

Estero Bay Aquatic Preserve

SEACAR Habitat Analyses

Last compiled on 08 April, 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

<i>Parameter Name</i>	<i>Units</i>	<i>Low Threshold</i>	<i>High Threshold</i>	<i>Sensor Type</i>
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

<i>Parameter Name</i>	<i>Units</i>	<i>Low Threshold</i>	<i>High Threshold</i>
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	-
NO ₂ +3 Filtered	mg/L	0	-
NH ₄ 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

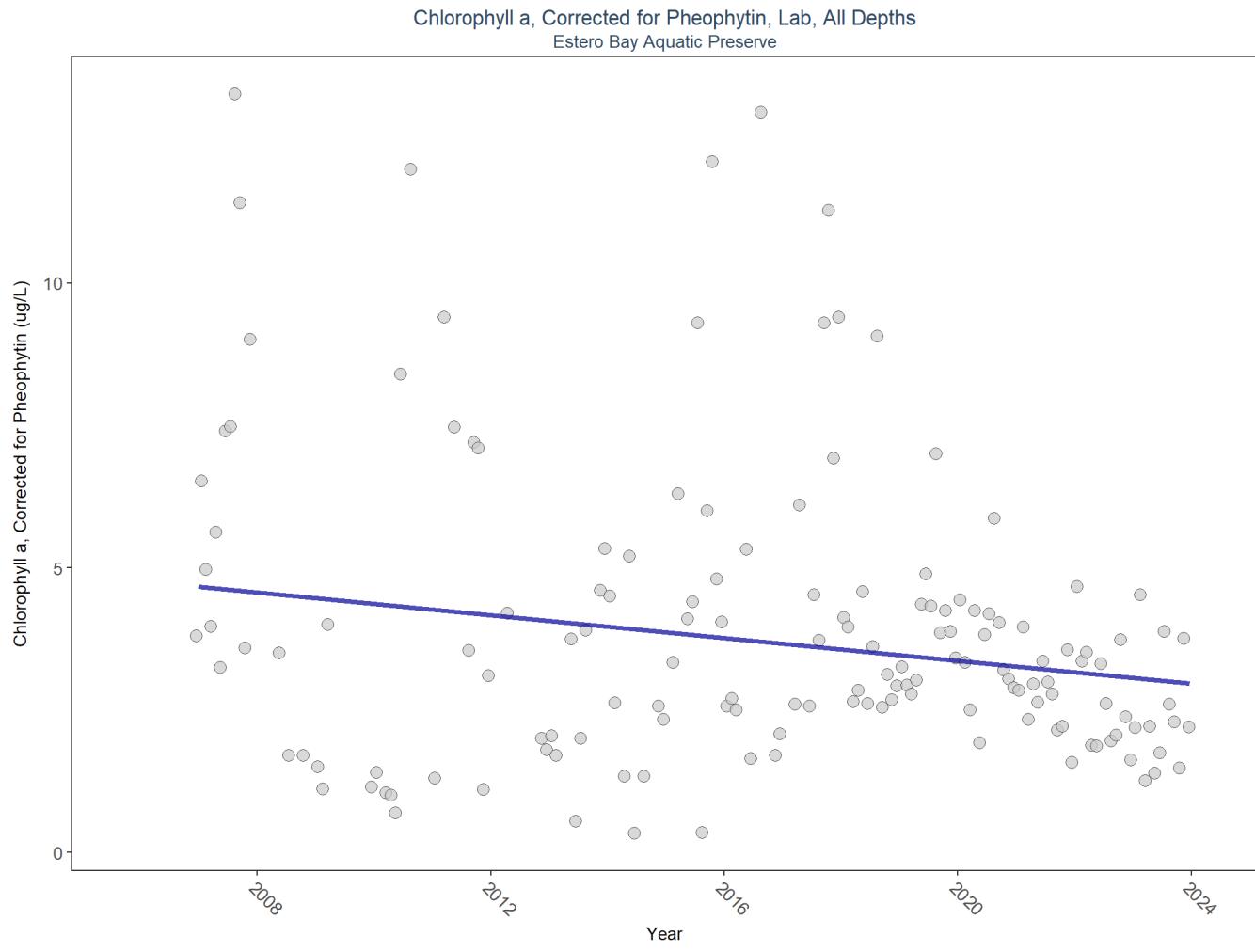
The following files were used in the discrete analysis:

- *Combined_WQ_WC_NUT_Chlorophyll_a_corrected_for_pheophytin-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Chlorophyll_a_uncorrected_for_pheophytin-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Colored_dissolved_organic_matter_CDOM-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Dissolved_Oxygen_Saturation-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_pH-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Salinity-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Secchi_Depth-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Total_Nitrogen-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Total_Phosphorus-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Total_Suspended_Solids_TSS-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Turbidity-2024-Mar-27.txt*
- *Combined_WQ_WC_NUT_Water_Temperature-2024-Mar-27.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.

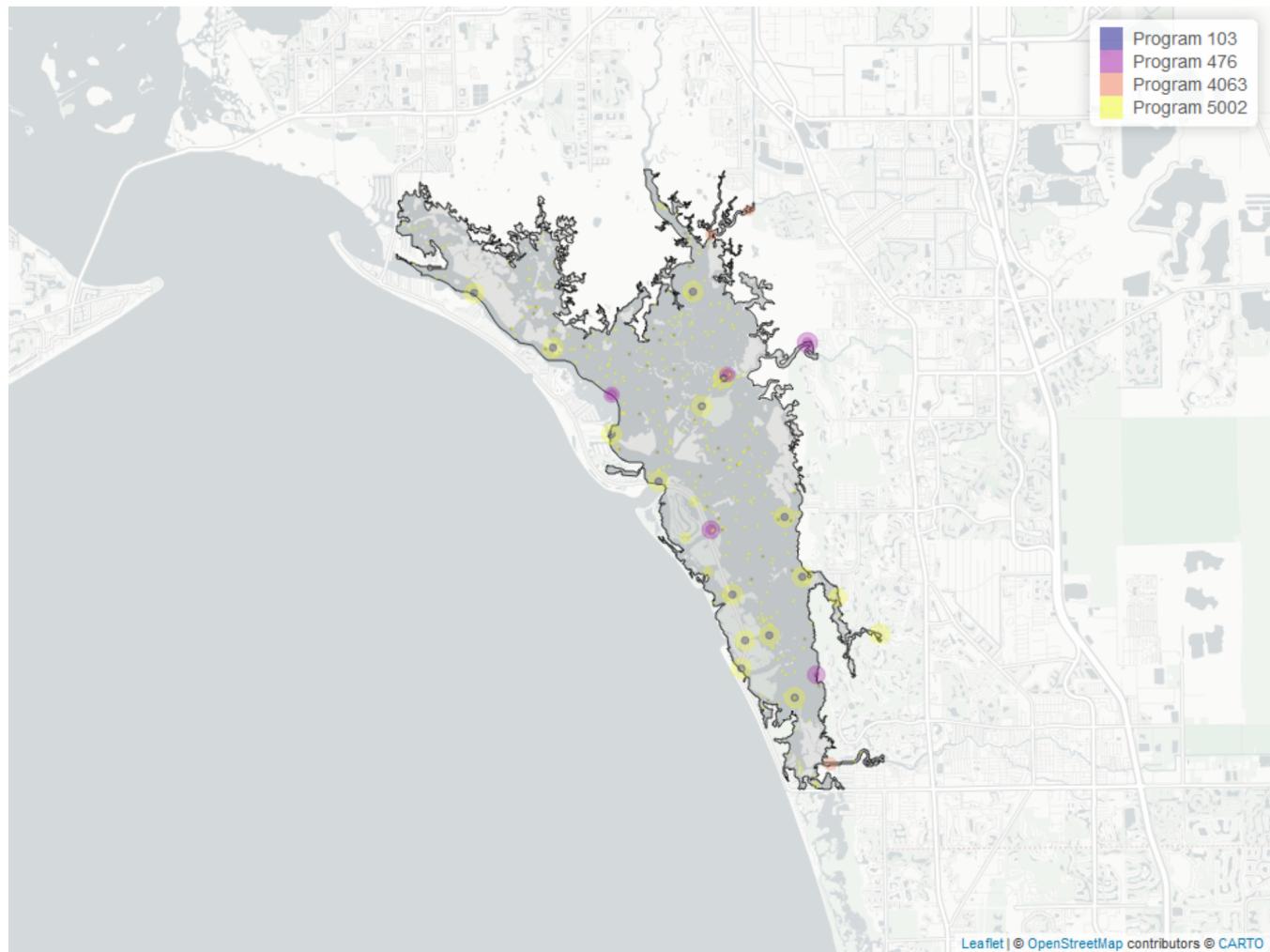
Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$ 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
5002	1386	2006	2023
476	313	2008	2023
103	170	2020	2021
4063	63	2018	2023

Program names:

5002 - Florida STORET / WIN

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

4063 - Estero Bay Tributary Monitoring

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	1	1	100.0				
2007	46	3	6.5			4	8.7
2008	5	2	40.0				
2009	8	7	87.5				
2010	9	5	55.6	3	33.3	1	11.1
2011	14	3	21.4	6	42.9		
2012	6	2	33.3			2	33.3
2013	25	10	40.0			5	20.0
2014	20	1	5.0	1	5.0	5	25.0
2015	26	4	15.4			3	11.5
2016	22	8	36.4	2	9.1		
2017	35	4	11.4				
2018	274	77	28.1				
2019	268	63	23.5			2	0.8
2020	261	59	22.6	1	0.4	1	0.4
2021	450	118	26.2			13	2.9
2022	262	108	41.2			20	7.6
2023	200	80	40.0			50	25.0

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

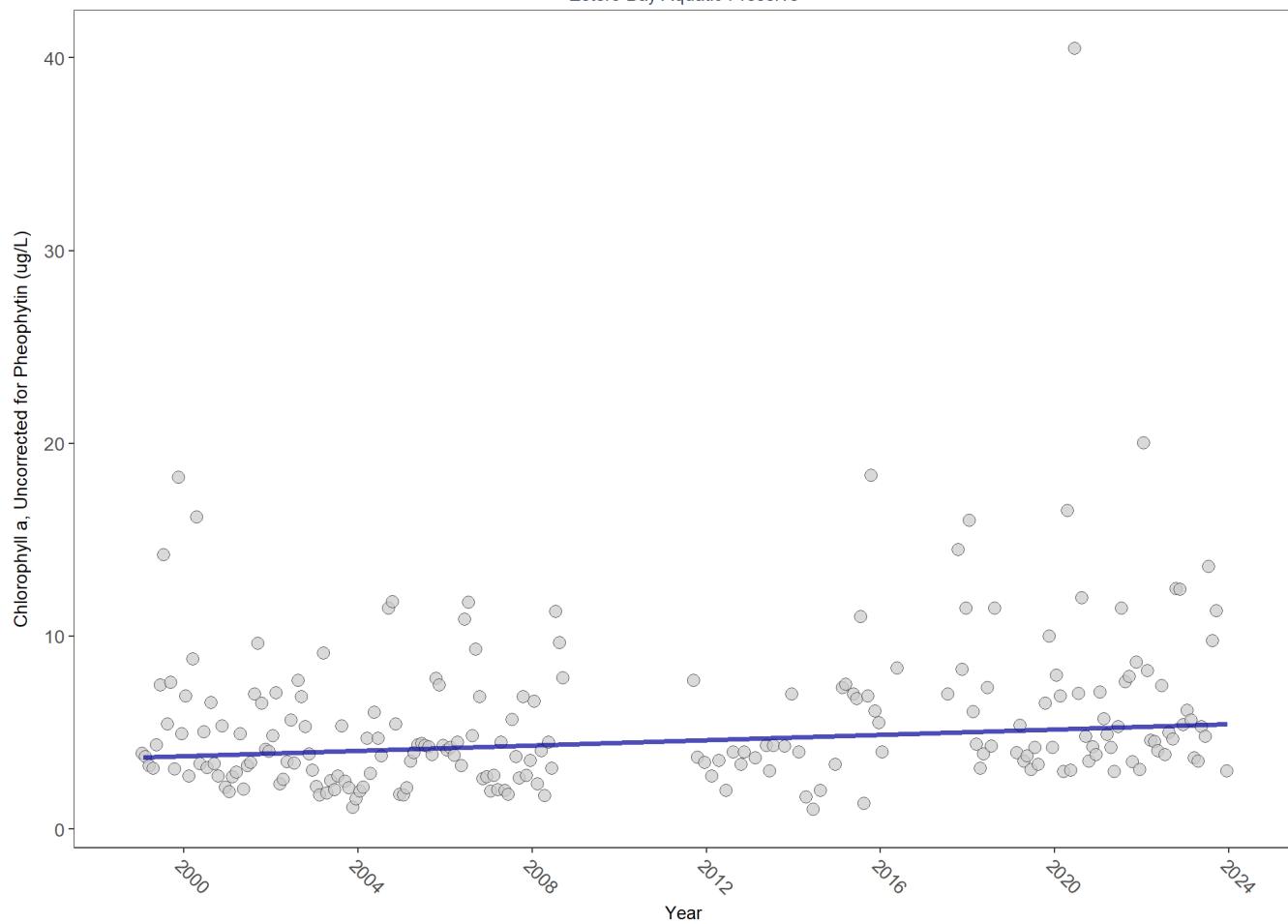
4063 - Estero Bay Tributary Monitoring

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

Chlorophyll a, Uncorrected for Pheophytin - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Chlorophyll a, Uncorrected for Pheophytin, Lab, All Depths
Estero Bay Aquatic Preserve

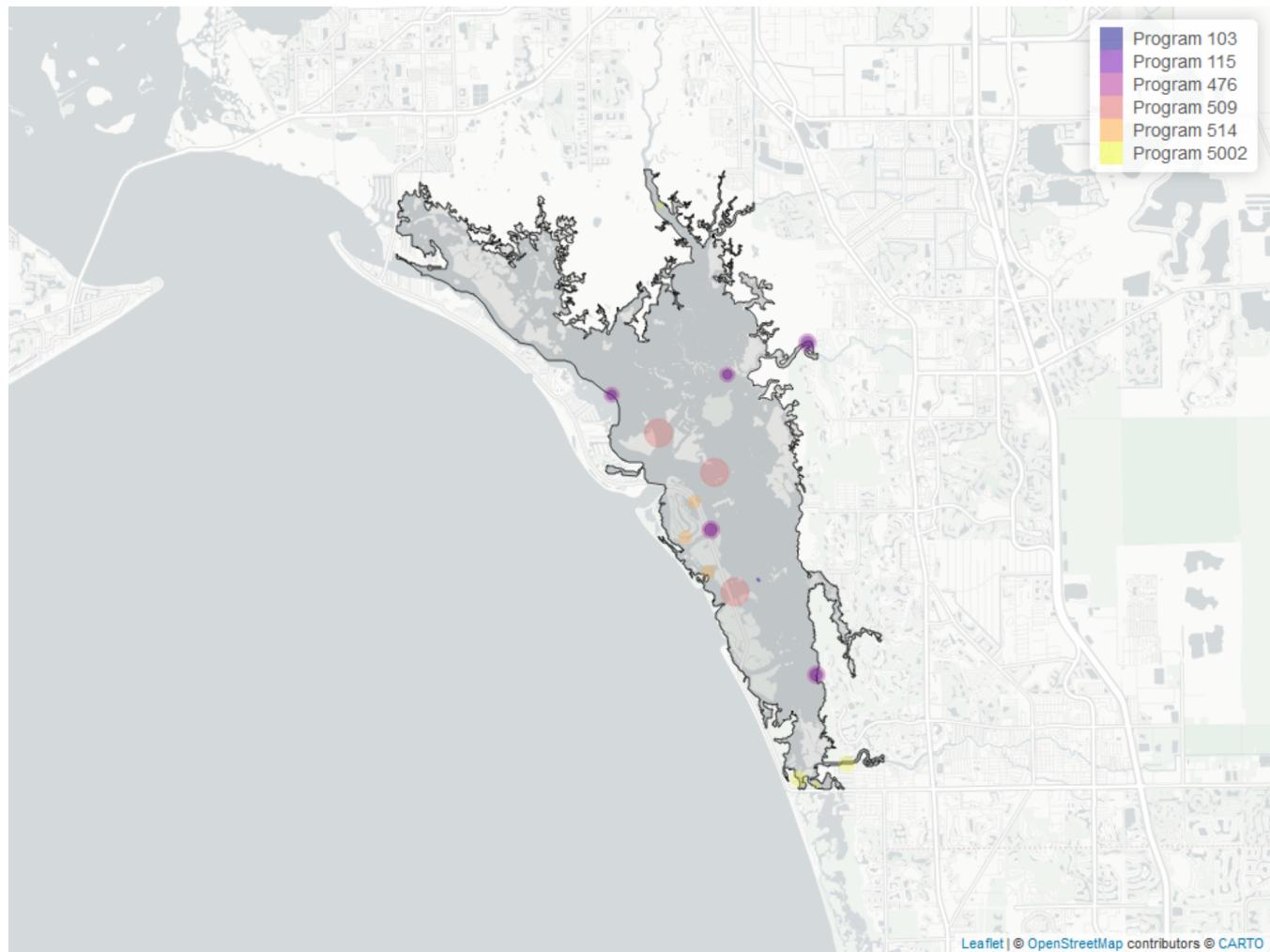


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	896	23	4.1	TRUE	0.1709	0.0006	0.06916524	3.699996	7.1386	0.7878	1

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 Chlorophyll a, Uncorrected for Pheophytin



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

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

ProgramID	N_Data	YearMin	YearMax
509	347	1999	2008
476	287	1999	2023
103	110	2003	2022
5002	84	2011	2023
514	82	2011	2018
115	1	2003	2003

Program names:

509 - SERC Water Quality Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

5002 - Florida STORET / WIN

514 - Florida LAKEWATCH Program

115 - Environmental Monitoring Assessment 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	$perc_U$
2000	46					2	4.3
2001	42					6	14.3
2003	44					6	13.6
2004	40	6	15.0			1	2.5
2005	37					1	2.7
2006	45					4	8.9
2007	55	14	25.4			2	3.6
2008	31	3	9.7				
2011	7				1	14.3	
2018	33	1	3.0				
2019	42	3	7.1				
2020	54	1	1.9	2		3.7	
2021	164	2	1.2				
2022	54	2	3.7	3		5.6	
2023	46	2	4.3	3		6.5	

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:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

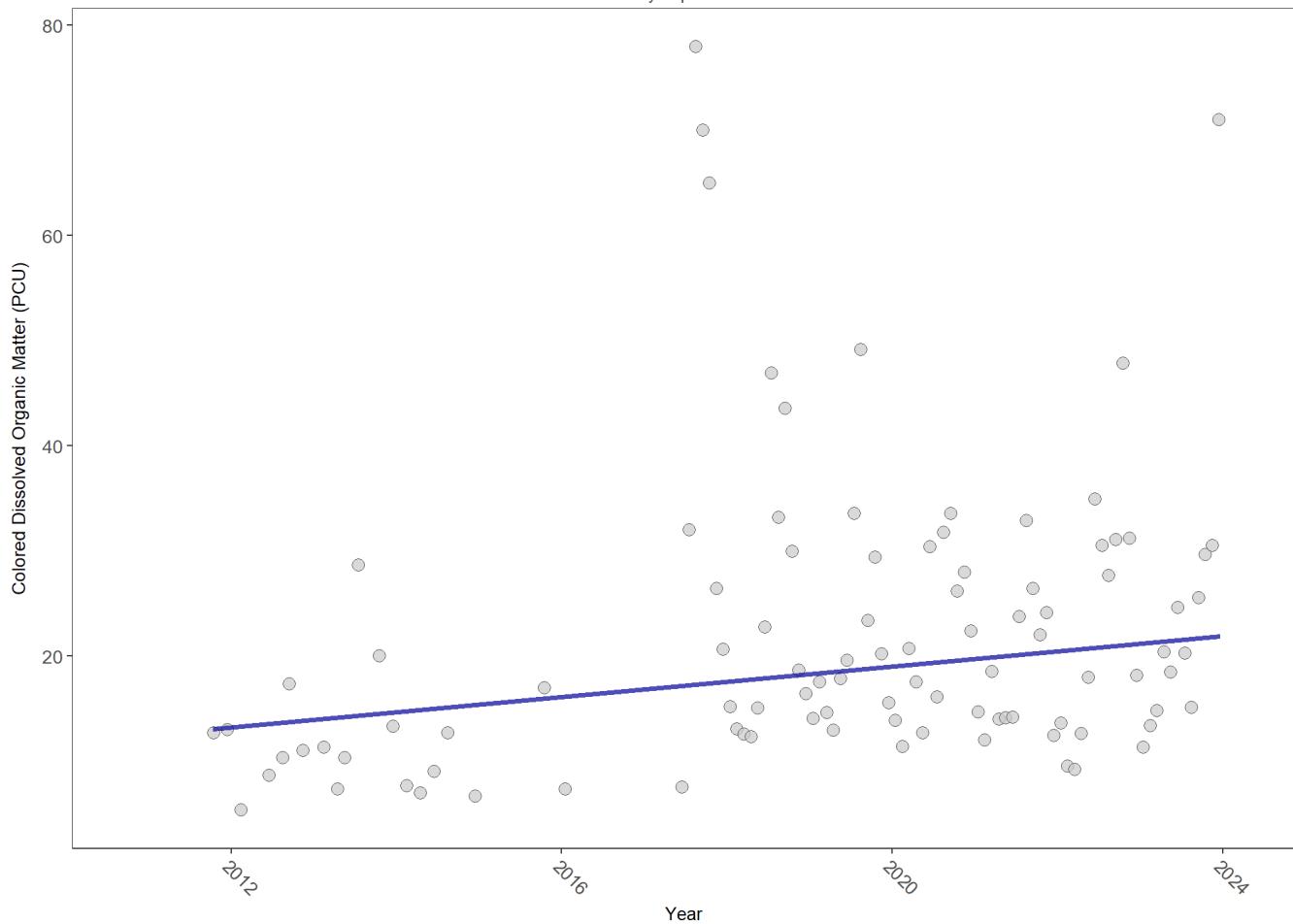
5002 - Florida STORET / WIN

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
Estero Bay Aquatic Preserve

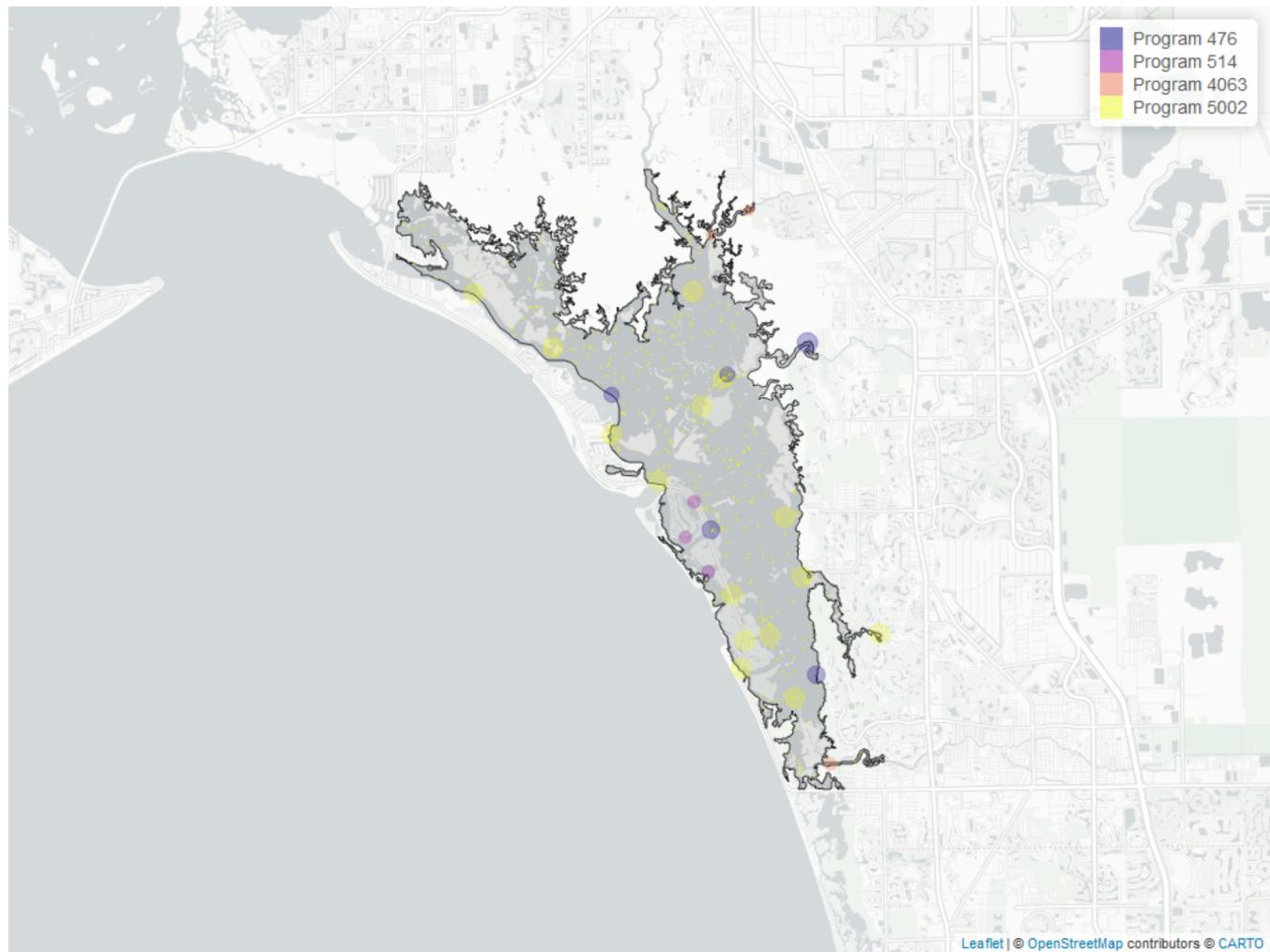


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1636	13	14.2	TRUE	0.2574	0.0011	0.7266524	12.47818	17.1589	0.1033	1

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
5002	1277	2018	2023
476	237	2017	2023
514	63	2011	2017
4063	63	2018	2023

Program names:

5002 - Florida STORET / WIN

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

514 - Florida LAKEWATCH Program

4063 - Estero Bay Tributary Monitoring

Value Qualifiers

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

Year	N_{Total}	N_{I}	perc_{I}	N_{Q}	perc_{Q}	N_{U}	perc_{U}
2017	35	4	11.4				
2018	275	34	12.4			4	1.4
2019	268	36	13.4			9	3.4
2020	242	49	20.2	1	0.4	2	0.8
2021	299	39	13.0			11	3.7
2022	262	38	14.5			7	2.7
2023	199	22	11.1				

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

Programs containing Value Qualified data:

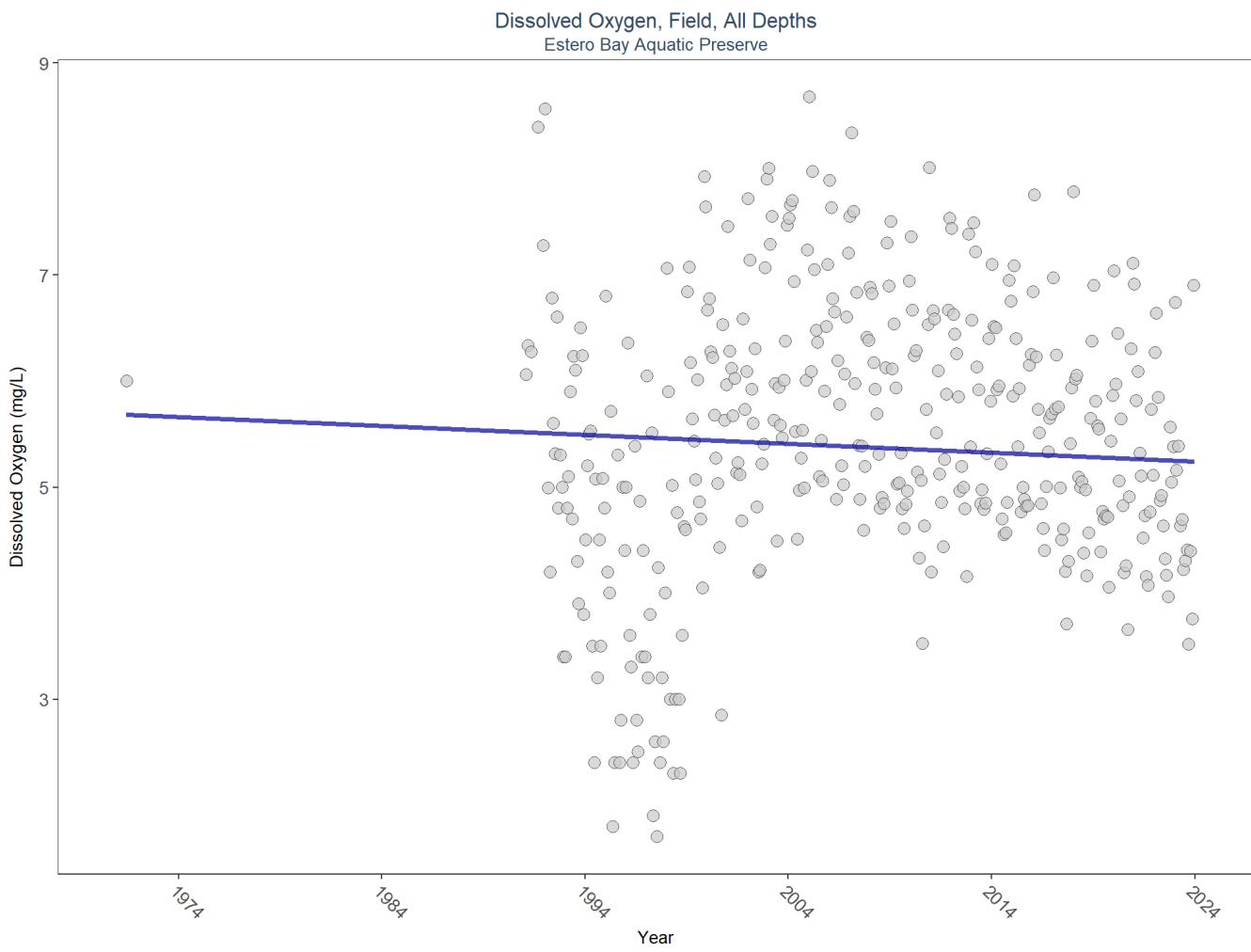
5002 - Florida STORET / WIN

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

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

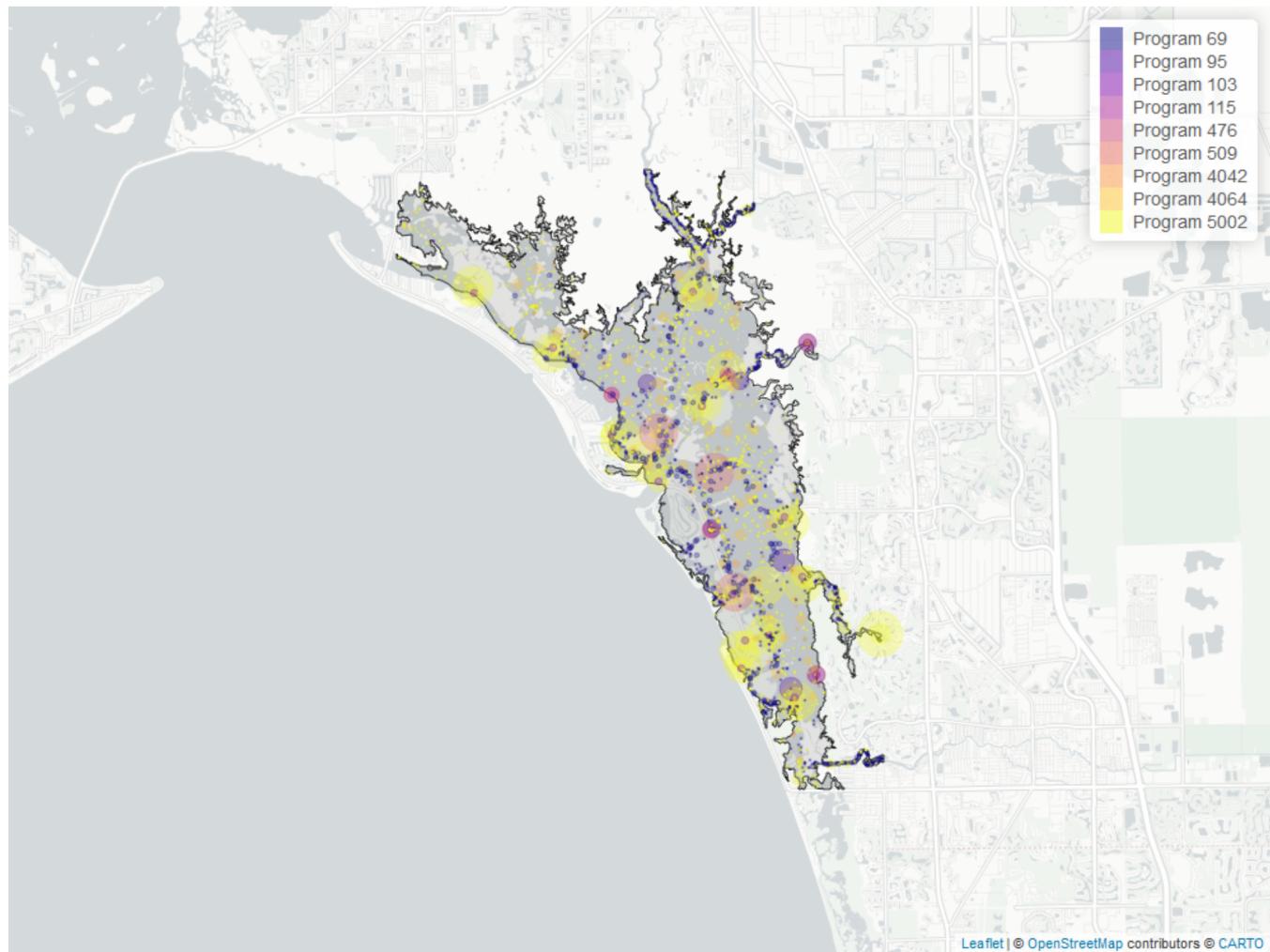


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10602	34	5.8	TRUE	-0.0593	0.1038	-0.008397731	5.684275	12.8516	0.3031	0

$p < 0.00005$ 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 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
5002	6151	1991	2023
69	2258	2001	2007
509	696	1999	2008
4064	619	2011	2012
95	442	1971	2018
476	325	2008	2023
103	252	2003	2022
4042	46	2016	2022
115	2	2003	2003

Program names:

5002 - Florida STORET / WIN
69 - Fisheries-Independent Monitoring (FIM) Program
509 - SERC Water Quality Monitoring Network
4064 - A spatial model to improve site selection for seagrass restoration in shallow boating environments
95 - Harmful Algal Bloom Marine Observation Network
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
103 - EPA STOrage and RETrieval Data Warehouse (STORET)
4042 - Estero Bay Oyster Monitoring
115 - Environmental Monitoring Assessment Program

Value Qualifiers

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

Table 13: Value Qualifiers for Dissolved Oxygen

Year	N_{Total}	N_H	$perc_H$
2008	301	10	3.3

Note: H^+ - Value based on field kit determination

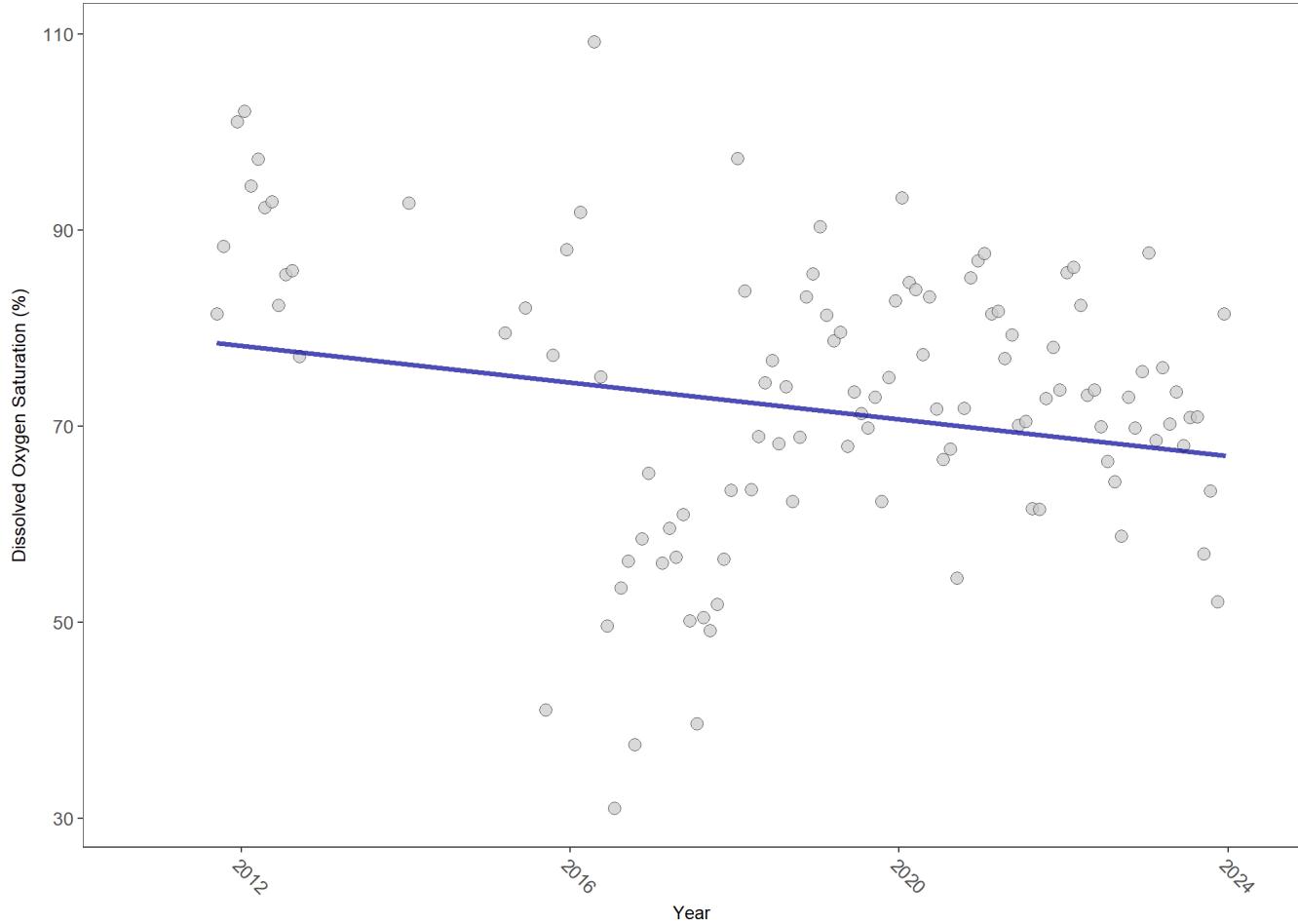
Programs containing Value Qualified data:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

Dissolved Oxygen Saturation - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Dissolved Oxygen Saturation, Field, All Depths
Estero Bay Aquatic Preserve

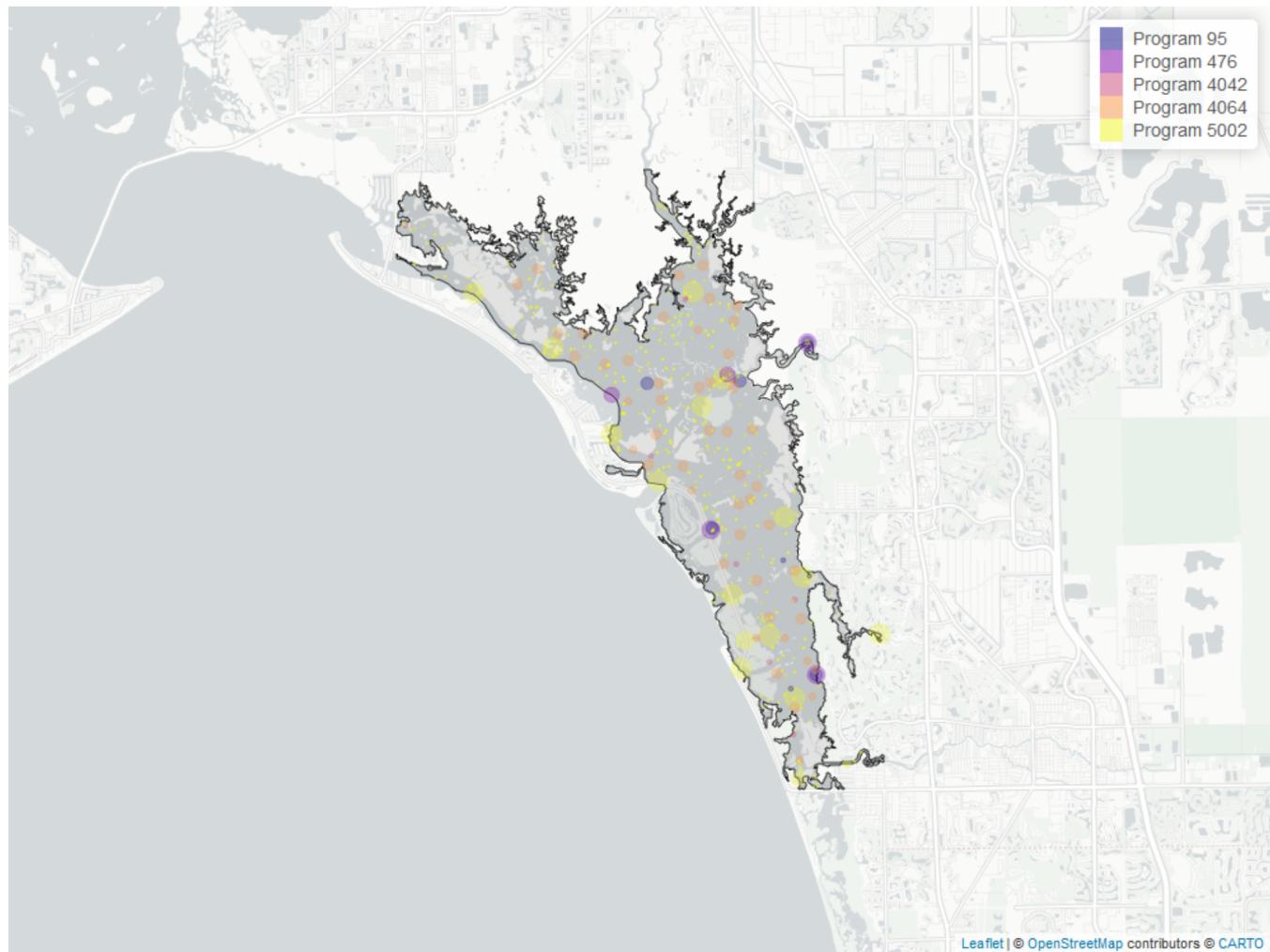


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2424	12	81.6	TRUE	-0.1888	0.0151	-0.9375	79.10854	6.6504	0.8267	-1

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 Saturation



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

Table 14: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	N_Data	YearMin	YearMax
5002	1453	2015	2023
4064	619	2011	2012
476	202	2017	2023
95	120	2011	2018
4042	37	2016	2022

Program names:

5002 - Florida STORET / WIN

4064 - A spatial model to improve site selection for seagrass restoration in shallow boating environments

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

95 - Harmful Algal Bloom Marine Observation Network

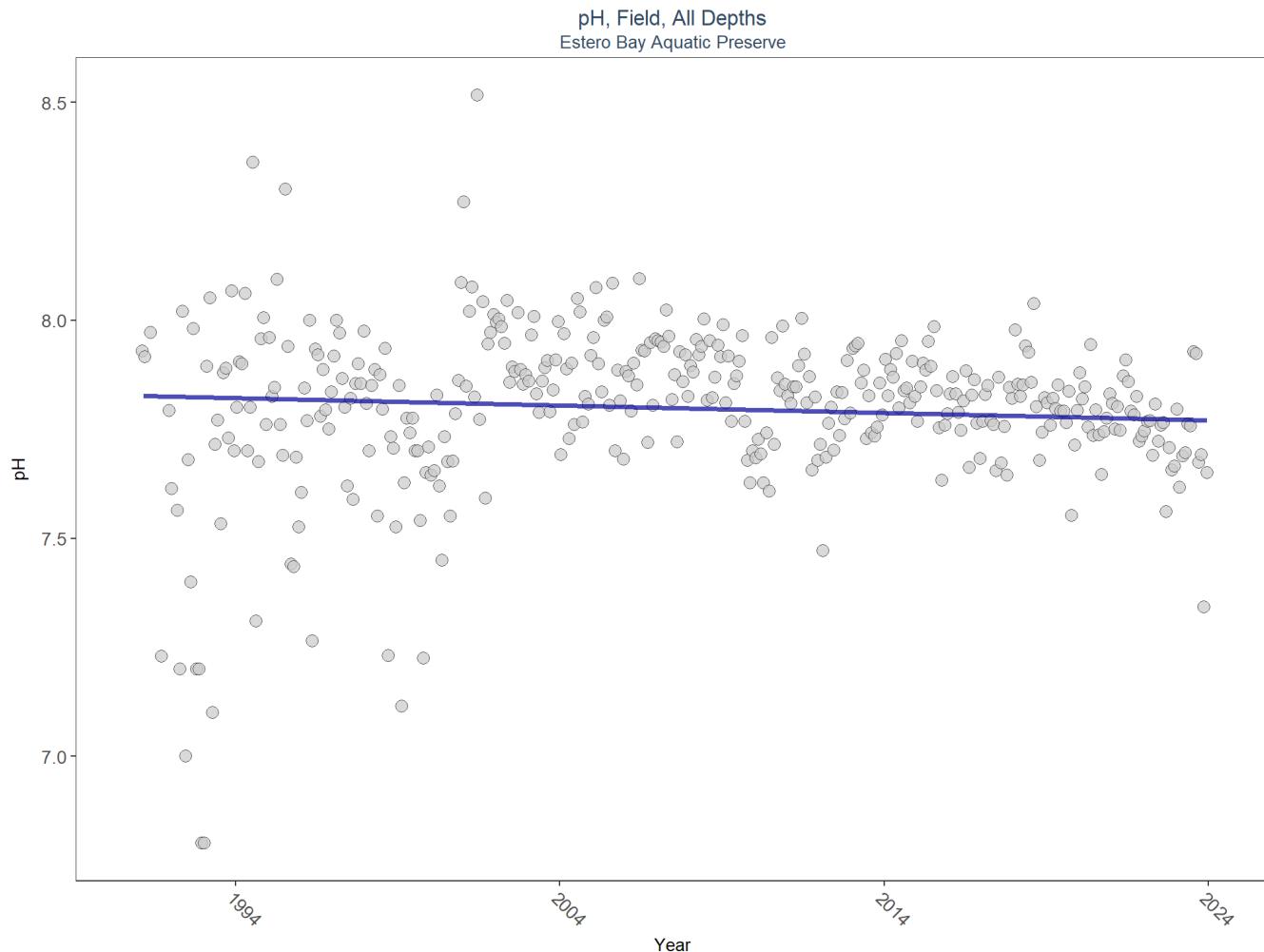
4042 - Estero Bay Oyster Monitoring

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in Estero Bay 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.

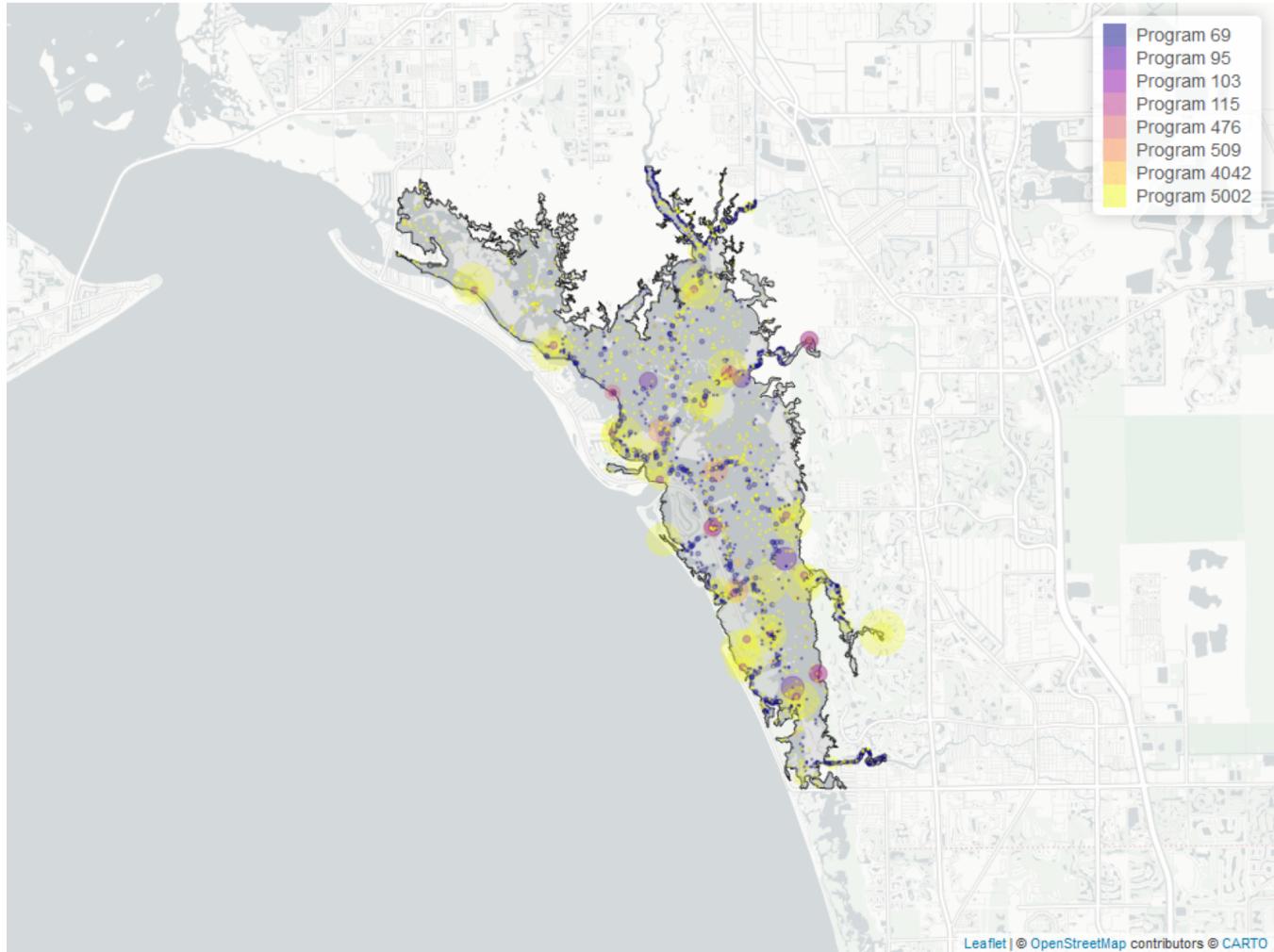
Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$ 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 15: Programs contributing data for pH

ProgramID	N_Data	YearMin	YearMax
5002	6436	1991	2023
69	2264	2001	2007
95	444	2005	2018
509	270	2001	2008
476	264	2009	2023
103	252	2020	2022
4042	40	2016	2022
115	2	2003	2003

Program names:

5002 - Florida STORET / WIN

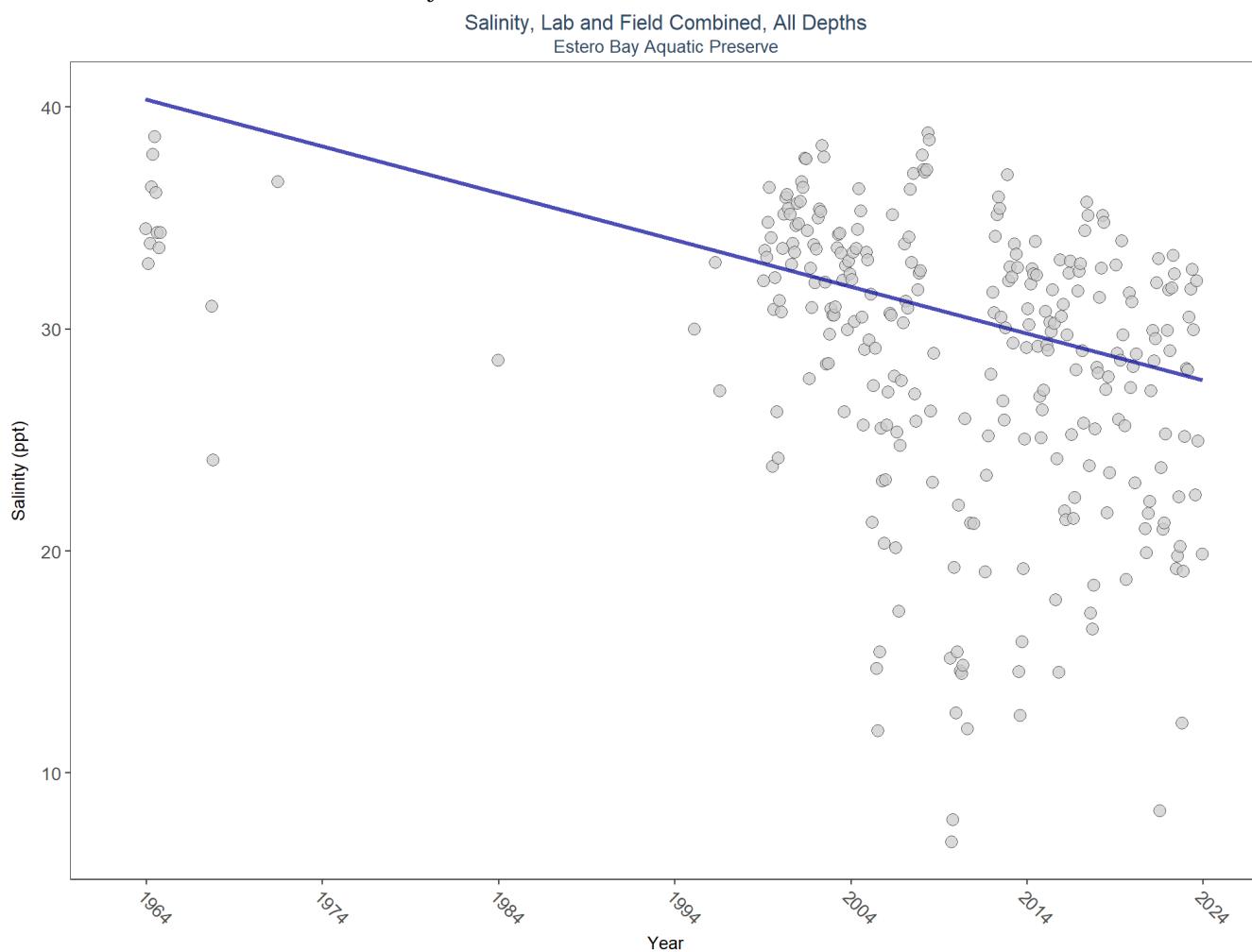
- 69 - Fisheries-Independent Monitoring (FIM) Program
- 95 - Harmful Algal Bloom Marine Observation Network
- 509 - SERC Water Quality Monitoring Network
- 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
- 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
- 4042 - Estero Bay Oyster Monitoring
- 115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for pH in Estero Bay 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

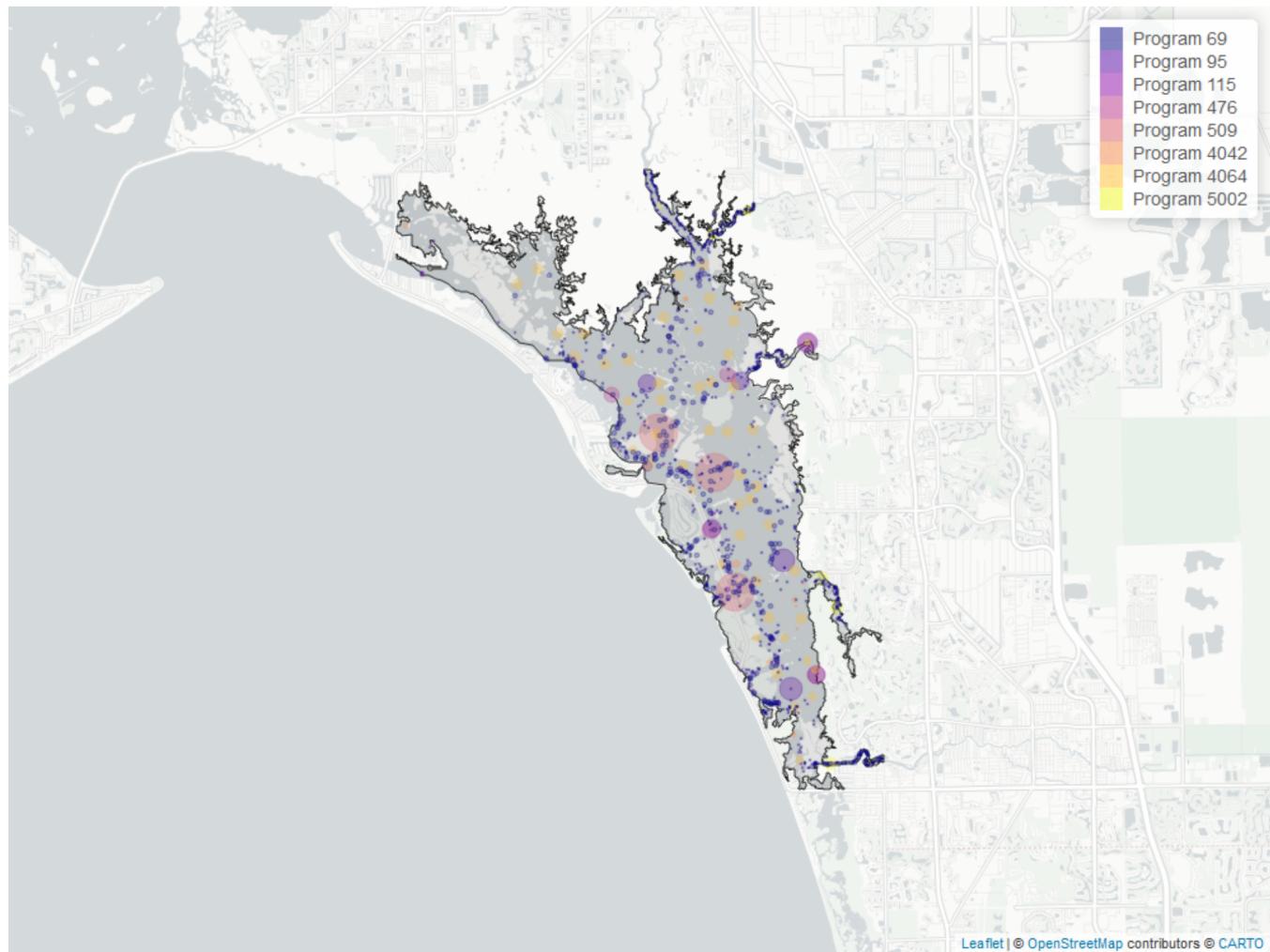


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	4492	32	32.4	TRUE	-0.3636	0.0000	-0.2108858	40.55381	3.7734	0.9761	-1

