

Loxahatchee River-Lake Worth Creek Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 14 March, 2024

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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	Sensor Type
Dissolved Oxygen	mg/L	0	50	YSI EXOs
Dissolved Oxygen	mg/L	0	50	Analysis Only - 2022-04-04
Dissolved Oxygen	mg/L	0	50	6600 Series
Salinity	ppt	0	70	6600 Series
Salinity	ppt	0	70	YSI EXOs
Salinity	ppt	0	70	Analysis Only - 2022-04-04
Water Temperature	Degrees C	-5	45	YSI EXOs
Water Temperature	Degrees C	-5	45	Analysis Only - 2022-04-04
Water Temperature	Degrees C	-5	45	6600 Series
pH	pH	2	14	Analysis Only - 2022-04-04
pH	pH	2	14	6600 Series
pH	pH	2	14	YSI EXOs
Dissolved Oxygen Saturation	%	0	500	YSI EXOs
Dissolved Oxygen Saturation	%	0	500	6600 Series
Dissolved Oxygen Saturation	%	0	500	Analysis Only - 2022-04-04
Specific Conductivity	mS/cm	0	100	6600 Series
Specific Conductivity	mS/cm	0	200	YSI EXOs
Turbidity	NTU	0	4000	YSI EXOs
Turbidity	NTU	0	1000	6600 Series
Turbidity	NTU	0	4000	Analysis Only - 2022-04-04

Table 2: Discrete Water Quality threshold values

Parameter Name	Units	Low Threshold	High Threshold
Dissolved Oxygen	mg/L	0.000001	22
Salinity	ppt	0	70
Water Temperature	Degrees C	3	40
pH		2	13
Dissolved Oxygen Saturation	%	0.000001	310
Specific Conductivity	mS/cm	0.005000001	100
Turbidity	NTU	0	-
Total Suspended Solids (TSS)	mg/L	0	-
Chlorophyll a uncorrected for pheophytin	ug/L	0	-
Chlorophyll a corrected for pheophytin	ug/L	0	-
Secchi Depth	m	0.000001	50
Light Extinction Coefficient	m^1	0	-
Colored dissolved organic matter, CDOM	PCU	0	-
Fluorescent dissolved organic matter, FDOM	QSE	0	-
Total Nitrogen	mg/L	0	-
Total Kjeldahl Nitrogen TKN	mg/L	0	-
NO2+3 Filtered	mg/L	0	-
NH4 Filtered	mg/L	0	-
Total Phosphorus	mg/L	0	-

Parameter Name	Units	Low Threshold	High Threshold
PO4 Filtered	mg/L	0	-
Ammonia- Un-ionized (NH3)	mg/L	0	-
Nitrate (N)	mg/L	0	-
Nitrite (N)	mg/L	0	-
Nitrogen, organic	mg/L	0	-

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

SEACAR QAQC Description	Include	SEACAR QAQCFlagCode
Exceeds Maximum threshold. Not verified in raw data	No	2Q
Exceeds Maximum threshold. Verified in raw data	No	3Q
Below Minimum threshold. Not verified in raw data	No	4Q
Below Minimum threshold. Verified in raw data	No	5Q
Within threshold tolerance	Yes	6Q
No defined thresholds for this parameter	Yes	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	No	0	Value based on field kit determination; results may not be accurate
STORET-WIN	J	No	0	Estimated value
STORET-WIN	V	No	0	Analyte was detected at or above method detection limit
STORET-WIN	Y	No	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 determination; 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

<i>Qualifier Source</i>	<i>Value Qualifier</i>	<i>Include</i>	<i>Description</i>
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 surface of all water bodies to the bottom sediments and encompasses the different features found in the water at different depths (National Oceanographic Center, 2016). The water column habitat must be viewed in relation to its interconnectedness with other habitats. A healthy water column is an integral component in ensuring a healthy marine and coastal ecosystem. Having a flourishing marine and coastal ecosystem in Florida is necessary to support a strong economy. The health of the water column is dependent upon factors as diverse as land use (e.g., agriculture, mining, forestry practices); human population growth; emissions, (e.g., power plants, automobiles, wastewater); climate (e.g., rainfall, temperature, winds and currents); and decadal trends (e.g., El Niño/La Niña, Atlantic Multidecadal Oscillation, climate change).

The water column is composed of various physical, chemical and biological features, and only a small number of them are adequately monitored. Features of the water column that are monitored are used as indicators of the water column health and help assess the status of other habitats. These indicators include nutrient concentrations (nitrogen and phosphorus); water quality (dissolved oxygen, temperature, salinity and pH); water clarity (Secchi depth, turbidity, chlorophyll-a and colored dissolved organic matter); and nekton (fish, macroinvertebrates and megafauna).

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**.

Water Quality - Discrete

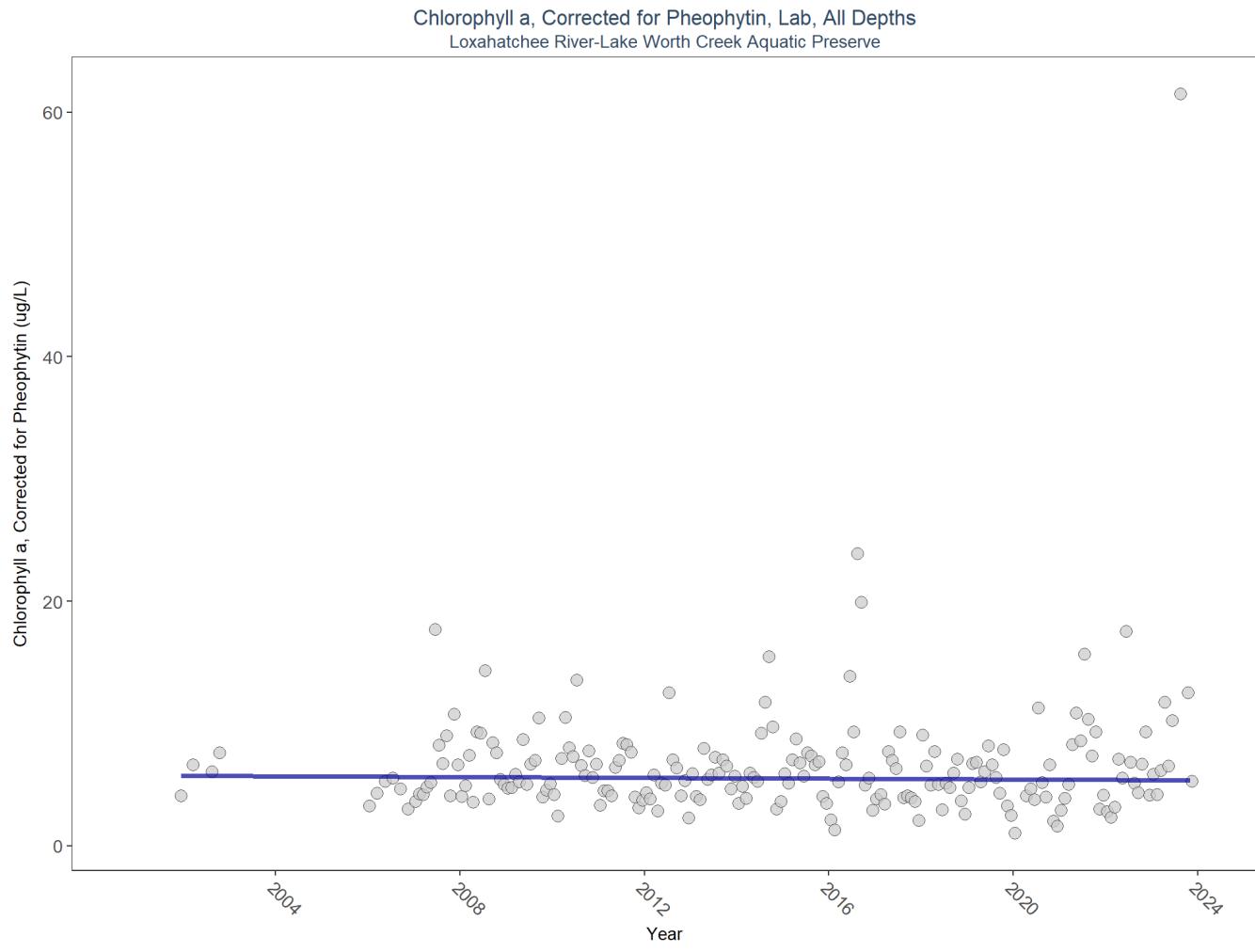
The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_pH-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Salinity-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Turbidity-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2024-Feb-22.txt*

Chlorophyll a, Corrected for Pheophytin - Discrete Water Quality

Chlorophyll-a is monitored as a measure of microalgae growing in the water. Algae are a natural part of coastal and aquatic ecosystems but in excess can cause poor water quality and clarity, and decreased levels of dissolved oxygen.

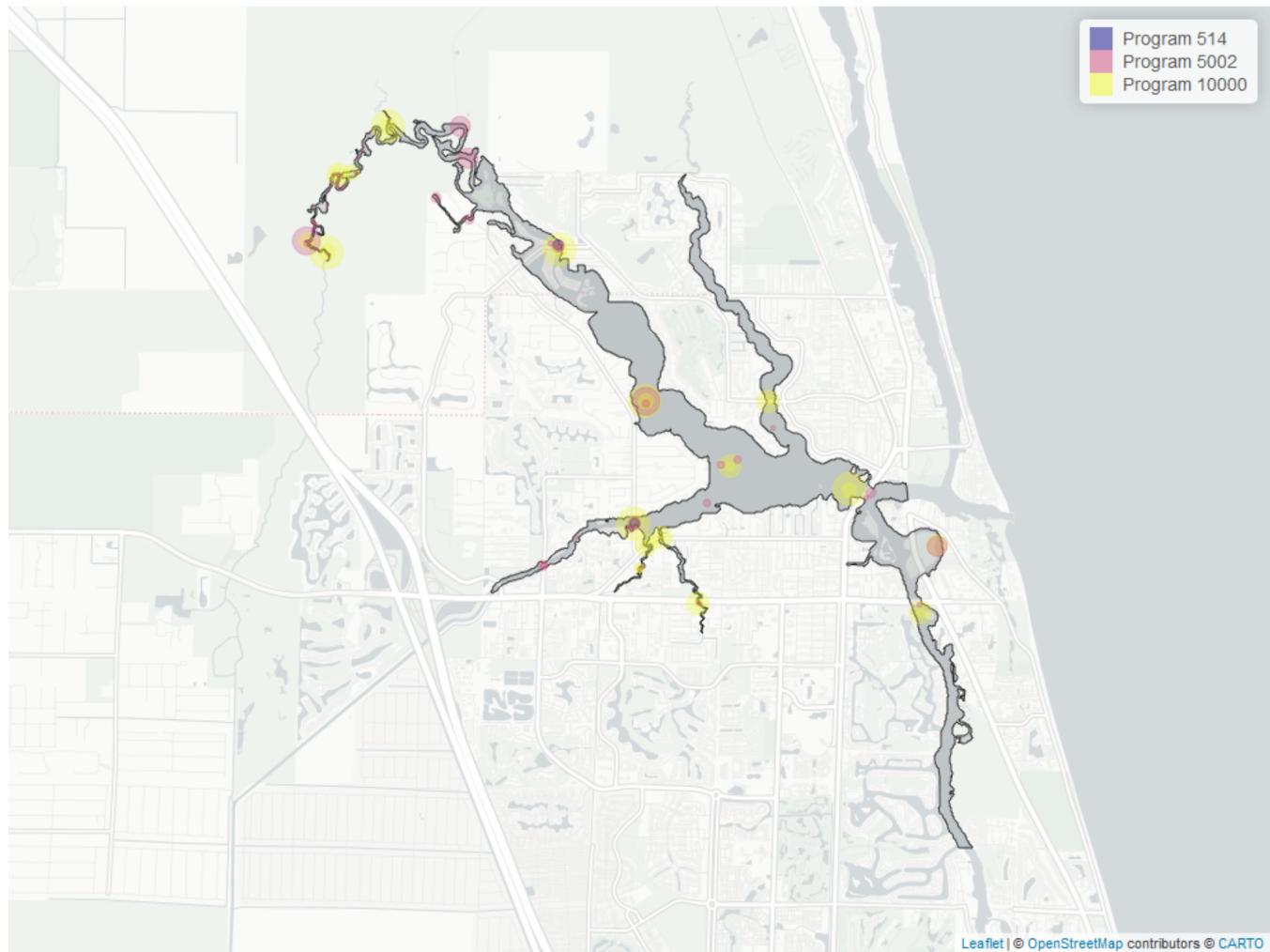
Seasonal Kendall-Tau Trend Analysis



p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Chlorophyll a, Corrected for Pheophytin



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 6: Programs contributing data for Chlorophyll a, Corrected for Pheophytin

ProgramID	N_Data	YearMin	YearMax
10000	2083	2006	2023
5002	682	2001	2023
514	28	2020	2023

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

Value Qualifiers

- N_{Total} is total amount of data for a given year
- $N_{}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 7: Value Qualifiers for Chlorophyll a, Corrected for Pheophytin

Year	N_{Total}	N_I	$perc_I$	N_Q	$perc_Q$	N_U	$perc_U$
2006	107					1	0.9
2007	220	6	2.7			31	14.1
2008	162			5	3.1	8	4.9
2009	162			1	0.6		
2011	166					1	0.6
2012	181	5	2.8			1	0.6
2013	176	1	0.6				
2015	192	1	0.5				
2016	195	1	0.5				
2020	109	3	2.8	4	3.7	8	7.3
2021	168	5	3.0			7	4.2
2022	147	3	2.0			3	2.0
2023	87					1	1.1

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²Q
 - Sample held beyond the accepted holding time ³U - Compound was analyzed for but not detected

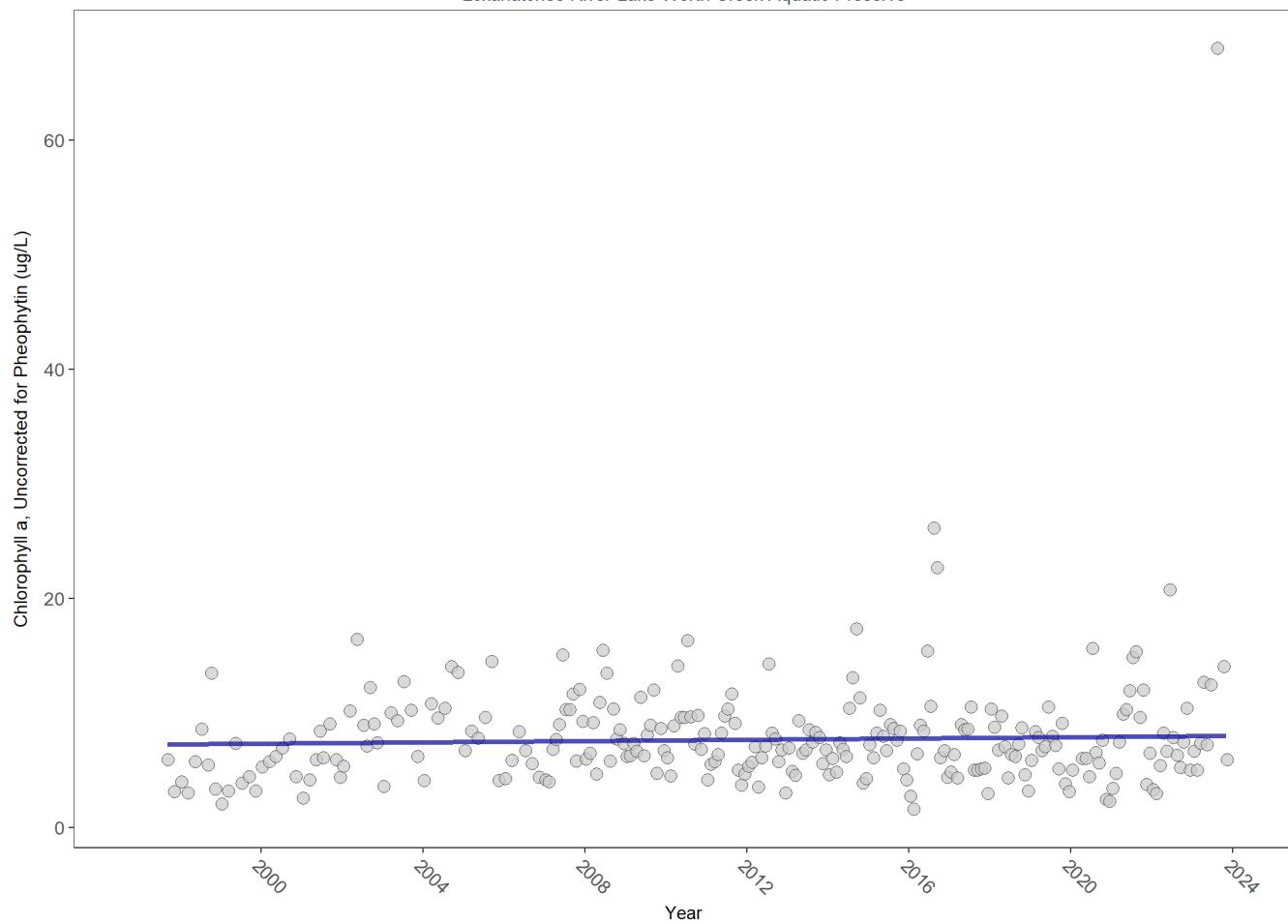
Programs containing Value Qualified data:

5002 - Florida STORET / WIN
 514 - Florida LAKEWATCH Program
 10000 - RiverKeeper

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths
 Loxahatchee River-Lake Worth Creek Aquatic Preserve



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	3805	27	5.6	TRUE	0.042	0.3120	0.02760867	7.245992	12.5965	0.3205	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Chlorophyll a, Uncorrected for Pheophytin

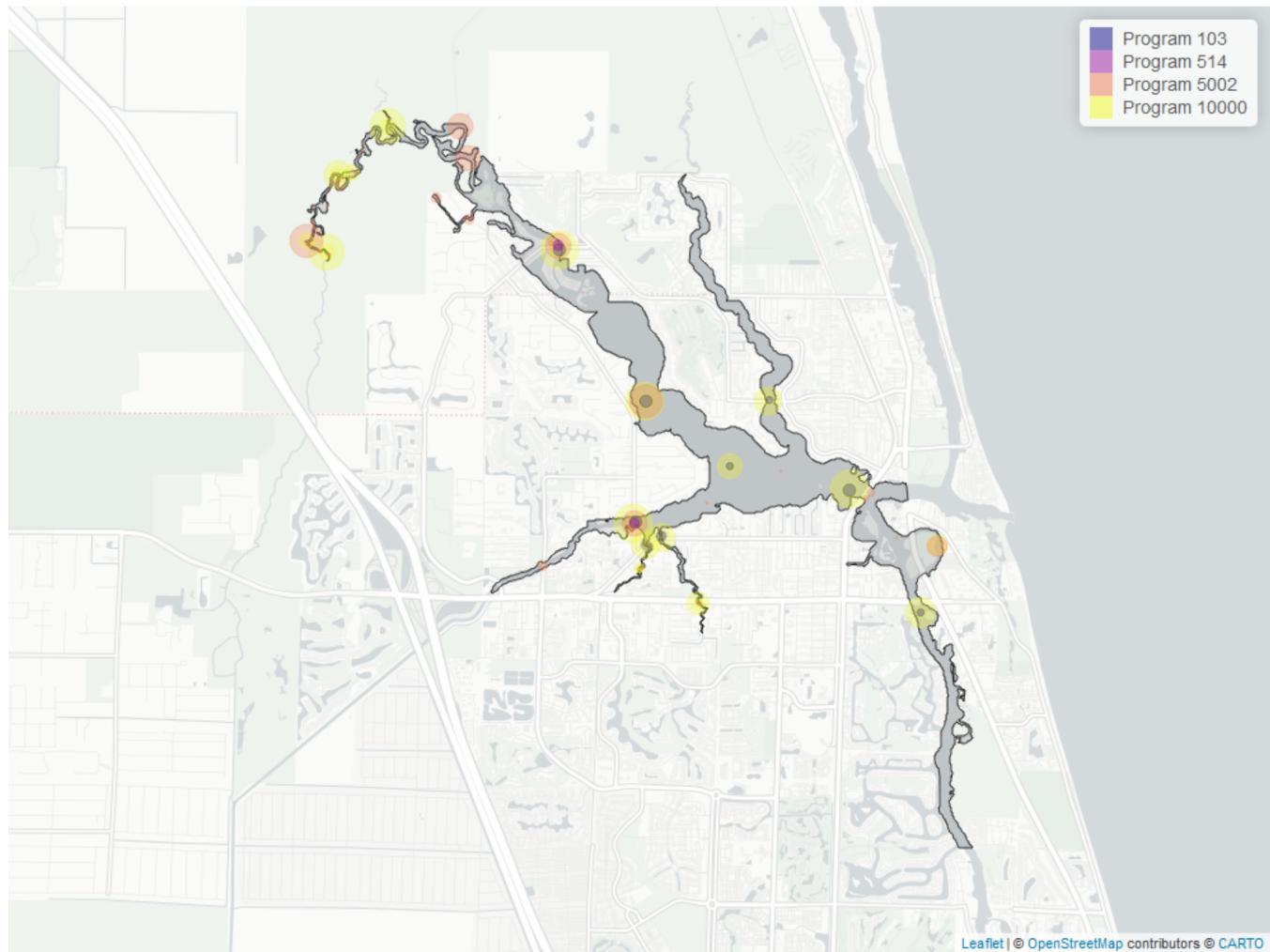


Table 8: Programs contributing data for Chlorophyll a, Uncorrected for Pheophytin

