Guana Tolomato Matanzas National Estuarine Research Reserve

SEACAR Habitat Analyses

Last compiled on 08 January, 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	Yes	Optional parameter not collected
SWMP	-2	No	Missing data
SWMP	-3	No	Data rejected due to QA/QC
SWMP	-4	No	Outside low sensor range
SWMP	-5	No	Outside high sensor range
SWMP	0	Yes	Passed initial QA/QC checks
SWMP	1	No	Suspect data
SWMP	2	Yes	Reserved for future use
SWMP	3	Yes	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	Yes	Historical: Pre-auto QA/QC
SWMP	5	Yes	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, andwater 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-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_pH-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Salinity-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Turbidity-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2024-Dec-08.txt*

Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

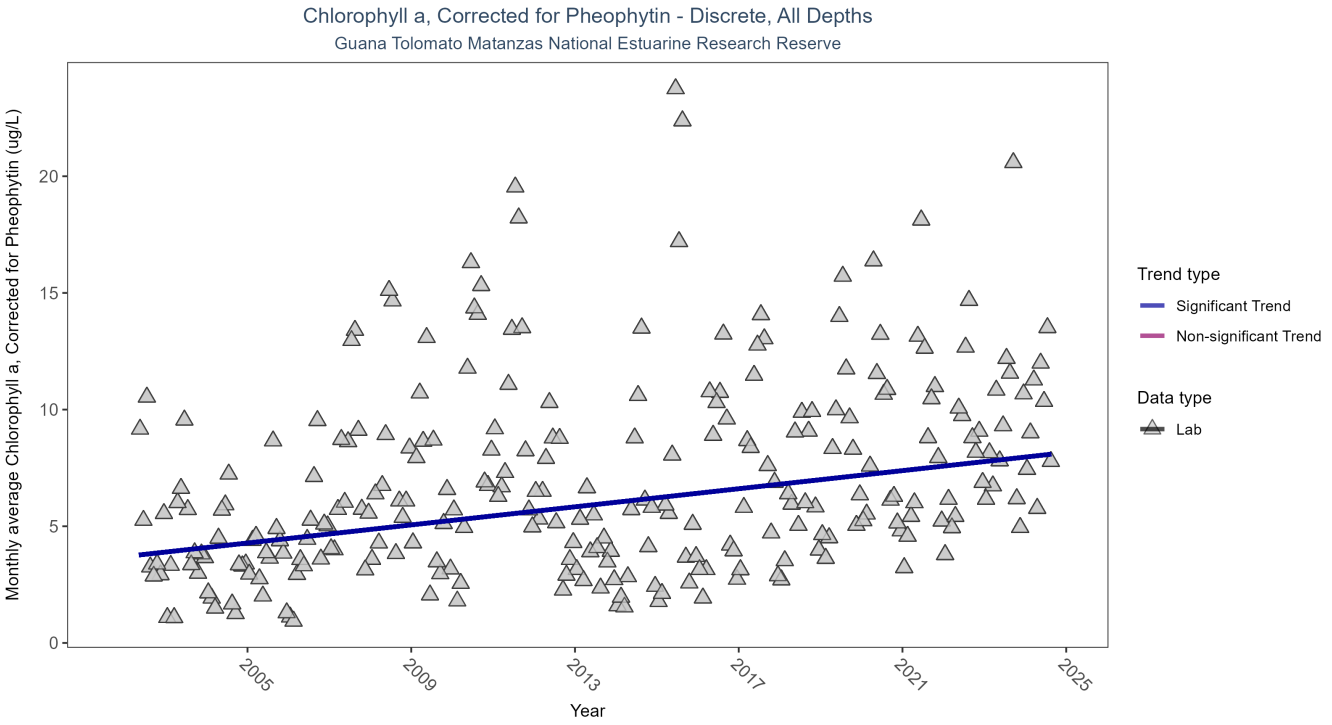

Figure 1: Seasonal Kendall-Tau Results for Chlorophyll a, Corrected for Pheophytin - Discrete

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

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	7975	23	4.7	TRUE	0.3067	0	0.1938	3.7011	2.9843	0.9909	1

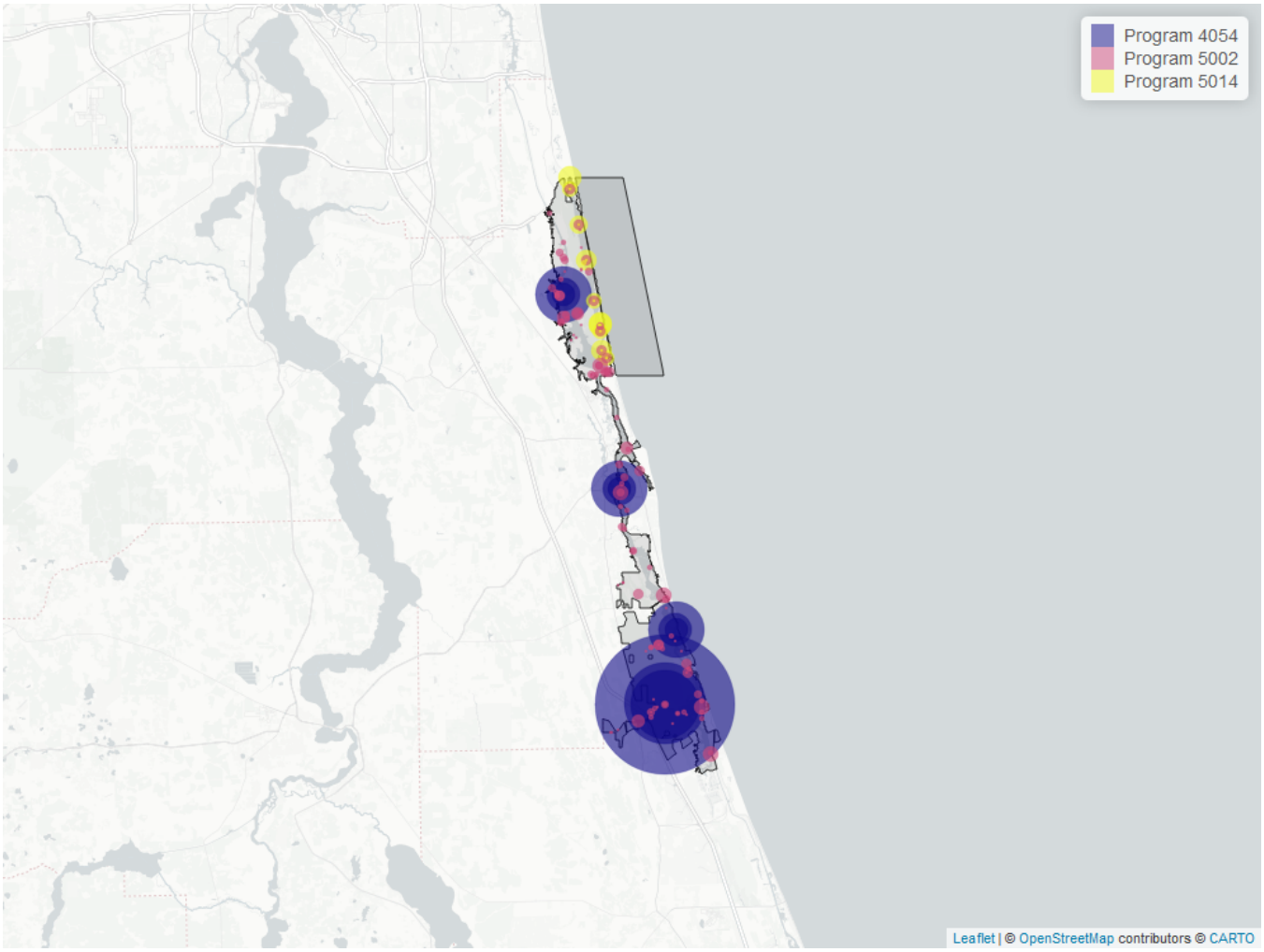

Figure 2: Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

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

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	6903	2002	2024
5002	855	2002	2024
5014	663	2017	2024

Program names:

4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

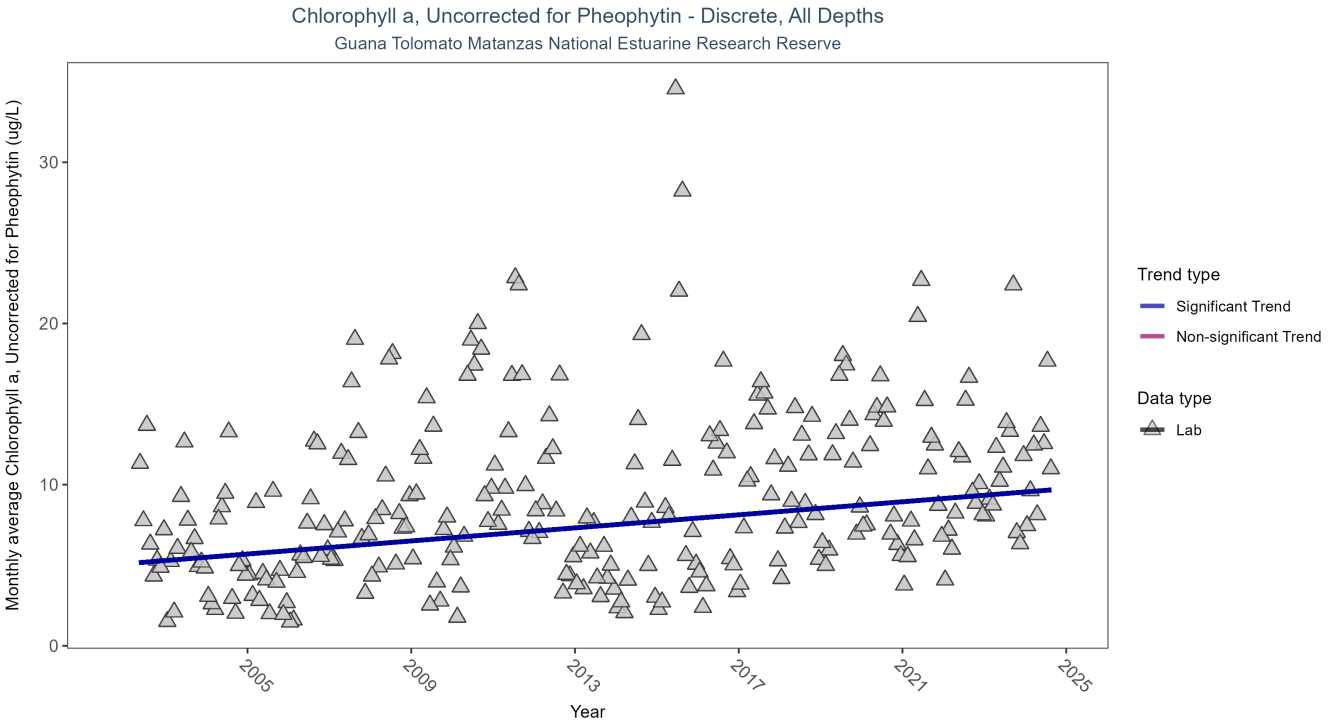

Figure 3: Seasonal Kendall-Tau Results for Chlorophyll a, Uncorrected for Pheophytin - Discrete

Table 8: Seasonal Kendall-Tau Trend Analysis for Chlorophyll a, Uncorrected for Pheophytin

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	6299	23	6.2	TRUE	0.265	0	0.2026	5.0887	1.93	0.9987	1

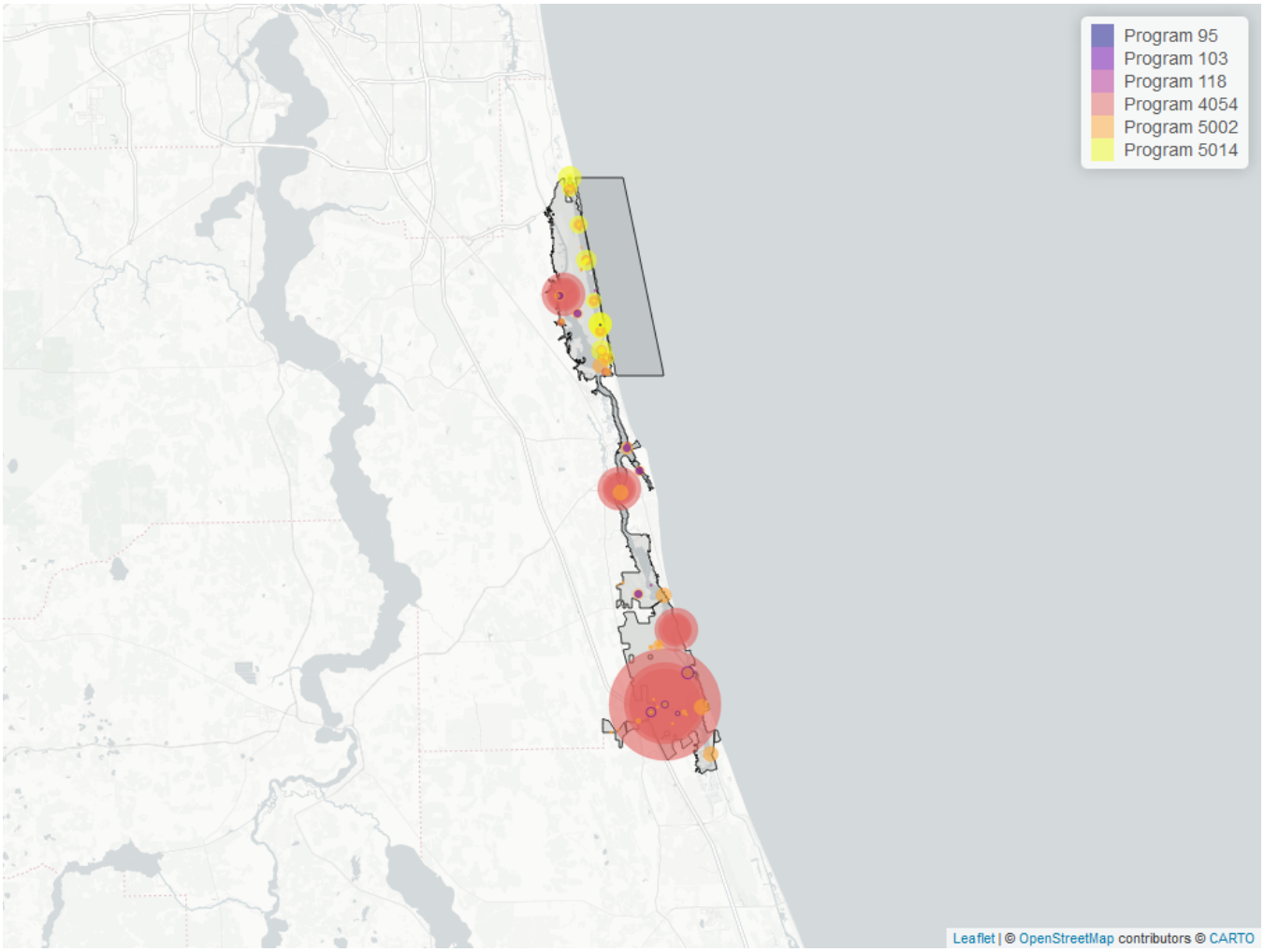

Figure 4: Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 9: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	5564	2002	2024
5014	723	2017	2024
5002	402	2008	2024
103	118	2020	2021
118	3	2006	2010
95	1	2012	2012

Program names:

95 - Harmful Algal Bloom Marine Observation Network[4]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[6]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Colored Dissolved Organic Matter - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

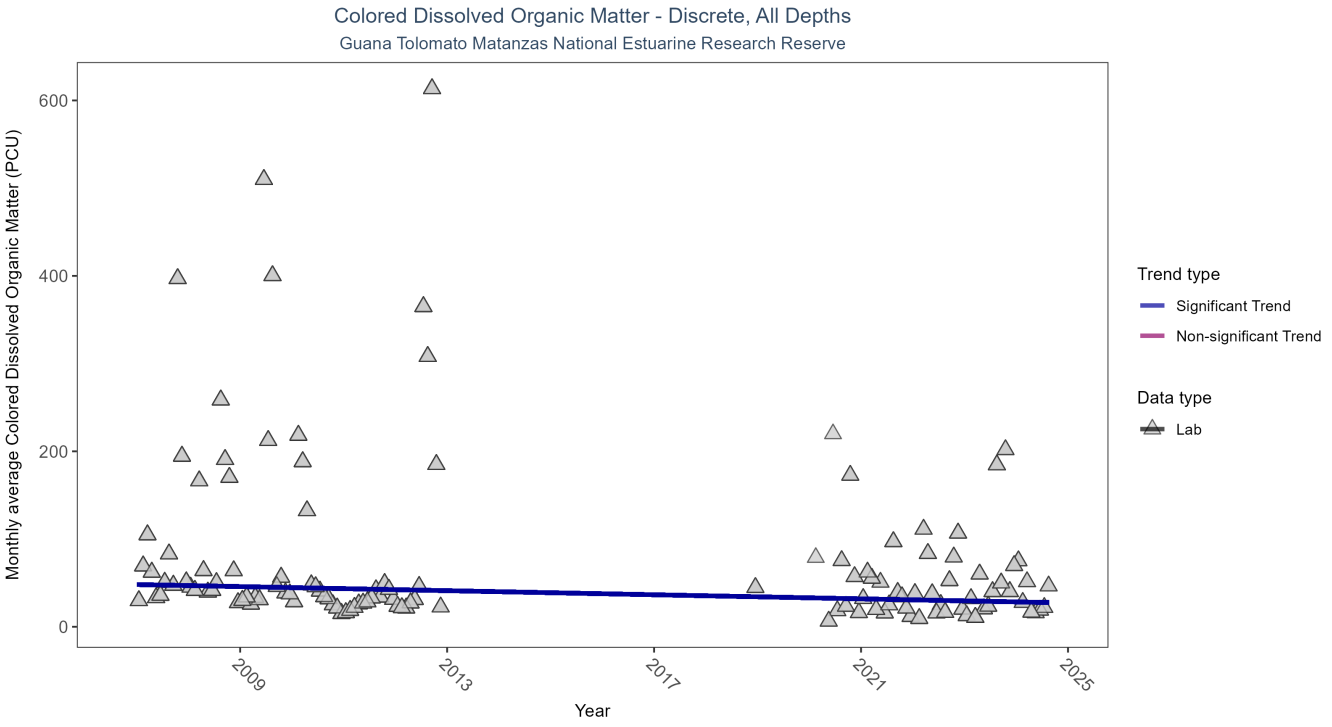

Figure 5: Seasonal Kendall-Tau Results for Colored Dissolved Organic Matter - Discrete

