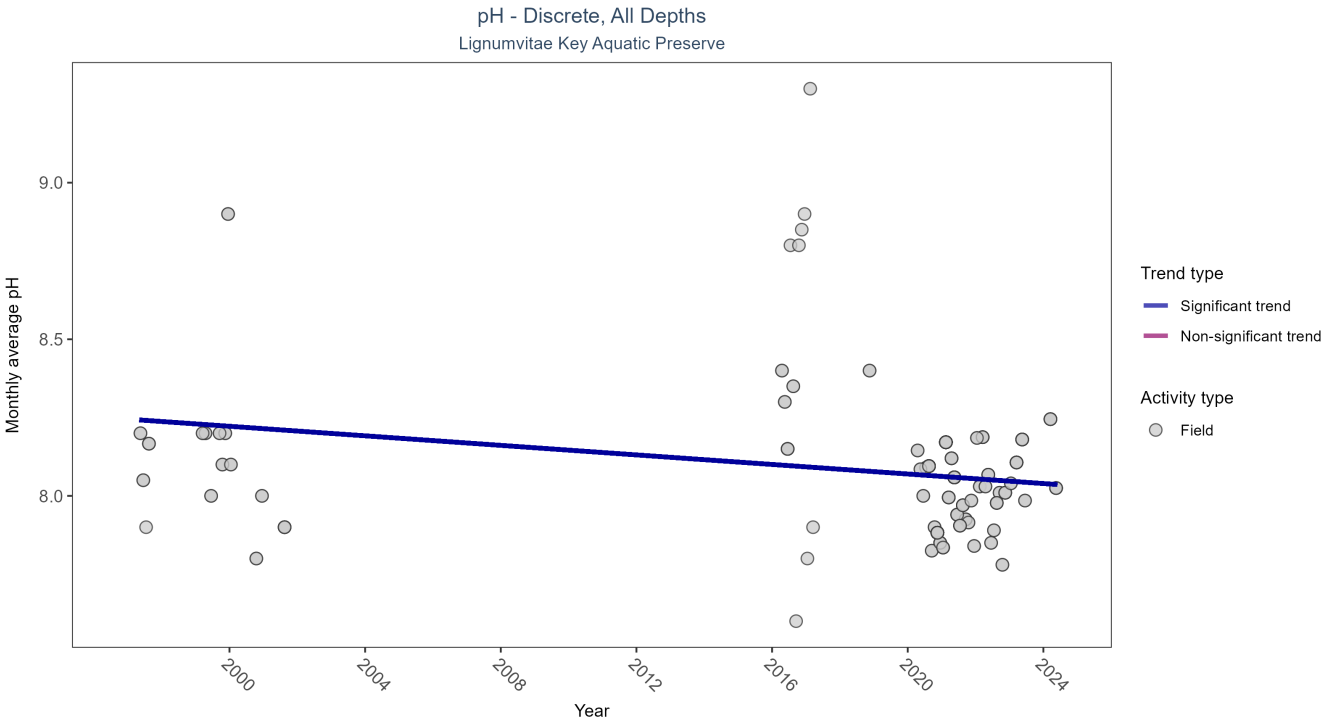

Figure 5: Scatter plot of monthly average pH over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only pH values measured in the field (circles) are included in the plot.

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	Significantly decreasing trend	281	12	1997 - 2024	8.07	-0.3237	8.2451	-0.0076	0.0046

Monthly average pH decreased by 0.01 pH units per year.

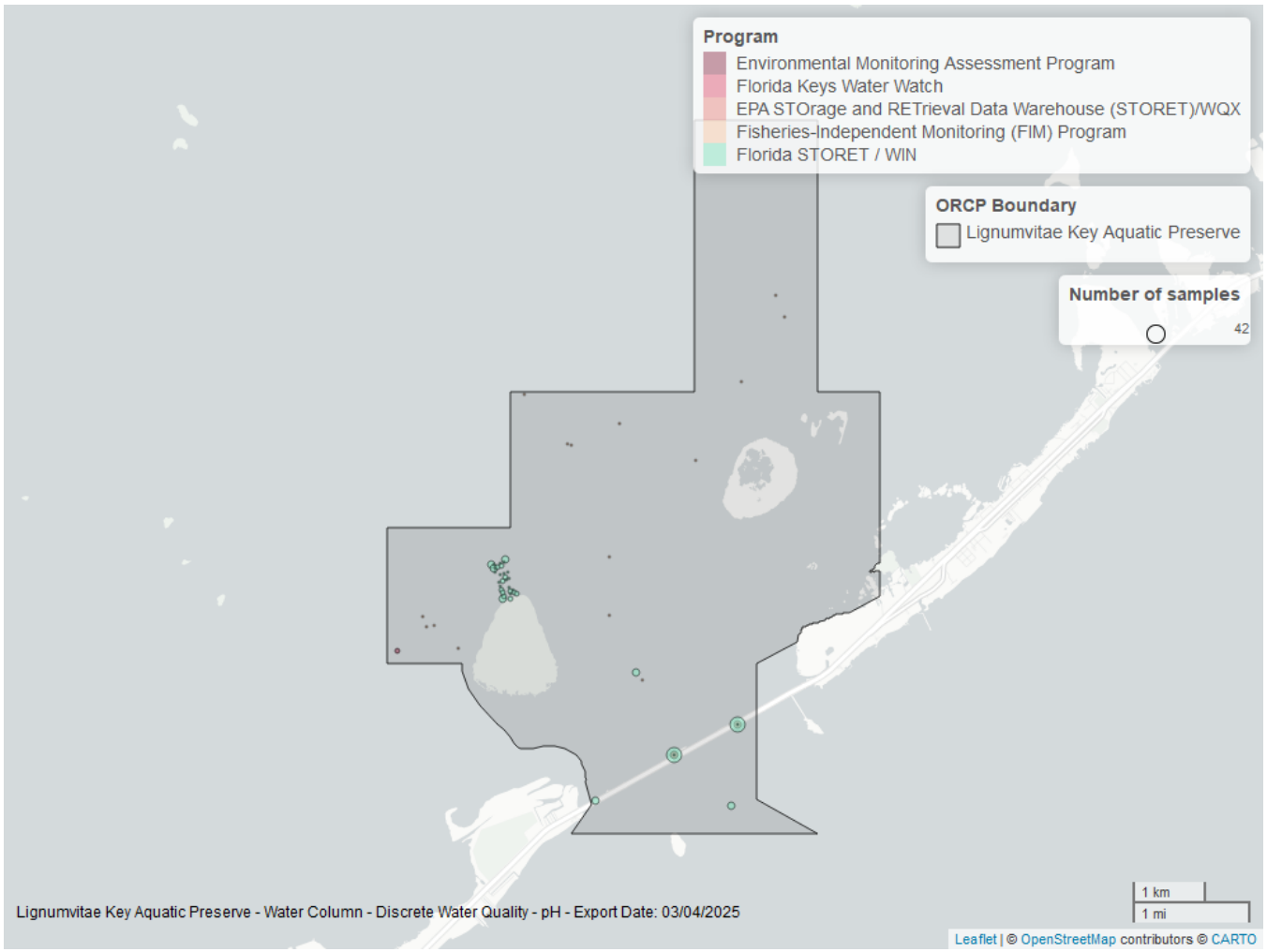

Figure 6: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	227	2016	2024
69	28	1997	2000
103	20	2020	2021
3000	9	2016	2017
115	4	2001	2001

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
3000 - Florida Keys Water Watch[6]
5002 - Florida STORET / WIN[4]

Salinity - Discrete

Seasonal Kendall-Tau Trend Analysis

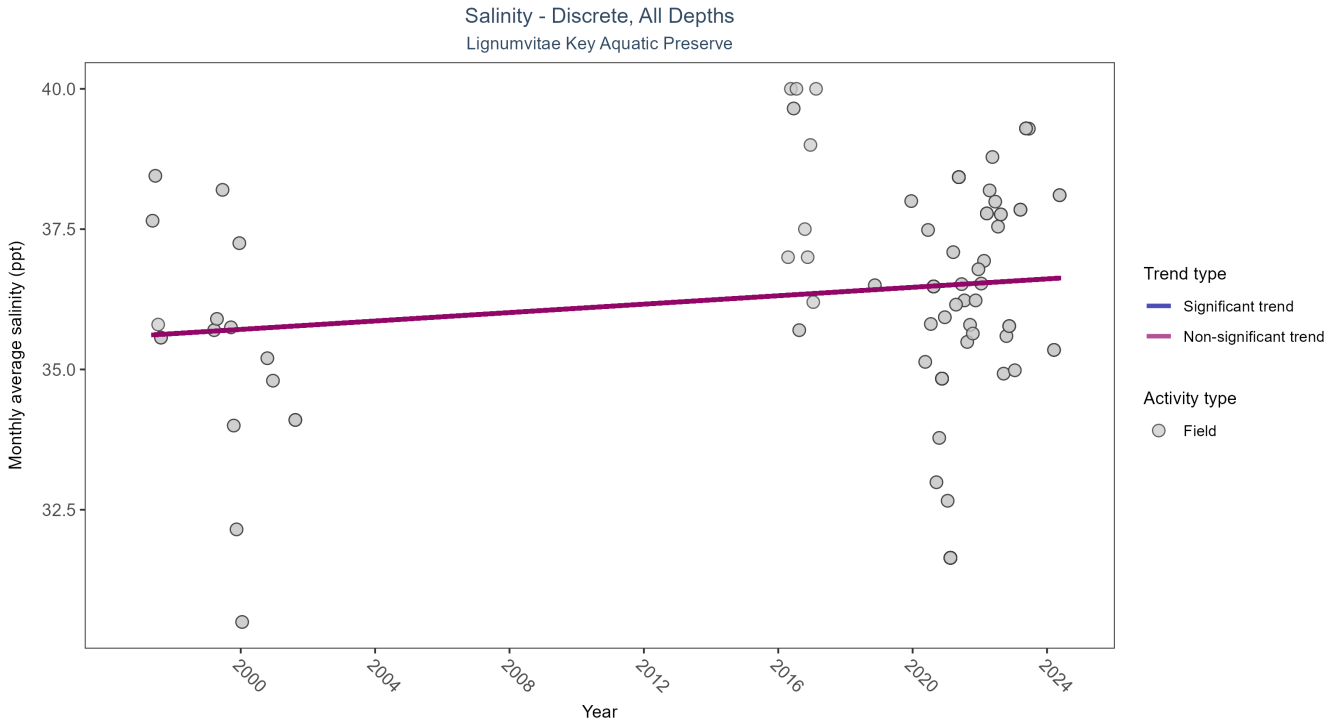

Figure 7: Scatter plot of monthly average salinity over time. If the time series included ten or more years of discrete observations, significant (blue) or non-significant (magenta) trend lines are also shown. Discrete salinity values derived from grab samples analyzed in the field (circles) or the laboratory (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	No significant trend	253	13	1997 - 2024	36.3	0.1542	35.6009	0.0375	0.2261

Salinity showed no detectable trend between 1997 and 2024.

