Southeast Florida Coral Reef Ecosystem Conservation Area

SEACAR Habitat Analyses

Last compiled on 08 April, 2024

Contents

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

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

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

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

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

Systemwide Monitoring Program (SWMP) value qualifier codes

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

Table 5: SWMP Value Qualifier codes

Qualifier Source	*Value Qualifier*	*Include*	*Description*
SWMP	-1	Yes	Optional parameter not collected
SWMP	-2	No	Missing data
SWMP	-3	No	Data rejected due to QA/QC
SWMP	-4	No	Outside low sensor range
SWMP	-5	No	Outside high sensor range
SWMP	0	Yes	Passed initial QA/QC checks
SWMP	1	No	Suspect data
SWMP	2	Yes	Reserved for future use
SWMP	3	Yes	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
SWMP	4	Yes	Historical: Pre-auto QA/QC
SWMP	5	Yes	Corrected data

Water Column

The water column habitat extends from the 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

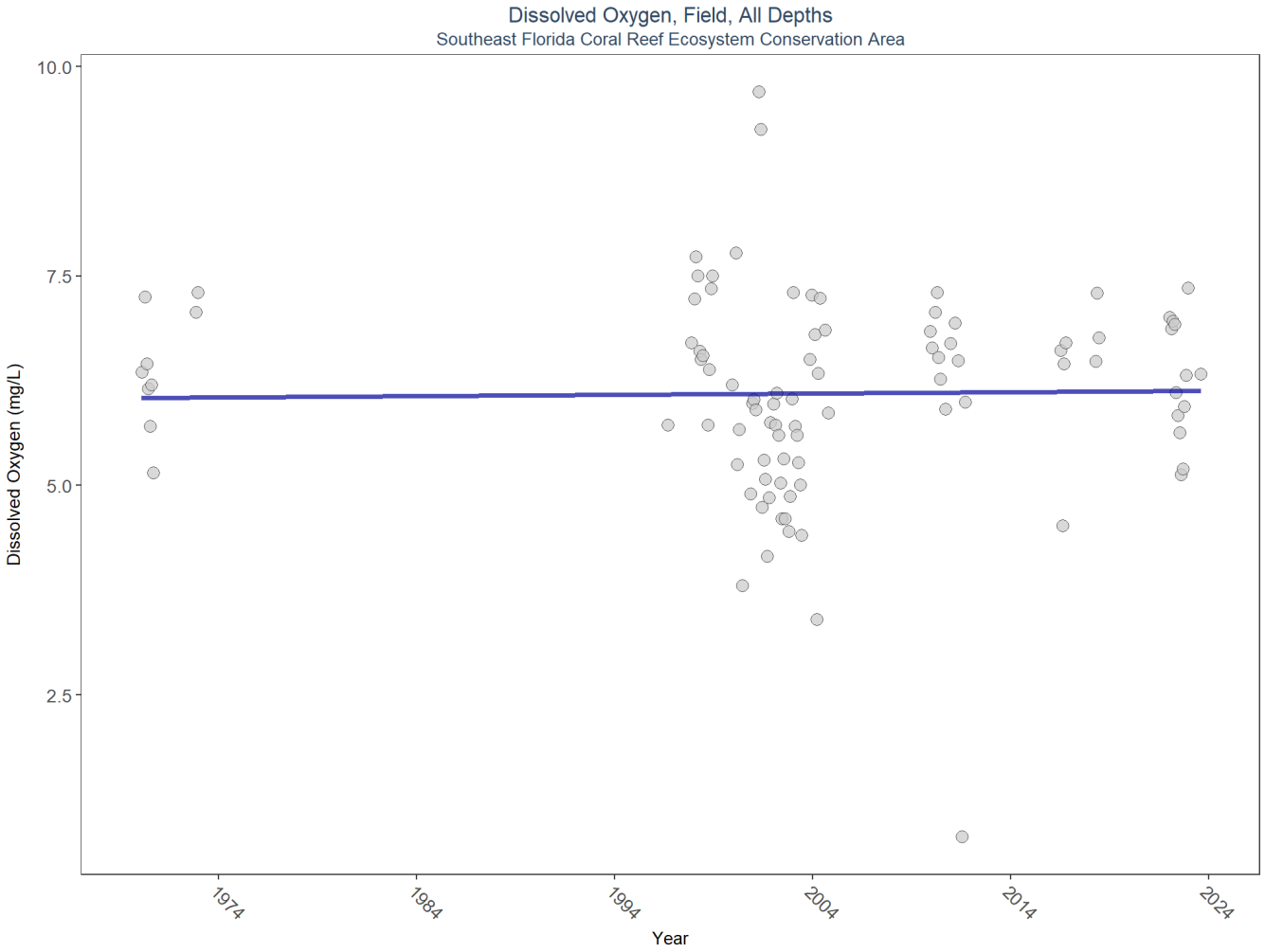
The following files were used in the discrete analysis:

- *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*

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

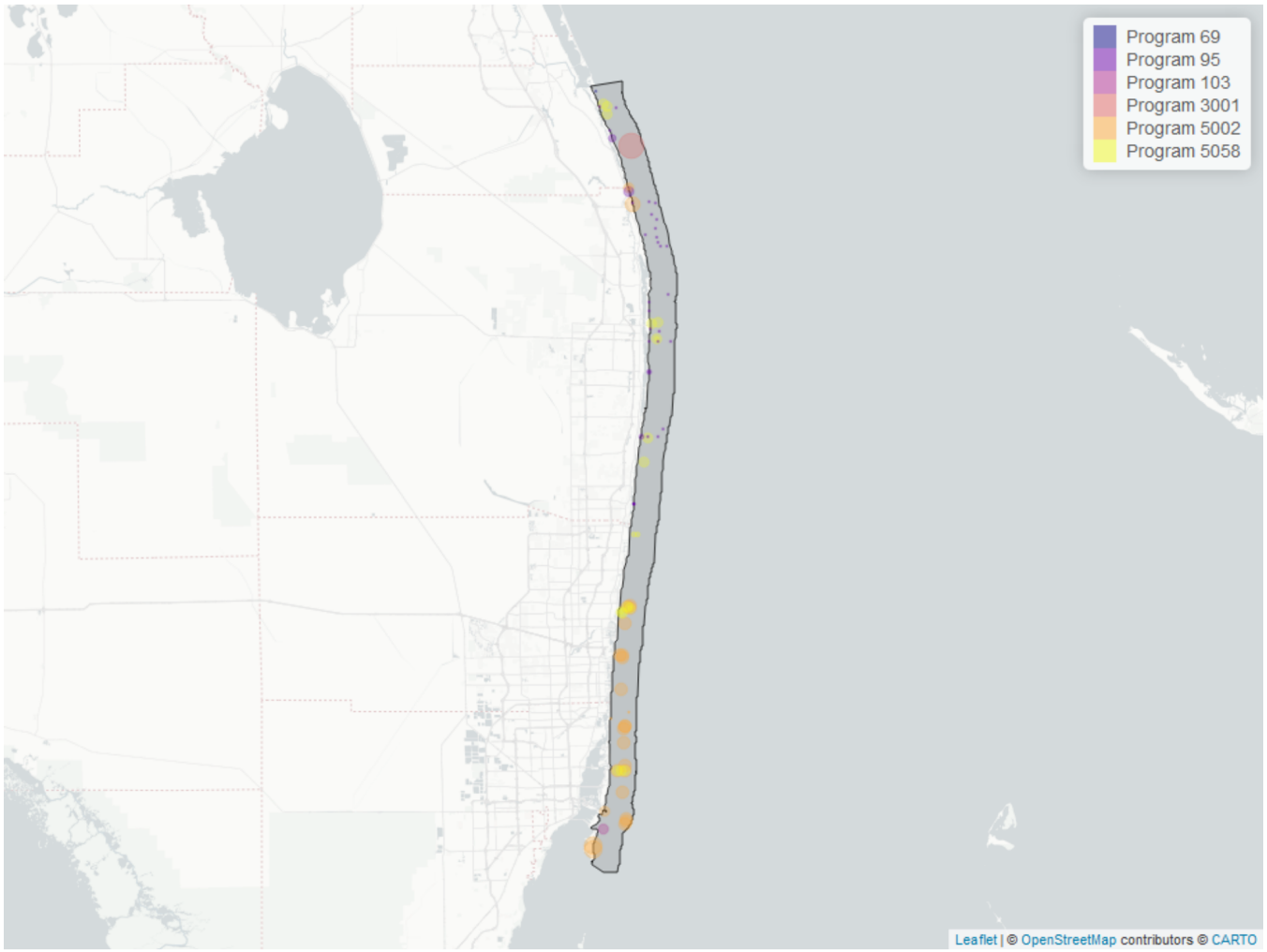


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	622	18	6.4781	TRUE	0.0321	0.7804	0.001575774	6.048008	4.1565	0.9651	0

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 6: Programs contributing data for Dissolved Oxygen

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	698	1996	2023
5058	266	2009	2011
3001	98	1999	2003
95	71	1972	2018
103	14	1970	1970
69	2	1998	1998

Program names:

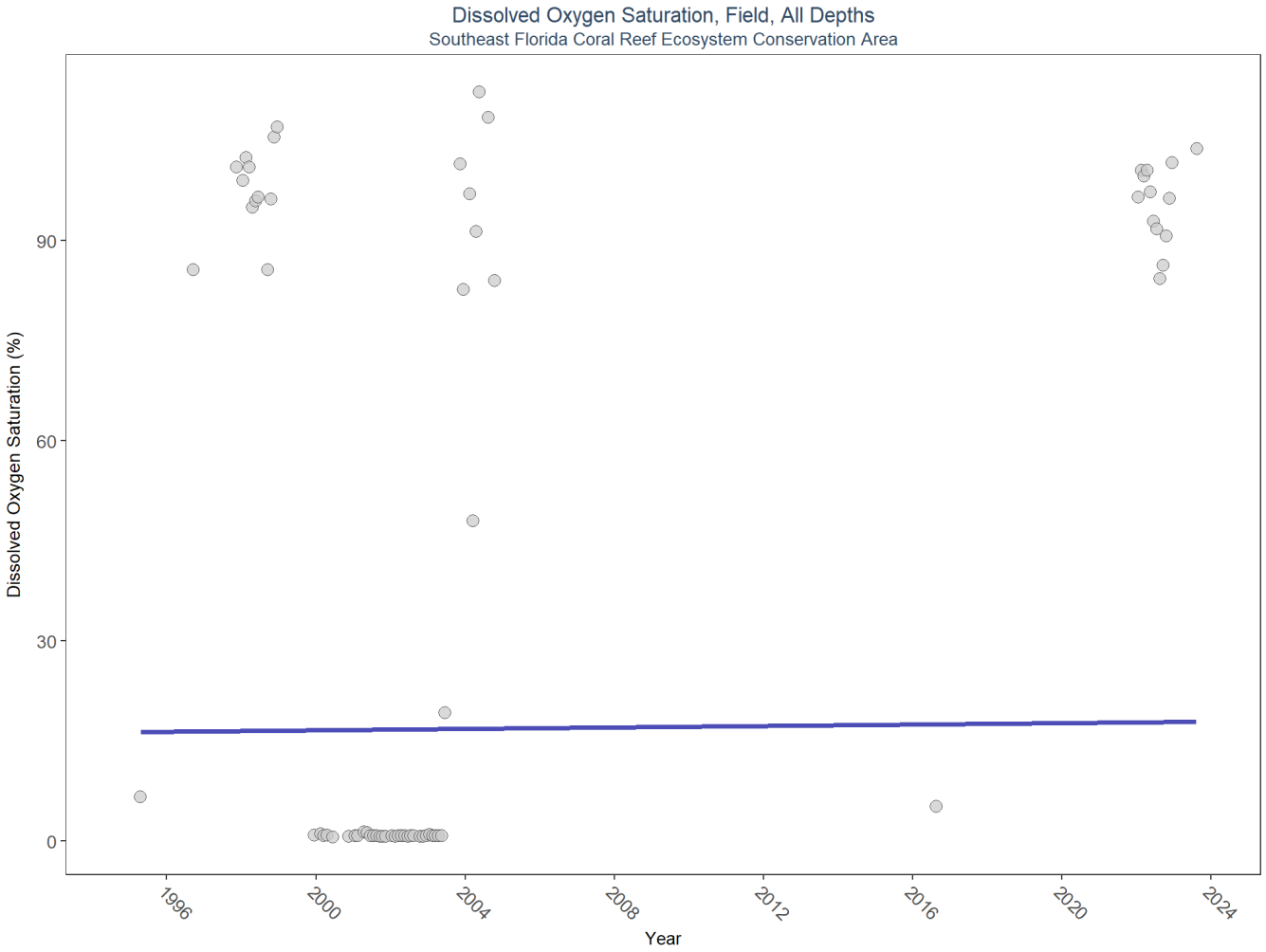
5002 - Florida STORET / WIN
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report
3001 - Lagoon Watch (Formerly Marine Discovery Center)

95 - Harmful Algal Bloom Marine Observation Network
103 - EPA STOrage and RETrieval Data Warehouse (STORET)
69 - Fisheries-Independent Monitoring (FIM) Program

There are no qualifying Value Qualifiers for Dissolved Oxygen in Southeast Florida Coral Reef Ecosystem Conservation Area

Dissolved Oxygen Saturation - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

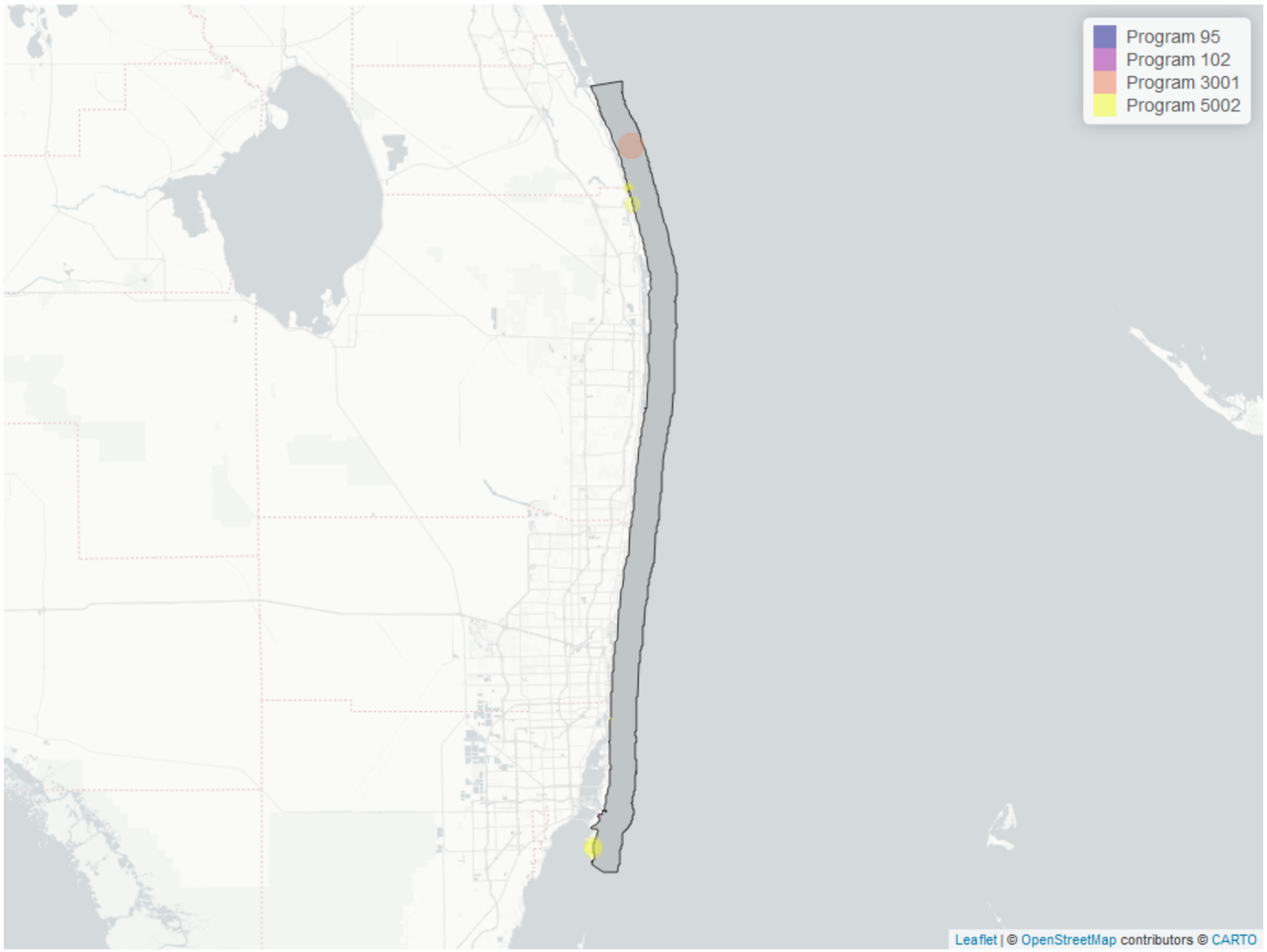


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	272	13	88.15	TRUE	0.1265	0.3484	0.0551355	16.3311	1.8632	0.9989	0

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 Saturation



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

Table 7: Programs contributing data for Dissolved Oxygen Saturation

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	171	1996	2023
3001	98	1999	2003
102	2	1995	1995
95	1	2016	2016

Program names:

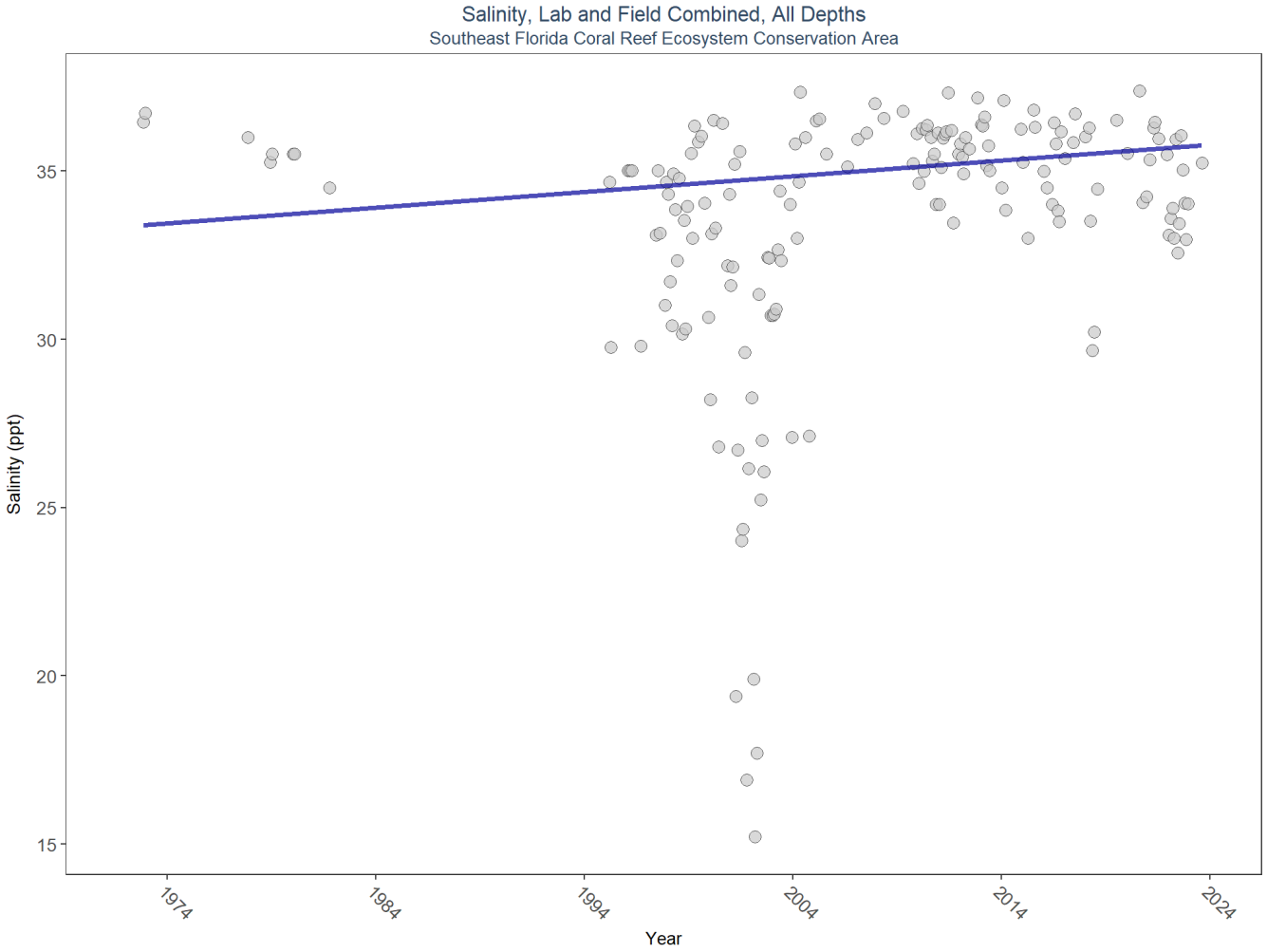
5002 - Florida STORET / WIN
3001 - Lagoon Watch (Formerly Marine Discovery Center)
102 - National Status and Trends Mussel Watch
95 - Harmful Algal Bloom Marine Observation Network