Table 10: Seasonal Kendall-Tau Trend Analysis for Colored Dissolved Organic Matter

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1811	12	33.4	TRUE	-0.2092	0.0024	-1.1629	48.1193	4.3156	0.9598	-1

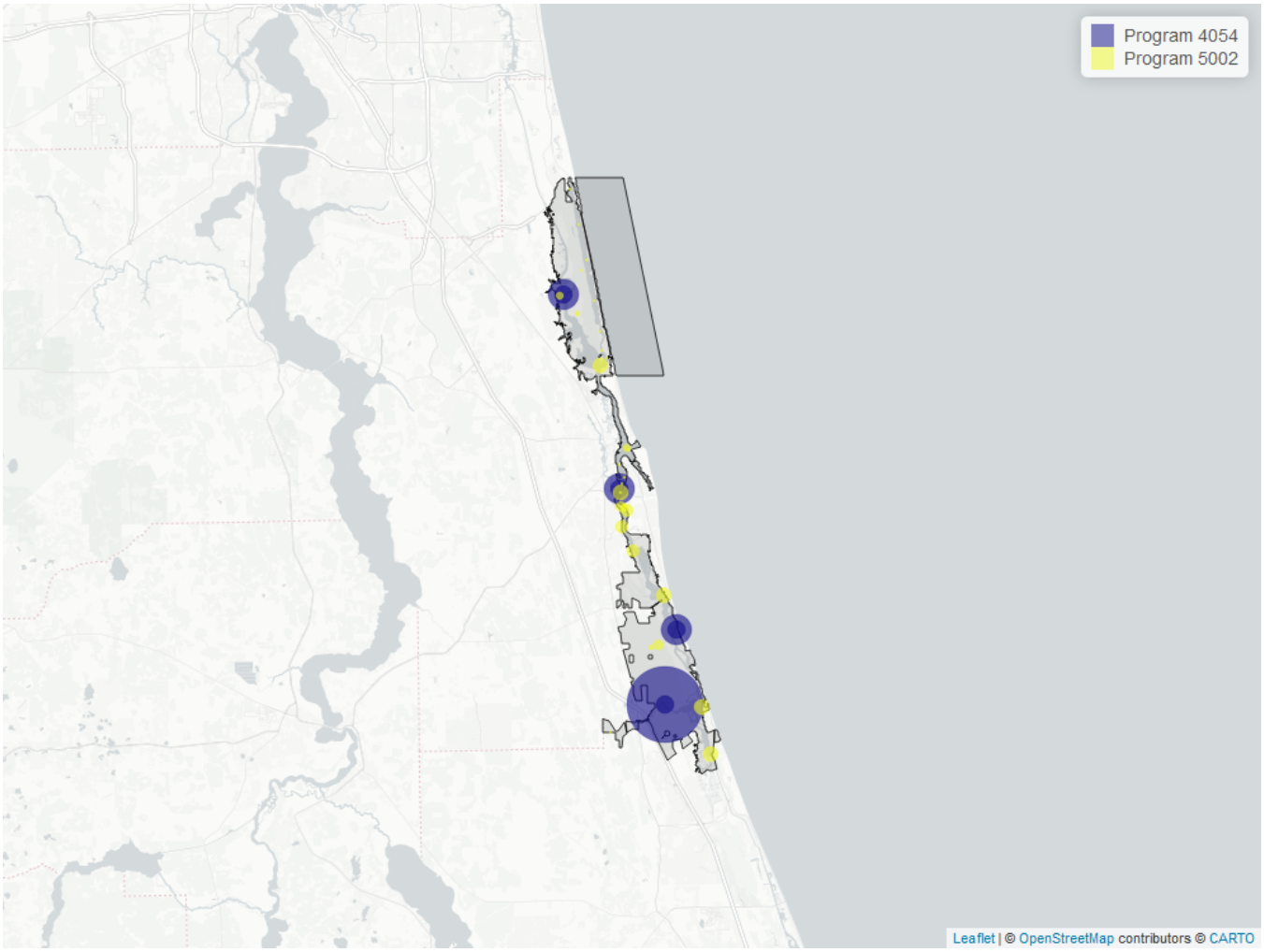

Figure 6: Map showing location of Discrete sampling sites for Colored Dissolved Organic Matter. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 11: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	1506	2007	2024
5002	306	2020	2024
5014	7	2018	2018

Program names:

4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Dissolved Oxygen - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

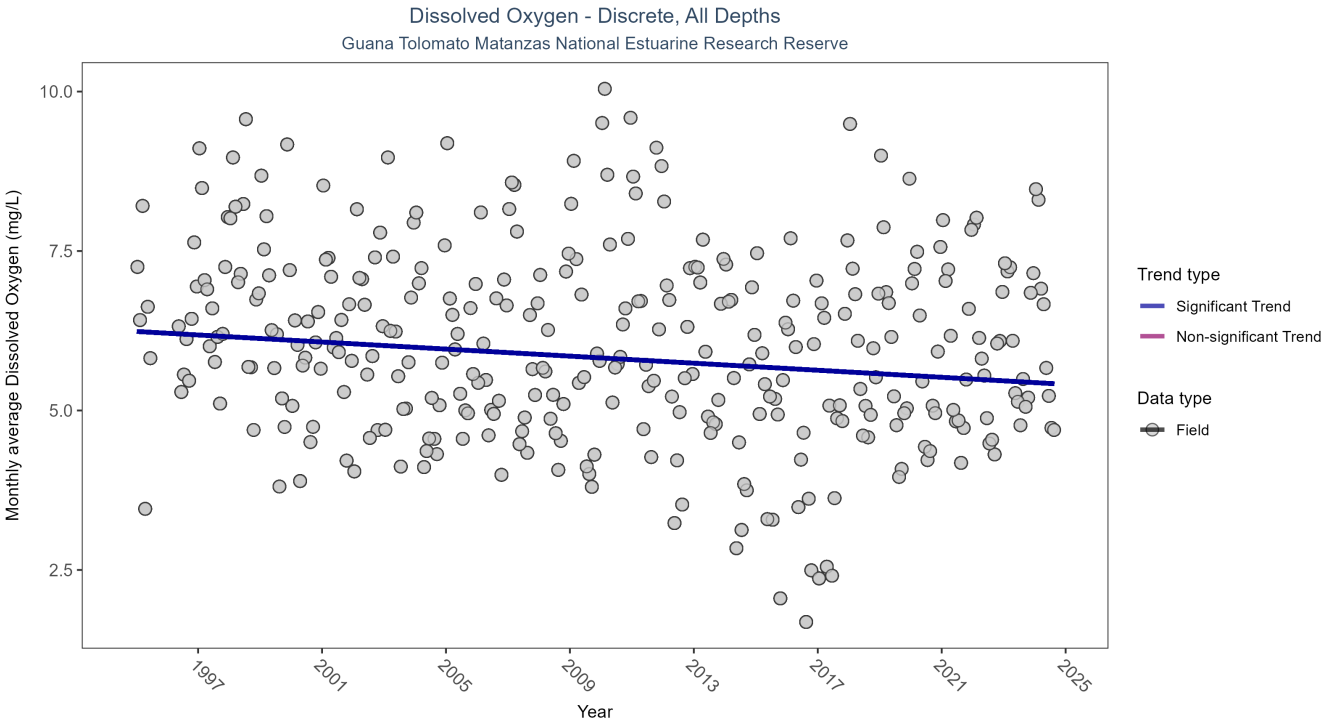

Figure 7: Seasonal Kendall-Tau Results for Dissolved Oxygen - Discrete

Table 12: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	22353	30	6	TRUE	-0.1735	0	-0.0276	6.2392	18.7761	0.0652	-1

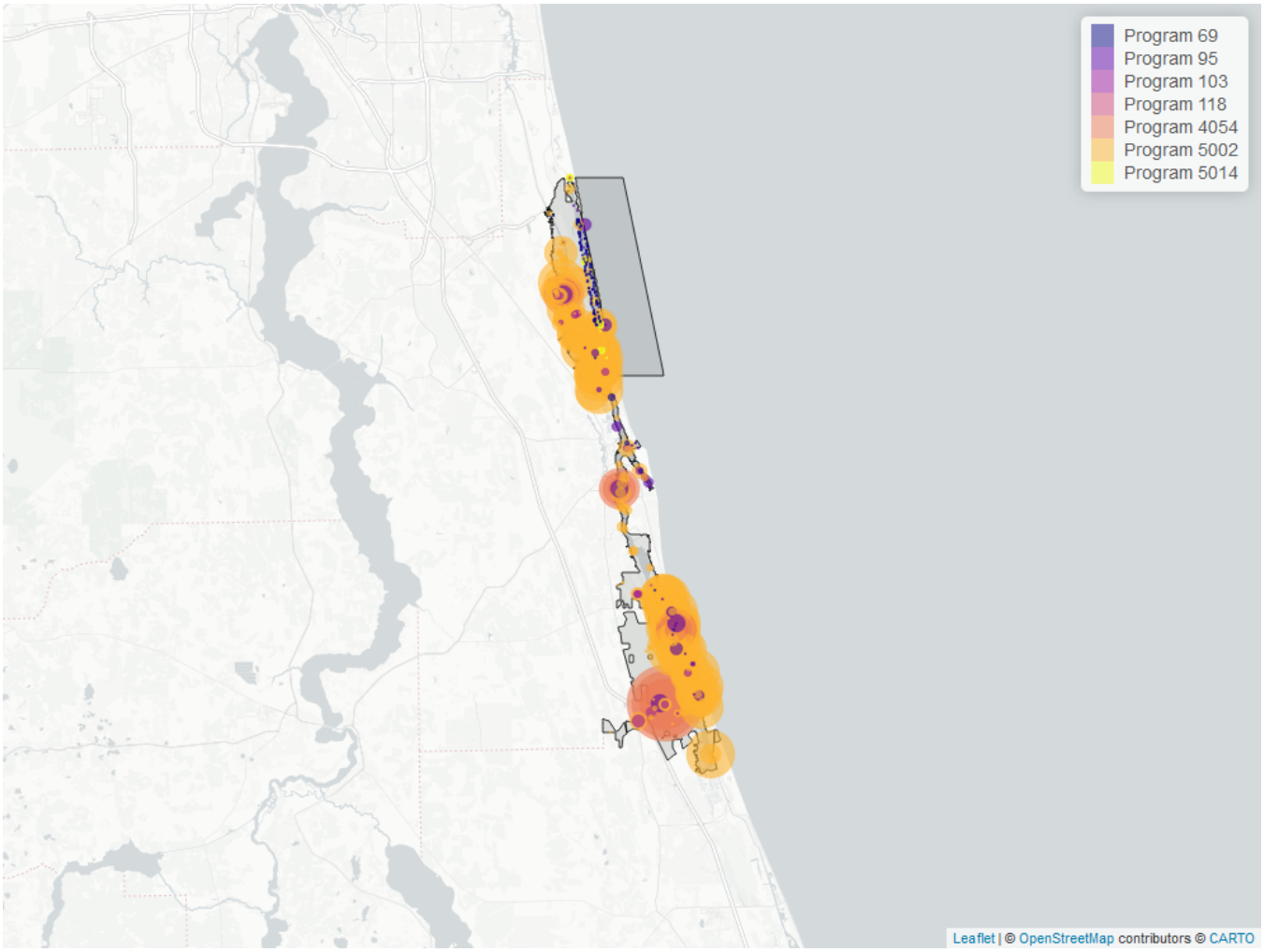

Figure 8: Map showing location of Discrete sampling sites for Dissolved Oxygen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 13: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	18112	1995	2024
4054	3469	2002	2024
95	400	2007	2018
5014	260	2017	2022
69	185	2001	2010
103	168	2020	2021
118	2	2006	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[4]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[6]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]

5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Dissolved Oxygen Saturation - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

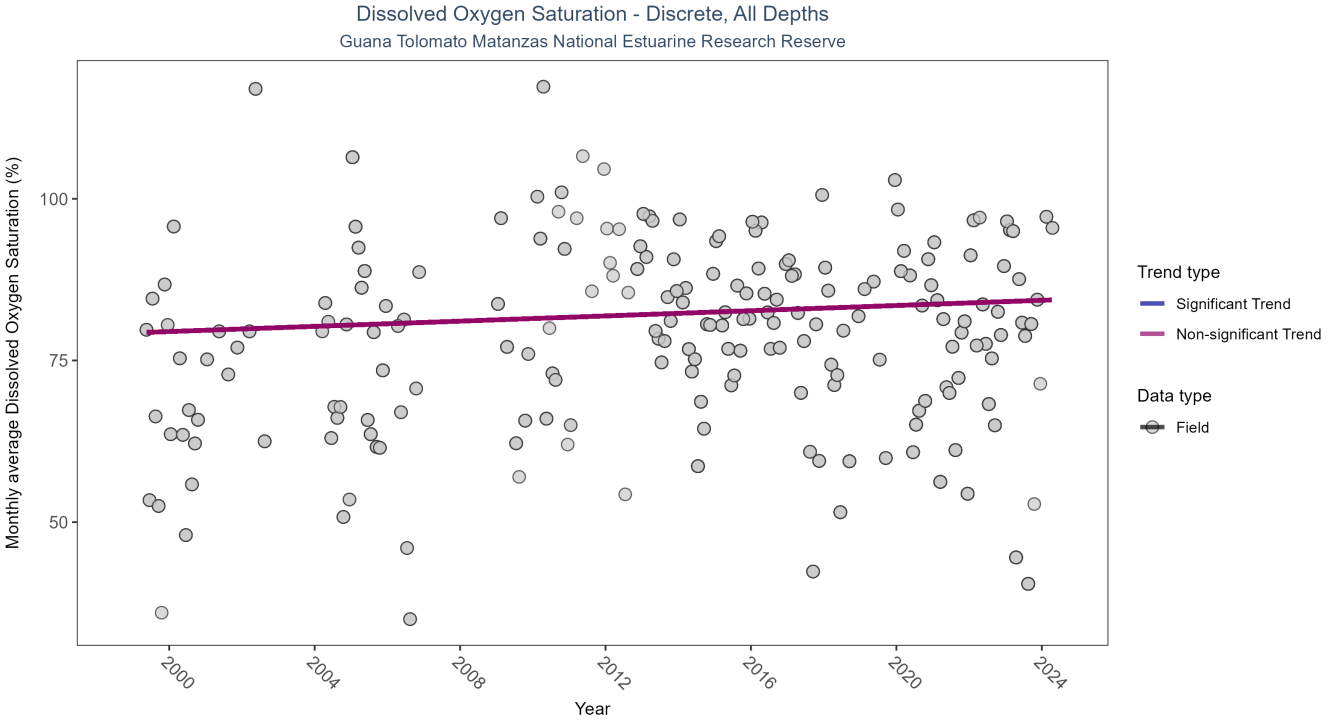

Figure 9: Seasonal Kendall-Tau Results for Dissolved Oxygen Saturation - Discrete

Table 14: Seasonal Kendall-Tau Trend Analysis for Dissolved Oxygen Saturation

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2346	23	81.2	TRUE	0.0876	0.0959	0.2015	79.2681	5.9269	0.8782	0