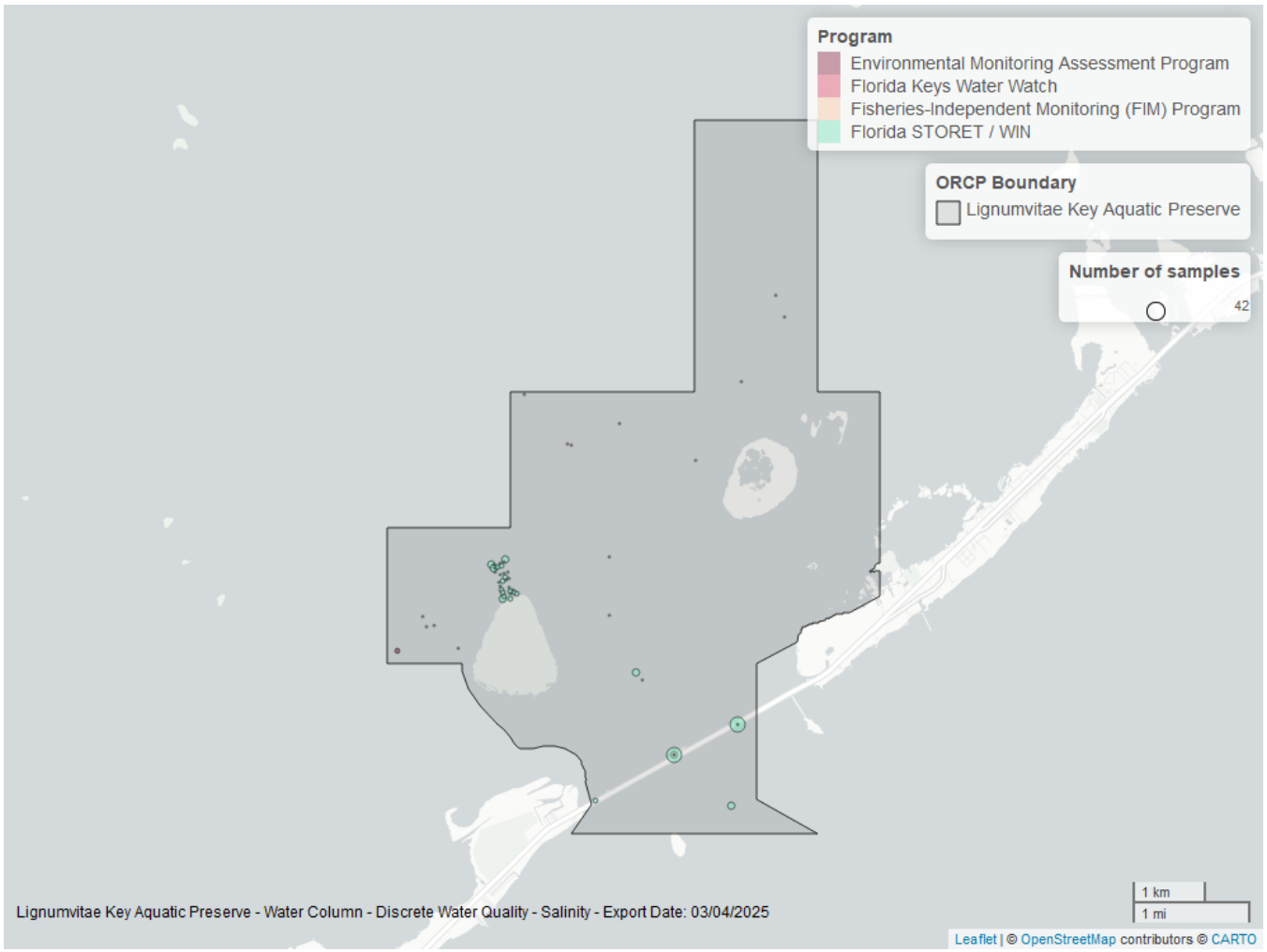

Figure 8: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	218	2016	2024
69	28	1997	2000
3000	9	2016	2017
115	4	2001	2001

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
115 - Environmental Monitoring Assessment Program[2]
3000 - Florida Keys Water Watch[6]
5002 - Florida STORET / WIN[4]

Total Nitrogen - Discrete

Total Nitrogen Calculation:

The logic for calculated Total Nitrogen was provided by Kevin O'Donnell and colleagues at FDEP (with the help of Jay Silvanima, Watershed Monitoring Section). The following logic is used, in this order, based on the availability of specific nitrogen components.

1) TN = TKN + NO3O2;
2) TN = TKN + NO3 + NO2;
3) TN = ORGN + NH4 + NO3O2;
4) TN = ORGN + NH4 + NO2 + NO3;
5) TN = TKN + NO3;
6) TN = ORGN + NH4 + NO3;

Additional Information:

- Rules for use of sample fraction:
  - Florida Department of Environmental Protection (FDEP) report that if both "Total" and "Dissolved" components are reported, only "Total" is used. If the total is not reported, then the dissolved components are used as a best available replacement.
  - Total nitrogen calculations are done using nitrogen components with the same sample fraction, nitrogen components with mixed total/dissolved sample fractions are not used. In other words, total nitrogen can be calculated when TKN and NO3O2 are both total sample fractions, or when both are dissolved sample fractions. *Future calculations of total nitrogen values may be based on components with mixed sample fractions.*
- Values inserted into data:
  - ParameterName = "Total Nitrogen"
  - SEACAR_QAQCFlagCode = "1Q"
  - SEACAR_QAQC_Description = "SEACAR Calculated"

Seasonal Kendall-Tau Trend Analysis

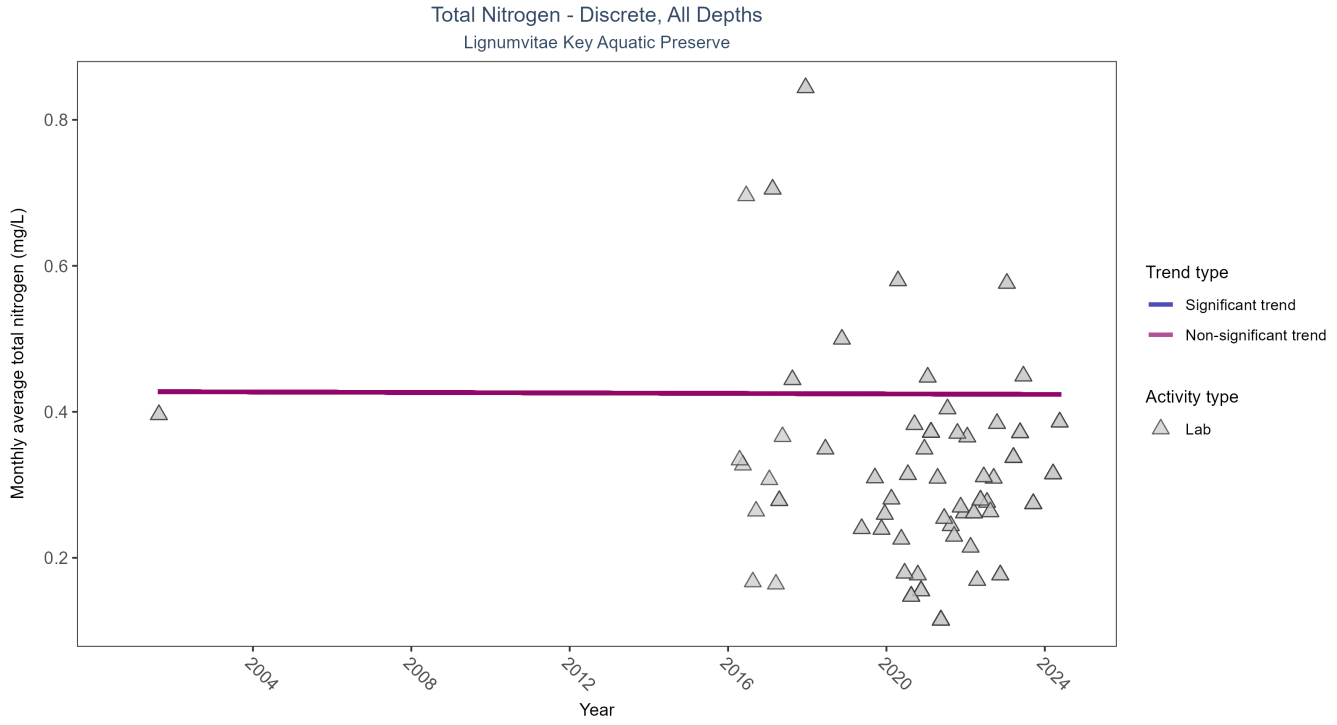

Figure 9: Scatter plot of monthly average total nitrogen over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only nitrogen values obtained from laboratory analyses (triangles) are included in the plot.

Table 14: Seasonal Kendall-Tau Trend Analysis for Total Nitrogen

Activity Type	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
Lab	No significant trend	188	10	2001 - 2024	0.264	-0.0026	0.4277	-0.0002	1

Total nitrogen showed no detectable trend between 2001 and 2024.

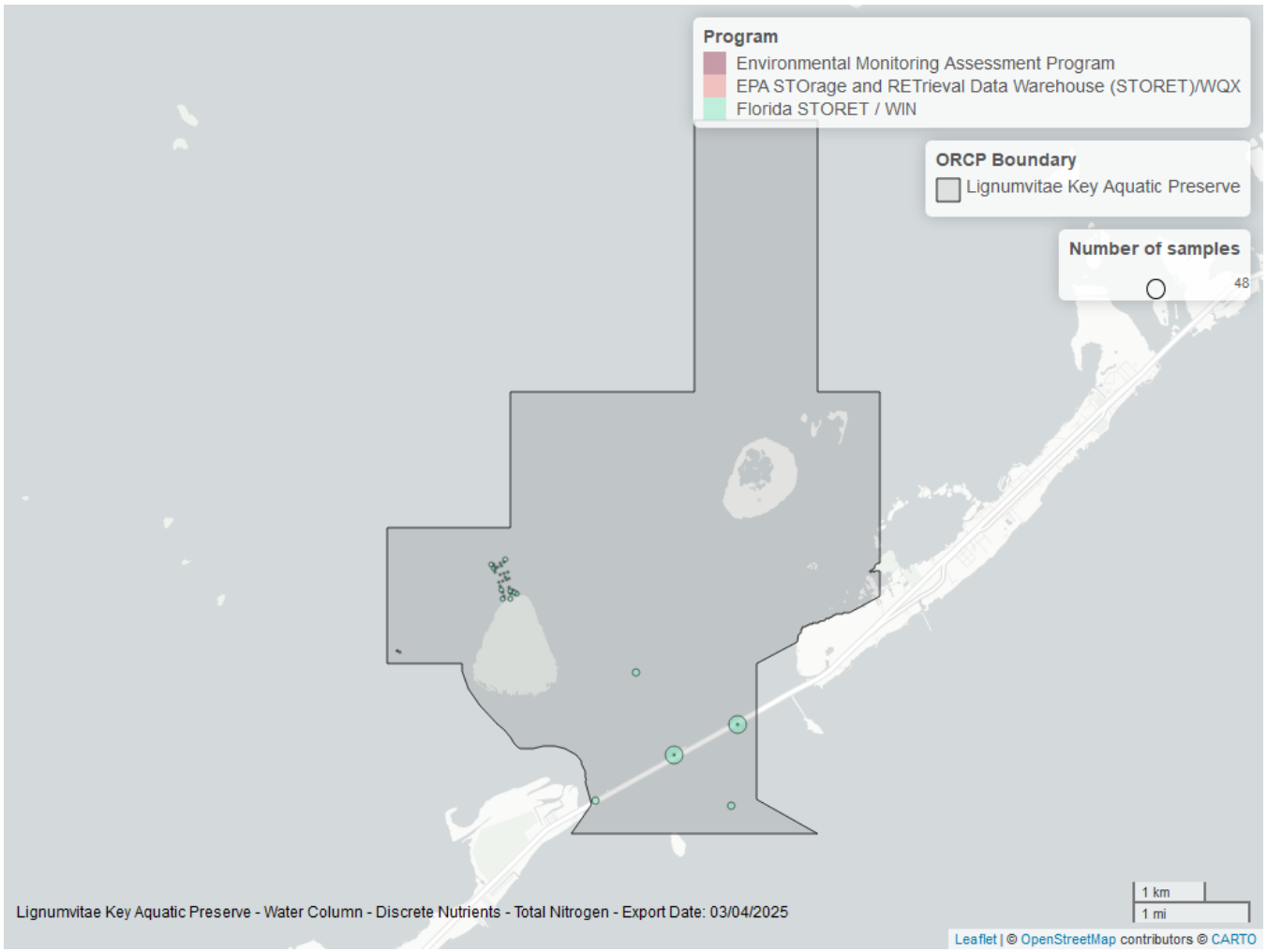

Figure 10: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	186	2016	2024
115	1	2001	2001
103	1	2001	2001