ProgramID	N_Data	YearMin	YearMax
10000	2640	1997	2023
5002	964	1997	2023
103	159	2020	2021
514	62	2016	2023

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

514 - Florida LAKEWATCH Program

Value Qualifiers

- N_{Total} is total amount of data for a given year
- $N_{}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 9: Value Qualifiers for Chlorophyll a, Uncorrected for Pheophytin

Year	N_{Total}	N_I	$perc_I$	N_Q	$perc_Q$	N_U	$perc_U$
1999	89					2	2.2
2003	101					4	4.0
2004	104					1	1.0
2005	116					1	0.9
2006	119					1	0.8
2008	186			5	2.7		
2009	180			1	0.6		
2012	189	1	0.5				
2016	198	1	0.5				
2020	116			4	3.5	2	1.7
2021	320					4	1.2
2022	147					1	0.7

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²Q - Sample held beyond the accepted holding time ³U - Compound was analyzed for but not detected

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

10000 - RiverKeeper

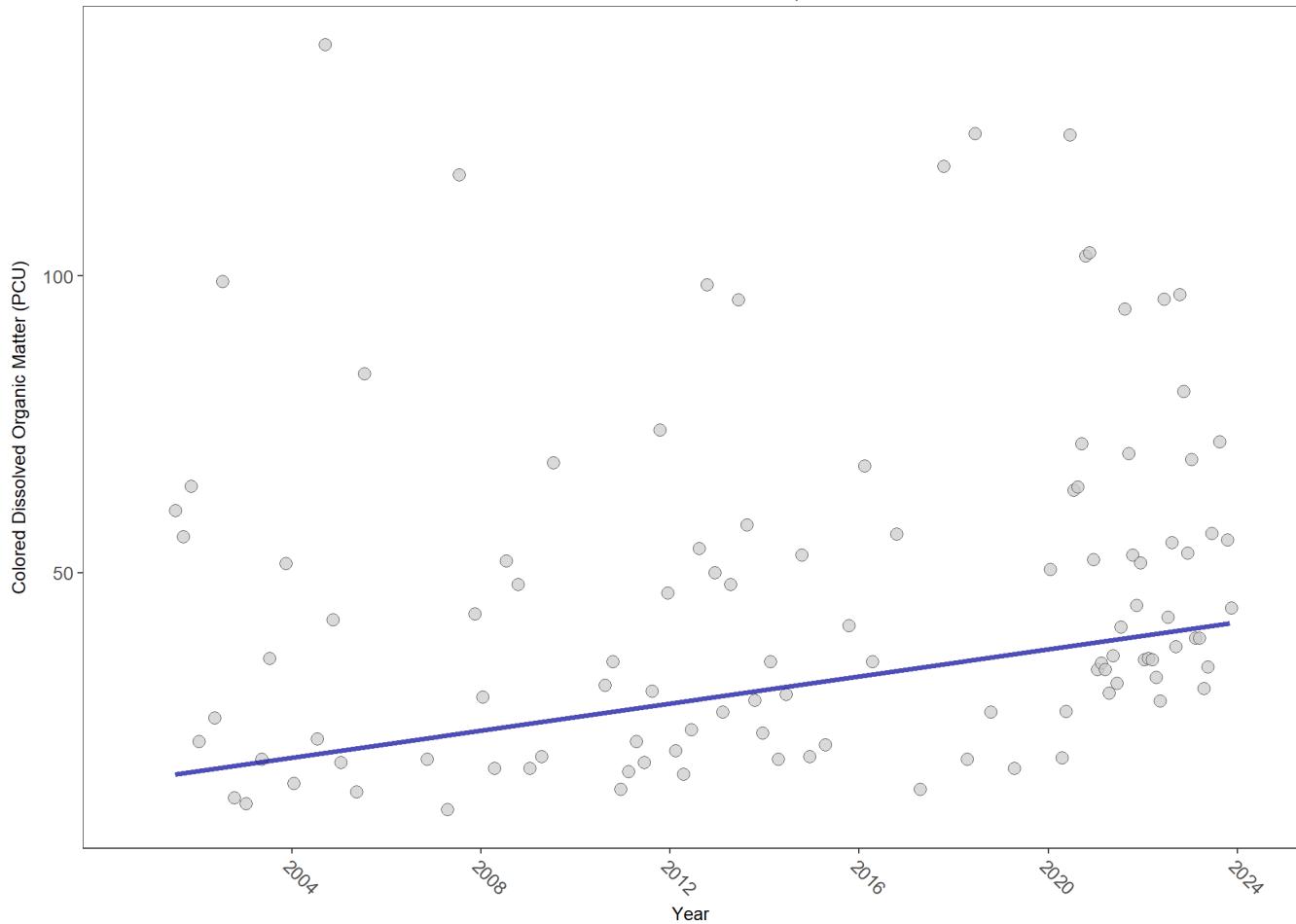
514 - Florida LAKEWATCH Program

Colored Dissolved Organic Matter - Discrete Water Quality

Colored Dissolved Organic Matter (CDOM) occurs naturally in every water body. It is made up of mainly plant material, algae and bacteria. The composition is determined by its source; plants, soil, algae, and wastewater are common sources.

Seasonal Kendall-Tau Trend Analysis

Colored Dissolved Organic Matter, Lab, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

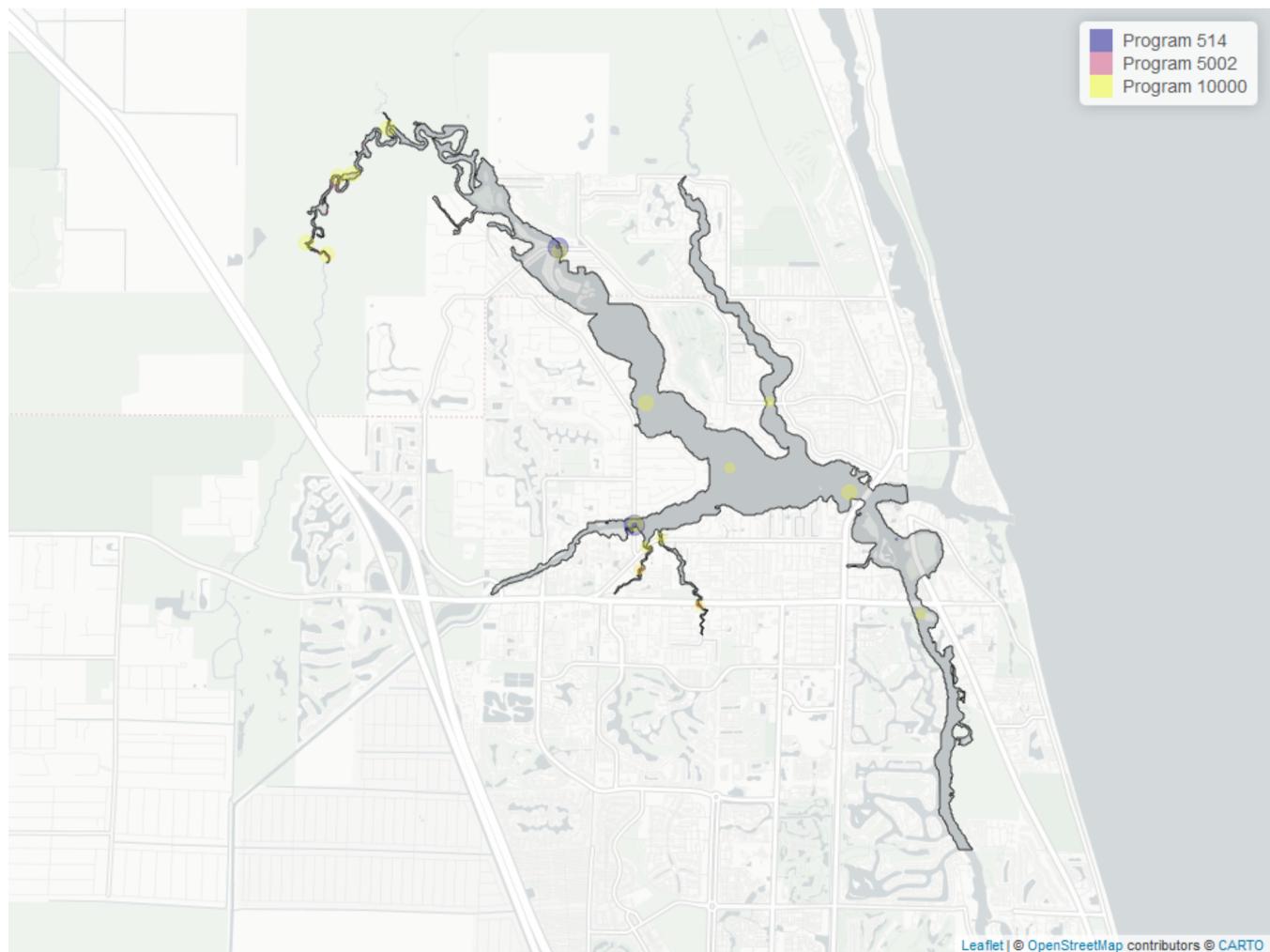


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	607	23	45	TRUE	0.3507	0.0000	1.138889	15.4231	14.5252	0.2053	1

$p < 0.00005$ appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Colored Dissolved Organic Matter



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 10: Programs contributing data for Colored Dissolved Organic Matter

ProgramID	N_Data	YearMin	YearMax
10000	449	2020	2023
514	138	2001	2020
5002	20	2020	2023

Program names:

10000 - RiverKeeper

514 - Florida LAKEWATCH Program

5002 - Florida STORET / WIN

Value Qualifiers

- N_{Total} is total amount of data for a given year
- $N_{_}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{_}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 11: Value Qualifiers for Colored Dissolved Organic Matter

<i>Year</i>	<i>N_Total</i>	<i>N_Q</i>	<i>perc_Q</i>
2020	102	22	21.6

Note: ¹**Q** - Sample held beyond the accepted holding time

Programs containing Value Qualified data:

10000 - RiverKeeper

514 - Florida LAKEWATCH Program

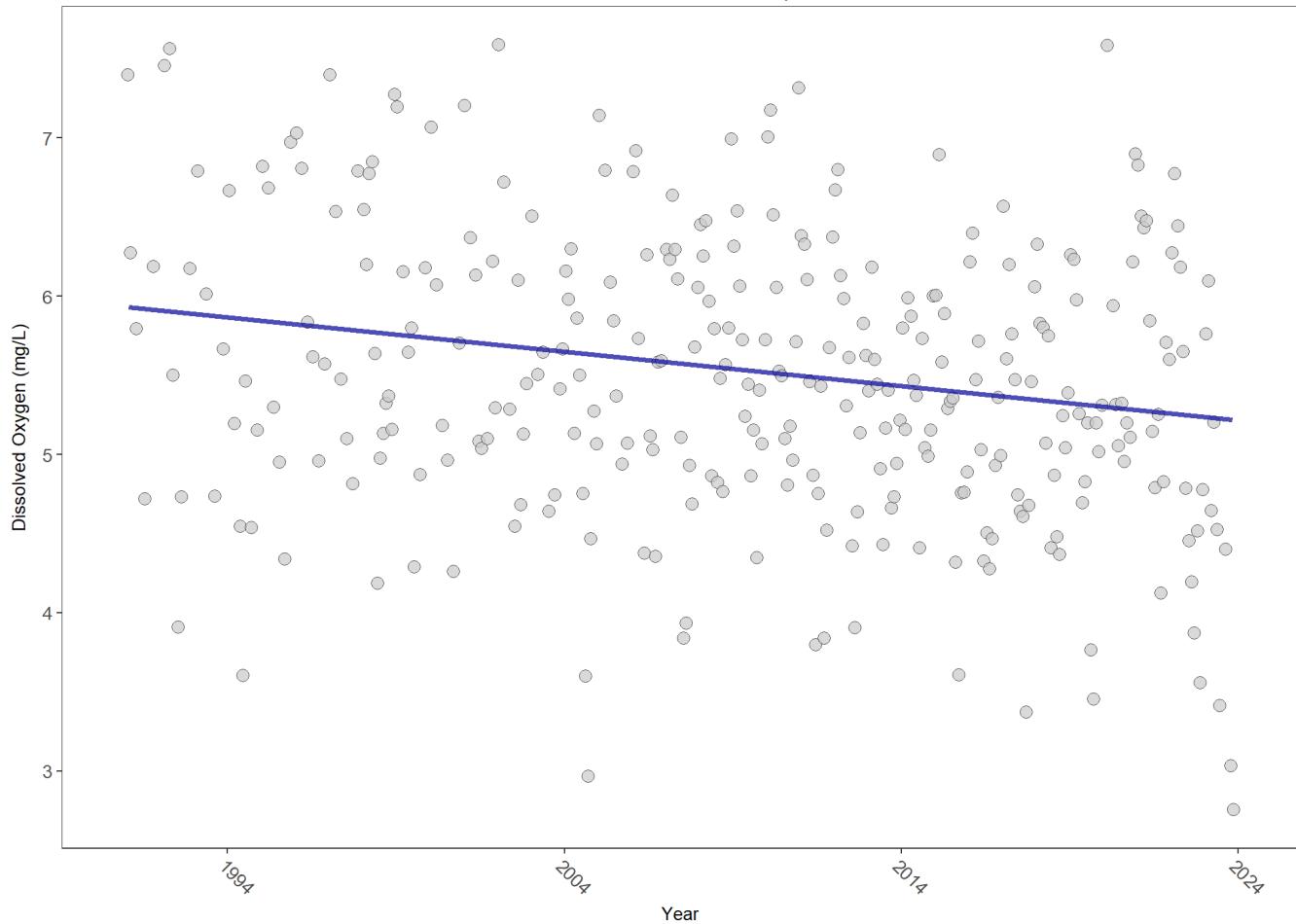
5002 - Florida STORET / WIN

Dissolved Oxygen - Discrete Water Quality

Dissolved Oxygen (DO) is a key indicator of water quality. Oxygen enters surface waters by air-sea gas exchange, by wind action, or as a byproduct of aquatic plant photosynthesis. The actual quantity of DO in aquatic environments is dependent on the above processes as well as water temperature and salinity.

Seasonal Kendall-Tau Trend Analysis

Dissolved Oxygen, Field, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

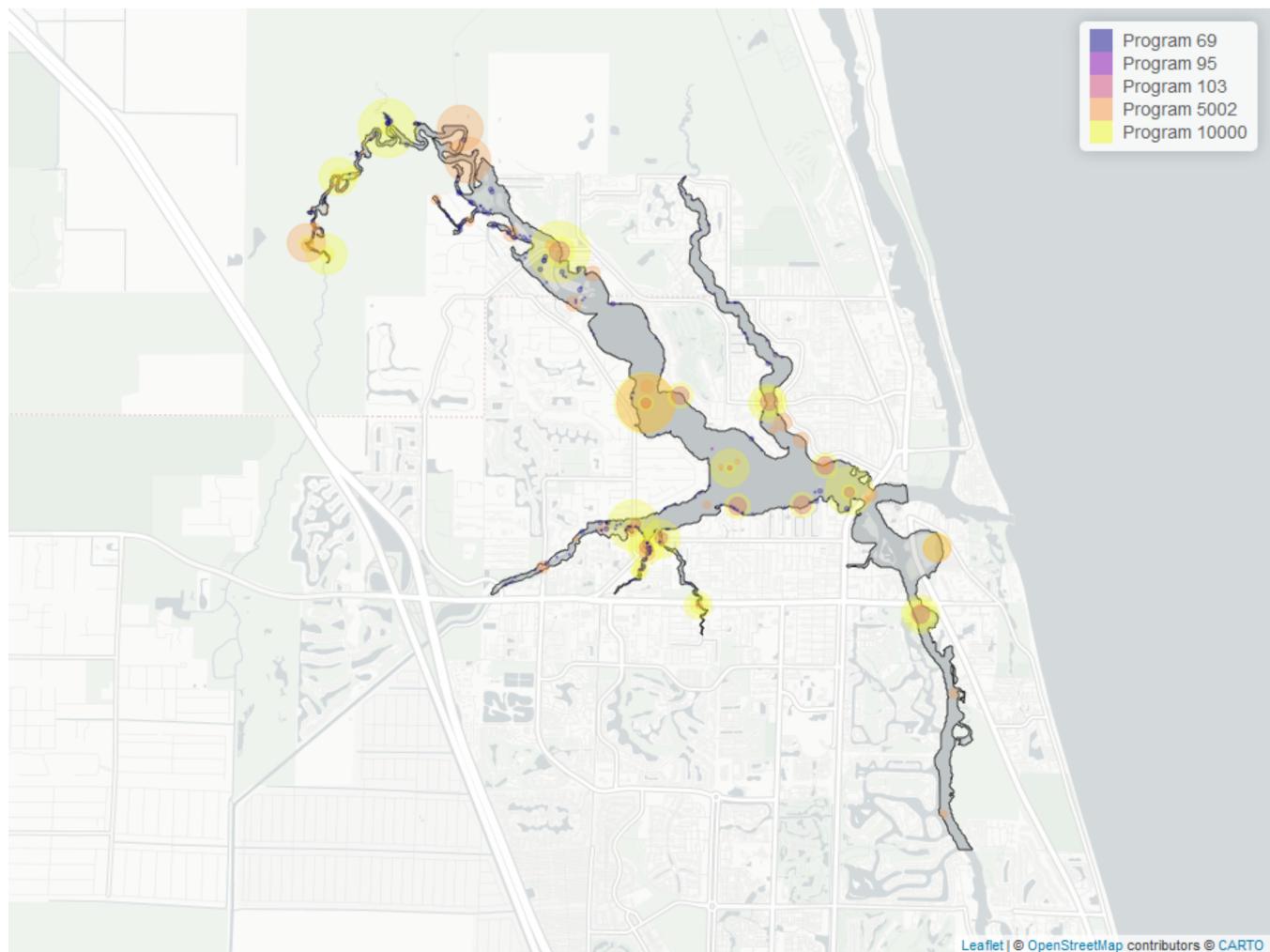


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	8719	33	5.66	TRUE	-0.2232	0.0000	-0.02172973	5.932693	9.6457	0.5625	-1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Dissolved Oxygen



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 12: Programs contributing data for Dissolved Oxygen

ProgramID	N_Data	YearMin	YearMax
10000	5621	1991	2023
5002	2116	1991	2023
103	479	2020	2021
69	447	2014	2017
3013	67	2004	2023
95	2	2016	2016