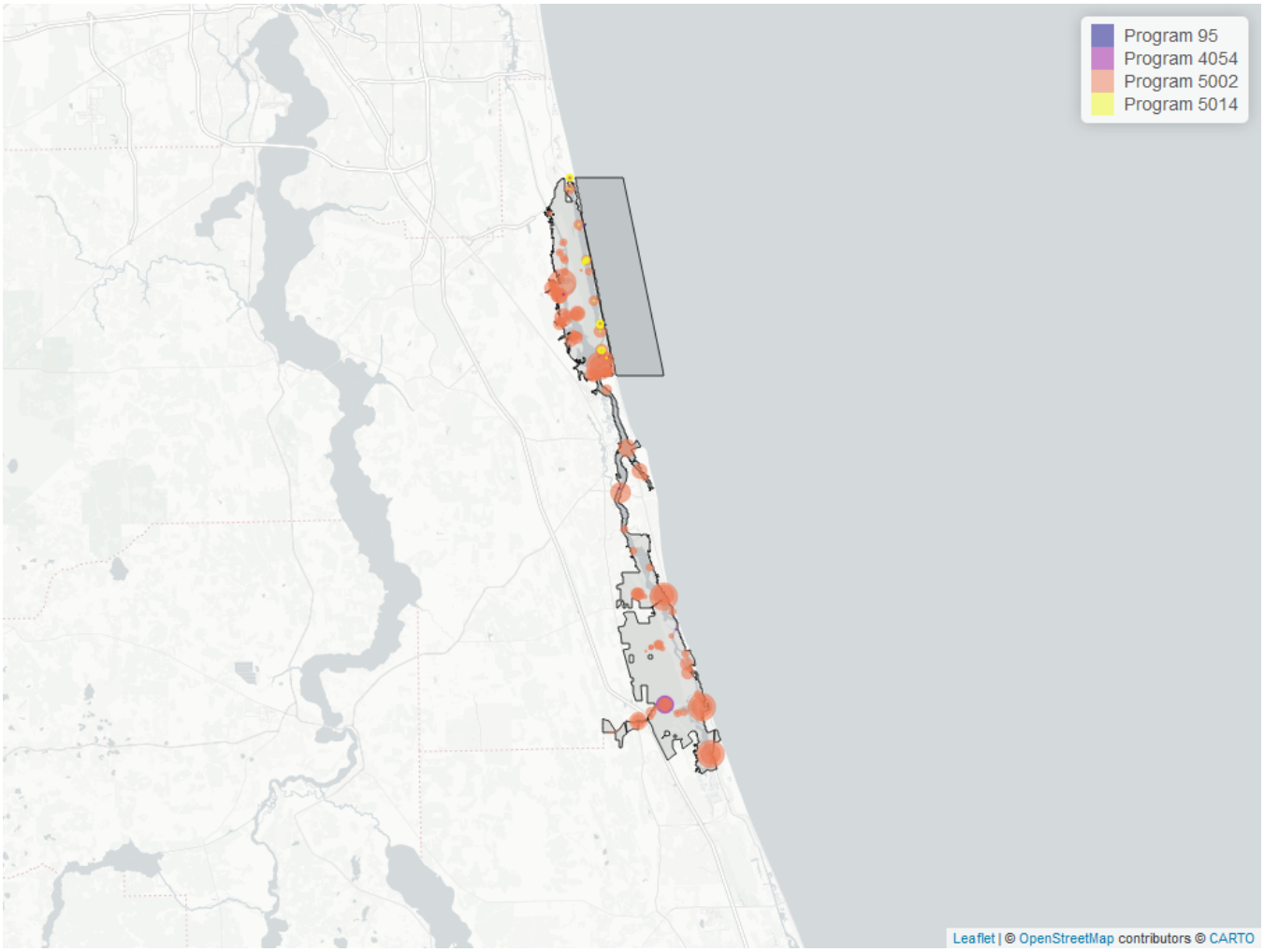

Figure 10: Map showing location of Discrete sampling sites for Dissolved Oxygen Saturation. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 15: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	2103	1999	2024
5014	238	2017	2022
4054	48	2021	2023
95	3	2012	2013

Program names:

95 - Harmful Algal Bloom Marine Observation Network[4]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

pH - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

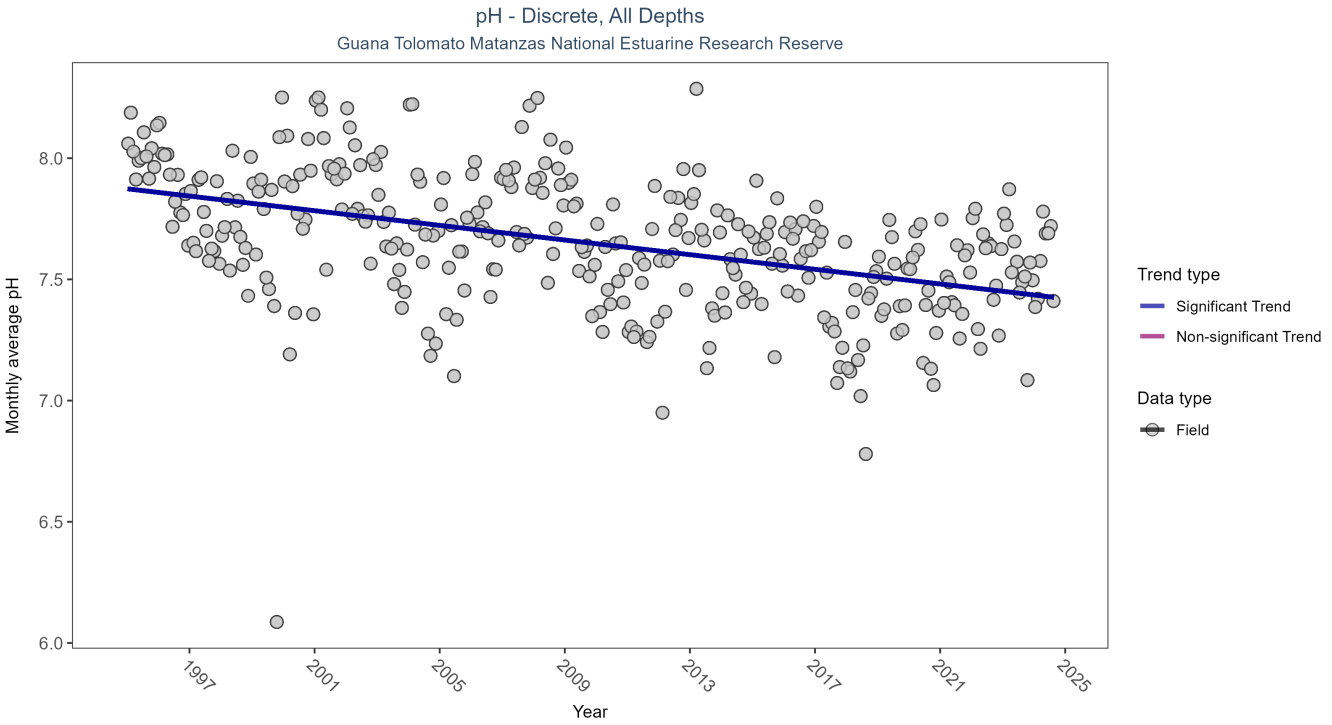

Figure 11: Seasonal Kendall-Tau Results for pH - Discrete

Table 16: Seasonal Kendall-Tau Trend Analysis for pH

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	18639	30	7.8	TRUE	-0.3862	0	-0.0151	7.8739	2.4389	0.9963	-1

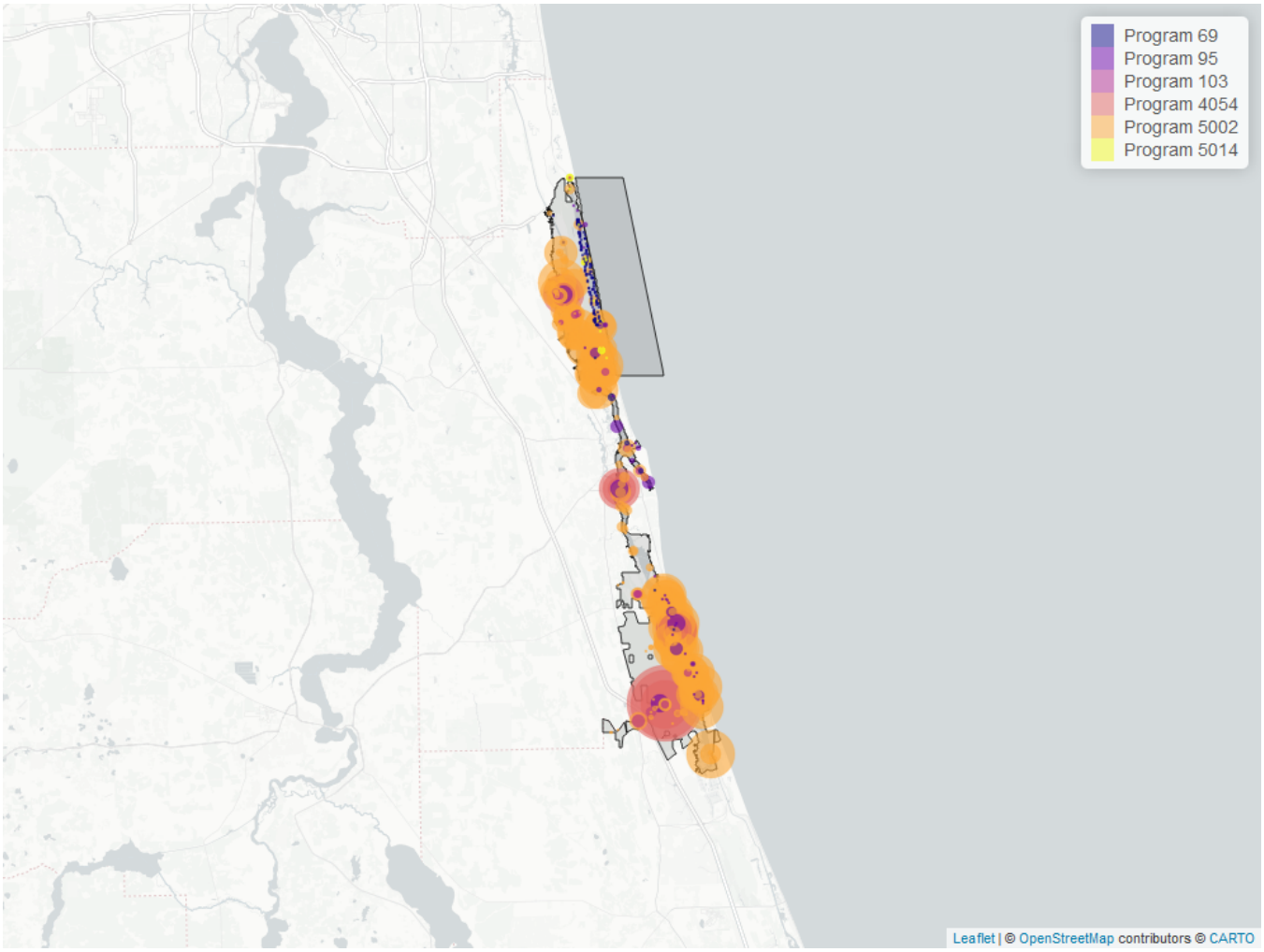

Figure 12: Map showing location of Discrete sampling sites for pH. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 17: Programs contributing data for pH

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	14729	1995	2024
4054	3507	2002	2024
95	401	2007	2018
5014	267	2017	2022
69	190	2001	2010
103	168	2020	2021

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[4]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Salinity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

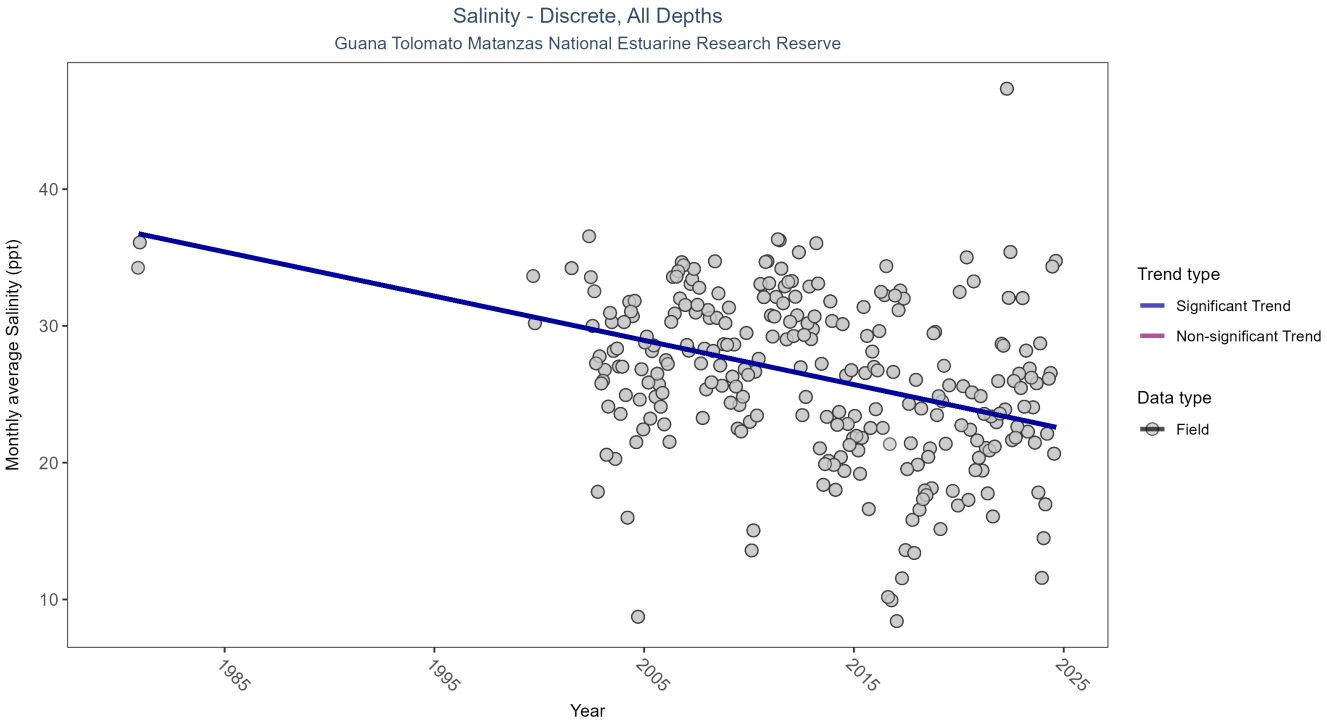

Figure 13: Seasonal Kendall-Tau Results for Salinity - Discrete

Table 18: Seasonal Kendall-Tau Trend Analysis for Salinity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	25596	31	31.725	TRUE	-0.3614	0	-0.3235	37.0306	4.5106	0.9525	-1

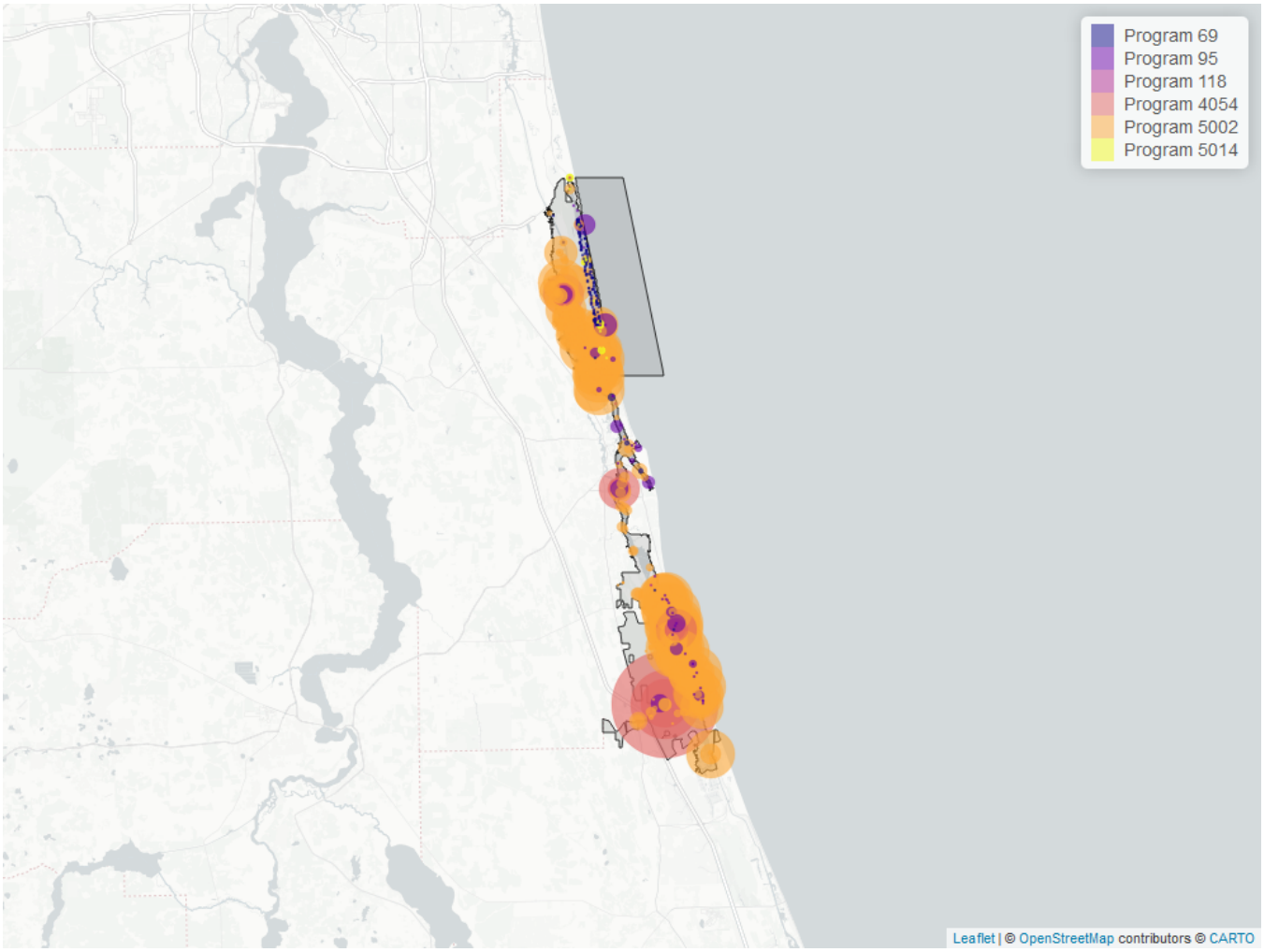

Figure 14: Map showing location of Discrete sampling sites for Salinity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 19: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	20775	1995	2024
4054	4083	2002	2024
95	563	1980	2018
5014	267	2017	2022
69	190	2001	2010
118	2	2015	2015