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
5002 - Florida STORET / WIN[4]

Total Phosphorus - Discrete

Seasonal Kendall-Tau Trend Analysis

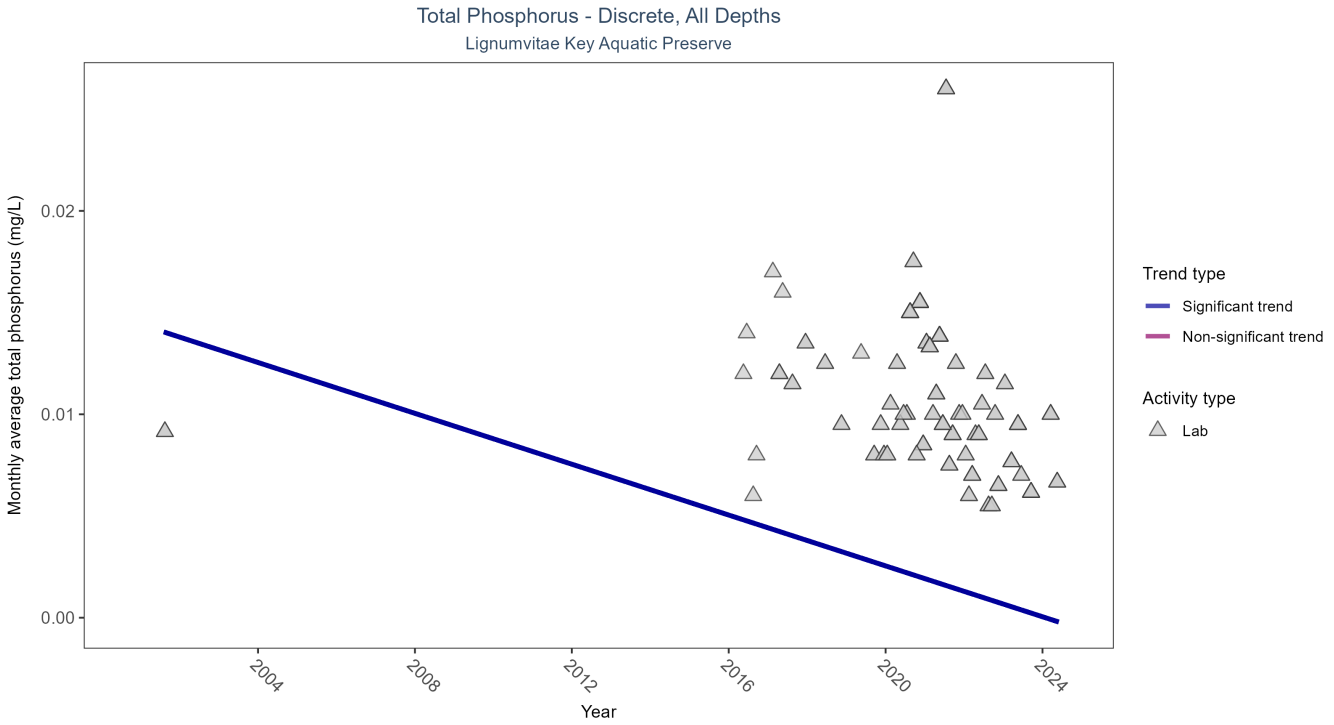

Figure 11: Scatter plot of monthly average total phosphorus over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only phosphorus values obtained from laboratory analyses (triangles) are included 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	204	10	2001 - 2024	0.01	-0.2337	0.0144	-0.0006	0.0138

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

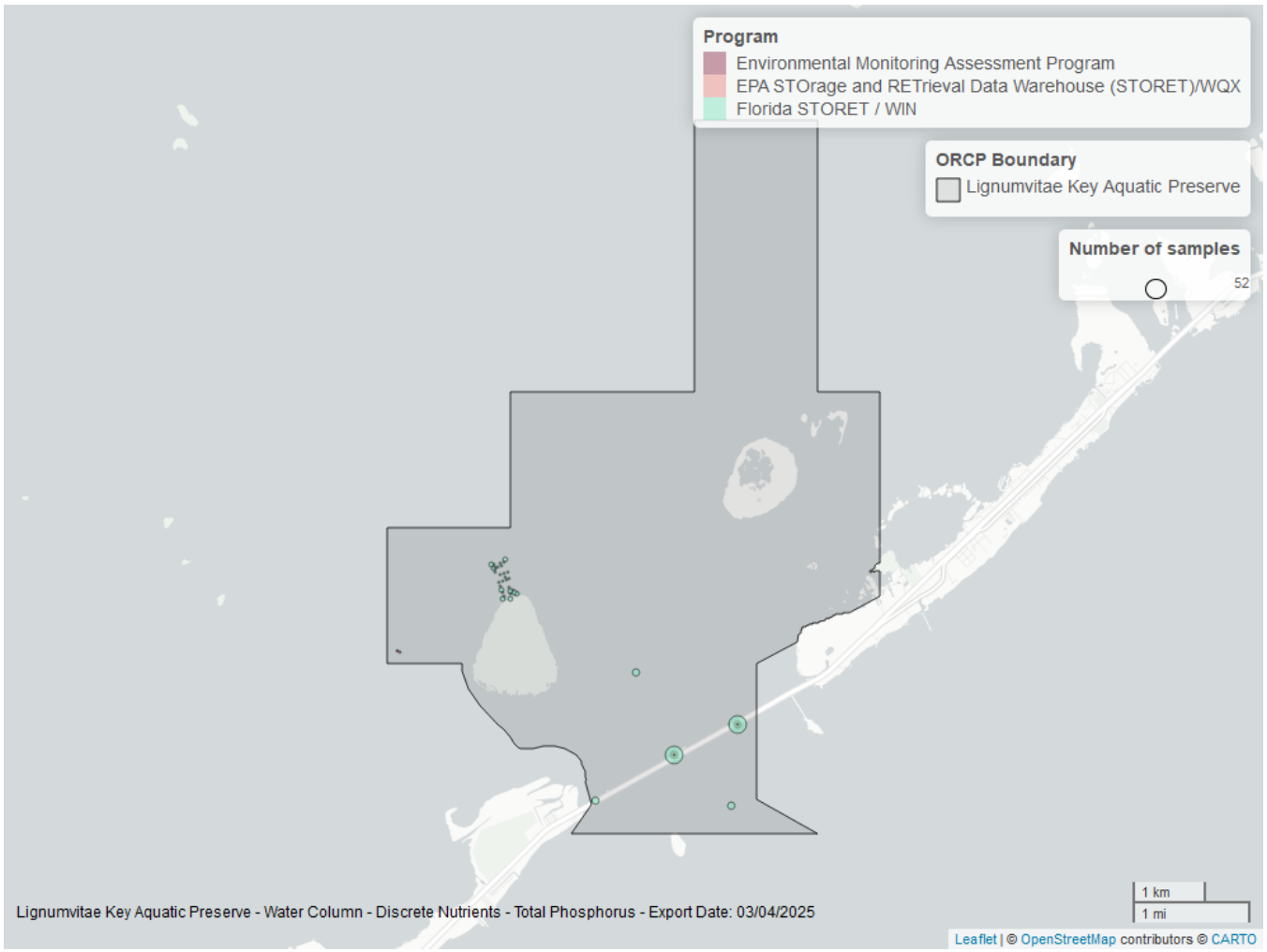

Figure 12: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	195	2016	2024
103	21	2001	2021
115	1	2001	2001

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
5002 - Florida STORET / WIN[4]

Water Temperature - Discrete

Seasonal Kendall-Tau Trend Analysis

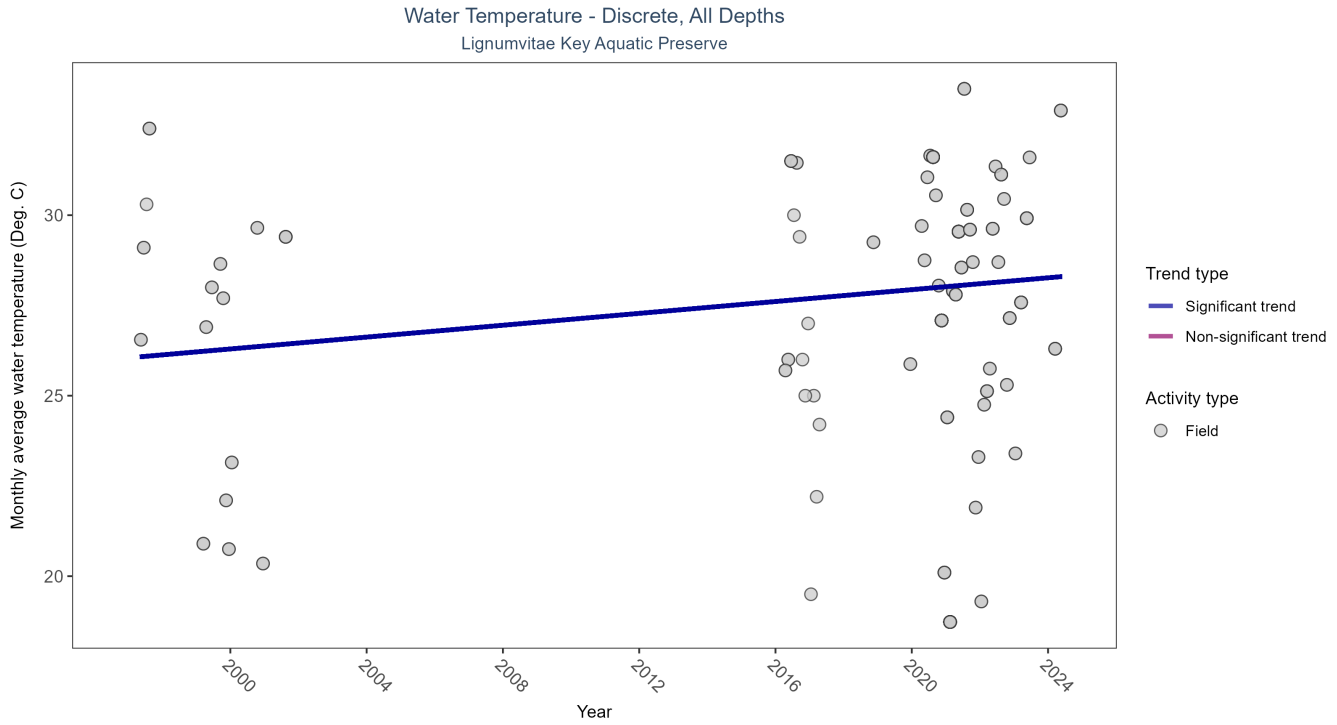

Figure 13: Scatter plot of monthly average water temperature over time. If the time series included ten or more years of discrete observations, a significant (blue) or non-significant (magenta) trend line is also shown. Only water temperature measurements taken in the field (circles) are included in the plot.

Table 18: 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	284	13	1997 - 2024	28	0.1902	26.0479	0.0821	0.0416

Monthly average water temperature increased by 0.08°C per year.