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 Salinity



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

Table 16: Programs contributing data for Salinity

ProgramID	N_Data	YearMin	YearMax
69	2258	2001	2007
509	702	1999	2008
4064	619	2011	2012
95	526	1963	2018
476	234	2014	2023
5002	114	2009	2023
4042	46	2016	2022
115	2	2003	2003

Program names:

69 - Fisheries-Independent Monitoring (FIM) Program

509 - SERC Water Quality Monitoring Network

4064 - A spatial model to improve site selection for seagrass restoration in shallow boating environments

95 - Harmful Algal Bloom Marine Observation Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5002 - Florida STORET / WIN

4042 - Estero Bay Oyster Monitoring

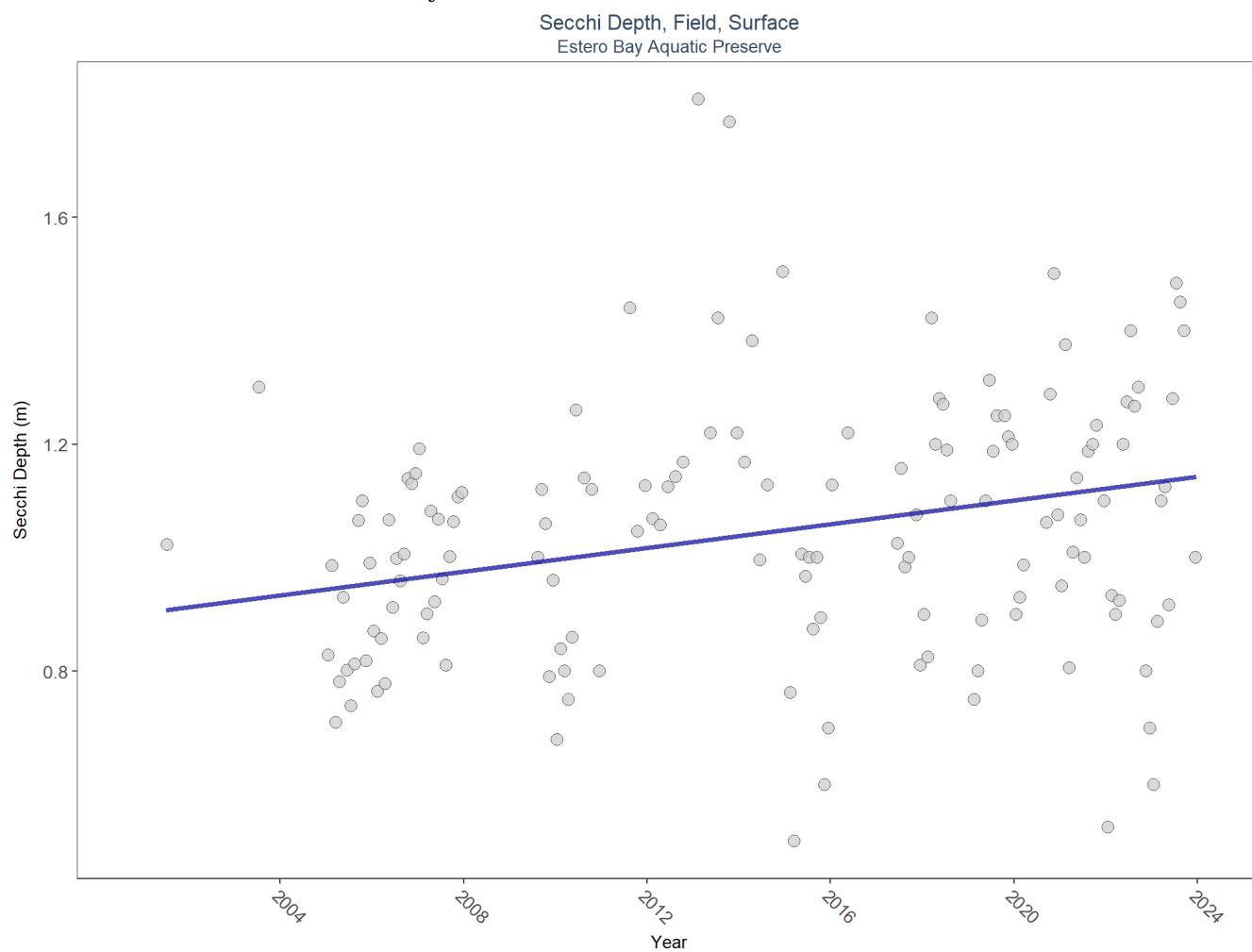
115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for Salinity in Estero Bay 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.

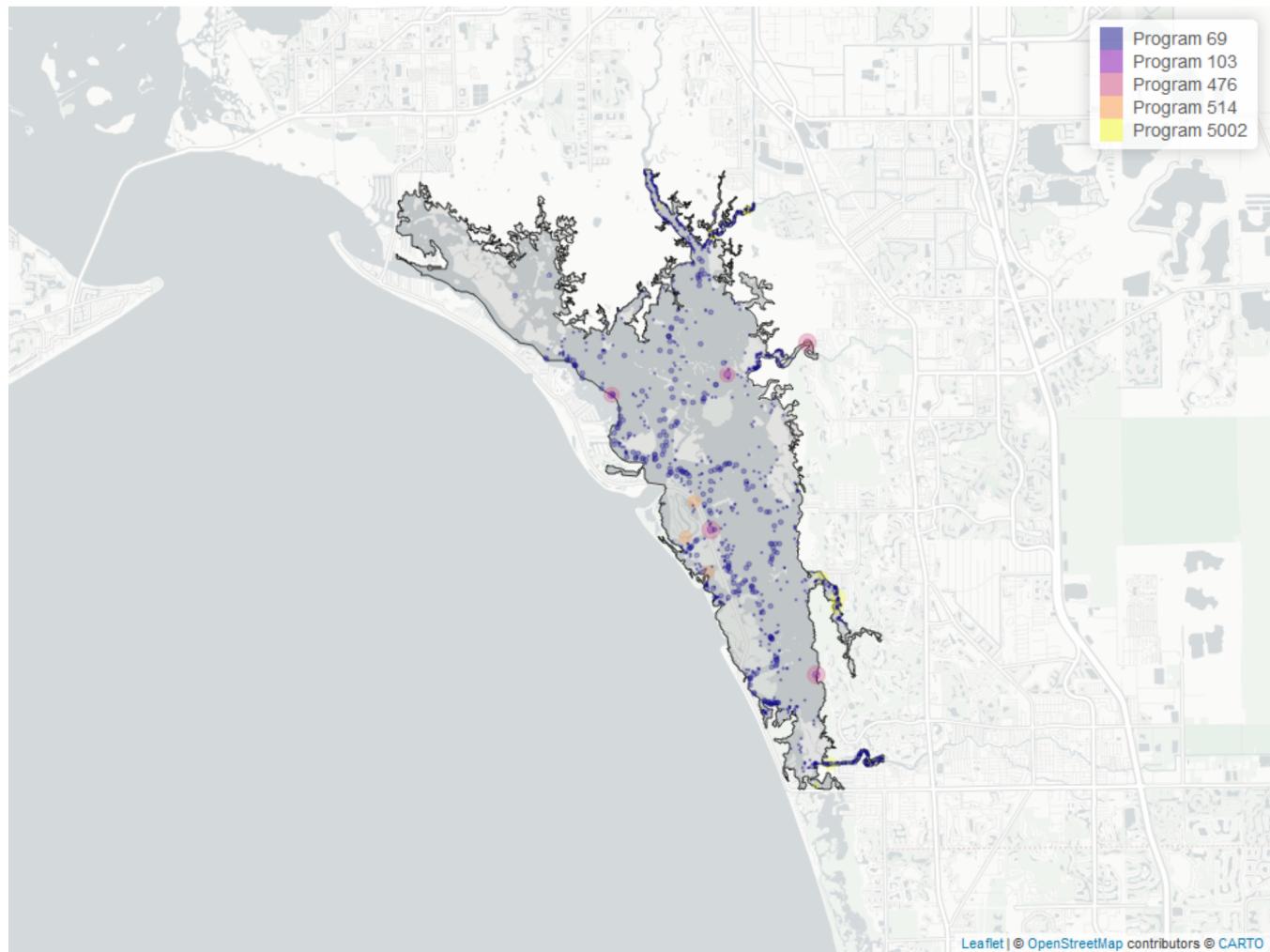
Seasonal Kendall-Tau Trend Analysis



$p < 0.00005$ 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 17: Programs contributing data for Secchi Depth

ProgramID	N_Data	YearMin	YearMax
69	2264	2001	2007
476	217	2017	2023
5002	150	2006	2023
514	76	2011	2018
103	53	2020	2022

Program names:

- 69 - Fisheries-Independent Monitoring (FIM) Program
- 476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
- 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 18: Value Qualifiers for Secchi Depth

Year	$N_{_Total}$	$N_{_S}$	$perc_{_S}$
2015	21	4	19.0
2017	24	2	8.3
2018	34	9	26.5
2019	42	14	33.3
2020	31	9	29.0
2021	94	14	14.9
2022	33	9	27.3
2023	28	12	42.9

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

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

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) $TN = ORGN + NH_4 + NO_3;$

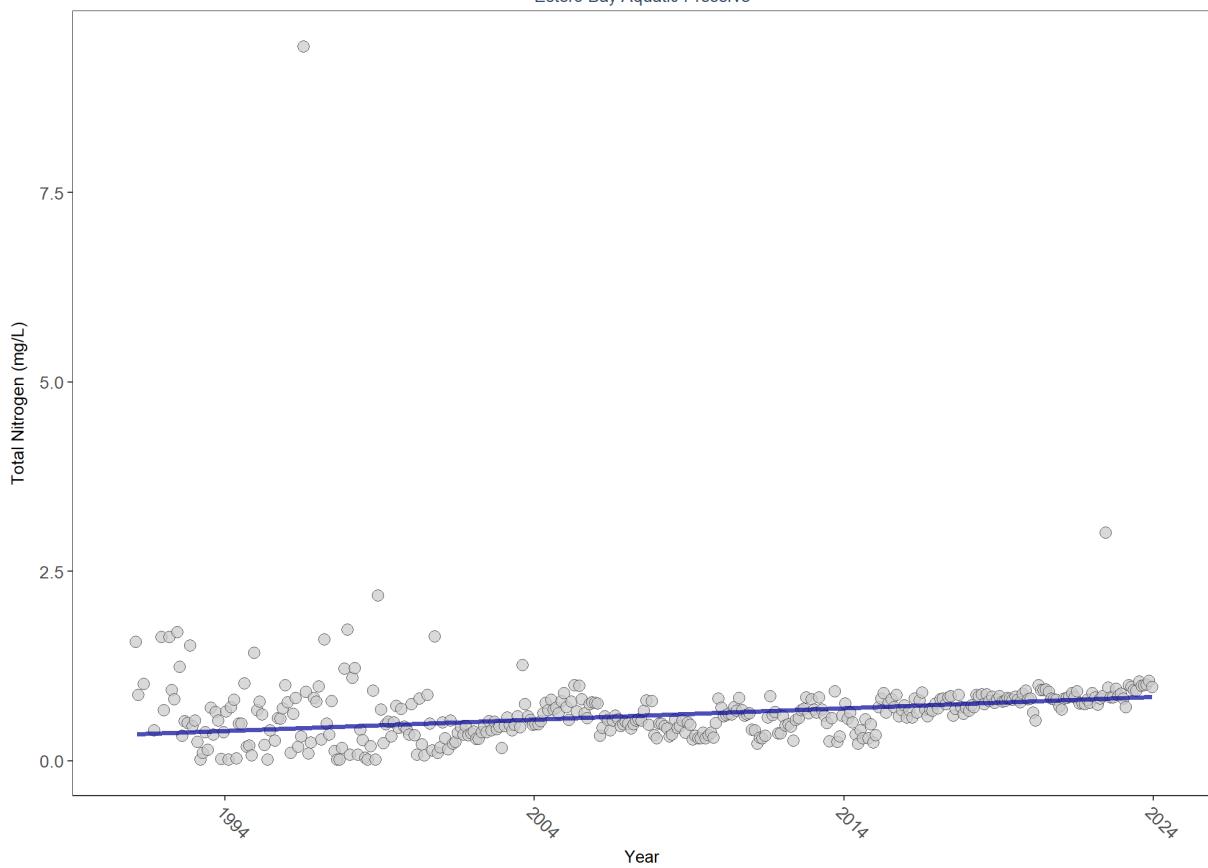
Additional Information:

- 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_QAQCFlagCode = “1Q”

- SEACAR_QAQC_Description = “SEACAR Calculated”

Seasonal Kendall-Tau Trend Analysis

Total Nitrogen, Lab, All Depths
Estero Bay Aquatic Preserve

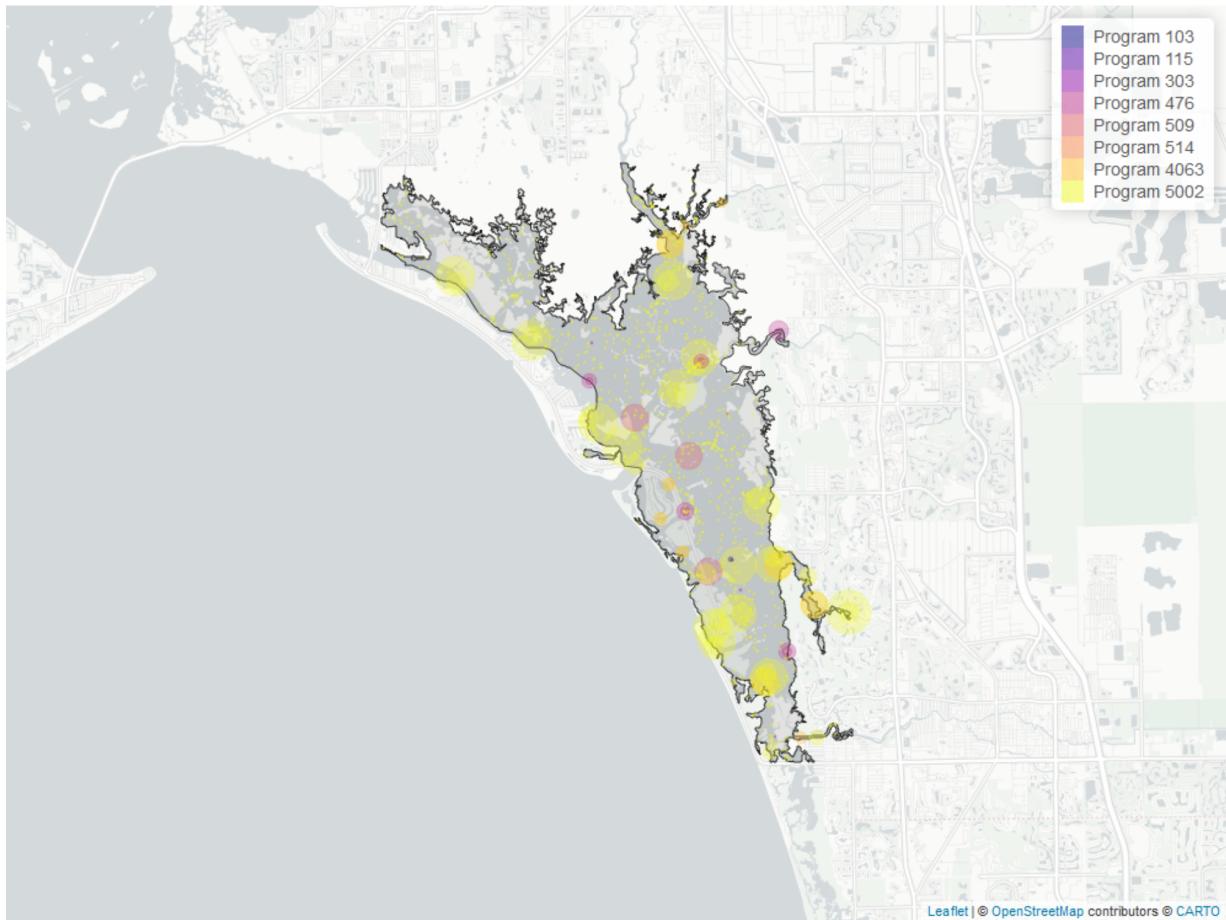


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	6992	33	0.614	TRUE	0.3216	0.0000	0.01496263	0.3534451	13.2733	0.2758	1

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 19: Programs contributing data for Total Nitrogen

ProgramID	N_Data	YearMin	YearMax
5002	6230	1991	2023
509	351	1999	2008
476	285	1998	2023
514	81	2011	2017
4063	58	2018	2023
303	8	2020	2021
103	6	2003	2003
115	1	2003	2003

Program names:

5002 - Florida STORET / WIN

509 - SERC Water Quality Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

514 - Florida LAKEWATCH Program

4063 - Estero Bay Tributary Monitoring

- 303 - River, Estuary and Coastal Observing Network
 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
 115 - Environmental Monitoring Assessment Program

Value Qualifiers

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

Table 20: Value Qualifiers for Total Nitrogen

Year	N_{Total}	N_I	$perc_I$	N_Q	$perc_Q$	N_U	$perc_U$
1991	55	1	1.8			1	1.8
1992	79					1	1.3
1993	41	1	2.4			19	46.3
1994	54	2	3.7			15	27.8
1995	39					1	2.6
1996	54	2	3.7			22	40.7
1997	54	1	1.9			15	27.8
1998	70	1	1.4			55	78.6
1999	109	1	0.9			20	18.4
2000	132	1	0.8			47	35.6
2001	209					4	1.9
2002	227	5	2.2			2	0.9
2004	322	2	0.6	2	0.6		
2005	324	16	4.9				
2006	313	100	32.0				
2007	356	61	17.1			11	3.1
2008	304	24	7.9			1	0.3
2009	281	57	20.3			19	6.8
2011	256	46	18.0			17	6.6
2012	255	6	2.4			5	2.0
2013	242	25	10.3			30	12.4
2014	283	42	14.8			13	4.6
2015	298	6	2.0			2	0.7
2017	280	1	0.4			1	0.4
2020	263			2	0.8		

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

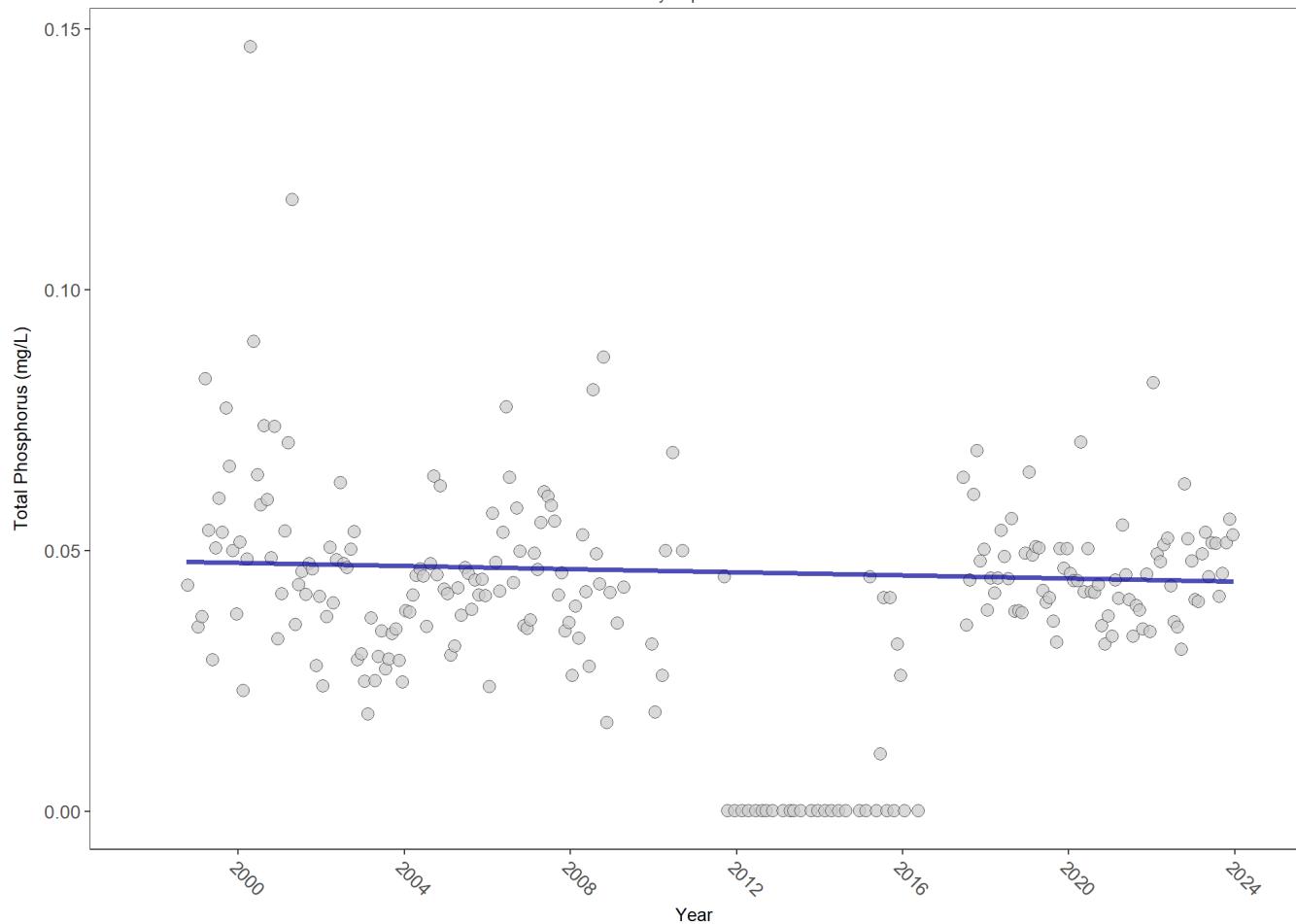
Programs containing Value Qualified data:

- 5002 - Florida STORET / WIN
 303 - River, Estuary and Coastal Observing Network

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

Total Phosphorus, Lab, All Depths
Estero Bay Aquatic Preserve

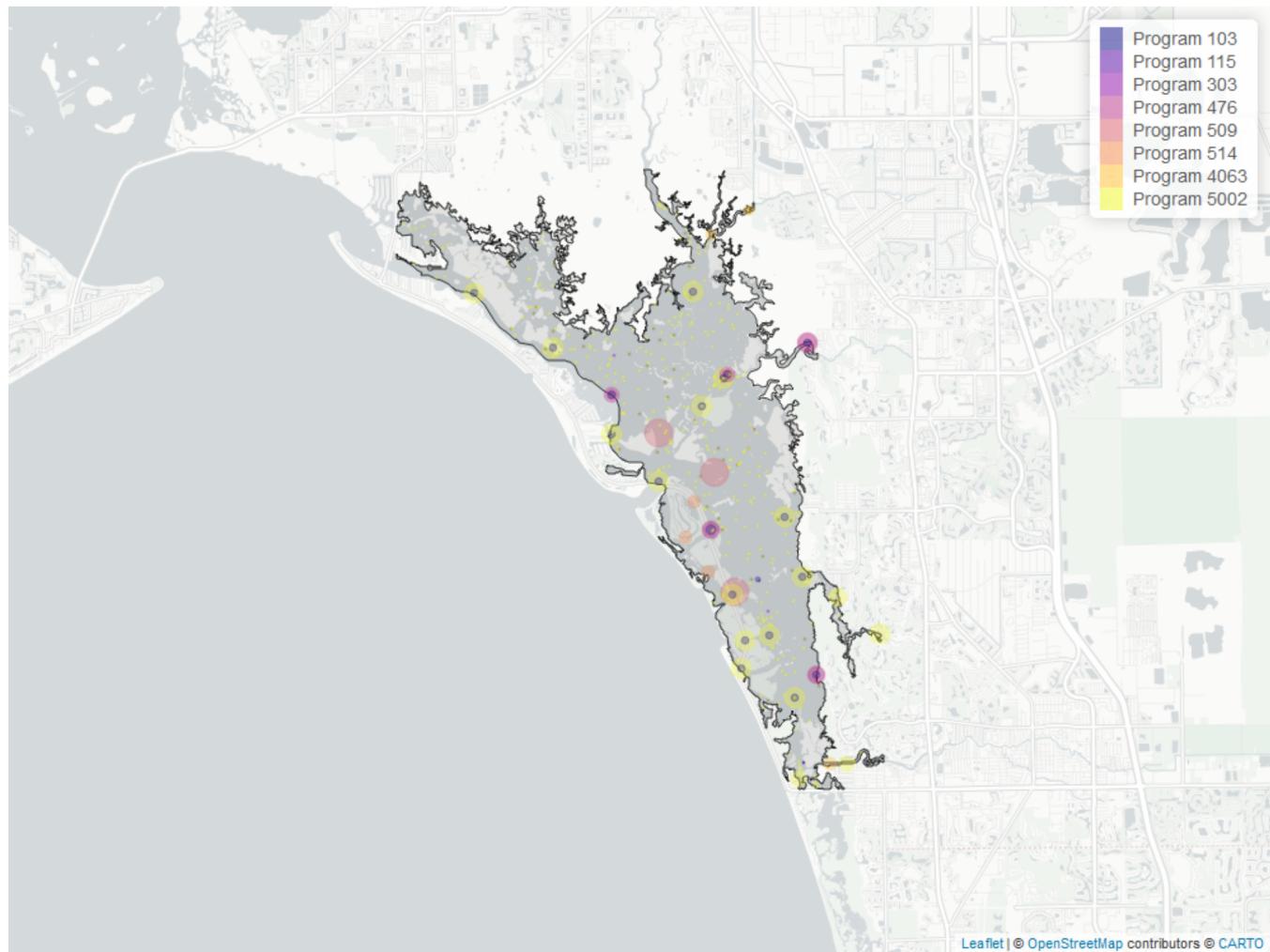


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	2501	26	0.041	TRUE	-0.0535	0.2599	-0.0001496672	0.04794737	13.3375	0.2718	0

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 21: Programs contributing data for Total Phosphorus

ProgramID	N_Data	YearMin	YearMax
5002	1406	2006	2023
476	397	1998	2023
509	351	1999	2008
103	230	2003	2022
514	81	2011	2017
4063	63	2018	2023
303	8	2020	2021
115	1	2003	2003

Program names:

5002 - Florida STORET / WIN

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
 509 - SERC Water Quality Monitoring Network
 103 - EPA STOrage and RETrieval Data Warehouse (STORET)
 514 - Florida LAKEWATCH Program
 4063 - Estero Bay Tributary Monitoring
 303 - River, Estuary and Coastal Observing Network
 115 - Environmental Monitoring Assessment Program

Value Qualifiers

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

Table 22: Value Qualifiers for Total Phosphorus

Year	N_{Total}	N_I	perc_I	N_Q	perc_Q	N_U	perc_U
1998	3			3	100.0		
1999	41			5	12.2		
2001	38	1	2.6			1	2.6
2002	43					7	16.3
2003	47					1	2.1
2004	51	10	19.6	4	7.8		
2005	65	24	36.9			5	7.7
2006	74	37	50.0			1	1.4
2007	99	49	49.5			2	2.0
2008	34	1	2.9				
2010	10	2	20.0				
2018	275	20	7.3			4	1.4
2019	268	8	3.0				
2020	287	20	7.0			5	1.7
2021	523	22	4.2			4	0.8
2022	281	19	6.8			3	1.1
2023	218	14	6.4			11	5.0

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:

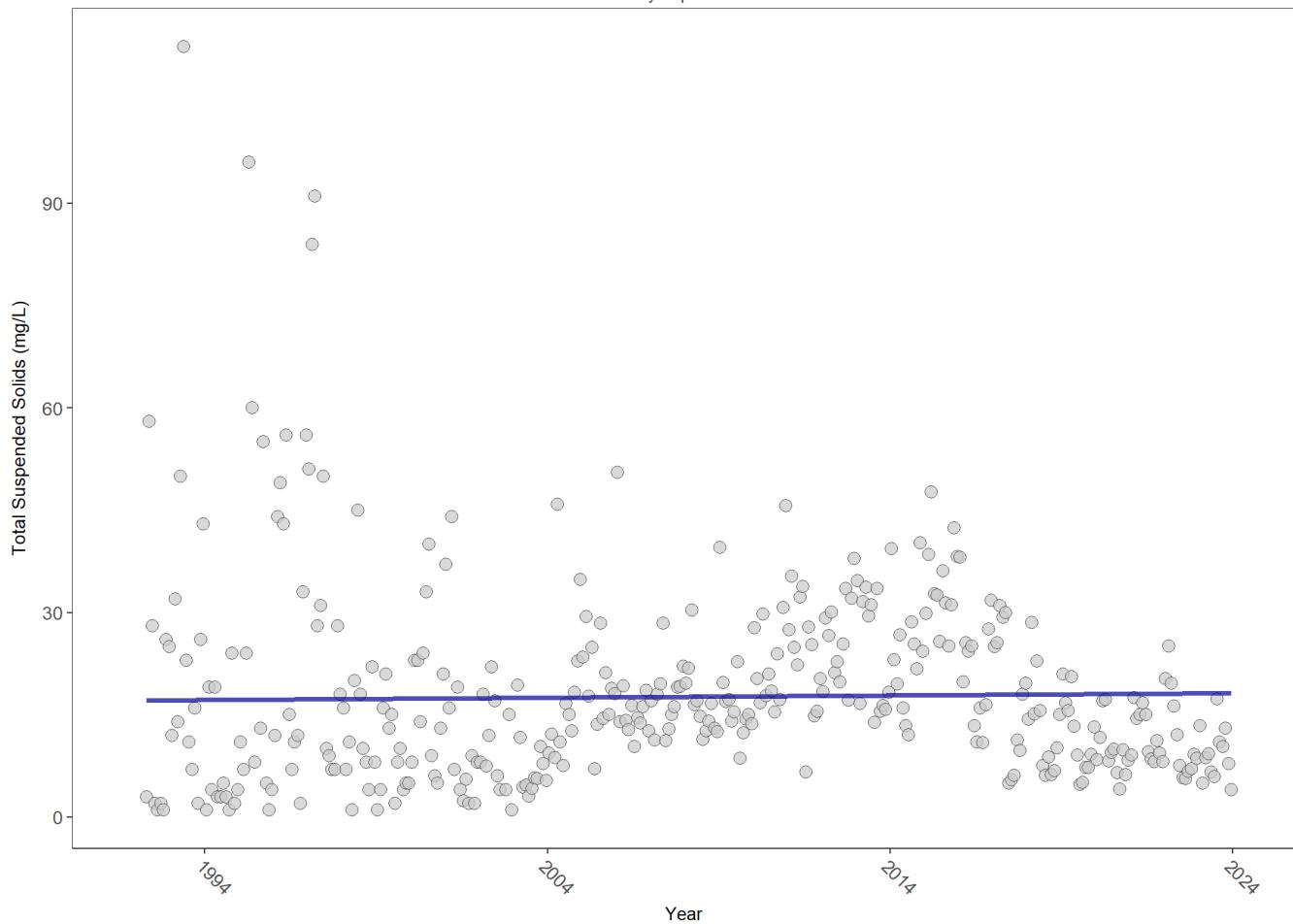
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
 5002 - Florida STORET / WIN
 303 - River, Estuary and Coastal Observing Network
 4063 - Estero Bay Tributary Monitoring

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
Estero Bay Aquatic Preserve

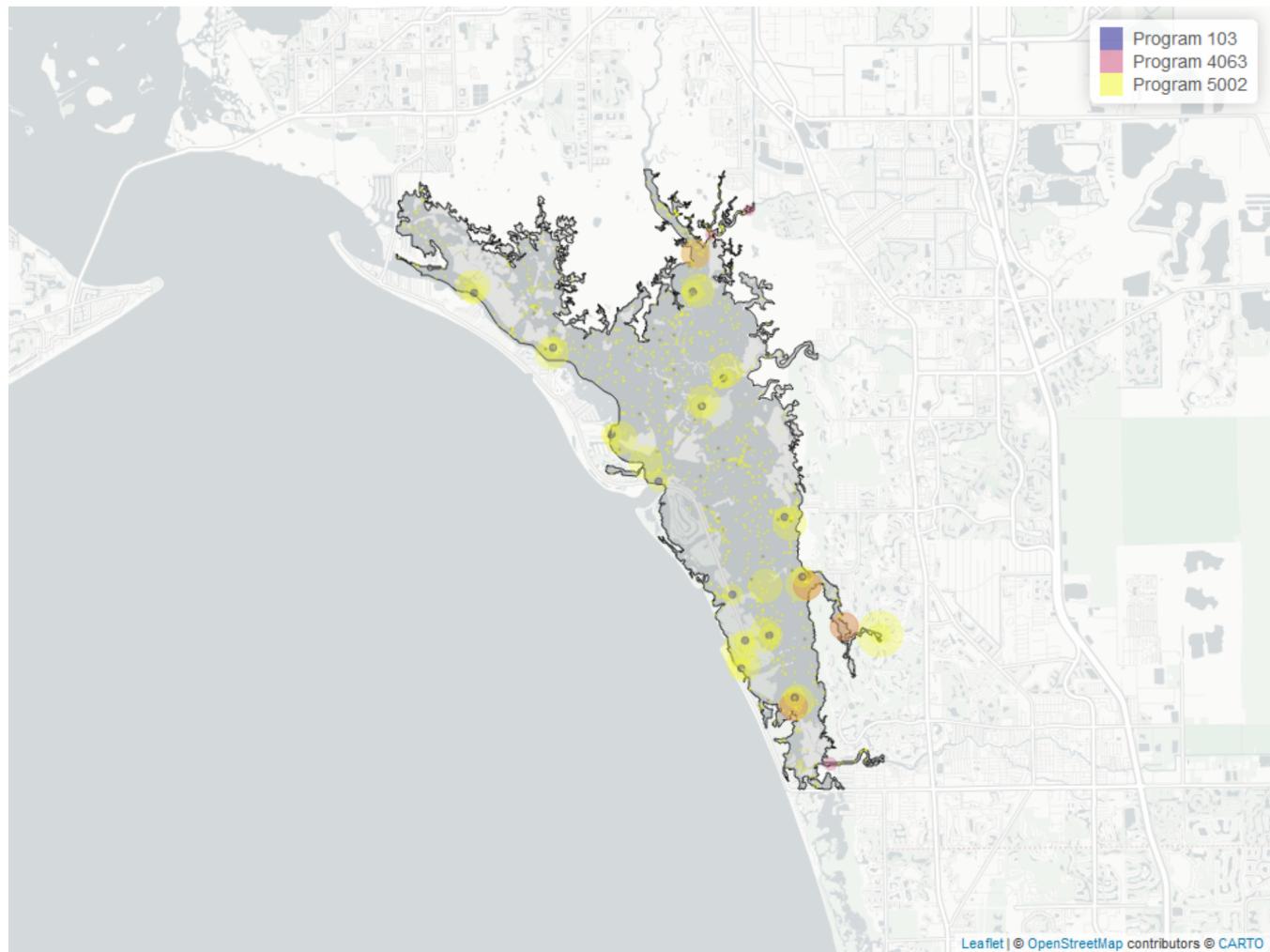


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	5328	32	14	TRUE	0.0206	0.5883	0.03284281	17.15911	15.2398	0.1718	0

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 23: Programs contributing data for Total Suspended Solids

ProgramID	N_Data	YearMin	YearMax
5002	5162	1992	2023
103	170	2020	2021
4063	63	2018	2023

Program names:

5002 - Florida STORET / WIN

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

4063 - Estero Bay Tributary Monitoring

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 24: Value Qualifiers for Total Suspended Solids

<i>Year</i>	<i>N_Total</i>	<i>N_I</i>	<i>perc_I</i>	<i>N_U</i>	<i>perc_U</i>
1992	9	3	33.3	2	22.2
1993	13	2	15.4		
1994	12	4	33.3	2	16.7
1995	11			1	9.1
1996	12	1	8.3		
1998	12			1	8.3
1999	12	1	8.3	1	8.3
2001	16	6	37.5		
2002	14	2	14.3	1	7.1
2003	188	85	45.2	36	19.1
2004	280	92	32.9	7	2.5
2005	286	8	2.8		
2006	276			1	0.4
2007	276	3	1.1		
2008	273	4	1.5		
2009	276	5	1.8	1	0.4
2010	217	7	3.2		
2011	242	6	2.5		
2012	218	3	1.4		
2013	204	1	0.5		
2014	250	4	1.6		
2015	265	9	3.4	1	0.4
2016	254	7	2.8		
2017	244	13	5.3		
2018	244	10	4.1	5	2.0
2019	226	13	5.8	5	2.2
2020	233	6	2.6	1	0.4
2021	401	4	1.0	7	1.8
2022	229	5	2.2	2	0.9
2023	178	7	3.9		

Note: ¹I - Reported value is greater than or equal to lab method detection limit, but less than quantitation limit ²U
- Compound was analyzed for but not detected

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

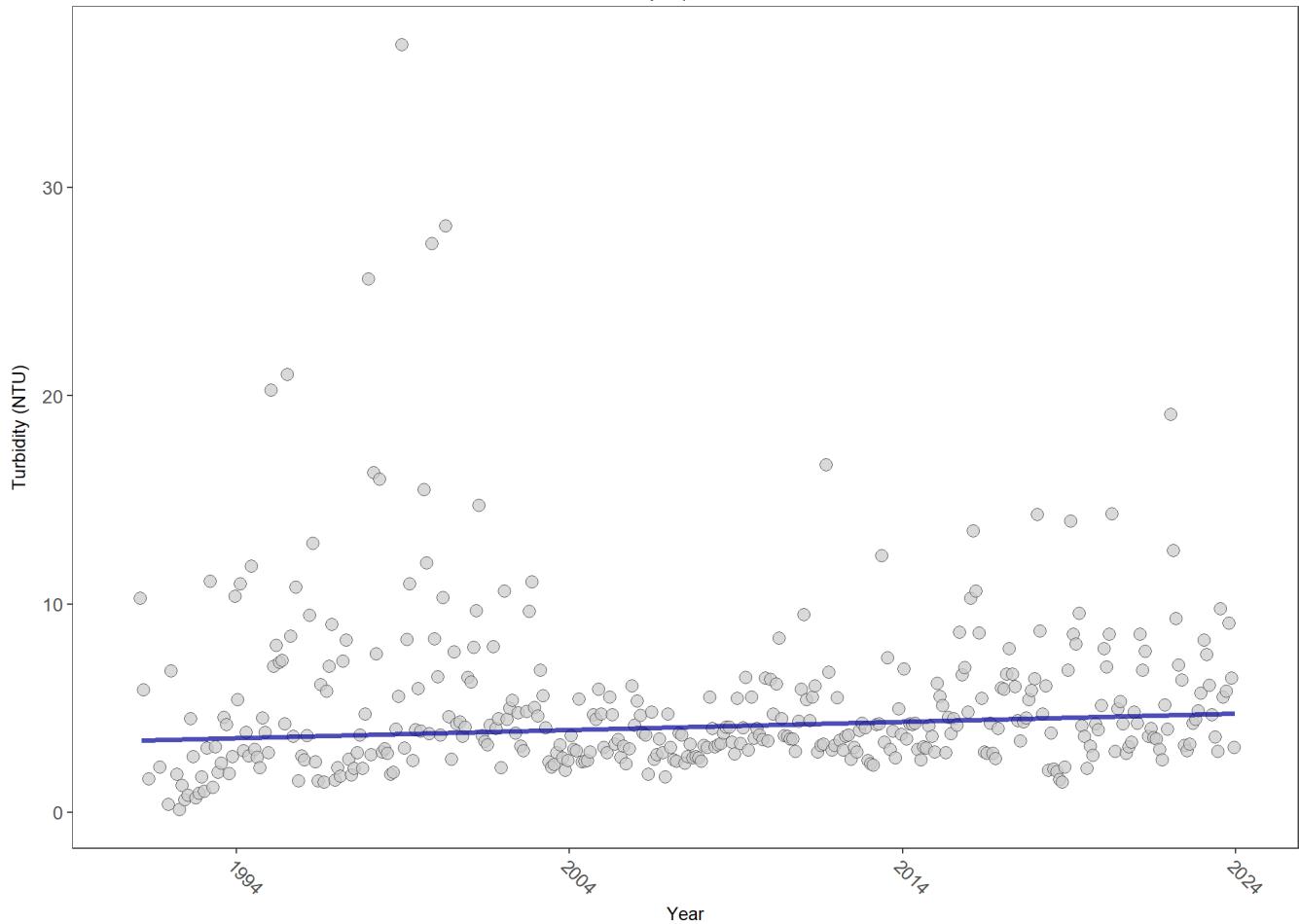
4063 - Estero Bay Tributary Monitoring

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
Estero Bay Aquatic Preserve

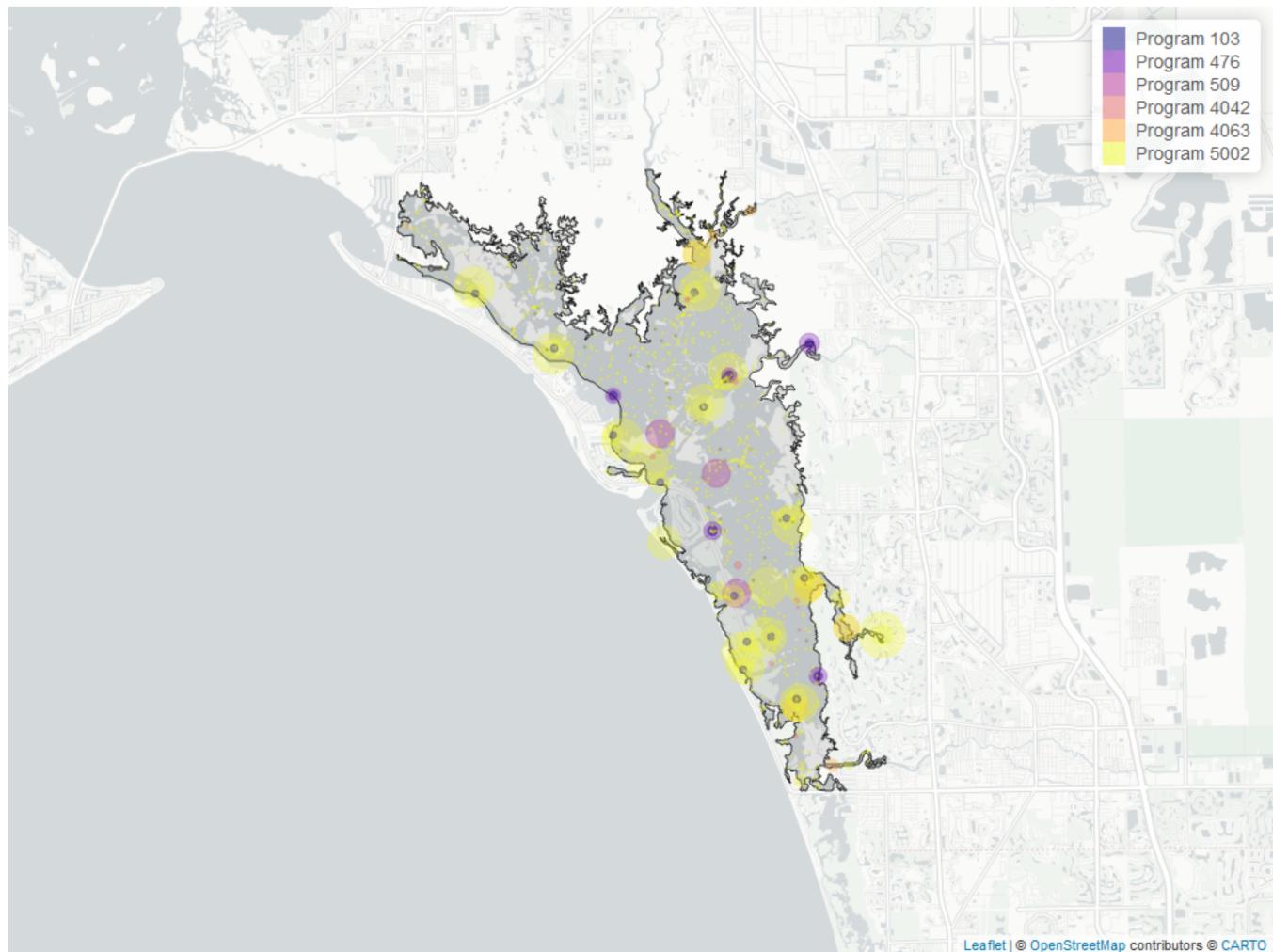


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	7231	33	3.39	TRUE	0.1383	0.0001	0.03898323	3.451771	7.2659	0.7772	1

$p < 0.00005$ 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 25: Programs contributing data for Turbidity

ProgramID	N_Data	YearMin	YearMax
5002	6265	1991	2023
509	348	1999	2008
476	331	1999	2023
103	221	2020	2022
4063	63	2018	2023
4042	45	2016	2022

Program names:

5002 - Florida STORET / WIN

509 - SERC Water Quality Monitoring Network

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

103 - EPA STOrage and RETrieval Data Warehouse (STORET)

4063 - Estero Bay Tributary Monitoring

4042 - Estero Bay Oyster Monitoring

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 26: Value Qualifiers for Turbidity

Year	N_{Total}	N_I	$perc_I$	N_Q	$perc_Q$	N_U	$perc_U$
2003	295					2	0.7
2004	355	14	3.9				
2010	205			3	1.5		
2011	245			4	1.6		
2014	255			1	0.4		
2016	263			2	0.8		
2018	279	28	10.0			4	1.4
2019	257	8	3.1			3	1.2
2020	276	3	1.1	1	0.4		
2021	508	7	1.4	4	0.8	1	0.2
2022	290	1	0.3				
2023	209	1	0.5			1	0.5

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:

476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

5002 - Florida STORET / WIN

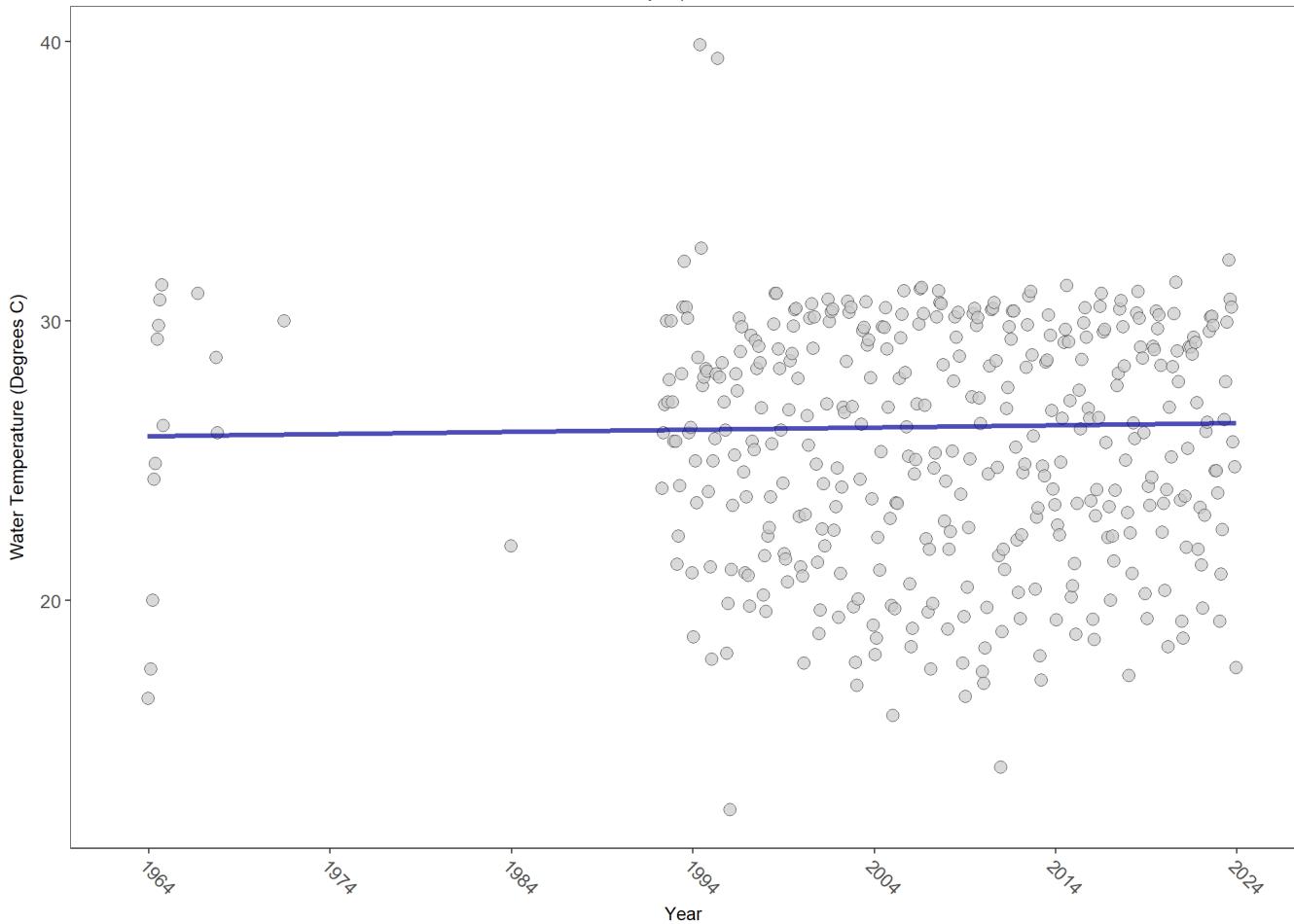
4063 - Estero Bay Tributary Monitoring

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
Estero Bay Aquatic Preserve

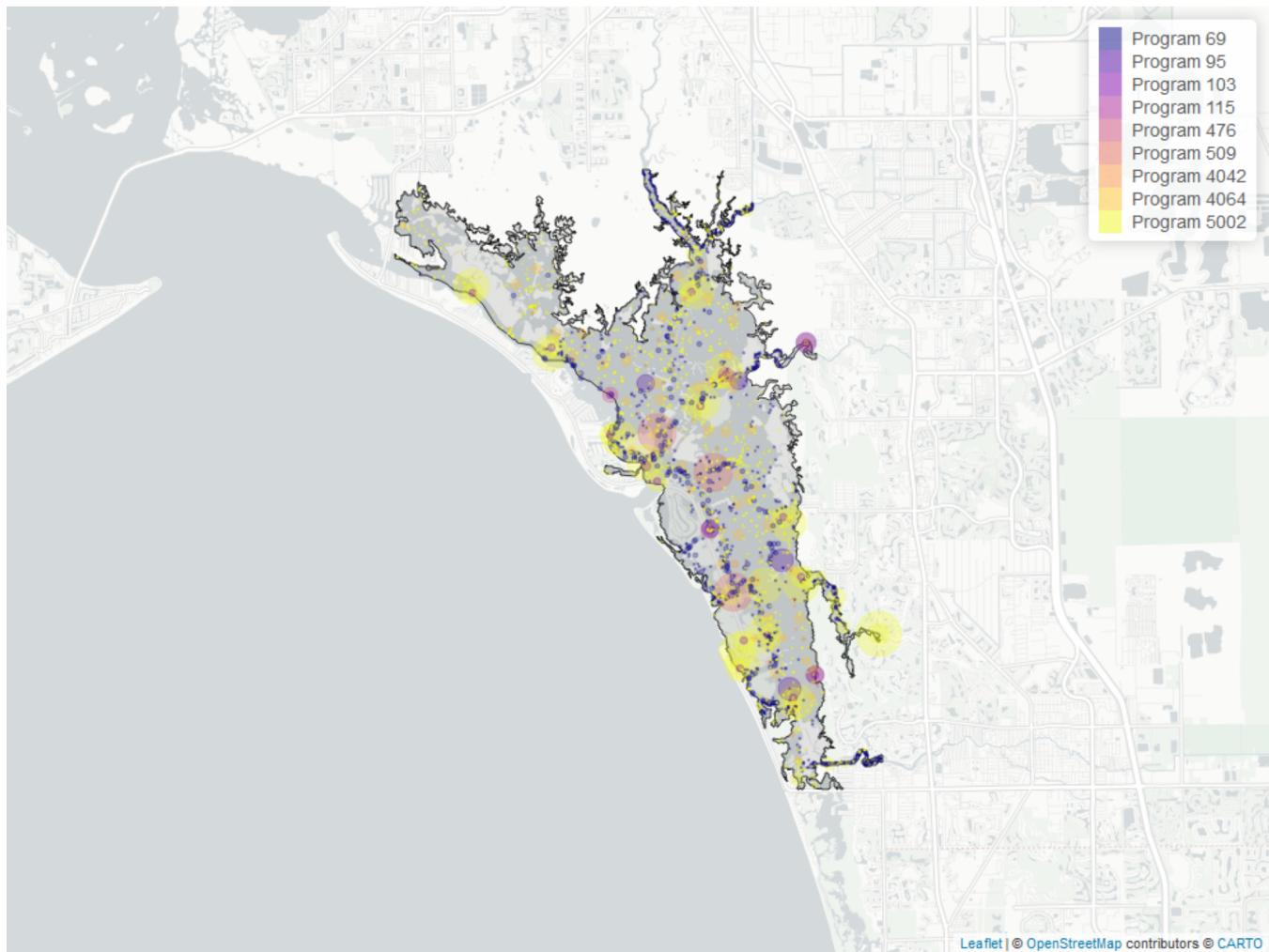


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	10058	38	26.2	TRUE	0.0293	0.4044	0.0078125	25.87015	6.1864	0.8606	0

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 Water Temperature



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

Table 27: Programs contributing data for Water Temperature

ProgramID	N_Data	YearMin	YearMax
5002	5459	1992	2023
69	2261	2001	2007
509	702	1999	2008
4064	619	2011	2012
95	492	1963	2018
103	253	2020	2022
476	229	2011	2023
4042	46	2016	2022
115	2	2003	2003

Program names:

5002 - Florida STORET / WIN
69 - Fisheries-Independent Monitoring (FIM) Program
509 - SERC Water Quality Monitoring Network
4064 - A spatial model to improve site selection for seagrass restoration in shallow boating environments
95 - Harmful Algal Bloom Marine Observation Network
103 - EPA STOrage and RETrieval Data Warehouse (STORET)
476 - Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network
4042 - Estero Bay Oyster Monitoring
115 - Environmental Monitoring Assessment Program

There are no qualifying Value Qualifiers for Water Temperature in Estero Bay Aquatic Preserve

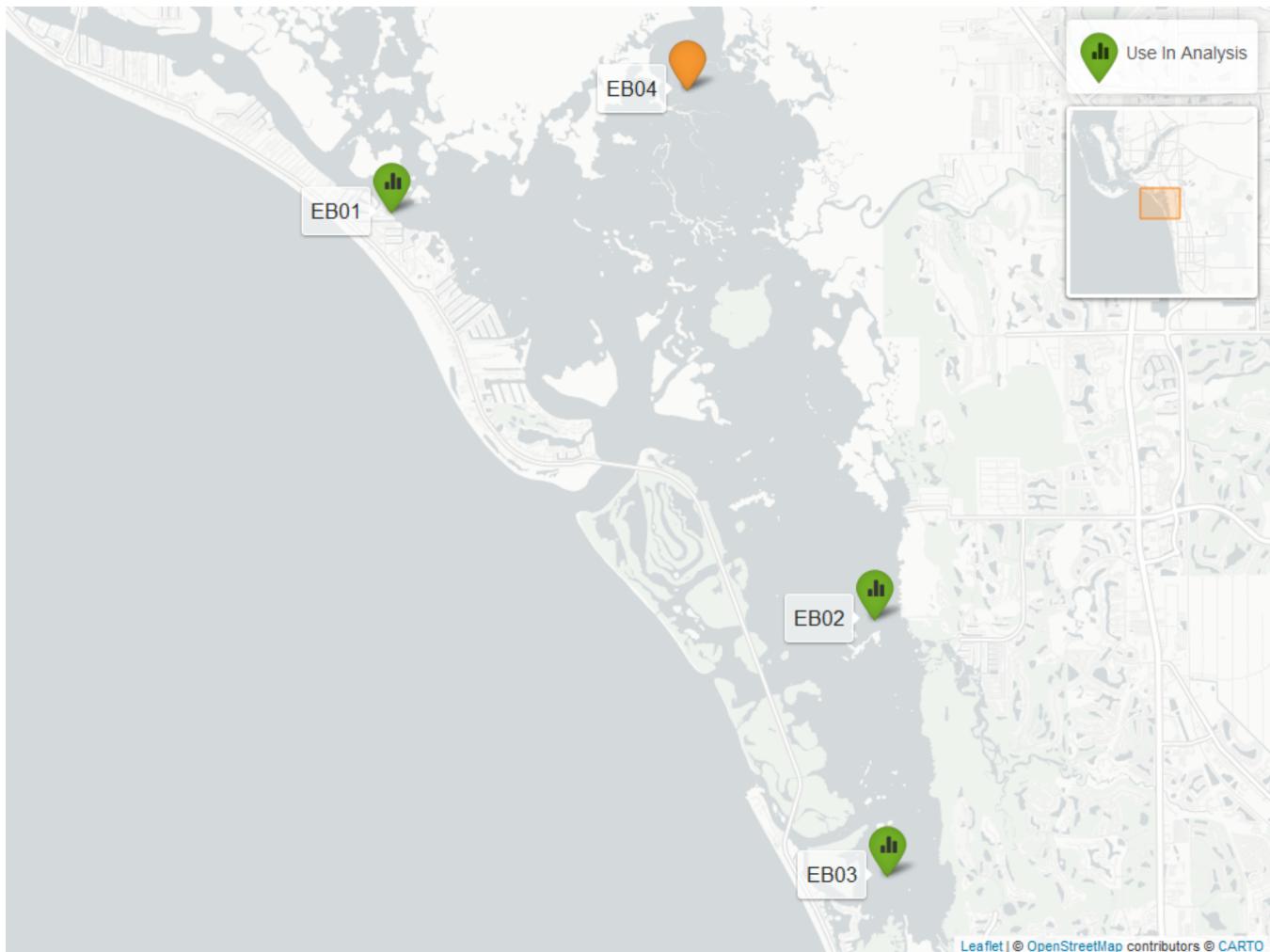
Water Quality - Continuous

The following files were used in the continuous analysis:

- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_SW-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_SW-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_pH_SW-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_SW-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_SW-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_SW-2024-Mar-23.txt*

Table 28: Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

<i>ProgramLocationID</i>	<i>Years of Data</i>	<i>Use in Analysis</i>	<i>Parameters</i>
EB01	19	TRUE	DO , DOS , pH , Sal , Turb , TempW
EB02	20	TRUE	DO , DOS , pH , Sal , Turb , TempW
EB03	19	TRUE	DO , DOS , pH , Sal , Turb , TempW
EB04	3	FALSE	DO , DOS , pH , Sal , Turb , TempW



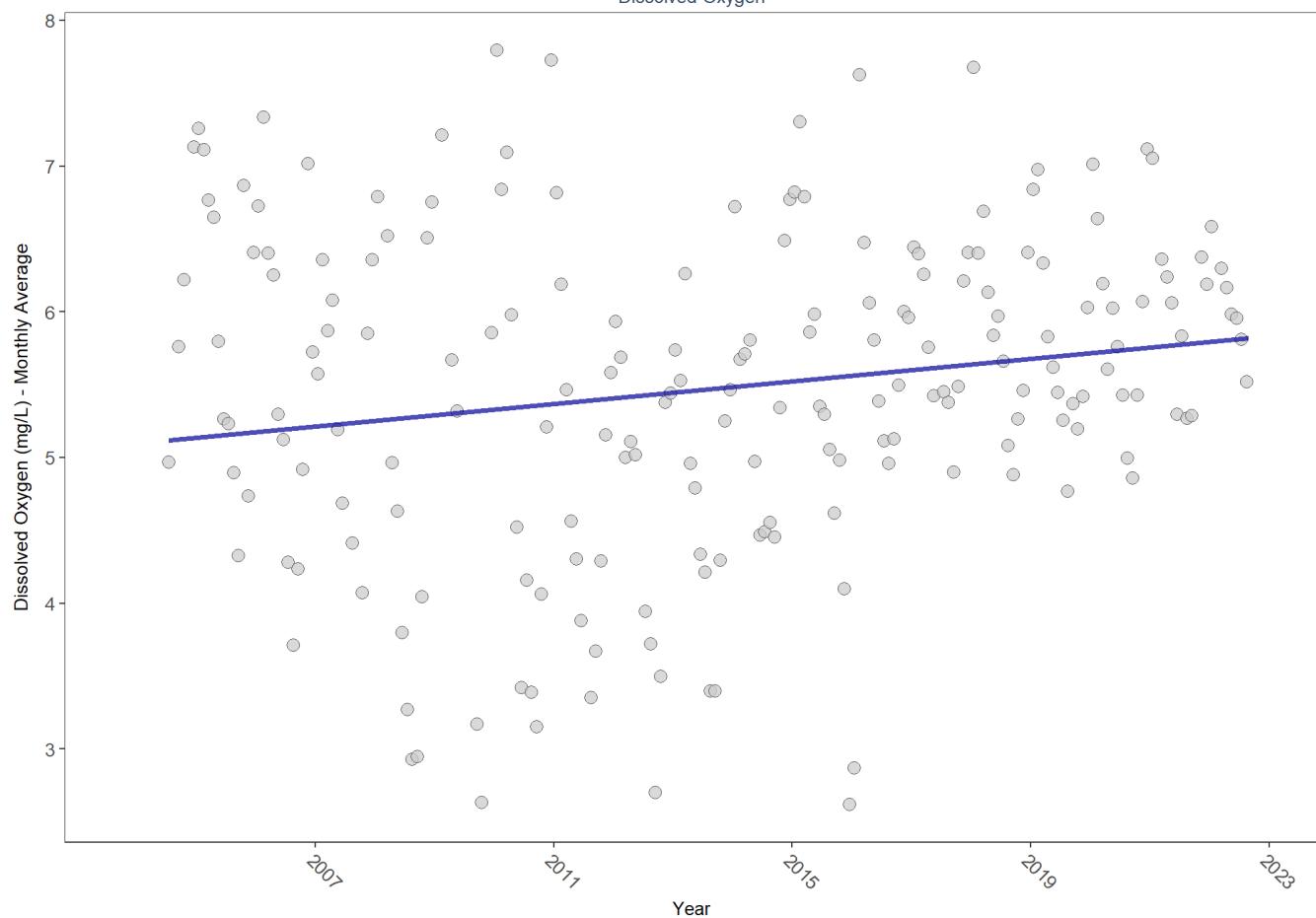
Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Estero Bay Aquatic Preserve. Sites marked as *Use In Analysis* are featured in this report.

Dissolved Oxygen - Continuous Water Quality

EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB01
Dissolved Oxygen



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	478415	19	5.6	TRUE	0.2196	0.0000	0.03869549	5.095745	20.9159	0.0343	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

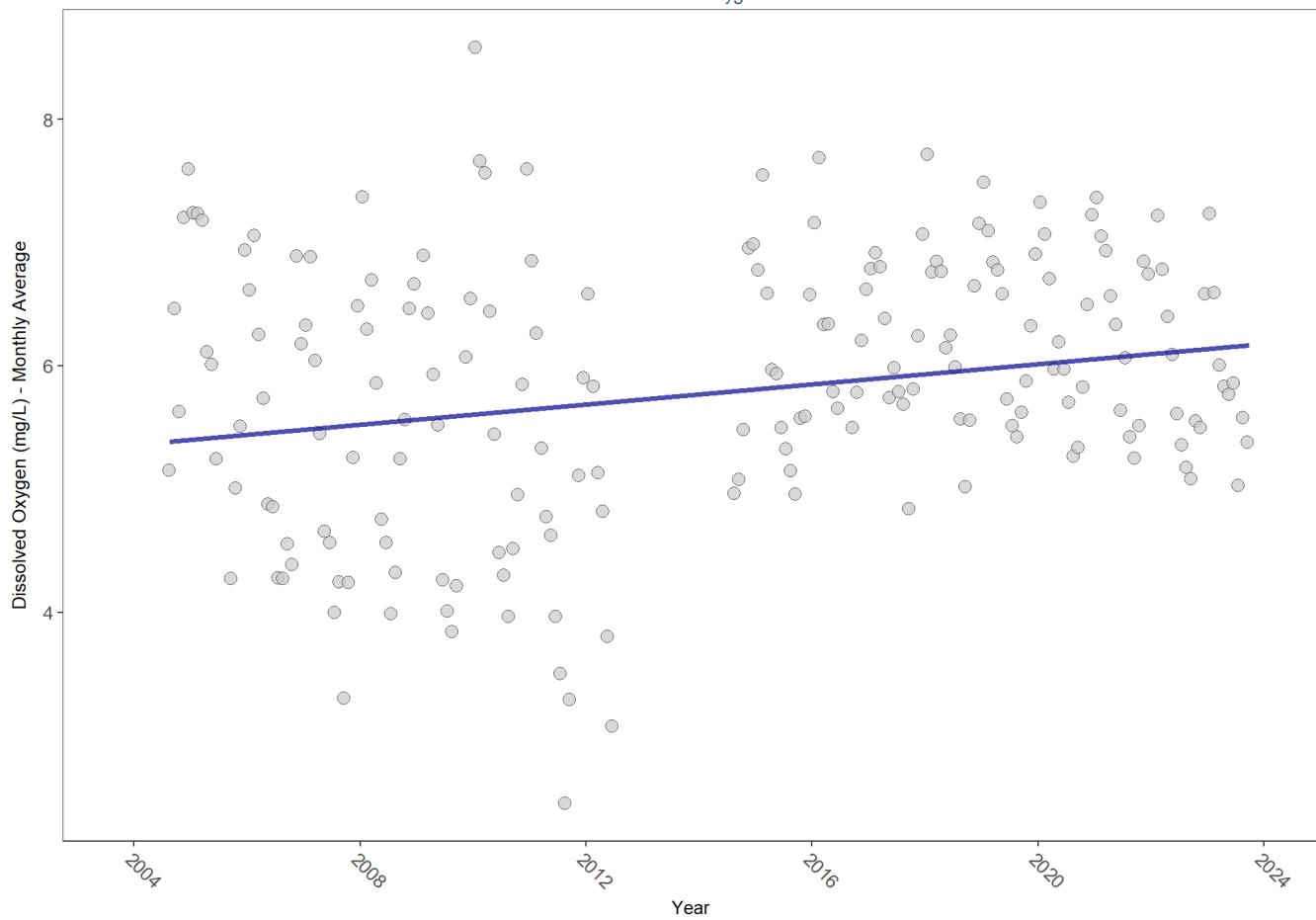
EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB02

Dissolved Oxygen



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	445908	19	6	TRUE	0.2514	0.0000	0.04084296	5.358373	7.6363	0.7455	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

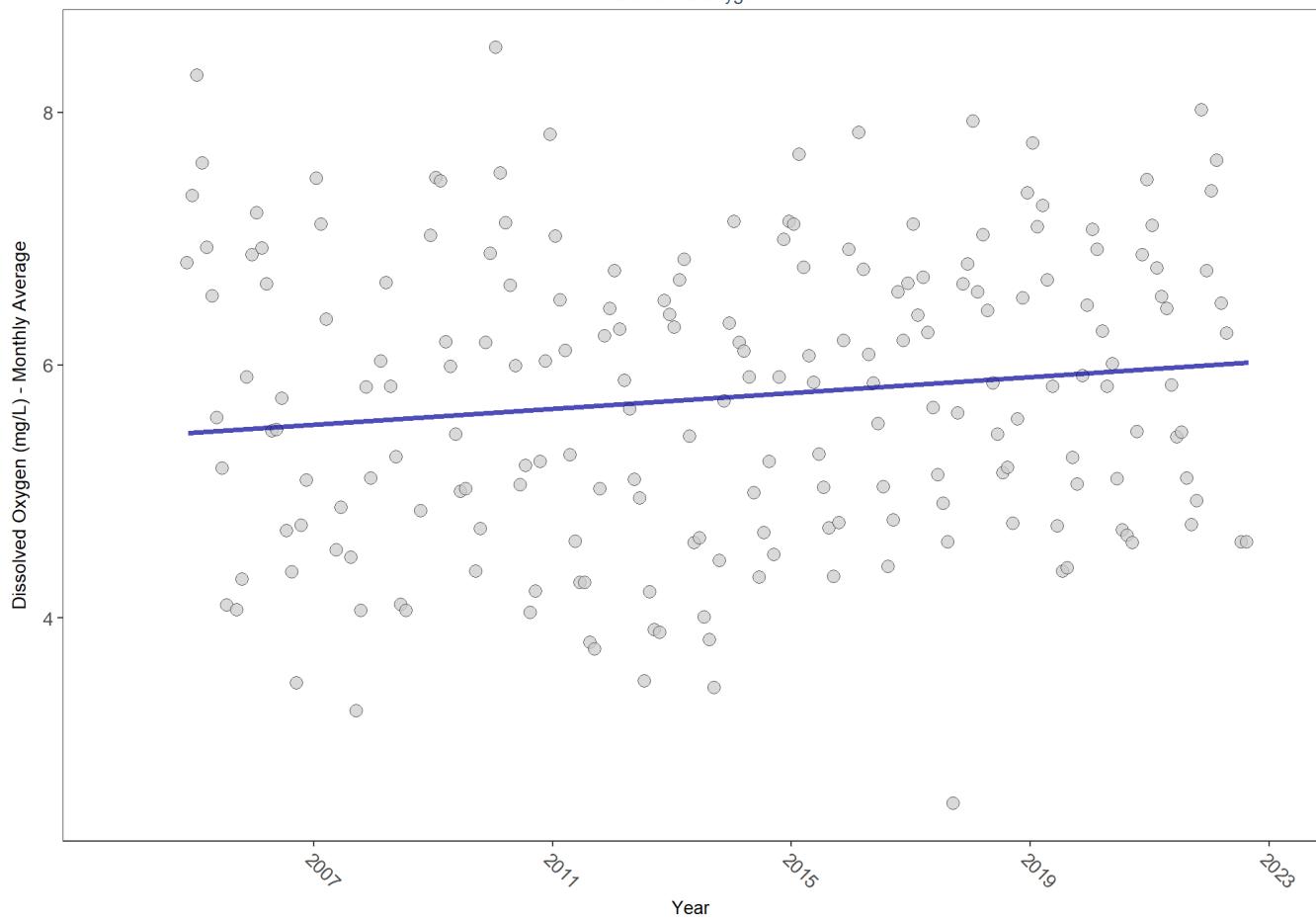
EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB03

Dissolved Oxygen



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	439701	19	5.9	TRUE	0.1991	0.0002	0.03138447	5.435208	11.2299	0.4242	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

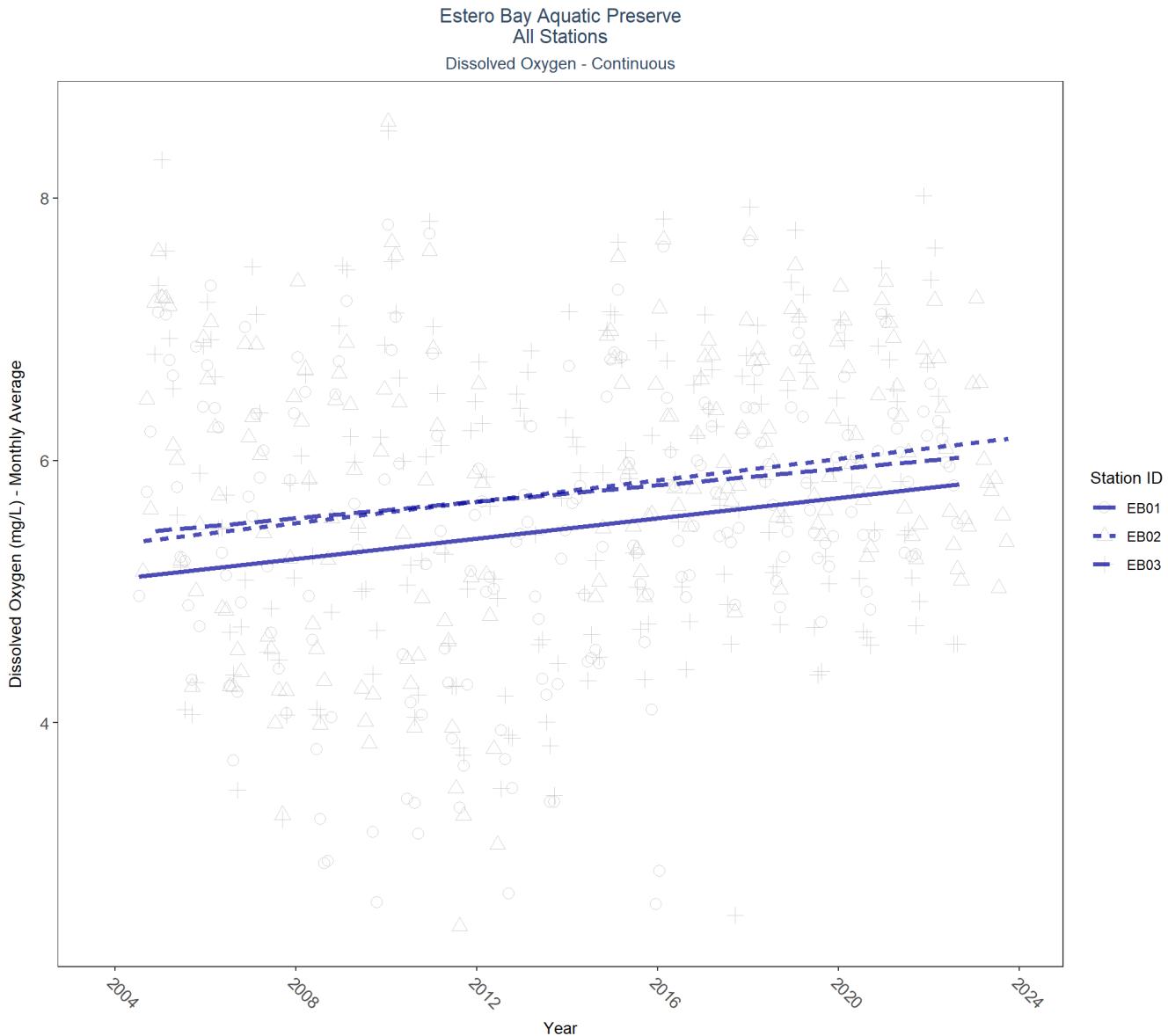


Table 29: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	478415	19	2004 - 2022	5.6	0.22	5.1	0.04	0.0000
EB02	445908	19	2004 - 2023	6.0	0.25	5.36	0.04	0.0000
EB03	439701	19	2004 - 2022	5.9	0.2	5.44	0.03	0.0002
EB04	65961	3	2021 - 2023	5.5	-	-	-	-

Dissolved Oxygen Saturation - Continuous Water Quality

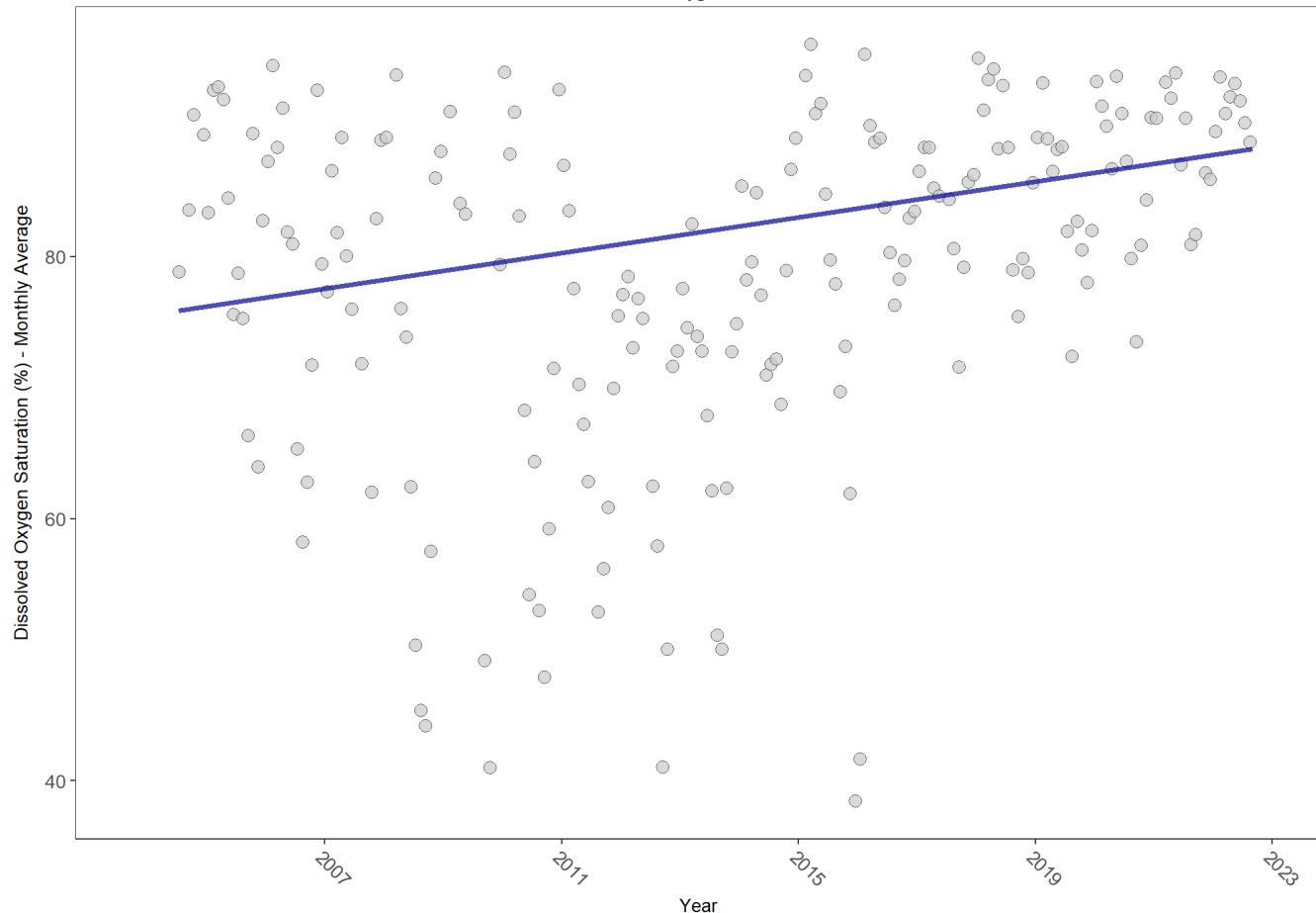
EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB01

Dissolved Oxygen Saturation



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	480233	19	81.6	TRUE	0.3057	0.0000	0.6815911	75.49737	13.4272	0.2663	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

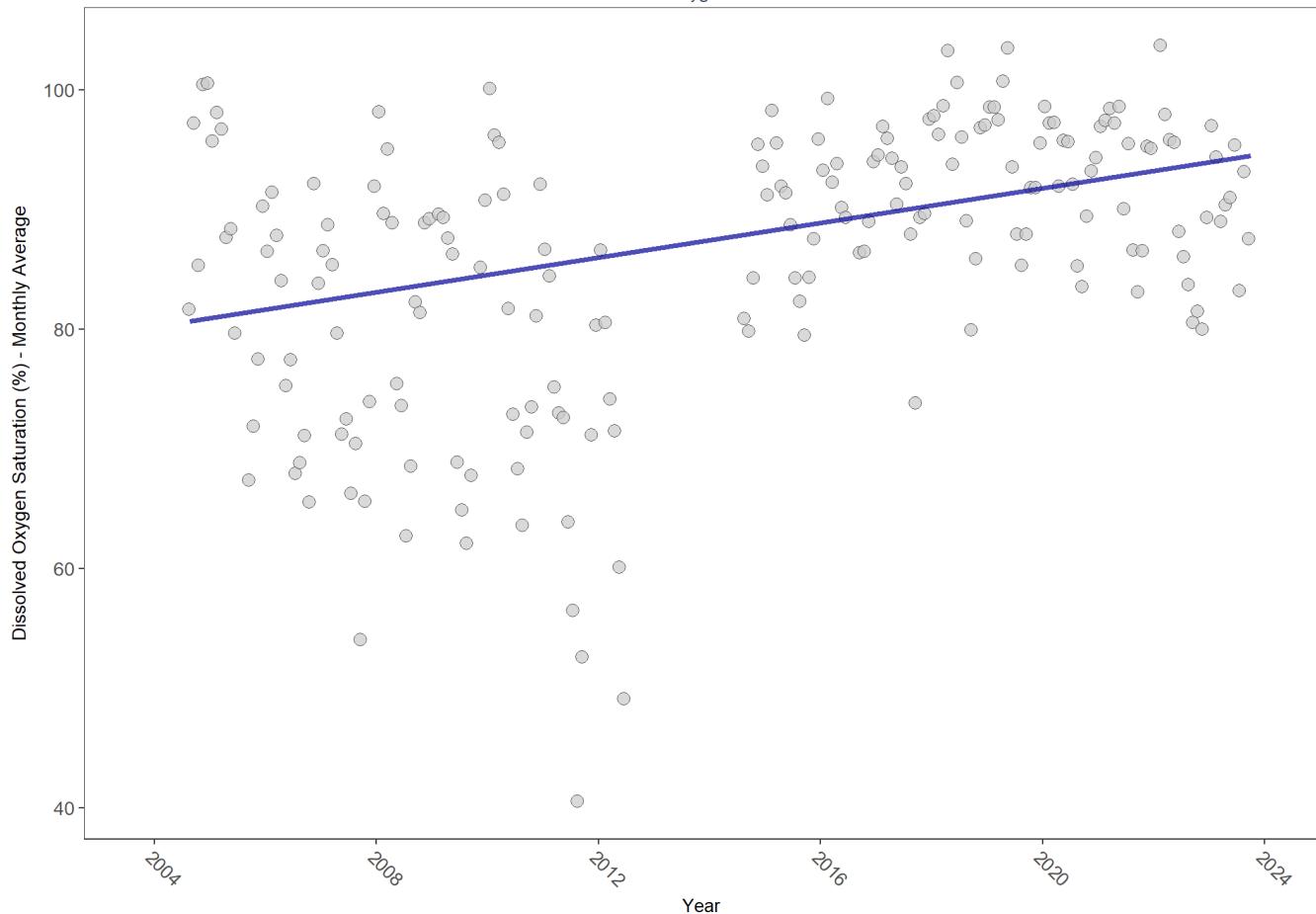
EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB02

Dissolved Oxygen Saturation



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	446145	19	87.6	TRUE	0.3811	0.0000	0.7242663	80.20564	3.5201	0.9819	1

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

SennIntercept is intercept value at beginning of record for monitoring location

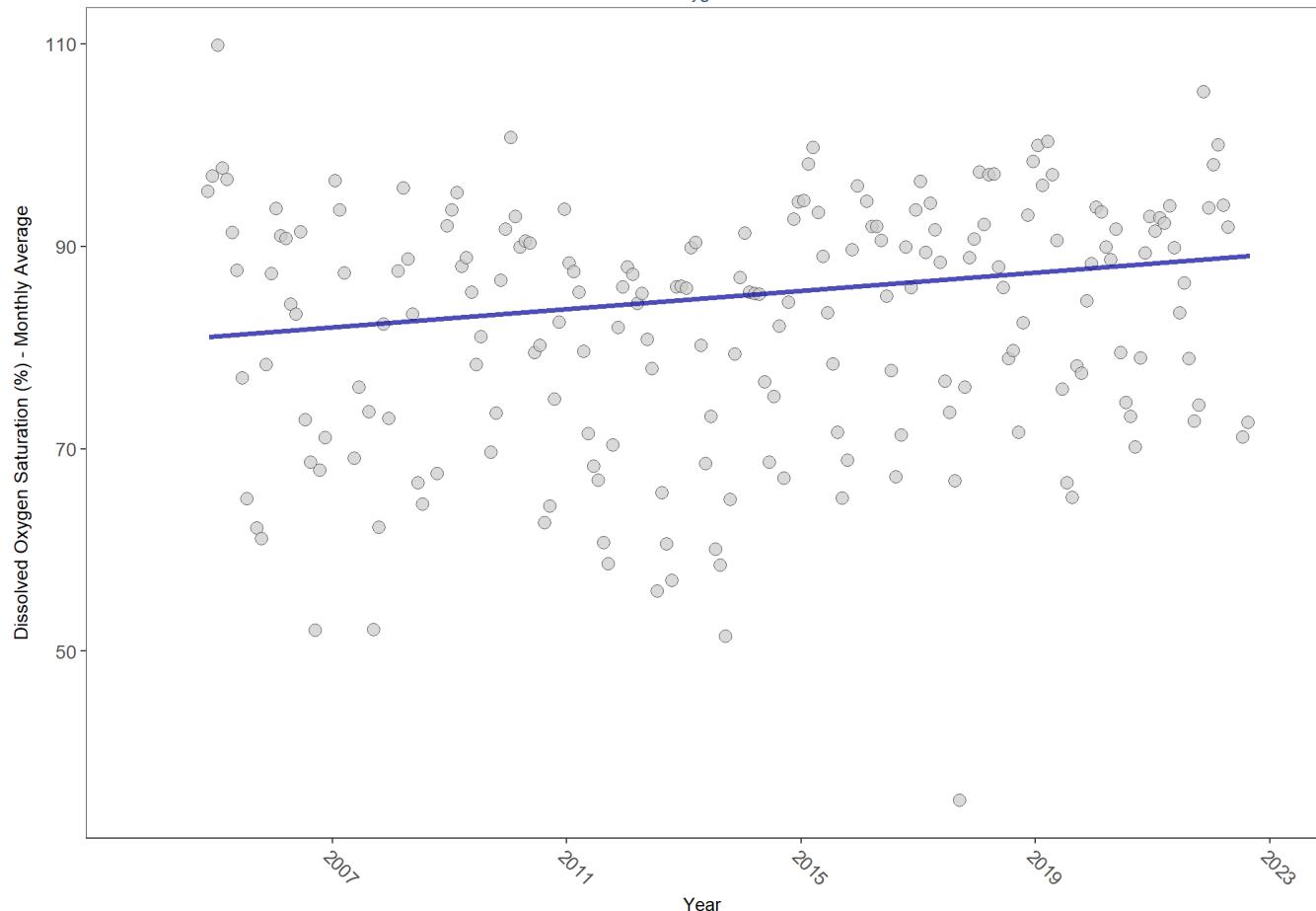
EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB03

