TREND ANALYSIS OF WATER QUALITY DATA FOR THE SARASOTA BAY NATIONAL ESTUARY PROGRAM

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EXECUTIVE SUMMARY

Trends in the historic water quality of Sarasota Bay have been previously characterized for the Sarasota Bay National Estuary Program (SBNEP) by Mote Marine Laboratory (MML) and Camp Dresser & McKee, Inc. (CDM) in Lowery, et al., 1993 for the 1968-1989. Changes in the wastewater disposal practices and increased seagrass coverage in selected bay regions have made it desirable to re-examine trends in water quality. Long term climatic changes were also to be isolated from anthropogenically mediated water quality changes by removing the effects of forcing functions such as rainfall, salinity, season, and temperature. Analyses were to be performed on data grouped by the 17 Sarasota Bay segments and for periods of 1968-1998, 1983-1998, and 1989-1998.

Parameters to be analyzed were those typically associated with eutrophication (nutrients, water clarity, and chlorophyll), with a total of 40 parameters analyzed as dependent variables. Least squares regressions were computed using a variety of models, provided data met requirements. A non-parametric analysis of residuals was conducted after the typical effects of forcing functions were removed from the data. The residuals analysis was performed on the entire database, from 1968 to present, segregated by segment. Supporting the robustness of the analytical approach, the significance and direction of trend were generally consistent between the parametric and non-parametric evaluations of the selected time periods. Results of both parametric and non-parametric analyses of trend with time were also generally consistent regardless of time period.

Salinity trends, in addition to the changes effected by varying rainfall amounts, reflect the alterations in patterns of freshwater delivery to Sarasota Bay with increases in the salinity of Palma Sola Bay and Anna Maria Sound, and decreases in lower Sarasota Bay, Little Sarasota Bay, and Blackburn Bay. Increases in water temperature above expected seasonal variations are clearly evident, especially for shallow segments with comparatively low flushing. Declining dissolved oxygen in Sarasota Bay (Segments 10 and 11) appears to be a water quality improvement as it is accompanied by a reduction in the incidence of supersaturation. Water clarity (secchi depths) has increased, particularly in the northern Bay. Increases in secchi depths were generally accompanied by significant declines in either turbidity, suspended solids (total and volatile), color, or chlorophyll, with significance of trend the strongest and relationships between parameters most coherent for lower Sarasota Bay and Roberts Bay. Northern Sarasota Bay also experienced declines in nutrient concentrations. The segment behind Longboat Pass, however, is experiencing a decline in water clarity. Areas experiencing seagrass recovery have, in general, experienced improved water clarity. Increases in chlorophyll were detected for the southern portion of the study area, including Lemon Bay. Lemon Bay has also increased in total phosphorus , but this increase appears to be the product of increased flows to the Bay. Step trends coincident with the closure of Midnight Pass are not evident in the nutrient data and while inorganic nitrogen has increased in this segment, total nutrient concentrations have declined. Improved wastewater treatment in the City of Sarasota, however, has clearly reduced the instances of high nutrients in the waters off Whitaker Bayou. Coastal waters have experienced a decline in water clarity and an overall increase in suspended solids and nutrient concentrations.

I. INTRODUCTION AND BACKGROUND

Trends in the historic water quality of Sarasota Bay, from Anna Maria to the Venice Inlet have been previously characterized for the Sarasota Bay National Estuary Program (SBNEP) by Mote Marine Laboratory (MML) and Camp Dresser & McKee, Inc. (CDM) in Lowery, et al., 1993. The period addressed in that work was between 1968 and 1989 and detected a number of both improving and degrading water quality trends.

Since 1989, additional data have been made available. Pre-1989 data from Sarasota County have been incorporated into the Environmental Protection Agency's STORET (Data Storage and Retrieval) system. The SBNEP supported four years of quarterly monitoring at high spatial intensity in both Manatee and Sarasota County. Sarasota and Manatee Counties each began or resumed ongoing monthly monitoring programs. MML is operating a new monitoring network in near-shore and coastal waters to investigate harmful algal blooms.

Changes in the wastewater disposal practices and increased seagrass coverage in selected bay regions have also made it desirable to re-examine trends in water quality. It was desired that data be analyzed both in the entire historical context and for a more recent time period. Accordingly the SBNEP contracted with MML for MML and CDM to repeat trend analyses using both parametric and non-parametric statistical approaches for selected variables to determine if water quality is measurably improving.

Sediment data were known to be minimal from previous work, and the more recent sediment analyses sponsored by the SBNEP were unsuited for temporal trend analyses. Trace metals and synthetic organics were also generally absent from water column data sets. As a result, trend analyses focused on eutrophication-related parameters, (nutrients, demands, chlorophylls, and water clarity) in accordance with the stated water clarity goals of the SBNEP.

II. OBJECTIVES

Trend analyses were to be conducted on water quality data to determine if the values of selected parameters in a defined geographic region had changed with respect to time. Long term climatic changes were also to be isolated from anthropogenically mediated water quality changes by removing the effects of forcing functions such as rainfall, salinity, season, and temperature. Residuals from the observed relationships were then to be examined non-parametrically with respect to time to detect underlying trends. Analyses were to be performed on data grouped by the 17 Sarasota Bay segments (Estevez and Palmer, 1990; **Figure 1**) which extended from Bay waters to approximately 3 nautical miles offshore. (Recent data from the Lemon Bay area **[Figure 2]** to the south of the SBNEP study area were also examined.)

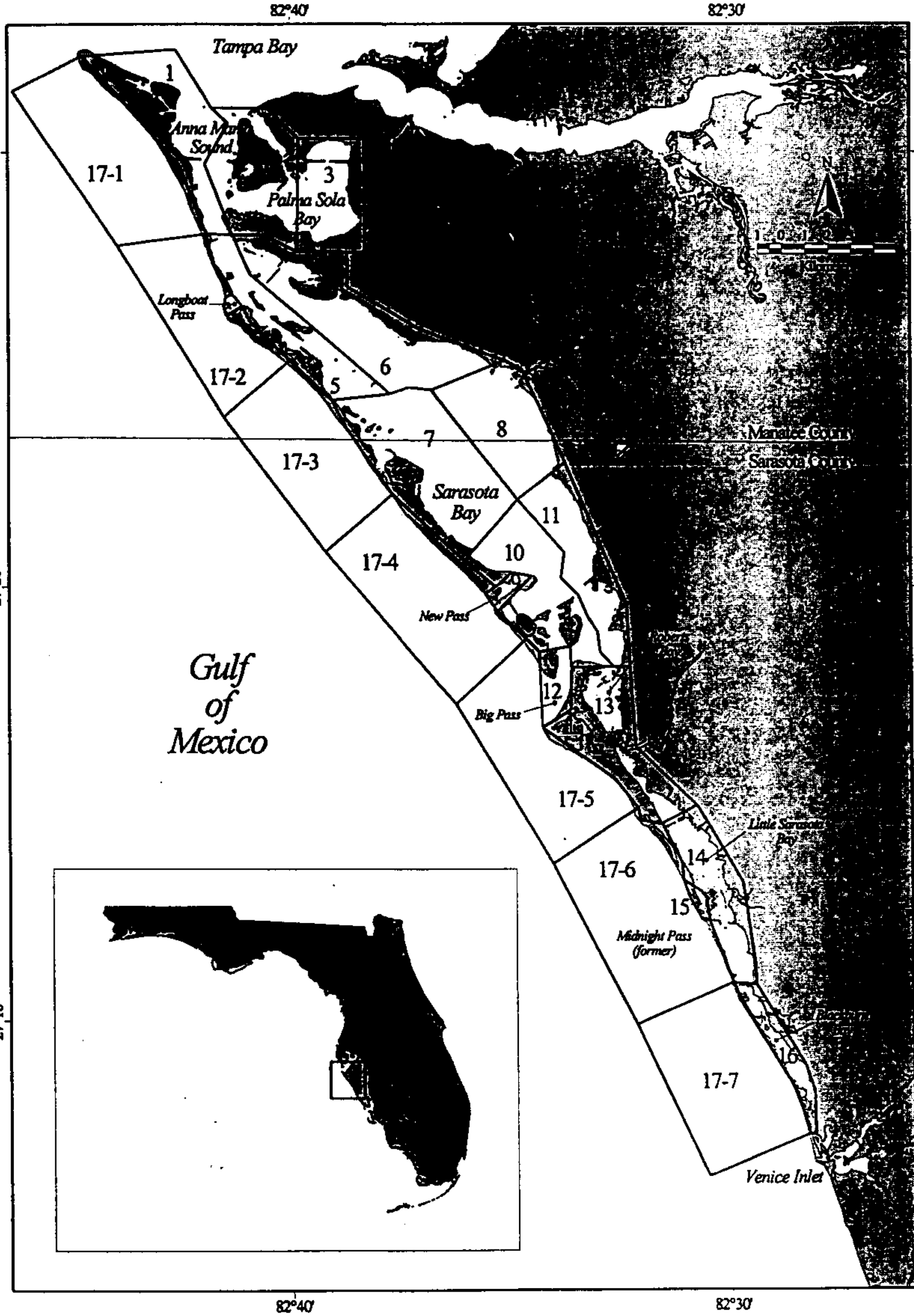

Figure 1. Segment numbers and geographic divisions (after Estevez and Palmer, 1990) for analysis of Sarasota Bay water quality data.

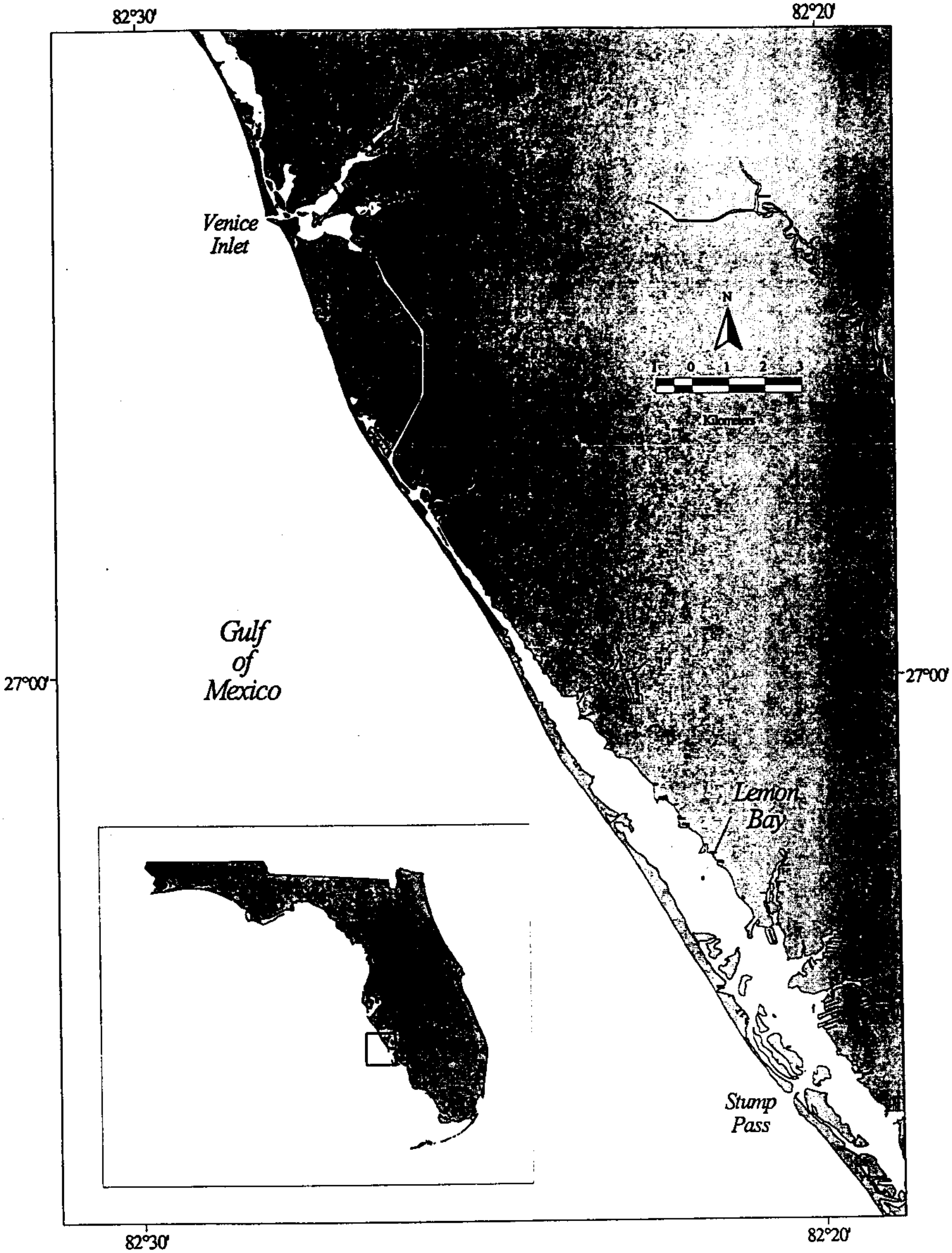

Figure 2. Lemon Bay data from 1995-1998 included in analyses of water quality trends.

III. DATA SOURCES

Components of the data set assembled for analysis included all data analyzed in previous efforts, plus additional work performed since 1989. A STORET download gathered data between January 1, 1968 and December 31, 1998 from the geographic region of interest (**Table 1**). Parameters queried were selected based on a inventory of available data from the region, identifying those eutrophication and water clarity parameters most commonly reported. Additional parameters were incorporated based on knowledge of the newer sampling programs to result in a final data file with parameters identified in **Table 2**. Parameters included salinity, temperature, pH, dissolved oxygen (DO), water clarity (as secchi depths and light extinction coefficients), color, nitrogen and phosphorus species, chlorophylls, total and volatile solids, biochemical oxygen demand, and selected trace metals. A total of 40 parameters were analyzed as dependent variables. The STORET download included most of the data gathered by the routine monitoring programs of Sarasota and Manatee Counties, as well as the quarterly monitoring supported by the SBNEP between 1990 and 1994. A wasteload allocation performed by MML in the early 1980's in Sarasota County was combined with the STORET data, as was a monitoring program conducted by Sarasota High School between 1975 and 1983. Also included was a 1987-1988 monitoring program of the northern portion of the study area, carried out jointly by MML and Manatee County Public Works Department and funded by the West Coast Inland Navigation District.

Coastal monitoring performed by MML for the study of harmful algal blooms between 1975 and 1980 was incorporated, as was more recent bay and coastal sampling (1996-1999). The recent monthly monitoring performed by Manatee and Sarasota Counties was obtained directly from the respective environmental sections, or from MML archives in the case of the most recent Sarasota County monitoring.

Table 1. Latitude, longitude pairs (degrees, minutes, seconds) defining boundaries of STORET data downloads.

Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
27 31 11	82 46 11	27 27 00	82 39 00	27 07 12	82 27 35
27 32 23	82 45 00	27 25 47	82 36 35	27 06 35	82 30 36
27 32 23	82 42 35	27 25 12	82 34 47	27 17 23	82 36 35
27 31 11	82 42 00	27 19 47	82 32 24	27 21 00	82 39 35
27 31 11	82 40 12	27 16 11	82 31 48	27 23 59	82 41 23
27 30 36	82 39 35	27 15 00	82 30 36	27 27 36	82 43 48
27 30 00	82 38 24	27 13 11	82 29 23	27 31 11	82 46 11
27 27 36	82 38 24	27 10 47	82 29 23	27 09 53	82 32 05
27 27 36	82 39 00	27 08 24	82 28 11		

Table 2. Structure of final data base. Contents limited to data with conductances greater than 5000 umhos (2.7 PSU) or at stations where estuarine conditions were reasonable. Values less than method detection limits (MDL) converted to ½ MDL. Values of '-9' indicate no data.

ATTCOEFF	Attenuation coefficient, m-1	TIC	Total Inorganic Carbon, mg/l C
BOD5	Biochemical Oxygen Demand, 5 Day, mg/l, #/l	TKN	Total Kjeldahl Nitrogen, mg/l N
CHLA_CORR	Chlorophyll a, corrected for Pheophytin, ug/l	TN	Total Nitrogen, mg/l N
CHLA	Chlorophyll a, uncorrected for Pheophytin, ug/l	TOC	Total Organic Carbon, mg/l C
CHLB	Chlorophyll b, ug/l	TP	Total Phosphorus, mg/l P
CHLC	Chlorophyll c, ug/l	TSS	Total Suspended Solids, mg/l
COLOR	Color, PCU	TURB	Turbidity, NTU
CU	Copper, ug/l	VSS	Volatile Suspended Solids, mg/l
DIN	Dissolved Inorganic Nitrogen, mg/l N	ZN	Zinc, ug/l
DNH4N	Dissolved Ammonia Nitrogen, mg/l N	PH	pH, SU
DNO23N	Dissolved Nitrate Nitrite Nitrogen, mg/l N	SAL_PSU	Salinity, PSU
DNO2N	Dissolved Nitrite Nitrogen, mg/l N	TEMP	Temperature, Degrees C
DNO3N	Dissolved Nitrate Nitrogen, mg/l N	YEARFRAC	Fractional Year
DO	Dissolved Oxygen, mg/l	RAIN3	Rain, 3 Day Cumulative Total, in
DPO4P	Dissolved Orthophosphate, mg/l P	RAIN7	Rain, 7 Day Cumulative Total, in
FE	Iron, ug/l	RAIN14	Rain, 14 Day Cumulative Total, in
IN	Inorganic Nitrogen, mg/l N	RAIN30	Rain, 30 Day Cumulative Total, in
JTU	Turbidity, JTU	RAIN60	Rain, 60 Day Cumulative Total, in
MN	Manganese, ug/l	RAIN90	Rain, 90 Day Cumulative Total, in
NH4N	Ammonia Nitrogen, mg/l N	STATION	Station Identifier
NO23N	Nitrate Nitrite Nitrogen, mg/l N	DLAT	Latitude, Decimal degrees
NO3N	Nitrate Nitrogen, mg/l N	DLONG	Longitude, Decimal degrees
ORGN	Organic Nitrogen, mg/l N	SEGMENT	Segment assigned for analysis
PB	Lead, ug/l	DATE	Sampling Date, MM/DD/YY
PERSAT	Percent Saturation of DO, %	NDATE	Numeric Sampling Date, year and fraction since 1900
PHEO_A	Pheophytin a, ug/l		
PO4P	Orthophosphate, mg/l P		
SECCHI_EST	Secchi, estimated, m (Values >bottom set equal to depth overall)		

The vast majority of DO data in the combined data set was collected as ambient data during daylight hours. Pre-dawn DO data collected by some sampling programs to capture DO minima were not included as it would be expected to produce spurious trends when analyzed together with older, daytime sampling programs.

IV. DATA PROCESSING

The resulting data file was scrutinized for outliers, removing data with obvious miskeyed entries (conductances greater than 70 mmhos/cm, pH values greater than 10.00 or less than 2.00 SU, dissolved oxygen greater than 20.00 mg/l, and temperature values less than 5°C). STORET data qualified with remark codes were deleted with the following exceptions. Data associated with qualifiers of:

K	- Actual value is known to be less.
T	- Value reported is less than the criteria of detection.
W	- Value observed is less than the lowest reportable value under the "T" code.
U	- Material analyzed but not detected.

were retained at one half of the numeric value. For example, a value reported as 0.5U mg/l was converted to 0.25 mg/l. Conversion of data less than detection limits to values of one half the detection limit provides acceptable error rates for the computation of summary statistics (USAEWES, 1995), permits the direct analysis of log-transformed data, and is more appropriate when samples cannot be assumed a priori to be from the same population. Data reported as 0.00 values were converted to one half of the lowest value reported by that agency or data source, considering typical analytical methods and detection limits for the parameter in question. Non-STORET data with values reported as less than detection limits were similarly adjusted. STORET values accompanied by a qualifier of "L - Actual value is known to be greater" were retained at face value.

Parameter values were transformed as appropriate to provide the largest number of data points possible per parameter category. Nitrogen and phosphorus species reported as ionic concentrations (NO_3, PO_4, etc.) were transformed to elemental concentrations (NO_3-N, PO_4-P, etc.) for both total and dissolved parameters. Total nitrogen quantities were computed from nitrate, nitrite, and total Kjeldahl nitrogen; organic nitrogen was computed from total Kjeldahl nitrogen and ammonium-nitrogen concentrations. Fahrenheit temperatures were converted to centigrade. Dissolved oxygen, pH, and conductivity observations were compiled from field observations and were supplemented with laboratory determinations in the absence of field data. Salinity was computed from conductance, and percent saturation of dissolved oxygen computed where temperature, conductance or salinity, and dissolved oxygen were available. Secchi depths described as "greater than bottom" were set equal to overall water depths where possible to avoid bias introduced by the analysis of only worst-case water clarity conditions.

Some sampling programs collected multiple samples per station, surface and bottom samples, or returned to a station at differing tidal conditions within a given day. To avoid undue weighting by multiple samples, daily averages were computed by parameter, following the conversions and corrections detailed above. The data set was also truncated to observations with specific conductances greater than or equal to 5 mmhos/cm (5000umhos/cm or 2.67 PSU) to avoid introduction of spurious trends generated by short term tributary sampling programs. In the case of stations with no conductance or salinity data, station location was used to determine if saline samples were reasonable from that particular station. The final data set of daily and/or depth averages, from 1968 to present, consisted of 12,018 separate records and 130,541 observations, with parameters distributed as described in **Table 3**.

Segment identifications (**Figure 1**) were assigned to stations using station latitude and longitude and geographic information system software. The data set exhibited distributions by date and segment as illustrated in **Figures 3** and **4** and **Table 4**. A total of 672 unique station designations (Appendix A) are represented (**Figure 5**), although some stations are undoubtedly duplicated by different agencies at different times. All segments, with the exception of Segment 4 in Longboat Pass, had data in multiple years, although the total number of observations in the smaller pass segments was much lower than for the larger segments.

Table 3. Number of observations by parameter category.

ATTCOEFF	2899	NO3N	211
BOD5	1439	ORGN	4696
CHLA_CORR	2053	PB	11
CHLA	2499	PERSAT	8210
CHLB	2749	PHEO_A	645
CHLC	319	PO4P	2890
COLOR	6496	SECCHI_EST	5803
CU	13	TIC	1128
DIN	1549	TKN	5219
DNH4N	1549	TN	4925
DNO23N	1549	TOC	1740
DNO2N	1146	TP	4899
DNO3N	1110	TSS	4262
DO	8637	TURB	5227
DPO4P	2548	VSS	2387
DSIO2	107	ZN	14
DTKN	24	PH	9449
DTOTP	24	SAL_PSU	7703
DTPN	12	TEMP	11746
DTPP	24	YEARFRAC	12018
FE	109	RAIN3	11988
IN	3223	RAIN7	11988
JTU	486	RAIN14	11988
MN	109	RAIN30	11983
NH4N	4759	RAIN60	12018
NO23N	4135	RAIN90	12011

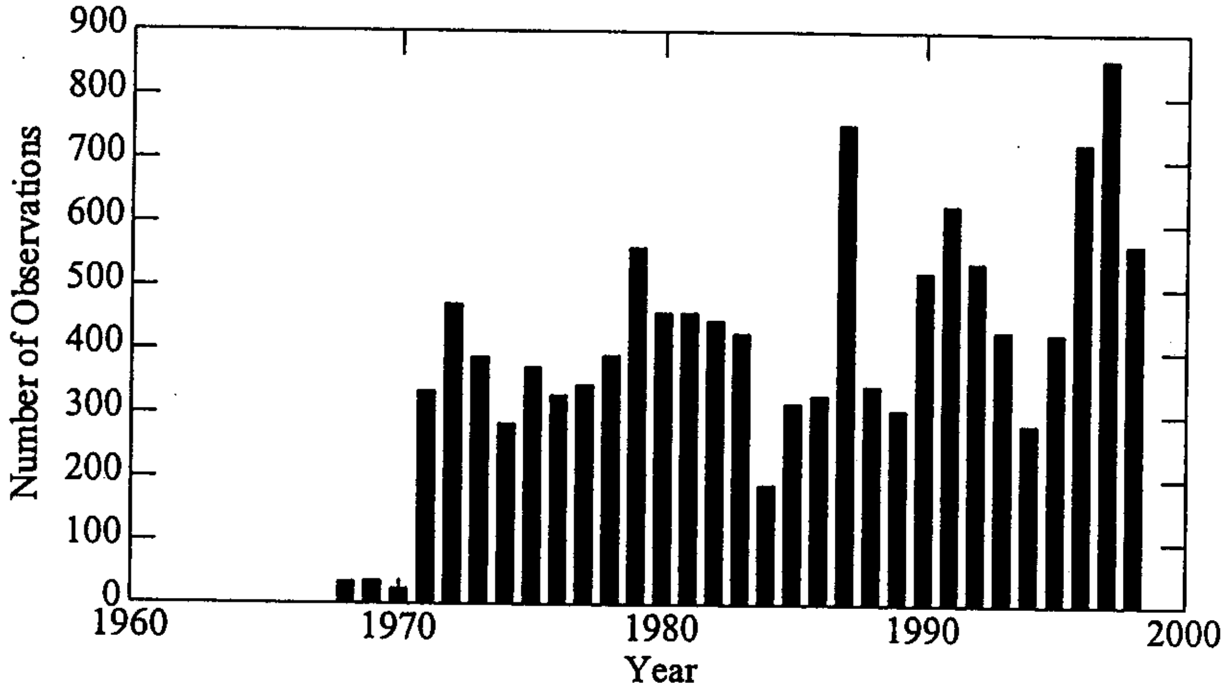

Figure 3. Distribution of water quality observations with time in combined Sarasota Bay data set.