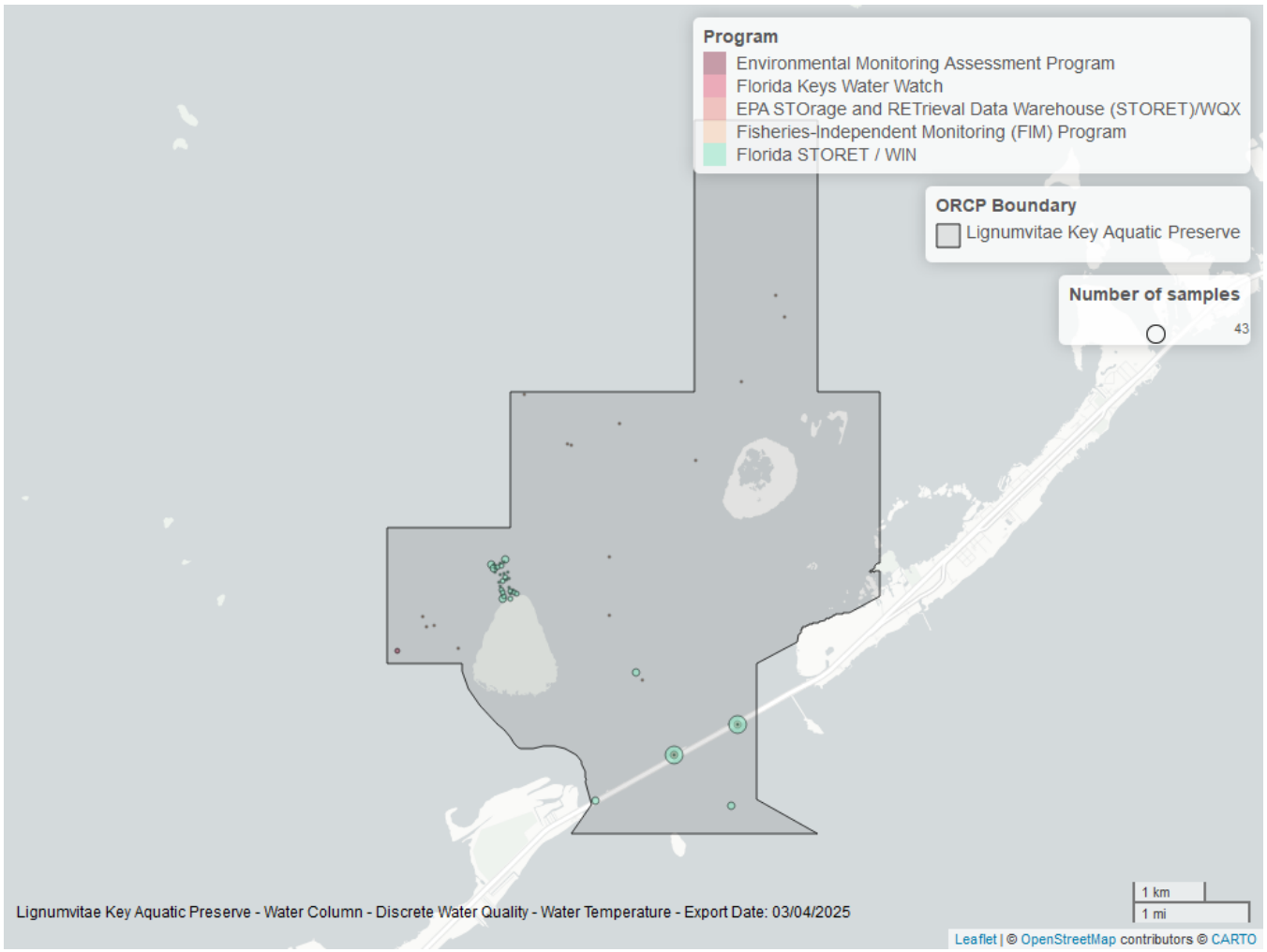

Figure 14: Map showing location of discrete water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	229	2016	2024
69	28	1997	2000
103	20	2020	2021
3000	9	2016	2017
115	4	2001	2001

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[5]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[1]
115 - Environmental Monitoring Assessment Program[2]
3000 - Florida Keys Water Watch[6]
5002 - Florida STORET / WIN[4]

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 Lignumvitae Key Aquatic Preserve

Table 20: Station overview for Continuous parameters by Program

ProgramID	*ProgramLocationID*	*Years of Data*	*Use in Analysis*	*Parameters*
7	245323080410100	3	FALSE	Sal , TempW
10004	FKLK	1	FALSE	DO , DOS , pH , Sal , Turb , TempW

Program names:

7 - National Water Information System[7]
10004 - Florida Keys Aquatic Preserves Continuous Water Quality Monitoring[8]

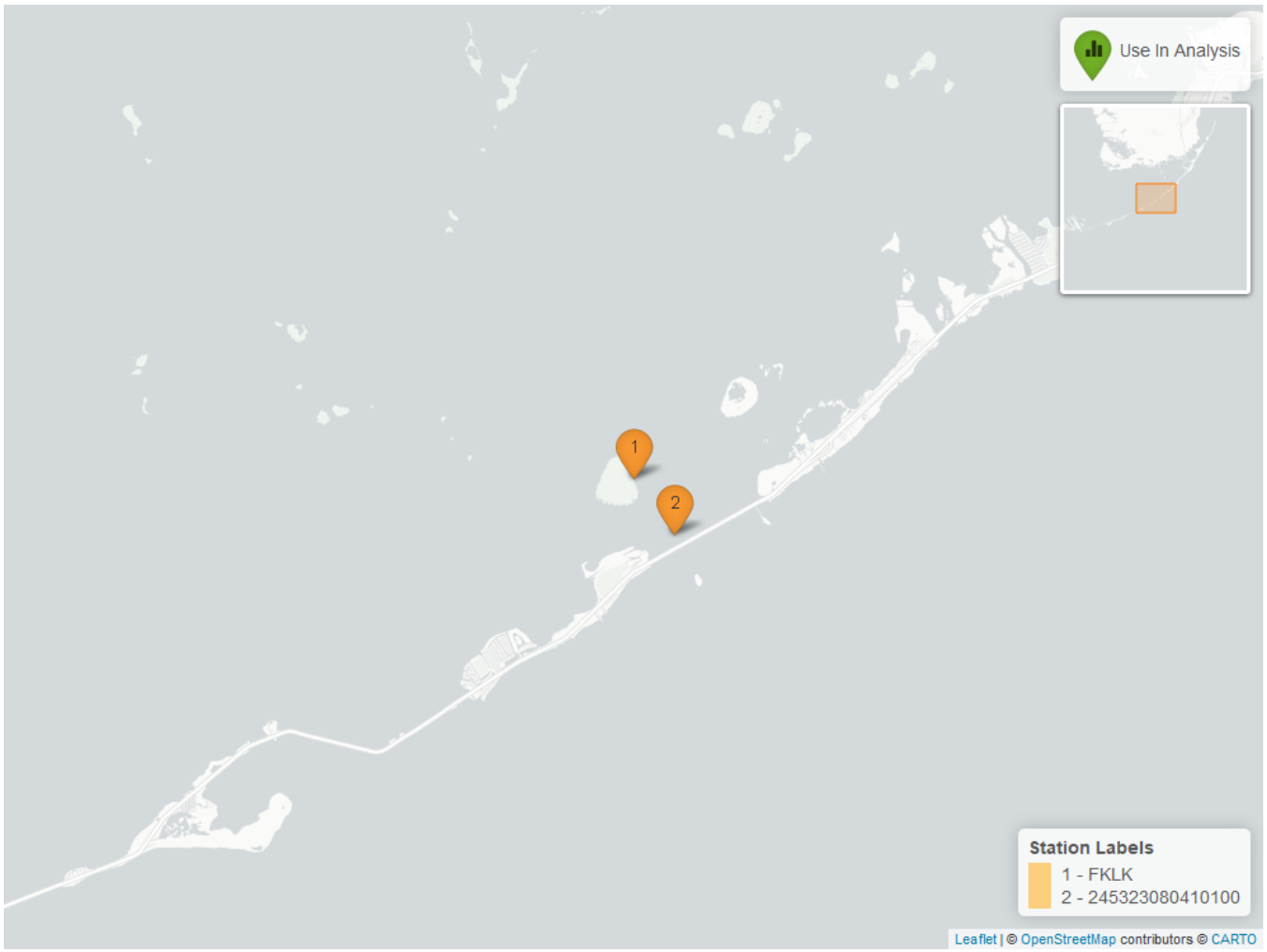

Figure 15: Map showing continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. Sites marked as *Use In Analysis* (green) are featured in this report.

Dissolved Oxygen - Continuous

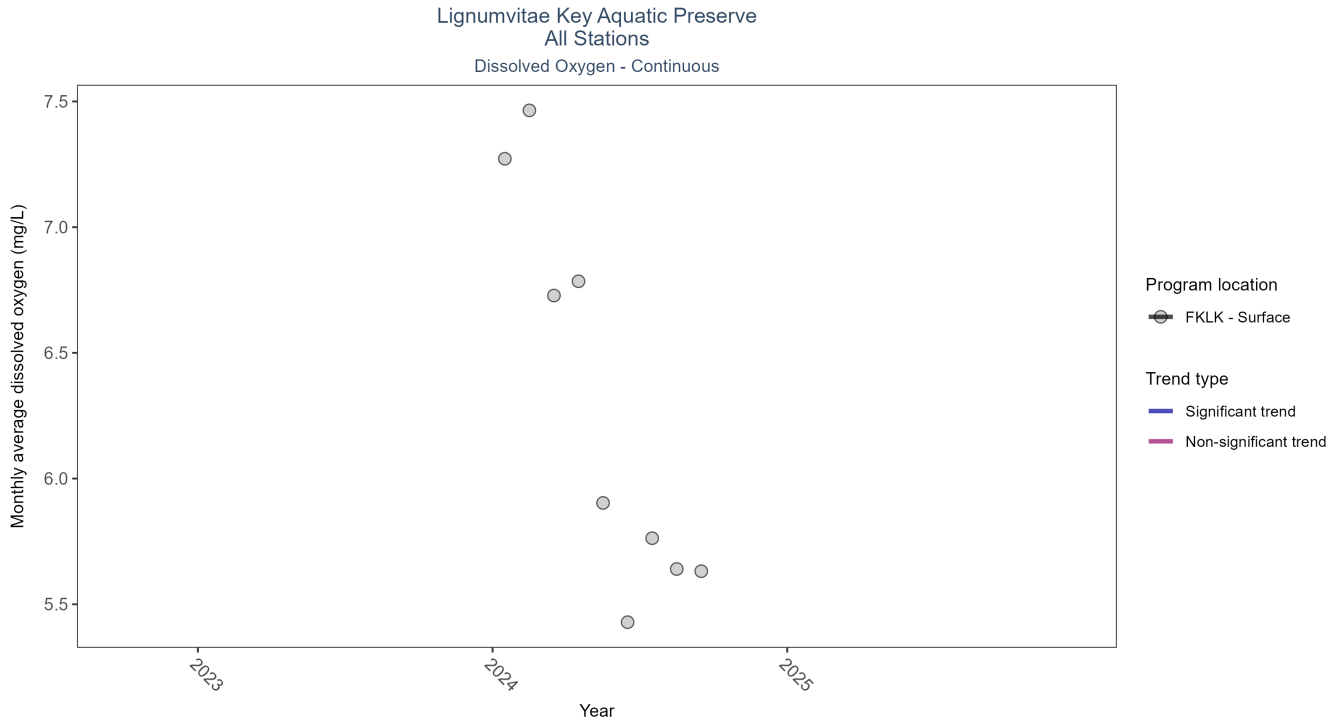

Figure 16: Scatter plot of monthly average dissolved oxygen over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 21: Seasonal Kendall-Tau Results for Dissolved Oxygen - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
FKLK	Insufficient data to calculate trend	21525	1	2024 - 2024	6.2	-	-	-	-

There was insufficient data to fit a model for one location.