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

69 - Fisheries-Independent Monitoring (FIM) Program

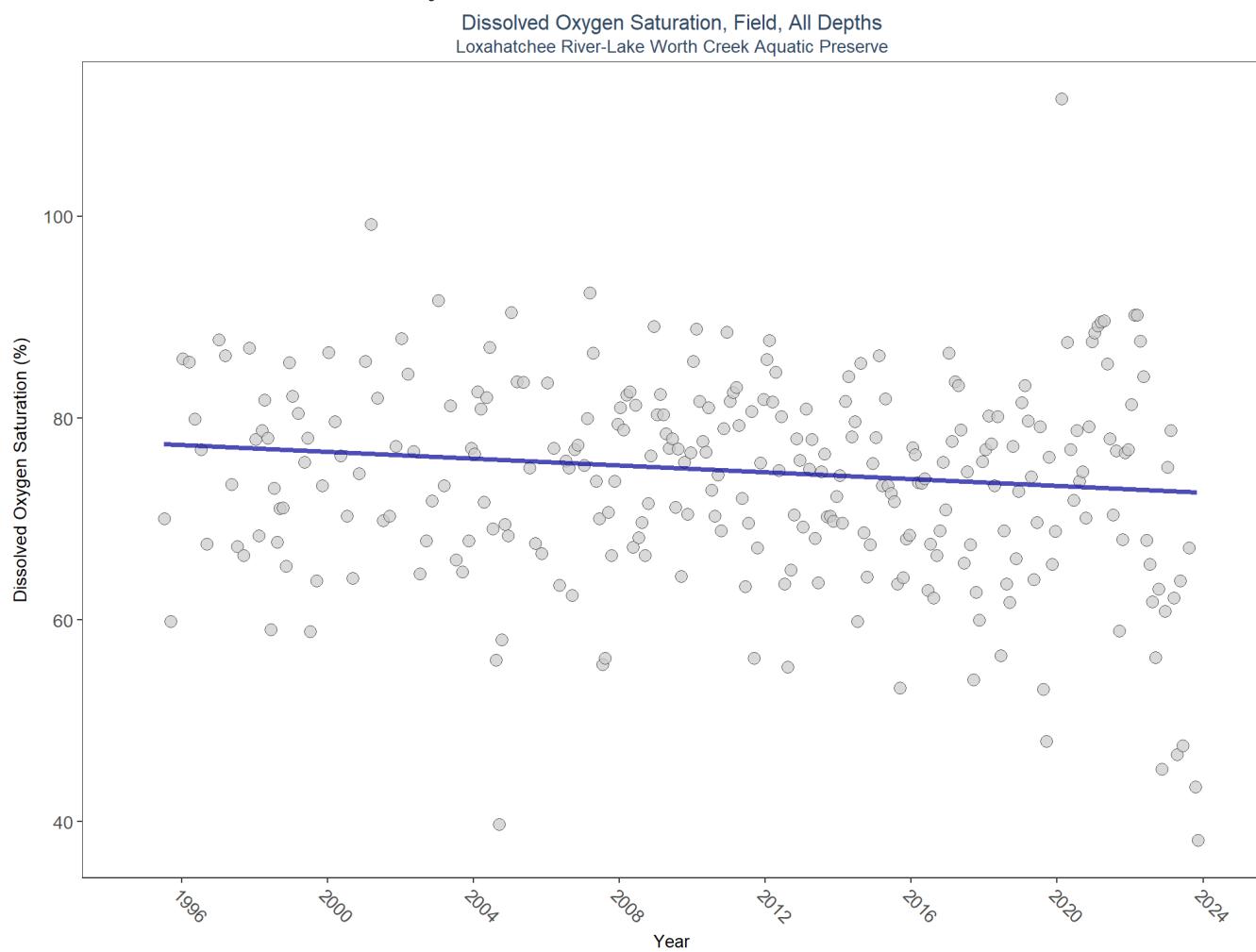
3013 - Seagrass (SJRWMD)

95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Dissolved Oxygen in Loxahatchee River-Lake Worth Creek Aquatic Preserve

Dissolved Oxygen Saturation - Discrete Water Quality

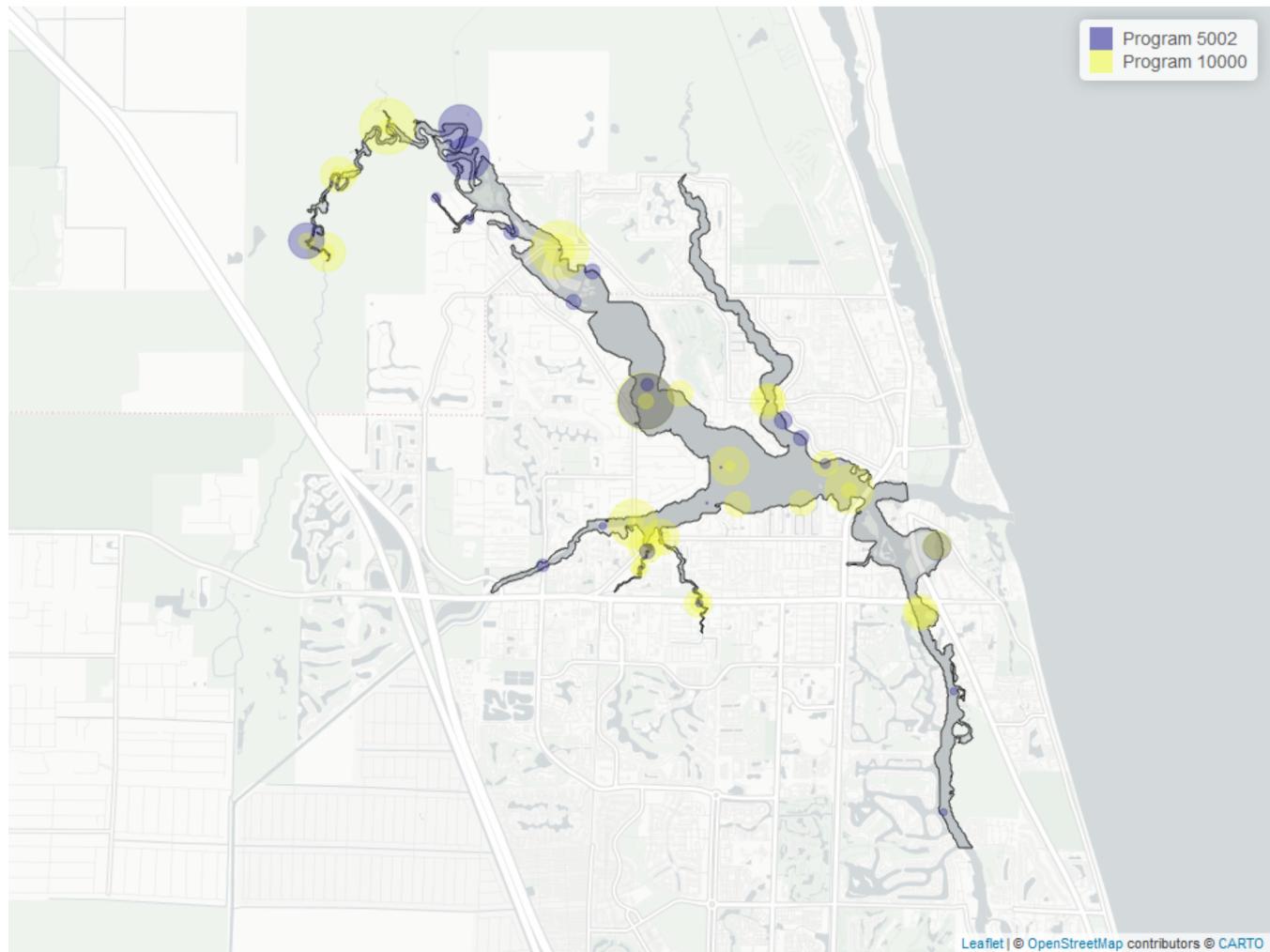
Seasonal Kendall-Tau Trend Analysis



p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Dissolved Oxygen Saturation



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 13: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	N_Data	YearMin	YearMax
10000	5332	1995	2023
5002	1797	1995	2023
3013	31	2014	2023

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

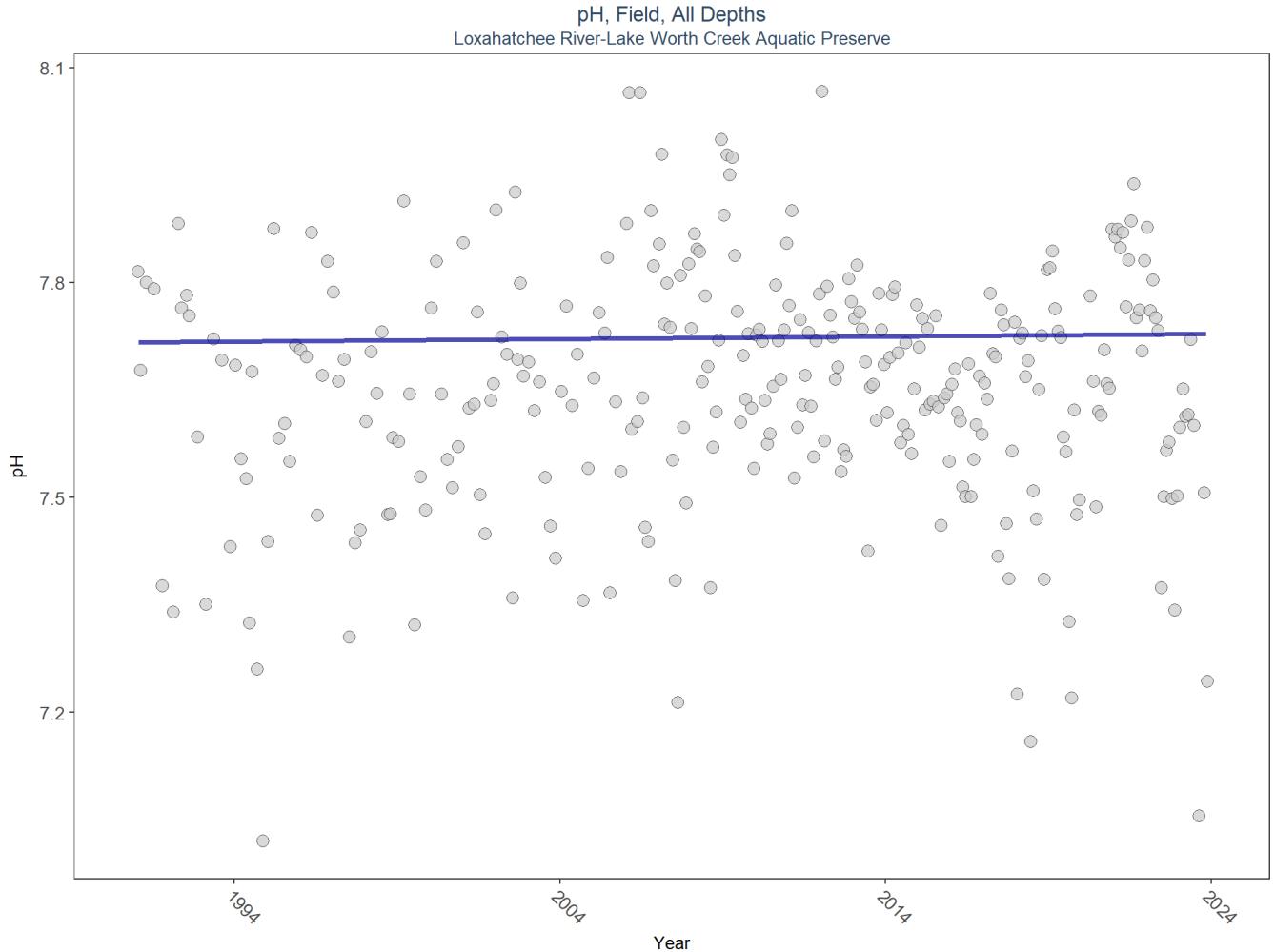
3013 - Seagrass (SJRWMD)

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in Loxahatchee River-Lake Worth Creek Aquatic Preserve

pH - Discrete Water Quality

The **pH** of water is the measure of how acidic or basic the water body is on a scale of 0-14, with lower readings indicating acidic and higher readings indicating basic, and a pH of 7 being neutral. Florida's natural waters fall between 6.5 and 8.5 on this scale. A water body's pH can change due to precipitation, geology, vegetation, water pollution and air pollution.

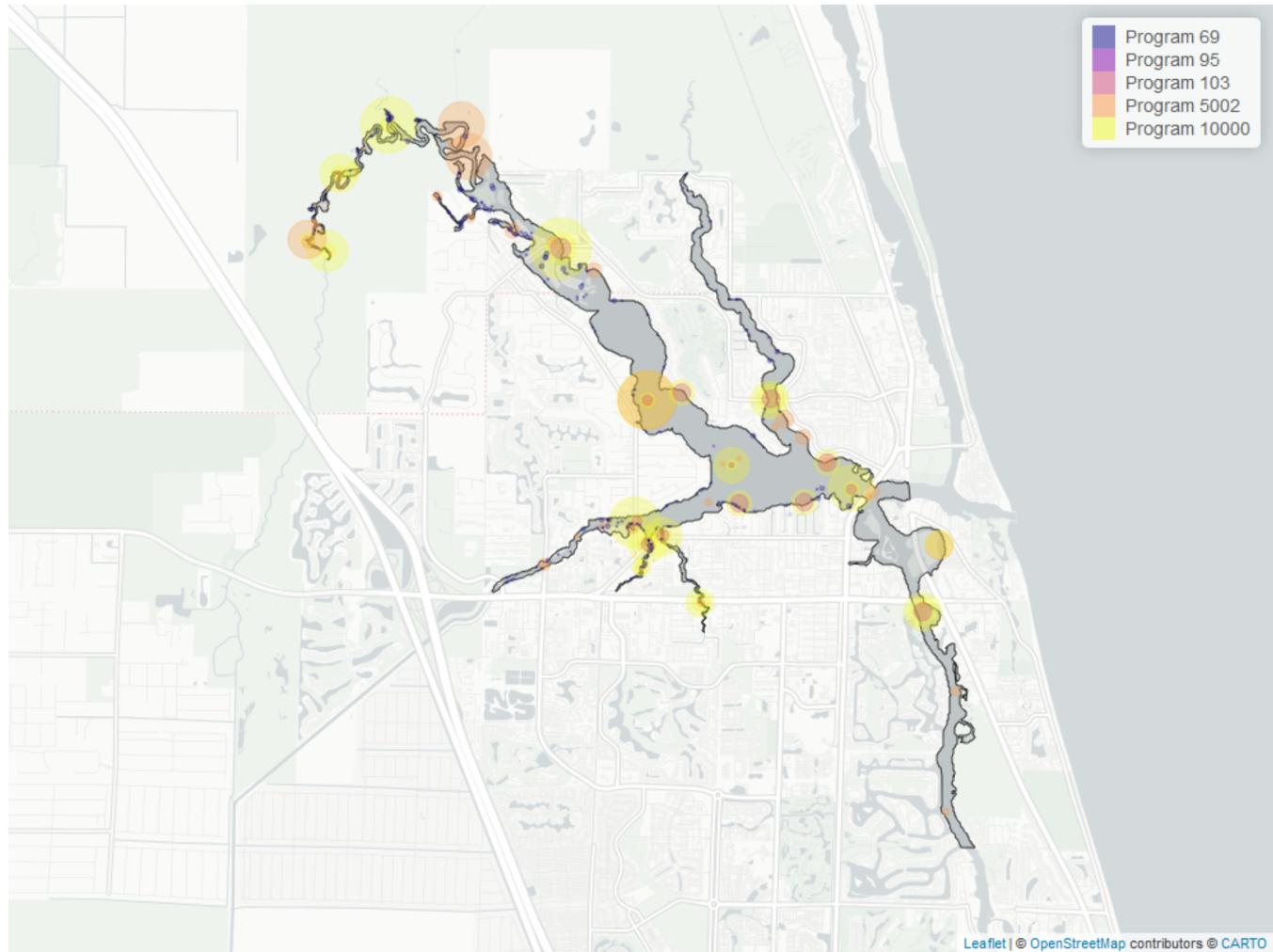
Seasonal Kendall-Tau Trend Analysis



p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for pH



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 14: Programs contributing data for pH

ProgramID	N_Data	YearMin	YearMax
10000	5413	1991	2023
5002	2009	1991	2023
103	473	2020	2021
69	453	2014	2017
3013	59	2004	2023
95	2	2016	2016

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

69 - Fisheries-Independent Monitoring (FIM) Program

3013 - Seagrass (SJRWMD)

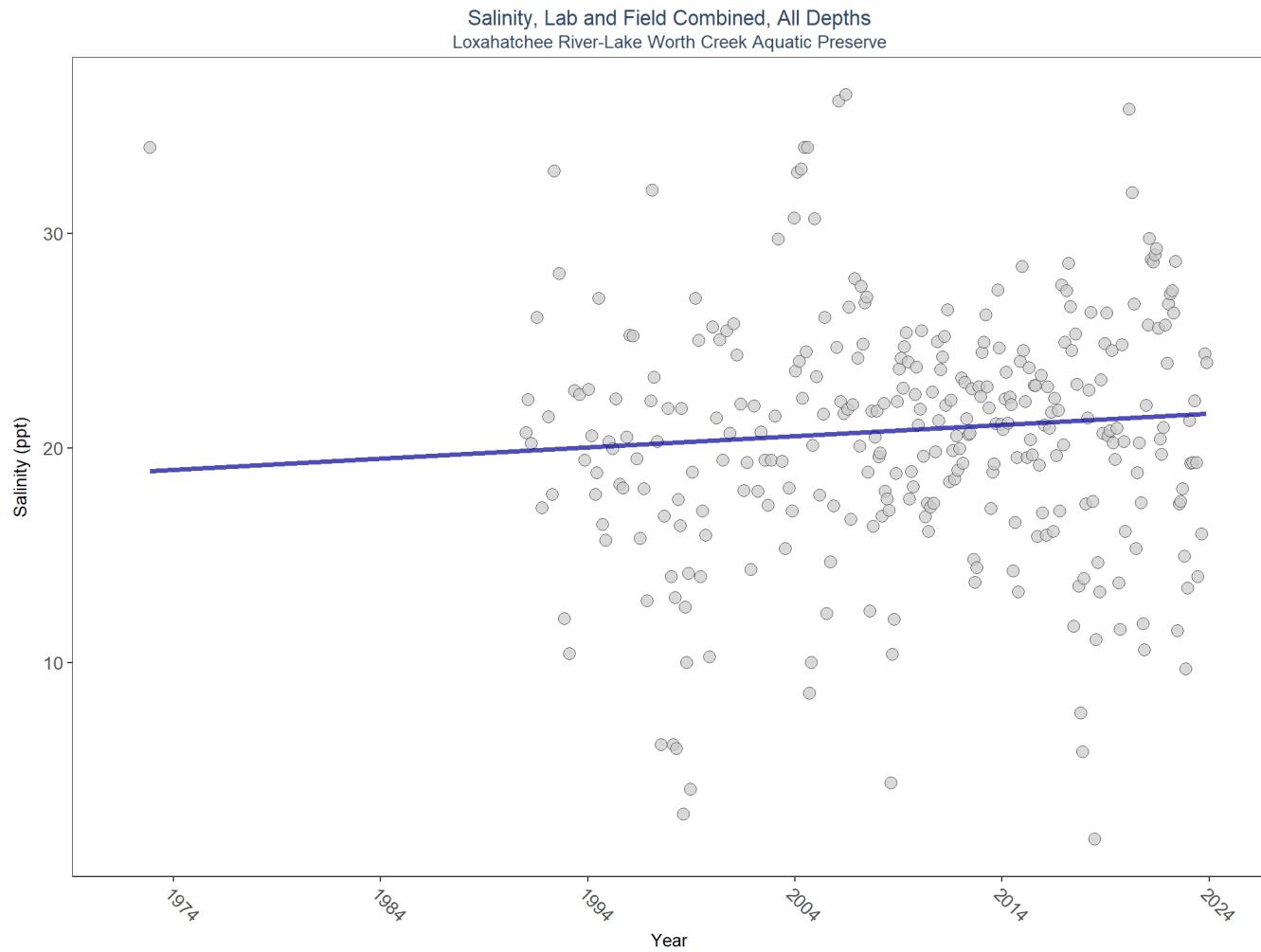
95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for pH in Loxahatchee River-Lake Worth Creek Aquatic Preserve

Salinity - Discrete Water Quality

Salinity is a measure of the amount of salt in the water. In estuarine ecosystems, salinity is influenced by precipitation, evaporation, surface-water inputs, and exchange with coastal waters.