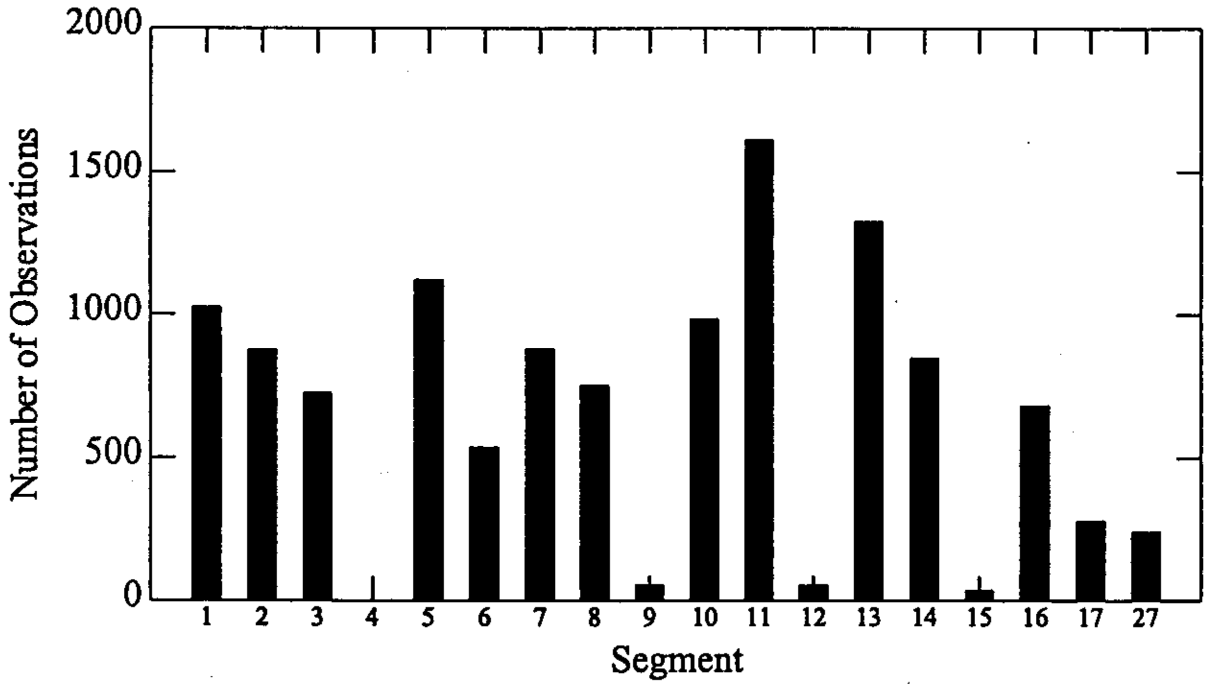

Figure 4. Number of water quality observations per segment in combined Sarasota Bay data set.

Table 4. Number of observation-days by segment and year contained in final database. Segment 4 analyzed with Segment 17. Segment 15 analyzed both with Segment 14 and individually.

Segment Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**27**
1968	12	11	12															
1969	12	12	12															
1970	6	12	6															
1971	10	13	4		1		87	40		38	72		35	13		21		
1972	86	34	24		54	10	63	45		24	63		35	14		20		
1973	77	36	27		60	14	19	22		22	40		47	13		10		
1974	76	36	28		59	12	9	15		9	10		15	11		4		
1975	80	35	28		60	12	16	19		19	43		29	12		6	13	
1976	70	36	28		62	12	7	16		9	33		19	13		4	20	
1977	68	35	28		60	12	15	20		11	46		12	15		4	19	
1978	63	34	26		58	11	20	21		26	67		27	15		8	15	
1979	68	36	27		72	12	32	29	1	50	100		65	33		30	6	
1980	41	24	20		45	6	28	23		42	92		65	35		27	11	
1981	33	24	28		38		30	29		50	109	1	61	33		21	2	
1982	27	22	25		36		37	39		40	125	4	48	22		17	4	
1983	32	24	28		39		35	31		44	91		60	27		15		
1984	14	14	13		22		14	13		12	20		41	15		11		
1985	30	22	25		36		26	25		25	36		45	26		21		
1986	26	20	23		33		32	25		31	38		52	28		21		
1987	32	112	72		80	134	59	64		37	45		67	27		25		
1988		28	14		15	42	40	30		29	44		49	32		21		
1989	10	10	20		25	9	32	25		30	39		53	33		21		
1990	19	27	30		31	25	50	39	2	50	64	6	75	51	4	36	14	
1991	29	41	42		41	41	48	43	4	54	68	12	79	52	8	38	28	
1992	27	42	38		38	39	40	37	4	44	57	12	56	43	8	26	28	
1993	25	37	33		37	37	28	29	4	32	40	12	35	32	8	20	22	
1994	20	31	32		36	25	14	22	2	16	20	6	18	15	4	10	14	
1995		15	2		6	3	2	1	8	54	58		59	59	1	61		60
1996	13	24	12		12	25	17	15	8	60	62		59	59	1	61	63	60
1997	11	21	10	4	56	44	73	26	14	71	72		59	59	1	61	8	60
1998	7	8	8		9	9	6	8	8	54	58		59	59	1	61	7	60

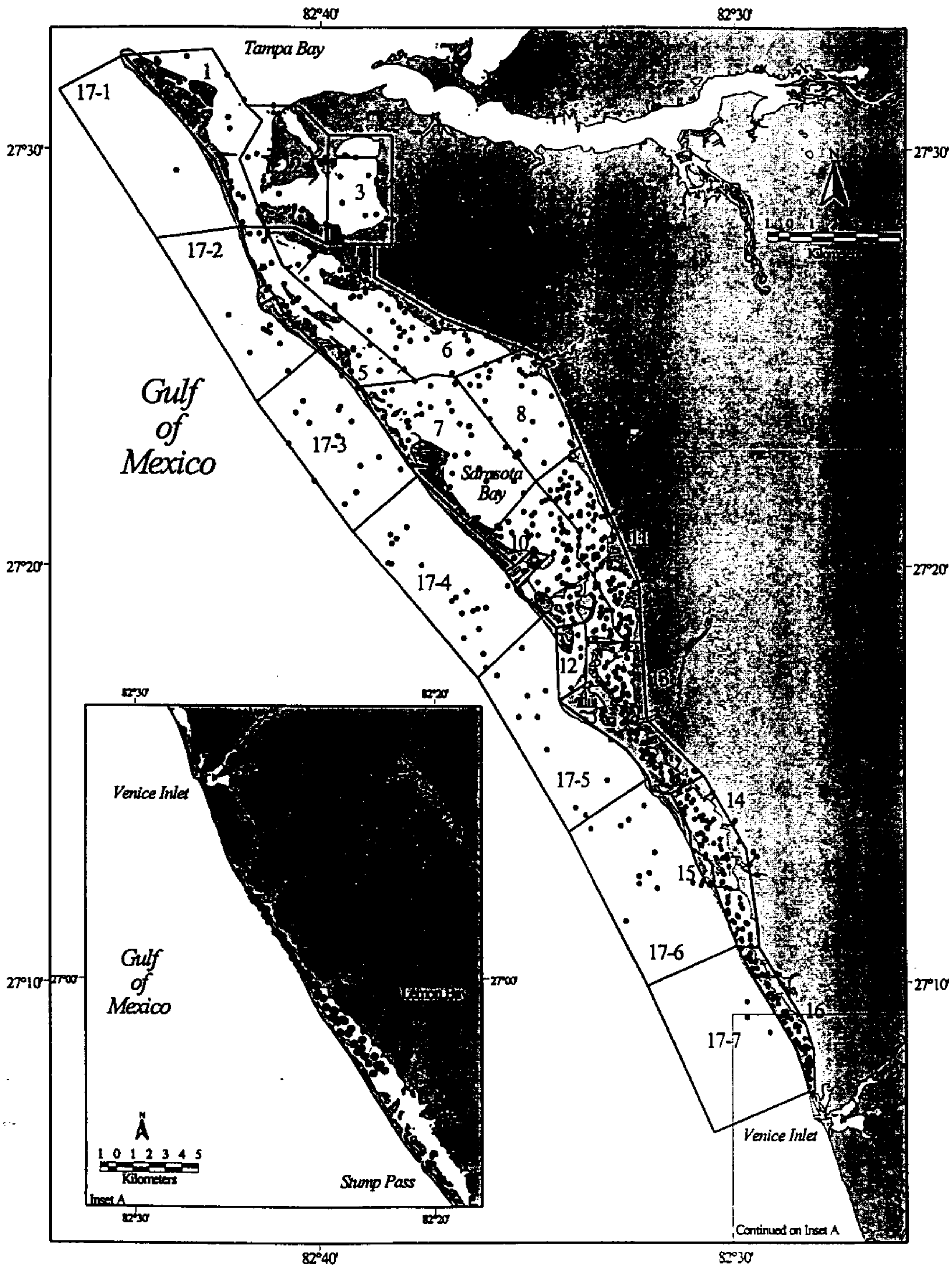

Figure 5. Density of stations with water quality data within the combined Sarasota Bay data set1.

The one station in Segment 4 was reassigned to the nearest coastal segment, Segment 17. Segment 15 in the former Midnight Pass, had only one observation for each of the last four years. Accordingly, Segment 15 data were pooled with Segment 14 data, as all values in Segment 15 had been collected after Pass closure. Segment 15 observations were also analyzed alone due to the public and regulatory interest in this region. Coastal segments 17-1 through 17-7 were analyzed as a single group, Segment 17.

For cumulative rainfall amounts, daily rainfalls for the period of record were obtained from selected stations of the Southwest Florida Water Management District's (SWFWMD) rainfall monitoring network (**Table 5**). Segments were assigned to the three nearest rainfall stations (**Table 6**). Sampling dates of the individual data records were used to enter the three rainfall files and compute cumulative rainfall totals at each rainfall station. The three rainfall totals were then averaged. A minimum of 85 percent completeness for a station's rainfall record was required before it would be included in the average. If one rainfall station was incomplete, the remaining two rainfall stations were used to produce the average cumulative rainfall value. Cumulative rainfall totals were computed for 3-day, 7-day, 14-day, 30-day, 60-day, and 90-day periods prior to the sampling date.

V. Analytical Methods

The parametric regression analyses described below were performed on data subsets specific to individual segments and time periods. Data from each of the 17 segments plus Lemon Bay were analyzed for trends between 1968 and present, 1983 to present, and 1989 to present time periods. Although time periods were varied, **Table 4** above illustrates that not all segments reported data for the entire time period of each analysis. As an example, analyses of Lemon Bay data would return identical results for all three time period analyses since the data base included data only between 1995 and 1999.

As described above, sufficient observations were present for all but Segment 4 (Longboat Pass), which was combined with the coastal Segment 17, and Segment 15, which was analyzed both by itself and combined with Segment 14. Least squares regressions, where the sum of the squared deviations from the mean is minimized, were computed using linear, logarithmic, power and exponential models, but only performed on normally distributed data sets (skewness values of both time and dependent variable between -0.7 and 0.7). Where both raw and transformed data resulted in acceptable skewness values, the model with the highest resulting significance was selected for discussion. Where significance values were comparable, models were selected in order by linear, log, exponential, and power transformations. Where data were present, but raw or transformed data remained skewed, non-parametric techniques (Kendall's tau) were used to test for monotonic trends with time, for all three time periods.

Table 5. Rain gages designations used for computing cumulative rainfall totals.

Bradenton	1
Sarasota Bradenton	2
Venice	3
Myakka	4
Fort Desoto	10
Longboat	11
Cutter Lane	12
Main Station	13
Siesta	14

Table 6. Rain gage stations used to compute average cumulative rainfall totals.

Segment	Location	Rain Gage Stations Used		
1	Northern Anna Maria Sound	1	2	10
2	Western Palma Sola Bay to the ICW	1	2	10
3	Eastern Palma Sola Bay	1	2	-
4	Longboat Pass	-	-	-
5	ICW Near Longboat Pass, Sister Keys	1	2	11
6	Tidy Island to Longbar Point	1	2	-
7	NW Sarasota Bay	1	2	12
8	NE Sarasota Bay	1	2	-
9	New Pass	1	2	12
10	SW Sarasota Bay by City Island, Bird Keys	1	2	13
11	SE Sarasota Bay east of ICW	1	2	13
12	Big Pass	1	2	13
13	Roberts Bay	2	3	14
14	Little Sarasota Bay	2	3	14
15	Midnight Pass	2	3	14
16	Blackburn Bay	2	3	14
17	Coastal Waters to 3 nm offshore	1	2	3
	Lemon Bay	3	4	14

Another non-parametric analysis that was performed that consisted of an analysis of residuals after the typical effects of selected forcing functions were removed from the data. The residuals analysis was performed on the entire database, from 1968 to present, segregated by segment using a non-parametric LOWESS procedures (Locally Weighted Scatterplot Smooth; Cleveland, 1979). The smoothing procedure computes general tendencies of data with respect to the selected independent variables (forcing function), describing the relationship between nitrogen concentration and rainfall, for example, while not requiring either linearity of relationship or normality of residuals. Iteration procedures in computing the smoothed curve reduce the impact of outlier data, particularly at the extremes of the independent data distributions. The procedure is also resistant to periodicity, missing and censored data, and serial correlation.

Once the influence of selected forcing functions is evaluated in the LOWESS smooth, residuals from the curve are then evaluated against time to detect temporal trends. Residuals were tested with non-parametric Kendall's tau, applicable to data with skewed distributions or outliers, and suitable for any monotonic correlation in addition to linear relationships. As a result, non-parametric tests are particularly suited to environmental data and especially to the analysis of large data sets where the appropriateness of each linear model cannot be examined. Serial correlation, however, cannot be present for computed P-values to be correct.

For the assembled data, dependent variables fitted through LOWESS procedures included all parameters listed in the first column of **Table 3.** As exogenous variables or forcing functions, the independent variables used were a series of cumulative rainfalls (3 day, 7 day, 14 day, 30 day, 60 day and 90 day), fraction of year (season), temperature, pH, and salinity. A minimum of ten data points were required for each analysis.

As an example of the technique (**Figure 6**), total Kjeldahl nitrogen data are plotted against date (**Figure 6A**) for time series which may or may not exhibit trend. Trends may be obscured by the high variability in the data set, or spurious trends could be produced by a temporal bias in sampling (more frequent sampling during the wet season in later years, for example). However, it is reasonable to expect some rainfall-related variation in nitrogen concentrations; typically increasing during the wet season when tributary inflows are more evident. Accordingly, the same nitrogen data are replotted in Figure 6B against cumulative rainfall (for the prior 60 days). In this instance, the rainfall is considered to be an independent variable which may account for some of the observed temporal variability in the nitrogen data. The LOWESS procedure is used to compute a smoothed, best-fit curve (**Figure 6B**). As expected, increases in nitrogen are associated with rainfall.

Residuals (observed nitrogen data less the LOWESS computed smoothed value) are then computed for all data points in Figure 6B. Residuals are then plotted against the original sampling date (**Figure 6C**) and examined for trend. Significance of trend in the residual values are then evaluated non-parametrically via Kendall's tau. In the example in **Figure 6C**, there is an increasing trend in nitrogen residuals with date. This does not necessarily mean that raw nitrogen concentrations are increasing with time, but that, for a given rainfall amount, more recent values are higher than previous data under similar rainfall conditions. (Alternatively stated, in **Figure 6B**, more recent data tend to be located above the LOWESS curve, while older data generally fall below it.)

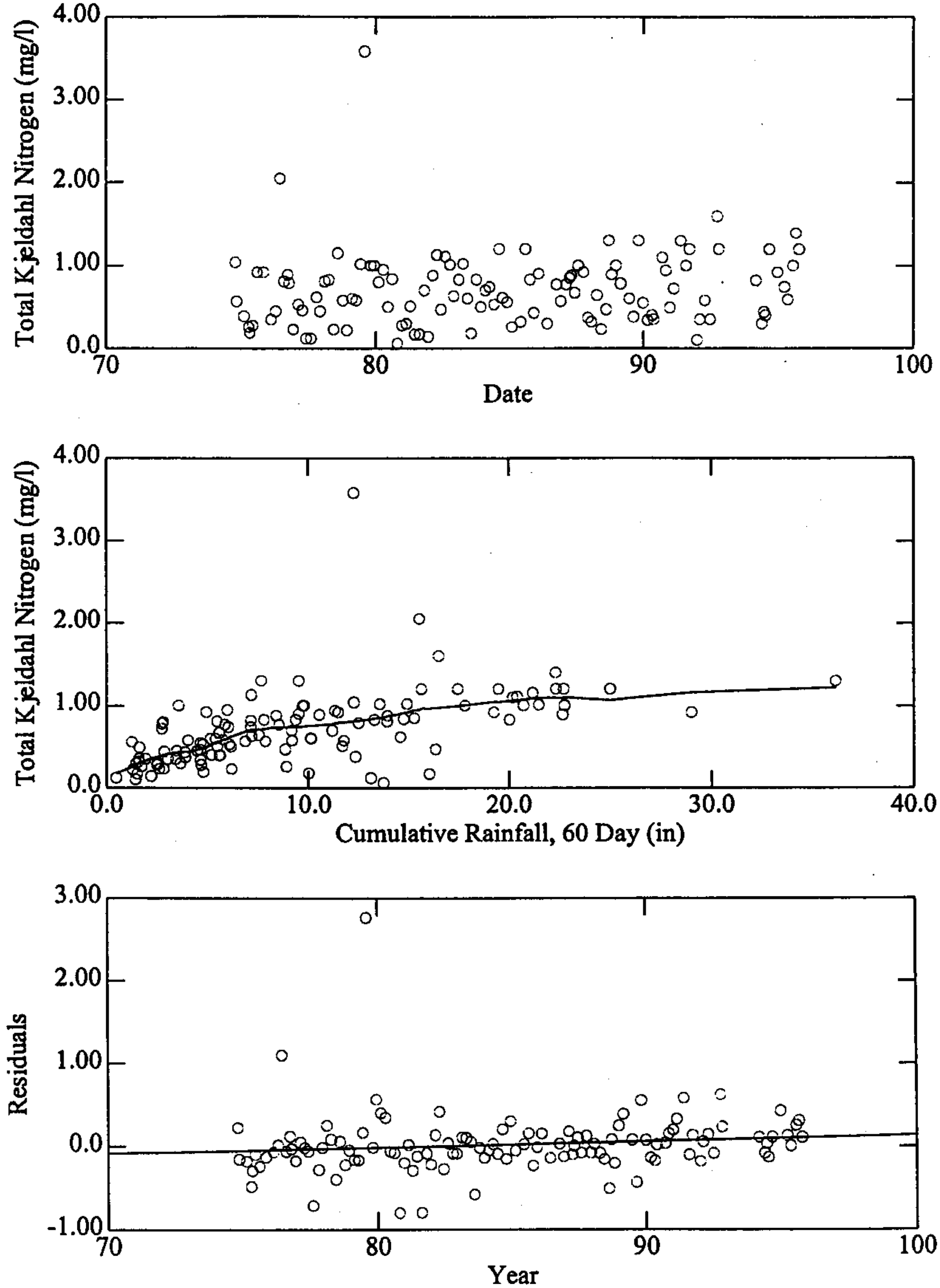

Figure 6. An example of a parameter (total Kjeldahl nitrogen) against time (7A), LOWESS smooth of the parameter against an explanatory independent variable (7B), and analysis of residuals from the LOWESS smooth against time (7C) to determine underlying trend. Linear representation only of remaining trend significance, as significance was detected with non-parameteric rank-correlation analyses.

There are no statements implied regarding the frequency or distribution of rainfall amounts. but the finding is consistent with observed increasing atmospheric loadings of nitrogen. In this example, the LOWESS analysis suggests that surface water concentrations of nitrogen are increasing due to either increasing atmospheric nitrogen deposition or increased nitrogen point or non-point source loadings rather than to higher rainfall amounts between years.

Other forcing functions control water quality and typically complicate trend analyses. In particular, seasonal cycles and dilution with coastal waters often have major effects on concentration. rainfall and runoff contain and transport many water quality parameters of interest.

VI. RESULTS AND DISCUSSION

Regression Models

Selected regression models, significance level and direction of slope (increasing or decreasing parameter value) with increasing time are presented in **Table 7** for all potential segment and parameter combinations. The three time periods investigated are grouped together for a particular segment and allow an examination of whether more recent trends are consistent with longer term data records. A regression result of "\" indicates either no data for the segment-parameter combination, insufficient data (n<10), data identical to that contained in a more recent time period analysis, or skewness remaining in either raw or log transformed data. Results of "ns" indicate that data sufficiency and skewness conditions were met, but that the slope of the parameter value against time was not significantly different from zero (no significant change with time). Direction of change and degree of significance for detected trends is also indicated ("***", p <= 0.001; "**", p<=0.01; and "*", p<=0.05). Of the 8,160 potential regression models, 3488 both met model assumptions and represented sufficient and unique data sets. Of these, 453 indicated very highly significant increasing trends, while 515 were decreasing.

To address those segment-parameter combinations which did not meet regression model assumptions, non-parametric tests for trend with time were also applied. Provided at least 10 data were present, the significance of Kendall's tau was calculated for daily segment averages for the entire data set (1968 to present), as well as the two more recent time periods. The results of non-parametric trends analyses on each time period are also included in **Table 7,** together with direction of trend. Of the 2040 potential analyses, sufficient data existed to test 1431 parameter-segment combinations. Of the resulting trends with very high significance (p<=0.001), 60 were increasing and 233 were decreasing.

Supporting the robustness of the analytical approach, results as to significance and direction of trend were generally consistent between the parametric and non-parametric evaluations of the selected time periods. There were no instances in which a trend for a given time period was significantly decreasing by one method and increasing by another. Results of both parametric and non-parametric analyses of trend with time were also generally consistent regardless of time period. In only a few instances were both increasing and decreasing trends computed for the same segment and parameter among the various time periods.

Table 7. Results of parametric and nonparametric (np) trends of parameter value against time for 1968-1998, 1983-1998, and 1989-1998. Direction of slope indicated by '-' and '+'. Significance indicated by '***' ($p<0.001$), '**' ($p<0.01$), and '*' ($p<0.05$). Insufficient data indicated by '\'.

YEAR		SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR
Segment 1														
89	np	*-	ns	ns	ns	*-	\	ns	ns	ns	\	**+	ns	ns
83	np	**-	ns	ns	ns	ns	\	\	\	\	ns	\	\	**+
68	np	ns	ns	***-	**+	**+	\	\	\	\	ns	\	\	*+
89		\	ns	ns	ns	ns	\	ns	ns	POW *+	\	\	LN *+	\
83		\	ns	\	ns	ns	\	\	\	\	ns	\	\	\
68		ns	EXP *+	\	ns	EXP *+	\	\	\	\	ns	\	\	\
Segment 2														
89	np	ns	ns	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns
83	np	ns	ns	***+	*+	***+	\	***+	\	*-	ns	*+	ns	ns
68	np	***+	**+	***-	***+	***+	\	\	\	\	ns	\	\	ns
89		\	ns	ns	ns	ns	\	ns	ns	\	\	\	LN **+	\
83		\	ns	\	EXP *+	EXP *+	\	LIN ***+	\	\	ns	LN ***+	LN *+	LN **-
68		\	EXP **+	\	LIN ***+	LIN ***+	\	\	\	\	ns	\	\	ns -
Segment 3														
89	np	ns	ns	**+	ns	ns	\	***-	ns	ns	\	*+	ns	ns
83	np	ns	ns	***+	ns	ns	\	**+	\	***-	ns	ns	ns	ns
68	np	***+	**+	ns	ns	ns	\	\	\	\	ns	\	\	ns
89		\	ns	EXP **+	ns	ns	\	\	ns	ns	\	\	LN **+	\
83		\	ns	\	ns	ns	\	OW ***	\	\	ns	ns	ns	\
68		\	EXP **+	\	\	\	\	\	\	\	ns	\	\	\
Segment 5														
89	np	*-	ns	**+	ns	ns	\	***-	ns	ns	\	ns	ns	ns
83	np	**-	ns	ns	ns	ns	\	***-	\	ns	\	ns	*+	ns
68	np	ns	ns	***-	ns	*+	\	***-	\	ns	ns	ns	\	**+
89		\	ns	EXP *+	ns	\	\	LN ***-	\	\	\	LN **+	LN ***+	\
83		\	ns	\	ns	\	\	LN ***-	\	\	\	LN **+	LN **+	\
68		\	EXP *+	\	\	\	\	\	\	\	\	\	\	\
Segment 6														
89	np	*-	ns	ns	ns	ns	\	ns	*-	ns	\	ns	ns	ns
83	np	ns	*-	ns	ns	ns	\	***+	\	**-	\	ns	ns	***-
68	np	\	ns	ns	\	\	\	\	\	\	\	\	\	\
89		\	ns	\	ns	ns	\	ns	\	\	\	\	LN **+	\
83		\	LIN ***-	\	ns	ns	\	\	\	\	\	ns	ns	\
68		\	\	ns	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR
Segment 7														
89	np	ns	ns	ns	*+	*+	\	ns	ns	ns	\	**+	**+	ns
83	np	ns	ns	**-	ns	*-	\	ns	\	ns	\	ns	ns	ns
68	np	***-	ns	ns	**-	***-	\	ns	\	ns	\	ns	ns	*-
89		\	ns	\	LIN ***+	\	\	\	\	\	\	\	LN ***+	\
83		\	ns	LIN ***-	ns	ns	\	POW **+	\	\	\	LN **+	\	\
68		\	ns	ns	EXP **-	LIN ***-	\	LN **+	\	ns	\	\	\	\
Segment 8														
89	np	ns	ns	ns	ns	ns	\	ns	ns	***-	\	ns	ns	*+
83	np	ns	ns	ns	ns	*+	\	***+	\	**-	\	ns	ns	ns
68	np	*-	ns	*-	ns	ns	\	***+	\	***-	\	*+	ns	ns
89		\	ns	LIN **-	EXP *+	EXP *+	\	ns	\	LIN ***-	\	\	ns	\
83		\	ns	\	ns	\	\	LN ***+	\	\	\	\	ns	\
68		\	ns	LIN *-	EXP *-	EXP **-	\	LN ***+	\	LN ***-	\	\	\	\
Segment 9														
89	np	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-
83	np	ns	ns	ns	ns	ns	\	\	\	\	\	\	\	\
68	np	ns	ns	ns	ns	ns	\	\	\	\	\	\	\	\
89		EXP *-	ns	ns	\	\	\	ns	ns	\	\	ns	LIN **+	LN **-
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 10														
89	np	ns	ns	***-	ns	ns	ns	ns	ns	**-	\	ns	*+	ns
83	np	ns	ns	***-	**-	**-	\	**+	\	***-	\	ns	*+	***-
68	np	***-	*+	***-	***-	***-	\	*+	\	***-	\	ns	ns	***-
89		\	ns	\	\	\	LN **-	ns	POW *+	POW ***	\	ns	LN ***+	\
83		\	ns	\	EXP **-	EXP **-	\	POW **+	\	LN ***-	\	\	\	\
68		\	LIN *+	\	LIN ***-	LIN ***-	\	LN **+	\	LN ***-	\	\	\	\
Segment 11														
89	np	*+	ns	**-	***+	***+	ns	***+	ns	***-	\	*-	ns	***-
83	np	***+	*+	*-	ns	ns	\	***+	\	***-	\	*-	ns	***-
68	np	ns	ns	***-	***-	***-	\	***+	\	***-	\	*-	ns	***-
89		\	ns	EXP **-	\	\	POW *-	LIN ***+	\	LN ***-	\	LN **-	LN ***+	LN ***-
83		\	EXP *+	\	LIN ***+	\	\	LN ***+	\	LN ***-	\	\	\	LN ***-
68		\	ns	\	LIN ***-	LIN ***-	\	LN ***+	\	LN ***-	\	\	\	LN ***-
Segment 12														
89	np	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns
83	np	ns	ns	\	ns	ns	\	\	\	\	\	ns	\	\
68	np	ns	ns	\	ns	ns	\	\	\	\	\	ns	\	\
89		EXP *-	ns	\	LIN *+	ns	\	ns	\	\	\	LN ***+	LN ***+	ns
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\

There are no statements implied regarding the frequency or distribution of rainfall amounts, but the finding is consistent with observed increasing atmospheric loadings of nitrogen. In this example, the LOWESS analysis suggests that surface water concentrations of nitrogen are increasing due to either increasing atmospheric nitrogen deposition or increased nitrogen point or non-point source loadings rather than to higher rainfall amounts between years.