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[4]
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment[6]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Secchi Depth - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

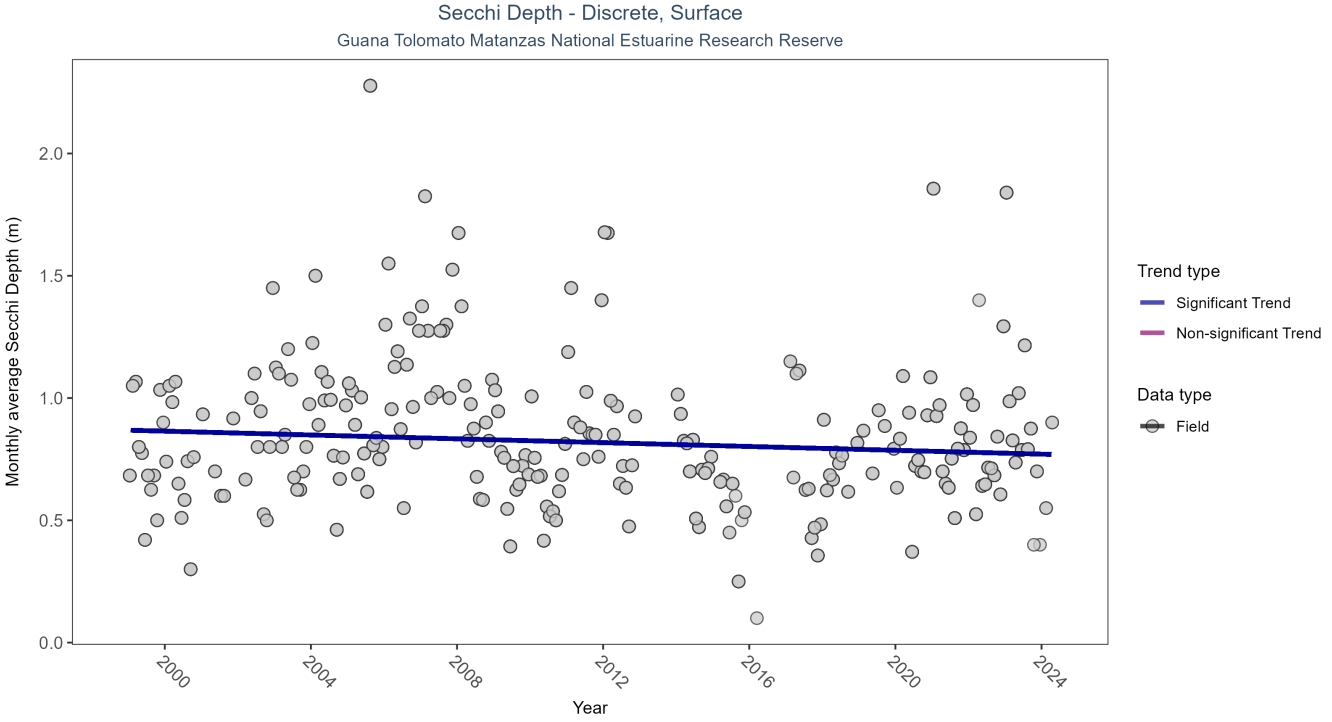

Figure 15: Seasonal Kendall-Tau Results for Secchi Depth - Discrete

Table 20: Seasonal Kendall-Tau Trend Analysis for Secchi Depth

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	2867	25	0.8	TRUE	-0.0978	0.042	-0.0039	0.8685	15.7093	0.1523	-1

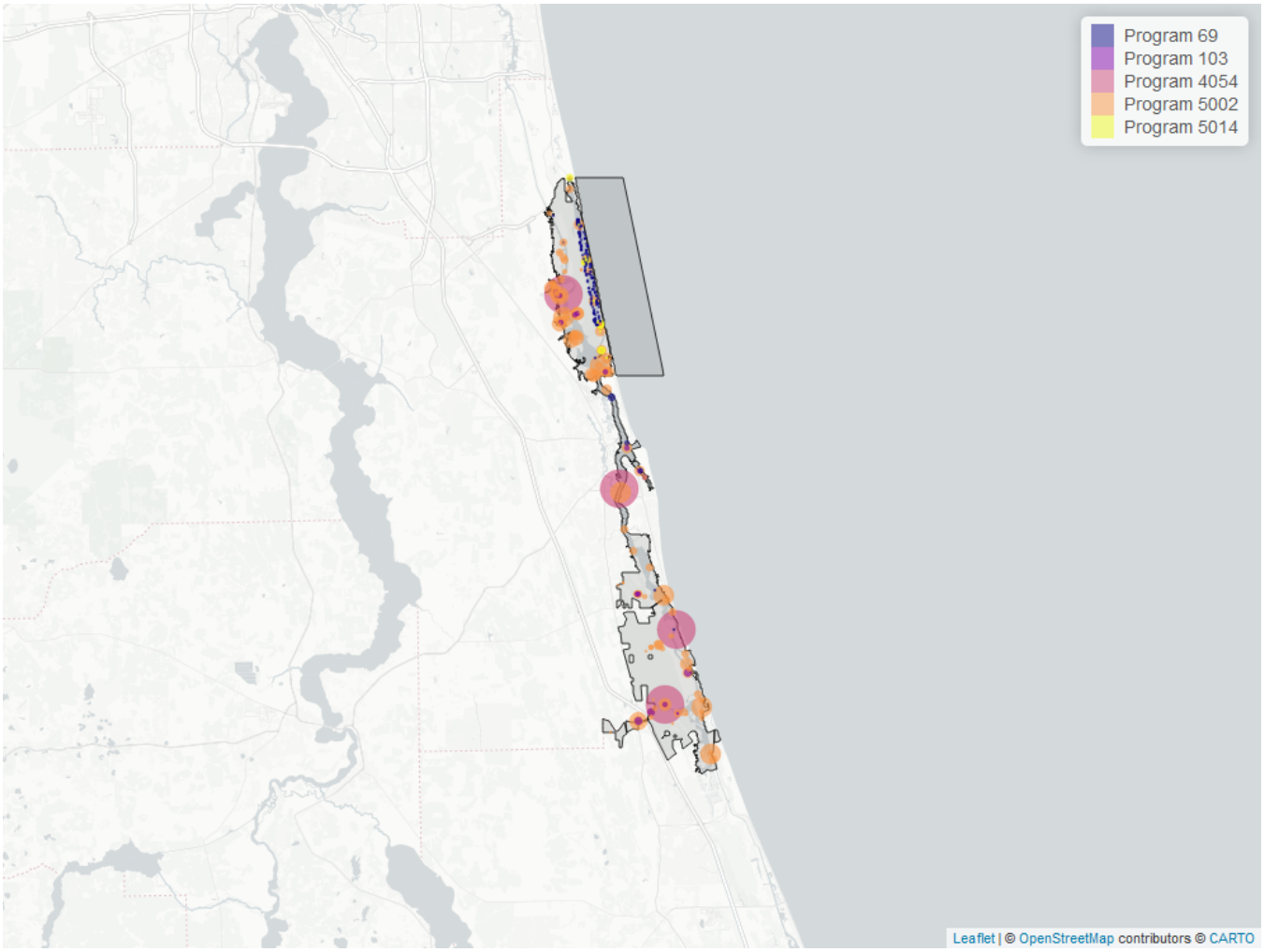

Figure 16: Map showing location of Discrete sampling sites for Secchi Depth. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 21: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	1420	1999	2024
4054	937	2002	2014
5014	228	2017	2022
69	190	2001	2010
103	93	2020	2021

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Total Nitrogen - Discrete Water Quality

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

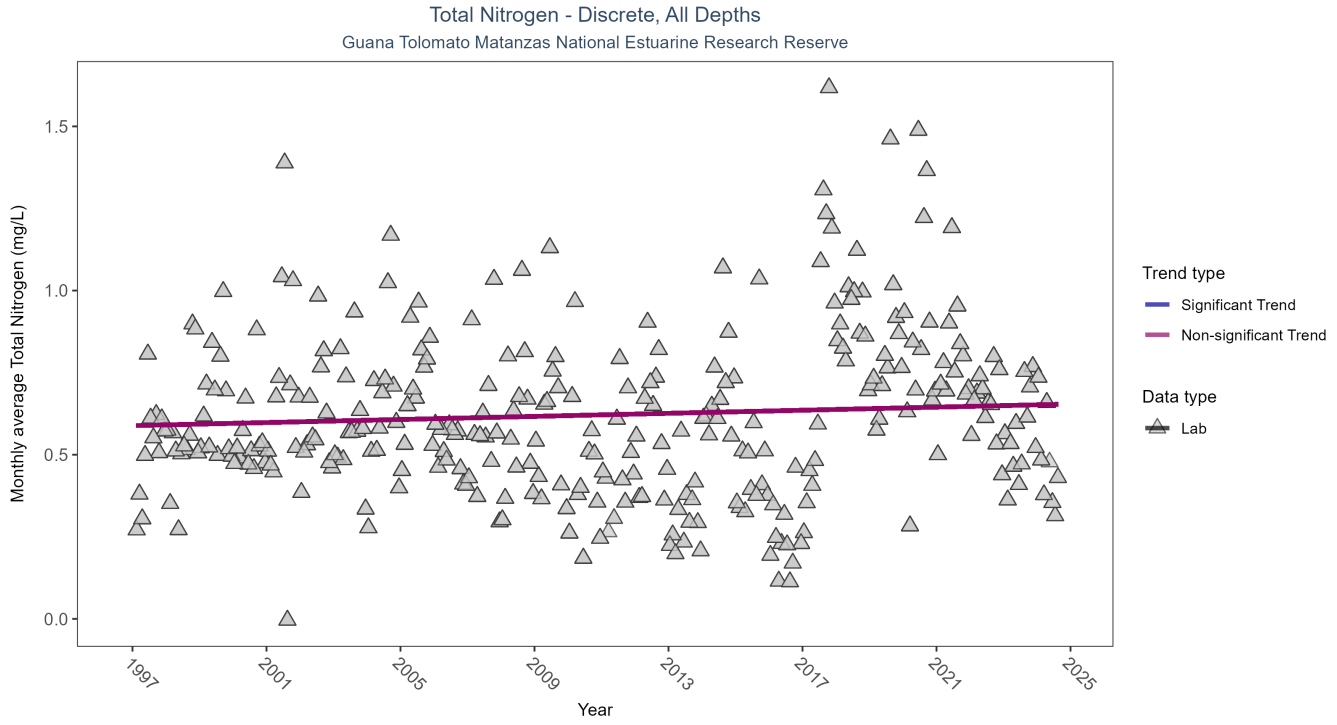

Figure 17: Seasonal Kendall-Tau Results for Total Nitrogen - Discrete

Table 22: Seasonal Kendall-Tau Trend Analysis for Total Nitrogen

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	5911	28	0.552	TRUE	0.061	0.1276	0.0023	0.5885	2.8199	0.9929	0

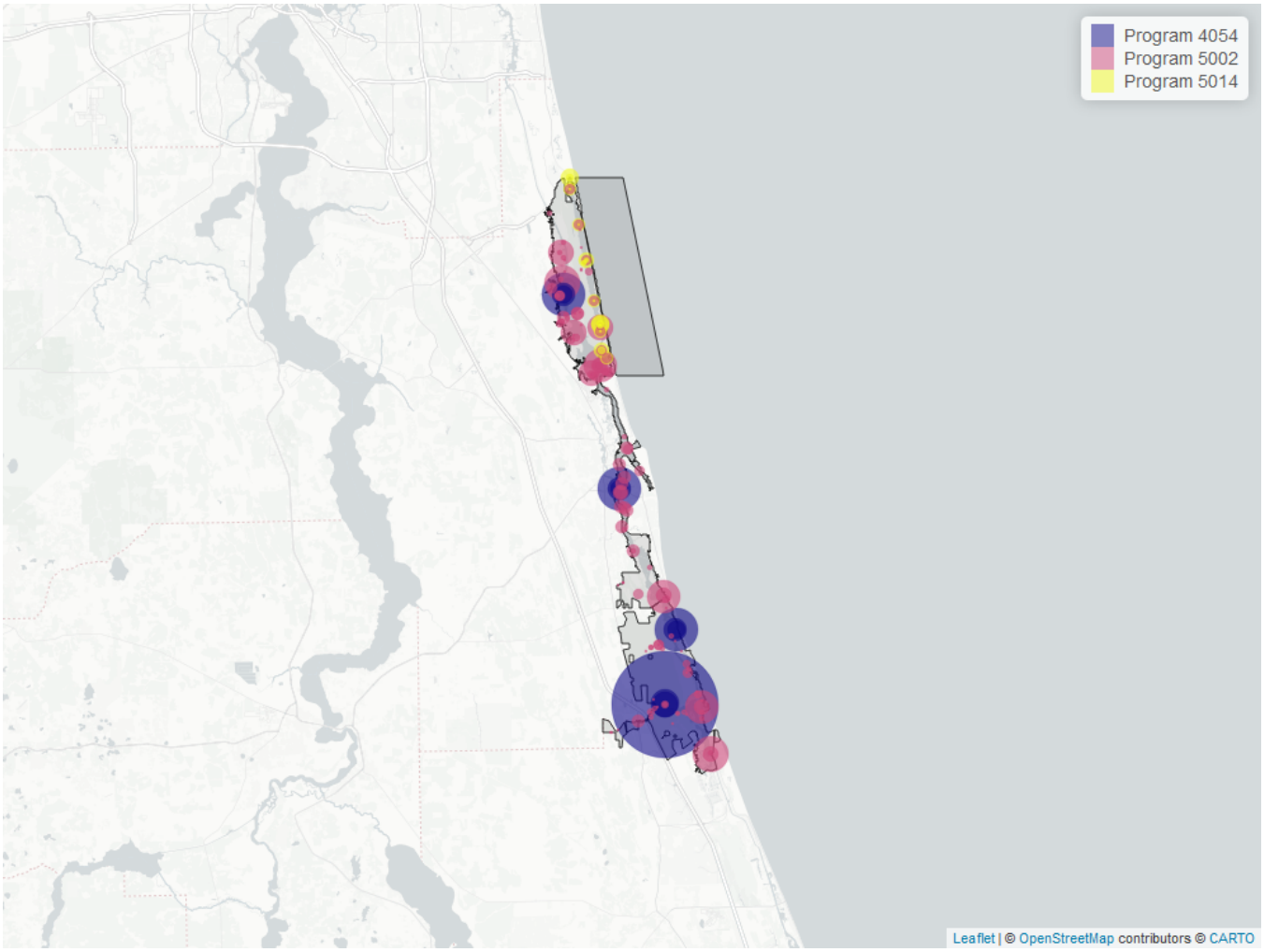

Figure 18: Map showing location of Discrete sampling sites for Total Nitrogen. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 23: Programs contributing data for Total Nitrogen

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	3222	2002	2024
5002	2334	1997	2024
5014	537	2017	2022

Program names:

4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

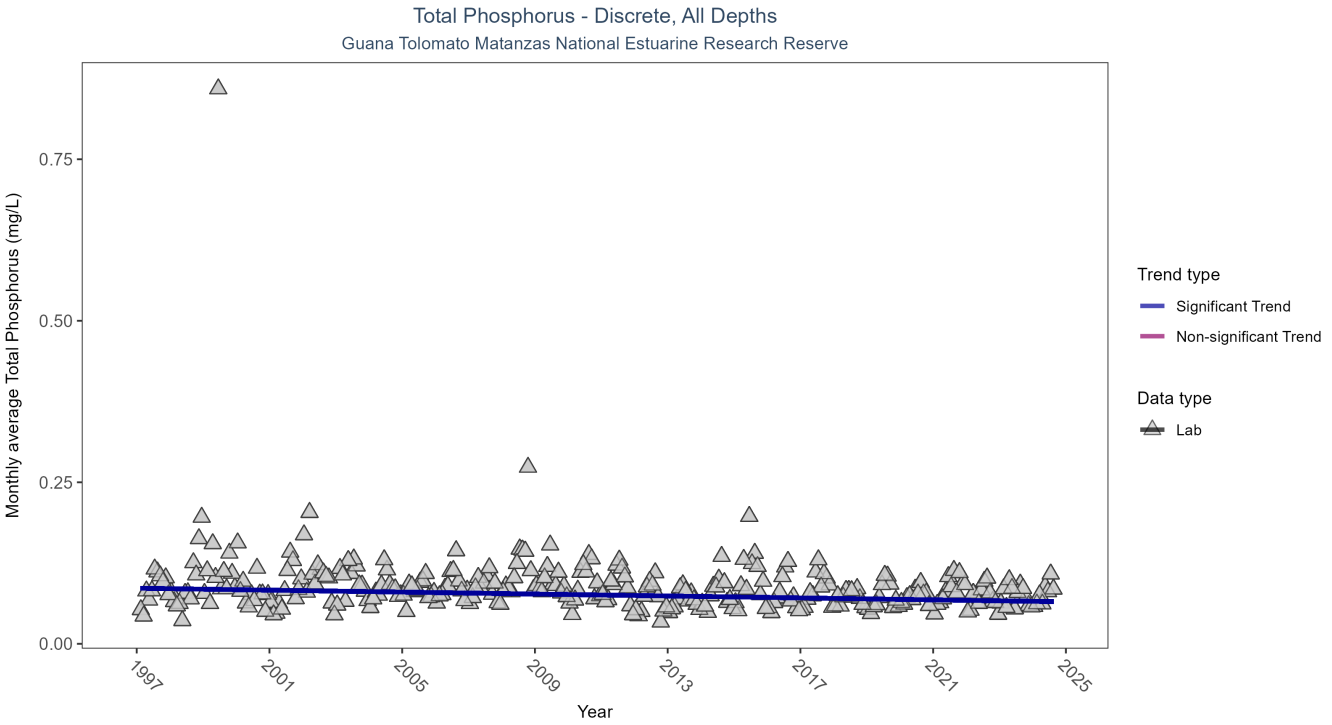

Figure 19: Seasonal Kendall-Tau Results for Total Phosphorus - Discrete

Table 24: Seasonal Kendall-Tau Trend Analysis for Total Phosphorus

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	9296	28	0.072	TRUE	-0.209	0	-0.0008	0.0861	6.0654	0.869	-1

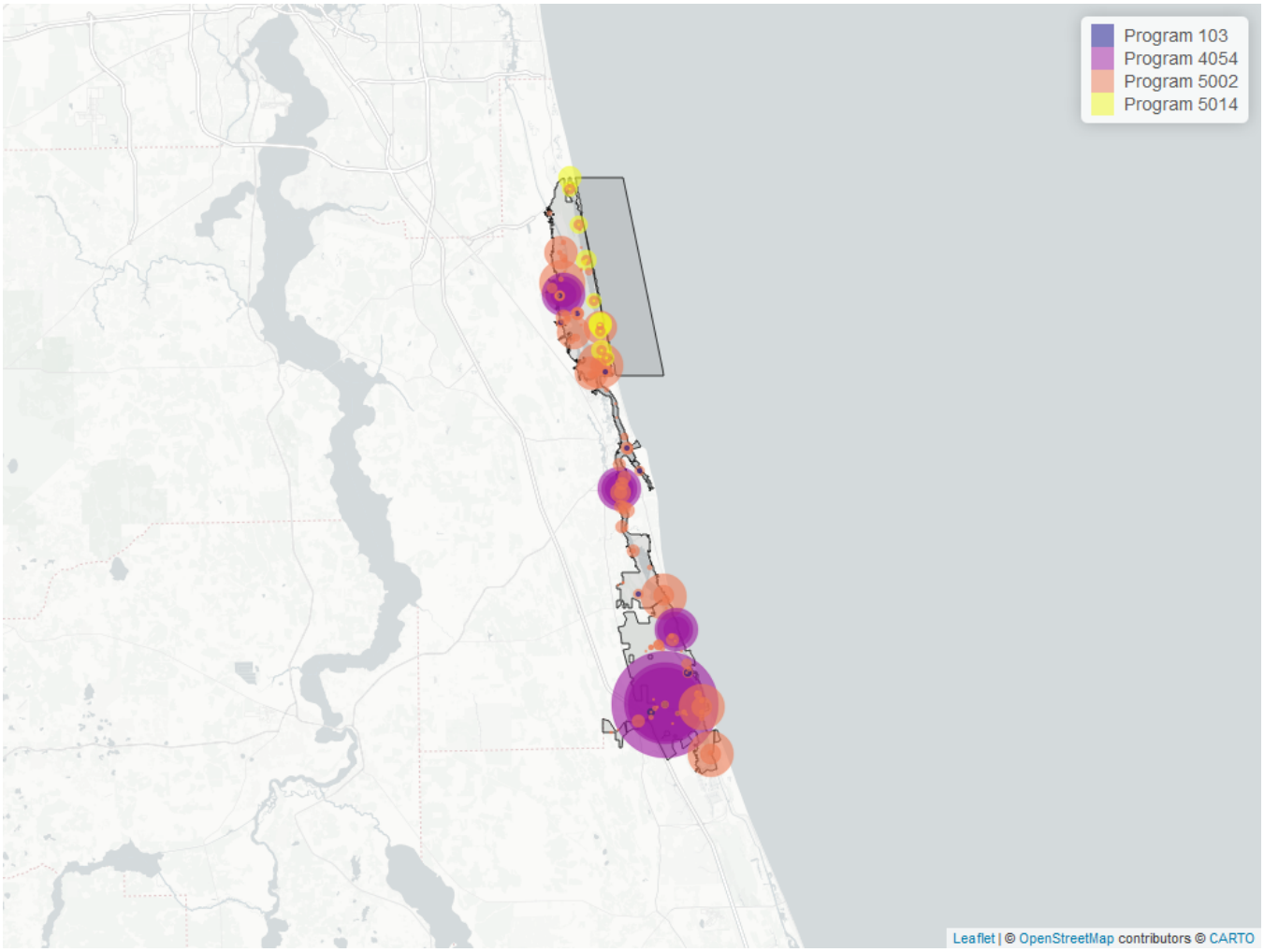

Figure 20: Map showing location of Discrete sampling sites for Total Phosphorus. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 25: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	5361	2002	2024
5002	3541	1997	2024
5014	664	2017	2024
103	59	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Total Suspended Solids - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

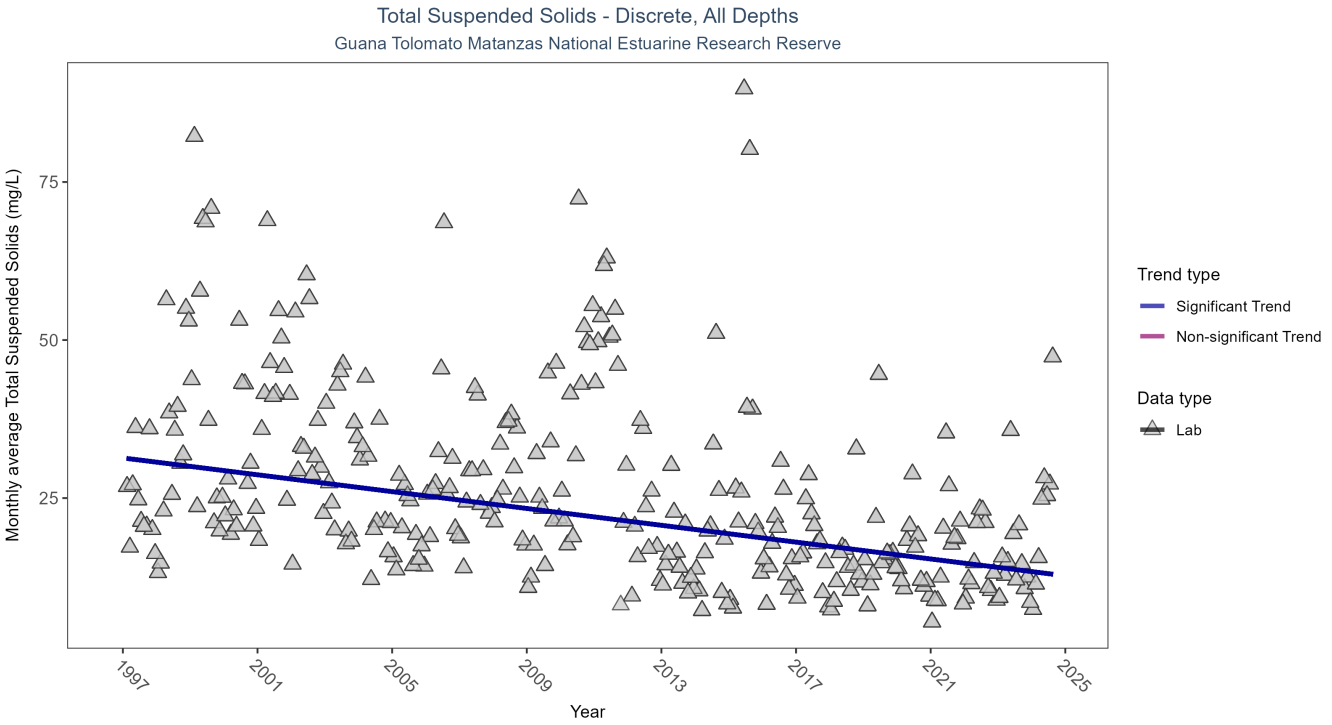

Figure 21: Seasonal Kendall-Tau Results for Total Suspended Solids - Discrete

Table 26: Seasonal Kendall-Tau Trend Analysis for Total Suspended Solids

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4961	28	17	TRUE	-0.3896	0	-0.6658	31.3471	6.8434	0.8116	-1

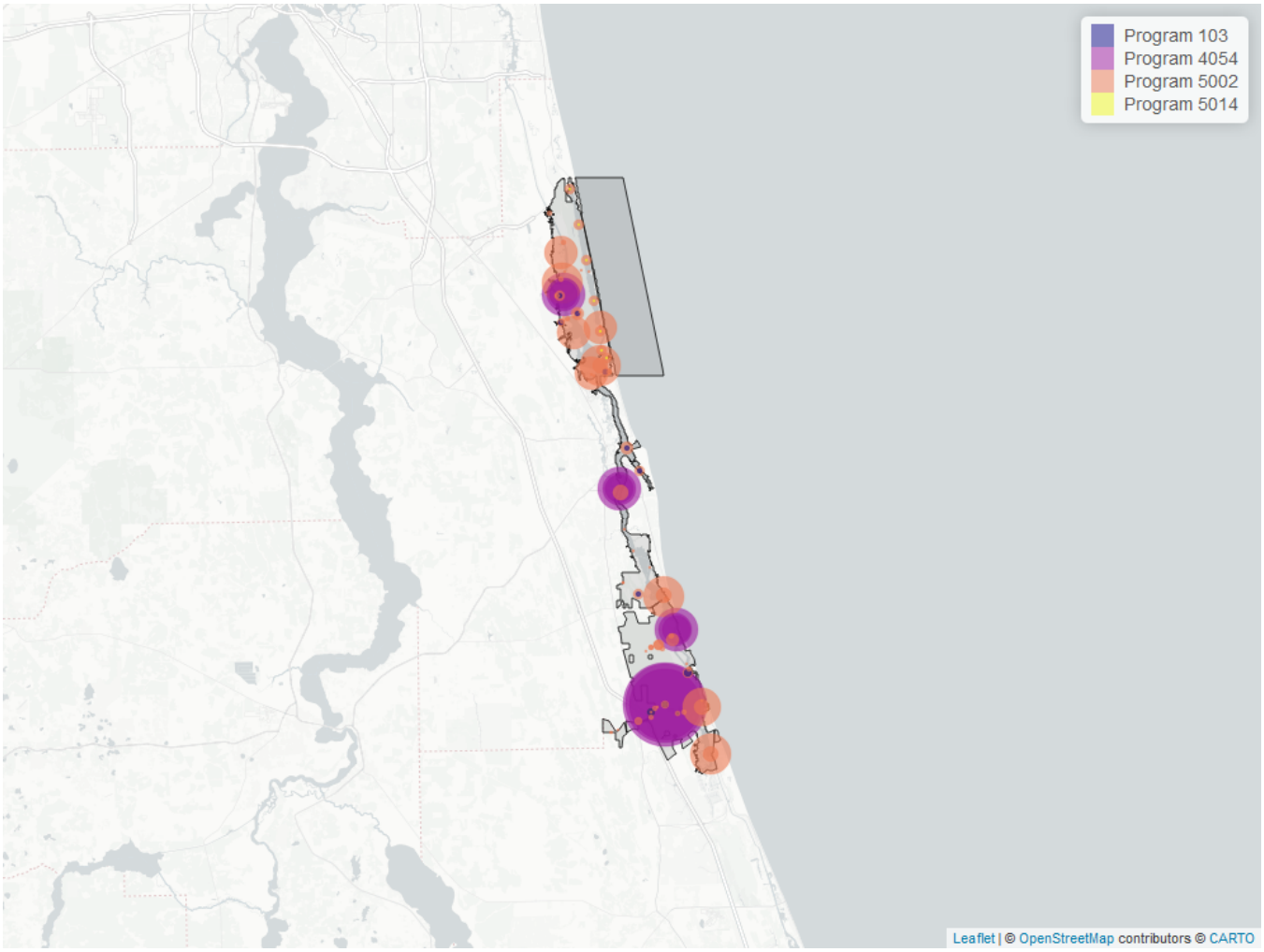

Figure 22: Map showing location of Discrete sampling sites for Total Suspended Solids. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 27: Programs contributing data for Total Suspended Solids

ProgramID	*N_Data*	*YearMin*	*YearMax*
4054	4605	2002	2024
5002	2466	1997	2024
5014	126	2018	2022
103	60	2020	2021

Program names:

103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Turbidity - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

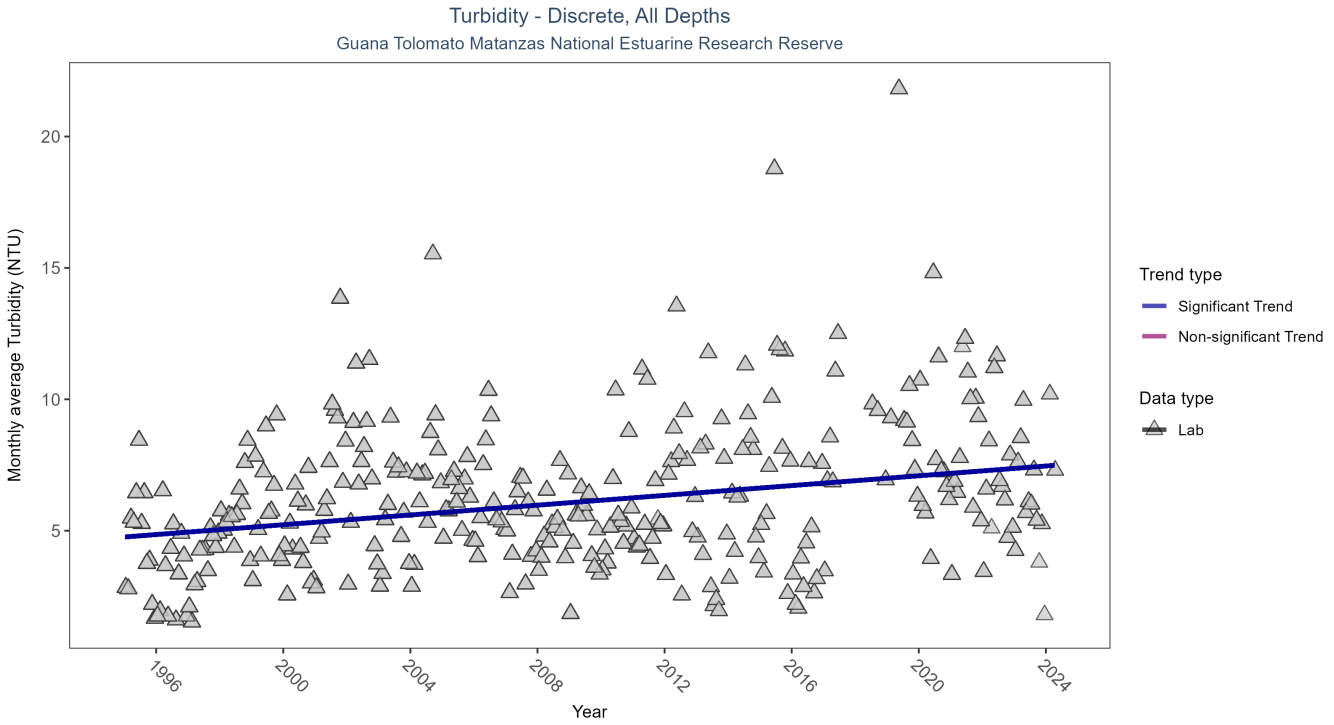

Figure 23: Seasonal Kendall-Tau Results for Turbidity - Discrete

Table 28: Seasonal Kendall-Tau Trend Analysis for Turbidity

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	14790	30	4.5	TRUE	0.238	0	0.0931	4.7606	8.0495	0.7089	1