Seasonal Kendall-Tau Trend Analysis

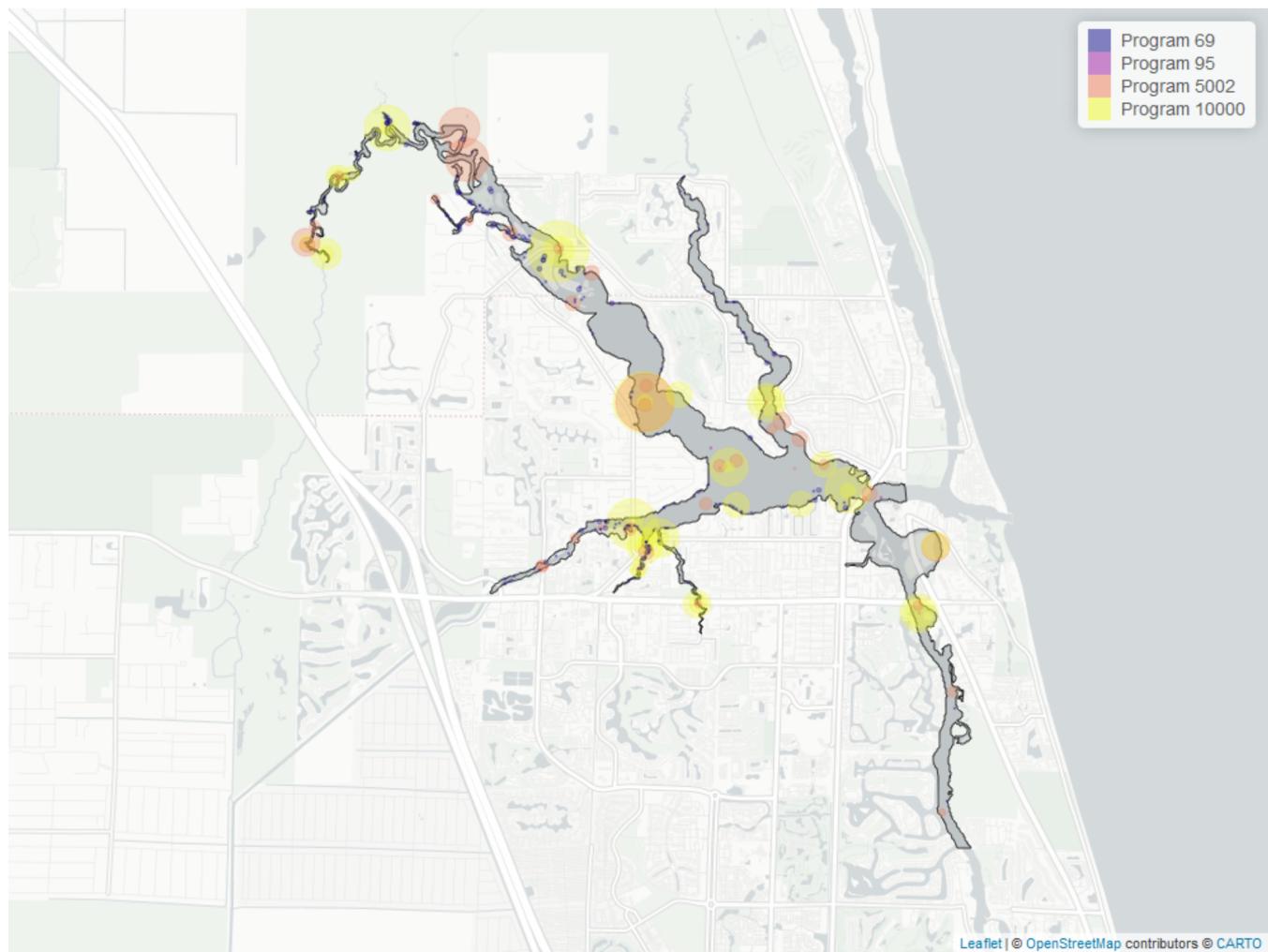


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	7669	34	25.1	TRUE	0.0543	0.1153	0.0526455	18.87549	15.6012	0.1566	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Salinity



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 15: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
10000	5122	1991	2023
5002	2021	1991	2023
69	456	1997	2017
3013	67	2004	2023
95	3	1972	2016

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

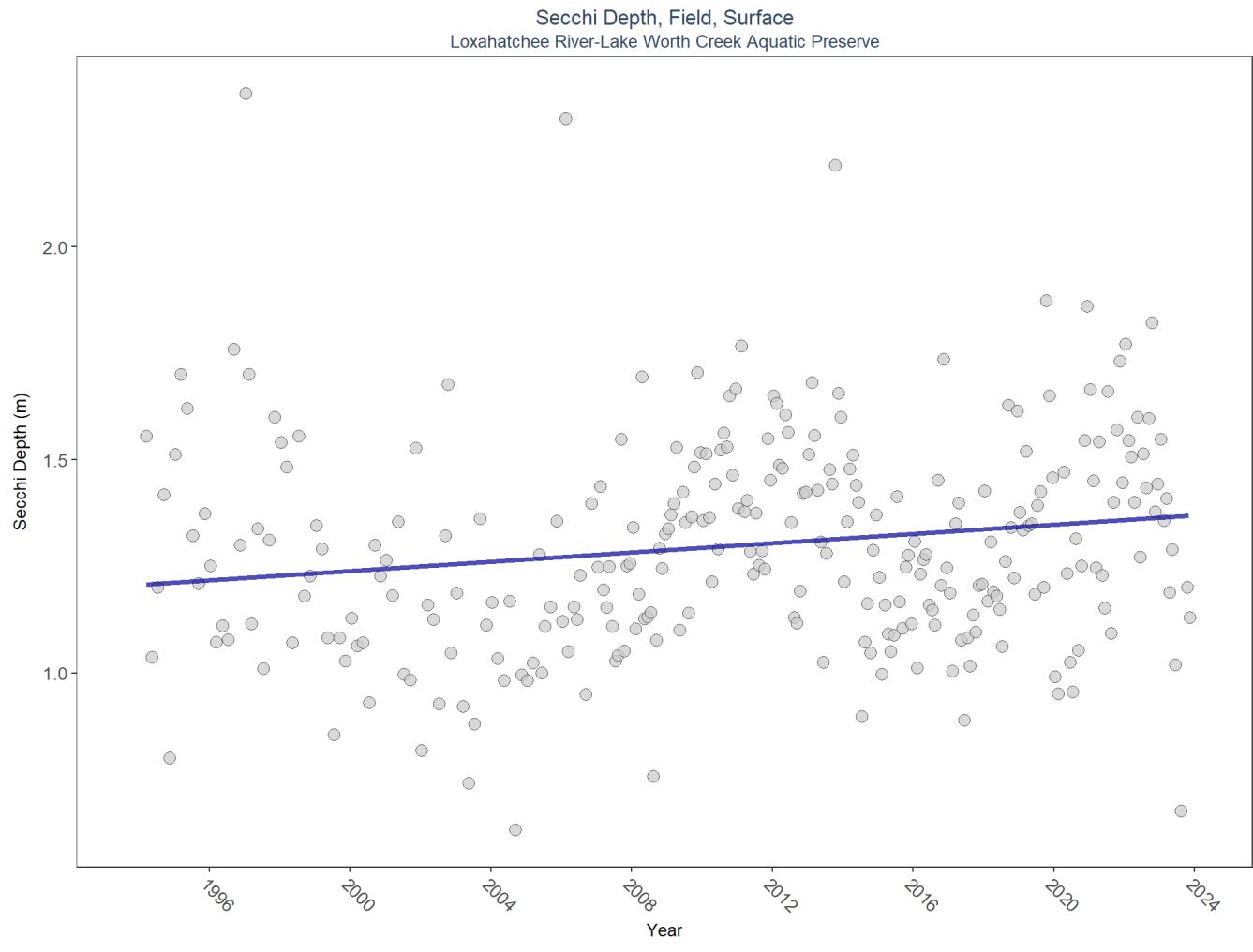
3013 - Seagrass (SJRWMD)

There are no qualifying Value Qualifiers for Salinity in Loxahatchee River-Lake Worth Creek Aquatic Preserve

Secchi Depth - Discrete Water Quality

Secchi depth is a measure of the transparency or clarity of the water by a device called a Secchi disk. A Secchi disk is a black and white disk that is lowered into the water on a cord. The Secchi depth is the depth at which the disk can no longer be seen. The deeper the Secchi depth, the greater the water clarity.

Seasonal Kendall-Tau Trend Analysis

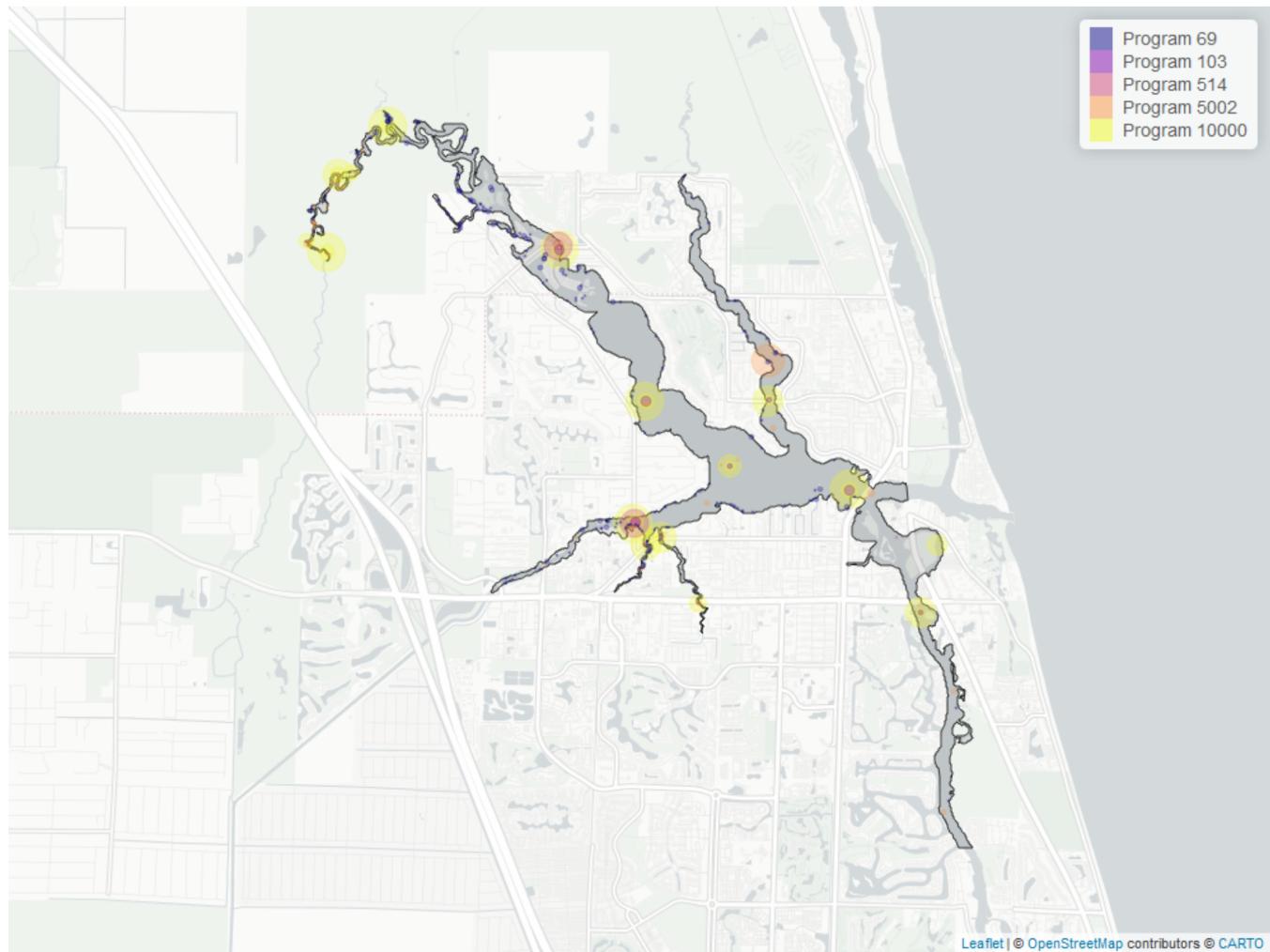


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	3801	30	1.3	TRUE	0.0965	0.0052	0.005444234	1.206234	12.9956	0.2936	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Secchi Depth



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 16: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
10000	2671	1994	2023
69	446	1997	2017
5002	277	2007	2023
514	274	2001	2023
103	72	2020	2021
3013	61	2004	2023

Program names:

10000 - RiverKeeper

69 - Fisheries-Independent Monitoring (FIM) Program

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

3013 - Seagrass (SJRWMD)

Value Qualifiers

- N_{Total} is total amount of data for a given year
- N_S is the total amount of values flagged with the respective value qualifier in a given year
- $perc_S$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 17: Value Qualifiers for Secchi Depth

Year	N_{Total}	N_S	$perc_S$
2015	338	44	13.0
2016	246	41	16.7
2017	272	38	14.0
2018	152	41	27.0
2019	118	12	10.2
2021	210	1	0.5
2022	138	2	1.4
2023	83	7	8.4

Note: 1S - Secchi disk visible to bottom of waterbody

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

Total Nitrogen - Discrete Water Quality

Nitrogen and **Phosphorous** are key nutrients that provide nourishment essential for the growth and maintenance of aquatic plants and animals; however, excess nutrients can cause harmful algal blooms and other water quality concerns. Nutrients enter water bodies several ways, including runoff from rain events and atmospheric deposition from natural and industrial sources.

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) $TN = TKN + NO_3O_2;$
- 2) $TN = TKN + NO_3 + NO_2;$
- 3) $TN = ORGN + NH_4 + NO_3O_2;$
- 4) $TN = ORGN + NH_4 + NO_2 + NO_3;$
- 5) $TN = TKN + NO_3;$
- 6) $TN = ORGN + NH_4 + NO_3;$

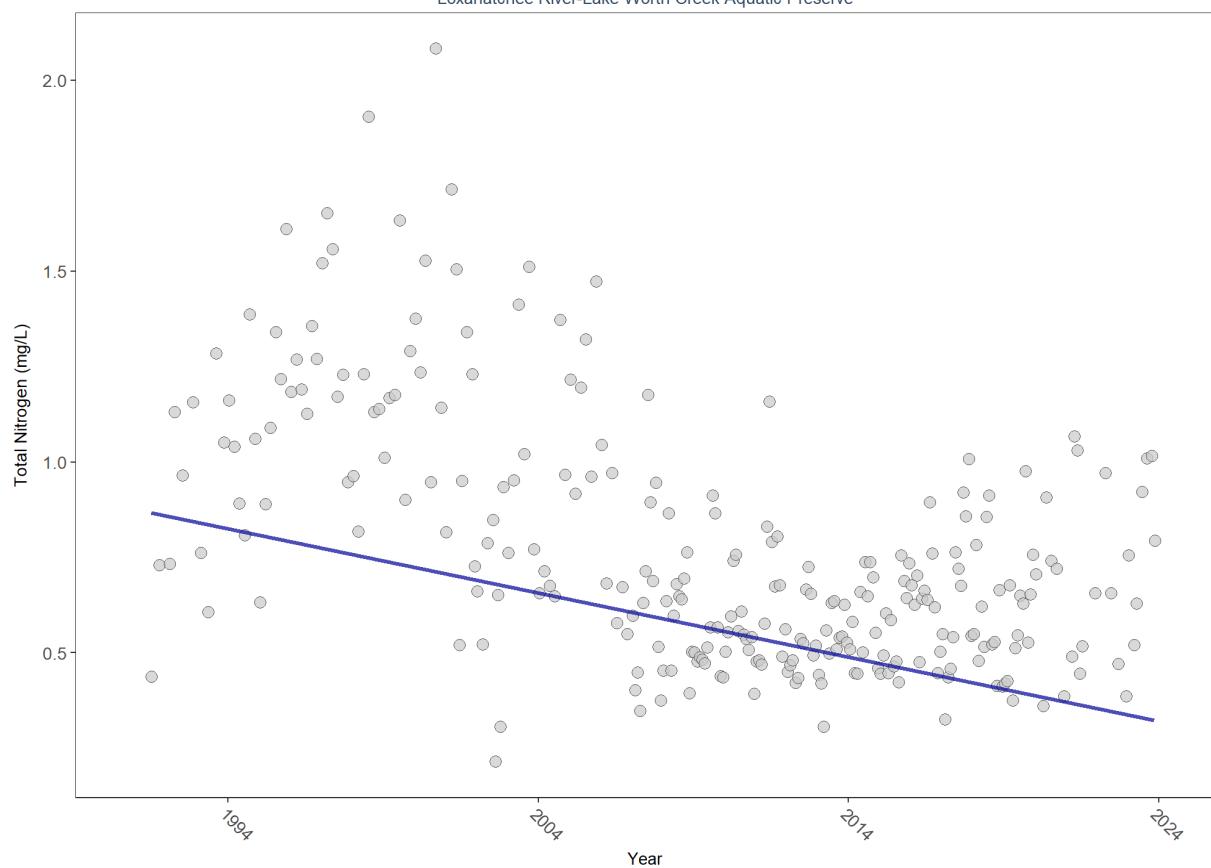
Additional Information:

- Rules for use of sample fraction:
 - FDEP report that if both “Total” and “Dissolved” are reported, only “Total” is used. If the total is not reported, they do use dissolved as a best available replacement.
 - An analysis of all SEACAR data shows that 90% of all possible TN calculations can be done using nitrogen components with the same sample fraction, rather than use nitrogen components with mixed total/dissolved sample fractions. In other words, TN can be calculated when TKN and NO_3O_2 are both total sample fraction, or when both are dissolved sample fraction. This is important, because then the calculated TN value is not based on components with mixed sample fractions.
- Values inserted into data:
 - ParameterName = “Total Nitrogen”

- SEACAR_QAACFlagCode = “1Q”
- SEACAR_QAAC>Description = “SEACAR Calculated”

Seasonal Kendall-Tau Trend Analysis

Total Nitrogen, Lab, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

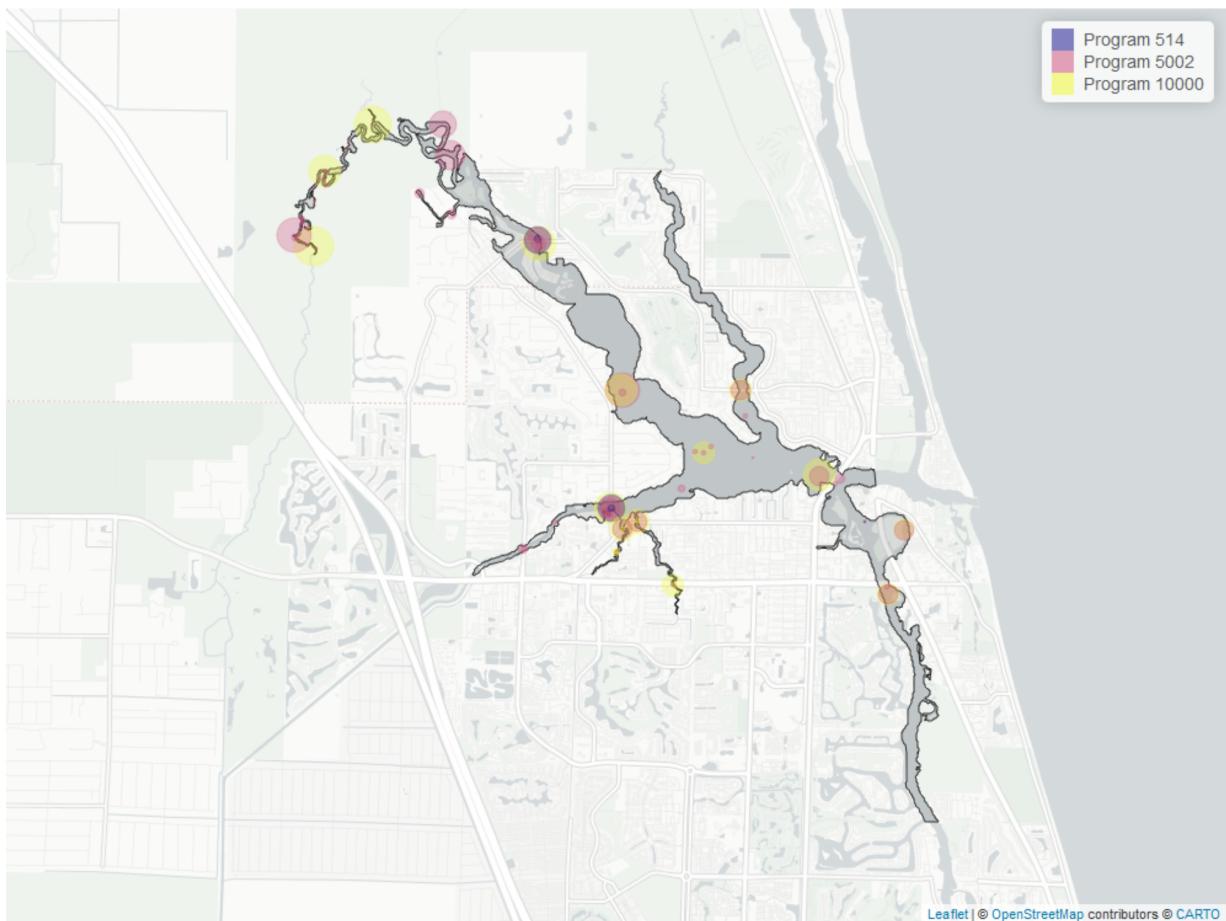


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	3321	33	0.696	TRUE	-0.2627	0.0000	-0.01678758	0.8750924	29.768	0.0017	-1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Total Nitrogen