Other forcing functions control water quality and typically complicate trend analyses. In particular, seasonal cycles and dilution with coastal waters often have major effects on concentration. rainfall and runoff contain and transport many water quality parameters of interest.

VI. RESULTS AND DISCUSSION

Regression Models

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YEAR		SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR
Segment 1														
89	np	*-	ns	ns	ns	*-	\	ns	ns	ns	\	**+	ns	ns
83	np	**-	ns	ns	ns	ns	\	\	\	\	ns	\	\	**+
68	np	ns	ns	***-	**+	**+	\	\	\	\	ns	\	\	*+
89		\	ns	ns	ns	ns	\	ns	ns	POW *+	\	\	LN *+	\
83		\	ns	\	ns	ns	\	\	\	\	ns	\	\	\
68		ns	EXP *+	\	ns	EXP *+	\	\	\	\	ns	\	\	\
Segment 2														
89	np	ns	ns	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns
83	np	ns	ns	***+	*+	***+	\	***+	\	*-	ns	*+	ns	ns
68	np	***+	**+	***-	***+	***+	\	\	\	\	ns	\	\	ns
89		\	ns	ns	ns	ns	\	ns	ns	\	\	\	LN **+	\
83		\	ns	\	EXP *+	EXP *+	\	LIN ***+	\	\	ns	LN ***+	LN *+	LN **-
68		\	EXP **+	\	LIN ***+	LIN ***+	\	\	\	\	ns	\	\	ns
Segment 3														
89	np	ns	ns	**+	ns	ns	\	***-	ns	ns	\	*+	ns	ns
83	np	ns	ns	***+	ns	ns	\	**+	\	***-	ns	ns	ns	ns
68	np	***+	**+	ns	ns	ns	\	\	\	\	ns	\	\	ns
89		\	ns	EXP **+	ns	ns	\	\	ns	ns	\	\	LN **+	\
83		\	ns	\	ns	ns	\	OW ***	\	\	ns	ns	ns	\
68		\	EXP **+	\	\	\	\	\	\	\	ns	\	\	\
Segment 5														
89	np	*-	ns	**+	ns	ns	\	***-	ns	ns	\	ns	ns	ns
83	np	**-	ns	ns	ns	ns	\	***-	\	ns	\	ns	*+	ns
68	np	ns	ns	***-	ns	*+	\	***-	\	ns	ns	ns	\	**+
89		\	ns	EXP *+	ns	\	\	LN ***-	\	\	\	LN **+	LN ***+	\
83		\	ns	\	ns	\	\	LN ***-	\	\	\	LN **+	LN **+	\
68		\	EXP *+	\	\	\	\	\	\	\	\	\	\	\
Segment 6														
89	np	*-	ns	ns	ns	ns	\	ns	*-	ns	\	ns	ns	ns
83	np	ns	*-	ns	ns	ns	\	***+	\	**-	\	ns	ns	***-
68	np	\	ns	ns	\	\	\	\	\	\	\	\	\	\
89		\	ns	\	ns	ns	\	ns	\	\	\	\	LN **+	\
83		\	LIN ***-	\	ns	ns	\	\	\	\	\	ns	ns	\
68		\	\	ns	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR
Segment 7														
89	np	ns	ns	ns	*+	*+	\	ns	ns	ns	\	**+	**+	ns
83	np	ns	ns	**-	ns	*-	\	ns	\	ns	\	ns	ns	ns
68	np	***-	ns	ns	**-	***-	\	ns	\	ns	\	ns	ns	*-
89		\	ns	\	LIN ***+	\	\	\	\	\	\	\	LN ***+	\
83		\	ns	LIN ***-	ns	ns	\	POW **+	\	\	\	LN **+	\	\
68		\	ns	ns	EXP **-	LIN ***-	\	LN **+	\	ns	\	\	\	\
Segment 8														
89	np	ns	ns	ns	ns	ns	\	ns	ns	***-	\	ns	ns	*+
83	np	ns	ns	ns	ns	*+	\	***+	\	**-	\	ns	ns	ns
68	np	*-	ns	*-	ns	ns	\	***+	\	***-	\	*+	ns	ns
89		\	ns	LIN **-	EXP *+	EXP *+	\	ns	\	LIN ***-	\	\	ns	\
83		\	ns	\	ns	\	\	LN ***+	\	\	\	\	ns	\
68		\	ns	LIN *-	EXP *-	EXP **-	\	LN ***+	\	LN ***-	\	\	\	\
Segment 9														
89	np	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-
83	np	ns	ns	ns	ns	ns	\	\	\	\	\	\	\	\
68	np	ns	ns	ns	ns	ns	\	\	\	\	\	\	\	\
89		EXP *-	ns	ns	\	\	\	ns	ns	\	\	ns	LIN **+	LN **-
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 10														
89	np	ns	ns	***-	ns	ns	ns	ns	ns	**-	\	ns	*+	ns
83	np	ns	ns	***-	**-	**-	\	**+	\	***-	\	ns	*+	***-
68	np	***-	*+	***-	***-	***-	\	*+	\	***-	\	ns	ns	***-
89		\	ns	\	\	\	LN **-	ns	POW *+	POW ***	\	ns	LN ***+	\
83		\	ns	\	EXP **-	EXP **-	\	POW **+	\	LN ***-	\	\	\	\
68		\	LIN *+	\	LIN ***-	LIN ***-	\	LN **+	\	LN ***-	\	\	\	\
Segment 11														
89	np	*+	ns	**-	***+	***+	ns	***+	ns	***-	\	*-	ns	***-
83	np	***+	*+	*-	ns	ns	\	***+	\	***-	\	*-	ns	***-
68	np	ns	ns	***-	***-	***-	\	***+	\	***-	\	*-	ns	***-
89		\	ns	EXP **-	\	\	POW *-	LIN ***+	\	LN ***-	\	LN **-	LN ***+	LN ***-
83		\	EXP *+	\	LIN ***+	\	\	LN ***+	\	LN ***-	\	\	\	LN ***-
68		\	ns	\	LIN ***-	LIN ***-	\	LN ***+	\	LN ***-	\	\	\	LN ***-
Segment 12														
89	np	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns
83	np	ns	ns	\	ns	ns	\	\	\	\	\	ns	\	\
68	np	ns	ns	\	ns	ns	\	\	\	\	\	ns	\	\
89		EXP *-	ns	\	LIN *+	ns	\	ns	\	\	\	LN ***+	LN ***+	ns
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR
Segment 13														
89	np	***+	ns	ns	***+	***+	ns	*+	ns	***-	\	ns	*+	***-
83	np	***+	*+	ns	ns	**+	\	**+	\	ns	\	ns	*+	***-
68	np	ns	ns	ns	ns	ns	\	***+	\	**-	ns	*-	ns	***-
89		\	ns	ns	LIN ***+	LIN ***+	POW *-	POW **+	ns	LN ***-	\	ns	LN ***+	LN ***-
83		\	EXP **+	EXP **-	LIN **+	LIN ***+	\	LN ***+	\	LN ***-	\	\	\	LN ***-
68		\	LIN **+	\	EXP *-	EXP **-	\	LN ***+	\	LN ***-	ns	\	\	LN ***-
Segment 14														
89	np	ns	ns	ns	***+	***+	ns	ns	ns	***-	\	ns	ns	ns
83	np	ns	ns	ns	ns	ns	\	ns	\	ns	\	ns	ns	*-
68	np	***-	ns	ns	ns	ns	\	ns	\	ns	\	ns	ns	***-
89		\	ns	ns	LIN ***+	LIN ***+	LN ***-	LN ***+	\	LIN ***-	\	ns	ns	LN ***-
83		\	ns	ns	LIN **+	LIN ***+	\	ns	\	LN ***-	\	\	\	LN ***-
68		\	LIN *+	ns	LIN *+	LIN **+	\	ns	\	LN ***-	\	\	\	LN ***-
Segment 15														
89	np	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns
83	np	\	\	\	\	\	\	\	\	\	\	\	\	\
68	np	\	. \	\	\	\	\	\	\	\	\	\	\	\
89		\	\	ns	\	\	ns	\	\	ns	\	\	LN *+	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 16														
89	np	ns	ns	*-	**+	***+	ns	ns	ns	*-	\	*-	ns	ns
83	np	ns	ns	***-	ns	*+	\	ns	\	ns	\	*-	ns	**-
68	np	**-	ns	***-	ns	ns	\	ns	\	*-	\	*-	ns	**-
89		\	ns	\	LIN ***+	LIN ***+	LN *-	ns	\	\	\	\	LN ***+	ns
83		\	EXP **+	LIN ***-	LIN *+	LIN ***+	\	ns	\	LN ***-	\	\	\	LN ***-
68		\	LIN *+	LIN ***-	ns	ns	\	ns	\	LN ***-	\	\	\	LN ***-
Segment 17														
89	np	ns	ns	\	ns	ns	\	ns	ns	\	\	*+	ns	ns
83	np	ns	ns	\	ns	ns	\	ns	\	\	\	*+	ns	ns
68	np	***-	ns	***-	**+	***+	\	**-	\	ns	\	**+	ns	*+
89		LIN ***-	LIN ***+	\	\	\	\	ns	\	\	\	LN ***+	LN ***+	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		LIN ***-	LIN ***+	\	LIN ***+	LIN ***+	\	LN ***-	\	ns	\	LN ***+	\	\
Lemon Bay														
89	np	ns	ns	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns
89		\	LIN **+	LN **+	EXP **-	ns	ns	ns	ns	LN ***+	\	ns	\	\

Table 7. (Continued)

YEAR		CHLA_C	CHLA	CHLB	CHLC	PHEO_A	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N
Segment 1															
89	np	\	ns	***-	*-	ns	\	\	\	\	\	*-	*-	ns	ns
83	np	\	ns	***-	\	\	\	\	\	\	\	*-	*-	ns	\
68	np	\	**+	**-	\	\	\	\	\	\	\	**-	***-	*-	\
89		\	ns	\	\	POW *-	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 2															
89	np	\	ns	**-	**-	ns	\	\	\	\	\	ns	*-	*-	ns
83	np	\	**-	ns	\	\	\	\	\	\	\	**-	**-	**-	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
89		ns	POW *+	\	POW ***	ns	\	\	\	\	\	\	\	\	\
83		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 3															
89	np	\	**+	***-	**-	ns	\	\	\	\	\	**-	*-	**-	ns
83	np	\	ns	ns	\	\	\	\	\	\	\	*-	***-	ns	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
89		\	OW ***	\	LN ***-	LN *-	\	\	\	\	\	\	\	\	\
83		\	ns	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 5															
89	np	\	ns	**-	***-	ns	\	\	\	\	\	ns	**-	ns	ns
83	np	\	*-	ns	\	\	\	\	\	\	\	ns	***-	***+	\
68	np	\	ns	*+	\	\	\	\	\	\	\	ns	***-	***+	\
89		ns	ns	\	\	LN **-	\	\	\	\	\	\	\	\	\
83		\	POW *-	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 6															
89	np	\	ns	***-	***-	*-	\	\	\	\	\	**-	**-	ns	ns
83	np	\	***-	ns	\	\	\	\	\	\	\	ns	***-	ns	\
68	np	\	\	\	\	\	\	\	\	\	\	\	***-	\	\
89		\	ns	\	\	POW **-	\	\	\	\	\	\	\	\	\
83		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		CHLA_C	CHLA	CHLB	CHLC	PHEO_A	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N
Segment 7															
89	np	\	ns	***-	**-	*-	\	\	\	\	\	**-	*-	ns	ns
83	np	\	***-	ns	\	\	\	\	\	\	\	ns	ns	***+	\
68	np	*-	***-	ns	\	\	\	\	\	\	\	ns	ns	**+	\
89		ns	\	\	\	LN **-	ns	ns	\	\	\	\	\	\	\
83		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
68		LN **-	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
Segment 8															
89	np	\	ns	***-	***-	ns	\	\	\	\	\	***-	***-	ns	ns
83	np	\	***-	ns	\	\	\	\	\	\	\	***-	***-	ns	\
68	np	ns	***-	ns	\	\	\	\	\	\	\	**-	***-	ns	\
89		ns	ns	\	\	ns	ns	ns	ns	\	\	\	\	\	\
83		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
68		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\	\
Segment 9															
89	np	**+	ns	*+	\	\	ns	ns	ns	ns	ns	*-	**+	***-	\
83	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
89		LN **+	ns	LN **+	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 10															
89	np	***+	ns	ns	\	ns	*-	ns	***-	ns	ns	ns	**-	ns	\
83	np	*+	ns	ns	\	\	\	\	\	\	\	**+	ns	*+	\
68	np	ns	ns	ns	\	\	\	\	\	\	\	**+	ns	*+	\
89		LN ***+	\	\	EXP *+	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 11															
89	np	***+	ns	ns	\	ns	***-	ns	***-	ns	ns	***-	***-	*-	\
83	np	ns	ns	ns	\	\	\	\	\	\	\	ns	***-	*+	\
68	np	ns	ns	*-	\	\	\	\	\	\	\	**-	***-	ns	\
89		LN ***+	\	\	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		LN ***-	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 12															
89	np	\	ns	ns	\	\	\	\	\	\	\	ns	ns	*-	\
83	np	\	\	\	\	\	\	\	\	\	\	ns	ns	*-	\
68	np	\	\	\	\	\	\	\	\	\	\	ns	ns	ns	\
89		\	LN *+	LN *+	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		ns	\	\	\	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		CHLA_C	CHLA	CHLB	CHLC	PHEO_A	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N
Segment 13															
89	np	***+	ns	ns	\	ns	ns	ns	ns	ns	ns	ns	***-	ns	\
83	np	***+	ns	ns	\	\	\	\	\	\	\	*+	***-	***+	\
68	np	*+	ns	**+	\	\	\	\	\	\	\	ns	***-	***+	\
89		LN ***+	ns	LN ***+	\	ns	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 14															
89	np	***+	ns	ns	\	ns	ns	ns	*-	ns	*+	ns	***-	ns	\
83	np	***+	ns	ns	\	\	\	\	\	\	\	***+	***-	***+	\
68	np	**+	ns	ns	\	\	\	\	\	\	\	***+	***-	***+	\
89		LN ***+	ns	LN ***+	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 15															
89	np	\	ns	ns	\	\	\	\	\	\	\	ns	ns	ns	\
83	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\	\
89		ns	ns	POW **+	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 16															
89	np	***+	ns	ns	\	ns	**-	ns	***-	ns	ns	***-	ns	***-	\
83	np	\	\	\	\	\	\	\	\	\	\	***-	***-	ns	\
68	np	\	\	\	\	\	\	\	\	\	\	**-	***-	ns	\
89		LN ***+	ns	LN ***+	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 17															
89	np	ns	ns	**-	ns	ns	ns	ns	ns	ns	\	ns	ns	*-	\
83	np	ns	\	**-	\	\	\	\	\	\	\	ns	ns	*-	\
68	np	ns	\	ns	\	\	\	\	\	\	\	ns	ns	***+	\
89		\	ns	\	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\	\
Lemon Bay															
89	np	***+	\	\	\	ns	ns	ns	***-	ns	ns	\	ns	ns	\
89		LN ***+	\	\	\	ns	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MN	FE	CU	PB	ZN
Segment 1														
89	np	***+	***+	ns	\	*-	ns	*-	*-	\	\	\	\	\
83	np	***+	***+	ns	\	ns	ns	*-	*-	\	\	\	\	\
68	np	*+	ns	ns	\	***-	ns	***-	ns	\	\	\	\	\
89		\	\	\	\	\	\	LN ***-	LN ***-	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	LIN **-	ns	\
Segment 2														
89	np	*+	**+	ns	\	ns	ns	**-	ns	\	\	\	\	\
83	np	**-	**-	***-	\	**-	***-	\	***-	\	\	\	\	\
68	np	\	\	\	\	***-	\	\	\	\	\	\	\	\
89		ns	\	\	\	\	\	LN ***-	LN ***-	\	\	\	\	\
83		\	EXP ***-	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 3														
89	np	*+	*+	*-	\	**-	***-	ns	ns	\	\	\	\	\
83	np	ns	ns	**-	\	ns	***-	\	***-	\	\	\	\	\
68	np	\	\	\	\	***-	\	\	\	\	\	\	\	\
89		\	\	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	LN ***-	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 5														
89	np	**+	**+	ns	\	**-	ns	**-	**-	\	\	\	\	\
83	np	ns	ns	ns	\	**-	ns	\	***-	\	\	\	\	\
68	np	ns	ns	ns	\	**-	ns	\	***-	\	\	\	\	\
89		OW ***	LN ***+	ns	\	\	\	LN ***-	LN ***-	\	\	\	\	\
83		ns	ns	ns	\	\	\	\	LN ***-	\	\	\	\	\
68		\	POW *-	\	\	\	\	\	\	\	\	ns	\	ns
Segment 6														
89	np	ns	*+	*-	\	***-	**-	*-	*-	\	\	\	\	\
83	np	***-	***-	***-	\	\	***-	\	***-	\	\	\	\	\
68	np	***-	***-	\	\	\	\	\	\	\	\	\	\	\
89		ns	\	LIN *-	ns	\	\	LIN ***-	LIN ***-	ns	ns	\	\	\
83		LN ***-	EXP ***-	LN ***-	\	\	\	\	\	\	\	\	\	\
68		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MN	FE	CU	PB	ZN
Segment 7														
89	np	*-	*-	**-	ns	ns	***-	**-	**-	\	\	\	\	\
83	np	***-	***-	***-	ns	ns	***-	\	***-	\	\	\	\	\
68	np	***-	***-	***-	ns	*-	**-	\	***-	\	\	\	\	\
89		\	\	\	\	\	\	LN ***-	LN ***-	ns	ns	\	\	\
83		LN ***-	LIN ***-	LIN ***-	\	\	\	\	LN ***-	\	\	\	\	\
68		\	\	LN ***-	\	\	\	\	\	\	\	\	\	\
Segment 8														
89	np	ns	ns	*-	ns	ns	***-	**-	**-	\	\	\	\	\
83	np	***-	***-	***-	ns	ns	***-	\	***-	\	\	\	\	\
68	np	***-	***-	***-	ns	*-	***-	\	***-	\	\	\	\	\
89		ns	ns	EXP **-	\	\	\	LIN ***-	LIN ***-	ns	ns	\	\	\
83		LIN ***-	LIN ***-	LIN ***-	\	\	\	\	LN ***-	\	\	\	\	\
68		\	\	LN ***-	\	\	\	\	\	\	\	\	\	\
Segment 9														
89	np	ns	*+	ns	***+	ns	ns	**-	**-	\	\	\	\	\
83	np	\	\	\	\	\	\	\	\	\	\	\	\	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\
89		ns	ns	ns	\	\	\	LN **-	LN **-	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 10														
89	np	***-	ns	***-	**-	ns	**-	**-	**-	\	\	\	\	\
83	np	***-	*-	***-	***-	ns	***-	\	**-	\	\	\	\	\
68	np	***-	ns	***-	***-	ns	**-	\	***-	\	\	\	\	\
89		\	ns	\	\	\	\	LIN ***-	LIN ***-	ns	ns	\	\	\
83		LN ***-	POW **-	LN ***-	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 11														
89	np	***-	***-	***-	***-	ns	***-	**-	**-	\	\	\	\	\
83	np	***-	***-	***-	***-	ns	***-	\	**-	\	\	\	\	\
68	np	***-	***-	***-	***-	***-	***-	\	***-	\	\	\	\	\
89		\	\	\	\	\	\	LN ***-	LN ***-	\	\	\	\	\
83		\	LN ***-	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 12														
89	np	ns	ns	ns	\	ns	ns	**-	**-	\	\	\	\	\
83	np	ns	ns	ns	\	ns	ns	\	**-	\	\	\	\	\
68	np	ns	ns	ns	\	ns	ns	\	***-	\	\	\	\	\
89		ns	ns	LN *-	\	\	\	LIN ***-	LIN ***-	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\

Table 7. (Continued)

YEAR		TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MN	FE	CU	PB	ZN
Segment 13														
89	np	***-	***-	***-	***-	ns	***-	ns	ns	\	\	\	\	\
83	np	***-	***-	***-	***-	ns	***-	\	ns	\	\	\	\	\
68	np	***-	***-	***-	***-	ns	***-	\	*-	\	\	\	\	\
89		LN ***-	LN ***-	\	\	\	\	\	\	\	\	\	\	\
83		LN ***-	LN ***-	\	\	\	\	\	\	\	\	\	\	\
68		LN ***-	LN ***-	\	\	\	\	\	\	\	\	\	\	\
Segment 14														
89	np	***-	***-	***-	**-	ns	***-	ns	ns	\	\	\	\	\
83	np	***-	***-	***-	***-	ns	***-	\	ns	\	\	\	\	\
68	np	***-	**-	***-	***-	ns	***-	\	ns	\	\	\	\	\
89		\	\	\	\	\	\	ns	ns	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 15														
89	np	ns	ns	ns	\	ns	ns	ns	ns	\	\	\	\	\
83	np	\	\	\	\	\	\	\	\	\	\	\	\	\
68	np	\	\	\	\	\	\	\	\	\	\	\	\	\
89		\	\	\	ns	\	\	EXP **-	EXP **-	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 16														
89	np	**-	ns	***-	ns	ns	*-	**-	**-	\	\	\	\	\
83	np	***-	ns	***-	***-	ns	***-	\	\	\	\	\	\	\
68	np	***-	*-	***-	***-	ns	***-	\	\	\	\	\	\	\
89		LN ***-	ns	LN ***-	\	\	\	LIN ***-	LN ***-	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 17														
89	np	ns	ns	ns	*-	ns	***-	ns	ns	ns	ns	\	\	\
83	np	ns	ns	ns	\	ns	***-	\	ns	\	\	\	\	\
68	np	***+	ns	***+	\	*+	***+	\	***-	\	\	\	\	\
89		\	\	\	\	\	\	\	\	\	\	\	\	\
83		\	\	\	\	\	\	\	\	\	\	\	\	\
68		\	\	\	\	\	\	\	\	\	\	\	\	\
Lemon Bay														
89	np	ns	**+	ns	ns	\	*+	\	\	\	\	\	\	\
89		ns	EXP ***+	ns	\	\	POW *+	\	\	\	\	\	\	\

Except for these few instances, the consistency of trends indicated that trends detected in one time period were typically either continuations of existing patterns or that trends exhibited during a single period were definitive enough to significantly affect the computed regression in all time periods. Notable exceptions were for dissolved oxygen in Segments 7, 8, 11, and 13 and percent saturation of dissolved oxygen in Segments 1, 7, 8, 11, and 13. In these segments, more recent dissolved oxygen data (1989 to present) are significantly increasing while the period since 1968 has had a significant overall decrease in dissolved oxygen (**Figure 7**).

Some unusual results noted were that for many areas (Segments 2, 3, 7, 8, 10, 14, 16), trends in salinity in ppt (as contained in STORET data) conflicted with trends in salinity in PSU (Practical Salinity Units; calculated from conductance values). Evaluating salinity (PSU) against salinity (ppt) indicate that agreement between the two quantities is best for data after 1984, while the poorest agreement is in pre-1984 data. During this time period, salinity data (ppt) are limited to the upper region of the study area (Segments 1, 2, and 3). The relationship of salinity (ppt) to conductance clearly differs between the two time periods (**Figure 8**) indicating differing measuring techniques. Differences between reported salinity (ppt) and calculated salinity (PSU) increase steadily and approach 15 ppt or PSU during the late 1970's. Depressed conductance values between the early and late 1970's were supported by increased color values but were not mirrored by similar depressions in salinity (ppt). Methods of salinity determination (calculation from chloride, conductance, or specific gravity) may well have differed between time periods, and instrumental readings of salinity (ppt) may also have had varying accuracy and sensitivity at lowered salinity values. Conductance methods (from which PSU are calculated), however, should represent a more coherent data set. Accordingly, discussions of salinity trends will be limited to the analysis of salinity (PSU).

Residuals Analyses

Sufficient data existed to perform LOWESS procedures on 5,265 of the 7380 potential segment-parameter-independent variable combinations. Residuals from the resultant LOWESS smoothing against original data were then examined non-parametrically for trends with time. Of the 6,800 potential evaluations, sufficient data were present for 4,671. Of these, 1039 were very highly significant, 189 increasing and 850 decreasing. A total of 1,963 relationships displayed significant ($p<=0.05$) trends. For visualization, graphics of significant results depict a linear fit through residuals as a function of time, but significance was determined by the non-parametric Kendall's tau coefficient of rank correlation.

Table 8 summarizes the significance of Kendall's tau of the LOWESS residuals against time. In addition to level of significance, the direction of the slope of the parameter with respect to time is indicated. In viewing the results, one should consider not only the significance of each trend, but also the number of independent variables with similar trends for that parameter. Where one parameter is increasing with respect to time against a number of independent variables, trends in other parameters were examined for intelligible patterns. Mixed trends against time (both positive and negative slopes for the same parameter against differing independent variables) imply that at least one of the independent variables does not reliably covary with the parameter. Additionally, where there are strong temporal trends in raw data, and little effect of independent variables on parameter values, LOWESS smoothing and residuals analysis may not appreciably reduce sample variation, and yet trends will still be evident due to the overriding trend present in the original data.