There are no qualifying Value Qualifiers for Dissolved Oxygen Saturation in Southeast Florida Coral Reef Ecosystem Conservation Area

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

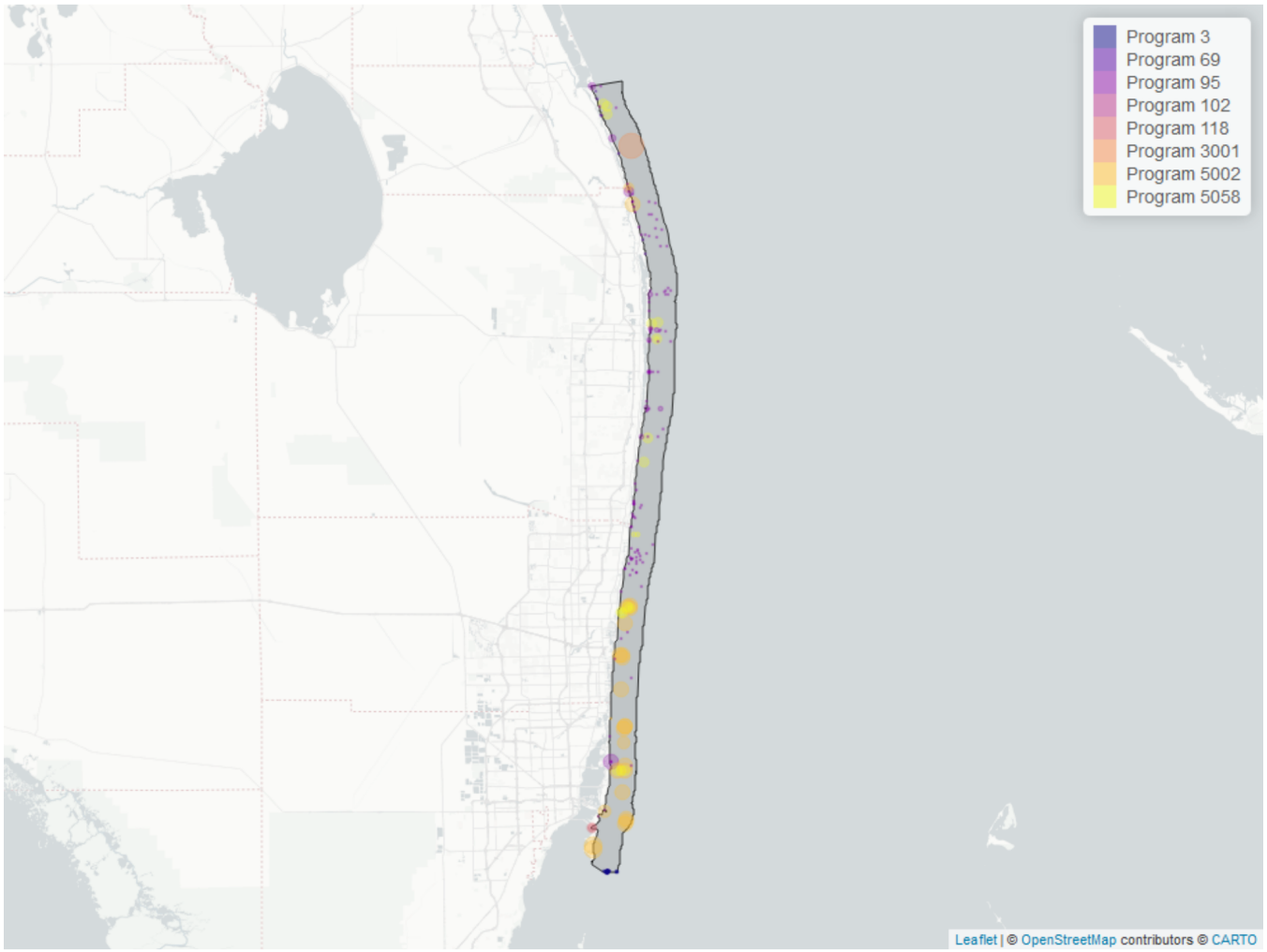


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	876	35	35.8	TRUE	0.1616	0.0085	0.04681275	33.35276	2.6662	0.9944	1

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 8: Programs contributing data for Salinity

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	816	1996	2023
5058	266	2009	2011
95	230	1972	2018
3001	102	1999	2003
3	76	1998	2022
118	23	2015	2020
69	8	1997	1998
102	2	1995	1995

Program names:

5002 - Florida STORET / WIN

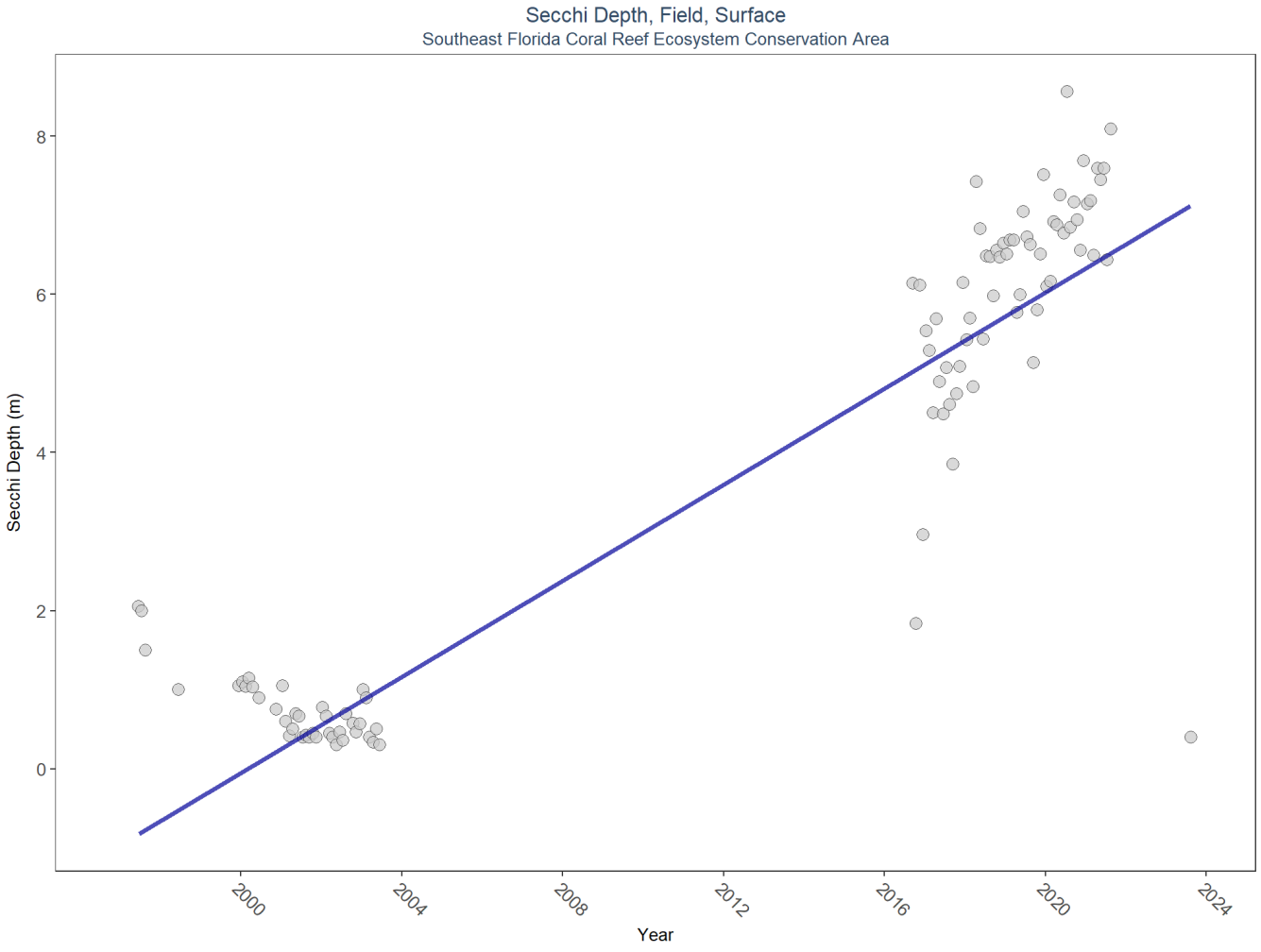
5058 - Southeast Florida Coral Reef Initiative (SEFCRI) Water Quality Monitoring Report
95 - Harmful Algal Bloom Marine Observation Network
3001 - Lagoon Watch (Formerly Marine Discovery Center)
3 - Atlantic Oceanographic and Meteorological Laboratory (AOML) South Florida Program Synoptic Shipboard Surveys
118 - National Aquatic Resource Surveys, National Coastal Condition Assessment
69 - Fisheries-Independent Monitoring (FIM) Program
102 - National Status and Trends Mussel Watch

There are no qualifying Value Qualifiers for Salinity in Southeast Florida Coral Reef Ecosystem Conservation Area

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

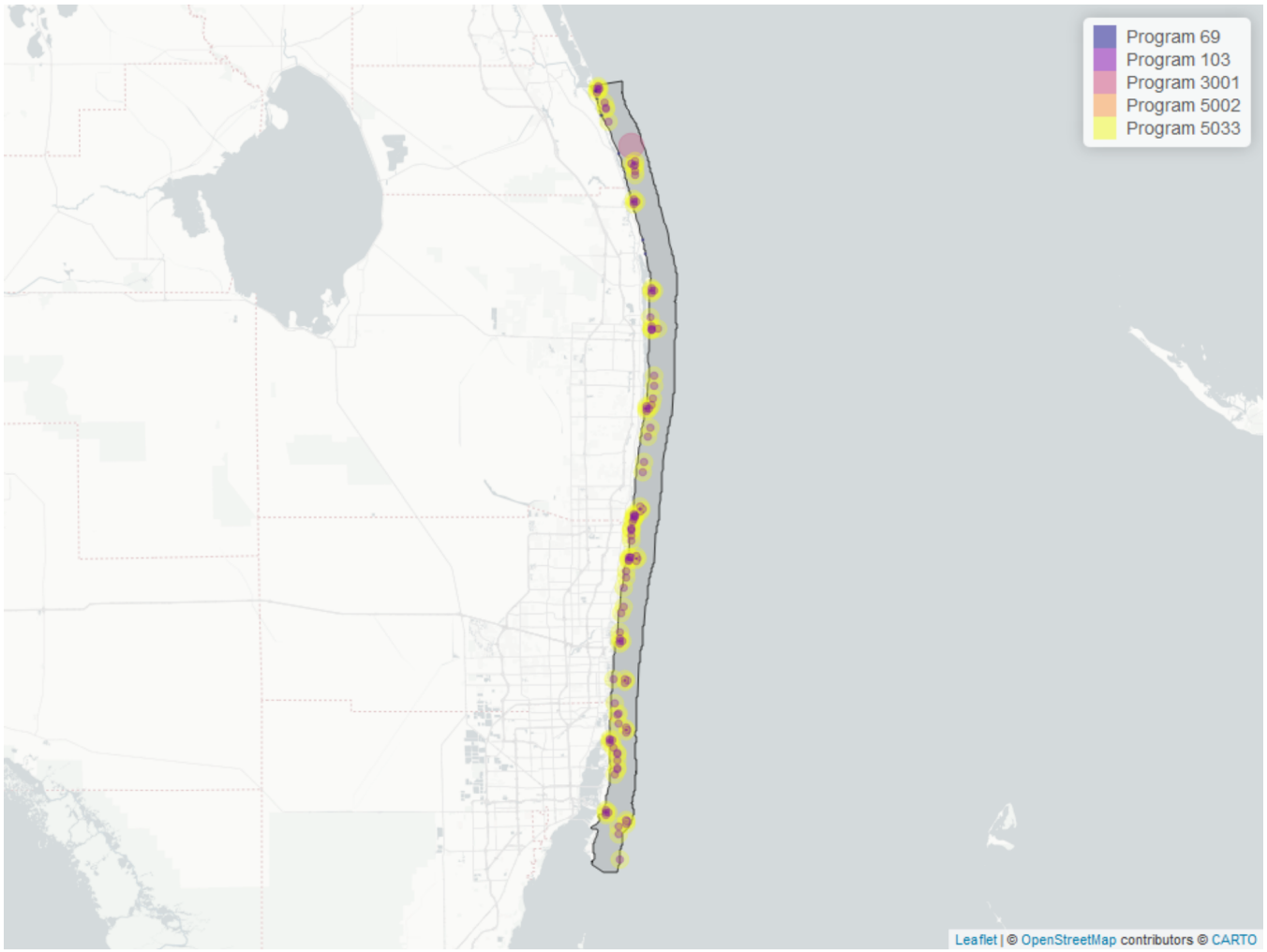


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	5866	14	5.2	TRUE	0.6421	0.0000	0.3040952	-0.9685242	3.1291	0.9889	1

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 9: Programs contributing data for Secchi Depth

ProgramID	*N_Data*	*YearMin*	*YearMax*
5033	4797	2016	2021
103	961	2020	2021
3001	99	1999	2003
69	8	1997	1998
5002	1	2023	2023

Program names:

5033 - Southeast Florida Water Quality Assessment Survey
103 - EPA STOrage and RETrieval Data Warehouse (STORET)
3001 - Lagoon Watch (Formerly Marine Discovery Center)
69 - Fisheries-Independent Monitoring (FIM) 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 10: Value Qualifiers for Secchi Depth

Year	*N_Total*	*N_S*	*perc_S*
2023	1	1	100

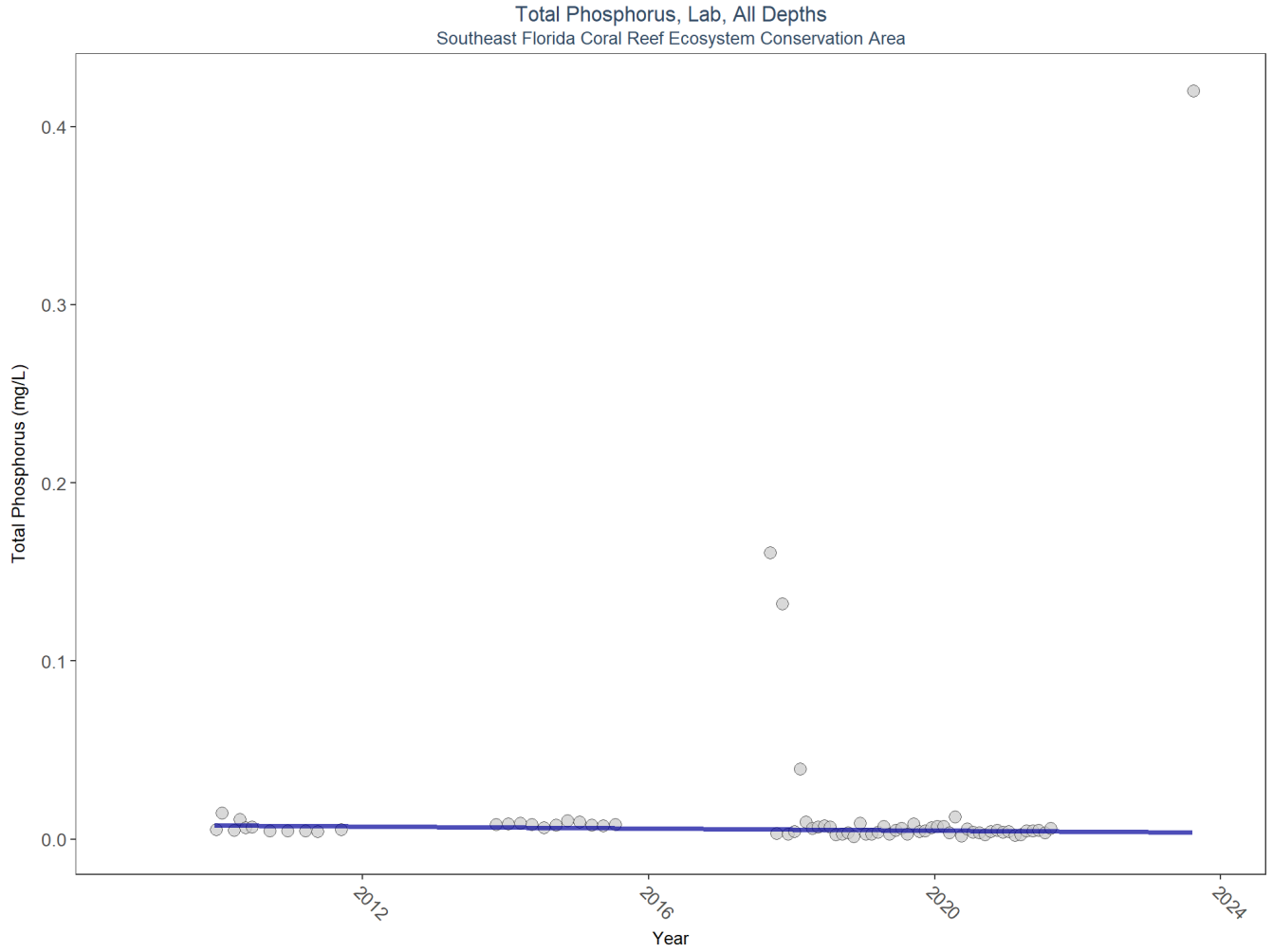
Note: [1]**S** - Secchi disk visible to bottom of waterbody

Programs containing Value Qualified data:

5002 - Florida STORET / WIN

Total Phosphorus - Discrete Water Quality

Seasonal Kendall-Tau Trend Analysis

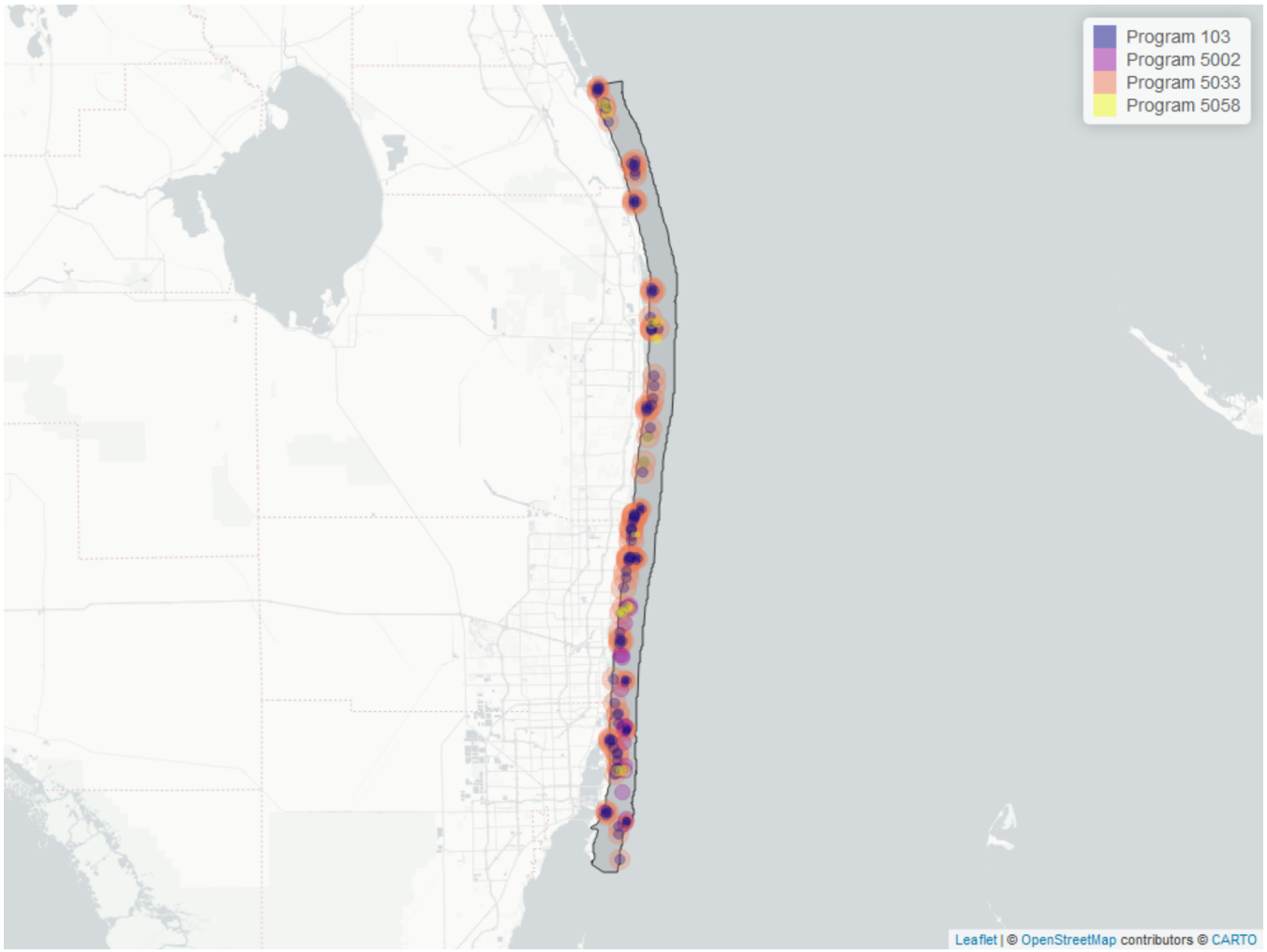


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	11066	12	0.001	TRUE	-0.2247	0.0128	-0.0002916834	0.007976768	20.0219	0.045	-2

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 11: Programs contributing data for Total Phosphorus

ProgramID	*N_Data*	*YearMin*	*YearMax*
5033	8353	2017	2021
103	1846	2020	2021
5002	664	2013	2023
5058	268	2009	2011

Program names:

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

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 12: Value Qualifiers for Total Phosphorus

Year	*N_Total*	*N_I*	*perc_I*	*N_Q*	*perc_Q*	*N_U*	*perc_U*
2013	62	57	91.9				
2014	361	28	7.8			1	0.3
2017	631	48	7.6	556	88.1	2	0.3
2018	1896	149	7.9	386	20.4	113	6.0
2019	2397	170	7.1	3	0.1	26	1.1
2020	2475	165	6.7	6	0.2	23	0.9
2021	2800	47	1.7			5	0.2

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

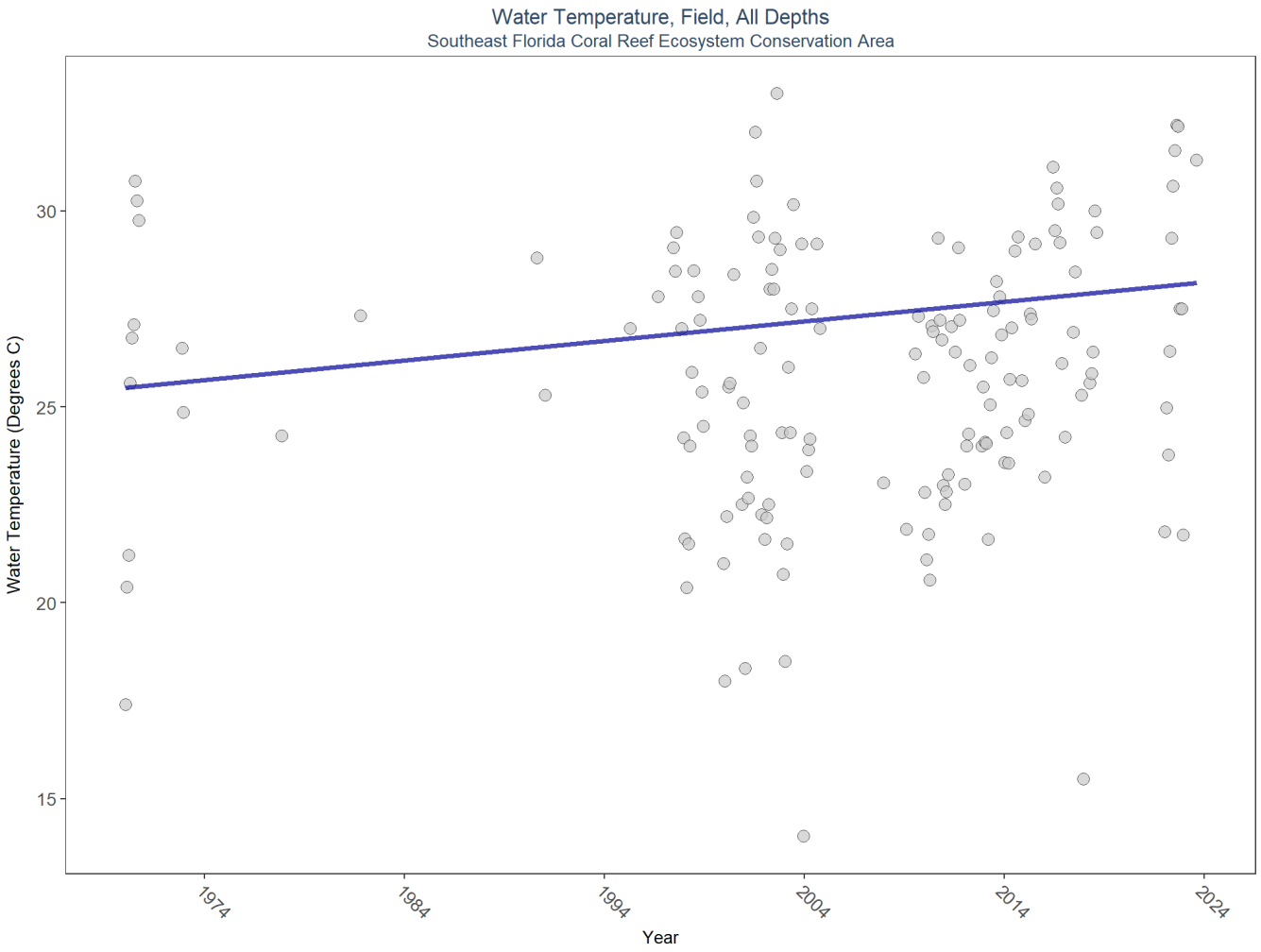
Programs containing Value Qualified data:

5033 - Southeast Florida Water Quality Assessment Survey
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

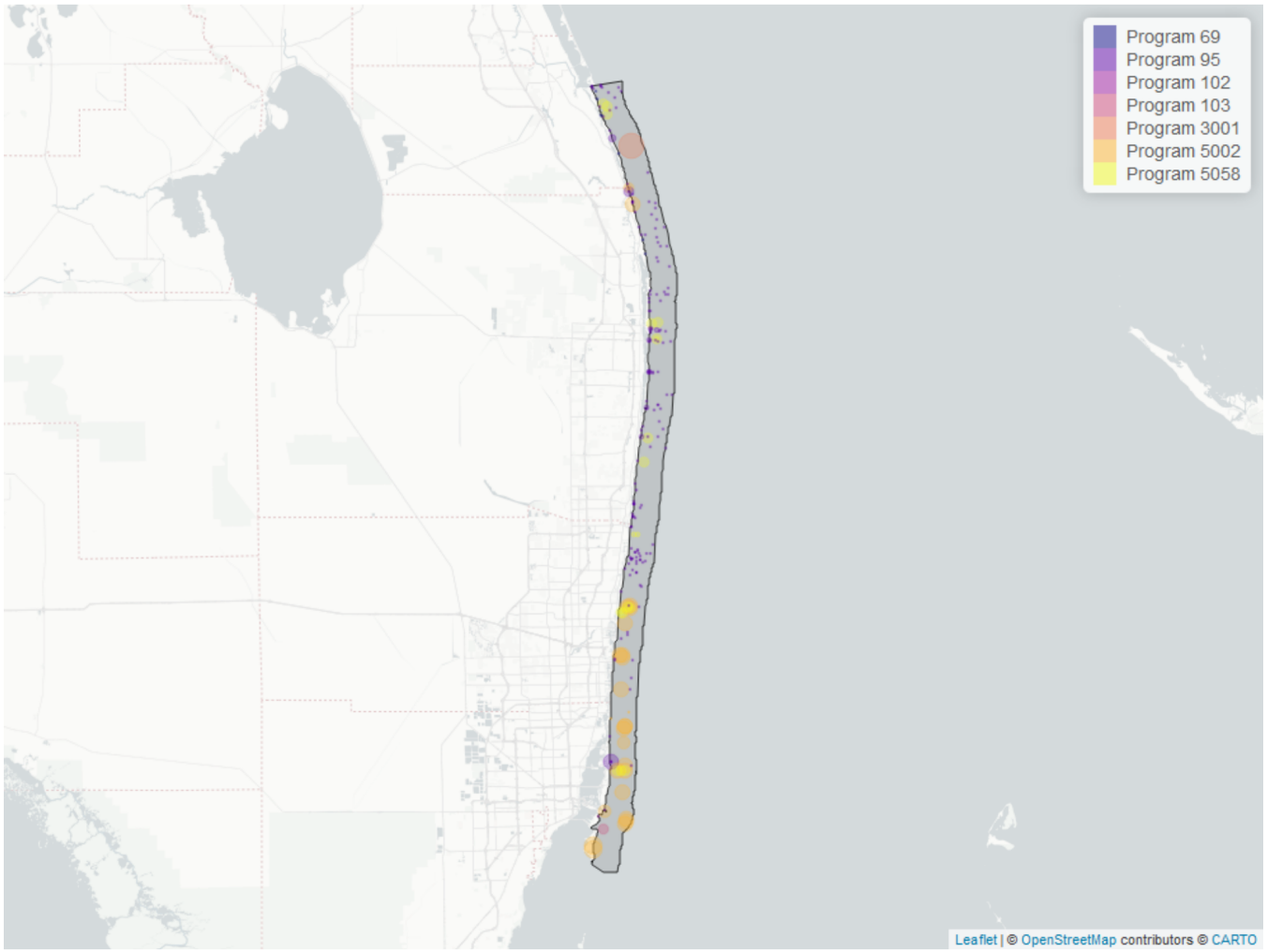


RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
All	1472	29	26.5	TRUE	0.2066	0.0006	0.05	25.48707	12.2884	0.3424	1

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 13: Programs contributing data for Water Temperature

ProgramID	*N_Data*	*YearMin*	*YearMax*
5002	820	1996	2023
5058	266	2009	2011
95	258	1972	2018
3001	104	1999	2003
103	17	1970	1970
69	8	1997	1998
102	2	1995	1995

Program names:

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

95 - Harmful Algal Bloom Marine Observation Network
3001 - Lagoon Watch (Formerly Marine Discovery Center)
103 - EPA STOrage and RETrieval Data Warehouse (STORET)
69 - Fisheries-Independent Monitoring (FIM) Program
102 - National Status and Trends Mussel Watch

There are no qualifying Value Qualifiers for Water Temperature in Southeast Florida Coral Reef Ecosystem Conservation Area

Water Quality - Continuous

The following files were used in the continuous analysis:

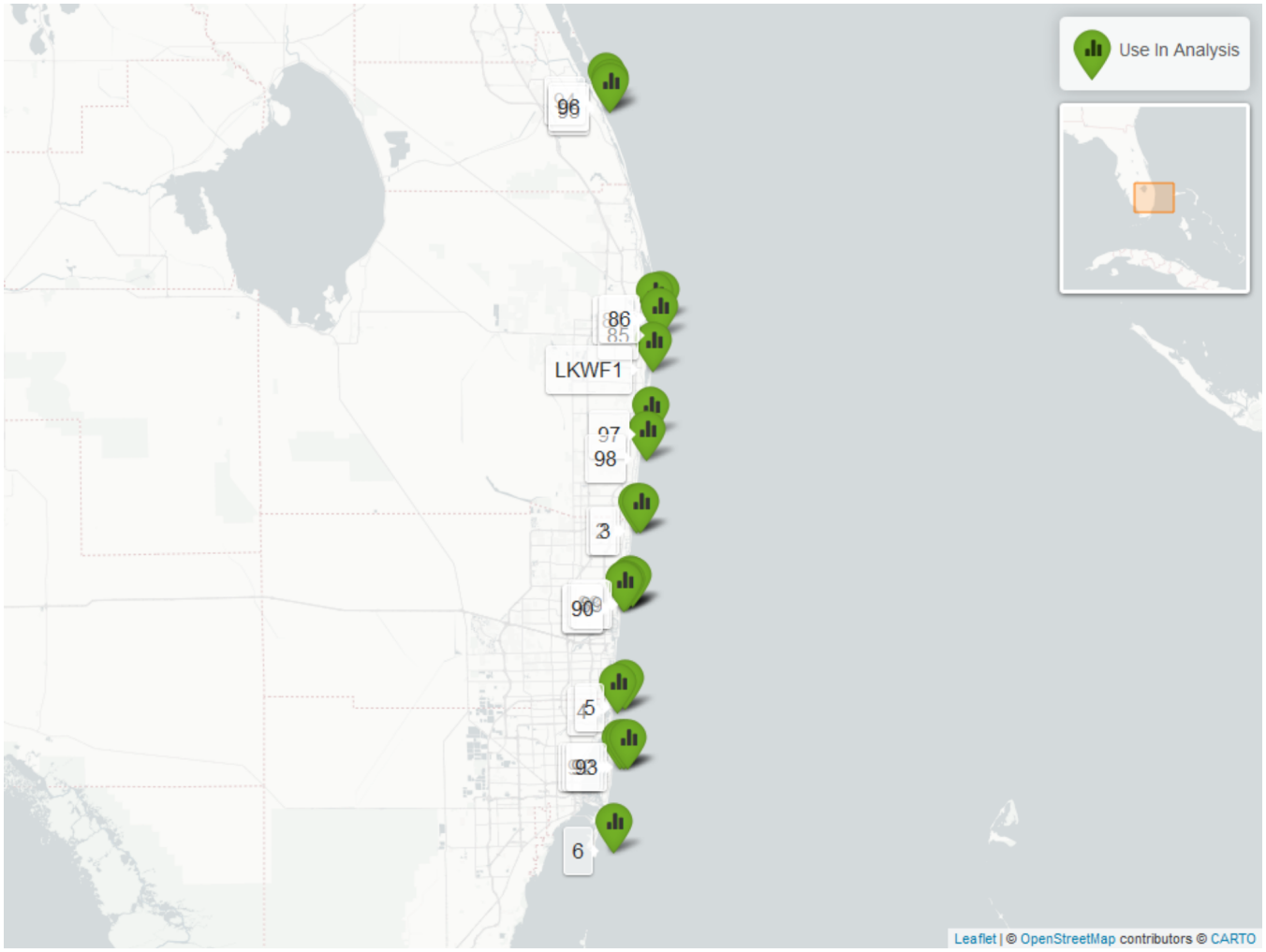
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_SE-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Dissolved_Oxygen_Saturation_SE-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_pH_SE-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Salinity_SE-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Turbidity_SE-2024-Mar-23.txt*
- *Combined_WQ_WC_NUT_cont_Water_Temperature_SE-2024-Mar-23.txt*

Table 14: National Data Buoy Center (5)

ProgramLocationID	*Years of Data*	*Use in Analysis*	*Parameters*
LKWF1	40	TRUE	TempW

Table 15: Water Temperature on Coral Reefs in the Florida Keys (986)

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

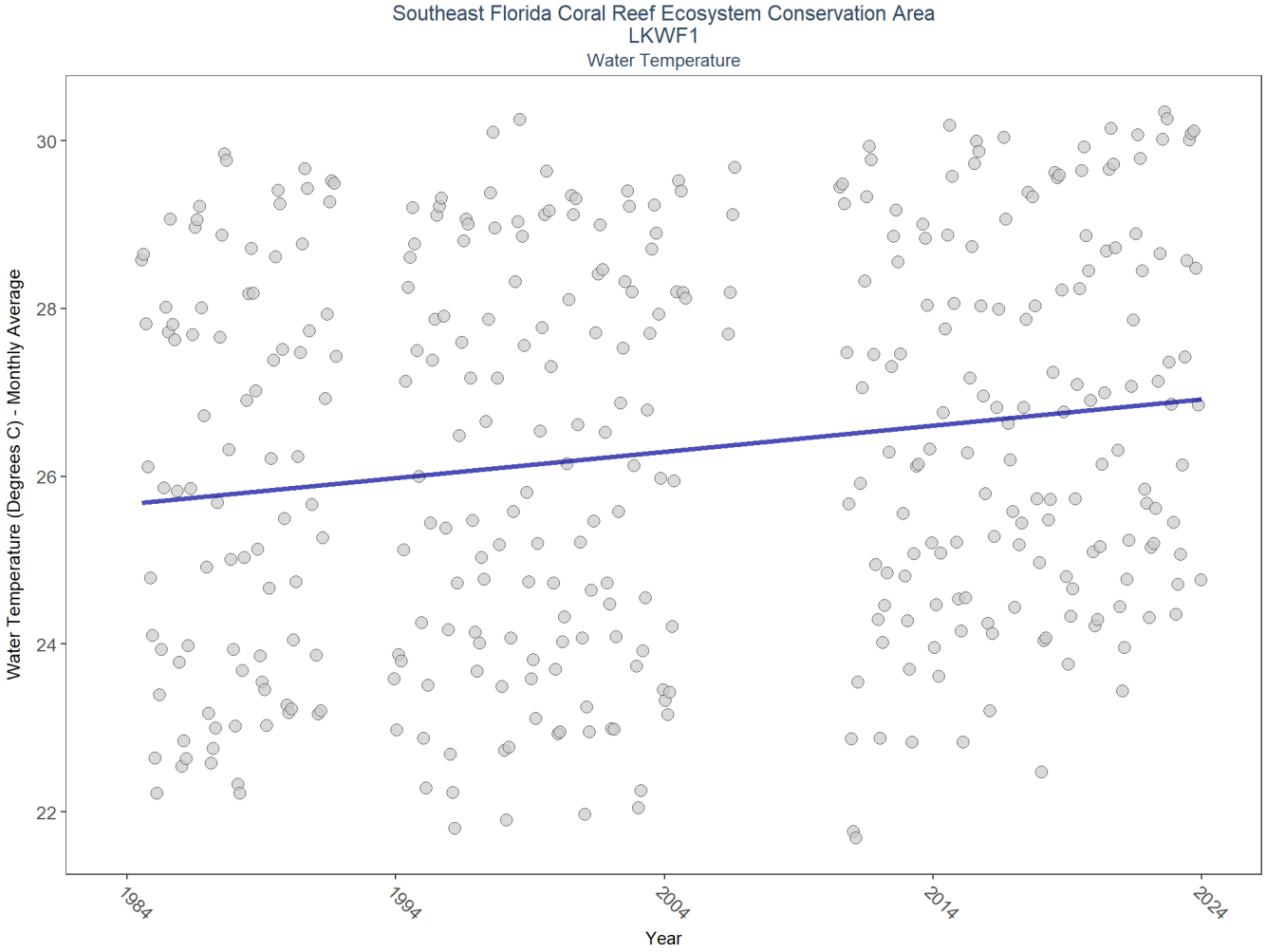


Map showing Continuous Water Quality Monitoring sampling locations within the boundaries of Southeast Florida Coral Reef Ecosystem Conservation Area. Sites marked as *Use In Analysis* are featured in this report.