Dissolved Oxygen Saturation



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	441227	19	83.7	TRUE	0.2531	0.0000	0.4503603	80.68982	6.4615	0.8409	1

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

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

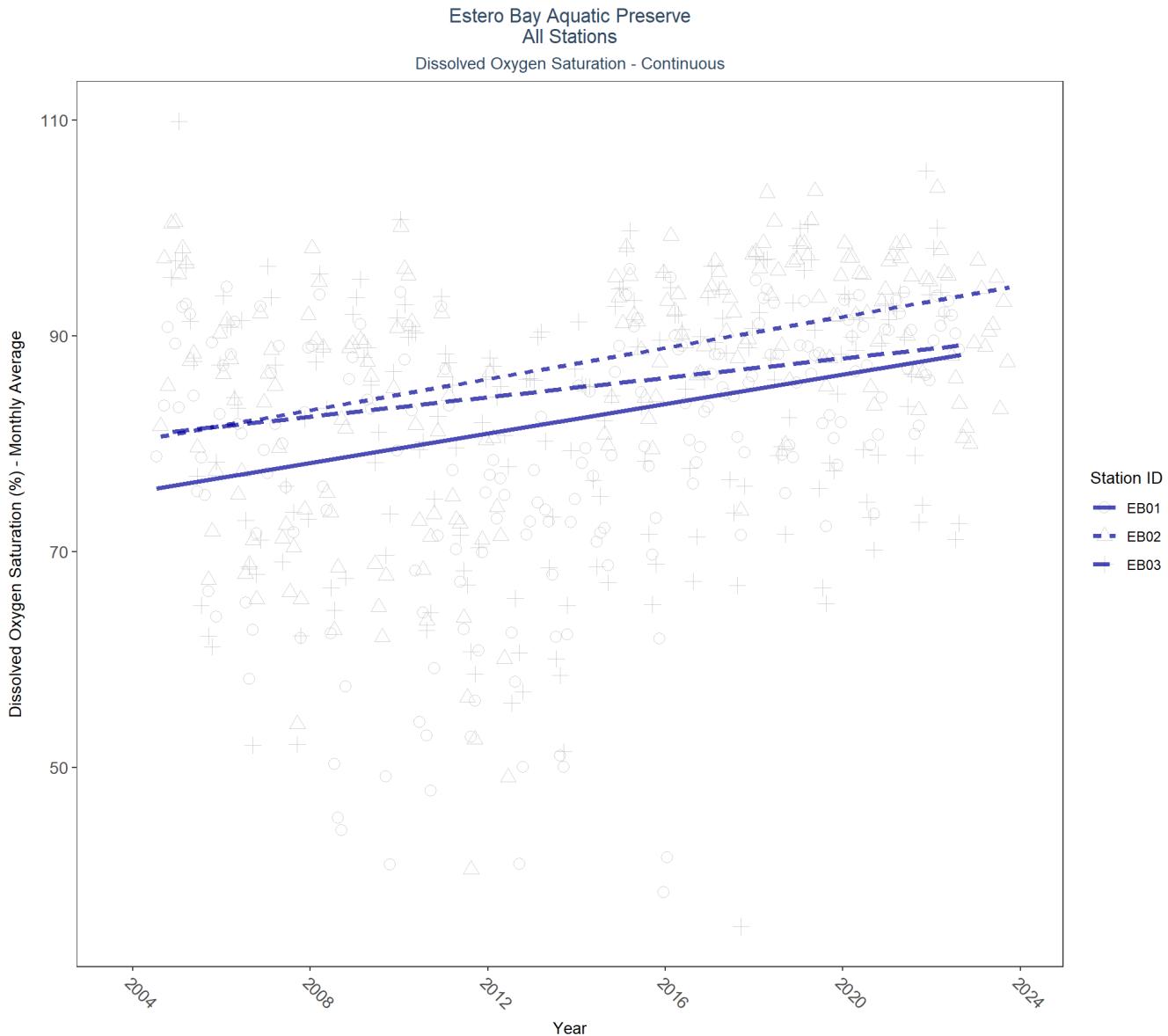


Table 30: Seasonal Kendall-Tau Results for All Stations - Dissolved Oxygen Saturation

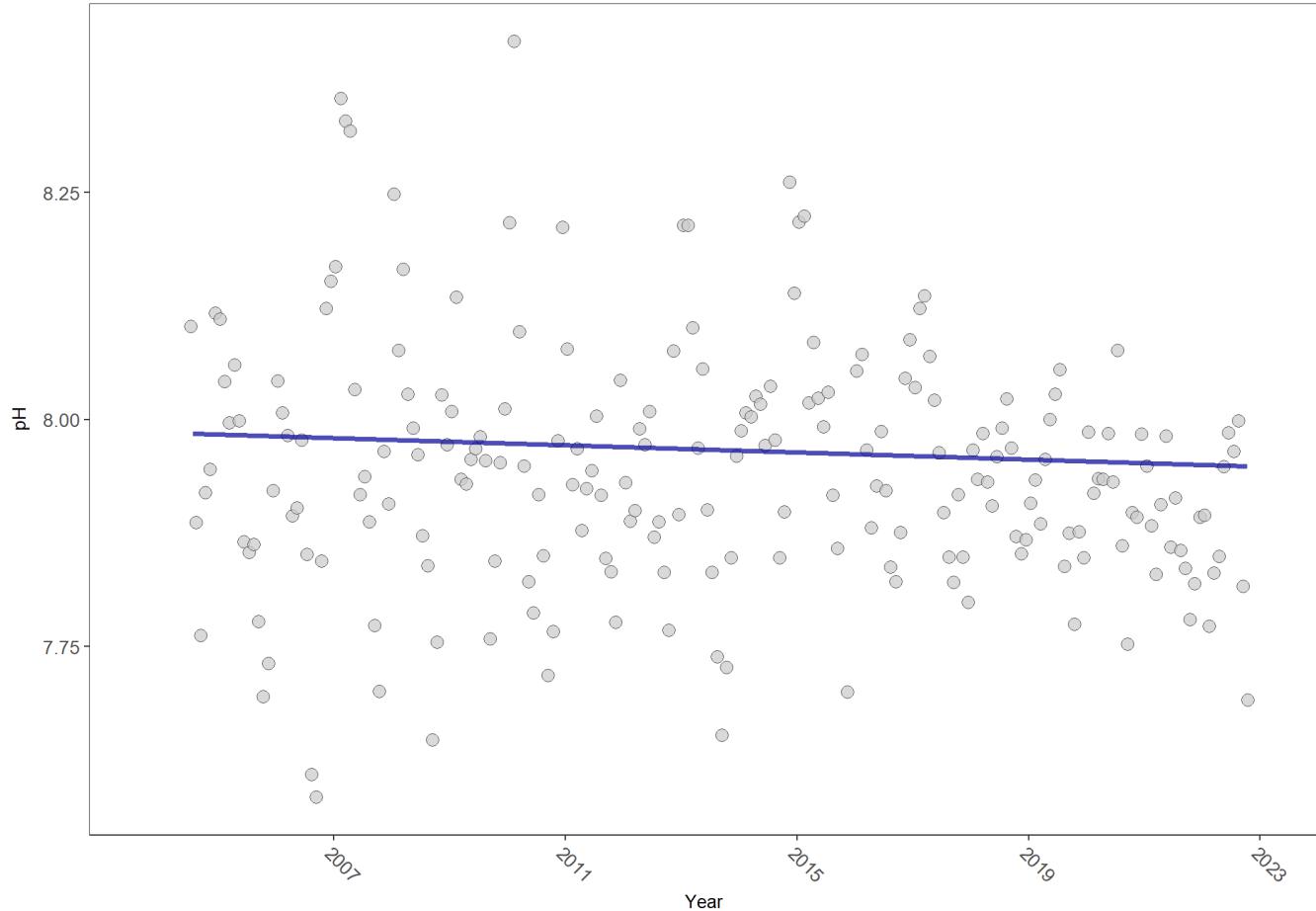
Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	480233	19	2004 - 2022	81.6	0.31	75.5	0.68	0.0000
EB02	446145	19	2004 - 2023	87.6	0.38	80.21	0.72	0.0000
EB03	441227	19	2004 - 2022	83.7	0.25	80.69	0.45	0.0000
EB04	76225	3	2021 - 2023	81.0	-	-	-	-

pH - Continuous Water Quality

EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB01
pH



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	562188	19	7.9	TRUE	-0.0841	0.1157	-0.001947073	7.985223	27.3963	0.004	0

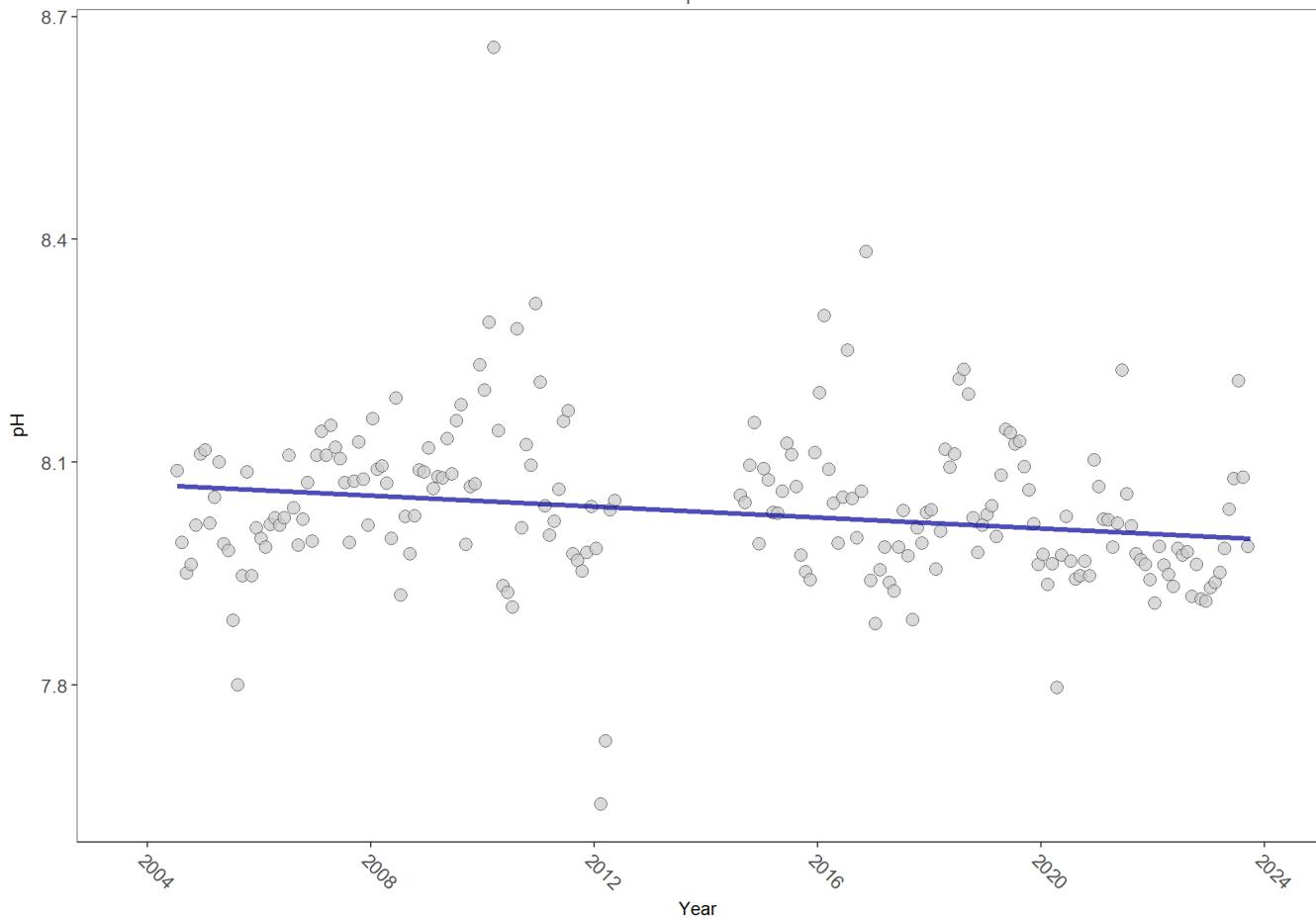
p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB02
pH



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	512064	19	8	TRUE	-0.1672	0.0013	-0.003690744	8.070007	15.9059	0.1447	-1

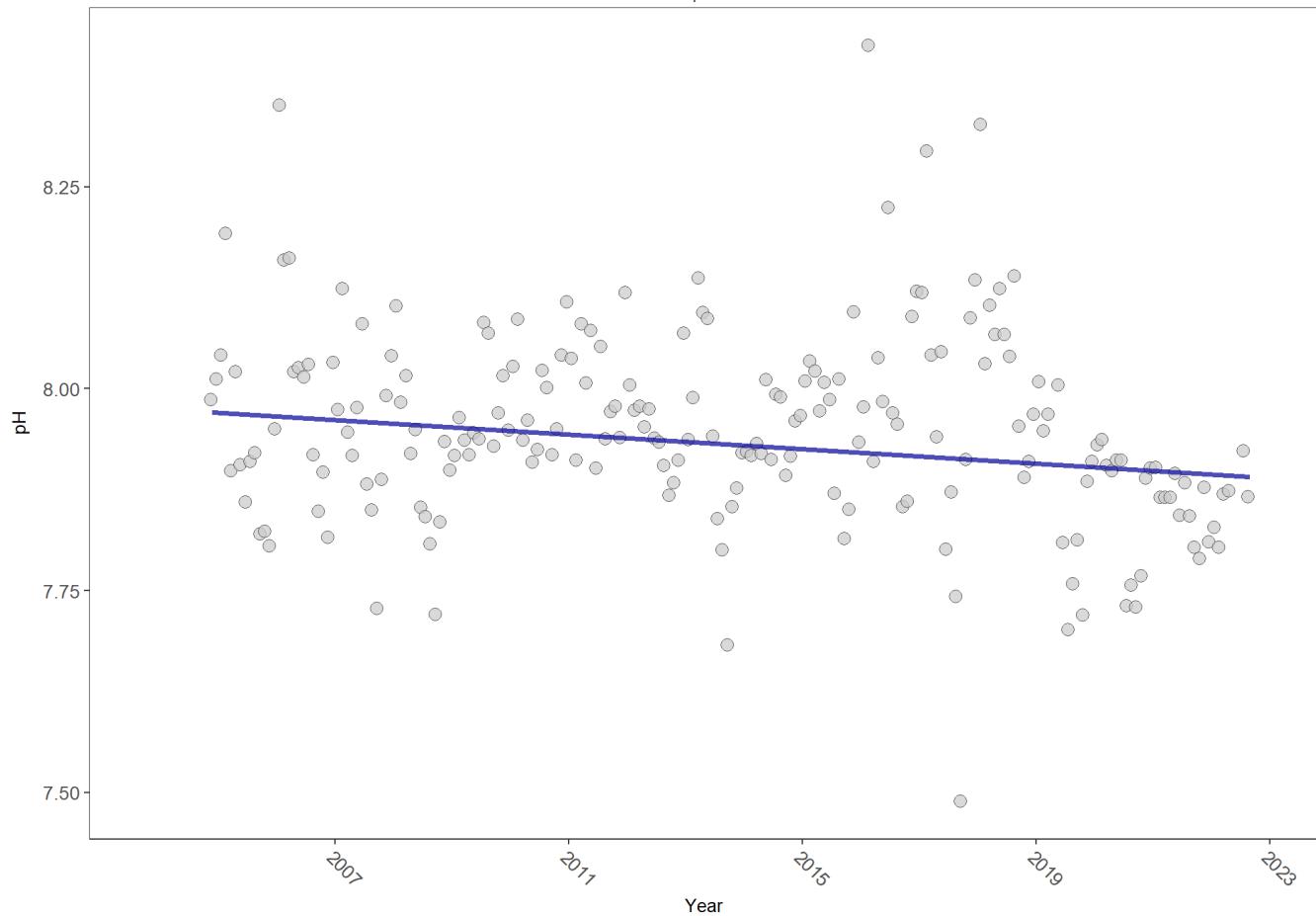
$p < 0.00005$ appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB03
pH



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	525178	19	8	TRUE	-0.1705	0.0007	-0.004519888	7.974864	5.7266	0.891	-1

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

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

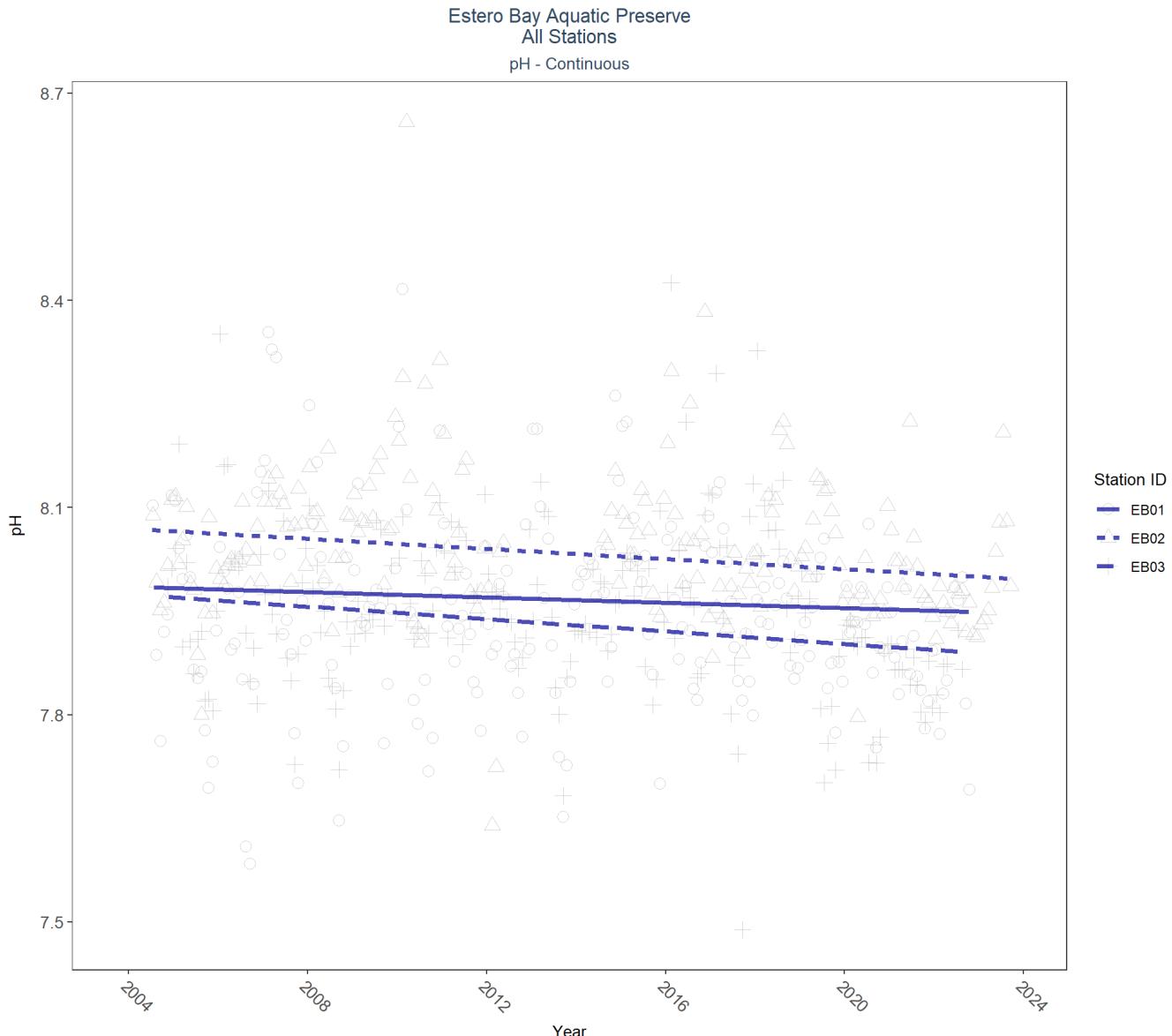


Table 31: Seasonal Kendall-Tau Results for All Stations - pH

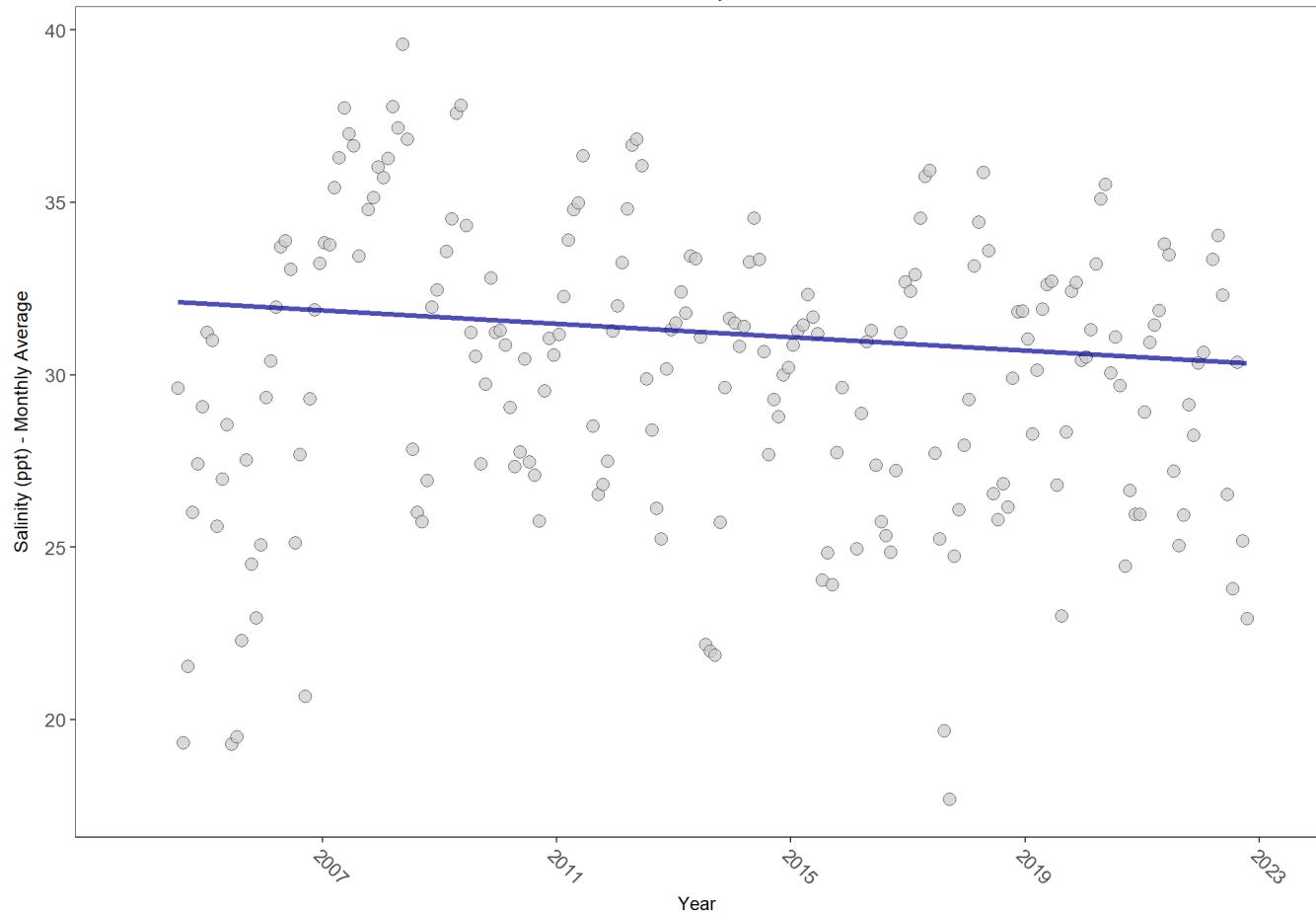
Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	562188	19	2004 - 2022	7.9	-0.08	7.99	0	0.1157
EB02	512064	19	2004 - 2023	8.0	-0.17	8.07	0	0.0013
EB03	525178	19	2004 - 2022	8.0	-0.17	7.97	0	0.0007
EB04	78723	3	2021 - 2023	7.8	-	-	-	-

Salinity - Continuous Water Quality

EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB01
Salinity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	567163	19	30.7	TRUE	-0.1318	0.0110	-0.09800266	32.17017	4.7446	0.9429	-1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

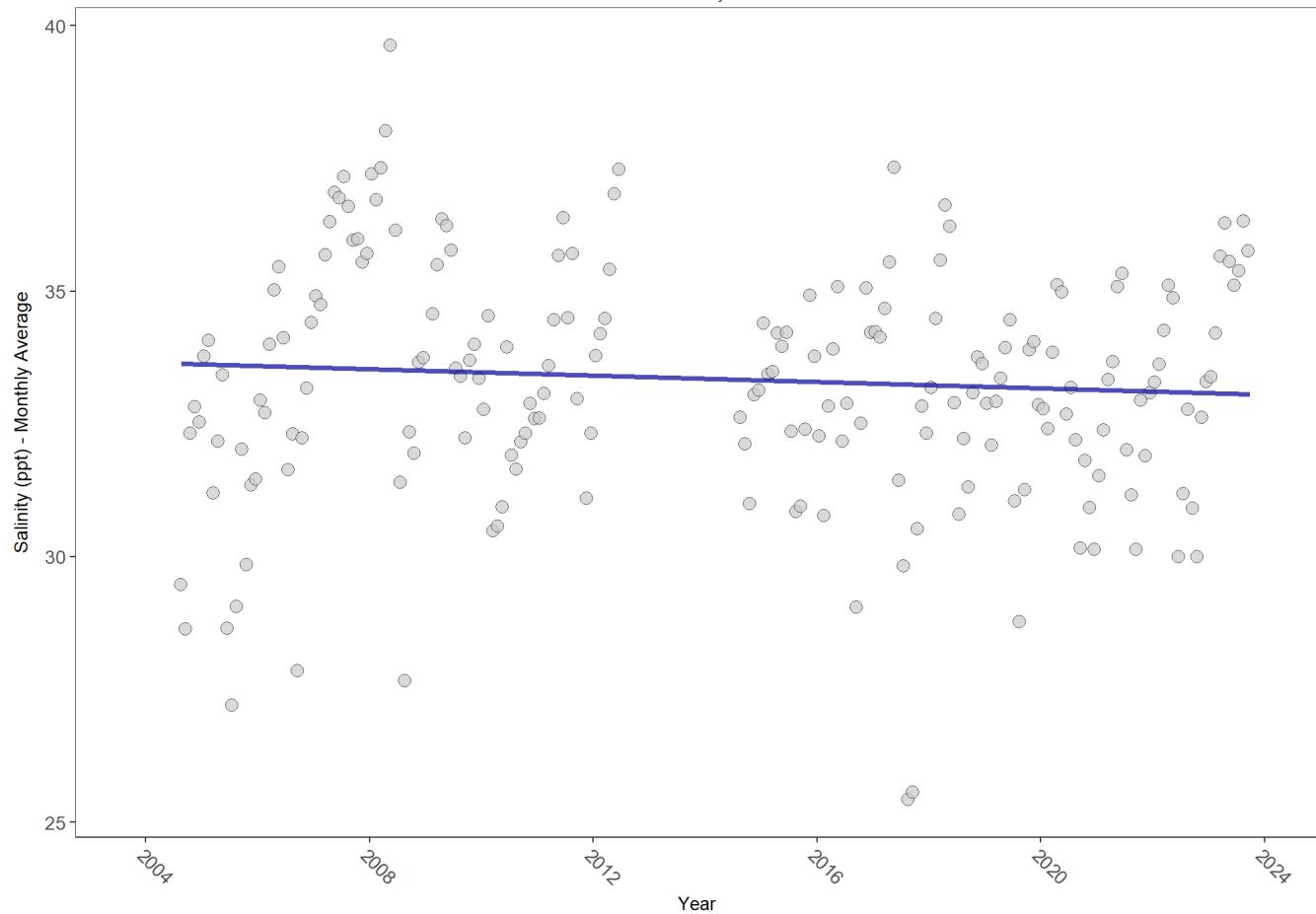
EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB02

Salinity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	531026	19	33.6	TRUE	-0.0697	0.1773	-0.02996144	33.64782	4.3561	0.9583	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