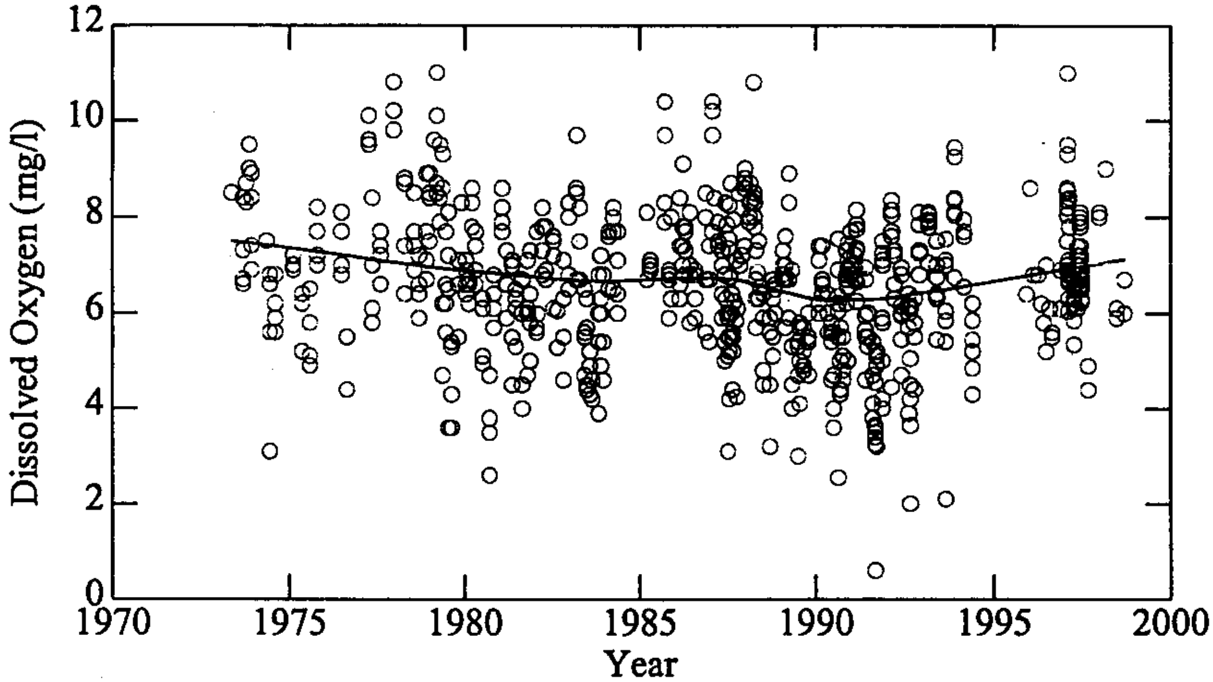

Figure 7. Non-monotonic trends in dissolved oxygen in Segment 7, 1968 through 1998.

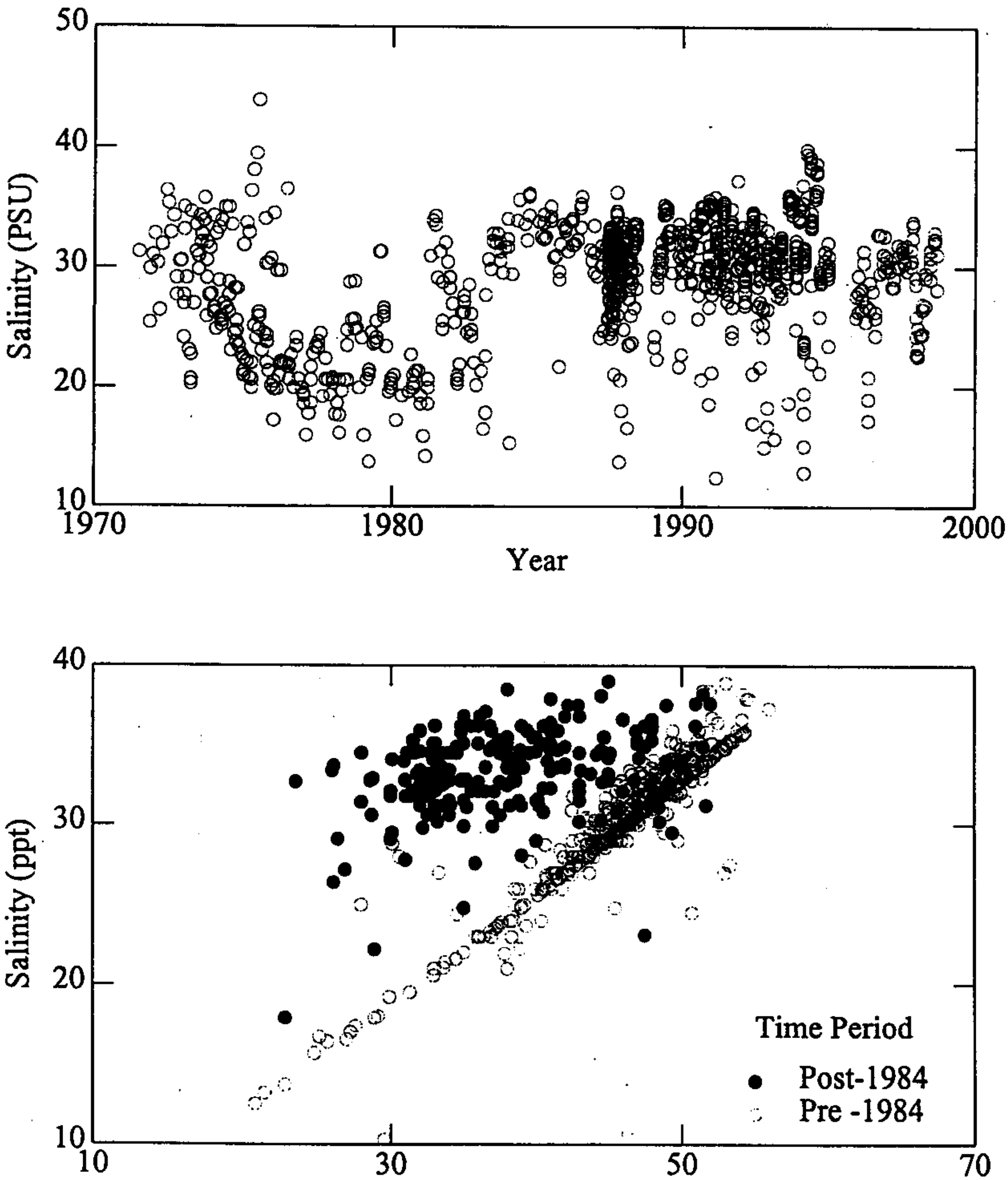

Figure 8. Non-monotonic tends in salinity in Segments 1, 2, and 3 and temporal variation in salinity:conductivity ratios.

Table 8. Results of trend analysis on residuals from a LOWESS smooth of parameter against forcing function. Forcing functions used were salinity (SAL_PSU), cumulative antecedent rainfall for 3, 7, 14, 30, 60, and 90 days, temperature (TEMP), season (YEARFRAC) , and ph (PH). Direction of slope indicated by '-' and '+'. Significance indicated by '***' ($p<0.001$), '**' ($p<0.01$), and '*' ($p<0.05$). Insufficient data indicated by '\'.

	SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR	HLA_C	CHLA	CHLB	CHLC	PHEO_A
Segment 1																		
SAL_PSU	\	ns	***-	ns	*+	\	ns	ns	ns	*+	**+	ns	ns	\	*+	*-	ns	ns
RAIN3	ns	ns	***-	**+	**+	\	**-	ns	ns	ns	**+	ns	ns	\	**+	ns	*-	ns
RAIN7	ns	ns	***-	*+	**+	\	ns	ns	ns	ns	***+	ns	*+	\	**+	*-	**-	ns
RAIN14	ns	ns	***-	*+	**+	\	*-	ns	ns	ns	**+	ns	ns	\	*+	ns	*-	ns
RAIN30	ns	ns	***-	*+	**+	\	ns	ns	ns	ns	*+	ns	ns	\	*+	**-	*-	ns
RAIN60	ns	ns	***-	*+	**+	\	ns	ns	ns	ns	**+	ns	*+	\	ns	**-	ns	*-
RAIN90	ns	ns	***-	*+	**+	\	ns	ns	ns	ns	***+	ns	ns	\	ns	*-	**-	*-
TEMP	ns	\	***-	***+	***+	\	ns	ns	ns	ns	**+	ns	*+	\	*+	*-	*-	*-
YEARFRA	ns	***+	***-	*+	**+	\	ns	ns	ns	ns	***+	ns	ns	\	**+	*-	ns	ns
PH	ns	ns	\	ns	ns	\	ns	ns	ns	ns	ns	ns	ns	\	*+	*-	ns	ns
Segment 2																		
SAL_PSU	\	ns	***-	***+	***+	\	**+	ns	*-	ns	*+	ns	ns	\	**-	ns	*-	ns
RAIN3	***+	**+	***-	***+	***+	\	***+	ns	*-	ns	**+	ns	ns	\	**-	ns	ns	ns
RAIN7	***+	*+	***-	***+	***+	\	***+	ns	**-	ns	*+	ns	ns	\	**-	ns	**-	ns
RAIN14	***+	*+	***-	***+	***+	\	**+	ns	ns	ns	*+	ns	ns	\	**-	ns	*-	ns
RAIN30	***+	*+	***-	***+	***+	\	***+	ns	*-	ns	*+	ns	ns	\	***-	ns	ns	ns
RAIN60	***+	*+	***-	***+	***+	\	***+	ns	ns	ns	*+	ns	ns	\	***-	ns	ns	ns
RAIN90	***+	**+	***-	***+	***+	\	**+	ns	*-	ns	**+	ns	ns	\	***-	ns	*-	ns
TEMP	***+	\	***-	***+	***+	\	***+	ns	ns	ns	**+	ns	ns	\	***-	ns	ns	ns
YEARFRA	***+	***+	***-	***+	***+	\	***+	ns	*-	ns	**+	ns	ns	\	***-	ns	*-	ns
PH	***+	ns	\	***+	***+	\	**+	ns	ns	*-	*+	ns	ns	\	ns	ns	**-	**-
Segment 3																		
SAL_PSU	\	ns	**-	ns	ns	\	**+	ns	**-	ns	ns	ns	ns	\	ns	ns	*-	ns
RAIN3	***+	*+	ns	ns	ns	\	*+	ns	***-	ns	ns	ns	ns	\	ns	ns	ns	ns
RAIN7	***+	**+	ns	ns	ns	\	**+	ns.	***-	ns	ns	ns	ns	\	ns	ns	**-	*-
RAIN14	***+	*+	ns	ns	ns	\	*+	ns	**-	ns	ns	ns	ns	\	ns	ns	***-	*-
RAIN30	***+	*+	ns	ns	ns	\	**+	ns	***-	ns	ns	ns	ns	\	ns	ns	*-	ns
RAIN60	***+	*+	ns	ns	ns	\	**+	ns	***-	ns	ns	ns	ns	\	*-	ns	*-	ns
RAIN90	***+	*+	ns	ns	ns	\	*+	ns	**-	ns	ns	ns	ns	\	*-	ns	**-	ns
TEMP	***+	\	ns	ns	ns	\	*+	ns	ns	ns	ns	ns	ns	\	ns	ns	***-	ns
YEARFRA	***+	***+	ns	ns	ns	\	*+	ns	**-	ns	ns	*+	ns	\	ns	ns	**-	ns
PH	***+	ns	\	ns	ns	\	ns	*+	*-	ns	ns	ns	ns	\	ns	ns	*-	ns
Segment 5																		
SAL_PSU	\	ns	ns	ns	ns	\	***-	ns	ns	ns	ns	ns	ns	\	ns	ns	*-	ns
RAIN3	ns	ns	***-	ns	ns	\	***-	ns	ns	ns	ns	**+	**+	\	ns	ns	**-	ns
RAIN7	ns	ns	***-	ns	*+	\	**-	ns	ns	ns	ns	*+	**+	\	ns	ns	***-	ns
RAIN14	ns	ns	***-	ns	*+	\	**-	ns	ns	ns	ns	*+	*+	\	ns	ns	***-	ns
RAIN30	ns	ns	***-	ns	*+	\	***-	ns	ns	ns	ns	*+	**+	\	ns	ns	ns	ns
RAIN60	ns	ns	***-	ns	*+	\	**-	ns	ns	ns	ns	*+	*+	\	ns	ns	ns	ns
RAIN90	ns	ns	***-	ns	*+	\	***-	ns	ns	ns	ns	ns	*+	\	ns	ns	**-	*-
TEMP	ns	\	***-	ns	ns	\	***-	ns	ns	ns	ns	*+	**+	\	ns	ns	***-	*-
YEARFRA	ns	**+	***-	ns	ns	\	***-	ns	ns	ns	ns	**+	*+	\	ns	ns	***-	*-
PH	ns	ns	\	ns	ns	\	***-	ns	ns	ns	ns	*+	**+	\	ns	ns	*-	ns

Table 8. (Continued)

	SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR	HLA_C	CHLA	CHLB	CHLC	PHEO_A
Segment 6																		
SAL_PSU	\	*-	ns	ns	ns	\	***+	*-	**-	\	ns	ns	***-	\	***-	ns	**-	ns
RAIN3	ns	ns	ns	ns	ns	\	***+	**-	**-	\	ns	ns	***-	\	***-	ns	**-	ns
RAIN7	ns	ns	ns	ns	ns	\	***+	*-	**-	\	ns	ns	***-	\	***-	ns	ns	ns
RAIN14	ns	ns	ns	ns	ns	\	***+	*-	**-	\	ns	ns	***-	\	***-	ns	**-	ns
RAIN30	ns	ns	ns	ns	ns	\	***+	**-	***-	\	ns	ns	***-	\	***-	ns	*-	ns
RAIN60	ns	ns	ns	ns	ns	\	***+	**-	***-	\	ns	ns	***-	\	***-	ns	**-	ns
RAIN90	ns	ns	ns	ns	ns	\	***+	*-	**-	\	ns	ns	***-	\	***-	ns	*-	*-
TEMP	ns	\	ns	ns	ns	\	***+	*-	*-	\	*+	ns	***-	\	***-	ns	***-	ns
YEARFRA	ns	ns	ns	ns	ns	\	***+	*-	**-	\	ns	ns	***-	\	***-	ns	***-	**-
PH	ns	ns	\	ns	ns	\	***+	ns	**-	\	ns	ns	***-	\	***-	ns	***-	ns
Segment 7																		
SAL_PSU	\	ns	ns	**-	***-	\	*+	ns	ns	\	ns	ns	*-	ns	***-	ns	*-	ns
RAIN3	***-	ns	ns	**-	***-	\	ns	ns	ns	\	*+	ns	ns	*-	***-	ns	*-	ns
RAIN7	***-	ns	ns	**-	***-	\	*+	ns	ns	\	ns	ns	ns	*-	***-	*-	**-	ns
RAIN14	***-	ns	ns	*-	***-	\	ns	ns	ns	\	ns	ns	ns	ns	***-	ns	ns	ns
RAIN30	**-	ns	ns	**-	***-	\	ns	ns	ns	\	*+	ns	*-	*-	***-	ns	*-	ns
RAIN60	**-	ns	ns	**-	***-	\	*+	ns	ns	\	*+	ns	*-	ns	***-	ns	*-	ns
RAIN90	***-	ns	ns	***-	***-	\	ns	ns	ns	\	*+	ns	ns	*-	***-	ns	*-	ns
TEMP	***-	\	ns	***-	***-	\	*+	*-	ns	\	ns	ns	ns	ns	***-	ns	**-	*-
YEARFRA	***-	ns	ns	**-	***-	\	*+	ns	ns	\	*+	ns	**-	*-	***-	ns	***-	*-
PH	**-	ns	\	*-	***-	\	ns	ns	ns	\	ns	ns	*-	\	*-	ns	*-	*-
Segment 8																		
SAL_PSU	\	ns	ns	ns	ns	\	***+	ns	***-	\	ns	ns	ns	ns	***-	ns	***-	ns
RAIN3	**-	ns	*-	ns	ns	\	***+	ns	***-	\	*+	ns	ns	*-	***-	ns	ns	ns
RAIN7	*-	ns	*-	ns	ns	\	***+	ns	***-	\	*+	ns	ns	ns	***-	ns	ns	ns
RAIN14	**-	ns	*-	ns	ns	\	***+	ns	***-	\	*+	ns	ns	ns	***-	ns	**-	ns
RAIN30	*-	ns	*-	ns	ns	\	***+	ns	***-	\	ns	ns	ns	ns	***-	ns	**-	ns
RAIN60	*-	ns	*-	ns	ns	\	***+	ns	***-	\	*+	ns	ns	ns	***-	ns	*-	ns
RAIN90	*-	ns	*-	ns	ns	\	***+	ns	***-	\	**+	ns	ns	*-	***-	ns	**-	ns
TEMP	*-	\	**-	ns	ns	\	***+	ns	***-	\	*+	*+	ns	ns	***-	ns	**-	ns
YEARFRA	**-	*+	*-	ns	ns	\	***+	ns	***-	\	**+	*+	*-	*-	***-	ns	***-	*-
PH	**-	ns	\	ns	ns	\	**+	ns	***-	\	ns	ns	*-	\	***-	ns	ns	ns
Segment 9																		
SAL_PSU	\	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	ns	***-	***+	ns	ns	\	\
RAIN3	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-	**+	ns	*+	\	\
RAIN7	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	**-	ns	ns	ns	\	\
RAIN14	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	**+	**-	*+	ns	*+	\	\
RAIN30	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-	*+	*+	*+	\	\
RAIN60	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-	*+	ns	*+	\	\
RAIN90	*-	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	**+	***-	**+	*+	*+	\	\
TEMP	ns	\	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-	*+	ns	*+	\	\
YEARFRA	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	*+	***-	**+	*+	**+	\	\
PH	ns	ns	\	ns	ns	ns	ns	ns	ns	\	ns	\	ns	*+	\	\	\	\

Table 8. (Continued)

	SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR	HLA_C	CHLA	CHLB	CHLC	PHEO_A
Segment 10																		
SAL_PSU	\	***+	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	**+	ns	ns	\	ns
RAIN3	***-	*+	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
RAIN7	***-	*+	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
RAIN14	***-	ns	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	**+	ns	\	ns
RAIN30	***-	ns	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
RAIN60	***-	ns	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
RAIN90	***-	ns	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
TEMP	***-	\	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
YEARFRA	***-	***+	***-	***-	***-	ns	*+	ns	***-	\	ns	ns	***-	ns	ns	ns	\	ns
PH	***-	ns	\	***-	***-	ns	ns	ns	***-	\	ns	\	*-	**+	\	*-	\	ns
Segment 11																		
SAL_PSU	\	**+	ns	***-	***-	ns	***+	*-	**-	\	*-	ns	***-	*+	ns	ns	\	ns
RAIN3	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	ns	ns	ns	\	ns
RAIN7	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	ns	ns	ns	\	ns
RAIN14	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	ns	ns	*-	\	ns
RAIN30	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	ns	ns	ns	\	ns
RAIN60	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	ns	*+	ns	\	ns
RAIN90	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	*-	ns	ns	\	ns
TEMP	ns	\	***-	***-	***-	ns	***+	ns	***-	\	**-	ns	***-	ns	ns	**-	\	ns
YEARFRA	ns	ns	***-	***-	***-	ns	***+	ns	***-	\	*-	ns	***-	*-	ns	ns	\	ns
PH	ns	ns	\	***-	***-	ns	***+	ns	***-	\	*-	\	***-	ns	\	***-	\	ns
Segment 12																		
SAL_PSU	\	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN3	ns	ns	\	**+	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN7	ns	ns	\	ns	*+	\	ns	ns	\	\	**+	ns	ns	\	ns	ns	\	\
RAIN14	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN30	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN60	*+	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN90	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	*+	*+	\	ns	ns	\	\
TEMP	ns	\	\	ns	ns	\	ns	ns	\	\	*+	ns	ns	\	ns	ns	\	\
YEARFRA	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
PH	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 13																		
SAL_PSU	\	*+	ns	ns	ns	ns	*+	ns	ns	ns	ns	ns	ns	**+	ns	ns	\	ns
RAIN3	ns	ns	ns	ns	ns	ns	***+	ns	**-	ns	**-	ns	***-	ns	ns	*+	\	ns
RAIN7	ns	ns	ns	ns	ns	ns	**+	ns	**-	ns	ns	ns	***-	*+	ns	**+	\	ns
RAIN14	ns	ns	ns	ns	ns	ns	***+	ns	**-	ns	ns	ns	***-	*+	ns	**+	\	ns
RAIN30	ns	ns	ns	ns	ns	ns	***+	ns	**-	ns	ns	ns	***-	ns	ns	***+	\	ns
RAIN60	ns	ns	ns	ns	ns	ns	***+	ns	**-	ns	**-	ns	***-	ns	ns	**+	\	ns
RAIN90	ns	ns	ns	ns	ns	ns	***+	ns	*-	ns	*-	ns	***-	ns	ns	**+	\	ns
TEMP	ns	\	ns	ns	ns	ns	***+	ns	***-	ns	*-	ns	***-	ns	ns	*+	\	ns
YEARFRA	ns	***+	ns	ns	ns	ns	***+	ns	***-	ns	*-	ns	***-	ns	ns	ns	\	ns
PH	ns	ns	\	ns	ns	ns	***+	ns	ns	ns	**-	\	***-	*+	\	ns	\	ns

Table 8. (Continued)

	SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR	HLA_C	CHLA	CHLB	CHLC	PHEO_A
Segment 14																		
SAL_PSU	\	*+	ns	ns	ns	*-	ns	ns	ns	\	*-	ns	***-	***+	ns	ns	\	ns
RAIN3	***-	ns	ns	ns	ns	ns	ns	*-	ns	\	*-	ns	***-	ns	ns	ns	\	ns
RAIN7	***-	ns	ns	ns	ns	ns	*-	ns	ns	\	ns	*+	***-	***+	ns	ns	\	ns
RAIN14	***-	ns	ns	ns	ns	ns	*-	*-	ns	\	ns	ns	***-	**+	ns	ns	\	ns
RAIN30	***-	ns	ns	ns	ns	ns	ns	*-	ns	\	ns	ns	***-	**+	ns	ns	\	ns
RAIN60	***-	ns	ns	ns	ns	*-	*-	ns	ns	\	ns	*+	***-	**+	ns	ns	\	ns
RAIN90	***-	ns	ns	ns	ns	*-	ns	ns	ns	\	ns	ns	***-	**+	ns	ns	\	ns
TEMP	***-	\	ns	ns	ns	ns	ns	ns	ns	\	*-	ns	***-	ns	ns	ns	\	ns
YEARFRA	***-	**+	ns	ns	ns	ns	ns	*-	ns	\	*-	ns	***-	**+	ns	ns	\	ns
PH	***-	ns	\	ns	ns	ns	ns	ns	ns	\	*-	\	***-	**+	\	\	\	ns
Segment 15																		
SAL_PSU	\	ns	\	ns	ns	\	ns	ns	\	\	ns	*+	*-	\	ns	ns	\	\
RAIN3	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN7	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN14	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN30	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	*+	ns	\	ns	ns	\	\
RAIN60	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
RAIN90	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	ns	ns	\	ns	ns	\	\
TEMP	ns	\	\	ns	ns	\	ns	*+	\	\	ns	*+	ns	\	ns	ns	\	\
YEARFRA	ns	ns	\	ns	ns	\	ns	ns	\	\	ns	**+	ns	\	*+	ns	\	\
PH	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 16																		
SAL_PSU	\	*+	***-	ns	ns	ns	ns	ns	ns	\	ns	ns	*-	***+	ns	**+	\	ns
RAIN3	**-	ns	***-	ns	ns	ns	ns	ns	*-	\	*-	ns	*-	***+	ns	ns	\	ns
RAIN7	***-	ns	***-	ns	ns	ns	ns	ns	*-	\	ns	ns	**-	***+	ns	ns	\	ns
RAIN14	**-	ns	***-	ns	ns	ns	ns	ns	*-	\	ns	ns	***-	**+	ns	ns	\	ns
RAIN30	*-	ns	***-	ns	ns	ns	ns	ns	ns	\	ns	ns	***-	**+	ns	ns	\	ns
RAIN60	*-	ns	***-	ns	ns	ns	ns	ns	ns	\	ns	ns	***-	***+	ns	ns	\	ns
RAIN90	*-	ns	***-	ns	ns	ns	ns	ns	*-	\	ns	ns	***-	***+	ns	ns	\	ns
TEMP	**-	\	***-	ns	ns	ns	ns	ns	ns	\	*-	ns	***-	**+	ns	**+	\	ns
YEARFRA	**-	**+	***-	ns	ns	ns	ns	ns	*-	\	*-	ns	***-	***+	ns	**+	\	ns
PH	ns	ns	\	ns	ns	ns	ns	ns	ns	\	*-	\	**-	***+	\	\	\	ns
Segment 17																		
SAL_PSU	\	ns	**-	ns	*+	\	*-	ns	ns	\	ns	ns	ns	ns	ns	ns	ns	ns
RAIN3	***-	ns	***-	**+	*+	\	**-	ns	ns	\	**+	*+	*+	ns	*-	ns	ns	ns
RAIN7	***-	ns	***-	**+	**+	\	**-	ns	ns	\	*+	ns	ns	ns	*-	*-	ns	ns
RAIN14	***-	ns	***-	**+	**+	\	*-	ns	ns	\	**+	ns	*+	ns	*-	*-	ns	ns
RAIN30	***-	ns	**-	**+	**+	\	**-	ns	ns	\	*+	ns	ns	ns	ns	ns	ns	ns
RAIN60	***-	*+	**-	**+	**+	\	*-	ns	ns	\	ns	ns	ns	ns	ns	ns	ns	ns
RAIN90	***-	ns	*-	**+	**+	\	**-	ns	ns	\	*+	ns	ns	ns	ns	ns	ns	*-
TEMP	***-	\	***-	***+	**+	\	**-	ns	ns	\	**+	*+	ns	ns	ns	ns	ns	ns
YEARFRA	***-	**+	**-	**+	*+	\	**-	ns	ns	\	*+	ns	*+	ns	ns	ns	ns	*-
PH	*-	ns	\	ns	ns	\	ns	\	ns	\	ns	ns	\	ns	\	ns	\	\

Table 8. (Continued)