Water Temperature - Continuous Water Quality

LKWF1

National Data Buoy Center (5)



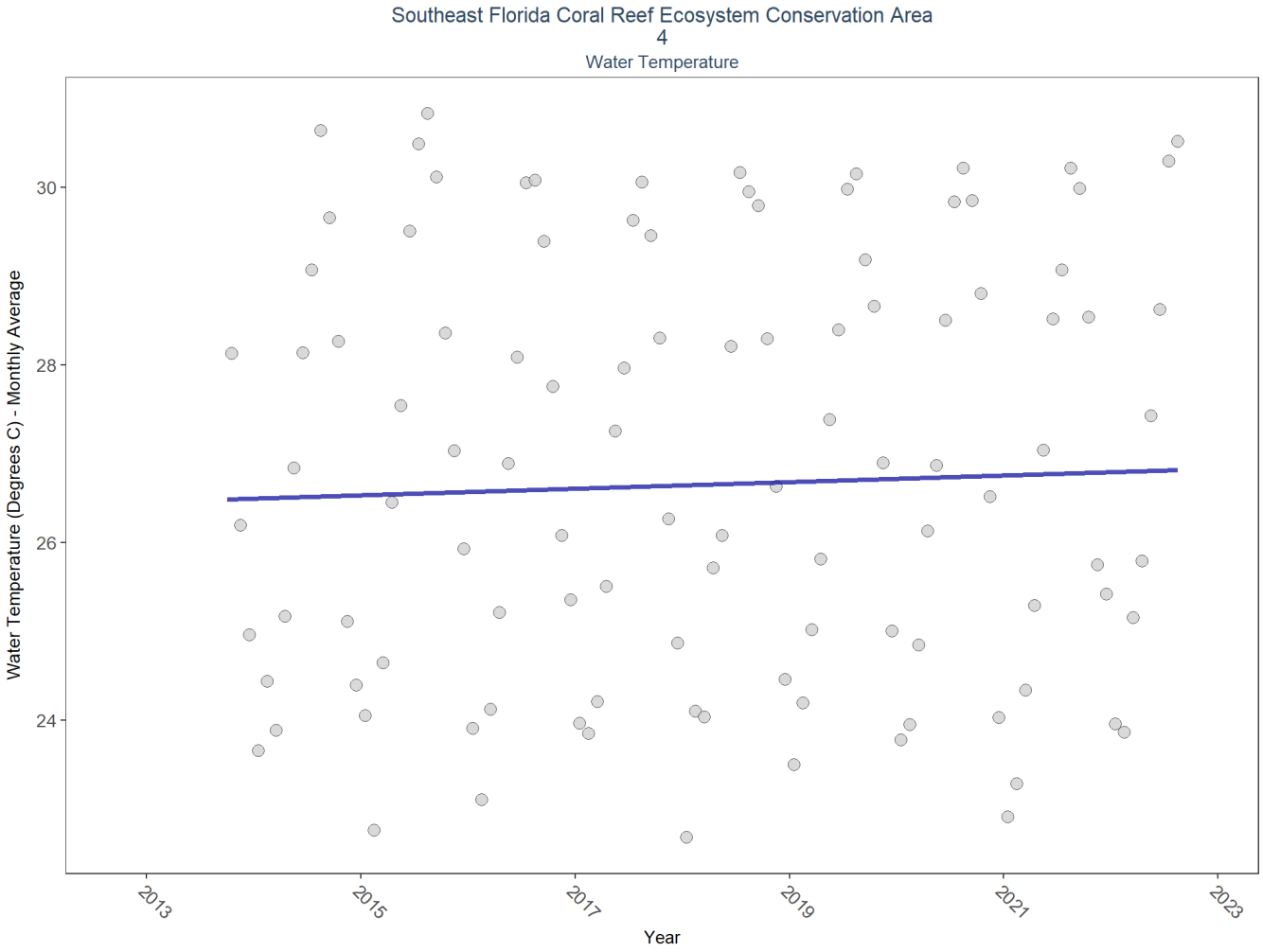
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
surface	1212179	35	26.5	TRUE	0.4081	0.0000	0.03131364	25.66536	5.6916	0.8931	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

4

Water Temperature on Coral Reefs in the Florida Keys (986)



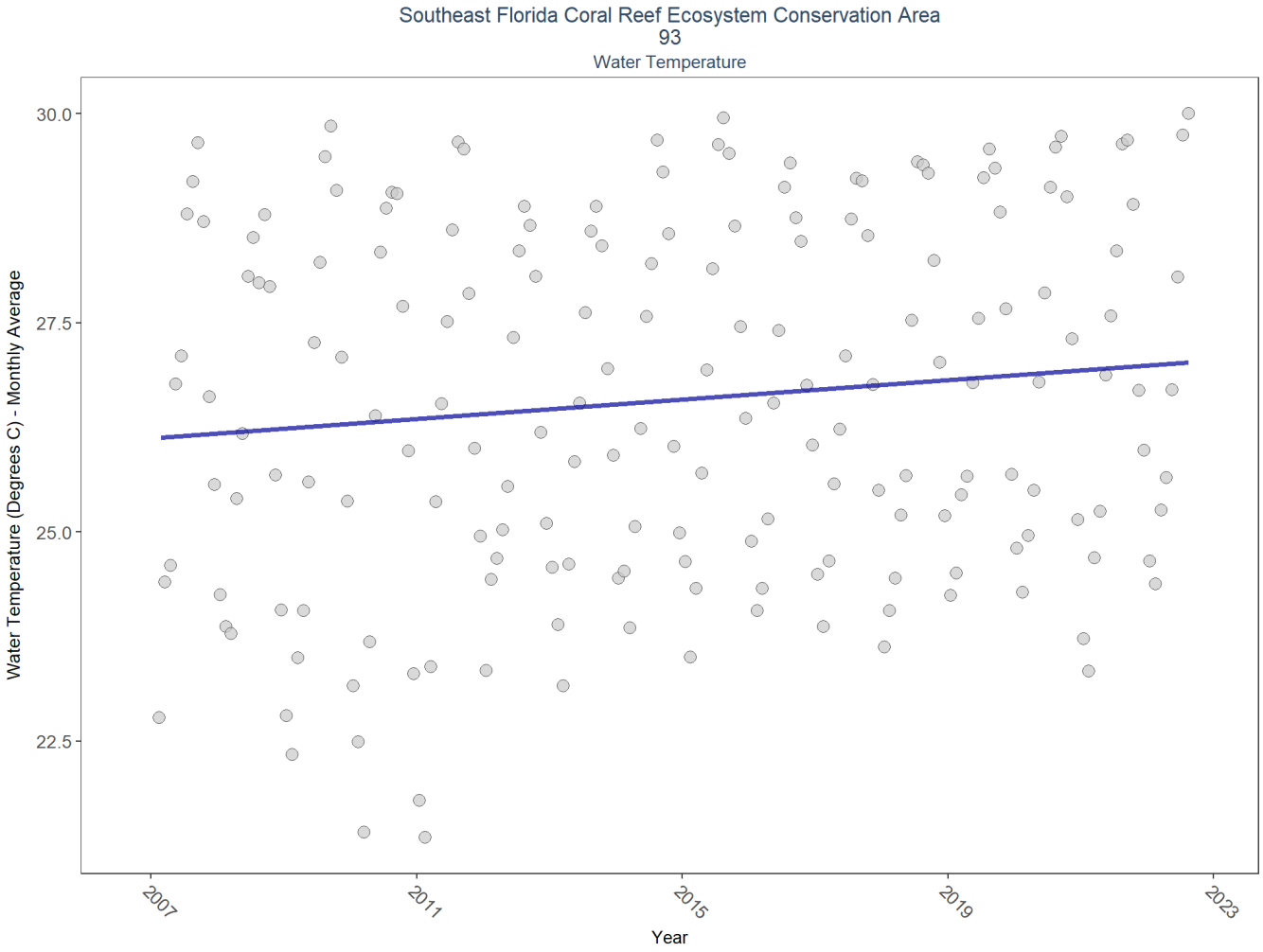
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	68937	10	26.59	TRUE	0.1696	0.0305	0.03739696	26.45596	8.3209	0.6843	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

93

Water Temperature on Coral Reefs in the Florida Keys (986)



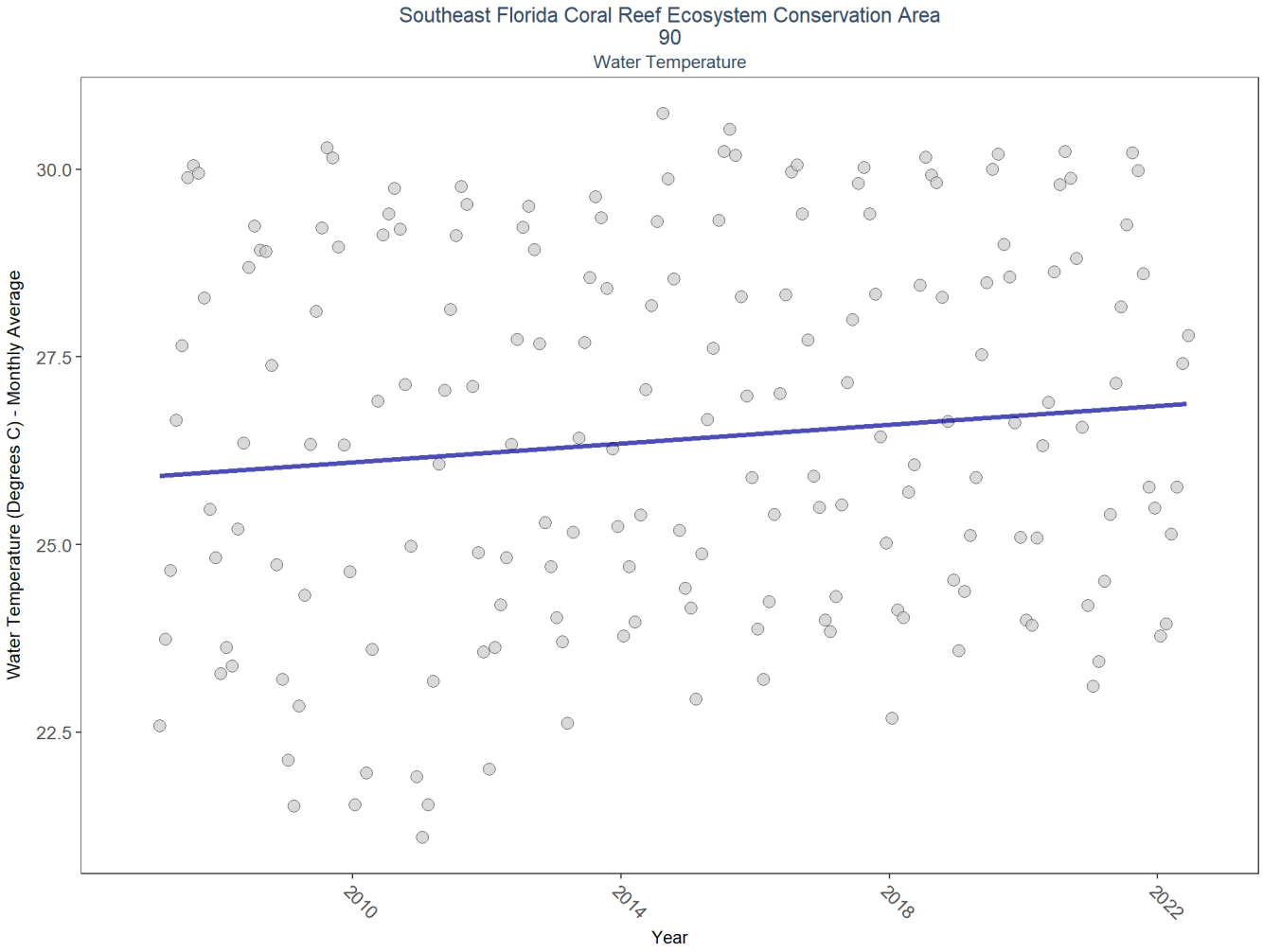
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	106903	16	26.47	TRUE	0.3458	0.0000	0.05819009	26.12078	3.5403	0.9815	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

90

Water Temperature on Coral Reefs in the Florida Keys (986)



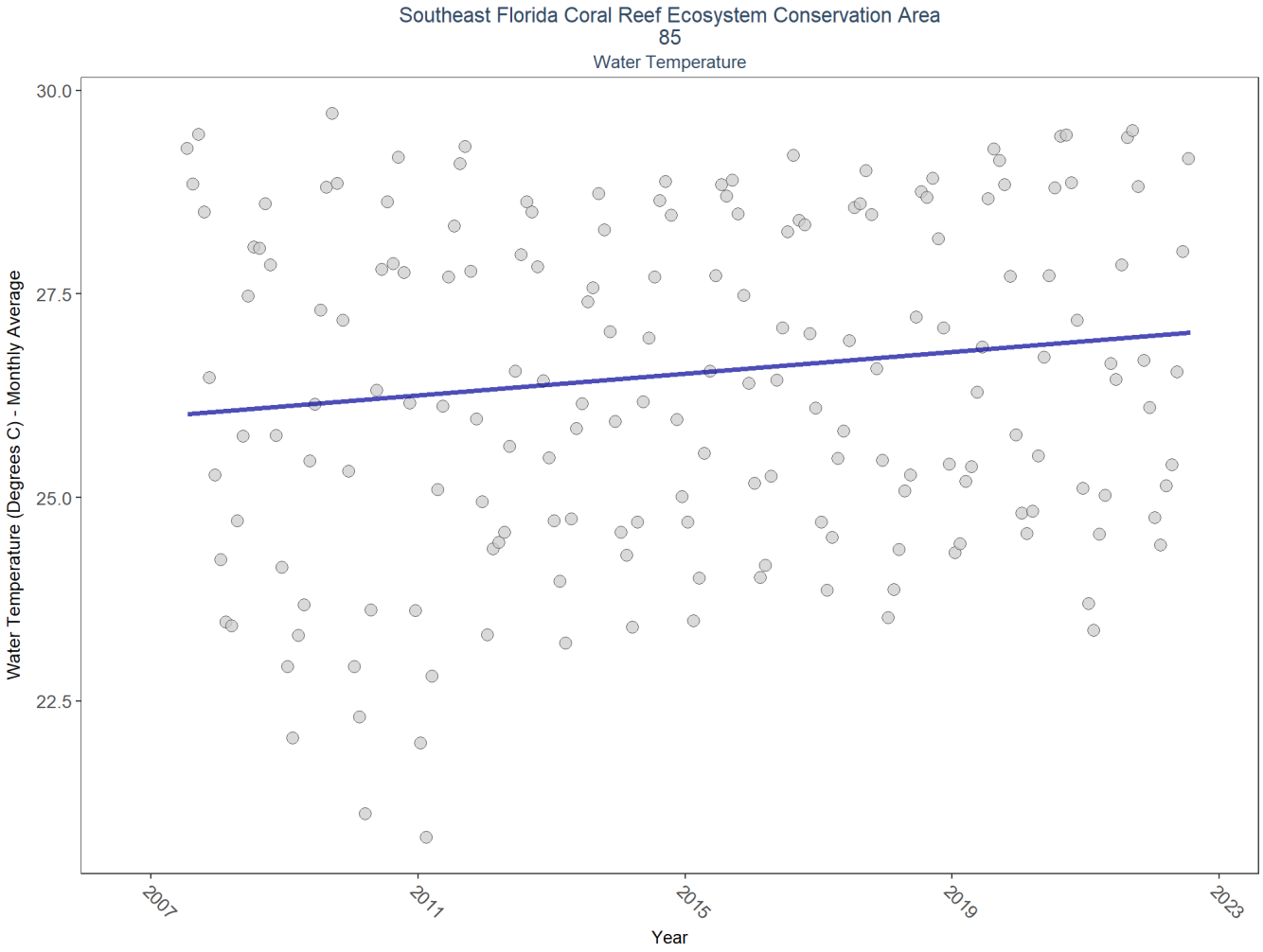
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	97006	16	26.43	TRUE	0.3333	0.0000	0.06265677	25.90917	6.6924	0.8234	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

85

Water Temperature on Coral Reefs in the Florida Keys (986)



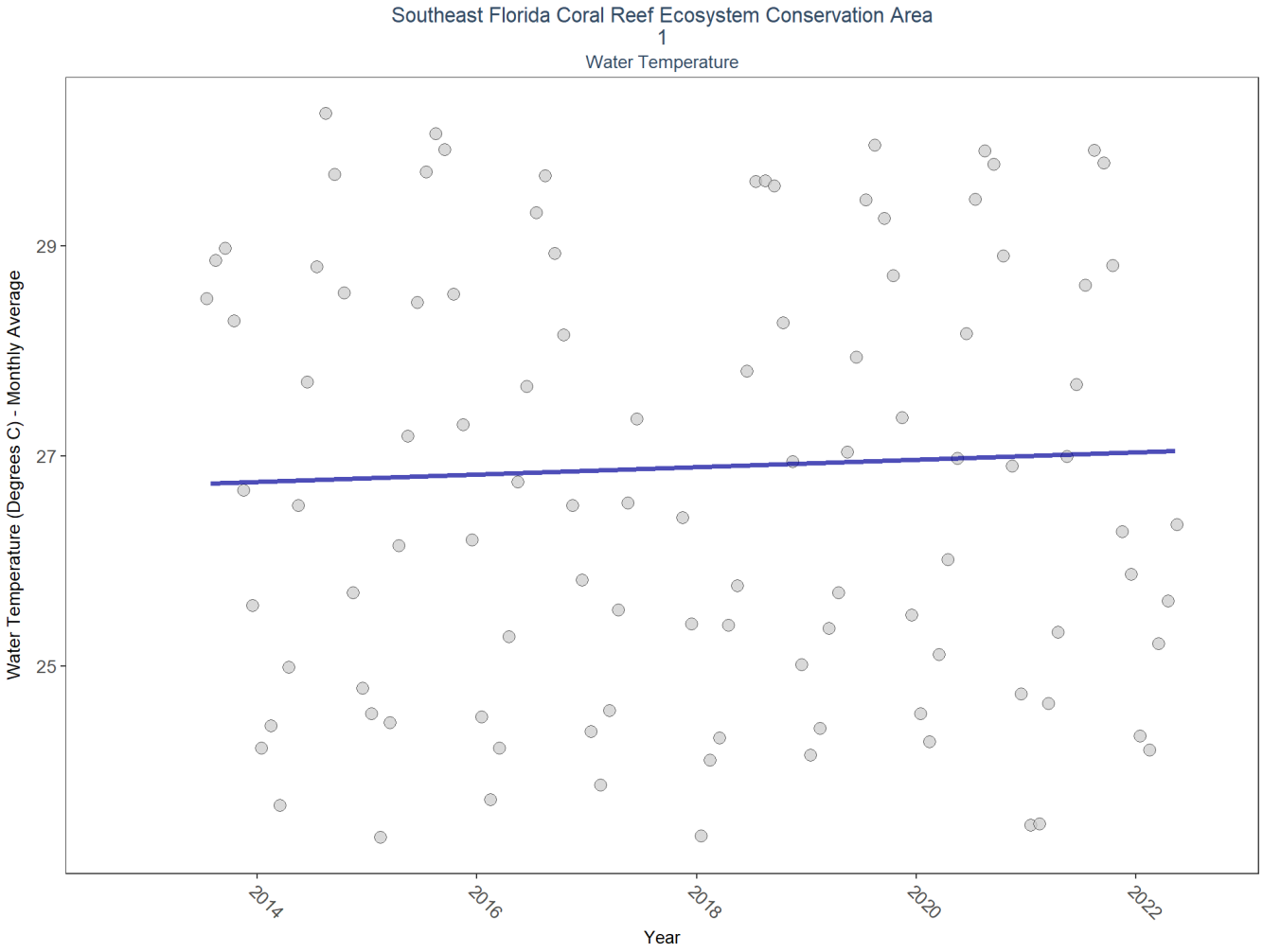
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	114214	16	26.26	TRUE	0.3435	0.0000	0.06653902	25.98866	6.962	0.8022	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

1

Water Temperature on Coral Reefs in the Florida Keys (986)