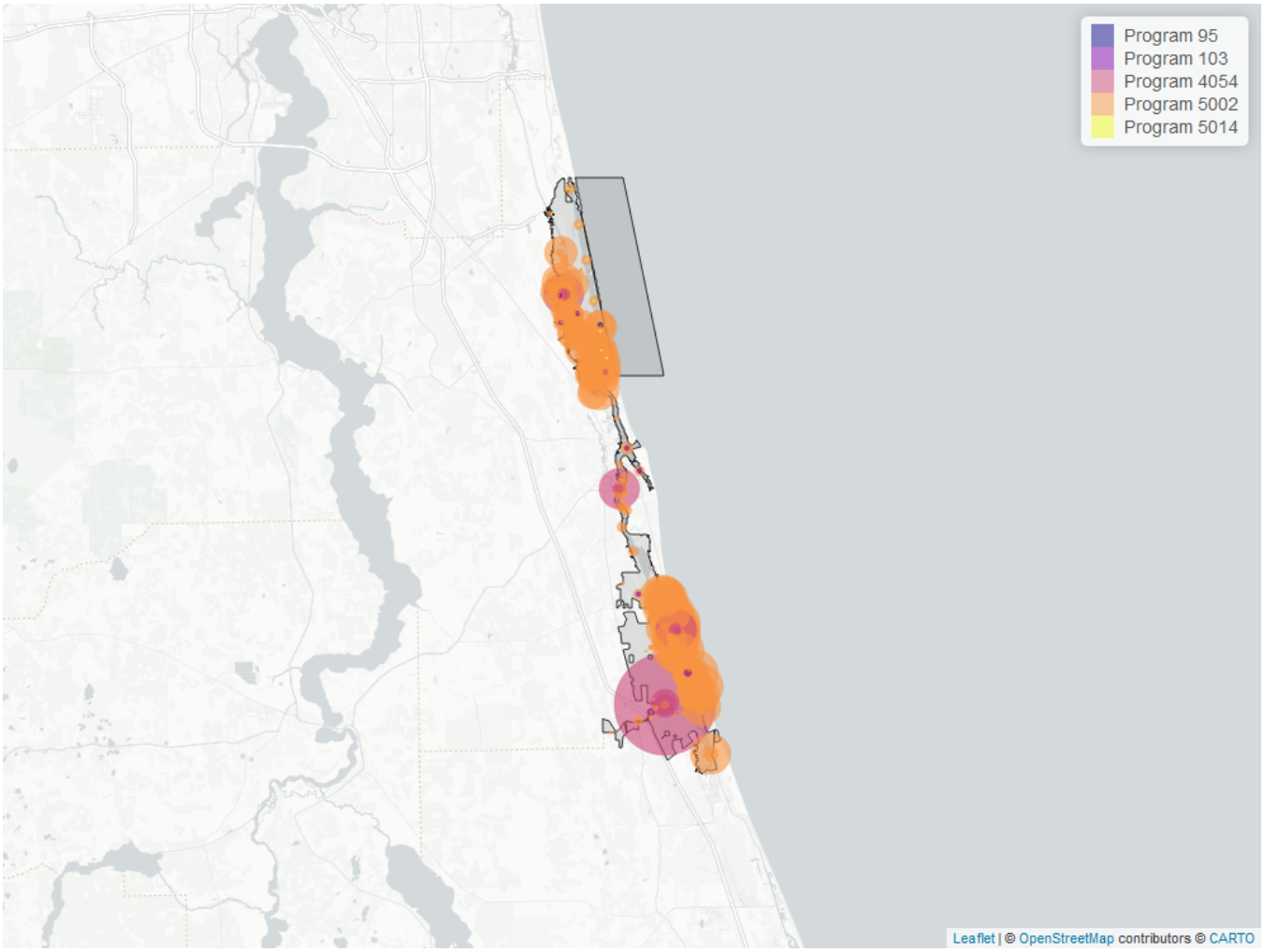

Figure 24: Map showing location of Discrete sampling sites for Turbidity. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 29: Programs contributing data for Turbidity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	14570	1995	2024
4054	2683	2002	2021
5014	126	2018	2022
103	59	2020	2021
95	4	2012	2012

Program names:

95 - Harmful Algal Bloom Marine Observation Network[4]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Water Temperature - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

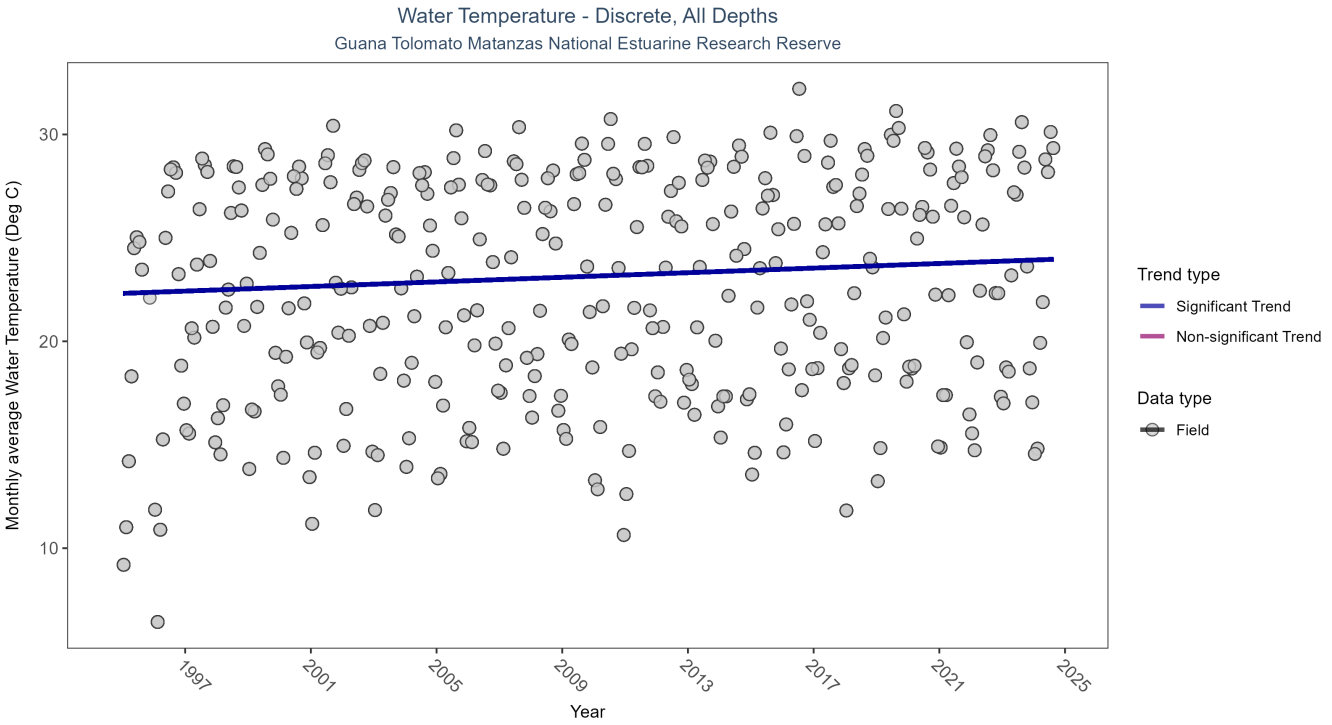

Figure 25: Seasonal Kendall-Tau Results for Water Temperature - Discrete

Table 30: Seasonal Kendall-Tau Trend Analysis for Water Temperature

RelativeDepth	N-Data	N-Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	25244	30	23.3	TRUE	0.2236	0	0.0556	22.3162	17.3004	0.0993	1

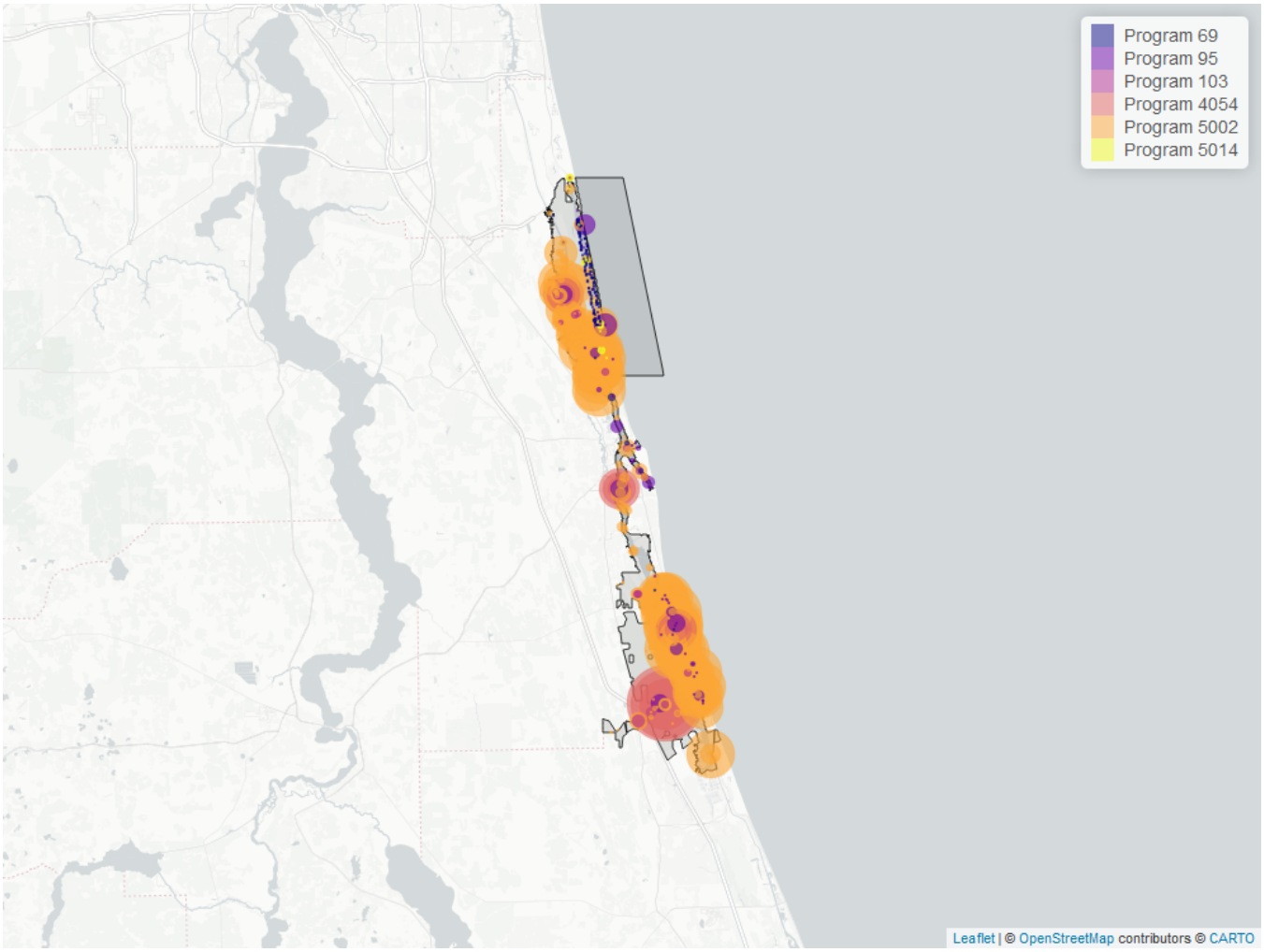

Figure 26: Map showing location of Discrete sampling sites for Water Temperature. The bubble size on the maps below reflect the amount of data available at each sampling site.

Table 31: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	21270	1995	2024
4054	3582	2002	2024
95	534	2007	2018
5014	267	2017	2022
69	190	2001	2010
103	168	2020	2021

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program[7]
95 - Harmful Algal Bloom Marine Observation Network[4]
103 - EPA STOrage and RETrieval Data Warehouse (STORET)/WQX[5]
4054 - Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program[1]
5002 - Florida STORET / WIN[2]
5014 - Guana River and Guana Lake Water Quality Monitoring[3]

Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NE-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NE-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_pH_NE-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NE-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NE-2024-Dec-08.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NE-2024-Dec-08.txt*

Continuous monitoring locations in Guana Tolomato Matanzas National Estuarine Research Reserve

Table 32: Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program (4054)

ProgramLocationID	*Years of Data*	*Use in Analysis*	*Parameters*
gtmfmwq	24	TRUE	DO , DOS , pH , Sal , Turb , TempW
gtmpcwq	24	TRUE	DO , DOS , pH , Sal , Turb , TempW
gtmpiwq	24	TRUE	DO , DOS , pH , Sal , Turb , TempW
gtmsswq	23	TRUE	DO , DOS , pH , Sal , Turb , TempW

Table 33: FDEP Bureau of Survey and Mapping Continuous Water Quality Program (5062)

ProgramLocationID	*Years of Data*	*Use in Analysis*	*Parameters*
872-0494	2	FALSE	Sal , TempW

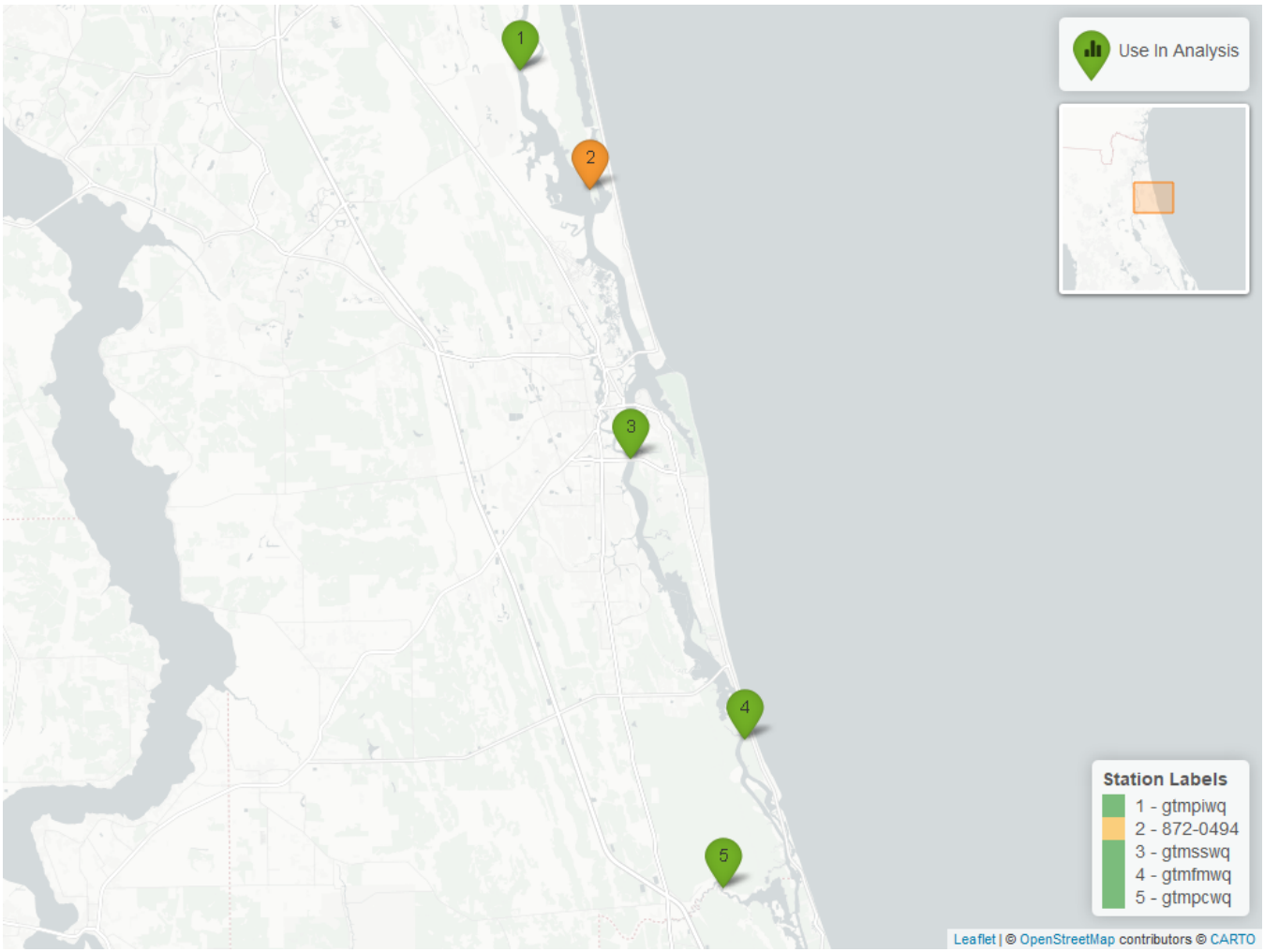

Figure 27: Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Guana Tolomato Matanzas National Estuarine Research Reserve. Sites marked as *Use In Analysis* are featured in this report.