	SAL_PS	TEMP	PH	DO	PERSAT	BOD5	SECCHI	ATTN	TURB	JTU	TSS	VSS	COLOR	HLA_C	CHLA	CHLB	CHLC	PHEO_A
Lemon Bay																		
SAL_PSU	\	ns	ns	ns	ns	ns	ns	ns	**+	\	ns	\	ns	***+	\	\	\	ns
RAIN3	ns	ns	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns	***+	\	\	\	ns
RAIN7	ns	ns	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns	***+	\	\	\	ns
RAIN14	ns	ns	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns	**+	\	\	\	ns
RAIN30	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	\	ns	*+	\	\	\	ns
RAIN60	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	*-	\	ns	***+	\	\	\	ns
RAIN90	ns	ns	ns	ns	ns	ns	ns	ns	ns	\	ns	\	ns	**+	\	\	\	ns
TEMP	ns	\	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns	***+	\	\	\	ns
YEARFRA	ns	ns	ns	ns	ns	ns	ns	ns	*+	\	ns	\	ns	***+	\	\	\	ns
PH	ns	ns	\	ns	ns	ns	ns	ns	*+	\	*-	\	ns	***+	\	\	\	ns

Table 8. (Continued)

	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N	TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MNAA	FE
Segment 1																			
SAL_PSU	\	\	\	\	\	*-	***-	ns	ns	*+	ns	ns	\	*-	ns	***-	ns	\	\
RAIN3	\	\	\	\	\	***-	***-	**-	ns	**+	ns	ns	\	***-	ns	***-	ns	\	\
RAIN7	\	\	\	\	\	**-	***-	**-	ns	**+	ns	ns	\	***-	ns	***-	ns	\	\
RAIN14	\	\	\	\	\	**-	***-	ns	ns	*+	ns	ns	\	***-	ns	***-	ns	\	\
RAIN30	\	\	\	\	\	***-	***-	*-	ns	**+	ns	ns	\	***-	*-	**-	ns	\	\
RAIN60	\	\	\	\	\	***-	***-	**-	ns	**+	ns	ns	\	***-	*-	***-	ns	\	\
RAIN90	\	\	\	\	\	**-	***-	*-	ns	*+	ns	ns	\	***-	*-	***-	ns	\	\
TEMP	\	\	\	\	\	**-	***-	ns	ns	ns	ns	ns	\	***-	*-	***-	ns	\	\
YEARFRA	\	\	\	\	\	**-	***-	*-	ns	***+	ns	ns	\	***-	*-	***-	ns	\	\
PH	\	\	\	\	\	ns	***-	ns	ns	***+	ns	ns	\	***-	ns	ns	ns	\	\
Segment 2																			
SAL_PSU	\	\	\	\	\	*-	**-	ns	ns	**-	**-	***-	\	*-	***-	*-	***-	\	\
RAIN3	\	\	\	\	\	**-	***-	**-	ns	**-	**-	***-	\	***-	***-	*-	***-	\	\
RAIN7	\	\	\	\	\	**-	**-	**-	ns	**-	**-	***-	\	***-	***-	ns	***-	\	\
RAIN14	\	\	\	\	\	**-	***-	*-	ns	**-	*-	***-	\	***-	***-	*-	**-	\	\
RAIN30	\	\	\	\	\	**-	***-	**-	ns	***-	***-	***-	\	***-	***-	**-	***-	\	\
RAIN60	\	\	\	\	\	**-	***-	**-	ns	***-	**-	***-	\	***-	***-	ns	***-	\	\
RAIN90	\	\	\	\	\	**-	***-	**-	ns	**-	**-	***-	\	***-	**-	**-	**-	\	\
TEMP	\	\	\	\	\	**-	***-	**-	ns	**-	**-	***-	\	***-	***-	*-	**-	\	\
YEARFRA	\	\	\	\	\	**-	***-	**-	ns	**-	**-	***-	\	***-	***-	*-	**-	\	\
PH	\	\	\	\	\	ns	ns	ns	ns	*-	*-	**-	\	***-	ns	\	ns	\	\
Segment 3																			
SAL_PSU	\	\	\	\	\	**-	***-	*-	ns	ns	*-	***-	\	ns	***-	*-	***-	\	\
RAIN3	\	\	\	\	\	ns	***-	ns	ns	ns	ns	*-	\	***-	***-	ns	**-	\	\
RAIN7	\	\	\	\	\	ns	***-	ns	ns	ns	*-	**-	\	***-	***-	ns	***-	\	\
RAIN14	\	\	\	\	\	ns	***-	ns	ns	ns	ns	**-	\	***-	***-	ns	**-	\	\
RAIN30	\	\	\	\	\	*-	***-	ns	ns	ns	ns	***-	\	***-	***-	ns	***-	\	\
RAIN60	\	\	\	\	\	*-	**-	ns	ns	ns	ns	***-	\	***-	***-	ns	***-	\	\
RAIN90	\	\	\	\	\	*-	***-	ns	ns	ns	ns	*-	\	***-	***-	ns	***-	\	\
TEMP	\	\	\	\	\	*-	***-	ns	ns	ns	ns	**-	\	***-	***-	ns	***-	\	\
YEARFRA	\	\	\	\	\	**-	***-	ns	ns	ns	ns	*-	\	***-	***-	ns	*-	\	\
PH	\	\	\	\	\	*-	***-	ns	ns	ns	ns	**-	\	***-	***-	\	***-	\	\
Segment 5																			
SAL_PSU	\	\	\	\	\	ns	**-	**+	ns	ns	ns	ns	\	*-	ns	ns	***-	\	\
RAIN3	\	\	\	\	\	ns	**-	***+	ns	ns	ns	ns	\	*-	ns	ns	***-	\	\
RAIN7	\	\	\	\	\	ns	**-	***+	ns	ns	*-	**-	\	*-	*-	ns	***-	\	\
RAIN14	\	\	\	\	\	ns	**-	***+	ns	ns	ns	ns	\	*-	ns	ns	***-	\	\
RAIN30	\	\	\	\	\	ns	***-	***+	ns	ns	ns	ns	\	**-	ns	ns	***-	\	\
RAIN60	\	\	\	\	\	ns	***-	***+	ns	ns	ns	**-	\	*-	ns	ns	***-	\	\
RAIN90	\	\	\	\	\	ns	***-	***+	ns	ns	ns	ns	\	**-	ns	ns	***-	\	\
TEMP	\	\	\	\	\	ns	*-	***+	ns	ns	ns	ns	\	**-	ns	ns	***-	\	\
YEARFRA	\	\	\	\	\	ns	**-	***+	ns	ns	ns	ns	\	**-	ns	**-	***-	\	\
PH	\	\	\	\	\	ns	***-	***+	ns	ns	ns	ns	\	ns	ns	\	***-	\	\

Table 8. (Continued)

	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N	TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MNAA	FE
Segment 6																			
SAL_PSU	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	\	***-	***-	*-	***-	\	\
RAIN3	\	\	\	\	\	ns	***-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
RAIN7	\	\	\	\	\	ns	**-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
RAIN14	\	\	\	\	\	ns	***-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
RAIN30	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	\	**-	***-	ns	***-	\	\
RAIN60	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
RAIN90	\	\	\	\	\	*-	**-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
TEMP	\	\	\	\	\	***-	***-	ns	ns	***-	***-	***-	\	***-	***-	*-	***-	\	\
YEARFRA	\	\	\	\	\	***-	***-	ns	ns	***-	***-	***-	\	***-	***-	ns	***-	\	\
PH	\	\	\	\	\	ns	**-	*+	ns	***-	***-	***-	\	***-	***-	\	***-	\	\
Segment 7																			
SAL_PSU	\	\	\	\	\	ns	*-	***+	ns	***-	**-	***-	ns	ns	**-	*-	***-	\	\
RAIN3	\	\	\	\	\	ns	ns	**+	ns	**-	***-	***-	ns	ns	*-	*-	***-	\	\
RAIN7	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	*-	**-	ns	**-	\	\
RAIN14	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	ns	**-	ns	***-	\	\
RAIN30	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	*-	**-	ns	***-	\	\
RAIN60	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	ns	**-	ns	***-	\	\
RAIN90	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	ns	ns	ns	***-	\	\
TEMP	\	\	\	\	\	ns	ns	*+	ns	***-	***-	***-	ns	ns	***-	ns	***-	\	\
YEARFRA	\	\	\	\	\	ns	ns	**+	ns	***-	***-	***-	ns	ns	**-	*-	***-	\	\
PH	\	\	\	\	\	ns	ns	**+	ns	***-	***-	**-	ns	\	**-	\	**-	\	\
Segment 8																			
SAL_PSU	\	\	\	\	\	ns	***-	ns	ns	***-	***-	***-	ns	ns	***-	ns	***-	\	\
RAIN3	\	\	\	\	\	**-	***-	ns	ns	***-	***-	***-	ns	ns	**-	**-	*-	\	\
RAIN7	\	\	\	\	\	**-	***-	*-	ns	***-	***-	***-	ns	*-	***-	ns	**-	\	\
RAIN14	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	ns	ns	***-	ns	*-	\	\
RAIN30	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	ns	ns	***-	ns	*-	\	\
RAIN60	\	\	\	\	\	**-	***-	ns	ns	***-	***-	***-	ns	ns	***-	ns	*-	\	\
RAIN90	\	\	\	\	\	**-	***-	*-	ns	***-	***-	***-	ns	*-	**-	ns	**-	\	\
TEMP	\	\	\	\	\	**-	***-	ns	*+	***-	***-	***-	ns	ns	***-	*-	***-	\	\
YEARFRA	\	\	\	\	\	*-	***-	ns	ns	***-	***-	***-	ns	ns	***-	**-	*-	\	\
PH	\	\	\	\	\	ns	***-	ns	ns	***-	***-	***-	ns	*-	**-	\	**-	\	\
Segment 9																			
SAL_PSU	ns	ns	ns	ns	ns	ns	ns	*-	\	ns	ns	ns	***+	ns	ns	ns	ns	\	\
RAIN3	ns	ns	ns	ns	ns	ns	ns	**-	\	ns	ns	ns	**+	ns	ns	**-	**-	\	\
RAIN7	ns	ns	ns	ns	ns	ns	*+	***-	\	ns	ns	ns	**+	ns	ns	ns	ns	\	\
RAIN14	ns	ns	ns	ns	ns	*-	ns	***-	\	ns	ns	ns	**+	ns	ns	*-	*-	\	\
RAIN30	ns	ns	ns	ns	ns	*-	ns	***-	\	ns	ns	ns	**+	ns	ns	ns	ns	\	\
RAIN60	ns	ns	ns	ns	ns	ns	*+	***-	\	ns	ns	ns	*+	ns	ns	*-	*-	\	\
RAIN90	ns	ns	ns	ns	ns	*-	*+	***-	\	ns	ns	ns	**+	ns	ns	ns	ns	\	\
TEMP	ns	ns	**-	ns	ns	ns	ns	**-	\	ns	ns	ns	***+	ns	ns	**-	**-	\	\
YEARFRA	ns	ns	*-	ns	ns	ns	ns	***-	\	ns	*+	ns	**+	ns	ns	*-	*-	\	\
PH	ns	ns	*-	ns	ns	\	ns	\	\	ns	*+	ns	**+	\	ns	\	\	\	\

Table 8. (Continued)

	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N	TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MNAA	FE
Segment 10																			
SAL_PSU	ns	ns	*-	ns	ns	*+	*-	ns	\	***-	*-	***-	***-	ns	**-	**-	**-	\	\
RAIN3	*-	ns	***-	ns	*-	**+	ns	*+	\	***-	ns	***-	***-	ns	**-	ns	**-	\	\
RAIN7	*-	ns	***-	ns	*-	**+	ns	ns	\	***-	ns	***-	***-	ns	*-	ns	*-	\	\
RAIN14	*-	ns	***-	ns	ns	**+	ns	*+	\	***-	ns	***-	***-	ns	**-	ns	**-	\	\
RAIN30	*-	ns	**-	ns	ns	**+	ns	**+	\	***-	ns	***-	***-	ns	**-	ns	*-	\	\
RAIN60	*-	ns	**-	ns	ns	***+	ns	**+	\	***-	*-	***-	***-	ns	**-	ns	*-	\	\
RAIN90	ns	ns	**-	ns	ns	***+	ns	*+	\	***-	ns	***-	***-	ns	**-	ns	ns	\	\
TEMP	*-	ns	**-	ns	ns	**+	ns	ns	\	***-	**-	***-	***-	ns	***-	ns	**-	\	\
YEARFRA	**-	ns	***-	ns	ns	**+	ns	ns	\	***-	*-	***-	***-	ns	**-	ns	ns	\	\
PH	**-	ns	***-	*-	*-	***+	ns	ns	\	*-	ns	*-	***-	ns	ns	\	\	\	\
Segment 11																			
SAL_PSU	**-	ns	**-	ns	*-	ns	***-	***+	\	***-	***-	***-	***-	ns	***-	**-	*-	\	\
RAIN3	**-	ns	***-	ns	ns	ns	***-	ns	\	***-	***-	***-	***-	***-	***-	*-	***-	\	\
RAIN7	**-	ns	***-	ns	ns	**-	***-	ns	\	***-	***-	***-	***-	***-	***-	ns	***-	\	\
RAIN14	**-	ns	***-	ns	ns	**-	***-	ns	\	***-	***-	***-	***-	***-	***-	ns	***-	\	\
RAIN30	**-	ns	***-	ns	ns	**-	***-	ns	\	***-	***-	***-	***-	***-	***-	ns	**-	\	\
RAIN60	**-	ns	**-	ns	ns	*-	***-	ns	\	***-	***-	***-	***-	**-	***-	ns	**-	\	\
RAIN90	**-	ns	***-	ns	ns	**-	***-	ns	\	***-	***-	***-	***-	**-	***-	ns	**-	\	\
TEMP	**-	ns	***-	ns	ns	*-	***-	ns	\	***-	***-	***-	***-	***-	***-	ns	**-	\	\
YEARFRA	***-	ns	***-	ns	ns	**-	***-	ns	\	***-	***-	***-	***-	**-	***-	*-	***-	\	\
PH	**-	ns	**-	ns	ns	ns	***-	ns	\	***-	***-	***-	***-	ns	***-	\	\	\	\
Segment 12																			
SAL_PSU	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
RAIN3	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	*-	***-	\	\
RAIN7	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	**-	\	\
RAIN14	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	*-	**-	\	\
RAIN30	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	***-	\	\
RAIN60	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	*+	*-	**-	\	\
RAIN90	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	**-	ns	\	\
TEMP	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	**-	\	\
YEARFRA	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	**-	***-	\	\
PH	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 13																			
SAL_PSU	ns	ns	ns	ns	ns	**+	**-	***+	\	***-	ns	***-	***-	ns	**-	**-	**-	\	\
RAIN3	ns	ns	ns	ns	ns	ns	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
RAIN7	ns	ns	ns	ns	ns	ns	***-	***+	\	***-	***-	***-	***-	*-	***-	ns	ns	\	\
RAIN14	ns	ns	ns	ns	ns	**+	***-	***+	\	***-	***-	***-	***-	*-	***-	ns	ns	\	\
RAIN30	ns	ns	ns	ns	ns	*+	***-	***+	\	***-	***-	***-	***-	*-	***-	ns	ns	\	\
RAIN60	ns	ns	ns	ns	ns	ns	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
RAIN90	ns	ns	ns	ns	ns	ns	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
TEMP	ns	ns	ns	ns	ns	ns	***-	***+	\	***-	***-	***-	***-	*-	***-	ns	ns	\	\
YEARFRA	ns	ns	ns	ns	ns	**+	***-	***+	\	***-	***-	***-	***-	*-	***-	ns	ns	\	\
PH	ns	ns	ns	ns	ns	***+	***-	*+	\	***-	***-	***-	***-	ns	***-	\	\	\	\

Table 8. (Continued)

	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N	TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MNAA	FE
Segment 14																			
SAL_PSU	ns	ns	*-	ns	*+	***+	ns	***+	\	***-	*-	***-	***-	ns	**-	ns	ns	\	\
RAIN3	ns	ns	ns	ns	ns	***+	***-	***+	\	***-	**-	***-	***-	ns	***-	ns	ns	\	\
RAIN7	ns	ns	ns	ns	ns	***+	***-	***+	\	***-	**-	***-	***-	ns	***-	ns	ns	\	\
RAIN14	ns	ns	*-	ns	ns	***+	**-	***+	\	***-	**-	***-	***-	ns	***-	*+	ns	\	\
RAIN30	ns	ns	ns	ns	*+	***+	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	*+	\	\
RAIN60	ns	ns	ns	ns	ns	***+	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
RAIN90	ns	ns	*-	ns	ns	**+	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
TEMP	ns	ns	ns	ns	**+	***+	**-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
YEARFRA	ns	ns	*-	ns	ns	***+	***-	***+	\	***-	***-	***-	***-	ns	***-	ns	ns	\	\
PH	ns	ns	ns	ns	ns	***+	**-	ns	\	***-	**-	***-	***-	\	***-	\	\	\	\
Segment 15																			
SAL_PSU	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
RAIN3	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
RAIN7	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
RAIN14	\	\	\	\	\	ns	ns	ns	\	*-	ns	*-	\	ns	ns	ns	ns	\	\
RAIN30	\	\	\	\	\	ns	ns	*-	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
RAIN60	\	\	\	\	\	ns	ns	*-	\	ns	ns	*-	\	ns	ns	*-	*-	\	\
RAIN90	\	\	\	\	\	ns	ns	*-	\	ns	ns	ns	\	ns	ns	*-	*-	\	\
TEMP	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
YEARFRA	\	\	\	\	\	ns	ns	ns	\	ns	ns	ns	\	ns	ns	ns	ns	\	\
PH	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\
Segment 16																			
SAL_PSU	*-	ns	***-	ns	ns	ns	***-	ns	\	***-	ns	***-	***-	ns	**-	*-	*-	\	\
RAIN3	**-	*-	**-	ns	ns	*-	***-	ns	\	***-	*-	***-	***-	ns	***-	*-	*-	\	\
RAIN7	**-	ns	**-	ns	ns	**-	***-	ns	\	***-	*-	***-	***-	ns	**-	ns	ns	\	\
RAIN14	**-	ns	***-	ns	ns	*-	***-	ns	\	***-	*-	***-	***-	ns	***-	ns	ns	\	\
RAIN30	**-	ns	***-	ns	ns	*-	***-	ns	\	***-	*-	***-	***-	ns	***-	ns	ns	\	\
RAIN60	*-	ns	***-	ns	ns	*-	***-	ns	\	***-	**-	***-	***-	ns	***-	*-	*-	\	\
RAIN90	*-	ns	**-	ns	ns	*-	***-	ns	\	***-	*-	***-	***-	ns	***-	ns	ns	\	\
TEMP	**-	ns	**-	ns	ns	*-	***-	ns	\	***-	**-	***-	***-	ns	***-	ns	ns	\	\
YEARFRA	**-	ns	***-	ns	ns	**-	***-	ns	\	***-	**-	***-	***-	ns	***-	*-	*-	\	\
PH	ns	ns	*-	ns	ns	ns	***-	ns	\	***-	ns	***-	***-	\	***-	\	\	\	\
Segment 17																			
SAL_PSU	ns	**-	ns	ns	\	ns	ns	***+	\	***+	ns	***+	*-	ns	***+	ns	ns	ns	ns
RAIN3	ns	ns	ns	ns	\	ns	ns	**+	\	***+	ns	***+	ns	**+	*+	**-	**-	ns	ns
RAIN7	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	ns	*+	***+	ns	ns	ns	ns
RAIN14	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	ns	*+	***+	ns	ns	ns	ns
RAIN30	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	ns	*+	***+	ns	**-	ns	ns
RAIN60	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	*-	*+	***+	ns	ns	ns	ns
RAIN90	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	ns	**+	***+	ns	ns	ns	ns
TEMP	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	***+	ns	ns	**+	ns	ns	ns	ns
YEARFRA	ns	ns	ns	ns	\	ns	ns	***+	\	***+	ns	**+	ns	**+	***+	*-	**-	ns	ns
PH	\	\	\	\	\	\	\	ns	\	**+	\	ns	\	ns	ns	\	\	\	\

Table 8. (Continued)

	DIN	DNH4N	DNO23N	DNO2N	DNO3N	IN	NH4N	NO23N	NO3N	TKN	ORGN	TN	DPO4P	PO4P	TP	TIC	TOC	MNAA	FE
Lemon Bay																			
SAL_PSU	ns	ns	**-	ns	ns	\	ns	ns	\	ns	**+	ns	ns	\	ns	\	\	\	\
RAIN3	ns	ns	*-	ns	ns	\	ns	ns	\	ns	ns	ns	ns	\	ns	\	\	\	\
RAIN7	ns	ns	**-	ns	*-	\	ns	ns	\	ns	*+	ns	ns	\	ns	\	\	\	\
RAIN14	*-	ns	***-	ns	*-	\	ns	ns	\	ns	*+	ns	ns	\	ns	\	\	\	\
RAIN30	*-	ns	**-	ns	ns	\	ns	ns	\	ns	ns	ns	ns	\	ns	\	\	\	\
RAIN60	ns	ns	**-	ns	ns	\	ns	ns	\	ns	ns	ns	ns	\	ns	\	\	\	\
RAIN90	ns	ns	*-	ns	*-	\	ns	ns	\	ns	*+	ns	ns	\	ns	\	\	\	\
TEMP	ns	ns	**-	ns	ns	\	ns	ns	\	ns	*+	ns	ns	\	ns	\	\	\	\
YEARFRA	ns	ns	**-	ns	ns	\	ns	ns	\	ns	ns	ns	ns	\	ns	\	\	\	\
PH	ns	ns	**-	ns	ns	\	ns	ns	\	ns	**+	ns	ns	\	*+	\	\	\	\

Discussion

Salinity

In investigating the non-agreement of the two salinity parameters, salinity trends in the upper portion of the study area did not appear to be monotonic (**Figure 8**, above). While an overall increase in salinity (PSU) in Segments 2 and 3 has occurred since 1968, the complete pattern consists of depressed salinity in the middle 1970's followed by a rapid increase and then a slight, although non-significant, decrease in salinity since approximately 1984. The increases were not related to rainfall received. The timing of effluent disposal practices, increasing reuse of effluent, and increasing urbanization of the surrounding watersheds coincide with these general patterns.

For the remaining segments, where salinity (PSU) changes were significant, trends since 1968 were downward (Segments 7, 8, 10, 12, 14, 16, and 17). Trends in Segment 14 (**Figure 9**), for example, appeared monotonic and in particular, may illustrate the closure of Midnight Pass in 1983, as maximum salinity values decline at this time. Also visible is the varying emphasis of the sampling programs both before and after 1996. Prior to 1996, sampling programs included a number of tidal creek stations. Salinity values at these stations were well below main-stem values but were still above the 5000 umho criteria established for this project. Subsequent to 1996, sampling in Segment 14 (and other study area segments) moved to a randomized station design, and stations were limited to navigable water depths at the random tide stage. The mouths of the tributaries are no longer sampled, appearing as an increase in minimum salinity values over time. Provided the sampling programs remain distinct in time, the "step trend" produced by the change in programs will not provide spurious trends using non-parametric techniques. (Trends for Segment 14 were further confirmed by repetition of the residuals analyses on data for which salinity (PSU) values were 16 PSU or greater.)

Salinity regression results are generally mirrored in the residuals analyses. Since 1968, and for equivalent amounts of antecedent rainfall or during comparable seasons of the year, salinity values have increased overall in Segments 2 and 3, significantly declined in Segments 7, 10, 14, and 17, and declined to a lesser extent in Segments 8 and 16. Implied is that prior sources of freshwater (other than rainfall) to Palma Sola Bay and Anna Maria Sound have been diverted elsewhere, while middle and lower Sarasota Bay, Little Sarasota Bay, and Blackburn Bay are receiving more freshwater than they have in the past under similar antecedent rainfall conditions. For more recent time periods, the bulk of the segments display stable conditions. The increasing salinity detected since 1983 and 1989 in Segment 13 and since 1989 in Segment 11 was apparently the product of changing climatological conditions as the residuals analyses against rainfall did not produce significant trends.

pH

Of the other physical parameters, pH and temperature, more segments and time periods have exhibited changes in pH. Against independent variables, Segments 1, 2, 5, 8, 10, 11, 16, 17 displayed declining pH values since 1968. Declines were noted for all time periods for Segments 10, 11, and 16. Patterns of pH decline however, were not always accompanied by variables which

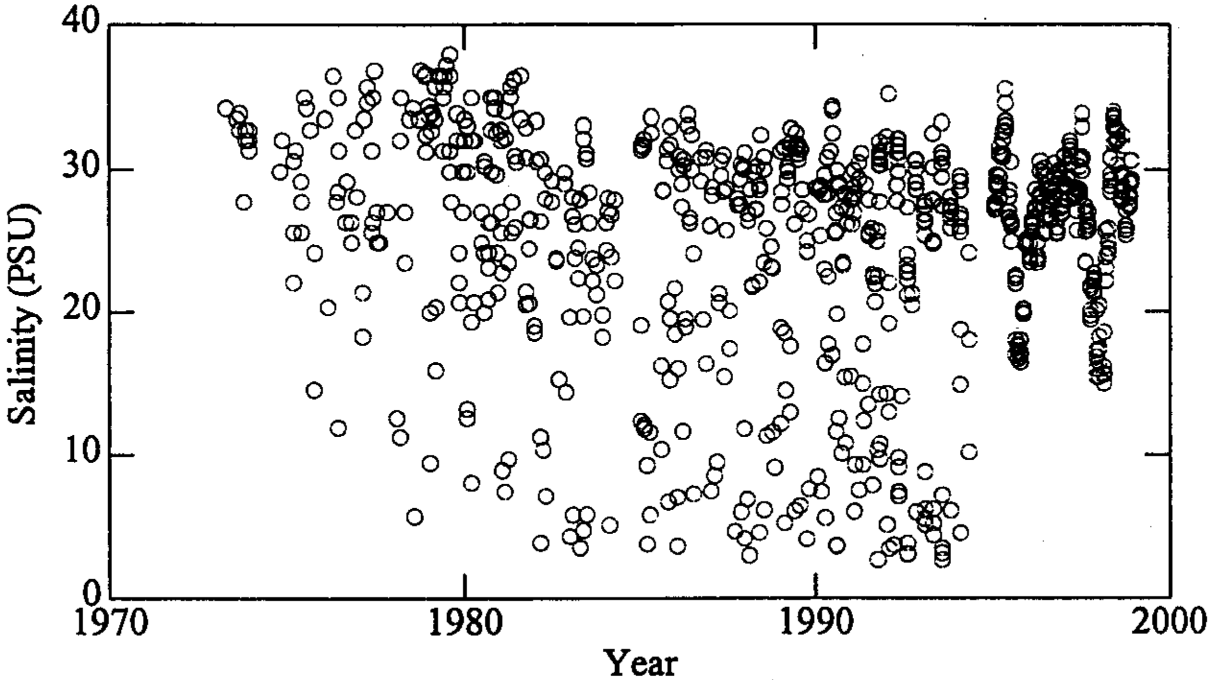

Figure 9. Salinity in Segment 14 over time, illustrating differing sampling emphasis before and after 1995, and a reduction in maximum salinity values near 1983.

typically covary (decreases in salinity, decreases in chlorophyll or decreases in dissolved oxygen). Increases in pH were noted in selected time periods in Segments 2, 3, and 5.
Again, pH trends were not uniformly accompanied by similar significant trends in salinity, dissolved oxygen, or chlorophyll.