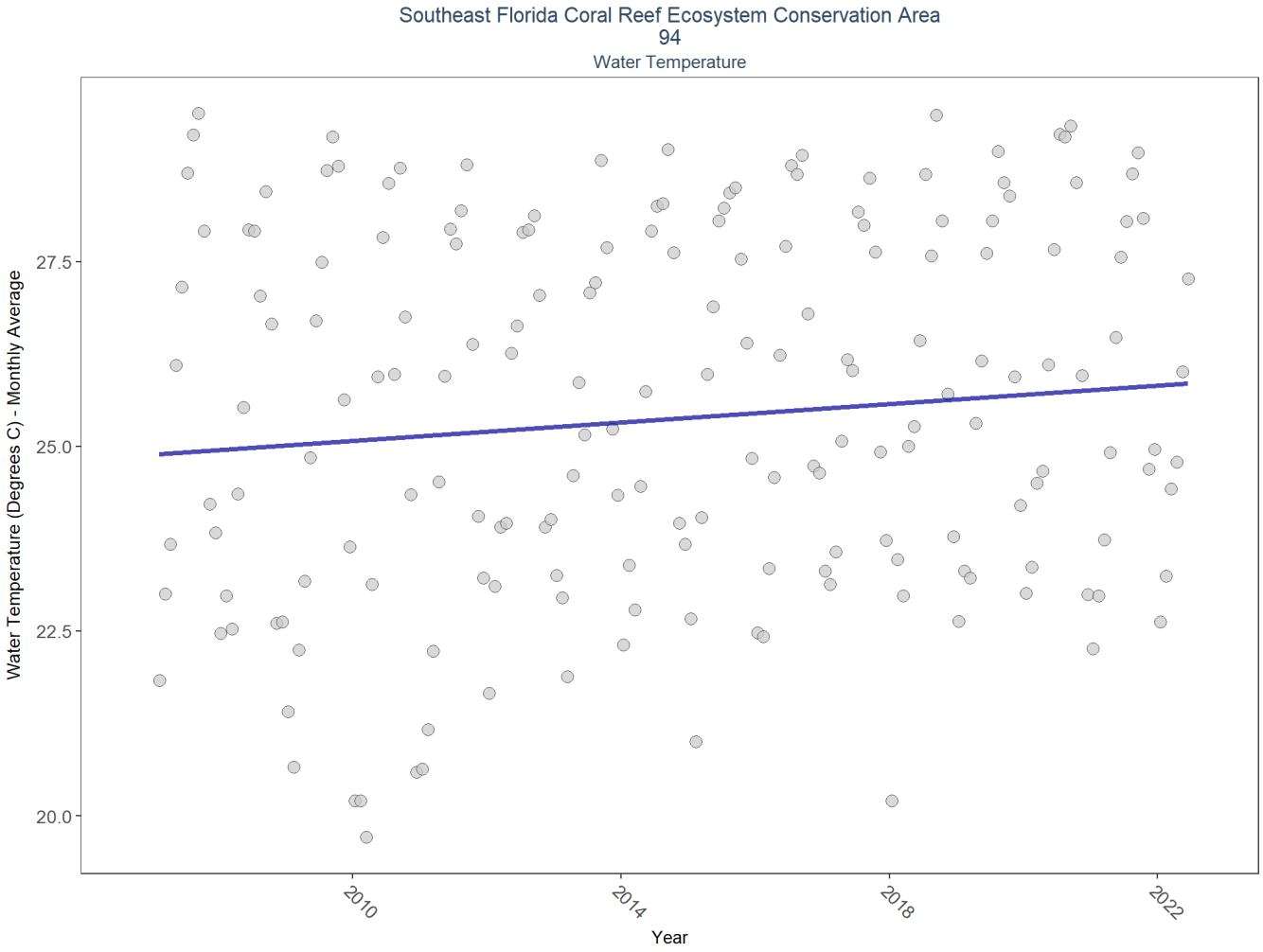
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	65108	10	26.4	TRUE	0.1304	0.1158	0.03541666	26.71585	7.547	0.7532	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

94

Water Temperature on Coral Reefs in the Florida Keys (986)



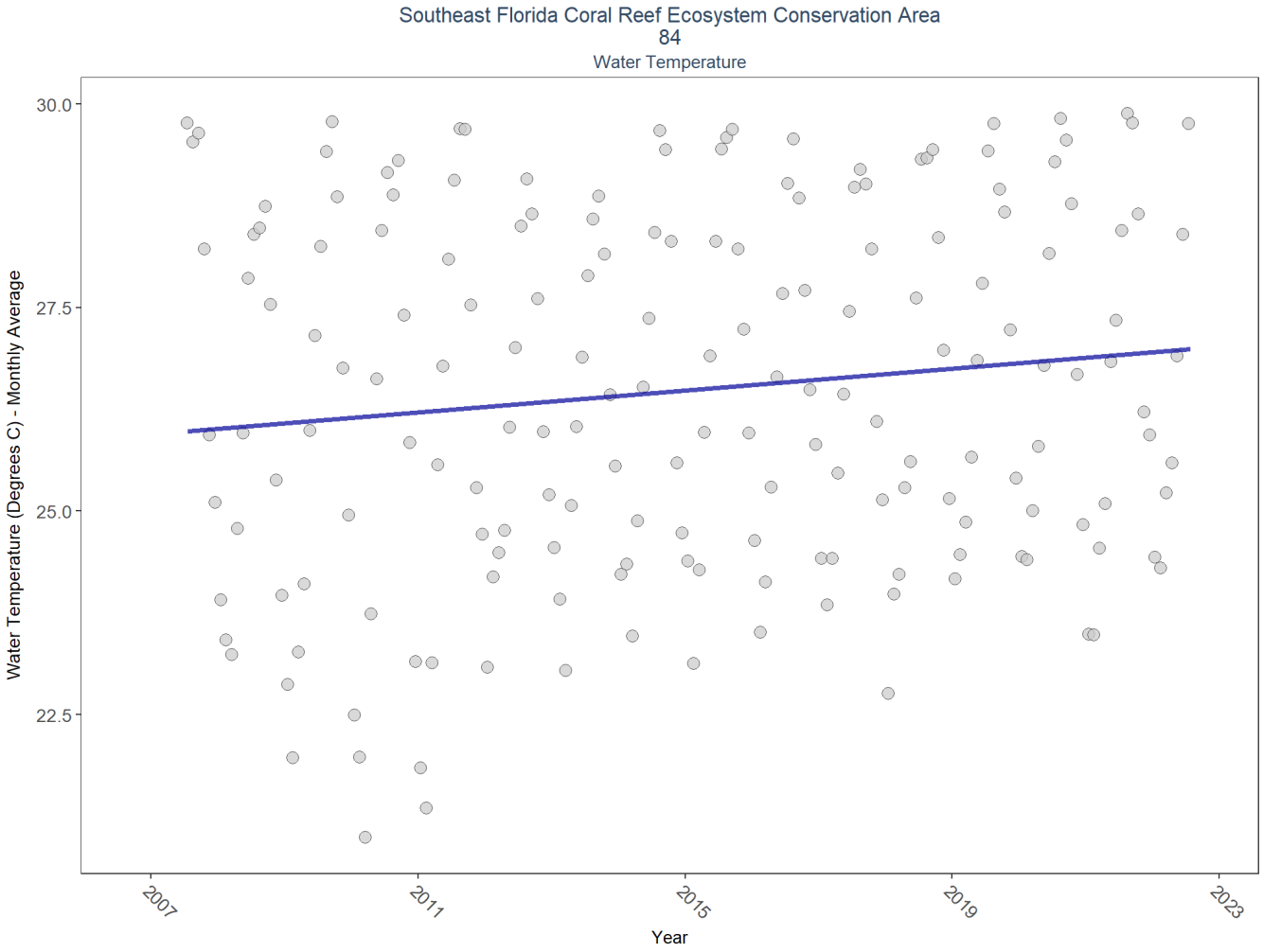
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	90265	16	25.55	TRUE	0.2788	0.0000	0.06233333	24.88922	10.6723	0.4711	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

84

Water Temperature on Coral Reefs in the Florida Keys (986)



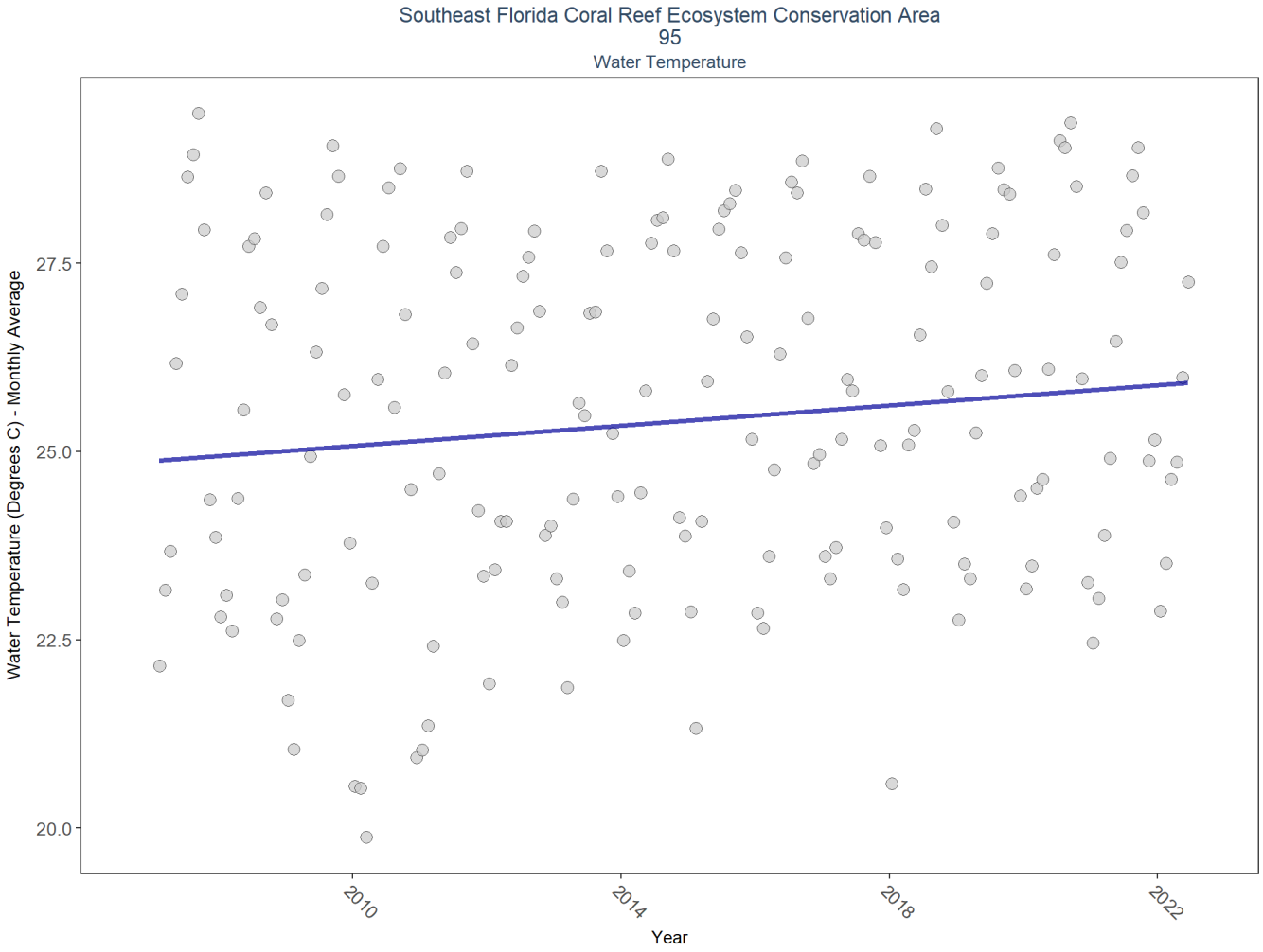
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	111153	16	26.32	TRUE	0.361	0.0000	0.06728683	25.94167	7.7394	0.7364	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

95

Water Temperature on Coral Reefs in the Florida Keys (986)



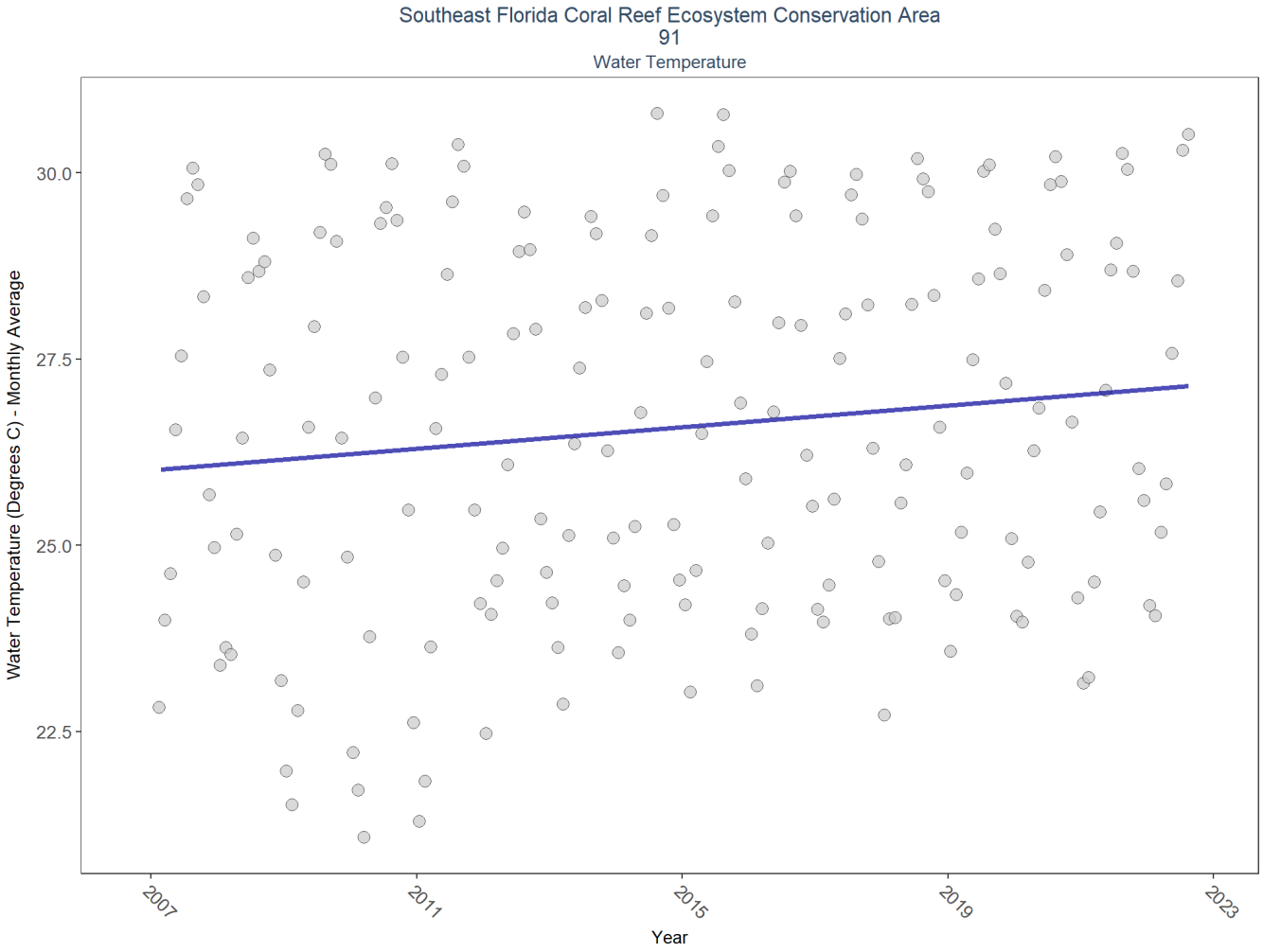
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	102279	16	25.58	TRUE	0.2997	0.0000	0.06738732	24.86972	8.7989	0.6404	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

91

Water Temperature on Coral Reefs in the Florida Keys (986)



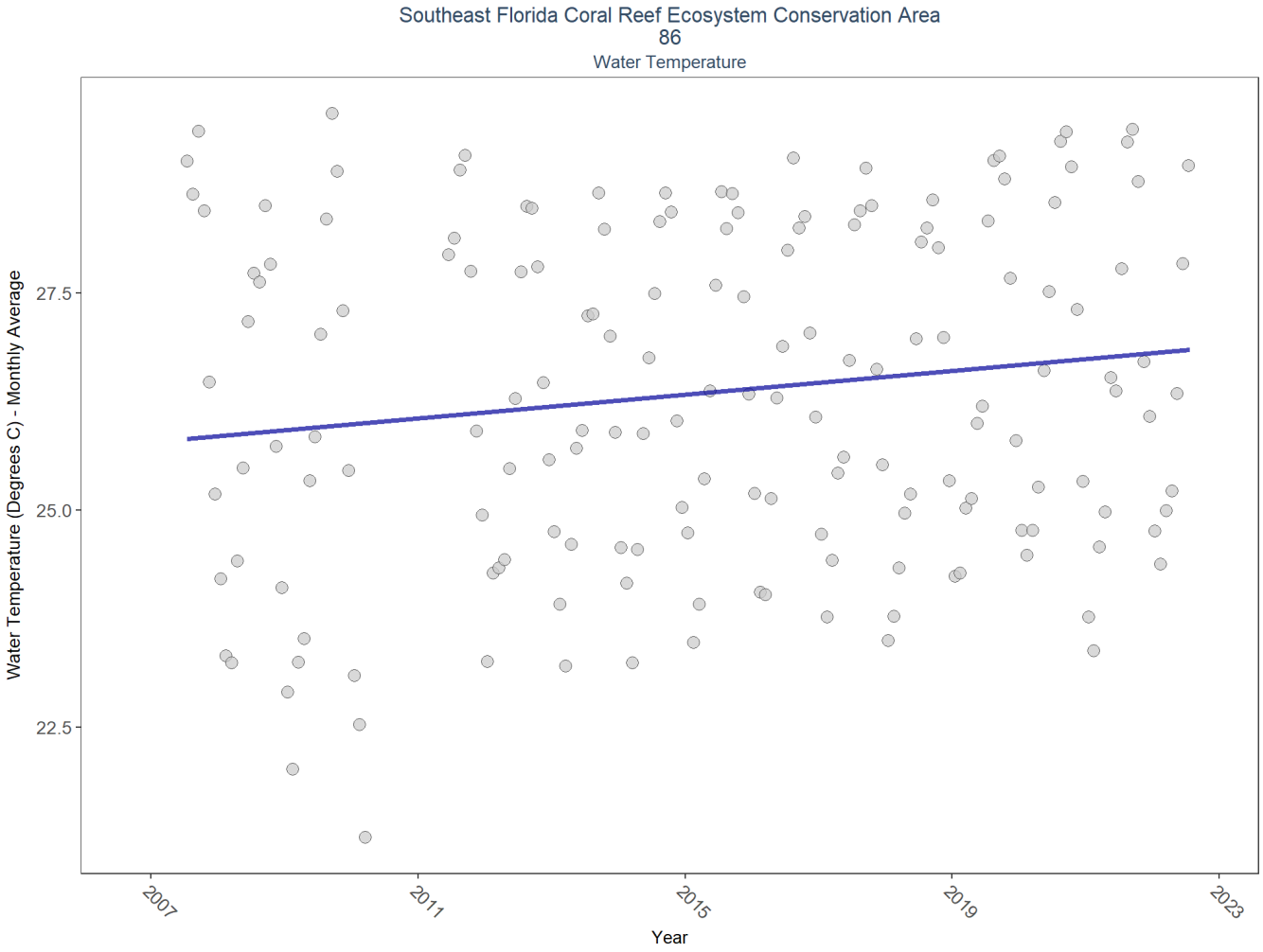
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	102406	16	26.54	TRUE	0.3337	0.0000	0.07217742	26.0081	4.6884	0.9453	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

86

Water Temperature on Coral Reefs in the Florida Keys (986)