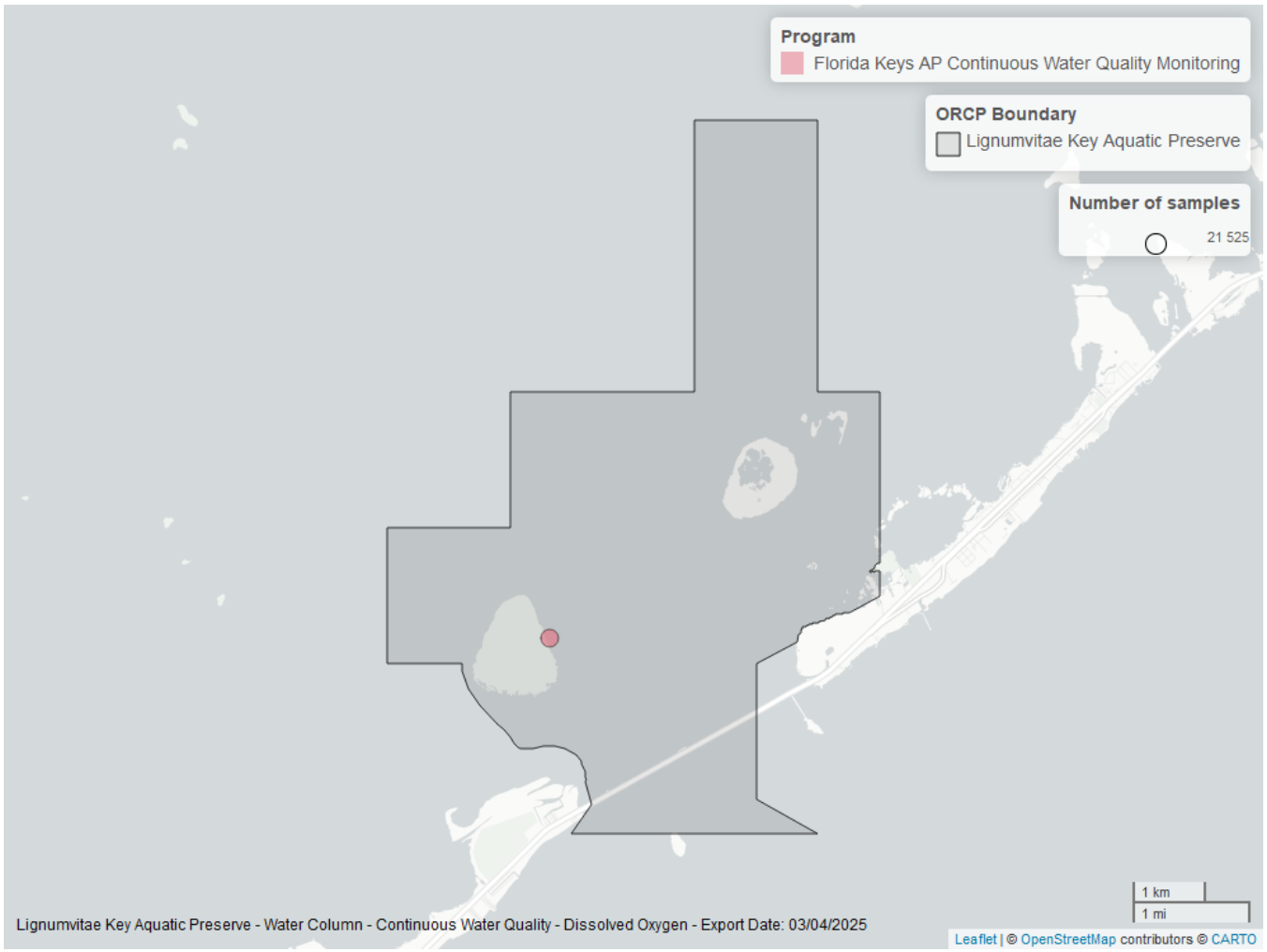

Figure 17: Map showing location of dissolved oxygen continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Dissolved Oxygen Saturation - Continuous

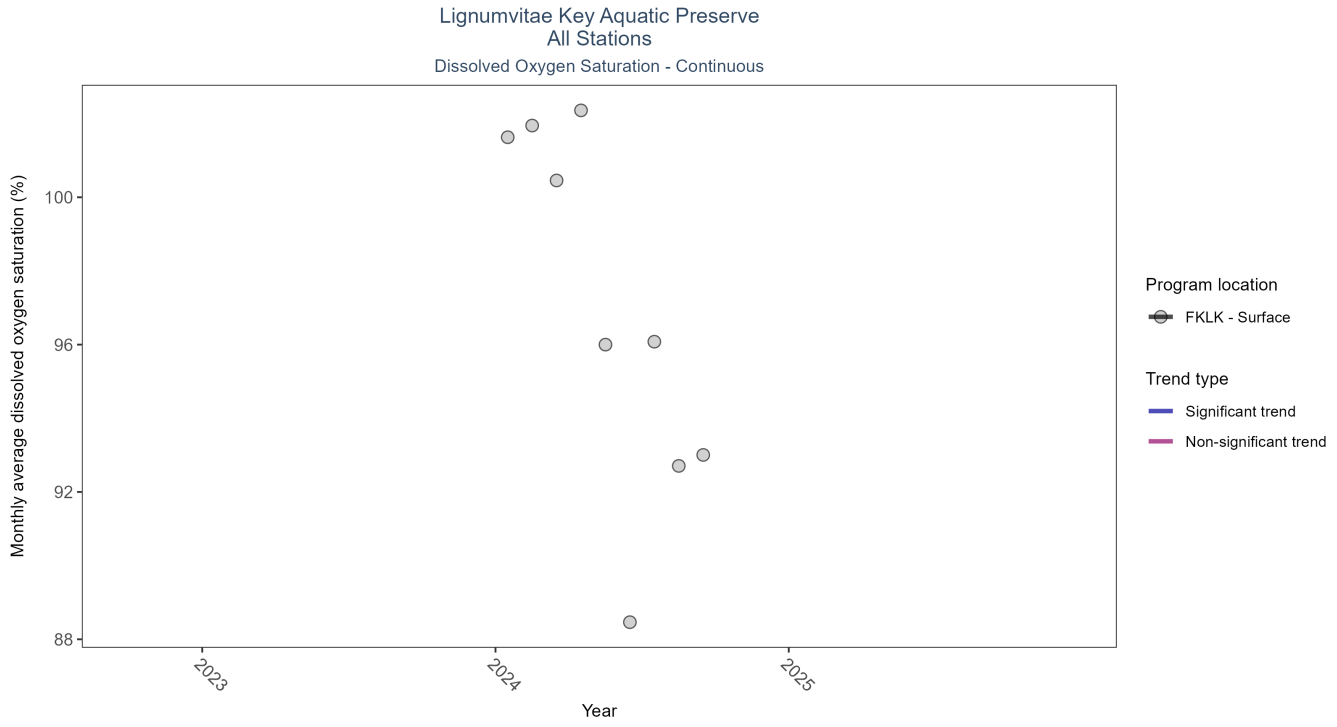

Figure 18: Scatter plot of monthly average dissolved oxygen saturation over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 22: Seasonal Kendall-Tau Results for Dissolved Oxygen Saturation - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
FKLK	Insufficient data to calculate trend	21525	1	2024 - 2024	91.9	-	-	-	-

There was insufficient data to fit a model for one location.

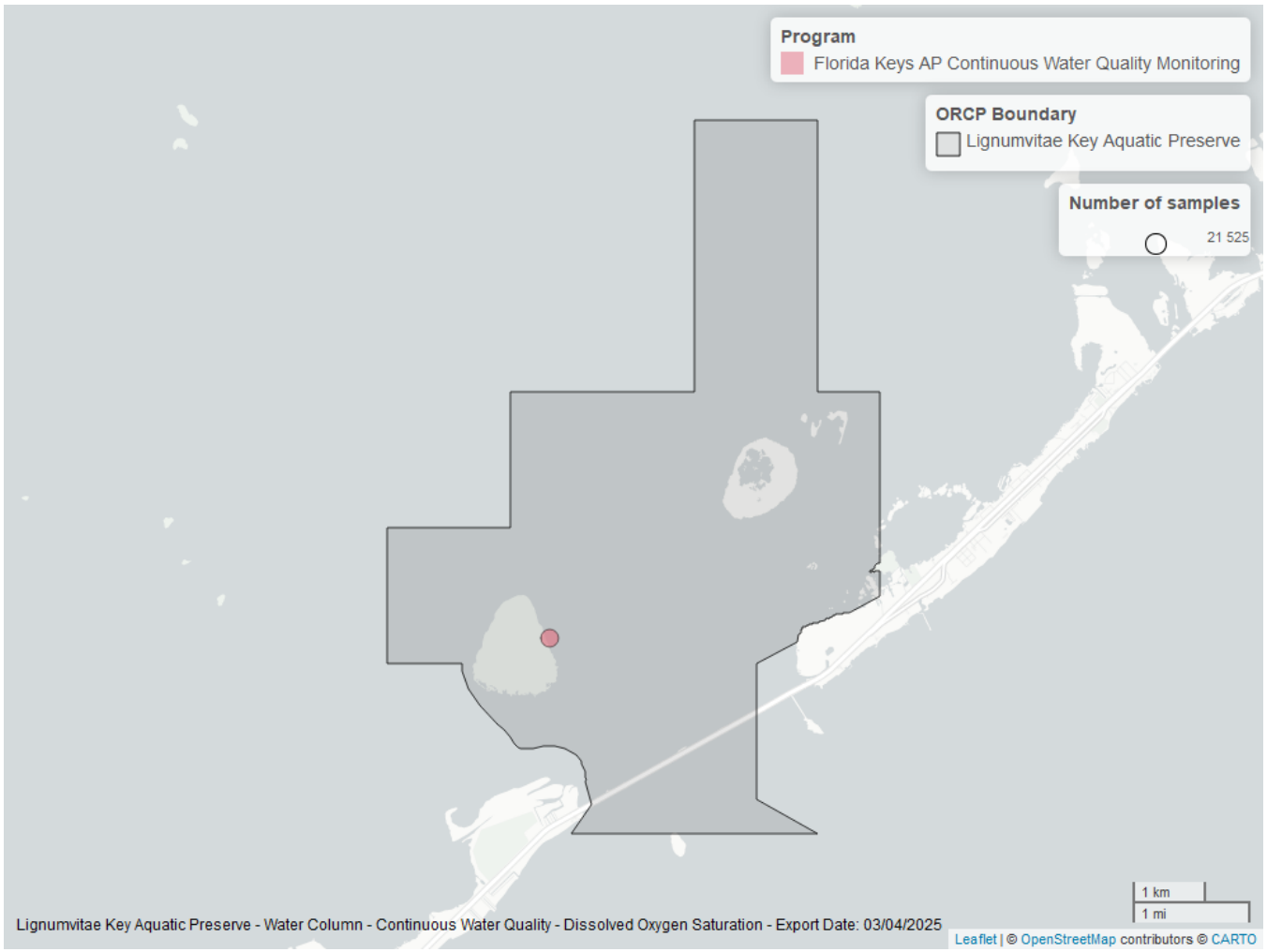

Figure 19: Map showing location of dissolved oxygen saturation continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

pH - Continuous

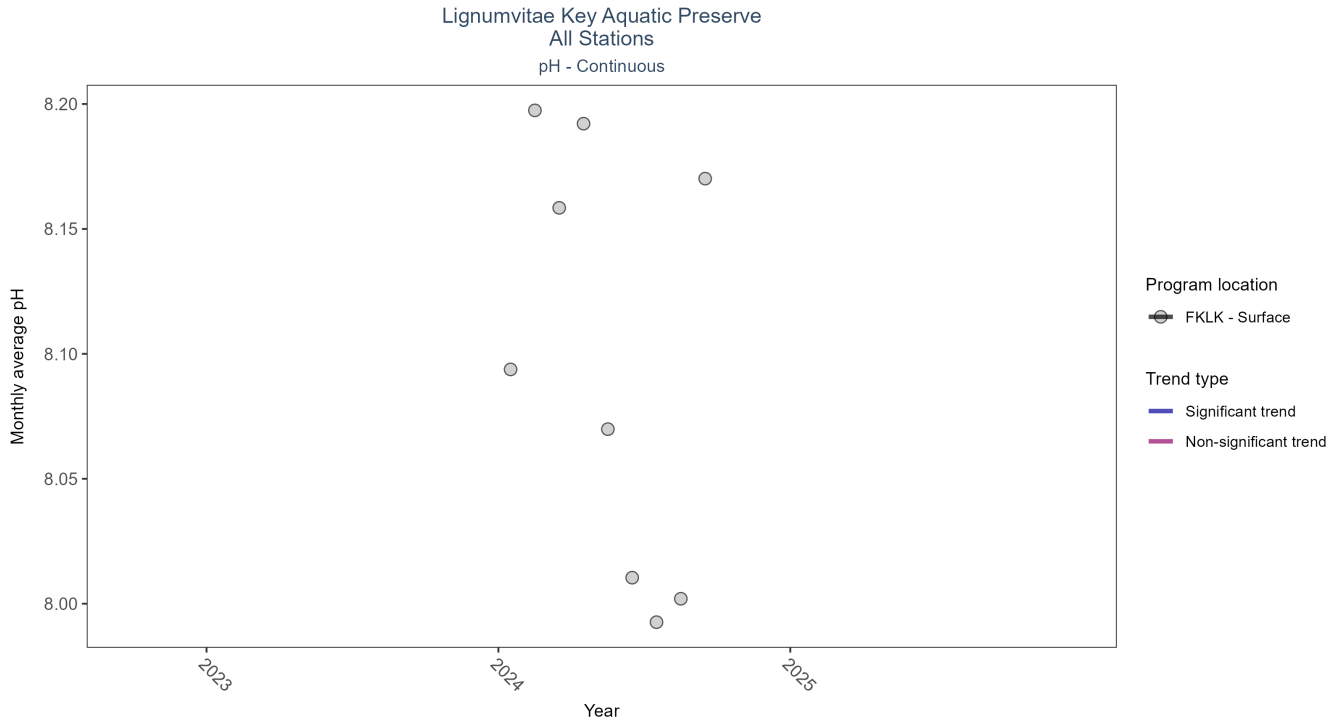

Figure 20: Scatter plot of monthly average pH over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 23: Seasonal Kendall-Tau Results for pH - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
FKLK	Insufficient data to calculate trend	21517	1	2024 - 2024	8.1	-	-	-	-

There was insufficient data to fit a model for one location.