Temperature

For temperature regressions and non-parametric tests against time, all but one of the significant relationships (Segment 6, 1983 to present) indicated increasing temperatures. In particular, Segments 13, 16, and 17 increased over a number of time periods. Once season is considered using the fraction of year as an independent variable, significant increasing temperature trends remain in a number of segments, particularly the shallow, enclosed ones. Segments 1, 2, 3, 10, and 13 displayed highly significant increasing trends (**Figure 10**), followed to a lesser extent by Segments 5, 8, 14, 16, and 17. The trend of increasing temperature has been observed in Tampa Bay monitoring data as well (Environmental Protection Commission of Hillsborough County) and is thought to be an example of large-scale climatological change.

Dissolved Oxygen and Percent Saturation

Trends in dissolved oxygen (DO) and percent saturation of dissolved oxygen varied widely and are not straightforward to interpret. An increase in DO can represent either an improvement or a decline in water quality. Decreases in phytoplankton blooms (chlorophyll a), a water quality improvement, can produce decreased DO during midday and late afternoon, and increased DO during the late night and early morning. Extensive submerged aquatic vegetation will impose large diurnal swings in DO on shallow waters. Decreases in oxygen demanding substances will increase DO. A decline in salinity, while not considered to be an improvement or a decline in overall water quality, permits a higher solubility of DO but will ofttimes decrease DO values, as the humic-laden waters typical of surface flows in the region are often naturally low in pH, productivity, and DO.

For a number of regions (Segments 7, 8, 11, and 13) in the study area, declines in DO and/or percent saturation since 1968 were also accompanied by more recent trends (1989 to present) of increases. This is an example of the non-monotonic trends discussed above (**Figure 7**, above). Of the remaining segments, increases have been noted for many time periods in Segments 2, 14, and 16, which, in Segments 14 and 16, were accompanied by increasing chlorophyll values. Although the chlorophyll values have increased in Segment 14, the incidence of supersaturation (>100% of DO saturation; typically accompanying nuisance chlorophyll levels) has actually declined. It is difficult to categorize the changes in DO of Segment 14 as either an improvement or a decline in water quality. In addition, the residuals analyses indicated that increasing trends in DO in Segments 14 and 16 were no longer present once the effects of forcing functions such as temperature or salinity had been removed.

Conversely, DO and percent saturation in Segment 10 have declined in 1968 and 1983 to present, but with slightly significant but unexpected increases in chlorophyll. Earlier percent saturation values in Segment 10 were typically greater than 100%, while more recent values (1989 to present)

Segment 13, p=0.000

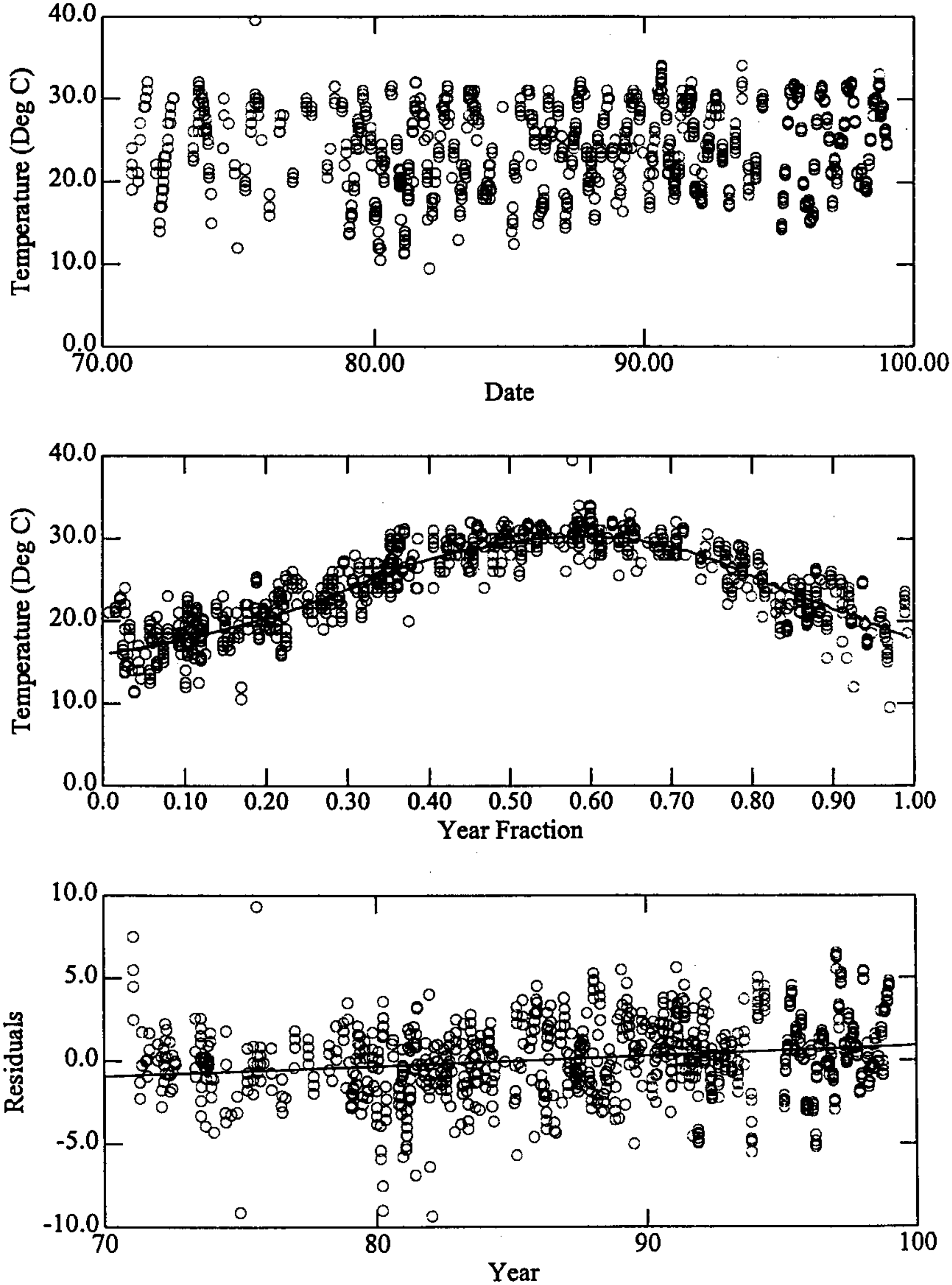

Figure 10. LOWESS analysis of temperature for Segment 13 illustrating increasing temperature values even after normalization for seasonal variation.

are centered near 100%. The decline in DO in Segment 10, therefore, represents an improvement in water quality. Removal of forcing functions demonstrated a similar decline in DO (improvement) for both Segments 10 and 11. Of the related parameters, biochemical oxygen demand, there were minimal data in the northern portion of the study area. What few significant relationships existed for BOD, all exhibited declines.

Water Clarity

Water clarity, and the link between increased clarity and seagrass restoration to Sarasota Bay, have been the subject of several technical investigations sponsored by the SBNEP and the Southwest Florida Water Management District. Water clarity changes were evident in many segments throughout the Bay. Regressions and non-parametric trends of attenuation coefficient with time were seldom significant, perhaps due to the comparatively short record (since 1990). Secchi depths, however, were shown to have increased (improved water clarity) by a variety of measures, particularly in Segments 2, 3, 6, 8, 10, 11 (**Figure 11**), 13 and to a lesser extent in Segments 6, 14, and 17. In all segments except 14 and 17, increases were significant despite the removal of seasonality, salinity, and rainfall as forcing functions. Increases in secchi depths were generally accompanied by significant declines in either turbidity, suspended solids (total and volatile), color, or chlorophyll, with significance of trend the strongest and relationships between parameters most coherent for Segments 8, 10, 11, and 13. As chlorophyll values generally increased for Segments 10, 11, and 13, one can infer that chlorophyll is not a dominant attenuator in these segments. These results confirm the investigations of Dixon and Kirkpatrick (1995) in which water column attenuation at stations within Segments 10 and 13 were shown to depend most heavily on non-chlorophyll suspended matter.

Declines in secchi depths, however, were significant in Segments 5 (**Figure 12**) and 17. For Segment 5, declines were most notable between 1990 and 1995 and were accompanied by significant trends of increasing suspended solids and color. Segment 17 data were limited to two periods in the 1970's and the 1990's between which, mean secchi depths have decreased significantly from 4.7 to 3.2 m, accompanied by a companion increase in total suspended solids. Several beach renourishment projects were conducted along Anna Maria and Longboat Key in the 1990's and the new supply of unsorted sediments may have contributed to these observed trends.

Trends in seagrass coverage between 1988-1994 and 1994-1996 have recently been described for Sarasota Bay (Kurz, et al., 1999). Both the Manatee (Segments 5, 6, and the northern portions of Segments and 8) and Sarasota County (the southern portion of Segments 7 and 8, and Segments 10 and 11) portions of Sarasota Bay have documented overall seagrass increases in each time period, as have Little Sarasota Bay (Segment 14), and to a lesser extent Roberts Bay (Segment 13). The results are generally consistent with observed increasing trends in secchi depths with the largest total recovery of seagrasses noted for regions within Segments 5, 6, 7, 8, 10, and 11. For Segment 5, however, decreasing secchi depths between 1990 and 1995 were not accompanied by seagrass losses in either the 1988 to 1994 or 1994 to 1996 seagrass analyses.

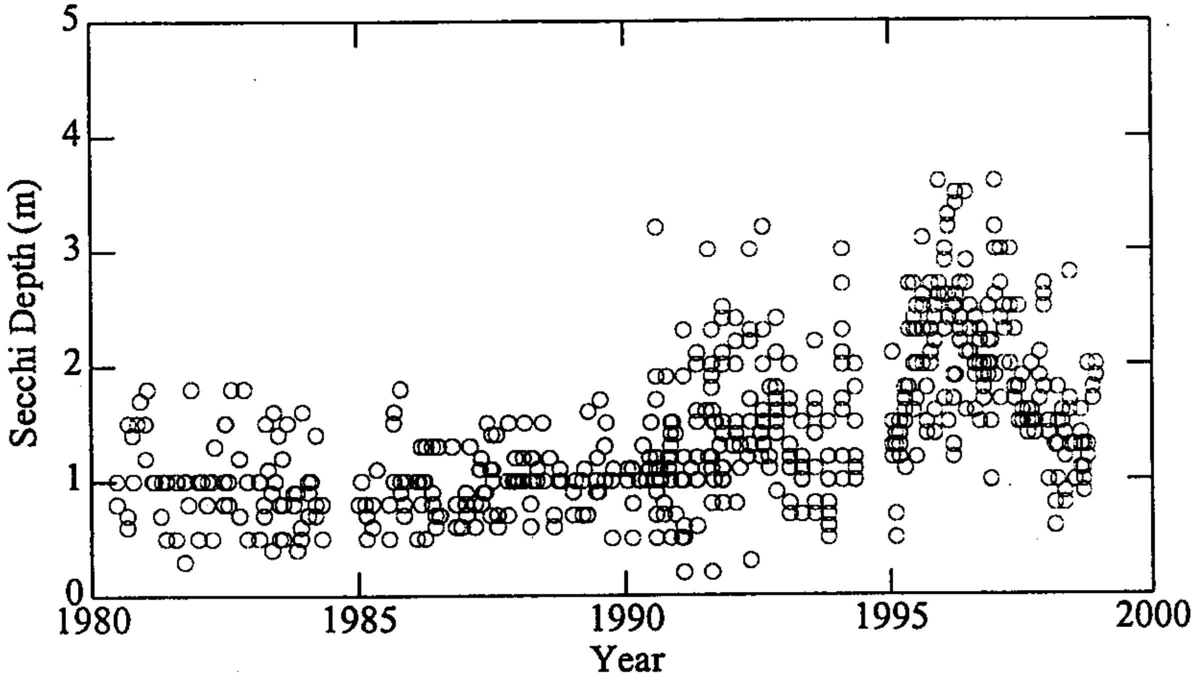

Figure 11. Secchi depths in Segment 11. Significant increases since 1968, 1983, and 1989 but with an apparent decline in water clarity since 1996.

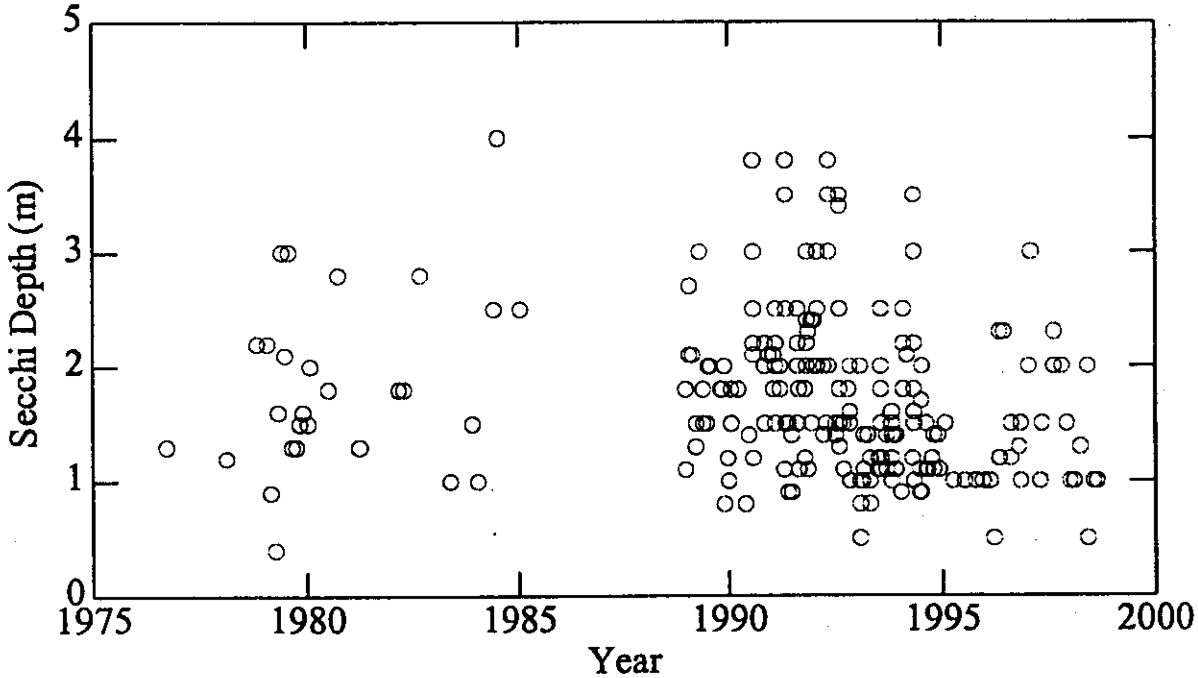

Figure 12. Declining secchi depths (decreasing water clarity) in Segment 5. Significant decreases since 1968, 1983, and 1989.

Chlorophyll

Chlorophyll concentrations are a classic indicator of the nutrient status of a particular water body, with increasing concentrations typically implying an increase in nutrient loads. Trends in chlorophyll (either as corrected or uncorrected for the presence of pheophytin) were mixed throughout the study area. Declines in chlorophyll were present in Segments 6, 7, and 8, especially between 1968 and 1983 and the present, and were present in addition to variations produced by seasonal, rainfall, or salinity forcing functions. Similar declines in total nitrogen and phosphorus were similarly evident for these three segments. The three segments also coincide with areas of seagrass increases (Kurz, et al., 1999) and, in general, displayed increasing water clarity. Increases in chlorophyll were detected for Segments 9, 10, 13, 14, 16, and Lemon Bay. Trends in Segments 10 and 13 were less significant once forcing functions were removed, while the increases in Segments 9, 14, 16, and Lemon Bay remained significant.

For the southern segments (Segments 13 and above), chlorophyll data were generally limited from 1990 to present, with increases in chlorophyll *a* noticeable between 1990 and 1995 and in chlorophyll *a*, corrected for pheophytin, between 1995 and 1999. Although increases in chlorophyll in Segments 14 and 16 were accompanied by significant declines in color and turbidity, the period of record for turbidity is much longer. More recent turbidity data (corresponding to the period from when chlorophyll data were available) correlate directly with chlorophyll concentrations, indicating a variety of influences on water clarity, and urging caution in assigning causation to particular trends without examination of the individual data. For Lemon Bay, where only data between 1995 and 1998 were examined, chlorophyll concentrations increased over time **(Figure 13)** by a factor of three. Values are highly correlated with increased turbidity, a relationship consistent with increased phytoplankton producing increased light scattering.

Nutrients

A wide variety of nutrient data were present for the study area. Both dissolved and total species of inorganic and organic nitrogen and phosphorus were analyzed at differing time periods. The discussion is generally limited to patterns of total nitrogen and phosphorus, and dissolved inorganic nitrogen and phosphorus. Total nutrient concentrations may be expected to correlate with chlorophyll data, while dissolved inorganic nutrients are more useful to predict algal growth potential as they represent the nutrients that have not yet been consumed.

Northern segments (Segments 9 and lower), together with Segments 11 and 16, experienced declining inorganic nitrogen (ammonium and nitrate-nitrite-nitrogen, summed). In particular, instances of elevated inorganic nitrogen (greater than 0.5 mg/l) declined dramatically in Segment 11 after about 1991, when the City of Sarasota completed their advanced waste treatment program and reduced the discharges and total loads to Sarasota Bay through Witaker Bayou. Increasing trends in inorganic nitrogen were noted for Segments 10, 13, and 14 (**Figure 14**), which remained even after accounting for seasonal, salinity, and rainfall variations. For Segment 14, there are no data prior to about 1980, and both annual median and annual maximum values generally increase through 1995 with isolated elevated values more prevalent especially after 1990. No step trends coincident

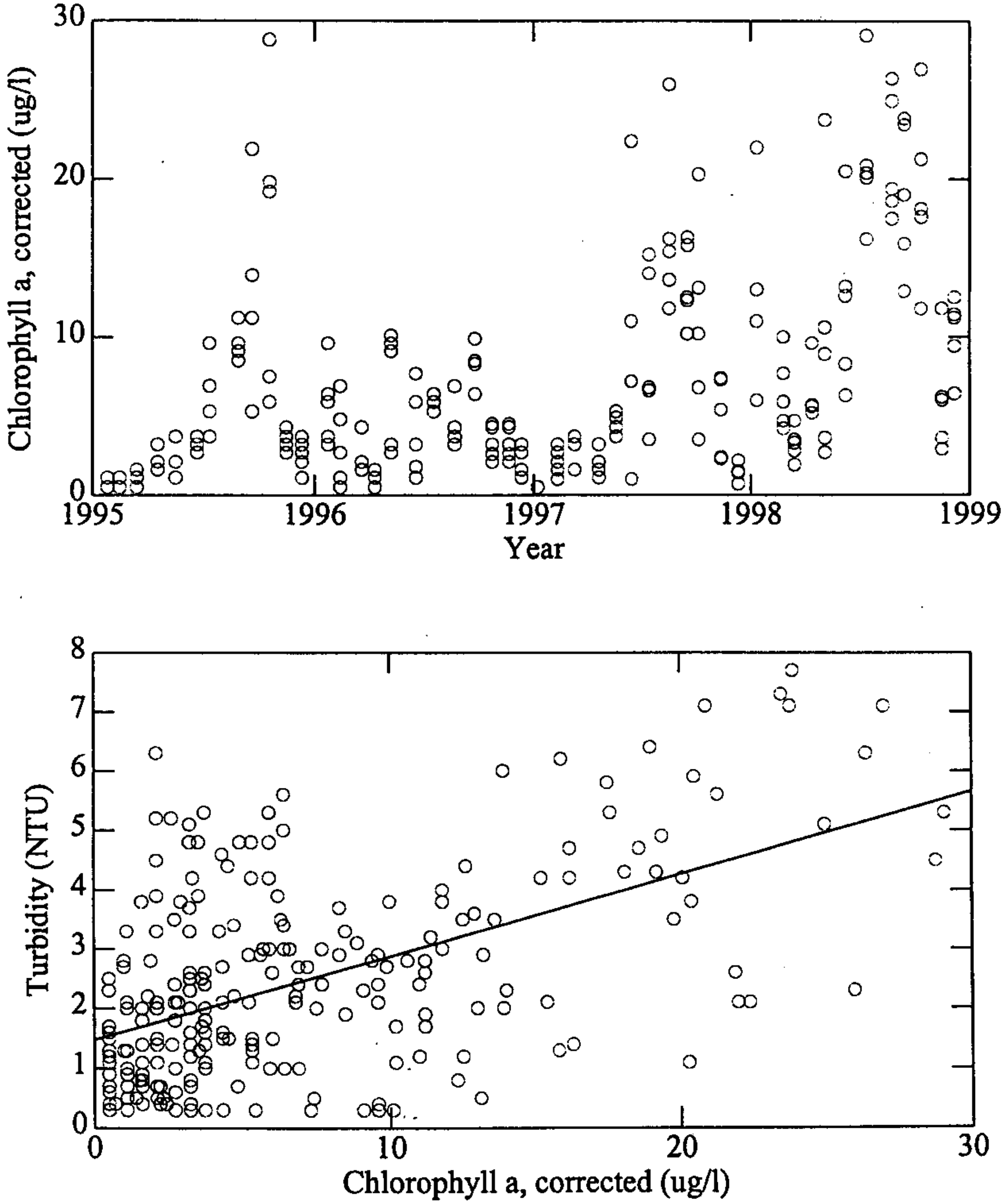

Figure 13. Recent trends of increasing chlorophyll in Lemon Bay, and relationship with turbidity.

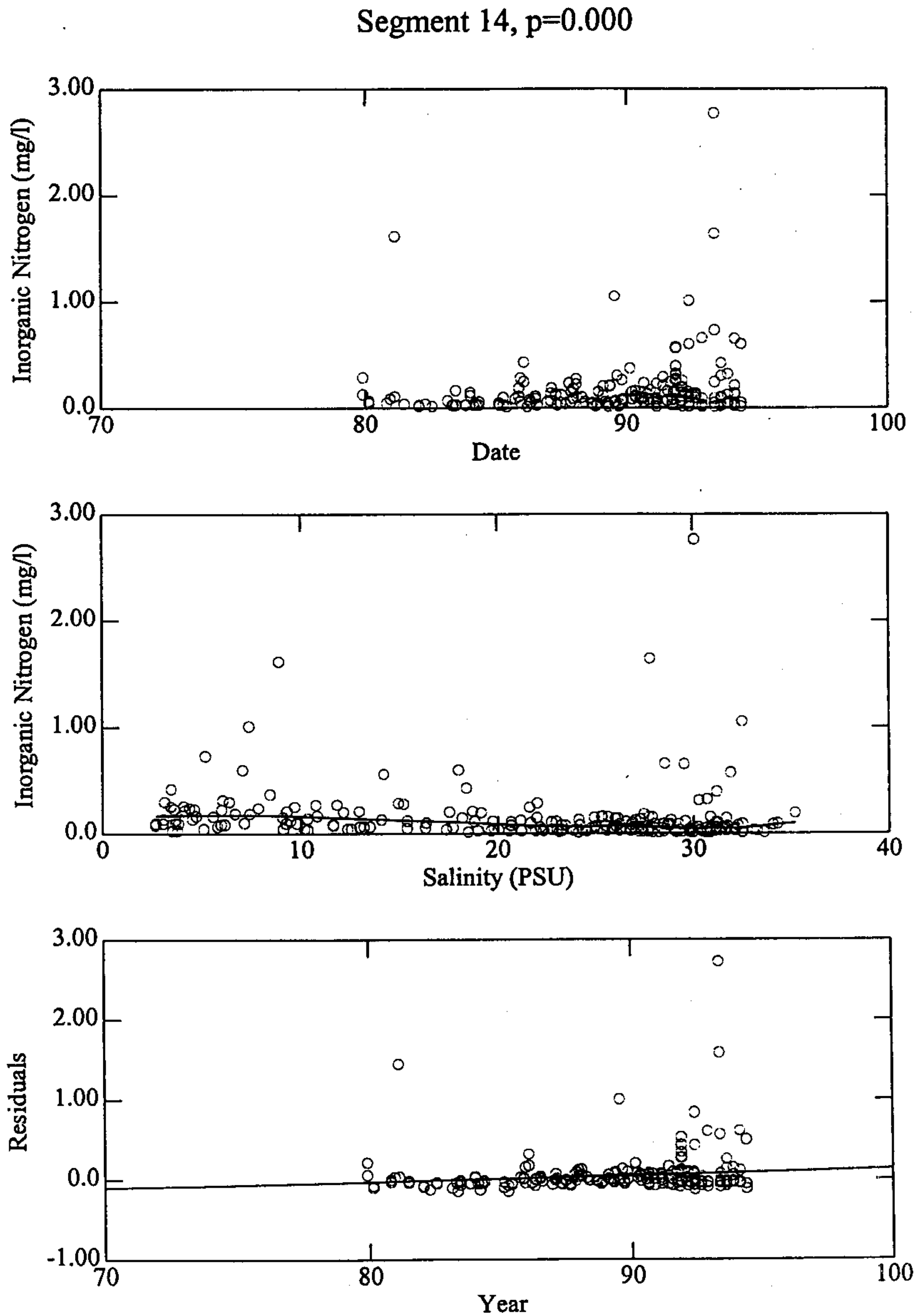

Figure 14. Inorganic nitrogen in Segment 14, relationship with salinity, and highly significant trend of increasing residuals with time.

with Midnight Pass closure are clearly apparent. Individual trends in ammonium and nitrate-nitrite were not always similar in direction and indicate that for Segments 13 and 14, nitrate-nitrite-nitrogen increases were greater than ammonium decreases.