Dissolved Oxygen - All Stations Combined

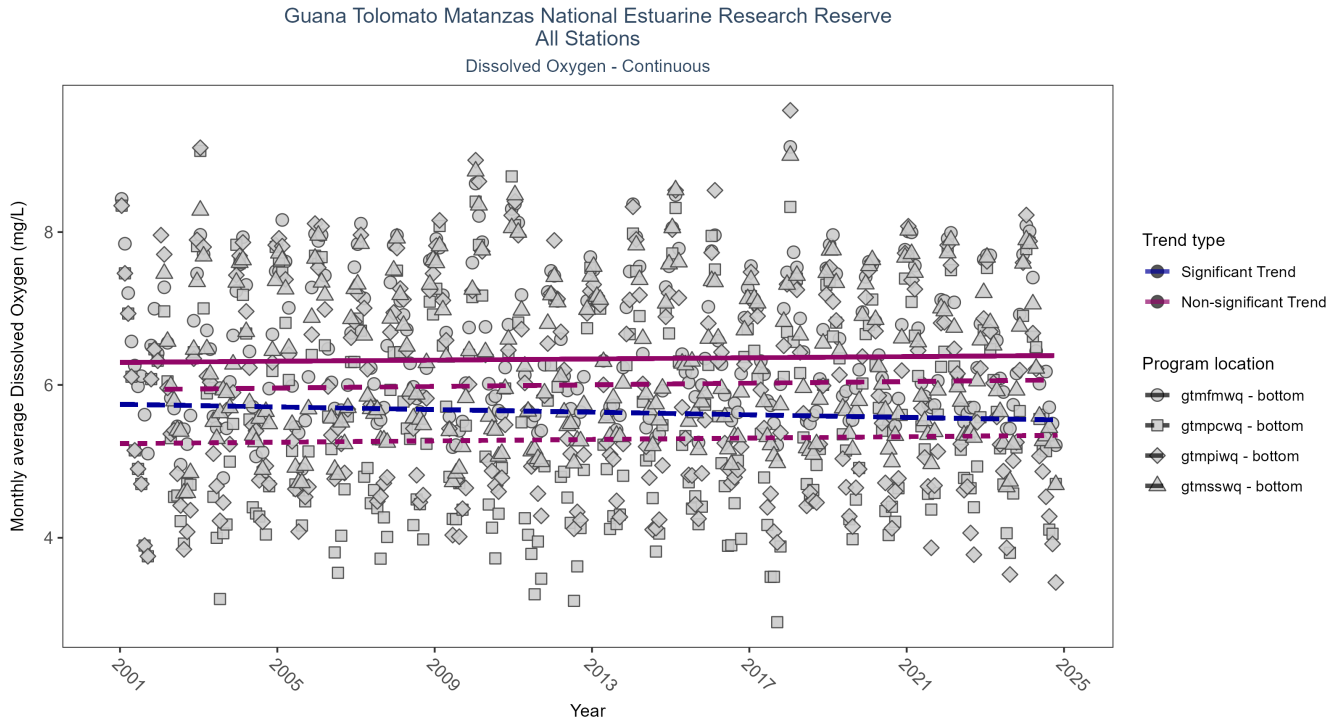

Figure 28: Figure for Dissolved Oxygen - Continuous - All stations combined

Table 34: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmsswq	651882	23	2002 - 2024	6.3	0.08	5.94	0.01	0.0701
gtmpcwq	694170	24	2001 - 2024	5.5	0.04	5.23	0.00	0.3089
gtmpiwq	657932	24	2001 - 2024	5.9	-0.11	5.75	-0.01	0.0126
gtmfmwq	673507	24	2001 - 2024	6.4	0.07	6.29	0.00	0.0860

Dissolved Oxygen Saturation - All Stations Combined

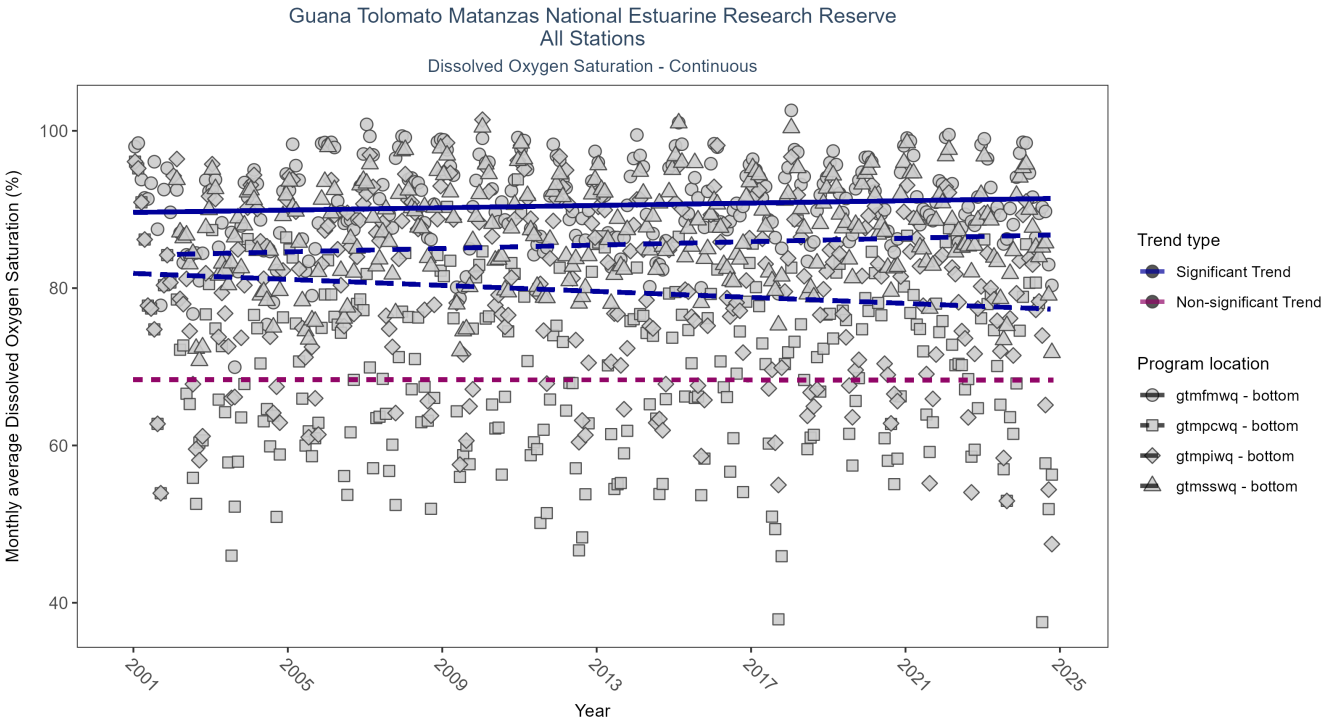

Figure 29: Figure for Dissolved Oxygen Saturation - Continuous - All stations combined

Table 35: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen Saturation

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmpcwq	695663	24	2001 - 2024	71.2	-0.01	68.37	0.00	0.9536
gtmsswq	657818	23	2002 - 2024	89.4	0.14	84.28	0.11	0.0019
gtmfmwq	685174	24	2001 - 2024	92.6	0.13	89.62	0.07	0.0029
gtmpiwq	663744	24	2001 - 2024	82.2	-0.19	81.87	-0.19	0.0000

pH - All Stations Combined

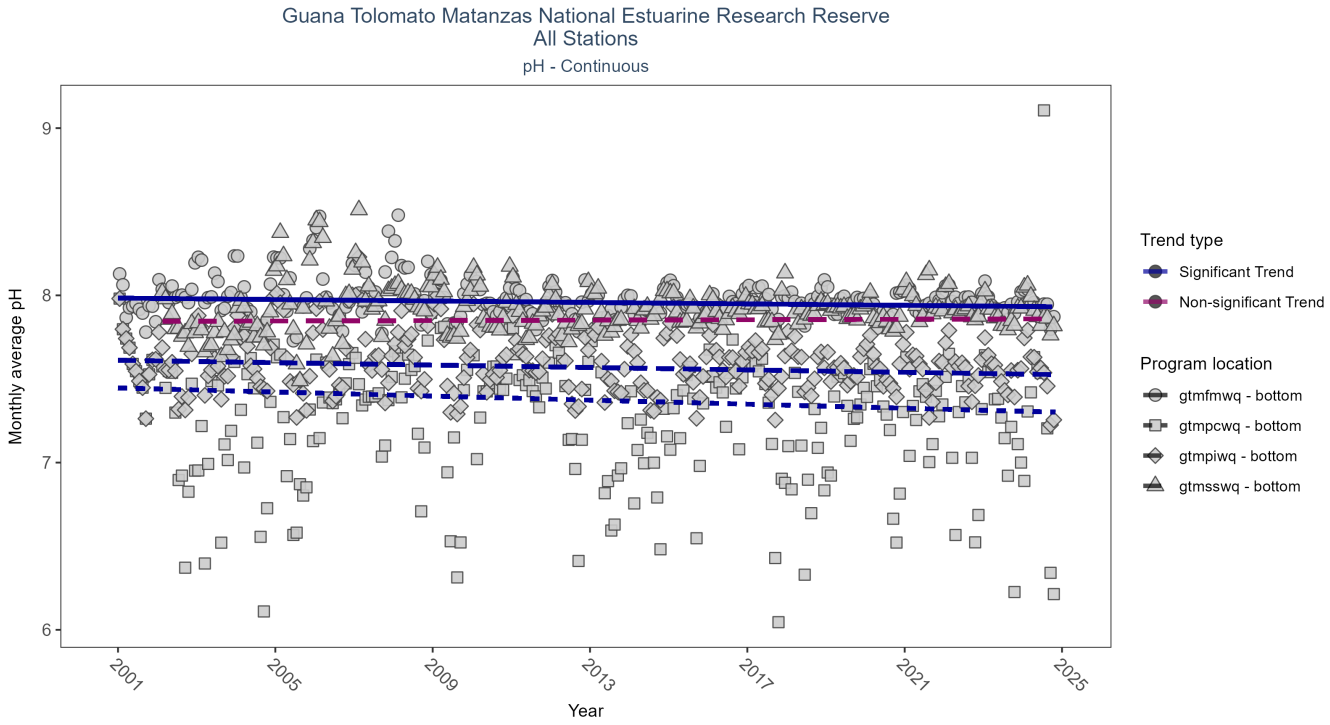

Figure 30: Figure for pH - Continuous - All stations combined

Table 36: Seasonal Kendall-Tau Results for All Stations - pH

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmsswq	627587	23	2002 - 2024	7.9	0.03	7.84	0.00	0.4181
gtmpiwq	654000	24	2001 - 2024	7.6	-0.17	7.61	0.00	0.0001
gtmpcwq	687239	24	2001 - 2024	7.4	-0.12	7.45	-0.01	0.0048
gtmfmwq	659640	24	2001 - 2024	8.0	-0.15	7.98	0.00	0.0007

Salinity - All Stations Combined

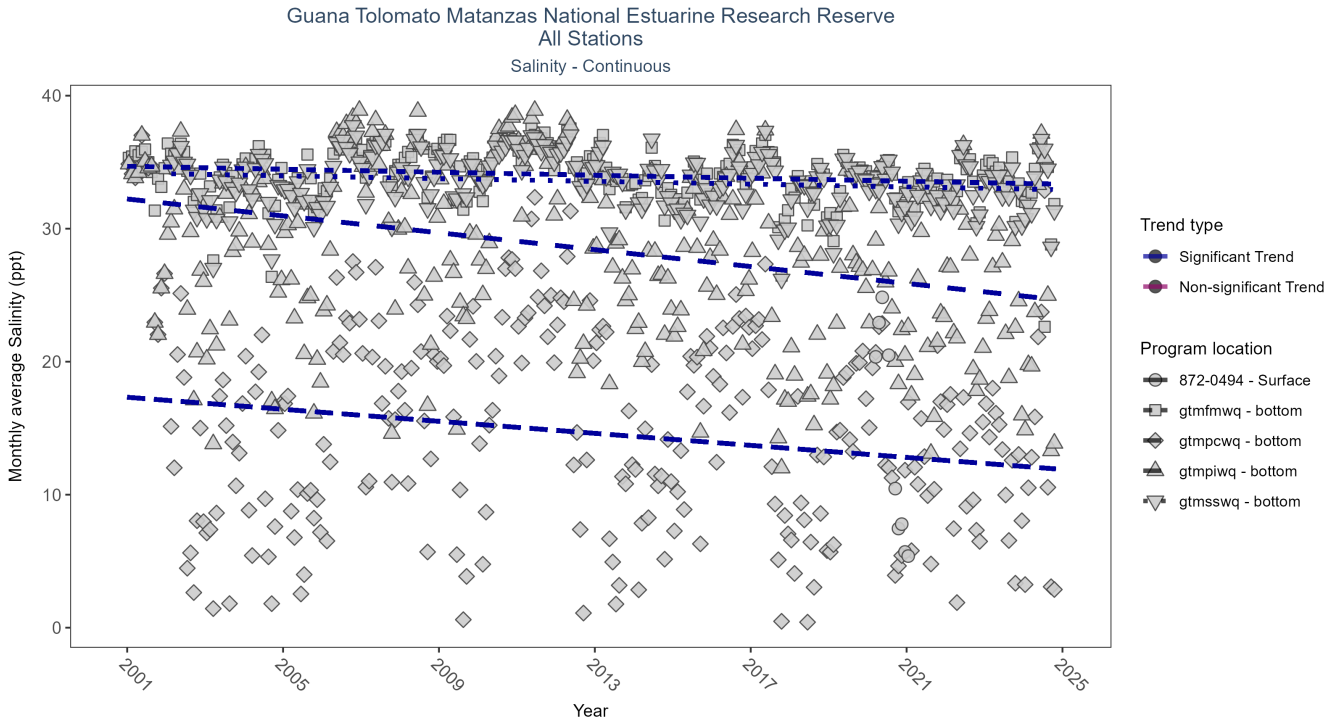

Figure 31: Figure for Salinity - Continuous - All stations combined

Table 37: Seasonal Kendall-Tau Results for All Stations - Salinity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmpiwq	659986	24	2001 - 2024	28.00	-0.26	32.23	-0.32	0.0000
gtmsswq	636557	23	2002 - 2024	34.00	-0.11	34.13	-0.05	0.0131
gtmpcwq	703730	24	2001 - 2024	16.70	-0.14	17.32	-0.23	0.0015
gtmfmwq	660962	24	2001 - 2024	34.40	-0.15	34.69	-0.06	0.0003
872-0494	34918	2	2020 - 2021	8.99	-	-	-	-

Turbidity - All Stations Combined

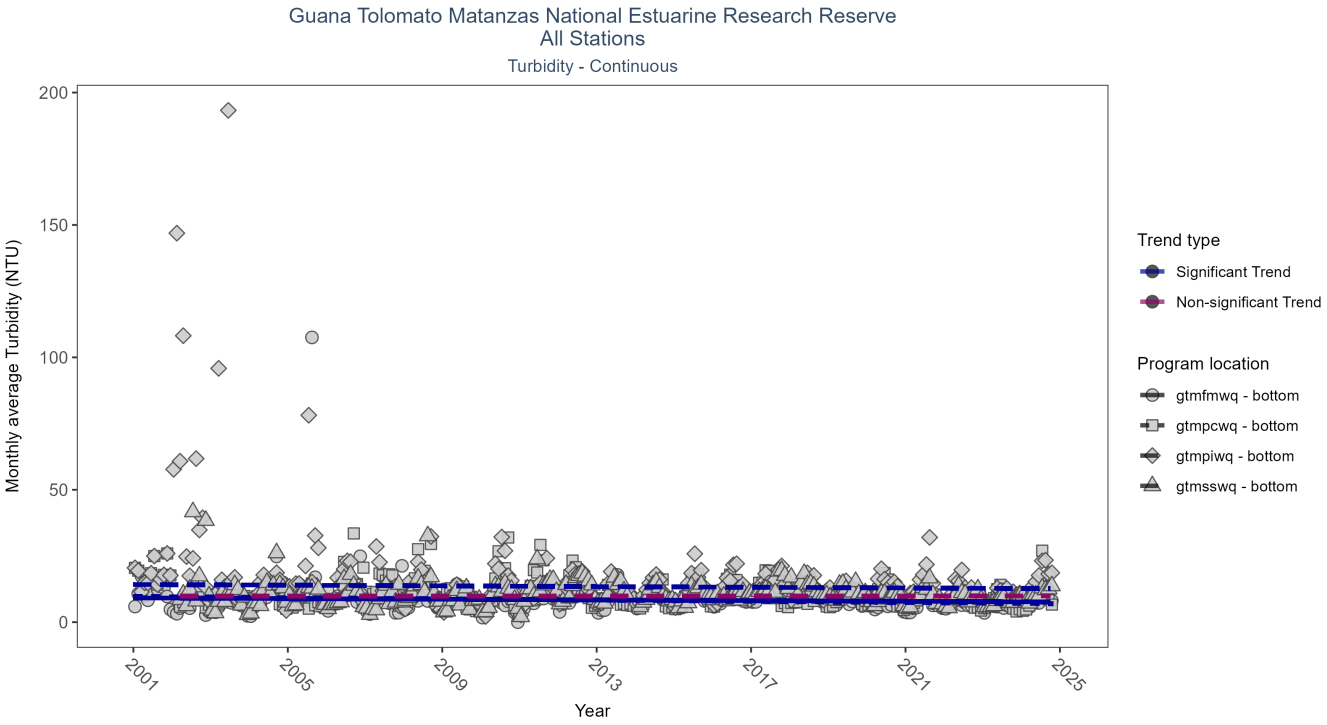

Figure 32: Figure for Turbidity - Continuous - All stations combined

Table 38: Seasonal Kendall-Tau Results for All Stations - Turbidity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmsswq	623179	23	2002 - 2024	9	0.01	9.87	0.00	0.9808
gtmfmwq	670954	24	2001 - 2024	7	-0.11	9.18	-0.06	0.0082
gtmpcwq	678303	24	2001 - 2024	9	-0.17	9.72	-0.11	0.0001
gtmpiwq	633953	24	2001 - 2024	11	-0.09	14.24	-0.07	0.0407