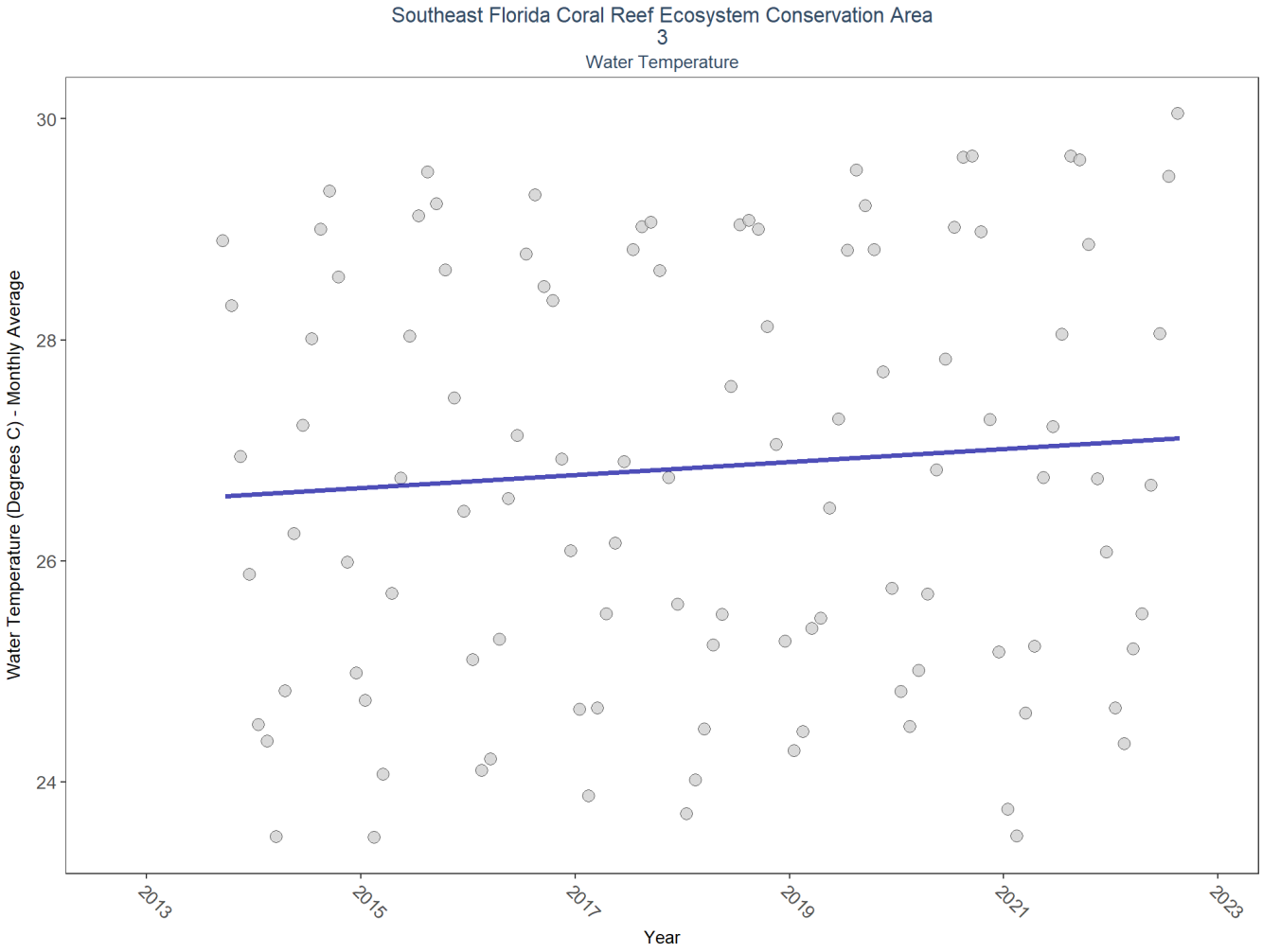
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	104767	16	26.16	TRUE	0.3559	0.0000	0.06840706	25.78181	6.4875	0.8389	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

3

Water Temperature on Coral Reefs in the Florida Keys (986)



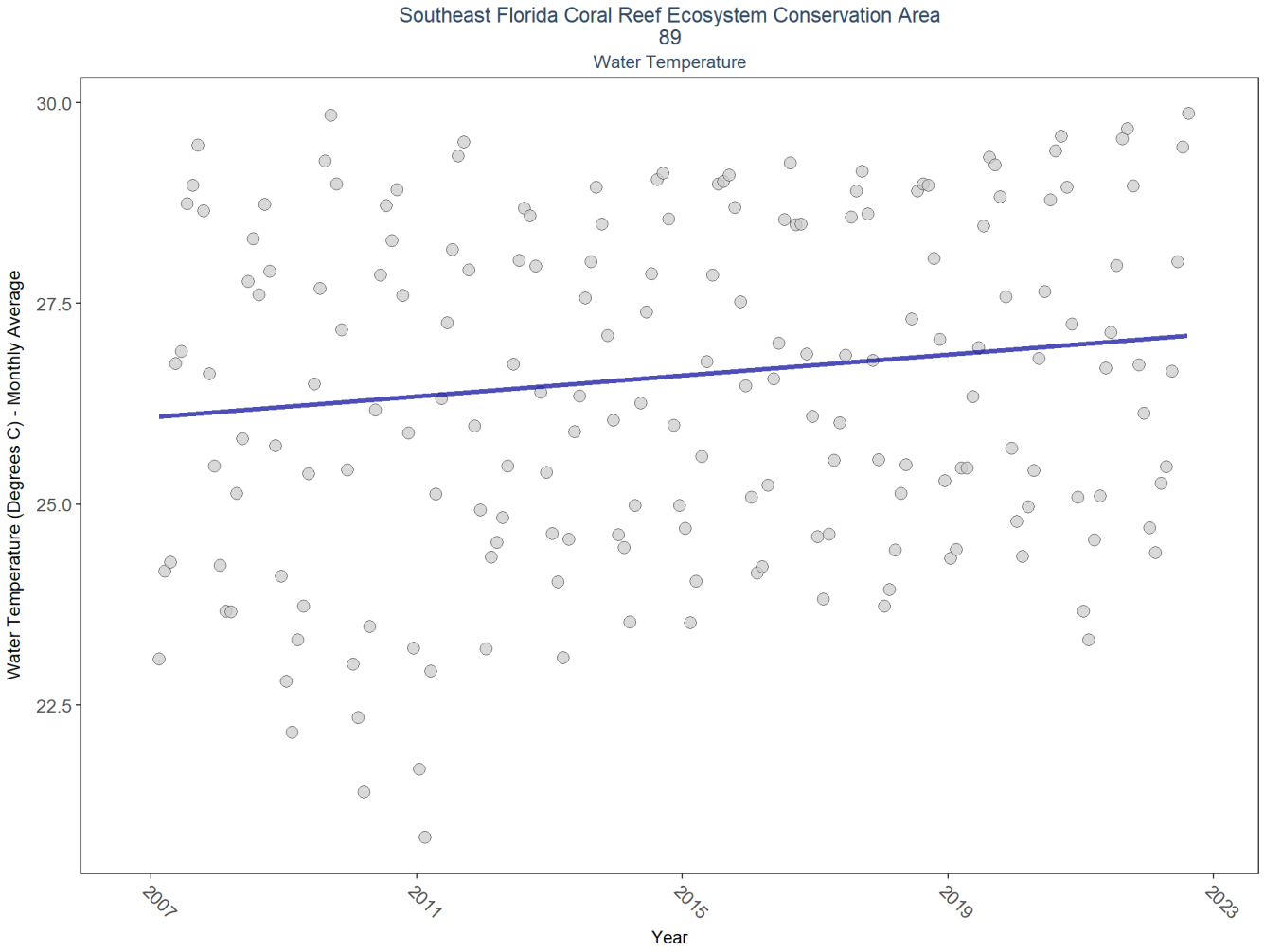
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	60887	10	26.65	TRUE	0.2546	0.0010	0.059007	26.54014	10.9094	0.4509	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

89

Water Temperature on Coral Reefs in the Florida Keys (986)



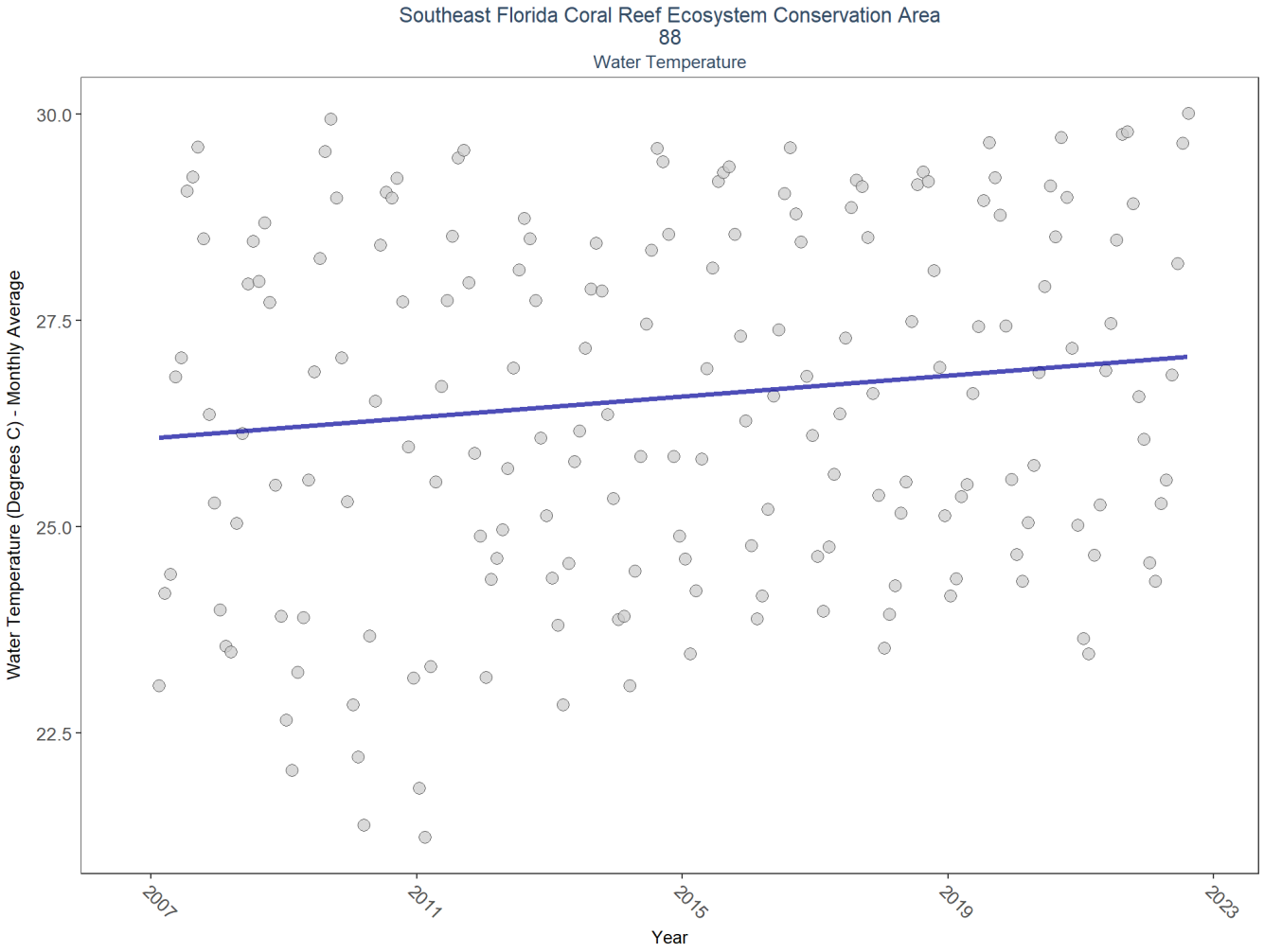
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	113809	16	26.28	TRUE	0.3503	0.0000	0.06539006	26.08242	4.8293	0.9392	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

88

Water Temperature on Coral Reefs in the Florida Keys (986)



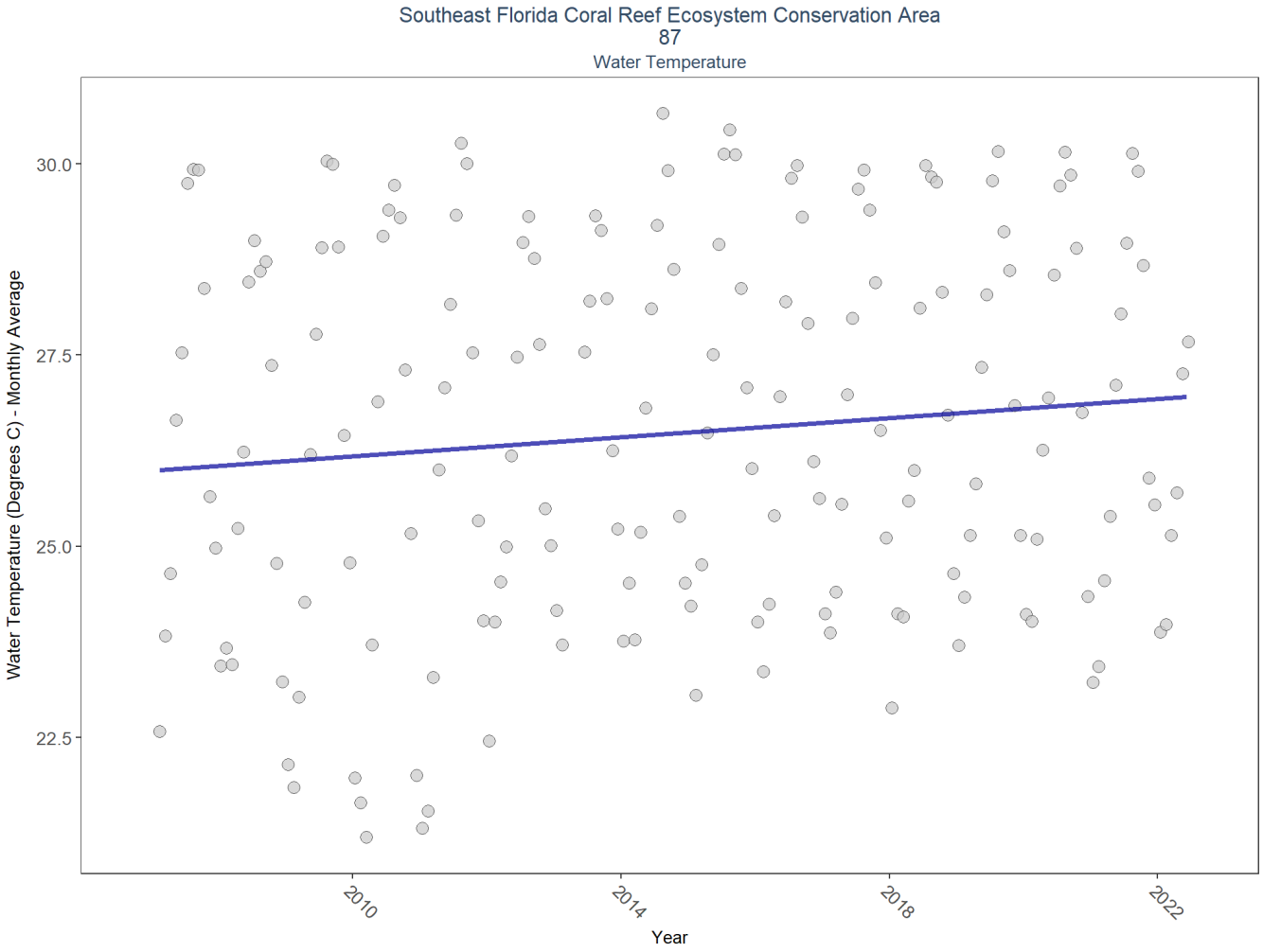
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	115305	16	26.35	TRUE	0.3447	0.0000	0.0629777	26.07714	4.9569	0.9332	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

87

Water Temperature on Coral Reefs in the Florida Keys (986)



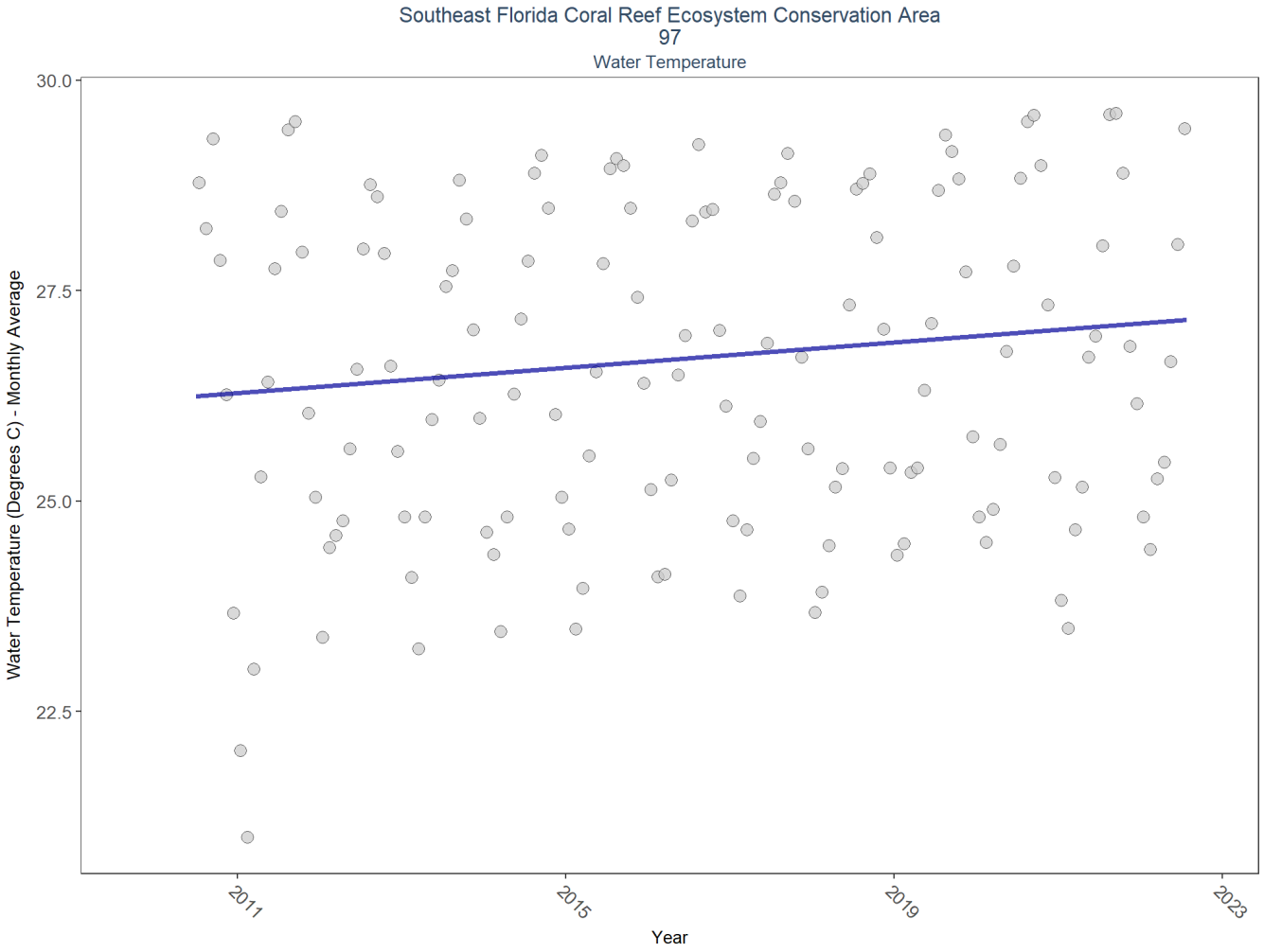
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	108339	16	26.44	TRUE	0.3065	0.0000	0.06207707	25.99264	7.6685	0.7427	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

97

Water Temperature on Coral Reefs in the Florida Keys (986)