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 18: Programs contributing data for Total Nitrogen

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
10000	1993	1991	2021
5002	1584	1991	2023
514	274	2001	2023

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

Value Qualifiers

- N_{Total} is total amount of data for a given year
- N_{\cdot} is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{\cdot}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 19: Value Qualifiers for Total Nitrogen

<i>Year</i>	<i>N_Total</i>	<i>N_Q</i>	<i>perc_Q</i>	<i>N_U</i>	<i>perc_U</i>
2006	126	10	7.9	1	0.8
2007	294	4	1.4	10	3.4
2008	209			4	1.9
2009	198			8	4.0
2010	187			3	1.6
2011	190			3	1.6
2012	203	1	0.5	1	0.5
2014	193	3	1.6	2	1.0
2015	203			2	1.0
2020	12	6	50.0		

Note: ¹**Q** - Sample held beyond the accepted holding time ²**U** - Compound was analyzed for but not detected

Programs containing Value Qualified data:

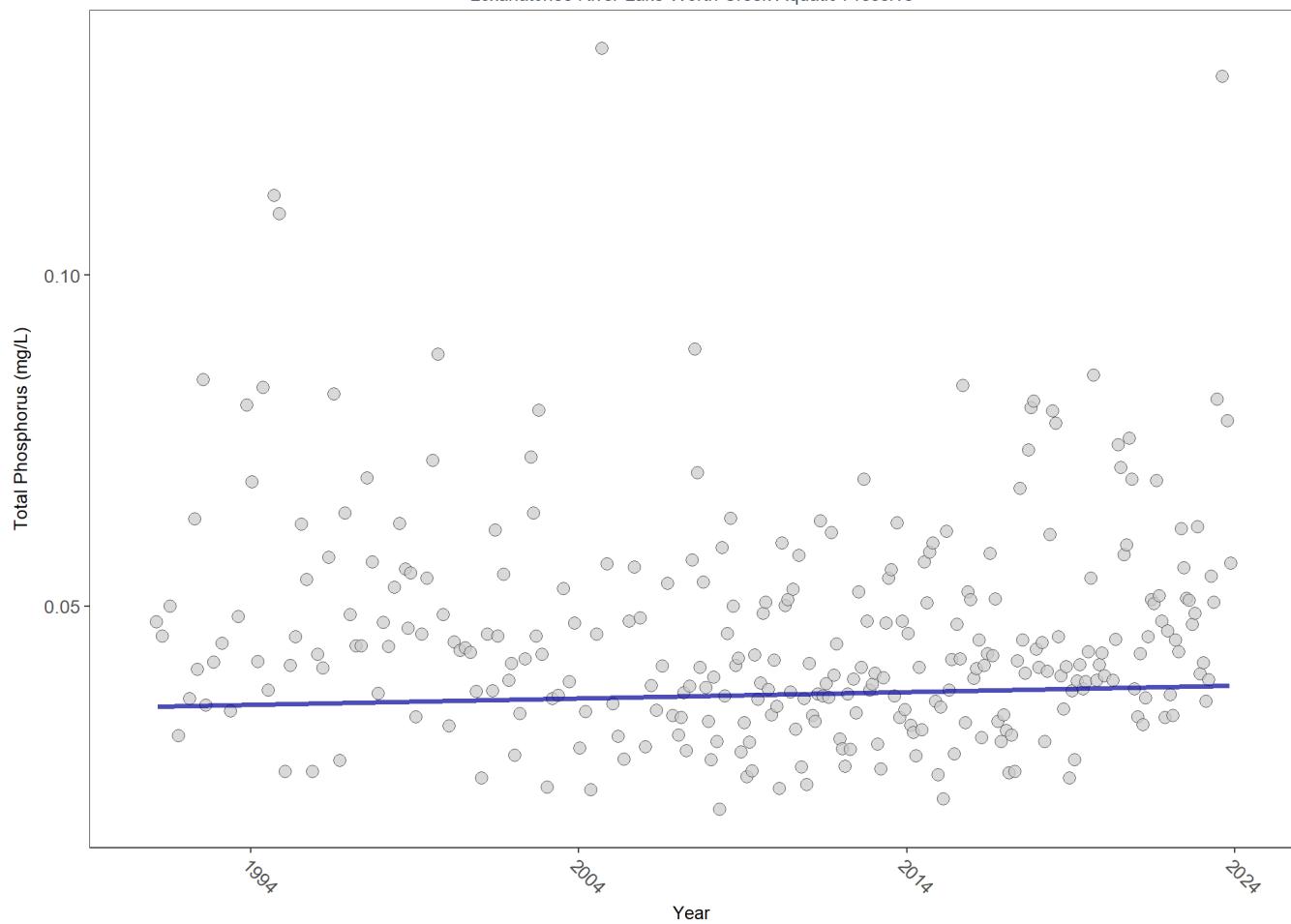
5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Total Phosphorus, Lab, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

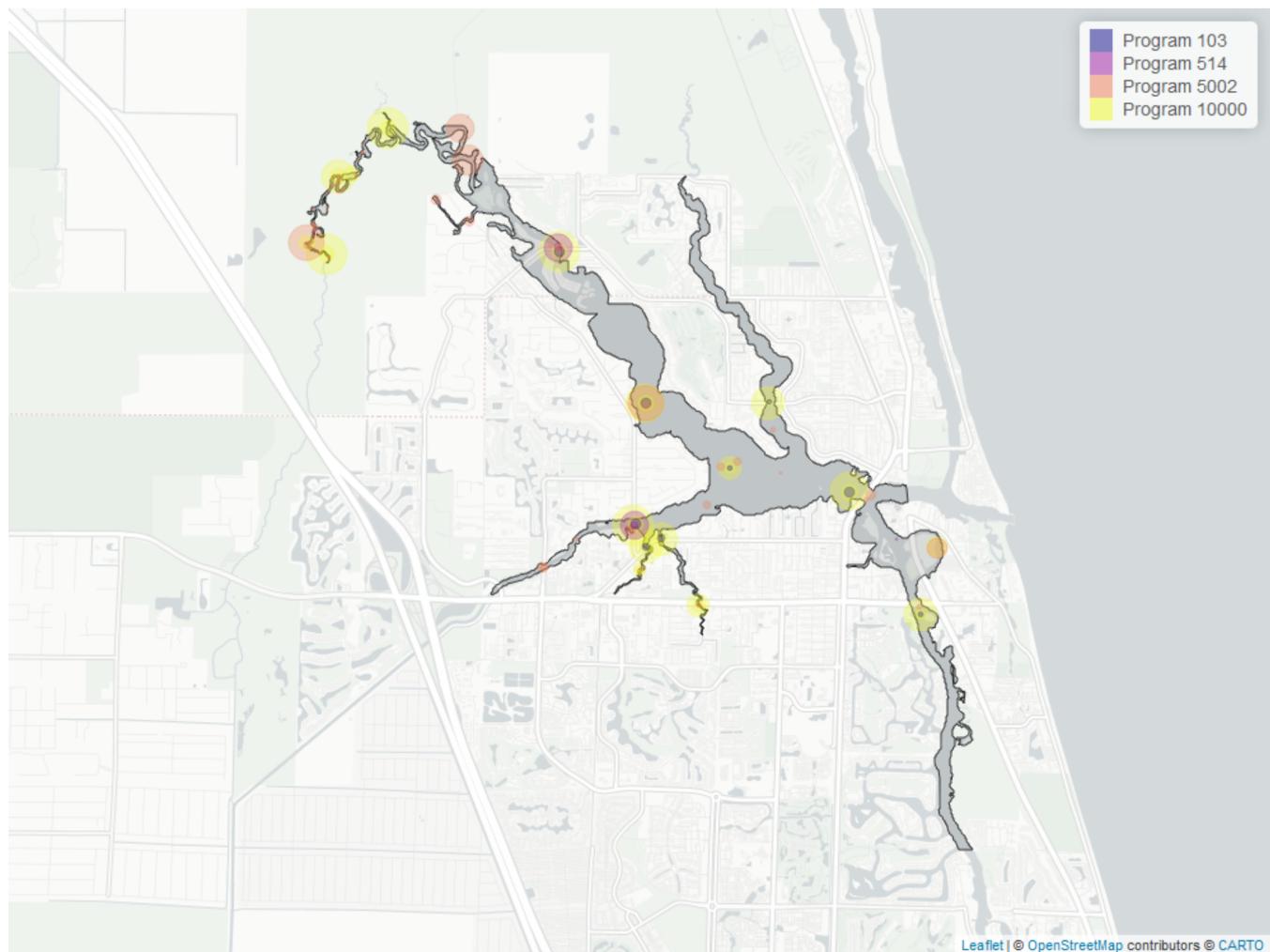


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4263	33	0.042	TRUE	0.0623	0.2939	0.00009473684	0.03484579	9.5542	0.5709	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Total Phosphorus



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 20: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
10000	2981	1991	2023
5002	959	1991	2023
514	274	2001	2023
103	82	2020	2021

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

Value Qualifiers

- N_{Total} is total amount of data for a given year
- $N_{_}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{_}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 21: Value Qualifiers for Total Phosphorus

Year	N_{Total}	N_I	$perc_I$	N_Q	$perc_Q$	N_U	$perc_U$
2007	274	50	18.2	4	1.5	18	6.6
2010	176			5	2.8		
2012	191	2	1.0				
2020	112			6	5.4		
2021	260	8	3.1			16	6.2
2022	145	1	0.7				

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²Q
 - Sample held beyond the accepted holding time ³U - Compound was analyzed for but not detected

Programs containing Value Qualified data:

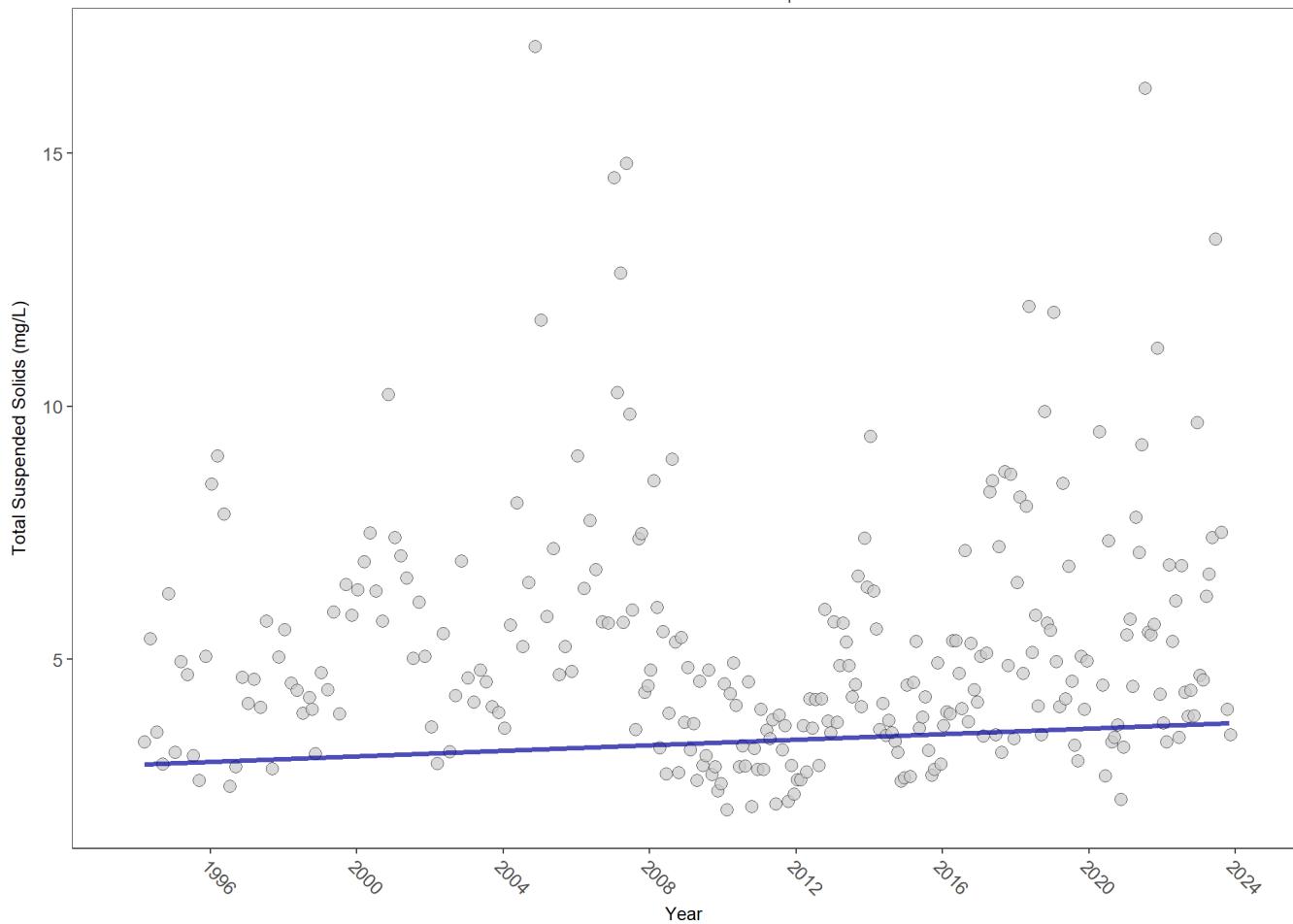
5002 - Florida STORET / WIN
 514 - Florida LAKEWATCH Program
 10000 - RiverKeeper

Total Suspended Solids - Discrete Water Quality

Total Suspended Solids (TSS) are solid particles suspended in water that exceed 2 microns in size and can be trapped by a filter.

Seasonal Kendall-Tau Trend Analysis

Total Suspended Solids, Lab and Field Combined, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

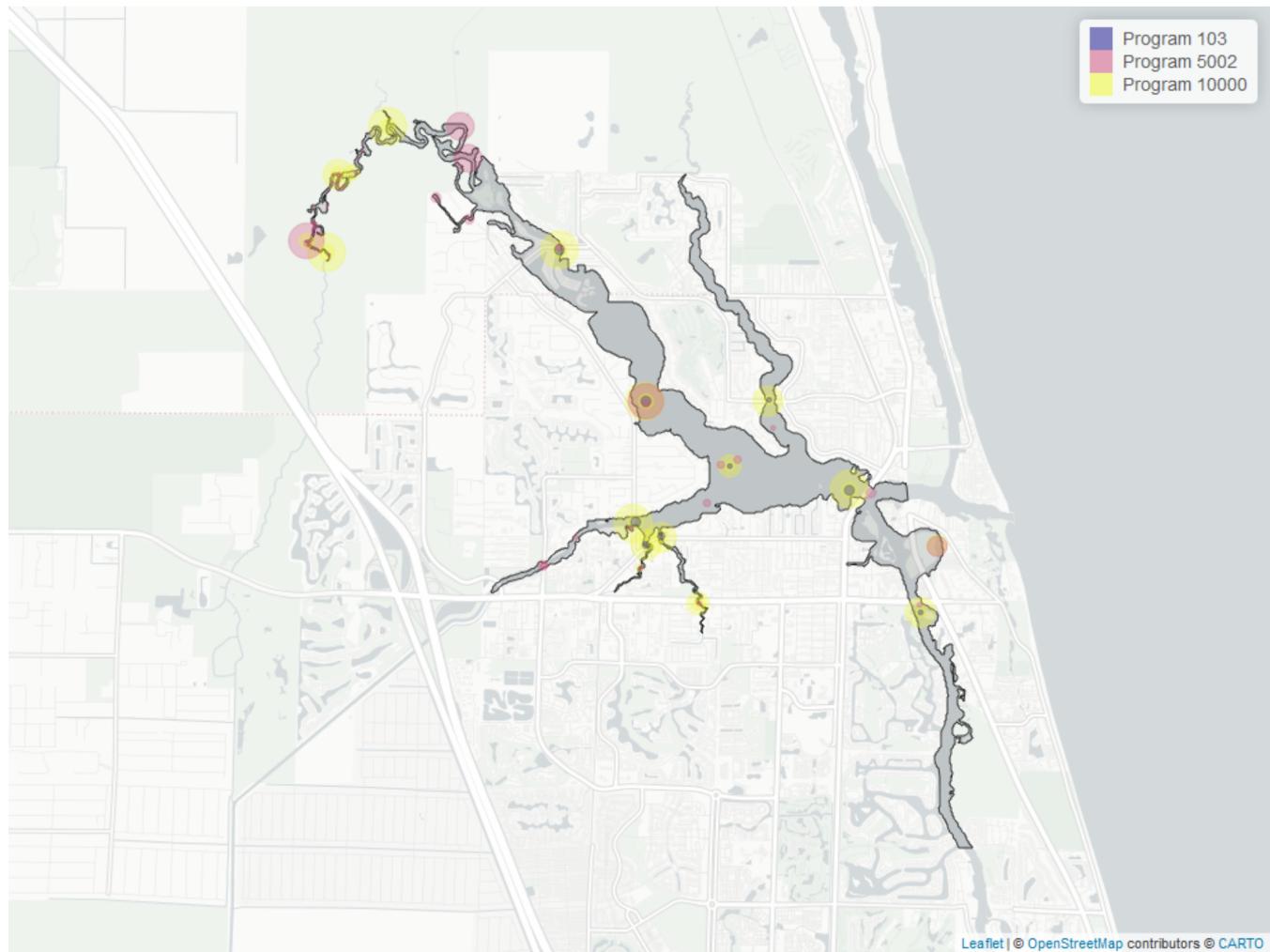


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	3835	30	4	TRUE	0.1077	0.0705	0.02761905	2.914338	15.1218	0.177	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Total Suspended Solids



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 22: Programs contributing data for Total Suspended Solids

<i>ProgramID</i>	<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>
10000	2845	1994	2023
5002	920	1994	2023
103	82	2020	2021

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

Value Qualifiers

- *N_Total* is total amount of data for a given year

- $N_{_}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{_}$ is the percent of data flagged with the respective value qualifier as a proportion of $N_{_Total}$

Table 23: Value Qualifiers for Total Suspended Solids

Year	$N_{_Total}$	$N_{_I}$	$perc_{_I}$	$N_{_Q}$	$perc_{_Q}$	$N_{_U}$	$perc_{_U}$
1994	72					2	2.8
2002	90					2	2.2
2003	90					1	1.1
2007	249	50	20.1	1	0.4	16	6.4
2009	162					1	0.6
2010	164	1	0.6			1	0.6
2011	166	4	2.4				
2012	179	12	6.7	4	2.2	2	1.1
2013	165	3	1.8				
2014	169	1	0.6				
2015	179					2	1.1
2016	165	3	1.8				
2017	126	4	3.2				
2020	100	2	2.0			2	2.0
2021	252	4	1.6			1	0.4
2022	135	1	0.7	1	0.7	1	0.7
2023	83	11	13.2			2	2.4

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²Q
 - Sample held beyond the accepted holding time ³U - Compound was analyzed for but not detected