Water Temperature - All Stations Combined

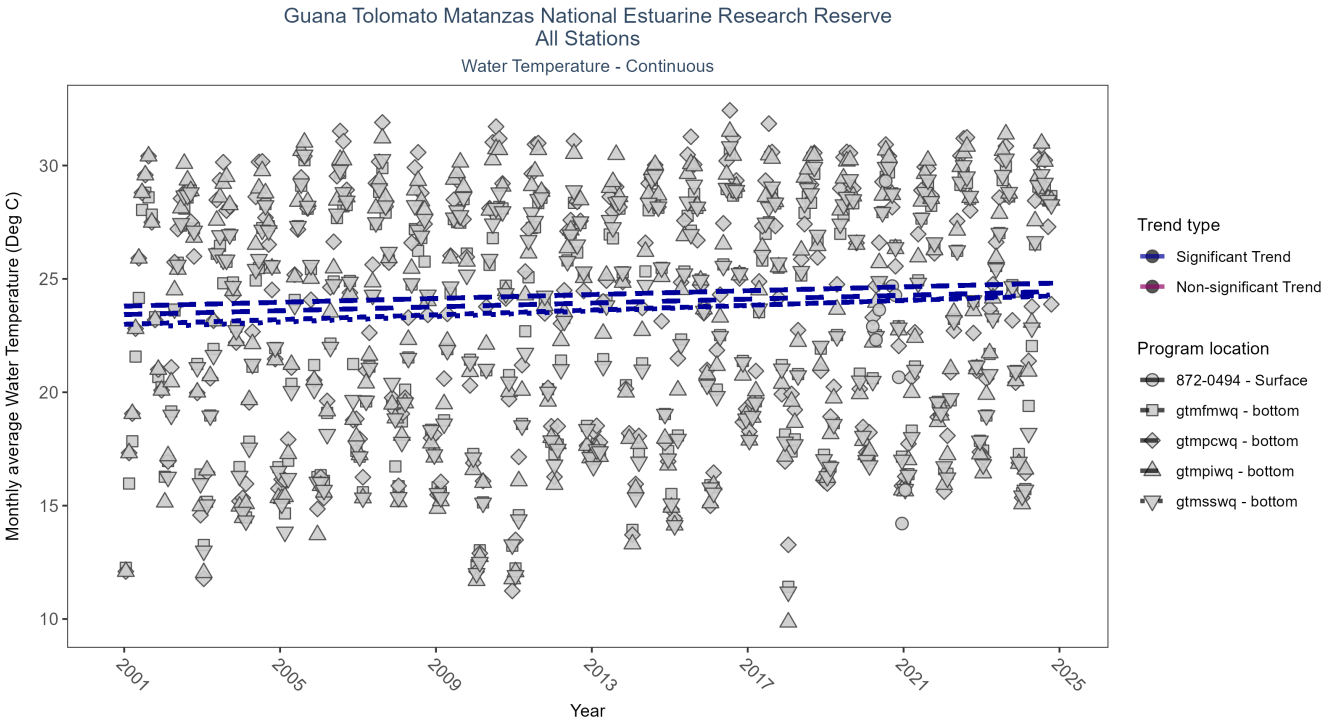

Figure 33: Figure for Water Temperature - Continuous - All stations combined

Table 39: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
gtmfmwq	704620	24	2001 - 2024	23.80	0.25	23	0.05	0.0000
gtmpcwq	712296	24	2001 - 2024	24.40	0.15	23.8	0.04	0.0004
gtmpiwq	710270	24	2001 - 2024	24.30	0.2	23.43	0.04	0.0000
gtmsswq	670158	23	2002 - 2024	23.90	0.25	22.91	0.06	0.0000
872-0494	35473	2	2020 - 2021	22.34	-	-	-	-

Coastal Wetlands

The data file used is: **All_CW_Parameters-2024-Dec-08.txt**

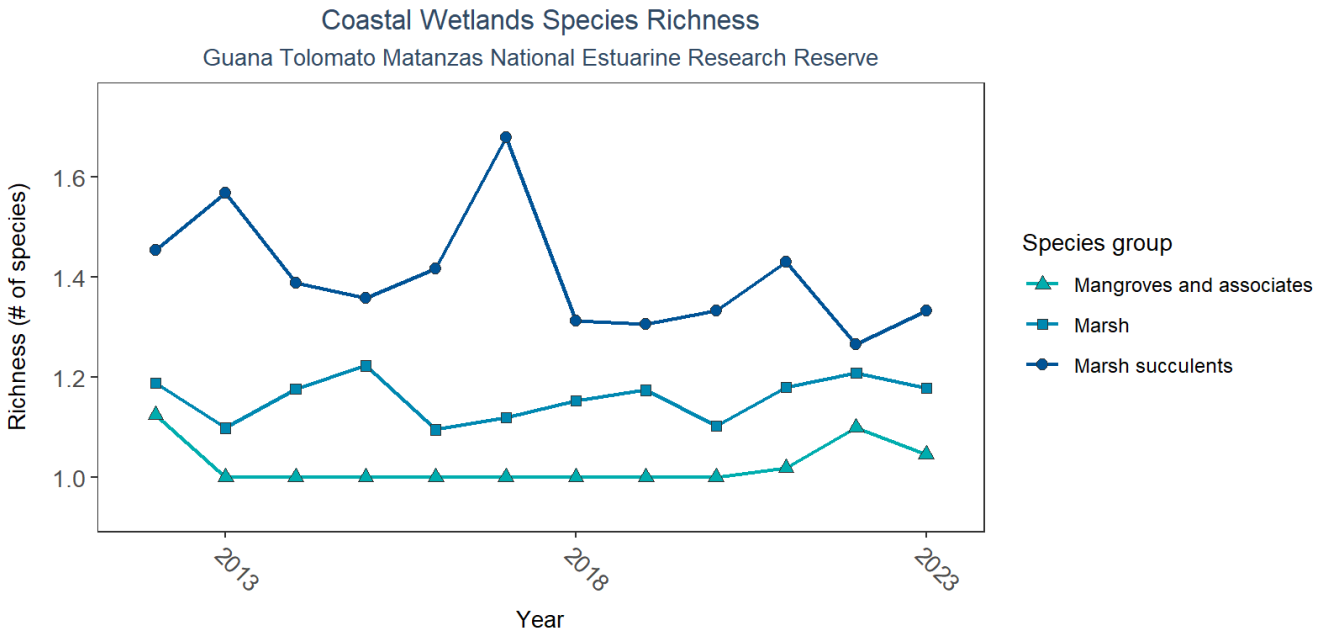

Figure 34: Figure for Coastal Wetlands Species Richness in Guana Tolomato Matanzas National Estuarine Research Reserve

Table 40: Coastal Wetlands Species Richness

Species Group	*Sample Count*	*Number of Years*	*Period of Record*	*Median N of Taxa*	*Mean N of Taxa*
Mangroves and associates	387	12	2012 - 2023	1	1.02
Marsh	1773	12	2012 - 2023	1	1.17
Marsh succulents	810	12	2012 - 2023	1	1.40

Oyster

The data file used is: **All_OYSTER_Parameters-2024-Dec-08.txt**

Density

Natural

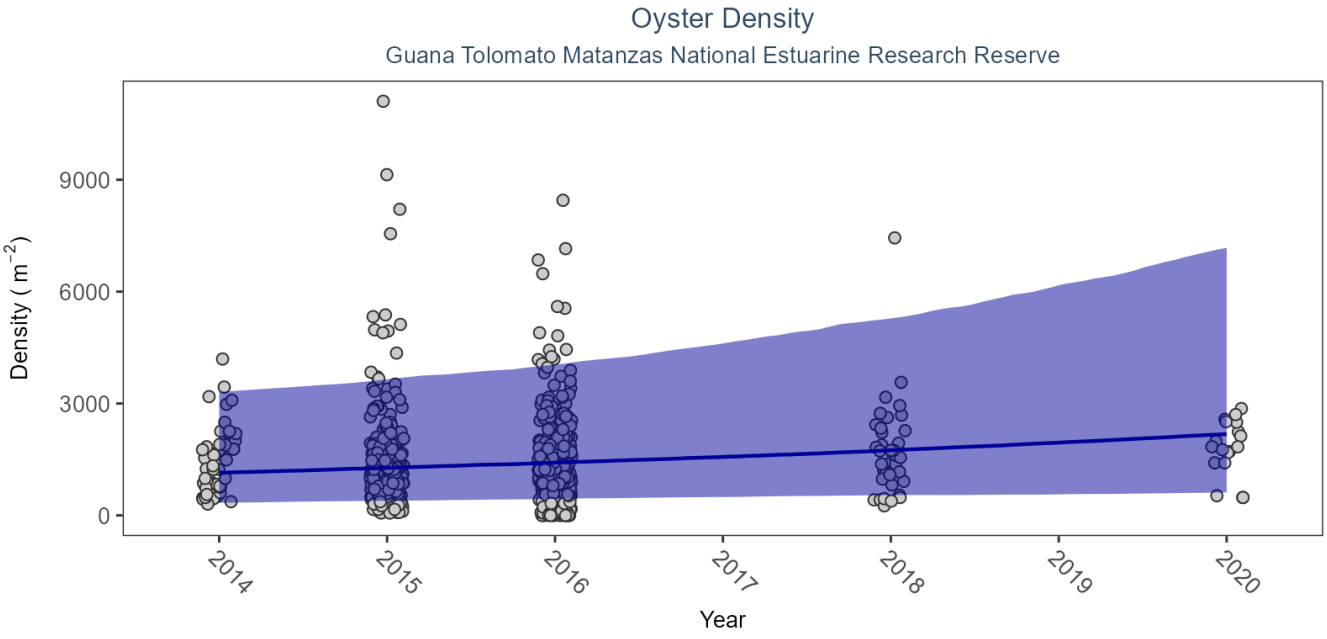

Figure 35: Figure for Oyster Density in Guana Tolomato Matanzas National Estuarine Research Reserve

Table 41: Model results for Oyster Density - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oyster Shells	Natural	No significant change	0.11	0.07	-0.02 to 0.25

Percent Live

Natural

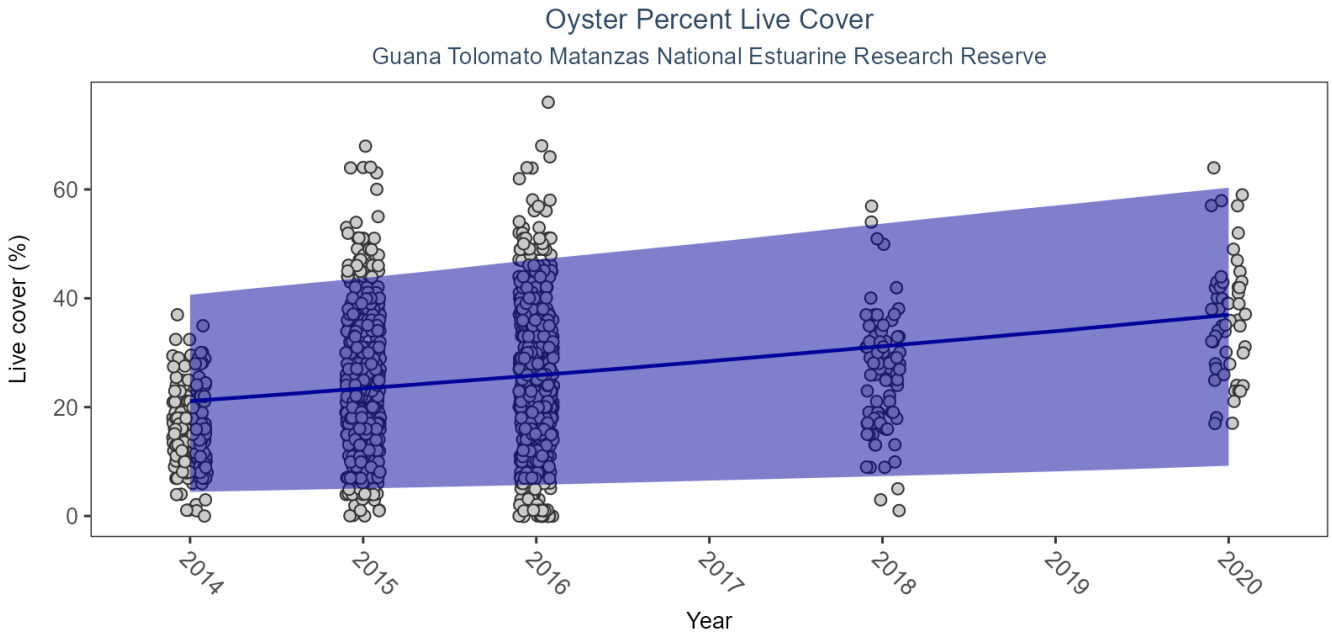

Figure 36: Figure for Oyster Percent Live in Guana Tolomato Matanzas National Estuarine Research Reserve

Table 42: Model results for Oyster Percent Live - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Live Oyster Shells	Natural	Significantly increasing trend	0.13	0.01	0.11 to 0.15

Shell Height

Natural

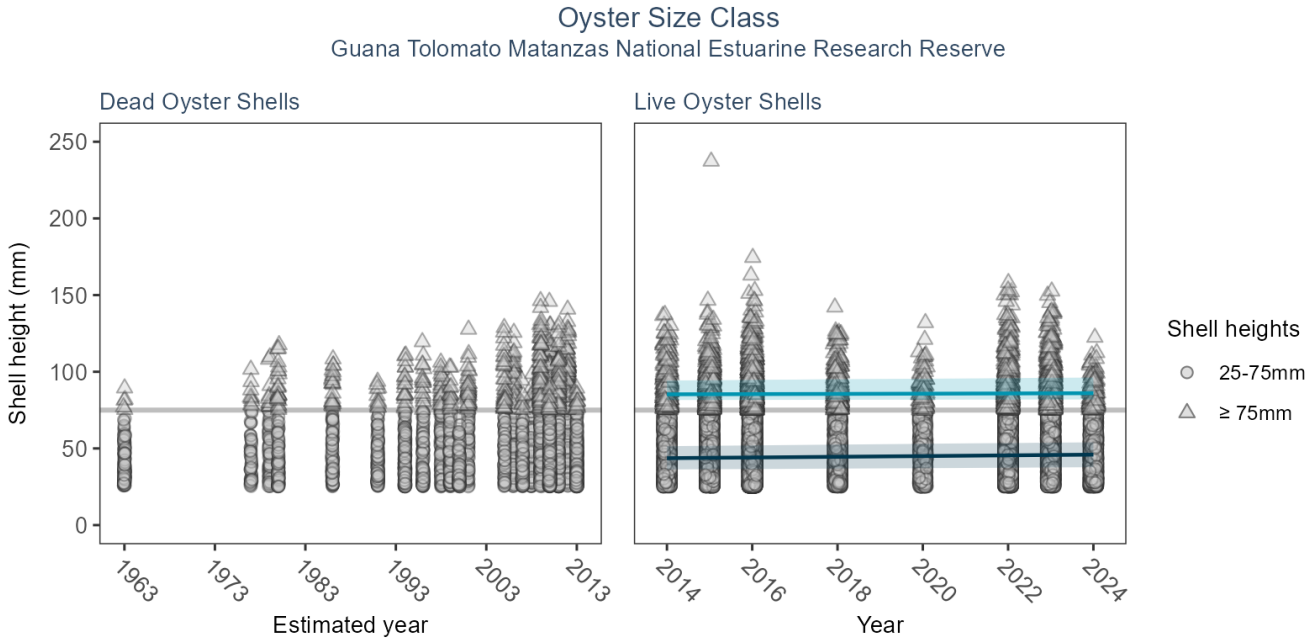

Figure 37: Figure for Oyster Shell Height in Guana Tolomato Matanzas National Estuarine Research Reserve

Table 43: Model results for Oyster Shell Height - Natural

Shell Type	*Habitat Type*	*Trend Status*	*Estimate*	*Standard Error*	*Credible Interval*
Dead Oyster Shells	Natural	-	-	-	NA to NA
Dead Oyster Shells	Natural	-	-	-	NA to NA
Dead Oyster Shells	Natural	-	-	-	NA to NA
Live Oyster Shells	Natural	No significant change	2.62	1.43	-0.13 to 5.6
Live Oyster Shells	Natural	Significantly increasing trend	2.29	1.04	0.34 to 4.44
Live Oyster Shells	Natural	-	-	-	NA to NA

References

1. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR); NOAA National Estuarine Research Reserve System (NERRS). Guana Tolomato Matanzas National Estuarine Research Reserve System-Wide Monitoring Program. (2024).
2. Florida Department of Environmental Protection (DEP). Florida STORET / WIN. (2024).
3. Florida Department of Environmental Protection (DEP); Office of Resilience and Coastal Protection (RCP); Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR); Friends of GTM; Florida Fish and Wildlife Conservation Commission (FWC). Guana River and Guana Lake Water Quality Monitoring . (2024).
4. Florida Fish and Wildlife Conservation Commission (FWC); Florida Fish and Wildlife Research Institute (FWRI). Harmful Algal Bloom Marine Observation Network. (2018).
5. U.S. Environmental Protection Agency (EPA). EPA STOrage and RETrieval Data Warehouse (STORET)/WQX. (2023).
6. 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).
7. Florida Fish and Wildlife Conservation Commission (FWC). Fisheries-Independent Monitoring (FIM) Program. (2022).