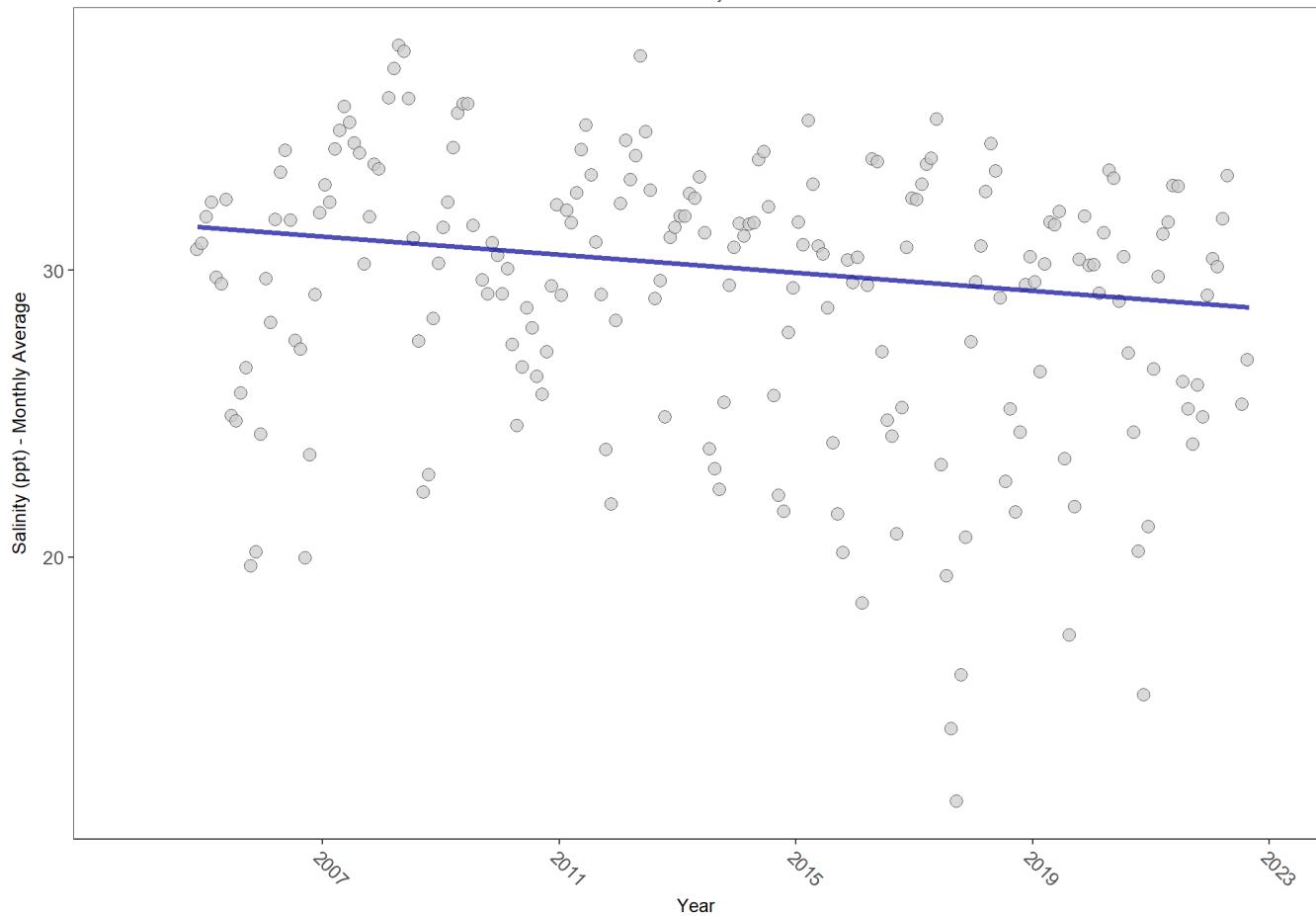
EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB03

Salinity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	533169	19	30.9	TRUE	-0.2138	0.0000	-0.1580336	31.65294	4.2465	0.9621	-1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

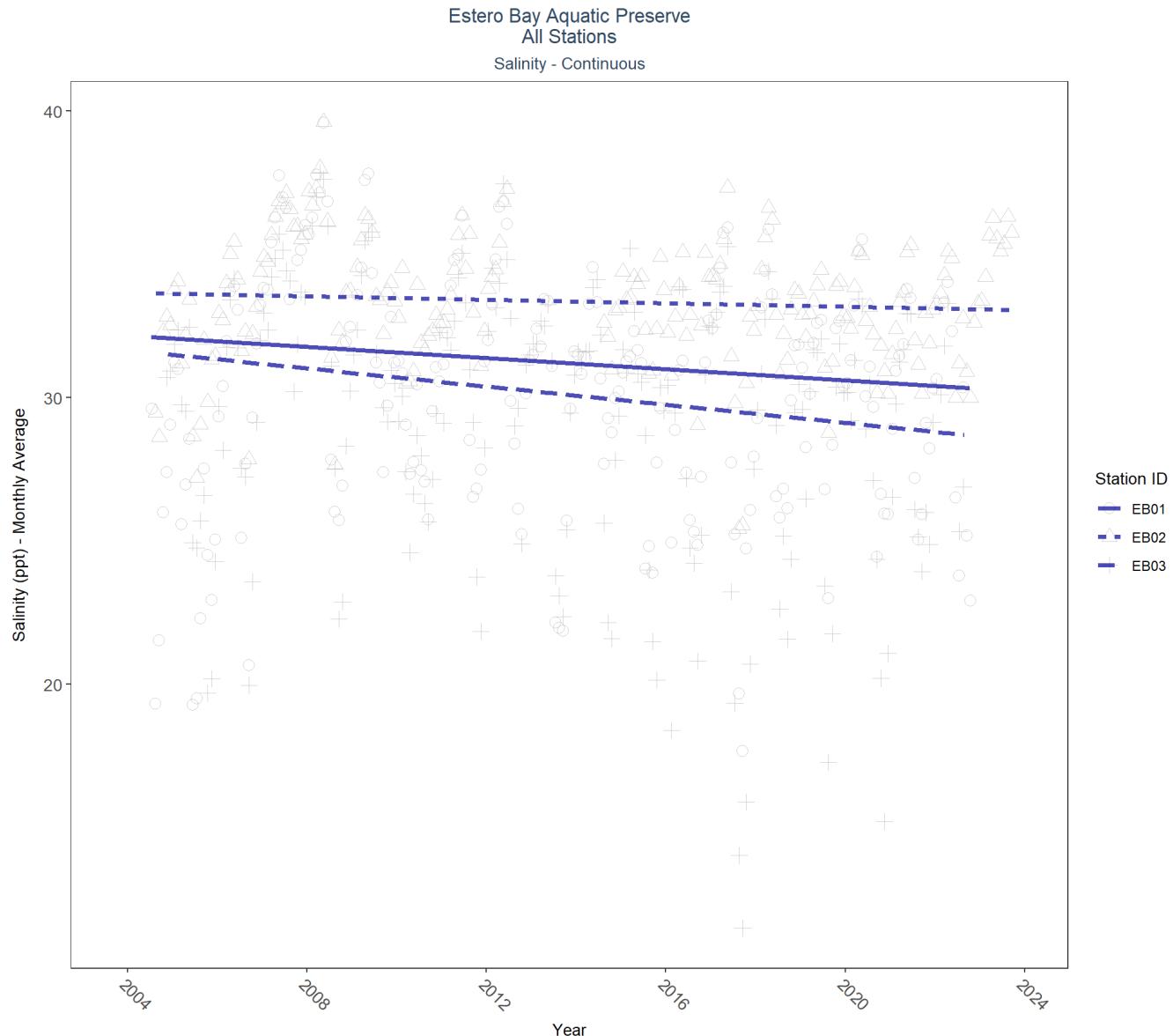


Table 32: Seasonal Kendall-Tau Results for All Stations - Salinity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	567163	19	2004 - 2022	30.7	-0.13	32.17	-0.1	0.0110
EB02	531026	19	2004 - 2023	33.6	-0.07	33.65	-0.03	0.1773
EB03	533169	19	2004 - 2022	30.9	-0.21	31.65	-0.16	0.0000
EB04	75655	3	2021 - 2023	28.4	-	-	-	-

Turbidity - Continuous Water Quality

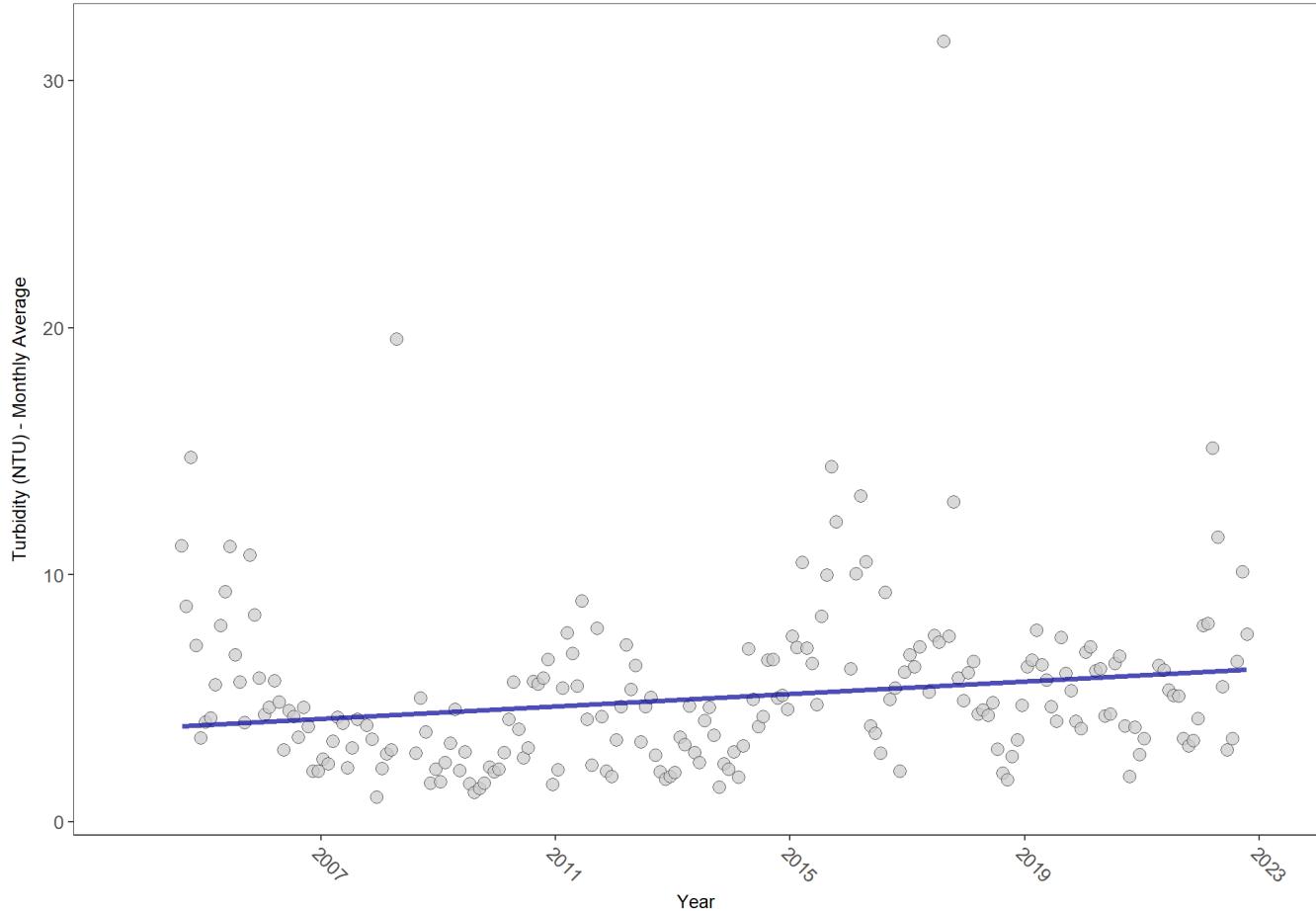
EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB01

Turbidity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	510965	19	4	TRUE	0.1797	0.0005	0.1255335	3.788219	11.0838	0.4363	1

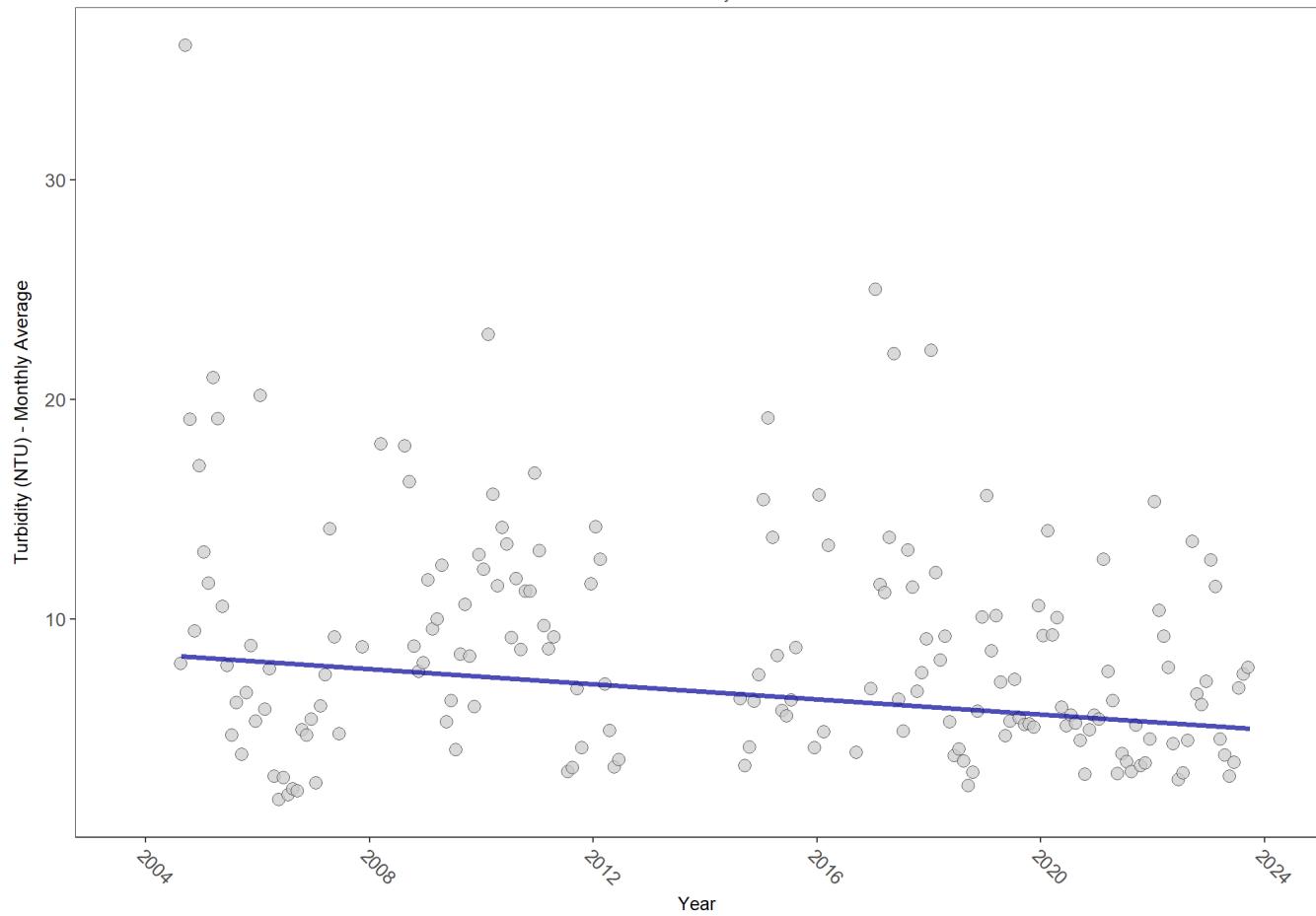
$p < 0.00005$ appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB02
Turbidity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	428586	19	5	TRUE	-0.1893	0.0009	-0.1719823	8.407386	13.3708	0.2698	-1

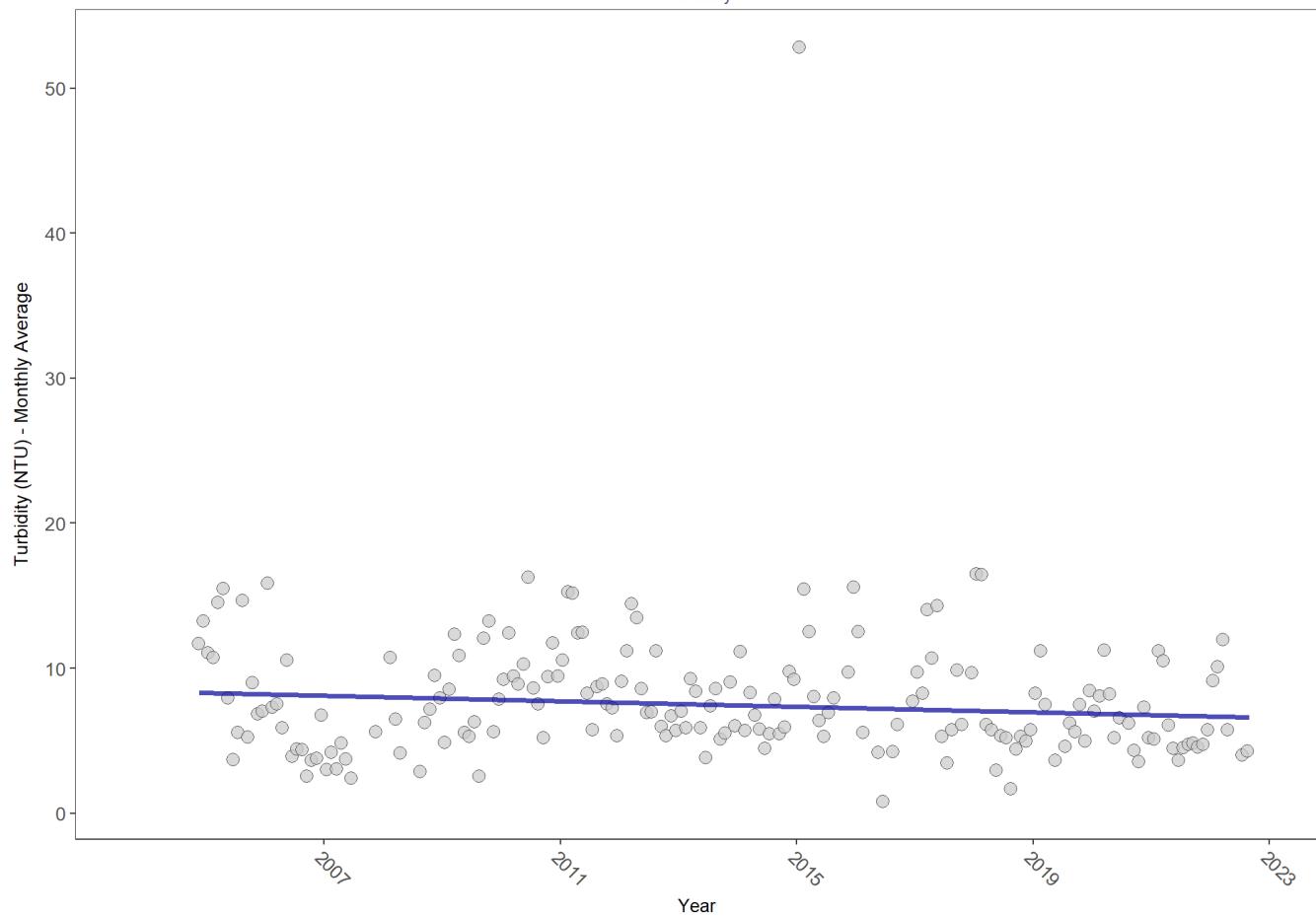
p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve
EB03
Turbidity



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	413599	19	5	TRUE	-0.1336	0.0190	-0.09501454	8.373902	7.8047	0.7307	-1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

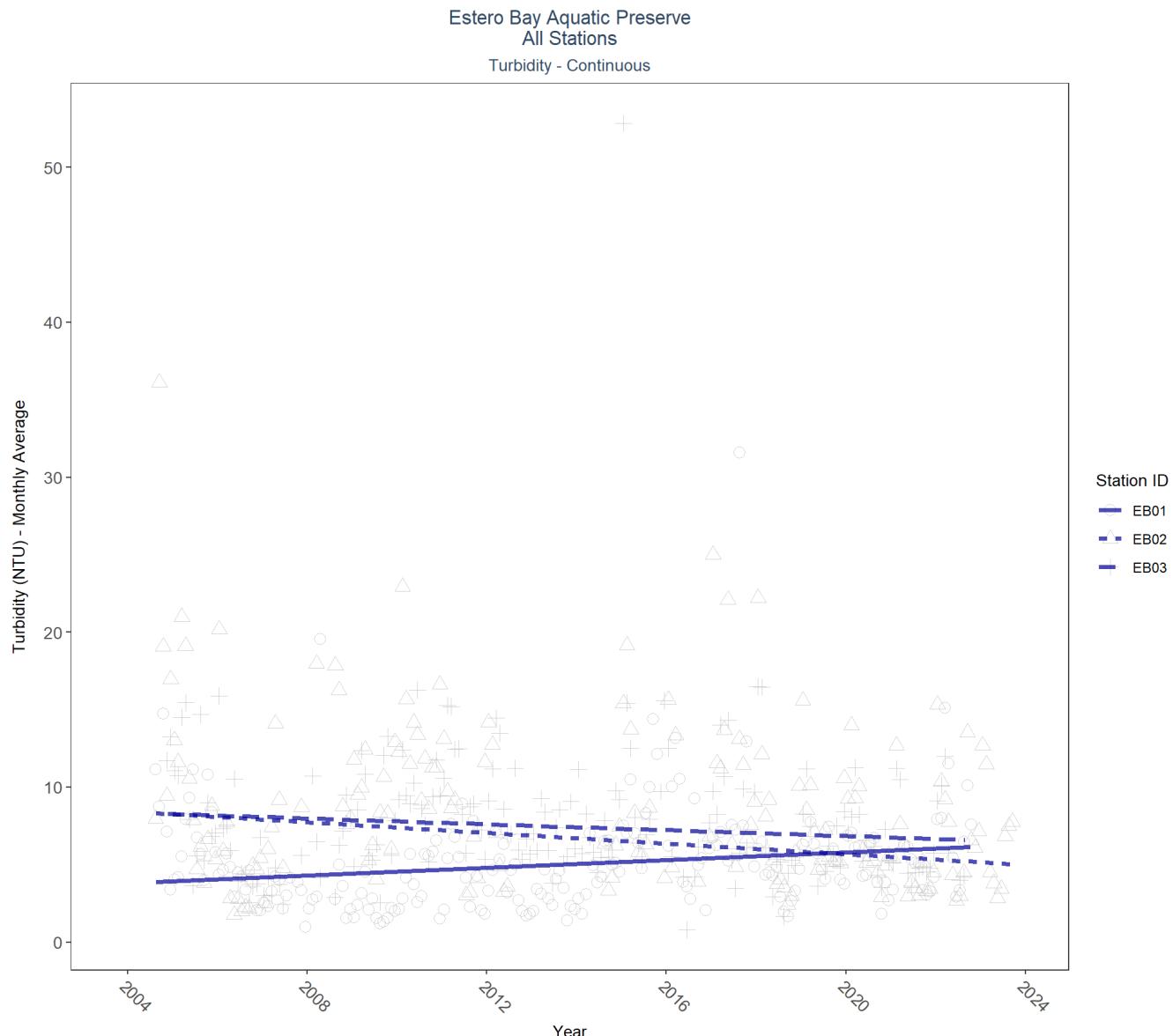


Table 33: Seasonal Kendall-Tau Results for All Stations - Turbidity

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	510965	19	2004 - 2022	4	0.18	3.79	0.13	0.0005
EB02	428586	19	2004 - 2023	5	-0.19	8.41	-0.17	0.0009
EB03	413599	19	2004 - 2022	5	-0.13	8.37	-0.1	0.0190
EB04	73526	3	2021 - 2023	5	-	-	-	-

Water Temperature - Continuous Water Quality

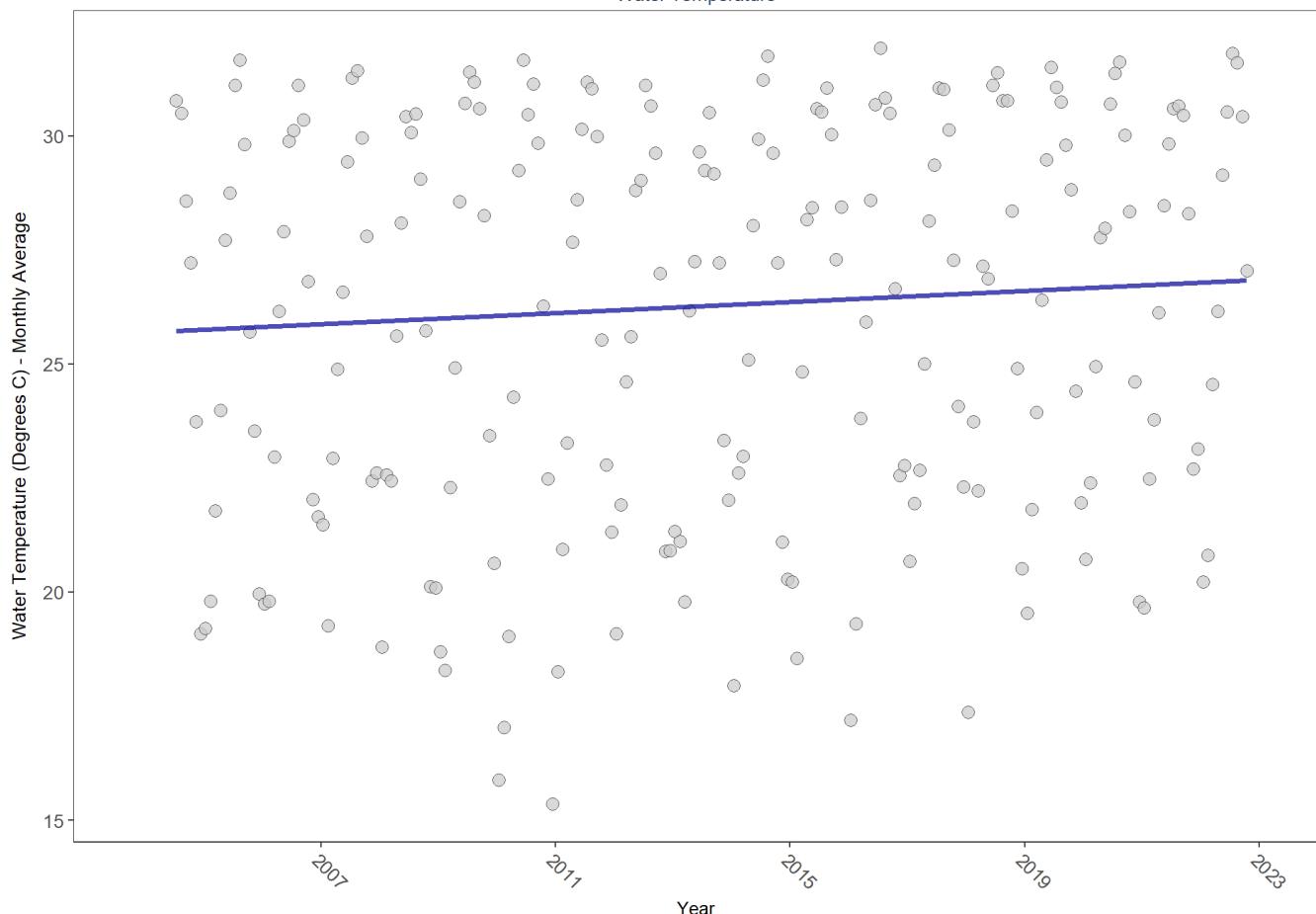
EB01

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB01

Water Temperature



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	617636	19	26.8	TRUE	0.2487	0.0000	0.06075982	25.69058	6.3259	0.8508	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

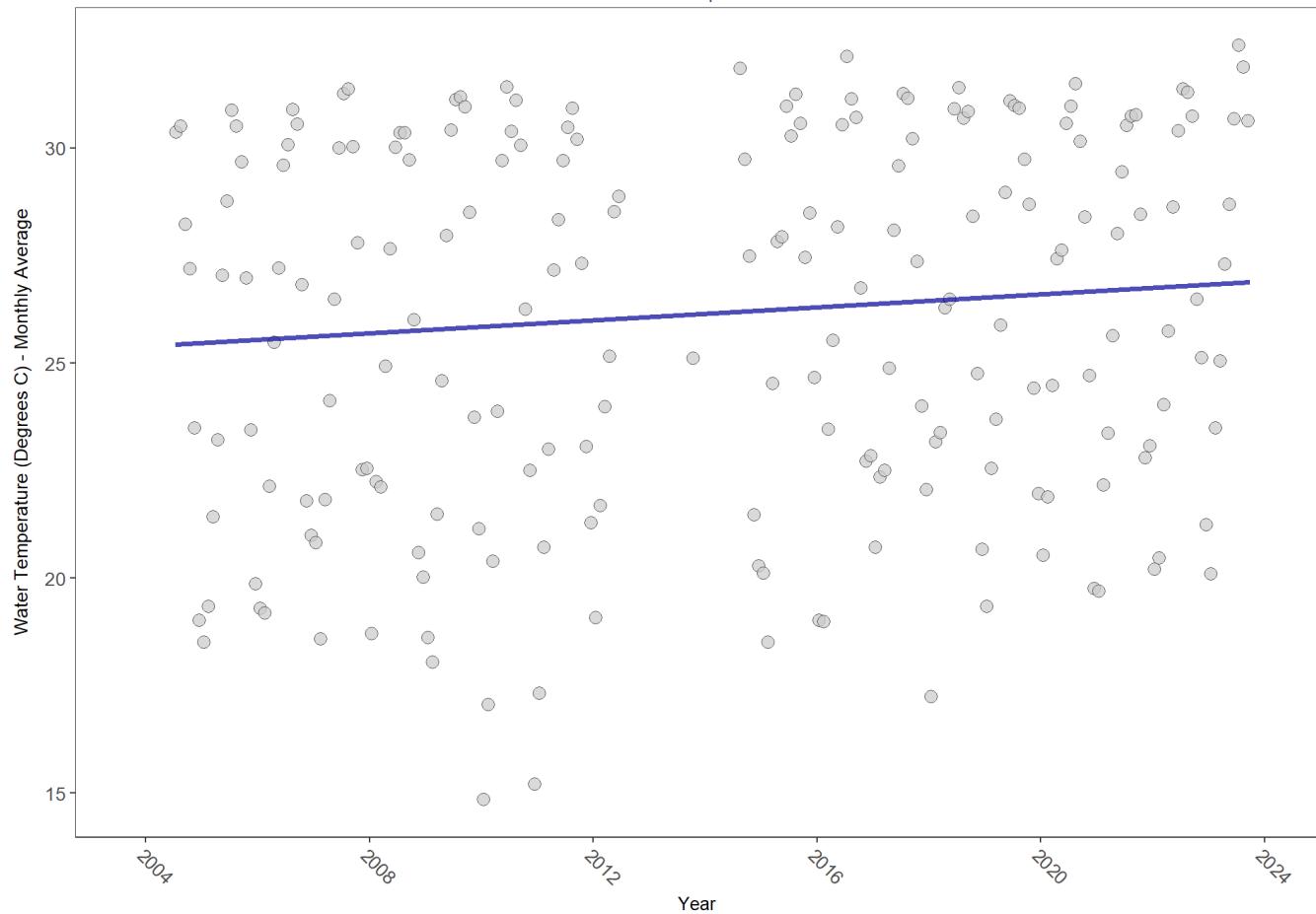
EB02

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB02

Water Temperature



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	574714	20	26.7	TRUE	0.3482	0.0000	0.07516799	25.39528	3.1459	0.9887	1