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

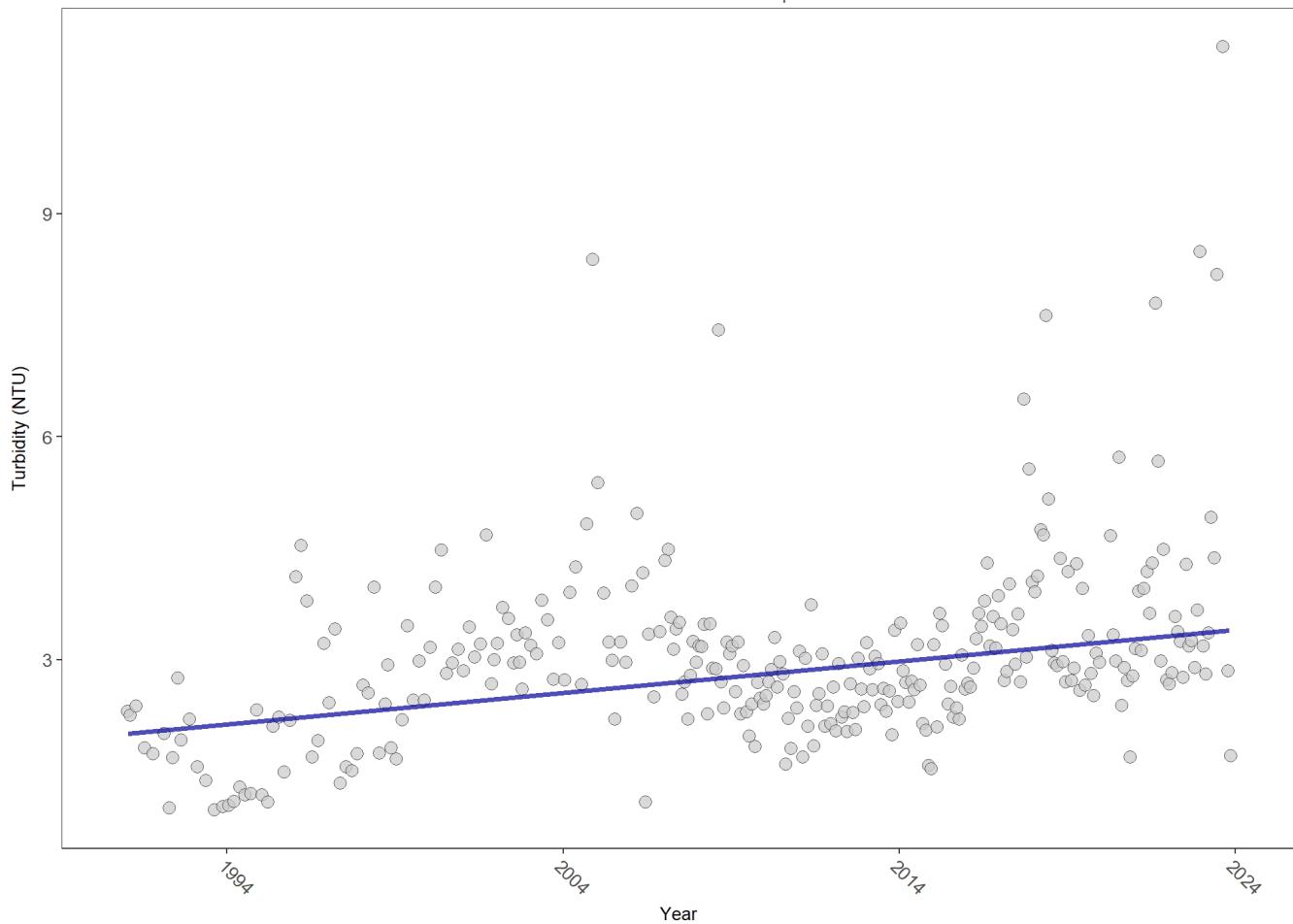
10000 - RiverKeeper

Turbidity - Discrete Water Quality

Turbidity results from suspended solids in the water, including silts, clays, tannins, industrial wastes, sewage and plankton, which are all factors that contribute to how clouded or murky a water column is. Turbidity is caused by soil erosion, excess nutrients, pollutants, and physical forces such as winds, currents and bottom feeders.

Seasonal Kendall-Tau Trend Analysis

Turbidity, Lab and Field Combined, All Depths
 Loxahatchee River-Lake Worth Creek Aquatic Preserve

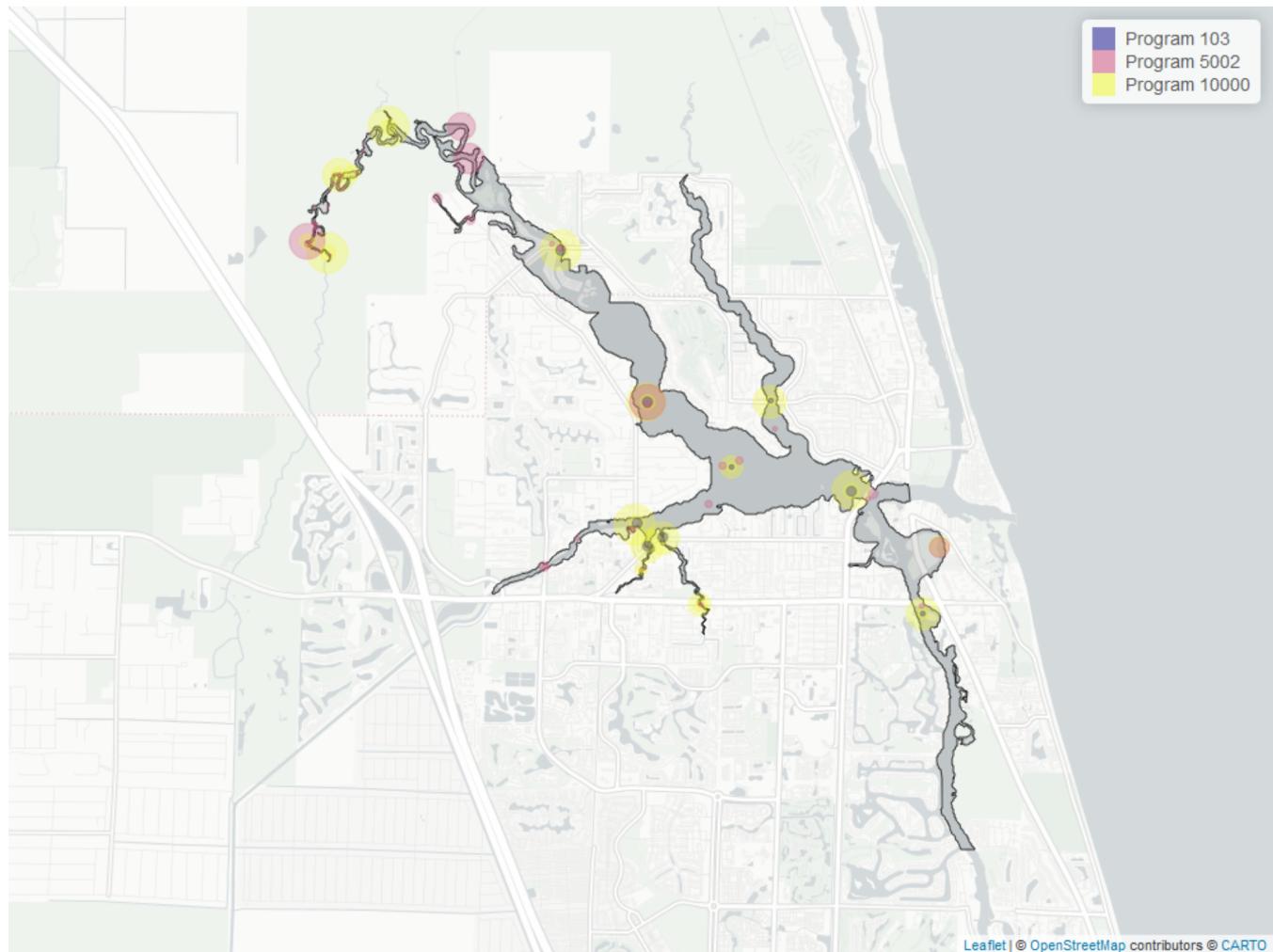


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4072	33	2.67	TRUE	0.2828	0.0000	0.04235198	1.996501	10.3893	0.4957	1

$p < 0.00005$ appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Turbidity



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 24: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
10000	2998	1991	2023
5002	954	1991	2023
103	94	2020	2021
3013	26	2004	2018

Program names:

- 10000 - RiverKeeper
- 5002 - Florida STORET / WIN
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
- 3013 - Seagrass (SJRWMD)

Value Qualifiers

- N_{Total} is total amount of data for a given year
- $N_{_}$ is the total amount of values flagged with the respective value qualifier in a given year
- $perc_{_}$ is the percent of data flagged with the respective value qualifier as a proportion of N_{Total}

Table 25: Value Qualifiers for Turbidity

<i>Year</i>	<i>N_Total</i>	<i>N_Q</i>	<i>perc_Q</i>
2015	180	6	3.3
2016	168	1	0.6

Note: ${}^1\mathbf{Q}$ - Sample held beyond the accepted holding time

Programs containing Value Qualified data:

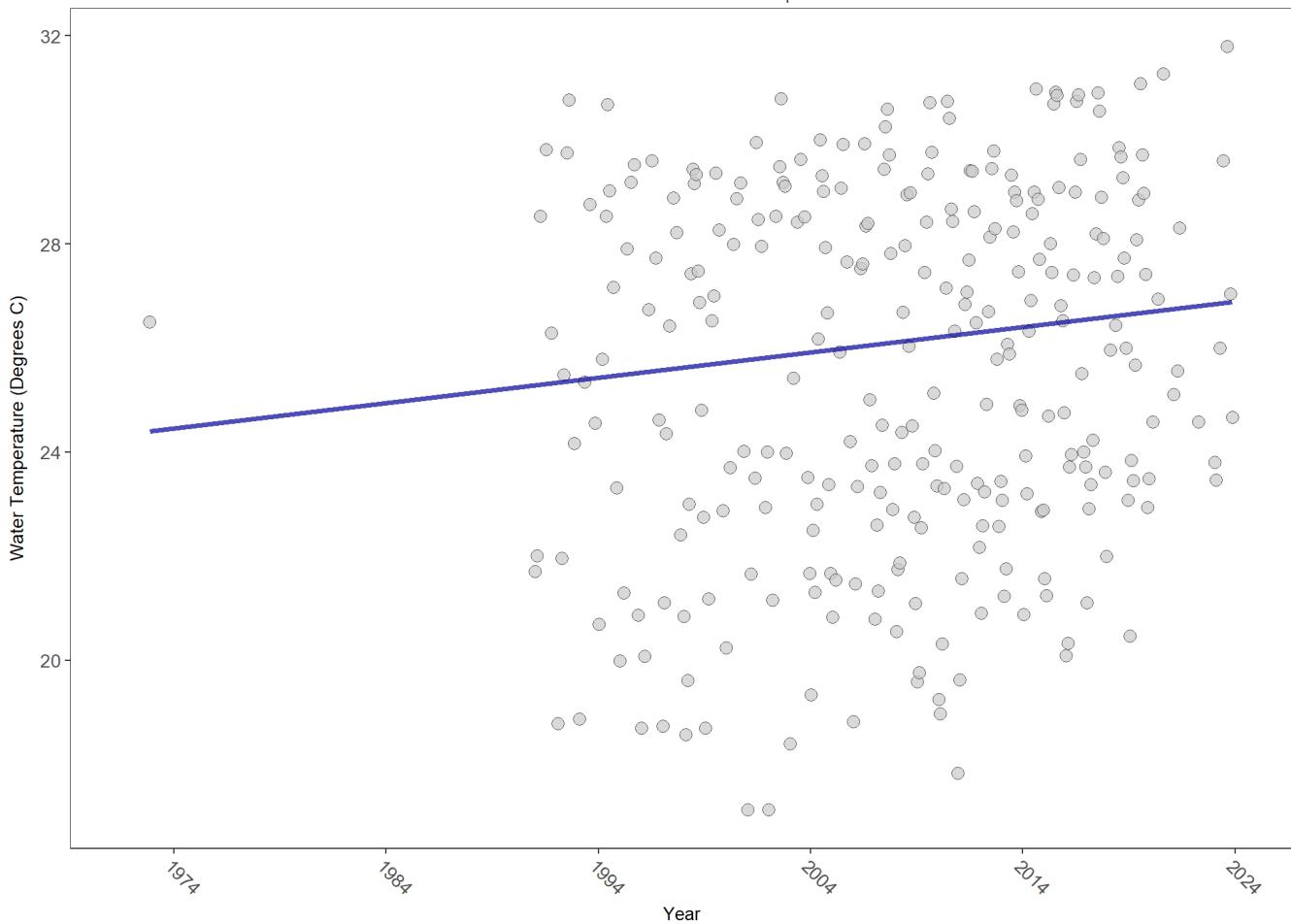
5002 - Florida STORET / WIN

Water Temperature - Discrete Water Quality

Temperature determines the capacity of water to hold oxygen. Cooler water can hold more dissolved oxygen because water molecules are more tightly packed, making it harder for oxygen to escape. Additionally, as water temperature increases, fish and other aquatic organisms become more active and consume oxygen at a faster rate.

Seasonal Kendall-Tau Trend Analysis

Water Temperature, Field, All Depths
Loxahatchee River-Lake Worth Creek Aquatic Preserve

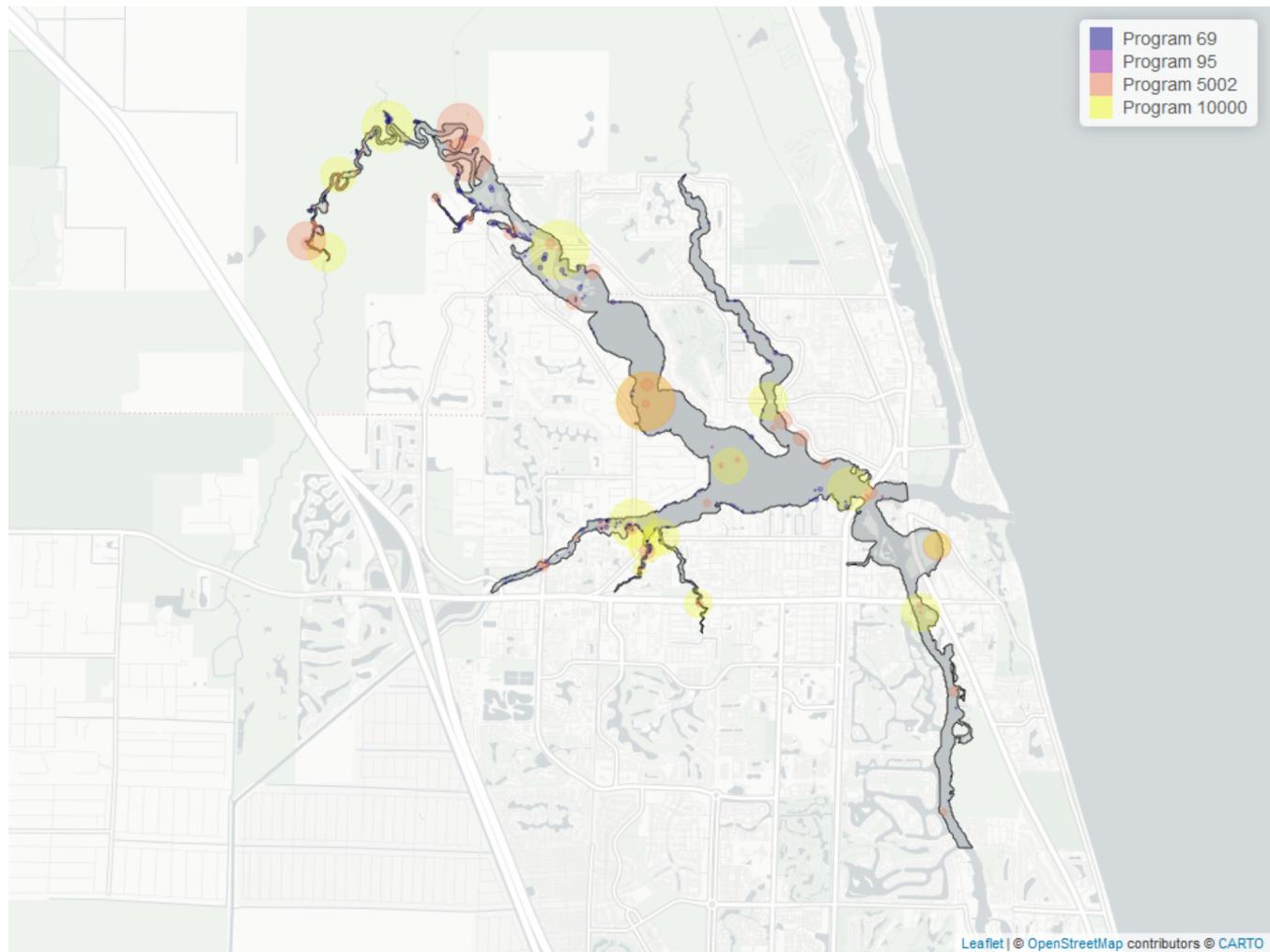


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	6477	34	25.6	TRUE	0.2249	0.0000	0.04853927	24.36324	13.3306	0.2723	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Map showing location of Discrete sampling sites for Water Temperature



The bubble size on the above plots reflects the amount of data available at each sampling site

Table 26: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
10000	3836	1991	2019
5002	2116	1991	2023
69	456	1997	2017
3013	66	2004	2023
95	3	1972	2016

Program names:

10000 - RiverKeeper

5002 - Florida STORET / WIN

69 - Fisheries-Independent Monitoring (FIM) Program

3013 - Seagrass (SJRWMD)

95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Water Temperature in Loxahatchee River-Lake Worth Creek Aquatic Preserve

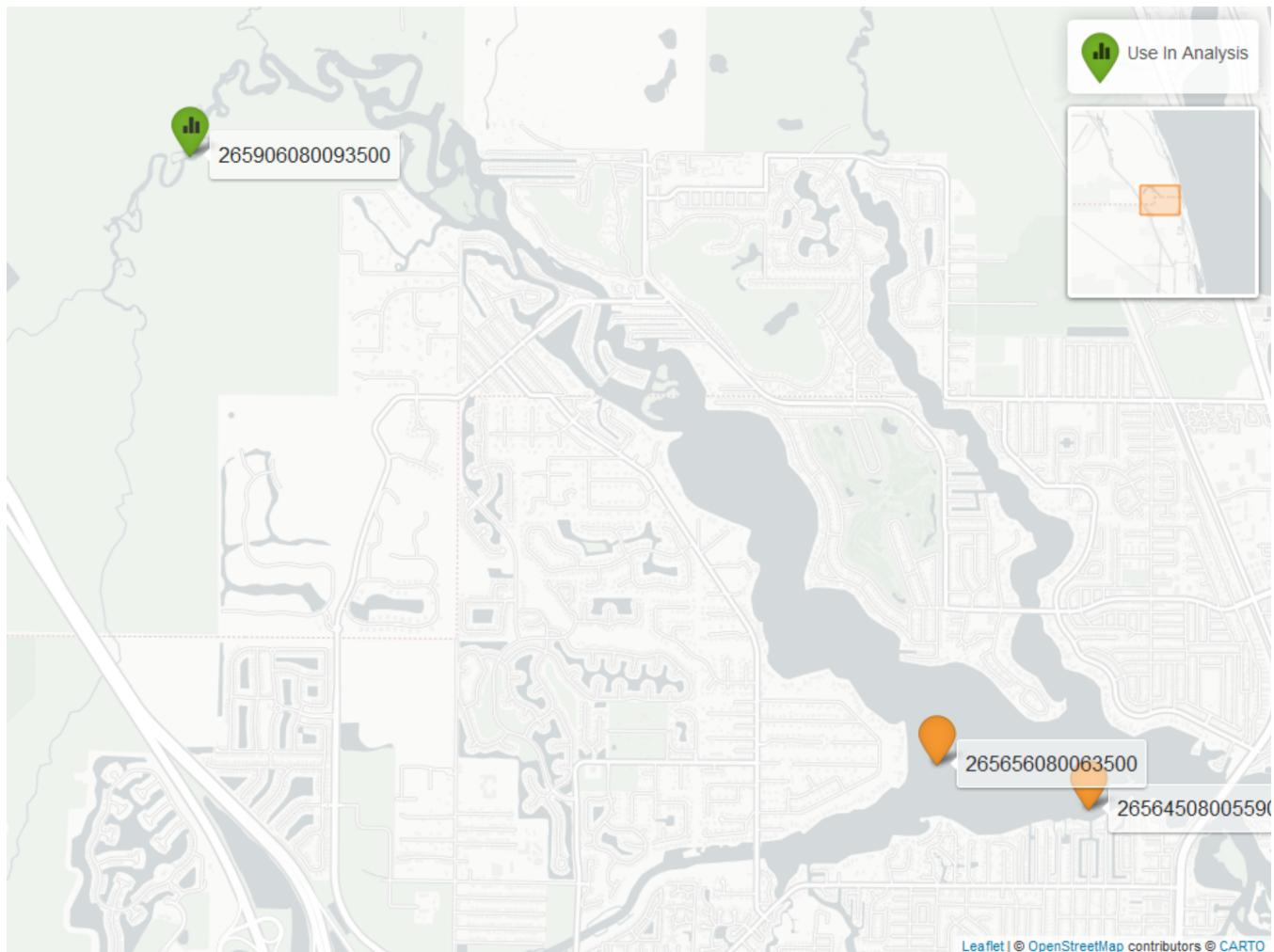
Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_pH_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_NE-2024-Feb-22.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_NE-2024-Feb-22.txt*