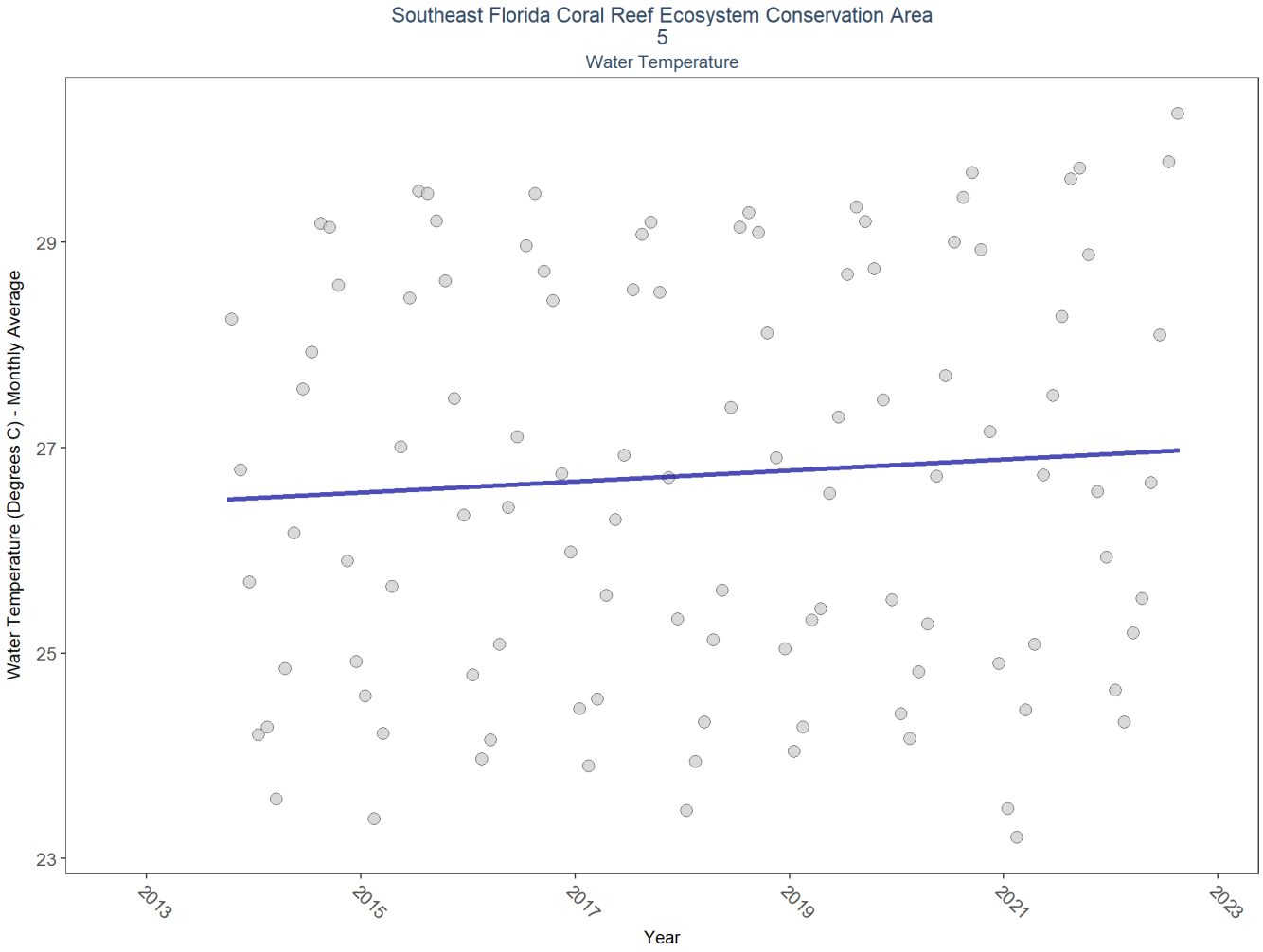
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	97533	13	26.45	TRUE	0.3789	0.0000	0.07519388	26.20984	6.1704	0.8618	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

5

Water Temperature on Coral Reefs in the Florida Keys (986)



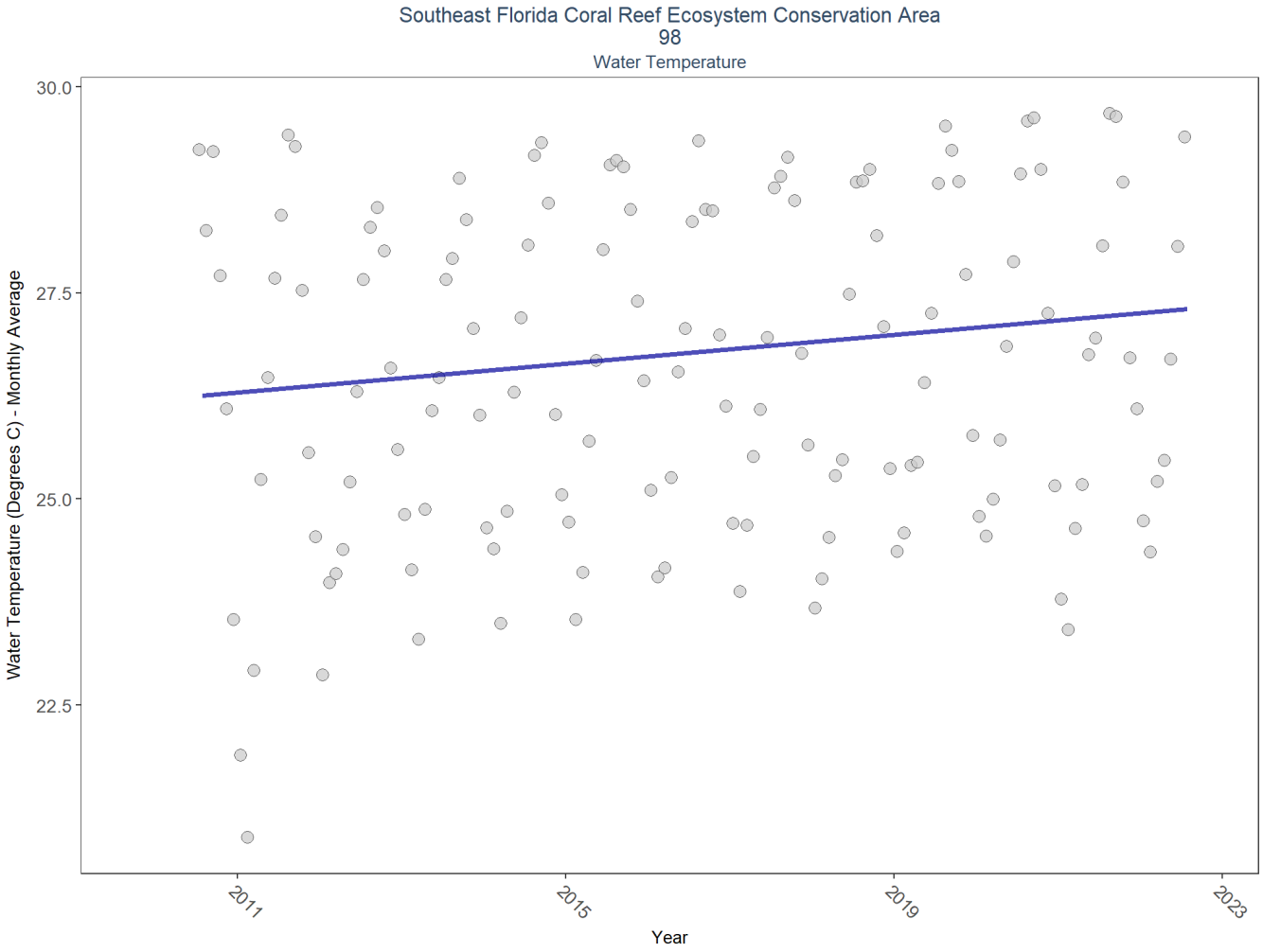
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	51977	10	26.62	TRUE	0.215	0.0067	0.05355964	26.45969	9.4917	0.5766	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

98

Water Temperature on Coral Reefs in the Florida Keys (986)



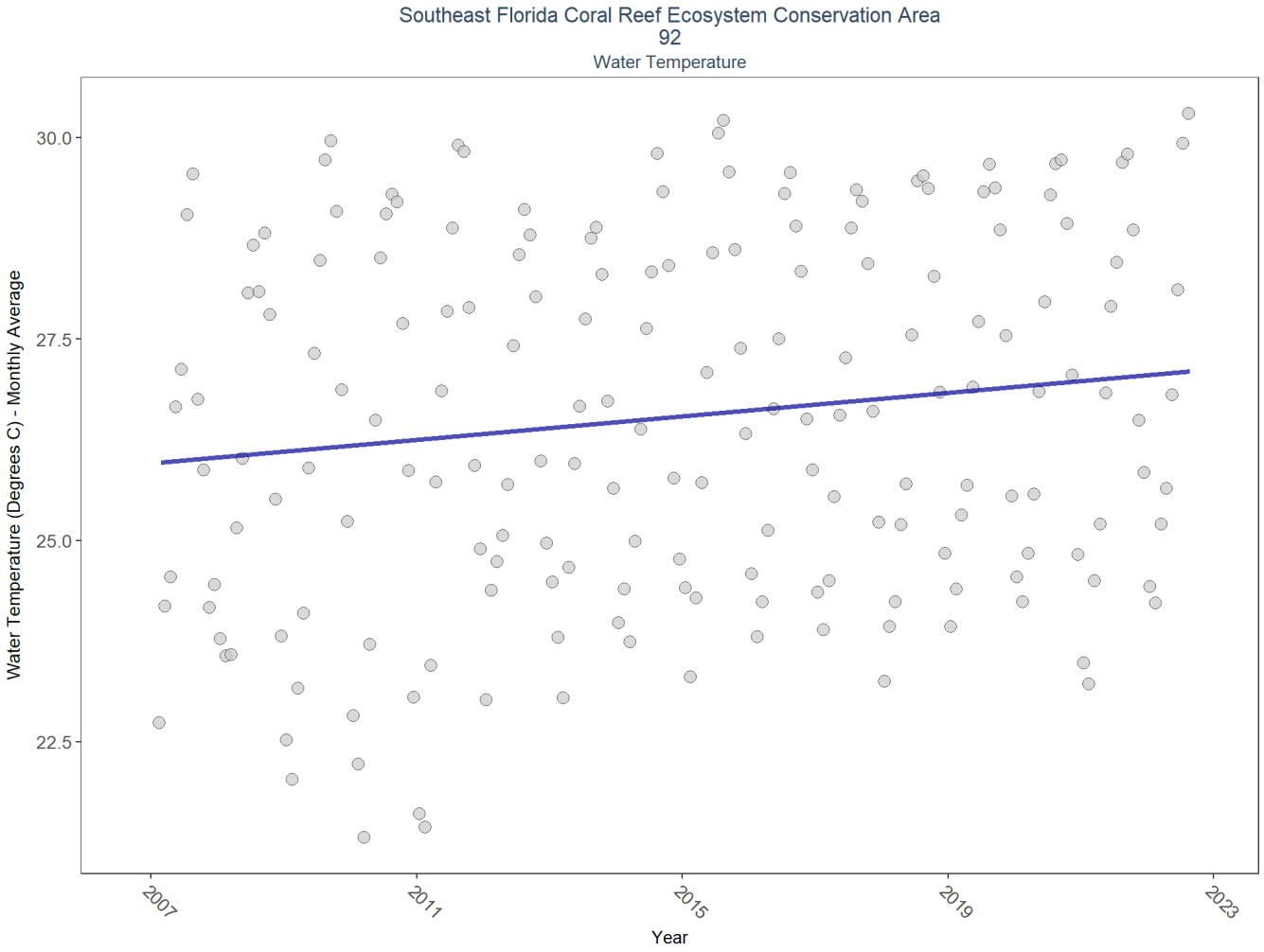
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	87973	13	26.4	TRUE	0.3868	0.0000	0.08715085	26.20704	6.914	0.806	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

92

Water Temperature on Coral Reefs in the Florida Keys (986)



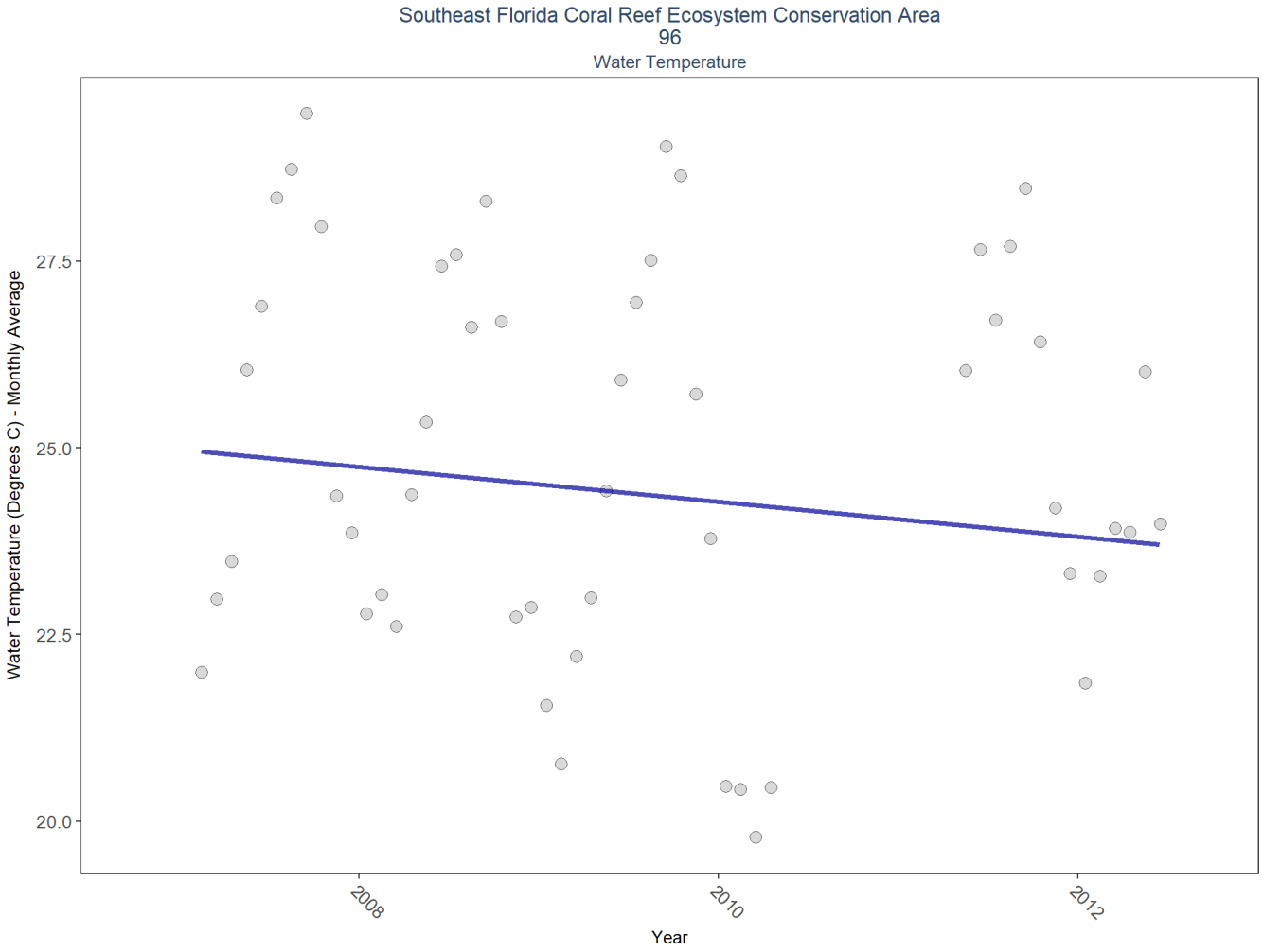
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	111826	16	26.45	TRUE	0.3699	0.0000	0.0730454	25.95553	4.004	0.9698	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

96

Water Temperature on Coral Reefs in the Florida Keys (986)



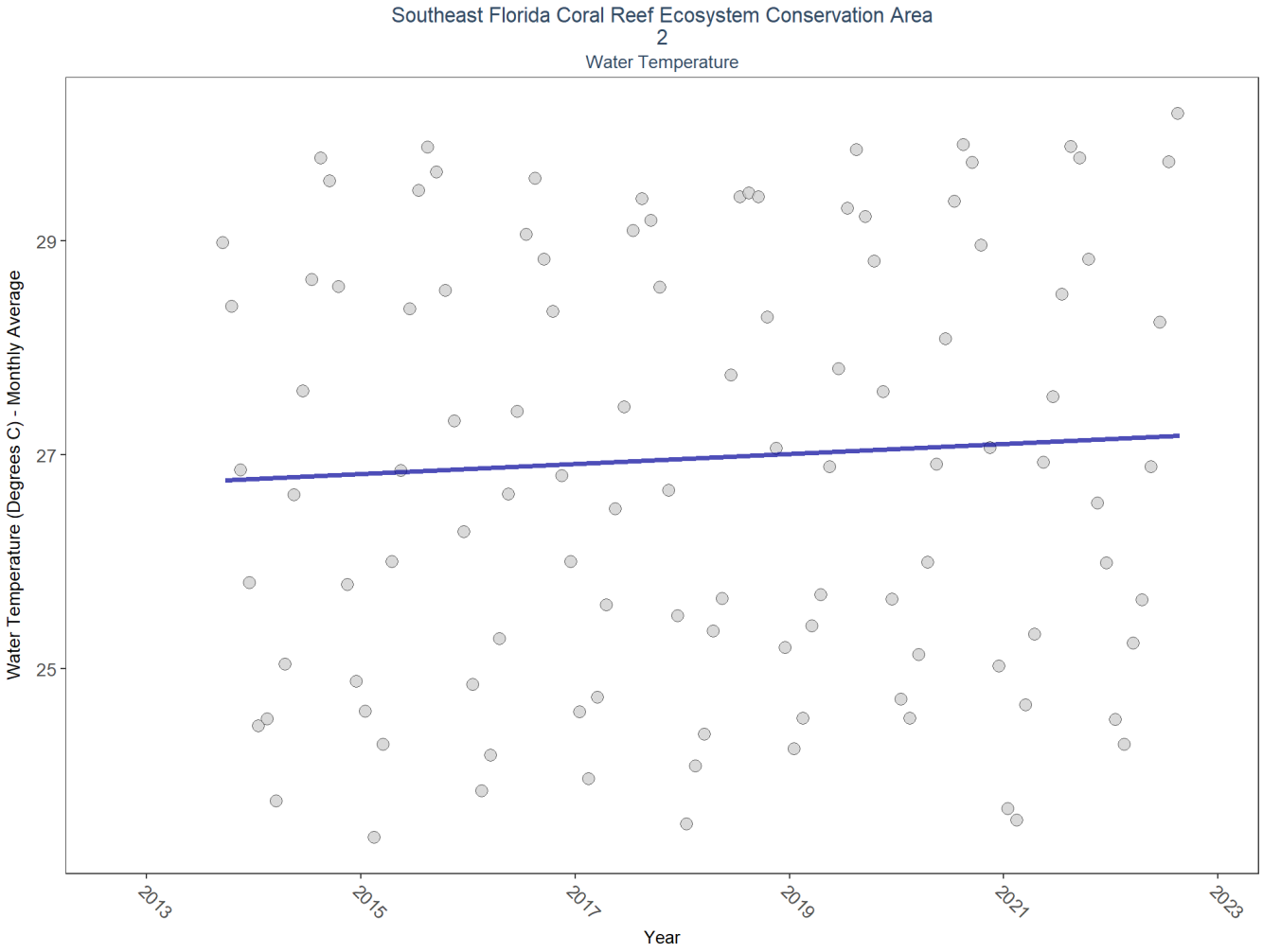
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	25550	6	24.87	TRUE	-0.2516	0.0801	-0.2336878	24.98051	3.2022	0.9878	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

2

Water Temperature on Coral Reefs in the Florida Keys (986)



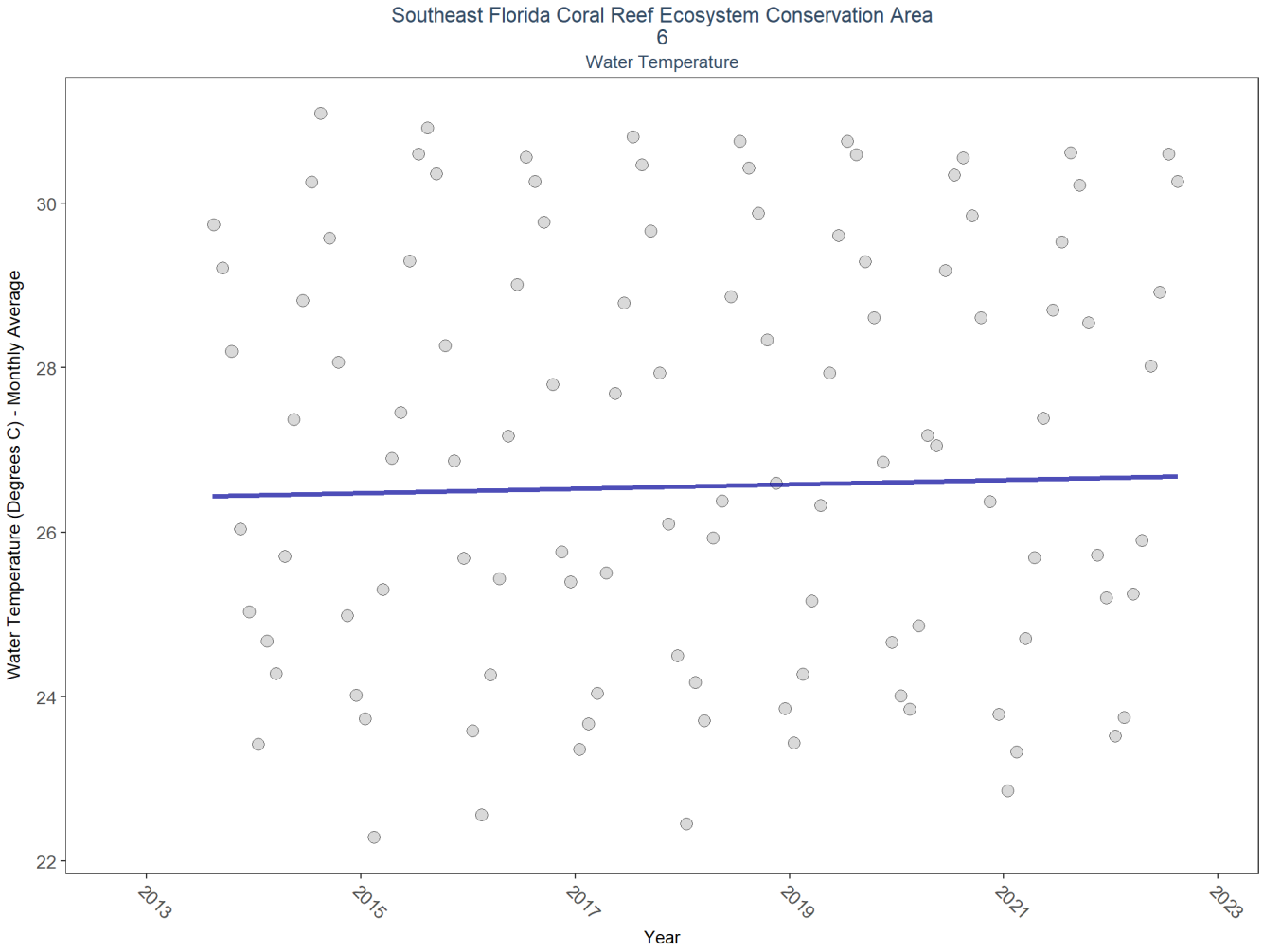
RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	64486	10	26.72	TRUE	0.2639	0.0007	0.046536	26.73175	8.2717	0.6888	1

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

6

Water Temperature on Coral Reefs in the Florida Keys (986)



RelativeDepth	N_Data	N_Years	Median	Independent	tau	p	SennSlope	SennIntercept	ChiSquared	pChiSquared	Trend
Surface	63582	10	26.77	TRUE	0.0892	0.2598	0.02716864	26.42151	6.162	0.8623	0

p < 0.00005 appear as 0 due to rounding.