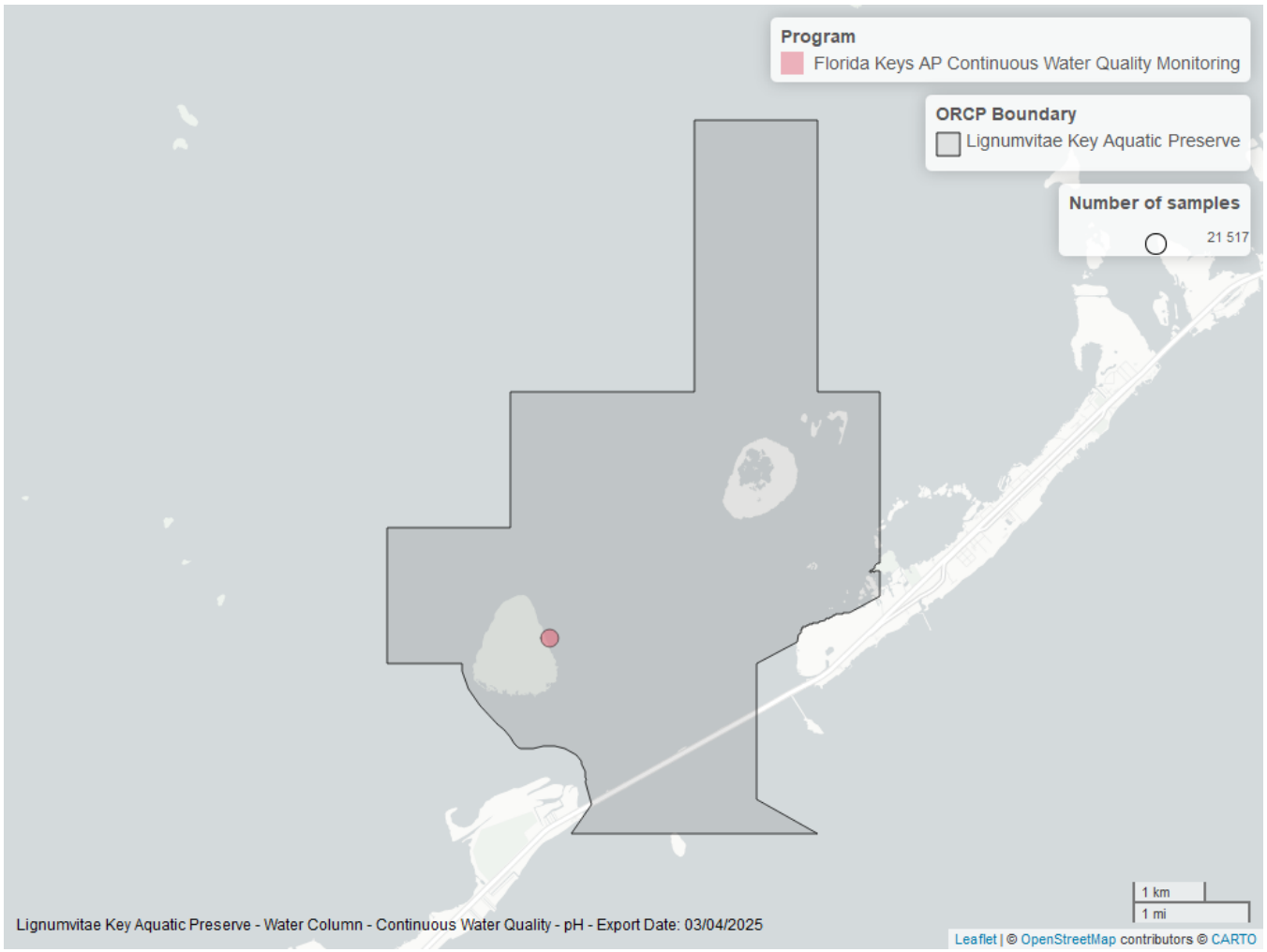

Figure 21: Map showing location of ph continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Salinity - Continuous

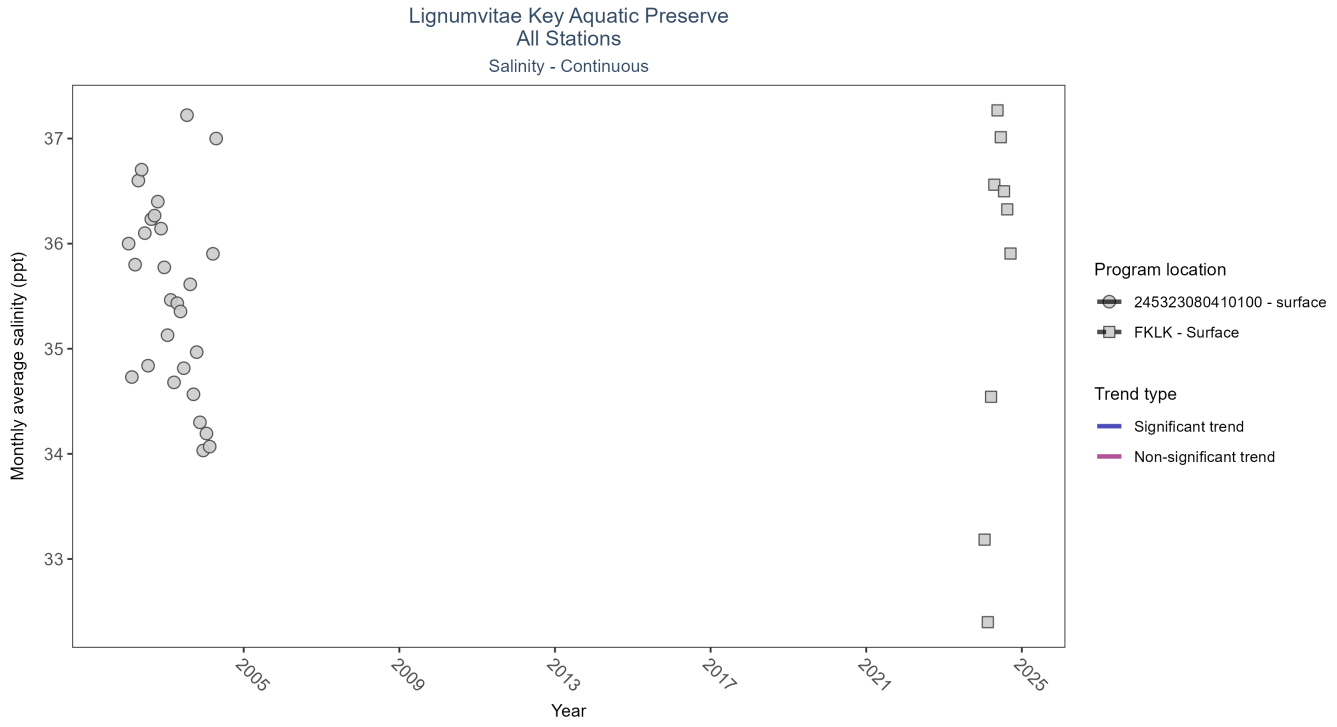

Figure 22: Scatter plot of monthly average salinity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 24: Seasonal Kendall-Tau Results for Salinity - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
245323080410100	Insufficient data to calculate trend	746	3	2002 - 2004	35.0	-	-	-	-
FKLK	Insufficient data to calculate trend	21517	1	2024 - 2024	36.1	-	-	-	-

There was insufficient data to fit a model for two locations.

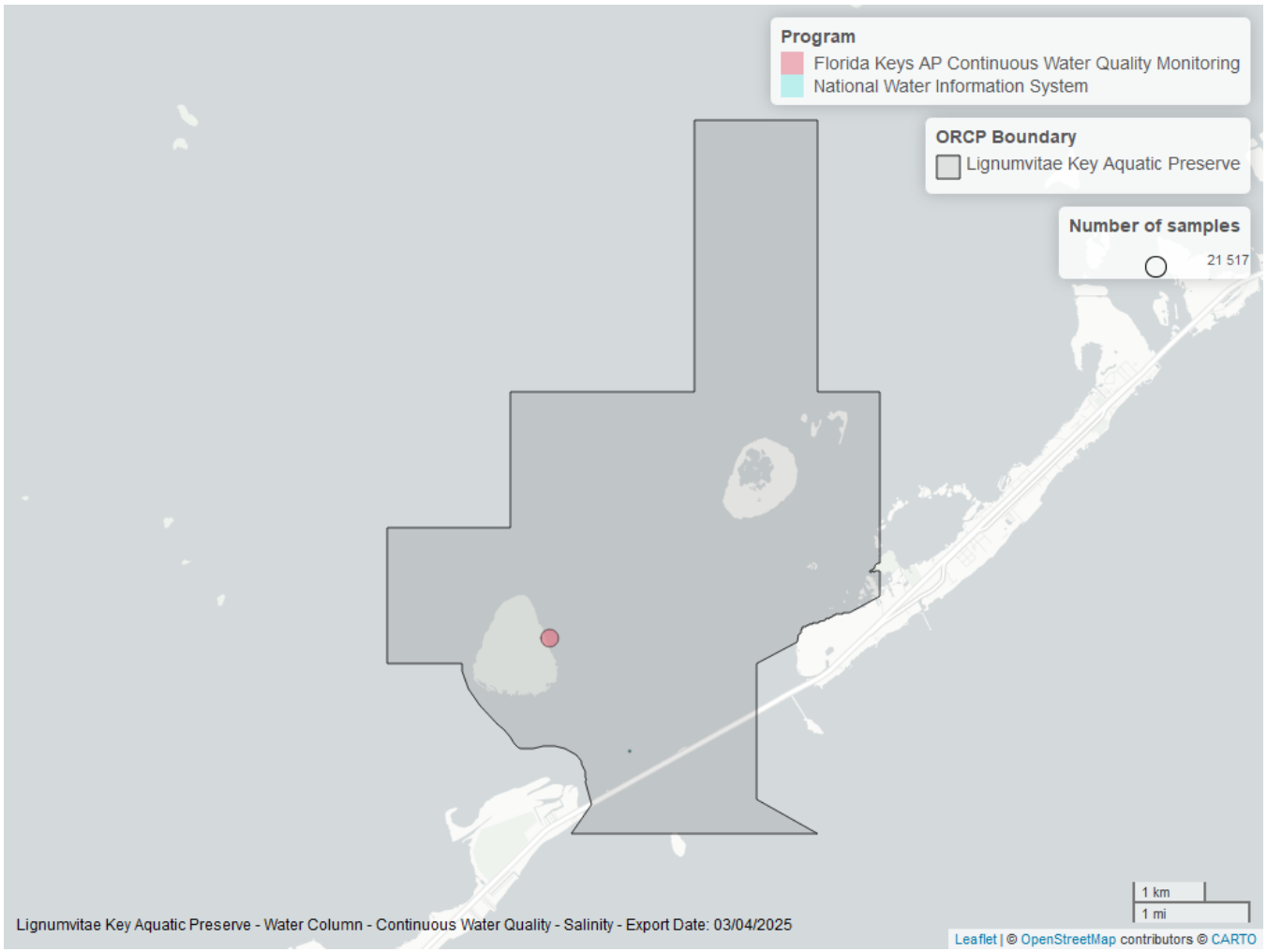

Figure 23: Map showing location of salinity continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Turbidity - Continuous