Table 27: National Water Information System (7)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
265645080055900	4	FALSE	Sal , TempW
265656080063500	4	FALSE	Sal , TempW
265906080093500	21	TRUE	Sal , TempW



Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Loxahatchee River-Lake Worth Creek Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

Salinity - Continuous Water Quality

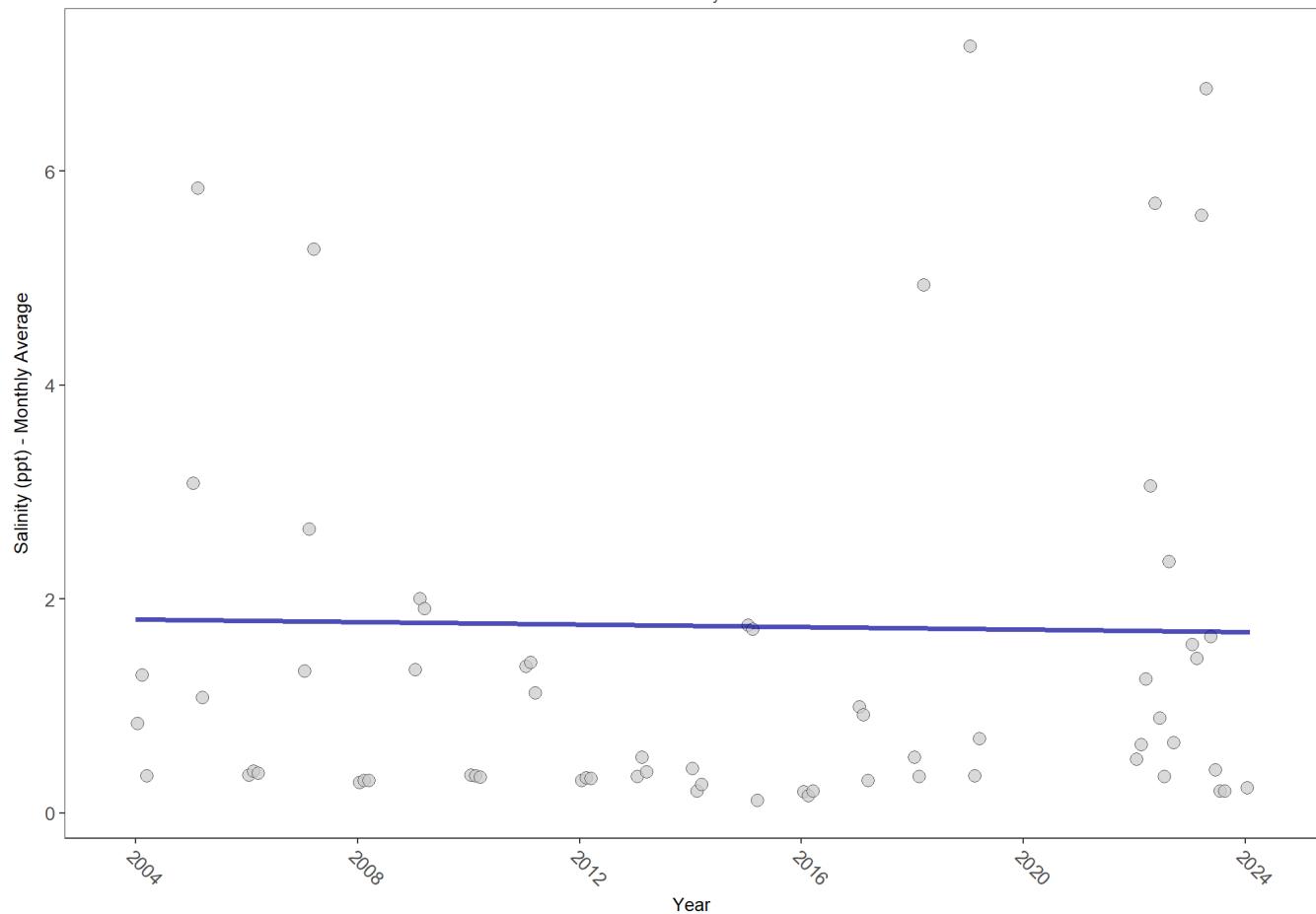
265906080093500

National Water Information System (7)

Loxahatchee River-Lake Worth Creek Aquatic Preserve

265906080093500

Salinity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
surface	2145	19	0.5	TRUE	-0.1409	0.5377	-0.005634702	1.805731	4.1457	0.7628	0

$p < 0.00005$ appear as 0 due to rounding.

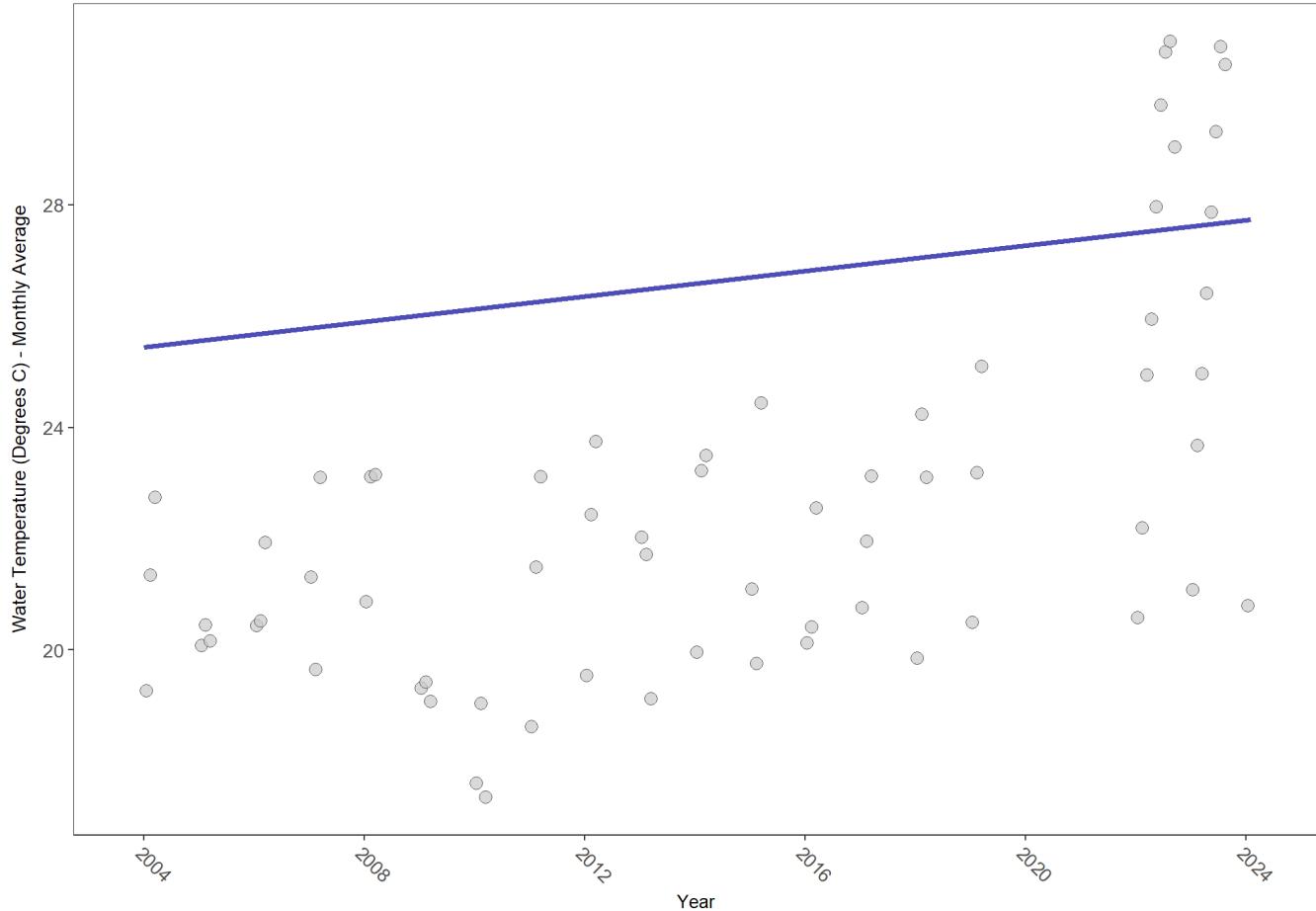
SennIntercept is intercept value at beginning of record for monitoring location

Water Temperature - Continuous Water Quality

265906080093500

National Water Information System (7)

Loxahatchee River-Lake Worth Creek Aquatic Preserve
265906080093500
Water Temperature



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
surface	2459	19	21.9	TRUE	0.2762	0.0003	0.1141679	25.43919	15.6628	0.0284	1

$p < 0.00005$ appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

Submerged Aquatic Vegetation

The data file used is: **All_SAV_Parameters-2024-Feb-23.txt**

Submerged aquatic vegetation (SAV) refers to plants and plant-like macroalgae species that live entirely underwater. The two primary categories of SAV inhabiting Florida estuaries are *benthic macroalgae* and *seagrasses*. They often grow together in dense beds or meadows that carpet the seafloor. *Macroalgae* include multicellular species of green, red and brown algae that often live attached to the substrate by a holdfast. They tend to grow quickly and can tolerate relatively high nutrient levels, making them a threat to seagrasses and other benthic habitats in areas with poor water quality. In contrast, *seagrasses* are grass-like, vascular, flowering plants that are attached to the seafloor by extensive root systems. *Seagrasses* occur throughout the coastal areas of Florida, including protected bays and lagoons as well as deeper offshore waters on the continental shelf. *Seagrasses* have taken advantage of the broad, shallow shelf and clear water to produce two of the most extensive seagrass beds anywhere in continental North America.

Parameters

Percent Cover measures the fraction of an area of seafloor that is covered by SAV, usually estimated by evaluating multiple small areas of seafloor. Percent cover is often estimated for total SAV, individual types of vegetation (seagrass, attached algae, drift algae) and individual species.

Frequency of Occurrence was calculated as the number of times a taxon was observed in a year divided by the number of sampling events, multiplied by 100. Analysis is conducted at the quadrat level and is inclusive of all quadrats (i.e., quadrats evaluated using Braun-Blanquet, modified Braun-Blanquet, and percent cover.)

Species

Turtle grass (*Thalassia testudinum*) is the largest of the Florida seagrasses, with longer, thicker blades and deeper root structures than any of the other seagrasses. It is considered a climax seagrass species.

Shoal grass (*Halodule wrightii*) is an early colonizer of vegetated areas and usually grows in water too shallow for other species except *widgeon grass*. It can often tolerate larger salinity ranges than other seagrass species. *Shoal grass* is characterized by thin, flat blades, that are narrower than *turtle grass* blades.

Manatee grass (*Syringodium filiforme*) is easily recognizable because its leaves are thin and cylindrical instead of the flat, ribbon-like form shared by many other seagrass species. The leaves can grow up to half a meter in length. *Manatee grass* is usually found in mixed seagrass beds or small, dense monospecific patches.

Widgeon grass (*Ruppia maritima*) grows in both fresh and salt water and is widely distributed throughout Florida's estuaries in less saline areas, particularly in inlets along the east coast. This species resembles *shoal grass* in certain environments but can be identified by the pointed tips of its leaves.

Three species of *Halophila spp.* are found in Florida - **Star grass** (*Halophila engelmannii*), **Paddle grass** (*Halophila decipiens*), and **Johnson's seagrass** (*Halophila johnsonii*). These are smaller, more fragile seagrasses than other Florida species and are considered ephemeral. They grow along a single long rhizome, with short blades. These species are not well-studied, although surveys are underway to define their ecological roles.

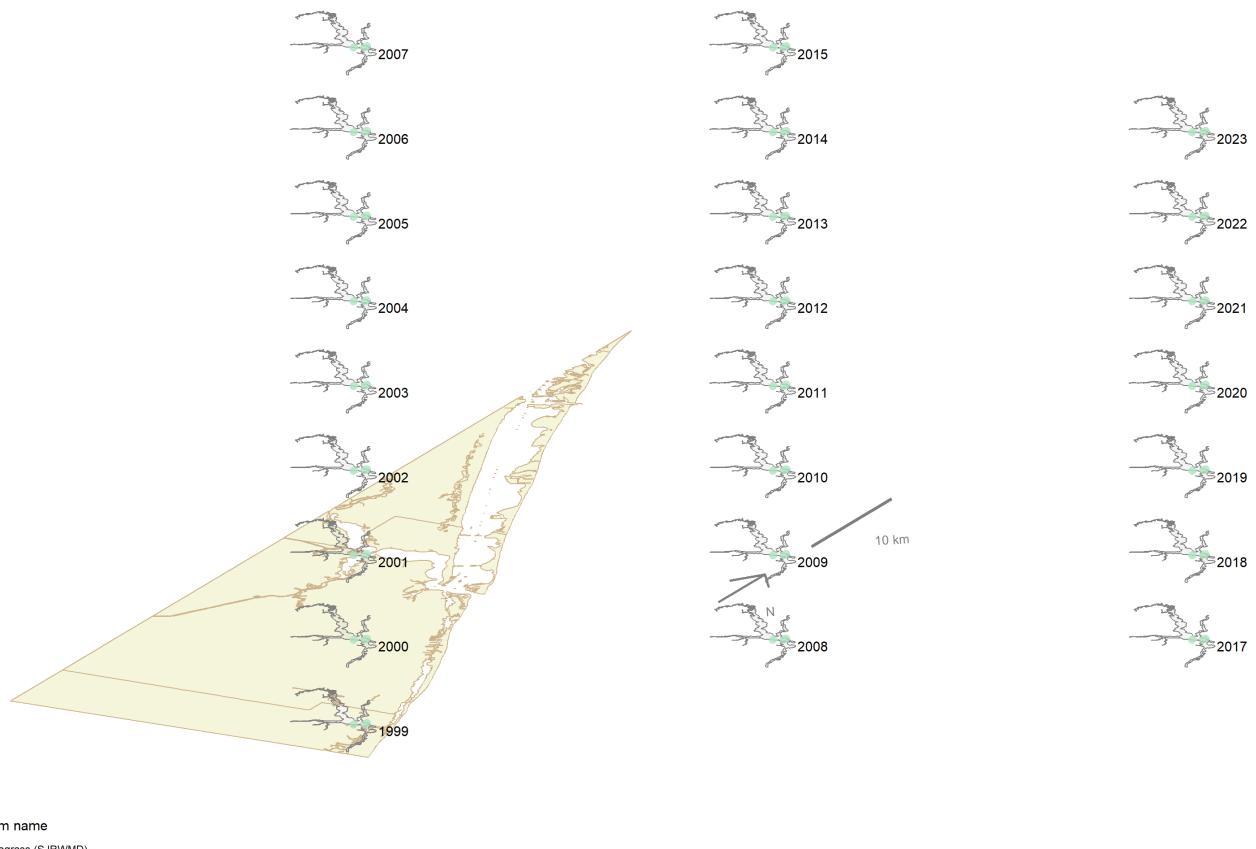
Notes

Star grass, *Paddle grass*, and *Johnson's seagrass* will be grouped together and listed as **Halophila spp.** in the following managed areas. This is because several surveys did not specify to the species level:

- Banana River Aquatic Preserve
- Indian River-Malabar to Vero Beach Aquatic Preserve
- Indian River-Vero Beach to Ft. Pierce Aquatic Preserve
- Jensen Beach to Jupiter Inlet Aquatic Preserve
- Loxahatchee River-Lake Worth Creek Aquatic Preserve
- Mosquito Lagoon Aquatic Preserve

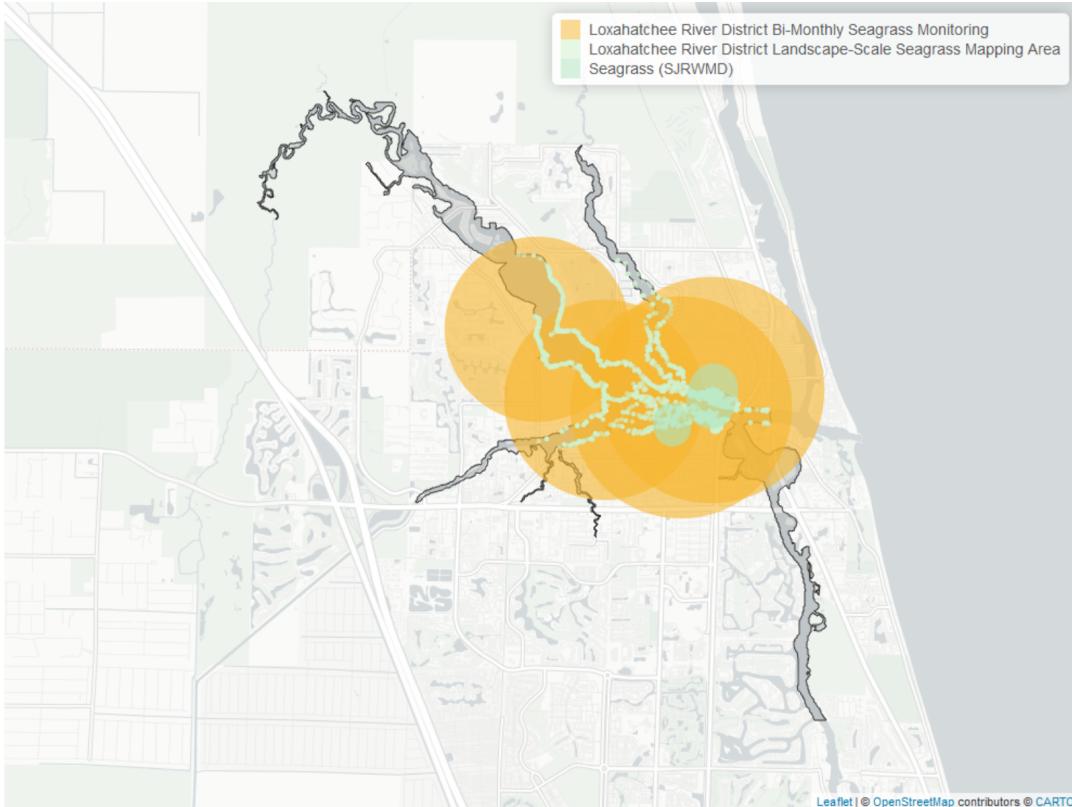
- Biscayne Bay Aquatic Preserve
- Florida Keys National Marine Sanctuary

Loxahatchee River-Lake Worth Creek Aquatic Preserve
SAV Percent Cover - Sample Locations



Maps showing the temporal scope of SAV sampling sites within the boundaries of *Loxahatchee River-Lake Worth Creek Aquatic Preserve* by Program name.