Sufficient data to evaluate dissolved inorganic nitrogen were only present for the southern study area, but where significant trends were present, trends indicated a reduction in nitrogen available for algal growth (Segments 10,11, and 16). These declining trends remained, even after adjustment for seasonal, salinity, and rainfall variations.

Total nitrogen declined in 10 of the 17 segments, increasing only in Segment 17. As an example, total nitrogen has significantly declined in Segment 14, both in absolute trend, and after removal of the salinity forcing function (**Figure 15**). Removal of forcing function effects from the remaining segments produced trends of declining total nitrogen in residuals from 12 of the 17 segments, with the increase in Segment 17 still significant. Total nitrogen has also decreased in Segment 11 (**Figure 16**), but for this area, the relationship with salinity is much less strong than for Segment 14 and concentrations were much higher. In particular, the incidence of high concentrations (greater than 2.0 mg/l) is much reduced following changes in the City of Sarasota's effluent management practices.

Segments 3 and 9 and Lemon Bay displayed interesting patterns, in that while total nitrogen displayed either a declining or no trend, the allocation between organic and inorganic nitrogen changed substantially, with increasing organic nitrogen and decreasing dissolved nitrate-nitrite-nitrogen. These patterns are consistent with algal uptake and the increase in chlorophyll observed for these segments.

Data for dissolved inorganic phosphorus were again limited to the southern portion of the study area. Where trends were significant, dissolved inorganic phosphorus exhibited declines (in 6 of 13 segments) with the exception of Segment 9. For Segment 9, the increase is clearly significant with a minimal data set and over a short time span (1995-1998). For inorganic phosphorus, 8 of 17 segments displayed decreases, with a significant increase only for Segment 17. Trends for both dissolved and total inorganic phosphorus remained despite removal of seasonal and salinity effects.

Total phosphorus typically paralleled trends in total nitrogen with declines over time in 10 of 17 segments. After removal of forcing functions, declining trends remained. Distributions of phosphorus in Segment 11 (**Figure 17**) were quite similar to that of nitrogen, with high and quite variable concentrations in lower salinity waters. Trends in Segment 17 were not monotonic, with an increase from the mid-1970's through the mid 1990's and a decline since approximately 1995. After removal of variation due to salinity, rainfall, and seasonality, increases in total phosphorus were highly significant in Segment 17. In contrast, Lemon Bay total phosphorus levels have increased between 1995 and 1998, but appear the product of variations in flow and resultant salinity changes.

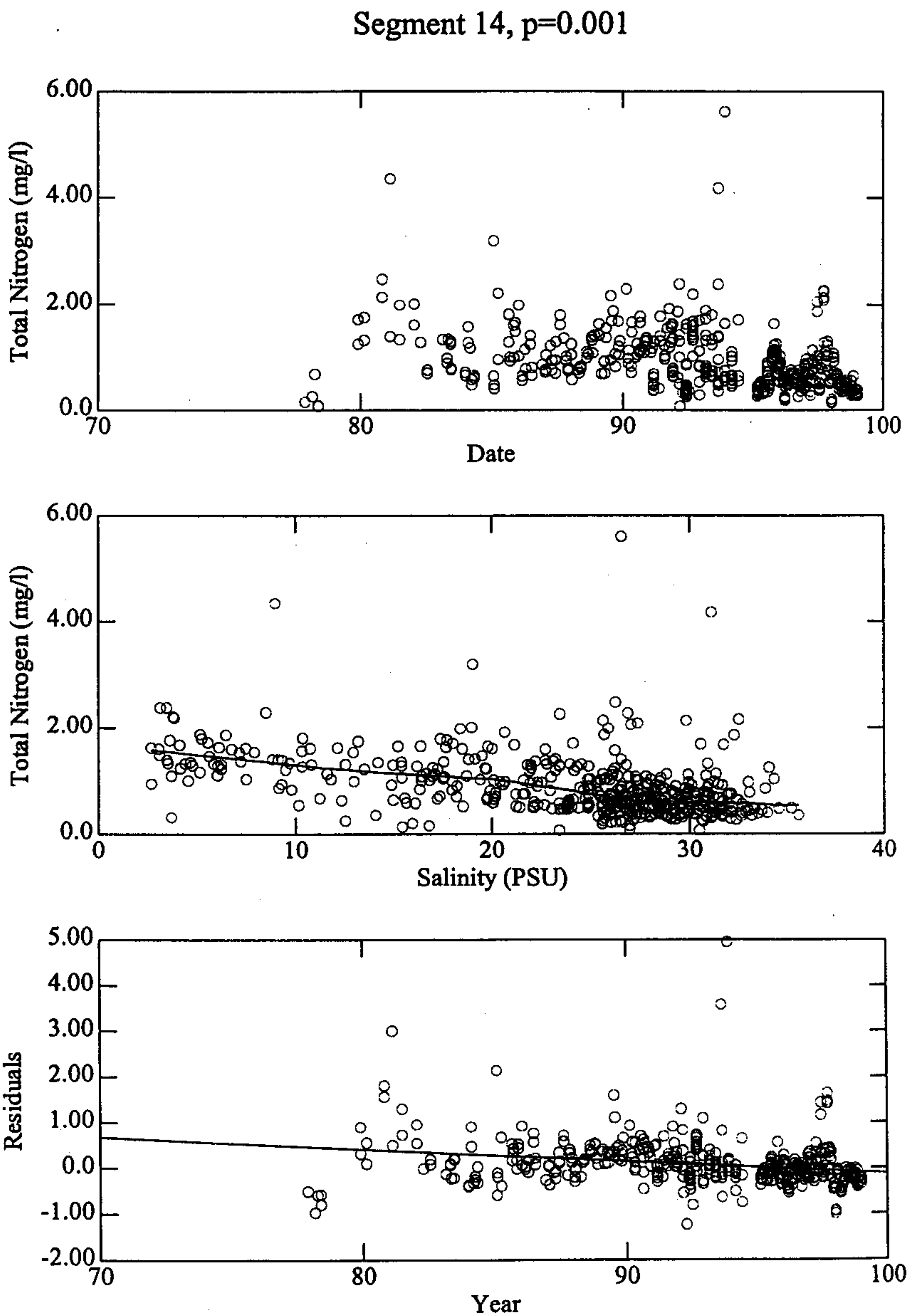

Figure 15. Total nitrogen in Segment 14, relationship with salinity, and highly significant trend of declining residuals with time.

Segment 11, p=0.000

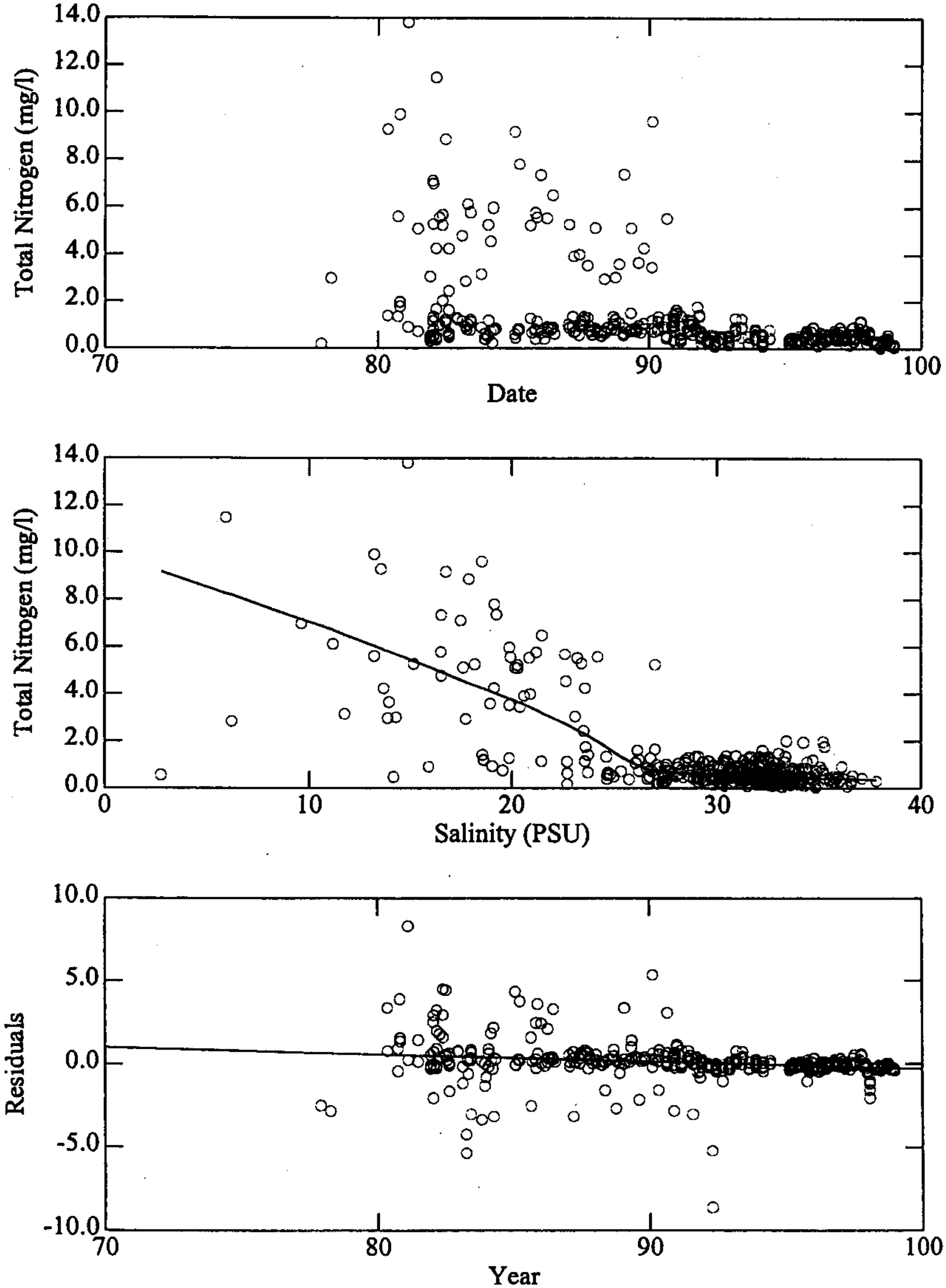

Figure 16. Total nitrogen in Segment 11, relationship with salinity, and highly significant trend of declining residuals with time.

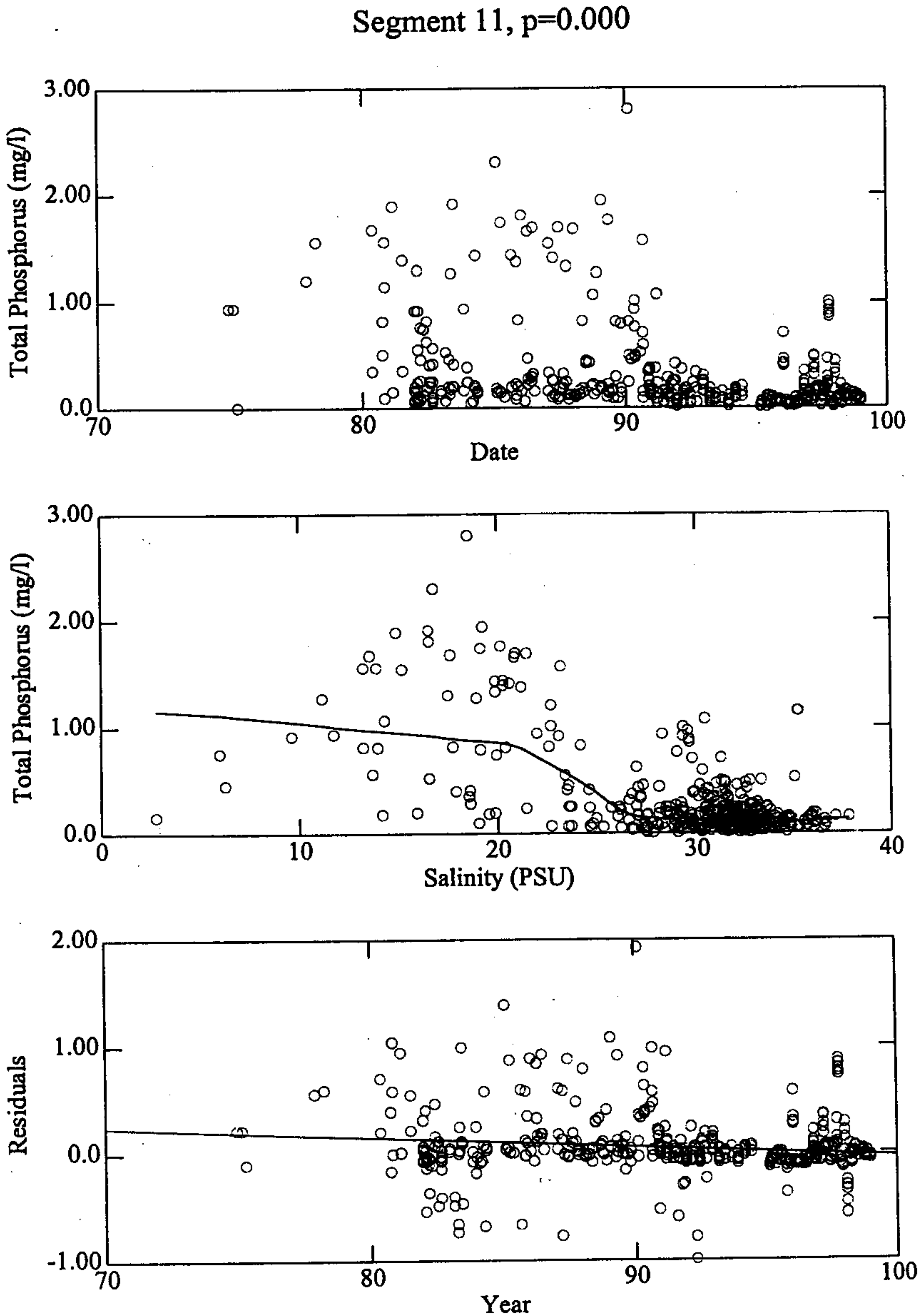

Figure 17. Total phosphorus in Segment 11, relationship with salinity, and highly significant trend of declining residuals with time.

Other Parameters

Data for total organic carbon (TOC) and total inorganic carbon were predominantly gathered during the 1990-1994 quarterly collection efforts sponsored by the SBNEP. Additional data collected in the northern Bay, and near Whitaker Bayou in the early 1980's expanded the data record in those regions. All significant trends were decreasing, with declining trends in one or both parameters for all segments except Segment 14 (not significant) and Lemon Bay (insufficient data).

Minimal trace metal data were available for analysis and there were no significant trends detected for iron, manganese, lead, or zinc. A single declining trend for copper in Segment 1 is based on minimal data over a two year period. Removal of variations from forcing functions did not alter the lack of trends.

VII. SUMMARY

The non-parametric trends among the various time periods are summarized for selected parameters in **Figures 18** and **19**. As a broad summary, there are some salinity alterations within the Bay system, some of which are in addition to climatological trends and influences. Many of the Bay segments show improved water clarity, with corresponding seagrass recovery. Segment 5, behind Longboat Pass, Segment 14, behind Midnight Pass, and the offshore segments, Segment 17, however, have had declines in water clarity since 1968. The declines at Segment 5 have continued, while the remaining segments appear generally stable since 1983. The declines in secchi depth offshore are quite distinct, and although color values have increased, the color data set is comparatively minimal. Declines in offshore secchi depths are present even after accounting for climatological trends and may be linked to the increases observed in total nitrogen and total phosphorus for this segment.

Dissolved oxygen data are complex to interpret and the declines in DO within Segment 10 appear to represent an improvement in water quality. For the Bay as a whole, total nitrogen and phosphorus levels have improved or remained stable over all time periods in all segments except for offshore (Segment 17). Offshore total nitrogen and phosphorus have increased, with levels noticeably higher in 1990-1995. Inorganic nitrogen has increased since 1968 and 1983 in Segments 10 and 14, but has remained stable since 1989. For Segment 14, increases in inorganic nitrogen appear to be the function of rainfall effects, based on the residuals analyses.

While changes in chlorophyll a within Segments 10 and 14 have not been significant, chlorophyll a corrected for pheophytin has significantly increased for Segments 9, 10, 13, 14, 16, and in Lemon Bay over the same time period. The linkage between inorganic nitrogen and chlorophyll is expected in the generally nitrogen-limited waters of the Sarasota Bay system. For most of the segments with increasing chlorophyll, significant trends are not present once rainfall are considered. Areas with increasing corrected chlorophyll a even after climatological trends were removed were Segments 14, 16, and Lemon Bay.

Chlorophylls have declined in the northern Bay, with the exception of recent (1989 to present) increase in eastern Palma Sola Bay (Segment 3) corresponding with a decrease in secchi depths for this segment. Bay-wide, nutrient reduction efforts appear to have had detectable effects and are over and above that expected from climatological trends.

VIII. LITERATURE CITED

Cleveland, W.S. 1979. Robust locally weighted regression and smoothing scatterplots. J. Amer. Statistical Assoc. 74:368(829-836).

Cleveland, W.S., S.J. Devlin and E. Grosse. 1988. Regression by local fitting: Methods, properties, and computational algorithms. J. Econometrics. 37:87-114.

Dixon, L.K. and G.J. Kirkpatrick. 1995. Light attenuation with respect to seagrasses in Sarasota Bay, Florida. Mote Marine Laboratory Technical Report No. 407. Submitted to the Sarasota Bay National Estuary Program, Sarasota, Florida.

Estevez, E.D. and C. Palmer. 1990. A segmentation system for Sarasota Bay National Estuary Program. Mote Marine Laboratory Technical Report No. 161. Submitted to the Sarasota Bay National Estuary Program, Sarasota, Florida.

Kurz, R.C., D.A. Tomasko, D. Burdick, T.F. Ries, K. Patterson, and R. Finck. 1999. Summary of recent trends in seagrass distributions in southwest Florida coastal waters. Southwest Florida Water Management District, Surface Water Improvement and Management Program Technical Report.

Lowrey, S.S., L.K. Dixon, P.M. Sherblom, and M.G. Heyl. 1993. Water and Sediment Quality: Trends and Status for Sarasota Bay. Mote Marine Laboratory Technical Report 254. Submitted to Sarasota Bay National Estuary Program, Sarasota, Florida.

U.S. Army Corp of Engineers Waterways Experiment Station. 1995. Environmental Effects of Dredging: Technical Notes: Guidelines for statistical treatment of less than detection limit data in dredged sediment evaluations. Vicksburg, MS.

Appendix A

Appendix A - Station designations, latitude and longitude in decimal degrees, and segments assigned for analysis.

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273108082414900	27.51889200	-82.69694800	1
273133082432100	27.52583700	-82.72250400	1
273201082435100	27.53361500	-82.73083700	1
273210082431000	27.53611500	-82.71944900	1
455	27.53500000	-82.73133333	1
458	27.49700000	-82.65683333	3
459	27.52882778	-82.70361111	1
460	27.51670833	-82.68531667	2
464	27.49603611	-82.69544167	2
48040SEAS	27.51083700	-82.68267000	2
54011SEAS	27.33717100	-82.58067000	9
54012SEAS	27.34517000	-82.59600400	10
54015SEAS	27.37650300	-82.58833700	7
54016SEAS	27.39067000	-82.63217000	7
54017SEAS	27.33617000	-82.58883700	10
54022SEAS	27.40667000	-82.61200300	7
54039SEAS	27.45200300	-82.68967100	5
54040SEAS	27.44317000	-82.68800300	17
54041SEAS	27.44567000	-82.68100400	5
54042SEAS	27.45400300	-82.68600400	5
54044SEAS	27.45117000	-82.65850400	6
54047SEAS	27.45633700	-82.67050400	6
54055SEAS	27.43733700	-82.68167100	5
54059SEAS	27.42850300	-82.66867000	5
54063SEAS	27.42133700	-82.65933700	5
54065SEAS	27.41817000	-82.65550400	5
54067SEAS	27.41083700	-82.65417000	5
54068SEAS	27.40417000	-82.65150300	7
54069SEAS	27.40233700	-82.64100300	7
54072SEAS	27.41000300	-82.58000300	8
54075SEAS	27.41667000	-82.58750400	8
54077SEAS	27.42333700	-82.60750400	6
54078SEAS	27.41167000	-82.63333700	6
54079SEAS	27.42833700	-82.63000300	6
54082SEAS	27.44083700	-82.65333800	6
54083SEAS	27.44667000	-82.66417000	6
54084SEAS	27.43850300	-82.67733700	5
54131SEAS	27.38517000	-82.60600300	7
54411SEAS	27.34000500	-82.56667000	10
54426SEAS	27.36433700	-82.61467100	7
54428SEAS	27.36983800	-82.61367000	7
54429SEAS	27.37733700	-82.61583700	7
54430SEAS	27.39350300	-82.62600300	7
54431SEAS	27.39217000	-82.64133800	7
54432SEAS	27.38300300	-82.63150500	7
54440SEAS	27.37533700	-82.56567000	11
54441SEAS	27.38950300	-82.56967000	8
54443SEAS	27.40083700	-82.57367100	8
54444SEAS	27.35633700	-82.55667100	11
54445SEAS	27.40833700	-82.59917000	8
54448SEAS	27.34383700	-82.54817000	11
54600SEAS	27.42717100	-82.64700400	6
54601SEAS	27.46300400	-82.68883800	5

587	27.47318889	-82.64874167	3
589	27.48150278	-82.68307500	2
590	27.46900000	-82.66366667	3
597	27.41525278	-82.59467222	8
598	27.43558333	-82.63980833	6
600	27.41874722	-82.60593333	6
604	27.40241944	-82.58064167	8
607	27.39904167	-82.60051667	8
608	27.38020278	-82.59224444	7
658	27.48111667	-82.69928611	1
659	27.46650000	-82.68750000	5
660	27.45331944	-82.67522222	6
667	27.43714444	-82.66078056	6
668	27.42151944	-82.64685556	5
669	27.41116667	-82.64316667	5
676	27.39768333	-82.62686111	7
ECO-1	27.30000000	-82.62000000	17
LB-1-01	27.03500000	-82.42777778	27
LB-1-02	27.04333333	-82.43416667	27
LB-1-03	27.03166667	-82.42583333	27
LB-1-04	27.03916667	-82.43000000	27
LB-1-05	27.04555556	-82.43555556	27
LB-1-06	27.04138889	-82.43138889	27
LB-1-07	27.03444444	-82.42666667	27
LB-1-08	27.03833333	-82.42750000	27
LB-1-09	27.04916667	-82.43722222	27
LB-1-10	27.04472222	-82.43222222	27
LB-1-11	27.03388886	-82.42638890	27
LB-1-12	27.03916667	-82.42972222	27
LB-2-01	27.01722222	-82.41527778	27
LB-2-02	27.02388889	-82.41972222	27
LB-2-03	27.00805556	-82.41000000	27
LB-2-04	27.01888889	-82.41694444	27
LB-2-05	27.01138889	-82.41222222	27
LB-2-06	27.02583333	-82.42222222	27
LB-2-07	27.01583333	-82.41416667	27
LB-2-08	27.01861111	-82.41611111	27
LB-2-09	27.02305556	-82.41805556	27
LB-2-10	27.01555556	-82.41305556	27
LB-2-11	27.02166670	-82.41805552	27
LB-2-12	27.01750000	-82.41527778	27
LB-3-01	27.00055556	-82.40583333	27
LB-3-02	26.99166667	-82.39833333	27
LB-3-03	26.98888889	-82.39527778	27
LB-3-04	27.00250000	-82.40555556	27
LB-3-05	26.99611111	-82.40138889	27
LB-3-06	27.00472222	-82.40805556	27
LB-3-07	27.00055556	-82.40305556	27
LB-3-08	26.99055556	-82.39888889	27
LB-3-09	26.99611111	-82.40000000	27
LB-3-10	27.00138889	-82.40555556	27
LB-3-11	26.99583334	-82.39888888	27
LB-3-12	26.99611111	-82.40333333	27
LB-4-01	26.98194444	-82.39000000	27
LB-4-02	26.96972222	-82.38611111	27
LB-4-03	26.97805556	-82.39083333	27
LB-4-04	26.97166667	-82.38027778	27
LB-4-05	26.97694444	-82.38472222	27
LB-4-06	26.98388889	-82.39388889	27
LB-4-07	26.97555556	-82.38750000	27
LB-4-08	26.96916667	-82.38166667	27
LB-4-09	26.97611111	-82.38361111	27
LB-4-10	26.98138889	-82.38916667	27
LB-4-11	26.97750002	-82.38916671	27
LB-4-12	26.98166667	-82.38888889	27
LB-5-01	26.95611111	-82.36722222	27
LB-5-02	26.96083333	-82.37444444	27
LB-5-03	26.94694444	-82.36777778	27
LB-5-04	26.95638889	-82.37277778	27
LB-5-05	26.95166667	-82.36416667	27
LB-5-06	26.94833333	-82.36138889	27
LB-5-07	26.95250000	-82.37055556	27
LB-5-08	26.96555556	-82.37416667	27
LB-5-09	26.96333333	-82.37833333	27
LB-5-10	26.95138889	-82.36583333	27
LB-5-11	26.95888893	-82.37666669	27
LB-5-12	26.95000000	-82.36472222	27
MMLRT07	27.19222200	-82.55333300	17
MMLWCINDAM-1	27.51333300	-82.68333300	2
MMLWCINDPS-1	27.47361100	-82.64444400	3
MMLWCINDPS-3	27.48888900	-82.64750000	3
MMLWCINDPS-5	27.47666700	-82.67666700	2
MMLWCINDPS-6	27.47277800	-82.67805600	2
MMLWCINDPS-7	27.48666700	-82.68916700	2
MMLWCINDSB-1	27.45222200	-82.65611100	6
MMLWCINDSB-10	27.41583300	-82.57500000	8
MMLWCINDSB-2	27.45527800	-82.65277800	6
MMLWCINDSB-3	27.44361100	-82.64861100	6
MMLWCINDSB-5	27.43750000	-82.63500000	6
MMLWCINDSB-6	27.43666700	-82.63500000	6
MMLWCINDSB-7	27.42500000	-82.63500000	6
MMLWCINDSB-9	27.40972200	-82.58194400	8
MMLWCINDWW-2	27.44000000	-82.67527800	5
MMLWCINDWW-3	27.42027800	-82.65333300	5
MMLWCINDWW-4	27.40694400	-82.62888900	7
MMLWLA27	27.40500000	-82.62250000	7
MMLWLA38	27.40500000	-82.58583300	8
MMLWLA40	27.41416700	-82.57305600	8
MMLWLA49	27.36666700	-82.58888900	7
MMLWLA51	27.37388900	-82.57666700	8
MMLWLA54	27.36194400	-82.56666700	11
MMLWLA59	27.35194400	-82.57027800	10
MMLWLA61	27.35722200	-82.55861100	11
MMLWLA63	27.35111100	-82.55638900	11
MMLWLA64	27.35333300	-82.55083300	11
MMLWLA65	27.35416700	-82.54805600	11