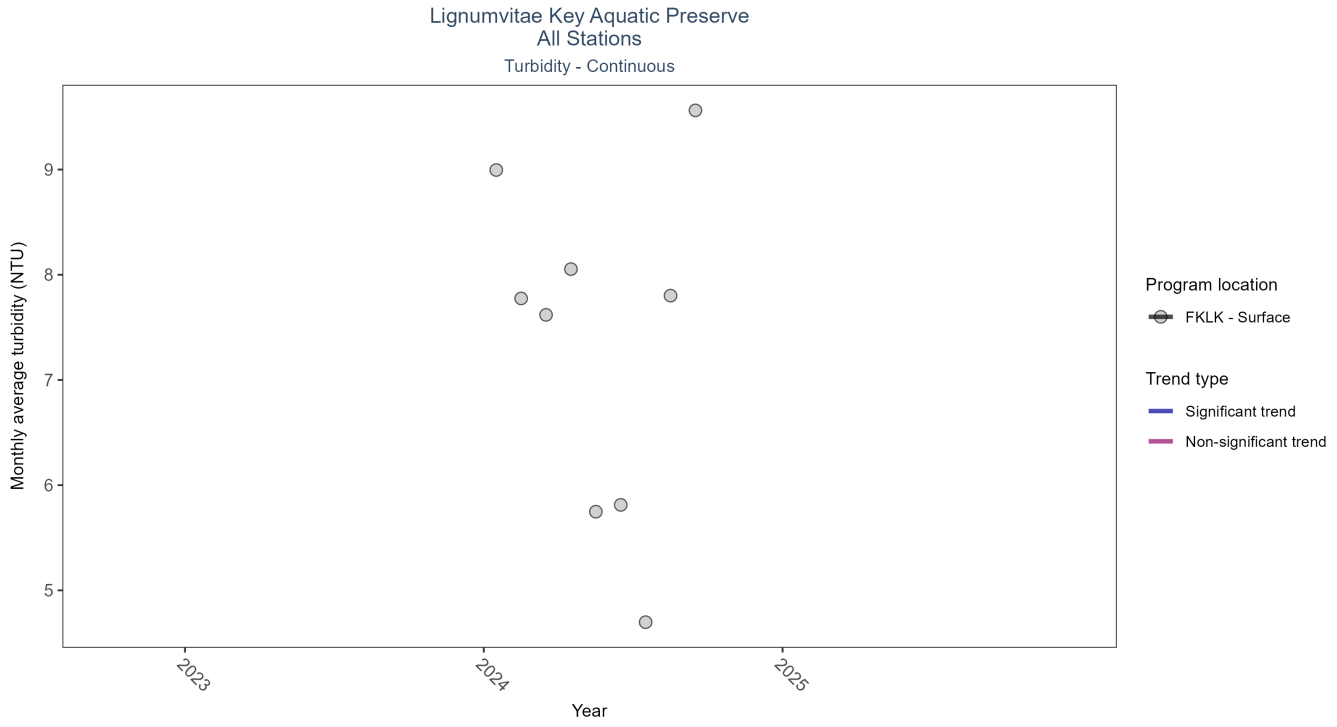

Figure 24: Scatter plot of monthly average turbidity over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 25: Seasonal Kendall-Tau Results for Turbidity - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
FKLK	Insufficient data to calculate trend	21399	1	2024 - 2024	6	-	-	-	-

There was insufficient data to fit a model for one location.

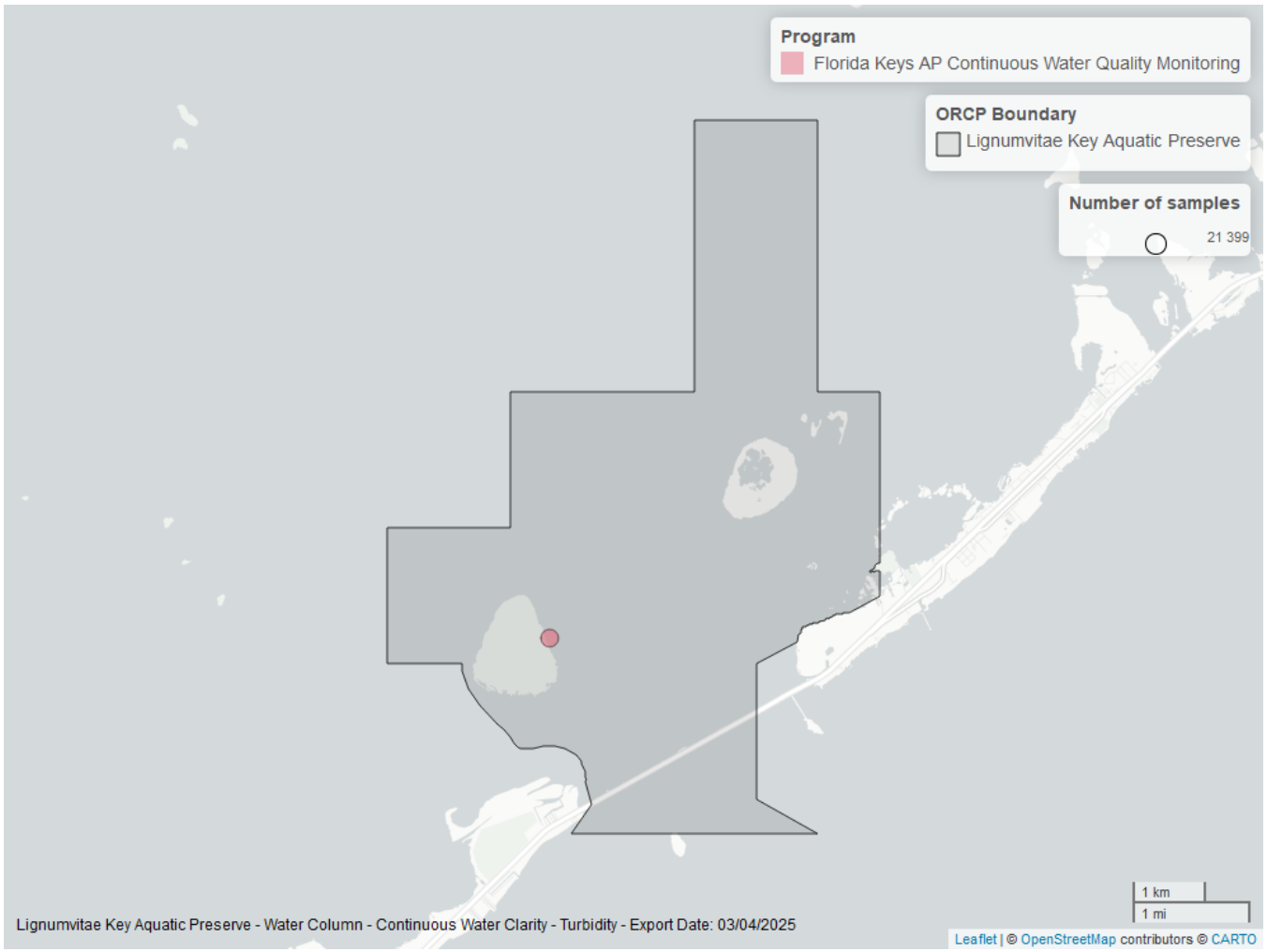

Figure 25: Map showing location of turbidity continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Water Temperature - Continuous

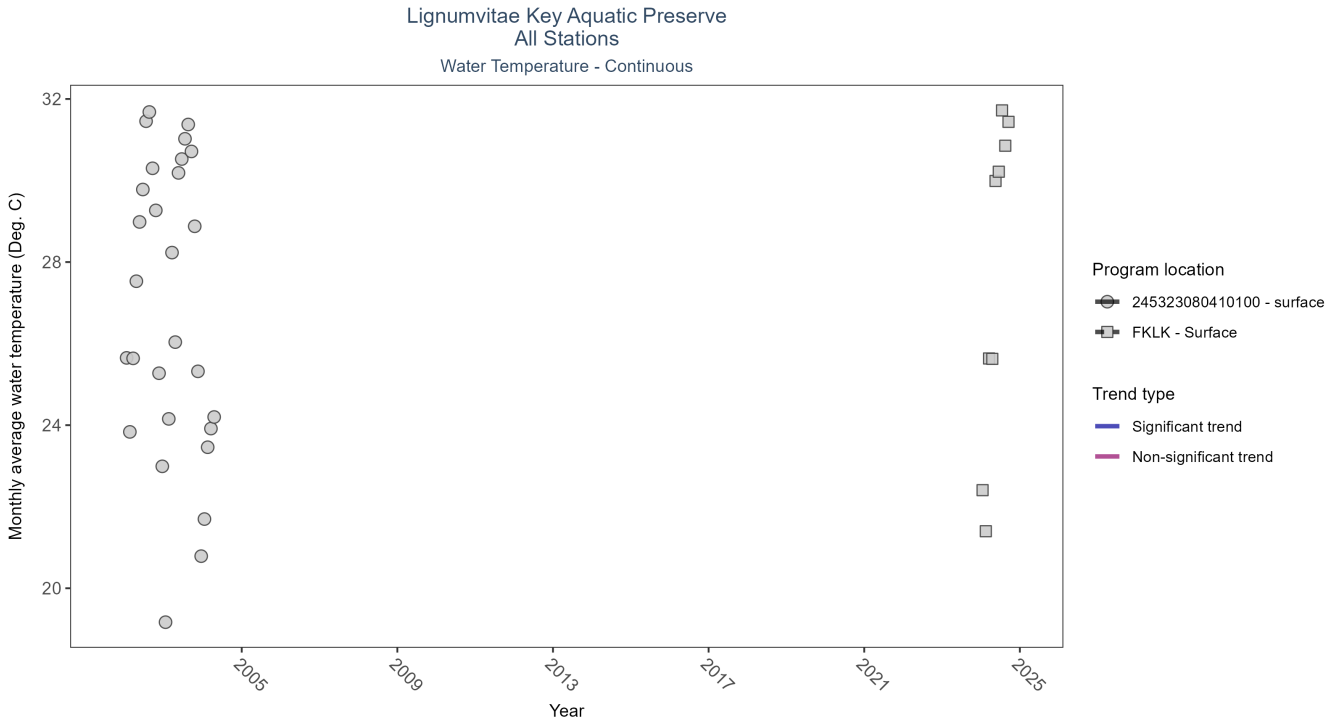

Figure 26: Scatter plot of monthly average water temperature over time at continuously monitored program locations. Each location is analyzed separately, with significant (blue) or non-significant (magenta) trend lines shown for time series that included five or more years of observations.

Table 26: Seasonal Kendall-Tau Results for Water Temperature - All Stations

Station	Statistical Trend	Sample Count	Years with Data	Period of Record	Median	tau	Sen Intercept	Sen Slope	p
245323080410100	Insufficient data to calculate trend	791	3	2002 - 2004	27.9	-	-	-	-
FKLK	Insufficient data to calculate trend	21517	1	2024 - 2024	29.0	-	-	-	-

There was insufficient data to fit a model for two locations.