Sampling locations by Program:



Map showing SAV sampling sites within the boundaries of *Loxahatchee River-Lake Worth Creek Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 28: Seagrass (SJRWM) - *Program 3013*

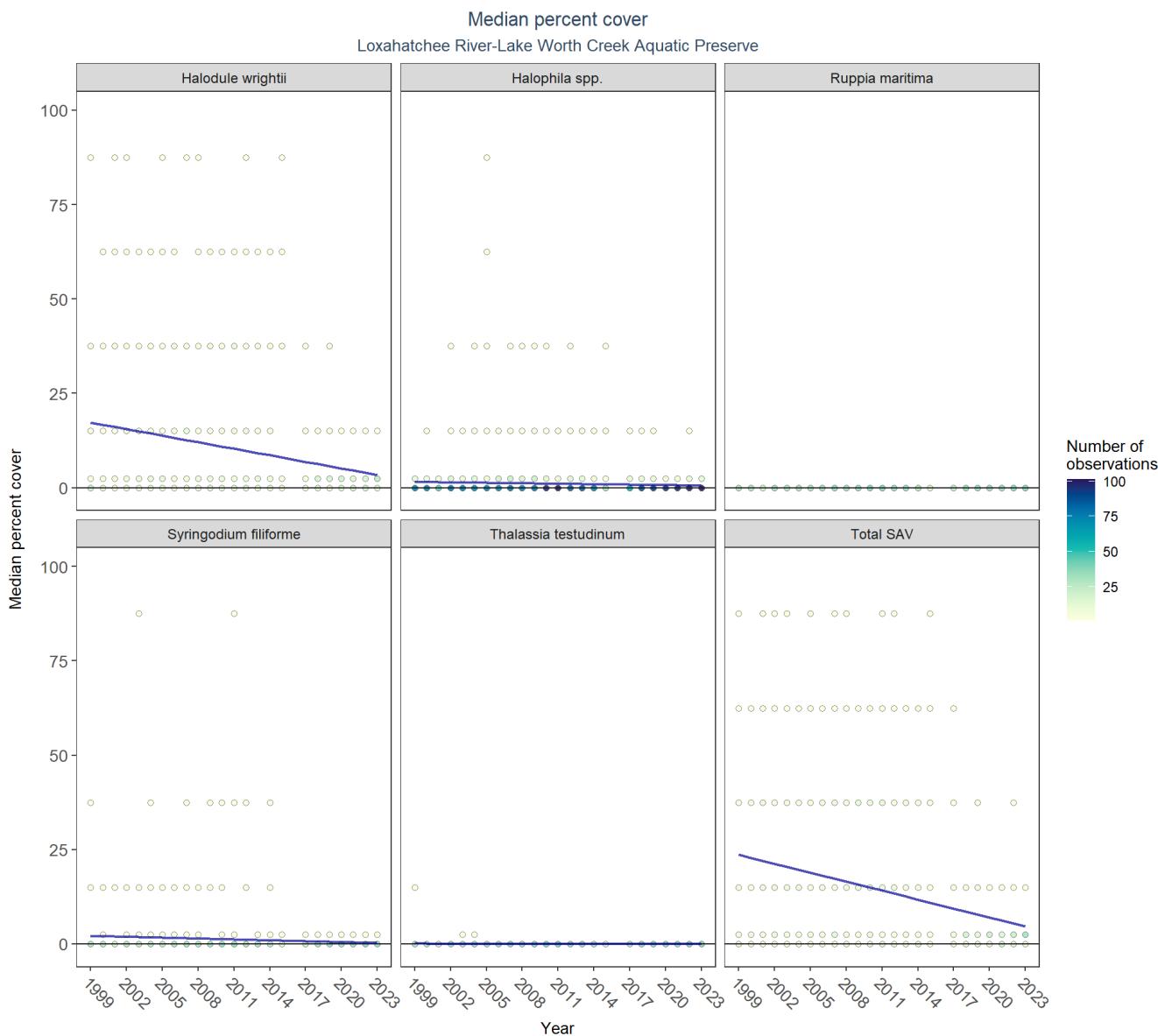
<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
6045	1999	2023	Percent Cover	2
6685	1999	2023	Percent Occurrence	2

Table 29: Loxahatchee River District Bi-Monthly Seagrass Monitoring - *Program 3017*

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
36944	2007	2022	Percent Occurrence	4

Table 30: Loxahatchee River District Landscape-Scale Seagrass Mapping Area - *Program 10001*

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
9672	2007	2007	Percent Occurrence	1612



Median percent cover by species in *Loxahatchee River-Lake Worth Creek Aquatic Preserve*. Linear mixed-effects models are applied to each species to produce species trends. The trendlines are then isolated and reproduced below for ease of viewing. The LME results are available in table form beneath the supplemental trendplot below.

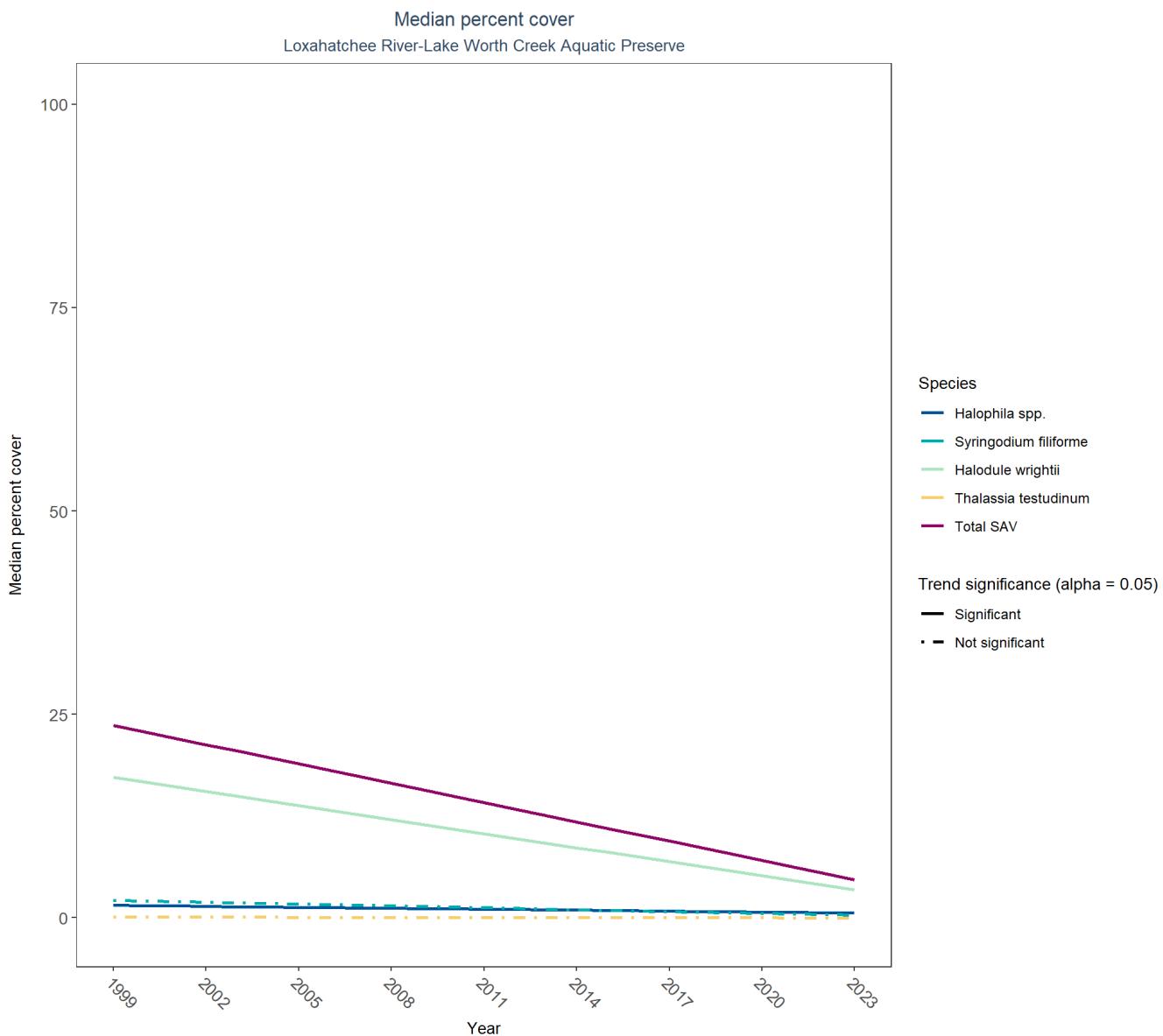
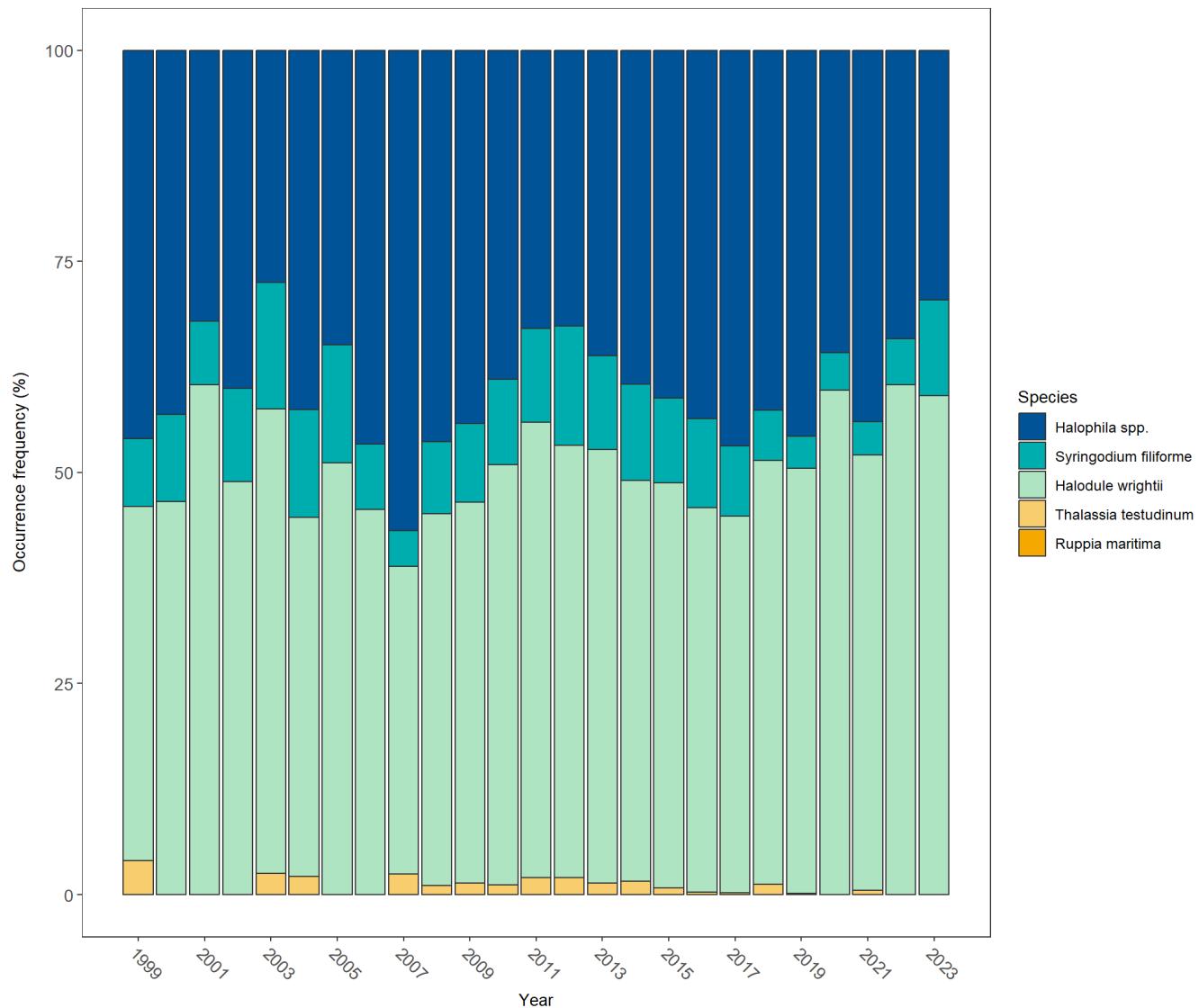
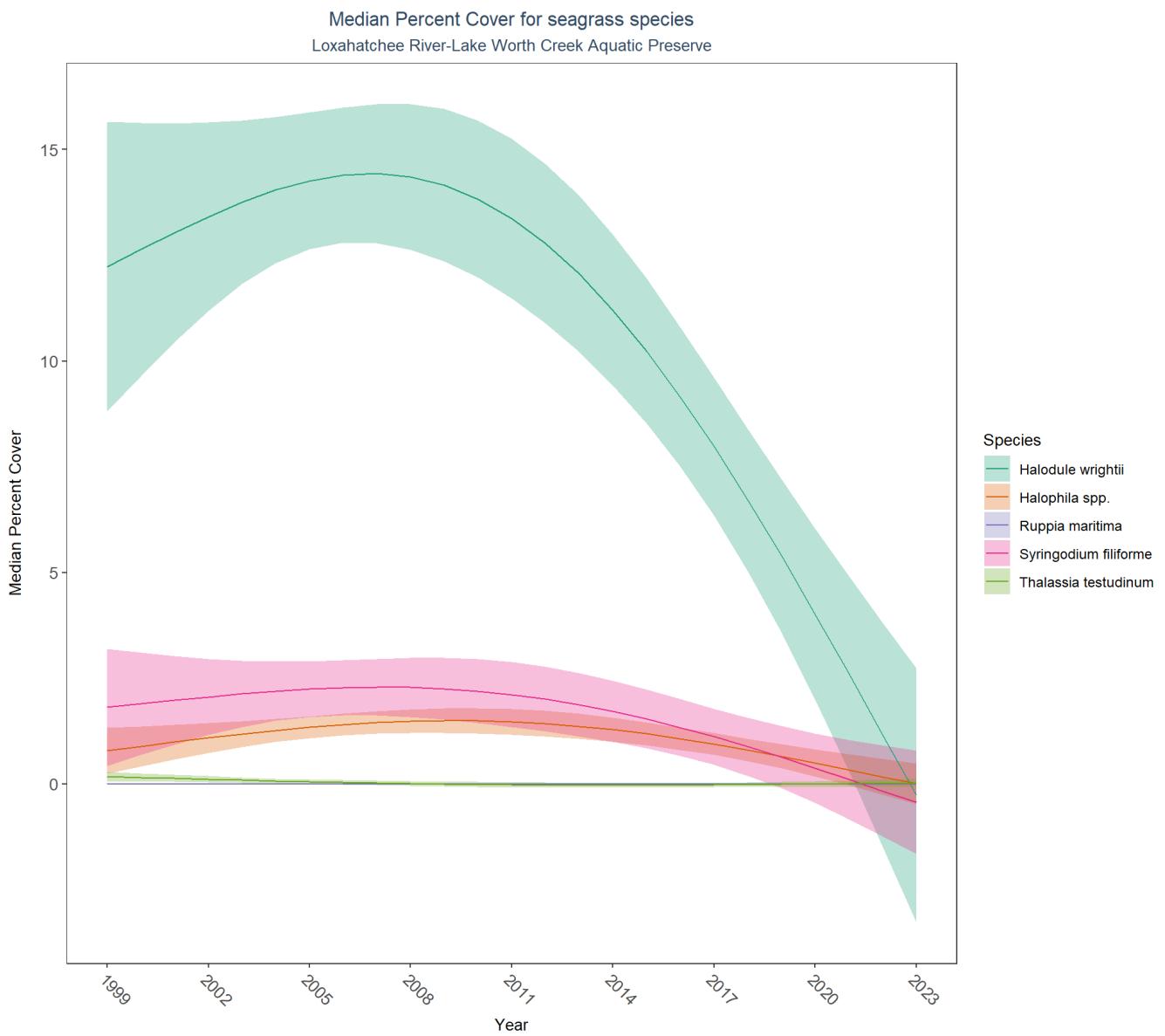


Table 31: Percent Cover Trend Analysis for Loxahatchee River-Lake Worth Creek Aquatic Preserve

Species	Common Name	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Drift algae		Insufficient data to calculate trend				
Halodule wrightii	Shoal grass	Significantly decreasing trend	1999 - 2023	20.1590	-0.5780	0.0000
Halophila spp.		Significantly decreasing trend	1999 - 2023	1.7078	-0.0392	0.0042
Ruppia maritima	Widgeon grass	Model did not fit the available data	1999 - 2023			
Syringodium filiforme	Manatee grass	No significant trend	1999 - 2023	2.5351	-0.0774	0.3485
Thalassia testudinum	Turtle grass	No significant trend	1999 - 2023	0.1034	-0.0047	0.3007
Total SAV		Significantly decreasing trend	1999 - 2023	27.6035	-0.7913	0.0000
Total seagrass		Insufficient data to calculate trend				

Frequency of occurrence
Loxahatchee River-Lake Worth Creek Aquatic Preserve





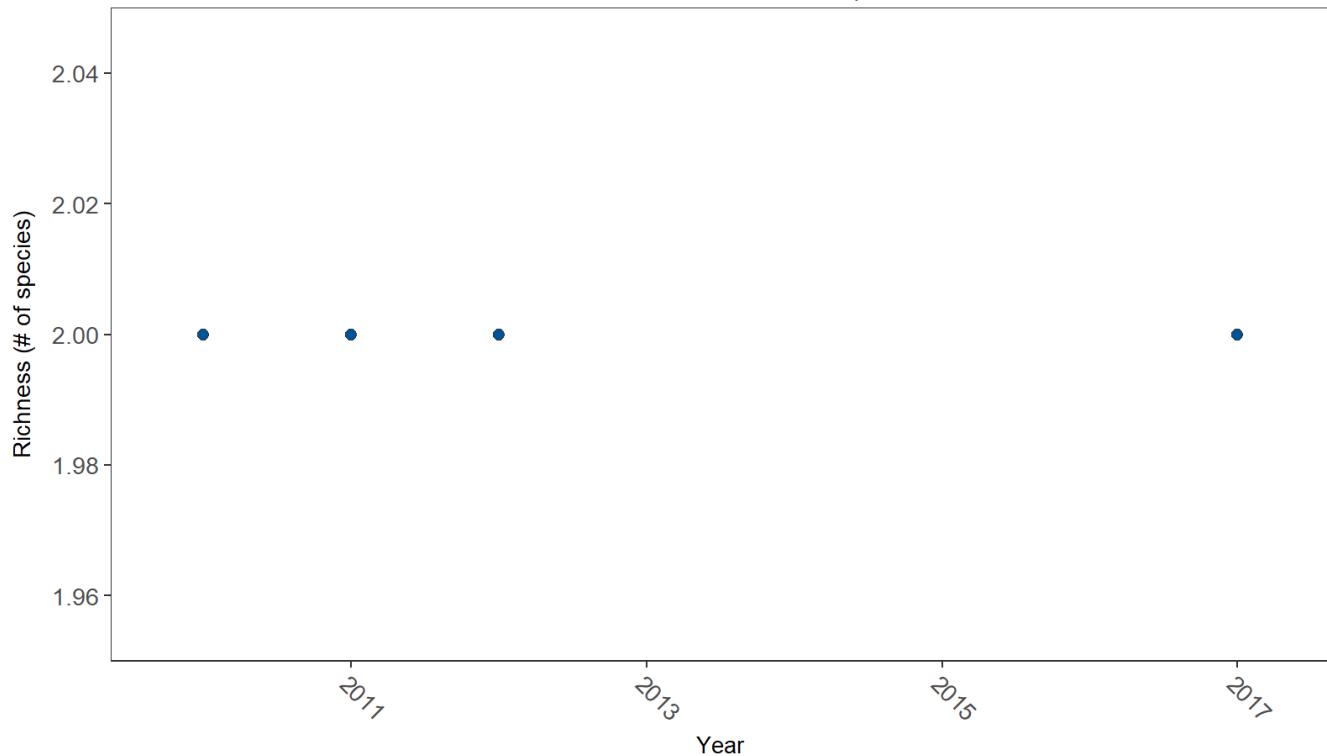
Generalized additive models for each species in Loxahatchee River-Lake Worth Creek Aquatic Preserve. Species must have at least 10 years of data to be evaluated.

Drift algae, Total seagrass, Attached algae, and Total SAV are excluded from the analyses.

Coral Reef

The data file used is: All_CORAL_Parameters-2024-Feb-23.txt

Grazers and Reef-Dependent Species Richness
Loxahatchee River-Lake Worth Creek Aquatic Preserve



N_Years	EarliestYear	LatestYear	N_Data	Min	Max	Median	Mean	StDev	Year_MinRichness	Year_MaxRichness
4	2010	2017	8	2	2	2	2	0	2010	2010