SennIntercept is intercept value at beginning of record for monitoring location

All Stations Combined by Program

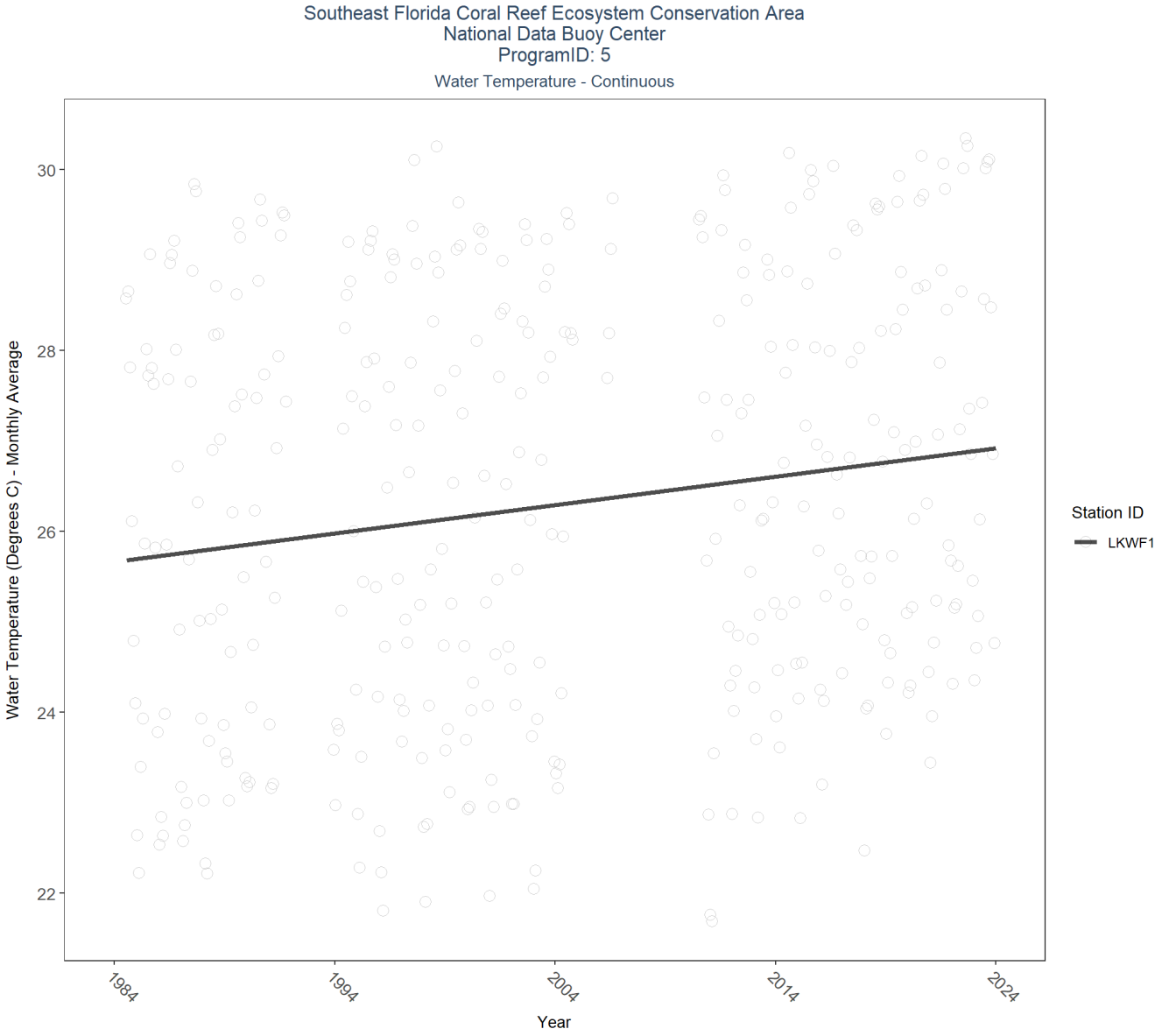


Table 16: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
LKWF1	1212179	35	1984 - 2023	26.5	0.41	25.67	0.03	0.0000

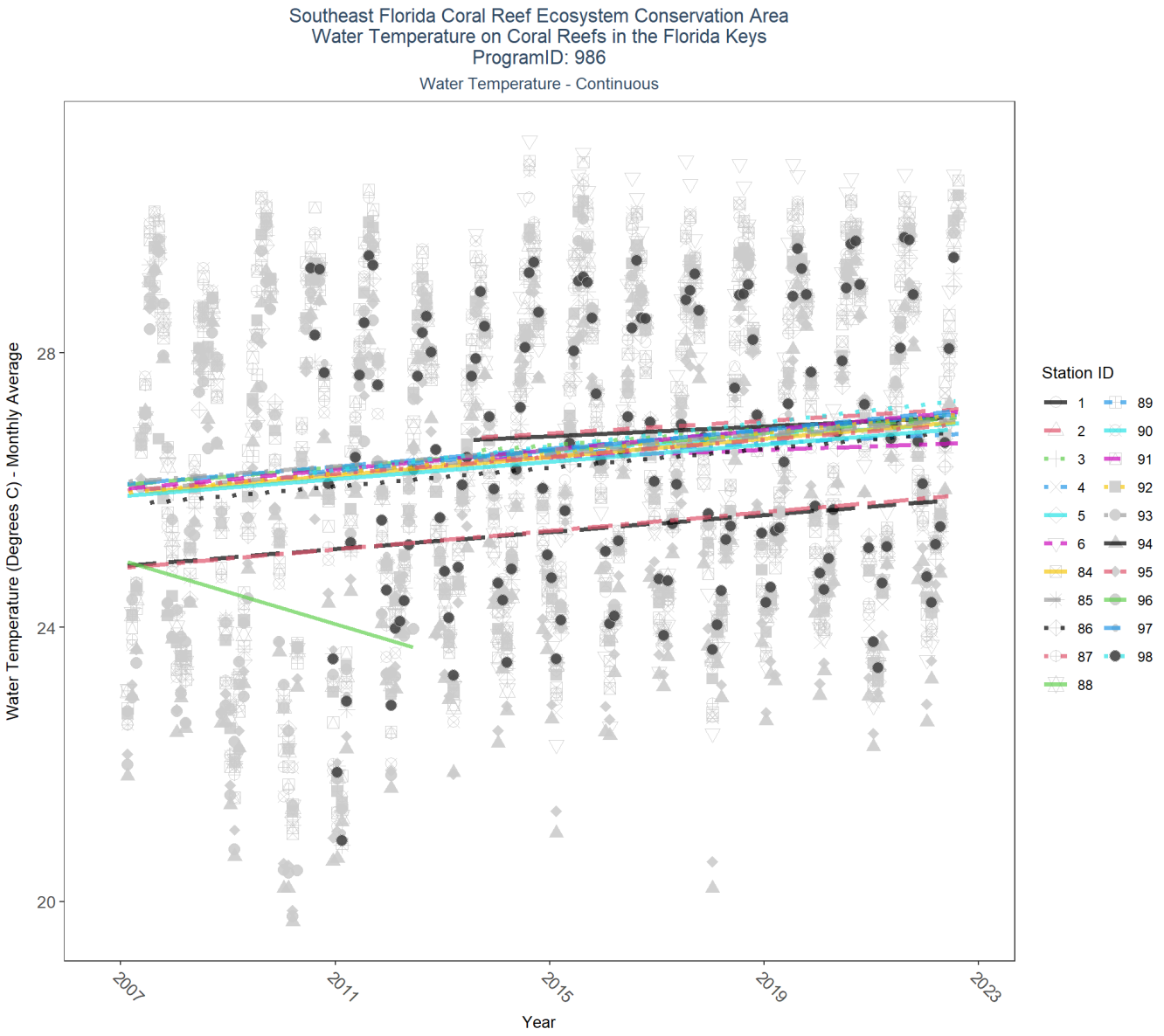


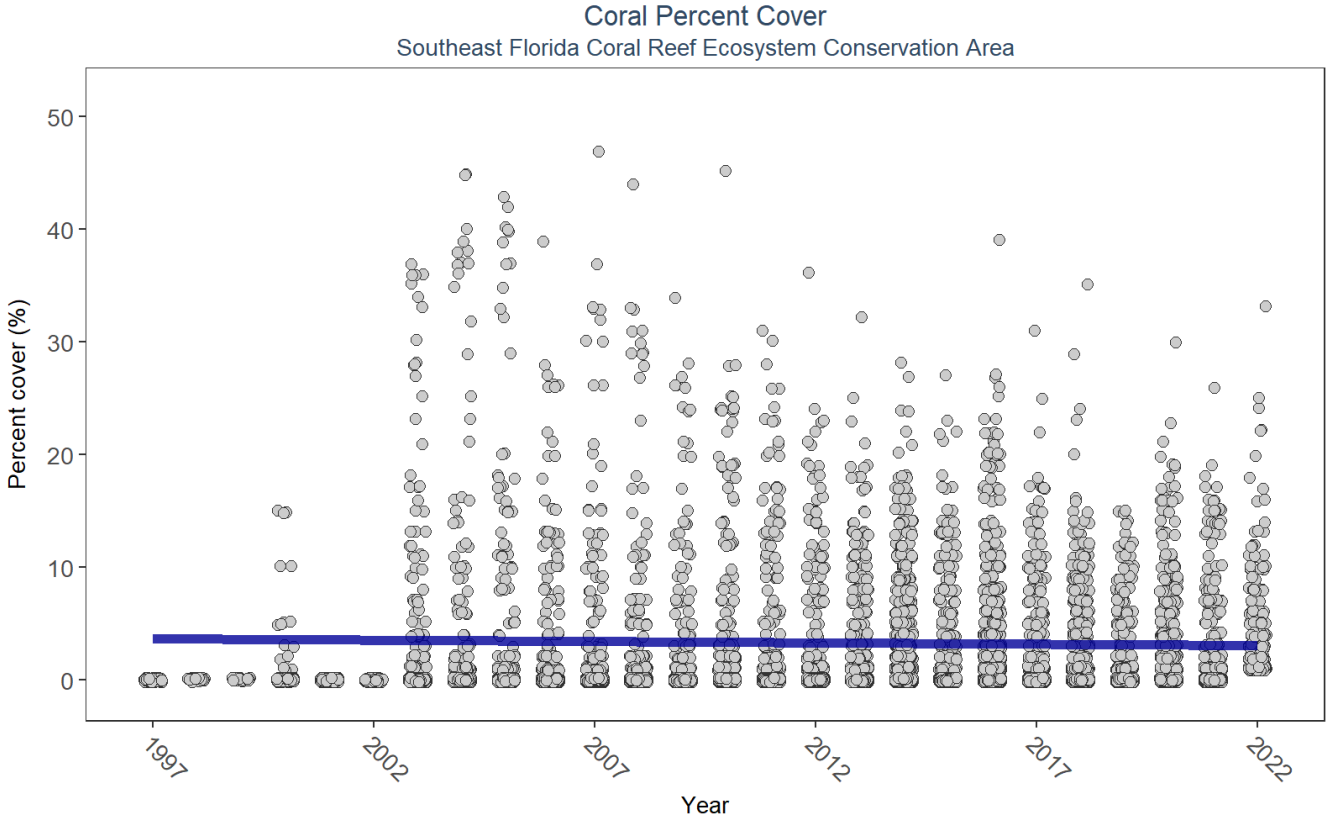
Table 17: Seasonal Kendall-Tau Results for All Stations - Water Temperature

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
4	68937	10	2013 - 2022	26.59	0.17	26.46	0.04	0.0305
93	106903	16	2007 - 2022	26.47	0.35	26.12	0.06	0.0000
90	97006	16	2007 - 2022	26.43	0.33	25.91	0.06	0.0000
85	114214	16	2007 - 2022	26.26	0.34	25.99	0.07	0.0000
1	65108	10	2013 - 2022	26.40	0.13	26.72	0.04	0.1158
94	90265	16	2007 - 2022	25.55	0.28	24.89	0.06	0.0000
84	111153	16	2007 - 2022	26.32	0.36	25.94	0.07	0.0000
95	102279	16	2007 - 2022	25.58	0.30	24.87	0.07	0.0000
91	102406	16	2007 - 2022	26.54	0.33	26.01	0.07	0.0000
86	104767	16	2007 - 2022	26.16	0.36	25.78	0.07	0.0000
3	60887	10	2013 - 2022	26.65	0.25	26.54	0.06	0.0010
89	113809	16	2007 - 2022	26.28	0.35	26.08	0.07	0.0000
88	115305	16	2007 - 2022	26.35	0.34	26.08	0.06	0.0000

Station	N_Data	N_Years	Period of Record	Median	tau	SennIntercept	SennSlope	p
87	108339	16	2007 - 2022	26.44	0.31	25.99	0.06	0.0000
97	97533	13	2010 - 2022	26.45	0.38	26.21	0.08	0.0000
5	51977	10	2013 - 2022	26.62	0.22	26.46	0.05	0.0067
98	87973	13	2010 - 2022	26.40	0.39	26.21	0.09	0.0000
92	111826	16	2007 - 2022	26.45	0.37	25.96	0.07	0.0000
96	25550	6	2007 - 2012	24.87	-0.25	24.98	-0.23	0.0801
2	64486	10	2013 - 2022	26.72	0.26	26.73	0.05	0.0007
6	63582	10	2013 - 2022	26.77	0.09	26.42	0.03	0.2598

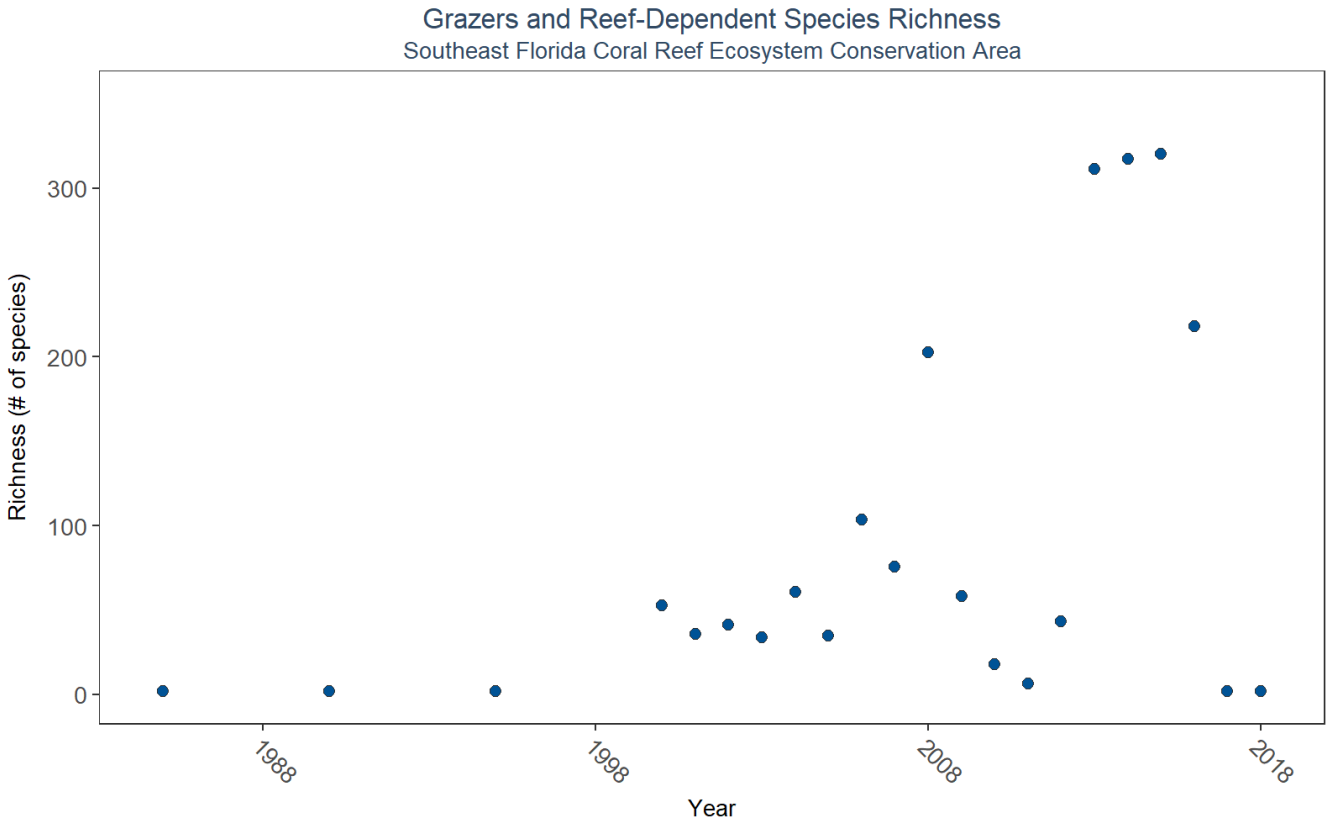
Coral Reef

The data file used is: **All_CORAL_Parameters-2024-Mar-28.txt**



N_Years	SufficientData	EarliestYear	LatestYear	N_Data	Min	Max	Median	Mean	StDev	LME_Intercept	LME_Slope	LME_p
26	1	1997	2022	29660	0	47	0	0.72	3.07	51.78	-0.02	0

LME_p < 0.00005 appear as 0 due to rounding.



N_Years	EarliestYear	LatestYear	N_Data	Min	Max	Median	Mean	StDev	Year_MinRichness	Year_MaxRichness
22	1985	2018	3040	2	327	319	246	119.08	1985	2015