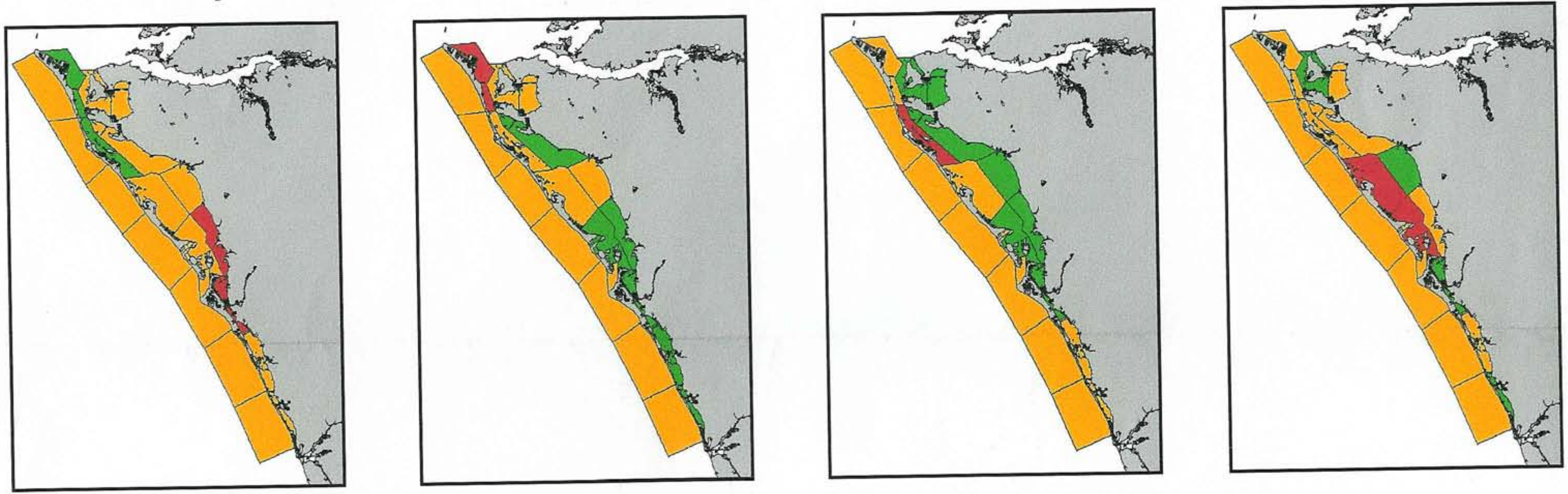
MMLWLA68	27.32500000	-82.59138900	17
MMLWLA73	27.34111100	-82.56250000	11
MMLWLA75	27.34444400	-82.55194400	11
MMLWLA85	27.32555600	-82.55472200	11
MMLWLA97	27.30000000	-82.56166700	12
MMLWLA99	27.29916700	-82.54888900	13
PS-1	27.49700300	-82.65683800	3
PS-2	27.47567000	-82.67350400	2
PS-3	27.46900300	-82.66367100	3
RT1	27.38315000	-82.58435000	8
RT10	27.22911667	-82.54553333	17
RT11	27.21006667	-82.53415000	17
RT12	27.32958333	-82.55635000	11
RT2	27.38886667	-82.60670000	7
RT3	27.44020000	-82.65426667	6
RT4	27.41815000	-82.69451667	17
RT5	27.38480000	-82.65935000	17
RT6	27.36666667	-82.66848333	17
RT7	27.33406667	-82.63811667	17
RT8	27.29780000	-82.60121667	17
RT9	27.28296667	-82.57601667	17
RTT1	27.32290000	-82.60778333	17
RTT3	27.31623333	-82.60016667	17
SB-1	27.46650300	-82.68750500	5
SB-2	27.44067000	-82.65083700	6
SB-3	27.41117000	-82.64317000	5
SB-4	27.41033700	-82.58567100	8
SHS11	27.32611100	-82.53888900	11
SHS12	27.35250000	-82.55333300	11
SHS13	27.35888900	-82.57194400	11
SHS14	27.35055600	-82.59111100	10
SHS2	27.32888900	-82.54194400	11
SHS3	27.33083300	-82.54333300	11
SHS4	27.33388900	-82.55305600	11
SHS6	27.32055600	-82.55333300	10
SHS7	27.30805600	-82.54638900	11
SHS8	27.28250000	-82.54472200	13
SHS9	27.25666700	-82.53305600	13
STA0042	27.51389200	-82.68528200	2
TB-4	27.53500300	-82.73133800	1

FIELD_NAME	FIELD_T	FIELD_L	FIELD_DEC	FIELD DESCRIPTION	UNITS
ATTCOEFF	N	5	2	Attenuation Coefficient	m^{-1}
BOD5	N	5	1	Biochemical Oxygen Demand	mg/l
CHLA_CORR	N	6	2	Chlorophyll a, corrected for pheophytin	ug/l
CHLA	N	6	2	Chlorophyll a	ug/l
CHLB	N	6	2	Chlorophyll b	ug/l
CHLC	N	6	2	Chlorophyll c	ug/l
COLOR	N	6	1	Color	PCU
CU	N	8	4	Copper	ug/l
DIN	N	7	4	Dissolved Inorganic Nitrogen	mg/l N
DNH4N	N	7	4	Dissolved Ammonium-nitrogen	mg/l N
DNO23N	N	7	4	Dissolved Nitrate-nitrite-nitrogen	mg/l N
DNO2N	N	7	4	Dissolved Nitrite-nitrogen	mg/l N
DNO3N	N	11	3	Dissolved Nitrate-nitrogen	mg/l N
DO	N	6	2	Dissolved Oxygen	mg/l
DPO4P	N	7	4	Dissolved Ortho-phosphorus	mg/l P
FE	N	7	3	Iron	ug/l
IN	N	7	4	Inorganic Nitrogen	mg/l N
JTU	N	6	1	Turbidity	JTU
MN	N	7	3	Manganese by atomic absorption	ug/l
NH4N	N	7	4	Ammonium-nitrogen	mg/l N
NO23N	N	7	4	Nitrate-nitrite-nitrogen	mg/l N
NO3N	N	6	3	Nitrate-nitrogen	mg/l N
ORGN	N	7	4	Organic Nitrogen	mg/l N
PB	N	8	4	Lead	ug/l
PERSAT	N	5	1	Percent Saturation of Dissolved Oxygen	%
PHEO_A	N	6	2	Pheophytin a	ug/l
PO4P	N	7	4	Ortho-phosphorus	mg/l P
SECCHI_EST	N	4	1	Secchi Depth, >B set equal to station depth	m
TIC	N	7	2	Total Inorganic Carbon	mg/l C
TKN	N	6	3	Total Kjeldahl Nitrogen	mg/l N
TN	N	7	4	Total Nitrogen	mg/l N
TOC	N	7	2	Total Organic Carbon	mg/l C
TOTP	N	6	3	Total Phosphorus	mg/l P
TP	N	7	4	Total Phosphorus	mg/l P
TSS	N	7	2	Total Suspended Solids	mg/l
TURB	N	6	1	Turbidity	NTU
VSS	N	7	2	Volatile Suspended Solids	mg/l
ZN	N	8	4	Zinc	ug/l
PH	N	5	2	pH	SU
SAL_PSU	N	5	2	Salinity	PSU
COND	N	6	3	Specific Conductance	mmhos
TEMP	N	5	2	Temperature	Degrees C
YEARFRAC	N	7	4	Year fraction, Jday/365	-
RAIN3	N	6	3	Rainfall, 3 day cumulative, nearby stations	in
RAIN7	N	6	3	Rainfall, 7 day cumulative, nearby stations	in
RAIN14	N	6	3	Rainfall, 14 day cumulative, nearby stations	in
RAIN30	N	6	3	Rainfall, 30 day cumulative, nearby stations	in
RAIN60	N	6	3	Rainfall, 60 day cumulative, nearby stations	in
RAIN90	N	6	3	Rainfall, 90 day cumulative, nearby stations	in
STATION	C	16	0	Station ID	-
DLAT	N	11	8	Latitude	degrees
DLONG	N	12	8	Longitude	degrees
SEGMENT	C	5	0	Segment Assigned	-
DATE	D	8	0	Sampling Date	mm/dd/yyyy
NDATE	N	6	3	Sampling Date, fractional year since 1900	year

Note: Data for Segment 15 appear twice, once identified as Segment 14, once as Segment 15
Data less than detection limit were converted to 1/2 detection limit. Depth and daily averaging by station and parameter was performed. Data set truncated to estuarine values of 5000 mmhos or greater, 2.7 PSU or greater, or known estuarine areas. '-9' indicates no data.

1983 – 1998 Trend

Salinity | **Color** | **Secchi Depth** | **Percent DO**



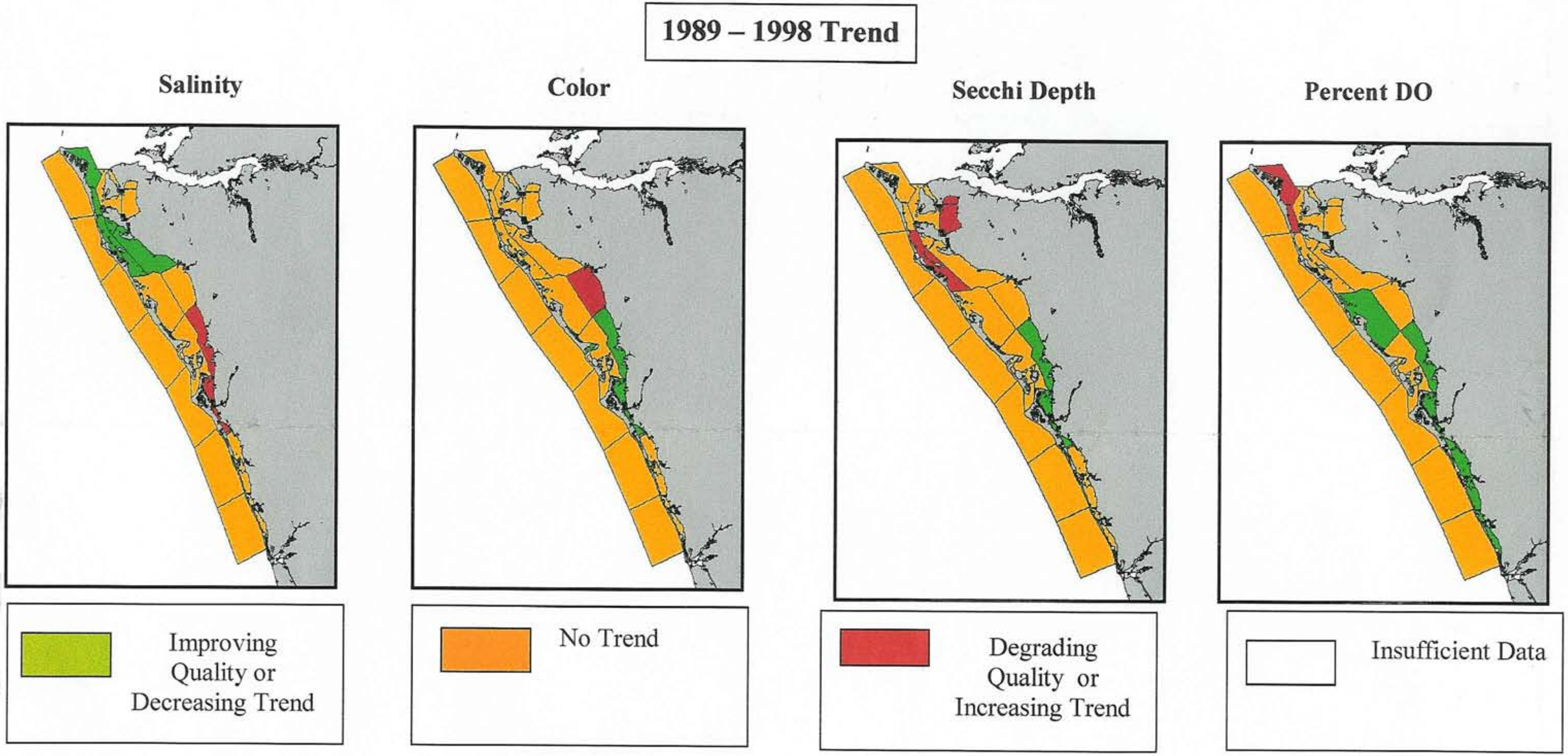
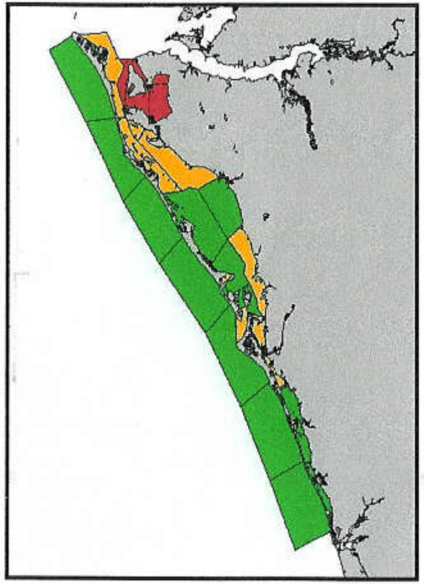


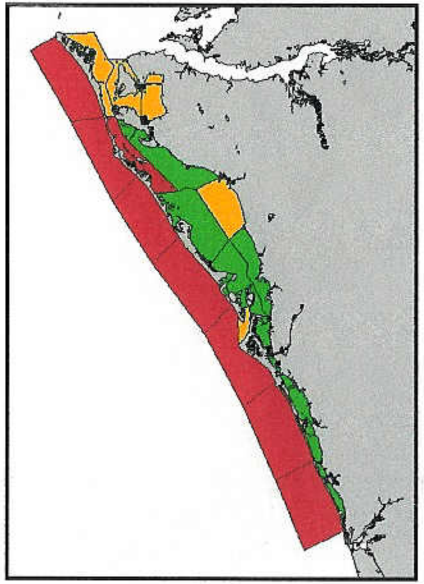
Figure 18. Nonparametric trends in water quality within Sarasota Bay; salinity, color, Secchi depth, and percent saturation of dissolved oxygen(DO). Declining DO (1983-1998) represents an improvement in water quality.

1968 – 1998 Trend

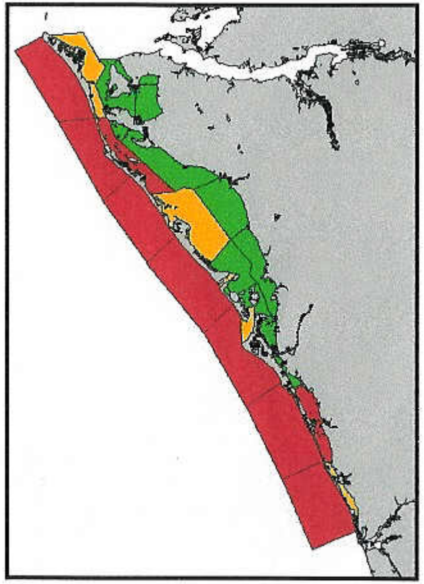
Salinity



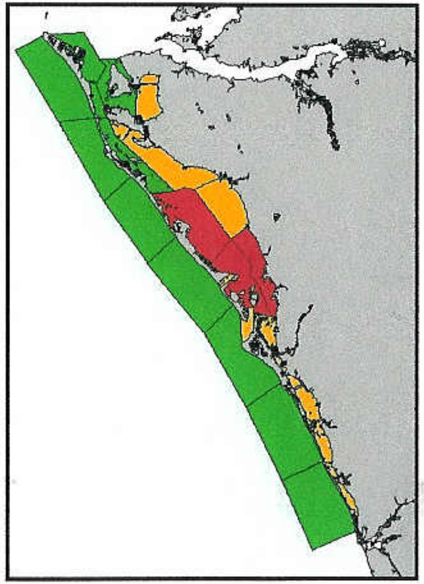
Color



Secchi Depth

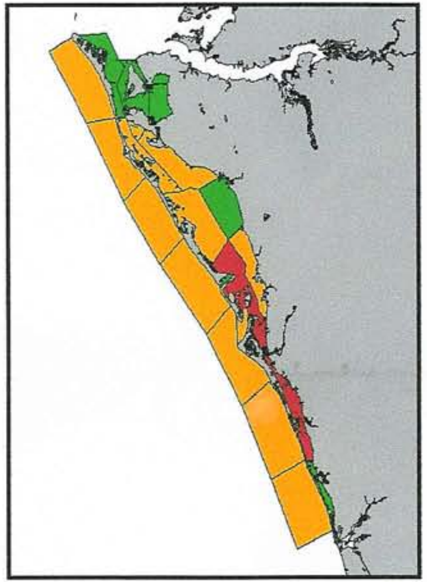


Percent DO

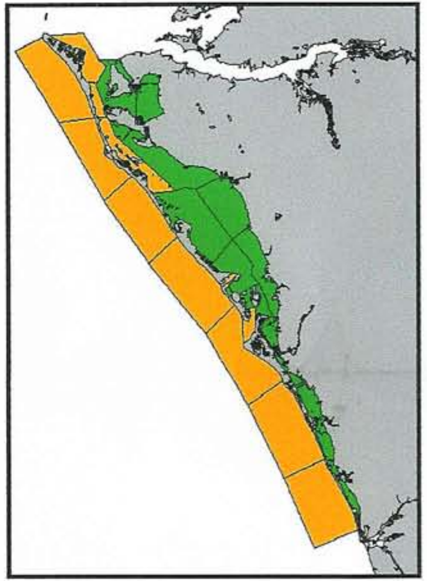


1983 – 1998 Trend

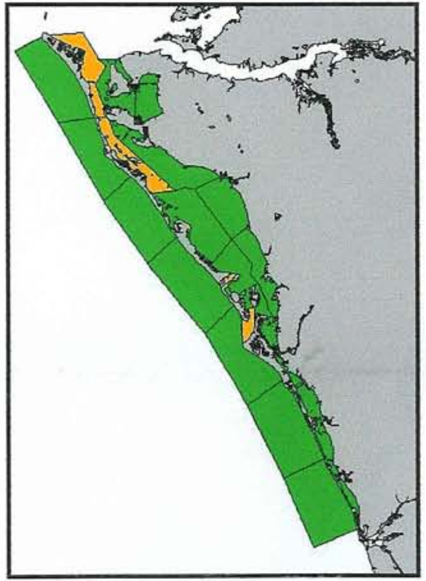
Inorganic Nitrogen



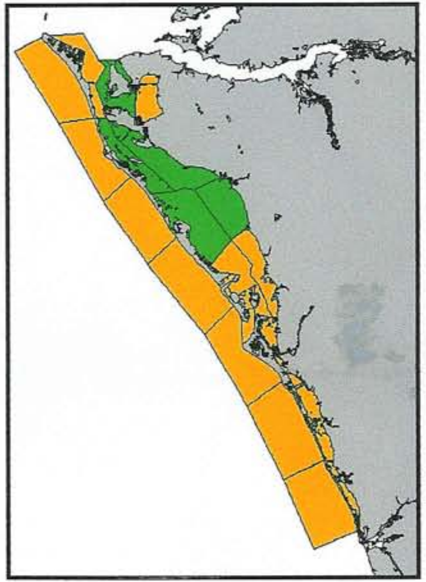
Total Nitrogen



Total Phosphorus



Chlorophyll a



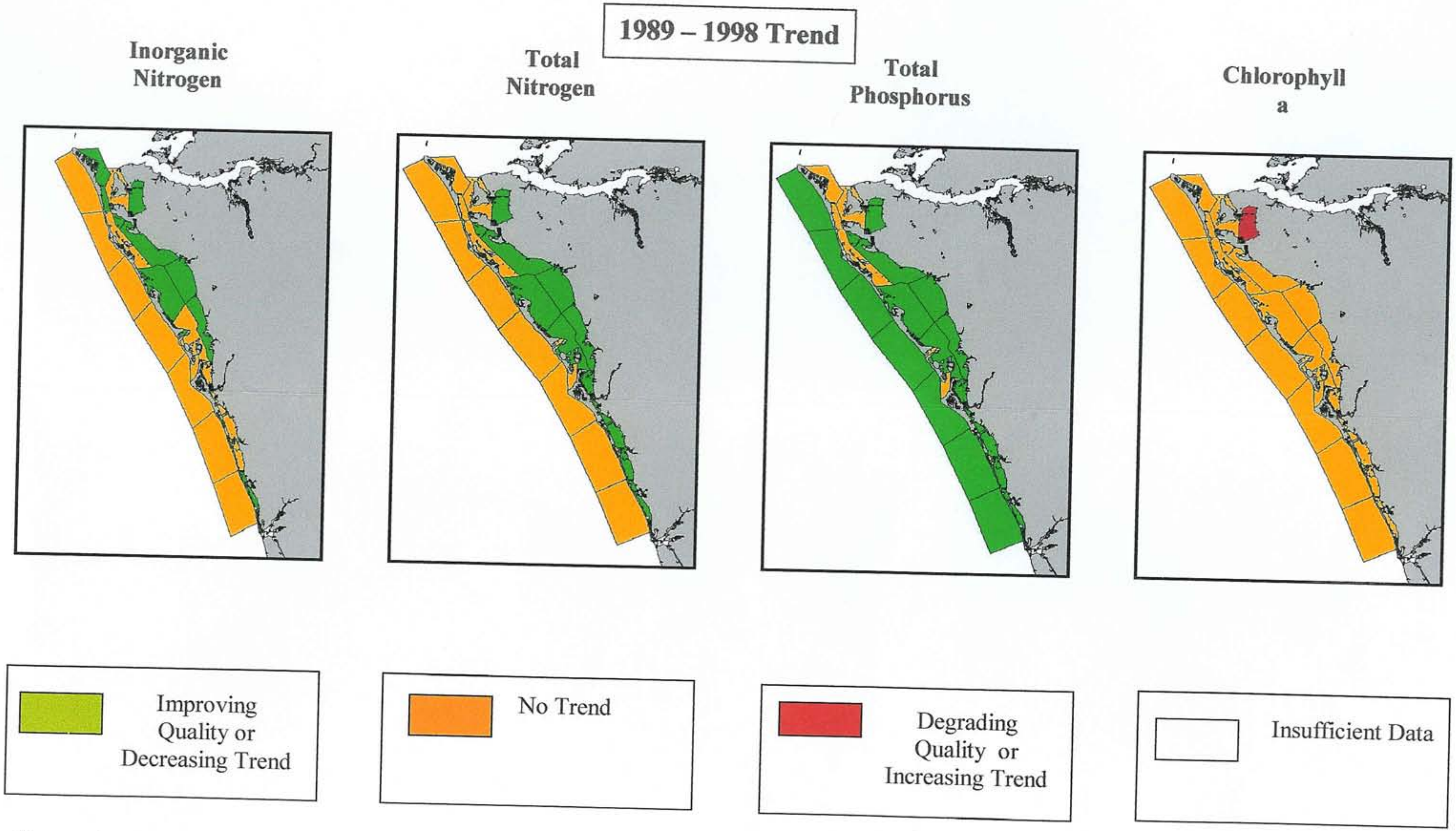
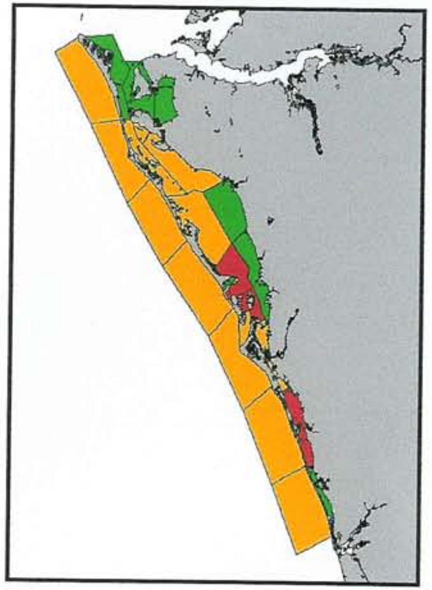


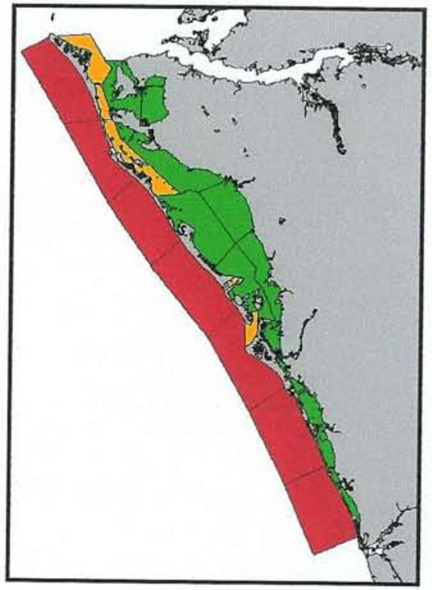
Figure 19. Nonparametric trends in water quality within Sarasota Bay; inorganic and total nitrogen, total phosphorus, and chlorophyll a.

1968 – 1998 Trend

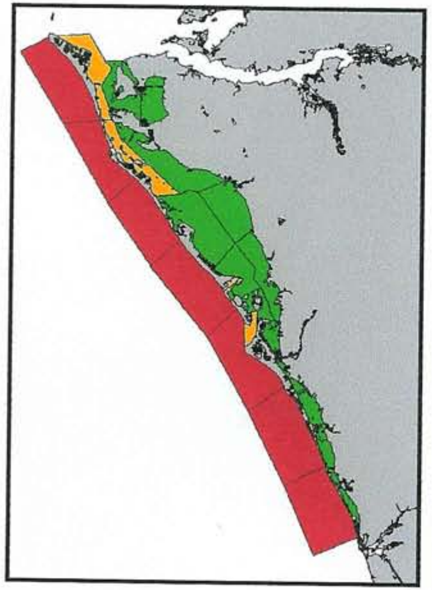
Inorganic Nitrogen



Total Nitrogen



Total Phosphorus



Chlorophyll a