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

SennIntercept is intercept value at beginning of record for monitoring location

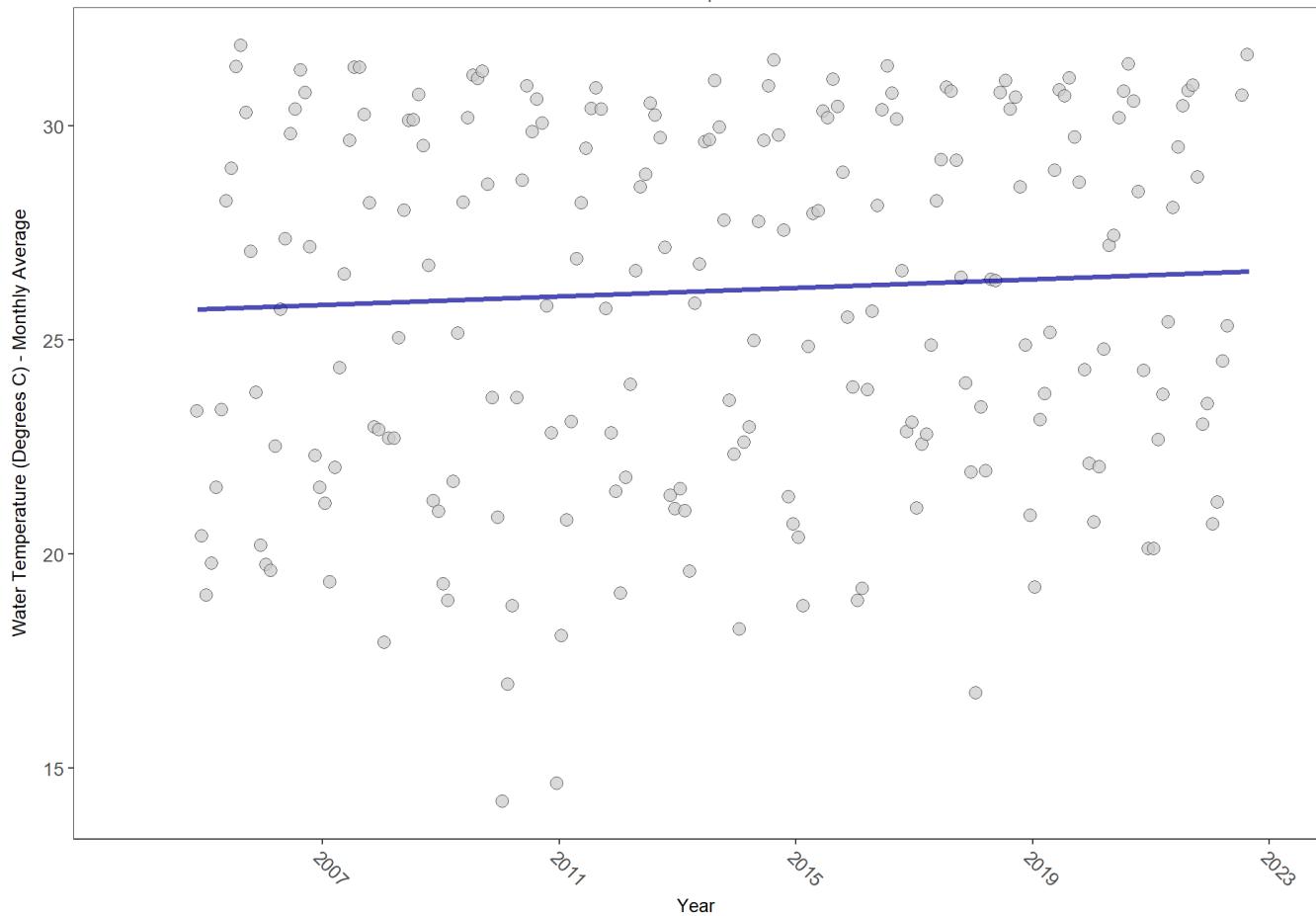
EB03

Estero Bay Aquatic Preserve Continuous Water Quality Monitoring (474)

Estero Bay Aquatic Preserve

EB03

Water Temperature



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
bottom	572084	19	26.5	TRUE	0.1722	0.0006	0.04927919	25.67835	7.636	0.7455	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined

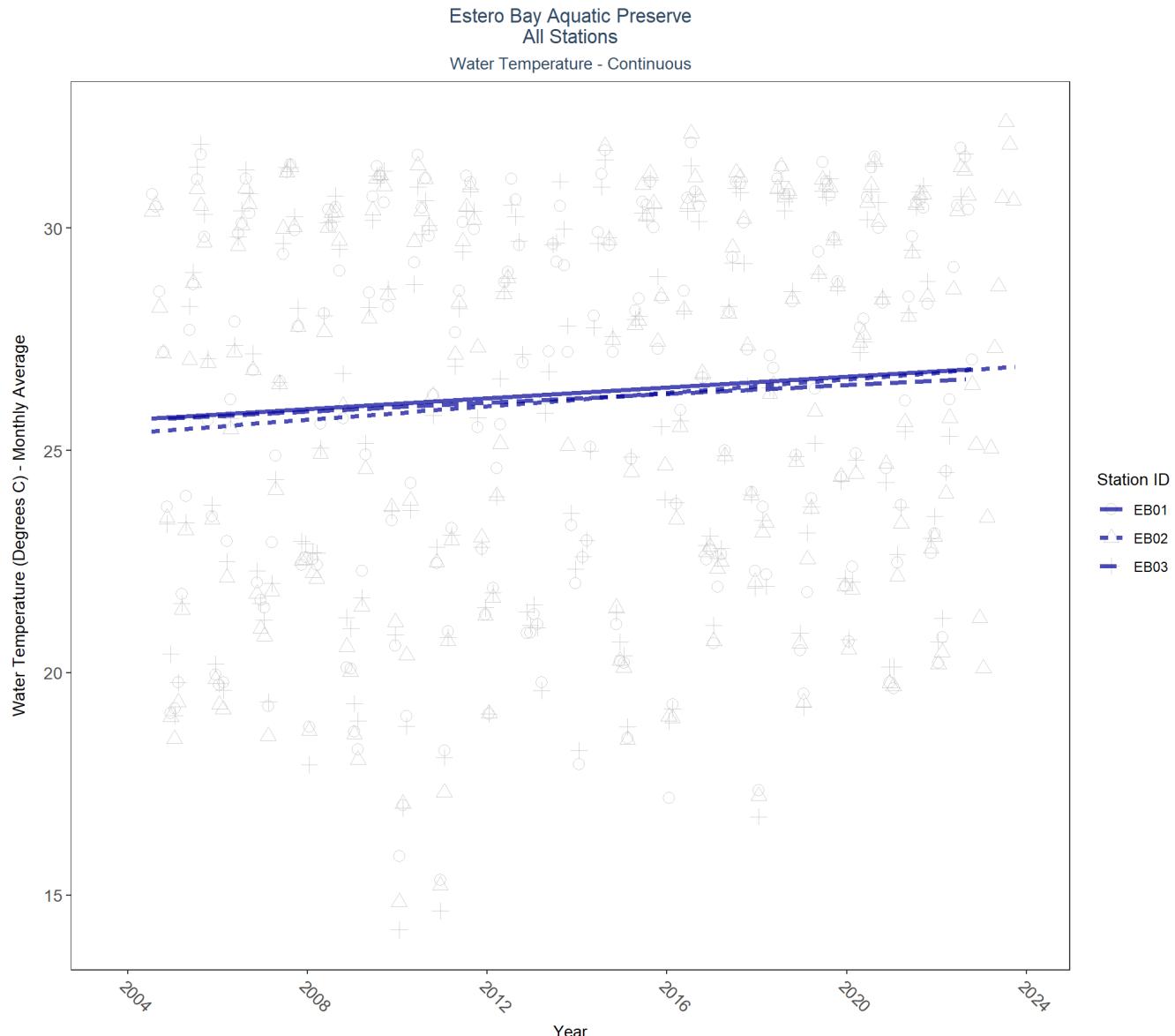


Table 34: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
EB01	617636	19	2004 - 2022	26.8	0.25	25.69	0.06	0.0000
EB02	574714	20	2004 - 2023	26.7	0.35	25.4	0.08	0.0000
EB04	83717	3	2021 - 2023	28.1	-	-	-	-
EB03	572084	19	2004 - 2022	26.5	0.17	25.68	0.05	0.0006

Submerged Aquatic Vegetation

The data file used is: All_SAV_Parameters-2024-Mar-29.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.

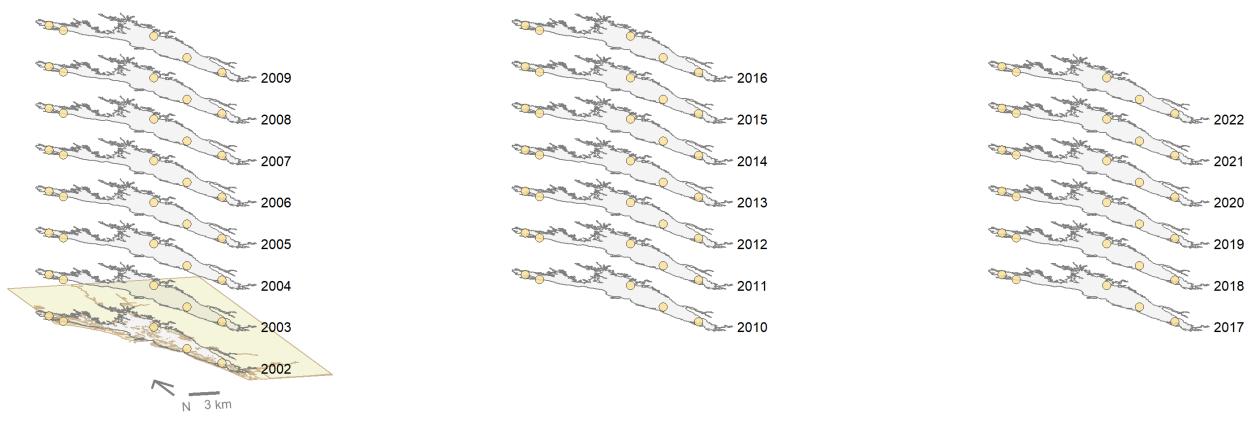
Notes

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

Estero Bay Aquatic Preserve
SAV Percent Cover - Sample Locations



Program name
○ Estero Bay Seagrass Monitoring

Maps showing the temporal scope of SAV sampling sites within the boundaries of *Estero Bay Aquatic Preserve* by Program name.

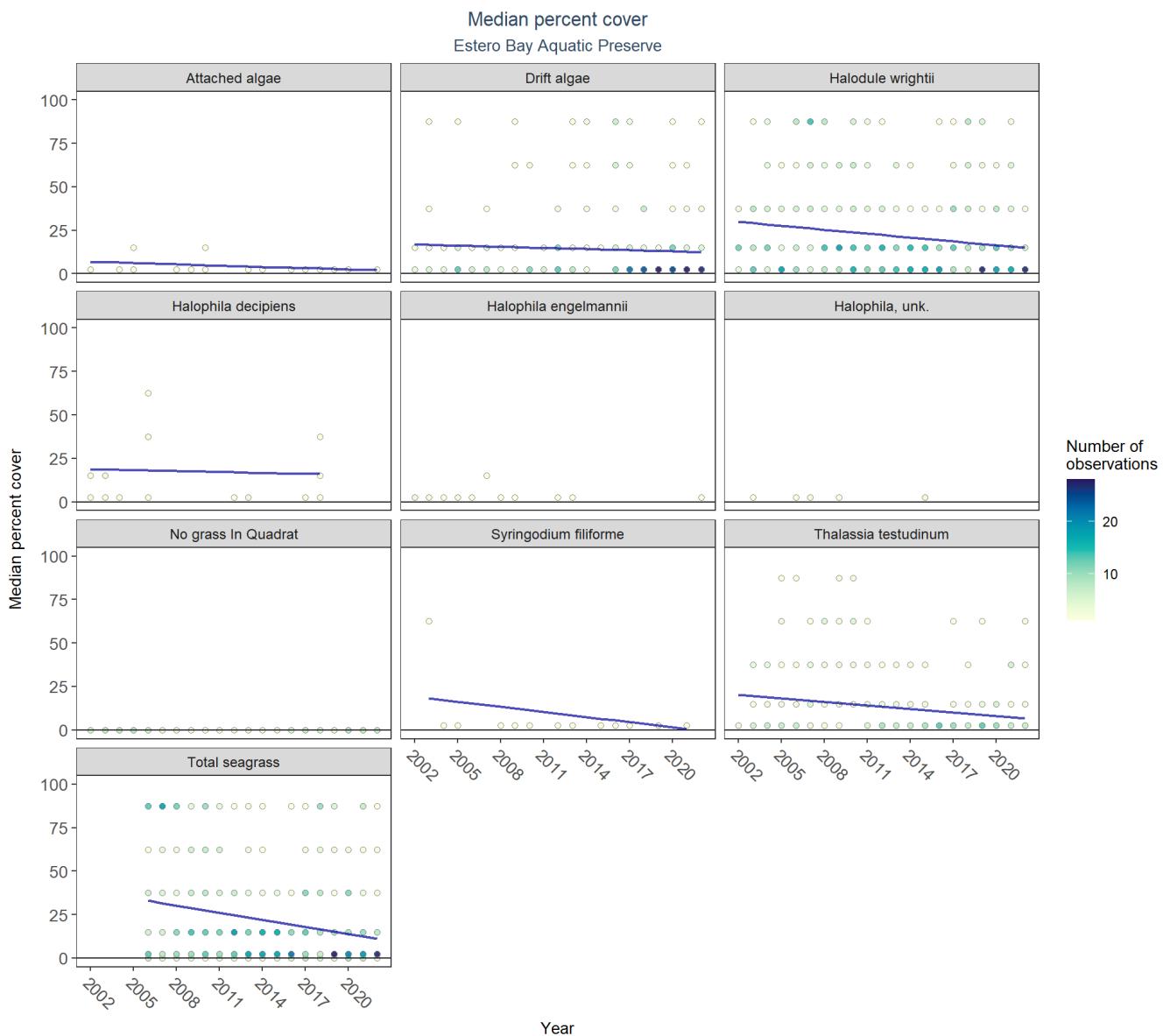
Sampling locations by Program:



Map showing SAV sampling sites within the boundaries of *Estero Bay Aquatic Preserve*. The point size reflects the number of samples at a given sampling site.

Table 35: Estero Bay Seagrass Monitoring - *Program 571*

<i>N_Data</i>	<i>YearMin</i>	<i>YearMax</i>	<i>Collection Method</i>	<i>Sample Locations</i>
2336	2002	2022	Braun Blanquet	5



Median percent cover by species in *Estero Bay 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.

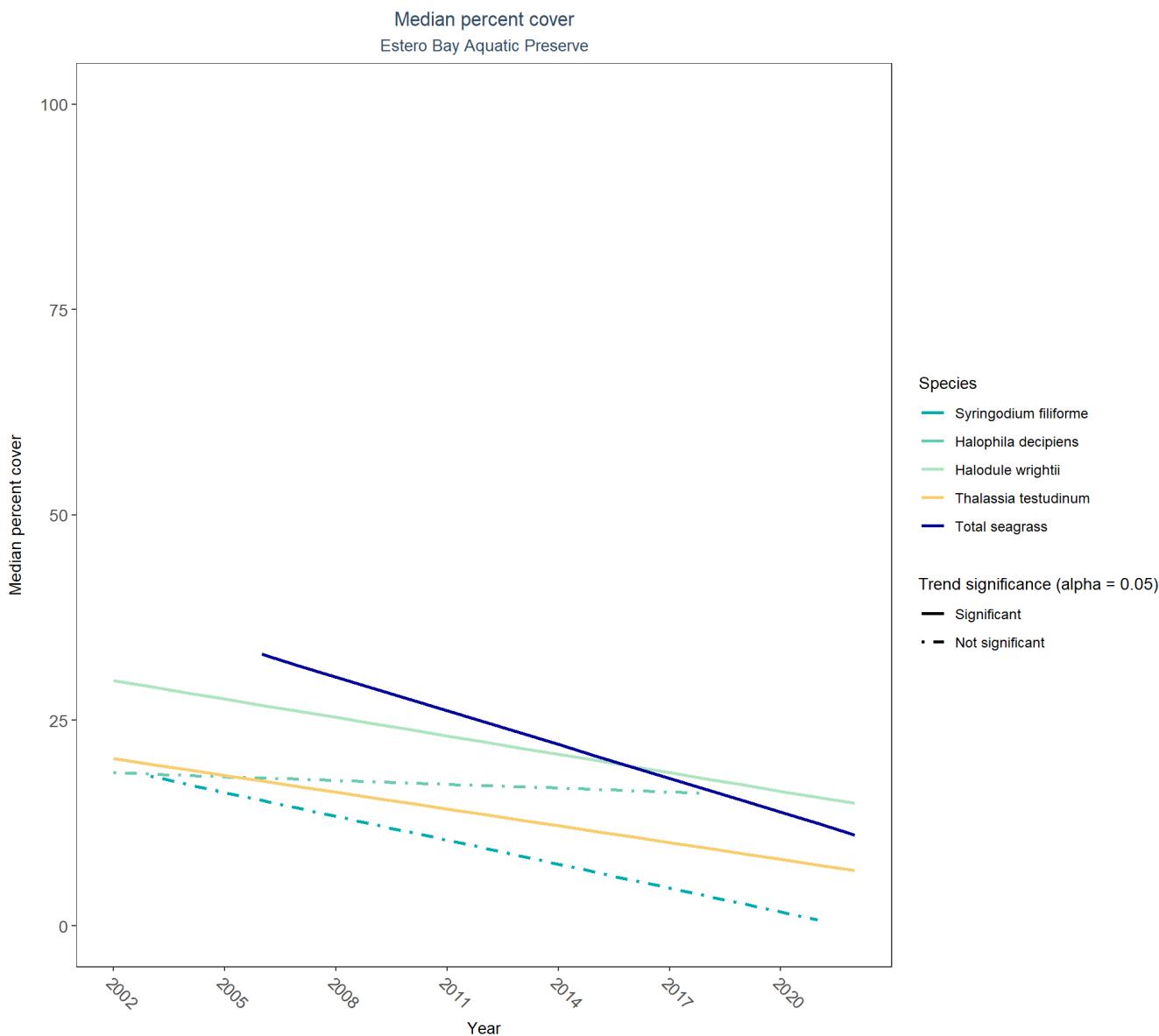
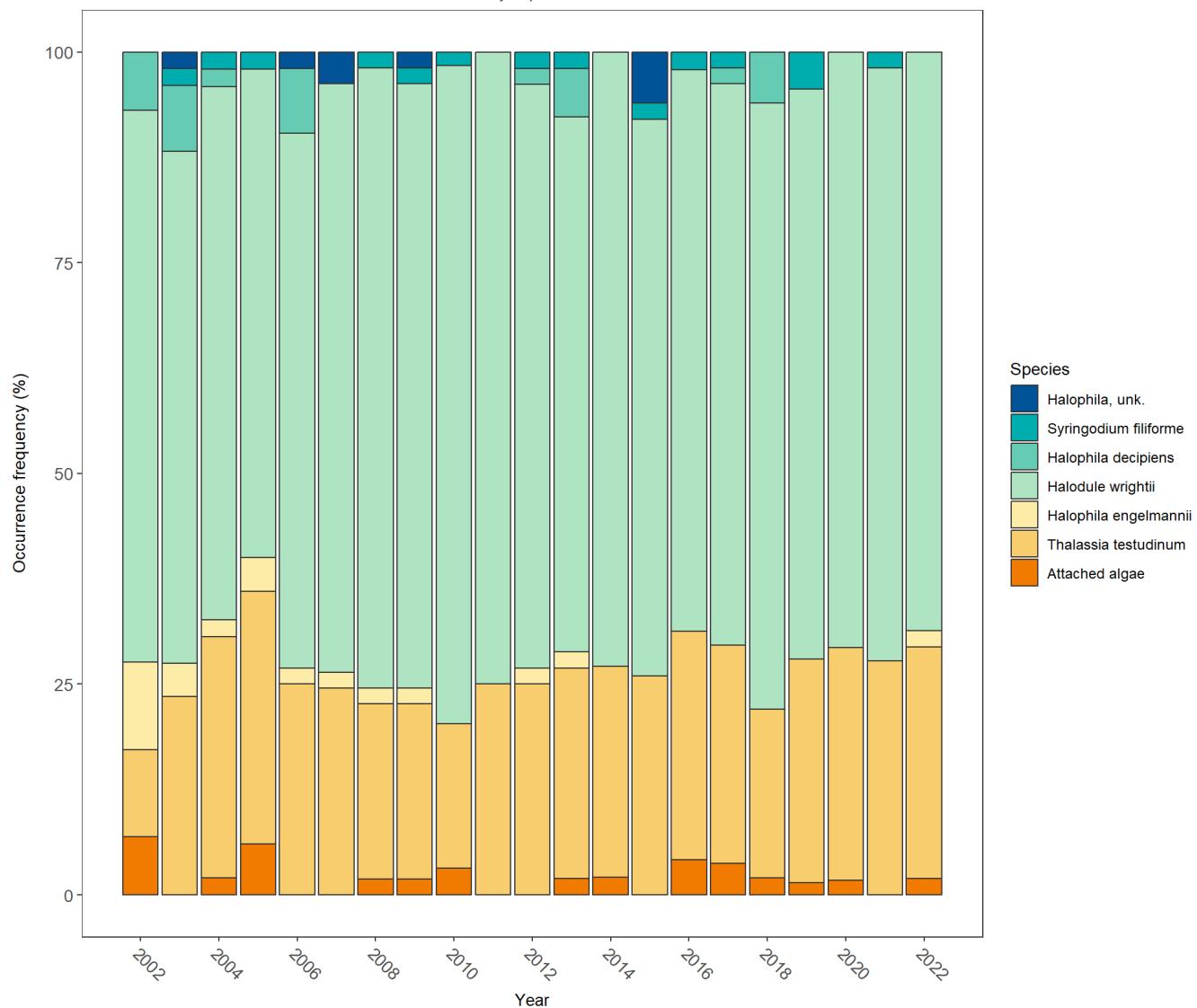


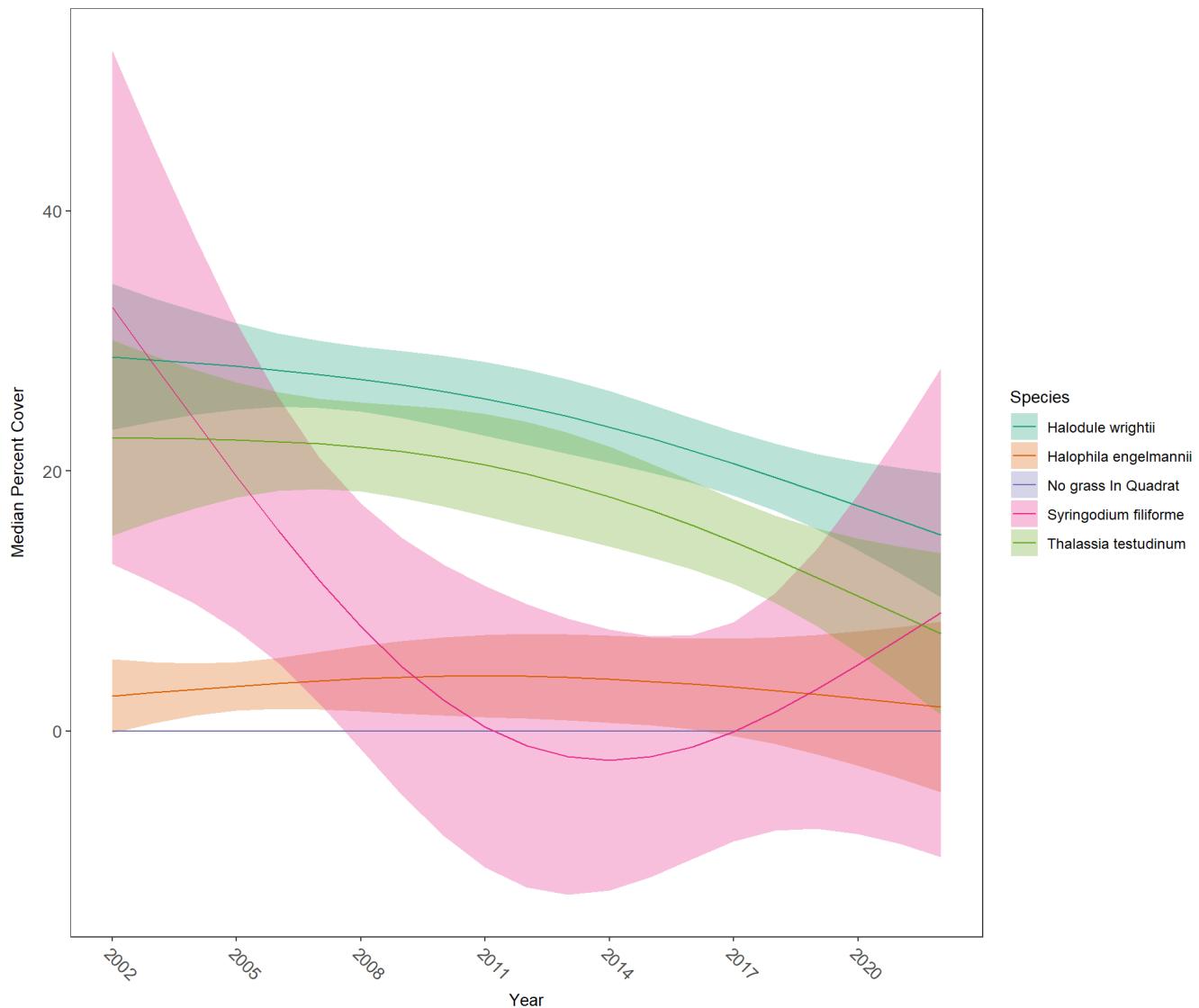
Table 36: Percent Cover Trend Analysis for Estero Bay Aquatic Preserve

Species	CommonName	Trend Significance (0.05)	Period of Record	LME-Intercept	LME-Slope	p
Attached algae		No significant trend	2002 - 2022	9.0354	-0.2507	0.3843
Drift algae		No significant trend	2002 - 2022	18.6207	-0.2207	0.4153
Halodule wrightii	Shoal grass	Significantly decreasing trend	2002 - 2022	35.8422	-0.7484	0.0042
Halophila decipiens	Paddle grass	No significant trend	2002 - 2018	19.9126	-0.1586	0.8100
Halophila engelmannii	Star grass	Model did not fit the available data	2002 - 2022			
No grass In Quadrat		Model did not fit the available data	2002 - 2022			
Syringodium filiforme	Manatee grass	No significant trend	2003 - 2021	26.9391	-0.9721	0.3518
Thalassia testudinum	Turtle grass	Significantly decreasing trend	2002 - 2022	25.7821	-0.6800	0.0270
Total seagrass		Significantly decreasing trend	2006 - 2022	49.5110	-1.3725	0.0183
Halophila, unk.		Model did not fit the available data	2003 - 2015			

Frequency of occurrence
Estero Bay Aquatic Preserve



Median Percent Cover for seagrass species
Estero Bay Aquatic Preserve



Generalized additive models for each species in Estero Bay Aquatic Preserve. Species must have at least 10 years of data to be evaluated.

Drift algae, Total seagrass, Attached algae, No grass in Quadrat, and Total SAV are excluded from the analyses.