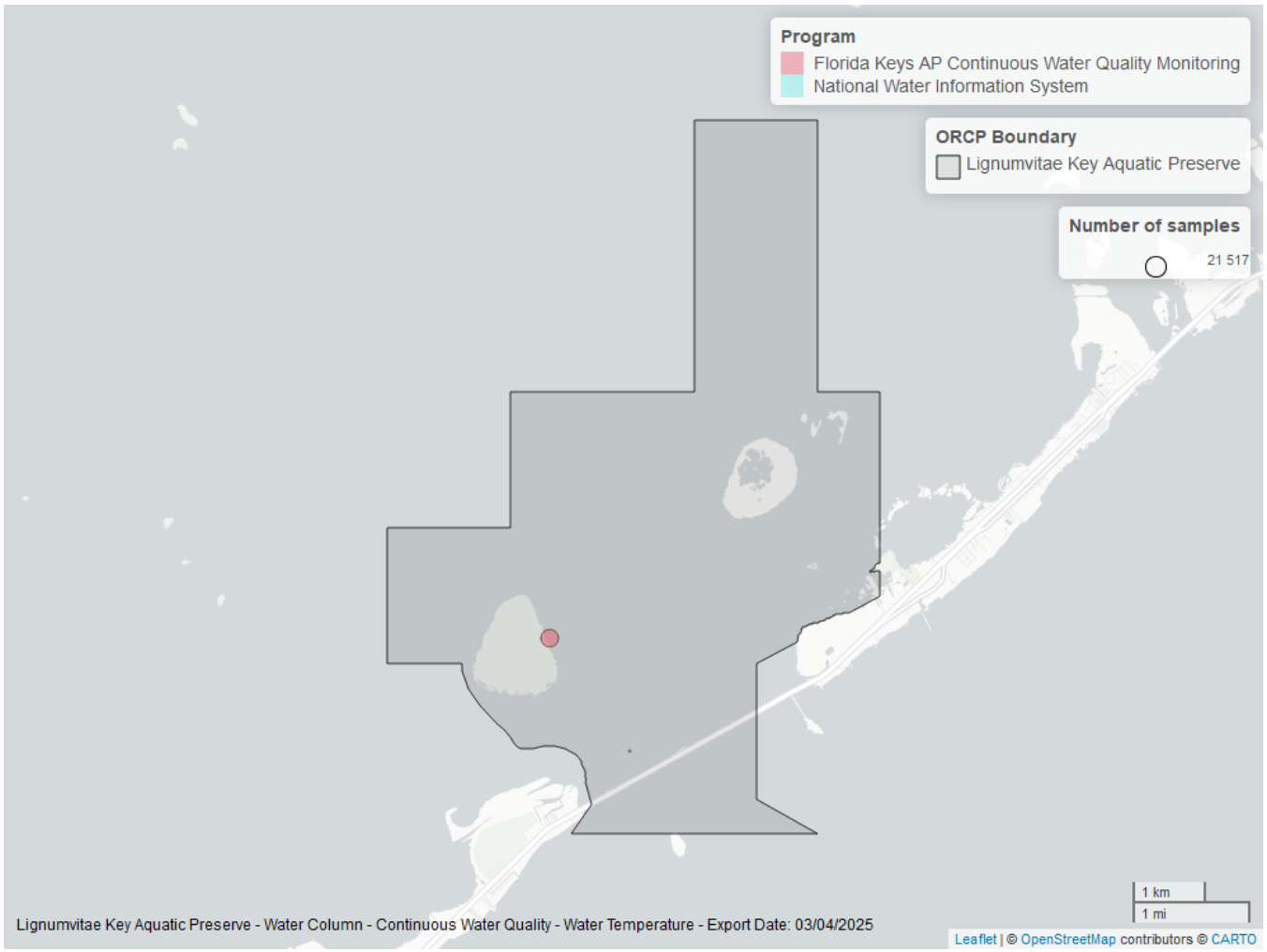

Figure 27: Map showing location of water temperature continuous water quality sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Coral Reef

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

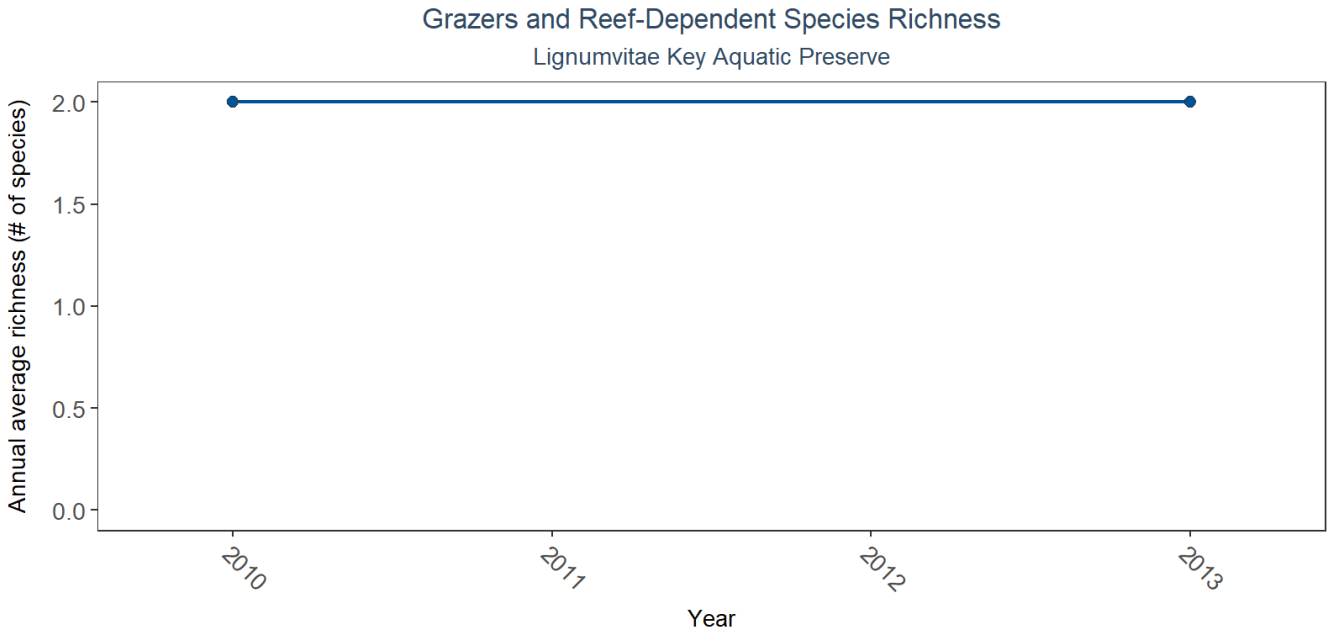

Figure 28: Line graph of annual average species richness of grazers and reef-dependent species over time. If the time series included more than one year of observations, a line connects the data points for visualization.

Table 27: Coral Species Richness

Sample Count	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
3	2	2010 - 2013	2	2

The median annual number of taxa was 2 based on 3 observations collected between 2010 and 2013.

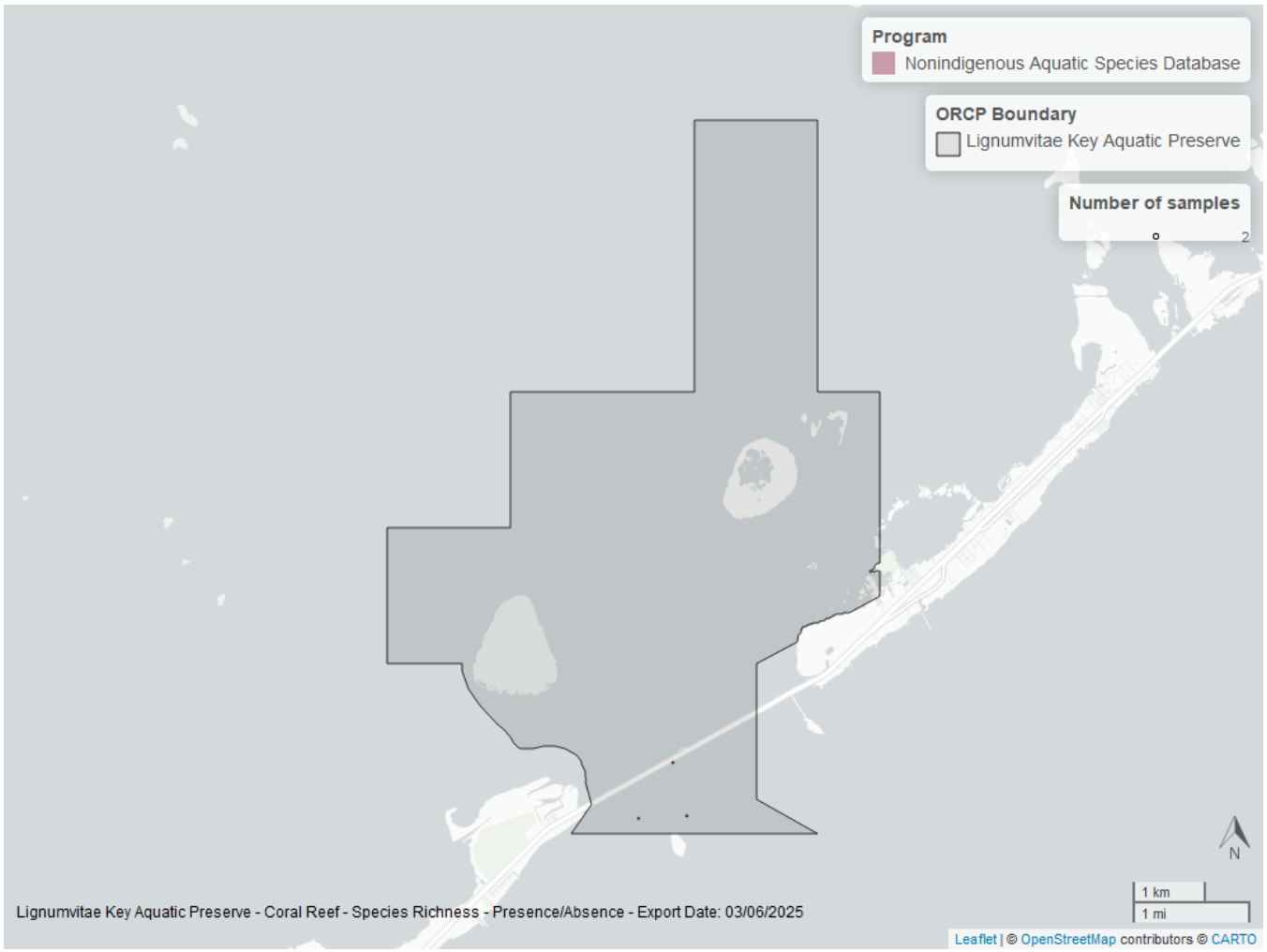

Figure 29: Map showing location of coral species richness sampling locations within the boundaries of *Lignumvitae Key Aquatic Preserve*. The bubble size on the maps above reflect the amount of data available at each sampling site.

Species list

Pterois miles[1]	Pterois volitans[1]	Pterois miles[1]

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

References

1. U.S. Environmental Protection Agency (EPA). EPA STOrage and RETrieval Data Warehouse (STORET)/WQX. (2023).
2. U.S. Environmental Protection Agency (EPA); Office of Research and Development. Environmental Monitoring Assessment Program. (2004).
3. 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).
4. Florida Department of Environmental Protection (DEP). Florida STORET / WIN. (2024).
5. Florida Fish and Wildlife Conservation Commission (FWC). Fisheries-Independent Monitoring (FIM) Program. (2022).
6. Florida Sea Grant; University of Florida IFAS Extension; Monroe County. Florida Keys Water Watch. (2019).
7. U.S. Geological Survey (USGS). National Water Information System. (2024).
8. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Florida Keys Aquatic Preserves. Florida Keys Aquatic Preserves Continuous Water Quality Monitoring. (2024).